Congestion Management Process: Methodology Report

Fiscal Years 2017-2020

South Jersey Transportation Planning Organization

www.sjtpo.org

[this page is intentionally left blank]

Congestion Management Process: Methodology Report FISCAL YEARS 2017-2020

Policy Board Approved November 26, 2018

SOUTH JERSEY TRANSPORTATION PLANNING ORGANIZATION

782 South Brewster Road, Unit B6
Vineland, New Jersey 08361
P: 856-794-1941
F: 856-794-2549
www.sjtpo.org

LEONARD DESIDERIO, CHAIRMAN
JENNIFER MARANDINO, EXECUTIVE DIRECTOR

[this page is intentionally left blank

Contents

Appendices

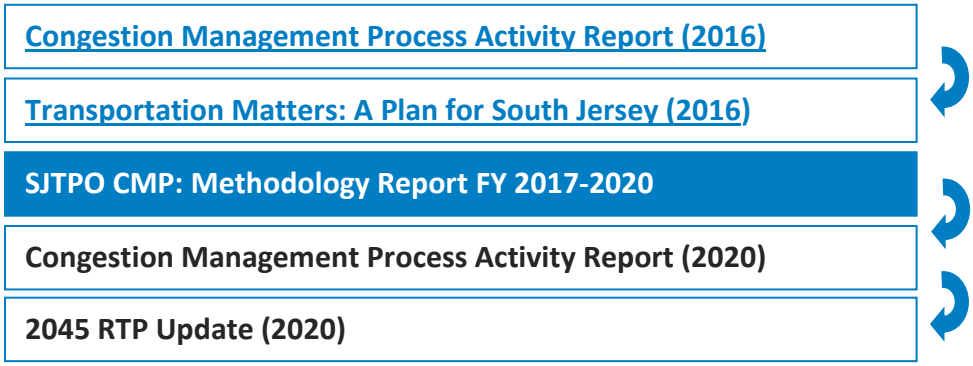
1. Introduction

The South Jersey Transportation Planning Organization (SJTPO) is the Metropolitan Planning Organization (MPO) for the New Jersey four-county area of Atlantic, Cape May, Cumberland, and Salem Counties. Federal law requires that Transportation Management Areas (TMAs) such as the SJTPO construct and implement a Congestion Management Process (CMP) as part of their overall regional transportation planning process. The United States Department of Transportation (USDOT) provides detailed guidelines related to this requirement. The MPO must provide a process for effective management and operation of new and existing transportation facilities using travel demand management (TDM) and operation management strategies. The CMP produces a prioritized list of locations, issues, or projects to be considered as input into the other parts of the SJTPO planning process.

The most recent SJTPO CMP document is the 2016 Congestion Management Process Activity Report, which was incorporated into the SJTPO's most recent Regional Transportation Plan (RTP), entitled Transportation Matters: A Plan for South Jersey (2016). SJTPO is now updating its CMP for the current RTP cycle (FY2017-FY2020). Through the updated process, SJTPO is taking advantage of the availability of vehicle probe travel time data and analytical tools for congestion screening and performance management. Revisions have been made to the CMP to incorporate the newly available data for regionwide congestion screening and location prioritization. In addition, SJTPO is emphasizing project-oriented congestion planning, with the goal of preparing cost-effective projects for federal funding or to produce Problem Statements for the New Jersey Department of Transportation (NJDOT). This report, the SJTPO Congestion Management Process Methodology Report FY 2017-2020, documents that process. This CMP Methodology has been vetted and approved by the Congestion Management Process Advisory Committee (CMPAC) and SJTPO's Technical Advisory Committee (TAC).

SJTPO will follow this approved methodology when conducting the CMP activity through FY 2020. The activity will be summarized with findings in a report to follow this one, the Congestion Management Process Activity Report (2020), to be incorporated into the 2045 RTP Update (2020). This report will detail all congestion planning activities for the current RTP cycle, including SJTPO's utilization of the newly-available archived travel time data. The CMP Activity Report will also document project-oriented planning efforts such as assisting SJTPO subregions in developing congestion relief projects and preparing Problem Statement reports for NJDOT. Figure 1.1, below, summarizes the chronological order and the relationship for these CMP-related documents.

Figure 1.1. Timetable of SJTPO CMP-Related Documents

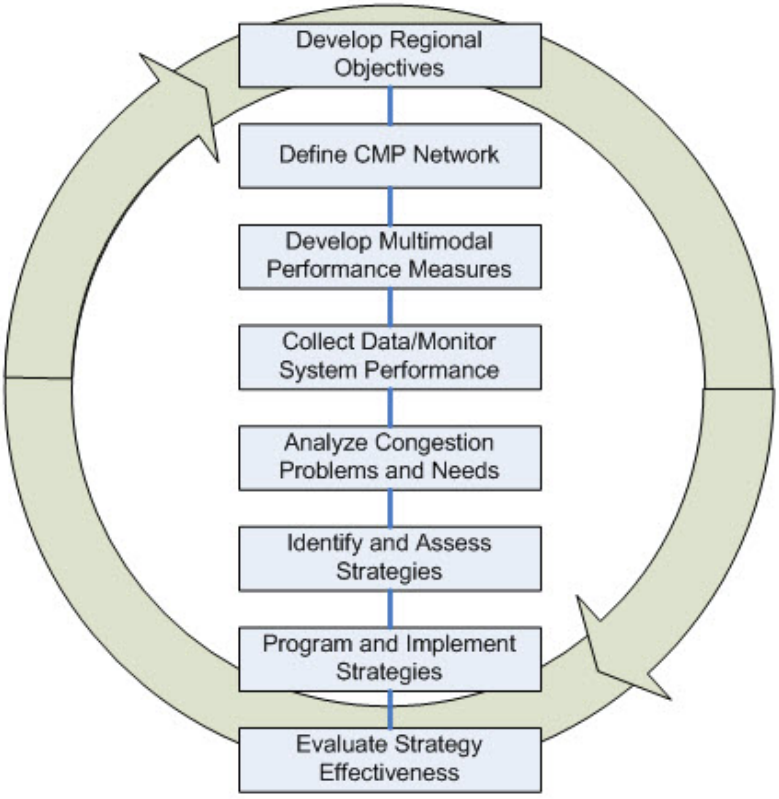


This report, the SJTPO Congestion Management Methodology Report 2017-2020, is a documentation of the SJTPO congestion planning process. The report is formatted to reflect the eight CMP steps outlined by the Federal Highway Administration (FHWA) in the Congestion Management Process Guidebook.

2. CMP Workflow

The SJTPO congestion planning process is based on the workflow detailed in the FHWA Congestion Management Process Guidebook and on SJTPO's Organizational Vision as detailed in Transportation Matters: A Plan for South Jersey (2016). The FHWA CMP Guidebook has eight distinct steps, which can be visualized in Figure 2.1, below.

Figure 2.1. CMP Workflow



Source: FHWA. Congestion Management Process Guidebook[1]

The FHWA CMP Guidebook is a compilation of state-of-the-practice congestion planning methods used throughout the nation and was most recently updated in 2017. The Guidebook was collaboratively developed by FHWA, FTA, and metropolitan transportation planning professionals. The Guidebook is not a strict prescription of the best methodology to use, but rather is a literature review of successful congestion planning processes documented and endorsed by FHWA.

[1] http://www.fhwa.dot.gov/planning/congestion_management_process/cmp_guidebook/fig2.cfm

SJTPO's most recent Regional Transportation Plan – Transportation Matters: A Plan for South Jersey – offers the following vision statement to guide all planning processes: "Our Vision: A transportation system, based on regional collaboration that moves people and goods in a safe and efficient manner and incorporates all modes and users."

This vision statement is followed by ten regional goals and associated strategies. The regional goals established in the RTP are based on planning factors provided by the FAST (*Fixing America's Surface Transportation*) Act, signed into law in 2015. These ten regional goals are used to define the regional objectives of the SJTPO CMP, which are in turn used to develop performance measures and strategies. The ten regional goals are:

1. Promote **Accessibility** and **Mobility** for the movement of people and goods
2. Support the **Regional Economy**
3. Mitigate **Traffic Congestion**
4. Improve the **Resiliency** and **Reliability** of the transportation infrastructure
5. Protect and enhance **the Environment**
6. **Restore, Preserve, and Maintain** the existing transportation system
7. Improve **Security**
8. Improve **Transportation Safety**
9. Enhance the **Integration** and **Connectivity** of the transportation system
10. Increase and enhance opportunities for **Travel** and **Tourism**

These ten regional goals shall be held in consideration when developing the goals, performance measures, and strategies of the CMP.

Detailed and Data Driven

The Federal transportation reauthorization legislation *Moving Ahead for Progress in the 21st Century*, (MAP-21), signed into law in 2012, called for a performance measure- driven planning process. This emphasis on performance-based planning was maintained in the FAST Act of 2015. In response, SJTPO developed performance measures for all systems, including Congestion Management. The CMP and related documentation is very detail-oriented. Some of the detail is placed in the appendices at the end of this report.

Figure 2.1 illustrates how the eight-step process from the FHWA CMP Guidebook is a continuous process which serves as a guide for the actions to be taken in developing a regional CMP methodology. The eight steps are as follows:

1. **Develop Regional Objectives for Congestion Management** – According to the Guidebook, these objectives should draw from the regional vision and goals outlined in the RTP. As such, the vision statement and ten regional goals from Transportation Matters: A Plan for South Jersey have been adopted for this document. Objectives should be specific, realistic, and bound by a specified time frame. These objectives will serve as the basis for the development of performance measures.

2. **Define CMP Network** – The key components of the transportation system focused on in the CMP will need to be determined. This requires defining two aspects of the system that will be examined as part of the planning process: the geographic scope and the system elements (e.g., freeways, major arterials, transit routes).

3. **Develop Multimodal Performance Measures** - Performance measures that will be used to measure congestion on a regional and local scale need to be established. The selected performance measures should relate to, and support, the CMP regional objectives developed in Step 1 of this eight-step process.

4. **Collect Data/Monitor System Performance** – With the performance measures developed, the next action is to collect and analyze data to determine how the transportation system performs. Data collection may be on-going and involve a wide range of data sources and partners. Several common types of data that can be used in the CMP are: traffic volume counts (automated or manual), speed and travel time data, transit data, bicycle/pedestrian data, and travel survey data.

5. **Analyze Congestion Problems and Needs** – As data is collected, the raw data must be translated into meaningful measures of performance. Specific locations with congestion problems present in the region or are anticipated should be addressed by using data and analysis techniques. Newly developed analysis tools such as the Probe Data Analytics (PDA) Suite may be used for this purpose.

6. **Identify and Assess Strategies** – The data and analysis should be turned into a set of recommended solutions to effectively manage congestion and achieve congestion management objectives. Potential strategies for mitigating congestion should be identified and assessed by working together with state and local planning partners.

7. **Program and Implement Strategies** – Project-oriented planning is crucial for implementing CMP strategies. SJTPO will work with its planning partners to prepare high-quality projects for federal funding, and to prepare Problem Statement reports for

initiating projects through NJDOT's Capital Program Delivery system. Implementation of CMP strategies occurs on three levels: system or regional, corridor, and project. SJTPO shall prioritize effective strategies in a regional context and integrate congestion planning strategies into the Transportation Improvement Program (TIP) process.

8. **Evaluate Strategy Effectiveness** – There shall be an ongoing process to evaluate the implemented strategies and monitor system performance. Future decision making about the effectiveness of transportation strategies can be informed through this step.

These eight steps form a "Process Model" that provides a flexible framework from which MPOs can develop an individualized approach. These steps are interrelated, and many steps are an ongoing process. As such, the steps are not necessarily performed sequentially, but rather form an ongoing and cyclical process. The end result of this process is to identify strategies, implement these strategies, evaluate their effectiveness, and repeat in a cyclical fashion.

