NATIONAL CAPITAL REGION TRANSPORTATION PLANNING BOARD

National Capital Region Congestion Report

3rd Quarter 2015

Metropolitan Washington Council of Governments
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Release date: October 29, 2015
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Congestion – Travel Time Index (TTI)

Interstate System

TTI 3rd Quarter 2015:	1.30	↑0.2% or 0.002[1]
TTI Trailing 4 Quarters:	1.32	↓0.1% or 0.002[2]

Non-Interstate NHS[3]

TTI 3rd Quarter 2015:	1.23	↓0.2% or 0.002
TTI Trailing 4 Quarters:	1.21	↓1.7% or 0.02

Transit-Significant[4]

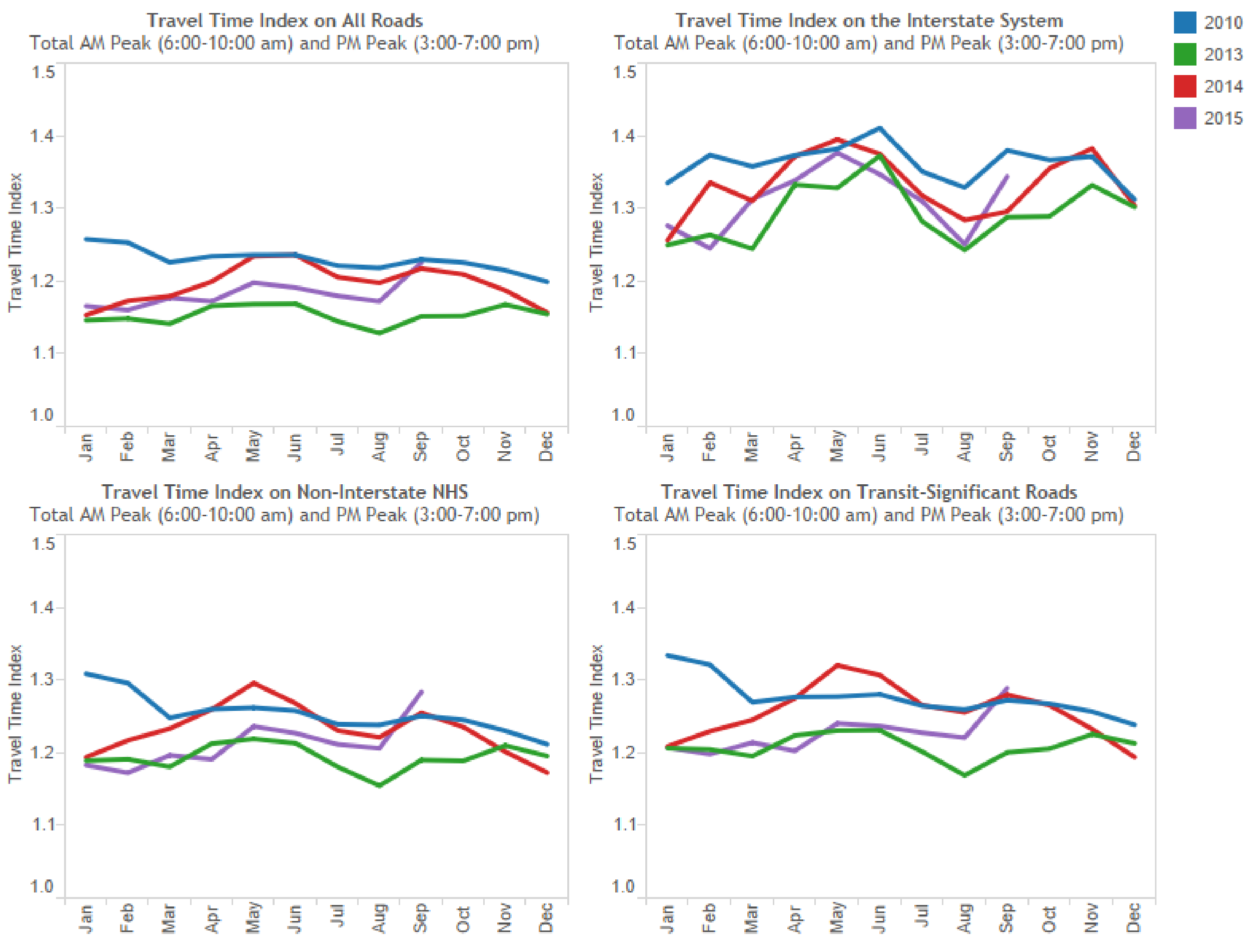
TTI 3rd Quarter 2015:	1.25	↓1.7% or 0.02
TTI Trailing 4 Quarters:	1.23	↓2.0% or 0.03

All Roads

TTI 3rd Quarter 2015:	1.19	↓1.2% or 0.01
TTI Trailing 4 Quarters:	1.18	↓0.5% or 0.01

[1] Compared to 3rd quarter 2014; [2]Compared to one year earlier; [3] NHS: National Highway System; [4]See page 14.

Figure 1. Monthly average Travel Time Index for Total AM peak (6:00-10:00 am) and PM peak (3:00-7:00 pm)



