

## *Transportation Systems Management & Operations - Congestion Management Process*

Congestion management systems (CMS) were first mandated in 1991 as part of the Intermodal Surface Transportation Efficiency Act (ISTEA). State departments of transportation and metropolitan planning organizations (MPOs) were required to implement a CMS with five other management systems (intermodal, public transportation, safety, pavement, and bridge). In 1995, the National Highway System Designation Act made all of the management systems optional at the state level. However, the metropolitan planning provisions of ISTEA continued to require that all transportation management areas (TMAs - MPOs with a population in excess of 200,000 such as HATS) maintain a CMS as part of their planning process. This stipulation continued in the subsequent Transportation Equity Act for the 21<sup>st</sup> Century (TEA-21) adopted in 1998, which required CMS findings to be considered in the development of a region's transportation plan (RTP) and its transportation improvement program (TIP). Moreover, for air quality non-attainment TMAs such as HATS, any expansion of roadway capacity must be developed in the context of the CMS process.

Current surface transportation legislation, Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), requires each metropolitan planning area to have a *congestion management process* (CMP). The CMP identifies congested facilities and multimodal strategies to mitigate it. The CMP enhances the existing concept of the CMS by emphasizing a dynamic and cooperative process to provide effective management and operation of transportation facilities through the use of travel demand reduction and operational management strategies. The CMP for the HATS region is comprised of a congestion management plan and measurement guide, a commuter alternatives program implemented through the Susquehanna Regional Transportation Partnership, locally-initiated tools, as well as ITS implementation. These initiatives are described below.

### **Congestion Management Systems (CMS) Plan**

HATS first adopted a CMS plan in 1995 and updated it in 2003. The overall goal of the CMS plan is to provide information on the region's congestion in terms of congested corridors and devise strategies to reduce congestion. The CMS plan includes a summary of each congested corridor and an analysis of travel demand management and operational strategies appropriate for that particular area.

### **Statewide Congestion Measurement Pilot Study**

PennDOT initiated a Statewide Congestion Measurement Study to develop best practices to measure and evaluate congestion. All MPO's in the state

participated and provided input in the process to determine the best practice to measure congestion.

CMS practices vary throughout Pennsylvania primarily due to the CMS legislation which allows for a large degree of flexibility on how congestion is measured and how the findings of the CMS are interpreted and applied. This deliberate flexibility allows organizations to tailor their CMS process to suit their specific needs and available budgets. The Statewide Congestion Measurement Study addresses the differences related to general CMS application, network and modal considerations, congestion measurement techniques, the data and tools used for analysis, performance measures, methods for corridor identification, methods to identify congestion causes, strategy evaluation and system monitoring. The HATS 2003 CMS plan will be updated to reflect the statewide study findings and guidelines, described below:

#### Role of the CMS in the MPO process

- Make CMS a “clearing house” of transportation data, performance measures, projects, studies.
- Use congestion measures to evaluate projects nominated for the RTP and TIP.
- Identify areas and corridors for further study.
- Periodically monitor congestion by corridor and region.
- Specifically address land use goals.
- Track projects for each corridor.
- Indicate areas where more detailed studies should be conducted.

#### Applying the CMS Process

- Update analyses and reports on a periodic basis and include the perceptions of those who use the transportation system.

#### Network and Modal Consideration

- Identify a network with significant impact on regional congestion, but avoid extending the network to a degree where congestion measurement or monitoring becomes impractical.

#### Measuring congestion

- Base performance measures on a set of criteria which account for the benefits, costs and implications of the use of each measure.

#### Prioritizing Corridors

- Prioritize areas for further study, ranking projects, and focusing limited resources with respect to the additional data collection and monitoring of key corridors.

### Strategy Evaluation

- Evaluate each project on its potential effectiveness and practicality in reducing corridor congestion.

### System Monitoring

- Involves periodic assessments of the transportation system using regional and corridor congestion measures.
- Includes maintenance, timing and synchronization of signals and signal corridors across multiple municipalities.

