Final Report
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prepared by
Gannett Fleming, Inc.

PENNSYLVANIA TRANSPORTATION ADVISORY COMMITTEE

Congestion Mitigation and Smart Transportation

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The Pennsylvania State Transportation Advisory Committee

The Pennsylvania State Transportation Advisory Committee (TAC) was established in 1970 by Act 120 of the State Legislature, which also created the Pennsylvania Department of Transportation (PennDOT). The Advisory Committee has two primary duties. First, the Committee "consults with and advises the State Transportation Commission and the Secretary of Transportation on behalf of all transportation modes in the Commonwealth." In fulfilling this task, the Committee assists the Commission and the Secretary "in the determination of goals and the allocation of available resources among and between the alternate modes in the planning, development and maintenance of programs, and technologies for transportation systems." The second duty of the Advisory Committee is "to advise the several modes (about) the planning, programs, and goals of the Department and the State Transportation Commission." The Committee undertakes in-depth studies on important issues and serves as a valuable liaison between PennDOT and the general public.

The Advisory Committee consists of the following members: the Secretary of Transportation; the heads (or their designees) of the Department of Agriculture, Department of Education, Department of Community and Economic Development, Public Utility Commission, Department of Environmental Protection, and the Governor's Policy Office; two members of the State House of Representatives; two members of the State Senate; and eighteen public members, six appointed by the Governor, six by the President Pro Tempore of the Senate, and six by the Speaker of the House of Representatives.

Public members with experience and knowledge in the transportation of people and goods are appointed to represent a balanced range of backgrounds (industry, labor, academic, consulting, and research) and the various transportation modes. Appointments are made for a three-year period and members may be reappointed. The Chair of the Committee is annually designated by the Governor from among the public members.

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TAC Study Task Force

The Advisory Committee Chair thanks the members of the TAC Study Task Force for their insight and active participation in completing this challenging study. Their constructive dialogue, review of draft technical papers and memoranda, and participation was essential to this effort.

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Acronyms

AADT	Annual Average Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
CCIP	Congested Corridor Improvement Program
CMAQ	Congestion Mitigation Air Quality funding program (federal funding category)
CMP	Congestion Management Process
DU	Dwelling Unit
DVMT	Daily Vehicle Miles of Travel
FHWA	Federal Highway Administration
HOT	High Occupancy Toll lanes
HOP	Highway Occupancy Permit
ITE	Institute of Transportation Engineers
ITS	Intelligent Transportation Systems
LOS	Level of Service
LRTP	Long-Range Transportation Plan
MPO	Metropolitan Planning Organization
NCHRP	National Cooperative Highway Research Program
NEPA	National Environmental Policy Act
PennDOT	Pennsylvania Department of Transportation
ROP	Regional Operations Plan
RPO	Rural Planning Organization
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
SOVCAP	Single-Occupant Vehicle Capacity Adding Project
STIP	Statewide Transportation Improvement Program
TAC	Transportation Advisory Committee
TIP	Transportation Improvement Program

TIS	Traffic Impact Study
TMA	Transportation Management Area
TOD	Transit Oriented Development
TRID	Transit Revitalization Investment Districts
TSEI	Traffic Signal Enhancement Initiative
TSOP	Transportation Systems Operations Plan
USDOT	United States Department of Transportation
V/C	Volume to Capacity ratio
VMT	Vehicle Miles Traveled

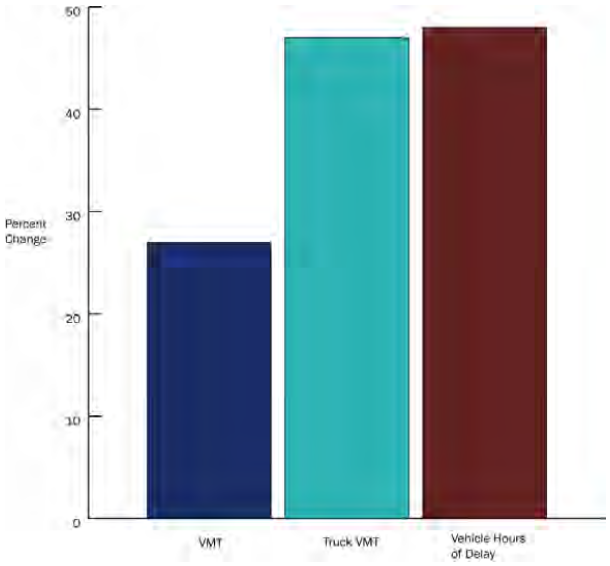
Executive Summary

Smart Transportation is about partnering to build great communities for future generations of Pennsylvanians by linking transportation investments with land use planning. Smart Transportation is an approach to roadway planning and design in which each transportation solution is tailored to the specific project and situation. The Pennsylvania Department of Transportation (PennDOT) is following a Smart Transportation direction in its planning and design activities. This report focuses on how to apply the principles of Smart Transportation to identify lower-cost congestion mitigation techniques that could be implemented relatively quickly to facilitate traffic flow.

Traffic congestion cost Pennsylvanians $2.7 billion in 2005. Unless it is addressed, it could cost $8 billion per year in fuel and delay costs by 2035.

This study is timely because congestion—whether caused by bottlenecks, poor traffic signal timing, or traffic incidents—is a growing problem across Pennsylvania. Vehicle travel continues to increase, but the capacity of the transportation system is not increasing. Traffic congestion cost Pennsylvanians $2.7 billion in 2005. Unless it is addressed, it could cost $8 billion per year in fuel and delay costs by 2035.

Percent Growth in Congestion Indicators, 2006 – 2030



Source: Statewide Travel Demand Model

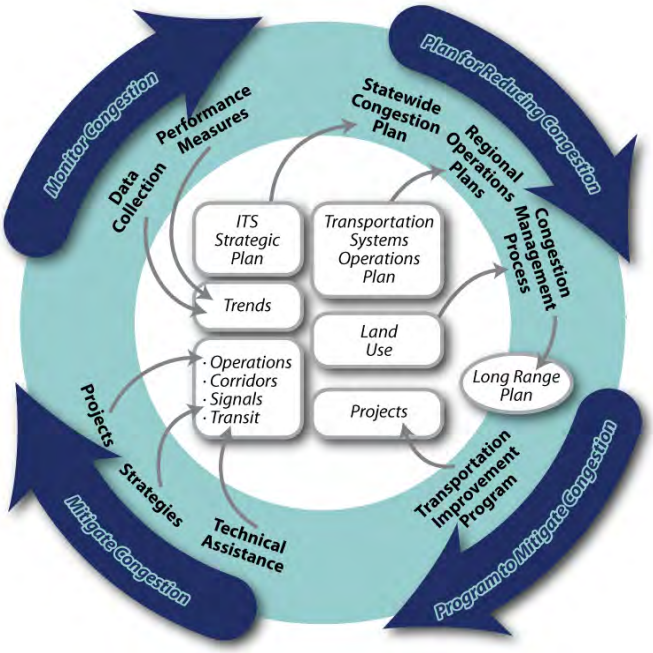
At the current rate, congestion costs the average urban motorist in Pennsylvania $300 to $700 per year in lost time.

However, Pennsylvania's transportation investment dollars are being spread thin in ongoing efforts to address extensive system preservation and improvement needs. For example, PennDOT has placed increased emphasis on bridge projects to address the high number of structurally deficient bridges across the state. The current Statewide Transportation Improvement Program allocates 86.4 percent of program dollars to highway and bridge restoration and safety improvements. That leaves 13.6 percent of transportation spending to address congestion through lane additions, corridor and intersection improvements, traffic signal upgrades, Intelligent Transportation Systems, and demand management strategies such as ridesharing and park-and-ride facilities.

It is therefore particularly important to find ways to maximize the capacity of our existing infrastructure in order to reduce current and future congestion. This must be accomplished through lower-cost alternatives which can produce the greatest return on investment.

To better address congestion in Pennsylvania, a continuous process of monitoring, planning, programming appropriate projects, and implementing mitigation strategies is required, as displayed on the following graphic.

The Congestion Mitigation Process



Communication and cooperation are keys to successfully mitigating congestion. PennDOT, planning partners, municipalities, and others need to be engaged in order to properly identify congestion concerns and to identify mitigation techniques, whether they be strategic capacity enhancements, operational initiatives, or demand management strategies. PennDOT must be better engaged in planning, and planning partners should focus on operational issues.

A Smart Transportation approach will strive to find the best solution that is affordable and cost effective.

Recommendations

This report presents recommendations for addressing congestion mitigation within a Smart Transportation context. These recommendations can be summarized into three broad categories:

- **Planning and Programming:** Establish comprehensive statewide, regional, and local planning processes to address congestion in a way that is strongly linked with the project programming process.
- **Congestion Mitigation:** Establish congestion mitigation approaches that minimize cost and maximize benefits.
- **Monitoring:** Establish monitoring so that PennDOT can allocate resources effectively and document improvement benefits.

Specific recommendations under each category are provided below.

Planning & Programming Recommendations

Establish comprehensive statewide, regional, and local planning processes to address congestion in a way that is strongly linked with the project programming process. This would include:

- Strengthen congestion management planning within PennDOT.
- Increase PennDOT participation from the Central Office and District Offices in development of regional Congestion Management Processes (CMPs).[1]

[1]CMP (Congestion Management Process)—a federally-mandated program within metropolitan planning areas to address and manage congestion; formerly known as a Congestion Management System (CMS).

- Integrate regional CMPs into a statewide CMP. Promote statewide and regional coordination of congestion management programs and processes
- Develop "rightsized" CMPs in all planning partner areas, not just the largest urban areas. These CMPs should include the appropriate operational focus through the incorporation of the Regional Operations Plans.
- Integrate CMP results with regional long-range plans.
- Develop a stronger planning focus at the PennDOT District level to better coordinate with municipalities on land use and transportation.
- Encourage land use controls at the county level so that land use and transportation decisions are more effectively managed.
- Encourage use of official maps to reserve needed right-of-way for future improvements.
- Continue Transportation Systems Operational Planning at the statewide and regional levels.
- Provide statewide direction on congested corridors and traffic signal enhancement.
- Involve transit agencies to a greater degree in planning and design when addressing congested corridors.
- Implement training and capacity-building in these areas for PennDOT and Metropolitan Planning Organization (MPO)/Rural Planning Organization (RPO) staff.
- Implement an "operations and demand management" review (similar to a safety review) to the PennDOT Project Development process to ensure that strategies that better manage capacity and reduce demand are considered with strategic capacity enhancements/additions.
- Continue to encourage development of local access management ordinances.

Congestion Mitigation Recommendations

Establish congestion mitigation approaches that minimize cost and maximize benefits:

- Establish a low-cost bottleneck program that focuses on affordable improvements such as low-cost capacity improvements, restriping to change lane configurations, use

of shoulder lanes, ramp extensions, and improved merge and acceleration areas. The Federal Highway Administration (FHWA) has materials that could be used as a basis for the program's development.

The CCIP and TSEI initiatives are good examples of Smart Transportation because they focus on maximizing capacity within the context of the community and surrounding land uses.

- Expand transportation operations to include appropriate intelligent transportation system (ITS) components for incident management and traveler information.
- Implement ramp management analysis and mitigation into planning and project development.
- Implement a quick clearance policy.
- Promote corridor improvements such as improved intersection geometry facilitating turning movements. When intersection configuration is involved, give strong consideration to the use of a modern roundabout design. and improved signal coordination for key arterial corridors based on planning partner CMPs. Reinstitute—with minor modifications—the Congested Corridor Improvement Program and the Traffic Signal Enhancement Initiative.
- Implement traffic signal recommendations identified in the TAC Study, *Traffic Signal Systems: A Review of Policy and Practices.* Many of the recommendations have not been carried forward or have been suspended. Key recommendations of that study include:
  - Develop a Signals Asset Management System.
  - Pursue tiered operations and maintenance on critical corridors—including implementing Integrated Corridor Management (ICM) on key corridors.
  - Pursue tiered operations and maintenance for most signals.
  - Promote a "holistic" approach to signal management.
  - Expand the Traffic Signal Enhancement Initiative (TSEI) and Congested Corridor Improvement Program (CCIP).
  - Review and update the traffic signal permit process.
  - Establish an operational audits program.
  - Complete updates and revisions to PennDOT traffic signal publications.
  - Allocate a portion of any new funding increase to signals.
  - Provide incentives for operational enhancements.

- Encourage regional maintenance contracts with operational incentives.
- Provide incentives (and tools) for interjurisdictional coordination.

Other recommendations included streamlining the retiming process, revising Highway Occupancy Permit (HOP) requirements to include system compatibility and fine-tuning, creating a modernization program, and creating a hotline and/or Web site for traffic signal concerns.

- Emphasize demand management strategies to encourage greater use of public transportation and other alternative modes. Promote directed use strategies where there is a robust transportation network to support demands.
- Introduce traffic calming measures to encourage "as-designed" system utilization.
- PennDOT should engage and educate stakeholders regarding revised highway occupancy permit (HOP) and traffic impact study (TIS) requirements.
- Create a model TIS ordinance for municipal use.
- Reevaluate obstacles to implementing traffic impact fee ordinances.

Monitoring Recommendations

Establish monitoring so that PennDOT can allocate resources effectively and document improvement benefits.

- Identify preferred congestion performance measures (in addition to level of service) that address both recurring and non-recurring congestion. These measures should be:
  - Easily measurable and understandable.
  - Addressing existing and future recurring and non-recurring congestion.
  - System-wide versus localized.
  - Easily monitored through a "dashboard."
- Highlight operational successes.

A 90-minute incident on an interstate carrying 30,000 vehicles daily results in $120,000 in lost fuel and time.

Congestion Mitigation Evaluation Matrix

This report includes a matrix to assist in implementing mitigation strategies. It presents potential congestion mitigation strategies and indicates their suitability for specific Smart Transportation roadway categories, potential benefits, and magnitude of costs.

The matrix is recommended for use by PennDOT and the planning partners in choosing appropriate strategies for any particular situation. PennDOT may want to incorporate this matrix in various publications and into the planning partner Congestion Management Processes.

1. Introduction and Purpose

Study Purpose:
To develop and document low-cost congestion mitigation strategies that are tailored to meet the Smart Transportation principles. The different contexts—financial, community, land use, transportation, and environmental—determine the best congestion solution.

Pennsylvania's transportation investment dollars are being spread thin in ongoing efforts to address extensive system improvement and maintenance needs. The Pennsylvania Department of Transportation (PennDOT) has placed increased emphasis on bridge projects to address the high number of structurally deficient bridges across the Commonwealth. This is highly resource-intensive, leaving little funding to address other transportation problems and needs such as congestion and new capacity. It is therefore particularly important to find ways to maximize the capacity of our entire existing infrastructure in order to reduce current and future congestion. This must be accomplished through lower-cost alternatives which can produce the greatest return on investment.

PennDOT's new direction in planning and design for transportation investments focuses on Smart Transportation concepts. The *Smart Transportation Guidebook* has been developed, and PennDOT is currently rolling out the Smart Transportation concepts to PennDOT Districts, planning agencies, and communities. Smart Transportation principles are aimed at better linking roadway planning and design with land use goals and community values to develop solutions that are properly scaled and appropriate for their context.

This report focuses on how to apply the principles of Smart Transportation to identify lower-cost congestion mitigation techniques that could be implemented relatively quickly to facilitate traffic flow. The following goals were established for the study:

- Highlight congestion mitigation strategies that reflect Smart Transportation principles of project development.
- Identify tools needed to implement congestion mitigation strategies through Smart Transportation practices.
- Provide recommendations to assist in implementing congestion mitigation in accordance with Smart Transportation practices.

The following chapters provide background information on the subjects of Smart Transportation and congestion mitigation, and recommend approaches to better address congestion mitigation in the context of the Smart Transportation principles.

2. Approach

The study was implemented under the guidance of a Task Force of the Pennsylvania Transportation Advisory Committee (TAC). The consultant team worked with the Task Force throughout the study to identify the goals to be achieved, review strategies and analyses, and review and comment on the draft report. The Task Force consisted of TAC members supplemented by subject experts and practitioners from PennDOT, the FHWA, Pennsylvania metropolitan planning organizations (MPOs), and local government. A list of Task Force members appears on page iii.

The study scope was broadly organized in three phases:

2.1 Phase I – Issue Identification/Information Gathering

The activities under this phase were aimed at identifying study issues, understanding PennDOT's Smart Transportation focus, documenting the characteristics of congestion problems in Pennsylvania, and assessing current programs and strategies that address congestion. The consultant team reviewed national and state reports, proceedings, and documents related to congestion and congestion reduction strategies. The team also reviewed the newly-released *Smart Transportation Guidebook*. Several meetings were held with PennDOT to understand the Smart Transportation direction and to review congestion-related programs and initiatives. A background briefing was developed and provided to the Task Force for review.

To gain perspectives from stakeholders, a Web-based survey was distributed to PennDOT Districts, MPOs, rural planning organizations (RPOs), local municipalities, transit agencies, transportation management associations, and other organizations.

2.2 Phase II – Strategy Identification and Analysis

Phase II entailed analyzing potential congestion mitigation strategies and assessing how those strategies could best be applied within the Smart Transportation context. Interviews with key stakeholders and practitioners were also a part of this analysis. A second Web-based survey was conducted with the Task Force members to gather their perspectives on specific strategies and issues on implementation. This phase also considered performance

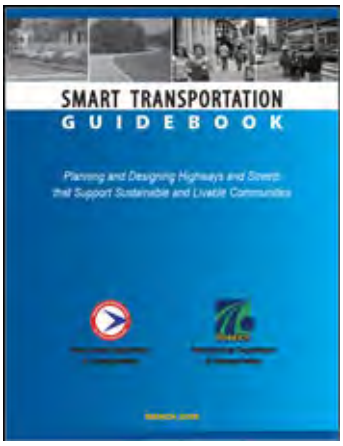
measures beyond level of service that could best be applied to low-cost mitigation techniques. A matrix was developed that arrayed congestion mitigation strategies against the transportation contexts to determine the suitability of each strategy for each of the Smart Transportation "contexts."

2.3 Phase III – TAC Report on Findings and Recommendations

The final phase of work entailed development of this report, which includes specific study recommendations. The recommendations were based on the initial interviews and surveys as well as extensive Task Force deliberations. The final report was presented to the full TAC and, upon approval, to the State Transportation Commission.

3. Smart Transportation

3.1 What is Smart Transportation?



Smart Transportation is an approach to roadway planning and design in which each transportation solution is tailored to the specific project and situation. This is accomplished by paying careful attention to the context in which the project will be designed and by using an inclusionary process that works closely with the community in which the roadway project is located. In practice, implementing Smart Transportation means that projects will be:

- Planned in a way that considers a host of factors, not solely transportation priorities.
- Designed using a "rightsizing" approach that addresses real needs in an appropriate and sustainable manner.
- Developed within the context of larger community and regional initiatives.

The idea and rationale behind Smart Transportation has been developed in the *Smart Transportation Guidebook*, published in March 2008 through collaboration of the New Jersey Department of Transportation and PennDOT. This chapter summarizes the guidebook, and in particular the concepts that are most applicable to this study. More information on Smart Transportation and the Guidebook can be found at:

www.smart-transportation.com

3.2 Why is Smart Transportation Important?

The goal of Smart Transportation is to integrate the planning and design of streets and highways in a way that fosters development of sustainable and livable communities. This is particularly applicable when addressing congestion issues that are tied directly to the land use and community character of an area. By better integrating land use and transportation planning, we can provide a better balance between the desire to go **through** a place and the desire to go **to** a place. A place that has been developed solely to accommodate the ever-increasing demand for vehicle mobility will not be a place that is enjoyable for people. Nationally, there is a growing recognition within the transportation profession and

beyond that transportation infrastructure and community character/design should be complementary.

3.3 Smart Transportation Principles

Smart Transportation can be summarized in the following six principles:

By better integrating land use and transportation planning, we can provide a better balance between the desire to go *through* a place and the desire to go *to* a place.

3.3.1 Tailor solutions to the context

Roadways must be designed for the context in which they exist. There are five components of context that must be considered for each project.

3.3.1.1 Land Use Context

Roadways should respect the character of the community and its current and planned land uses. The design of a roadway should change as it transitions from rural to suburban to urban areas. Changes in roadway widths, the presence or absence of parking lanes, and other factors provide clues to motorists on how fast to drive when they pass from one land use type to another. If roadways are appropriately designed, vehicular speeds should fit the local context. The concept of desired operating speed is key to the context-sensitive roadway.

3.3.1.2 Community Context

Community context is much more than the physical appearance of buildings and streets. At the local level, this context includes the role of the particular roadway in supporting active community life. It can involve how other modes of travel are accommodated through inclusion of bike lanes, adequate sidewalks, or incorporation of transit friendly features in highway design.

3.3.1.3 Transportation Context

The transportation context of the roadway is essential. Smart Transportation is not meant to result in a "cookie cutter" roadway template, in which the same Main Street or commercial corridor design appears in every town. The design of every roadway must respond to its unique circumstances. PennDOT will continue to value the mobility offered by high speed roadways that serve a larger region or heavy freight traffic. Conversely, other state roadways serve mostly local traffic and can be designed to be more sensitive to the local context.

The needs of pedestrians, bicyclists, and transit users must be considered in designing all roadway projects.

3.3.1.4 Environmental Context

The presence of natural and environmental resources must always be reflected in the development of alternatives. A Smart Transportation approach strives to identify environmental constraints early in the process. Project alternatives can then consider avoidance, minimization or mitigation of impacts.

3.3.1.5 Financial Context

In Pennsylvania, as in most states, transportation needs far exceed funding. Wise investment in transportation infrastructure requires sensitivity to available funding. It is important to consider potential project costs and available resources at the earliest possible time. Virtually all projects offer a range of options with different levels of value, but a Smart Transportation approach will strive to find the best transportation solution that is affordable and cost effective.