CMP Advisory Committee

Feedback is continually solicited from SJTPO's CMP Advisory Committee (CMPAC), which consists of local stakeholders and planning partners. The CMPAC was formally designated by SJTPO's Technical Advisory Committee (TAC) in advance of the 2016 CMP Methodology update. The CMPAC is comprised of TAC members and subject matter experts from partnering agencies. A list of participating agencies and organizations are listed below:

- Atlantic, Cape May, Cumberland, and Salem Counties
- City of Vineland and City of Atlantic City
- New Jersey Department of Transportation (NJDOT)
- South Jersey Transportation Authority (SJTA)
- Delaware Valley Regional Planning Commission (DVRPC)
- New Jersey Transportation Planning Authority (NJTPA)
- Federal Highway Administration (FHWA)
- New Jersey Transit (NJ Transit)
- Cross County Connections

In early 2018, SJTPO organized a series of meetings with local planning partners to discuss congested locations and revisions to CMP methodology. Preliminary lists of congested locations were prepared based on 2017 data from the PDA Suite. Two lists were prepared for each county: an annual list, which included data from all twelve months, and a summer list, which included data from Memorial Day to Labor Day 2017. All locations from these lists were discussed with

stakeholders from the respective counties, and their feedback was integrated to form the final rankings presented in Appendix 2.4 of this report. In some cases, the PDA Suite produced "outlier" false-positive results, and such locations were removed from the lists. In other cases, local stakeholders provided valuable feedback on additional concerns at locations that were considered high-priority. For high-priority locations on state highways, SJTPO is committed to preparing Problem Statement reports for submission to NJDOT, as described in the following section. Ongoing dialogue with CMPAC members throughout the RTP cycle and beyond is crucial to the success of the CMP process.

NJDOT's Problem Statement Screening Process

SJTPO continues to participate in NJDOT's Congestion Relief Problem Statement Development Process. SJTPO works with NJDOT and partner MPOs to select state highway locations for problem statement development. SJTPO participates in field visits to congested locations and assists in the completion of problem statements. Problem Statement development is the first step in NJDOT's Capital Project Delivery process. Each problem statement submitted goes through the Problem Screening phase, where it is reviewed by the Division of Capital Investment Planning and Development (CIPD). CIPD analyzes the problem statements submitted and weighs its merit against data and information contained in the Department's various management systems.

SJTPO has recently submitted a congestion and safety-focused problem statement to NJDOT for the intersection of Route 47 (Delsea Drive) and Sherman Avenue in the City of Vineland, Cumberland County. This intersection was identified as a location of interest through SJTPO's CMP. Cumberland County also indicated the intersection as a high priority congested location. The problem statement identifies a need for congestion and safety improvements. The report included field observations, data collection, problem identification, and potential strategies for improvements. The problem statement report was submitted to NJDOT's Capital Program Committee for consideration. Earlier in 2018, SJTPO completed and submitted a problem statement for the intersection of Route 109 and Schellinger's Landing Road in Lower Township, Cape May County. Details on these and future problem statements will be provided in the CMP Activity Report that will be included in the next update to the RTP. SJTPO will continue to work with its subregions and NJDOT to identify high priority congested locations to submit as problem statements for potential future projects.

Intelligent Transportation Systems (ITS)

SJTPO continues to participate in New Jersey statewide Intelligent Transportation Systems (ITS) initiatives. SJTPO participated in the merger of New Jersey's regional ITS architectures into a single unified statewide ITS architecture in 2006. SJTPO also participated in the NJ ITS

Architecture Update project in 2012, for which the NJ ITS architecture was modernized and brought into compliance with revised Federal Highway guidance. Most recently, SJTPO served on the core team of the NJ ITS Architecture Advancement project, which sought to bring the ITS architecture into mainstream use by agencies throughout the state. SJTPO serves as a member agency of the ITS Society of New Jersey, and SJTPO's Executive Director serves on the Board of this organization.

In addition, SJTPO recognizes the value of planning for regional operations and has initiated data collection efforts and technical studies to assist local planning partners in planning for transportation systems management and operations.

SJTPO recognizes that ITS as a field will only continue to grow in the future. Planning for operations and ITS project development will continue to become more important parts of the metropolitan planning process, and funding must be programmed for these purposes. Emerging technologies will continue to transform transportation worldwide. Ridesharing services such as Uber and Lyft have rapidly brought on-demand transit to within the reach of every household. Traffic signals are becoming smarter, with demand-responsive systems becoming more common and adaptive systems seeing deployment on many busy corridors in New Jersey. Variable message signs make it possible to communicate important information to travelers at a moment's notice. In the near future, planning for autonomous and connected vehicles will become a high priority for planning agencies throughout the country.

SJTPO subregions have expressed interest in deploying ITS strategies throughout the region. Demand-responsive traffic signals may be a solution to the region's highly variable seasonal congestion. Such systems may even be able to anticipate fluctuations in traffic or be programmed to respond to special events or changes in weather. Variable message signs may be used to warn travelers when drawbridges have been raised on the approaches to many of the region's barrier islands. ITS technologies may also have an important role to play in disaster preparedness - "preparing for the next Sandy".

3. SJTPO's Congestion Management Process

3.1. Step 1: Develop Regional Objectives for Congestion Management

The CMP Objectives listed in this report are for the FY 2017-2020 RTP cycle. These objectives were developed in coordination with the vision statement and regional goals found in the Transportation Matters: A Plan for South Jersey (2016). MAP-21 and FAST Act emphasize performance-based planning, and these objectives should have a direct relationship with those measures. The ten regional goals from the RTP have been combined into a smaller set of four CMP objectives for which performance measures can be developed. SJTPO's CMP objectives reflect a multi-modal approach and emphasize travel demand and system management, as encouraged in the FHWA CMP Guidebook. The CMP objectives are as follows:

1. Reduce congestion and improve travel time reliability

This objective summarizes one of the main functions of the congestion management process and incorporates three regional goals from the RTP: mitigate traffic congestion, improve the resiliency and reliability of the transportation infrastructure, and increase and enhance opportunities for travel and tourism. Progress toward this objective shall be measured by system-level performance measures of travel time reliability derived from archived operations data. As the SJTPO region experiences significant seasonal congestion, it is important to ensure that travel time reliability is measured during summer seasons to ensure that the travel and tourism sectors are properly accounted for.

2. Improve the safety and security of the transportation system

This objective combines two regional goals: improve security and improve transportation safety. It is important that all strategies considered in the CMP result in a safer transportation system for all users, including bicyclists and pedestrians. Progress toward this objective shall be measured by using region-wide crash rates.

3. Improve multimodal mobility and the accessibility of the transportation system to all users

Federal guidance emphasizes multimodal accessibility to ensure that all users of the surface transportation system are served. Personal vehicle travel should not be prioritized to the detriment of transit, bicycle, and pedestrian travel. Strategies that provide alternatives to new Single Occupancy Vehicle (SOV) capacity should be considered first, and all strategies should be evaluated in a multimodal context. Progress toward this objective shall be measured by the rates of transit usage, transit reliability scores, and bicycle/pedestrian count data where available. This

objective incorporates the RTP goals to promote accessibility and mobility and enhance the integration and connectivity of the transportation system.

4. Support the regional economy, protect the environment, promote goods movement, and ensure that the CMP supports the regional goals established in Transportation Matters: A Plan for South Jersey

This objective combines the regional plan goals relating to economic development and the preservation of transportation infrastructure. Progress toward this objective shall be measured by tracking region-wide vehicle emissions, vehicle-miles traveled, pavement condition, and freight network reliability.

These four core objectives will be used to establish performance measures and develop strategies for the CMP implementation.

3.2. Step 2: Define the Congestion Management System Network

The CMP network is defined by both geographic boundaries and the components that comprise the surface transportation system. The CMP network is multi-modal, and includes components essential to freight transport, transit facilities, and bicycle and pedestrian infrastructure. The inclusion of multi-modal components helps ensure that strategies to reduce single-occupancy vehicle travel are represented. The CMP network is also defined in the context of data availability. New data sources such as vehicle probe data have expanded the scope of roadways for which high-quality travel time and congestion data is available. Roadways that serve South Jersey's important tourism and recreation economic sectors are also included in the CMP network.

Geographic Area of Application

The CMP Network covers the four-county SJTPO planning region: Atlantic, Cape May, Cumberland, and Salem counties in New Jersey. Congestion screening and analysis will be carried out on all CMP network components in this region for which data can be obtained.

In addition, SJTPO acknowledges the importance of planning for in a greater regional context. SJTPO staff participate in many statewide congestion management and freight activities in collaboration with NJDOT and other planning partners.

System Components

The CMP network is defined to be comprised of the following system components in the SJTPO planning region:

- All roadways on the National Highway System (NHS)
- All NJ State Highways and US Routes
- County highways classified as Major Collector or higher
- Roadways that carry NJ Transit service
- Roadways identified as Freight Highway Components in the 2017 NJ Statewide Freight Plan
- Bicycle facilities, pedestrian facilities, and multi-use trails
- Other roadways specifically identified as corridors of interest by subregional planning partners

For most of the components listed above, travel time data is available through the PDA Suite, which can be used for network-wide screening. Performance Measures such as travel time reliability, delay, and bottleneck occurrences shall be developed network-wide to generate screening lists for further analysis. For bicycle and pedestrian facilities, data is limited to spot counts as broad screening tools are not available.

3.3. Step 3: Develop Multimodal Performance Measures

The emphasis on performance-based planning introduced in MAP-21 and continued in FAST Act leads to planning processes becoming grounded in quantifiable performance measures. The measures selected for the SJTPO CMP directly address the objectives established earlier in this report and cover a wide variety of congestion-related issues.

According to the CMP Guidebook, objectives and their related performance measures should be SMART: Specific, Measurable, Agreed-upon (support by a consensus of CMP stakeholders), Realistic, and Time-bound. As such, each performance measure shall have an identified data source by which it can be measured and a timeline in which it should be achieved. The four core objectives of the SJTPO CMP and their associated performance measures are listed below:

1. Reduce congestion and improve travel time reliability

Performances measures for this objective shall be derived from archived operations data. Congestion performance measures have four dimensions: intensity, duration, extent, and variability. Variability is of particular interest in the SJTPO region, as congestion on many major corridors is seasonal and heavily effected by special events, the weather, and holiday weekends. As such, each measure will be computed for both the calendar year and for the summer season. The following performance measures will be computed from archived operations data:

Travel time reliability on National Highway System roadways - a region-wide measure that will be computed for each year and for each summer season (Memorial Day to Labor Day). This measure is calculated using archived operations data provided through the PDA Suite, which is described in detail in the following section. This measure can also be computed at the corridor level as needed. In the SJTPO region, the NHS includes most major regional roadways including the Garden State Parkway, New Jersey Turnpike, Atlantic City Expressway, many State and US Highways, and other Principal Arterials that serve the shore region.

Bottleneck ranking - the intensity, duration, and extent of congestion are all factors in computing a roadway's bottleneck ranking. This measure will be used for initial screening and to prioritize congested locations in each county and for the entire region. This measure shall be computed for each year and for each summer season. Screening lists shall be produced for each county and for the region as a whole. These lists will be used for congestion screening, location prioritization, and to track congestion at individual locations from year to year.

Additional corridor-level and intersection-level measures, such as planning time index or cost of delay, will be computed for priority locations as needed.

2. Improve the safety and security of the transportation system

Corridor and hotspot (intersection) -level crash rates for both vehicle crashes and bicycle/pedestrian crashes shall be used to assist in congested location prioritization. These performance measures are tracked in network screening lists provided to SJTPO by NJDOT and are summarized in the NJDOT Safety Management System's Safety Score. These measures are already in use for NJDOT's congestion problem statement screening process, for which the safety score is one of the ranking criteria. When evaluating CMP strategies, safety issues must be accounted for in addition to congestion.

3. Improve multimodal mobility and the accessibility of the transportation system to all users

SJTPO shall work in collaboration with NJ Transit and our subregional transit providers to develop performance measures relating to the number of transit users each year and the reliability of transit trips each year. Ideally, transit reliability shall be measured by the percentage of on-time transit trips each year. Number of passenger-trips in the SJTPO region shall also be computed on an annual basis, pending data availability. Measures relating to bicycle and pedestrian trips are more difficult to quantify, as spot counts from studies are the only available data sources. Measures relating to the deployment of ADA-enhancing projects shall also be considered.