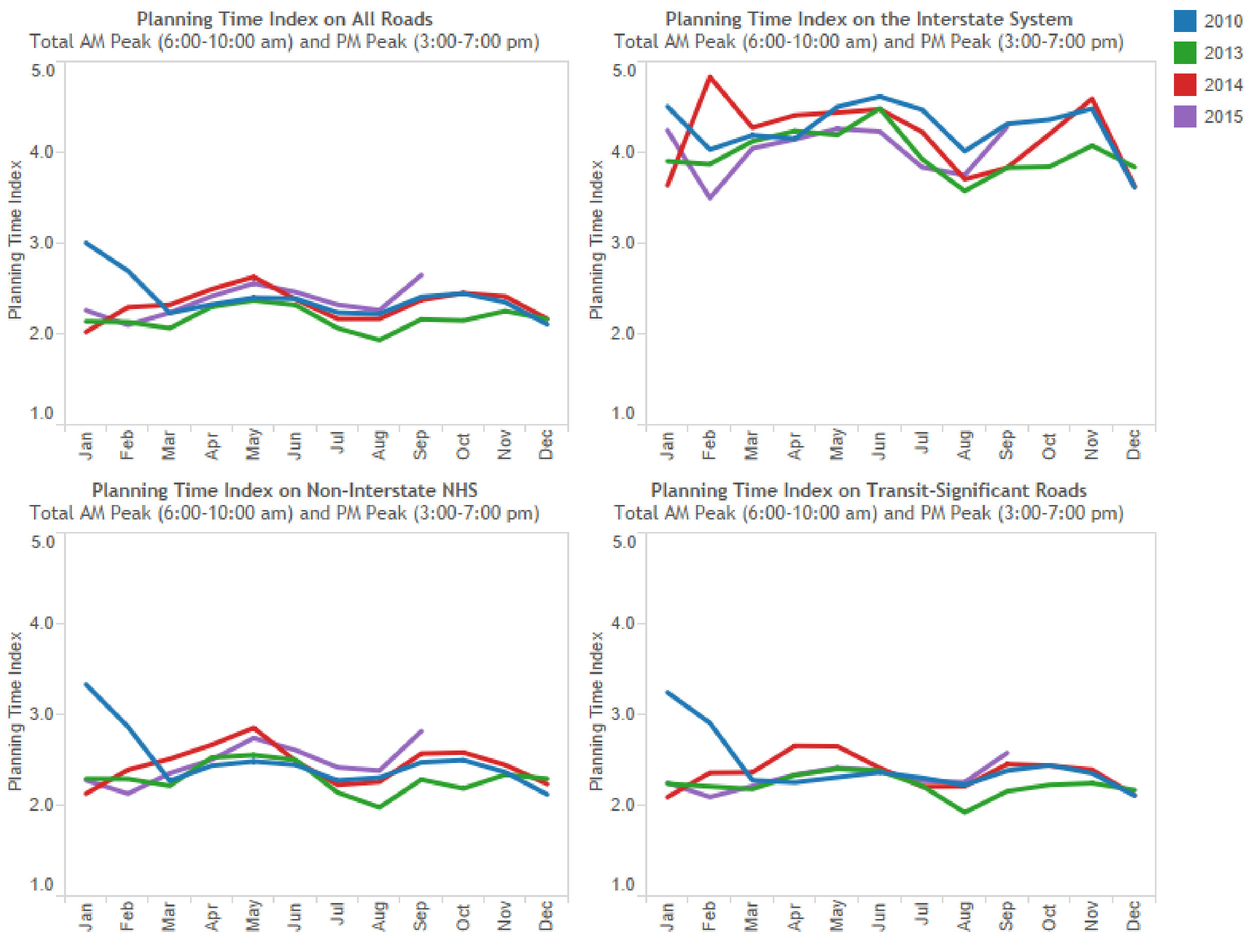
> ***Travel Time Index***
> *Travel Time Index (TTI), defined as the ratio of actual travel time to free-flow travel time, measures the intensity of congestion. The higher the index, the more congested traffic conditions it represents, e.g., TTI = 1.00 means free flow conditions, while TTI = 1.30 indicates the actual travel time is 30% longer than the free-flow travel time.*

Unreliability – Planning Time Index (PTI)

Interstate System				**Non-Interstate NHS**[3]		
PTI 3rd Quarter 2015:	3.95	↑0.9% or 0.04[1]		PTI 3rd Quarter 2015:	2.54	↑8.0% or 0.19
PTI Trailing 4 Quarters:	4.06	↓1.8% or 0.07[2]		PTI Trailing 4 Quarters:	2.46	↑2.0% or 0.05
Transit-Significant[4]				**All Roads**		
PTI 3rd Quarter 2015:	2.37	↑3.4% or 0.08		PTI 3rd Quarter 2015:	2.41	↑7.8% or 0.17
PTI Trailing 4 Quarters:	2.31	↓1.1% or 0.03		PTI Trailing 4 Quarters:	2.36	↑3.2% or 0.07

[1] Compared to 3rd quarter 2014; [2]Compared to one year earlier; [3] NHS: National Highway System; [4]See page 14.

Figure 2. Monthly average Planning Time Index for Total AM peak (6:00-10:00 am) and PM peak (3:00-7:00 pm)

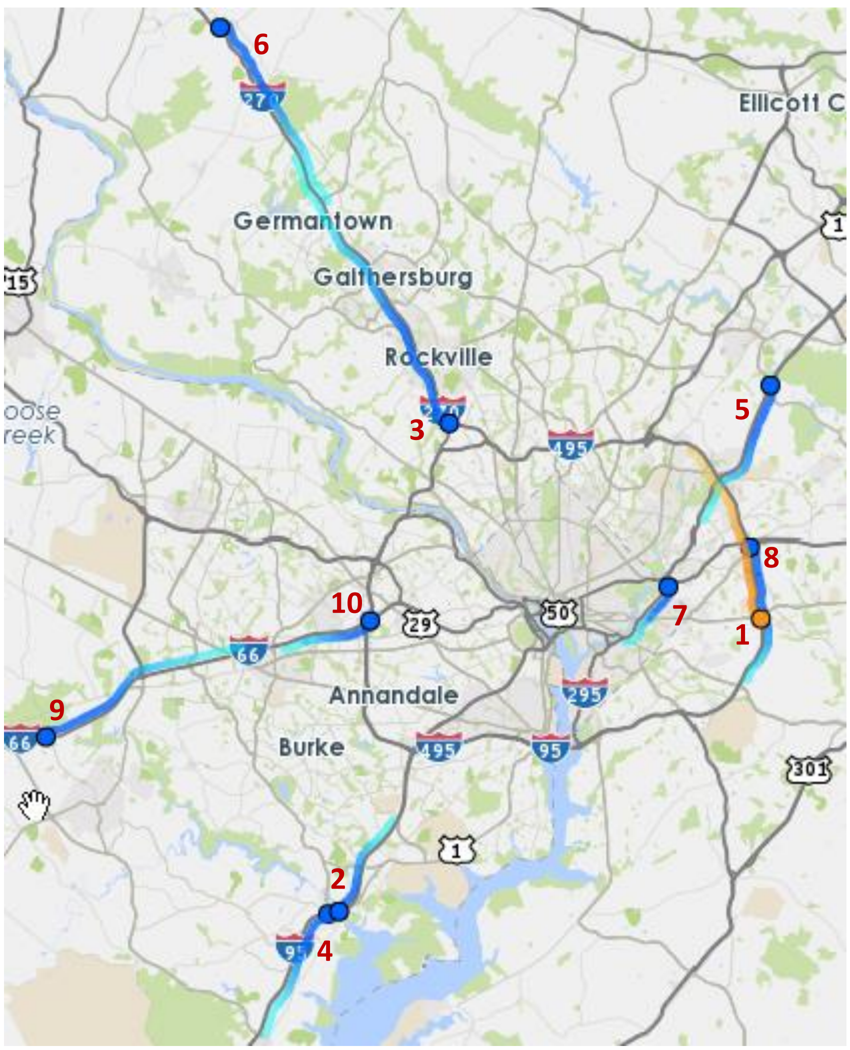


> ***Planning Time Index***
> *Planning Time Index (PTI), defined as the ratio of 95th percentile travel time to free flow travel time, measures travel time reliability. The higher the index, the less reliable traffic conditions it represents, e.g., PTI = 1.30 means a traveler has to budget 30% longer than the uncongested travel time to arrive on time 95% of the times (i.e., 19 out of 20 trips).*