3.3.2 Tailor the approach

Projects vary in their need, type, complexity, and range of solutions. Therefore, the approach should be tailored to the specific project. This tailored approach should be developed with the team members and project stakeholders early in the process. PennDOT's forthcoming guidance on Linking Planning and NEPA (National Environmental Policy Act) will describe this in more detail.

3.3.3 Plan all projects in collaboration with the community

All state transportation projects are planned through ongoing partnerships between PennDOT and local communities. As part of this collaboration, both parties have responsibilities. PennDOT reviews proposed roadway projects to ensure that they align with vital regional or statewide mobility goals. If the design is not consistent with community plans, PennDOT may recommend revising the roadway design or working with the community on alternative strategies to better accommodate regional trips. The local government is responsible for sound land use planning and development. Network connectivity is an important concept of Smart Transportation. Local government should help create a well-connected street network that will better accommodate local trips, thus removing these trips from major roadways. Linking developments along arterials also serves to moderate traffic growth on these roads. The local government should also

encourage mixed-use districts that can reduce the number of vehicular trips.

Local government should help create a well-connected street network that will better accommodate local trips, thus removing these trips from major roadways.

In summary, the collaboration between state and community involves the integration of land use and transportation planning, and a focus on the overall transportation network rather than on a single roadway. These concepts should be incorporated into all corridor plans for PennDOT.

3.3.4 Plan for alternative transportation modes

The needs of pedestrians, bicyclists, and transit users must be considered in designing all roadway projects. Sidewalk networks should be well connected with opportunities for regular, safe street crossings. On collector and arterial roadways, bike lanes or wide curb lanes can encourage people to bike rather than drive for short- and moderate-distance trips. If a roadway is designed to discourage vehicular speeding, it can be comfortably and safely used by pedestrians and bicyclists. Transit-friendly design should support a high level of transit activity. By encouraging alternative transportation modes, communities can break the pattern of sprawling suburbs with rapidly multiplying vehicular trips and congestion. It should be acknowledged that there are potential trade-offs between vehicular mobility and pedestrian, bicycle, and transit mobility. A balance should be sought in attaining these goals on all projects. Many communities across the nation have achieved such a balance. Philadelphia, for example, has extensive vehicular traffic but also has been aggressive in establishing bike lanes.

3.3.5 Use sound professional judgment

Although the *Smart Transportation Guidebook* provides direction on the range of dimensions for roadway elements, all

recommendations should be filtered through the best judgment of the project team after considering the specific circumstances of each project. There is no one-size-fits-all approach to good decision-making. The smart solution on some projects may be to seek design exceptions or waivers to allow for true context-based design.

3.3.6 Scale the solution to the size of the problem

The best transportation solution must be found that fits within the context, is affordable, is supported by the communities, and can be implemented in a reasonable time frame. Lower scale alternatives such as network additions or transportation system management should be examined before developing alternatives such as new or widened roadways. If safety is a greater issue than congestion, focused solutions should be considered that can improve safety without increasing capacity. Safety must be considered on all roadway projects.

3.4 Smart Transportation Themes

In support of Smart Transportation, PennDOT has developed ten Smart Transportation Themes:

1. Money counts (every dollar must be invested wisely and prudently).
2. Understand the context; plan and design within the context.
3. Choose projects with high value/price ratio.
4. Enhance the local network.
5. Look beyond level of service.
6. Safety first and maybe safety only.
7. Accommodate all modes.
8. Leverage and preserve existing investments.
9. Build towns, not sprawl.
10. Develop local governments as strong land use partners.

3.5 Land Use Context

Although there are five different contexts to consider when planning transportation projects, two of those contexts—land use and transportation—together form the organizing framework for the design of the physical improvement. It is for this reason that

the *Smart Transportation Guidebook* proposes a new approach to determining the appropriate design for a roadway that takes into account both the land use and transportation contexts. The land use context is described by one of seven categories listed below:

Rural – This context area consists of a few houses and structures dotting farm land or forest land. The areas are predominantly natural wetlands, woodlands, meadow, or cultivated land. Small commercial uses are often seen at intersections or along arterial or collector roads.

Suburban Neighborhood – Predominantly low density residential communities, many built since World War II. House lots are typically arranged along a curvilinear internal system of streets with limited connections to the regional road network or surrounding streets. Lot sizes usually vary between one-quarter-acre and two acres, but in older suburbs, lots may be as small as one-eighth-acre. Garden apartments are also included in this type. Neighborhoods can include community facilities such as schools, churches, recreational facilities, and some stores and offices.

Suburban Corridor – This area is characterized by commercial strips, including shopping centers, restaurants, auto dealerships, office parks, and gas stations. These uses are sometimes interspersed with natural areas and occasional clusters of homes. Buildings are usually set back from the roadway behind surface parking.

Suburban Center – Often a mixed-use, cohesive collection of land uses that may include residential, office, retail, and restaurant uses, where commercial uses serve surrounding neighborhoods. These areas are typically designed to be accessible by car, and may include large parking areas and garages. They are less accommodating to pedestrians than town centers, and opportunities to cross the primary roadway can be limited. On-street parking may or may not be provided.

Town/Village Neighborhood – Predominantly residential neighborhoods, sometimes mixed with retail, restaurant, and office uses. In urban places, residential buildings tend to be close to the street. Rowhouses fronting the sidewalk, and houses 30 feet behind a front lawn, are both common types. Small retail establishments sometimes occupy principal corners. Block sizes are regular and

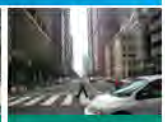
often small in comparison to suburban neighborhood blocks. Even where streets are narrow, on-street parking is common and typically well-used. The large majority of neighborhoods have sidewalks.

Town/Village Center – A mixed-use, high density area with buildings adjacent to the sidewalk, that are typically two to four stories tall with commercial operations on the ground floor and offices or residences above. Parallel parking usually occupies both sides of the street with parking lots behind the buildings. Important public buildings, such as the town hall or library, have special prominence.

Urban Core – Downtown areas consisting of blocks of higher density, mixed-use buildings. Buildings vary in height from 3 to more than 60 stories with most buildings dating from an era when elevators were new technology—so 5 to 12 stories was the standard.

An area can be classified into one of the seven land use categories based on the area and bulk characteristics of the land use, similar to the area and bulk factors contained in many zoning ordinances. In Exhibit 3.1 the land use classifications are laid out in tabular format.

Exhibit 3.1: Area and Bulk Descriptions of Land Use Contexts

Defining Land Use Contexts	RURAL	SUBURBAN			URBAN		
	 Rural	 Suburban Neighborhood	 Suburban Corridor	 Suburban Center	 Town/Village Neighborhood	 Town Center	 Urban Core
Density Units	1 DU/20 ac	1 DU/ac - 8DU/ac	2 - 30 DU/ac	3 - 20 DU/ac	4 - 30 DU/ac	8 - 50 DU/ac	16 - 75 DU/ac
Building Coverage	NA	< 20%	20% - 35%	35% - 45%	35% - 50%	50% - 70%	70% - 100%
Lot Size/Area	20 acres	5,000 - 80,000 sf	20,000 - 200,000 sf	25,000 - 100,000 sf	2,000 - 12,000 sf	2,000 - 20,000 sf	25,000 - 100,000 sf
Lot Frontage	NA	50 to 200 feet	100 to 500 feet	100 to 300 feet	18 to 50 feet	25 to 200 feet	100 to 300 feet
Block Dimensions	NA	400 wide x varies	200 wide x varies	300 wide by varies	200 by 400 ft	200 by 400 ft	200 by 400 ft
Max. Height	1 to 3 stories	1.5 to 3 stories	retail -1 story; office 3-5 stories	2 to 5 stories	2 to 5 stories	1 to 3 stories	3 to 60 stories
Min./Max. Setback	Varies	20 to 80 feet	20 to 80 ft	20 to 80 ft	10 to 20 ft	0 to 20 ft	0 to 20 ft

Source: *Smart Transportation Guidebook*, March 2008.

For areas that don't expect any near-term development or redevelopment, the characteristics of the existing land use should be used for classification. If an area is to be developed or redeveloped, is expected to be rezoned in the near future, or is shown as a different land use on the community's comprehensive plan, then consideration should be given to the expected future land use when determining classification.

3.6 Transportation Context

Working in concert with the land use context of an area is the transportation context. The idea behind the transportation context is similar to and is intended for the same purpose as the existing idea of functional classification—roadways are classified and then that classification helps determine the design standards for roadway improvements. Currently, roadways are assigned a functional classification consistent with the American Association of State Highway and Transportation Officials (AASHTO) *Green Book–A Policy on Geometric Design of Highways and Streets:*

- Principal Arterial
- Minor Arterial

- Collector (divided into major and minor in rural areas)
- Local

The problem with the existing classification structure is that often long stretches of roadway are placed into a single classification based on selected characteristics that don't adequately take into account the road's actual use in the community. For example, many state highways are classified as principal arterials even though portions of them are often used more for community access than for regional mobility. This can cause a road to be designed for higher speeds and less pedestrian accommodation than is necessary for a roadway providing community access.

The proposed roadway classification system is designed to more accurately capture the role the roadway plays in the community and how it interacts with the area's land use. The *Smart Transportation Guidebook* also suggests providing greater segmentation of a roadway into various classifications. The classification system understands that a roadway's transportation context will change as it moves through places with different land uses. The classification and roadway design should also change accordingly.

The five proposed classifications of roadway context and their defining characteristics are shown in Exhibit 3.2.

Exhibit 3.2: Transportation Context Roadway Categories

Roadway Class	Roadway Type	Desired Operating Speed (mph)	Average Trip Length (mi)	Volume	Intersection Spacing (ft)	Comments
Arterial	Regional	30-55	15-35	10,000-40,000	660-1,320	Considered "Principal Arterial" in traditional functional classification.
Arterial	Community	25-55	7-25	5,000-25,000	300-1,320	Often classified as "Minor Arterial" in traditional classification, but may include road segments classified as "Principal Arterial."
Collector	Community	25-55	5-10	5,000-15,000	300-660	Often similar in appearance to a community arterial. Typically classified as "Major Collector."
Collector	Neighborhood	25-35	<7	<6,000	300-660	Similar in appearance to local roadways. Often classified as "Minor Collector."
Local	Local	20-30	<5	<3,000	200-660	

One category not included in the above figure, but with an important place in Smart Transportation, is a Main Street. Main Streets anchor a downtown or village center and often provide on-street parking, wide sidewalks, and slow vehicle speeds.

When the two concepts of Land Use Context and Transportation Context are interwoven, a matrix can be created that allows an area to be placed into one of 31 unique classifications. With such a diverse range of classifications, design standards can be created that are much more finely tuned to the needs of the area.

3.7 Smart Transportation Implementation

PennDOT has a series of actions under way to fully integrate Smart Transportation into the policies, processes, projects, and everyday business of transportation planning and design throughout Pennsylvania. To do this, it is necessary to reach out to many stakeholders, integrate Smart Transportation into PennDOT publications and processes, and include Smart Transportation within the funding and programming process.

Communications – Better linking land use and transportation requires strong partnerships between PennDOT, MPOs/RPOs, and local municipalities. PennDOT has conducted outreach on Smart Transportation to PennDOT District Offices, planning agencies, municipal organizations, and other organizations. Efforts are under way to reach out to municipal representatives across the Commonwealth.

Publications – PennDOT is currently updating design manuals to fully integrate Smart Transportation into the project design process. As the Linking Planning and NEPA strategies are being finalized for project development, Smart Transportation is also being integrated. The Highway Occupancy Permit (HOP) guidelines have been rewritten to incorporate the Smart Transportation principles.

Program/Funding – PennDOT has developed the Pennsylvania Community Transportation Initiative to provide an incentive for projects that promote collaborative decision-making, advance integrated land use and transportation decisions, and encourage regional and multi-municipal cooperation throughout the Commonwealth. A total of $60 million in federal and state transportation funds is being made available over the first two years of the 2009-2012 Statewide Transportation Improvement Program. Projects will be selected based on the degree to which the project supports Smart Transportation principles and the ability to implement local land use actions in support of the transportation investment. Initial applications were due on December 15, 2008. Approvals are expected by Spring 2009.

4. Congestion

4.1 What is Congestion?

In general, congestion results when traffic demand approaches or exceeds the available capacity of the system.

Virtually everyone who has ever traveled America's roadways, whether in their own personal automobile, on a bus, or behind the wheel of a big rig, has had the experience of sitting in traffic. Congestion is the level at which transportation system performance is no longer acceptable due to traffic interference. The level of acceptable performance can vary by the type of transportation facility, by location within the region, and by time of day. For instance, commuters typically expect and are generally willing to accept a certain amount of traffic during morning and evening "rush hours." However, they may not be willing to accept that same level of performance in the middle of the day.

Congestion is relatively easy to recognize—roads filled with cars, trucks, and buses, and sidewalks filled with pedestrians. The definitions of the term congestion mention such words as "clog," "impede," and "excessive fullness." [2]

In general, congestion results when traffic demand approaches or exceeds the available capacity of the system. The level of traffic demand can vary significantly depending on the season, the day of the week, and the time of day. Also, the capacity of the highway system, which is usually thought of as constant, can change because of weather, work zones, traffic incidents, or other non-recurring events.

There are four components of congestion:

1. **Duration** – This is the length of time during which congestion affects the travel system.
2. **Extent** – This is described by estimating the number of people or vehicles affected by congestion and by the geographic distribution of congestion.
3. **Intensity** – The severity of congestion that affects travel is a measure from an individual traveler's perspective. In

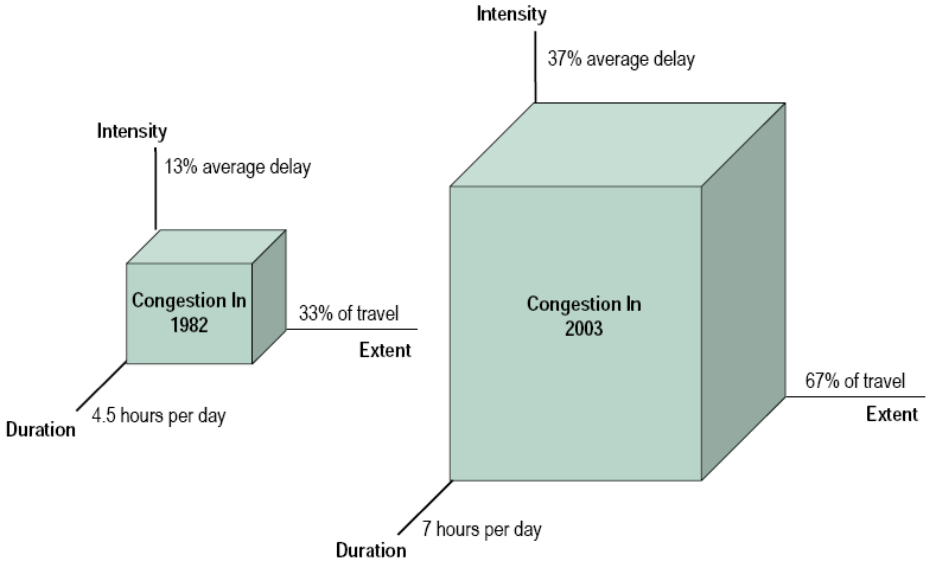
[2] *Traffic Congestion and Reliability: Linking Solutions to Problems*, FHWA, 2004.

concept, it is measured as the difference between the desired condition and the conditions being analyzed.

4. **Variation** – This key component describes the change in the other three elements. Recurring delay (the regular, daily delay that occurs due to high traffic volumes) is relatively stable. Delay that occurs due to incidents is more difficult to predict.

In Pennsylvania, delay and fuel costs due to traffic signal congestion is estimated at $120 to $160 million annually.

Exhibit 4.1: Components of Congestion



Source: *Urban Mobility Report*, Texas Transportation Institute, 2005.

In most applications, congestion is measured in terms of level of service (LOS). LOS is a qualitative measure describing the intensity of conditions of a segment or traffic stream. Six different levels are defined (LOS A, B, C, D, E, and F) with LOS A representing the best condition and LOS F representing the worst condition. It should be noted that LOS does not fully consider duration, extent, and variation components.

4.2 Types of Congestion

There are two basic types of congestion: recurring and non-recurring. Recurring congestion takes place virtually every day when and where traffic demand exceeds the existing roadway capacity. This is sometimes called peak period or "drive time"

congestion. Non-recurring congestion is caused by random events such as crashes, roadway hazards, highway construction, adverse weather, and special events. Both need to be addressed in different ways to effectively deal with the full spectrum of congestion.

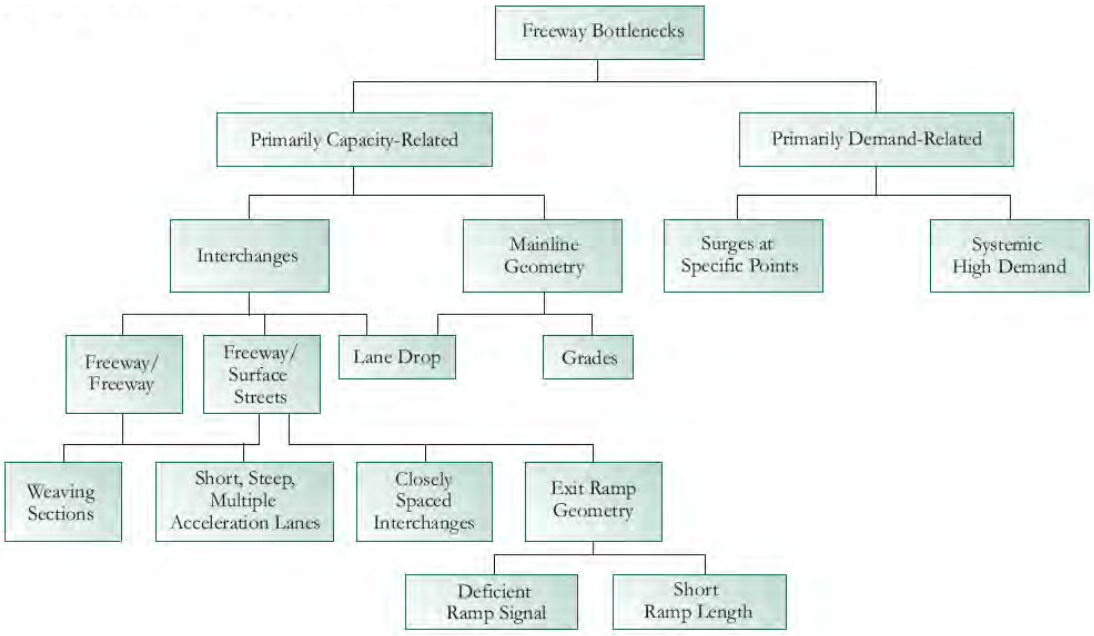
Exhibit 4.2: Causes of Congestion

Causes of Recurring Congestion	Causes of Non-recurring Congestion
• Inadequate roadway capacity (i.e., not enough lanes) • Roadway bottlenecks (i.e., from two lanes to one lane) • Intersections • Railroad crossings • Roadway tunnels	• Crashes (and associated delays) • Construction activities • Special events • Emergency management and incidents • Weather

According to the FHWA Report, *Traffic Congestion and Reliability: Linking Solutions to Problems*, only 45 percent of congestion is recurring. This type of congestion generally consists of poor signal timing and bottlenecks. The majority, or 55 percent, of congestion is non-recurring.

Nearly 40 percent of congestion can be linked to bottlenecks. A bottleneck is a phenomenon by which the performance or capacity of a transportation system is severely limited by a location. A physical bottleneck occurs when the performance or capacity is limited due to a physical feature along the transportation system. The limitations of throughput through a bottleneck typically create a critical focus area along a transportation system. Examples may include: lane drops, tunnels, bridges, unconventional roadway geometry, inadequate drive guidance, etc. The result of improving a recurring bottleneck location is to provide additional base capacity. Improving base capacity by addressing recurring bottleneck locations will also benefit non-recurring events. As a result, FHWA recently launched a low-cost improvement program focused on reducing bottlenecks.

Exhibit 4.3: Bottleneck Elements



Source: *Traffic Bottlenecks: A Primer – Focus on Low Cost Operational Improvements*, FHWA, 2005.

4.3 Causes of Congestion

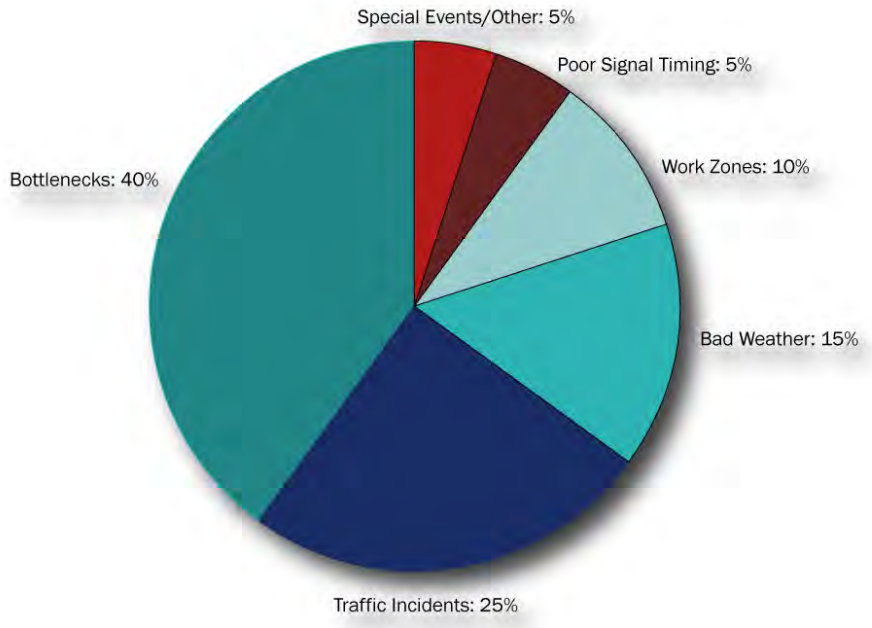
Congestion is the result of several root causes, often interacting with one another:

- **Physical Bottlenecks** ("Capacity") – Capacity is the maximum amount of traffic capable of being handled by a given highway section. Capacity is determined by a number of factors: the number and width of lanes and shoulders; merge areas at interchanges; and roadway alignment (grades and curves).
- **Traffic Incidents** – Events that disrupt the normal flow of traffic, usually by physical impedance in the travel lanes. Events such as vehicular crashes, breakdowns, and debris in travel lanes are the most common form of incidents.
- **Work Zones** – Construction activities on the roadway that result in physical changes to the highway environment.