4. Support the regional economy, protect the environment, promote goods movement, and ensure that the CMP supports the regional goals established in Transportation Matters: A Plan for South Jersey

While many regional plan goals are qualitative, others may be tracked through performance measures. Regionwide ozone emissions, already tracked for air quality conformity purposes, shall be used. Both NOx (oxides of nitrogen) and VOC (volatile organic compounds) are tracked by SJTPO through the use of the South Jersey Travel Demand Model (SJTDM) and air quality post-processing tools. These measures are generally computed for each TIP cycle, or every two years. Emissions may also be computed in project-level analyses using tools available to SJTPO such as Trafficware Synchro and NJ-AQONE (Air Quality Off-network Estimator). In addition, the region-wide truck travel time reliability index shall be computed on an annual basis.

The economic benefit of a congestion reduction project may also be estimated using the PDA Suite's User Delay Cost Analysis tool. This tool is used to estimate the cost of congestion, in dollars, as a function of the vehicle-hours of delay and a standard cost of delay for different types of vehicles. This tool is described in more detail in Appendix 2.3.

SJTPO will continue to work with its state and local planning partners to access additional data sources and develop performance measures that can meaningfully track progress toward CMP goals. Table 3.1, below, summarizes the CMP objectives and the corresponding performance measures.

Table 3.1 - CMP Performance Measures

Objectives	Performance Measures
1 Reduce congestion and improve travel time reliability	• Travel time reliability on National Highway System roadways – annual and summer season • Bottleneck ranking – annual and summer season
2 Improve the safety and security of the transportation system	• Corridor and intersection-level vehicle crash rates – total crashes in a three-year period • Corridor and intersection-level bicycle/pedestrian crash rates – total crashes in a five-year period
3 Improve multimodal mobility and the accessibility	• Transit reliability – percentage of on-time transit trips each year • Transit usage – number of trips made by transit each year • Corridor and intersection-level bicycle and pedestrian trips
4 Support the economy, environment, goods movement, and contribute toward regional goals	• Regionwide ozone precursor emissions – tons per day • Project-level emissions impact – kilograms of ozone precursors reduced per year • Truck travel time reliability index – annual

3.4. Step 4: Collect Data/Monitor System Performance

Data is collected and monitored for all the SJTPO Management Systems. Some of the data is used in the CMP as well as other systems. The data sources tie directly into the CMP Performance Measures; this is illustrated in Table 3.2, later in this section. The following is a comprehensive list of CMP Data Sources, with the PDA Suite as the primary data source. Not all of the data sources listed here are needed for the performance measures found in this report; some are used in more detailed analysis.

Data Sources:

- Prove Data Analytics (PDA) Suite
- NJDOT Highway Performance Monitoring System (HPMS)
- SJTPO Data Collection – Technical Studies and Subregional Program
- NJDOT Congested Places Screening Process
- Local Member Agencies – Stakeholder Collaboration
- NJ Transit
- Air Quality Modeling

PDA Suite

The PDA Suite is a product of the University of Maryland's CATT (Center for Advanced Transportation Technology) Lab. This project was known in prior publications as the Vehicle Probe Project. The PDA Suite is a set of analysis tools initially made available to member agencies of the I-95 corridor coalition, including the State of New Jersey, but is now available in many other parts of the nation as well. This suite of analysis tools takes vehicle probe data provided by vendors such as INRIX, HERE, and TomTom and outputs usable metrics such as travel times on individual roadways, travel time reliability scores, congestion bottleneck screening, delay cost analysis, and more. Real-time data is collected by the aforementioned vendors through smart phone navigation apps. This data is anonymously aggregated to determine travel speed on individual Traffic Message Channel (TMC) roadway segments. The real-time travel time data is useful to operating agencies such as NJDOT and the NJ Turnpike Authority, but SJTPO's primary interest is in the analysis of the archived travel time data. The archived data can be analyzed as far back as 2012 for certain major roadways, and 2014 for most collectors and arterials in the SJTPO region. The PDA Suite provides tools for computing performance measures for these roadways which have proven invaluable in the congestion planning process.

SJTPO has made use of the PDA Suite for both performance measurement and congestion screening. Performance measures, including vehicle-hours of delay, Planning Time Index (PTI), Travel Time Index (TTI), and others have been developed for all major regional roadways. Roadways have been ranked by each of these performance measures. The PDA Suite coverage in the region is extensive, including all authority roadways, state highways, and many major county and municipal arterials and collectors, allowing for a comprehensive congestion-screening tool. At a smaller scale, the PDA's Suite Bottleneck Ranking tool has been used to locate bottleneck conditions, allowing sources of recurring congestion to be identified. Appendix 2 includes a detailed description and explanation of the Bottleneck Tool, including lists of the top 10 congested state and authority roadways and lists for each county. It also includes technical reports on some of the features of this powerful tool, including congestion scans and the cost of delay.

NJDOT Highway Performance Monitoring System (HPMS)

NJDOT's HPMS collects traffic count data on many roadways throughout the state on a recurring basis. These counts may be used to determine average daily traffic on corridors and approach volumes at intersections. NJDOT also uses this data to estimate vehicle-miles traveled (VMT) by county and by roadway functional classification.

SJTPO Data Collection – Technical Studies and Subregional Program

SJTPO staff manage technical studies and projects performed by consultants. Projects may involve data collection (traffic volume counts, turning moving counts, etc.), travel time studies, or intersection delays. Recent data collection efforts include the FY 2016-2017 Traffic Data Collection project, for which 86 counts were conducted at signalized intersections throughout the region. SJTPO also receives traffic counts from its subregions as part of its Subregional Transportation Work Program.

NJDOT Congested Places Screening Process

SJTPO works collaboratively with NJDOT through the Congested Places Vetting Process to prioritize state highway locations for problem statement development. Through this process, data is made available from the NJ Congestion Management System (NJCMS), NJDOT's Transportation Data and Safety Unit, NJDOT's Freight Planning unit, and other management systems. This data is used to quantitatively rank congested locations using a number of criteria relating to congestion, safety, freight, and stakeholder input. SJTPO participates in field visits to congested locations to record traffic data and observations. SJTPO also assists in authoring the problem statement reports.

Local Member Agencies – Stakeholder Collaboration

SJTPO works closely with its subregional counties and municipalities throughout the congestion planning process. Qualitative input from planning partners is crucial to supplement the data provided by the PDA Suite and other quantitative data sources. Upon completion of the preliminary congestion screening lists, SJTPO met with each county individually to discuss the rankings. At these in-person meetings, SJTPO and its planning partners discussed each location and ensured that subregional feedback was incorporated into the finalized congested locations lists. Outlier locations were identified for further examination. Locations of high interest to subregions were noted, and each county prioritized locations for future problem statements and project development. Other input collected for each location included seasonality of congestion, safety concerns, potential strategies to improve congestion, prior studies or projects, and other information. Input from local planning partners is invaluable to the planning process, and SJTPO will continue to work with local stakeholders throughout the ongoing congestion planning process.

NJ Transit

SJTPO shall request from NJ Transit data relating to transit ridership and reliability in the region. NJ Transit operates bus lines on many major regional corridors and operates the Atlantic City Rail Line which carries passengers between Atlantic City and Philadelphia.

Air Quality Modeling

SJTPO maintains the South Jersey Travel Demand Model (SJTDM) for the purposes of air quality conformity and traffic growth modeling. The SJTDM models estimated travel volumes on major regional roadways from its base year of 2015 through 2040. Projections are based on growth in population and employment. Future-year highway projects are included in the model to determine their impacts. The SJTDM projected volume data is provided to consulting firms who run it through US Environmental Protection Agency MOVES (Motor Vehicle Emissions Simulator) software to estimate emission rates.

Table 3.2, below summarizes which data sources will be used for each performance measure identified in the previous section.

Table 3.2 – Performance Measure Data Sources

Objectives	Performance Measures	Data Source(s)
1 Reduce congestion and improve travel time reliability	• Travel time reliability on National Highway System roadways – annual and summer season • Bottleneck ranking – annual and summer season	• Probe Data Analytics Suite
2 Improve the safety and security of the transportation system	• Corridor and intersection-level vehicle crash rates – total crashes in a three-year period • Corridor and intersection-level bicycle/pedestrian crash rates – total crashes in a five-year period	• NJDOT Division of Transportation Data and Safety
3 Improve multimodal mobility and the accessibility	• Transit reliability – percentage of on-time transit trips each year • Transit usage – number of trips made by transit each year • Corridor and intersection-level bicycle and pedestrian trips	• NJ Transit • SJTPO Technical studies and subregional count data
4 Support the economy, environment, goods movement, and contribute toward regional goals	• Regionwide ozone precursor emissions – tons per day • Project-level emissions impact – kilograms of ozone precursors reduced per year • Truck travel time reliability index – annual	• SJTPO Air Quality Modeling Process • NJ-AQONE (Air Quality Off-Network Estimator) • Probe Data Analytics Suite

3.5. Step 5: Analyze Congestion Problems and Needs

Once all data are collected, the raw data must be translated into useful measures of performance. Specific locations with congestion problems present in the region or are anticipated should be addressed by using data and analysis techniques. It is vital to identify what congestion problems there are, where they are located, and what is causing them before strategies are determined. Throughout this process, stakeholder collaboration is critical. The SJTPO shall continue to work closely with its subregional counties and municipalities, as well as state agencies, while identifying and prioritizing congested locations.

According to the FHWA CMP Guidebook, when evaluating data for the purpose of defining or locating congestion problems, MPOs should consider:

- **Locations of major trip generators –** It is beneficial to have a knowledge of major trip generators and the typical traffic patterns, users, and times of high demand at these locations to fully understand the congestion issues. Examples of major trip generators are freight/intermodal facilities, major tourist attractions, stadiums/areas, universities, hospitals, major employers, airports, and major shopping centers. In the SJTPO region, travel demand is generated in shore communities such as Atlantic City, Ocean City, and Cape May.
- **Seasonal traffic variations –** Traffic patterns can vary immensely due to seasonal changes. Seasonal changes may vary depending on the area, but the different types include school-related trips, tourist/resort activity, farming and farm equipment activity, weather conditions, and/or daylight conditions. The SJTPO region experiences large variations in seasonal travel demand due to the shore communities in Atlantic and Cape May counties. Because of this, congestion performance measures shall be computed for the summer season.
- **Time-of-day traffic variations –** The highest demand may not be experienced during typical periods at all locations. For example, areas with heavy school traffic coincides with the morning peak but has an earlier afternoon peak. Areas with large employers with shift change times may have a higher demand that occurs outside the typical peak period.
- **Work trips vs. non-work trips –** Knowing and understanding the balance between work-related trips and non-work-related trips within an area can be valuable. Strategies may differ for these different trip types.

Data should be translated for correlation between the diverse levels of congestion in the region. The performance measures considered in Step 2 need to be inflicted on specific sections of the system. The FHWA CMP Guidebook recommends the following steps:

- A set of areas or corridors may be defined as “congested”. Corridors characterized as congested may then be used to indicate what activities are necessary and appropriate to address congestion.
- A ranking of corridors throughout the region may be developed. The locations could be ranked separately in categories based on the function/scale of the facility. Using the ranked lists, corridors with the highest rank based on congestion relief needs can be determined.
- As a whole, an analysis may be conducted to determine how well the region is meeting congestion management objectives denoted in Step 1.

SJTPO shall use archived operations data to develop initial screening lists of congested locations in each county. These lists will use the bottleneck ranking score provided by the PDA Suite as a preliminary ranking system. Each list shall be screened for outliers, then brought to SJTPO's subregional planning partners for discussion. SJTPO has already completed this step earlier in 2018, having met with each county to discuss congested locations and receive feedback on the top-ranked locations.

In order to determine how well (or poorly) the system is meeting the desired objectives, explicit benchmarks or targets need to be identified and used. Targets may be used to analyze the data on a corridor level, as well as a regional level. If available, more advanced analytical methods (detailed traffic modeling) could be used to determine if the system meets the desired conditions.

It is imperative to understand which congestion mitigation strategies are appropriate for each selected corridor by identifying and interpreting the causes of congestion. SJTPO will continue to conduct technical analyses and collaborate with local stakeholders and subject matter experts to further analyze identified causes of congestion.

