Transportation Systems Operations Plan

Prepared for
Pennsylvania Department of Transportation

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Prepared by

PB

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# TABLE OF CONTENTS

## EXECUTIVE SUMMARY

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## 1 INTRODUCTION

1.1 TSOP Purpose
1.2 The Congestion Issue
1.3 Solutions to the Congestion Issue
1.4 What is TSOP?
1.5 Strategic Direction and Guiding Principles

## 2 BACKGROUND AND HISTORY

2.1 PennDOT Districts
2.2 District Directions
2.3 PennDOT Central Office
2.4 Transportation Management Approach

## 3 GOALS DISCUSSION

3.1 Goal # 1: Build and Maintain Transportation Operations Foundation
3.2 Goal # 2: Improve Highway Operational Performance
3.3 Goal # 3: Improve Safety
3.4 Goal # 4: Improve Security
3.5 Incident Management and Traveler Information Has Applicability to All Four Goals

## 4 CANDIDATE PROJECTS

4.1 Description of TSOP Projects
4.2 Project Highlights and Interrelationships
4.3 Relationships Between TSOP Goals and Projects
4.4 Additional Project Groupings
4.5 Project Status Levels

## APPENDIX A: DETAILED PROJECT PROFILES

- TSOP-01: Inter-Agency Incident Reporting System
- TSOP-02: Road Closure Reporting System
- TSOP-03: Interstate Incident Management Program
- TSOP-04: Incident Management Traveler Information
- TSOP-05: Incident Management Processes and Procedures
- TSOP-06: Roadway Weather Management
- TSOP-07: Crash Prevention/Safety
- TSOP-08: TAC Signal Study Implementation
- TSOP-09: STMC and TMC's
- TSOP-10: ITS Equipment Maintenance
- TSOP-11: Technology-Assisted Enforcement

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LIST OF TABLES
Table 1-1: Transportation-Related Congestion ..................................................... 3
Table 1-2: Pennsylvania Linear Mileage and DVMT ............................................. 5
Table 1-3: Population Trends (2004-2020) ........................................................... 5
Table 1-4: Strategic Direction and Guiding Principles ....................................... 10
Table 2-1: ITS Equipment Types by PennDOT District ........................................ 21
Table 4-1: TSOP Project Highlights .................................................................... 56
Table 4-2: TSOP Project Interrelationships ......................................................... 70
Table 4-3: TSOP Goals, Objectives, Strategies, and Projects ............................. 72
Table 4-4: TSOP Projects Grouped by Component Areas ................................. 78
Table 4-5: TSOP Projects by Status Level .......................................................... 79
Table 4-6: TSOP Status Levels by Project, Effort, and Costs ............................. 80

LIST OF FIGURES
Figure 1-1: Approach for Improving Congested Conditions ............................. 6
Figure 1-2: ITS Technology and Services ............................................................ 7
Figure 1-3: TSOP Drivers .................................................................................... 8
Figure 1-4: TSOP Cycle ...................................................................................... 9
Figure 2-1: PennDOT Engineering Districts ...................................................... 14
Figure 2-2: Right-Sized PennDOT TMC’s .......................................................... 17
Figure 2-3: AFLADS ......................................................................................... 18
Figure 2-4: DMS ............................................................................................... 19
Figure 2-5: HAR ............................................................................................... 19
Figure 2-6: RWIS ............................................................................................ 20
Figure 2-7: Winter Operations ......................................................................... 22
Figure 2-8: Penn State’s Beaver Stadium .......................................................... 23
Figure 2-9: Detour Signs ................................................................................... 24
Figure 2-10: District 4-0 TMC .......................................................................... 24
Figure 2-11: District 5-0 TMC .......................................................................... 25
Figure 2-12: District 6-0 Traveler Information Websites ..................................... 27
Figure 2-13: Blair County 911 Center’s Workstation .......................................... 28
Figure 2-14: Crash Avoidance System .............................................................. 29
Figure 2-15: Traffic.com Traveler Information Website ....................................... 30
Figure 2-16: TMA Corridor-Based Coverage for RTMC’s ................................. 37
Figure 3-1: ITS Equipment ............................................................................. 39
Figure 3-2: ITS Maintenance ........................................................................... 40
Figure 3-3: Congestion ..................................................................................... 42
Figure 3-4: Traffic Signals ............................................................................... 43
Figure 3-5: Commercial Vehicle Operations .................................................... 44
Figure 3-6: Incident Reporting ......................................................................... 47
Figure A-1: Incident Reporting System ............................................................. 88
EXECUTIVE SUMMARY

Transportation System Operations signifies a new frontier of opportunity for the Pennsylvania Department of Transportation (PennDOT). Like other transportation departments across the nation, PennDOT finds itself challenged to make its surface transportation system function more effectively. No longer do transportation agencies routinely have the luxury of undertaking massive new road-building and expansion projects on a statewide basis. Instead, bolder, more innovative approaches must be employed to maximize capacity of the existing transportation infrastructure and achieve heightened operational efficiencies.

The American Association of State Highway and Transportation Officials (AASHTO) only recently reached consensus on what is meant by systems operations and management, defining it as:

“An integrated program designed to make the best use of existing highway infrastructure through provision of systems and services that preserve and improve performance.”¹

The fact that AASHTO has just now articulated this definition is a poignant reminder that “operations” constitutes a very new transportation business function with little history for guidance and no clearly-illuminated path to follow.

Through a process of internal scrutiny, detailed planning, and dialogue with its planning partners, PennDOT has determined that it must embrace and evolve an operational paradigm, even though the hour is still early. “Operations” is an important wave of the future, PennDOT has concluded. Moreover, an operations program is essential to PennDOT more aptly serving the transportation needs of its citizens. The Transportation Systems Operations Plan (TSOP), documented in this report, is the outgrowth of PennDOT’s initial operations planning efforts.

This first iteration of TSOP sets strategic and tactical directions for transportation system operations in the Commonwealth. It reflects important departmental initiatives, considers national priorities and progress, focuses on the customer, and builds on PennDOT’s experiences and successes to date.

TSOP’s vision is a transportation system that performs optimally for the people, places, and businesses across Pennsylvania. To achieve this vision, TSOP focuses on those foundational elements that support operational activities statewide. It emphasizes projects and actions most likely to improve transportation system reliability and customer satisfaction.

At its core, TSOP is driven by *statewide direction and regional needs*. A fundamental precept of TSOP is that PennDOT engineering districts, in conjunction with their regional planning partners, will be able to “right-size” – or adapt – statewide directions to the specialized needs and circumstances of their local regions. The objective here is that travelers, regardless of where they are in the Commonwealth, will have consistent experiences as they encounter roadway incidents, work zones, traveler advisories, AMBER Alerts, etc.

A second TSOP precept is *customer-centeredness*. PennDOT’s responsibility is to create and maintain a safe and efficient traveling environment for its citizens and transportation system users. While it cannot ensure that all travel will be free of incidents and delays, PennDOT can and will keep travelers apprised of conditions and circumstances. Thus, TSOP emphasizes reliable, real-time traveler information routinely disseminated to customers.

A third precept of TSOP is *measured performance and accountability*. Most TSOP projects will utilize quantitative metrics for objectively evaluating operational performance. These performance measures will be used to identify operational successes, shortcomings and failures, candidate actions for overcoming deficiencies, and opportunities for future successes. As appropriate, metrics will be chosen and defined in accordance with recognized national standards, such as those postulated by AASHTO, the National Transportation Operations Coalition (NTOC), and the I-95 Corridor Coalition.

TSOP is predicated on four goals, as follows:

1. *Build and Maintain a Transportation Operations Foundation*
2. *Improve Highway Operational Performance*
3. *Improve Safety*
4. *Improve Security*

To meet these goals, the plan identifies 19 distinct projects involving both deployments and additional planning efforts. Collectively, these projects constitute the “building blocks” of an initial, five-year program focused on incident management, congestion mitigation, and traveler information. Project priorities include operations mainstreaming, ITS maintenance, standards and procedures, resource management, information technology, and intermodal support. Implementation of TSOP will be coordinated through a succession of statewide initiatives and regional deployments right-sized to local needs.
Key operational objectives to be achieved within the initial five-year period include:

- Providing and supporting uniform, fundamental operational elements in all engineering district offices.
- Providing consistent interstate incident response on all sections of the interstate system.
- Sharing incident information for all hazards among federal, state, regional, and local emergency management agencies.
- Providing timely, reliable information to travelers using low-cost and no-cost media.

The advent of TSOP begins a new planning process strategically linked to two-year transportation improvement program (TIP) updates. Unlike “conventional” plans, TSOP funding and implementation will be shared among multiple business units since major deployments of equipment, operations, and services will necessarily be the consequence of collaborative efforts among partners. TSOP, itself, will be routinely updated – at two-year intervals.

By its very nature, TSOP is dynamic. The program will be shaped and guided by its executive goal owners. Rapid changes in technology, the evolution of Departmental strategies and national standards and guidelines, and changes in staffing and fiscal conditions will all compel TSOP’s owners to reevaluate progress and make adjustment to TSOP in accordance with the latest opportunities and conditions.

Delivery of this first TSOP offers the Department a potentially valuable tool set. This tool set, focused on demand reduction strategies, when coupled with more traditional, selective capacity expansion strategies, opens the way to new vistas of opportunity for effectively managing the mobility, safety, and security of Pennsylvania’s transportation infrastructure.
1 INTRODUCTION

It is increasingly clear, because of fiscal and environmental constraints, that the Commonwealth of Pennsylvania cannot build its way out of congestion. Travel demand is exceeding new construction, maintenance needs are surpassing available funding, environmental regulation is growing more vigilant, and congestion is expanding exponentially. New methods, technologies, and techniques are needed to maximize operational efficiencies and ensure that capacity of the existing transportation infrastructure is efficiently utilized. The scale and magnitude of investment made in the existing infrastructure has compelled the Pennsylvania Department of Transportation (PennDOT) to start thinking “operationally.” Until now, there has never been a centrally-led and coordinated statewide approach to transportation operations. The Transportation Systems Operations Plan (TSOP) kicks off this endeavor.

This document presents a statewide plan for systems operations, as envisioned by PennDOT. The plan formalizes and extends PennDOT’s business focus to include operations.

The document builds on national definitions of “operations,” such as that promulgated by the American Association of State Highway and Transportation Officials (AASHTO).

Transportation Systems Operations and Management

“An integrated program designed to make the best use of existing highway infrastructure through provision of systems and services that preserve and improve performance.”

1.1 TSOP Purpose

The purpose of TSOP is to set the statewide direction for projects in Intelligent Transportation Systems (ITS) and operations. Additionally, TSOP is intended to give PennDOT engineering districts, metropolitan planning organizations (MPO’s), and rural planning organizations (RPO’s) discretion to custom-tailor statewide priorities to the specialized needs of their regions. TSOP is driven by

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2 Operations and Management Strategic Plan, American Association of State Highway and Transportation Officials (AASHTO), Subcommittee on Systems Operation and Management, 2005.
an Executive Goal, a Vision, and TSOP Goals. Presented below are these driving forces:

**Executive Goal No. 6**

Effectively and efficiently operate the transportation system

**PennDOT’s TSOP Vision**

Provide the best performing transportation system for people, businesses, and places.

**PennDOT’s TSOP Goals**

1. Build and Maintain a Transportation Operations Foundation
2. Improve Highway Operational Performance
3. Improve Safety
4. Improve Security

Note: Incident Management and Traveler Information have applicability to all four goal areas

**1.2 The Congestion Issue**

The central impediment to safety, security, and mobility is roadway congestion. Congestion slows down travel, increases the likelihood of crashes and other safety incidents, and makes rapid responses to emergencies and security incidents more cumbersome and perilous. Congestion wastes travelers’ time, burns fuel unnecessarily, costs a considerable amount of money, and frustrates everyone.

Transportation-related congestion is nearly everywhere across the Commonwealth. In many parts of the state, it is a consistent and recurring problem and it is growing worse. National data show the following:
Table 1-1: Transportation-Related Congestion

<table>
<thead>
<tr>
<th>Sources of Congestion</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bottlenecks (physical, recurring congestion)</td>
<td>40%</td>
</tr>
<tr>
<td>Incidents (crashes, breakdowns, special events)</td>
<td>25%</td>
</tr>
<tr>
<td>Weather</td>
<td>15%</td>
</tr>
<tr>
<td>Work Zones</td>
<td>10%</td>
</tr>
<tr>
<td>Signals</td>
<td>5%</td>
</tr>
<tr>
<td>Other</td>
<td>5%</td>
</tr>
</tbody>
</table>

Highway travel in the United States continues to grow as the population increases, particularly in metropolitan areas.

Construction of new highway and transit capacity to accommodate this growth in travel has not kept pace. Of particular note:

- In 2003, nationwide congestion in the 75 largest urban areas resulted in 3.7 billion hours of travel delay and 2.3 billion gallons of wasted fuel. The cost of this congestion was estimated at $63 billion. Aggregate annual delay per peak-period traveler equated to 47 hours in 2003; by contrast, in 1982, aggregate delay amounted to only 16 hours per peak-period traveler.4

- Over-the-road freight movements are also dramatically on the rise. Freight volumes are forecast to grow by 69 percent between 1998 and 2020 – from 15.3 billion tons of freight to 25.8 billion tons per annum.5

- In 2003, the delay per peak period traveler in Philadelphia was estimated at 38 hours; this compared with 14 hours of delay in 1982, signifying a 171-percent increase in congestion delay. In Pittsburgh, delay was assessed at 10 hours in 1982, compared with 14 hours in 2003 – a 40-percent worsening in conditions. In the Allentown/Bethlehem metropolitan area, aggregate delay grew from 7 hours in 1982 to 17 hours in 2003 – representing a 143-percent increase in delay time.6

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4 The 2005 Urban Mobility Report, Texas Transportation Institute, The Texas A&M University System, College Station, TX, 2005.

5 Ibid.

6 The 2005 Urban Mobility Report.
As traffic conditions continue to deteriorate, the incidence of roadway crashes has spiked upwards as well:

- From 1994-2003, the number of fatalities on the nation’s roadways increased by 4.7 percent, from 40,716 in 1994 to 42,643 in 2003.7

- From 1994-2003, total fatalities on Pennsylvania’s roadways grew by 9.4 percent, from 1,441 in 1994 to 1,577 in 2003. Though total annual fatalities increased over this 10-year period, the rate of fatalities actually decreased by 5.1 percent – from 1.56 fatalities per 100 million vehicle miles of travel (VMT) in 1994 to 1.48 fatalities per 100 million VMT in 2003.8

- The total economic cost of all motor vehicle crashes in Pennsylvania, in 2000, was estimated at $8.17 billion.9

Pennsylvania maintains more than 120,000 linear miles of roadway; nearly 70 percent of the roadway miles are in rural parts of the state. In 2003, the vehicle miles of travel along Pennsylvania’s roads averaged 291 million miles per day.10 From 1990-1999, total statewide vehicle miles traveled increased by 18 percent, while total lane miles added to the roadway system went up by just 2 percent. In other words, over this 10-year period, vehicle miles traveled increased nine times faster than the rate at which new lane miles were added to the system.11 During the subsequent 5-year period, 1999-2003, the differential slowed somewhat – however, growth in VMT still outstripped the addition of new linear miles to the system by a factor of 4:1.12 In just four years, from 1995-1999, the proportion of Pennsylvania roads that were congested grew from 17 percent to 20 percent.13

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8 Ibid.


12 Pennsylvania Mileage and Travel: 2003 Highway Statistics.

Table 1-2: Pennsylvania Linear Mileage and DVMT

<table>
<thead>
<tr>
<th></th>
<th>Linear Miles</th>
<th>DVMT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural</td>
<td>68.7%</td>
<td>37.9%</td>
</tr>
<tr>
<td>Urban</td>
<td>31.3%</td>
<td>62.1%</td>
</tr>
<tr>
<td>Total System</td>
<td>120,423</td>
<td>290,726,000</td>
</tr>
</tbody>
</table>

Continued mobility is important to Pennsylvania’s economy and its quality-of-life. Congestion, clearly, is not a problem that will go away on its own.

Modest growth is anticipated for the Commonwealth of Pennsylvania between the years 2004 and 2020. During this sixteen year period, the eastern and south-central part of the state are expected to experience the fastest growth. As shown in Table 1-3, below, District 8-0 is expected to experience the most rapid growth of any region in the state. Districts 3-0, 4-0, and 5-0 are also expected to grow significantly.

Table 1-3: Population Trends (2004-2020)\(^\text{14}\)

<table>
<thead>
<tr>
<th></th>
<th>2004 Population</th>
<th>2020 Population</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>District 1-0</td>
<td>595,897</td>
<td>604,225</td>
<td>1.40%</td>
</tr>
<tr>
<td>District 2-0</td>
<td>336,128</td>
<td>333,209</td>
<td>-0.87%</td>
</tr>
<tr>
<td>District 3-0</td>
<td>263,208</td>
<td>278,191</td>
<td>5.69%</td>
</tr>
<tr>
<td>District 4-0</td>
<td>697,256</td>
<td>742,251</td>
<td>6.45%</td>
</tr>
<tr>
<td>District 5-0</td>
<td>1,368,033</td>
<td>1,468,104</td>
<td>7.31%</td>
</tr>
<tr>
<td>District 6-0</td>
<td>3,882,573</td>
<td>3,872,232</td>
<td>-0.27%</td>
</tr>
<tr>
<td>District 8-0</td>
<td>1,532,765</td>
<td>1,742,293</td>
<td>13.67%</td>
</tr>
<tr>
<td>District 9-0</td>
<td>466,345</td>
<td>447,594</td>
<td>-4.02%</td>
</tr>
<tr>
<td>District 10-0</td>
<td>428,195</td>
<td>413,988</td>
<td>-3.32%</td>
</tr>
<tr>
<td>District 11-0</td>
<td>1,951,037</td>
<td>1,788,369</td>
<td>-8.34%</td>
</tr>
<tr>
<td>District 12-0</td>
<td>760,182</td>
<td>721,646</td>
<td>-5.07%</td>
</tr>
<tr>
<td>Pennsylvania</td>
<td>12,281,619</td>
<td>12,412,102</td>
<td>1.06%</td>
</tr>
</tbody>
</table>

\(^\text{14}\) Pennsylvania State Data Center, Penn State University, 2001.
1.3 Solutions to the Congestion Issue

Efforts to improve mobility must include strategies for mitigating congestion. PennDOT has committed to a Statewide Mobility Plan. This plan encompasses a three-pronged approach to improving congested conditions: (1) build capacity, (2) reduce demand, and (3) manage capacity. Of the three approaches, TSOP focuses on managing capacity. A “transportation operations” program will be the mechanism for managing capacity.

![Figure 1-1: Approach for Improving Congested Conditions](image)

**Build Capacity**

Adding new capacity to the transportation system involves building new roads, adding additional lanes to existing roads, building interchanges, etc. These activities are important and will need to continue to occur. However, as noted previously, road building and expansion activities are not keeping pace with increases in vehicle miles of travel. With limited funds available for new construction, PennDOT cannot build its way out of congestion.

**Reduce Demand**

Reducing demand on the highway system requires that a portion of the traffic be diverted off the roadways and on to alternative modes of travel. These alternatives include buses, trains, boats, bikes, and walking. They also cover the use of carpools and vanpools, designation of commuter parking lots, etc. Sound land-use practices can also help to minimize trips. Reducing demand, like increasing capacity, is an important, ongoing concept for managing congestion. However, while a demand-reduction program is a potentially effective long-term tool to help control congestion, it will not solve the problem.
**Manage Capacity**

The third alternative is to better manage the existing capacity of the transportation system. This means defining and implementing actions that will likely maximize the efficiencies and effectiveness of the existing transportation infrastructure. It means defining an approach for leveraging ITS techniques and technology in order to provide a safe, reliable transportation system. Effective transportation management is an approach that PennDOT will continue to take.

For some years now, PennDOT has employed ITS technologies to improve mobility and safety. These technologies have helped conditions, but they have been largely deployed as independent efforts to meet local/regional needs. By adopting a structured, systematic, statewide approach to operations, PennDOT anticipates realizing the benefits of consistency, standardization, strategic sourcing, and the elimination of duplicate efforts.

Figure 1-2, below, illustrates the elements necessary to provide the foundation for operations programs and services. TSOP projects will address the priority issues in all four foundation elements given the Department’s strategic direction and the current evolutionary state of ITS.

![Figure 1-2: ITS Technology and Services](image)

Managing capacity through ITS and operations is one more piece of the puzzle. While utilizing ITS and efficiently operating the transportation system can help alleviate congestion, it is not a “silver bullet” solution. Population growth/shifts, economic development, land-use patterns, jobs, commercial vehicle traffic, and other factors outside of PennDOT’s control all aggravate the problem. Notably,
however, PennDOT does hold some of the cards for solving the problem. It can for example, help by making improvements in travel time reliability, disseminating information to the traveling public, fostering conditions that will reduce the likelihood of secondary crashes, etc.

1.4 What is TSOP?

TSOP is a statewide tactical plan for deploying, operating, and maintaining tools and technologies in support of the transportation system. A fundamental tenet of the plan is that operational deployments must be driven by statewide direction and regional needs:

- “Statewide direction” emphasizes PennDOT’s role in centrally leading and managing the foundational elements of the transportation system and providing general guidance to regional deployment efforts.

- “Regional needs,” on the other hand, acknowledges that districts, MPO’s and RPO’s are, themselves, the best authorities about their own conditions and have a reasonable degree of autonomy to adapt statewide directions to their particular circumstances.

- A third driver is the fact that the Department has already learned important lessons from its experiences in deploying and operating ITS technologies. PennDOT can build on best practices from the past in making preparations for the future.

![Figure 1-3: TSOP Drivers](image-url)
The development of TSOP was influenced by many initiatives, but two efforts, in particular, stand out: (1) nine regional ITS architectures, finalized in 2005, that provide the information on activities, needs, and ideas on a region-by-region basis; and (2) a transportation management approach (TMA), developed in 2004, that envisions new and enhanced transportation management centers (TMC’s) – at the state, regional, and district levels – to monitor and control transportation system activities.

TSOP will also end up influencing a number of initiatives, especially a currently-evolving statewide mobility plan, to be completed in 2006. Possible regional operations plans may also be influenced by TSOP.

TSOP will be implemented through continuing communication, coordination with PennDOT’s partners and a series of projects involving planning, deployment, or both. In most instances, TSOP initiatives will lead to operational activities. Those candidate projects that move forward will be determined by such factors as program priorities, human constraints and funding constraints. The impact that operational activities are having on transportation conditions will be continuously evaluated, so that the performance indicators are fed back into TSOP as the cycle continues. This “plan/do/check/act” relationship is depicted in Figure 1-4:

![Figure 1-4: TSOP Cycle](image)

TSOP will outline a number of project initiatives. Some general aspects of TSOP projects include:
• Projects will emphasize the sharing of information among transportation stakeholders so that they have the information they need and can be part of the solution.

• TSOP projects extend the information sharing to travelers. Informed travelers can often avoid congested and hazardous locations or choose an alternate route.

• Deployment projects in TSOP will establish and measure performance. Findings will be used to define and prioritize current and future TSOP initiatives.

TSOP will function as a planning tool for PennDOT and its partners. TSOP outlines PennDOT’s priorities in operations and ITS. As a guide, TSOP should be considered before projects are planned, funded, and procured. TSOP can also be used in earmarking efforts either through national or state political groups. As projects are being developed, TSOP can be considered in the development stage.

1.5 Strategic Direction and Guiding Principles

As TSOP evolved, a series of strategic motifs and guiding principles were found to impact the discussions, time-and-time again. Ultimately, most of these principles were “embedded” into the fabric of individual projects. These recurring strategies and principles are examined below. As TSOP planning continues to move forward, these strategies and principles should continue to shape and inform the planning process.

Table 1-4: Strategic Direction and Guiding Principles

<table>
<thead>
<tr>
<th>Strategic Direction</th>
<th>Guiding Principle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incrementally Deploy</td>
<td>Dynamic and Sustainable</td>
</tr>
<tr>
<td>Priorities will Change</td>
<td>Innovation and Integration</td>
</tr>
<tr>
<td>Common Needs</td>
<td>Coordination and Cooperation</td>
</tr>
<tr>
<td>Right-Sized</td>
<td>Right-Sizing</td>
</tr>
<tr>
<td>Focus on the Fundamentals</td>
<td>Cost-Effectiveness and Efficiency</td>
</tr>
<tr>
<td>Plan in the Near-Term</td>
<td>Tactical Planning</td>
</tr>
<tr>
<td>Measured Performance</td>
<td>Performance</td>
</tr>
<tr>
<td>Implement Traveler Information</td>
<td>Consistency and Responsiveness</td>
</tr>
<tr>
<td>Seek Win/Win</td>
<td>Win/Win Approach</td>
</tr>
</tbody>
</table>
1. **Incrementally Deploy**

*Dynamic:* This is the first publication of TSOP. This plan signifies the start – not the finish – of an extended operations dialogue. It begins the work of establishing a structured operational environment within PennDOT. TSOP will be updated at two-year intervals to coincide with development of the Transportation Improvement Programs (TIP's) and will be used for developing annual business plans.

*Sustainable:* When technology is deployed, it is with the understanding that it must be maintained and operated. Capital investment and initial deployment is only the beginning. The mandate to “go out and do good” continues with the understanding that sustainable deployment considerations must be analyzed.

2. **Priorities will Change**

*Innovative:* Innovation in technology is key. Because ITS applications utilizing technology will continue to change, innovative solutions will continue to present themselves. PennDOT recognizes this challenge and opportunity. TSOP is predicated on innovative solutions, and PennDOT will continue to pilot appropriate applications of technology that are both inventive and appropriate for the local need.

*Integrated:* Integration is an important guiding principle. ITS deployments can no longer remain isolated islands of equipment and information. PennDOT recognizes the great investment that has been made in ITS and sees the need to integrate for statewide and regional benefits. The regional ITS Architecture efforts began this understanding of integrated operations and TSOP will continue the dialogue.

3. **Common Needs**

*Cooperative:* Cooperation is key to the success of TSOP. Since this is the first plan of its kind, it is imperative that stakeholders have input and keep an open mind. Deployment of technology has many challenges. A cooperative environment in the creation of TSOP and its use will be important.

*Coordinated:* Coordination among stakeholders participating in TSOP is essential. The regional ITS Architectures began a process to ensure regional coordination. Each of the nine regions in Pennsylvania have district and MPO/RPO-based regional groups that meet to discuss ITS and operations. Although these groups are all different, all strive for a coordinated discussion of ITS and operations issues.
4. **Right-Sized**

*Right-Sized:* Whatever the investment for operations that is made, the investment must be right-sized to the requirements. This means that the investment is appropriately sized for the need that operations will be considered in construction, and that technology will be employed as appropriate. Right-sizing implies that all community needs for mobility and safety will be met.

5. **Focus on the Fundamentals**

*Cost-Effective:* It is imperative that public dollars be invested with the utmost care. Developing, deploying, and operating cost-effective solutions offering the greatest benefit to travelers is essential.

*Efficient:* Efficiencies are frequently the consequences of smart, comprehensively planned actions. TSOP will help PennDOT and partnering MPO’s and RPO’s realize efficiencies by thinking through statewide issues and regional considerations as a unified, systemic process.