These changes may include a reduction in the number or width of travel lanes, lane "shifts," lane diversions, reduction or elimination of shoulders, and even temporary roadway closures.

- **Weather** – Environmental conditions can lead to changes in driver behavior that affect traffic flow.
- **Traffic Control Devices** – Intermittent disruption of traffic flow by control devices such as railroad grade crossings and poorly-timed signals also contribute to congestion and travel time variability.
- **Special Events** – Demand fluctuations whereby traffic flow in the vicinity of the event will be radically different from "typical" patterns. Special events occasionally cause "surges" in traffic demand that overwhelm the system.[3]

Exhibit 4.4: National Causes of Congestion



Source: http://www.fhwa.dot.gov/congestion/describing_problem.htm

[3] *Traffic Congestion and Reliability: Trends and Advanced Strategies for Congestion Mitigation*, FHWA, 2005.

Nationally, bottlenecks are the most significant cause of congestion at 40 percent, while incidents rank second at 25 percent. Presently, Pennsylvania does not compile system wide performance measures for congestion. This makes mitigating congestion a challenge since root causes are not fully understood.

Pennsylvania's most significant causes of congestion:

1. Bottlenecks
2. Incidents
3. Traffic Signals
4. Work Zones
5. Weather
6. Special Events

Source: TAC survey

In reality, the causes of congestion vary greatly throughout the state. During the development of Regional Operations Plans (ROPs), available at www.paits.org, and based on a review of available Congestion Mitigation Plans (CMPs), rural regions typically have indicated that traffic incidents and weather are more significant causes of congestion. Urban areas contribute much of congestion to bottlenecks as well as traffic incidents. All areas have identified traffic signals as the greatest opportunity for decreasing congestion with limited resources.

As part of outreach activities, a survey was distributed to a targeted stakeholder audience including MPO/RPO/TMAs, PennDOT staff, municipalities, transit providers, developers, special interest groups, consultants, and others. Respondents ranked bottlenecks as the biggest contributing factor.

4.4 Congestion Perspective

4.4.1 National Perspectives

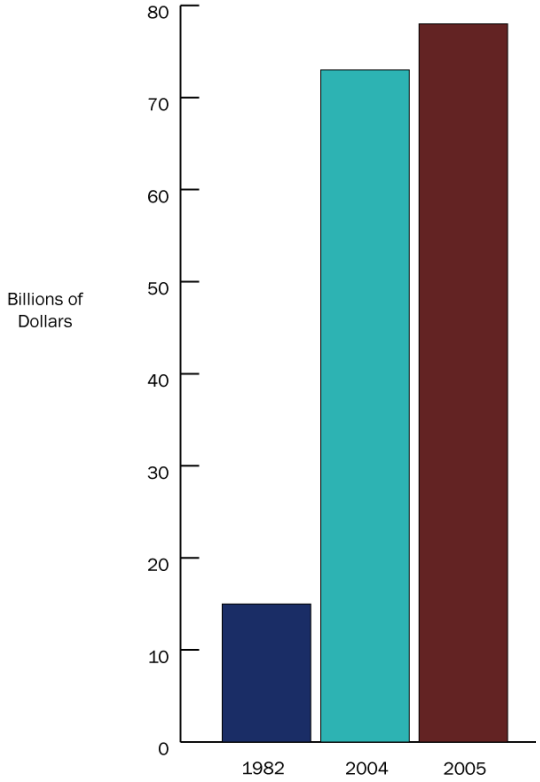
Congested roadways waste time and money, and take a toll on people. Nationally, it is estimated that congestion results in:

- 4.2 billion hours of delay
- 2.9 billion gallons of wasted fuel (enough to fill 58 supertankers)[4]

This equates to $78 billion in fuel and delay costs annually. This statistic will worsen in the future since these congestion costs are growing at 8 percent per year, more than double the growth rate of the economy.

[4] *Urban Mobility Report*, Texas Transportation Institute, 2007.

Exhibit 4.5: National Cost of Congestion



Source: *Urban Mobility Report*, Texas Transportation Institute, 2007.

Overall the cost of congestion is equivalent to 0.6 percent of the Gross Domestic Product (GDP).[5] Congestion costs are particularly prevalent in the freight community, where the value of time under certain just-in-time delivery circumstances may exceed $5 per minute.[6]

Additional costs of congestion include:

- Environmental costs due to increased fuel consumption and increased vehicle emissions
- Safety costs
- Loss of productivity due to reduced scale economies and labor market sizes

[5] *Traffic Congestion and Reliability: Trends and Advanced Strategies for Congestion Mitigation,* FHWA, 2005.
[6] http://www.fhwa.dot.gov/congestion/describing_problem.htm

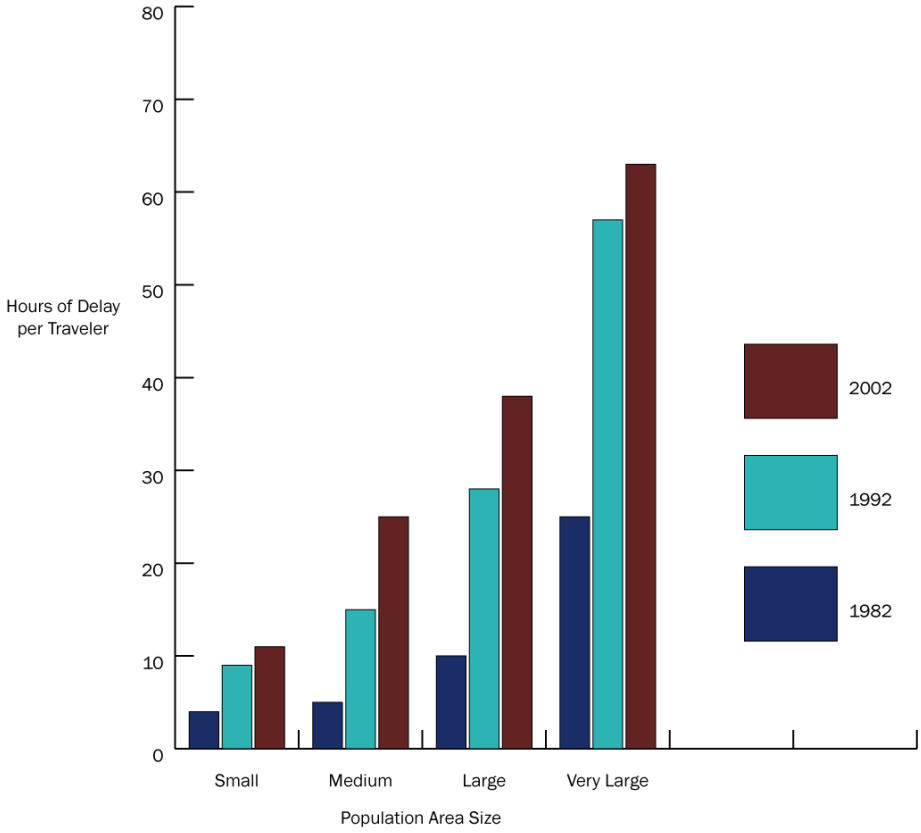
- Costs of cargo delays and inventory costs
- Vehicle wear and tear on passenger cars[7]

Over the past 20 years, the extent of congestion has grown from 33 to 67 percent of travel. The portion of the day impacted by traffic congestion has grown from 4.5 to 7.0 hours.

Not only does congestion dampen the economy, it also impacts the way we live. Parents miss events with their children; friends and families find it harder to spend time together; civic participation is increasingly difficult; and so on. Additionally, evidence suggests that each additional 10 minutes in commuting time cuts involvement in community affairs by 10 percent.

Over the past 20 years congestion has continued to worsen. Exhibit 4.6 shows the increase in hours of delay per traveler. This trend is not expected to diminish despite increased demand management options.

Exhibit 4.6: Congestion Trends



Source: *Urban Mobility Report*, Texas Transportation Institute, 2005.

[7] *Traffic Bottlenecks: A Primer – Focus on Low Cost Operational Improvements*, FHWA, 2005.

4.4.2 Pennsylvania Perspectives

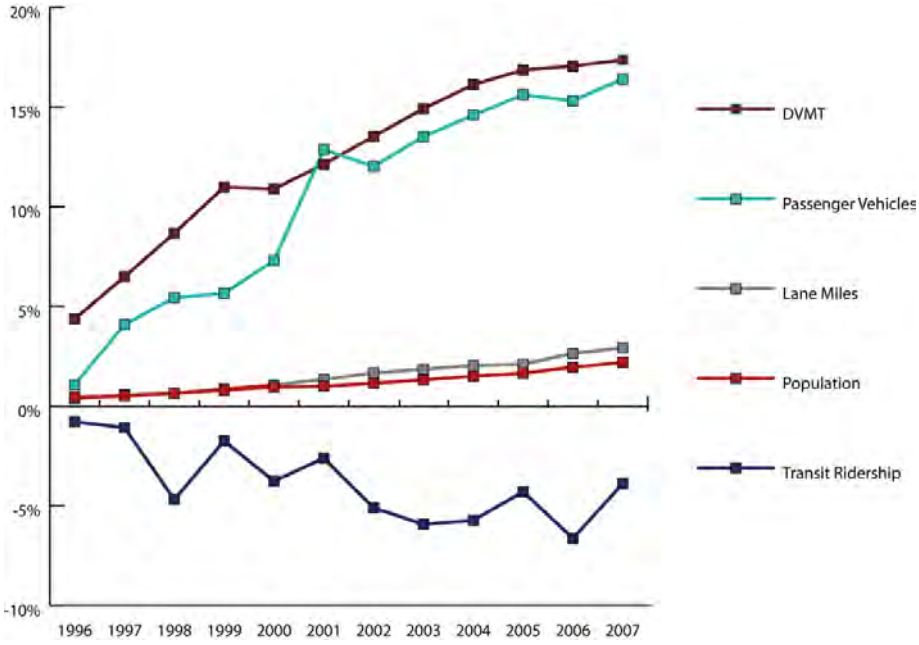
The perception of congestion varies throughout the Commonwealth. While the focus of congestion is often urban areas such as Philadelphia and Pittsburgh, the concerns with respect to congestion should not be understated. Urban areas tend to have more modal choices and routes than rural areas.

Congestion is difficult to define precisely in a mathematical sense—it actually represents the difference between the highway system performance that users expect and how the system actually performs.

As a result, the definition of highway congestion varies significantly from time to time and place to place based on user expectations. An intersection that may seem very congested in a rural community may not even register as an annoyance in a large metropolitan area. A level of congestion that users expect during peak commute periods may be unacceptable if experienced on Sunday morning. Because of this, congestion is difficult to define precisely in a mathematical sense—it actually represents the difference between the highway system performance that users expect and how the system actually performs.

In Pennsylvania, as well as in other states, this rise in congestion can be attributed to increasing travel. Over the last decade, Pennsylvania travel has generally increased between 1.5 and 2 percent per year. As seen in Exhibit 4.7, growth in Daily Vehicle Miles of Travel (DVMT) has tracked closely with the increase in registered vehicles. Over the same period, however, there has been only a minor increase in lane-miles added to accommodate additional demands. This may be due to combination of issues including increased environmental and land use sensitivity and limited funding.

Exhibit 4.7: Pennsylvania Transportation Usage Characteristics as a Percent of 1995 Values

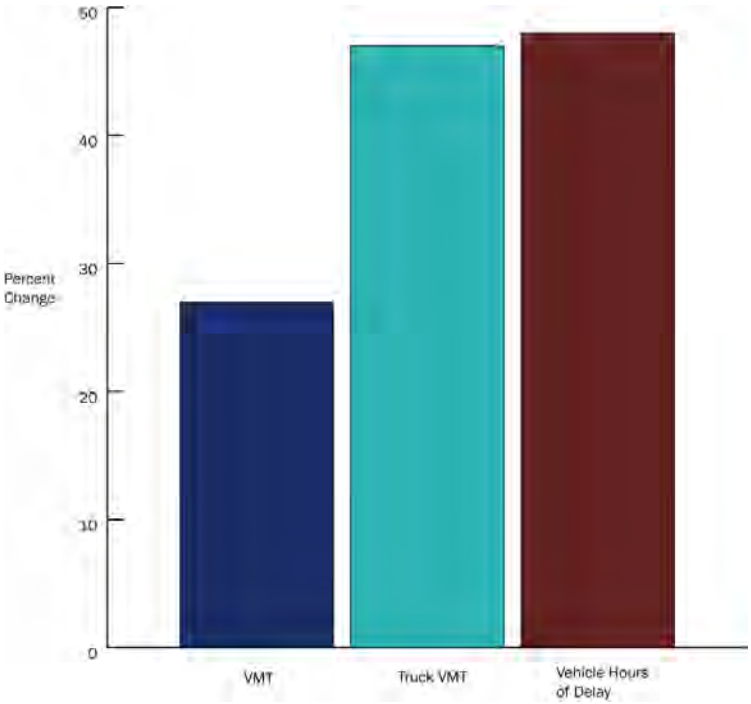


Source: PennDOT

Looking into the future, data from the Statewide Travel Demand Model shows how travel is expected to continue its growth trends. Total vehicle miles traveled are projected to grow by 27 percent by 2030. However, truck vehicle miles traveled are expected to grow by 47 percent. The model also projects that the total vehicle hours of delay will increase by 48 percent as shown in Exhibit 4.8.

It is estimated that congestion costs Pennsylvania $2.7 billion each year.

Exhibit 4.8: Percent Growth in Congestion Indicators, 2006 - 2030



Source: Pennsylvania Statewide Travel Demand Model

The *Urban Mobility Report*, 2007 estimates that the cost of congestion is growing exponentially. This is illustrated in Exhibit 4.9, which shows the cost of congestion for three Pennsylvania metropolitan areas. For the entire state it is estimated that congestion costs $2.7 billion annually.

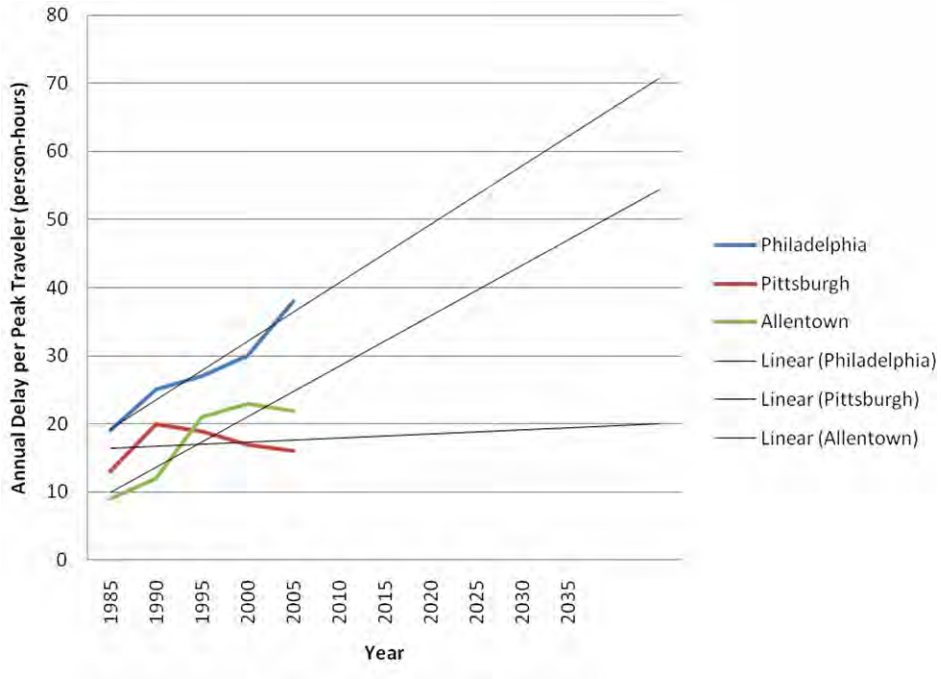
Exhibit 4.9: Total Cost of Congestion (millions of dollars)

City	1985	1995	2005
Philadelphia	$338	$802	$2,076
Pittsburgh	$84	$218	$285
Allentown-Bethlehem	$19	$77	$137

Source: *Urban Mobility Report*, 2007.

- From 1985 to 1995, the cost of congestion for the three cities listed above doubled; however, the cost of congestion increased by five times from 1985 to 2005.
- At the current rate, congestion costs the average urban motorist in Pennsylvania roughly $300 to $700 per year in lost time.
- In Philadelphia, the annual delay per peak traveler is approximately 40 person-hours. In Pittsburgh and Allentown, the annual delay per peak traveler is between 15 and 25 person-hours.
- Exhibit 4.Exhibit 4.10 shows the person-hours of delay per peak traveler for these three Pennsylvania metropolitan areas.

Exhibit 4.10: Delay per Peak Traveler

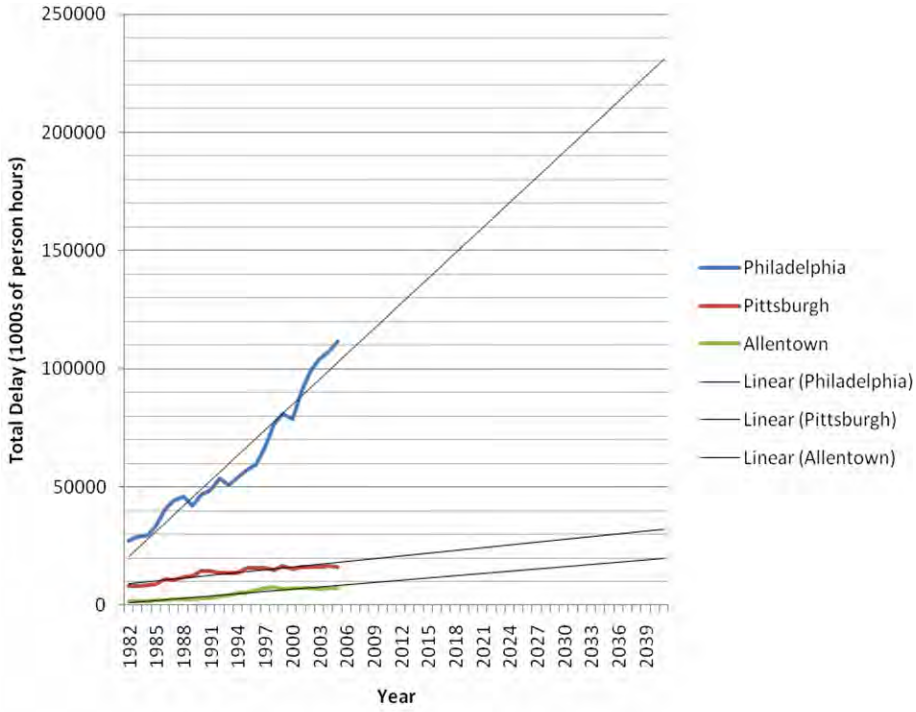


Source: *Urban Mobility Report*, 2007.

In the three representative areas evaluated, total delay has historically been a linear relationship; however, total delay has grown at a faster pace in Philadelphia than Pittsburgh or Allentown.

Conservative estimates indicate that congestion could cost $8 billion per year in fuel and delay costs by 2035 unless major initiatives are undertaken.

Exhibit 4.11: Total Delay



Source: *Urban Mobility Report*, 2007.

Conservative estimates indicate that congestion will increase by 50 to 60 percent within Pennsylvania over the next 30 years unless a multifaceted congestion mitigation program is established. This is consistent with statewide travel demand model projections. In Philadelphia, congestion will likely double in the next 30 years without major initiatives.

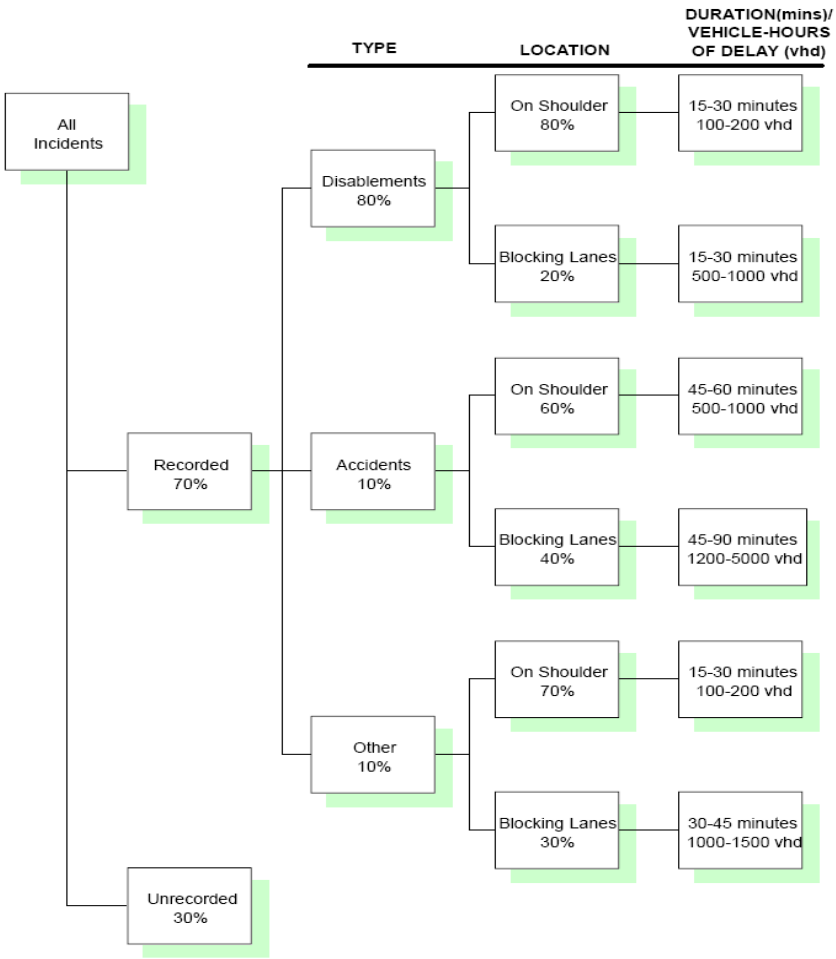
The costs of congestion will be magnified due to the combination of increased delay and inflation. Conservative estimates indicate that congestion could cost $8 billion per year in fuel and delay costs by 2035 unless major initiatives are undertaken.