Top 10 Bottlenecks

Rank (Last Quarter Rank)	Location	Average duration	Average max length (miles)	Occur-rences	Impact factor
1 (1)*	I-495 CW @ MD-214/CENTRAL AVE/EXIT 15	2 h 17 m	8.88	187	227,530
2 (2)	I-95 S @ VA-123/EXIT 160	3 h 9 m	5.05	231	220,658
3 (6)	I-270 S @ I-270	2 h 11 m	14.09	111	204,923
4 (4)	I-95 N @ VA-123/EXIT 160	2 h 31 m	5.9	183	163,030
5 (12)	MD-295 N @ MD-197/EXIT 11	3 h 20 m	6.84	111	151,922
6 (20)	I-270 N @ MD-80/EXIT 26	2 h 4 m	10.33	113	144,748
7 (8)	DC-295 N @ EASTERN AVE	3 h 13 m	3.42	181	119,424
8 (7)	I-495 CCW @ US-50/EXIT 19	1 h 59 m	7.55	127	114,102
9 (3)	I-66 W @ VA-234/EXIT 47	2 h 34 m	10.5	70	113,177
10 (5)	I-66 E @ I-495/EXIT 64	1 h 47 m	4.43	234	110,990

** See "Bottlenecks" section in the "Background" chapter for ranking variability from quarter to quarter.*



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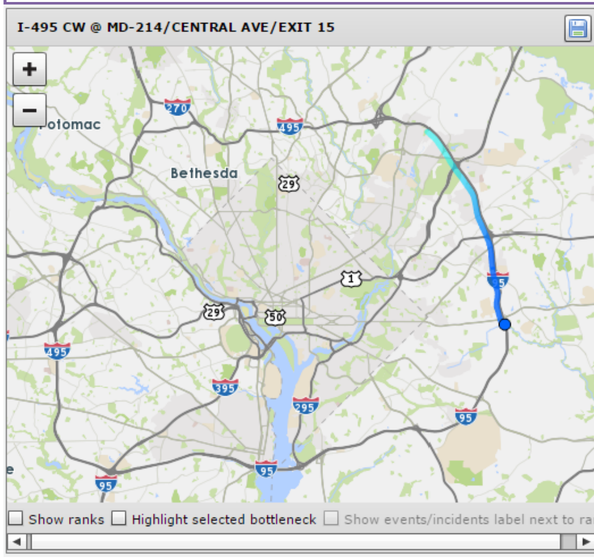

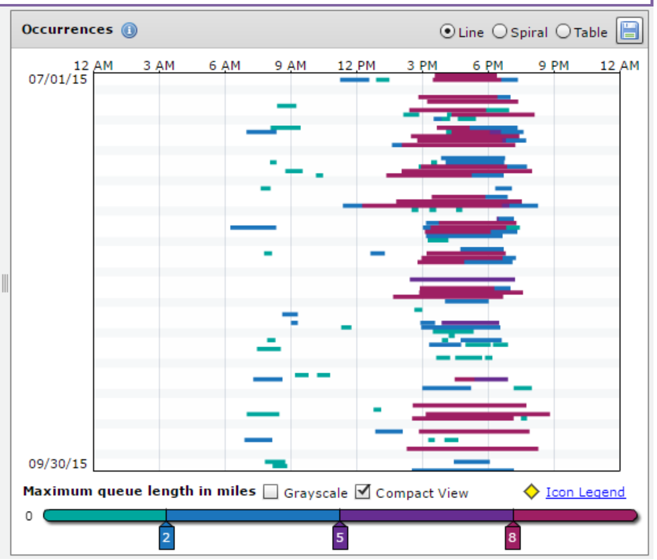

* The Impact Factor of a bottleneck is simply the product of the Average Duration (minutes), Average Max Length (miles) and the number of occurrences.

Rank	Location	Average duration	Average max length (miles)	Occurrences	Impact factor
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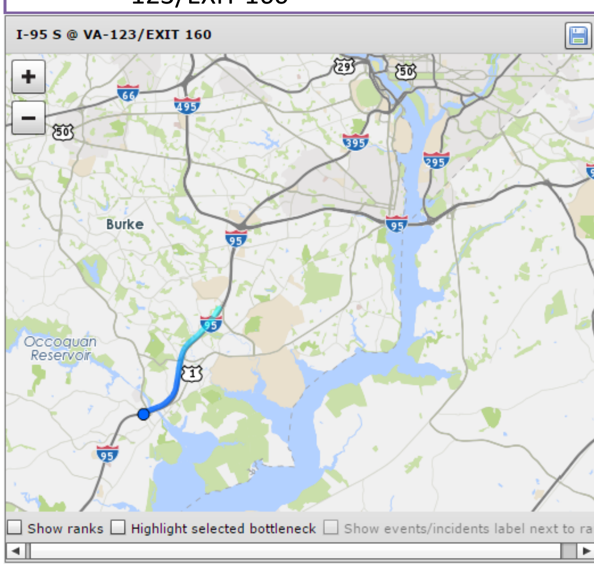

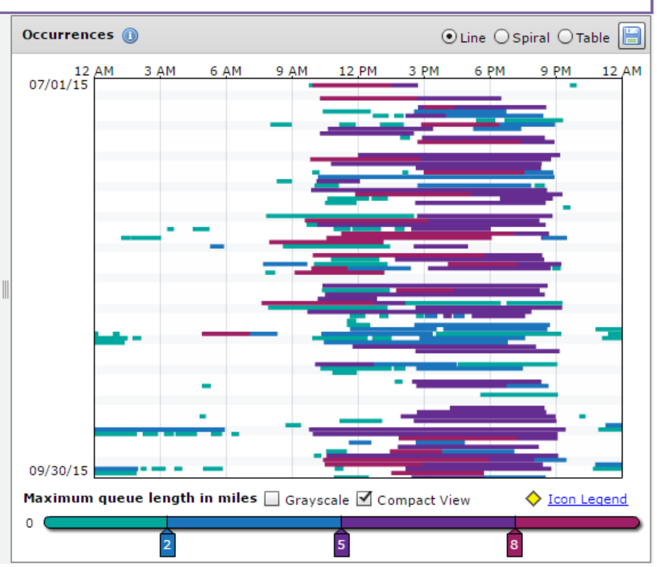

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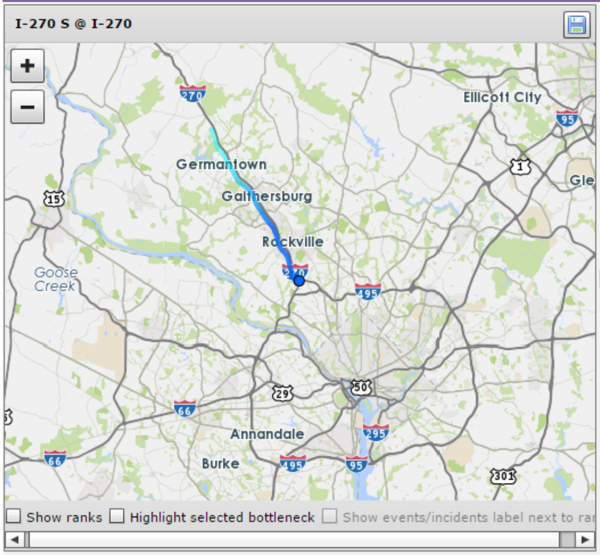