6. **Plan in the Near-Term**

*Tactical Planning:* The regional ITS Architectures completed across the state set in motion a strategic planning effort for ITS and operations. TSOP will bridge the gap from the strategic planning of the regional Architectures to the regional business planning process of long-range plans and transportation improvement programs. TSOP is a short- to mid-term tactical plan covering a multi-year effort. It will be revised approximately every 2 years.

7. **Measured Performance**

*Performance:* Sustaining investments in operations require measurements to quantify benefits. The use of appropriate and effective performance measurements – and the subsequent meeting of performance goals – will be emphasized as part of PennDOT’s ITS/operations culture.

8. **Implement Traveler Information**

*Consistency:* Where appropriate, consistent approaches, processes, deployments, measures, and operations must occur. Consistency will engender benefits in efficiencies and the mainstreaming of operations. Traveler information needs to be delivered in a timely and accurate manner and needs to be consistent. For example, as travelers cross Pennsylvania along I-80, their experiences around ITS and operations should be consistent.
over the entire journey. Gaps in that consistent experience should be avoided.

**Responsiveness:** PennDOT will engage in efforts with ITS and operations that consistently demonstrate responsiveness to travelers and operators of the transportation system. This includes being responsive to incidents and giving responsive information to travelers.

9. **Seek Win/Win**

**Win-Win:** Creating win/win scenarios for all stakeholders is an important guiding principle. Because TSOP is a plan, and not a mandate, its success depends on its ability to address the needs of a broad group of stakeholders. PennDOT is a comprehensive organization and TSOP is a comprehensive document. Projects outlined in TSOP speak to a wide range of interests and concerns for ITS and operations, including both highway and non-highway projects. This comprehensive look will help to ensure a win/win for both PennDOT and its partners.
2 BACKGROUND AND HISTORY

This chapter provides background of the roles and responsibilities of PennDOT Central Office and the districts. It also discusses the history and direction of planning and deployments that have set the stage for the future of ITS/operations in Pennsylvania.

PennDOT has long been actively engaged in managing and operating its transportation system, as documented below. In general, statewide planning has been led by the Central Office while PennDOT’s districts have embarked on numerous ITS deployments to meet their regional and local needs.

2.1 PennDOT Districts

In order to better manage and operate Pennsylvania’s extensive transportation network, PennDOT has divided the Commonwealth into eleven engineering districts. These districts are identified in Figure 2-1:

![Figure 2-1: PennDOT Engineering Districts](image)

Central Office provides leadership and guidance for statewide coordination, but it is ultimately each districts’ responsibility to manage and operate the transportation system infrastructure within its boundaries. In general, the districts are responsible for:
PennDOT districts manage both unexpected incidents and planned events in an effort to minimize adverse impacts on the transportation network and to improve traveler safety. This is accomplished by utilizing various surveillance devices and coordinating with regional traffic and emergency management agencies during incidents/events. PennDOT’s role in incident and event management has, historically, been to implement appropriate responses that restore traffic to pre-incident conditions in coordination with emergency management, maintenance and construction management, and other incident response personnel. Incident and event information is currently being shared among responsible agencies on an ad-hoc basis. Coordination presently occurs over the telephone or via email, and relies heavily on personal relationships between PennDOT and staff at other agencies.

Traffic Information Dissemination – PennDOT districts provide information to travelers using roadway equipment such as dynamic message signs (DMS) and highway advisory radio (HAR). A wide range of information is disseminated, including traffic and road conditions, closure and detour information, incident information, emergency alerts, and driver advisories. Information is provided to drivers at strategic on-road locations between the hours of 7:00am and 4:30pm.

PennDOT districts also share traffic information with other regional stakeholder agencies. PennDOT is currently sharing traffic information with 911 Communication Centers, attractions and event promoters, County EMA Centers, Information Service Providers, municipalities, the Pennsylvania State Police (PSP), the Pennsylvania Turnpike Commission (PTC), regional media outlets, and regional transit agencies. For the most part, this information is being shared through email and telephone using contact lists; by-and-large, automated systems and processes are not currently in place. The current state-of-the-practice means that information dissemination is usually sporadic or done in a limited basis.

AMBER Alerts – PennDOT coordinates with PSP and other responsible agencies during AMBER Alerts. The protocol for displaying an AMBER Alert message on a DMS requires PSP to contact the PennDOT Emergency Preparedness Liaison Officer at Central Office. The Liaison Officer then relays the information to the cognizant PennDOT district for message display on the DMS.

Traveler Information – Each district maintains a District Web Page, which links to a central PennDOT web site (http://www.dot.state.pa.us). The central site offers travelers information on construction activity, road closures, and road weather information. Additionally, some PennDOT
districts work with third-party vendors to provide customers with additional traffic condition information.

- **Roadway Maintenance and Construction** – PennDOT is responsible for scheduled and unscheduled maintenance and construction services on the roadway system. Maintenance services include hazard removal (e.g., roadway debris and dead animals), routine maintenance activities, and repair and maintenance of both ITS and non-ITS equipment.

- **Winter Maintenance** – PennDOT districts support winter road maintenance, including snow plow operations, roadway treatments (e.g., salt spraying and other anti-icing material applications), and additional snow and ice control activities. Road weather information systems (RWIS) and other sources are used to monitor environmental conditions.

- **Work Zone Management** – PennDOT districts manage work zones, controlling traffic in areas of the roadway where maintenance, construction, and utility work are underway. Work zone information is also coordinated with other agencies including the PSP, PTC, municipalities, and other traffic and emergency management agencies.

To perform these functions, PennDOT districts work together with other transportation and emergency management agencies. Communications between agencies are typically conducted by telephone and email. Automated information-sharing systems, for the most part, are not in place at this time. In general, agencies that coordinate with PennDOT districts include, but are not limited to:

- 911 Communication Centers,
- Adjacent State Transportation Agencies,
- County EMA Centers,
- Information Service Providers,
- Local Police, Fire, and EMS,
- Municipal Traffic Management Offices,
- Pennsylvania State Police,
- Pennsylvania Turnpike Commission,
- Regional Media Outlets,
- Regional Transit Agencies, and
- Towing Industry Responders.

Relationships with these agencies can and need to be further explored to help foster advances in transportation and emergency management activities throughout the Commonwealth. Potential synergies exist between PennDOT and the aforementioned agencies that can help contribute to a coordinated and
interoperable transportation system. Examples of these synergies include: (1) working with local emergency management agencies with AVL and signal preemption, (2) exploring electronic payment methods and parking management, (3) information sharing with PTC systems, (3) coordination for local special events, and (4) coordination with neighboring states.

Transportation Management Centers

The Transportation Management Center (TMC) is the centerpiece of ITS/operations in the districts. It serves as the hub of the transportation management system where information about PennDOT’s roadways is collected and combined with other operational and control data in order to manage the transportation network. Except for Districts 3-0 and 10-0, each PennDOT district contains a TMC, although they vary in size and functionality to meet the needs of the district. PennDOT TMC’s range in size and sophistication from a single workstation in a district office to an entire room or facility dedicated to operations.

Urban, suburban, and rural environments each face different transportation problems. As a result, the districts have developed “right-sized” TMC’s to meet their needs. For example, transportation conditions in Pittsburgh differ significantly from those in Erie. Consequently, the TMC that has evolved in District 1-0 (Erie) is quite different from the TMC in District 11-0 (Pittsburgh).

District 11-0 is an example of an urban district that has adapted itself to meet its transportation needs. Pittsburgh is facing an increase in congestion, especially in its suburbs. In fact, the congestion that was once limited to Pittsburgh has extended to other parts of the district and is beginning to impact neighboring districts. In order to deal with these problems, District 11-0 has taken a proactive approach towards incident/congestion management. ITS devices have been deployed throughout the district, and the roadway is monitored on a regular basis by personnel located in a sizable TMC. The TMC also assumes control of cross-district field devices in Districts 1-0 (along interstate I-79), 10-0, and 12-0.

District 1-0, on the other hand, is a rural district and faces far less congestion than District 11-0. In this case, a workstation within the district office is used to
control devices and manage the transportation network. Operations are primarily focused on peak-hour activity.

**ITS Equipment and Devices**

Districts have deployed various ITS devices to assist in operating the transportation network. ITS devices that have been deployed throughout the state include:

- **Automatic Fixed Location Anti/De-Icing Systems (AFLADS)** – AFLADS’s are used to prevent black ice and to prevent snow from bonding to the roadway surface. AFLADS’s provide additional time for PennDOT’s crews to mobilize through the early-warning periods and assist in providing safer driving conditions for the motoring public.  

  ![Figure 2-3: AFLADS](image)

- **Automatic Traffic Recorders (ATR)** – ATR’s record traffic volume using an inductive loop sensor. The loop is connected to a traffic recorder housed in a roadside cabinet. ATR’s operate 24 hours a day, 365 days per year and are polled daily via phone lines from the Bureau of Planning & Research (BPR).

- **Automatic Truck Rollover Warning System (ATRWS)** – ATRWS’s alert truck drivers to slow down when maximum safe speeds are exceeded as they approach interstate entry/exit ramps. Speed, weight, and height data is utilized to determine if an approaching truck is at risk of rollover. If it is, a message sign is activated to warn drivers to slow down.

- **Closed Circuit Television (CCTV)** – CCTV is real-time video surveillance equipment monitored and manipulated by operations personnel. For highways, CCTV’s are installed at locations where crash rates, congestion levels, or both are known to be high. The cameras dispatch real-time video images to the TMC, which means that PennDOT can be instantly aware of emergency and hazardous conditions on those roadway segments outfitted with CCTV.

- **Detector** – A sensor which detects and monitors road traffic. Detectors can provide presence detection as well as volume, occupancy, and vehicle speed. Some detectors, such as the RTMS (a radar-based, multi-zone sensor operating at the microwave band), can detect conditions in up to eight lanes. By using proper software and spacing, detector data can be used to identify and locate incidents, as well as to predict travel times.
- **Dynamic Message Signs (DMS)** – DMS’s provide real-time en-route travel advisories to travelers. For highways, the DMS’s are either centered over travel lanes or placed alongside the roadway. Messages on permanent DMS’s typically originate from TMC’s.

- **Freeway Service Patrols (FSP)** – FSP’s are designed to improve the efficiency of the highway system through the quick resolution of minor incidents, including disabled vehicles, vehicles out of gas, and other minor incidents that impede traffic flow. FSP’s patrol highways and provide assistance to disabled vehicles. FSP operators are equipped to perform minor repairs such as changing a flat tire or providing gasoline. When major repairs are needed, FSP operators often assist motorists in contacting towing companies to move the disabled vehicles.

- **Highway Advisory Radio (HAR)** – HAR’s provide travelers with real-time roadway information, including incident and weather information, agency hotline numbers, and roadway construction advisories, directly over their car radios. The Federal Communications Commission (FCC) has designated selected AM and FM frequencies for broadcast of these special travel advisories.

- **Information Exchange Network (IEN)** – The IEN is a real-time information exchange network designed to interconnect I-95 Corridor Coalition member agency facilities. The networked workstations in each agency include data and maps in a graphical environment for inputting and displaying current operational corridor-wide information.

- **Other In-Pavement Loop Sites (OIP)** – OIP’s record traffic volume via an inductive loop sensor. The loop is connected to a portable recorder in a cabinet. These sites record 7-day counts, 3 times per year, and are not configured to "dump" data via polling. Data are transferred to a diskette and forwarded to the Bureau of Planning and Research (BPR). These data are primarily used to estimate traffic growth.

- **Ramp Metering** – Ramp metering is designed to control the rate of traffic entering a freeway. The objective is to maintain a predetermined level of service on the freeway by adjusting the on-ramp traffic volume with a traffic control signal.
• **Road Weather Information Systems (RWIS)** – RWIS are typically installed at locations that experience disproportionate numbers of crashes attributable to fog, snow, or icy conditions. Sensor information, when optimally utilized, can be used to more effectively deploy road maintenance resources and issue weather-specific warnings to drivers and general advisories to motorists. Weather sensors are connected to remote-processing units located in the field which measure, collect, and pre-process environmental data and then transmit the information to operations centers, where staff can act on the information.

• **Weigh-in-Motion (WIM)** – Weight-measuring equipment, including fixed sensors embedded in the pavement, is used to gauge the approximate weight of commercial vehicles traveling at highway speeds. They provide gross indications as to whether trucks are operating within allowable weight limits. WIM stations can also be used to assess highway usage taxes on commercial vehicles.

The types of ITS equipment currently utilized by individual PennDOT districts are summarized in Table 2-1, below.
<table>
<thead>
<tr>
<th>ITS Equipment</th>
<th>District 1-0</th>
<th>District 2-0</th>
<th>District 3-0</th>
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2.2 District Directions

This section of the report examines current conditions, equipment, and activities in each PennDOT engineering district. Although their core functions are similar, each district has tended, historically, to utilize ITS technologies and perform operational-like activities in its own unique way. Until now, there has been minimal guidance on the subject of operations from PennDOT Central.

**District 1-0**

Located in the northwest part of the state, District 1-0 borders New York and Ohio. It is comprised of six counties – Crawford, Erie, Forest, Mercer, Venango, and Warren – and is home to nearly 640,000 people. District 1-0 is primarily a rural area with unique transportation challenges. Current ITS/operations focus includes:

- Developing, maintaining, and managing an adequate, safe, accessible, and environmentally-sound intermodal transportation network that provides for the efficient movement of people and goods.
- Identifying and responding, safely and efficiently, to roadway emergencies and incidents.
- Furnishing road and traffic conditions data, transit data, travel advisories, routing information, etc. to travelers and commuters.
- Increasing winter weather monitoring coordination to reduce the number of weather-related incidents.

ITS devices that have been deployed across the District include AFLADS, ATR, DMS, HAR, OIP, RWIS, and WIM. Several of these devices are controlled from a workstation in the District 1-0 office. This workstation functions as the TMC for the district.

District 1-0 faces harsh winter weather, perhaps the most intense of any district in the state. During cold weather, the district emphasizes winter-time activities. Most construction activities are halted during these months, and the National Weather Service (NWS) and RWIS stations are monitored regularly. PennDOT maintenance crews are dispatched, as needed,

*Figure 2-7: Winter Operations*
to clear roadways. District 1-0 also sends daily weather reports to the District 11-0 TMC.

In 1997, District 1-0 completed an *I-79 Early Deployment Program Study* in conjunction with Districts 10-0, 11-0, and 12-0. Other District 1-0 developments have included the establishment of an ITS Task Force, development of a Strategic Plan in 2004, and an RWIS/DMS Pilot Project.

**District 2-0**

District 2-0 is located in North-Central Pennsylvania and consists of nine counties: Cameron, Centre, Clearfield, Clinton, Elk, Juniata, McKean, Mifflin, and Potter. The region is highly rural. Only State College has a population that exceeds 50,000; hence, the district is classified as a “small urban area.” Some of the challenges faced by District 2-0 personnel include the following:

- During the winter, snow and ice can be harsh impediments for motorists traveling through the district.

- Because District 2-0 encompasses a large, sparsely-populated geographic area, responding in a timely fashion to incidents and emergencies can be difficult.

- The Pennsylvania State University’s Main Campus is home to over 40,000 students per school year. During the Fall, the Penn State Football Stadium typically attracts over 90,000 fans per game to State College. These events draw from people throughout the Commonwealth of Pennsylvania. As a result, not only is District 2-0 impacted by the influx of fans, but Districts 1-0, 3-0, 8-0, 9-0, and 10-0 are impacted as well.

PennDOT has established a TMC in the District 2-0 office in Clearfield to operate the transportation system. The primary focus of the TMC is on I-80 and I-99, the only interstates that traverse the district. Devices controlled by the TMC include DMS and HAR. Other devices deployed in District 2-0 include AFLADS, ATR, OIP, RWIS, and WIM.

The district completed an *ITS Strategic Plan* in December 2004. A broad number of stakeholders participated in development of this plan.
**District 3-0**

District 3-0 is located in North-Central Pennsylvania and consists of nine mostly rural counties: Bradford, Columbia, Lycoming, Montour, Northumberland, Snyder, Sullivan, Tioga, and Union. Williamsport is the largest city in the region; however, because the city is located in an east-west valley, the main highway corridor through the region, I-80, does not pass through Williamsport. Instead, access to Williamsport is via I-180, US 15, or US-220.

District 3-0 is in the preliminary stages of establishing an ITS program. Although its transportation problems may not be as significant as more urban areas, District 3-0 has realized the importance of ITS/operations.

District 3-0 has deployed several field devices, including ATR, DMS, HAR, OIP, RWIS, and WIM. Many of these devices are currently being programmed and operated by county personnel.

Other activities in the District include pre-assigned detour routes which can be used in the event of major incidents that necessitate closure of an interstate highway. Current plans call for disseminating Information about which detour routes to follow using DMS, HAR, and other ITS systems.

**District 4-0**

District 4-0 is located in the northeastern part of the state and is comprised of six counties: Lackawanna, Luzerne, Pike, Susquehanna, Wayne, and Wyoming. The Scranton/Wilkes-Barre metropolitan area is the region’s main urban concentration. All of the interstate highways within the district pass through Scranton/Wilkes-Barre, with the exception of I-80, which traverses the southern border of the district. The bulk of the district’s population lives in or near the Scranton/Wilkes-Barre metropolitan area. District 4-0 is continuing to grow in population. A 6.45% increase in population is expected between 2004 and 2020.

Current activities in District 4-0 are focused around the District TMC, which consists of a workstation housed at the district office. The workstation controls field devices and serves as the hub for coordination with other transportation and emergency management agencies. The

**Figure 2-9: Detour Signs**

**Figure 2-10: District 4-0 TMC**
Carbondale Technology Transfer Center (CTTC) Project is planned as an upgrade to the TMC. The project includes a new dedicated facility and the integration of hardware and software under a single workstation.

As in District 3-0, pre-assigned detour signs have been deployed and are used in the event of a major incident on, or closure of, an interstate highway. Mile markers (intermediate reference markers) installed along 50 miles of I-81 delineate every one-tenth of a mile location. The markers are used to more accurately locate incidents and improve the reliability of roadway condition information passed on to motorists.

District 4-0 has completed a Scranton/Wilkes-Barre Early Deployment Program Study which was completed in 1997. The Early Deployment Program defined a baseline set of potential ITS investments for the district.

**District 5-0**

District 5-0 is located in the eastern part of the state and is comprised of six counties: Berks, Carbon, Lehigh, Monroe, Northampton, and Schuylkill. District 5-0 is one of the fastest growing districts in Pennsylvania. The influx in population is presumably a consequence of suburban growth extending out from New York and Philadelphia. The district consists of an unusual blend of urban and rural areas. Allentown/Bethlehem/Easton and Reading are the two main urban concentrations in the district. A large proportion of the district’s population lives in or near these two metropolitan areas and this has resulted in serious congestion issues, particularly in and around Allentown. Congestion also occurs regularly in the winter season in the Poconos areas.

In 1999, an Allentown-Bethlehem-Easton Area Early Deployment Program Study was completed. The Early Deployment Program developed a long-range and immediate action plan for deploying ITS technologies in the Lehigh Valley. This plan is still being used and has led to several deployments across the district.

District 5-0 recently established a TMC. The TMC consists of a video wall and operating software that enable PennDOT personnel to take a proactive role in operations. The TMC is used to monitor CCTV, broadcast HAR and DMS messages, control ramp meters, and dispatch the Freeway Service Patrol.

PennDOT District 5-0 is also working to manage and mitigate congestion. Along I-80, a Congestion Alert System has been deployed to notify motorists of upcoming congestion in Tannersville. The system detects queue backups and
sends messages to portable signs and warns travelers of slow traffic ahead. When appropriate, it can direct drivers to use alternate exit ramps.

Mile markers (intermediate reference markers) are also being utilized in District 5-0 to assist in incident management. The mile-marker system consists of signs along major freeways at one-tenth mile intervals that assist in identifying motorist locations during incidents.

The district is considering video-sharing with several partners, including 911 Communication Centers, PSP, and the media.

**District 6-0**

With a population of approximately 3.8 million people, this five-county district consists of Bucks, Chester, Delaware, Montgomery, and Philadelphia. It is the most populated district in the Commonwealth. Urban and suburban congestion has been a longstanding problem in District 6-0. The Delaware Valley Regional Planning Commission (DVRPC) is extremely proactive and has taken the lead in promoting ITS in the Delaware Valley. Together, PennDOT and DVRPC have created one of the most mature operations programs in Pennsylvania.

Philadelphia is ranked as one of the most congested urban areas in the country, according to the 2005 Texas Transportation Institute’s (TTI) Urban Mobility Study. The study shows that Philadelphia commuters experience an average of 38 hours of delay per year due to congestion during rush hour. The area is ranked as the 28th most congested area in the country. Trends show that congestion has increased since 1982.15

District 6-0 has embarked on several efforts to alleviate this congestion and is on the cutting edge of ITS/operations in Pennsylvania. In 1992, a Traffic and Incident Management System (TIMS) Study was completed. This was the first study conducted in the Commonwealth that focused on ITS. This study was followed up in 1993, with the completion of the District 6-0 TMC. Recently, the TMC began staffing round-the-clock, on a 24/7-basis.

District 6-0 has deployed an array of ITS equipment along its highways to help manage the transportation network. ITS devices used to manage congestion include CCTV, detectors, DMS, HAR, and ramp meters.

Traveler Information has been prominent in District 6-0. Information Service Providers and the media provide traveler information via SmarTraveler (www.smartraveler.com) and Traffic.com (www.traffic.com). The interfaces for these websites are depicted in Figure 2-12, below.

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15 The 2005 Urban Mobility Report.
In 2001, DVRPC completed the state’s first Regional ITS Architecture. The document is a planning resource that helps state, local, and regional transportation agencies identify information-sharing possibilities. The region is currently studying establishment of a system, the Regional Integrated Multi-Modal Information Sharing System (RIMIS), which is intended to enable transportation and emergency management agencies to share information across the Region.

**District 8-0**

Located in the south central part of the state, District 8-0 is comprised of eight counties: Adams, Cumberland, Dauphin, Franklin, Lancaster, Lebanon, Perry, and York. The district includes the capital of Pennsylvania, Harrisburg. As the "Capital Region," this district is home to the headquarters for PennDOT, PEMA, PSP, and PTC. District 8-0 is the fastest growing district in the Commonwealth—a 13.67-percent increase in population is expected between 2004 and 2020.

In 1999, District 8-0 completed its Harrisburg Metro Early Deployment Program Study. The study focused on enhancing the region’s ability to address existing and future transportation needs. It identified opportunities for improved communication and management activities between regional agencies; it also recommended systems for achieving key transportation management goals.

The Early Deployment Program made short-, medium-, and long-term recommendations. The short-term (0-4 years) recommendations are currently being addressed by the district. One-tenth mile markers (intermediate reference markers) have been deployed along with signed detour routes on PennDOT roadways. The district has also deployed a freeway service patrol for the Capital Beltway and is studying the desirability of establishing a permanent TMC in the District. The current TMC is used to control devices throughout the district.

Medium Term (5-8 years) recommendations include building a permanent TMC, continuing ITS equipment deployments, deploying automatic vehicle location
(AVL) systems, and improving activities related to commercial vehicle operations. Covering the Metro Area with a traffic management system and providing traveler information to the public and supporting in-vehicle devices are long term (8-12+ years) recommendations from the Early Deployment Program.

**District 9-0**

PennDOT District 9-0 is situated in the Southern Alleghenies region of Pennsylvania, and covers six counties: Bedford, Blair, Cambria, Fulton, Huntingdon, and Somerset.

District 9-0 has taken an unusual approach to managing its transportation system. District 9-0 established a TMC, even though the District Traffic Unit only has resources to operate 7:00AM-4:30PM. The district faced the challenge of how to operate the system outside of normal working hours. The solution was to hand over operations to the Blair County 911 Communications Center — a 24/7 center — after working hours. Additional equipment (depicted to the right) has been installed in the 911 Center. Protocol and procedures have been established that enable the 911 Center to assume TMC functions during non-working hours.

The collaboration with Blair County has led to benefits for PennDOT as well as the 911 Center. The agreement helped PennDOT improve incident response time. Also, managing the transportation network on a 24/7-basis lays the foundation for a potentially safer highway system with reduced secondary crashes; motorists can be provided with alternate route information during incidents or other events at virtually any time, day or night. PennDOT was able to achieve round-the-clock activity without increasing its staff, and the 911 Center received equipment and response capabilities it might not otherwise have had.

District 9-0 is actively seeking other partnerships. It is currently looking to share operational responsibilities with the PTC and its neighboring PennDOT Districts: 2-0, 8-0, 10-0, and 12-0.

**District 10-0**

District 10-0 includes Armstrong, Butler, Clarion, Indiana, and Jefferson counties. The district office is located in White Township in Indiana County. District 10-0 is a rural area and is in the preliminary stages of developing an ITS program. The district is unusually situated in that it is surrounded by five other PennDOT districts (1-0, 2-0, 9-0, 11-0, and 12-0) and is the only district that does not border
another state. Coordination between District 10-0 and districts is an important near-term goal for this region.

In an early effort at regional coordination, District 11-0 has started operating as a “Regional Transportation Management Center” (RTMC) and District 10-0 has relinquished some control of its ITS devices to its larger, more urban neighbor. Districts 1-0, 10-0, 11-0, and 12-0 all worked together on the I-79 Early Deployment Program Study; the plan was completed in 1997.

District 10-0 has deployed an innovative ITS technology along PA-38 that improves safety at intersections. This intersection crash avoidance system notifies mainline and side roads vehicles of crossing traffic. Utilizing detectors and message signs the system sends motorists warning of crossing vehicles at the intersection. Depiction of the intersection crash avoidance system is depicted in figure 2-14.

**District 11-0**

Situated in western Pennsylvania, PennDOT Engineering District 11-0 encompasses Allegheny, Beaver, and Lawrence counties. The district includes the City of Pittsburgh, the main urban locale in western Pennsylvania.

The 2005 TTI Urban Mobility Study shows that Pittsburgh motorists experience 14 hours of delay per rush-hour commuter per year\(^\text{16}\). Unlike many urban areas, trends show, however, that congestion in Pittsburgh has leveled off over the past 10 years.

District 11-0’s TMC became operational in 1998. It is located in a 5,200 square-foot building and includes a fully integrated centralized software system. This fully integrated software system is under complete configuration management control and comprises eight integrated software subsystems including alarm, CCTV, HAR, DMS, HOV, vehicle detection, and traffic management. Also included are 6 operator workstations, a media partner room, 18 CCTV monitors, a rear-projection screen, and a real-time traffic conditions map. TMC workstations also exist at the Fort Pitt and Squirrel Hill Tunnels along with adjacent districts and the Pittsburgh State Police Barracks. Functions of the TMC include:

- Detecting and verifying incidents using microwave detectors and CCTV,
- Providing traveler Information via DMS and HAR,

\(^{16}\) The 2005 Urban Mobility Report.
• Coordinating the deployment of the Freeway Service Patrol on I-279, I-579, I-376, US-22/30, PA-60, and HOV lanes during the morning and afternoon peak hours,

• Integrated HOV system with interlock safety features with remote operation from the TMC,

• Real-time video sharing with ABC, CBS, and NBC affiliate television stations,

• Real-time camera snapshots on district website every 1 ½ minutes,

• Partnering with Pittsburgh sports teams by providing travel information on DMS’s, and

• Partnering with the Port Authority Transit integration and video-sharing of their Wabash HOV facility.