4.5 Relationship between Safety and Congestion

Crashes (and other traffic incidents) equate to 25 percent of congestion. The Institute of Transportation Engineers (ITE) estimates that a lane blockage that lasts an estimated 30 minutes causes approximately 500 to 2,000 vehicle-hours of delay. ITE estimates that a major crash lasting approximately 90 minutes causes 1,200 to 5,000 vehicle-hours of delay.

A 90-minute incident on an interstate carrying 30,000 vehicles daily results in $120,000 in lost fuel and time.

Exhibit 4.12: Impact of Incidents on Congestion



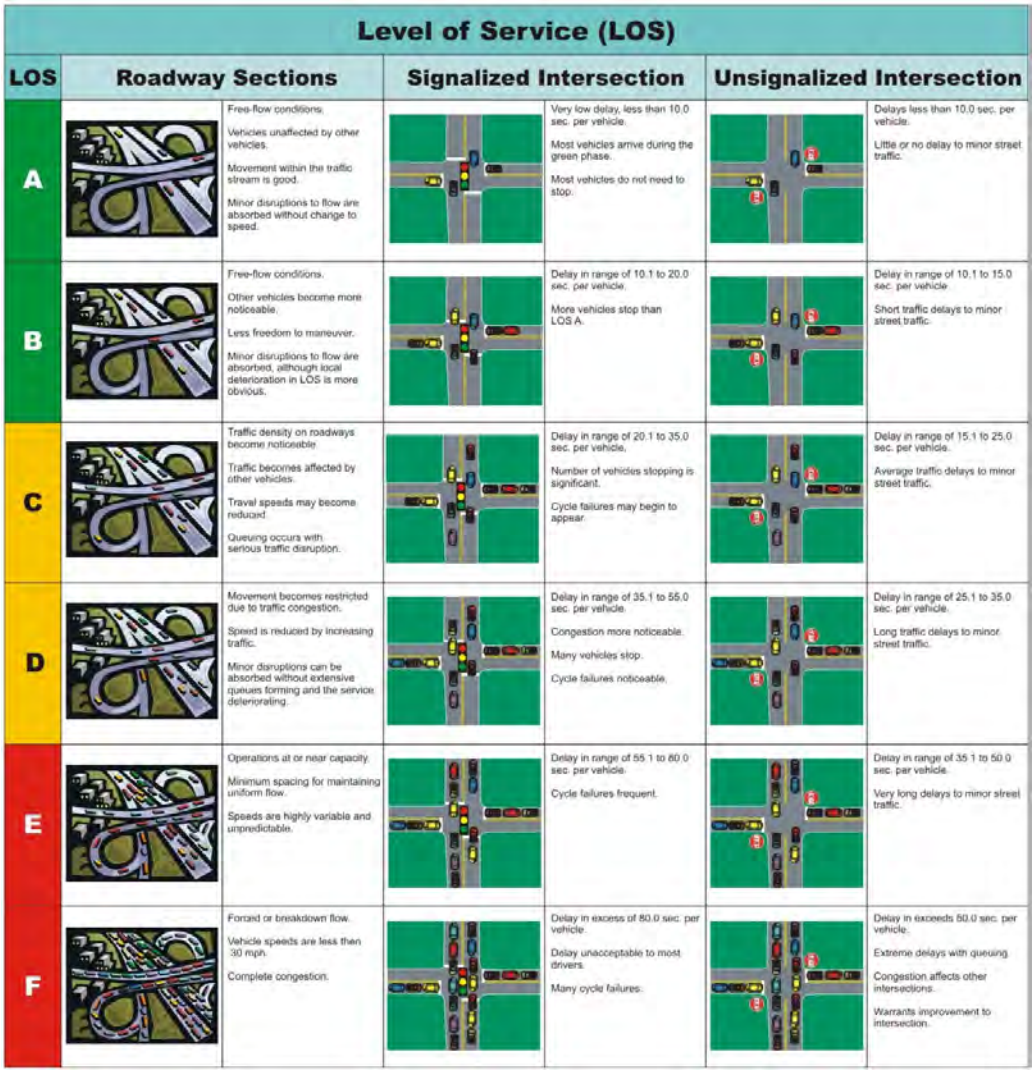
Source: Institute of Transportation Engineers (and Cambridge Systematics), 1996.

As a result, the mitigation of high crash locations not only can improve safety, it also can reduce non-recurring congestion. Additionally, incident detection and response strategies can reduce the level of congestion associated with an incident.

4.6 Measuring Congestion

Congestion has historically been measured by minutes of delay as well as through Level of Service (LOS) as defined by the Highway Capacity Manual. In urban areas, LOS D or better is typically deemed acceptable. In rural areas, LOS C or better is typically deemed acceptable.

Exhibit 4.13: Level of Service Overview



LOS does not provide a measure of non-recurring congestion and it does not fully consider the duration, extent, and variation of congestion. Many practitioners agree that it can be valuable to consider congestion performance measures in addition to delay and LOS. The National Transportation Operations Coalition (NTOC) measures for operations/congestion are:

- Customer satisfaction
- Extent of congestion—spatial, temporal
- Incident duration
- Non-recurring delay
- Speed
- Throughput—person, vehicle
- Travel time—facility, reliability, trip
- Land use
- Multimodal

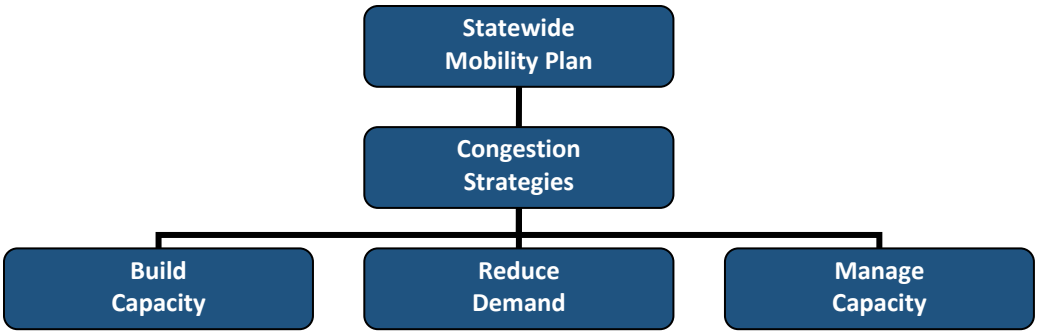
5. Congestion Mitigation Techniques and Strategies in a Smart Transportation Context

5.1 General Strategies

The Pennsylvania Mobility Plan identified three overall strategies to address congestion. They are:

1. **Building capacity** – Building capacity is a viable alternative for addressing congestion; however, not all capacity-adding projects may be considered Smart Transportation. While there is still an important need for the strategic addition of new capacity, the likelihood of building our way out of congestion is diminished due to environmental and land use sensitivity and limited funding. Building capacity in a Smart Transportation context includes strategic capacity enhancements designed in the context of the community, the implementation of turn lanes to improve congestion and safety at critical intersections, development of multimodal corridors and improved street connectivity.
2. **Reducing demand** – Nearly all demand management strategies are consistent with Smart Transportation. These strategies attempt to address congestion at the root of the problem by reducing the number of vehicles on the road.
3. **Managing capacity** – Managing capacity is also consistent with Smart Transportation. These efforts are intended to enhance the operation of the transportation system and make it as efficient as possible.

Exhibit 5.1: Mobility Plan Strategies



These strategies are consistent with FHWA guidance on congestion mitigation as presented in 2008 in *Traffic Bottlenecks: A Primer – Focus on Low Cost Operational Improvements.*

Exhibit 5.2: FHWA Congestion Strategies

Bring Supply and Demand into Alignment
Road Pricing
Ramp Metering
Corridor Management
Provide Real-Time Travel Information
Provide Better Choices as to How, When, Where, and If to Travel
Provide More Attractive Alternatives to Single-Occupant Vehicle Transportation (Including Better Transit, More Telecommuting, or High Occupancy Toll Lanes)
Provide Real-Time Travel Information
Strategically Invest in New Transportation Capacity
Add New Construction on New Alignment

Improve the Management and Operation of the System
Quickly Restore Capacity After Traffic-Disrupting Events • Improve the Management of Traffic Incidents • Improve Mobility at Work Zones • Respond Effectively to Inclement Weather Conditions • Plan Ahead for Special Events
Improve the Day-to-Day Operation of the System • Improved Traffic Signal Timing • Operational and Low-Cost Construction Improvements to Relieve Bottlenecks (e.g., restriping)
Provide Real-Time Travel Information to Agencies and System Users

Source: Traffic Bottlenecks: A Primer – Focus on Low Cost Operational Improvements, FHWA, 2008.

5.2 Mitigation Techniques

FHWA has also identified numerous mitigation techniques associated with each category. In reality, the most successful approach may be to implement a combination of appropriate strategies from all three categories, outlined below.

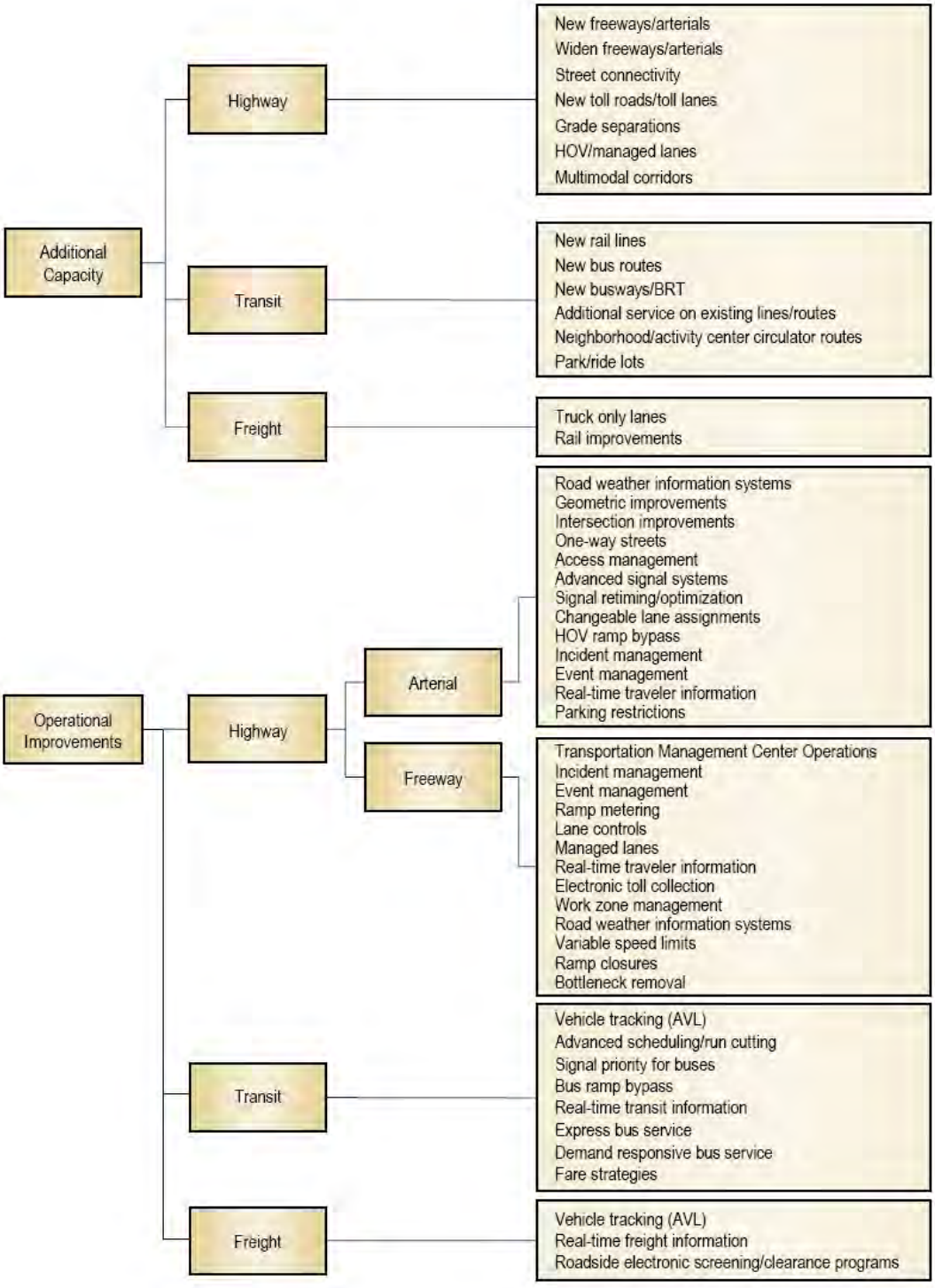
Congestion Mitigation Techniques

Capacity Enhancements can include new roadways and roadway widening for additional single-occupancy vehicle lanes (SOVCAP), but may also include minor geometric enhancements and the elimination of bottlenecks. Large-scale capacity enhancements are typically the last measures that transportation professionals consider, because they are often the most expensive and can have adverse environmental impacts, such as consuming considerable right-of-way. Also, large-scale capacity enhancements can induce additional travel, which may result in the roadway becoming congested again in the future. However, strategic capacity enhancements can alleviate existing congestion and may accommodate some future growth if properly considered.

Operational Improvements are geared toward improving the "supply side" of the transportation system. These efforts are intended to enhance the operation of the transportation system and make it as efficient as possible. Operational improvements include intersection upgrades, access management, reversible lanes, traffic signal improvements, and Intelligent Transportation Systems. Operations represent technologies and institutional arrangements that allow transportation systems to operate more closely to their maximum design intent.

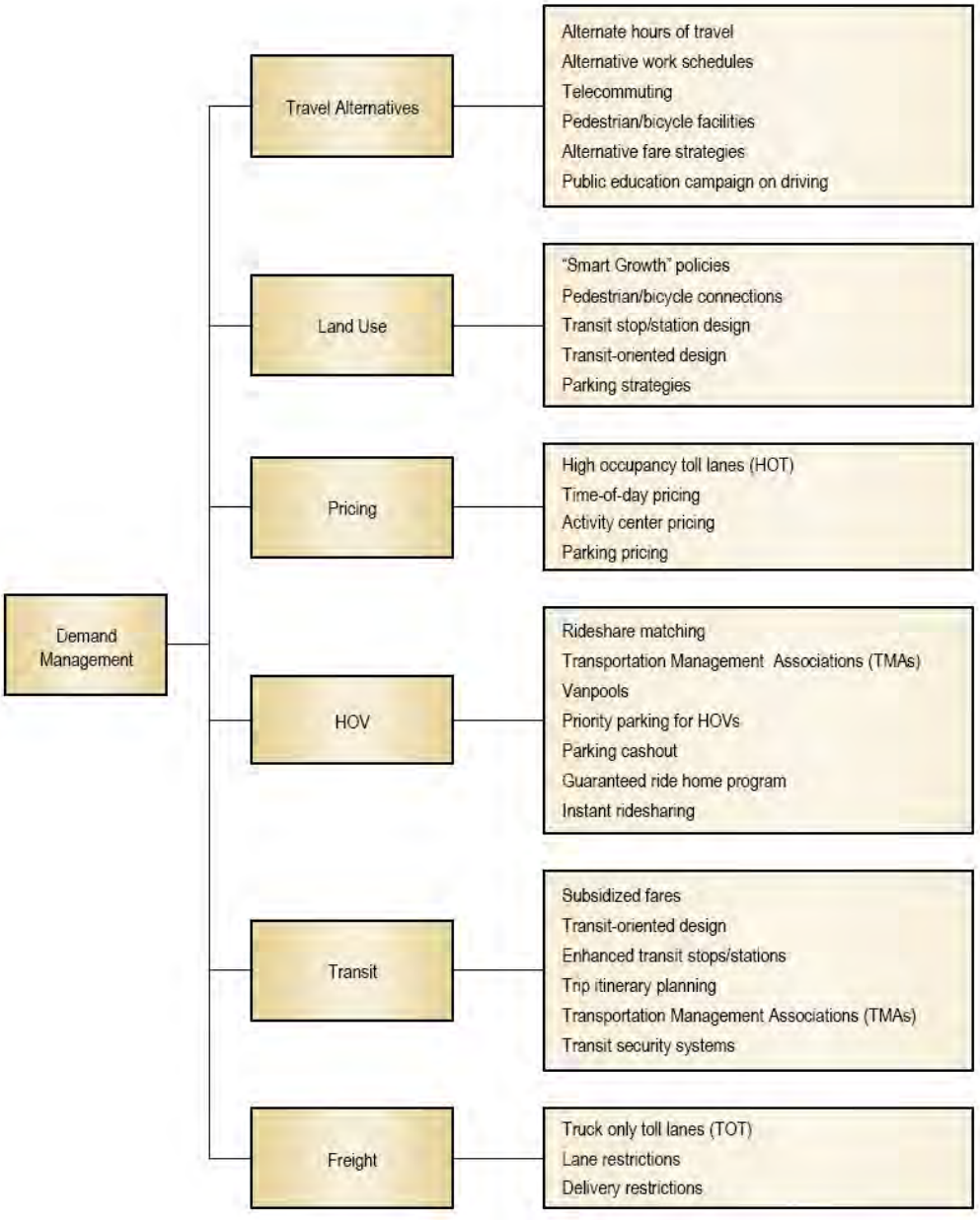
Demand Management Programs attempt to address congestion at the root of the problem by reducing the number of vehicles on the road. These initiatives work to modify driver behavior by encouraging people to make fewer single-occupancy trips, travel in off-peak hours when possible, and support land use policies that reduce the demand for automobile transportation.

Exhibit 5.3: Congestion Mitigation Techniques



Congestion Mitigation Techniques (continued)

USDOT set a goal that calls for reducing congestion, not just reducing the rate of growth of congestion.



Source: *Traffic Congestion and Reliability: Trends and Advanced Strategies for Congestion Mitigation*, FHWA, 2005.

5.3 U.S. Department of Transportation Congestion Initiative

In May 2006, the U.S. Department of Transportation (USDOT) announced the National Strategy to Reduce Congestion of America's Transportation Network (otherwise known as the Congestion Initiative). This initiative is focused on making

meaningful and near-term reductions in congestion. Because of this initiative, USDOT set a goal that calls for reducing congestion, not just reducing the rate of growth of congestion.

The Congestion Initiative includes areas of interest. Each area encompasses activities with the potential to both reduce congestion in the short term and to build the foundation for successful longer-term congestion reduction efforts.

Relieve Urban Congestion – USDOT has entered into Urban Partnership Agreements with selected cities willing to pursue comprehensive, bold, and innovative congestion pricing strategies to reduce congestion. These have included high occupancy toll (HOT) lanes, congestion pricing for parking, bus rapid transit, etc. It is important to note that for road pricing to be successful it must be part of a comprehensive package that includes making transit more attractive; providing travel alternatives, such as telecommuting, that reduce the demand for highway transportation; and ensuring that the system is operating at peak performance and that proper technology is in place to support effective and efficient application of the pricing strategy.

Unleash Private Sector Investment Resource – USDOT is working to reduce or remove barriers to private sector investment in the construction, ownership, and operation of transportation infrastructure.

Promote Operational and Technological Improvements – USDOT is working to advance low-cost operational and technological improvements aimed at congestion reduction. It is encouraging and supporting state efforts to:

- Provide real-time traffic information to all users.
- Deploy incident management strategies such as the formation of roving response teams and quick clearance and "move it" laws.
- Improve traffic signal timing.
- Improve work zone safety and mobility.
- Deploy quick-fix operational and low-cost construction strategies to address congestion.[8]

[8] *Traffic Bottlenecks: A Primer – Focus on Low Cost Operational Improvements*, FHWA, 2008.

6. Congestion Mitigation Planning and Programming

In the past, addressing congestion problems generally involved building additional travel lanes or constructing a bypass around a community. Metropolitan planning processes with travel demand models predicted which facilities would need to be expanded at some point in the future. However, economic and environmental climates no longer support this approach. Transportation agencies do not have the luxury of undertaking massive new statewide road building and expansion programs. Pennsylvania has been transitioning to a new era in plans and programs to address congestion. The following summarizes recent developments in planning and programming.

In recent years, PennDOT's statewide planning efforts have largely been directed toward the "managing capacity" strategy.

6.1 Statewide Congestion Mitigation Planning

As mentioned previously, *The Pennsylvania Mobility Plan* addressed congestion in a new context. The plan identified three overall strategies to address congestion: building capacity, reducing demand, and managing capacity.

In recent years, PennDOT's statewide planning efforts have largely been directed toward the "managing capacity" strategy, specifically operations planning. In 2005, PennDOT developed a Transportation Systems Operations Plan (TSOP)[9] which defined the general framework for managing capacity along the state's highways. TSOP focused on a number of statewide projects in the areas of incident management, traveler information, and congestion mitigation. However, the primary activities have been directed at building the foundation for transportation operations—deployment of Intelligent Transportation System (ITS) equipment, systems acquisition, and establishing transportation management centers.

