
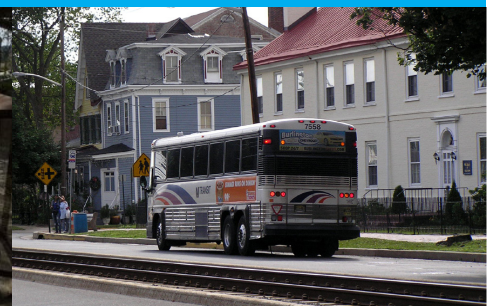

Evaluating Opportunities for Transit Signal Priority in Southern New Jersey

DELAWARE VALLEY
dvrpc
REGIONAL
PLANNING COMMISSION

December 2015

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Executive Summary

Transit agencies are increasingly looking to prioritize operational enhancements that can be implemented at relatively low cost, such as Transit Signal Priority (TSP). This report details a method of scoring corridors on their likelihood for successful and cost-effective TSP and related signal investments. The study team has built upon prior data gathering, analysis, and mapping work to refine a TSP prioritization framework. This framework was developed in 2013 as a part of the Delaware Valley Regional Planning Commission's (DVRPC) publication, *Transit Signal Priority Favorability Score: Development and Application in Philadelphia and Mercer County*, which identified the corridors where TSP was likely to be the most effective and have the greatest operational benefits for transit and all road users, drawing on measures that were (a) available at the corridor or county level, (b) were simple and legible, and (c) related to anticipated TSP success, either positively or negatively. To inform project decision making in Mercer, Burlington, Camden, and Gloucester counties (southern New Jersey), DVRPC staff adapted this set of criteria to evaluate and compare prospective TSP corridors. These criteria are based on a review of industry best practices and available data sources.

Once all of the criteria were mapped and their numerical values were assigned to segments across southern New Jersey's network, each segment was assigned scores for each criterion. These criteria-level scores were then added to create the composite TSP Favorability Score for each segment. The highest possible TSP Favorability Score that a segment could achieve was 50. This study can be used as a guideline for southern New Jersey counties and New Jersey Transit (NJ Transit) to select the locations, technology, and routes that will be most useful for the implementation of TSP.

ES Table 1 summarizes the Top 10 TSP Favorability Scores for road segments in southern New Jersey.

ES Table 1: Top 10 TSP Favorability Scores by Segment for Camden, Gloucester, Burlington, and Mercer Counties

Rank	Bus Routes	TSP Score	Street Segment	Municipality
1	400	44	Mt. Ephraim Ave. between Kaighns Ave. and Ferry Ave.	City of Camden
1	401, 402, 410, 412, 450, 452, 453, 457, 460	44	Broadway Tpk. between Penn St. and Walnut St.	City of Camden
1	455, 457	44	Kings Hwy./Chews Landing Rd. between Tanner St. and Bradshaw Ave.	Haddonfield Borough
1	400, 403, 451, 460	44	Haddon Ave. between Federal St. and Pine St E.	City of Camden
1	608, 610	44	W. State St. between Gouverneur Ave. and Taylor Pl.	City of Trenton
1	409, 603, 613	44	South Broad St. between Market St. and Chestnut Ave.	City of Trenton
1	600, 624, 611	44	Perry St. between North Warren St. and S. Clinton Ave.	City of Trenton
1	603, 613	44	US 206 S. between N. Rose St. and US 206 N.	City of Trenton
9	409, 418, 600, 601, 606, 608, 609, 611, 619	43	E. State St. between Montgomery St. and S. Clinton Ave.	City of Trenton
10	400	42	Mt. Ephraim Ave. between Haddon Ave. and Kaighns Ave.	City of Camden

Source: DVRPC, 2015

Chapter 1: Introduction

Transit agencies are increasingly looking to prioritize operational investments that can be implemented at relatively low cost, such as TSP. This study applies a method of scoring corridors (developed by DVRPC) and considers their likelihood for successful and cost-effective TSP and related signal investments. The study team has built upon prior data gathering, analysis, and mapping work to refine a TSP prioritization framework. The screening tool that was developed identifies the corridors where TSP is likely to be most effective and have the greatest operational benefits for transit and all road users, drawing on measures that are (a) available at the corridor or county level, (b) simple and legible, and (c) transparently related to anticipated TSP success, either positively or negatively.

DVRPC's 2013 publication, *Transit Signal Priority Favorability Score: Development and Application in Philadelphia and Mercer County*, compiled a set of weighted criteria to assess the likely effectiveness of TSP along corridors based on a review of industry best practices and available data sources. The favorability scores that were developed using the weighted criteria were ranked by segment, route, and proposed route for each geography.

Continuing that type of analyis, DVRPC analyzed the four southern New Jersey counties within the DVRPC Region—Camden, Burlington, Mercer (updated), and Gloucester—for their TSP Favorability. This report details a method of scoring corridor segments based on their likelihood for successful TSP. This project was funded by the NJ Transit Support Program.

TSP Description, Objectives, and Cost Savings

Public transit vehicles in the Delaware Valley region (buses, trackless trolleys, and trolleys) commonly operate on roadways without dedicated lanes. During peak periods, when roadways are typically congested, signal delay can significantly impair transit running times, especially where there is short intersection spacing, making service less reliable for passengers. One tool for enhancing service is TSP, or, providing public transportation vehicles with preferential treatment at traffic signals. The primary objectives of TSP are to decrease transit travel times, improve schedule adherence, mitigate emissions, relieve congestion, and potentially reduce headways where time savings are sufficient to make that possible.

TSP is a modification of the phase split times of a traffic signal. In some cases, the approaching transit vehicle receives a green phase whenever it arrives at the signal (signal preemption). Generally, however, the green phase is extended or the red phase truncated (signal priority) to provide more time for the transit vehicle to pass through the intersection. TSP can be implemented at a single intersection or at a number of intersections along a transit corridor. Signal times given to the transit vehicle upon TSP actuation are generally recovered on the following signal cycle or cycles, still allowing for signal loop coordination. TSP is particularly effective when combined with complementary time savings strategies, such as stop consolidation or the relocation of near-side bus stops to the far side of an intersection.

TSP is often found to work best with far-side transit stops, as this allows the transit vehicle to clear the intersection before stopping to load and unload passengers. As a result, the time that it takes the transit vehicle to clear the intersection after being detected by the controller is more predictable. Alternatively, the major benefit of TSP for near-side stops, especially under moderately congested conditions, is the ability to clear the general traffic queue between a transit vehicle and the near-side stop. This allows the transit vehicle to only stop once, if at all, instead of twice—once behind the vehicle queue to reach the stop, and a second time while waiting to load and unload passengers.

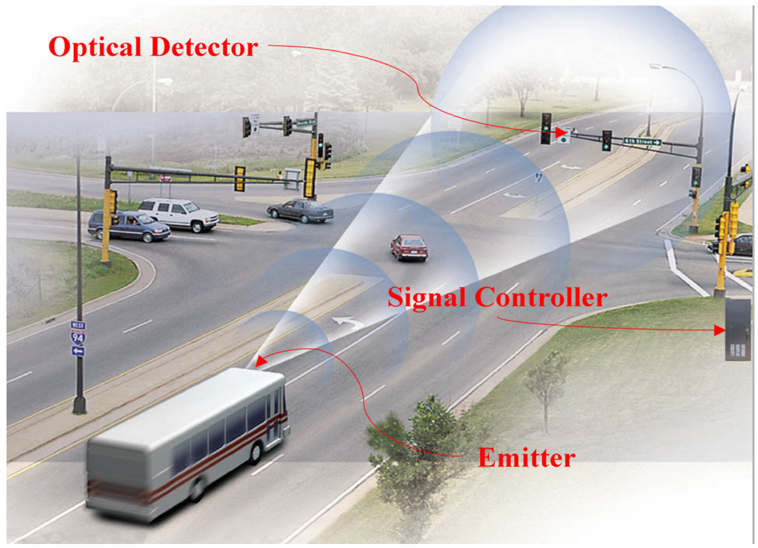
One indicator to assess service effectiveness for transit vehicles is operating speed (or end-to-end running times). Faster service makes public transportation more competitive with the automobile which, in turn, can attract additional riders. Furthermore, when transit vehicles are operating at higher speeds, it makes service less expensive per mile because the same frequencies can be realized with fewer vehicles. Cost savings owing to speed improvement become particularly significant when there are travel time savings of more than one headway, achieving the same service frequency with one less vehicle: the "save a bus" principle.[1] This cost savings can be used to offset higher levels of service, capital costs, or maintenance costs, which can help to further attract new ridership.

1 Delaware Valley Regional Planning Commission, *Speeding Up SEPTA: Finding Ways to Move Passengers Faster.* Publication No. 08066 (Philadelphia: Delaware Valley Regional Planning Commission, August 2008).

Types of TSP Technology

There are two common types of TSP implementation in practice: simple (unconditional) and conditional. Simple TSP is where a request for signal priority is sent by the on-board vehicle emitter to a signal controller, which will grant priority if possible. The signal at an intersection changes as each bus is detected by the signal controller.

Figure 1: Optical/Infrared Visual



Source: Global Traffic Technologies

Conditional TSP allows for transit priorities to be predefined by conditions or scenarios, and has capabilities to allow vehicles to interact with one another. For example, a vehicle with higher priority, such as an express bus, could get green time over a local bus. TSP can be implemented in various ways. At a minimum, simple and conditional TSP require technology to detect an approaching transit vehicle at an intersection and the ability for signal priority requests to be sent by the transit vehicle to the signal controller, which will grant priority if possible. Four types of TSP equipment can be installed theoretically or can be used in practice; these are summarized below.

- Many transit fleets now include **Global Positioning System (GPS)** units installed on transit vehicles to transmit the vehicle location, speed, direction, and time of day. This technology can be adapted to interface with traffic signal controllers for TSP.

- **Loop-Detection equipment** works using an inductive loop embedded in the roadway pavement and a transponder mounted on the underside of the transit vehicle to distinguish transit vehicles from other traffic.

- **Optical/Infrared Detection**, shown in Figure 1, transmits from an on-board transit emitter to a detector mounted at the intersection, which connects to the traffic signal controller to modify signal timing. This system requires a line of sight between the transit vehicle emitter and signal receiver; additional maintenance to maintain sight lines via tree and branch clearance may be required.

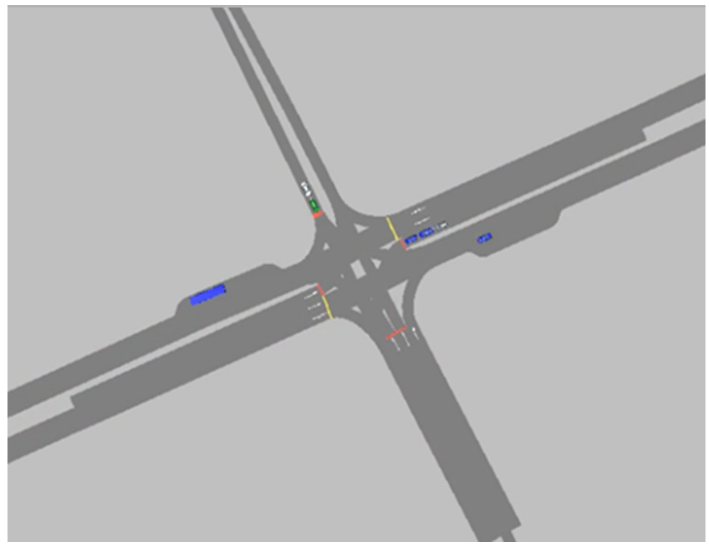
- Another detection system is based on a network of **WiFi wireless cards** transmitted by radio waves between the transit vehicle and the controller at the intersection.

Nationally, it is increasingly common for traffic signals to have some type of vehicle detection device (most likely optical or infrared) for emergency vehicle preemption. This can provide a less costly platform for TSP implementation, but can also present vehicle conflicts between the emergency and transit vehicles if not handled carefully.