3.6. Step 6: Identify and Assess Strategies

A wide variety of strategies, including demand management, operational improvements, and multimodal facilities/services should be identified and evaluated to address congestion. This process requires review of the research literature and outreach to subject matter experts. A number of strategies are identified in the FHWA CMP Guidebook and are included with the understanding that not all strategies are appropriate in all contexts. Innovative strategies identified as part of FHWA Every Day Counts initiatives, such as Adaptive Signal Control, shall also be considered. SJTPO will also solicit feedback from SJTPO's CMPAC.

3.6.1. Strategy Identification

The FHWA CMP Guidebook outlines these general strategy categories:

- **Reduce Demand** – for motorized vehicular capacity on the congested corridors;
- **Shift Mode of Trip** – from single-occupant vehicles to more capacity-efficient modes;
- **Improve Operations** – specifically the operational aspects of congested corridors;
- **Increase Capacity** – of the congested corridors to accommodate additional traffic.

When evaluating strategies, the four objectives identified in Step 1 shall be used. Strategies should contribute to congestion relief, but contributions to other regional objectives such as safety and multimodal mobility must also be considered. Increasing single-occupancy vehicle (SOV) capacity shall not be considered as a first choice – alternatives to additional SOV capacity shall be given priority per Federal guidance.

Strategies that will be evaluated will include, but are not limited to, the following:

Demand Management Strategies – Travel Demand Management (TDM), promoting alternatives to SOV travel, and encouraging effective land use shall be considered. Specific strategies may include promoting transit and ridesharing services, improving bicycle and pedestrian facilities, promoting flexible work hours or telecommuting programs, and promoting transit-oriented development. SJTPO shall work with planning partners at agencies such as Cross County Connections TMA to promote these and other demand management strategies. Strategies such as congestion pricing or high-occupancy vehicle (HOV) lanes may be appropriate for Authority planning partners to consider. Research into the cost-effectiveness of many TDM strategies has been compiled by FHWA and shall be reviewed.

Traffic Operations Strategies – Operational improvements should always be considered as an alternative to new SOV capacity. Research has shown that operations investments can be very cost-effective for both congestion reduction and safety improvements. Operations strategies considered shall include: traffic signal retiming, traffic signal upgrades, corridor-level signal coordination, arterial access management, restricting turning movements, geometric improvements to intersections and corridors, traffic calming, road diets, and more. Many of these strategies are already being pursued through SJTPO's CMAQ program, which has funded traffic signal upgrades and retiming efforts throughout the region. SJTPO shall also continue to work with State planning partners to bring operational improvements to state highways. NJDOT has successfully deployed Dynamic Shoulder Lane use on US-1 in South Brunswick, Middlesex County.

Intelligent Transportation Systems (ITS) Strategies – An area of special emphasis is ITS. SJTPO's participation in statewide ITS planning efforts is outlined in Section 2, earlier in this report. ITS strategies identified through FHWA Every Day Counts initiatives and by the organizations such as ITS New Jersey shall be considered. Specific strategies shall include Active Traffic Management, incident management, transit signal priority, adaptive signal control, integrated corridor management, automated traffic signal performance measures, and more. NJDOT has started to include Connected Vehicle Infrastructure in certain projects. NJDOT has also deployed Truck Safety Warning Systems at two interchanges with histories of truck rollovers.

Public Transportation Strategies – SJTPO shall work with NJ Transit and subregional transit providers to identify strategies that may improve transit accessibility and reliability in the region. Strategies may include real-time information systems for transit users, transit signal priority, bus rapid transit, improvements to bicycle and pedestrian facilities that serve as intermodal connectors, and more.

Road Capacity Strategies – Adding new capacity to a roadway network is costly and should not be carried out until alternatives can be considered. Many operations strategies have been found to be more cost-effective than roadway widenings. Road capacity strategies that shall be considered include widenings, removing bottlenecks, intersection improvements, installation of left turn lanes, interchange reconfigurations, and more. Such strategies are generally non-exempt from air quality conformity analysis, and thus the additional emissions must be modeled and included in conformity analyses. Though costly, adding new capacity can be effective in reducing congestion and improving regional mobility.

The strategies identified should be considered in collaboration with the appropriate implementing agencies and local stakeholders.

3.6.2. Strategy Assessment

Each strategy shall be assessed in comparison to the four CMP objectives outlined in Section 3.1. Strategy assessment shall be conducted collaboratively with partner agencies. Methods available to evaluate strategies include:

Research literature review – Compilations of research provided by FHWA and other agencies can provide comparisons of different strategies. Research studies come in the form of before-and-after studies, benefit-cost analyses, and more. Implementing agencies often publish white papers and similar research detailing their experiences with specific strategies.

Travel demand modeling – SJTPO maintains the South Jersey Travel Demand Model (SJTDM) for the purposes of air quality conformity and forecasting future traffic volumes. The travel demand model may be used to evaluate the impacts of capacity-enhancing projects.

Traffic simulation modeling – SJTPO has used Trafficware Synchro and SimTraffic in-house to model various proposed projects including traffic signal improvements and road diets. Simulation models may be used to determine the impact of traffic signal upgrades and retiming efforts. They can also be used to determine if intersection reconfigurations or road diets will have impacts on congestion.

Past experience or evaluations of strategies – Working with subject matter experts can yield valuable insights into which solutions have worked in the past, and which have fallen short of expectations. Strategies such as adaptive signal control may not be one-size-fits-all solutions to traffic congestion and must be applied selectively. It is important to draw from past experiences, especially on projects that cannot easily be modeled.

Technical studies – Through the SJTPO Unified Planning Work Program (UPWP), consultant-led technical studies may be conducted to evaluate strategies and provide recommendations. These studies can target individual intersections, corridors, or groups of corridors. Project development efforts conducted in the past have initiated projects in the City of Vineland, Atlantic County, Cape May County, and elsewhere in the SJTPO region. Consultants can bring outside expertise and new assessment methodologies, which are especially important when new or innovative strategies are being considered.

Each strategy should be evaluated in a local context. The project's contribution to other goals (besides congestion relief) should be considered. In many cases, SJTPO will not have control over the desired mitigation efforts. There will be projects that are jurisdiction-sensitive. Therefore, the need for proper coordination with other agencies is an evaluation factor.

The overall assessment of any project or effort will take all the above into consideration. A point system will be used to weight the various evaluation factors (cost/benefit, RTP goal contribution, Inter-agency coordination, etc.). A score for each factor will be given to the project, and each factor score will be weighted. The total of the combined weighted scores will be the score for the project.

A Balanced Approach

As stated earlier, all the elements of the CMP (strategies, techniques, etc.) are driven by the regional goals. In some cases, the region's goals may have conflicting desired results. For example, increasing speed may negatively impact safety. Therefore, strategies and the mitigation techniques selected should be considered collectively, as opposed to individually. A balanced approach ensures all the goals are addressed.

Regional and Financial Environment Considerations

Strategy and congestion mitigation techniques also consider the unique nature of the region and anticipated financial constraints. In many instances, the specific solutions recommended will depend on the types of trips using the corridor. For example, a corridor servicing primarily freight traffic will have different solutions than one servicing primarily tourism traffic. Financial considerations may limit the solutions that can be realistically employed.

3.7. Step 7: Program and Implement Strategies

CMP Strategies are implemented through the SJTPO Transportation Improvement Program (TIP), the SJTPO Unified Planning Work Program (UPWP), and through the work programs of our partner agencies. SJTPO participates in the planning process of NJDOT and other partners; it is in this capacity that SJTPO strives to implement strategies that are shared with other organizations.

Although other venues are used, the TIP programming is the most direct method of CMP strategy implementation. Therefore, the TIP should be in sync with the CMP and the RTP. CMP Strategies can be at the regional, corridor, or project levels. Examples of regional strategies are TMA activities and SJTPO's safety education outreach. Corridor strategy examples may include traffic signal coordination, addition of bicycle lanes, and operational improvements.

The strategies generated by the CMP are forwarded to the SJTPO Capital Programming Division for consideration during the TIP and UPWP programming. SJTPO also participates in the NJDOT Capital Project Delivery process by submitting problem statements for congested locations on state highways.

Programming & Implementation

For projects funded through SJTPO's TIP, the Congestion Mitigation and Air Quality Program (CMAQ) is one method of implementing congestion management strategies. CMAQ is a federal program that funds projects and programs that improve air quality and reduce traffic congestion. As such, it is well-suited for implementing projects developed under the CMP.

Any transportation project that improves air quality is eligible for CMAQ funding, including traffic flow improvements, TDM, bicycle and pedestrian facility improvements, transit projects, transportation control measures (TCM), and many other project types. In recent years, SJTPO has been allocated $1.9 million for its CMAQ program. Regional agencies submit project applications to SJTPO, which are scored based on cost-effectiveness and support of other regional goals such as safety. SJTPO staff works actively with its subregions to develop CMAQ projects each year. For more on the SJTPO CMAQ program, visit http://sjtpo.org/cmaq.

CMP projects may also be funded through the Surface Transportation Block Grant Program. This funding source has traditionally been used mainly for resurfacing projects. In addition, SJTPO subregions receive State funding that SJTPO does not administrate that may be used for CMP project implementation at the local level.

Technical studies and staff activities that contribute to the CMP may be funded through SJTPO's UPWP. In recent years, many studies have been completed including data collection efforts, concept development studies, corridor studies, and a traffic signal inventory. SJTPO can effectively bundle multiple locations together across multiple counties for administrative efficiency.

For congested locations on State highways, SJTPO can prepare problem statements to submit to the NJDOT Capital Programming Committee. Problem statements are the first step in the NJDOT

Project Delivery Process. Problem statements completed by MPOs and other agencies are evaluated by NJDOT's management systems and brought to the Capital Programming Committee for consideration for advancement to concept development. SJTPO has completed and submitted problem statements for two locations in the SJTPO region this year, and more are planned.

CMP Implementation Partners

SJTPO will work with the agencies listed below to implement many of its congestion mitigation strategies:

- NJDOT
- NJ Turnpike Authority
- SJTA
- NJ Transit
- Cross-County Connection TMA
- Atlantic, Cape May, Cumberland, and Salem Counties
- City of Atlantic City
- City of Vineland
- Rutgers University
- NJTPA
- DVRPC

3.8. Step 8: Evaluating Strategy Effectiveness

The CMP evaluation/ monitoring step is part of the continual planning improvement cycle. It is a multi-level evaluation; the projects, programs, and the entire process is monitored. The FHWA Guidebook identifies two general approaches for strategy evaluation:

1. **System-level performance evaluation** – Using region-wide or system-level performance measurement.
2. **Strategy effectiveness evaluation** - Project-level or program-level analysis of conditions before and after the implementation of a congestion mitigation effort.

Monitoring Projects and Programs

The effectiveness of each project and program will allow for improvements to those projects and program types. It may also call for entirely different projects and programs when confronted with similar issues in the future. Before-and-after studies can be conducted on projects for which good baseline data has been collected. For example, for traffic signal improvement projects, baseline traffic simulation models are typically developed and capture the "before" conditions. After the upgraded signals have been in operation for some time, the "after" conditions can be developed,

and the effectiveness of the signal upgrades can be determined. Projects that seek to promote transit, bicycle, or pedestrian modes can also be evaluated using before-and-after studies.