In addition, PennDOT has taken initial steps toward developing a Statewide Congestion Management Plan. Such a plan would primarily be aimed at incident management and 511 traveler

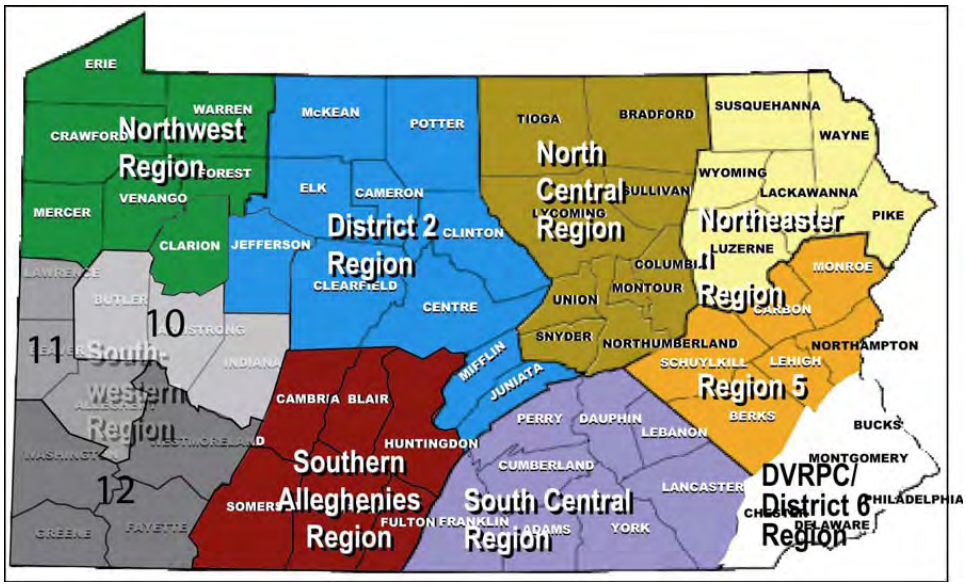
[9] The ITS Strategic Plan was developed in 2008 as a follow-up to address Pennsylvania's ITS needs.

information purposes, but would also address congested corridors and advanced signal systems.

6.2 Regional Congestion Mitigation Planning

Following TSOP, there was a coordinated effort to develop Regional Operations Plans (ROPs). A ROP was developed for each of nine regions, shown on Exhibit 6.1. In constructing their ROP, each region used TSOP as a starting point, but adapted statewide directions to specific regional needs. Each ROP included specific projects and strategies for improving operations within that region. The intent is that the projects identified through the ROPs will be incorporated into the long-range transportation plans (LRTPs) and Transportation Improvement Programs (TIPs) for each planning partner region. The ROPs were also intended to integrate regional operations into the planning process at each MPO and RPO across the state.

Exhibit 6.1: Pennsylvania Regional Operations Plan (ROP) Regions



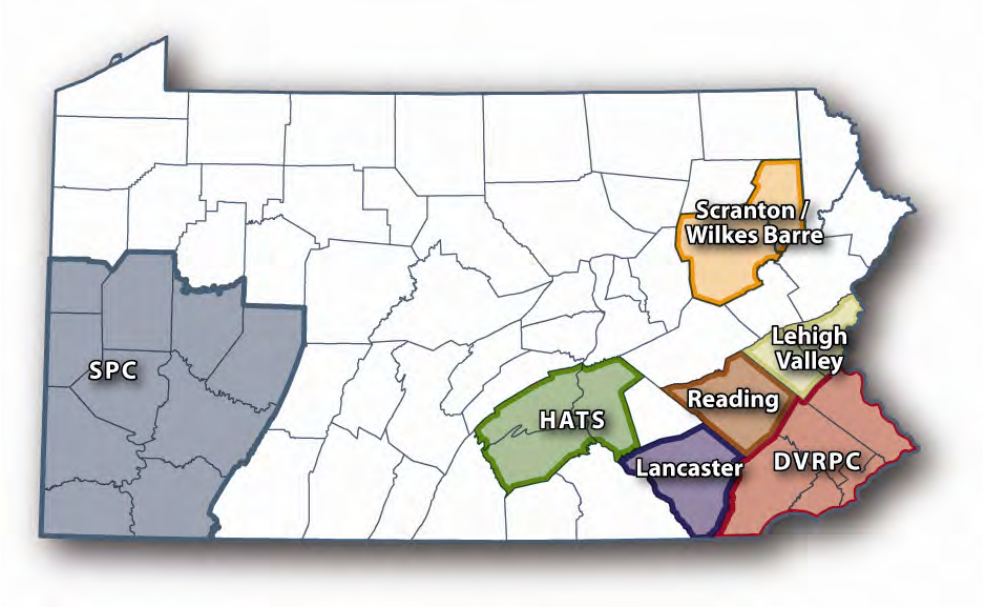
6.3 Congestion Management Processes

The original requirement for Congestion Management Systems (CMS) was included in the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). At that time all MPOs in Pennsylvania were required to maintain a CMS. At the very least, each area identified congested corridors and strategies to address

congestion. Later, the law was changed to require CMSs only in Transportation Management Areas (TMAs)—urban areas with a population of more than 200,000. With the 2005 passage of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), the requirement was updated to a Congestion Management Process (CMP) rather than a CMS. The change is intended to be substantive in perspective and practice, to address congestion management through a process that provides for effective management and operations, and an enhanced linkage to the planning and environmental review processes. The change is also based on cooperatively-developed travel demand reduction and operational management strategies as well as capacity increases.

In Pennsylvania, the seven largest MPOs—Philadelphia, Pittsburgh, Harrisburg, Lehigh Valley, Scranton/Wilkes-Barre, Lancaster, and Reading—are required to maintain a CMP. In addition, the York MPO and the Lebanon MPO currently have CMPs in place, and the Shenango Valley MPO is in the process of developing its CMP.

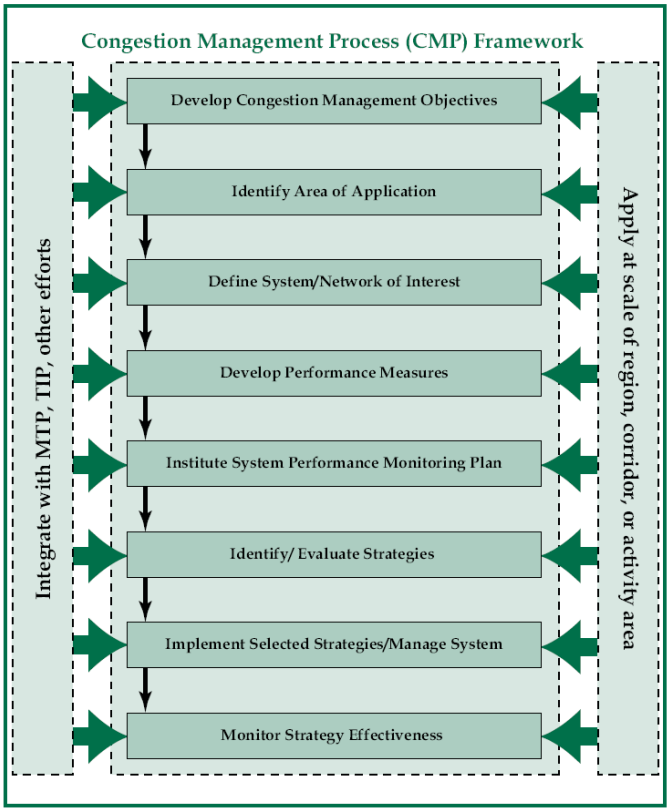
Exhibit 6.2: Transportation Management Areas Required to Maintain a Congestion Management Process



For these areas, the CMP should be the focal point of congestion planning. A CMP in these areas is intended to:

- identify congested corridors,
- determine causes of congestion,
- develop alternative strategies to mitigate congestion,
- evaluate the potential results of different strategies,
- propose alternative strategies that best address the causes and impacts of congestion, and
- track and evaluate the impact of previously implemented congestion strategies.

Exhibit 6.3: Congestion Management Process Framework



Source: FHWA/FTA *Guidebook on the Congestion Management Process*, 2008.

CMPs can be an integral component of the planning and programming process and can create stronger linkages between planning and operations.

PennDOT had a "best practices" review of the CMPs throughout Pennsylvania completed in 2005.[10] This review made the following points:

- CMPs can be an integral component of the planning and programming process when performance measures, corridor prioritization, and strategy evaluations are fully utilized in the development of the long-range plan and the transportation improvement program.
- The CMP can create a stronger linkage between planning and operations by helping to raise awareness among the planning community of the efficiencies that operational strategies can contribute.
- The inclusion of land use and socio-economic data within the CMP provides another means to link land use and transportation and can provide important insights into the impacts of land use strategies.
- A major objective of the CMP is to ensure that highway improvement funding is spent in an efficient manner for the corridors and projects that need it most. Low-cost operational improvements should be considered and evaluated in direct comparison to capacity improvements.

These points have a strong linkage to PennDOT's Smart Transportation principles. This demonstrates that Pennsylvania's CMPs can play a key role on putting Smart Transportation into practice.

6.4 Congestion Programs

Pennsylvania's transportation program is developed through a collaborative process involving PennDOT, the State Transportation Commission, metropolitan and rural planning organizations, federal transportation agencies, and owners and stakeholders of the transportation system. Priority projects are included in the Statewide Transportation Improvement Program (STIP).

To understand what resources are being applied to the congestion issues, the 2009-2012 STIP was reviewed for all projects that are in some way addressing congestion. The following project categories were extracted from the current STIP.

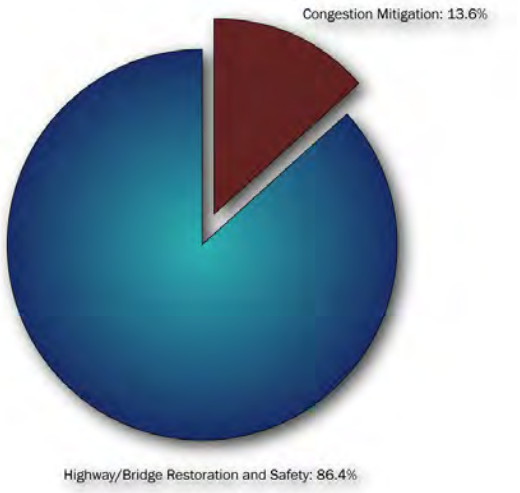
[10] *Best Practice Recommendation Report for Congestion Management Systems*, Michael Baker Jr., Inc.

Exhibit 6.4: STIP Projects Addressing Congestion

Program Category	Description/Types of Projects	2009-2012 Programmed Amount
Capacity	Widening to provide lane additions, roadway relocations, construction of new roadway sections, and construction of new interchanges or new grade separations	$761,333,880
Corridors/ Intersections/ Interchanges	Corridor-wide improvements to provide improved traffic flow such as intersection improvements, traffic signal coordination and upgrade, and other geometric improvements; individual intersection improvements such as addition of turning lanes, realignment, and signal modernization; interchange improvement such as ramp modifications	$665,889,521
Signals	Signal upgrades, new signals, interconnectivity and signal timings	$132,379,976
ITS	Intelligent Transportation System improvement to include detection systems, dynamic message signs, highway advisory radio, traffic management centers, etc.	$56,939,612
Mobility	Demand management strategies such as ridesharing and vanpooling programs, transit check marketing, and construction or expansion of park-and-ride facilities	$44,376,646
Total		$1,660,919,635

These categories are not exclusive; for example, signal improvements may be included with other categories such as intersection or corridor improvements. The chart does present an approximation of spending to address congestion. It also indicates the Commonwealth's current emphasis on system preservation for roads and bridges. The current $12.2 billion Statewide Transportation Improvement Program allocates 86.4 percent of program dollars to highway and bridge restoration and safety improvements. That leaves 13.6 percent of transportation spending to address congestion through lane additions, corridor and intersection improvements, traffic signal upgrades, Intelligent Transportation Systems, and demand management strategies such as ridesharing and park-and-ride facilities.

Exhibit 6.5: Congestion Spending in the Current Program



When looking at specific funding opportunities to address congestion, many of the funding categories within the program could be eligible, but any congestion mitigation project must compete with the overwhelming restoration needs across the Commonwealth. The federal category of Congestion Mitigation and Air Quality is the one category that is targeted directly to congestion.

6.4.1 Signal Enhancement Initiatives

As part of PennDOT's overall effort to manage congestion, two programs are aimed at improving efficiency along key corridors. These are the Congested Corridor Improvement Program (CCIP) and the Traffic Signal Enhancement Initiative (TSEI). These programs have been funded at $1.3 million each over the past several years. However, with the Commonwealth's current financial constraints, these programs have been temporarily suspended.

The CCIP is directed at congested corridors and identifying improvements that can be implemented within a short timeframe (less than three years) and at a reasonable cost. CCIP funding is directed at the corridor study only, and each MPO/RPO needs to program the actual project within their TIP. Typical improvements include traffic signal enhancements, minor geometric improvements, access management, and multimodal initiatives.

Each corridor study contains immediate, short-term, and possible long-term recommendations. The immediate recommendations normally consist of retiming traffic signals and have an average benefit to cost ratio of 47:1. The average benefit to cost ratio for the short-term recommendations is 14:1. Also, when the immediate and short-term recommendations are implemented, the peak hour travel times would be reduced by an average of 18.6 percent, and the system delay would be reduced by an average of 41.8 percent.

PennDOT has completed more than 25 CCIP projects. The average delay reduction has exceeded 18 percent and the average benefit-to-cost has exceeded 14:1.

Program	Congested Corridor Improvement Program (CCIP)
Description	• PennDOT initiated the Congested Corridor Improvement Program (CCIP) to identify congested corridors in the Commonwealth, and, in conjunction with its partners, define and implement needed improvements. • Transportation corridors and associated improvements are identified in partnership with MPOs/RPOs including utilization of existing congestion management systems (plans). • The proposed improvements are directed at activities such as roadway geometry, signal operations, access management, multimodal initiatives, intelligent transportation systems (ITS), traffic regulation techniques, transportation demand management (TDM) measures, and planning and zoning practices that are appropriate for a particular transportation corridor.
Evaluation Funding Considerations	• CCIP studies have been compiled for over 25 corridors statewide. • Approximately $1 million was allocated per year until recently, when the program was suspended.
Range of Solutions	• The CCIP study phase is managed by PennDOT, and the design and implementation of physical improvements are funded by planning organizations or the local authorities. Since the CCIP focuses on a broader range of potential solutions, stakeholder "buy-in" is critical to the success of each corridor.
Success Factors	• Reduce traffic congestion. • Improve mobility. • Improve travel safety.
Future Considerations	• Place more emphasis on metrics when selecting candidate corridors. • Include signal maintenance providers in process. • Provide more communication of the benefits through newsletters, newspaper articles, and others. • Encourage development of short-term solutions (such as signal timings) that can be implemented without additional engineering efforts. • Explore energy efficient solutions such as solar/wind-assisted signals to minimize municipal maintenance and operating costs. • Explore integration of signalized intersections into the local traffic management center (TMC) for the possibility of continued evaluation of the intersection. • Permit study activities and design activities to be completed under one contract effort to streamline process. • Require greater commitment from the municipality for system upkeep after a project is completed. • Conduct yearly self evaluations of the effectiveness of the program and how to progress to the next level.

The TSEI is aimed at optimizing traffic flow through certain signalized corridors throughout the state. Projects are generally retiming of signals, but may involve additional work. Corridors are nominated by the PennDOT District Offices and involve cooperation of local municipalities.

PennDOT has completed more than 20 TSEI projects. The average delay reduction has exceeded 20 percent and the average benefit-to-cost ratio has exceeded 15.

Program	Traffic Signal Enhancement Initiative
Description	• The Traffic Signal Enhancement (TSEI) Initiative called for PennDOT to "partner with municipalities to identify traffic signals that need to be retimed, upgraded, or better integrated into an overall congestion management strategy." • The goal of the TSEI is to reduce travel times and delay on specified signalized corridors. The TSEI seeks to optimize traffic flow through signalized intersections. • All projects under the TSEI must have traffic flow as their primary focus, but safety enhancements may be included as an additional benefit. Moreover, PennDOT focuses on corridor-based projects but will consider improvements to grid systems or isolated intersections if sufficiently justified.
Evaluation Funding Considerations	• Implementation of the TSEI began with a $1 million set aside in PennDOT's 2001-2002 and 2002-2003 Highway Administration Business Plans. • Each District may submit a maximum of two municipally-supported projects for consideration each year. • Approximately $1 million was allocated per year until recently, when the program was suspended.
Range of Solutions	• The TSEI focuses primarily on signal enhancement issues and other operational improvements. Since the program is managed and funded by PennDOT, improvements are implemented in a timely manner provided other stakeholders concur with the improvements.
Success Factors	• Reduce traffic congestion. • Improve mobility. • Improve travel safety.
Future Considerations	• Place more emphasis on metrics when selecting candidate corridors. • Include signal maintenance providers in process. • Provide more communication on the benefits through newsletters, newspaper articles, and others. • Explore energy efficient solutions such as solar/wind-assisted signals to minimize municipal maintenance and operating costs. • Explore integration of signalized intersections into the local traffic management center (TMC) for the possibility of continued evaluation of the intersection. • Require greater commitment from the municipality for system upkeep after a project is completed. • Conduct yearly self evaluations of the effectiveness of the program and how to progress to the next level.

The CCIP and TSEI initiatives are good examples of Smart Transportation because they focus on maximizing capacity within the context of the community and surrounding land uses.

The CCIP and TSEI initiatives are good examples of Smart Transportation because they focus on maximizing capacity within the context of the community and surrounding land uses. Recently both the CCIP and TSEI initiatives have been suspended due to other priorities and limited resources.

In recent years, many planning partners have taken a more active role in signal operations in order to promote regional mobility and as a mechanism to maximize resources.

The Southwestern Planning Commission (SPC), Delaware Valley Regional Planning Commission (DVRPC), and Lebanon Metropolitan Planning Organization, among others, have undertaken regional signal initiatives in coordination with PennDOT and local municipalities.

Southwestern Planning Commission
Regional Signal Initiatives

Improved traffic signal maintenance, coordination, and technology upgrades have been identified as high priorities in the SPC region. This is because traffic signal systems have been shown to provide some of the highest returns on investment of any transportation infrastructure projects. SPC has established two programs:

- Signals in Coordination (SINC) focuses on implementation of new timing and coordination plans provided the intersections have proper equipment.
- Signals in Coordination with Equipment Upgrades (SINC-UP) focuses on upgrading traffic signal equipment so that timing and coordination plans can be optimized.

The SR 68/528 corridor through Evans City Borough, Jackson Township and Forward Township in Butler County was included as a SINC-UP pilot project. Improvements included repairing loops, installing GPS time clocks, and optimizing timings. The total cost was approximately $20,000; however, delay was decreased by more than 50 percent in the PM peak hour. This equates to a 43:1 benefit-to-cost ratio.

6.5 Municipal and Developer Improvements

PennDOT has increasingly emphasized partnerships with local governments, because the problems and solutions for moving people and goods are larger than transportation and extend beyond the Department. PennDOT is working to increase outreach and support to local municipalities and strengthen the benefits of connecting local and regional plans.

Because land use decisions are made by Pennsylvania's more than 2,500 municipalities—many of which lack zoning or other planning documents—land use planning practices can be inconsistent statewide.

The Pennsylvania Municipalities Planning Code (MPC) empowers municipal government officials to plan for community development through comprehensive planning, zoning, and subdivision and land development ordinances. How local land use is controlled, and particularly new growth and development, is important in managing congestion on local roads and state highways. Because land use decisions are made by Pennsylvania's more than 2,500 municipalities—many of which lack zoning or other planning documents—land use planning practices can be inconsistent statewide.

The Smart Transportation concept demands that PennDOT have a greater involvement and coordination role in land use through working relationships with local governments. Many advances can be promoted, including improving the connected street network and transit-oriented design that integrates land use, zoning, and planning elements to promote higher density, mixed use development that is more easily accessible by other transportation modes.

Another important aspect of development's impact on congestion is the Highway Occupancy Permit (HOP) requirements. For any new development to access a state highway, a HOP is required. This process generally requires a traffic impact study and resultant developer improvements to mitigate traffic and safety impacts caused by the development. PennDOT has updated the HOP guidelines to better reflect its Smart Transportation focus.

7. Stakeholder Perspectives

Task Force members and other stakeholders were engaged to gain their perspectives on congestion and Smart Transportation. This was accomplished through meetings, surveys, and interviews. Below is a summary of the feedback received.

7.1 Stakeholder Survey

In September 2008, a Web-based survey was distributed to an identified stakeholder audience including MPO/RPO/TMAs, PennDOT staff, municipalities, transit providers, developers, special interest groups, consultants, and others. Respondents represented both rural and urban areas.

Respondents were asked to rank the primary causes of congestion.

Exhibit 7.1: Causes of Congestion Answer Ranking

Answer Choice	Average	Rank
Bottlenecks (lane reductions, lack of turning lanes, etc.)	1.89	1
Traffic incidents/crashes	3.30	2
Poor traffic signal timings	3.41	3
Work zones	3.57	4
Bad weather	4.43	5
Special events	4.67	6

Most respondents agreed that performance measures in addition to Level of Service (LOS) should be considered. Other themes of note include:

- Continue to educate stakeholders about Smart Transportation and implement Smart Transportation programs.
- PennDOT needs to focus on planning and programming.
- Provide more funding for congestion mitigation programs.