Regional Applications of TSP

TSP is not a new concept. It has been widely used in Europe, throughout North America, and regionally in New Jersey and Pennsylvania. In order to evaluate the cost effectiveness of prospective TSP investments, it is helpful to understand the levels of potential running time savings that can be achieved through TSP. For purposes of order-of-magnitude time savings estimates, previous studies drew on the TSP experiences of Los Angeles and Portland in referencing a rule-of-thumb reduction of 6.8 percent in running times following TSP implementation.[2]

Figure 2: Microsimulation Snapshot of SEPTA Route 104



Source: DVRPC, 2010

Analytical models, and specifically microsimulation, provide a more sophisticated tool to explore the potential effectiveness of TSP along transit routes. Microsimulation focuses on a small area, such as an intersection or group of intersections. This is a powerful analytical tool because both vehicle and driver behavior are modeled in a realistic way at the vehicle level. Microsimulation models also offer the ability to evaluate multiple scenarios and combined alternatives. DVRPC conducted microsimulation analyses for Trolley Route 34 (surface stops only) in Philadelphia and Bus Route 104 in Chester and Delaware counties to evaluate various proposed TSP and stop- consolidation combinations (see Figure 2). In the TSP base—case scenario modeled for Route 34 (no-stop consolidation), the model estimated an end-to-end running time savings of 6.25 percent eastbound and about 5 percent westbound. In the base-case TSP scenario for the Route 104 bus, the model estimated an average time savings of just 2.9 percent in both directions. These varying results relate to significant differences between the operating contexts of these two routes, urban versus suburban; lessons learned from these studies have informed the criteria choices for the present analysis.[34]

There have also been previous TSP installations in Philadelphia that used optical/infrared equipment. This technology works by using an optical emitter on vehicles that triggers an optical receiver on the traffic signal from a distance of 50 to 250 feet (or more), resulting—for prior Philadelphia installations—in a 10-second green phase extension for that signal. In 2004 and 2005, a demonstration installation of TSP using this approach was completed for Bus Route 52 at 50 intersections. In addition to TSP, a handful of near-side stop locations were also moved to the far side of intersections and two stops were removed from the route. A comparison of scheduled running times before and after the installation found an estimated 4.7 percent in time savings; however, due to other route changes and variations, it was difficult to assign a specific time savings for TSP alone.

In 2000, a similar TSP program, as well as a number of stop consolidations, was completed for Trolley Route 10 (surface stops only) at 26 intersections. A study comparing Route 10 travel times found that average

2 Ibid.

3 Delaware Valley Regional Planning Commission, *Transit First Analysis of SEPTA Route 34.* Publication No. 09040 (Philadelphia: Delaware Valley Regional Planning Commission, March 2010).

4 Delaware Valley Regional Planning Commission, *Boosting the Bus: Better Transit Intergration Along West Chester Pike.* Publication No. 10033 (Philadelphia: Delaware Valley Regional Planning Commission, August 2011).

surface travel times improved by 5.7 percent between 2000 and 2007 following TSP implementation. Unfortunately, it proved infeasible to keep this TSP operation in reliable service due to equipment obsolescence and replacement issues.

In 2012, a new TSP pilot installation was completed for Route 10, where equipment was installed on 30 traffic signals and 18 vehicles. A before-and-after comparison found that there was approximately a 3.7 percent time savings using TSP under this pilot.

In Mercer County, TSP has been suggested in prior planning efforts, such as the NJ TRANSIT Central Jersey Bus Rapid Transit (BRT) plan and the Mercer County Future Bus Plan, as a way to improve the effectiveness and attractiveness of bus transit. As a result of this prior analysis, a county prioritization framework was developed so that as funding becomes available, it can be directed to the most effective projects. The present analysis for all of southern New Jersey includes an update of that prioritization.

TSP is currently used by NJ Transit in Newark along the 28 Go Bus, a BRT "lite" route, which connects the Bloomfield Rail Station to the Newark International Airport. NJ Transit found that signal prioritization at 14 intersections along Bloomfield Avenue has resulted in a three minute travel time savings (7.6 percent) for passengers. Since implementing BRT features, the 28 Go Bus has seen an increase in ridership with 12 percent diverted from automobiles.[5]

TSP has recently been added to six total corridors in Philadelphia. Two corridors along Bustleton Avenue and Woodland Avenue were installed through U.S. Department of Transportation Tiger Grants and four through Transportation Community and Systems Preservation grants on 52nd Street, Frankford Avenue, Allegheny Avenue, and Ogontz Avenue. TSP equipment and fiber connectivity has been installed, and continues to be tested for all corridors. Where TSP is not fully functional, issues are being fixed and re-tested until in working condition. Transit First, a collaborative venture between the Philadelphia Mayor's Office of Transportation and Utilities (MOTU), Southeastern Pennsylvania Transportation Authority (SEPTA), and DVRPC, has been working to determine best practices to measure effectiveness and impact on transit as well as general traffic flow along these corridors.

Overall, the findings of estimates, simulations, and demonstration projects indicate that TSP is more effective in some locations and for some routes than others, with wide variations across route operating contexts and corridor characteristics. The scoring framework used in this study builds on the effective characteristics to help better predict the success of TSP investments across bus route corridors in DVRPC's New Jersey counties, in order to help prioritize future installations. Table 1 summarizes the travel time savings of regional TSP case studies.

Table 1: Regional TSP Time Savings Summary

Agency	Route	Mode	Summary of End-to-End Travel Time Savings	Travel Time Savings (avg EB and WB)
SEPTA	10	City Trolley	TSP Implemented Pilot, Travel Time Run	5.7%*, 3.7%**
SEPTA	34	City Trolley	Modeled Travel Time	6.25% ***
SEPTA	52	City Bus	TSP Implemented Pilot	4.7%
SEPTA	104	Suburban Bus	Modeled Travel Time	2.9%
NJ Transit	28 Go Bus	BRT Lite	BRT Features, Including Signal Prioritization	7.6%

*Savings based on 2007 demonstration; **Savings based on 2012 pilot; ***Included additional time savings due to operation changes.

Sources: DVRPC, 2013; NJ Transit, 2013

5 Jim Gilligan, Bus Rapid Transit: *NJ Transit's Perspectives on BRT Corridor Assessment and Lessons Learned from Go Bus* (presentation, Next Generation Bus Technology: Bus Rapid Transit, Newark, NJ, May 20, 2013).

Chapter 2: Southern New Jersey TSP Analysis and Results

In 2013, DVRPC developed a method of scoring corridors on their likelihood for successful and cost-effective TSP investments in its *Transit Signal Priority Favorability Score: Development and Application in Philadelphia and Mercer County* (Publication 13033) study. The *Evaluating Opportunities for Transit Signal Priority in Southern New Jersey* project uses similar criteria to the 2013 publication's analysis of Mercer County to find favorability scores for all of the New Jersey counties in the DVRPC region.

Southern New Jersey Analysis Criteria

Using this previously-developed DVRPC method, a set of criteria was compiled to assess likely TSP effectiveness along corridors in DVRPC's New Jersey counties based on a review of industry best practices and available data sources. The inputs are intended to account for as many relevant factors as possible that would affect optimal TSP deployment. The TSP Favorability Score is a preliminary screening tool, and further review would be required prior to implementation to determine if a high-scoring segment or corridor could truly be a successful location for TSP.

Source: YT Transport Photography, 2015

The raw data that was available for each criterion was reviewed, and numerical values were grouped into bins to distribute and score the data of each criterion. A consistent scoring framework made it possible to make an apples-to-apples comparison between criteria and aggregate them in an internally consistent way. The 11 criteria were divided into four categories: traffic, transit supply, transit demand, and planning priorities. A weighting scheme per category and per criterion was developed to ensure that the criteria deemed most meaningful were given the greatest weight in the prioritization. Most criteria are mapped "by segment." A segment is typically one mile, except in instances where the road length is less than one mile or the length of the road is greater than one mile and does not evenly divide into one-mile segments. Table 2 summarizes each of the criteria used in this analysis and their scoring with detailed explanations of each below. The farthest right column shows an example of one of the highest-scoring segments in Camden County (Mt. Ephraim Avenue). Appendix A on page A-1 contains maps illustrating each segment in southern New Jersey scored by criterion.

Table 2: Criteria for Southern New Jersey TSP Screening Tool

Criterion		Scoring Treatment	Weight	Mt. Ephraim Ave Example Segment (Weighted Score)
Traffic	V/C ratio	1 = Low, 5 = Med, 2.5=High; Medium= Higher score	0.5	2 (1)
	Cross-street AADT	Low = 5, Low-Med = 4, Med = 3, Med-High = 2, High = 1	0.5	5 (2.5)
	Signal density	Low = 1, Low-Med = 2, Med = 3, Med-High = 4, High = 5	2.0	5 (10)
	Total for Traffic		**3.0**	**12 (13.5)**
Transit Supply	Transit vehicle volumes	Low = 1, Low-Med = 2 Med = 3, Med-High = 4, High = 5	1.0	5 (5)
	Peak transit vehicle volumes	Low = 1, Low-Med = 2 Med = 3, Med-High = 4, High = 5	1.0	5 (5)
	Far-side stops	5 quantiles; More far-side stops= Higher score	1.0	5 (5)
	Operations issues (bottlenecks)	1 = No issues, 5 = Congested areas; Higher value = Higher score	1.0	1 (1)
	Total for Transit Supply		**4.0**	**16 (16)**
Transit Demand	Transit Score	Low = 1, Low-Med = 2 Med = 3, Med-High = 4, High = 5	2.0	5 (10)
	Total for Transit Demand		**2.0**	**5 (10)**
Planning Priorities	ICM	1 = No, 5 = Yes; Yes = Higher score	0.25	5 (1.25)
	Roadway functional class	5 categories; Higher class = Higher score	0.5	4 (2)
	CMP corridor	1 = No, 5 = Yes; Yes = Higher score	0.25	5 (1.25)
	Total for Planning Priorities		**1.0**	**14 (4.5)**
Total for All Criteria			**10.0**	**47 (weighted score 44)**

Source: DVRPC, 2015

Traffic Criteria

The traffic set of criteria is intended to explore automobile traffic conditions in a prospective TSP corridor, and includes the following measures: Volume-to-Capacity (V/C) ratio, cross-street traffic volumes, and signal density. As a whole, the traffic category was weighted three out of the 10 total points in the composite scoring framework.

- The **(V/C) ratio** is a standard measure of roadway congestion. Peak-hour V/C ratios were calculated for the 2012 DVRPC Congestion Management Process (CMP) by using several years of recent traffic counts and roadway capacities derived from the DVRPC Regional Travel Demand Model. The traffic counts were converted from Average Annual Daily Traffic (AADT) counts to peak-hour volumes. Precise capacities are not available for all roads, so Travel Demand Model capacities were used. The literature suggests that TSP is most effectively applied where there is significant, but not debilitating, traffic congestion. Therefore, V/C ratios were grouped into a range of bins of <0.75, 0.75 to 1.25, and >1.25, with the middle bin having the most favorable score.

► In addition to congestion levels along a corridor, it is also important to consider the implications for cross-streets. **Cross-Street Annual Average Daily Traffic** was used in the screening tool to assure that the characteristics of a corridor were effectively evaluated in comparison to its cross-streets, so that potential TSP would not inappropriately benefit one corridor at the expense of others. For higher volumes, a lower (less favorable) score was assigned.

► **Signal density** is a measure of the number of traffic signals per segment. In general, corridors with higher signal densities may lead to greater time savings from the application of TSP because transit vehicles are more likely to be impacted by signal delay. Therefore, a higher density of signals was awarded a higher score in the screening tool. Signal count by segment was used as a proxy for density.

Transit Supply Criteria

The transit supply criteria are intended to reflect the level and characteristics of transit service in each corridor, and include the following measures: transit vehicle volumes, peak transit vehicle volumes, location of stops, and bus operations issues. The transit supply category was weighted four out of the 10 total points in the composite scoring framework.

► **Transit vehicle volumes** reflect the levels of transit service along a segment over a 24-hour period, whether provided via a single NJ Transit route or multiple routes that share a street segment. Higher volumes mean a higher number of scheduled transit runs that could benefit from TSP. As a result, higher volumes were awarded a higher score in the screening tool. This data was derived from NJ Transit General Transit Feed Specification schedule data as processed through the DVRPC Regional Travel Demand Model.

► **Peak transit vehicle volumes** are the levels of transit service along a segment during the morning peak period. In suburban locations, transit service is more concentrated during peak periods because of higher commuter usage. Higher peak transit vehicle volumes result in higher scores in the screening as well.

► **Far-side stops** are meaningful because they enhance TSP effectiveness (since intersection clearance times are more predictable). A higher percentage of far-side stops resulted in higher scores being assigned.

► **Operational issues at bottlenecks** indicate the areas identified by NJ Transit staff that experience bus operations issues throughout the southern New Jersey bus network and where concentrated congestion occurred within each of the counties. These segments were awarded the highest score.

Transit Demand Criteria

The transit demand criteria are intended to reflect actual passenger demand in a given corridor, or the number of individual transit riders who stand to benefit from TSP time savings. The transit demand criteria category was weighted two out of the 10 total points in the composite scoring framework.

► **Transit Score** is a measure that estimates the potential for success of various transit investments as a function of the densities of population, employment, and carless households; as such, Transit Score can inform the selection of appropriate transit investments for a given community. In this analysis, Transit Score was a proxy for transit passenger volumes (demand), which were not available at the segment level.

Planning Priorities Criteria

This group of criteria builds upon prior work by DVRPC's Office of Transportation Operations Management and Office of Transportation Safety and Congestion Management. This category was weighted one out of the total 10 points in the composite scoring framework.