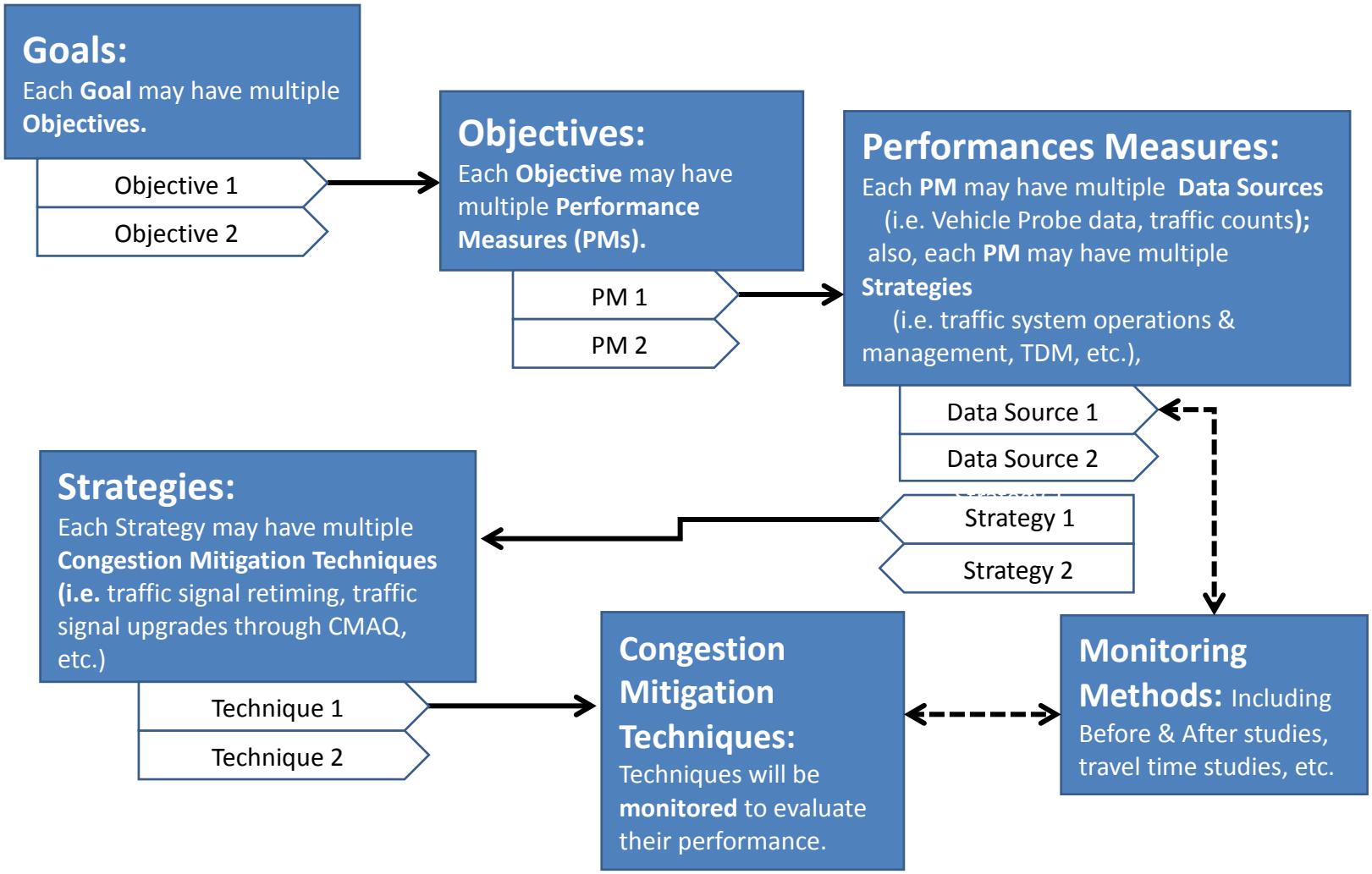
Archived operations data may also be used to evaluate strategy effectiveness for a wide variety of projects. As archived travel time data stretches back to 2014 for most of the SJTPO region, this data can serve as a "before" baseline for corridor-level projects. After improvements are made, the real-time data can be observed and compared against the baseline. For example, for the Garden State Parkway grade separation project in Cape May County, travel time and delay data can be compiled for the year prior to and the year following construction. For traffic signal improvement projects, the corridor travel time can also be evaluated using archived operations data.

3.9. Next Steps

This CMP FY2017-2020 report constitutes SJTPO's latest version of its CMP. It should be noted, however, that the CMP is continually evolving and will continue to evolve over time in conjunction with both internally generated documents and studies, such as the RTP goals and objectives, as well as external factors, such as changing planning guidelines, regional demographics and available fiscal resources.

As noted earlier, this report will be followed by a CMP Activity Report to be issued in 2020, as part of the 2040 Regional Transportation Plan Update (2020).

Appendix 1 SJTPO CMP Workflow



Appendix 2.1 PDA Suite Bottleneck Rankings

Background

Travel time data can provide an excellent basis for congestion screening. Travel time is a direct measure of roadway user experience, with high travel times indicating high delay and poor driver experience. By comparing an observed travel time to the expected free-flow travel time, the performance of the roadway can be measured.

Travel time data is becoming increasingly available and widespread in use. The primary data source used in this analysis is travel time data collected from probe vehicles and compiled by the Probe Data Analytics (PDA) Suite. The PDA Suite is a project of the University of Maryland's CATT Lab (Center for Advanced Transportation Technology). This project was formerly called the Vehicle Probe Project (VPP). The PDA Suite provides tools to retrieve archived travel time data and to analyze the data in several ways.

This travel time data is archived and is retrievable for analysis. Presently, the PDA Suite covers all authority roadways in the region (NJ Turnpike, Atlantic City Expressway, and Garden State Parkway), almost all state and US routes, and some county and local arterials and collectors.

Data for the PDA Suite is collected from GPS-enabled connected devices, including smart phones and GPS units, and is compiled by three vendors: INRIX, HERE, and TomTom. Roadways are divided into segments referenced by Traffic Message Channel (TMC) code. Urban segments are typically one-tenth to one-quarter of a mile in length, and rural segments are longer. Segments typically begin and end at major intersections. Speed data reported by probe vehicles is aggregated by segment and into 1-minute time periods; this raw data may be downloaded directly as a database or analyzed using the tools provided in the PDA Suite.

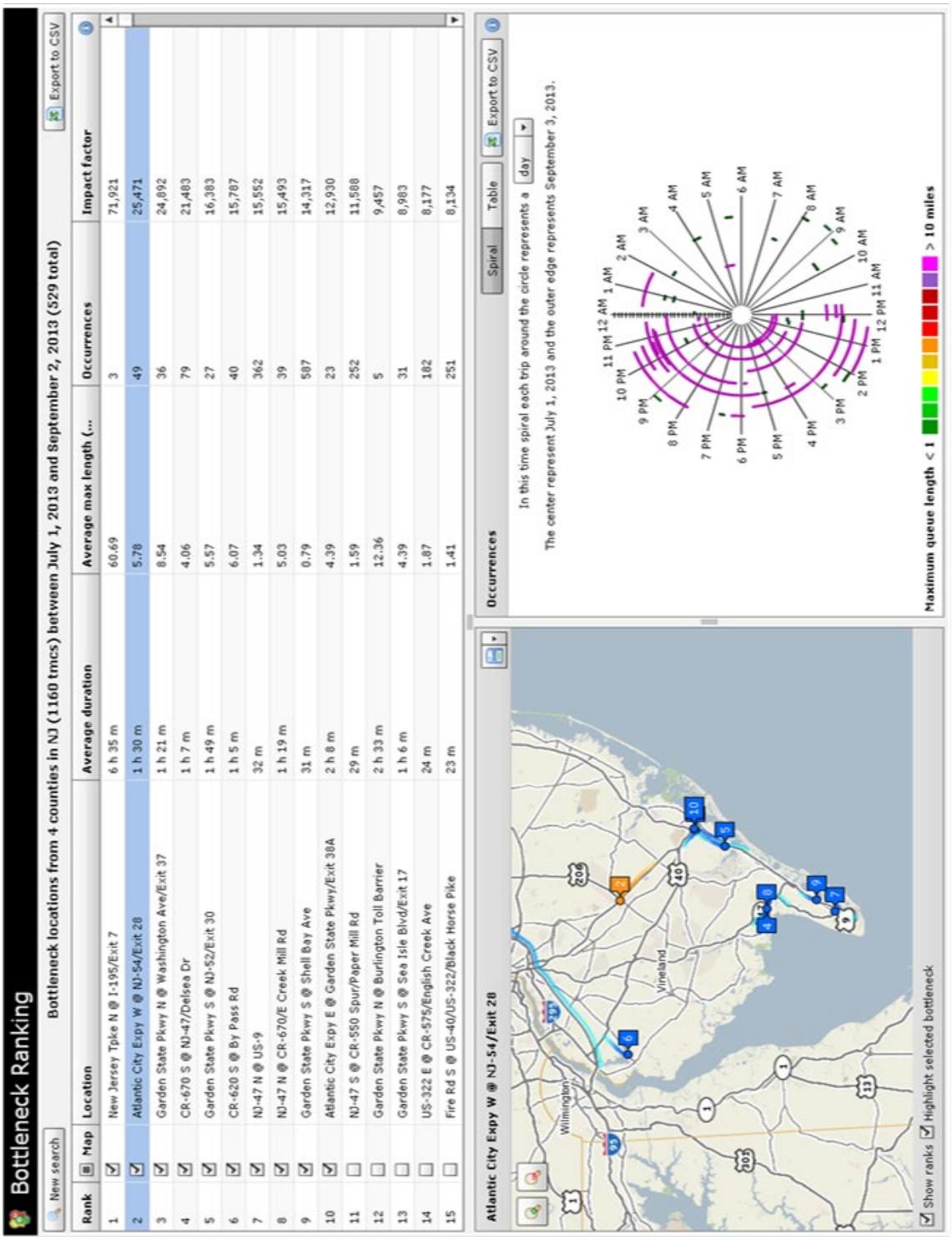
Bottleneck ranking tool

One of the tools available in the PDA Suite is the Bottleneck Ranking tool. This tool scans the archived travel time data for all roadways in a user-defined region for which there is PDA coverage. For each bottleneck, the location, average duration, average maximum bottleneck length, and number of occurrences are reported by the bottleneck tool. Bottleneck roadway segments are then ranked according to their Impact Factor, which is computed as a function of the duration, length, and frequency of the bottlenecks.

Pictured on the following page is a screenshot of the bottleneck ranking tool. This list on the top shows the top-ranked bottleneck locations for the given time period. In the bottom-left, the

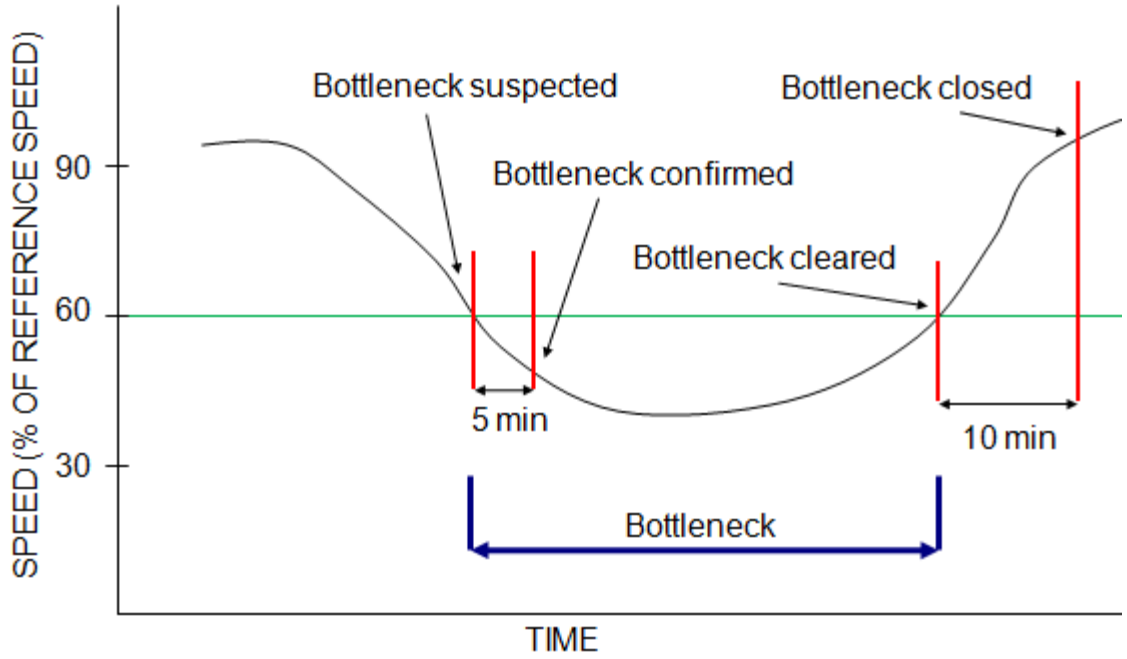
locations are mapped. In the bottom-right, the times at which bottlenecks occur are plotted on the circular graph.