- Additional partnering is needed between PennDOT, planning partners, and municipalities to encourage Smart Transportation solutions in addressing congestion.
- Generate projects from the MPOs' Congestion Management Processes and implement continual congestion management planning.
- Promote operational programs including incident management and traveler information programs, ITS, and improved traffic signals.
- Encourage mode-neutral improvements.
- Provide incentives for developers who do more than the minimum and promote developer accountability.

A detailed summary is contained in **Appendix B**.

7.2 Task Force Brainstorming Session

At the August 8, 2008, meeting, Task Force members were divided into two groups and asked to brainstorm the following items.

1. **Identify five congestion mitigation strategies that you believe best reflect the Smart Transportation principles.**

Group 1
1. Traffic signal coordination and operations management
2. Highway access management/HOP coordination
3. Traffic communications/Dynamic Message Boards/Highway Advisory Radio
4. Alternative routes/enhance the network
5. Multi-municipal planning and land use planning

Group 2
1. Upgrade and optimization of signals
2. Access management
3. Low-cost safety improvements
4. Quick clear of incidents
5. Multi-modalism

2. **For any of the chosen strategies, identify what challenges or problems can arise in relation to implementing those strategies.**

Group 1
1. Money
2. Quick fix without thought for the long-term consequences
3. Too many stakeholders that are sometimes at odds with each other
4. Politics
5. Inability or unwillingness to change
6. Need for education

7. Theory versus practice issue
8. Lack of trust between PennDOT and municipalities, and among municipalities
9. Fragmentation
10. Challenging land use patterns and responsibility
11. Human and economic resources
12. Different visions of varying stakeholders

Group 2

1. Working out ownership/partnership, training staff, asset management systems, funding, streamlining of project, scope creep
2. Teamwork, advance planning, perception, education, consistency
3. Not just bridges; what is low cost/benefit?
4. Incident management, legislation changes, other states' best practices, teamwork
5. Education of communities, planning, funding, joint planning (transit-bicycle-pedestrian)

The responses of the second group coordinated with their top five congestion mitigation strategies.

7.3 Task Force Survey

Subsequent to the stakeholder survey and Task Force brainstorming session, a Web-based survey was distributed to Task Force members to gain additional perspectives on congestion mitigation. There were 17 responses, which were comparable to stakeholder viewpoints.

Exhibit 7.2: Comparison of Stakeholder and Task Force Input

Answer Choice	Stakeholder Input		Task Force Input	
	Average	Rank	Average	Rank
Poor traffic signal timings	3.4	3	2.4	1
Bottlenecks (lane reductions, lack of turning lanes, etc.)	1.9	1	2.5	2-T
Traffic incidents/crashes	3.3	2	2.5	2-T
Work zones	3.6	4	3.3	4
Bad weather	4.4	5	5.1	5
Special events	4.7	6	5.2	6

Task Force members were also asked which resources, programs, and policies are needed.

Exhibit 7.3: Responses on Resources Needed

What resources, programs, and policies are needed to implement initiatives in a Smart way?
General
▪ Bolster the role of the Congestion Management Processes at the regional and statewide levels. ▪ Create a comprehensive "statewide" plan for Smart Transportation that is measurable. ▪ Implement regional coordination meetings with the state, county, and municipal officials to determine best congestion mitigation strategies. ▪ Develop a statewide formula to rank and prioritize projects. ▪ Implement "just in time" delivery of maintenance and rehabilitation road and bridge projects along with congestion reduction projects to keep the public's confidence. ▪ Create a local taxing option so that regions can develop the funding mechanisms for locally significant projects.
Capacity Enhancement
▪ Continue to provide earmark funding. ▪ Reject blanket “no new capacity” policies. ▪ Identify future links on official (municipal) maps. ▪ Provide additional funding targeted to capacity enhancement projects, especially those that are relatively lower in cost.
Operational Strategies
▪ Establish separate funding mechanisms for operational improvements. ▪ Establish dedicated funding for signal improvements (both coordination and also traffic responsive). ▪ Encourage a greater PennDOT role in signal operations. ▪ Continue/expand traffic signal retiming/upgrade programs. ▪ Consider including signals in PennDOT’s Agility and Turnback Programs with municipalities. ▪ Implement a quick clearance policy. ▪ Highlight operational successes. ▪ Identify operational performance measures (for the skeptics).
Demand Management
▪ Implement a program where PennDOT and planning partners complete a review of local governments’ land use and zoning ordinances and either certify a community as "Smart" or provide a community feedback as to what changes could be made in their ordinances to make them "Smart." Then give "Smart" communities preference for dedicated "Smart" funding. ▪ Increase local and regional land use planning that is linked to the transportation impacts that development may generate. ▪ Educate the public on land use, travel demand, and how their travel decisions impact congestion, the environment, etc. ▪ Work with large employers to develop specific transportation demand management initiatives for their employees. ▪ Study the feasibility of diverting freight onto rail from highways.

Task Force members were also asked about guidance on project delivery.

Exhibit 7.4: Responses on Procedure Modifications

Please provide guidance on how project delivery procedures could be modified to better promote congestion mitigation strategies and Smart Transportation principles.	
PennDOT Project Development Process	▪ Make congestion mitigation a PennDOT and planning partner collaborative focus area. ▪ Encourage PennDOT to be involved in focused discussions with each county and region about all modes of transportation and projects to be included in a long-range transportation plan. ▪ Involve MPO CMP coordinators in PennDOT's project development processes.
Evaluation of Development (HOP/TIS)	▪ Coordinate HOP and traffic impact study (TIS) reviews among all involved parties. There needs to be informal and formal dialogue so that PennDOT and municipalities are "on the same page." ▪ Implement up-to-date traffic TIS procedures. ▪ Consider on-capacity adding alternatives (e.g., transit, flex hours, etc.).

Task Force members were also asked about overall planning and coordination.

Exhibit 7.5: Responses on Planning and Coordination

Planning and Coordination	
How could congestion mitigation be better managed and coordinated among municipal stakeholders, planning partners, and PennDOT?	▪ Establish working groups that meet periodically and use the CMP as a mechanism for pulling together various levels of government, community stakeholders, and modal representatives. ▪ Encourage municipalities, MPOs/RPOs, and PennDOT to collaborate much more closely on land use and transportation plans and programs that address congestion. ▪ Create a comprehensive plan at the state level where municipal planning is coordinated relative to Smart Transportation. ▪ Encourage land use controls at the county level so that land use and transportation decisions are more effectively managed. ▪ Encourage PennDOT to have a greater involvement in multi-municipal and major corridor signal operations.

Planning and Coordination	
Please provide guidance on how planning could be adjusted to better promote congestion mitigation strategies and Smart Transportation principles?	▪ Encourage MPOs/RPOs and municipalities to collaborate on municipal comprehensive plans and MPO/RPO long-range plans to ensure that they are in sync. ▪ Educate the public that programming of projects results directly from the planning processes. ▪ Provide a pool of annual planning funds (administered by PennDOT) for congestion mitigation efforts. Provide funds if the planning partner agrees to implement the study's recommendations in a timely manner. ▪ Encourage coordination of development initiatives among all involved (PennDOT, municipalities, MPOs/RPOs) to ensure that developers adequately address congestion (and fund it).

7.4 Key Interviews

Interviews were conducted with representatives of several organizations to gain their perspectives on congestion mitigation:

- FHWA
- PennDOT Bureau of Highway Safety and Traffic Engineering (BHSTE)
- PennDOT Bureau of Design (BOD)
- PennDOT Planning
- Pennsylvania Public Transportation Association (PPTA)/Rabbittransit

Key themes from interviews are as follows:

FHWA	▪ Need a strong planning focus within PennDOT. ▪ Promote regional collaboration. ▪ There is no clear statewide congestion management plan. ▪ Need right-sized congestion plans at the regional level. ▪ Link congestion mitigation to long-range transportation plans. ▪ An organizational challenge is linking land use and planning. ▪ Focus on additional measures of effectiveness. ▪ Implement performance measures (dashboard) and system-wide benefit/cost analyses. ▪ Consider delay at a system (regional) level not just at the local level. ▪ Consider more operational strategies such as traveler information and incident management initiatives, signal system enhancements, freeway service patrols, ramp management, parking management, ▪ Consider multimodal options. ▪ Address bottlenecks.

BHSTE (meeting 1)	▪ Due to other priorities (bridges, system maintenance), capacity enhancement opportunities are limited. ▪ BHSTE supports addressing bottlenecks, but there are limited resources available. ▪ There is no overarching congestion management program linking BHSTE and planning and programming. ▪ New highway occupancy and traffic impact study guidelines are being developed with consideration of Smart Transportation: • Require PennDOT/municipal/county/developer meeting. • Promote Smart Transportation. • Consider traffic signals and roundabouts. • Require alternate transportation plan if LOS is not mitigated. • Link HOP process and land development process. • Decrease horizon from 10 years to 5 years. • Developer can increase delay by 10 seconds.
BHSTE (meeting 2)	▪ In process of identifying bottlenecks and is developing a bottleneck program. ▪ Developing freeway service patrol guidelines. ▪ Developing congestion performance measures. ▪ Will use (511) travel time data to monitor congestion. ▪ Has developed an ITS Strategic Plan. ▪ Recognizes signal system needs, but there is limited funding available due to other pressing priorities.
BOD	▪ PennDOT is developing an updated project development process that will consider linking planning with NEPA and Smart Transportation. ▪ PennDOT is updating design manuals to better address Smart Transportation. ▪ PennDOT is developing Smart Transportation performance measures. ▪ There is no overarching congestion management program.
Planning	▪ Smart Transportation needs to be incorporated into the way we plan. All planning partners are being briefed early in the outreach process. ▪ To give priority to Smart Transportation initiatives, $60 million was reserved in the 2009-2012 program. ▪ The Pennsylvania Community Transportation Initiative was developed to provide incentives for projects that integrate land use and transportation and are in line with the Smart Transportation principles. Applications were due December 15, 2008. Approvals are expected by Spring 2009.
PPTA/ Rabbittransit	▪ The transit agency is working with the local MPO on the Congestion Management Process. It is examining congested corridors to identify potential transit solutions. ▪ Transit must look at new market areas to increase ridership where it makes sense. ▪ As it calls for in Smart Transportation, transit operators need to be consulted during the highway design process. Designs should be more transit friendly and provide greater efficiency for bus trips. ▪ Most people who do not ride transit indicate that the buses experience the same congestion as autos. Ideas that can keep buses moving include HOVs or bus lanes (but these do require capacity), signal prioritization, and jump lanes at intersections that would allow a bus to get a green signal sooner. ▪ Park and Rides should be considered, especially to serve express routes which are a growing ridership segment.

8. Findings

This study evaluated congestion mitigation in the context of Smart Transportation. The team reviewed congestion trends in Pennsylvania as well as the current processes and programs for addressing congestion. The perspectives of various stakeholders have also been considered. Based on these activities, the study Task Force provides the following findings:

8.1 With respect to Congestion across the Commonwealth

- Travel continues to increase. Vehicle miles traveled are forecast to increase by 27 percent by 2030, with truck travel increasing by 47 percent over the same period. Total vehicle hours of delay are projected to increase by 48 percent by 2030.
- The cost of congestion has doubled over the past 20 years.
- Current (2005) congestion costs are:
  - Philadelphia - $2 billion per year in lost time and fuel.
  - Pittsburgh - $285 million per year in lost time and fuel.
  - For the entire state it is estimated that congestion costs $2.7 billion per year in lost time and fuel.
  - $120,000 per major interstate incident (assumes 30,000 ADT and 90-minute duration).
- Congestion will continue to worsen. Conservative estimates indicate that congestion will increase by 50 to 60 percent within Pennsylvania over the next 30 years unless a multifaceted congestion mitigation program is established. This is consistent with statewide travel demand model projections. In Philadelphia, congestion will likely double in the next 30 years without major mitigation initiatives.
- The impacts of congestion are both economic and societal.
- Conservative estimates indicate that congestion could cost $8 billion per year in fuel and delay costs by 2035 without major initiatives.

- Based on survey findings, the primary causes of congestion in Pennsylvania are bottlenecks, poor traffic signal timing, and traffic incidents/crashes.
- Based on survey findings, traffic signal improvements offer the best opportunity to reduce congestion while maximizing resources.

8.2 With respect to Smart Transportation

- PennDOT's new direction in planning and design incorporates the Smart Transportation concepts. PennDOT is incorporating Smart Transportation into its everyday business activities.
- PennDOT has initiated Smart Transportation outreach to many stakeholders across the Commonwealth. These efforts will need to continue, particularly with municipal officials.
- Greater PennDOT involvement in regional and local land use planning is necessary to move forward on Smart Transportation.
- Low-cost congestion mitigation aligns well with the principles of Smart Transportation. Furthering the Smart Transportation direction within the planning process can assist in addressing congestion with limited resources.

8.3 With respect to Congestion Planning

- Several planning processes at the statewide and regional levels are addressing elements of congestion. Statewide planning has primarily been focused on operational strategies and freeway management.
- There is some disconnect between PennDOT congestion initiatives and regional planning partner congestion management processes. The development of Regional Operations Plans has been an important step to better integrate operations with plans and programs.
- Congestion Management Processes (CMPs) have proven to be valuable in targeting regional resources to critical congested corridors. CMPs are typically used only in larger metropolitan areas.
- PennDOT lacks a planning function in the District offices. Districts need to play a stronger role in congestion

mitigation planning, development, and use of CMPs, as well as closer coordination of land use and transportation as called for in the Smart Transportation direction.

- Coordination with transit agencies in the planning and design process needs to be improved to make transit a more viable option in congested corridors.
- Greater coordination with local governments and land use strategies is necessary to promote interconnected local networks which can encourage local trips to stay on local roadways.

Low-cost congestion initiatives typically yield the highest return on investment and are normally the quickest improvements to implement.

8.4 With respect to Congestion Mitigation

- There is no single solution to combat congestion. The overall strategies are to manage capacity, reduce demand, and strategically build capacity. A combination of these strategies in varying degrees will be necessary to address congestion in the future. This will require a renewed emphasis on efficient system operation and maximizing the use of public transportation and other pedestrian and freight modes. An extensive "toolbox" of congestion mitigation strategies has been identified and is outlined in this report.
- PennDOT has revised the highway occupancy permit (HOP) and traffic impact study (TIS) requirements to integrate the Smart Transportation principles. The new requirements allow for:
  - Mandatory PennDOT, planning partner, and municipal meetings.
  - Linkage of the municipal land development process to PennDOT's HOP process.
  - Allowance for alternative transportation plans.
  - Consideration of traffic signals and roundabouts.

8.5 With respect to Statewide Spending on Congestion

- With the overwhelming preservation and restoration needs of the existing system, PennDOT's current program emphasis is on rebuilding roads and bridges, leaving limited resources for congestion mitigation.
- Programmed funds for congestion-related projects represent 13.6 percent of spending over the next four years.

- Low-cost congestion initiatives typically yield the highest return on investment and are normally the quickest improvements to implement.

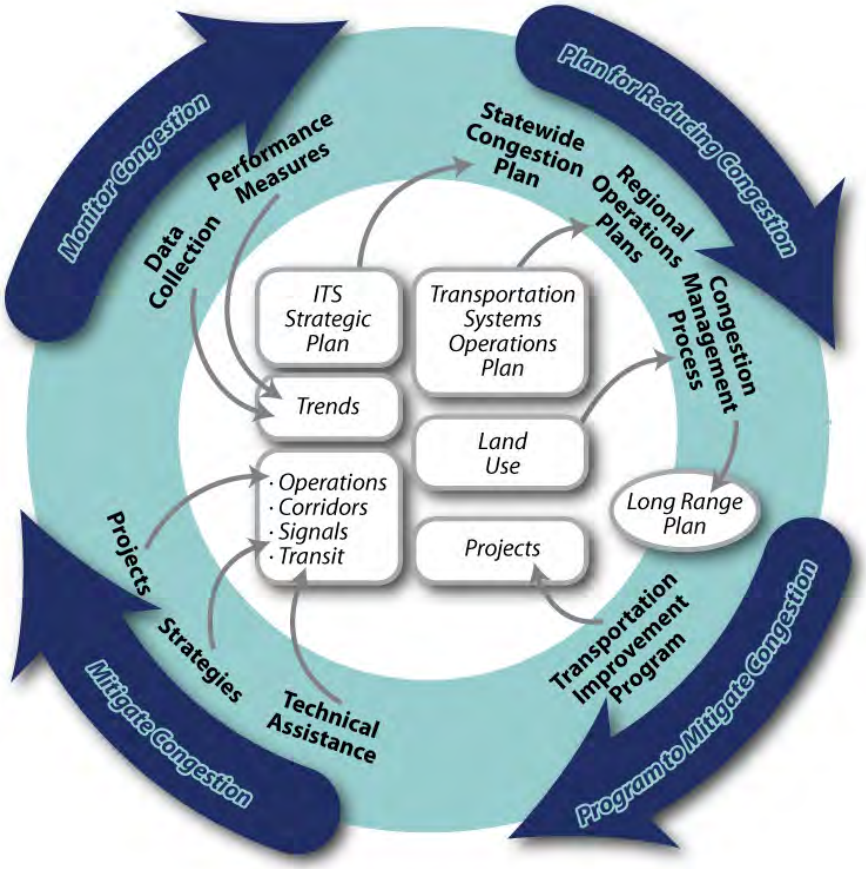
8.6 With respect to Current Implementation of Congestion Mitigation

- PennDOT has deployed ITS equipment on the heaviest travelled freeways. Great strides have been made in improved system operations, but gaps remain. A continued emphasis on operations is needed, and operational systems will require operations and maintenance resources.
- The Congested Corridor Improvement Program (CCIP) and the Traffic Signal Enhancement Initiative (TSEI) help fund low-cost congested corridor improvements and signal modernization and retiming. These programs have shown beneficial results, however they have been suspended due to budget constraints.
- Traffic signals are owned and operated by the many local municipalities across the state, of which 80 percent have 10 or fewer signals, 64 percent have 5 or fewer signals, and 25 percent have one signal. Many municipalities do not have the technical expertise or the resources to properly maintain and operate their traffic signals.

9. Recommendations

The Task Force believes that to better address congestion in Pennsylvania a continuous process of monitoring, planning, programming appropriate projects, and implementing mitigation strategies is required, as graphically displayed below:

Exhibit 9.1: The Congestion Mitigation Process



Communication and cooperation are keys to successfully mitigating congestion. PennDOT, planning partners, municipalities, and others need to be engaged in order to properly identify congestion concerns and to identify mitigation techniques, whether they be capacity enhancements, operational initiatives, or demand management strategies. PennDOT must be better engaged in planning, and planning partners should focus on operational issues.

Addressing congestion mitigation within a Smart Transportation context will require a three-pronged approach:

- **Planning and Programming:** Establish comprehensive statewide, regional, and local planning processes to address congestion in a way that is strongly linked with the project programming process.
- **Congestion Mitigation:** Establish congestion mitigation approaches that minimize cost and maximize benefits.
- **Monitoring:** Establish monitoring so that PennDOT can allocate resources effectively and document improvement benefits.

Specific recommendations under each category are provided below.

Establish comprehensive statewide, regional, and local planning processes to address congestion in a way that is strongly linked with the project programming process.

9.1 "Planning & Programming to Mitigate Congestion" Recommendations

Establish comprehensive statewide, regional, and local planning processes to address congestion in a way that is strongly linked with the project programming process. This would include:

- Establish strengthened congestion management planning within PennDOT:
  - Increase PennDOT participation from the Central Office and District Offices in development of regional CMPs.
  - Integrate regional CMPs into a statewide CMP. Promote statewide and regional coordination of congestion management programs and processes.
- Develop "rightsized" CMPs in all planning partner areas, not only the largest urban areas. These CMPs should include the appropriate operational focus through the incorporation of the Regional Operations Plans.
- Integrate CMP results with MPO/RPO long-range plans.
- Develop a stronger planning focus at the District level to better coordinate with municipalities on land use and transportation.
- Encourage land use controls at the county level so that land use and transportation decisions are more effectively managed.

- Encourage use of official maps to reserve needed right-of-way for future improvements.
- Continue Transportation Systems Operational Planning at the statewide level and regional level.
- Provide statewide direction on congested corridors and traffic signal enhancement. PennDOT should move toward an expanded role in signal operations, providing technical assistance and technology transfer to municipalities across the state. This will be particularly important because, in light of resource limitations, system operations solutions will receive a greater emphasis than building new facilities or expanding existing facilities.
- Involve transit agencies to a greater degree in planning and design when addressing congested corridors.
- Implement training and capacity building in these areas for PennDOT and MPO/RPO staff.
- Implement an "operations and demand management" review (similar to safety review) to the PennDOT Project Development process to ensure that strategies that better manage capacity and reduce demand are considered along with strategic capacity enhancements/additions.
- Continue to encourage development of local access management ordinances

Establish congestion mitigation approaches that minimize cost and maximize benefits.

9.2 "Congestion Mitigation" Recommendations

Establish congestion mitigation approaches that minimize cost and maximize benefits:

- Establish a low-cost bottleneck program that focuses on affordable improvements such as low-cost capacity improvements, restriping to change lane configurations, use of shoulder lanes, ramp extensions, and improved merge and acceleration areas. The Federal Highway Administration (FHWA) has materials that could be used as a basis for the program's development.
- Expand transportation operations to include appropriate ITS components for incident management and traveler information.