- **Integrated Corridor Management (ICM)** is a simple "yes or no" criterion determined by a TSP location falling into an ICM corridor, as identified in the DVRPC Transportation Operations Master Plan. ICM optimizes travel in a corridor by synchronizing traffic on expressways and arterials, as well as between highways and transit modes. The plan identifies potential corridors for ICM treatment. This is an established method that already has significance in the region; if a given segment is included in an ICM corridor, it was awarded a higher score.

- **Roadway functional class** is based on the New Jersey Department of Transportation road-classification system. For this category, five classes were used: local road, major collector, minor arterial, principal arterial, interstate/ freeway/ expressway. In general, more investments are likely to be made on higher-classification roadways. Therefore, a higher roadway classification was awarded a higher score in the screening tool.

- The DVRPC **CMP** is a systematic process to minimize congestion and enhance the ability of people and goods to reach their destinations. The CMP advances the goals of the DVRPC Long-Range Plan and strengthens the connection between the plan and the regional Transportation Improvement Program. With input from its advisory committee, the CMP identifies congested corridors and multimodal strategies to mitigate congestion for all locations in the region. The most recent CMP update was published in 2012. Segments of CMP corridors identified as more congested in the 2012 CMP were given higher scores in the screening tool.

Evaluation Process and Analysis

Once the scoring framework was established, the inputs were analyzed in a Geographic Information System (GIS) to create a composite TSP Favorability Score. The data for each criterion was mapped to a network of segments that consist of each signalized roadway. The TSP Favorability Score is an overall approximation of the locations where TSP is likely to be most successful, considering a segment's overall transit and transportation context. NJ Transit is interested in the TSP Favorability Score as a tool to inform the implementation of TSP on portions (by segment) of existing routes in southern New Jersey.

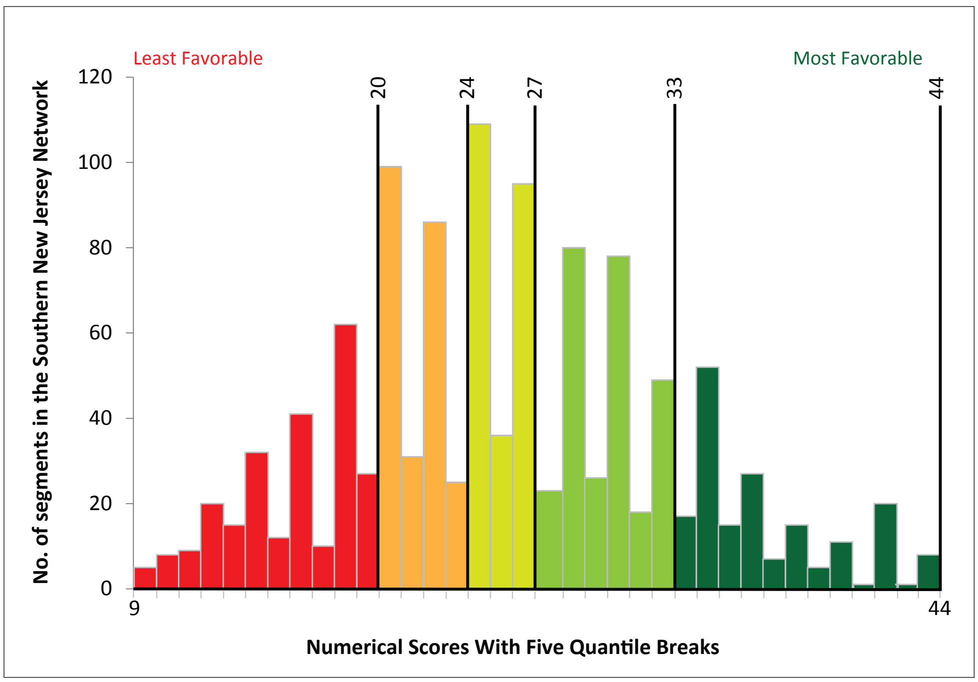
Once all of the criteria were mapped and their numerical values were assigned to segments across southern New Jersey's network, each segment was assigned scores for each criterion according to the scoring and weighting framework summarized in Table 2. These criteria-level scores were then added to create the composite TSP Favorability Score for each segment. The highest possible TSP Favorability Score that a segment could achieve was 50. This study can be used as a guideline for southern New Jersey counties and NJ Transit to select the locations and routes that will be most useful for the implementation of TSP.

TSP Favorability Score Results

Figure 3 summarizes the distribution of southern New Jersey segment-level TSP Favorability Scores in a histogram. The range of scores is between 9 and 44, where the mean score is 24.

Table 3 exhibits the top 10 scoring road segments. Five out of 10 segments are within the City of Trenton, four are in the City of Camden, and one is in Haddonfield Borough. Figure 4 maps these road segments and summarizes their TSP Favorability Scores.

Figure 3: TSP Favorability Score Histogram for Segments in Camden, Gloucester, Burlington, and Mercer Counties



Source: DVRPC, 2015

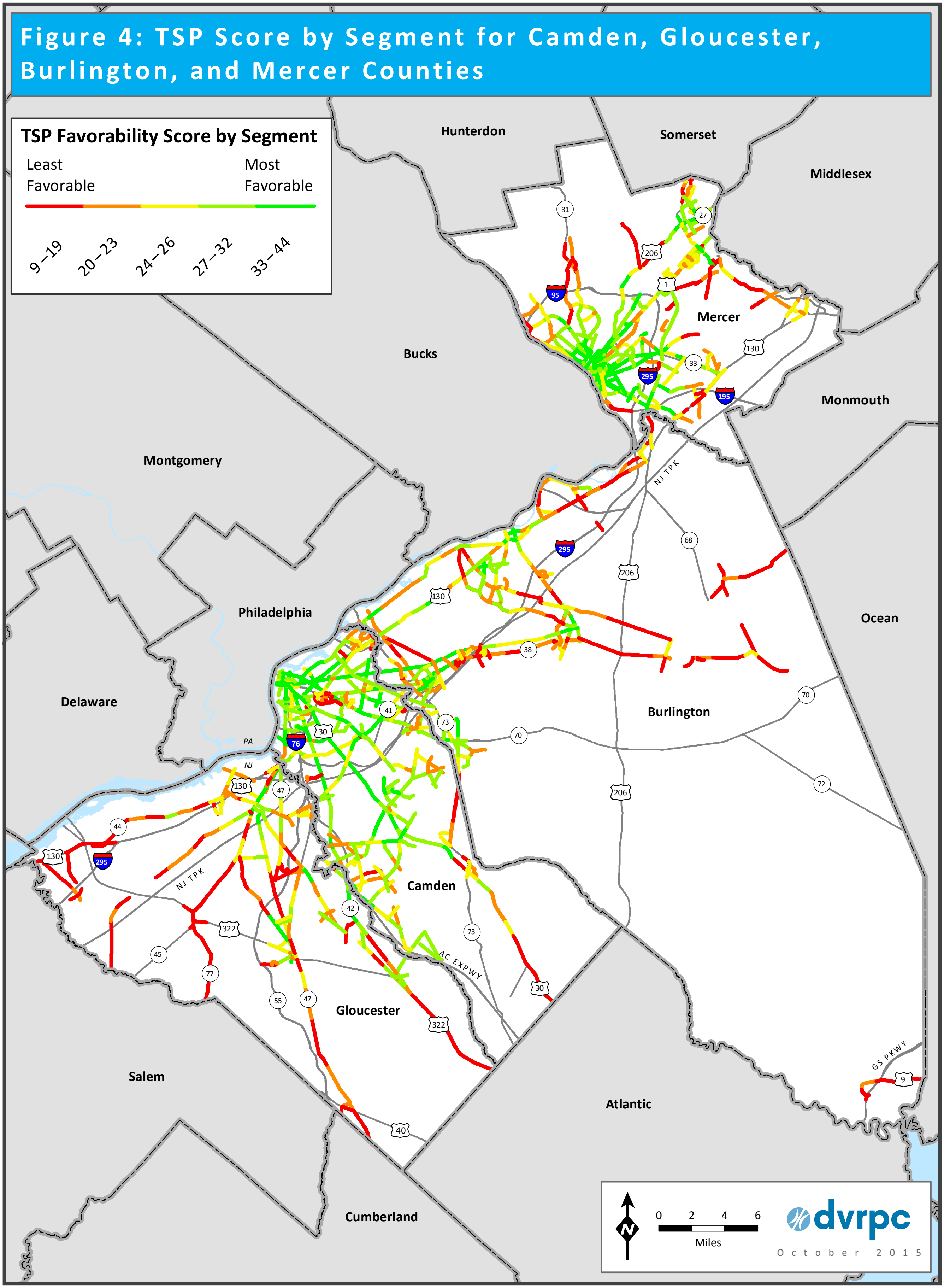


Figure 4: TSP Score by Segment for Camden, Gloucester, Burlington, and Mercer Counties
TSP Favorability Score by Segment
Least Favorable
Most Favorable
9 – 19
20 – 23
24 – 26
27 – 32
33 – 44
Hunterdon
Somerset
Middlesex
Mercer
Bucks
Monmouth
Montgomery
Philadelphia
Ocean
Delaware
Burlington
Camden
Gloucester
Salem
Atlantic
Cumberland
PA
NJ
NJ TPK
AC EXPWY
GS PKWY
0 2 4 6
Miles
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October 2015

Table 3: Top 10 TSP Favorability Scores by Segment for Camden, Gloucester, Burlington, and Mercer Counties

Rank	Bus Routes	TSP Score	Street Segment	Municipality
1	400	44	Mt. Ephraim Ave. between Kaighns Ave. and Ferry Ave.	City of Camden
1	401, 402, 410, 412, 450, 452, 453, 457, 460	44	Broadway Tpk. between Penn St. and Walnut St.	City of Camden
1	455, 457	44	Kings Hwy./Chews Landing Rd. between Tanner St. and Bradshaw Ave.	Haddonfield Borough
1	400, 403, 451, 460	44	Haddon Ave. between Federal St. and Pine St.	City of Camden
1	608, 610	44	W. State St. between Gouverneur Ave. and Taylor Pl.	City of Trenton
1	409, 603, 613	44	South Broad St. between Market St. and Chestnut Ave.	City of Trenton
1	600, 624 611	44	Perry St. between North Warren St. and S. Clinton Ave.	City of Trenton
1	603, 613	44	US 206 S. between N. Rose St. and US 206 N.	City of Trenton
9	409, 418, 600, 601, 606, 608, 609, 611, 619	43	E. State St. between Montgomery St. and S. Clinton Ave.	City of Trenton
10	400	42	Mt. Ephraim Ave. between Haddon Ave. and Kaighns Ave.	City of Camden

Source: DVRPC, 2015

Applications and Future Work

This project was intended to assemble a set of factors to evaluate the likely effectiveness of TSP investments, considering a wide range of industry best practice criteria. The screening tool that was developed is intended to be used (with locally appropriate modifications to criteria, scoring, or weights) for a range of future regional and national applications.

As additional TSP investments are made in the DVRPC region over the next several years, it will be important to assess the time savings that are achieved in comparison with each project's TSP Favorability Score in order to make further refinements to the screening tool. It would also be appropriate to conduct a similar analysis for DVRPC's Pennsylvania suburban counties.

Chapter 3: County-Level TSP Analysis and Results

As a complement to the four-county southern New Jersey analysis, segment level analysis is presented by individual county for closer analysis.

Mercer County TSP Favorability Score by segment is listed in Table 4 and shown in Figure 5.

Burlington County TSP Favorability Score by segment is listed in Table 5 and shown in Figure 6.

Camden County TSP Favorability Score by segment is listed in Table 6 and shown in Figure 7.

Gloucester County TSP Favorability Score by segment is listed in Table 7 and shown in Figure 8.