### **Susquehanna Regional Transportation Partnership**

In response to concerns about increasing congestion and decreasing air quality in the region, the transit agencies, regional chambers, and metropolitan planning organizations of the four major metropolitan areas in South Central Pennsylvania (Harrisburg, Lancaster, Lebanon, and York) formed the Susquehanna Regional Transportation Partnership (SRTP). The funding for the program comes mainly from the Congestion Mitigation and Air Quality (CMAQ) Improvement Program, which funds projects that reduce criteria air pollutants regulated from transportation-related sources. All CMAQ funds for SRTP are overseen by HATS and PennDOT. In November 2004, SRTP officially hired URS to create the South Central Pennsylvania Commuter Services program and the Program Director was hired in early 2005. Through URS and SRTP's efforts, this region has:

- Established a regional computerized ridematching system
- Initiated a regional Emergency Ride Home Program
- Set up toll-free number (1-866-579-RIDE) and local number (717-234-RIDE) for information on public transportation and ridematching services.
- Conducted a benchmark commuter database survey (Penn State Harrisburg) in September 2005
- Began employer partnerships with around 30 active employers (employing approximately 28,000 commuters in the region) and established partnership levels.
- Launched website ([www.PaCommuterServices.com](http://www.PaCommuterServices.com)) with an interactive ridematching component
- 1,400+ commuters are currently in ridematching system
- COLT, Rabbit Transit, and Red Rose Transit have joined CAT in accepting TransitChek (pre-tax transit vouchers) as of November 2005
- Conducted traffic volume surveys and developed roadway sign plan; signs were designed and produced; projected installation Spring 2007
- Expanded service area to include Adams County, Fall 2006

It is too early in the program to define the amount of congestion mitigation which has been accomplished so far. The Penn State Harrisburg benchmark commuter database survey was done to set a benchmark for future surveys and studies that look at the affects of the program in the region. SRTP is currently in the process of designing the next round of surveys and analysis to look at the impacts of this program.

### **Susquehanna Valley Air Quality Partnership**

The [Susquehanna Valley Air Quality Partnership](#) (AQP), formerly the Ozone Action Partnership, is a public/private coalition of volunteers dedicated to improving air quality in the South Central Pennsylvania region. The Tri-County Regional Planning Commission Office Administrator serves as the Chairman of the Partnership's Financial Committee and acts as treasure for the CMAQ grant money, which the Partnership receives.

The Susquehanna Regional Transportation Partnership is also a "partner" on the Air Quality Partnership board with the Director of the South Central PA Commuter Services program acting as SRTP's representative. Commuter Services and AQP have conducted some joint marketing with billboards to promote transportation alternatives and AQP will be sponsoring some of Commuter Services marketing materials. There are also plans to co-exhibit at the four major chambers' expos (Harrisburg, Lancaster, Lebanon, and York) over the coming year to attract employers to both programs. As partners with AQP, URS and Commuter Services receive "Ozone Action Day" notices and attend their meetings. HATS, SRTP, and AQP will be looking at more ventures to collaborate on for the future.

### **Local Tools**

Local municipalities are able to take a proactive approach to development and development-related traffic problems through their comprehensive plans, official maps, and subdivision and land development regulations. These tools should be implemented to ensure adequate transportation infrastructure is available to support proposed development. Communities typically react to local traffic problems created by development, rather than provide the setting in which traffic is permitted to occur.

To address circulation issues municipalities can implement circulation plans as part of their comprehensive plans. This element should contain pertinent data on existing and future traffic conditions, and should be analyzed to identify transportation needs, both vehicular and non-vehicular, as well as physical and service-oriented improvements.

Official maps can be used as a land use regulatory tool to create a coordinated transportation network, direct the location of improvements as future development and subdivision activity occur, and reserve the necessary rights-

of-way. The official map should reflect the objectives set forth in the circulation element of the comprehensive plan.

Subdivision and land development ordinances (SALDOs) may also improve the transportation system by providing relevant street design and context sensitive design standards, as well as access management opportunities. Examples of poor access management are evident throughout the HATS region, such as offset intersections, multiple curb cuts/driveways in close proximity to one another on a property, and uncontrolled access from a property to a highway (which functions in a manner similar to having multiple curb cuts or driveways on a property). Problems occur when these features are allowed, as the road's mobility function is reduced and the number of potential conflict points is increased.