Traveler Information has been prominent in District 11-0. PennDOT has worked with Information Service Providers (ISP) to provide motorists with route-specific travel reports and construction/special event information. Metro Traffic broadcast live from the TMC weekdays from 5:00 a.m. to 7:00 p.m., while KDKA radio, Metro Traffic, and Traffic.com provide real-time traffic information for the Pittsburgh region from the TMC during the morning and afternoon peak periods. Real-time traffic information is available on Traffic.com (www.traffic.com).

As noted previously, District 11-0 has recognized the importance of and need for regional coordination and operations. The District 11-0 Pittsburgh Regional TMC is currently operating devices in neighboring Districts 1-0 (along interstate I-79 and I-80), 10-0 (I-79), and 12-0 (I-70). Some of the concepts and approaches pioneered by District 11-0 were encapsulated in the Transportation Management Approach, discussed in Section 2.4 of this document.

District 12-0
PennDOT District 12-0 is located in the Southwestern corner of Pennsylvania and covers four counties: Fayette, Greene, Washington, and Westmoreland. District 12-0 is similar to District 10-0, in that it is primarily a rural district, is in the early stages of establishing an ITS program, and is relinquishing control of some ITS devices to District 11-0.

ITS devices deployed in the district include AFLADS, ATR, DMS, HAR, OIP, and RWIS. The District intends to deploy a TMC to:

- Gather roadway data from sensors and CCTV cameras,
- Control various ITS field devices,
- Disseminate information to the public and other agencies, and
- Coordinate incident response throughout the district.

District 12-0 was a partner with the surrounding districts in developing the I-79 Early Deployment Program Study

2.3 PennDOT Central Office

Within Central Office, the Bureau of Highway Safety and Traffic Engineering (BHSTE) is responsible for congestion management and highway operations using ITS technology and traffic signalization. BHSTE provides leadership and guidance for statewide coordination to the PennDOT districts. BHSTE is actively involved in supporting a better understanding of operations through a number of activities.

**BHSTE’s Mission**

To provide leadership, guidance, and support for advancing effective highway safety and congestion management efforts to meet the needs of our customers and partners.

As PennDOT’s districts continue to utilize technology to support local and sometimes regional operations, PennDOT Central Office has been completing plans and guidance documents needed to sustain a growing ITS and operations program. A chronological listing of some of these endeavors, dating back to 1996, is provided below:

- The Central Office completed its first Statewide ITS Strategic Plan in 1996. The purpose of the Strategic Plan was to (1) improve safety, efficiency, and reliability, (2) identify ITS funding opportunities, (3) establish an ITS multidisciplinary structure, (4) foster ITS partnerships, (5)
expedite ITS service delivery, and (6) heighten ITS awareness. This plan was updated in 1999 and 2000.

- In 1997, the Department gained inclusion of a Highway Systems Technology Appropriation 140 (currently known as Appropriation 576) in its budget as approved by the General Assembly. Funds from Appropriation 576, along with A-576 in MySAP continue to be used today to fund ITS and operations activity.

- BHSTE created the ITS/Congestion Management Division in 1997. The Division is responsible for congestion management and highway operations through the use of ITS and traffic signalization. It develops and implements programs and initiatives to assist districts and their partners in managing recurring and non-recurring traffic congestion. It provides liaison and communications efforts on the benefits of ITS to urban, suburban, and rural areas throughout the Commonwealth.

- The Transportation Management Center (TMC) Operations Guidelines were completed in 2002. These guidelines provided a useful reference information for PennDOT staff to gain knowledge about operations centers, how they are structured, how they operate, and other considerations.

- In 2003, PennDOT and the Federal Highway Administration (FHWA) evaluated ITS/operations projects in Pennsylvania and completed an Independent Oversight Program (IOP) Review of “Operations and ITS Efforts.” The effort helped to identify what projects have worked, what has not worked, and what should be done in the future.

- From 2003-2005, PennDOT took a statewide approach to developing seven Regional ITS Architectures. PennDOT, FHWA, PSP, and the planning partners championed the effort. The Architectures are planning tool resources that help state, local, and regional transportation agencies identify information-sharing possibilities.

- In 2004, PennDOT developed a Transportation Management Approach. This effort looked at enhancing existing TMC’s, and establishing new TMC’s, to monitor and control the transportation system in partnership with other transportation operations providers.

- In 2005, a Transportation Advisory Committee (TAC) Study examined Pennsylvania’s traffic signal systems and the policies and practices associated with their management and operation. In particular, traffic signal systems were considered in the context of their role in congestion relief.
2.4 Transportation Management Approach

In 2004, PennDOT developed a Transportation Management Approach (TMA.) The TMA is a concept of how to produce managed operations and offers a potential methodology for implementing 24/7 operations in Pennsylvania. At a minimum, this approach required coverage on AMBER Alerts, weather emergencies, and major incidents. The TMA was needed for the development of the Regional ITS Architectures and provided levels of activities that were not prescriptive.

A number of issues and areas of concern compelled PennDOT to develop or adopt new operational approaches in the TMA. These areas of influence, called “drivers,” include:

- **Economic Development** – An important statewide issue influenced by a multiplicity of factors. Economic development and a strong transportation system are intrinsically linked. Increasingly, states, regions, and localities are acknowledging and building on the synergistic relationship between economic development and transportation.

- **Safety, Security, and Mobility** – These are the issues that are first and foremost in the minds of all travelers. Tools that increase safety, promote security, and advance mobility need to be encouraged and supported.

- **Congestion Management** – Congestion is a sign of a healthy economy; however, if not kept in check, congestion may have negative consequences.

- **Build Capacity** – For decades, this was the model of choice for transportation professionals. Although not at a total standstill, building new capacity will continue to decrease under current and forecasted projections.

- **Maintain Capacity** – A non-trivial task, almost always requiring dedicated funding to keep existing facilities in proper condition.

- **Manage Capacity** – Operating capacity is a relatively new concept that entails looking at the entire transportation system of a region and operating it in a manner that optimizes available capacity. New technology tools and techniques are available to PennDOT for managing capacity. These tools and techniques are called ITS.

- **Reduce Demand** – Other activities are helping to reduce demand on the transportation system. These activities include intermodal alternatives,
telecommuting options, and creative land use techniques. Some communities are using the latter to reduce demand for – and dependency on – automobiles.

The TMA focused on the “manage capacity” driver. It emphasized PennDOT’s role to centrally lead and manage the foundational elements of ITS and develop more specific plans to guide regional deployment efforts.

The problem statement for this driver assumed that:

- ITS deployments must be driven by regional needs and statewide direction.
- To date, however, ITS has been driven more by regional needs than by statewide direction.

Hence, the issue becomes:

- Further deployment of ITS requires greater statewide direction and coordination to:
  - Focus and manage limited resources,
  - Ensure statewide consistency, and
  - Deploy ITS technologies and services more effectively.

The TMA uses proven traditional processes that incorporate non-transitional tools and techniques.

The approach is comprehensive, incorporating issues dealing with:

- Planning and funding,
- Software and data,
- Hardware and communications, and
- People.

Statewide guidance and direction will be given without undermining district-level authority and autonomy. Specifically, guidance will be given to:

- Enhance direction in the state through production of a baseline vision that will evolve from the Regional ITS Architectures to the Long-Range Transportation Plan, and

- Provide flexibility to meet regional needs.

The TMA looked at enhancing existing TMC’s and establishing new TMC’s to monitor and control the transportation system in partnership with other transportation operations providers. The document offered a written summary of
the prospective PennDOT management approach. Although not yet policy, the document was used to help transportation professionals understand PennDOT’s approach to statewide transportation management.

The TMA defined a preliminary plan for statewide coordination. The approach defined three levels of TMC activity for the state, with each level having associated functions. The high-level concepts of operations for each of these centers with generalized functions are identified below:

**Level I – District Transportation Management Center – TMC**
- Minimum level-of-service
  - Proactive operations during peak periods
  - Control DMS, HAR, etc.
  - Participate in AMBER Alert
  - On-call to respond to incidents during off-peak periods
- This level is primarily involved with operating equipment during peak periods and may not be involved in internal/cross-district management

**Level II – Regional Transportation Management Center – RTMC**
- Proactive incident/congestion management
- 24/7 operations
- Assumes control of cross-district TMC’s during off-peak periods
- This level is primarily involved with operating equipment and may be involved in internal/cross-district transportation management

**Level III – Statewide Transportation Management Center – STMC**
- Coordinates incident, emergency, and interstate and intrastate events
- Serves as back-up Operations Management to RTMC’s
- This level is primarily concerned with coordinating multi-district/state operations, establishing a statewide data repository, and providing redundant operations for RTMC’s

Functions for each level include:

- Levels I, II and III
  - Incident management
  - Traveler information/advisories
  - Special-events management
  - AMBER Alert
  - Monitor roadway conditions and status
  - Coordinate with other agencies as appropriate

- Level I only
  - Proactive peak period operations; on-call during off-peak periods
• Level II only
  o Internal district proactive operations 24X7
  o Operates internal-district ITS equipment
  o Off-peak control of designated functions in other districts

• Level III only
  o Back-up (redundant) control for Level II

• Levels II and III
  o 24x7 operations
  o Supporting ATIS systems (if not done privately)
  o Snow operations

• Level III only
  o Central data repository
  o Coordination of statewide operations
  o Coordination among districts/other states
  o Coordination with other State agencies (e.g., PSP, PTC, PEMA)

As part of TSOP-09: STMC and TMC’s a Statewide Strategy will be identified that assigns a level of TMC (TMC or RTMC) to each PennDOT district. Further detail on this project is contained in Chapter 4 of this document. The following figure shows the corridor-based coverage areas that will be included in the Statewide Strategy:
The TMA was developed by PennDOT Central Office and verified by the districts in 2004. Since development of the concept, the TMA has been introduced to executives and engineers from various agencies across the state. The response to the TMA has generally been positive, both internally and externally.
3 GOALS DISCUSSION

PennDOT’s history shows that the Department has taken an active role in ITS/operations. District planning and deployments have been conducted to meet the local needs, while Central Office planning has begun to lay out a direction for statewide operations. PennDOT has learned from its past and is continuing to move forward in ITS/operations. The following is a discussion of TSOP common themes, issues, directions, and trends as they are matched with TSOP Goals.

**TSOP Goals:**

1. Build and Maintain a Transportation Operations Foundation
2. Improve Highway Operational Performance
3. Improve Safety
4. Improve Security

Note: Incident Management and Traveler Information have applicability to all four goals.

3.1 Goal #1: Build and Maintain Transportation Operations Foundation

*Transportation Management Centers*

Technology applications and the resulting operations of this equipment requires infrastructure. The operation of ITS equipment in PennDOT has logically occurred in centers. These centers have evolved over time, depending on the amount of equipment deployed and operated by the center. For the most part, center activity revolves around the equipment. Throughout Pennsylvania, these centers have been right-sized to meet the needs of the districts. This concept of right-sizing will continue to be used with regard to future centers.

Over the past two years, PennDOT has been involved in the development of Regional ITS Architectures. Overall, nine Architectures were completed covering every county in the state – seven through a statewide effort and two initiated at the regional level. As part of the Regional ITS Architecture process, the TMA was defined. The TMA was needed, in part, to help define the future need for PennDOT centers as well as their interrelationships. The TMA outlined centers in each of the PennDOT districts, right-sized to fit regional and local needs. The TMA also outlined the future need for a center in Harrisburg, primarily functioning during statewide crises and emergencies.
ITS equipment is also required to go along with the centers. In order to fulfill the managed interstate concept, ITS equipment will need to be strategically deployed along the interstate to provide consistency and standardization that exceeds the expectations of travelers. PennDOT has done a commendable job deploying valuable ITS equipment throughout the state, but the deployments are not comprehensive. From a statewide perspective, there are gaps in ITS device coverage along interstates. As motorists travel from region-to-region, the consistent availability of information across the state should become standard practice.

Deployment and maintenance of ITS equipment must, ideally, be shaped by statewide directions and requirements conjoined with local and regional needs. Therefore, the districts and the state will have to work together to determine what needed equipment is needed and a plan for funding, scheduling, and deploying the equipment.

**ITS Equipment Gaps**

The need for a fully managed interstate has also been articulated by PennDOT. A transportation system equipped with ITS technology deployed at strategic locations is needed to support incident management and to provide traveler information. Each link of Pennsylvania’s interstate system is important and carefully maintained. With the same importance, each link should be instrumented with the appropriate technology to ensure efficient incident management and traveler information dissemination. Travelers expect consistency and standardization.

The transportation system maintains a high level of consistency and standardization throughout the state. From road pavement width and design to signage and landscaping, PennDOT has invested resources to understand, develop, and follow consistent and standard practices addressing these and other transportation-related elements. In the same way, incident management and traveler information need to be consistent and standardized. To begin achieving this consistency, PennDOT needs to establish statewide guidelines and parameters.

**Telecommunications and IT**

One area of infrastructure that is absolutely critical to successful transportation operations is telecommunications. Communicating from field devices to centers and from centers-to-centers is part of the transfer of information needed for
successful operations. PennDOT has begun the difficult task of working inter-departmentally to ensure that telecommunications needs are examined and planned, as appropriate, for future need. One concept being explored by PennDOT is a center-to-center Publish-and-Subscribe Information Sharing Network. Operating much like a library, information would, under this concept, be published to the network by a center and then a center could subscribe to the any part of the community of information available on the network. The Justice Network (JNET) is being explored as a potential vehicle for this effort. JNET is currently being used for information-sharing on criminal cases, is currently connected to each county in the State, and has capacity available to possibly support the transportation effort.

Another aspect of telecommunication is the processing and procedures for field communications. PennDOT understands that there is a need to look statewide both at (1) field ITS field communication requirements, and (2) center communication requirements. Better understanding the requirements from a statewide perspective will help each district create efficiencies and eliminate redundant efforts.

**ITS Maintenance**

Appropriate deployment of technology is not the end. Maintenance practice and procedures are also important. Currently, a number of maintenance contracts exist within the PennDOT districts. Deployed ITS equipment is manufactured by various vendors that have various warranty and maintenance clauses. District approaches have proven in some cases to be the right approach, and in other cases, regional maintenance contracts have been explored. From a statewide perspective, maintenance practice and procedures may be more efficiently approached. Asset database management of equipment, vendor specifications, warranties, maintenance, and other issues can be tracked for trend analysis and information sharing. Experience has shown that valuable information is gained by operating and maintaining specific ITS equipment. Sharing of this information is critical.

**Organizational Change**

PennDOT owns and operates maintenance vehicles, conducts snow operations in winter, and operates ITS equipment. All three types of PennDOT operations have value. The difference in these activities is that the organization, processes, procedures, planning, funding, and staffing are fully understood and appreciated.
for the first two functional activities, but much less understood and appreciated for the third.

Organizational change comes about over time. As ITS equipment, centers, and eventually operations all become more common, this organizational change will continue to occur.

This may be the perfect time in PennDOT’s own evolution to consider the impact of ITS operations on PennDOT as an organization. Many states are discovering the need to examine and change the DOT culture to accommodate ITS and operations. The American Association of State Highway and Transportation Officials (AASHTO) is supporting this examination. One of the first steps is to recognize and understand the effects that ITS and operations will likely have on staffing, job definition, and growth. In general, ITS can be expected to have the most significant impacts in the maintenance and traffic areas; however, design, construction, and administration will also be affected. Understanding and anticipating these effects, and developing an organizational approach for incorporating these outcomes, will eventually be needed.

Policy

Policies will undoubtedly be needed to realize the full potential of technology benefits. 24/7 operations, AMBER Alerts, and public/private partnerships are just a few of the policy issues that may need to be tackled. But even with policies articulated, without the proper planning that leads to funding, ITS/operations will not likely survive. Linkages of ITS Architectures, Regional Operations Plans (ROP’s), Long-Range Plans, TSOP, and Transportation Improvement Plans (TIP’s) are just some of the issues that will need to be fully expressed in clear terms. It will take time for the new policy perspectives to take hold. In the meantime, PennDOT Central Office and the engineering districts will need to work with regional MPO’s and RPO’s to organize and mainstream a process for planning and funding ITS and operations into the future.

Planning and Funding

Mainstreaming of ITS and operations is important for planning and funding. It is also important to look at ITS and operations in the traditional fields of traffic engineering and transportation planning. These professional fields lead the way to the transportation network of the future. By mainstreaming ITS and operations into these traditional fields, PennDOT can ensure that all possibilities are explored for needed improvements using scarce resources efficiently. There have been “best practices” for doing these things in Pennsylvania, but the experience is inconsistent and depends on the project team in place.
Performance Measures

Performance metrics are needed to ensure that reliability and accountability are integral parts of the process when decisions are made on how best to spend limited transportation funds. Bridge and pavements have long measured performance through data collection, analysis, and needs justification. Operations now needs to do much the same. The performance of the center operation or ITS equipment can be measured. These measurements can be assessed and trend analyses can be performed. Comparisons to other centers and equipment can also take place. This becomes very useful for ensuring what was established as performance is achieved, and if not, mitigation plans can be put into place to help support the efforts to ensure performance gains are achieved. Also, as performance gains are realized, the performance bar often needs to be raised yet higher still so that improved operations are always on the horizon. Established and measured performance will also help ensure that benefits are clearly articulated and justification for a given operation or set of ITS equipment is always at hand. Measures can also be helpful to the public so they can understand speed, delay, and reliability. Questions about what PennDOT should invest in to achieve results – and what achievement has occurred for the investment made – should be answered by performance metrics.

3.2 Goal # 2: Improve Highway Operational Performance

Congested Corridors

As discussed earlier in this report, congestion is a household word for Americans, yet it has different meaning to travelers throughout the nation. Pennsylvania is no different is this regard. Travel through Lancaster, for example, on a Saturday in the Summer, and congestion is experienced. Travel in central Pennsylvania on a Saturday in the Fall, and congestion is experienced. Both urban and rural areas of the state are routinely congested. Tolerance for congestion varies by the individual. But regardless of the perceptions, congestion is real and affects travelers every day.

PennDOT is actively seeking solutions to congestion by adding capacity (physical improvements) and using technology to manage and operate the transportation system. Throughout the state, there are examples of successful projects that have tackled this issue. In Philadelphia, one area of congestion is the Schuykill Expressway. Over the past year, PennDOT led the effort to relieve congestion on this corridor. The project looked at updating the
infrastructure (adding capacity), as well as possibly employing operational approaches. Transit, arterial, freeway, and other supporting technology applications were examined. The results were an interwoven set of community-based solutions to tackle the congestion issue.

PennDOT recognizes the need to lead similar efforts throughout the state. The identification of congested corridors is the first step towards paving the way to improving highway operations. By comprehensively examining the community-based issues of a corridor – i.e., getting from point A to point B – PennDOT may be able to discover solutions that may never have been thought to work. Technology can play a large part in solving some of these problems. For example, some areas of the state, such as the I-79, I-80, and I-90 corridors, experience very tough and unpredictable winter weather. Through technology, travelers can get information before they leave home from television forecast and web sources. Enroute, however, most travelers have only their radio, and as bad weather descends, they need information. PennDOT is collecting weather information throughout the state. Getting this information to travelers using in-vehicle and roadside devices will not only be a challenge, but will also provide a consistent, uniform solution.

**Signals**

Part of the state’s critical infrastructure resides along arterial roadways. Many arterial roadways in the Commonwealth are signalized, some heavily. PennDOT provides permitting for signals, but does not operate signals. Municipalities, for the most part, operate signals. There are approximately 13,600 signals across the Commonwealth that are owned and operated by 1,192 municipalities.

The Traffic Signal Enhancement Initiative (TSEI) and the Congested Corridor Improvement Program (CCIP) are two initiatives focused on optimizing the performance of traffic signals in Pennsylvania. TSEI partners PennDOT with “municipalities to identify traffic signals that need to be retimed, upgraded, or better integrated into an overall congestion management strategy.” Under CCIP, PennDOT and its partners identify congested corridors across the state and define and implement improvements to alleviate congestion.

This past year, PennDOT conducted the TAC Study to further explore and document the issues around this decentralized operation of traffic signals. A number of recommendations came out of this report. PennDOT will need to prioritize these recommendations as this issue is tackled. From an efficiency perspective, operational enhancements that result in regional- or corridor-wide coordination of signal timings could potentially have a very positive impact on
mobility along arterials. Use of advanced technology to maximize the capacity of the existing arterial infrastructure is, of course, the desired outcome.

**Multimodal Efforts**

The majority of PennDOT’s focus and staff are involved primarily in the design, maintenance, and construction of the roadway network. However, there are also efforts in multimodal activity. PennDOT does, for example, have staff involved in transit, rail, air, freight, and port activity. Project efforts suggested as part of TSOP may be incorporated into other activities under consideration – either by PennDOT or PennDOT’s transportation partners. Operation of these non-highway activities are important and will have direct and indirect impacts on highway capacity, safety, and efficiencies. PennDOT recognizes that the state has one transportation system with many parts. The economic health of the Commonwealth is affected by the health of the entire transportation system – both the highway and non-highway elements.

**Transit**

Transit operations utilizing technology is a growing trend in the United States. Many transit agencies in Pennsylvania do have active systems such as automated dispatching, automated vehicle location, and rider information systems. There is a growing interest in this area, as efficiencies are being realized that make the capital and maintenance investment cost-effective. PennDOT is supporting these trends and may ultimately play a more active role in statewide planning and technology transfer.

**Commercial Vehicles**

Commercial vehicle operations (CVO) is a changing environment. Permitting and credentialing of trucks is a PennDOT responsibility. Enforcement of trucks is now the responsibility of PSP. The Pennsylvania Motor Carrier Safety Advisory Committee is an organization appointed by the governor that brings PSP, PennDOT, and others in the industry together quarterly to discuss issues. Technology is playing a larger role in all aspects of commercial vehicle activity. PSP may begin to look at technology to help enforce weight regulations and perform driver-vehicle safety inspections; it may ultimately look to permanent facilities for security, safety, and regulatory enforcement.
Freight

Freight movement is growing in Pennsylvania. Freight and warehousing activities have been key factors to economic growth and jobs. The increase in freight movement has also created quality-of-life, safety, and congestion concerns. Freight flows are increasing and forecasts show that this increase will continue well into the future. The Harrisburg metropolitan area is beginning an effort in planning for this future. The region has begun a Goods Movement Study to document the impacts of freight on the region and to begin to plan for the future. As this study concludes and benefits are realized, PennDOT may need to look at the entire state with regard to freight flows and impacts. The balance between economic growth and quality-of-life is important. The documenting of forecasts of the future may help to realize a balanced approach and create win/win conditions for commercial interests, as well as communities.

3.3 Goal # 3: Improve Safety

Work Zones

Although congestion can be caused by incidents, it is usually associated with recurring events that reduce capacity to the point where demand becomes too great. Construction, maintenance, and utility work can also have this effect. Work zones are an important part of maintaining the existing infrastructure, but they can also be a cause for significant delay and congestion. Conditions can change daily, if not hourly. PennDOT can help by informing travelers of changing conditions. Travelers empowered with information about congestion often change behavior, thereby reducing demand.

Road-Weather

Located in the Northeastern United States, Pennsylvania faces severe weather conditions during the winter months. PennDOT has taken an active role in roadway weather management. PennDOT has deployed RWIS throughout the Commonwealth. RWIS is used to monitor weather conditions along the roadway. PennDOT also established a Winter Road Condition Hotline for Interstate Highways. This phone service disseminates seasonal statewide road conditions, including road closures, detours, alternative routes, work zone/construction events, and road surface conditions. The availability and reliability of road and weather condition reporting will continue having an important impact on traveler safety.

Crash Prevention

PennDOT has deployed crash prevention/safety systems at critical locations across the Commonwealth. These systems include, but are not limited to,
Automatic Fixed Location Anti/De-Icing Systems (AFLADS), Automatic Truck Rollover Warning Systems (ATRWS), and crash-avoidance systems. These projects have been driven by regional needs in the past. PennDOT will continue to evaluate existing crash prevention/safety systems and look at the possibility of replicating these systems elsewhere in the state.

**Research and Development/New Technology**

Research and development of new and emerging technologies, as well as applications of these technologies, is an important activity for PennDOT to continue to engage in. PennDOT may choose to be active in supporting a partnership with universities and other organizations that choose to be on the front-end of technology development. At the same time, PennDOT may opt to wait until technologies significantly mature before investing significant resources in those still-primitive technologies or applications. In some cases, this choice may be the wise one to make because considerable efforts and resources can be expended in deploying immature technologies.

Technology continues to mature and change. Because of this, PennDOT will want to continue to explore the use of new technologies to help deal with congestion. For example, PennDOT is exploring applications such as technology-assisted enforcement in partnership with PSP and automated red light enforcement systems in partnership with the Philadelphia Parking Authority. Legislation is currently in place for automated red light enforcement systems at specified intersections within the City of Philadelphia, but legislation is not in place to implement this technology statewide. PennDOT and its partners have been experimenting with these applications so they can be considered for statewide implementation if legislation so permits.

**3.4 Goal # 4: Improve Security**

Since the terrorist attacks of September 11, 2001, PennDOT has recognized the significant threat of terrorism and the Commonwealth’s responsibility to protect its communities and citizens. PennDOT understands the need to fulfill new or increased roles in the area of homeland security, specifically:

- For the protection of critical facilities, such as bridges, tunnels, and highways;

- As a first responder if an incident occurs on or near a highway; and

- As a public information provider to help control public response to an incident.
While a relatively new issue in itself, transportation security can be viewed as a layer of emergency management. Preparedness, mitigation, response, and recovery represent the continuous cycle of both emergency management and transportation security. PennDOT uses an Advisory System to provide a comprehensive and effective means to disseminate information regarding the risk of terrorist acts to state authorities. The system provides warnings in the form of a set of graduated “Threat Levels” that increase commensurate to the risk of threat. The PennDOT Advisory System is intended to create a common vocabulary, context, and structure for an ongoing statewide discussion about the nature of the threats that confront the homeland and the appropriate measures that should be taken in response.

3.5 Incident Management and Traveler Information Has Applicability to All Four Goals

Incident Reporting

PennDOT needs a statewide electronic incident reporting system that allows the Department to respond to, and manage, regional incidents and the secondary effects that these incidents may create. This type of coordinated reporting creates consistency throughout the state so that all parties involved in responding to the incident are essentially in real-time "speaking one language.” Disseminating road closure information to travelers in Pennsylvania is also important as it allows travelers to plan accordingly. For instance, last year, when hurricanes caused flooding in the state, many roads were closed by PennDOT. Getting information about the closures to travelers is critical.

PennDOT is doing an exceptional job with incident management in many areas of the state. This excellence tends to be in selected districts where incident management is coordinated by a district/regional champion who fully understands the issue and is successfully using ITS to operate the transportation system. Unfortunately, statewide guidelines are not clearly defined throughout the state to assist others to better report, manage, and inform travelers of incidents. PennDOT needs to identify roles for their staff and establish relationships internally and externally. These relationships and concepts are critical to managing incidents more timely, effectively, and safely.
Incident Management

Incident management is a critical focus for PennDOT and has been for many years. Whether it is a crash, special event, or weather, incidents have an impact on personal property, quality of life, safety, and mobility. Over the past decade, ITS has proven to be beneficial in helping PennDOT manage the effects of incidents. Utilizing ITS for incident management has many benefits. It helps to improve incident detection, verification, response, and clearance. PennDOT is currently exploring the use of mile-markers (intermediate reference markers) to assist with incident reporting. Technology can also be used to provide travelers with information over websites, cell phones, and other electronic devices.