Figure 5: Mercer County TSP Favorabilty Score by Segment

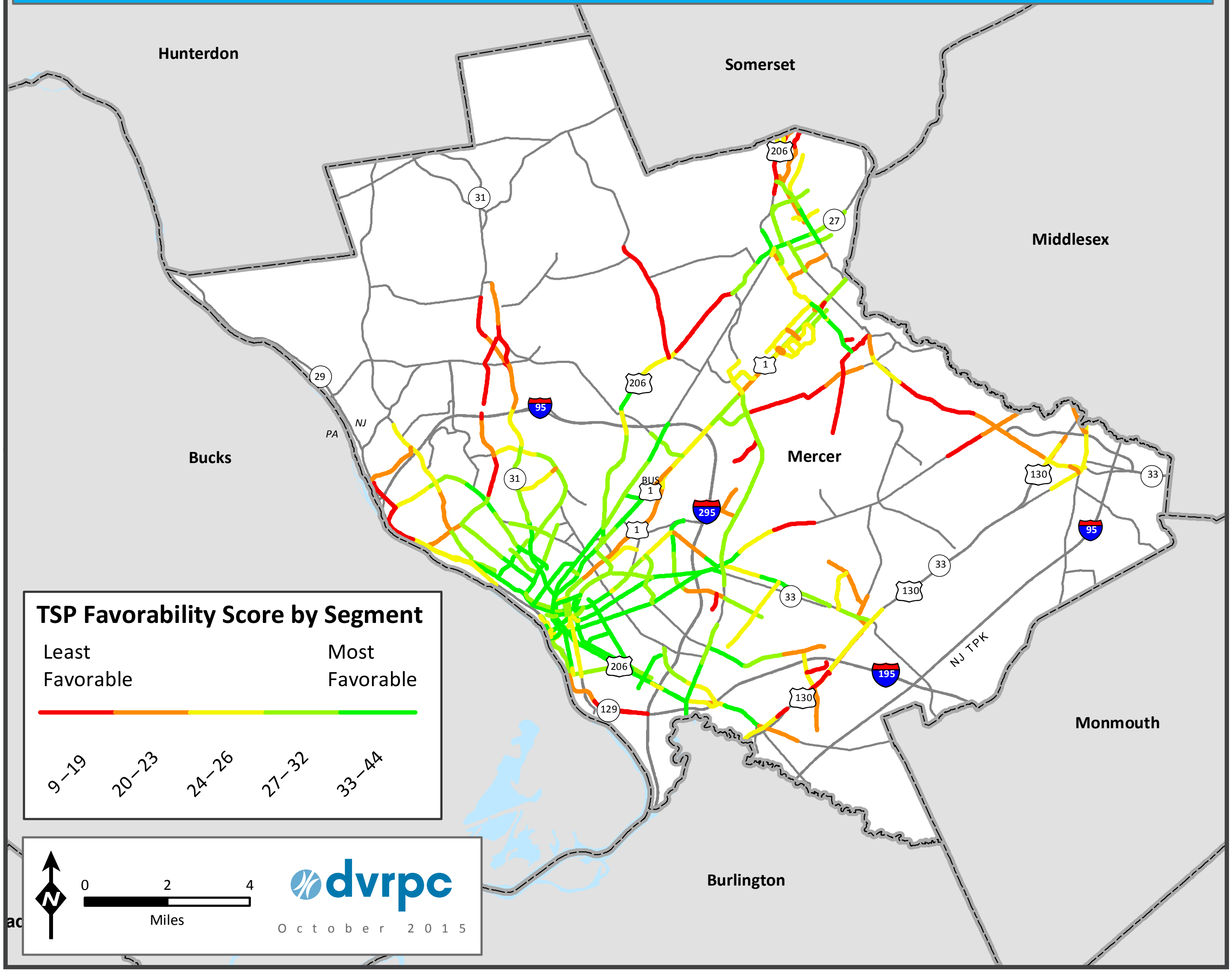


Table 4: Top 10 TSP Favorability Score Segments in Mercer County

Rank	Bus Routes	TSP Score	Street Segment	Municipality	County
1	608, 610	44	W. State St. between Gouverneur Ave. and Taylor Pl.	City of Trenton	Mercer
1	409, 603, 613	44	South Broad St. between Market St. N. and Chestnut Ave.	City of Trenton	Mercer
1	600, 611, 624	44	Perry St. between North Warren St. and S Clinton Ave.	City of Trenton	Mercer
1	603, 613	44	US 206 S. between N. Rose St. and US 206 N.	City of Trenton	Mercer
5	409, 418, 600, 601, 606, 608, 609, 611, 619	43	E. State St. E. between Montgomery St. and S. Clinton Ave.	City of Trenton	Mercer
6	418, 601, 606, 608, 609, 619	42	West State St. between Greens Pl. and N. Warren St.	City of Trenton	Mercer
6	600, 603, 607, 613, 624	42	N. Broad St. between Old Rose St. and Market St.	City of Trenton	Mercer
6	606, 610, 624	42	Greenwood Ave. between US 1 and South Cook Ave.	City of Trenton	Mercer
6	601, 609, 619	42	Prospect St. between Parkway Ave. and West State St.	City of Trenton	Mercer
6	418, 601, 606, 609, 619	42	S. Clinton Ave. between Lincoln Ave. and Mott St.	City of Trenton	Mercer

Source: DVRPC, 2015

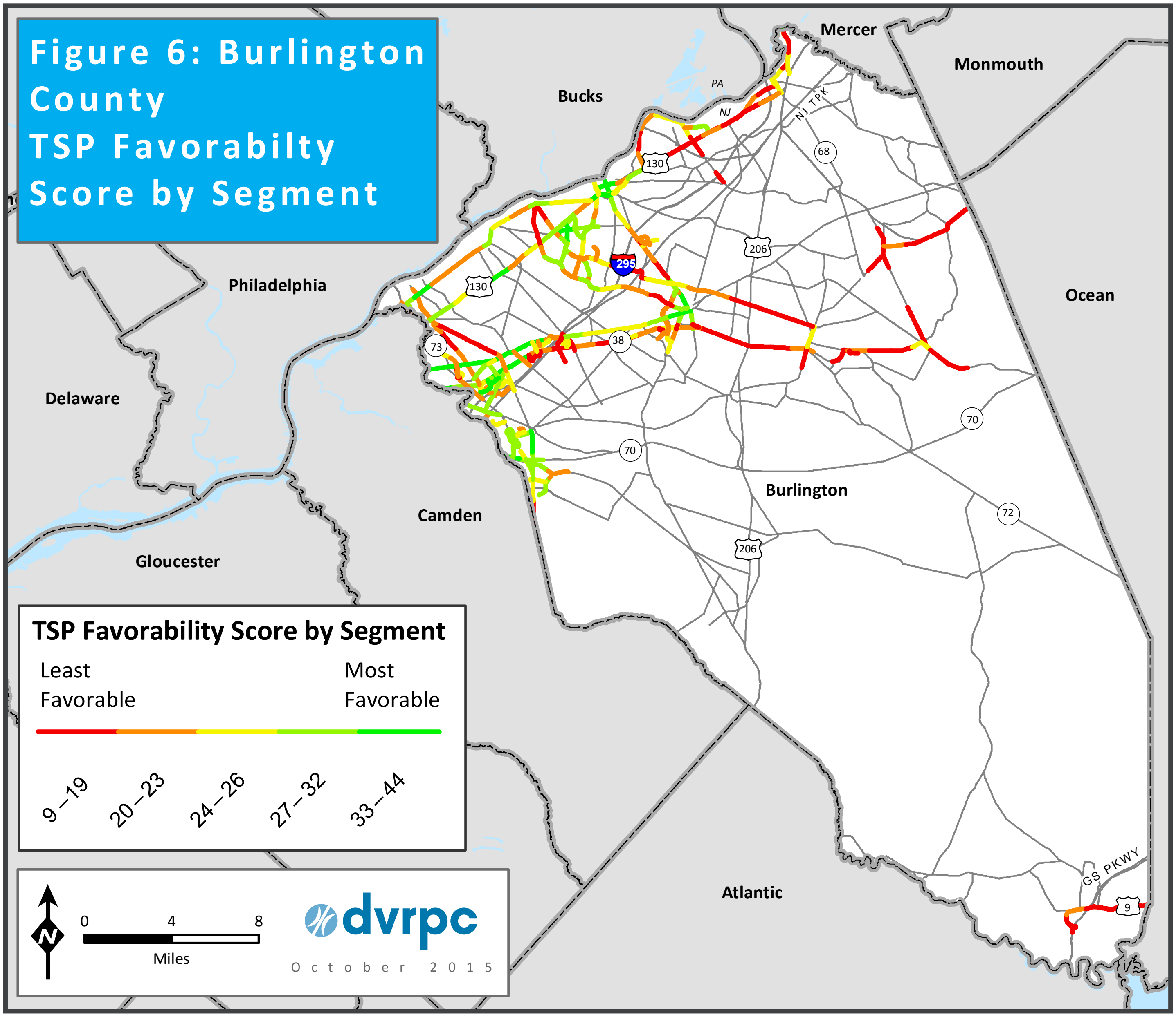


Table 5: Top 10 TSP Favorability Score Segments in Burlington County

Rank	Bus Routes	TSP Score	Street Segment	Municipality	County
1	407, 413, 414	42	E. Main St. between Mill St. and Madison Ave.	Moorestown Township	Burlington
2	317, 413, 418	39	NJ 38 between Maple Ave. and Rudderrow Ave.	Cherry Hill Township/Maple Shade Township	Burlington
3	409, 419	38	Broad St. Secondary between NJ 413 and Tatham St.	Burlington City	Burlington
4	409, 417, 418	38	CR 634 between CR 630 and Van Sciver Pkwy.	Willingboro Township	Burlington
4	317, 407, 413, 457	38	Harper Dr. between Ring Rd. and Pleasant Valley Ave.	Moorestown Township	Burlington
4	409, 603, 613	38	US 206 N. between Maddock Ave. and Hamilton line	Hamilton Township	Burlington
7	413	37	CR 691 between Mt. Holly Bypass and Garden St. E.	Mount Holly Township	Burlington
7	343, 409, 419	37	E. Broad St. between NJ 413 Secondary and Tatham St.	Burlington City	Burlington
7	317, 413, 418	37	NJ 38 E. between S. Lenola Rd. and Pleasant Valley Ave.	Moorestown Township/ Maple Shade Township	Burlington
7	407, 414	37	Camden Ave. between S. Maple Ave. and New Albany Rd.	Moorestown/Maple Shade	Burlington

Source: DVRPC,2015

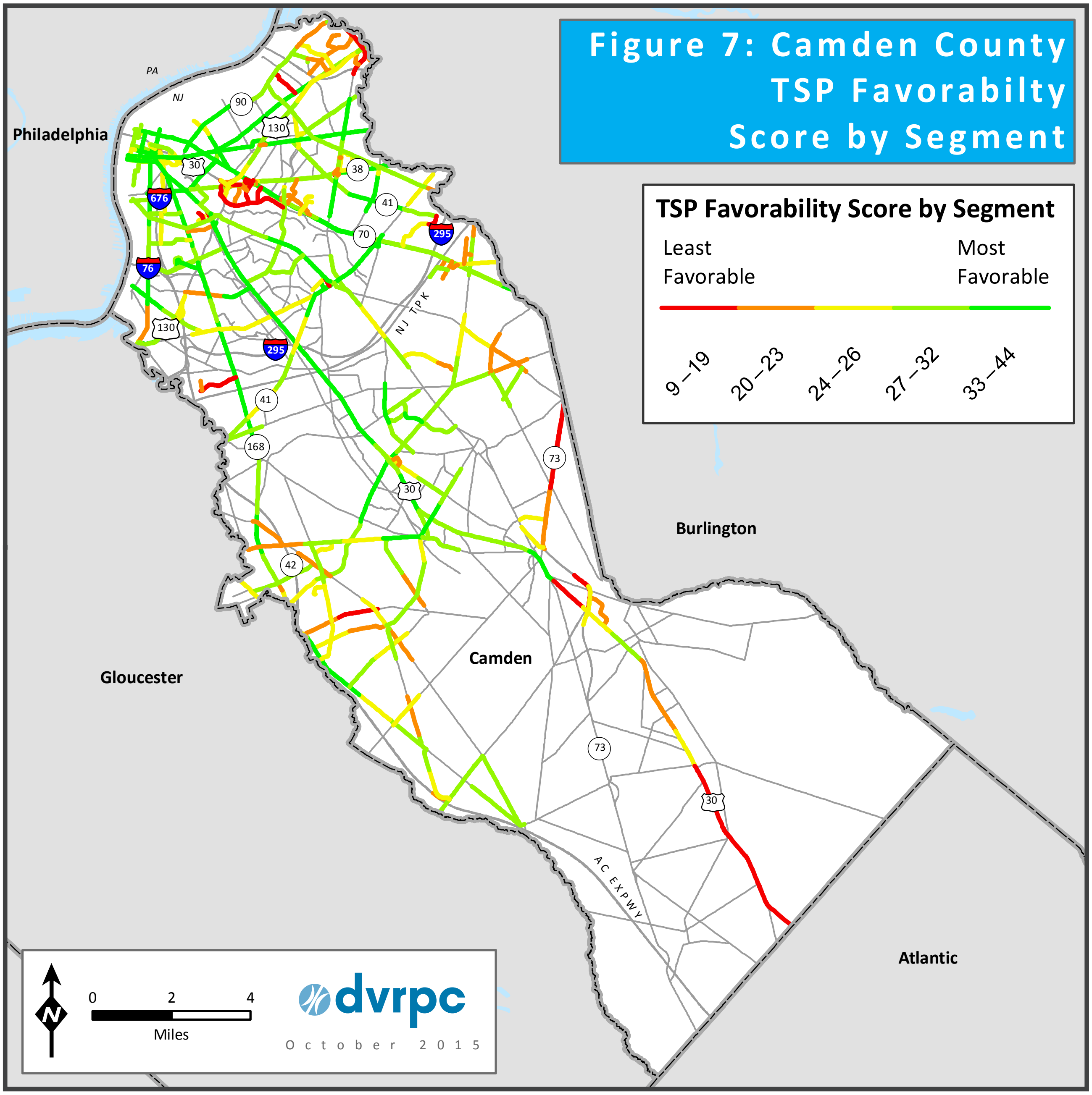


Table 6: Top 10 TSP Favorability Score Segments in Camden County

Rank	Bus Routes	TSP Score	Street Segment	Municipality	County
1	400	44	Mt. Ephraim Ave. between Kaighns Ave. and Ferry Ave.	City of Camden	Camden
1	401, 402, 410, 412, 450, 452, 453, 457, 460	44	Broadway Tpk. between Penn St. and Walnut St.	City of Camden	Camden
1	455, 457	44	Kings Hwy./Chews Landing Rd. between Tanner St. and Bradshaw Ave.	Haddonfield Borough	Camden
1	400, 403, 451, 460	44	Haddon Ave. between Federal St. and Pine St.	City of Camden	Camden
5	400	42	Mt. Ephraim Ave. between Haddon Ave. and Kaighns Ave.	City of Camden	Camden
5	400	42	NJ 168 N. between Apple Ave. and 9th Ave.	Bellmawr Borough/ Runnemede Borough	Camden
5	452, 453, 460	42	CR Rt. 537 Spur E. between Front St. and Newton Ave.	City of Camden	Camden
5	404	42	CR 610 E. between CR 537 E. and N. 39th St.	City of Camden	Camden
5	317, 404, 405, 406, 407, 409, 413, 418, 460	42	CR 537 between CR 737 and Cooper St.	City of Camden	Camden
5	404, 405, 407, 460	42	CR 537 between N. 23rd St. and Garfield Ave.	City of Camden	Camden