Access management programs can enhance safety, improve roadway efficiencies, and protect both private and public investments. In Pennsylvania both PennDOT and local municipalities have responsibility for access management. PennDOT requires an access permit (Highway Occupancy Permit or HOP) be acquired to access a state road from a driveway or intersection. PennDOT's authority includes ensuring capacity and safety are sufficient in newly created intersections, safety issues as they relate to the adjacent stretches of highway, and drainage issues. However, PennDOT does not have authority to deny access because a roadway has insufficient capacity -- unless it can be directly tied to the site of the development. Local municipalities can control access through their SALDOs and zoning regulations. Municipalities have broad powers to address access improvements in relationship to the comprehensive plan, increases in traffic, drainage and design issues. Thus, their powers are not limited to improvements recommended by PennDOT. Measures need to be taken to enhance the authority of PennDOT to address capacity problems in its access management system, or local municipalities need to undertake much stronger access management measures than in the past. The PA Municipalities Planning Code (MPC) requires PennDOT to consider comprehensive plans, zoning ordinances, and multi-municipal agreements when issuing access permits. PennDOT also implements a local land use questionnaire component as part of its HOP process.

Finally, impact fees can be used to supplement funding for transportation improvements. However, legislative rules make their implementation cumbersome. Impact fee legislation should be amended to make this tool more reasonable to implement by municipalities.

## *Transportation Systems Management & Operations - Intelligent Transportation Systems (ITS) Planning*

Intelligent Transportation Systems (ITS) planning, also sometimes called operations planning, is a CMS-related effort that addresses congestion and safety issues by making the existing transportation infrastructure work more efficiently. To identify possible ITS improvements within the region, HATS is in the process of implementing an ITS Regional Operations Plan (ROP), as described in the following sections. The ROP has its roots in the ITS Regional Architecture, adopted in late 2004. The plan identifies various operational strategies that can help reduce recurring congestion caused by bottlenecks and inefficient capacity use, as well as non-recurring congestion caused by accidents, special events, and other, non-regular occurrence factors.

### **Intelligent Transportation Systems (ITS) – Regional Architecture**

The South Central Pennsylvania Intelligent Transportation Systems (ITS) [Regional Architecture](#), which covers the eight counties of PennDOT District 8-0, was endorsed by HATS in December 2004. The architecture is simply a formal communications procedure. Through this procedure transportation system managers, transportation operators and providers, emergency service agencies, major event generators, large municipalities, and information service providers can communicate more efficiently with one another and respond more quickly and appropriately to congestion or emergency-related situations.

Input into the regional architecture structure and key communication flows necessary to improve transportation system operations were identified through a five-step process:

- Define Architecture Scope – Define the region and identify key participants in architecture development and creation of a Regional Advisory Panel (RAP).
- Inventory Systems and Define Needs, Services, and Operations Concept – Obtain information from participants/RAP members about future operations and communications flows to address emergency and congestion-related events which impact the transportation network.
- Generate Strawman Architecture – Chart all communication flows identified in Step 2 and create the draft architecture. Specialized software called Turbo Architecture was used to generate the comprehensive communication flow chart.
- Conduct Outreach to Validate Architecture – Contact stakeholders to determine accuracy of the communication flows depicted in the draft architecture.

- Finalize the Regional Architecture - Use the validation information received in Step 4 to finalize the draft architecture.

The ITS regional architecture was the first step to identify ITS/operational improvement needs within the region. The Regional Advisory Panel will apply the regional architecture to specific situations to address operational improvement needs. Ultimately, the ITS/operations planning process identified by the ITS regional architecture will be integrated into the RTP and TIP planning process. Potential ITS/operations improvement projects can then be evaluated and funded as an integral part of the transportation planning process.

### **South Central Pennsylvania Regional Advisory Panel (RAP)**

The South Central Pennsylvania Regional Advisory Panel (RAP) was created during the development of the ITS Regional Architecture. The RAP continues to meet to address ongoing regional ITS/operational needs.