Figure A2.1-1: PDA Suite bottleneck ranking tool



For each roadway segment, a reference speed is computed as the 85th percentile of the observed speeds for all time periods, with a maximum value of 65 mph. When the observed speed drops below 60% of the reference speed, a potential bottleneck is identified. If speeds remain below 60% of the reference speed for more than five minutes, the bottleneck is confirmed. The bottleneck is cleared when the roadway speed is above 60% of the reference speed for at least 10 minutes. The duration of the bottleneck is then computed as the length of time the observed speed fell below 60% of the reference speed. The figure below illustrates the methodology used to identify bottlenecks and their durations.

Figure A2.1-2- - PDA Bottleneck Criteria



Multiple adjacent roadway segments experiencing bottleneck conditions at the same time are joined together to determine the length of the bottleneck queue. In some cases, bottlenecks cause queues many miles in length. Bottlenecks of less than 0.3 miles in length are ignored by the PDA Suite Bottleneck Ranking tool. Because bottleneck queues can merge or break into multiple pieces, the tool may appear to display inconsistent numbers of bottleneck occurrences. According to PDA developers, the occurrence count includes only a single entry for each bottlenecked location, even if the queues merge or break apart before the queue completely clears.

The PDA Suite Bottleneck Ranking tool lists all bottleneck occurrences in the region in descending order of Impact Factor. The Impact Factor is calculated as the product of average bottleneck duration (in minutes), average maximum queue length (in miles), and the number of occurrences.

In this way, more severe bottlenecks (either in terms of length or duration) contribute greater weight toward the impact factor. Note that the Impact Factor does not directly take traffic volumes or roadway capacity into account. Greater volumes cause longer queues, so volume is indirectly accounted for in this way, but low-capacity roadways may appear high on the list even if they have relatively low volume. The Impact Factor should be considered in conjunction with volume data to estimate the total magnitude and cost of the bottleneck.

Methodology

The PDA bottleneck ranking tool allows up to ten years of data to be analyzed. For this report, only a one-year period was selected and analyzed (2017). The bottleneck ranking tool was utilized for each sub region individually as well as for the entire region (i.e. all four counties selected at once). As congestion in Atlantic County and Cape May County is largely seasonal, a period of three summer months was also selected: May 26st through September 4th, 2017. This period includes three major holiday weekends: Memorial Day, Fourth of July and Labor Day. All roadways for which there was PDA coverage were selected. The bottleneck tool produced a list of roadways segments ranked by total impact factor. The list serves as a data source for preliminary congestion screening, and for identifying roadway segments that are commonly overcapacity.

Listed below are a series of tables of the top ten bottlenecked locations for the SJTPO region and for each respective county for 2017, as ranked by the PDA bottlenecking ranking tool. A total of eight lists are presented. The first, Figure A2.1-3a, lists bottlenecks on state or authority roadways in the SJTPO region, defined as segments with PDA road classification of Interstate, State Route, US Route, Parkway, Turnpike, or Expressway. The second, Figure A2.1-3b, contains bottlenecks on county or local roadways in the SJTPO region, defined as PDA road classification ‘other’.

The lists were manually screened; outliers caused by erroneous data were removed, and bottlenecks originating outside of the SJTPO region and extending onto SJTPO-region road segments were also removed. Note that PDA coverage on county and local roads is not comprehensive, and the list reflects the top bottlenecks only on the limited set of county and local roads with coverage.

Table A2.1-3a. Top 10 Bottlenecked Locations—SJTPO Region (State and Authority roadways)

Rank	Location	Direction	Average duration	Average max length (miles)	Occurrences	Impact factor
1	US-322 W @ CR-575/WRANGLEBORO RD	WESTBOUND	2 h 43 m	1.44	526	79,131.83
2	CR-575 S @ US-40/US-322/BLACK HORSE PIKE	SOUTHBOUND	1 h 49 m	1.96	4	77,701.20
3	US-322 E @ CR-575/ENGLISH CREEK AVE	EASTBOUND	1 h 52 m	1.90	90	77,011.15
4	CR-575 N @ US-40/US-322	NORTHBOUND	3 h 35 m	1.19	0	72,697.67
5	CR-623 W @ GARDEN STATE PKWY	WESTBOUND	2 h 33 m	1.18	0	62,104.60
6	NJ-47 S @ NJ-83	SOUTHBOUND	1 h 05 m	2.18	127	61,916.71
7	US-322 W @FIRE RD	WESTBOUND	2 h 13 m	1.16	16	54,496.32
8	US-40 E @ NJ-50/MILL ST	EASTBOUND	5 h 40 m	0.31	0	44,554.76
9	US-40 W @NEW JERSEY TPKE	WESTBOUND	1 h 30 m	1.17	17	34,037.67
10	NJ-47 N @ NJ-83	NORTHBOUND	1 h 16 m	1.15	61	33,982.81

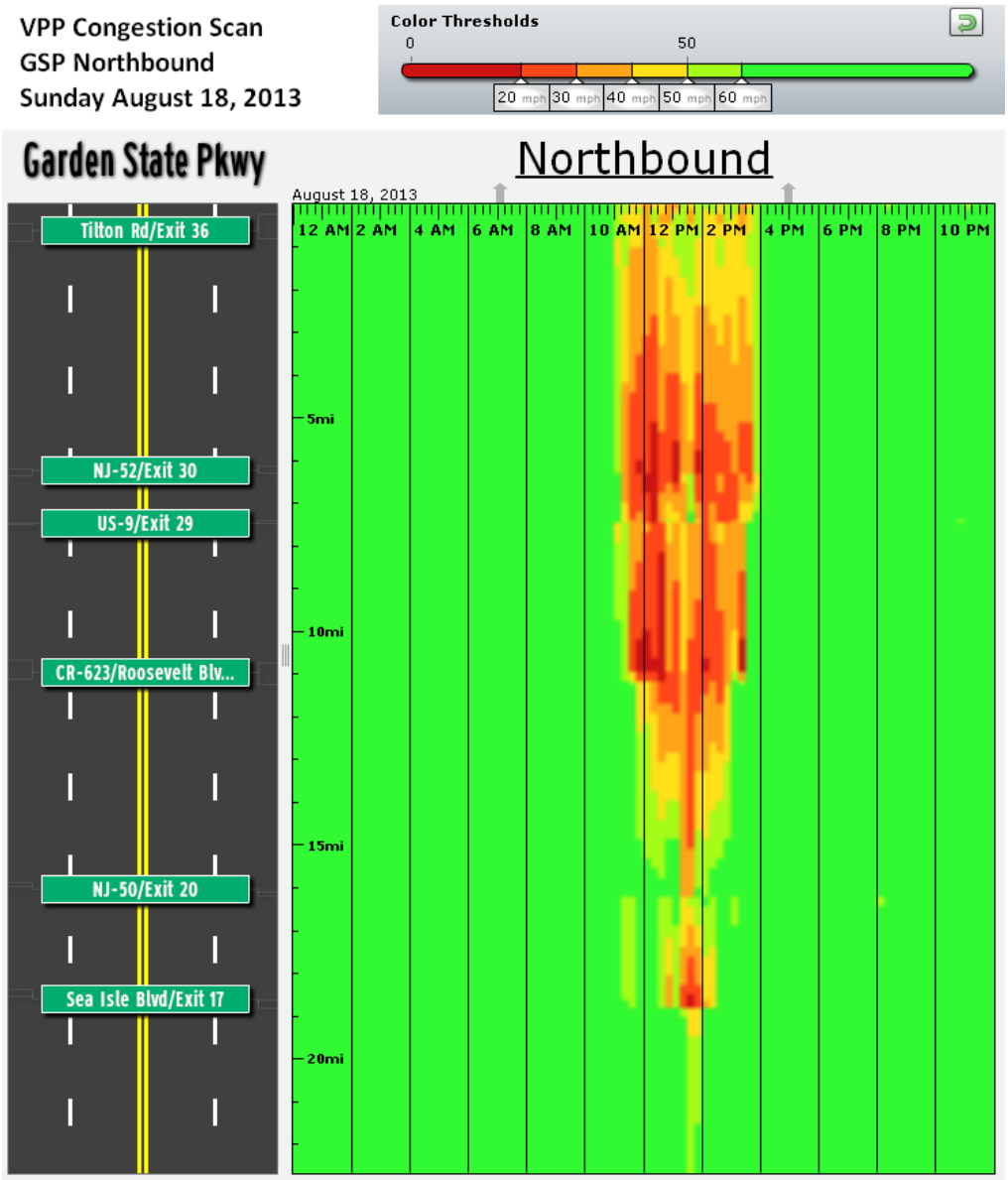
Table A2.1-3b. Top 10 Bottlenecked Locations-- SJTPO Region (County and local roadways)

Rank	Location	Direction	Average duration	Average max length (miles)	Occurrences	Impact factor
1	CR-623 E @ BAY AVE	EASTBOUND	2 h 47 m	1.13	0	63,297.59
2	RTE-563 S @ DELILAH RD/AMELIA EARHART BLVD	SOUTHBOUND	3 h 22 m	0.77	1	34,285.63
3	N MISSOURI AVE S @ ATLANTIC AVE	SOUTHBOUND	3 h 41 m	0.35	0	27,830.64
4	ATLANTIC AVE W @ N ARKANSAS AVE	WESTBOUND	1 h 33 m	0.54	9	16,866.44
5	NJ-52 N @ BAY AVE	NORTHBOUND	2 h 17 m	0.29	1	14,330.88
6	NJ-52 S @ BAY AVE	SOUTHBOUND	16 m	2.36	79	14,051.95
7	CR-623 W @ BAY AVE	WESTBOUND	2 h 57 m	0.19	0	12,246.07
8	NJ-52 S @ CENTRAL AVE	SOUTHBOUND	1 h 17 m	0.54	105	12,139.44
9	GARDEN STATE PKWY S @ CR-623/ROOSEVELT BLVD/EXIT 25	SOUTHBOUND	10 m	3.00	210	11,687.12
10	S MAIN RD S @ E SHERMAN AVE	SOUTHBOUND	10 m	2.91	0	11,546.92

Appendix 2.2 PDA Suite Congestion Scan

Background

Another tool provided by the PDA Suite is the Congestion Scan. This tool produces a graph depicting congestion by time of day and by segment along a roadway. Users can select a roadway, or portion of a roadway, along with a time period, and congestion is graphed from red (heavy congestion) to green (no congestion) as a function of the percentage of the free-flow speed. The raw speed data may be plotted as well, as in the graph below.



This congestion scan shows congestion that occurred on the Garden State Parkway in the summer of 2013. The horizontal axis is the time of day, the vertical axis is the location on the roadway, and the color indicates the average speed at that location and time. In this scan, the congestion began around 11:00 AM and cleared up around 4:00 PM. On a nearly 20-mile stretch of the Parkway in Atlantic and Cape May counties, speeds fell from above 60 mph to less than 40 mph, with patches of dark red indicating speeds below 20 mph at sometimes. As this congestion was in the northbound direction on a Sunday afternoon, it was likely caused by visitors to the shore heading home at the end of the weekend. Congestion is worse north of CR-623, which carries traffic from Ocean City onto the Parkway, indicating that this additional northbound traffic caused the Parkway to become over-capacity.

Congestion scans allow users to gain a clear picture of the extent and severity of congestion and can help locate the causes of bottlenecks. The congestion scan tool works well in conjunction with the bottleneck ranking tool. As congested segments are screened on a regional level by the bottleneck ranking tool, these segments may then be examined at a closer level using the congestion scan tool.