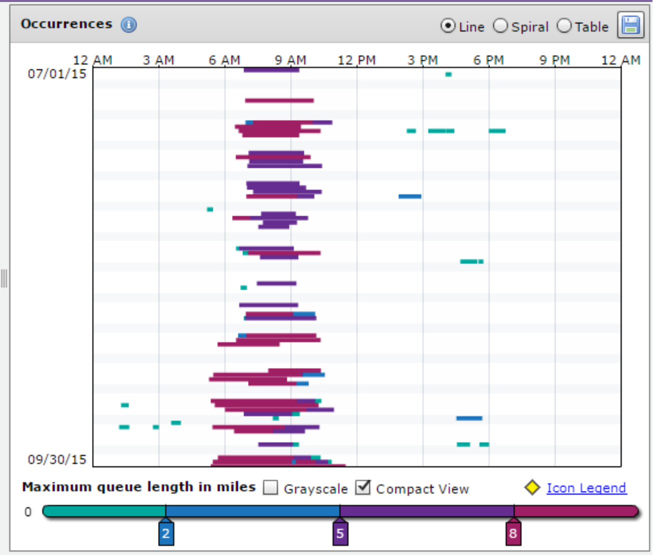

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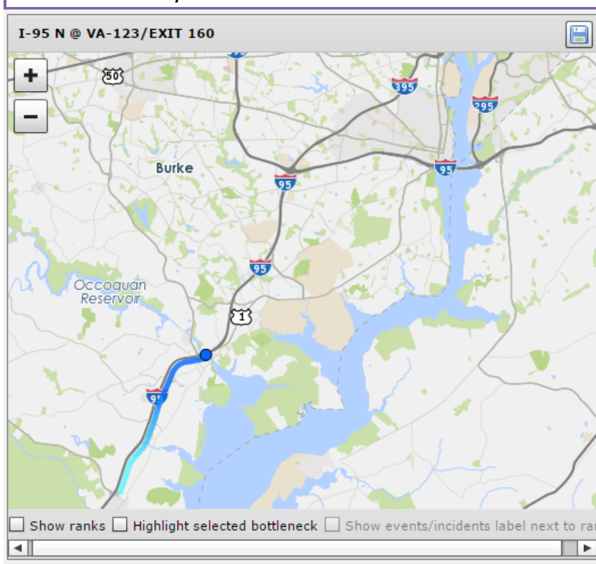

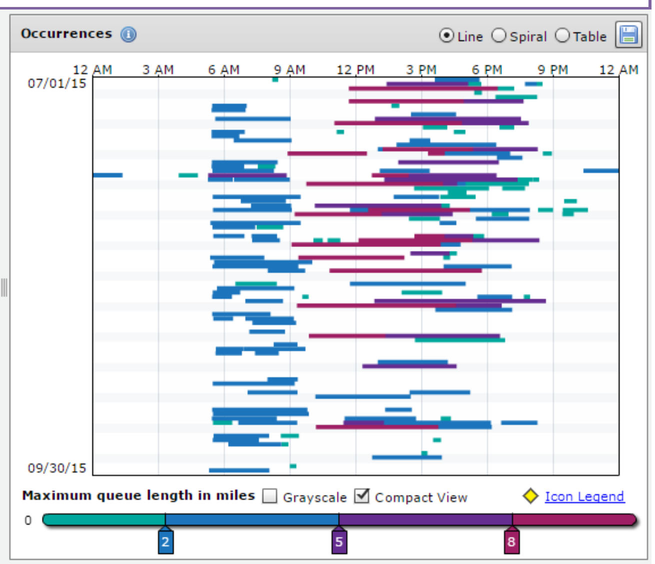

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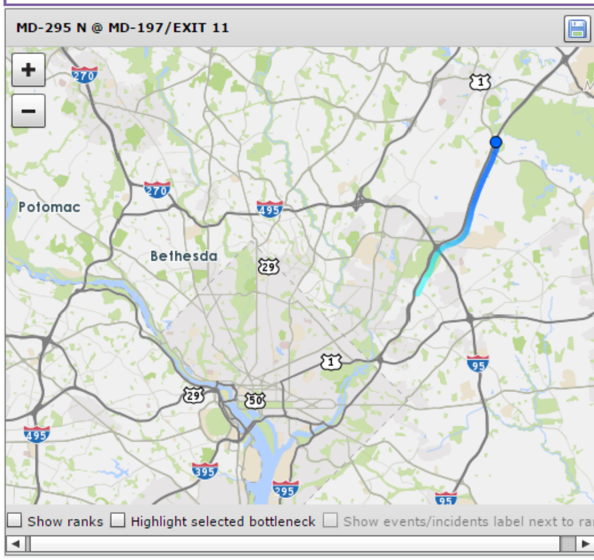

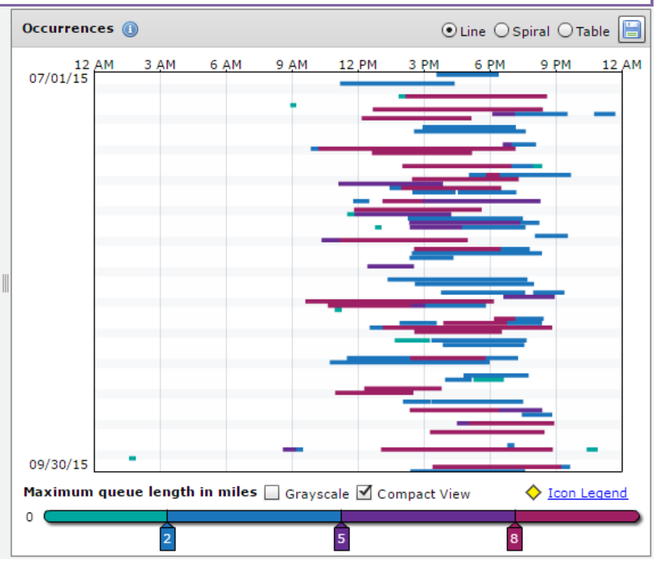

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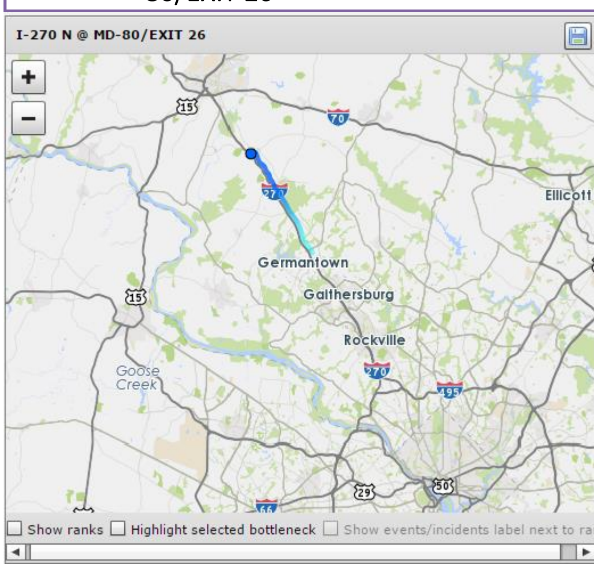