Throughout the state, PennDOT incident reporting takes on different forms. If the incident is local in nature, incident reporting is conducted and managed locally, without the need to share or expand the knowledge of the incident beyond the local scene. When an incident becomes large enough to begin affecting other districts, such as a winter blizzard, consistent and coordinated regional and statewide incident reporting becomes paramount.

Traveler Information

In the future, PennDOT will be able to share incident information with travelers. PennDOT will need to explore options for distributing this information to motorists themselves (i.e., 511 phone service, traveler information websites, etc.) or work with the private sector to disseminate customized/individualized information to travelers. Some private companies are examining the potential use of in-vehicle devices to provide unique customized services to travelers. Need a hotel? Need a dentist? Would you like to know where the nearest McDonald’s is? These types of services, as well as customized routing and delay information, will most likely be serviced by private, for-profit companies and fee-based services to travelers.

PennDOT will be providing traveler information related to incidents, events, weather, and work zones. This type of information is already being shared by PennDOT and will probably continue to be expanded in the future. Currently, a toll-free number for winter road conditions, active Welcome Centers, and traveler information websites are being utilized to disseminate information to travelers. PennDOT can be expected to continue to expand usage of technologies such as DMS, HAR, and partnerships with the media and private traveler information providers. New techniques in traveler information may also be explored, such as 511 phone service and other new and expanding technologies related to vehicle and infrastructure communications.
4 CANDIDATE PROJECTS

This section of the report identifies and describes the projects to be pursued during the initial TSOP period. These projects are the “building blocks” of TSOP and signify important statewide priorities. The proposed projects were selected because of their ability, collectively, to establish an operations framework for PennDOT and contribute markedly towards achieving PennDOT’s operational goals. Of course, the fact that individual projects are identified here is not assurance that particular projects will ultimately be funded and “green-lighted” to move forward.

The candidate TSOP projects all have the following factors in common:

- All conform to the PennDOT vision and address one or more of PennDOT’s operational goals.

- All offer solutions to ongoing statewide problems; most offer potentially significant benefits, often with rapid pay-offs at comparatively modest costs.

- Many of the projects lay a foundation for important work in such areas as incident management and traveler information.

- All projects adhere to the strategic directions and guiding principles discussed previously.

Project synopses are offered in this section. For more detailed information on individual projects, see Appendix A: Detailed Project Profiles.

4.1 Description of TSOP Projects

TSOP shall be comprised of the following projects during the initial program period:

- TSOP-01: Inter-Agency Incident Reporting System
- TSOP-02: Road Closure Reporting System
- TSOP-03: Interstate Incident Management Program
- TSOP-04: Incident Management Traveler Information
- TSOP-05: Incident Management Processes and Procedures
- TSOP-06: Roadway Weather Management
- TSOP-07: Crash Prevention/Safety
- TSOP-08: TAC Signal Study Implementation
- TSOP-09: STMC and TMC’s
These 19 projects are described below:

**TSOP-01: INTER-AGENCY INCIDENT REPORTING SYSTEM**
This project develops and deploys a system for exchanging information concerning incidents within PennDOT and between PennDOT and other stakeholders. The resultant Incident Reporting System (IRS): (1) functions in a flexible environment that supports the timely exchange of information; (2) enables emergency response stakeholders to “subscribe” to and receive the specific data elements of relevance to them; and (3) permits stakeholders to continue using their existing systems and infrastructures. Users will connect to the IRS through a common communications backbone.

**TSOP-02: ROAD CLOSURE REPORTING SYSTEM**
This project refines and deploys a system for the timely and accurate dissemination of information on road closures across the Commonwealth. The Road Closure Reporting System (RCRS): (1) reports on road closures that result from adverse weather conditions, but will eventually be expanded to include closures for other reasons; (2) is accessible both over-the-web and through internal PennDOT systems, such as Advanced Traffic Management Systems (ATMS); and (3) will, in the future, be integrated with the Incident Reporting System (IRS) and traveler information systems.

**TSOP-03: INTERSTATE INCIDENT MANAGEMENT PROGRAM**
This project establishes a statewide Interstate Incident Management Program and identifies “gaps” in ITS equipment for: (1) surveillance, detection, and verification, and (2) notification of incident management partners and the traveling public. The program will be established through cooperation and coordination between PennDOT Central Office and the engineering districts. Once “gaps” in ITS equipment have been identified, a programmatic review will be conducted and plans and approaches to funding will be prepared. ITS equipment will then be deployed at tactical locations to close existing gaps. Coverage of this program includes all interstate highways, key interstate-to-interstate intersections, and interstate-to-interstate transitions (look-a-likes).
**TSOP-04: INCIDENT MANAGEMENT TRAVELER INFORMATION**

This project establishes a statewide incident management traveler information program for Pennsylvania. It will: (1) examine best practices for using third-party vendor and infrastructure to deliver traveler information; (2) define means, media, and methods for delivering traveler information; and (3) develop and deploy a statewide traveler information program. The program’s structure for statewide consistency in traveler information will be sufficiently flexible for individual districts/regions to have discretion when establishing processes that address their own specialized circumstances.

**TSOP-05: INCIDENT MANAGEMENT PROCESSES AND PROCEDURES**

This project defines the processes, procedures, and relationships needed to more effectively manage roadway incidents. The central objective of the effort is to improve the time required to respond to and clear incidents, and to manage these processes safely and efficiently. Towards this end, this incident management project focuses on: (1) defining and implementing a statewide infrastructure for managing incidents; (2) strengthening relationships among IM partners; (3) refining the skills, responsibilities, and procedures used by regional IM Response Teams; and (4) monitoring and managing IM performance regionally and statewide.

**TSOP-06: ROADWAY WEATHER MANAGEMENT**

This project augments PennDOT’s existing roadway weather management activities. PennDOT has undertaken several efforts in roadway weather management, including: (1) deploying road weather information systems (RWIS) to monitor road weather conditions throughout the Commonwealth; and (2) establishing a "Winter Road Condition Hotline" for interstate highways. The latter phone service disseminates seasonal statewide road conditions, including road closures, detours, alternative routes, work zone/construction events, and road surface conditions. The purpose of this project is to monitor existing road weather management activities in Pennsylvania and broaden those activities, as necessary.

**TSOP-07: CRASH PREVENTION/SAFETY**

PennDOT has deployed crash prevention/safety systems at site-specific locations across the Commonwealth. These systems include: automatic fixed-location anti/de-icing systems (AFLADS), automatic truck rollover warning systems (ATRWS), and crash-avoidance systems. These deployments have, in the past, been driven by regional needs. The purpose of this project is to evaluate existing crash prevention/safety systems and assess the practicality and suitability of replicating these systems elsewhere in the state.
TSOP-08: IMPLEMENT TAC SIGNAL STUDY
This project paves the way for a more effective statewide traffic signals program that plans and coordinates activities at the corridor and regional levels. It builds on the findings and recommendations contained in a study sponsored by the Pennsylvania State Transportation Advisory Committee (TAC), entitled *Pennsylvania Traffic Signal Systems: A Review of Policies and Practices (2004)*, January 2005. The TAC study is predicated on several key premises, including the following: (1) traffic signal operations and maintenance activities can be optimized by employing corridor- and region-wide approaches; and (2) a more centralized approach to signals management will encourage new economies-of-scale, such as the ability to negotiate superior maintenance contracts. The project, which will begin the process of implementing key TAC study recommendations, pertains to the 13,600 traffic signalized installations currently in operation across the Commonwealth.

TSOP-09: STMC AND TMC’S
This project begins implementing the requirements of the *2004 Transportation Management Approach (TMA)*, which called for the establishment of transportation management centers (TMC’s) in each of the eleven PennDOT engineering districts. Specifically, the TMA defined three levels of TMC’s, as follows:

- **Level I:** District Transportation Management Centers (TMC’s) will manage operations within their district.
- **Level II:** Regional Transportation Management Centers (RTMC’s) will manage operations within their districts, support other district TMC’s within their region, and manage overall operations along major regional corridors.
- **Level III:** A Statewide Transportation Management Center (STMC) will support and coordinate with TMC’s and RTMC’s and establish a statewide repository of archived data.

Although they vary in size and functionality, many PennDOT districts already maintain some form of TMC. This new effort will formally expand the TMC concept in accordance with statewide directions, right-sized to the individualized needs of districts and regions.

TSOP-10: ITS EQUIPMENT MAINTENANCE
This project establishes a statewide maintenance inventory of ITS devices, incorporates IT devices into common BIS device maintenance and replacement programs, and defines and establishes cost-effective maintenance contracts or in-house maintenance programs.
**TSOP-11: TECHNOLOGY-ASSISTED ENFORCEMENT**
Technology-assisted enforcement (TAE) is the use of technology to assist police in the enforcement of traffic laws, within the limits of current legislation. TAE allows for remote monitoring and surveillance by police officers, who then conduct standard procedures for ticketing violators. TAE applications currently include speed-limit enforcement and tailgating. A pilot project for technology-assisted speed enforcement (TASE) has been tested in Pennsylvania, but has not been certified for enforcement. The objective of this project is to monitor and evaluate planned Pennsylvania TAE applications and stay abreast of TAE activities and deployments in other states. Additionally, this project will monitor automated enforcement programs, such as the Philadelphia Automated Red-Light Enforcement (ARLE) program, which is not currently permitted in most parts of the Commonwealth. This effort ensures that PennDOT remains knowledgeable about the subject matter should the state laws change.

**TSOP-12: MOBILITY IN WORK ZONES**
This project sets forth a playbook of potential ITS strategies for improving safety and mobility in construction work zones. ITS technologies and strategies can generally be used to help improve the safety of workers and travelers in work zones, as well as to facilitate traffic flow through and around construction areas.

**TSOP-13: ITS AND IT**
This project encompasses the elements and practices around ITS and IT issues. For instance, communications from an operations center to roadside equipment or other operation centers require a telecommunications infrastructure. Additionally, the scope of required communications compels PennDOT to determine how best to plan for, process, and maintain communications linkages.

**TSOP-14: OPERATIONS MAINSTREAMING**
This project examines the impacts of ITS/operations on PennDOT processes for starting and successfully completing projects. Beginning with the planning process, guidance for incorporating projects into long-range plans and TIP’s will occur with the help of PennDOT’s planning partners. Under this effort, ITS procurement guidance and design guidance will also be developed. Operational staffing issues (e.g., job descriptions, job classifications, and job training) will be addressed as well. This project also addresses ITS project implementation methodologies. It considers project consistency with the regional ITS architectures, development of contract documentation, testing of ITS equipment, payment schedule, use of NTCIP and other standards, and processes for the inclusion of ITS in larger construction projects.

**TSOP-15: ADVANCED PLANNING AND STRATEGY**
This project recognizes that new techniques in planning and applications exist in the rapidly-growing and evolving areas of ITS and operations. The purpose of
this project is to examine emergent ITS policies, procedures, and technologies in order to plan for the future and commit resources wisely.

**TSOP-16: DATA-ACQUISITION AND ARCHIVE**

This project establishes statewide procedures and guidelines for collecting and archiving transportation-related data. This will include both (1) basic statistical data, and (2) key performance metrics that support both planning and operational initiatives. Planners tend to require archived data, whereas operators generally need real-time information. Consequently, this project will consider whether common collection, classification, and archival strategies can be used to support both planners and operators.

**TSOP-17: STATEWIDE TRANSIT OPERATIONS**

The goal of this project is to provide a blueprint for using advanced ITS technologies to improve transit operations management in Pennsylvania. Because the report that results from this effort will be PennDOT-centric, the analysis will focus on identifying specific roles for PennDOT that encourage the implementation of advanced technologies. At the same time, the analysis and subsequent report will need to be responsive to the independence of individual transit agencies, as well as the diversity of systems within Pennsylvania (ranging from large multimodal agencies operated by regional authorities all the way to small, demand-response services operated by medical and social service institutions). The final product of this project will be an Advanced Transit Operations Management report, which will lay out a vision and direction for using ITS technologies to improve transit operations management, as well as a pathway for making that vision a reality.

**TSOP-18: FREIGHT MOVEMENTS ASSESSMENT**

This project will analyze freight movement from a statewide perspective. Through this analysis, future scenarios can be evaluated by various stakeholders, who will then make recommendations as to needed improvements to the transportation system. Pennsylvania’s freight movement should be enhanced through these recommended strategies, policies, and capital improvements, while maintaining a high quality of life and a strong economy. The project will identify next steps that are consistent with the *South Central Pennsylvania Regional Goods Movement Study* which is currently being sponsored by the Tri County Regional Planning Commission. These goals are to (1) developing essential freight data, (2) identifying policies and strategies that achieve economic benefit goals while minimizing transportation impacts and related costs, and (3) creating an effective and enduring public private partnership forum.

**TSOP-19: CVO PARTNERSHIP WITH PSP**

This project considers the current state of commercial vehicle operations (CVO) within the Commonwealth, with the goal of exploring a partnership between
PennDOT and the Pennsylvania State Police (PSP). It focuses on PennDOT’s role in commercial vehicle permitting and credentialing, and supporting PSP in the conduct of safety inspections and other enforcement actions. The effort will also define CVO infrastructure requirements that will lead to a comprehensive CVO network throughout Pennsylvania. It will also lay out a vision and direction for the future of CVO within the Commonwealth and provide guidance to PennDOT, PSP, and other stakeholders on how this vision can be achieved.

4.2 Project Highlights and Interrelationships

Additional details on the 19 TSOP projects are highlighted in Table 4-1, beginning on the following page.

Interrelationships exist between the nineteen projects. The TSOP projects are crosscutting, often impacting one or more other projects. For example, information from TSOP-01: Inter-Agency Reporting System may serve as an information backbone for TSOP-04: Incident Management Traveler Information. These interrelationships are depicted Table 4-2, on page 75.
## Table 4-1: TSOP Project Highlights

<table>
<thead>
<tr>
<th>Project</th>
<th>Activities and Milestones</th>
<th>Project Owners and Key Stakeholders</th>
<th>Status</th>
<th>Outputs</th>
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| TSOP-01: Inter-Agency Incident Reporting System | 1. Define IRS concept of operations (CONOPS) and system requirements.  
2. Design system, including network infrastructure, communications approach, API structure, system functions, and data elements.  
3. Develop HTML-based prototype for testing and demonstrating the system.  
4. Deploy system and network infrastructure, and link key agencies via API's.  
5. Implement IRS processes and procedures.  
6. Conduct pilot test, refine system, establish QA/QC procedures, and launch IRS.  
7. Furnish training and technical assistance to users.  
8. Perform after-action review.  
9. Plan future system enhancements. | • PennDOT Central Office: BHSTE, BIS, BOMO, BPR, ITPO, Press Office  
• PennDOT/Engineering Districts  
• Office of Administration/Office for Information Technology (OIT)  
• Office of Administration/Pennsylvania Justice Network (JNET) | Preliminary conceptual design and planning for the IRS have been completed. | Information-sharing infrastructure  
Inter-Agency Incident Reporting System |
| TSOP-02: Road Closure Reporting System | 1. Finalize the RCRS prototype to cover road closures that result from adverse weather conditions.  
2. Develop and pilot-test the system over the PennDOT Intranet. Also, conduct tests on the Internet, using county users as “testers.” (Ultimately, districts and counties will be responsible for entering the road closure data into the RCRS.)  
3. Replicate and pilot-test the system in an ATMS | • PennDOT Central Office: BHSTE, BPR  
• PennDOT Engineering Districts | Development of an RCRS prototype is underway. | Road Closure Reporting System |
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<td><strong>TSOP-03: Interstate Incident Management Program</strong></td>
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<td>1. Identify ITS equipment pertinent to surveillance, detection, verification, and notification.</td>
<td>• PennDOT Central Office: BHSTE, BIS, BPR, ITPO</td>
<td>• ITS equipment has been deployed by PennDOT districts</td>
<td>• CONOPS</td>
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<td>2. Update the ITS equipment GIS database with existing PennDOT Central Office and district field devices.</td>
<td>• PennDOT Engineering Districts</td>
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<td>• Updated ‘GIS ITS Equipment Database’</td>
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<td>3. Identify ITS equipment deployed by other agencies that PennDOT may utilize.</td>
<td>• Metropolitan Planning Organizations (MPO’s)</td>
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<td>• Programmatic listing for planning and funding ITS Equipment</td>
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<td>4. Work with other stakeholders to identify key corridors and strategic locations throughout the state.</td>
<td>• Other transportation agencies deploying ITS equipment</td>
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<td>• District ITS Master Plan</td>
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<td>5. Establish guidelines and criteria for identifying gaps in ITS equipment.</td>
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<td>• Deployed ITS Equipment (as funding becomes available)</td>
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<td>6. Compile district and regional inputs and provide a statewide approach for closing gaps.</td>
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<td>7. Produce a prioritized list for deploying ITS</td>
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<td>Project</td>
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<td>TSOP-04: Incident Management Traveler Information</td>
<td>equipment in each PennDOT district. 8. Present programmatic lists to MPO’s/RPO’s to incorporate in the planning and funding process. 9. Develop ITS Master Plan for each district identifying a comprehensive future vision for ITS deployment. 10. Deploy ITS equipment as funding becomes available.</td>
<td>- PennDOT Central Office: BHSTE, BIS  - PennDOT Engineering Districts  - Pennsylvania Office of Administration  - Third-Party Vendors  - Representative Transit and Multimodal Agencies</td>
<td>- A customer survey for traveler information was conducted by BHSTE in the fall of 2004.  - A 511 feasibility study is underway.  - BOMO operates a 1-800 number for roadway conditions during winter months.  - Pittsburgh and Philadelphia are providing traveler information.</td>
<td>- PennDOT traveler information business model  - Pilot Project for incident management traveler information  - Statewide incident management traveler information system</td>
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| TSOP-05: Incident Management Processes/Procedures | 1. Identify and define incident management processes and procedures, including (1) procedures that may vary according to the type, location, and severity of incidents; (2) communications protocols; and (3) roles and responsibilities of PennDOT and its partners in managing incidents.  
2. Continue building and formalizing IM relationships with partners – both statewide and regionally.  
3. Establish or enhance IM Response Teams in each district or region.  
4. Furnish on-going training and technical assistance to PennDOT and partner IM staff.  
5. Deploy IM procedures.  
7. Identify potential enhancements to the IM program. | • PennDOT Central Office: BHSTE  
• PennDOT Engineering Districts | • Initial relationships among IM partners have been established in some regions.  
• IM Response Teams currently exist in some locations.  
• Development by PennDOT of a GIS-based application for pinpointing locations of incidents is underway. | • Incident management processes and procedures  
• Memoranda-of-understanding or other agreements with key partners  
• IM training materials |
2. Identify the issues/barriers, lessons learned, opportunities for success of other similar applications through case studies, best practices guides, and other similar documents.  
3. Develop a roadway weather management plan, including recommendations and conclusions for identifying and implementing appropriate | • PennDOT Central Office: BHSTE, BOMO | • RWIS sites have been deployed throughout the state.  
• A "Winter Road Condition Hotline" exists during the winter months. | • A document discussing current best practices of implementing roadway weather management.  
• A roadway weather |
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2. Identify the issues/barriers, lessons learned, and opportunities for success of other similar applications.  
3. Developing a plan that includes recommendations and conclusions for identifying and implementing appropriate strategies. | • PennDOT Central Office: BHSTE  
• PennDOT Engineering Districts | • PennDOT has deployed AFLADS, ATRWS, and crash avoidance systems | • A document discussing current best practices of implementing crash prevention/safety practices.  
• A crash prevention/safety plan.  
• Next steps |
2. Conduct a pilot that tests corridor-wide operation of integrated freeway/arterial traffic signals; evaluate the pilot results. The pilot will utilize variable timing plans under key scenarios, e.g., normal traffic conditions, light and heavy traffic conditions, incidents and events, detours, etc. PA-23 in District 6-0 is a candidate for this pilot. | • PennDOT Central Office: BHSTE, BIS, BMS, ITPO  
• PennDOT Engineering Districts  
• Representative Municipalities operating traffic signal systems | • District-level Asset Management Systems are functional in Districts 5-0 and 6-0.  
• Integrated signals activity is underway in District 6-0.  
• TSEI and CCIP | • Model Signals Asset Management System  
• Integrated corridor pilot findings and recommendations  
• O&M pilot findings and recommendations |
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<td>3.</td>
<td>Conduct a pilot that tests cross-jurisdictional, inter-municipal operations and maintenance (O&amp;M) of traffic signals; evaluate the pilot results. The pilot may include the pooling of O&amp;M resources, sharing of maintenance responsibilities, and negotiation of corridor- or regional-level contracts.</td>
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<td>4.</td>
<td>Expand the following two programs: (1) the Traffic Signal Enhancement Initiative (TSEI), and (2) the Congested Corridor Improvement Program (CCIP). TSEI partners PennDOT with “municipalities to identify traffic signals that need to be retimed, upgraded, or better integrated into an overall congestion management strategy.” Under CCIP, PennDOT and its partners identify congested corridors across the state and define and implement improvements to alleviate congestion.</td>
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<td>5.</td>
<td>Define baseline performance metrics for assessing traffic signal activity. These metrics will be expanded as implementation of the TAC study recommendations continue moving forward.</td>
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<td>6.</td>
<td>Identify and develop plans for implementing additional TAC study recommendations.</td>
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<td>TSOP-09: STMC and TMC’s</td>
<td>1. Develop district/regional and statewide concepts of operations. 2. Perform communications planning. 3. Develop an operations and maintenance plan.</td>
<td>• PennDOT Central Office: BHSTE, CDPM  • PennDOT Engineering</td>
<td>• TMC’s are currently operating in many PennDOT districts.  • Facilities to operate ITS equipment in a coordinated approach</td>
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<td>TSOP-10: ITS Equipment Maintenance</td>
<td>1. Identify institutional issues related to maintenance of ITS equipment. 2. Identify standard maintenance practices and</td>
<td>PennDOT Central Office: BHSTE, GIS/DGS/BOCM,</td>
<td>Best practices for equipment maintenance are</td>
<td>Policy and procedures</td>
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<td>4. Develop software systems. 5. Prepare test plans and performance specifications for operational activities. 6. Perform detailed design of facilities. 7. Build and install the facilities. 8. Test and operate. 9. Revisit and plan for the future.</td>
<td>Districts  • PSP  • PEMA  • PTC  • Pennsylvania Office of Homeland Security  • Emergency Management Agencies (EMA)  • 911 Communication Centers  • Regional Media Outlets  • Municipal Traffic Management Offices  • Representative Transit and Multimodal Agencies  • Cognizant Agencies in Adjacent States</td>
<td>The TMA articulated a concept for establishing TMC’s. The TMA concept was validated in each Regional ITS Architecture. PennDOT has engaged in a preliminary effort to begin a statewide operations strategy and concept of operations.</td>
<td>statewide</td>
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| TSOP-11: Technology-Assisted Enforcement | standards as set forth by FHWA and various ITS device manufacturers.  
3. Define proper maintenance practices for each type of device.  
4. Develop a plan for tracking and recording maintenance actions and equipment failures.  
5. Evaluate the benefits of a regional or statewide contract for ITS equipment maintenance and consider implementation. | BIS, BOS, GID, ITPO, press Office, PMC  
- PennDOT Engineering Districts  
- Pennsylvania Department of General Services | continually being discussed.  
- Planning databases for ITS equipment maintenance are in place.  
- ITS real-time maintenance information is available, but is not necessarily archived. | A document discussing current best practices of implementing TAE  
A TAE plan  
A guidance document on monitoring and evaluating TAE performance and effectiveness  
Next steps |

2. Identify the issues/barriers, lessons learned, opportunities for success of other similar applications through case studies, best practices guides, and other similar documents.  
3. Develop a TAE Plan, including recommendations and conclusions for identifying and implementing appropriate strategies. | PennDOT Central Office: BHSTE  
PennDOT Engineering Districts  
Pennsylvania State Police (PSP)  
Pennsylvania Turnpike Commission (PTC)  
Local law enforcement agencies  
Select local and state politicians | Pennsylvania is currently field testing TASE in variable speed limit work zones.  
PennDOT is monitoring and assessing the Philadelphia ARLE effort. |
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<th>Status</th>
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| TSOP-12: Mobility in Work Zones | 1. Identify general focus areas in mobility in work zones throughout Pennsylvania.  
2. Identify various work zone types (e.g., lane closure, shoulder closure, bridge work, etc.) by geographic area (e.g., urban or rural) for analysis.  
3. Identify best practices including, AASHTO’s ITS Work Zone playbook of potential ITS strategies.  
4. Define suggested performance measures, or a range of measures, to evaluate different ITS strategies in improving work zone safety and mobility. As all work zones are different, the designer and contractor (with PennDOT approval) should have the ability to set performance measures that are appropriate to the work zone.  
5. Develop procedures for recording and archiving data from work zones to be used in evaluating the effectiveness of ITS strategies and performance of the current playbook.  
6. Compare the performance results with the corresponding ITS strategies, and make recommendations as to the best ITS and operations configurations for different work zone types.  
7. Update the playbook of ITS work zone strategies. | • PennDOT Central Office: BHSTE  
• PennDOT Engineering Districts  
• Pennsylvania State Police (PSP) | • No work has been performed on this project. | • An ITS Work Zone Playbook that sets forth a list of potential ITS strategies for the purpose of improving safety and mobility in the construction work zone. |
| TSOP-13: ITS and IT | 1. Develop a telecommunications plan.  
2. Develop IT guidance document for linking IT and | • PennDOT Central Office: BIS/BHSTE/ | • IT inventories have already | • ITS and IT inventory |

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*Final Report — September 2005*  
64
## Activities and Milestones