Appendix 2.3 PDA Suite Cost-of-Delay Analysis

Background

Another tool provided by the PDA Suite is the User Delay Cost Analysis. This tool allows users to estimate the total cost of congestion by assigning an average cost to each vehicle-hour of delay. The user may select any roadway, collection of roadways, or region to analyze. The user may also select a time period. A speed threshold may be defined as a function of the historic average speed, the free-flow speed, or an absolute speed (such as the speed limit). Delay is calculated as the difference between travel time at the free-flow speed and the travel time at the delay threshold speed. For each vehicle-hour of delay, a dollar value is assigned. By default, these values are:

- **Passenger vehicles:** $16.79/veh-hr
- **Commercial vehicles:** $86.81/veh-hr

These values are based on research conducted by the Texas Transportation Institute and are commonly used in cost-of-delay studies. When the delay cost report is run, a table is provided which lists the cost of delay for each hour of each day in the designated time period, along with the total delay cost.

The tables below show an example cost-of-delay analysis for the Garden State Parkway for a typical Friday-Saturday-Sunday period in August of 2013. In the first table, the columns show the total vehicle-hours of delay for each hour and day. The second table shows the cost of delay, in dollars, for this delay.

Table A2.3-1: PDA Suite Vehicle-hours of delay on the Garden State Parkway

(Atlantic and Cape May counties)

	12 AM	1 AM	2 AM	3 AM	4 AM	5 AM	6 AM	7 AM	8 AM	9 AM	10 AM	11 AM
8/16/13	0	0.07	0	0	0	0	0	0	0.42	2.72	0	0
8/17/13	0	0.63	0	0.06	0.08	0	4.26	0.22	0	0.33	26.42	74.3
8/18/13	44.11	53.07	0.82	0	0	0.06	0	0.65	1.57	0	0.91	175.81
Hourly totals	**44.11**	**53.77**	**0.82**	**0.06**	**0.08**	**0.06**	**4.26**	**0.87**	**1.99**	**3.05**	**27.33**	**250.11**

	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	8 PM	9 PM	10 PM	11 PM	Daily Totals
8/16/13	0.5	0	0	0	0	0	0.55	0.64	0.38	0	0	0	5.28
8/17/13	235.3	245.1	100.0	14.4	0	0.89	0	1.43	2.03	1.12	2.78	1	710.6
8/18/13	389.7	498.1	467.5	401.6	306.9	82.08	0	0	0	4.18	1.58	0	2,428.98
Hourly totals	**625.6**	**743.3**	**567.6**	**416.0**	**306.9**	**82.97**	**0.55**	**2.07**	**2.41**	**5.3**	**4.36**	**1**	**3,144.86**

As seen in the table above, this Friday-Saturday-Sunday period experienced 3,145 vehicle-hours of delay on the Parkway in the SJTPO region. Using these delay estimates, the cost-of-delay values can be applied to obtain delay cost estimates, in dollars, as seen in the following table.

Table A2.3-2: VPP Cost of delay, in dollars, on the Garden State Parkway

(Atlantic and Cape May counties)

	12 AM	1 AM	2 AM	3 AM	4 AM	5 AM	6 AM	7 AM	8 AM	9 AM	10 AM	11 AM
8/16/13	0	2	0	0	0	0	0	0	16	102	0	0
8/17/13	0	24	0	2	3	0	160	8	0	12	989	2782
8/18/13	1652	1987	31	0	0	2	0	24	59	0	34	6583
Hourly totals	**$1,652**	**$2,013**	**$31**	**$2**	**$3**	**$2**	**$160**	**$32**	**$74**	**$114**	**$1,024**	**$9,365**

	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	8 PM	9 PM	10 PM	11 PM	Daily Totals
8/16/13	19	0	0	0	0	0	21	24	14	0	0	0	$198
8/17/13	8813	9179	3747	540	0	33	0	53	76	42	104	37	$26k
8/18/13	14595	18654	17507	15039	11493	3073	0	0	0	157	59	0	$90k
Hourly totals	**$23k**	**$27k**	**$21k**	**$15k**	**$11k**	**$3k**	**$21**	**$77**	**$90**	**$199**	**$163**	**$37**	**$117k**

As seen in the table above, the 3,145 vehicle-hours of delay are estimated by the PDA to cost approximately $117,000, according to the delay-cost figures provided by the Texas Transportation Institute. The cost of delay for the entire year of 2013 is estimated at $2.4 million by the PDA Suite, and this figure may be used to help justify the cost of congestion-relief improvements.

Appendix 2.4 PDA Suite Bottleneck Ranking Lists for SJTPO Region

A one-year period from January 1, 2017 to December 31, 2017 was selected and analyzed. The bottleneck ranking tool was utilized for each sub region individually for each county's feedback. As congestion in Atlantic County and Cape May County is largely seasonal, a period of three summer months was also selected: May 26st through September 4th, 2017. This period includes three major holiday weekends: Memorial Day, Fourth of July and Labor Day. All roadways for which there was PDA coverage were selected. The bottleneck tool produced a list of roadways segments ranked by total impact factor.

Each county list obtained from the PDA Suite was reviewed by each county's engineers, where in-person meetings were held with each of the four counties to discuss their qualitative input at the locations listed. The counties provided their highest priority congestion locations that could be submitted as a problem statement to NJDOT. All feedback from the county and from SJTPO's screening has been incorporated into this section. For example, some locations were thought to be outliers by the counties and SJTPO, so those locations should be crossed off the list. Some counties provided congested locations that were not on the PDA list, but should be added to the list.

Listed on the following pages are a series of tables of the top twenty bottlenecked locations for the SJTPO region and for each respective county for 2017, as ranked by the PDA bottlenecking ranking tool. The counties feedback is included in the notes column in the tables. A total of seven lists are presented. Figure A2.4-1 lists bottlenecks on state and county/local roadways in the SJTPO region for an entire year. The second, Figure A2.4-2a, lists bottlenecks on state and county/local roadways in Atlantic County for a one-year period. The third, Figure A2.4-2b, lists bottlenecks for a period of three summer months in Atlantic County to account for the seasonal congestion. Similarly, Figure A2.4-3a contains bottlenecks, for a one-year period, on state and county/local roadways in Cape May County, whereas Figure A2.4-3b contains bottlenecks for the congested summer months. Figure A2.4-4 and Figure A2.4-5 lists bottlenecks for a one-year period on state and county/local roadways in Cumberland County and Salem County, respectively.

Table A2.4-1. Top 20 Bottlenecked Locations—SJTPO Region, 12-month rank (2017)

Rank	Location	Average duration	Average max length (miles)	Impact Factor	Notes
1	US-322 W @ CR-575/WRANGLEBORO RD	2 h 43 m	1.44	79,131.83	
2	CR-575 S @ US-40/US-322/BLACK HORSE PIKE	1 h 49 m	1.96	77,701.20	
3	US-322 E @ CR-575/ENGLISH CREEK AVE	1 h 52 m	1.90	77,011.15	
4	CR-575 E @ BAY AVE	3 h 35 m	1.19	72,697.67	Some false positives (outliers)
5	CR-623 E @ BAY AVE	2 h 47 m	1.13	63,297.59	Some false positives (outliers)
6	CR-623 W @ GARDEN STATE PKWY	2 h 33 m	1.18	62,104.60	
7	NJ-47 S @ NJ-83	1 h 05 m	2.18	61,916.71	
8	US-322 W @ FIRE RD	2 h 13 m	1.16	54,496.32	
9	US-40 E @ NJ-50/MILL ST	5 h 40 m	0.31	44,554.76	
10	RTE-563 S @ DELILAH RD/AMELIA EARHART BLVD	3 h 22 m	0.77	34,285.63	
11	US-40 W @ NEW JERSEY TKPE	1 h 30 m	1.17	34,037.67	
12	NJ-47 N @ NJ-83	1 h 16 m	1.15	33,982.81	
13	NEW JERSEY TPKE S @ I-295/US-40/NJ-49/1ST AVE/EXIT 1	43 m	1.63	33,858.87	
14	US-322 W @ CR-585/S MAIN ST	34 m	2.52	31,702.15	
15	NJ-49 W @ NJ-55	44 m	1.74	30,809.00	Some false positives (outliers)
16	NJ-47 N @ US-9	2 h 41 m	0.53	30,212.10	
17	NJ-47 N @ CR-670/E CREEK MILL RD	19 m	4.11	30,160.94	
18	GARDEN STATE PKWY N @ ATLANTIC CITY EXPY/EXIT 38	28 m	2.97	29,528.06	
19	US-40 W @ NJ-45/N MAIN ST	20 m	3.89	28,863.47	
20	NJ-50 S @ US-40/MILL ST/CAPE MAY AVE	3 h 28 m	0.39	28,129.42	

Table A2.4-2a. Top 20 Bottlenecked Locations—Atlantic County, 12-month rank (2017)

Rank	Location	Average duration	Average max length (miles)	Impact Factor	Notes
1	US-322 W @ CR-575/WRANGLEBORO RD*	2 h 43 m	1.44	79,131.83	
2	CR-575 S @ US-40/US-322/BLACK HORSE PIKE	1 h 49 m	1.96	77,701.20	
3	US-322 E @ CR-575/ENGLISH CREEK AVE*	1 h 52 m	1.90	77,011.15	Left turn lane is not long enough, dualize left turn slot
4	CR-575 N @ US-40/US-322	3 h 35 m	1.19	72,697.67	Some false positives (outliers)
5	US-322 W @ FIRE RD	2 h 13 m	1.16	54,496.32	
6	US-40 E @ NJ-50/MILL ST	5 h 40 m	0.31	44,554.76	
7	NJ-54 N @ NJ-542/CENTRAL AVE/HORTON ST	56 m	1.94	39,453.68	Should be lower on list, no current congestion problem
8	GARDEN STATE PKWY N @ WASHINGTON AVE/EXIT 37	29 m	3.56	36,338.16	Should be lower on list, no current congestion problem
9	US-40 W @ OLD EGG HARBOR RD	22 m	4.25	34,291.49	Should be lower on list, no current congestion problem
10	RTE-563 S @ DELILAHA RD/AMELIA EARNHART BLVD	3 h 22 m	0.77	34,285.63	
11	US-322 W @ CR-585/S MAIN ST	34 m	2.52	31,702.15	Critical problem area, backs up 3-5 pm both north and south
12	GARDEN STATE PKWY N @ ATLANTIC CITY EXPY/EXIT 38	28 m	2.97	29,528.06	Construction is taking place now, new additional lane
13	NJ-50 S @ US-40/MILL ST/CAPE MAY AVE	3 h 28 m	0.39	28,129.42	
14	N MISSOURI AVE S @ ATLANTIC AVE	3 h 41 m	0.35	27,830.64	
15	US-322 W @ CR-575/ENGLISH CREEK AVE	41 m	1.89	27,451.73	Left turn lane is too short on westbound
16	US-9 N @ W DELIAH RD	2 h 46 m	0.49	27,211.09	Need better turning lanes and signals, AM/PM peak congestion
17	US-30 E @ US-9/NEW RD	2 h 31 m	0.55	26,363.05	Traditional PM peaks
18	US-40 W @ NJ-50/MILL ST	3 h 43 m	0.38	25,679.86	Bad congested location especially in summer, AM/PM peaks, needs to permit turns on red, add detection
19	US-322 E @ CAPTAIN JOHN A O'DONNELL PKWY	4 h 02 m	0.31	25,115.50	
20	US-322 E @ DOUGHTY RD*	55 m	1.29	24,608.86	No left turn slots, left turns not permitted, short queues, needs geometric improvements

**Suggested location by the county for a problem statement*

Table A2.4-2b. Top 20 Bottlenecked Locations—Atlantic County, Summer months rank (2017)