Source: DVRPC, 2015

Figure 8: Gloucester County TSP Favorabilty Score by Segment

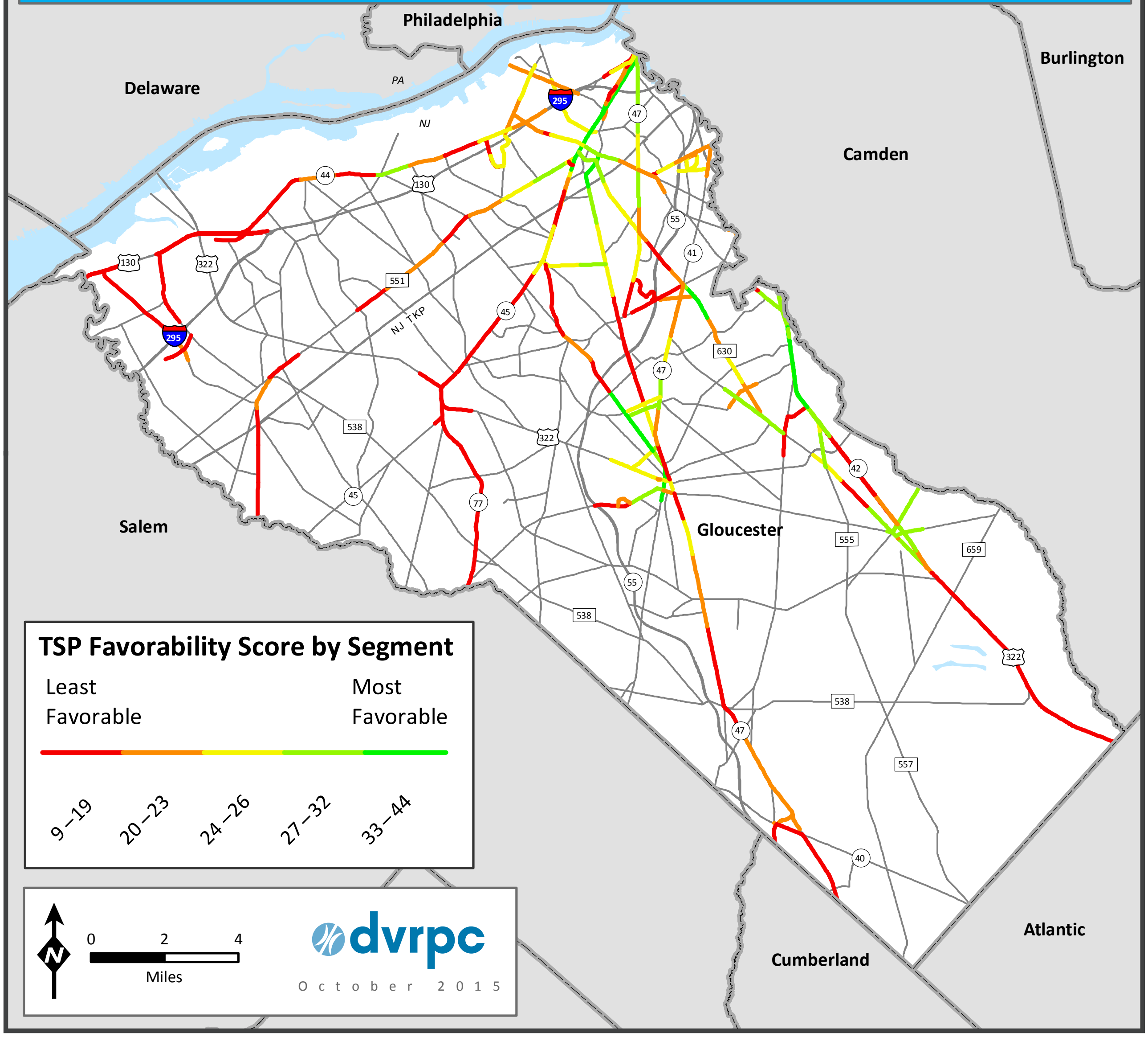


Table 7: Top 10 TSP Favorability Scores Segments in Gloucester County

Rank	Bus Routes	TSP Score	Street Segment	Municipality	County
1	401, 402, 410, 412	36	NJ 45 N. between Hunter St. and Colonial Ave.	City of Woodbury/ West Deptford Township	Gloucester
1	315, 400, 403	36	Blackhorse Pl. between NJ 42 Secondary and CR 639	Washington Township	Gloucester
1	315, 400, 403	36	NJ 42 N. between McKinley Ave. and Watson Dr.	Washington Township	Gloucester
1	315, 400, 403	36	NJ 42 N. between McKinley Ave. and Unnamed St.	Washington Township	Gloucester
5	401, 402, 410, 412	35	CR 551 between Olive St. and Delsea Dr.	Westville Borough	Gloucester
6	412	34	CR 553 between Cooper Ave E. and NJ Tpk.	City of Woodbury/ Borough of Woodbury Heights	Gloucester
6	401, 402, 410, 412	34	Broadway between E. Olive St. and Fisher Ave.	Westville Borough /Deptford Township	Gloucester
6	463	34	Egg Harbor Rd. between CR 603 E. and Berkshire Dr.	Washington Township	Gloucester
6	412	34	Broadway between Mantua Rd. and W Jersey Ave.	Pitman Borough/Mantua Township	Gloucester
10	408, 412	33	Main St. between Silver Ave. and Grove St.	Glassboro Borough	Gloucester

Source: DVRPC, 2015

Appendix A: Southern New Jersey TSP Criteria Maps

Figure A1: TSP Favorability Score Criterion: Volume-to-Capacity Ratio (per Segment)

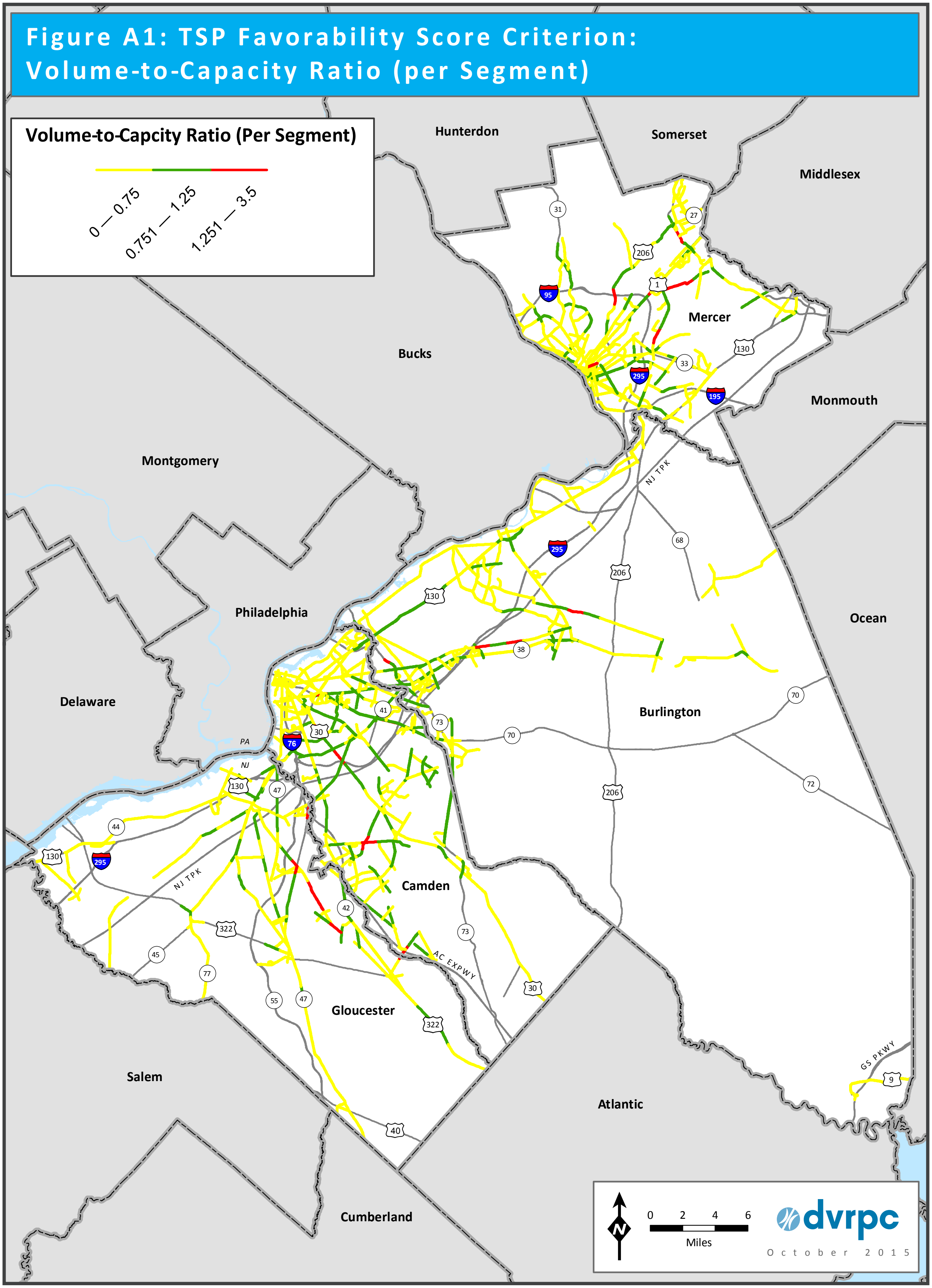


Figure A2: TSP Favorability Score Criterion: Cross-Street Annual Average Daily Traffic (Volume per Segment)