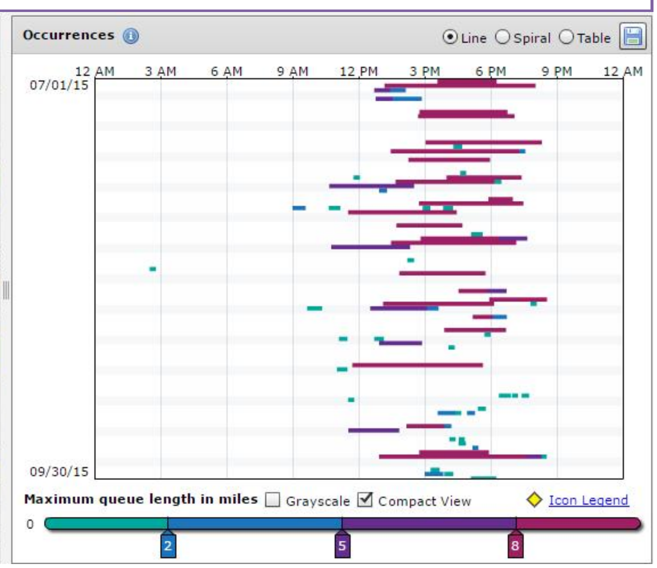

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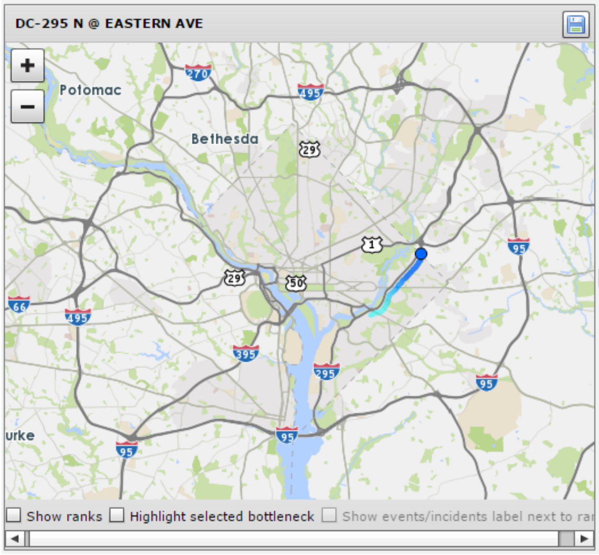

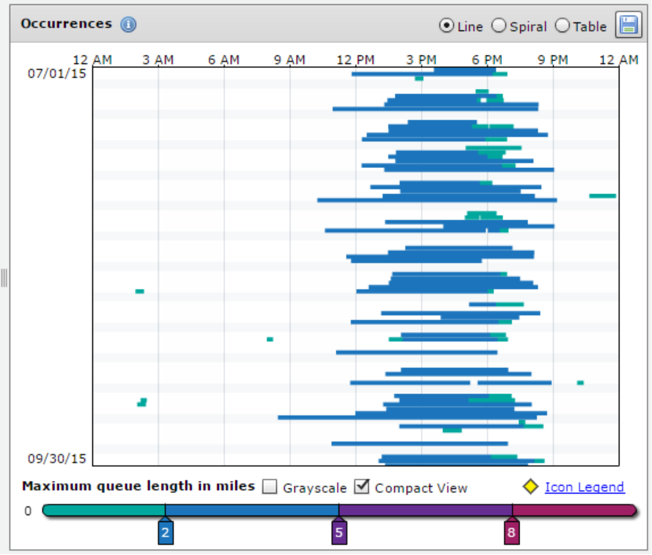

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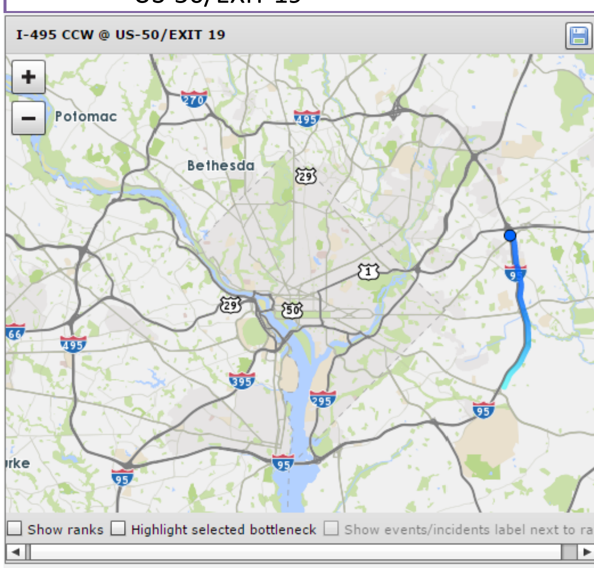

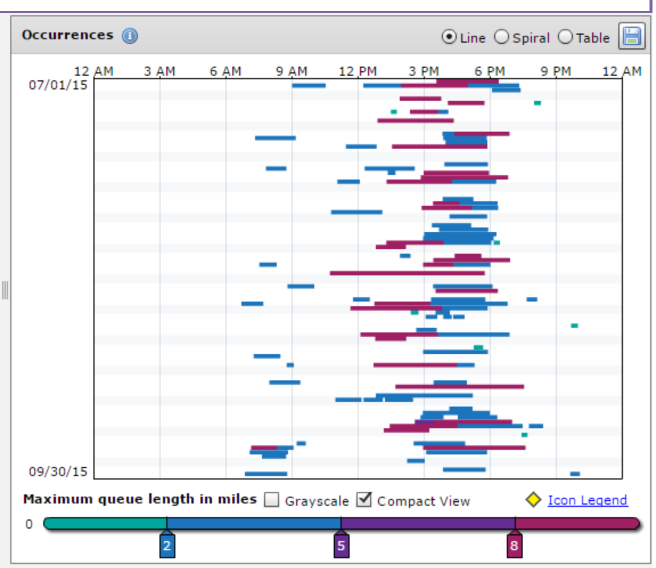

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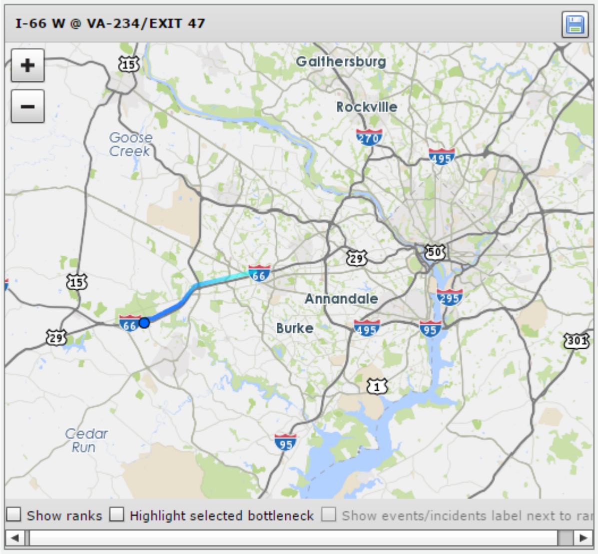