Four priority needs were identified by the RAP and will be addressed through implementation of the Regional Operations Plan (ROP), as follows:

- Regional Transportation Management Center (TMC) - The creation of a TMC will standardize and centralize transportation management operations within the PennDOT District 8-0. The center would monitor transportation system conditions using technologies such as variable message signs (VMS), closed-circuit television cameras (CCTV), and highway advisory radio (HAR). It could be tied into information available at other TMC locations, such as those operated by the state police and county emergency management agencies. It also could be connected to PennDOT's statewide TMC for better awareness of large-scale traffic incident events occurring in other regions. The District 8-0 TMC would allow PennDOT to respond more quickly to changing traffic conditions and distribute appropriate information for commercial vehicle operators, transit providers, and other motorists. The TMC will be based at the District 8-0 offices and is expected to be operational in 2007.
- Enhance Incident Management Systems - A majority of all congestion is non-recurring congestion caused by incidents, weather, work zones, traffic signals, or other, non-physical attributes. Overall transportation system operation can be improved by clearing accidents more quickly, directing drivers to alternate routes, or improving traffic signals. Providing timely and accurate information to drivers about the transportation system's current conditions, improving and standardizing communications between emergency response providers and transportation operators during incident situations, and improving inter-agency and inter-municipal transportation system coordination can assist in this regard.

- Real-time Traveler Information Website - A website or a phone line with real-time traveler information allows drivers to make more informed decisions about the preferred routes and modes to use for trips, as well as the time required and distance traveled to make those trips. A website also allows transportation system operators to more accurately identify the preferred routes for travel during congested periods.
- Expanded Use of Traffic Responsive Signal Systems - Traffic signals are designed to maximize traffic flow, but can hinder traffic flow by not responding to changing conditions. Poorly-timed traffic signals are problematic in corridors that have high traffic volumes and a series of signals in close proximity to one another. Adding traffic-sensitive sensors to existing signal systems and coordinating signal timings will improve traffic signals efficiency. Because municipalities operate and maintain the signals, implementing these improvements can be delayed if there are budget or staffing issues involved. Multi-municipal coordination also is an important factor in implementing effective signal system upgrades.

The regional operations plan (ROP) includes video sharing, improved non-interstate/ limited access highway incident management procedures, improved regional detour map, and evacuation route mapping and planning.

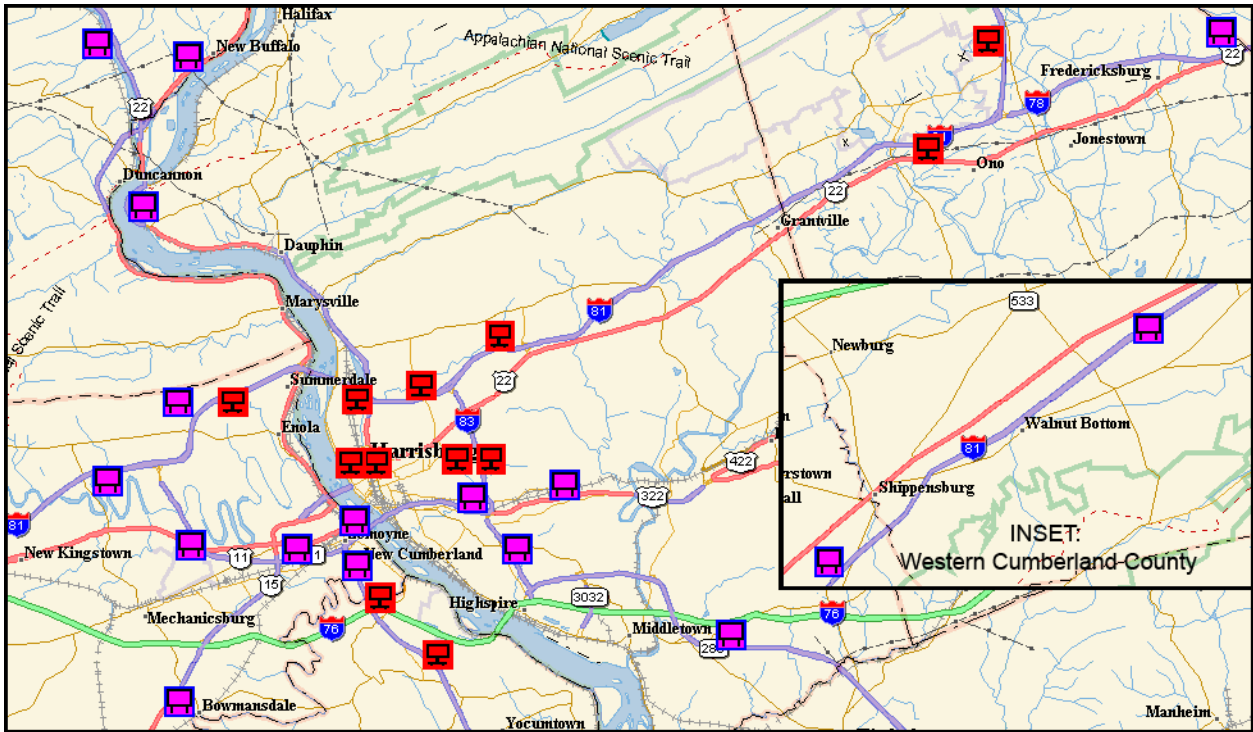
The south central Pennsylvania ITS RAP and its counterpart panels throughout the state, continue to improve operations and to strengthen the tie between project planning and implementation and the ITS/Operations planning process.