12-month rank	Summer Rank	Location	Average duration	Average max length (miles)	Impact Factor
8	1	GARDEN STATE PKWY N @ WASHINGTON AVE/EXIT 37	4.95	1 h 02 m	32,128.13
12	2	GARDEN STATE PKWY N @ ATLANTIC CITY EXPY/EXIT 38	4.45	49 m	22,617.69
1	3	US-322 W @ CR-575/WRANGLEBORO RD	1.55	2 h 24 m	20,787.96
4	4	CR-575 N @ US-40/US-322	1.14	3 h 38 m	19,190.49
6	5	US-40 E @ NJ-50/MILL ST	0.32	7 h 30 m	18,645.96
2	6	CR-575 S @ US-40/US-322/BLACK HORSE PIKE	1.95	1 h 25 m	16,836.29
3	7	US-322 E @ CR-575/ENGLISH CREEK AVE	1.89	1 h 27 m	16,671.73
45	8	ATLANTIC CITY EXPY E @ GARDEN STATE PKWY/EXIT 38A	2.17	58 m	13,905.06
7	9	NJ—54 N @ NJ-542/CENTRAL AVE/HORTON ST	1.95	1 h 01 m	12,189.18
5	10	US-322 W @ FIRE RD	1.14	1 h 34 m	10,686.87
10	11	RTE-563 S @ DELILAH RD/AMELIA EARHART BLVD	0.79	3 h 38 m	10,481.95
99	12	GARDEN STATE PKWY N @ US-40/US-322/BLACK HORSE PIKE	3.62	32 m	9,879.45
39	13	GARDEN STATE PKWY N @ TILTON RD/EXIT 36	3.45	27 m	9,479.06
9	14	US-40 W @ OLD EGG HARBOR RD	4.25	21 m	9,477.46
74	15	NJ-52 S @ US-9/NEW RD	0.47	3 h 04 m	8,870.48
14	16	N MISSOURI AVE S @ ATLANTIC AVE	0.35	4 h 08 m	8,714.47
13	17	NJ-50 S @ US-40/MILL ST/CAPE MAY AVE	0.35	4 h 08 m	8,248.48
19	18	US-322 E @ CAPTAIN JOHN A O'DONNELL PKWY	0.29	5 h 07 m	8,173.81
53	19	NJ-52 N @ US-9/NEW RD	0.38	4 h 02 m	7,727.25
23	20	NJ-54 S @ ATLANTIC CITY EXPY	1.98	39 m	7,655.90

In addition to the locations on both lists above, the county also stated that the following congested locations are missing from the list and should be added:

- NJ-49 @ River Road – Also formally known as "Sugar Hill Circle". This location has a lot of congestion in the summer.
- US-322 @ McKee Avenue – This location has a lot of congestion, where the PM peak hours have the worst congestion. The county suggested that a problem statement should be written for this location. A third lane is needed to accommodate the westbound congestion along with the PM peak hours congestion. Purchase of 20 feet of right-of-way can fix the bottleneck problem.

Table A2.4-3a. Top 20 Bottlenecked Locations—Cape May County, 12-month rank (2017)

Rank	Location	Average duration	Average max length (miles)	Impact Factor	Notes
1	CR-623 E @ BAY AVE	2 h 47 m	1.13	63,297.59	Congestion will be addressed with county project
2	CR-623 W @ GARDEN STATE PKWY	2 h 33 m	1.18	62,104.60	Congestion will be addressed with county project
3	NJ-47 S @ NJ-83*	1h 05 m	2.18	61,916.71	Congestion and safety issues
4	NJ-47 N @ NJ-83	1 h 16 m	1.15	33,982.81	
5	NJ-47 N @ US-9	2 h 41 m	0.53	30,212.10	
6	NJ-47 N @ CR-670/E CREEK MILL RD	19 m	4.11	30,160.94	
7	NJ-50 N @ NJ-49	31 m	2.23	26,458.87	
8	NJ-83 W @ NJ-47/DELSEA DR	4 H 36 M	0.92	21,926.98	Omit - False positives, should not me on list
9	CR-670 S @ NJ-47/DELSEA DR	15 m	3.39	18,611.87	
10	NJ-47 S @ GARDEN STATE PKWY	1 h 23 m	0.60	17,263.54	
11	NJ-50 N @ US-9/SHORE RD	2 h 34 m	0.37	17,113.46	Should be lower on list now since resurfacing project complete (congestion improved)
12	US-9 N @ NJ-83	1 h 22 m	0.74	16,278.23	Some false positives (outliers)
13	CR-623 W @ US-9	4 h 48 m	0.26	15,201.96	Congestion will be addressed with county project
14	NJ-52 N @ BAY AVE	2 h 17 m	0.29	14,330.88	Some false positives (outliers)
15	NJ-52 S @ BAY AVE	16 m	2.36	14,051.95	
16	NJ-47 N @ GEORGE REDDING BRIDGE	52 m	0.71	13,364.21	Cape May is addressing issues, widening road (Gateway Project)
17	CR-623 E @ GARDEN STATE PKWY	2 h 50 m	0.22	13,279.02	
18	NJ-47 N @ CR-657/BEAVER DAM RD	11 m	3.11	12,997.37	
19	AVALON BLVD W @ US-9	1 h 16 m	0.44	12,251.36	
20	CR-623 W @ BAY AVE	2 h 57 m	0.19	12,246.07	Congestion will be addressed with county project

**Suggested location by the county for a problem statement*

Table A2.4-3b. Top 20 Bottlenecked Locations—Cape May County, Summer months rank (2017)

12-month rank	Summer Rank	Location	Average duration	Average max length (miles)	Impact Factor
3	1	NJ-47 S @ NJ-83	2 h 24 m	2.61	45,591.23
4	2	NJ-47 N @ NJ-83	2 h 29 m	1.51	22,749.03
7	3	NJ-50 N @ NJ-49	1 h 17 m	2.31	18,996.05
6	4	NJ-47 N @ CR-670/E CREEK MILL RD	37 m	4.62	18,449.57
8	5	NJ-83 W @ NJ-47/DELSEA DR**	6 h 39 m	1.12	14,815.34
9	6	CR-670 S @ NJ-47/DELSEA DR	40 m	3.39	14,130.10
5	7	NJ-47 N @ US-9	3 h 57 m	0.54	12,855.81
11	8	NJ-50 N @ US-9/SHORE RD	4 h 04 m	0.44	9,690.98
15	9	NJ-52 S @ BAY AVE	40 m	2.36	9,300.08
12	10	US-9 N @ NJ-83	2 h 33 m	0.80	8,955.60
22	11	NJ-49 E @ CR-617/WOODBINE RD	24 m	3.07	8,379.18
16	12	NJ-47 N @ GEORGE REDDING BRIDGE	1 h 51 m	0.74	8,302.58
19	13	AVALON BLVD W @ US-9	2 h 44 m	0.44	7,407.90
21	14	NJ-52 S @ CENTRAL AVE	2 h 16 m	0.70	7,175.42
10	15	NJ-47 S @ GARDEN STATE PKWY	1 h 56 m	0.65	7,134.57
29	16	NJ-47 S @ PACIFIC AVE	1 h 18 m	0.94	7,102.83
18	17	NJ-47 N @ CR-657/BEAVER DAM RD	20 m	3.29	6,890.52
24	18	GARDEN STATE PKWY S @ CR-623/ROOSEVELT BLVD/EXIT 25	19 m	3.14	6,343.52
14	19	NJ-52 N @ BAY AVE	3 h 37 m	0.29	6,311.98
36	20	NJ-49 E @ NJ-50/CR-557	16 m	3.56	6,189.72

***Location should not be on the list – false positive (outliers)*

Table A2.4-4. Top 20 Bottlenecked Locations—Cumberland County, 12-month rank (2017)

Rank	Location	Average duration	Average max length (miles)	Impact Factor	Notes
1	CR-553 N @ HALEYVILLE RD	23 m	4. 19	36,146.88	Omit - False positives, should not me on list
2	NJ-49 W @ NJ-55	44 m	1.74	30,809.00	Shore congestion
3	NJ-47 N @ NJ-49/E MAIN ST*	13 m	5.11	25,535.21	Traditional peak congestion
4	NJ-47 N @ CR-548/BROADWAY ST	36 m	1.74	23,671.82	
5	CR-670 N @ NJ-47/MAURICETOWN CROSSWAY RD*	43 m	1.50	23,566.79	
6	CR 670 W @ E BUCKSHUTEM RD	41 m	1.51	22,907.41	Omit - False positives, should not me on list
7	NJ-55 @ SCHOONER LANDING RD/EXIT 21	25 m	2.47	22,879.35	
8	NJ-47 S @ NJ-55 (MILLVILLE)*	1 h 16 m	1.07	22,795.34	
9	CR-555/CHURCH ST S @ CR-553/MAIN ST	7 m	6.47	18,739.49	Omit - False positives, should not me on list
10	NJ-47 N @ NJ-55 (VINELAND)	1 h 27 m	0.68	18,473.78	
11	W SHERMAN AVE E @ NJ-47/S DELSEA DR*	50 m	1.00	18,215.95	
12	NJ-49 E @ CARMEL RD/BEECH ST	13 m	3.86	17,686.15	
13	NJ-77 S @ CR-659/WEATHERBY RD	35 m	1.33	16,911.99	
14	NJ-55 S @ NJ-47	1 h 18 m	0.53	16,804.98	
15	NJ-49 W @ CR 634	11 m	3.73	16,056.96	Omit - False positives, should not me on list
16	NJ-49 E @ CR-548/WEATHERBY RD	4 m	8.56	14,693.16	Should be removed from list and put on Cape May County's list
17	NJ-49 E @ NJ-47/2ND ST	1 h 42 m	0.43	14,431.82	
18	NJ-47 N @ W LANDIS AVE	2 h 28 m	0.47	14,251.93	Some false positives
19	NJ-49 W @ CEDAR ST	1 h 29 m	0.49	13,478.59	
20	HALEYVILLE RD W @ MAIN ST	9 m	3.84	13,112.09	Omit - False positives, should not me on list

**Suggested location by the county for a problem statement*

In addition to the locations on both lists above, the county also stated that the following congested locations are missing from the list and should be added:

- NJ-49 @ NJ 77
- NJ-47/Delsea Drive @ Sharp St

Table A2.4-5. Top 20 Bottlenecked Locations—Salem County, 12-month rank (2017)

Rank	Location	Average duration	Average max length (miles)	Impact Factor	Notes
1	INDUSTRIAL PARK RD W @ RIVIERA DR	1 h 49 m	1.08	42,906.76	Omit - False positives, should not me on list
2	US-40 W @ NEW JERSEY TPKE	1 h 30 m	1.17	34,037.67	
3	NEW JERSEY TPKE S @ I-295/US-40/NJ-49/1ST AVE/EXIT 1	43 m	1.63	33,858.87	
4	HARVARD RD E @ FORT MOTT RD	1 h 23 m	1.09	33,160.22	Omit - False positives, should not me on list
5	US-40 W @ NJ-45/N MAIN ST	20 m	3.89	28,863.47	
6	CR-620 N @ US-40/HARDING HWY	51 m	1.49	27,241.47	Omit - False positives, should not me on list
7	US-40 E @ NEW JERSEY TPKE	4 h 27 m	0.26	25,205.87	
8	NJ-45 N @ CR-603/WOODSTOWN ALLOWAY RD	1 h 22 m	0.67	19,853.90	
9	W MILL ST N @ PORCUPINE RD/W MILL ST	1 h 28 m	0.81	19,486.77	Omit - False positives, should not me on list
10	US-40 E @ NJ-45/N MAIN ST	1 h 22 m	0.65	19,391.98	
11	US-40 E @ NJ-48/HARDING HWY	14 m	3.53	19,073.27	
12	FORT MOTT RD S @ LIGHTHOUSE RD/LEHIGH RD	1 h 19 m	0.68	19,017.55	Omit - False positives, should not me on list
13	US-40 E @ NJ-45/CR-616/BAILEY ST	32 m	1.60	18,604.35	
14	HIGHLAND AVE W @ RIVIERA DR	1 h 14 m	0.67	18,108.66	Omit - False positives, should not me on list
15	FORT MOTT RD S @ ISSAC DR	28 m	1.74	17,609.12	Omit - False positives, should not me on list
16	LIGHTHOUSE RD W @ FORT MOTT RD	21 m	2.18	17,080.16	Omit - False positives, should not me on list
17	NJ-77 N @ HARRISONVILLE WAY/FERRELL RD	10 m	4.21	16,669.56	
18	NJ-77 S @ US-40/POLE TAVERN WOODSTOWN RD	1 h 09 m	1.02	16,616.70	
19	US-40 E @ N MAIN ST	12 m	3.51	16,373.75	
20	N GOLFWOOD AVE S @ PENNSGROVE AUBURN RD	16 m	2.76	15,989.81	Omit - False positives, should not me on list