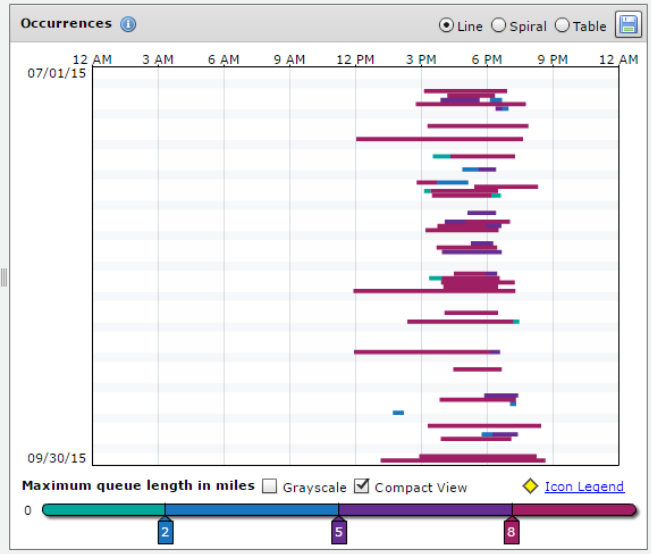

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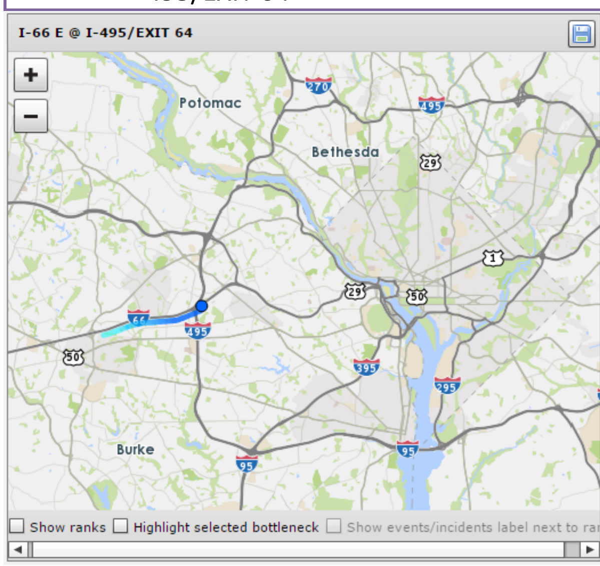
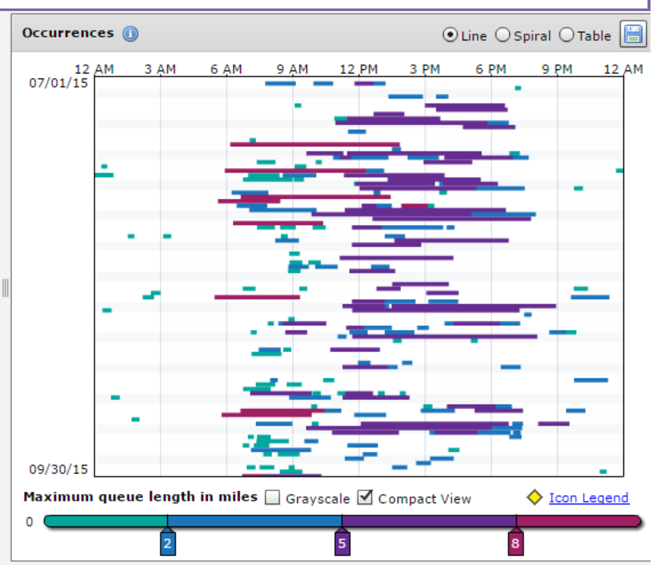