### **District 8-0 ITS Deployment Projects**

District 8-0 also plans to implement various ITS/Operations field devices within the next few years to help make the roadway system work more efficiently. The improvements will include 15 new permanent overhead, center mount, and semi-portable variable message signs, 29 new closed circuit television cameras, and 6 new highway advisory radio broadcast locations within the HATS area that will augment existing devices. These devices will help District 8-0 monitor the Capital Beltway and many key highways of the Harrisburg area.

District 8-0 also intends to expand its coverage area and hours of service for its Capital Beltway Service Patrol. The service patrol, in service since 2000, is designed to assist travelers who break down during peak hours. This helps reduce the congestion which results from these incidents. Currently the District operates two vehicles that cover 35 miles of the beltway and its connecting roads during peak hours. By 2009, the District plans to add a third vehicle, increase the number of miles covered to 45 miles, and expand the afternoon hours of operation to 2:00-6:30 PM or 2:30-7:00 PM, depending on the time of year.

## HATS Area Variable Message Sign Locations - 2009



## HATS Area Closed Circuit Television Camera Locations - 2009





## *Transportation Systems Management & Operations - Travel Demand Model*

An important tool for HATS transportation planning is the travel demand model. It is a computer model of the HATS region road network that simulates trips based upon socio-economic data and land use input. The region is divided into 489 traffic analysis zones (or TAZs). Each TAZ contains current and projected data on a variety of social and economic variables used to predict trip generation data.

A four step modeling process is used and includes trip generation, trip distribution, mode choice, and trip assignment. Trip generation estimates the number of trips entering and leaving each zone, on the basis of that zone's land use and socioeconomic characteristics; trip distribution shows the number of trip between TAZs; mode choice predicts how the trips will be divided among the available modes of travel (highway, transit, carpool, etc.); and trip assignment predicts the routes the trips will take. The model uses an iterative trip assignment process, assigning and reassigning trips to the network until the overall shortest travel time is reached for each trip.

Data outputs from the model include highway traffic volumes, highway operating conditions by measuring congestion and level of service (LOS), transit ridership, carpooling, vehicle miles traveled, lane miles, and trip orientation. Through this output future transportation network improvement needs are identified. Alternative scenarios can be created and tested by varying input assumptions, then evaluated to help determine a preferred transportation improvement or program and its priority.

The HATS travel demand model uses TP+/Viper (CUBE) software. The traffic volumes estimated by the travel demand model were checked against the actual 2000 traffic counts, and a root-mean-square error (%RMSE) measurement calculated to evaluate trip assignment accuracy and is a much more stringent measure than a simple observed/estimated comparison. For the HATS model the %RMSE was less than 1. *(The smaller the RMSE, the better the model performance. In a perfect model, the RMSE would be zero.)*

Updates to the model have been done periodically to reflect changes to land use, employment and demographics. RTP updates as well as ongoing studies and analysis of regular HATS work program efforts utilize the travel demand model to better understand and program the future regional transportation system improvement possibilities for our region. Scenario building is planned as a future application of the travel demand model, as HATS continues to connect land use and transportation planning efforts.