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<thead>
<tr>
<th>Project</th>
<th>Activities and Milestones</th>
<th>Project Owners and Key Stakeholders</th>
<th>Status</th>
<th>Outputs</th>
</tr>
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| ITS operations.  
3. Classify ITS projects for IT planning and approvals.  
4. Incorporate ITS PC’s and peripherals in standard DOT IT equipment maintenance and replacement cycles.  
5. Mainstream ATMS and other ITS software into IT software support programs. | ITPO  
- PennDOT Engineering Districts  
- Governor’s Office of Administration (OIT) | begun.  
- Classification work for IT planning has also begun. | Telecom Master Plan  
- IT guidance document that links ITS and operations |
| TSOP-14: Operations Mainstreaming | 1. Work with MPO and RPO planning partners to incorporate ITS into planning processes, evaluate outcome of 2007 TIP, and engage ITS personnel in the planning process.  
2. Review ITS project procurement guidance, reviewing design build, software and equipment – Bulletin 15.  
3. Ensure ITS design is coordinated with project development in IT for right-sizing.  
4. Create staffing guidance for ITS personnel, job descriptions, classifications and training.  
5. Conduct outreach. | PennDOT Central Office: BOD/BHSTE/OS/CPDM/BHR  
PennDOT Engineering Districts  
MPO’s and RPO’s | Regional ITS Architectures began this understanding of partnership with MPO’s and RPO’s.  
Organizational processes have begun to be discussed.  
Staffing issues have been articulated and discussed. | Processes for planning and funding operations  
Organizational behavior changes  
Newly-established or changed policy recommendations |
| TSOP-15: Advanced Planning and Strategy | 1. Review state-of-practice, looking especially at public/private data sharing such as Mobility Technologies.  
2. Establish guidance, procedures, and policy.  
3. Provide outreach regarding findings. | PennDOT Central Office: BHSTE, BPR | Best practices are continually being discussed. | Policy and procedures |
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<tr>
<th>Project</th>
<th>Activities and Milestones</th>
<th>Project Owners and Key Stakeholders</th>
<th>Status</th>
<th>Outputs</th>
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</table>
| TSOP-16: Data-Acquisition and Archive | 1. Review state-of-the-practice for data collection, use, and archiving. Consider data accuracy, classification, speeds, axles, and other data fields. Collection areas will look at ITS devices, automatic traffic recorders, and road-weather instruments.  
2. Identify the use of archived data for real-time operations and planning needs.  
3. Identify the tools to use for data archiving, such as GIS.  
4. Develop a common platform for data life-cycle and guidance procedures.  
5. Provide outreach to operators and planners regarding the findings of this project. | PennDOT Central Office: BHSTE, BPR | BPR is actively assessing various vehicle detector technologies for applicability to their data collection needs  
Best practices for data acquisition and archiving are continually being discussed.  
Databases for archived planning data are currently in place.  
Real-time ITS data is available, but is not necessarily archived. | Policy and procedures |
| TSOP-17: Statewide Transit Operations | 1. See current Pennsylvania Regional ITS Architectures at [www.paits.org](http://www.paits.org) to review and document existing and planned interconnects and information flows between transit centers | PennDOT Central Office: BPT, BHSTE, CPDM  
Representative | The recently completed Pennsylvania Regional ITS | Advanced-Transit Operations Management |
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<th>Status</th>
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<td></td>
<td>1. Collect and analyze current statewide freight data, including goods movement patterns, issues, opportunities, and concerns. Identify critical locations where freight movement adversely affects safety and congestion.</td>
<td>PennDOT Central Office: BRF, BHSTE, CPDM  Pennsylvania State Police (PSP)  Pennsylvania Turnpike Commission (PTC)  Commercial Vehicle Companies  Airport and Railroad Offices  SINET</td>
<td>Several freight studies have been conducted in the past for Pennsylvania.</td>
<td>Maps and databases of statewide freight data  Improvements for the freight system  Implementation Plan for freight system improvement  Goods</td>
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<td>2. Prepare recommendations for managing the database, including basic methodology and database structure, location, staffing requirements, and update cycles.</td>
<td>Transit and Multimodal Agencies  Pennsylvania Public Transportation Association</td>
<td>Architectures provide a basis for understanding interconnects between Transit Agencies and PennDOT.</td>
<td>Report</td>
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<td>3. Evaluate current policies, including economic, market-based, ITS, defense/homeland security, land use, and funding. Also examine institutional</td>
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<td>and PennDOT TMC’s.</td>
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<td>TSOP-18: Freight Movements Assessment</td>
<td>2. Research and document the state-of-the-art and state-of-the-practice in the deployment of ITS and other advanced operational technologies nationally and internationally. As part of this review, identify examples of coordinated implementation that have created synergies or greater efficiencies.</td>
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<td>3. Determine the specific role that PennDOT should play in promoting advanced transit operations, both as a central funding partner and as a statewide coordinating agency.</td>
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<td>4. Complete the Advanced Transit Operations Management Report which lays out a vision and direction for future transit operations in Pennsylvania, and details the role that PennDOT expects to play in making this vision a reality.</td>
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2. Work with PSP to clearly define PennDOT’s roles and responsibilities relating to credentialing, permitting, and enforcement.  
3. Define CVO infrastructure requirements. | • Port Authorities  
• Port officials  
• U.S. DOT Administrations (FHWA, FRA, FAA, MARAD, ACE)  
• DCED and other economic development agencies | • PennDOT and PSP have started discussions pertaining to a CVO partnership.  
• A study that examines PennDOT and PSP roles and responsibilities, infrastructure requirements, | Movement 2012 Action Plan |
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<th>Status</th>
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<td>4. Set appropriate policy pertaining to Commercial Vehicle Operations.</td>
<td>Vehicle Companies</td>
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<td>and steps toward policy and deployment for CVO activity.</td>
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<td>5. Compose draft report.</td>
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<td>6. Validate and revise draft report with key personnel.</td>
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<td>7. Produce final report.</td>
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### Table 4-2: TSOP Project Interrelationships

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4.3 Relationships Between TSOP Goals and Projects

In formulating its TSOP program, PennDOT worked from specific challenges, in the form of operational goals and objectives, to candidate solutions to those challenges, detailed as projects. There is, consequently, a strong, synergistic relationship between PennDOT's operational requirements and the solutions proposed to address those requirements.

Table 4-3, on the following page, traces these interrelationships. Traceability extends from the TSOP goals to the objectives associated with each goal. Strategies for achieving individual objectives are also specified, and the project or projects that encompass the strategies are identified. Note that individual projects match to multiple goals, objectives, and strategies, reinforcing the sense that the 19 core projects are, appropriately, the “building blocks” of TSOP.
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<tr>
<th>Goals</th>
<th>Objectives</th>
<th>Strategies</th>
<th>Projects</th>
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<tbody>
<tr>
<td>Build and Maintain a Transportation Operations Foundation</td>
<td>Establish a base-level operations capability in all districts</td>
<td>Deploy minimum capability in districts necessary to respond efficiently and safely to incidents and emergencies</td>
<td>TSOP-09: STMC and TMC’s</td>
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<td>TSOP-03: Interstate Incident Management Program</td>
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<td>Mainstream operations in all districts</td>
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<td>TSOP-14: Operations Mainstreaming</td>
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<td>Standardize essential activities and procedures in all districts</td>
<td>Provide statewide direction on incident management</td>
<td>TSOP-05: Incident Management Processes and Procedures</td>
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<td>TSOP-03: Interstate Incident Management Program</td>
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<td>Provide statewide direction on traffic signal management</td>
<td>TSOP-08: TAC Signal Study Implementation</td>
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<td>Provide statewide direction on asset management and maintenance</td>
<td>TSOP-10: ITS Equipment Maintenance</td>
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<td>Establish a statewide infrastructure for information exchange and dissemination</td>
<td>Define and implement a telecommunications infrastructure</td>
<td>TSOP-13: ITS and IT</td>
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<td>Implement real-time exchange of information on roadway incidents</td>
<td>TSOP-01: Inter-Agency Incident Reporting System</td>
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<td>TSOP-02: Road Closure Reporting System</td>
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<td>Implement dissemination of accurate and reliable incident data to travelers and commuters</td>
<td>TSOP-06: Roadway Weather Management</td>
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<td>Establish a statewide repository for statistical and performance data</td>
<td>Define and implement a telecommunications infrastructure</td>
<td>TSOP-04: Incident Management Traveler Information</td>
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<td>Design and implement a centralized data archive</td>
<td>TSOP-13: ITS and IT</td>
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<td>TSOP-16: Data-Acquisition and Archive</td>
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<td>Goals</td>
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<tr>
<td>Improve Highway Operational Performance</td>
<td>Minimize non-recurring travel delay statewide</td>
<td>Respond faster and more efficiently to incidents</td>
<td>TSOP-05: Incident Management Processes and Procedures</td>
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<td>TSOP-03: Interstate Incident Management Program</td>
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<td>Better manage traffic conditions during incidents</td>
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<td>Utilize crash prevention/safety systems at strategic locations throughout the Commonwealth</td>
<td></td>
<td>TSOP-07: Crash Prevention/Safety</td>
</tr>
<tr>
<td></td>
<td>Exchange information and coordinate activities with state, regional, and municipal partners during incidents</td>
<td></td>
<td>TSOP-05: Incident Management Processes and Procedures</td>
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<td></td>
<td></td>
<td></td>
<td>TSOP-01: Inter-Agency Incident Reporting System</td>
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<td>TSOP-02: Road Closure Reporting System</td>
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<td>TSOP-06: Roadway Weather Management</td>
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<td></td>
<td>Disseminate status and advisory information to travelers during incidents</td>
<td></td>
<td>TSOP-04: Incident Management Traveler Information</td>
</tr>
<tr>
<td>Minimize recurring travel delay statewide</td>
<td>Optimize traffic signal operations at the corridor-wide and regional levels</td>
<td></td>
<td>TSOP-08: TAC Signal Study Implementation</td>
</tr>
<tr>
<td></td>
<td>Better manage traffic and conditions in work zones</td>
<td></td>
<td>TSOP-12: Mobility in Work Zones</td>
</tr>
<tr>
<td>Goals</td>
<td>Objectives</td>
<td>Strategies</td>
<td>Projects</td>
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<tr>
<td></td>
<td>Improve transit operations and identify technological and operational</td>
<td>TSOP-17: <em>Statewide Transit Operations</em></td>
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<td></td>
<td>enhancements to make transit a more attractive commuting alternative</td>
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<td></td>
<td>Better manage credentialing and selection of trucks for weigh-ins</td>
<td>TSOP-19: <em>CVO Partnership with PSP</em></td>
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<tr>
<td></td>
<td>and safety inspections</td>
<td></td>
<td></td>
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<tr>
<td>Implement mechanisms</td>
<td>Define performance metrics and collection methodologies</td>
<td>All TSOP Projects</td>
<td></td>
</tr>
<tr>
<td>and procedures to assess</td>
<td>Collect and archive performance data</td>
<td>TSOP-09: <em>STMC and TMC’s</em></td>
<td></td>
</tr>
<tr>
<td>operational performance</td>
<td>Assess operational performance in support of planning and remediation</td>
<td>TSOP-14: <em>Operations Mainstreaming</em></td>
<td></td>
</tr>
<tr>
<td>Plan for new operational</td>
<td>Learn from current operational experiences and performance metrics</td>
<td>All TSOP Projects</td>
<td></td>
</tr>
<tr>
<td>requirements, technological</td>
<td>Keep abreast of state-of-the-practice operational technologies</td>
<td>TSOP-15: <em>Advanced Planning and Strategy</em></td>
<td></td>
</tr>
<tr>
<td>innovations, and operational</td>
<td>Define the operational requirements for effectively managing ongoing</td>
<td>TSOP-11: <em>Technology-Assisted Enforcement</em></td>
<td></td>
</tr>
<tr>
<td>enhancements</td>
<td>growth in statewide freight movements</td>
<td>TSOP-12: <em>Mobility in Work Zones</em></td>
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<td></td>
<td></td>
<td>TSOP-19: <em>CVO Partnership with PSP</em></td>
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<tr>
<td>Improve Safety</td>
<td>Mitigate safety hazards and conditions statewide</td>
<td>TSOP-05: <em>Incident Management Processes and Procedures</em></td>
<td></td>
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<tr>
<td></td>
<td>Detect incidents faster; respond to incidents more quickly; and better</td>
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<tr>
<td>Goals</td>
<td>Objectives</td>
<td>Strategies</td>
<td>Projects</td>
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<tr>
<td>Protect travelers, commuters, and roadway workers</td>
<td>Safeguard conditions during incidents and events</td>
<td>TSOP-05: Incident Management Processes and Procedures</td>
<td>TSOP-01: Inter-Agency Incident Reporting System&lt;br&gt;TSOP-02: Road Closure Reporting System&lt;br&gt;TSOP-06: Roadway Weather Management&lt;br&gt;TSOP-04: Incident Management Traveler Information</td>
</tr>
<tr>
<td></td>
<td>Safeguard conditions at intersections</td>
<td>TSOP-08: Implement TAC Signal Study</td>
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<tr>
<td></td>
<td>Safeguard conditions in work zones</td>
<td>TSOP-12: Mobility in Work Zones</td>
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<td></td>
<td>Safeguard transit users</td>
<td>TSOP-17: Statewide Transit Operations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Target at-risk drivers and commercial carriers for enforcement actions</td>
<td>TSOP-11: Technology-Assisted Enforcement&lt;br&gt;TSOP-19: CVO Partnership with PSP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Assess safety performance</td>
<td>Monitor the occurrence and severity of crashes</td>
<td>TSOP-16: Data-Acquisition and Archive</td>
</tr>
<tr>
<td>Goals</td>
<td>Objectives</td>
<td>Strategies</td>
<td>Projects</td>
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<tr>
<td></td>
<td><strong>Goals</strong></td>
<td><strong>Objectives</strong></td>
<td><strong>Strategies</strong></td>
</tr>
<tr>
<td></td>
<td>Identify high-risk locations and corridors</td>
<td>TSOP-16: <em>Data-Acquisition and Archive</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Monitor safety performance metrics</td>
<td>TSOP-16: <em>Data-Acquisition and Archive</em></td>
<td>All TSOP Projects</td>
</tr>
<tr>
<td>Plan future safety enhancements</td>
<td>Plan future safety enhancements</td>
<td>TSOP-11: <em>Technology-Assisted Enforcement</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Expand automated enforcement efforts, if appropriate</td>
<td>TSOP-15: <em>Advanced Planning and Strategy</em></td>
<td></td>
</tr>
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<td></td>
<td>Plan for new technologies and operational enhancements</td>
<td>TSOP-14: <em>Operations Mainstreaming</em></td>
<td></td>
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<tr>
<td></td>
<td>Mainstream operational safety in all districts</td>
<td>TSOP-09: STMC and TMC’s</td>
<td></td>
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<td></td>
<td></td>
<td>TSOP-13: <em>ITS and IT</em></td>
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<td></td>
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<td>TSOP-10: <em>ITS Equipment Maintenance</em></td>
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<td></td>
<td>Perform surveillance of the transportation network</td>
<td>TSOP-05: <em>Incident Management Processes and Procedures</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Provide statewide direction on asset management and maintenance to ensure that essential equipment is functional</td>
<td>TSOP-17: <em>Statewide Transit Operations</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stand ready to execute large-scale evacuations</td>
<td>TSOP-18: <em>Freight Movements Assessment</em></td>
<td></td>
</tr>
<tr>
<td>Improve Security</td>
<td>Perform surveillance of the transportation network</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Provide statewide direction on asset management and maintenance to ensure that essential equipment is functional</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Stand ready to execute large-scale evacuations</td>
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<tr>
<td></td>
<td>Safeguard the security of public transit</td>
<td></td>
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<tr>
<td></td>
<td>Safeguard the public from security risks associated with over-the-road freight transports</td>
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<tr>
<td></td>
<td>Develop strategies for future security improvements</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Mainstream operational safety in all districts</td>
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</tr>
</tbody>
</table>

*Pennsylvania Department of Transportation
Transportation Systems Operations Plan (TSOP)*

*Final Report — September 2005* 76
<table>
<thead>
<tr>
<th>Goals</th>
<th>Objectives</th>
<th>Strategies</th>
<th>Projects</th>
</tr>
</thead>
</table>
|       | Provide response and recovery in the event of an emergency | Implement real-time exchange of information with partners during emergencies | TSOP-01: *Inter-Agency Incident Reporting System*  
TSOP-02: *Road Closure Reporting System* |
|       |           | Better manage traffic conditions during incidents | TSOP-03: *Interstate Incident Management Program*  
TSOP-05: *Incident Management Processes and Procedures* |
|       |           | Implement dissemination of accurate and reliable incident data to travelers and commuters | TSOP-04: *Incident Management Traveler Information* |
4.4 Additional Project Groupings

The TSOP projects may be organized by different frameworks, depending on specific needs. Table 4-4, below, shows the projects grouped into the following four “component” areas:

- Incident management,
- Highway operations/congestion,
- Infrastructure, and
- Non-highway activities.

Use of the component areas may offer PennDOT practitioners a convenient short-hand for discussing pertinent categories of TSOP projects.

**Table 4-4: TSOP Projects Grouped by Component Areas**

<table>
<thead>
<tr>
<th>Component Area</th>
<th>Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incident Management</td>
<td>TSOP-01: Inter-Agency Incident Reporting System</td>
</tr>
<tr>
<td></td>
<td>TSOP-02: Road Closure Reporting System</td>
</tr>
<tr>
<td></td>
<td>TSOP-03: Interstate Incident Management Program</td>
</tr>
<tr>
<td></td>
<td>TSOP-04: Incident Management Traveler Information</td>
</tr>
<tr>
<td></td>
<td>TSOP-05: Incident Management Processes and Procedures</td>
</tr>
<tr>
<td>Highway Operations/Congestion</td>
<td>TSOP-06: Roadway Weather Management</td>
</tr>
<tr>
<td></td>
<td>TSOP-07: Crash Prevention/Safety</td>
</tr>
<tr>
<td></td>
<td>TSOP-08: TAC Signal Study Implementation</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>TSOP-09: STMC and TMC’s</td>
</tr>
<tr>
<td></td>
<td>TSOP-10: ITS Equipment Maintenance</td>
</tr>
<tr>
<td></td>
<td>TSOP-11: Technology-Assisted Enforcement</td>
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<td></td>
<td>TSOP-12: Mobility in Work Zones</td>
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<td></td>
<td>TSOP-13: ITS and IT</td>
</tr>
<tr>
<td></td>
<td>TSOP-14: Operations Mainstreaming</td>
</tr>
<tr>
<td></td>
<td>TSOP-15: Advanced Planning and Strategy</td>
</tr>
<tr>
<td></td>
<td>TSOP-16: Data-Acquisition and Archive</td>
</tr>
<tr>
<td>Non-Highway</td>
<td>TSOP-17: Statewide Transit Operations</td>
</tr>
<tr>
<td></td>
<td>TSOP-18: Freight Movements Assessment</td>
</tr>
<tr>
<td></td>
<td>TSOP-19: CVO Partnership with PSP</td>
</tr>
</tbody>
</table>
4.5 Project Status Levels

Each TSOP project is assigned one of three “status” codes, as follows:

- **Status Level A – Active Projects.** These are PennDOT-led projects in which key components are actively underway. They represent early action items for TSOP.

- **Status Level B – Pending Projects.** These are PennDOT-led projects to be initiated as resources become available. Their development is important to laying a solid foundation for Operations.

- **Status Level C – Projects Owned by Others.** These are projects that will need to be owned or initiated by stakeholders outside of PennDOT. PennDOT will work with the external stakeholders on moving these projects forward, but PennDOT cannot make unilateral decisions on the timetables for these projects.

Table 4-5, below, identifies the status codes associated with each TSOP project:

<table>
<thead>
<tr>
<th>TSOP Project</th>
<th>Status Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSOP-01: Inter-Agency Incident Reporting System</td>
<td>A</td>
</tr>
<tr>
<td>TSOP-02: Road Closure Reporting System</td>
<td>A</td>
</tr>
<tr>
<td>TSOP-03: Interstate Incident Management Program</td>
<td>B</td>
</tr>
<tr>
<td>TSOP-04: Incident Management Traveler Information</td>
<td>B</td>
</tr>
<tr>
<td>TSOP-05: Incident Management Processes and Procedures</td>
<td>B</td>
</tr>
<tr>
<td>TSOP-06: Roadway Weather Management</td>
<td>B</td>
</tr>
<tr>
<td>TSOP-07: Crash Prevention/Safety</td>
<td>B</td>
</tr>
<tr>
<td>TSOP-08: Implement TAC Signal Study Implementation</td>
<td>A</td>
</tr>
<tr>
<td>TSOP-09: STMC and TMC’s</td>
<td>A</td>
</tr>
<tr>
<td>TSOP-10: ITS Equipment Maintenance</td>
<td>B</td>
</tr>
<tr>
<td>TSOP-11: Technology-Assisted Enforcement</td>
<td>B</td>
</tr>
<tr>
<td>TSOP-12: Mobility in Work Zones</td>
<td>B</td>
</tr>
</tbody>
</table>
Table 4-6 shows TSOP project by status level. It also shows the estimated “level of effort” and “cost range” associated with each project.

**Level-of-effort** for individual projects is estimated as follows:

- **“Simple,”** means that the project is generally planning-related, easily managed, involves a small number of stakeholders, and requires normal staff activities.

- **“Moderate,”** means that the project is partially planning-related, but may require some deployment or pilot testing, involves multiple primary stakeholders, and probably requires augmentation of normal staff activities.

- **“Complex,”** means that the project requires a major systems design effort or significant deployment activity, involves a potentially large number of primary stakeholders, and may need full-time assignment of staff to the effort.

<table>
<thead>
<tr>
<th>Status Level</th>
<th>TSOP Project</th>
<th>Level-of-Effort</th>
<th>Cost Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>TSOP-01: Inter-Agency Incident Reporting System</td>
<td>Moderate</td>
<td>$250,000 – $1,000,000</td>
</tr>
<tr>
<td></td>
<td>TSOP-02: Road Closure Reporting System</td>
<td>Simple</td>
<td>$50,000 - $250,000</td>
</tr>
<tr>
<td></td>
<td>TSOP-08: Implement TAC Signal Study Implementation</td>
<td>Moderate</td>
<td>$1,000,000 – $5,000,000</td>
</tr>
<tr>
<td>Status Level</td>
<td>TSOP Project</td>
<td>Level-of-Effort</td>
<td>Cost Range</td>
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</tr>
<tr>
<td>B</td>
<td>TSOP-09: STMC and TMC’s</td>
<td>Complex</td>
<td>$5,000,000 – $10,000,000</td>
</tr>
<tr>
<td>B</td>
<td>TSOP-13: ITS and IT</td>
<td>Moderate</td>
<td>$100,000 - $500,000</td>
</tr>
<tr>
<td>B</td>
<td>TSOP-14: Operations Mainstreaming</td>
<td>Moderate</td>
<td>$50,000 - $250,000</td>
</tr>
<tr>
<td>B</td>
<td>TSOP-03: Interstate Incident Management Program</td>
<td>Complex</td>
<td>$1,000,000 – $5,000,000</td>
</tr>
<tr>
<td>B</td>
<td>TSOP-04: Incident Management Traveler Information</td>
<td>Moderate</td>
<td>$500,000 – $2,000,000</td>
</tr>
<tr>
<td>B</td>
<td>TSOP-05: Incident Management Processes and Procedures</td>
<td>Moderate</td>
<td>$250,000 – $1,000,000</td>
</tr>
<tr>
<td>B</td>
<td>TSOP-06: Roadway Weather Management</td>
<td>Simple</td>
<td>$50,000 - $250,000</td>
</tr>
<tr>
<td>B</td>
<td>TSOP-07: Crash Prevention/ Safety</td>
<td>Simple</td>
<td>$100,000 - $500,000</td>
</tr>
<tr>
<td>B</td>
<td>TSOP-10: ITS Equipment Maintenance</td>
<td>Simple</td>
<td>$50,000 - $250,000</td>
</tr>
<tr>
<td>B</td>
<td>TSOP-11: Technology-Assisted Enforcement</td>
<td>Simple</td>
<td>$50,000 - $250,000</td>
</tr>
<tr>
<td>B</td>
<td>TSOP-12: Mobility in Work Zones</td>
<td>Simple</td>
<td>$50,000 - $250,000</td>
</tr>
<tr>
<td>B</td>
<td>TSOP-15: Advanced Planning and Strategy</td>
<td>Simple</td>
<td>$50,000 - $250,000</td>
</tr>
<tr>
<td>B</td>
<td>TSOP-16: Data-Acquisition and Archive</td>
<td>Simple</td>
<td>$200,000 - $750,000</td>
</tr>
<tr>
<td>C</td>
<td>TSOP-17: Statewide Transit Operations</td>
<td>Simple</td>
<td>$50,000 - $250,000</td>
</tr>
<tr>
<td>C</td>
<td>TSOP-18: Freight Movements Assessment</td>
<td>Simple</td>
<td>$50,000 - $250,000</td>
</tr>
<tr>
<td>C</td>
<td>TSOP-19: CVO Partnership with PSP</td>
<td>Simple</td>
<td>$50,000 - $250,000</td>
</tr>
</tbody>
</table>
APPENDIX A: DETAILED PROJECT PROFILES
Appendix A provides in-depth descriptions of the 19 projects. Each project is described in relation to the following: (1) scope, (2) needs, (3) long-term goals, (4) near-term objectives, (5) performance metrics, (6) project oversight, (7) project owners, (8) key stakeholders, (9) activities and milestones, (10) key outputs, (11) status, (12) period-of-performance, (13) level-of-effort, (14) Cost Range, (15) related projects, and (16) other related factors.

*Estimated periods-of-performance* for individual projects are reported by the following categories:

- Less than 1 year,
- 1-3 years, and
- More than 3 years.

*Level-of-effort* for individual projects is estimated as follows:

- “Simple,” means that the project is generally planning-related, easily managed, involves a small number of stakeholders, and requires normal staff activities.

- “Moderate,” means that the project is partially planning-related, but may require some deployment or pilot testing, involves multiple primary stakeholders, and probably requires augmentation of normal staff activities.

- “Complex,” means that the project requires a major systems design effort or significant deployment activity, involves a potentially large number of primary stakeholders, and may need full-time assignment of staff to the effort.
TSOP-01: Inter-Agency Incident Reporting System

Scope

This project develops and deploys a system for exchanging information concerning incidents within PennDOT and between PennDOT and other stakeholders. The resultant Incident Reporting System (IRS):

- Functions in a flexible environment that supports the timely exchange of information.
- Enables emergency response stakeholders to “subscribe” to and receive the specific data elements of relevance to them.
- Permits stakeholders to continue using their existing systems and infrastructures.

Users will connect to the IRS through a common communications backbone. Coverage of this system is anticipated in all TMC’s and key agencies within the next three years, and may include the Commonwealth Fusion Center. Information may also be shared with adjacent states and coalitions.

Needs

- Automated mechanisms are needed by PennDOT and stakeholders for routinely exchanging essential information on incidents and events.
- The availability of timely, accurate, and reliable incident data will enable PennDOT and its partners to better manage traffic, safety, and security conditions.

Long-Term Goals

- Quickly and efficiently share information about incidents among stakeholder organizations.
- Access up-to-date, reliable information on incident conditions at specific roadway and transit locations by “clicking” on a summary map.
- Support both automated and manual updates of incident data.
- Feed pertinent incident data into traveler information systems.
Near-Term Objectives

- Design and deploy an IRS infrastructure.
- Connect key stakeholder agencies.
- Begin capturing and exchanging incident data.

Performance Metrics

- Ease of implementing and subscribing to the IRS.
- Ease of data-entry and automated data-updates.
- Ease of accessing data.
- Timeliness, accuracy, and reliability of data.

Project Oversight

A Project Advisory Panel (PAP) shall oversee development and deployment of the IRS. Doug Tomlinson will be the Project Manager.

Project Owners

- PennDOT/Bureau of Highway Safety and Traffic Engineering (BHSTE)
- PennDOT/Bureau of Information Systems (BIS)
- Office of Administration/Office for Information Technology
- Office of Administration/Pennsylvania Justice Network (JNET)

Key Stakeholders

- PennDOT/Bureau of Maintenance & Operations (BOMO)
- PennDOT/Bureau of Planning & Research (BPR)
- PennDOT/Information Technology Program Office (ITPO)
- PennDOT/Press Office
- PennDOT/Engineering Districts

Activities and Milestones

1. Define IRS concept of operations (CONOPS) and system requirements.
2. Design system, including network infrastructure, communications approach, API structure, system functions, and data elements.
3. Develop HTML-based prototype for testing and demonstrating the system.
4. Deploy system and network infrastructure, and link key agencies via API’s.