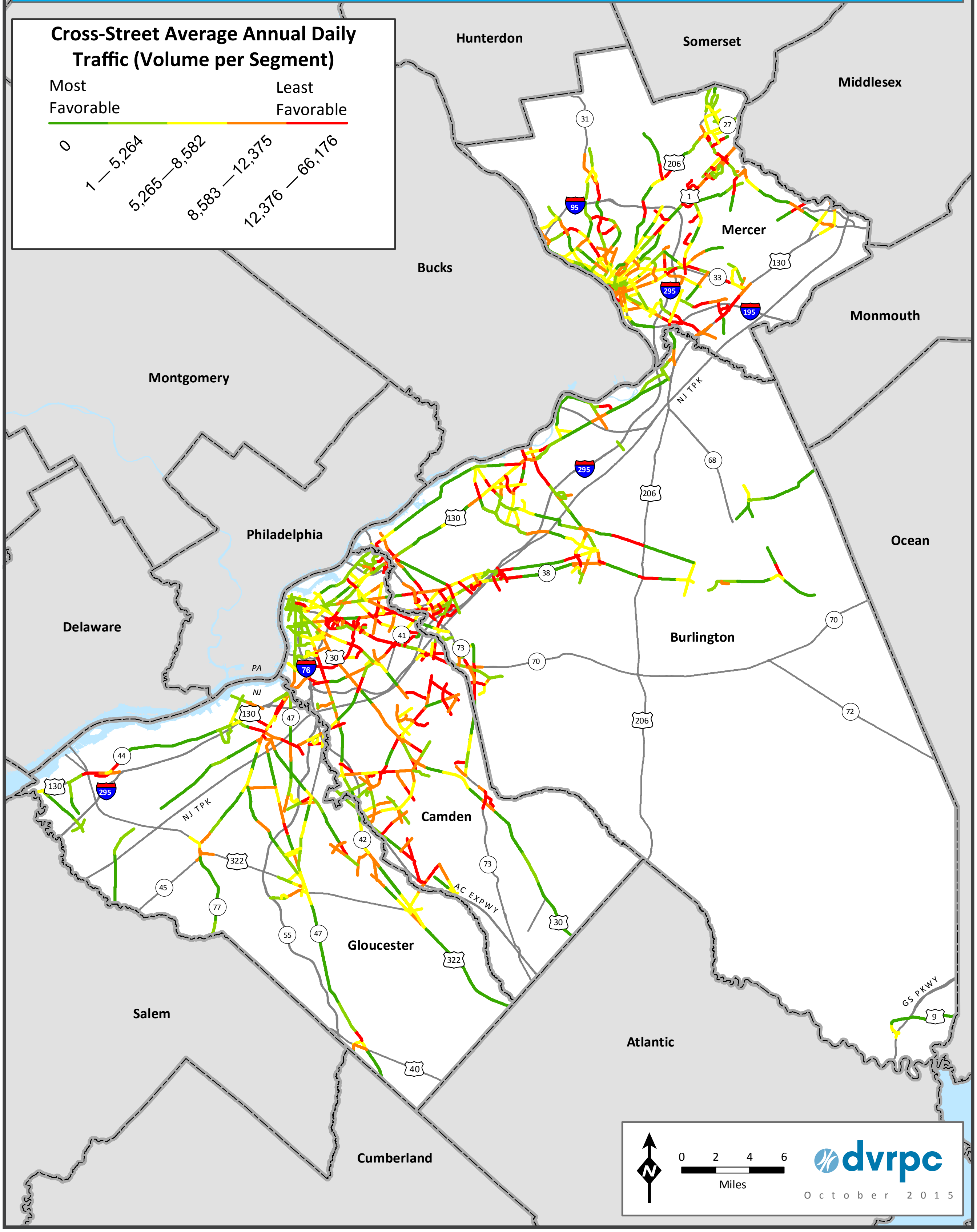


Figure A3: TSP Favorability Score Criterion: Signal Density (Count per Segment)

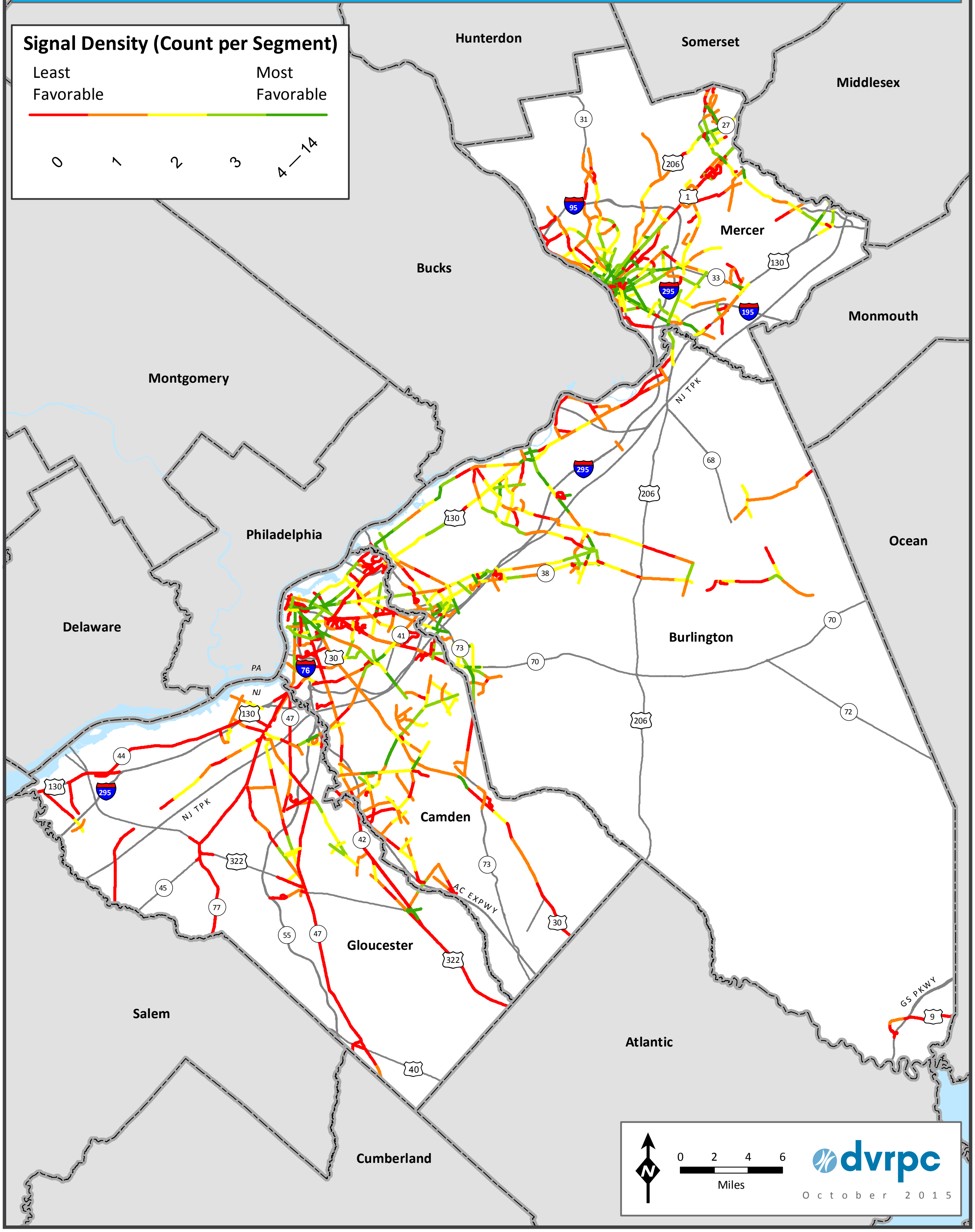
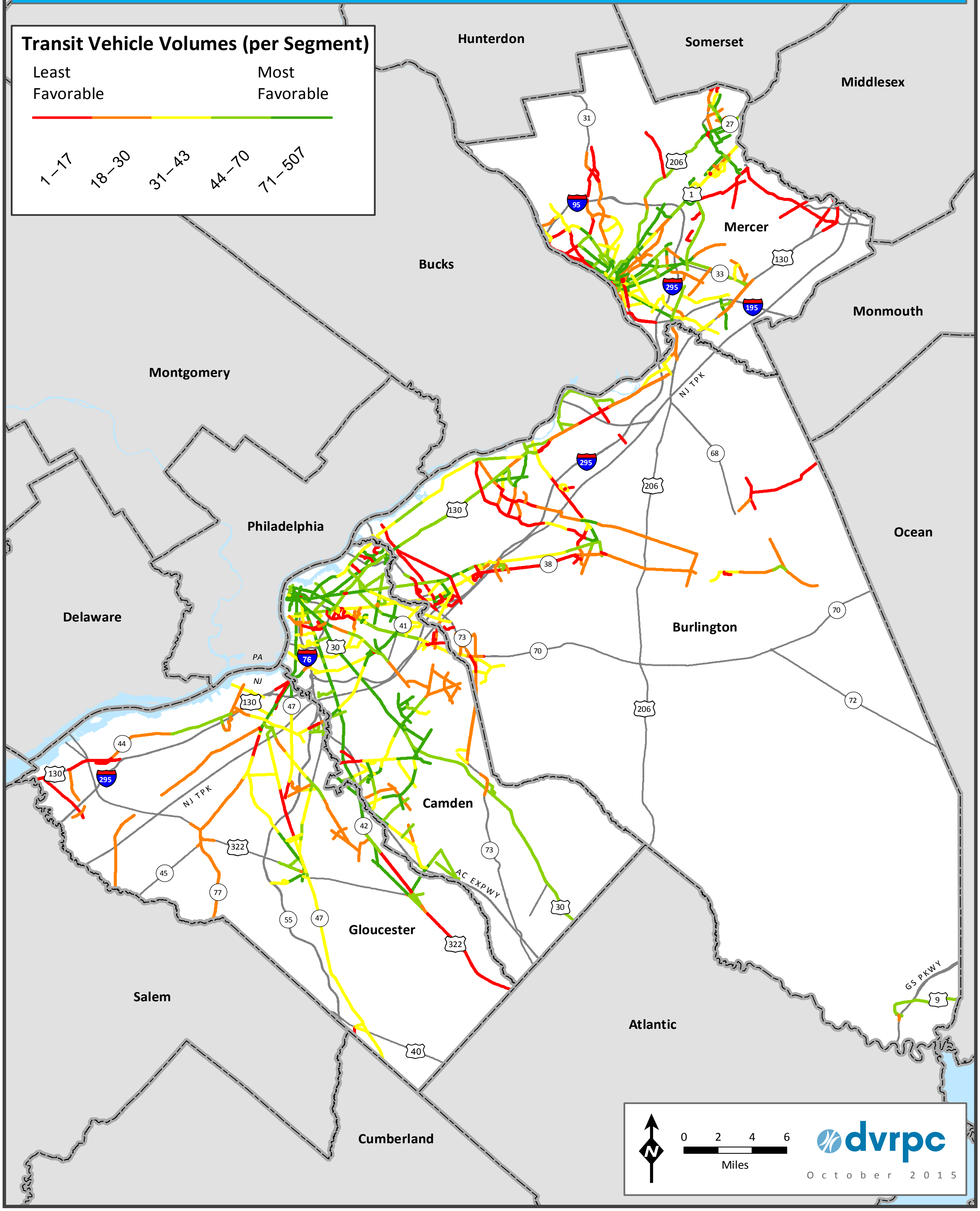


Figure A4: TSP Favorability Score Criterion: Transit Vehicle Volumes (per Segment)



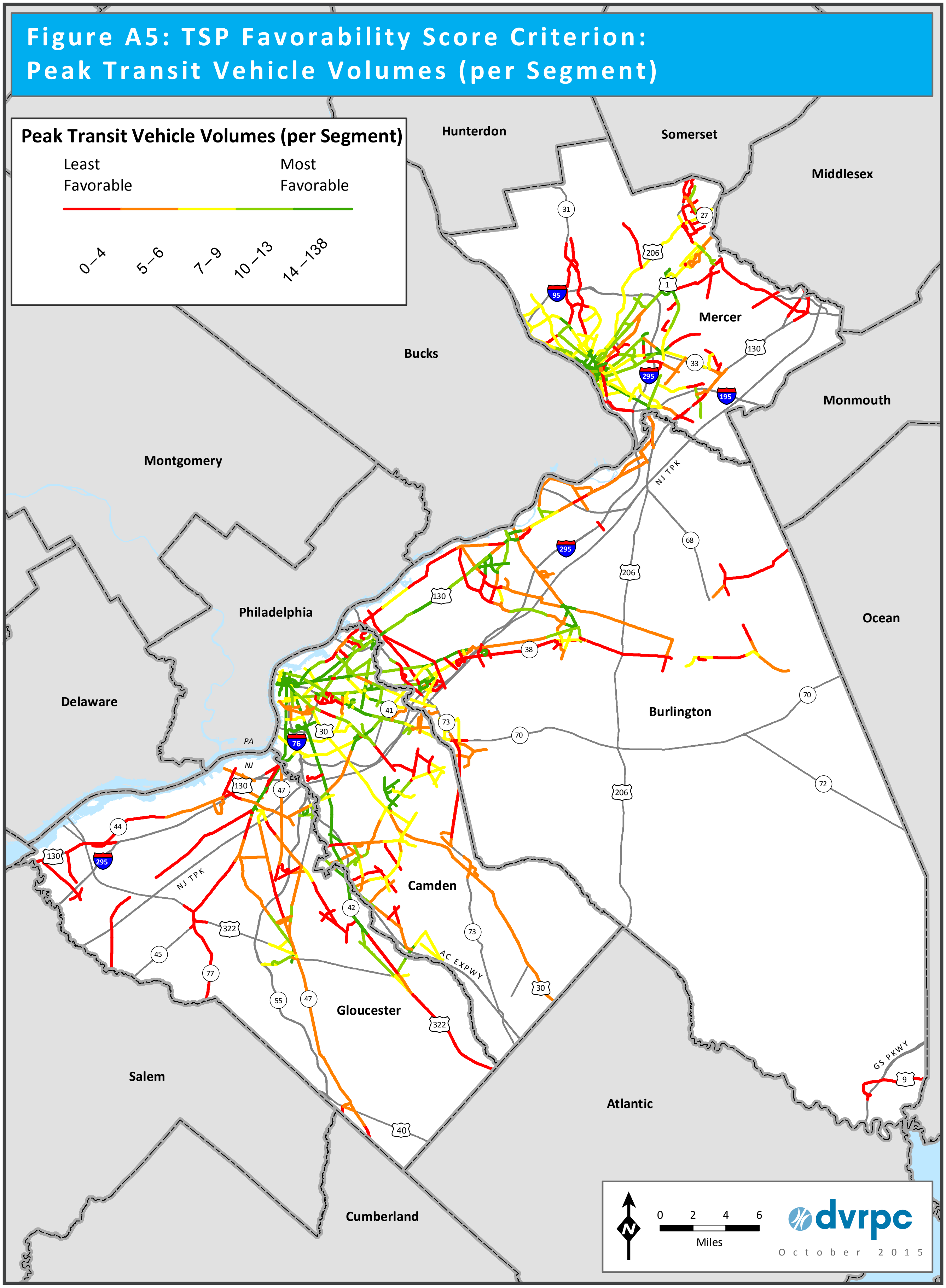


Figure A5: TSP Favorability Score Criterion:
Peak Transit Vehicle Volumes (per Segment)
Peak Transit Vehicle Volumes (per Segment)
Least Favorable
Most Favorable
0 – 4
5 – 6
7 – 9
10 – 13
14 – 138
Hunterdon
Somerset
Middlesex
Mercer
Bucks
Monmouth
Montgomery
Ocean
Philadelphia
Delaware
Burlington
Camden
Gloucester
Salem
Atlantic
Cumberland
PA
NJ
NJ TPK
AC EXPWY
GS PKWY
0 2 4 6
Miles
dvrpc
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Figure A6: TSP Favorability Score Criterion: Number of Far-Side Stops (per Segment)