## *Transportation Systems Management & Operations - Air Quality Conformity*

The air quality conformity process is intended to ensure federal funding and approval of transportation projects which are consistent with air quality goals. The conformity process also integrates air quality and transportation planning. The Clean Air Act specifies the National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful for public health and the environment. Metropolitan areas where air pollution levels persistently exceed or have previously exceeded the NAAQS are designated as “non-attainment” or “maintenance” areas. In non-attainment and maintenance areas the Regional Transportation Plan (RTP) and the Transportation Improvement Program (TIP) must conform to the regional air quality plans.

The Harrisburg region is designated as a *basic ozone non-attainment area* under the 8-hour ozone standard and as a *non-attainment area* for fine particulate matter (PM<sub>2.5</sub>). Transportation conformity for the 8-hour ozone and particulate matter must demonstrate that emissions in future years are not greater than those in 2002. Ozone emissions are analyzed for a summer weekday and fine particulate analyses are for annualized emissions.

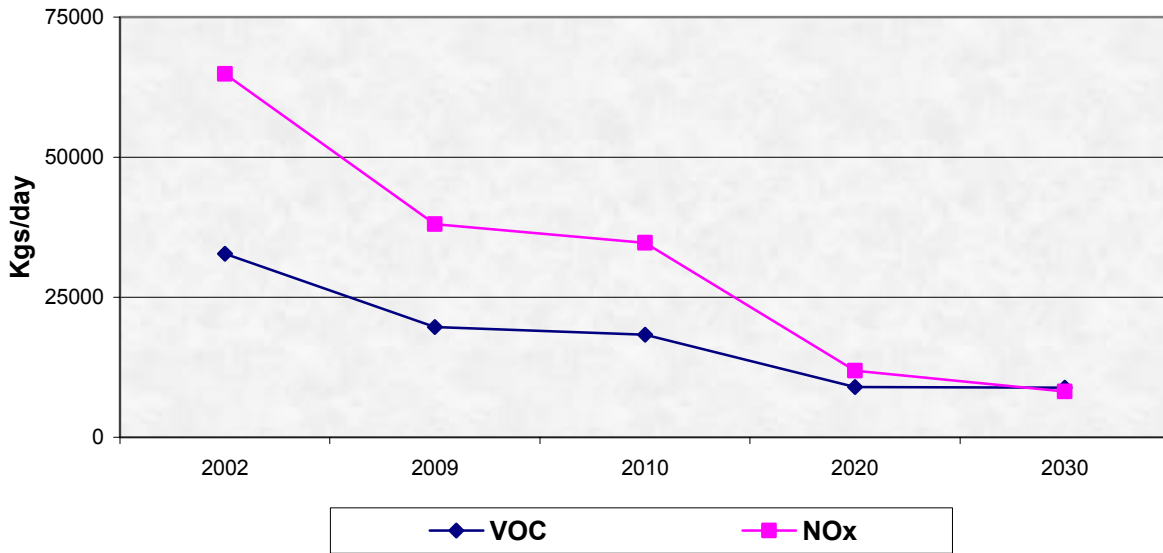
The analysis for PM<sub>2.5</sub> considers the impacts of emissions within urban and rural areas of Dauphin and Cumberland Counties. Although the MPO includes Perry County, it is excluded from the emission analysis since it is in attainment of the PM<sub>2.5</sub> standard. For ozone analysis all of the counties (Dauphin, Cumberland and Perry) in the MPO are included. Both ozone and fine particulate matter conformity analyses are coordinated with Lebanon County, because it shares the Harrisburg urbanized area EPA-designated air shed.

Conformity determinations are made at least every four years, or when transportation plans or TIPs are updated. HATS has consistently approved transportation plans that have increased mobility and lowered emissions from the base model year. By March 1998, HATS reached attainment with respect to air quality based on the standards set by Environmental Protection Agency (EPA). From that point, air quality conformity did not apply to the HATS MPO at all until EPA revised its standards in 2000. The HATS MPO is once again considered a non-attainment area.