- Implement ramp management analysis and mitigation into planning and project development.
- Implement a quick clearance policy.
- Promote corridor improvements such as improved intersection geometry facilitating turning movements and improved signal coordination for key arterial corridors based on planning partner CMPs. When intersection configuration is involved, give strong consideration to the use of a modern roundabout design. Reinstitute the Congested Corridor Improvement Program and the Traffic Signal Enhancement Initiative with minor modifications.
- Implement traffic signal recommendations identified in the TAC Study, *Traffic Signal Systems: A Review of Policy and Practices.* Many of the recommendations have not been carried forward or have been suspended:
    - Develop a signals asset management system.
    - Pursue tiered operations and maintenance on critical corridors—including implementing integrated corridor management (ICM) on key corridors.
    - Pursue tiered operations and maintenance for most signals.
    - Promote a "holistic" approach to signal management.
    - Expand Traffic Signal Enhancement Initiative (TSEI) and Congested Corridor Improvement Program (CCIP).
    - Review and update the traffic signal permit process.
    - Establish operational audits program.
    - Complete updates and revisions to PennDOT traffic signal publications.
    - Allocate a portion of any new funding increase to signals.
    - Provide incentives for operational enhancements.
    - Encourage regional maintenance contracts with operational incentives.
    - Provide incentives (and tools) for inter-jurisdictional coordination.

Other recommendations included streamlining the retiming process, revising HOP requirements to include system compatibility and fine-tuning, creating a modernization

program and creating a hotline/website for traffic signal concerns.

- Emphasize demand management strategies to encourage greater use of public transportation and other alternative modes. Promote directed use strategies where there is a robust transportation network to support demands.
- Introduce traffic calming measures to encourage "as-designed" system utilization.
- PennDOT should engage and educate stakeholders regarding revised highway occupancy permit (HOP) and traffic impact study (TIS) requirements.
- Create a model TIS ordinance for municipal use.
- Reevaluate obstacles to implementing traffic impact fee ordinances.

Establish monitoring so that resources can be allocated effectively and improvement benefits can be documented.

9.3 "Monitoring" Recommendations

Establish monitoring so that resources can be allocated effectively and improvement benefits can be documented.

- Identify preferred congestion performance measures (in addition to level of service) that address both recurring and non-recurring congestion. These measures should be:
  - Easily measurable and understandable.
  - Addressing existing and future recurring and non-recurring congestion.
  - System-wide versus localized.
  - Easily monitored through a "dashboard."
- Highlight operational successes.

9.4 Congestion Mitigation Evaluation Matrix

The study presents the following matrix to assist in implementing mitigation strategies. It presents potential congestion mitigation strategies and indicates the:

- Suitability of the strategy for each of the Smart Transportation roadway categories
- Potential benefits

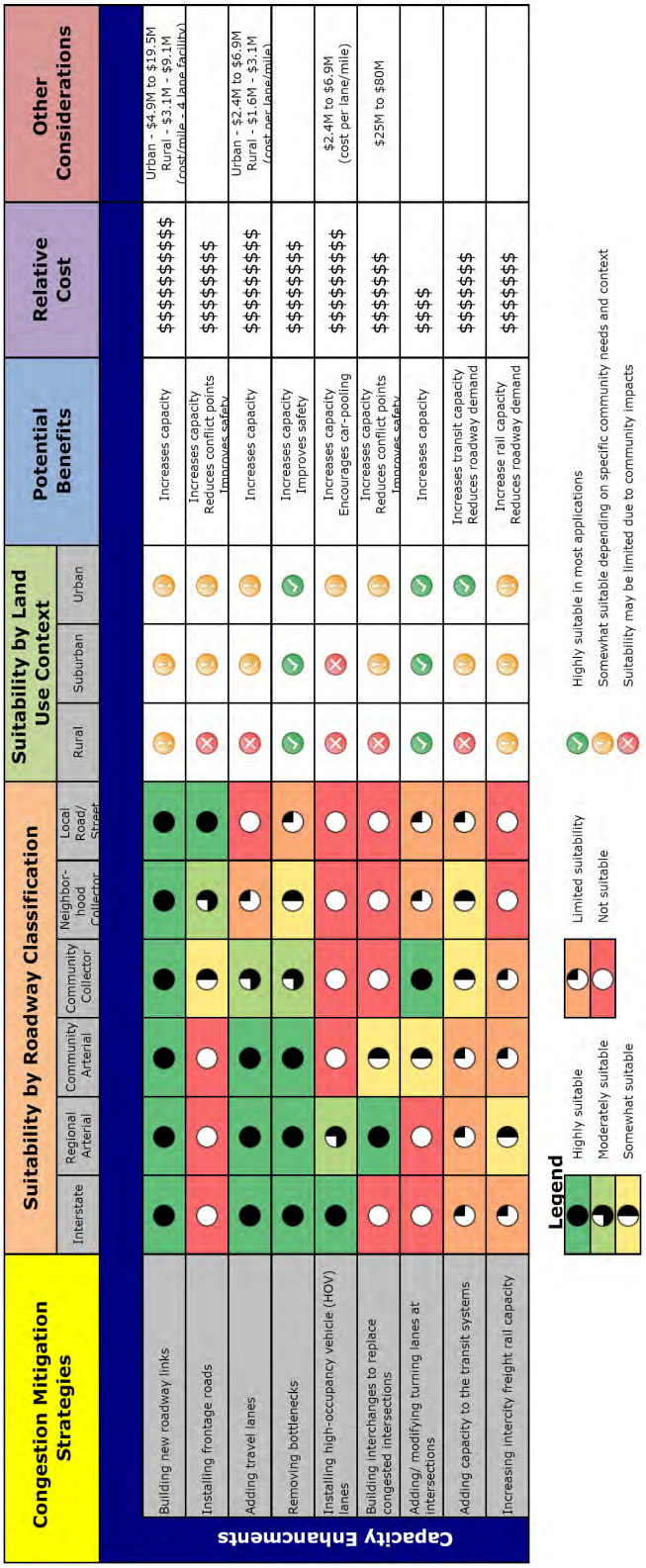
- Magnitude of costs

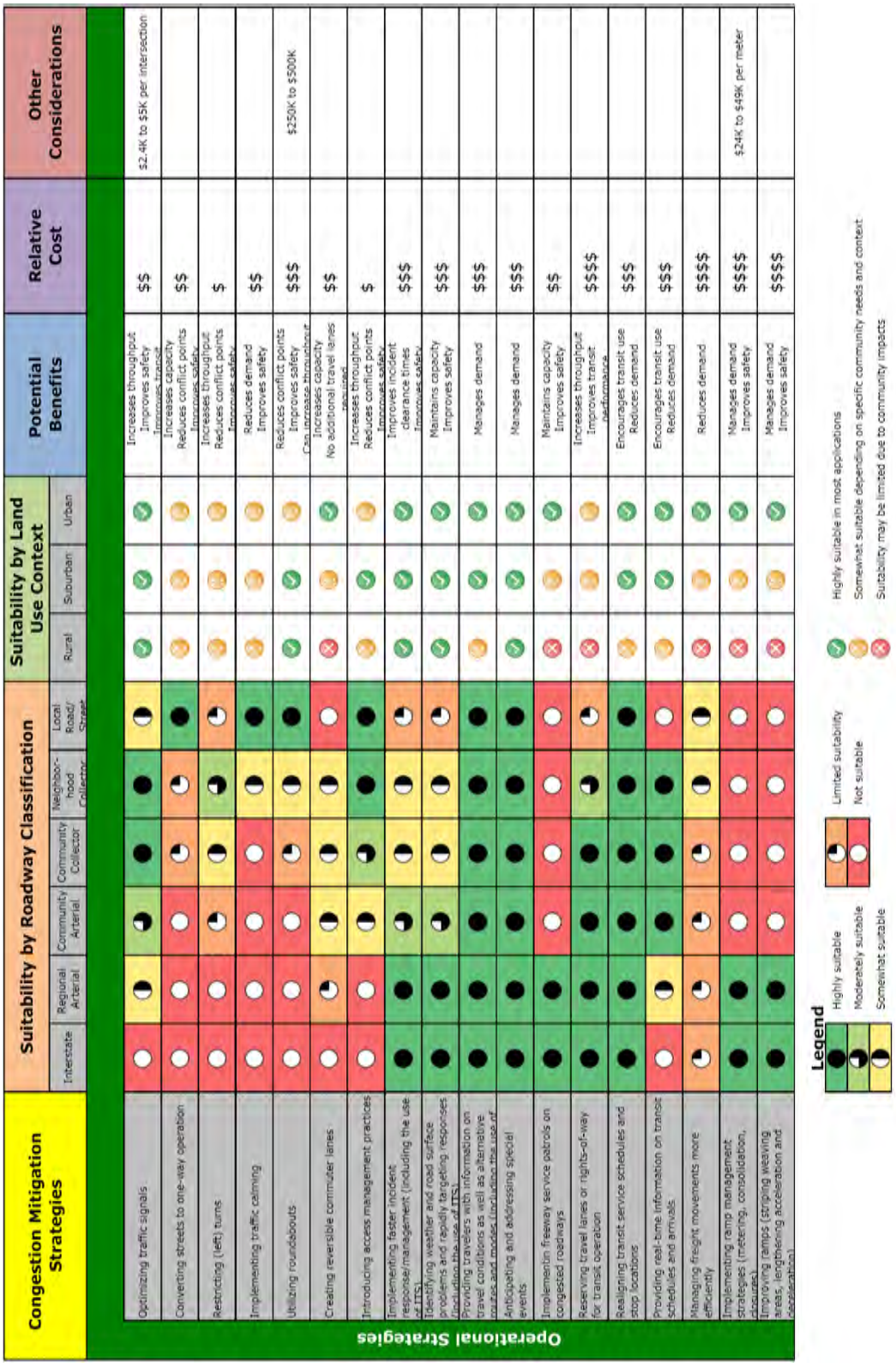
This matrix is recommended for use by PennDOT and the planning partners in selecting appropriate strategies for any particular situation. PennDOT may want to incorporate this matrix in various publications and into the planning partner Congestion Management Processes.

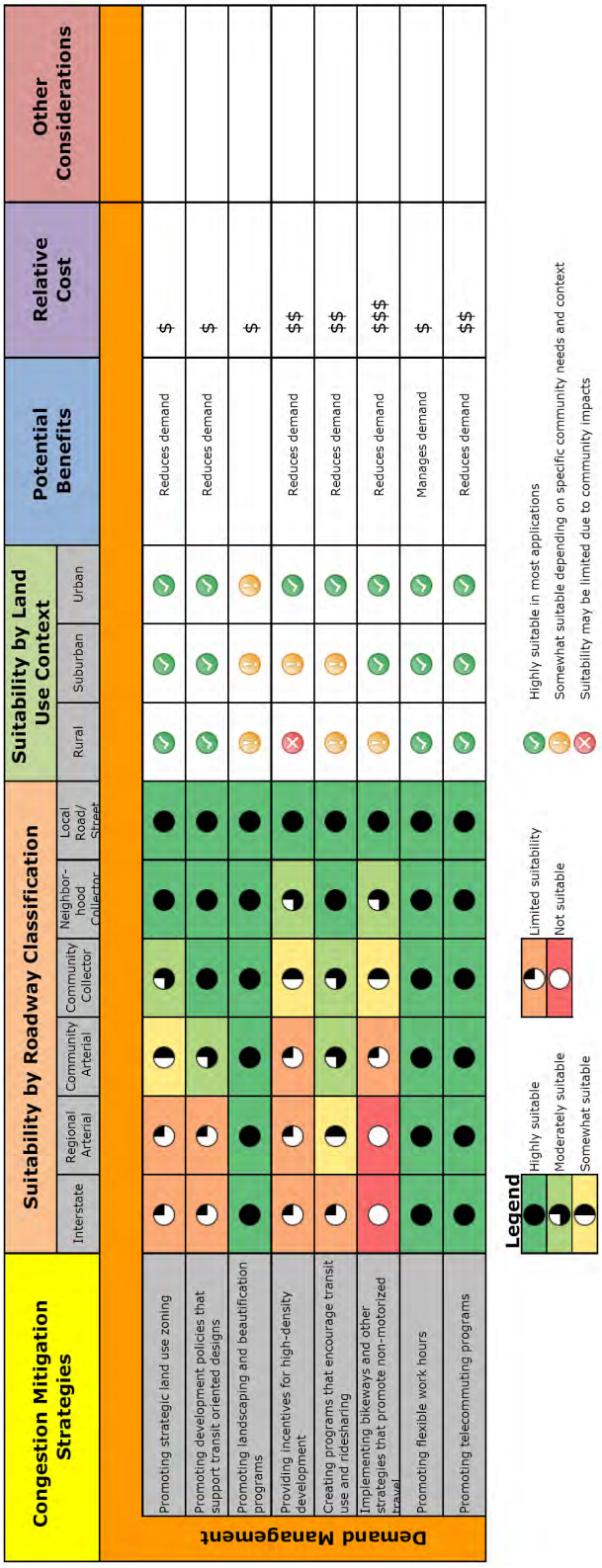
Potential uses include:

- Expand Smart Transportation guidance to include capacity strategies and better consideration of interstate roadways.
- Incorporate in Congestion Management Processes as part of strategy screening.
- Incorporate in PennDOT's Alternative Transportation Plan (ATP) guidelines for HOPs.
- Incorporate in PennDOT's Project Development Process as a tool to evaluate "operations and demand management" strategies as part of capacity enhancement/additions.

Exhibit 9.2: Congestion Mitigation Evaluation Matrix







Appendix A – Sources

Additional source information and references on Congestion Mitigation and Smart Transportation are noted here in Appendix A.

Exhibit 9.3: References and Resources

Electronic Appendix	Author	Date	Document Name
National Resources			
A1	FHWA	2004	*Traffic Congestion and Reliability: Linking Solutions to Problems*
A2	FHWA	2005	*Traffic Congestion and Reliability: Trends and Advanced Strategies for Congestion Mitigation*
A3	FHWA	2005	*Statewide Opportunities for Linking Planning and Operations*
A4	FHWA	2008	*An Interim Guidebook on the Congestion Management Process in Metropolitan Transportation Planning*
A5	FHWA	2008	*Traffic Bottlenecks: A Primer – Focus on Low Cost Operational Improvements*
A6	NCHRP	2008	*Cost-Effective Performance Measures for Travel Time Delay, Variation, and Reliability*
A7	ITE	1996	*A Toolbox for Alleviating Traffic Congestion and Enhancing Mobility*
A8	TTI	2007	*Urban Mobility Report*
Pennsylvania Resources			
B1	PennDOT	2008	*Smart Transportation Guidebook Executive Summary*
B2	PennDOT	2008	*Smart Transportation Guidebook*
B3	PennDOT	2008	*Smart Transportation Status Report*
B4	PennDOT	2008	*Bureau of Highway Safety and Traffic Engineering (BHSTE) Congestion Management Plan*
B5	TAC	2004	*Traffic Signal Systems: A Review of Policies and Practices*

Appendix B – Survey Results

Web Survey

- **Audience -** MPO/RPO/TMA's, PennDOT staff, municipalities, transit providers, developers, special interest groups, consultants, others
- **Purpose** – Gain perspectives on congestion mitigation from various stakeholders
- **Released** – Early to mid September

Survey Respondents

1. What type of organization do you represent?

	Response Total	Response Percent
Pennsylvania Department of Transportation	12	13%
Metropolitan planning organization	13	15%
Rural planning organization	5	6%
Transportation management association	7	8%
Municipality	41	46%
Transit provider	9	10%
Developer	0	0%
Consultant	2	2%
Other	2	2%
Total Respondents	**89**	
(skipped this question)	29	

PENNSYLVANIA STATE
TRANSPORTATION ADVISORY COMMITTEE

Area Type Represented

7. What type of area do you represent?

	Response Total	Response Percent
A primarily rural area	13	27%
A primarily urban area	16	33%
A mixed (rural/urban) area	18	38%
The entire state	0	0%
Other, please specify view	1	2%
Total Respondents	48	
(skipped this question)	71	

Causes of Congestion

- 47 responses

Answer Choice	Average	Rank
Bottlenecks (lane reductions, lack of turning lanes, etc)	1.89	1
Traffic incidents/crashes	3.30	2
Poor traffic signal timings	3.41	3
Work zones	3.57	4
Bad weather	4.43	5
Special events	4.67	6

Smart Transportation

10. Have you attended a PennDOT outreach session/ presentation on "Smart Transportation?"

	Response Total	Response Percent
Yes	22	47%
No	25	53%
Total Respondents	47	
(skipped this question)	72	

11. What is your current perception of "Smart Transportation"?

	Response Total	Response Percent
Great business practice. I'm already doing it.	17	38%
Good idea. How do I make it happen?	7	16%
I'd like to learn more about it before I comment.	20	44%
I don't agree with it.	1	2%
Total Respondents	45	
(skipped this question)	74	

Smart Transportation

1. *Funding is the key!*
2. *We are striving to incorporate the principles into our current update of the Long Range Transportation Plan, and our regular practice.*
3. *In a lot of instances the rural areas have been the leaders in this concept.*
4. *I have not taken the outreach session yet, but would like to learn more about what Smart Transportation means.*
5. *While I say "already doing it" I would also say we have a lot of work to do*
6. *Thanks, provide a wider variety of travel mode choices.*
7. *Some of the smart transportation ideas sound good. Those that deal with land use are beyond the control of PennDOT, MPOs and counties. Municipalities control municipal planning and zoning decisions and they carefully guard their powers.*
8. *Implementation of Smart Transportation is a great idea. How to make it work in a predominantly rural area is another thing.*
9. *I feel that PennDOT could go a long way in helping advance this concept by partnering more with the MPOs & RPOs. PennDOT's Planning & Programming units seem to focus almost exclusively on Programming. Increasing the role and involvement of the MPOs & RPOs could help improve planning, which in the long run would make programming easier. For example, improving connections between the Districts and the MPO/RPO Congestion Management Process could help advance "Smart Transportation".*

Good Ideas

13. Do you feel that low-cost, high-benefit improvement projects are a good idea?

	Response Total	Response Percent
Yes	45	98%
No	1	2%
Total Respondents	46	
(skipped this question)	73	

15. Do you think it is a good idea to coordinate transportation improvements with land use planning?

	Response Total	Response Percent
Yes	46	98%
No	1	2%
Total Respondents	47	
(skipped this question)	72	

Good Ideas

Additional Points

- Partnering is needed
  - But partners don't always agree
- Rural areas are a challenge
  - May not have zoning
  - Land use decisions are local

Already Doing It

17. Are you involved in any transportation improvement projects that are reducing congestion through minor capacity enhancements versus major capacity projects?

	Response Total	Response Percent
No	23	52%
If Yes, please describe below view	21	48%
Total Respondents	44	
(skipped this question)	75	

18. Are you involved in any transportation improvement projects that are reducing congestion through operational strategies such as access management, traffic signal enhancements and intelligent transportation enhancements?

	Response Total	Response Percent
No	23	50%
If Yes, please describe below view	23	50%
Total Respondents	46	
(skipped this question)	73	

Already Doing It

19. Are you involved in any transportation improvement projects that are reducing congestion through demand management such as encouraging mixed land uses and promoting alternate modes?