5. Implement IRS processes and procedures.

6. Conduct pilot test, refine system, establish QA/QC procedures, and launch IRS.

7. Furnish training and technical assistance to users.

8. Perform after-action review.


**Key Outputs**

- Information-sharing infrastructure
- Inter-Agency Incident Reporting System

**Status**

- Preliminary conceptual design and planning for the IRS have been completed.

**Period-of-Performance**

- 1-3 years in length.

**Level-of-Effort**

- Moderate staffing required.

**Cost Range**

- $250,000 – $1,000,000 for systems deployment only.

**Related Projects**

- TSOP-02: Road Closure Reporting System. This project will implement an independent module identifying road closures and may eventually be made a part of the IRS.
• **TSOP-03: Interstate Incident Management Program.** ITS devices will help feed and disseminate information to and from the IRS.

• **TSOP-04: Incident Management Traveler Information.** This project will use data from the IRS to support traveler information.

• **TSOP-05: Incident Management Processes and Procedures.** This companion project will identify the IRS partners, data elements, data utility, etc.

• **TSOP-06: Roadway Weather Management.** RWIS devices will help feed information to the IRS.

• **TSOP-09: STMC and TMC’s.** The STMC and TMC’s will operate and use the RCRS.

• **TSOP-13: ITS and IT.** An IT infrastructure will be necessary to establish the IRS.

• **TSOP-14: Operations Mainstreaming.** The mainstreaming of ITS will impact all TSOP projects.

• **TSOP-15: Advanced Planning and Strategy.** All TSOP projects should incorporate new technologies and advanced strategies as applicable.

• **TSOP-16: Data-Acquisition and Archive.** Performance metrics will be collected and archived for every TSOP project.

**Other Pertinent Factors**

• The IRS information-exchange concept will allow partnering agencies to continue using their existing IM systems and infrastructures; specially-outfitted PC workstations will function as the API gateways to the information-exchange network. (See the schematic, below.)

• Ideally, the IRS will utilize an existing statewide communications infrastructure. The Pennsylvania Justice Network (JNET) may be able to serve as that communications backbone. JNET was created to enhance public safety by providing a common, on-line environment whereby authorized state, county, and local officials could access offender records and other criminal justice information from participating agencies. If the JNET communications backbone is not available to the IRS – or the backbone’s use in the IRS is otherwise impractical – then an alternative infrastructure will need to be identified or built.
The system design must safeguard the security of each agency’s systems and data.

**Figure A-1: Incident Reporting System**
TSOP-02: Road Closure Reporting System

Scope

This project refines and deploys a system for the timely and accurate dissemination of information on road closures across the Commonwealth. The Road Closure Reporting System (RCRS):

- Reports on road closures that result from adverse weather conditions, but will eventually be expanded to include closures for other reasons.
- Is accessible over-the-web and through internal PennDOT systems, such as Advanced Traffic Management Systems (ATMS).
- Will, in the future, be integrated with the Incident Reporting System (IRS) and traveler information systems.

The RCRS is a small-scale system that contains important information and can be implemented quickly. Successful deployment and usage of the RCRS will help signify proof-of-concept of the Incident Reporting System (IRS) and other future information system deployments. The system is expected to be deployed for operations in the winter of 2006 and deployed for all road closures sometime in 2006. This system will expand to include all hazardous incident reporting and will become a foundation for traveler information. The software will be the base for inter-agency incident reporting and may replace PennDOT’s incident reporting software.

Needs

- PennDOT, stakeholders, and the general public all require basic information on roadway closures.
- The availability of timely and accurate road closure data will help PennDOT and stakeholders better manage conditions and travelers to more aptly plan their travel.

Long-Term Goals

- Accommodate and report on road closures of interstate, state, and county roads, regardless of the circumstances or conditions that led to the closures.
- Ensure that road closure data are timely, accurate, and complete.
Integrate road closure data with the statewide IRS and traveler information systems.

**Near-Term Objectives**

- Develop, test, and deploy an automated module for reporting information on weather-related road closures timely and accurately (e.g., closure locations and estimated times of reopening).
- Implement the road-closure module in a flexible environment – over the Internet or on internal PennDOT systems.
- Build basic management capabilities into the RCRS, e.g., automatic notification that a road has not been flagged as “reopened,” even though the estimated time for its reopening has elapsed.

**Performance Metrics**

- Ease of accessing the RCRS.
- Ease of entering and editing RCRS data.
- Timeliness, accuracy, and completeness of the RCRS.

**Project Oversight**

A Project Advisory Panel (PAP) shall oversee implementation and deployment of the RCRS. Doug Tomlinson will be the Project Manager.

**Project Owners**

- PennDOT/Bureau of Highway Safety and Traffic Engineering (BHSTE)

**Key Stakeholders**

- PennDOT/Bureau of Planning & Research (BPR)
- PennDOT/Engineering Districts

**Activities and Milestones**

1. Finalize the RCRS prototype to cover road closures that result from adverse weather conditions.
2. Develop and pilot-test the system over the PennDOT Intranet. Also, conduct tests on the Internet, using county users as “testers.” (Ultimately,
districts and counties will be responsible for entering the road closure data into the RCRS.)

3. Replicate and pilot-test the system in an ATMS environment (e.g., in District 11-0).

4. Evaluate the experiences of the pilot tests, including the timeliness, accuracy, and completeness of data. Modify the RCRS, as appropriate.

5. Deploy the RCRS statewide and furnish technical assistance to users.

6. Make plans for future enhancements, including (1) expansion of the RCRS to cover road closures resulting from maintenance and construction activity, and (2) integration of the RCRS with the IRS and traveler information systems.

**Key Outputs**

- Road Closure Reporting System

**Status**

- Development of an RCRS prototype is underway.

**Period-of-Performance**

- Less than 1 year in length.

**Level-of-Effort**

- Simple staffing required.

**Cost Range**

- $50,000 – $250,000 for systems development, testing, and deployment.

**Related Projects**

- *TSOP-01: Inter-Agency Incident Reporting System*. It is anticipated that the RCRS module will eventually be integrated into the IRS.

- *TSOP-03: Interstate Incident Management Program*. ITS devices will help feed and disseminate information to and from the RCRS.
• **TSOP-04: IM Traveler Information.** This project is expected to use data from the RCRS to support traveler information.

• **TSOP-05: IM Processes and Procedures.** This companion project will help refine the future content, uses, and utility of the RCRS.

• **TSOP-06: Roadway Weather Management.** RWIS devices will help feed information to the RCRS.

• **TSOP-09: STMC and TMC’s.** The STMC and TMC's will operate and use the RCRS.

• **TSOP-13: ITS and IT.** An IT infrastructure will be necessary to establish the IRS.

• **TSOP-14: Operations Mainstreaming.** The mainstreaming of ITS will impact all TSOP projects.

• **TSOP-15: Advanced Planning and Strategy.** All TSOP projects should incorporate new technologies and advanced strategies as applicable.

• **TSOP-16: Data-Acquisition and Archive.** Performance metrics will be collected and archived for every TSOP project.

**Other Pertinent Factors**

• Success of the RCRS will be substantially dependent on the timeliness, accuracy, and completeness of data. **Timeliness** means that road closures are reported on the system at the time the roads are closed. **Accuracy** means that the data reported by the system are correct, i.e., that roads reported by the system as “open” have, in fact, been reopened. **Completeness** connotes that closures are reported for all roads across the state meeting the specified criteria for RCRS reporting.

• Major new hardware in support of the RCRS is not contemplated.
TSOP-03: Interstate Incident Management Program

Scope

This project establishes a statewide Interstate Incident Management Program and identifies “gaps” in ITS equipment for: (1) surveillance and detection, (2) verification, and (3) notification of incident management partners and the traveling public. The program will be established through cooperation and coordination between PennDOT Central Office and the engineering districts. Once “gaps” in ITS equipment have been identified, a programmatic review will be conducted and plans and approaches to funding will be prepared. ITS equipment will then be deployed at tactical locations to close existing gaps. Coverage of this program includes all interstate highways, key interstate-to-interstate intersections, and interstate-to-interstate transitions (look-a-likes).

Project Needs

- ITS equipment needs to be deployed along interstate highways to assist PennDOT in incident and event management, highway operations, and providing traveler information.

- PennDOT needs a programmatic approach for planning and funding ITS equipment across the state.

Long-Term Goals

- Fill in the “gaps” in ITS equipment throughout the Commonwealth. ITS equipment will be deployed at strategic locations throughout the state.

- Establish consistent statewide procedures for planning and programming ITS deployments through PennDOT districts and MPO’s/RPO’s.

Near-Term Objectives

- Establish a Concept of Operations (CONOPS) for Interstate Incident Management.

- Update the existing ‘GIS ITS Equipment Database’ and identify “gaps” in ITS equipment.

- Begin deploying ITS equipment at strategic locations to fill the “gaps.”
Performance Metrics

- Aggregate time to detect incidents.
- Aggregate time to respond to incidents.
- Aggregate time to clear incidents.
- Aggregate time to restore pre-incident traffic flow.
- Reduction in the number of incidents.
- Reduction in the number of secondary incidents.
- Reduction in weather-related incidents.
- Customer satisfaction ratings.
- Arterial travel speeds.
- Percentage of key roadways covered with ITS deployments.

Project Oversight

A Project Advisory Panel (PAP) shall oversee this project. Matt Weaver will be the Project Manager.

Project Owners

- PennDOT/Bureau of Highway Safety and Traffic Engineering (BHSTE)
- PennDOT/Engineering Districts

Key Stakeholders

- PennDOT/Bureau of Information Systems (BIS)
- PennDOT/Bureau of Planning and Research (BPR)
- PennDOT/Information Technology Program Office (ITPO)
- Metropolitan Planning Organizations (MPO’s)
- Other transportation agencies deploying ITS equipment

Activities and Milestones

1. Identify ITS equipment pertinent to surveillance, detection, verification, and notification.

2. Update the ITS equipment GIS database with existing PennDOT Central Office and district field devices.

3. Identify ITS equipment deployed by other agencies that PennDOT may utilize.
4. Work with other stakeholders to identify key corridors and strategic locations throughout the state.

5. Establish guidelines and criteria for identifying gaps in ITS equipment.

6. Compile district and regional inputs and provide a statewide approach for closing gaps.

7. Produce a prioritized list for deploying ITS equipment in each PennDOT district.

8. Present programmatic lists to MPO’s/RPO’s to incorporate in the planning and funding process.

9. Develop ITS Master Plan for each district identifying a comprehensive future vision for ITS deployment.

10. Deploy ITS equipment as funding becomes available.

**Key Outputs**

- Interstate Incident Management Concept of Operations (CONOPS)
- Updated ‘GIS ITS Equipment Database’
- Programmatic listing for planning and funding ITS Equipment
- District ITS Master Plan
- Deployed ITS Equipment (as funding becomes available)

**Status**

- ITS equipment has been deployed by PennDOT districts at various locations throughout the state.
- A ‘GIS ITS Equipment Database’ has been developed by BHSTE.

**Period-of-Performance**

- Greater than 3 years in length.
Level-of-Effort

- Complex staffing required.

Cost Range

- $1,000,000 – $5,000,000 for planning and programming.

Related Projects

- **TSOP-01: Inter-Agency Reporting System.** ITS devices will help feed and disseminate information to and from the IRS.

- **TSOP-02: Road Closure Reporting System.** ITS devices will help feed and disseminate information to and from the RCRS.

- **TSOP-04: IM Traveler Information.** ITS equipment will be used to broadcast traveler information to motorists.

- **TSOP-05: IM Processes and Procedures.** This companion project will help refine the future content, uses, and utility of ITS devices.

- **TSOP-09: STMC and TMC’s.** TMC’s are and will be responsible for operating ITS devices.

- **TSOP-10: ITS Equipment Maintenance.** This project establishes procedures for maintaining ITS equipment.

- **TSOP-13: ITS and IT.** This project establishes a telecommunications plan that will assist in field-to-center communication.

- **TSOP-14: Operations Mainstreaming.** The mainstreaming of ITS will impact all TSOP projects.

- **TSOP-15: Advanced Planning and Strategy.** All TSOP projects should incorporate new technologies and advanced strategies as applicable.

- **TSOP-16: Data-Acquisition and Archive.** Performance metrics will be collected and archived for every TSOP project.

Other Pertinent Factors

- Internally, PennDOT will need to refocus its deployment strategies regionally and statewide. In the past, operations and equipment
deployments have primarily been focused at the district level with some regional and statewide considerations. This new approach will need to carefully balance statewide needs with district and regional differences.
TSOP-04: Incident Management Traveler Information

Scope

This project establishes a statewide incident management traveler information program for Pennsylvania. It will:

- Examine best practices for using third-party vendor and infrastructure to deliver traveler information.
- Define means, media, and methods for delivering traveler information.
- Develop and deploy a statewide traveler information program.

The program’s structure for statewide consistency in traveler information will be sufficiently flexible for individual districts/regions to have discretion when establishing processes that address their own specialized circumstances.

Project Needs

- Mechanisms, processes and procedures for accumulating, validating and disseminating traveler information throughout an institutionally-complex environment.
- Accurate, consistent, and reliable traveler information so motorists can make informed pre-trip and en-route decisions.

Long-Term Goals

- Reliable, real-time traveler information disseminated consistently throughout the Commonwealth.
- A “one-stop shop” of information provided by multiple transportation and emergency management agencies, along with third-party vendors.
- Consistent and coordinated information provided to motorists seamlessly and independent of agency, jurisdiction, or geographic boundaries.
Near-Term Objectives

• Define traveler expectations for information in various environments including rural, urban, corridor-based, transit, commuter, and long-distance travelers (trips of over 100 miles).

• Develop a traveler information business model, including the interface between public sector agency operations data and the information disseminated to the traveling public.

• Establish a program that provides interstate weather and incident information to motorists throughout the state.

Performance Metrics

• Aggregate time to respond to incidents.
• Aggregate time to clear incidents.
• Aggregate time to restore pre-incident traffic flow.
• Traffic throughput during incidents/events.

Project Oversight

A Project Advisory Panel (PAP) shall oversee this project. Bob Pento will be the Project Manager.

Project Owners

• PennDOT/Bureau of Highway Safety and Traffic Engineering (BHSTE)

Key Stakeholders

• PennDOT/Bureau of Information Systems (BIS)
• PennDOT/Engineering Districts
• Office of Administration/Office for Information Technology (OIT)
• Third-Party Vendors
• Representative Transit and Multimodal Agencies

Activities and Milestones

1. Define and develop an incident management traveler information program. Develop a traveler information business model that accommodates public agency, private sector, and end-user issues.
2. Explore traveler expectations of Pennsylvanians, and identify data availability from key stakeholders.

3. Identify, evaluate, and select means, media, and methods for providing IM information to motorists.

4. Define metrics and performance measures for evaluating the incident management traveler information system.

5. Deploy and test a pilot project for the incident management traveler information system.

6. Define and implement a quality assurance (Q/A) program.

7. Implement the statewide incident management traveler information system.

**Key Outputs**

- PennDOT traveler information business model
- Pilot project for incident management traveler information
- Statewide incident management traveler information system

**Status**

- A customer survey for traveler information was conducted by BHSTE in the fall of 2004.
- A 511 feasibility study is currently underway.
- BOMO operates a 1-800 number for roadway conditions during winter months.
- Pittsburgh and Philadelphia are working with third-party vendors to provide traveler information to motorists. This information is disseminated on [www.smartraveler.com](http://www.smartraveler.com) and [www.traffic.com](http://www.traffic.com).

**Period-of-Performance**

- 1-3 years in length.
Level-of-Effort

- Moderate staffing required.

Cost Range

- $500,000 – $2,000,000 for planning and systems deployment.

Related Projects

- **TSOP-01: Inter-Agency Incident Reporting System.** The IM Traveler Information Project will utilize information from the Inter-Agency Incident Reporting System.

- **TSOP-02: Road Closure Reporting System.** The IM Traveler Information Project will utilize information from the Road Closure Reporting System (RCRS).

- **TSOP-03: Interstate Incident Management Program.** ITS devices will be used to feed and disseminate information to and from the IM Traveler Information system.

- **TSOP-05: IM Processes and Procedures.** This companion project will help refine the future content, uses, and utility of incident management information.

- **TSOP-06: Roadway Weather Management.** Road weather information will feed the Traveler Information system.

- **TSOP-13: ITS and IT.** This project will support the telecommunications network for the IM Traveler Information system.

- **TSOP-14: Operations Mainstreaming.** The mainstreaming of ITS will impact all TSOP projects.

- **TSOP-15: Advanced Planning and Strategy.** All TSOP projects should incorporate new technologies and advanced strategies as applicable.

- **TSOP-16: Data-Acquisition and Archive.** Performance metrics will be collected and archived for every TSOP project.
Other Pertinent Factors

- Data ownership, privacy or right to use issues associated with data will most likely arise during the implementation of the incident management traveler information system.

- Potential players, such as transit and municipal agencies, who have tended to be excluded from traveler information activities in the past, need to be brought to the table.

- Travelers have shown that they want real-time traveler information 24/7. In order to provide this service, PennDOT will need to work round-the-clock to feed the traveler information system and/or disseminate information to travelers.

- Providing alternate route information to travelers may have legal implications. The subject matter should be investigated and legal agreements should be put in place prior to the dissemination of this information.

- As the incident management traveler information system becomes more mature, additional infrastructure will need to be deployed to assist in data gathering and information dissemination.
TSOP-05: Incident Management Processes and Procedures

Scope

This project defines the processes, procedures, and relationships needed to more effectively manage roadway incidents. The central objective of the effort is to improve the time required to respond to and clear incidents, and to manage the processes safely and efficiently. Towards this end, this incident management (IM) project focuses on:

- Defining and implementing a statewide infrastructure for managing incidents.
- Strengthening relationships among IM partners.
- Refining the skills, responsibilities, and procedures used by regional IM Response Teams.
- Monitoring and managing IM performance regionally and statewide.

Across the Commonwealth, in both urban and rural settings, roadway incidents are the primary cause of non-recurring congestion. Improved management of incidents is, therefore, expected to go a long ways towards alleviating congestion and enhancing safety and mobility.

Needs

- Comprehensive policies and procedures are needed for managing incidents, special events, national security emergencies, and large-scale evacuations on Pennsylvania’s roadways.
- Often too much time is required to respond to incidents, clear the roads, restore traffic flow, and communicate information on conditions and status to PennDOT and its partners.
- Incident management policies and procedures must be consistent, uniform, and seamless so that communications, responses, and protocols are the same anywhere in the state, regardless of the staff on-duty at PennDOT.
Long-Term Goals

- Utilize clearly-defined, universally understood procedures for responding to and managing roadway incidents.
- Routinely share essential data about incidents among state, regional, and municipal agencies, regardless of who detected and first reported the incident.
- Enhance PennDOT’s ability to manage incidents by sharing pertinent data with the general public.
- Achieve significant, demonstrable reductions in total time required to identify, respond to, and manage incidents.

Near-Term Objectives

- Define and implement incident management processes and procedures.
- Cultivate and formalize IM relationships.
- Establish Incident Management Response Teams in each district.
- Measure and monitor performance on the management of incidents.

Performance Metrics

- Average time to detect incidents.
- Average time to respond to incidents.
- Average time to clear incidents.
- Average time to restore pre-incident traffic flow.
- Results of annual program reviews and after-action reviews.
- Results of customer satisfaction surveys.

Project Oversight

A Project Advisory Panel (PAP) shall oversee development of incident management processes and procedures. Doug Tomlinson will be the Project Manager.

Project Owners

- PennDOT/Bureau of Highway Safety and Traffic Engineering (BHSTE)
- PennDOT/Engineering Districts
Key Stakeholders

- There are no other stakeholders associated with this project.

Activities and Milestones

1. Identify and define incident management processes and procedures, including (1) procedures that may vary according to the type, location, and severity of incidents; (2) communications protocols; and (3) roles and responsibilities of PennDOT and its partners in managing incidents.

2. Continue building and formalizing IM relationships with partners – both statewide and regionally.

3. Establish or enhance IM Response Teams in each district or region.

4. Furnish on-going training and technical assistance to PennDOT and partner IM staff.

5. Deploy IM procedures.


7. Identify potential enhancements to the IM program.

Key Outputs

- Incident Management processes and procedures

- Memoranda-of-understanding (MOU) or other agreements with key partners

- IM training materials

Status

- Initial relationships among IM partners have been established in some regions.

- IM Response Teams currently exist in some locations.

- Development by PennDOT of a GIS-based application for pinpointing locations of incidents is underway.
Period-of-Performance

- 1-3 years in length.

Level-of-Effort

- Moderate staffing required.

Cost Range

- $250,000 – $1,000,000, exclusive of staff salaries.

Related Projects

- **TSOP-01: Inter-Agency Incident Reporting System.** This companion project will identify the data to be gathered and exchanged in support of IM processes and procedures.

- **TSOP-02: Road Closure Reporting System.** This companion project will identify the data to be gathered and exchanged in support of IM processes and procedures.

- **TSOP-03: Interstate Incident Management Program.** This project will identify potential deficiencies or “gaps” in equipment/technologies for detecting and managing incidents.

- **TSOP-04: IM Traveler Information.** This project will make pertinent IM data available to travelers and commuters.

- **TSOP-09: STMC and TMC’s.** The STMC and TMC’s will be responsible for implementing the processes and procedures.

- **TSOP-14: Operations Mainstreaming.** The mainstreaming of ITS will impact all TSOP projects.

- **TSOP-15: Advanced Planning and Strategy.** All TSOP projects should incorporate new technologies and advanced strategies as applicable.

- **TSOP-16: Data-Acquisition and Archive.** Performance metrics will be collected and archived for every TSOP project.
Other Pertinent Factors

- Major reeducation activities aimed at PennDOT field personnel will be needed for these new IM activities to succeed. These efforts must emphasize the benefits of a comprehensive IM program: preparation, detection, response, clearance, good communications with IM partners and the general public, etc. Internally, the Department must alter the current paradigm (which generally relies on the personnel on-duty to manage conditions and events as they see fit) to a Department-wide, systemic approach to IM. The new approach must emphasize safety, quick-clearance, mobility, timeliness, and exhaustive communications among partners.

- Walls between agencies must be broken down. PennDOT will need to work with its statewide, regional, and municipal partners to define comprehensive, better structured approaches to IM. Clearly-delineated lines of communications – and roles and responsibilities – among the partners will need to be spelled out in formal agreements. Potential players, such as transit and municipal agencies, who have tended to be excluded from incident management activities in the past, need to be brought to the table.

- The issue of whether TMC’s will operate on a 24/7 basis will potentially impact the management of incidents. PennDOT’s round-the-clock readiness to respond to emergencies and other unscheduled incidents will impact overall IM responsiveness and the time required to clear incidents and restore traffic flows.

- The proposed approach assumes that adequate statewide mechanisms are in place to detect incidents consistently and in a timely manner. This assumption could be overly optimistic and inadequate detection capabilities could be a potential impediment to comprehensive and timely management of incidents. TSOP-03: Interstate Incident Management Program will help address these issues.
TSOP-06: Roadway Weather Management

Scope

This project augments PennDOT's existing roadway weather management activities. PennDOT has undertaken several efforts in roadway weather management which include:

- Deploying road weather information systems (RWIS) to monitor road weather conditions throughout the Commonwealth of Pennsylvania.
- Establishing a ‘Winter Road Condition Hotline’ for interstate highways. This phone service disseminates seasonal statewide road conditions including road closures, detours, alternative routes, work zone/construction events, and road surface conditions.

The purpose of this project is to monitor existing road weather management activities in Pennsylvania and broaden those activities, as it becomes necessary.

Project Needs

- Monitor existing efforts and developing recommendations and conclusions for identifying and implementing appropriate strategies for the future.
- Improve safety and provide motorists will accurate weather information.

Long-Term Goals

- Deploy ITS devices to improve safety along the Pennsylvania highways and arterial roadways.
- Provide motorists with accurate, real-time road weather information.

Near-Term Objectives

- Review best practices and identify any issues or needs relating to roadway weather management strategies and deployments.
- Develop a plan that provides direction for roadway weather management applications across the Commonwealth of Pennsylvania.

Performance Metrics
• Fatality and accident rates due to weather conditions.
• Customer satisfaction surveys of roadway weather traveler information.

**Project Oversight**

A Project Advisory Panel (PAP) shall oversee this project. Bob Pento will be the Project Manager.

**Project Owners**

• PennDOT/Bureau of Highway Safety and Traffic Engineering (BHSTE)

**Key Stakeholders**

• PennDOT/Bureau of Maintenance and Operations (BOMO)

**Activities and Milestones**

1. Review road weather activities in Pennsylvania and across the United States.

2. Identify the issues/barriers, lessons learned, opportunities for success of other similar applications through case studies, best practices guides, and other similar documents.

3. Develop a roadway weather management plan, including recommendations for identifying and implementing appropriate strategies.

**Key Outputs**

• A document discussing current best practices of implementing roadway weather management, including roadblocks experienced in developing similar strategies

• A roadway weather management plan including recommendations to implementing strategies

• Recommendations and next steps for the roadway weather management program
Status

- RWIS sites have been deployed throughout the state and roadway weather information is available on the internet.
- A ‘Winter Road Condition Hotline’ exists during the winter months providing travelers with seasonal statewide road conditions.

Period-of-Performance

- 1 year or less in length.

Level-of-Effort

- Simple staffing required.

Cost Range

- $50,000 – $250,000, dependant of scope and decision to contract.

Related Projects

- **TSOP-01: Inter-Agency Reporting System.** Road weather information will help feed and disseminate information to and from the IRS.
- **TSOP-02: Road Closure Reporting System.** Road weather information will help feed and disseminate information to and from the RCRS.
- **TSOP-04: IM Traveler Information.** Road weather information will feed the IM traveler information system.
- **TSOP-14: Operations Mainstreaming.** The mainstreaming of ITS will impact all TSOP projects.
- **TSOP-15: Advanced Planning and Strategy.** All TSOP projects should incorporate new technologies and advanced strategies as applicable.
- **TSOP-16: Data-Acquisition and Archive.** Performance metrics will be collected and archived for every TSOP project.

Other Pertinent Factors

- There are no other pertinent factors.
TSOP-07: Crash Prevention/Safety

Scope

PennDOT has deployed crash prevention/safety systems at certain site-specific locations throughout the Commonwealth. These systems include: automatic fixed location anti-/de-icing systems (AFLADS), automatic truck rollover warning systems (ATRWS), and crash avoidance systems. These deployments have, in the past, been driven by regional needs. The purpose of this project is to evaluate existing crash prevention/safety systems and assess the practicality and suitability of replicating these systems elsewhere in the state.

Project Needs

- Monitor existing efforts and develop recommendations for identifying and implementing appropriate strategies for crash prevention/safety in the future.
- Deploy crash prevention/safety systems appropriately to improve safety throughout the state.

Long-Term Goals

- Deploy crash prevention/safety systems along Pennsylvania’s highways and arterial roadways.