Congestion Maps

Figure 3. Travel Time Index during weekday 8:00-9:00 AM in 3rd Quarter 2015

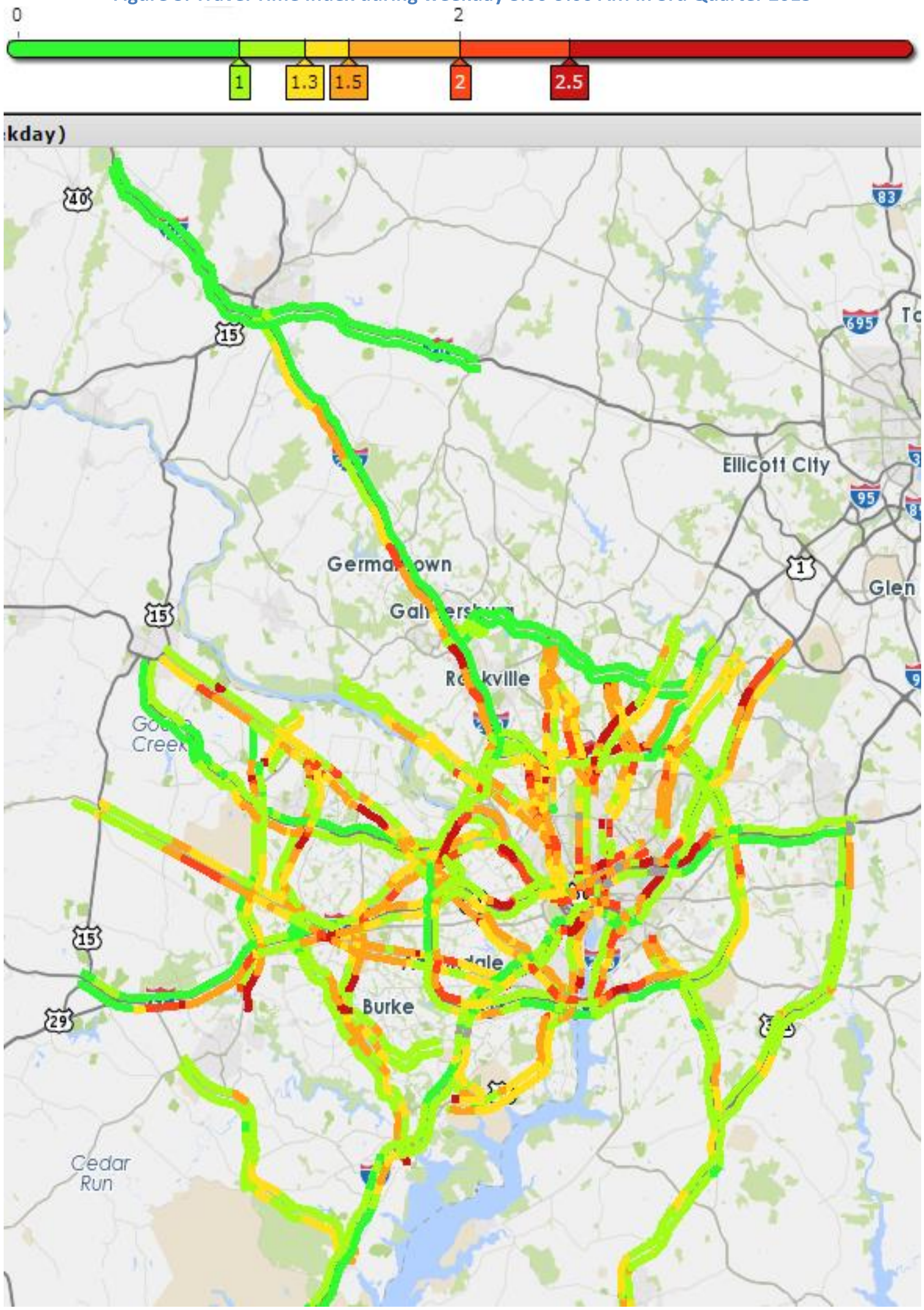
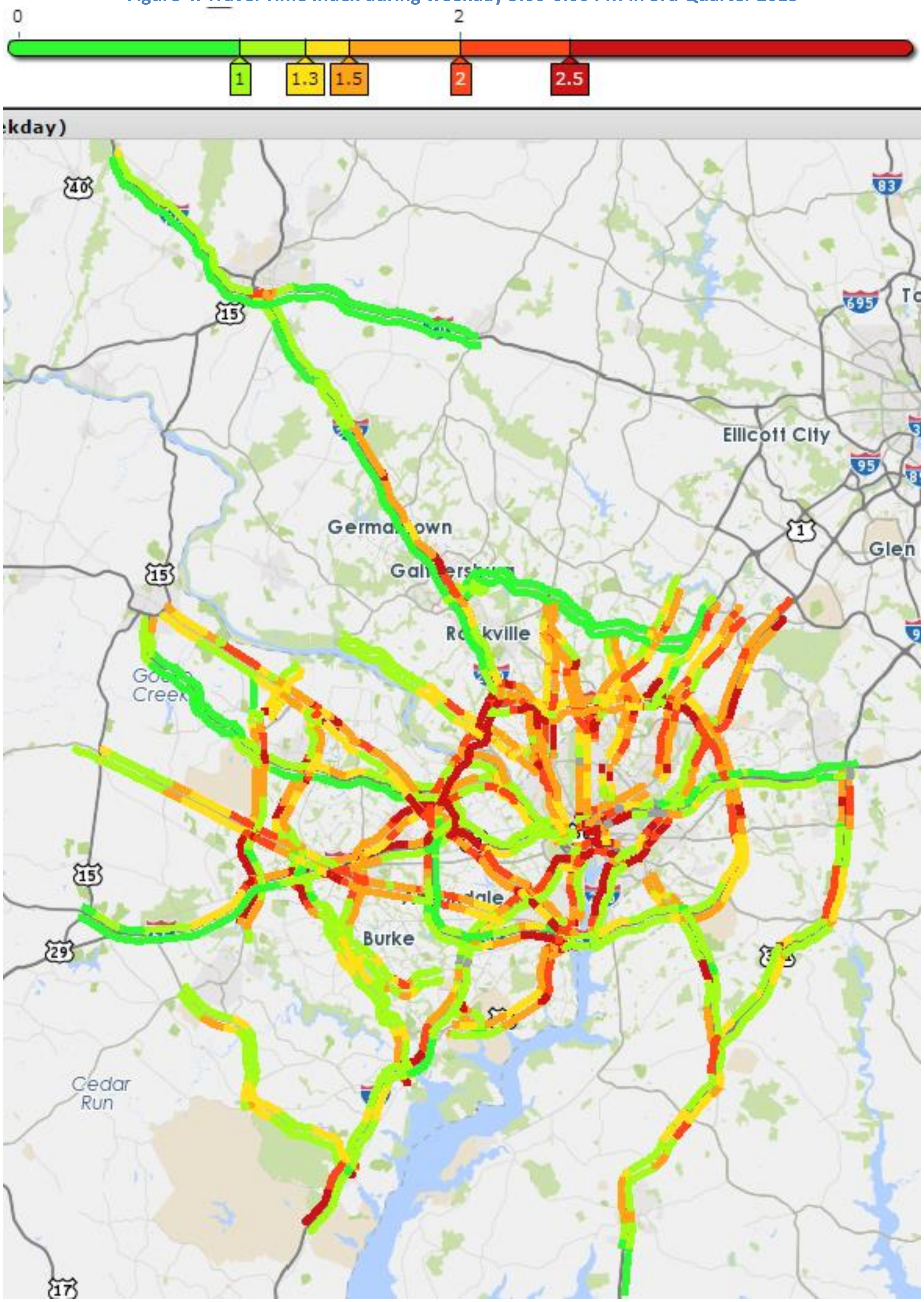


Figure 4. Travel Time Index during weekday 5:00-6:00 PM in 3rd Quarter 2015



3rd Quarter 2015 Spotlight –Papal Visit Transportation Impacts

Introduction

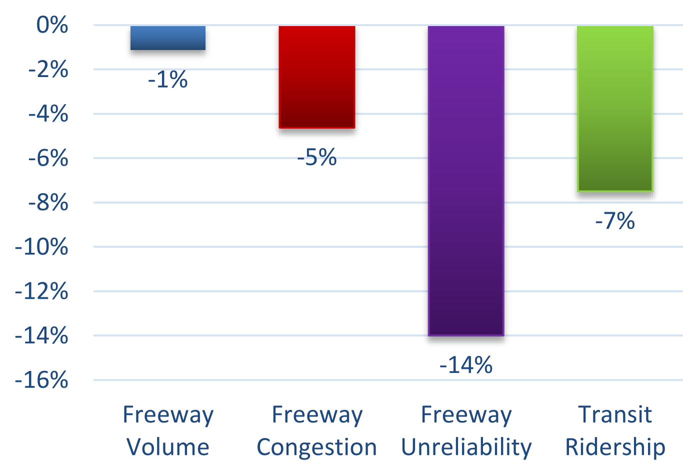
The Pope visited Washington, DC September 22-24, 2015 as part of his multi-city official visit to the United States. Contrary to expectations that roads would be exceptionally congested and the transit systems would be overcrowded, the Washington region actually experienced notable improvements in transportation conditions on both highways and transit systems during his visit.

This quarter's spotlight summarizes the impacts of the Papal visit on the Washington region's transportation systems based upon sets of traffic volume, traffic congestion, and transit ridership data immediately available after the Papal visit. The analysis compared the transportation conditions of the week of the Papal visit, September 21-25 or Monday through Friday, to that of the week preceding, September 14-18, Monday through Friday. Overall, a modest reduction in traffic volumes led to a significant reduction in congestion and an even larger improvement in travel time reliability on freeways, and transit ridership notably declined for the week.