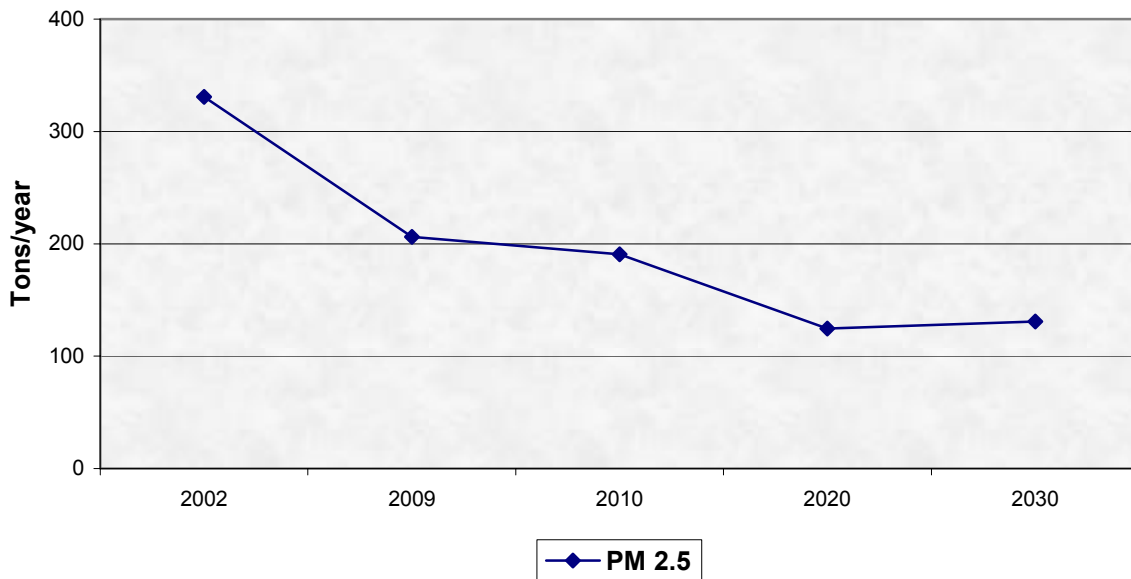
As required by the Clean Air Act Amendments of 1990 (CAAA), a study of vehicle emissions was performed for the Harrisburg region ozone and PM<sub>2.5</sub> non-attainment areas. State and federal emissions control measures were included in the analysis for the relevant analysis year. The study compared the base emissions for VOC, NO<sub>x</sub> and PM<sub>2.5</sub> to future emission projections that would result from implementation of the TIP and RTP. The following graphs

show the future year emissions for ozone and PM<sub>2.5</sub>. As shown, the future year emissions for ozone and PM<sub>2.5</sub> will be lower than in the year 2002.

### Ozone Emissions



### PM 2.5 Emissions



Travel control measures (TCM) directed at reducing vehicle trips are important and should be implemented in the RTP and TIP programs. TCMs help in reducing congestion and are very much needed in some areas to demonstrate attainment of the NAAQS. Examples of TCMs that reduce congestion and improve traffic flow include:

- Bicycle/pedestrian facilities
- Transit related projects
- Park and ride lots
- Traffic signal improvements

These TCMs form the basis for funding eligibility in the Congestion Mitigation and Air Quality (CMAQ) Improvement Program. The CMAQ program allocates funding to states for implementation of projects that seek to improve air quality by reducing demands on the highway network. These projects serve MPOs that are in non-attainment meet the standards set by the Clean Air Act for Ozone (O<sub>3</sub>), Carbon Monoxide (CO), and suspended Particulate Matter (PM<sub>10</sub> & PM<sub>2.5</sub>)

HATS performs the conformity analysis for Cumberland, Dauphin and Perry Counties, while PennDOT conducts the analysis for Lebanon County. The combined analysis and report is reviewed by the Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) and a determination made by the Environmental Protection Agency (EPA). The complete air quality conformity analysis for this RTP Update is a separate document available at the Tri-County Regional Planning Commission office. The summary report is included in the Appendix.