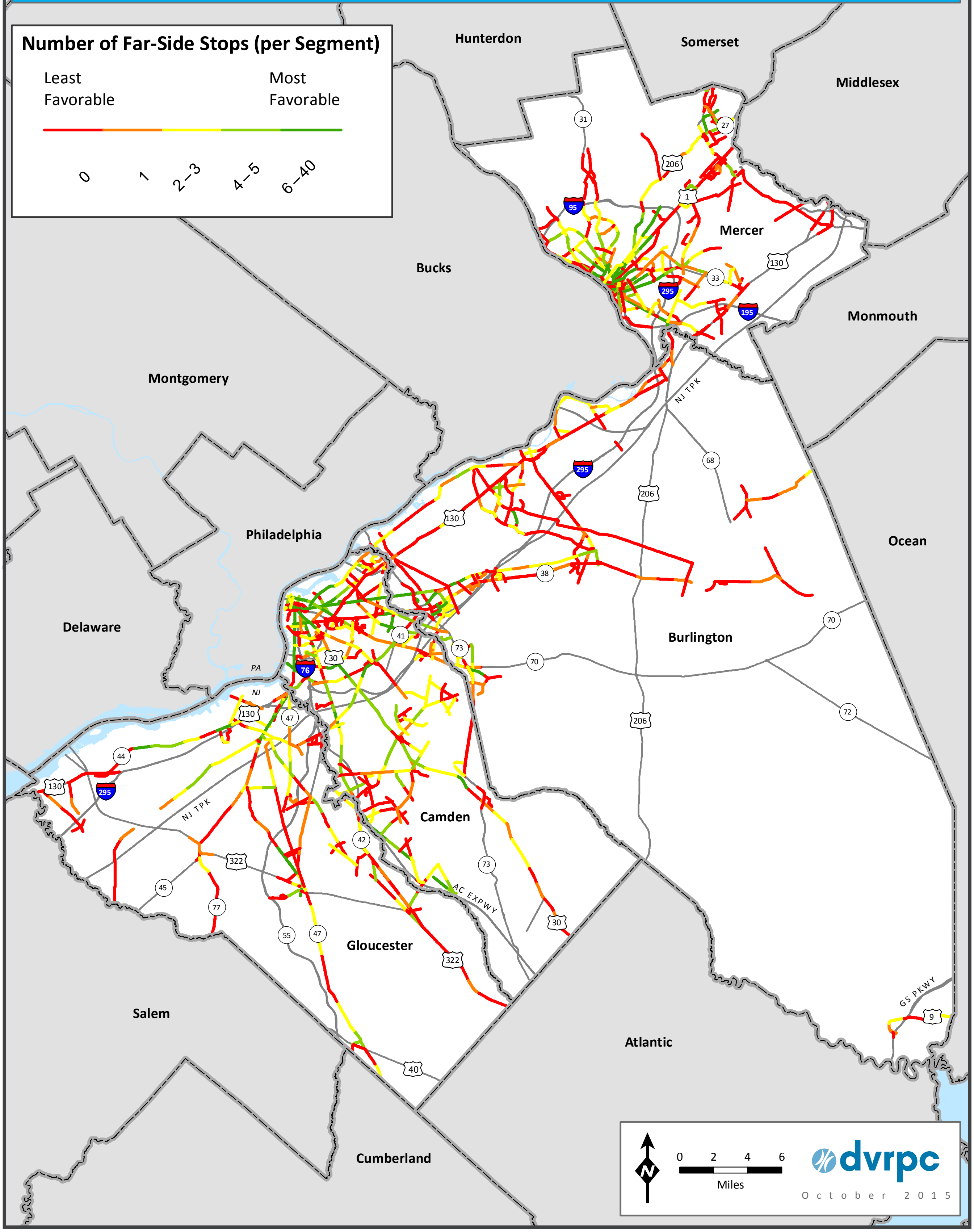


Figure A7: TSP Favorability Score Criterion: Operational Issues at Bottlenecks

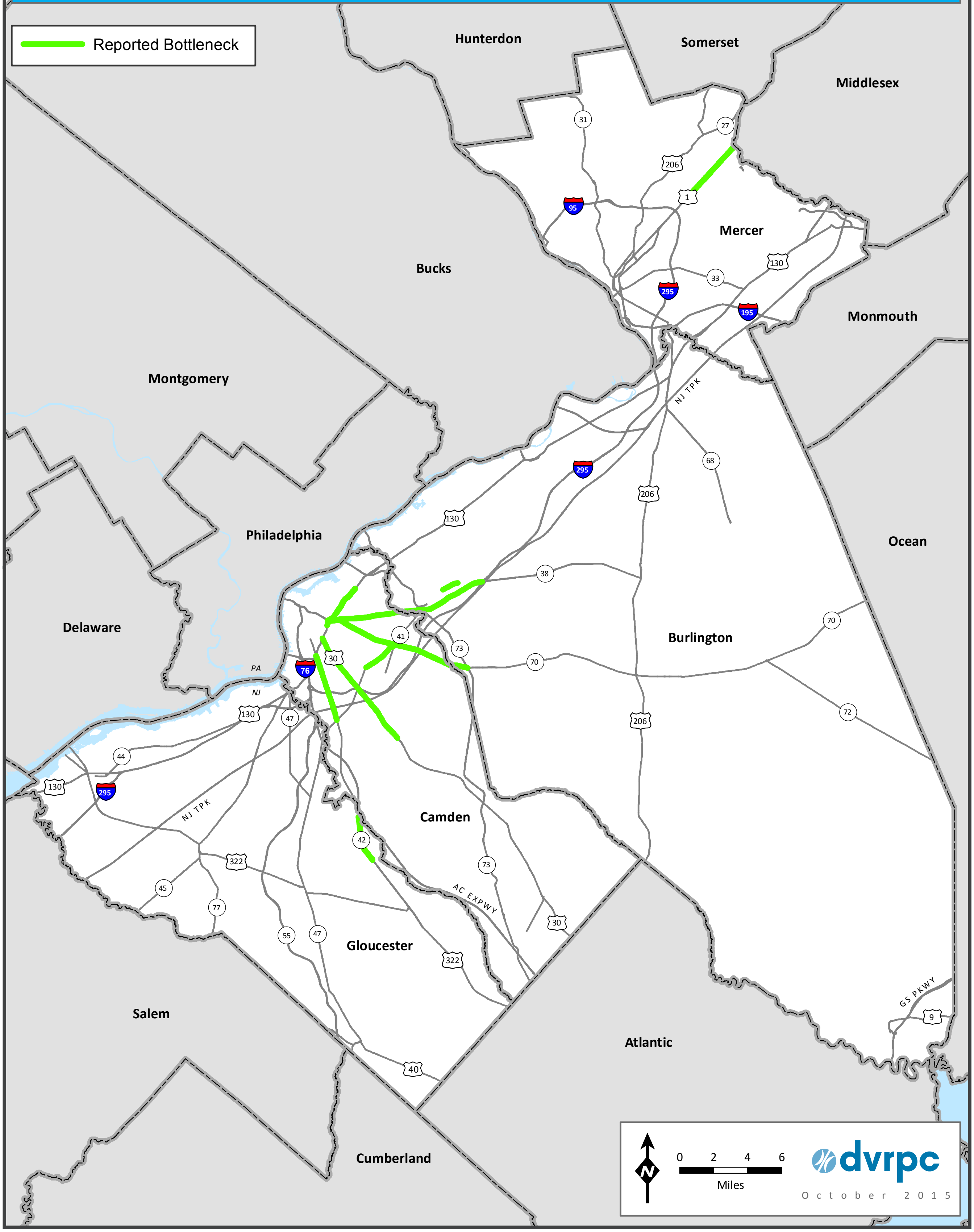


Figure A8: TSP Favorability Score Criterion: Transit Score

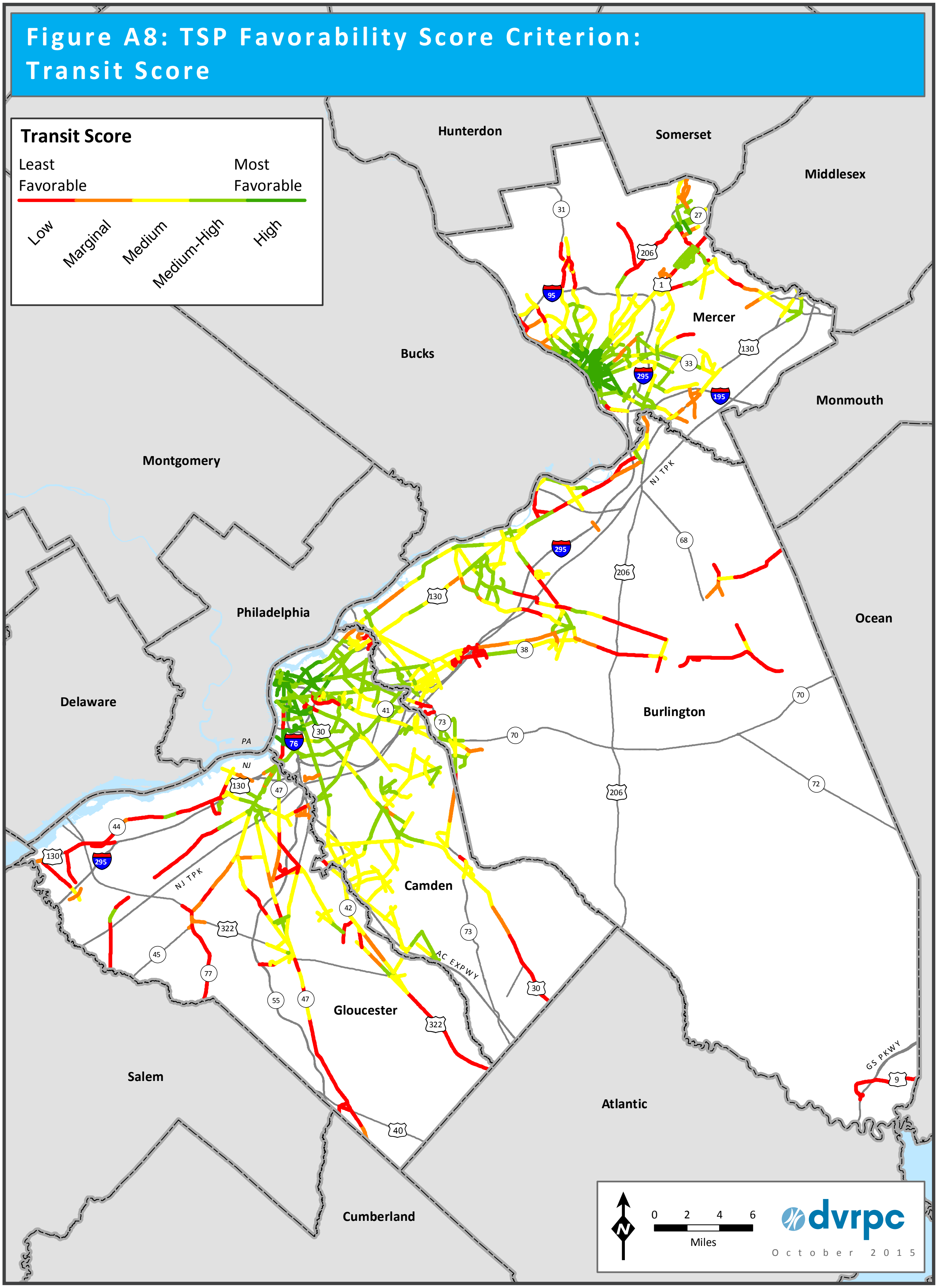


Figure A9: TSP Favorability Score Criterion: Integrated Corridor Management

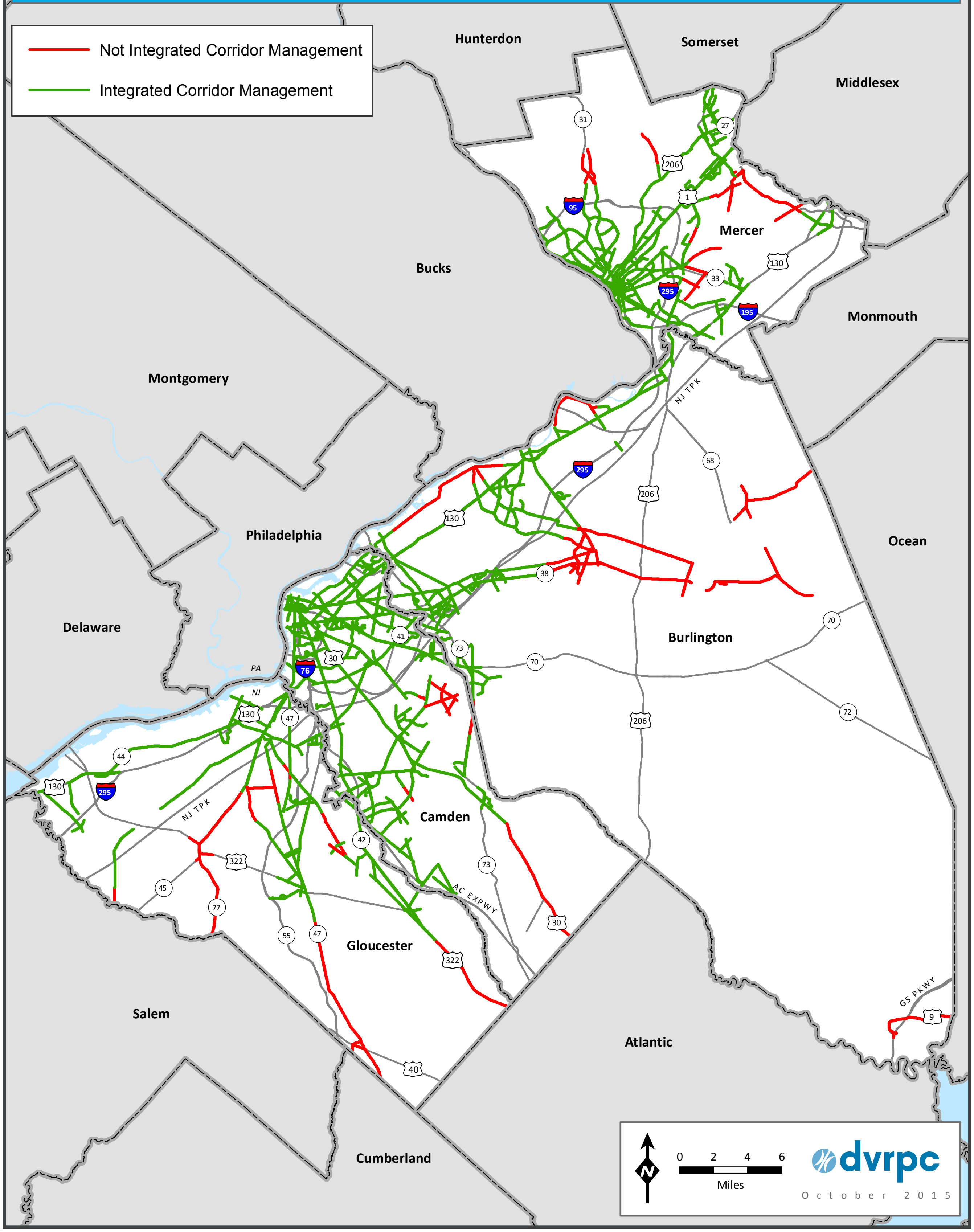


Figure A10: TSP Favorability Score Criterion: Roadway Functional Class

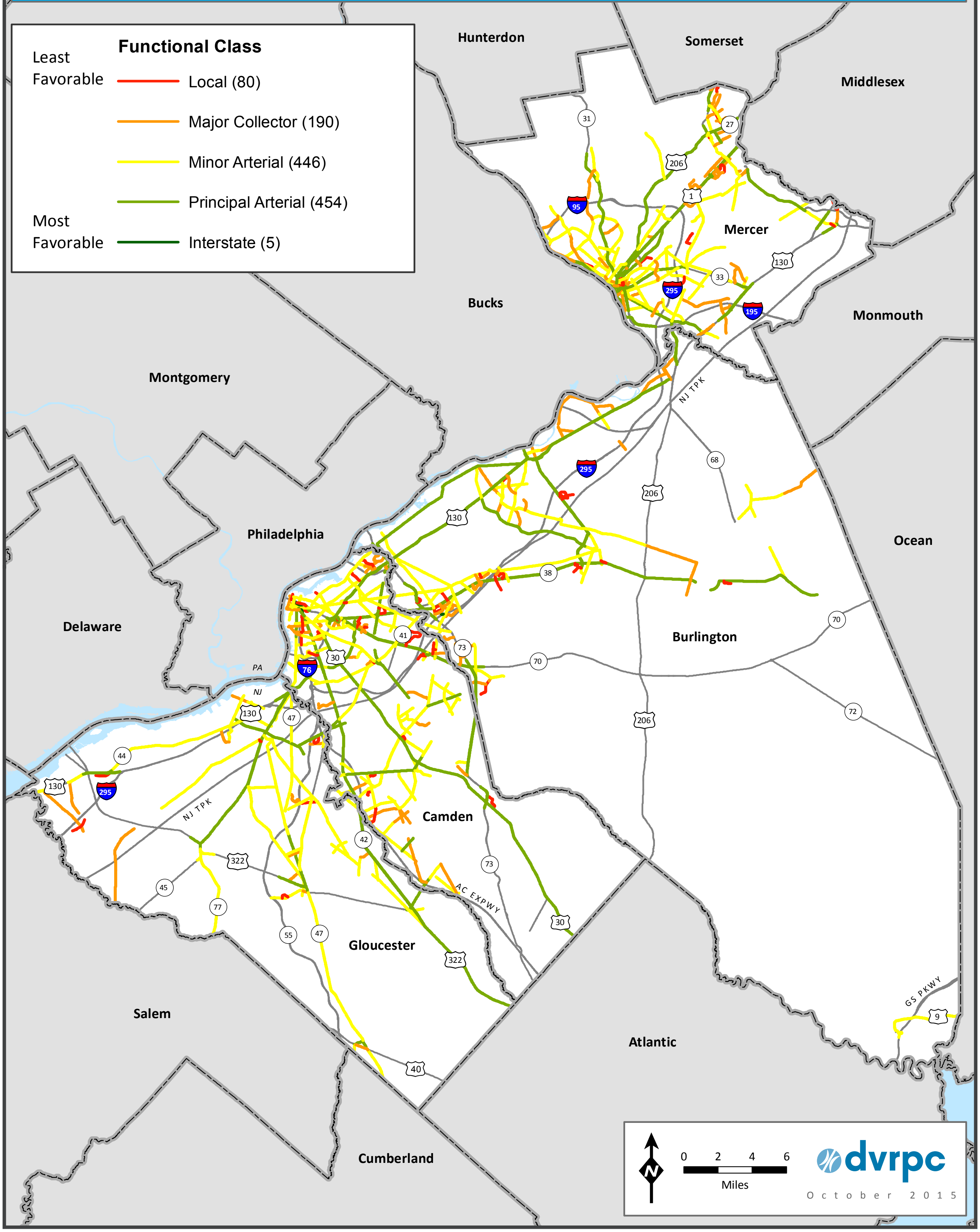
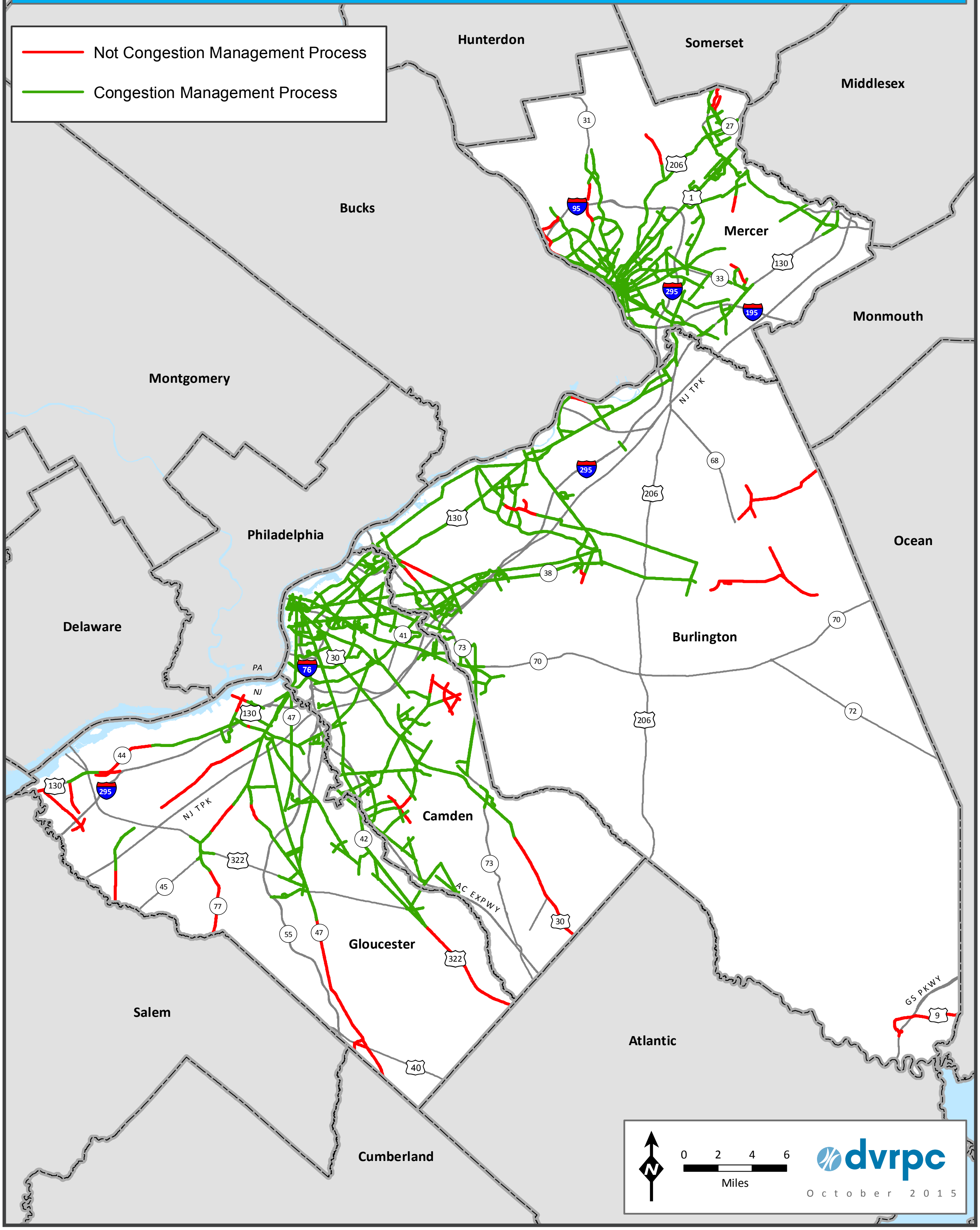


Figure A11: TSP Favorability Score Criterion: Congestion Management Process



Evaluating Opportunities for Transit Signal Priority in Southern New Jersey

Publication Number:	15016
Date Published:	December 2015
Geographic Area Covered:	Mercer County, Burlington County, Camden County, Gloucester County, New Jersey
Key Words:	Mercer County, Burlington County, Camden County, Gloucester County, Transit Signal Priority, New Jersey Transit, Bus, Public Transportation, BRT

Abstract:

This study examines signalized corridors and surface transit routes in Mercer, Burlington, Camden, and Gloucester counties and develops a method of scoring corridors on their likelihood for successful and cost-effective TSP and related signals investments. To develop a TSP prioritization framework, the study team has built upon prior data gathering, analysis, and mapping work. The screening tool identifies the corridors where TSP is likely to be the most effective and have the greatest operational benefits for transit and all road users.

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