	Response Total	Response Percent
No	28	62%
If Yes, please describe below view	17	38%
Total Respondents	45	
(skipped this question)	74	

Capacity Enhancement Strategies

- Please rate the following capacity enhancement strategies based on their congestion benefit, consistency with Smart Transportation principles, and their typical magnitude of cost.
  - Please answer with a number: 1=High 2=Moderate 3=Low 4=None

Strategy	Congestion Benefit	Smart Tran. Consistency	Magnitude of Cost
Building new roadway links	1.5	2.4	1.3
Adding travel lanes	1.7	2.5	1.4
Removing bottlenecks	1.2	1.6	1.6
Installing high-occupancy vehicle (HOV) lanes	2.4	2.4	1.7
Building interchanges to replace congested intersections	1.8	2.4	1.3
Adding/ modifying turning lanes at intersections	1.7	1.8	2.2
Adding capacity to the transit systems	2.2	1.7	2.2
Increasing intercity freight rail capacity	2.4	1.8	3.4

Operational Strategies

- Please rate the following operational strategies based on their congestion benefit, consistency with Smart Transportation principles, and their typical magnitude of cost.
  - Please answer with a number: 1=High 2=Moderate 3=Low 4=None

Strategy	Congestion Benefit	Smart Trans. Consistency	Magnitude of Cost
Optimizing traffic signals	1.4	1.2	2.6
Converting streets to one-way operation	2.4	2.2	2.7
Restricting (left) turns	2.3	2.1	3.1
Implementing traffic calming and roundabouts	2.4	2.0	2.2
Creating reversible commuter lanes	2.2	2.1	2.2
Introducing access management practices	1.9	1.6	2.5
Implementing faster incident response/management (including the use of ITS)	1.8	1.7	2.4
Identifying weather and road surface problems and rapidly targeting responses (including the use of ITS)	2.0	1.7	2.3

Operational Strategies (cont)

- Please rate the following operational strategies based on their congestion benefit, consistency with Smart Transportation principles, and their typical magnitude of cost.
  - Please answer with a number: 1=High 2=Moderate 3=Low 4=None

Strategy	Congestion Benefit	Smart Trans. Consistency	Magnitude of Cost
Providing travelers with information on travel conditions as well as alternative routes and modes (including the use of ITS)	1.8	1.6	2.5
Anticipating and addressing special events	1.9	1.7	3.0
Reserving travel lanes or rights-of-way for transit operation	2.4	1.9	2.2
Realigning transit service schedules and stop locations	2.2	1.6	2.9
Providing real-time information on transit schedules and arrivals	2.4	1.7	2.7
Managing freight movements more efficiently	2.3	1.8	2.6

Demand Management Strategies

- Please rate the following demand management based on their congestion benefit, consistency with Smart Transportation principles, and their typical magnitude of cost.
  - Please answer with a number: 1=High 2=Moderate 3=Low 4=None

Strategy	Congestion Benefit	Smart Trans. Consistency	Magnitude of Cost
Promoting strategic land use zoning	1.7	1.4	2.7
Promoting development policies that support transit oriented designs	1.6	1.4	2.6
Promoting landscaping and beautification programs	3.1	2.5	2.7
Providing incentives for high-density development	2.2	1.9	2.3
Creating programs that encourage transit use and ridesharing	1.6	1.3	2.7
Implementing bikeways and other strategies that promote non-motorized travel	2.4	1.6	2.3
Promoting flexible work hours	1.9	1.6	3.0
Promoting telecommuting programs	1.9	1.5	2.9

Performance Measures

26. Which statement best describes your perspective?

	Response Total	Response Percent
Level of service is the only thing that should be considered	1	2%
Level of service and safety should both be considered	7	16%
Level of service, safety as well as other performance measures should be considered.	36	80%
I don't know what level of service is	1	2%
Total Respondents		45
(skipped this question)		76

Performance Measures

Performance Measure	High importance / relevance	Moderate importance / relevance	Limited importance / relevance	No importance / relevance	Response Total
Crash rate	78% (32)	15% (6)	5% (2)	2% (1)	41
Crash fatalities	70% (28)	20% (8)	8% (3)	2% (1)	40
Traffic volume (average annual daily traffic - AADT)	56% (23)	34% (14)	7% (3)	2% (1)	41
Intersection level of service (LOS)	54% (22)	37% (15)	7% (3)	2% (1)	41
Volume to capacity ratio	52% (21)	38% (15)	8% (3)	2% (1)	40
Delay (intersection/ corridor)	49% (20)	41% (17)	7% (3)	2% (1)	41
Customer satisfaction (community input)	41% (16)	46% (18)	10% (4)	3% (1)	39
Arterial level of service (LOS)	40% (16)	48% (19)	8% (3)	5% (2)	40
Travel time	40% (16)	42% (17)	15% (6)	2% (1)	40
Incident duration	32% (13)	50% (20)	12% (5)	5% (2)	40
Regional traffic usage	31% (12)	44% (17)	23% (9)	3% (1)	39
Travel time reliability	28% (11)	50% (20)	20% (8)	2% (1)	40
Incident response time	28% (11)	48% (19)	20% (8)	5% (2)	40

Performance Measures (cont)

Performance Measure	High importance / relevance	Moderate importance / relevance	Limited importance / relevance	No importance / relevance	Response Total
Number of stops (along corridor)	28% (11)	46% (18)	21% (8)	5% (2)	**39**
Number of driveways	27% (11)	54% (22)	12% (5)	7% (3)	**41**
Economic development	26% (10)	56% (22)	15% (6)	3% (1)	**39**
Pedestrian/ bicycle crashes	25% (10)	57% (23)	12% (5)	5% (2)	**40**
Desired operating speed	24% (10)	54% (22)	20% (8)	2% (1)	**41**
Transit service time	22% (9)	48% (19)	25% (10)	5% (2)	**40**
Open space impacted	22% (9)	38% (15)	28% (11)	12% (5)	**40**
Travel speed	20% (8)	54% (22)	24% (10)	2% (1)	**41**
Multi-modal elements serviced	18% (7)	54% (21)	23% (9)	5% (2)	**39**
Special needs (evacuation route, detour route, special events)	13% (5)	49% (19)	31% (12)	8% (3)	**39**
Cost per VMT	13% (5)	49% (19)	28% (11)	10% (4)	**39**
Cost per user	13% (5)	46% (18)	33% (13)	8% (3)	**39**
Cost per trip	12% (5)	40% (16)	40% (16)	8% (3)	**40**

Tools and Resources

What tools (resources, programs and policies) are needed to mitigate congestion on Department-led projects?

- Provide more funding
- Continue to educate stakeholders about Smart Transportation
- Generate projects from MPOs Congestion Management Processes
- Enhance municipal collaboration/ community involvement
- Implement Smart Transportation programs
- Encourage mode-neutral improvements
- Improve traffic signal guidelines
- Implement ITS
- Better incident management and traveler information programs

Tools and Resources

What tools (resources, programs and policies) are needed to mitigate congestion on developer-led (HOP) projects?

- Improve PennDOT/municipal communication/ coordination
- Promote consistency in HOP process
- Provide incentives for developers who do more than the minimum
- Promote developer accountability

Tools and Resources

What tools (programs and policies) are needed to implement Smart Transportation projects?

- Provide more funding
- Continue to educate stakeholders about Smart Transportation
  - Target municipal officials in addition to PennDOT
- Encourage PennDOT/municipal communication/ coordination
- Improve integrated (transportation and land use) planning
  - Local and regional planning
- Promote
- Introduce (Smart Transportation and congestion mitigation) performance measures

Tools and Resources

Are there other tools (resources, programs and policies) that are needed to mitigate congestion?

- Provide more funding
  - Funding for mode-neutral programs that reduce congestion by applying the Smart Transportation principles
  - Encouragement or incentives to coordinate signals across municipal boundaries
  - Incentives to maintain and improve signal timing at the local level
- Implement continual congestion management planning
- Revisit traffic impact fee ordinance regulations

Task Force Survey

- 17 responses
- Comparable responses to stakeholder survey

Causes of Congestion

Answer Choice	Stakeholder Input		Task Force Input	
	Average	Rank	Average	Rank
Poor traffic signal timings	3.4	3	2.4	1
Bottlenecks (lane reductions, lack of turning lanes, etc)	1.9	1	2.5	2-T
Traffic incidents/crashes	3.3	2	2.5	2-T
Work zones	3.6	4	3.3	4
Bad weather	4.4	5	5.1	5
Special events	4.7	6	5.2	6

Capacity Enhancement Strategies

1=High 2=Moderate 3=Low 4=None

Strategy	Stakeholder Input			Task Force Input		
	Congestion Benefit	Smart Tran. Consistency	Magnitude of Cost	Congestion Benefit	Smart Tran. Consistency	Level of Difficulty to Implement
Building new roadway links	1.5	2.4	1.3	1.6	2.5	1.3
Installing frontage road	NA	NA	NA	1.9	2.0	1.3
Adding travel lanes	1.7	2.5	1.4	1.8	2.5	1.6
Removing bottlenecks	1.2	1.6	1.6	1.7	2.0	1.6
Installing high-occupancy vehicle (HOV) lanes	2.4	2.4	1.7	2.4	2.5	1.4
Building interchanges to replace congested intersections	1.8	2.4	1.3	2.1	2.9	1.1
Adding/ modifying turning lanes at intersections	1.7	1.8	2.2	1.8	2.0	2.2
Adding capacity to the transit systems	2.2	1.7	2.2	2.2	1.5	2.0
Increasing intercity freight rail capacity	2.4	1.8	3.4	1.7	1.4	2.0

Operational Strategies (cont)

1=High 2=Moderate 3=Low 4=None

Strategy	Stakeholder Input			Task Force Input		
	Congestion Benefit	Smart Tran. Consistency	Magnitude of Cost	Congestion Benefit	Smart Tran. Consistency	Level of Difficulty to Implement
Optimizing traffic signals	1.4	1.2	2.6	1.4	1.4	2.9
Converting streets to one-way operation	2.4	2.2	2.7	2.0	2.1	2.0
Restricting (left) turns	2.3	2.1	3.1	2.4	2.1	2.6
Implementing traffic calming	2.4	2.0	2.2	2.6	1.9	2.3
Utilizing roundabouts				1.9	1.8	1.8
Creating reversible commuter lanes	2.2	2.1	2.2	1.6	1.9	1.5
Introducing access management practices	1.9	1.6	2.5	1.6	1.1	1.5
Implementing faster incident response/ management (including ITS)	1.8	1.7	2.4	1.4	1.7	2.3
Identifying weather & road surface problems & rapidly targeting responses (including ITS)	2.0	1.7	2.3	2.1	1.7	2.1

Operational Strategies

1=High 2=Moderate 3=Low 4=None

Strategy	Stakeholder Input			Task Force Input		
	Congestion Benefit	Smart Tran. Consistency	Magnitude of Cost	Congestion Benefit	Smart Tran. Consistency	Level of Difficulty to Implement
Providing travelers information on travel conditions	1.8	1.6	2.5	1.7	1.4	2.8
Anticipating and addressing special events	1.9	1.7	3.0	1.3	1.2	2.9
Reserving travel lanes or rights-of-way for transit operation	2.4	1.9	2.2	2.2	1.4	1.8
Realigning transit service schedules and stop locations	2.2	1.6	2.9	1.9	1.4	2.4
Providing real-time information on transit schedules and arrivals	2.4	1.7	2.7	1.9	1.4	2.0
Managing freight more efficiently	2.3	1.8	2.6	1.4	1.4	1.9
Implementing ramp management strategies (metering, consolidation, closures)	NA	NA	NA	2.0	1.7	1.8
Improving ramps (striping weaving areas, lengthening acceleration and deceleration)	NA	NA	NA	1.9	1.8	1.8

Demand Management Strategies

1=High 2=Moderate 3=Low 4=None

Strategy	Stakeholder Input			Task Force Input		
	Congestion Benefit	Smart Tran. Consistency	Magnitude of Cost	Congestion Benefit	Smart Tran. Consistency	Level of Difficulty to Implement
Promoting strategic land use zoning	1.7	1.4	2.7	1.2	1.0	1.6
Promoting development policies that support transit oriented designs	1.6	1.4	2.6	1.8	1.2	2.0
Promoting landscaping and beautification programs	3.1	2.5	2.7	3.0	2.4	2.6
Providing incentives for high-density development	2.2	1.9	2.3	2.2	1.7	2.0
Creating programs that encourage transit use and ridesharing	1.6	1.3	2.7	1.6	1.2	2.4
Implementing bikeways and other strategies that promote non-motorized travel	2.4	1.6	2.3	2.3	1.2	2.0
Promoting flexible work hours	1.9	1.6	3.0	1.2	1.3	2.0
Promoting telecommuting programs	1.9	1.5	2.9	1.3	1.6	2.0

5. What resources, programs and policies are needed to implement capacity enhancement initiatives in a smart way?

- Reject blanket “no new capacity” policies.
- Provide additional funding targeted to capacity enhancement projects, especially those that are relatively lower in cost.
- Create a local taxing option so that regions can develop the funding mechanisms for locally-significant projects.
- Continue to provide earmark funding.
- Create a comprehensive "Statewide" plan for Smart Transportation that is measurable.
- Develop statewide formula to rank and prioritize projects.
- Identify future links on official (municipal) maps.
- Study the feasibility of diverting freight onto rail from highways.
- Implement "just in time" delivery of maintenance and rehabilitation road and bridge projects along with congestion reduction projects to keep the public's confidence.

6. What resources, programs and policies are needed to implement operational initiatives in a smart way?

- Implement regional coordination meetings with the state, county, and municipal officials to determine best congestion mitigation strategies.
- Bolster the role of the Congestion Management Processes at a regional and state-wide level.
- Establish separate funding mechanisms for operational improvements.
- Establish dedicated funding for signal improvements (both coordination and also traffic responsive).
- Encourage a greater PennDOT role in signal operations.
- Continue/expand traffic signal retiming/upgrade programs.
- Consider including signals in PennDOT’s Agility and Turnback Programs with municipalities .
- Implement a quick clearance policy.
- Highlight operational successes.
- Identify operational performance measures (for the skeptics).

7. What resources, programs and policies are needed to implement demand management initiatives in a smart way?

- Implement a program where PennDOT and planning partners complete a review of local governments land use and zoning ordinances and either certify a community as "Smart" or provide a community feedback as to what changes could be made in their ordinances to make them "Smart". Then give "Smart" communities preference for dedicated "Smart" funding.
- Increase local and regional land use planning that is linked to the transportation impacts development may generate.
- Educate the public on land use, travel demand, and how their travel decisions impact congestion, the environment, etc.
- Work with large employers to develop specific TDM initiatives for their employees.

8. How could congestion mitigation be better managed and coordinated among municipal stakeholders, planning partners and PennDOT?

- Create a comprehensive plan at the state level where municipal planning is coordinated relative to Smart Transportation.
- Encourage some land use controls at the county level so that land use and transportation decisions are more effectively managed.
- Encourage municipalities, MPOs/RPOs, and PennDOT to collaborate much more closely on land use and transportation plans and programs which address congestion.
- Establish working groups that meet periodically and use the CMP as a mechanism for pulling together various levels of government, community stakeholders and modal representatives.
- Encourage PennDOT to have a greater involvement in multi-municipal and major corridor signal operations.

9. Please provide guidance on how planning could be adjusted to better promote congestion mitigation strategies and smart transportation principles?

- Encourage MPOs/RPOs and municipalities to collaborate on municipal comprehensive plans and MPO/RPO long range plans to assure they are in sync.
- Educate the public that programming of projects results directly from the planning processes.
- Provide a pool of annual planning funds (administered by PennDOT) for congestion mitigation efforts. Provide funds if the planning partner agrees to implement the study's recommendations in a timely manner.
- Encourage coordination of development initiatives among all involved (PennDOT, municipalities, MPOs/RPOs) to assure that developers adequately address congestion (and fund it).

10. Please provide guidance on how the project development process could be adjusted to better promote congestion mitigation strategies and smart transportation principles?

- Encourage PennDOT to be involved in focused discussions about what needs to happen in each county and region when it comes to all modes of transportation and projects to be included in a long range transportation plan.
- Involve MPO CMP coordinators in PennDOT's project development processes.
  - Planners and PennDOT Project Managers "live" in two different realms and do not interact.
  - Planners need to be more involved in the development of projects (i.e. scoping field views, etc.).
- Make congestion mitigation a PennDOT and planning partner collaborative focus area.
- Be more than “just bridges.”

11. Please provide guidance on how the evaluation of development could be modified to better promote congestion mitigation strategies and smart transportation principles?

- Coordinate HOP and TIS reviews among all involved parties. There needs to be informal and formal dialogue so PennDOT and municipalities are "on the same page."
- Implement up-to-date traffic (transportation) impact study (TIS) procedures. We need TISs and HOPs that support incremental improvements over time where "fair shares" are established in new and different ways and we establish new metrics for this sort of decision-making.
- Consider on-capacity adding alternatives (e.g., transit, flex hours, etc.)

12. What are potential solutions or outcomes you expect from the TAC study?

- Highlight and reinforce some of the positive things that are going on around the state and provide a springboard to move some of these things forward even further.
- Identify policy or operational recommendations that should be considered by PennDOT, MPOs/RPOs, and municipalities (and maybe even the Legislature) as they consider congestion issues.
- Identify programs being developed and funded to address the issues specified in the TAC study.
- Increase integration and interaction between PennDOT and MPO/RPO planning partners.
- Encourage fresh approaches that might be beyond the traditional institutional arrangements when it comes to congestion mitigation.
- Develop a tool box of strategies that can be applied to different conditions.
- Implement a low cost bottleneck program to remove bottlenecks and other congestion creating problems.
- Identify “pilot” opportunities.

Pennsylvania Traffic Signal Systems: A Review of Policies and Practices –

- Identified 12 core recommendations
- Identified 30 other potential solutions and recommendations

Key Themes

- **Asset management**
- Maintained and **operated**
- **Shared responsibility**
- **Corridor and regional operations**
- Revise **policy and procedures**
- Training and education
- Creative procurement approaches

- The study as well as the executive briefing can be accessed at http://www.dot.state.pa.us
  - Select "Transportation Advisory Committee" on the FIND AN ORG pull down
  - Select committee reports

Pennsylvania Traffic Signal Systems: A Review of Policies and Practices –

1. Develop a Signals Asset Management System
2. Pursue Tiered Operations and Maintenance on Critical Corridors
3. Pursue Tiered Operations and Maintenance for Most Signals
4. Promote a "Holistic" Approach to Signal Management
5. Expand Traffic Signal Enhancement Initiative (TSEI) and Congested Corridor Improvement Program (CCIP)
6. Review and Update the Traffic Signal Permit Process

Pennsylvania Traffic Signal Systems: A Review of Policies and Practices –

7. Establish Operational Audits Program
8. Complete Updates and Revisions to PennDOT Traffic Signal Publications
9. Allocate a Portion of Any New Funding Increase to Signals
10. Provide Incentives for Operational Enhancements
11. Encourage Regional Maintenance Contracts with Operational Incentives
12. Provide Incentives for Inter-jurisdictional Coordination

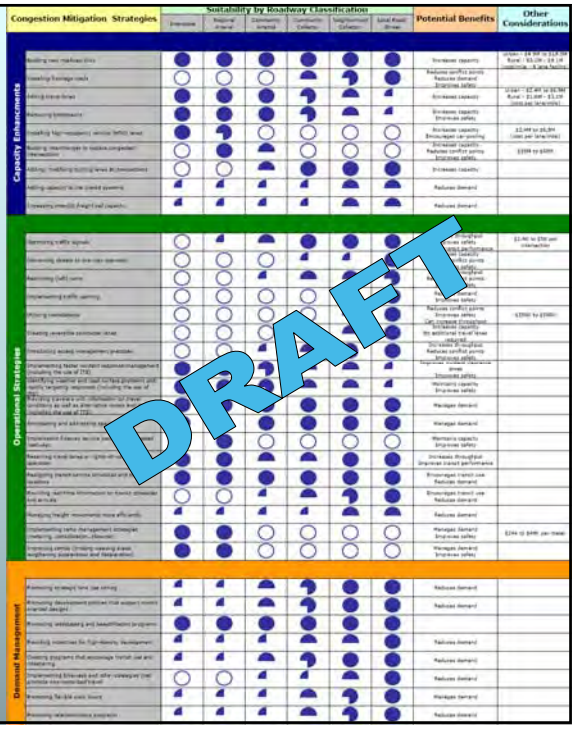
PENNSYLVANIA STATE
TRANSPORTATION ADVISORY COMMITTEE

Stakeholder	Suggested Roles and Responsibilities
Planning Organization	✓Planning and programming ✓Coordination of Regional Traffic Signal Improvement Program
PennDOT BHSTE	✓Development of training and education ✓Statewide asset management ✓Implementation of technology ✓Coordination of Statewide Signal Committee
PennDOT Districts	✓Signal warrant analysis ✓Design under certain conditions ✓Operations of some signal systems (critical corridors) ✓Coordination of Critical Corridor Consortiums ✓Operational oversight/ evaluation of signal systems ✓Traffic Management Center (TMC) integration with signal systems ✓Asset management of systems
Local Municipalities	✓Design under certain conditions ✓Operations of some signal systems ✓Utility services ✓Maintenance activities
Others	✓Emergency preemption enhancements ✓Transit priority systems

Congestion Mitigation Evaluation Matrix

- Uses
  - Expand Smart Transportation guidance
  - Incorporate in Congestion Management Processes as part of strategy evaluations
  - Incorporate in PennDOT's Alternative Transportation Plan (ATP) guidelines
  - Others?
- Components
  - Smart Transportation roadway categories
  - Suitability of strategies
  - Potential benefits
  - Historical costs
  - Others?

Congestion Mitigation Evaluation Matrix



Ongoing Smart Transportation Activities

- Outreach to Local Governments and Other Partners - PennDOT must continue working with local governments and our other partners in community building. A number of activities related to this initiative will be rolled out over the next several months.
- Linking Planning and NEPA: PennDOT is defining a new planning process that will be used to better understand transportation problems, the potential solutions and related costs before they are programmed for funding. Criteria used to determine if a project receives funding will be based on Smart Transportation principles and Pennsylvania's Keystone principles.
- Revisions to the Highway Occupancy Permit (HOP) Process: The Department is currently revamping the HOP Process to more closely align it with the principles of Smart Transportation.
- Revisions to the Design Manuals and other Policy Documents: PennDOT is changing their rules and standards to better reflect the principles of Smart Transportation, so that our projects can be sensitive to the local land use, environmental, and social contexts.

Recommendations Brainstorming

Policy

- Establish an overarching congestion management program within PennDOT
  - Implement congestion mitigation strategies in a smart transportation context
  - Emphasize demand management and operational strategies (operational strategies to include elements of freeway operations and arterial/corridor operations)
  - Implement bottleneck analysis and mitigation into planning and project development
  - Provide guidance to planning partners on congestion management direction
  - Integrate into program update guidance

Recommendations Brainstorming

Planning

- Place increased planning emphasis on Congestion Management Processes (CMPs) at MPO level
  - Develop guidance on content and application of CMPs and minimum expectations
  - Encourage "right-sized" CMPs in all areas, not just TMAs
- Increase PennDOT participation from central office and district offices in congestion management processes
- Integrate CMP results with MPO long range plans
- Encourage integrated (land use and transportation) planning
- Develop a stronger planning focus at the District level to better coordinate with municipalities on land use and transportation
- Encourage some land use controls at the county level so that land use and transportation decisions are more effectively managed
- Encourage use of official maps

Partnering and Communication

- Promote statewide and regional coordination of congestion management programs and processes

Recommendations Brainstorming

Implementation

- Expand and streamline traffic signal enhancement programs
- Implement ramp management analysis and mitigation into planning and project development
- Implement a quick clearance policy
- Encourage a greater PennDOT role in signal operations – see other recommendations
- Engage and educate stakeholders regarding PennDOT revised highway occupancy permit (HOP) and traffic impact study (TIS) requirements
  - Mandatory PennDOT, planning partner, municipal meeting
  - Linking municipal land development cycle to PennDOT HOP process
  - Alternative transportation plans
  - Consider signals and roundabouts

Recommendations Brainstorming

Implementation (cont.)

- Create a model TIS ordinance for municipal use
- Reevaluate obstacles to implementing traffic impact fee ordinances
- Identify key performance measures (in addition to level of service) and correlate there relationship to level of service
  - Easily measurable and understandable
  - Addressing existing and future recurring and non-recurring congestion
  - System-wide versus localized
  - Visibility/dashboard of performance measures

Recommendations Brainstorming

Funding

- Provide incentives for regionally beneficial solutions
- Provide incentives for Smart Transportation solutions in Smart Communities
- Establish separate funding mechanisms for operational improvements including signals and ITS
- Provide a pool of annual planning funds (administered by PennDOT) for congestion mitigation efforts

Other

- Highlight operational successes
- Revisit TAC Traffic Signal System Study recommendations