Near-Term Objectives

- Review best practices and identify any issues or needs relating to crash prevention/safety systems.
- Develop a crash prevention/safety plan that provides direction for applications across the Commonwealth of Pennsylvania.

Performance Metrics

- Reduction in fatality and accident rates at sites equipped with crash prevention/safety systems
Project Oversight

A Project Advisory Panel (PAP) shall oversee this project. Gary Modi will be the Project Manager.

Project Owners

- PennDOT/Bureau of Highway Safety and Traffic Engineering (BHSTE)

Key Stakeholders

- There are no other stakeholders associated with this project.

Activities and Milestones


2. Identify the issues/barriers, lessons learned, and opportunities for success of other similar applications.

3. Developing a plan that includes recommendations for identifying and implementing appropriate strategies.

Key Outputs

- A document discussing current best practices of implementing crash prevention/safety practices, including roadblocks experienced in developing similar strategies.

- A crash prevention/safety plan including recommendations to implementing strategies

- Recommendations and next steps

Status

- PennDOT districts have deployed AFLADS, ATRWS, and crash avoidance systems at site specific locations throughout the Commonwealth.

Period-of-Performance

- 1 year or less in length.
Level-of-Effort

- Simple staffing required.

Cost Range

- $100,000 – $500,000, dependant of scope and decision to contract.

Related Projects

- **TSOP-14: Operations Mainstreaming.** The mainstreaming of ITS will impact all TSOP projects.

- **TSOP-15: Advanced Planning and Strategy.** All TSOP projects should incorporate new technologies and advanced strategies as applicable.

- **TSOP-16: Data-Acquisition and Archive.** Performance metrics will be collected and archived for every TSOP project.

Other Pertinent Factors

- There are no other pertinent factors.
TSOP-08: TAC Signal Study Implementation

Scope

This project paves the way for a more effective statewide traffic signal program that plans and coordinates activities at the corridor and regional levels. It builds on the findings and recommendations contained in a study sponsored by the Pennsylvania State Transportation Advisory Committee (TAC), entitled *Pennsylvania Traffic Signal Systems: A Review of Policies and Practices (2004)*, January 2005. The TAC study is predicated on several key premises, as noted below:

- Optimizing traffic signal operations and maintenance activities requires corridor- and region-wide approaches that treat the collection of signals in a “holistic” – or systemic – context. This contrasts with the Commonwealth’s traditional approach to signalization, which has viewed traffic signals in a relatively isolated context, on a jurisdiction-by-jurisdiction basis.

- A more centralized approach to signals management encourages new economies-of-scale. For example, instead of each municipality negotiating its own signal maintenance contract, the use of regional agreements can be expected to lead to more attractive contract terms and allow for the pooling of scarce staffing and funding resources. Similarly, the development of statewide, standardized approaches to operations and maintenance will help to ensure consistency and uniformity, and minimize the likelihood that individual jurisdictions will need to “reinvent the wheel.”

The project pertains to the 13,600 traffic signalized installations currently in operation across the Commonwealth. A complete traffic signal inventory is expected to be completed within five years.

Needs

- Staffing and resources necessary to effectively operate and maintain traffic signals.

- Traffic signals may, in fact, be most effectively operated and maintained on a corridor- or region-wide basis, but this premise has not been demonstrated in Pennsylvania.

- Develop a statewide inventory of traffic signals.
New or expanded mechanisms are needed for funding signal systems operations and maintenance.

**Long-Term Goals**

- Synchronize traffic signals along key corridors, regardless of municipal or other jurisdictional boundaries.

- Implement and operate signal timings that are responsive, i.e., can vary according to traffic needs and conditions.

- On selected corridors across the state, give signal prioritization to designated vehicle types, such as emergency vehicles, transit buses, and school buses.

- PennDOT, regional planning organizations, and municipalities work together to operate and maintain the traffic signal infrastructure.

- Use performance data results at specific intersections to adjust signal timings, manage lane conditions, etc.

- Centralize and administer regionally traffic signal procurement and maintenance activities.

**Near-Term Objectives**

- Implement an asset management system for signals.

- Pilot (1) corridor-wide integrated freeway/arterial signal management, and (2) multi-jurisdictional traffic signal operations and maintenance (O&M) programs.

- Expand mechanisms for funding traffic signals O&M.

- Implement performance metrics.

**Performance Metrics**

- Aggregate travel time and delay through intersection by day of week and time of day.

- Aggregate travel time and delay through corridor by day of week and time of day.

- Total incidents and incident severity by intersection and corridor.

- Time required deploying new signals, repairing malfunctioning signals, etc.
• Results of annual program reviews.

**Project Oversight**

A TAC Implementation Team shall oversee this project’s activities. Bill Laubach will be the Project Manager.

**Project Owners**

• PennDOT/Bureau of Highway Safety and Traffic Engineering (BHSTE)

**Key Stakeholders**

• PennDOT/Bureau of Information Systems (BIS)
• PennDOT/Bureau of Municipal Services (BMS)
• PennDOT/Information Technology Program Office (ITPO)
• PennDOT/Engineering Districts
• Representative Municipalities operating traffic signal systems

**Activities and Milestones**

1. Develop, deploy, pilot-test, and evaluate a model Signals Asset Management System (SAMS). Also, determine the relationship between SAMS and general Asset Management Systems.

2. Conduct a pilot that tests corridor-wide operation of integrated freeway/arterial traffic signals; evaluate the pilot results. The pilot will utilize variable timing plans under key scenarios (e.g., normal traffic conditions, light and heavy traffic conditions, incidents and events, detours, etc). PA-23 in District 6-0 is a candidate for this pilot.

3. Conduct a pilot that tests cross-jurisdictional, inter-municipal operations and maintenance (O&M) of traffic signals; evaluate the pilot results. The pilot may include the pooling of O&M resources, sharing of maintenance responsibilities, and negotiation of corridor- or regional-level contracts.

4. Expand the following two programs: (1) the Traffic Signal Enhancement Initiative (TSEI), and (2) the Congested Corridor Improvement Program (CCIP). TSEI partners PennDOT with “municipalities to identify traffic signals that need to be retimed, upgraded, or better integrated into an overall congestion management strategy.” Under CCIP, PennDOT and its partners identify congested corridors across the state and define and implement improvements to alleviate congestion.
5. Define baseline performance metrics for assessing traffic signal activity. These metrics will be expanded as implementation of the TAC study recommendations continue moving forward.

6. Identify and develop plans for implementing additional TAC study recommendations.

**Key Outputs**

- Model Signals Asset Management System
- Integrated corridor pilot findings and recommendations
- O&M pilot findings and recommendations
- Enhanced TSEI and CCIP
- Traffic signals performance metrics
- Next steps plan

**Status**

- District-level Asset Management Systems are functional in Districts 5-0 and 6-0.
- Integrated signals activity is underway in District 6-0.
- TSEI and CCIP are both existing PennDOT programs.

**Period-of-Performance**

- 1-3 years in length.

**Level-of-Effort**

- Moderate staffing required.

**Cost Range**

- $1,000,000 – $5,000,000, exclusive of signal systems acquisitions and additional TSEI/CCIP funding.
**Related Projects**

- **TSOP-10: ITS Equipment Maintenance.** This companion project will cover several interrelated topics, including funding and procurement strategies, equipment standards, and asset management.

- **TSOP-14: Operations Mainstreaming.** The mainstreaming of ITS will impact all TSOP projects.

- **TSOP-15: Advanced Planning and Strategy.** All TSOP projects should incorporate new technologies and advanced strategies as applicable.

- **TSOP-16: Data-Acquisition and Archive.** Performance metrics will be collected and archived for every TSOP project.

**Other Pertinent Factors**

- New levels of multi-jurisdictional, cross-agency cooperation not traditionally practiced in the traffic signal arena will be required to achieve the objectives identified in this project set.

- It has been the longstanding practice in Pennsylvania that municipalities own and maintain the traffic signals within their jurisdictional boundaries. This has created a system that has traditionally emphasized independent and decentralized management of traffic signals in contrast to the TAC study findings, which advocate corridor- and region-wide planning and management of signals coupled with additional state-level oversight, guidance, and support. The institutional and policy challenges ahead will require creative solutions. There will also likely be new legal issues, as well as human resource and funding matters, requiring resolution.

- Additionally, potentially significant policy and practice changes in the following areas may be required: (1) process for issuing signal permits, (2) procurement of signal systems, (3) procedures for planning and implementing timing modifications, and (4) procedures and contracts for signal maintenance.
TSOP-09: STMC and TMC’s

Scope

This project begins implementing the requirements of the 2004 Transportation Management Approach (TMA), which called for the establishment of transportation management centers (TMC’s) in each of the eleven PennDOT engineering districts. Specifically, the TMA defined three levels of TMC’s as follows:

- **Level I**: District Transportation Management Centers (TMC’s) will manage operations within their District.

- **Level II**: Regional Transportation Management Centers (RTMC’s) will manage operations within their districts, support other district TMC’s within their region, and manage overall operations along major regional corridors.

- **Level III**: The Statewide Transportation Management Center (STMC) will support and coordinate with TMC’s and RTMC’s and establish a statewide repository of archived data.

Although they vary in size and functionality, many PennDOT districts already maintain some form of TMC. This new effort will formally expand the TMC concept in accordance with statewide directions, right-sized to the individualized needs of districts and regions.

Needs

- Operate existing and future ITS devices.

- Coordinate border area operations, where multiple operations centers have influence.

- Coordinate regionally or statewide where regional or statewide events have impact.

Long-Term Goals

- Strategically deployed ITS devices controlled by TMC’s enable PennDOT to take a proactive role in incident and event management, improve highway operations, and provide users with accurate real-time traveler information.
• Fully establish TMC’s throughout the Commonwealth with adequate physical and communications infrastructure to perform effectively.

• Appropriately staff the TMC’s.

Near-Term Goals

TMC activities include the following:

• Control ITS field devices.

• Operate key corridors.

• Coordinate operations within PennDOT and externally with PSP, PEMA, PTC, municipalities, and with other transportation and emergency management agencies.

Performance Metrics

• Improved incident management measured against corridor performance trends.

• Right-sized TMC operation in each district or region, formulated by incident and congestion need.

• Coordinated operation measured by after-action reviews.

• Improvements in incident response and clearance and reductions in congestion due to ITS and operations.

Project Oversight

A Project Advisory Panel (PAP) will oversee development of this project. Doug Tomlinson and Matt Weaver will be the Project Managers.

Project Owners

• PennDOT/Bureau of Highway Safety and Traffic Engineering (BHSTE)
• PennDOT/Engineering Districts

Key Stakeholders

• PennDOT/Center for Program Development and Management (CPDM)
Activities and Milestones

1. Develop district/regional and statewide concept of operations.
2. Perform communications planning.
3. Develop an operations and maintenance plan.
4. Develop software systems.
5. Prepare test plans and performance specifications for operational activities.
6. Perform detailed design of facilities.
7. Build and install the facilities.
8. Test and operate.
9. Revisit and plan for the future.

Key Outputs

- Facilities to operate ITS equipment in a coordinated approach statewide

Status

- TMC’s are currently operating in many PennDOT districts.
- The TMA articulated a concept for establishing TMC’s.
- The TMA concept was validated in each Regional ITS Architecture.
- PennDOT has engaged in a preliminary effort to begin a statewide operations strategy and concept of operations.

Period-of-Performance

- Greater than 3 years in length.

Level-of-Effort

- Complex staffing required.
Cost Range

- $5,000,000 – $10,000,000 for planning, software, design, and development.

Related Projects

- **TSOP-01: Inter-Agency Incident Reporting System.** The TMC’s will utilize information from the IRS for operations.

- **TSOP-02: Road Closure Reporting System.** The TMC’s will utilize information from the RCRS for operations.

- **TSOP-03: Interstate Incident Management Program.** This program will outline the STMC and TMC’s role in certain incident management scenarios.

- **TSOP-05: IM Processes/Procedures.** This project’s examination of best-practices will help guide investments and operations at the TMC’s and STMC.

- **TSOP-13: ITS and IT.** The STMC and TMC’s will use this project’s guidance on communications development.

- **TSOP-14: Operations Mainstreaming.** The mainstreaming of ITS will impact all TSOP projects.

- **TSOP-15: Advanced Planning and Strategy.** All TSOP projects should incorporate new technologies and advanced strategies as applicable.

- **TSOP-16: Data-Acquisition and Archive.** The STMC will likely serve as the center for collecting and archiving performance data statewide.

Other Pertinent Factors

- Statewide needs must be balanced with district and regional needs.

- New approaches to procurement and deployment techniques need to be considered.

- Specialized building areas, equipment, and software need to be explored.
TSOP-10: ITS Equipment Maintenance

Scope

This project establishes a statewide maintenance inventory of ITS devices, incorporates IT devices into common BIS device maintenance and replacement programs, and defines and establishes cost-effective maintenance contracts or in-house maintenance programs.

Needs

- Efficient statewide maintenance vendor agreements for devices deployed throughout the Commonwealth.
- Consistent schedules for equipment replacements based on life-cycle.
- Departmental staff trained to maintain ITS devices.
- Development of a Departmental asset management program that incorporates ITS maintenance with traditional road and bridge asset management programs.
- Development of a configuration management strategy for ITS software.
- Policies and procedures for proper maintenance of ITS equipment.

Long-Term Goals

- A working partnership exists between PennDOT and ITS suppliers.
- IT devices that meet equipment standards are included in devices replacement upgrade programs.
- GIS is vital in maintaining up to date records of ITS equipment location and status.
- Standard software is deployed in all TMC’s with a clear configuration management strategy.
Near-Term Objectives

- ITS maintenance becomes centralized in information sharing and performance tracking.
- ITS devices have less down time due to excellent maintenance, and provide more accurate data to TMC’s.
- Equipment and vendors are included in a performance-based program that weeds out poor equipment and non-responsive vendors.

Performance Metrics

- Hardware and software purchased to meet pre-set goals for service.
- Effective hardware and software systems better manage traffic flow.
- Recognize and eliminate redundancies.
- Regularly-scheduled maintenance reduces equipment failures.
- Better response time for faulty equipment or repairs.
- Properly serviced ITS devices produce more accurate data.
- Increase in the average lifespan of ITS equipment.

Project Oversight

A Project Advisory Panel (PAP) will oversee development of this project. Matt Weaver will be the Project Manager.

Project Owners

- PennDOT/Bureau of Highway Safety and Traffic Engineering (BHSTE)

Key Stakeholders

- PennDOT/Bureau of Information Systems (BIS)
- PennDOT/Bureau of Office Services (BOS)
- PennDOT/Geographic Information Division (GID)
- PennDOT/Information Technology Program Office (ITPO)
- PennDOT/Press Office
- PennDOT/Program Management Committee (PMC)
- PennDOT/Engineering Districts
- Pennsylvania Department of General Services
Activities and Milestones

1. Identify institutional issues related to maintenance of ITS equipment.

2. Identify standard maintenance practices and standards as set forth by FHWA and various ITS device manufacturers.

3. Define proper maintenance practices for each type of device.

4. Develop a plan for tracking and recording maintenance actions and equipment failures.

5. Evaluate the benefits of a regional or statewide contract for ITS equipment maintenance and consider implementation.

Key Outputs

- Policy and procedures

Status

- Best practices for equipment maintenance are continually being discussed.
- Planning databases for ITS equipment maintenance are in place.
- ITS real-time maintenance information is available, but is not necessarily archived.

Period-of-Performance

- Less than 1 year in length.

Level-of-Effort

- Simple staffing required.

Cost Range

- $50,000 – $250,000, dependant of scope and decision to contract.
Related Projects

- **TSOP-03: Interstate IM Program.** ITS equipment from this project will be inventoried and maintained.

- **TSOP-08: TAC Signal Study Implementation.** Some strategic traffic signals may be inventoried by PennDOT under this project.

- **TSOP-13: ITS and IT.** ITS and IT systems will be maintained.

- **TSOP-14: Operations Mainstreaming.** The mainstreaming of ITS will impact all TSOP projects.

- **TSOP-15: Advanced Planning and Strategy.** All TSOP projects should incorporate new technologies and advanced strategies as applicable.

- **TSOP-16: Data-Acquisition and Archive.** Performance metrics will be collected and archived for every TSOP project.

Other Pertinent Factors

- Operators and planners will need to explore equipment maintenance procedures together to seek common ground.
TSOP-11: Technology-Assisted Enforcement

Scope

Technology-assisted enforcement (TAE) is the use of technology to assist police in the enforcement of traffic laws, within the limits of current legislation. TAE allows for remote monitoring and surveillance by police officers, who then conduct standard procedures for ticketing violators. TAE applications currently include speed-limit enforcement and tailgating. A pilot project for technology-assisted speed enforcement (TASE) has been tested in Pennsylvania, but has not been certified for enforcement. The objective of this project is to monitor and evaluate planned Pennsylvania TAE applications and stay abreast of TAE activities and deployments in other states. Additionally, this project will monitor automated enforcement programs, such as the Philadelphia Automated Red-Light Enforcement (ARLE) program, which is not currently permitted in most parts of the Commonwealth. This effort ensures that PennDOT remains knowledgeable about the subject matter should the state laws change.

Project Needs

- Technology-Assisted Enforcement is needed to improve the safety of PennDOT's transportation system, by allowing more efficient and comprehensive enforcement of existing traffic laws.

- Clearly defined roles and relationships between PennDOT, PSP, and local law enforcement are needed to ensure that TAE is implemented and operated successfully.

Long-Term Goals

- Establish legislation and gain general acceptance by the traveling public for a TAE program.

- Use TAE to improve safety and increase mobility along the Pennsylvania highways and arterial roadways.

Near-Term Objectives

- Review best practices and identify any issues or needs relating to TAE strategies and deployments.

- Define roadblocks to implementing TAE strategies including legislation and public acceptance.
• Develop a statewide technology-assisted enforcement plan that provides direction for TAE applications across the Commonwealth of Pennsylvania.

Performance Metrics

• Fatality and accident rates in each area utilizing TAE.
• Number of traffic violations in each area utilizing TAE.
• Number of citations issued in each area utilizing TAE.
• Cost to law enforcement per citation issued in each area utilizing TAE.
• Average travel speed in each area utilizing TAE versus without TAE.
• Customer satisfaction surveys of TAE.

Project Oversight

A Project Advisory Panel (PAP) shall oversee this project. Bob Pento will be the Project Manager.

Project Owners

• PennDOT/Bureau of Highway Safety and Traffic Engineering (BHSTE)

Key Stakeholders

• PennDOT/Engineering Districts
• Pennsylvania State Police (PSP)
• Pennsylvania Turnpike Commission (PTC), if applicable for the corridor
• Local law enforcement agencies
• Select local and state politicians

Activities and Milestones


2. Identify the issues/barriers, lessons learned, opportunities for success of other similar applications through case studies, best practices guides, and other similar documents. Based on this research, define an approach to implementing:
   - Technology strategies for the deployment of the TAE programs.
   - Legislative strategies for automated enforcement.
   - Public support strategies for the successful implementation of the TAE program.
3. Develop a TAE Plan, including recommendations and conclusions for identifying and implementing appropriate strategies.

**Key Outputs**

- A document discussing current best practices of implementing TAE, including roadblocks experienced in developing similar strategies
- A TAE plan including recommendations and conclusions to implementing TAE strategies
- A guidance document on monitoring and evaluating TAE performance and effectiveness
- Recommendations and next steps for the TAE program

**Status**

- Pennsylvania is currently field testing the deployment of technology-assisted speed enforcement in variable speed limit work zone along I-81 near Harrisburg.
- The Philadelphia iParking Authority is currently implementing Automated Red Light Enforcement (ARLE) as a pilot project in the city of Philadelphia. The Philadelphia Streets Department, Philadelphia Police Department, and PennDOT are providing guidance and oversight support.

**Period-of-Performance**

- Less than 1 year in length.

**Level-of-Effort**

- Simple staffing required.

**Cost Range**

- $50,000 – $250,000 for monitoring and evaluating TAE.

**Related Projects**

- *TSOP-14: Operations Mainstreaming.* The mainstreaming of ITS will impact all TSOP projects.
• **TSOP-15: Advanced Planning and Strategy.** All TSOP projects should incorporate new technologies and advanced strategies as applicable.

• **TSOP-16: Data-Acquisition and Archive.** Performance metrics will be collected and archived for every TSOP project.

**Other Pertinent Factors**

• Statewide implementation of TAE will be dependant upon legislative action.

• The successful deployment of TAE programs involves the coordination and cooperation among PSP, PennDOT, and local law enforcement, as well as input from the general public. Developing formal Memorandums of Understanding (MOU’s) or other agreements between PennDOT and PSP will help define roles and responsibilities.
TSOP-12: Mobility in Work Zones

Scope

This project sets forth a playbook of potential ITS strategies for the purpose of improving safety and mobility in the construction work zones. ITS technologies and strategies can generally be used to help improve the safety of workers and travelers in work zones, as well as to facilitate traffic flow through and around construction areas.

Needs

- Strategies for improving safety and increasing mobility are needed at work zones in Pennsylvania.

Long-Term Goals

- Establish ITS and operations support at all PennDOT work zones.
- Disseminate warnings of approximate delays and possible alternate routes for work zones to the general public.
- Archive various data concerning different work zones and various ITS configurations. This data will be periodically evaluated to determine the effectiveness of different ITS strategies, for future mobility and safety improvements, as well as investment decision-making.

Near-Term Goals

- Identify various work zone types and review action on work zone management policies and programs.
- Identify safety and mobility issues related to work zone operations.
- Review best practices and guidance on deploying ITS work zone strategies.
- Develop an ITS playbook of potential ITS work zone strategies to mitigate identified issues.
Performance Metrics

- Reduction in delay (reoccurring) and congestion in each work zone.
- Traffic throughput in each work zone.
- Average travel time in each work zone.
- Average travel speed in each work zone.
- Fatality and accident rates in each work zone.
- Customer satisfaction surveys of work zone management strategies.

Project Oversight

A Project Advisory Panel (PAP) will oversee development of this project. Glenn Rowe will be the Project Manager.

Project Owners

- PennDOT/Bureau of Highway Safety and Traffic Engineering (BHSTE)
- PennDOT/Engineering Districts

Key Stakeholders

- Pennsylvania State Police (PSP)
- Pennsylvania Turnpike Commission (PTC), if applicable for the corridor

Activities and Milestones

1. Identify general focus areas in mobility in work zones throughout Pennsylvania.

2. Identify various work zone types (e.g., lane closure, shoulder closure, bridge work, etc.) by geographic area (e.g., urban or rural) for analysis.

3. Identify best practices including, AASHTO’s ITS Work Zone playbook of potential ITS strategies.

4. Define suggested performance measures, or a range of measures, to evaluate different ITS strategies in improving work zone safety and mobility. As all work zones are different, the designer and contractor (with PennDOT approval) should have the ability to set performance measures that are appropriate to the work zone.

5. Develop procedures for recording and archiving data from work zones to be used in evaluating the effectiveness of ITS strategies and performance of the current playbook.
6. Compare the performance results with the corresponding ITS strategies, and make recommendations as to the best ITS and operations configurations for different work zone types.

7. Update the playbook of ITS work zone strategies.

**Key Outputs**

- An ITS Work Zone Playbook that sets forth a list of potential ITS strategies for the purpose of improving safety and mobility in the construction work zone

**Status**

- No work has been performed on this project.

**Period-of-Performance**

- Less than 1 year in length.

**Level-of-Effort**

- Simple staffing required.

**Cost Range**

- $50,000 – $250,000, for monitoring and evaluating TAE.

**Related Projects**

- *TSOP-14: Operations Mainstreaming.* The mainstreaming of ITS will impact all TSOP projects.

- *TSOP-15: Advanced Planning and Strategy.* All TSOP projects should incorporate new technologies and advanced strategies as applicable.

- *TSOP-16: Data-Acquisition and Archive.* Performance metrics will be collected and archived for every TSOP project.

**Other Pertinent Factors**

- For ITS work zone strategies to be successfully implemented, a significant effort will be required to educate planners, program managers,
construction managers and designers on the merits of ITS in the work zone.

- More extensive data archiving is needed to properly evaluate different ITS and operations strategies. PennDOT will need to develop more intensive data collection and data archiving around construction work zones throughout Pennsylvania.
TSOP-13: ITS and IT

Scope

This project encompasses the elements and practices around ITS and IT issues. For instance, communication from an operations center to roadside equipment or other operation centers requires a telecommunications infrastructure. Additionally, the scope of required communications compels PennDOT to determine how best to plan for, process, and maintain record of and maintenance of communication linkages.

Needs

- Mechanisms to provide field-to-center and center-to-center communications within a secure environment.

- Documented plans and processes to integrate ITS/operations needs and IT requirements.

- Telecommunications infrastructure that will reduce operating costs and take advantage of all telecommunications funding sources.

Long-Term Goals

- Fully integrated, seamless, reliable, and easy to use telecommunications network.

- Telecommunications infrastructure enabling command-and-control of ITS devices and allows real-time video images to be shared statewide.

Near-Term Goals

- IT requirements for ITS and operations will be part of the Department's IT function.

- ITS requirements will be known by IT personnel and easily understood and documented.

- A telecommunications network that makes real-time data readily accessible.
Performance Metrics

- Reliability of the telecommunications network.
- Cost accounting of technology alternatives as well as capital, operations, and maintenance costs.
- Efficiency in design, as the process for IT design and construction is planned prior to deployment.

Project Oversight

The Bureau of Information Systems (BIS) and The Bureau of Highway Safety & Traffic Engineering (BHSTE) are likely oversight groups. Bob Pento will be the Project Manager.

Project Owners

- PennDOT/Bureau of Highway Safety and Traffic Engineering (BHSTE)

Key Stakeholders

- PennDOT/Bureau of Information Systems (BIS)
- PennDOT/Information Technology Program Office (ITPO)
- PennDOT District Offices
- Office of Administration/Office of Information Technology (OIT)

Activities and Milestones

1. Develop a telecommunications plan.
2. Develop IT guidance document for linking IT and ITS operations.
3. Classify ITS projects for IT planning and approvals.
4. Incorporate ITS PC’s and peripherals in standard DOT IT equipment maintenance and replacement cycles.
5. Mainstream ATMS and other ITS software into IT software support programs.

Key Outputs

- Telecommunications inventory
Telecommunications Master Plan

IT guidance document that links ITS and operations

Status

IT inventories have already begun.

Classification work for IT planning has also begun.

Period-of-Performance

Less than 1 year in length.

Level-of-Effort

A simple staffing requirement is needed for this effort.

Cost Range

$100,000 – $500,000 dependant of scope and decision to contract.

Related Projects

TSOP-01: Inter-Agency Incident Reporting System. The IRS’s complex communications will be able to use information from the ITS and IT project to make decisions about proposed communication linkages.

TSOP-02: Road Closure Reporting System. The RCRS will utilize communication linkages from the ITS and IT project.

TSOP-03: Interstate Incident Management Program. ITS devices will need telecommunications infrastructure from the ITS and IT project.

TSOP-04: IM Traveler Information. The IM Traveler Information system will require telecommunications infrastructure from the ITS and IT project.

TSOP-09: STMC and TMC’s. This project will use the recommendations provided by the ITS and IT project when developing communications between various agencies.

TSOP-10: ITS Equipment Maintenance. ITS and IT systems will be maintained.
• **TSOP-14: Operations Mainstreaming.** The mainstreaming of ITS will impact all TSOP projects.

• **TSOP-15: Advanced Planning and Strategy.** All TSOP projects should incorporate new technologies and advanced strategies as applicable.

• **TSOP-16: Data-Acquisition and Archive.** Performance metrics will be collected and archived for every TSOP project.

**Other Pertinent Factors**

• A centralized approach is needed to identify and document an approach for ITS and IT.

• Right-sizing will be an important consideration in developing plans and infrastructure.

• To ensure that efficiencies are achieved, disciplined use of the plan and procedures are required.

• The Commonwealth of Pennsylvania (Office of Administration) has entered into a long-term statewide telecommunications contract with a telecommunications provider (TelCove). This contract is in place until 2011. The integration or linking of IT and ITS equipment will need to meet the security guidelines of this contract.

• Connecting TMC PC’s to the PennDOT LAN is currently against OA policy. This policy will have to be reviewed before they can become a part of the network.
TSOP-14: Operations Mainstreaming

Scope

This project examines the impacts of ITS and operations on PennDOT processes for starting and successfully completing projects. Beginning with the planning process, guidance for incorporation of projects into long-range plans and TIP’s will occur with the help of PennDOT’s planning partners. Under this effort, ITS procurement guidance and design guidance will also be developed. Operational staffing issues (e.g., job descriptions, job classifications, and job training) will be addressed as well. This project also addresses ITS project implementation methodologies. It considers project consistency with the regional ITS architectures, development of contract documentation, testing of ITS equipment, payment schedule, use of NTCIP and other standards, and processes for the inclusion of ITS in larger construction projects.

Needs

- A clear, cohesive process for long-term planning and funding that builds from the Pennsylvania’s Regional ITS Architectures, TSOP, and ROP’s and mainstreams into Long-Range Plans and TIP’s.

- A transition from a culture based on highway design, construction, and maintenance to an expanding culture that encompasses operations.

- Addressing potentially difficult policy issues, such as expanding hours of operations, and staffing and skills requirements associated with these issues. The Commonwealth’s job classification process and its inflexibility is part of the staffing and skills challenge.

Long-Term Goals

- Mainstream planning and funding processes for operations where ITS and operations is part of long-range plans and TIP cycles.

- Ensure that each business unit within PennDOT (e.g., design, construction, and maintenance) possesses clearly-articulated operational roles and responsibilities for right-sizing ITS and operations through documented processes.

- Understood policy with regard to ITS and operations impacts on staffing, hours of service, and performance. The success of PennDOT’s
operational activities is measured using a series of objective, performance-based metrics.

- Mainstream ITS project implementation methodologies including consistency with the regional ITS architectures, development of contract documentation, testing of ITS equipment, payment schedule, use of NTCIP and other standards, and processes for the inclusion of ITS in larger construction projects.

**Near-Term Goals**

- Mainstream operations into existing business practices.
- Improve organization around operations with clear definitions of roles and responsibilities.
- Establish policy for staffing.

**Performance Metrics**

- Measures for assessing performance in this component area will likely include qualitative reviews.

**Project Oversight**

A Project Advisory Panel will oversee development of this project. Craig Reed and Steve Koser will be the Project Managers.

**Project Owners**

- PennDOT/ Bureau of Highway Safety and Traffic Engineering (BHSTE)
- PennDOT Districts

**Key Stakeholders**

- PennDOT/Center for Program Development and Management (CPDM)
- PennDOT/Bureau of Office Services (BOS)
- PennDOT/Bureau of Design (BOD)
- PennDOT/Bureau of Human Resources (BHR)
- MPO’s and RPO’s
Activities and Milestones

1. Work with MPO and RPO planning partners to incorporate ITS into planning processes, evaluate outcome of 2007 TIP, and engage ITS personnel in the planning process.

2. Review ITS project procurement guidance, reviewing design build, software and equipment – Bulletin 15.

3. Ensure ITS design is coordinated with project development in IT for right-sizing.

4. Establish procedures for mainstreaming ITS project implementation methodologies.

5. Create staffing guidance for ITS personnel, job descriptions, classifications and training.

6. Conduct outreach.

Key Outputs

- Processes for planning and funding operations
- Organizational behavior changes
- Newly established or changed policy recommendations

Status

- Regional ITS Architectures began this understanding of partnership with MPO’s and RPO’s.
- Organizational processes have begun to be discussed.
- Staffing issues have been articulated and discussed.

Period-of-Performance

- Less than 1 year in length.
Level-of-Effort

- A moderate staffing requirement is needed for this effort because of the policy issues involved.

Cost Range

- $50,000 – $250,000, dependant of scope and decision to contract.

Related Projects

- All projects are affected by this effort.

Other Pertinent Factors

- Changing the transportation culture may prove more difficult than obtaining funding and implementing new technologies.

- Strong leadership is essential at all levels to move PennDOT forward towards an operations focus.
TSOP-15: Advanced Planning and Strategy

Scope

This project recognizes that new techniques in planning and applications exist in the rapidly-growing and evolving areas of ITS and operations. The purpose of this project is to examine emergent ITS policies, procedures, and technologies in order to plan for the future and commit resources wisely.

Project Needs

- Awareness of new approaches, procedures, policies and technology applications.

Long-Term Goals

- Ensure PennDOT is utilizing the best state-of-practice applications and techniques.

Near-Term Objectives

- Ensure policy and procedures is reviewed and understood.

Performance Metrics

- Measures for assessing performance in this component area will likely include qualitative reviews.

Project Oversight

A Project Advisory Panel (PAP) shall oversee this project. Steve Koser will be the Project Manager.

Project Owners

- PennDOT/Bureau of Highway Safety and Traffic Engineering (BHSTE)
- PennDOT/Bureau of Planning and Research (BPR)

Key Stakeholders

- There are no other stakeholders associated with this project.
Activities and Milestones

1. Review state-of-practice, looking especially at public/private data sharing such as Mobility Technologies.

2. Establish guidance, procedures, and policy.

3. Provide outreach regarding findings.

Key Outputs

- Policy and procedures

Status

- Best practices are continually being discussed.

Period-of-Performance

- Less than 1 year in length.

Level-of-Effort

- A simple staffing requirement is needed for this effort.

Cost Range

- $50,000 – $250,000, dependant of scope and decision to contract.

Related Projects

- All projects are affected by this effort.

Other Pertinent Factors

- Private sector partnerships can prove very beneficial but can also be very challenging for the public sector.
TSOP-16: Data-Acquisition and Archive

Scope

This project establishes statewide procedures and guidelines for collecting and archiving transportation-related data. This will include both (1) basic statistical data and (2) key performance metrics that support both planning and operational initiatives. Planners tend to require archived data, whereas operators generally need and use real-time information. Consequently, this project will consider whether common collection, classification, and archival strategies can be used to support both planners and operators.

Needs

- A comprehensive look at data that PennDOT collects for use by both planners and operators.

Long-Term Goals

- Efficient collection, archiving, and use of transportation data.

Near-Term Objectives

- Better understand the planning and operations data needs.

Performance Metrics

- Measures for assessing performance in this component area will likely include qualitative reviews.

Project Oversight

A Project Advisory Panel (PAP) will oversee development of this project. Steve Koser will be the Project Manager.

Project Owners

- PennDOT/Bureau of Highway Safety and Traffic Engineering (BHSTE)
- PennDOT/Bureau of Planning and Research (BPR)
Key Stakeholders

- There are no other stakeholders associated with this project.

Activities and Milestones

1. Review state-of-the-practice for data collection, use and archiving. Consider data accuracy, classification, speeds, axels and other data fields. Collection areas will look at ITS devices, automatic traffic recorders and road-weather instruments.

2. Identify the use of archived data for real-time operations and planning needs.

3. Identify the tools to use for data archiving, such as GIS.

4. Develop a common platform for data life-cycle and guidance procedures.

5. Provide outreach to operators and planners regarding the findings of this project.

Key Outputs

- Policy and procedures

Status

- BPR is actively assessing various vehicle detector technologies for applicability to their data collection needs

- Best practices for data-acquisition and archiving are continually being discussed.

- Databases for archived planning data are currently in place.

- Real-time ITS data is available, but is not necessarily archived.

Period-of-Performance

- Less than 1 year in length.

Level-of-Effort

- Simple staffing required.
Cost Range

- $200,000 – $750,000, dependant of scope and decision to contract.

Related Projects

- All projects are affected by this effort.

Other Pertinent Factors

- Operators and planners will need to explore together to seek common ground if identified.
TSOP-17: Statewide Transit Operations

Scope

The goal of this project is to provide a blueprint for using advanced ITS technologies to improve transit operations management in Pennsylvania. Because the report that results from this effort will be PennDOT-centric, the analysis will focus on identifying specific roles for PennDOT that encourage the implementation of advanced technologies. At the same time, the analysis and subsequent report will need to be responsive to the independence of individual transit agencies, as well as the diversity of systems within Pennsylvania (ranging from large multimodal agencies operated by regional authorities all the way to small, demand-response services operated by medical and social service institutions). The final product of this project will be an Advanced Transit Operations Management report, which will lay out a vision and direction for using ITS technologies to improve transit operations management, as well as a pathway for making that vision a reality.

Project Needs

- Pennsylvania needs to improve the efficiency of transit operations through ITS technologies and statewide coordination.

Long-Term Goals

- Utilize ITS technologies, such as Automatic Vehicle Location (AVL), Computer-Aided Dispatching (CAD), and on-vehicle diagnostics to enhance transit operations, improve system efficiency and fleet utilization, and provide real-time traveler information to customers.

- Coordinate the use of advanced transit operations technologies to take advantage of synergies in technology development, procurement, and maintenance.

- Promote public transit to the traveling public as a more viable option for commuting and other trips, in both large and small metropolitan areas.

Near-Term Objectives

- Begin to understand the full potential of transit interconnections and technology applications with PennDOT. Interconnects and information exchanges between transit agencies and PennDOT TMC’s will be explored.
• Perform a review of transit-specific technology deployments statewide.

• Identify potential synergies that can be captured through coordination of planning and funding on a statewide basis.

• Develop statewide guidance and overall direction for advanced transit operations, particularly with respect to the role that PennDOT can play.

Performance Metrics

• Number of transit vehicles equipped with advanced technologies.
• Number of transit agencies with advanced dispatch centers.
• Number of web sites providing real-time passenger information.
• Number of public locations providing real-time passenger information.
• Increases in transit ridership attributable to improved technology and operations.
• Customer satisfaction surveys of transit services’ passenger information systems.

Project Oversight

A Project Advisory Panel (PAP) shall oversee this project.

Project Owners

• PennDOT/Bureau of Public Transportation (BPT)

Key Stakeholders

• PennDOT/Bureau of Highway Safety and Traffic Engineering (BHSTE)
• PennDOT/Center for Program Development and Management (CPDM)
• Representative Transit and Multimodal Agencies
• Pennsylvania Public Transportation Association

Activities and Milestones

1. See current Pennsylvania Regional ITS Architectures at www.paits.org to review and document existing and planned interconnects and information flows between transit centers and PennDOT TMC’s.

2. Research and document the state-of-the-art and state-of-the-practice in the deployment of ITS and other advanced operational technologies.
nationally and internationally. As part of this review, identify examples of coordinated implementation that have created synergies or greater efficiencies.

3. Determine the specific role that PennDOT should play in promoting advanced transit operations, both as a central funding partner and as a statewide coordinating agency.

4. Complete the Advanced Transit Operations Management Report which lays out a vision and direction for future transit operations in Pennsylvania, and details the role that PennDOT expects to play.

**Key Outputs**

- Advanced Transit Operations Management Report

**Status**

- The recently completed Pennsylvania Regional ITS Architectures provide a basis for understanding the operational and technological interconnects that currently exist, as well as those that are planned (or desired) for the future between transit agencies, PennDOT, and other stakeholders.

**Period-of-Performance**

- Less than 1 year in length.

**Level-of-Effort**

- Simple staffing required.

**Cost Range**

- $50,000 – $250,000, dependant of scope and decision to contract.

**Related Projects**

- **TSOP-14: Operations Mainstreaming.** The mainstreaming of ITS will impact all TSOP projects.

- **TSOP-15: Advanced Planning and Strategy.** All TSOP projects should incorporate new technologies and advanced strategies as applicable.
• **TSOP-16: Data-Acquisition and Archive.** Performance metrics will be collected and archived for every TSOP project.

**Other Pertinent Factors**

• In order to use ITS and other advanced technologies to leverage improvements and advances in transit operations, it may be necessary to undertake significant educational activities directed at transit agency staff. These activities will be necessary to explain the potential benefits of advanced technologies from an operational point of view.

• Because of the ongoing fiscal constraints on public transit within the Commonwealth, it will be important to show that these advanced operations technologies can be implemented at relatively low short-term cost, and will lead to either operational savings or ridership improvements in the long-term.

• In addition, if the report that results from this project suggests that PennDOT take on an expanded role in planning or coordinating transit operations in Pennsylvania, this may lead to significant resistance from transit agencies that are accustomed to operating independently. As a result, it will be necessary to demonstrate to these transit agencies how they will benefit from PennDOT’s enhanced role, particularly in terms of cost savings that can result from coordinated development and procurement of technology.
TSOP-18: Freight Movements Assessment

Scope

This project will analyze freight movement from a statewide perspective. Through this analysis, future scenarios can be evaluated by various stakeholders, who will then make recommendations as to needed improvements to the transportation system. Pennsylvania’s freight movement should be enhanced through these recommended strategies, policies, and capital improvements, while maintaining a high quality of life and a strong economy. The project will identify next steps that are consistent with the South Central Pennsylvania Regional Goods Movement Study which is currently being sponsored by the Tri County Regional Planning Commission. These goals are to (1) developing essential freight data, (2) identifying policies and strategies that achieve economic benefit goals while minimizing transportation impacts and related costs, and (3) creating an effective and enduring public-private partnership forum.

Project Needs

- Pennsylvania needs to mitigate increases in freight traffic through institutional and capital improvements.

Long-Term Goals

- Develop a concerted comprehensive plan to freight movement.
- Establish an up-to-date database of current and projected freight information that allow planners and other stakeholders to anticipate transportation network improvements years into the future.

Near-Term Objectives

- Develop policies that improve goods movement in a cost-effective manner.
- Recommend effective capital improvements for Pennsylvania’s freight transportation system.
- Develop these policies and recommendations in a way that encourage discussion and consensus among stakeholders.
Performance Metrics

- Measures for assessing performance will depend on the recommendations generated through the study.

Project Oversight

A Project Advisory Panel (PAP) shall oversee this project.

Project Owners

- PennDOT/Bureau of Rail and Freight (BRF)

Key Stakeholders

- PennDOT/Bureau of Highway Safety and Traffic Engineering (BHSTE)
- PennDOT/Center for Program Development and Management (CPDM)
- Pennsylvania State Police (PSP)
- Pennsylvania Turnpike Commission (PTC)
- Commercial Vehicle Companies
- Airport and Railroad Offices
- Port Authorities
- Port officials (Philadelphia, Pittsburgh and Erie)
- U.S. DOT Administrations (FHWA, FRA, FAA, MARAD,ACE)
- DCED and other economic development agencies

Activities and Milestones

1. Collect and analyze current statewide freight data, including goods movement patterns, issues, opportunities, and concerns. Identify critical locations where freight movement adversely affects safety and congestion.

2. Prepare recommendations for managing the database, including basic methodology and database structure, location, staffing requirements, and update cycles.

3. Evaluate current policies, including economic, market-based, ITS, defense/homeland security, land use, and funding. Also examine institutional issues of the trucking, rail, maritime, and aviation industries.

4. Project the future conditions for statewide freight under different scenarios, each reflecting a broad improvement strategy (e.g., do nothing, economic development, minimal environmental impact, balanced approach, safety, and congestion impacts etc).
5. Develop recommendations concerning transportation network improvements, land use issues, and policy issues as they relate to freight movement.

6. Develop a plan for implementing the recommendations. Include a proposed schedule that is coordinated with local and regional capital improvement programs. Also include an estimated budget for improvements and recommended funding methods.

7. Identify next steps for being consistent with the South Central Pennsylvania Regional Goods Movement Study project goals. These goals are to (1) developing essential freight data, (2) identifying policies and strategies that achieve economic benefit goals while minimizing transportation impacts and related costs, and (3) creating an effective and enduring public private partnership forum.

Key Outputs

- Maps and databases of statewide freight data
- Recommendations for freight system improvement
- An Implementation Plan for freight system improvement
- Goods Movement Action Plan

Status

- Several freight studies have been conducted in the past for Pennsylvania.

Period-of-Performance

- Less than 1 year in length.

Level-of-Effort

- Simple staffing required.

Cost Range

- $50,000 – $250,000, dependant of scope and decision to contract.
Related Projects

- **TSOP-14: Operations Mainstreaming.** The mainstreaming of ITS will impact all TSOP projects.

- **TSOP-15: Advanced Planning and Strategy.** All TSOP projects should incorporate new technologies and advanced strategies as applicable.

- **TSOP-16: Data-Acquisition and Archive.** Performance metrics will be collected and archived for every TSOP project.

Other Pertinent Factors

- For the freight analysis study to succeed, goods movement must be examined from a statewide perspective. PennDOT will need to actively include statewide, regional, municipal, and private partners in developing solutions to Pennsylvania’s freight flow issues. Stakeholders must work together to reach a general agreement about strategies to address the future.

- The policy changes recommended by the study could potentially be very broad, including market-based, economic, ITS, homeland security, land use, and funding policies. Because these policies affect so many stakeholders, an education effort is needed to emphasize the benefits of implementing the proposed policies. Through education, stakeholders will appreciate how policies in their field influence and improve the freight transportation network statewide.
TSOP-19: CVO Partnership with PSP

Scope

This project considers the current state of commercial vehicle operations (CVO) within the Commonwealth, with the goal of exploring a partnership between PennDOT and the Pennsylvania State Police (PSP). It focuses on PennDOT’s role in commercial vehicle permitting and credentialing, and supporting PSP in the conduct of safety inspections and other enforcement actions. The effort will also define CVO infrastructure requirements that will lead to a comprehensive CVO network throughout Pennsylvania. It will also lay out a vision and direction for the future of CVO within the Commonwealth and provide guidance to PennDOT, PSP, and other stakeholders on how this vision can be achieved.

Project Needs

- Clearly define PennDOT and PSP roles and responsibilities for credentialing, permitting, and enforcement of commercial vehicles to improve commercial vehicle operations in the Commonwealth.

- A comprehensive infrastructure system is needed to support commercial vehicle operations.

Long-Term Goals

- Establish communication between: (1) PennDOT and PSP infrastructure and (2) public and private commercial vehicle mobile communication systems, navigation and tracking systems, on-board vehicle monitors, crash restraints, and other devices.

- Virtually eliminate en-route delays at weigh stations and establish permanent electronic screening sites to check for compliance at mainline speeds.

- Provide sufficient overnight parking for carriers along major interstate highways.

Near-Term Objectives

- Define and establish a working partnership between PennDOT and PSP to support commercial vehicle operations.

- Establish infrastructure requirements.
• Begin moving towards CVO policy and deployments.

**Performance Metrics**

• Number of commercial vehicle incidents.
• Number of commercial vehicle violations.
• Percent participation of commercial motor carriers in electronic screening
• Number of commercial motor carriers that are electronically by-passed at weigh stations.

**Project Oversight**

A Project Advisory Panel (PAP) shall oversee this project.

**Project Owners**

• PennDOT/Bureau of Rail and Freight (BRF)
• Pennsylvania State Police (PSP)

**Key Stakeholders**

• PennDOT/Bureau of Highway Safety and Traffic Engineering (BHSTE)
• PennDOT/ Center for Program Development and Management (CPDM)
• Commercial Vehicle Companies

**Activities and Milestones**

1. Conduct meetings with PennDOT and PSP personnel to discuss and determine:
   o Roles and responsibilities
   o Commercial Vehicle Information Systems and Networks (CVISN)
   o Infrastructure requirements
   o Policy

2. Work with PSP to clearly define PennDOT’s roles and responsibilities relating to credentialing, permitting, and enforcement.

3. Define CVO infrastructure requirements.

4. Set appropriate policy pertaining to Commercial Vehicle Operations.

5. Compose draft report.
6. Validate and revise draft report with key personnel.

7. Produce final report.

**Key Outputs**

- A study that examines PennDOT and PSP roles and responsibilities, infrastructure requirements, and steps toward policy and deployment for CVO activity.

**Status**

- PennDOT and PSP have started discussions pertaining to a CVO partnership.

**Period-of-Performance**

- Less than 1 year in length.

**Level-of-Effort**

- Simple staffing required.

**Cost Range**

- $50,000 – $250,000, dependant of scope and decision to contract.

**Related Projects**

- **TSOP-14: Operations Mainstreaming.** The mainstreaming of ITS will impact all TSOP projects.

- **TSOP-15: Advanced Planning and Strategy.** All TSOP projects should incorporate new technologies and advanced strategies as applicable.

- **TSOP-16: Data-Acquisition and Archive.** Performance metrics will be collected and archived for every TSOP project.

**Other Pertinent Factors**

- Plans, policy, and procedures may need to be put in place to support the partnership between PennDOT and PSP.
PennDOT currently controls CVO infrastructure in Pennsylvania while PSP is responsible for operations. If PSP desires additional infrastructure, such as permanent weigh stations, funding would have to come from PennDOT.

Infrastructure is not in place to fully support the needs of Commercial Vehicle Operations. Permanent weigh stations, truck parking, and other infrastructure will need to be deployed in the future.

Historically, state agencies and motor carriers have had difficulty developing cooperative, non-adversarial relationships. For the most part, carriers have seen the state only as a regulator and collector of fees and taxes. Carriers and agencies often have difficulty communicating, and frequently are unable to work together.
APPENDIX B: LIST OF ACRONYMS
LIST OF ACRONYMS

AASHTO American Association of State Highway and Transportation Officials
ACE Army Core of Engineers
AFLADS Automatic Fixed Location Anti/De-Icing System
AM Amplitude Modulation
AMBER America’s Missing: Broadcast Emergency Response
API Applications Program Interface
ARLE Automated Red Light Enforcement
ATMS Advanced Traffic Management System
ATR Automatic Traffic Recorder
ATRWS Automatic Truck Rollover Warning System
AVL Automatic Vehicle Location
BHR Bureau of Human Resources
BHSTE Bureau of Highway Safety and Traffic Engineering
BIS Bureau of Information Systems
BMS Bureau of Municipal Services
BOD Bureau of Design
BOMO Bureau of Maintenance & Operations
BOS Bureau of Office Services
BPR Bureau of Planning & Research
BPT Bureau of Public Transportation
BRF Bureau of Rail and Freight
CAD Computer-Aided Dispatching
CCIP Congested Corridor Improvement Program
CCTV Closed-Circuit Television
CONOPS Concept of Operations
CPDM Center for Program Development and Management
CTTC Carbondale Technology Transfer Center
CVISN Commercial Vehicle Information Systems and Networks
CVO Commercial Vehicle Operation
DCED Department of Community and Economic Development
DMS Dynamic Message Sign
DVMT Daily Vehicle Miles of Travel
DVRPC Delaware Valley Regional Planning Commission
EDP Early Deployment Program
EMA Emergency Management Agency
EMS Emergency Medical Services
FAA Federal Aviation Administration
FCC Federal Communications Commission
FHWA Federal Highway Administration
FM Frequency Modulation
FRA Federal Railroad Administration
FSP Freeway Service Patrol
GID Geographic Information Division
HAR Highway Advisory Radio
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEN</td>
<td>Information Exchange Network</td>
</tr>
<tr>
<td>IM</td>
<td>Incident Management</td>
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<tr>
<td>IOP</td>
<td>Independent Oversight Program</td>
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<tr>
<td>IRS</td>
<td>Incident Reporting System</td>
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<tr>
<td>ISP</td>
<td>Information Service Providers</td>
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<tr>
<td>ITPO</td>
<td>Information Technology Program Office</td>
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<tr>
<td>ITS</td>
<td>Intelligent Transportation System</td>
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<tr>
<td>JNET</td>
<td>Justice Network</td>
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<tr>
<td>MARAD</td>
<td>Maritime Administration</td>
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<tr>
<td>MOU</td>
<td>Memoranda-of-Understanding</td>
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<tr>
<td>MPO</td>
<td>Metropolitan Planning Organization</td>
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<tr>
<td>NHTSA</td>
<td>National Highway Traffic Safety Administration</td>
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<tr>
<td>NWS</td>
<td>National Weather Service</td>
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<tr>
<td>O&amp;M</td>
<td>Operations and Maintenance</td>
</tr>
<tr>
<td>OA</td>
<td>Office of Administration</td>
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<tr>
<td>OIP</td>
<td>Other in-Pavement Loop Site</td>
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<tr>
<td>OIT</td>
<td>Office for Information Technology</td>
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<tr>
<td>PAP</td>
<td>Project Advisory Panel</td>
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<tr>
<td>PEMA</td>
<td>Pennsylvania Emergency Management Agency</td>
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<tr>
<td>PennDOT</td>
<td>Pennsylvania Department of Transportation</td>
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<tr>
<td>PMC</td>
<td>Program Management Committee</td>
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<tr>
<td>PSP</td>
<td>Pennsylvania State Police</td>
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<tr>
<td>PTC</td>
<td>Pennsylvania Turnpike Commission</td>
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<tr>
<td>Q/A</td>
<td>Quality Assurance</td>
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<tr>
<td>RCRS</td>
<td>Road Closure Reporting System</td>
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<tr>
<td>RIMIS</td>
<td>Regional Integrated Multimodal Information Sharing</td>
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<tr>
<td>ROP</td>
<td>Regional Operations Plan</td>
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<tr>
<td>RPO</td>
<td>Regional Planning Organization</td>
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<tr>
<td>RTMC</td>
<td>Regional Transportation Management Center</td>
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<tr>
<td>RTMS</td>
<td>Remote Traffic Microwave Sensor</td>
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<tr>
<td>RWIS</td>
<td>Road Weather Information System</td>
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<tr>
<td>SAMS</td>
<td>Signals Asset Management System</td>
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<tr>
<td>STMC</td>
<td>Statewide Transportation Management Center</td>
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<tr>
<td>TAC</td>
<td>Transportation Advisory Committee</td>
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<tr>
<td>TAE</td>
<td>Technology-Assisted Enforcement</td>
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<tr>
<td>TIMS</td>
<td>Traffic and Incident Management System</td>
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<tr>
<td>TIP</td>
<td>Transportation Improvement Program</td>
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<tr>
<td>TMA</td>
<td>Transportation Management Approach</td>
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<tr>
<td>TMC</td>
<td>Transportation Management Center</td>
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<tr>
<td>TSEI</td>
<td>Traffic Signal Enhancement Initiative</td>
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<tr>
<td>TSOP</td>
<td>Transportation Systems Operations Plan</td>
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<tr>
<td>TTI</td>
<td>Texas Transportation Institute</td>
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<tr>
<td>USDOT</td>
<td>United States Department of Transportation</td>
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<tr>
<td>VMT</td>
<td>Vehicle Miles of Travel</td>
</tr>
<tr>
<td>WIM</td>
<td>Weigh-in-Motion</td>
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</tbody>
</table>