Summary of Findings

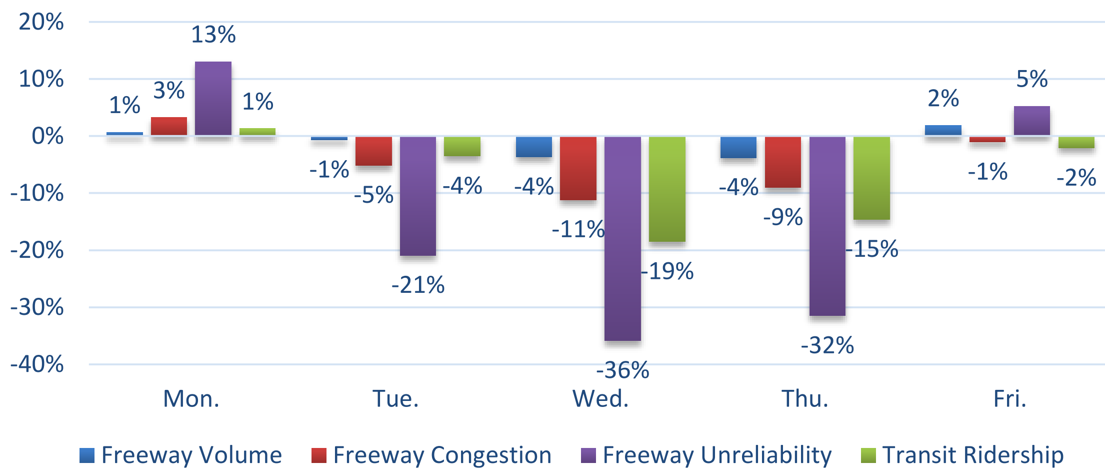
1. *Overall, the Papal visit had notable impacts on the Washington region's transportation systems.* Although traffic volume on freeways for the week of the Papal visit was only 1 percent down compared to the week preceding, traffic congestion was relieved by 5 percent, and travel time reliability improved by 14 percent. Transit ridership on Metrorail, Metrobus, and other major public transportation providers was down 7 percent (Figure 5).

Figure 5. Weekly Average Changes of The Week of Papal Visit Compared to the Week Preceding



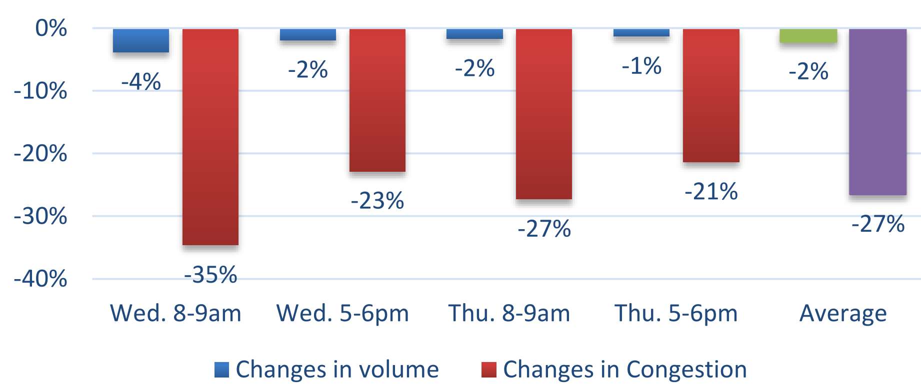
2. *The most significant impact on transportation during the week of the Papal visit was observed on September 23-24, Wednesday and Thursday, the days of the Pope's public events in Washington.* On those two days, freeway traffic volume and congestion were down 4 percent and about 10 percent respectively, and transit ridership declined 15-19 percent, compared to the same days one week earlier (Figure 6). Travel time reliability on freeways was improved by 21, 36 and 32 percent on September 22, 23 and 24, respectively, and declined 13 and 5 percent on September 21 and 25, respectively. Travel time reliability, a measure which is sensitive to extreme conditions, tends to vary to a greater magnitude than other travel metrics.

Figure 6. Daily Average Changes of The Week of Papal Visit Compared to the Week Preceding



3. *During typical peak hours on Wednesday and Thursday, September 23-24, an average of 2 percent decline in volume led to a 27 percent decrease in congestion on freeways*, showing the effectiveness of that travel demand management can have in combating congestion (Figure 7).

Figure 7. Reduction in Volume and Congestion in Typical Peak Hours



4. *Travel times on the region's major freeways were significantly shortened during peak hours on September 23-24 compared to the same days one week earlier,* especially those inside the Beltway and during AM peak hour 8:00-9:00 am. For example, the inbound travel time on I-395 from the Beltway to the Potomac River in AM peak hour was reduced from 44 minutes to only 12 minutes, a 73 percent reduction; southbound I-270 travel time from I-370 to the Beltway was shortened from 38 minutes to only 11 minutes, a 71 percent savings.

Contributing Factors

Many factors may have played roles in contributing to the changes observed on the Washington region's transportation systems. Most significantly, the Office of Personnel Management asked federal agencies to allow employees to telework, adjust their work hours or take time off during Pope Francis' visit. Many other employers also implemented similar telework and flexible work hours policies. The significant reduction of freeway and region-wide congestion during peak hours could be an indication of the contributions from workers that took advantage of telework and flexible work hours arrangement policies, and could encourage further use of such programs. It should be cautioned, however, that teleworking and flexible work hours are probably not a silver bullet for congestion. The Papal visit was a highly publicized event occurring during a very limited time period, and telework and flexible work hour-derived congestion relief of the magnitude recently experienced was a result of an extraordinary event.

Other factors may include: 1) Wednesday, September 23 was also Yom Kippur, and schools were closed in some jurisdictions; and 2) Some local transit providers reduced or rerouted services on September 23-24 based on anticipated travel patterns during the Papal visit.

Notes and Caveats on Data Sources and Analyses

Comparison to the Previous Week: The choice of using the week preceding the Papal visit to represent an "average" week for comparison is instructive but imperfect. Any week chosen as a comparison in this type of analysis has its own unique factors such as weather, incidents or school schedules that cause variations from week to week – no given week is perfectly "average".

Traffic Volume Data: Traffic volume on freeways were obtained from the Federal Highway Administration's Transportation Technology Innovation and Demonstration (TTID) Program. The company HERE currently hosts a Stakeholder Application website, from which the volume data were downloaded. Data reduction revealed that on average there were 184 detection stations producing usable data during the analysis period in the Washington region. Average volumes of the 184 stations were calculated for each hour of the day (hourly volume) and each day (daily volume), which were used in the above traffic volume analysis. It should be noted that these volume data are a reasonable representative sampling, but do not cover every single freeway segment in the region.

Traffic Speed Data: Traffic speed data were provided by the I-95 Corridor Coalition Vehicle Probe Project (VPP) and INRIX, Inc. through the VPP Suite enabled by the Center of Advanced Transportation Technologies Laboratory (CATT Lab) of the University of Maryland. Although the speed data cover about 5,500 directional miles of roads in the region, many side streets and local roads are not covered by the data providers.

Transit Data: COG/TPB analyzed ridership data from transit providers that carry the majority of the region's transit trips, including WMATA's Metrorail and Metrobus, Arlington ART, Alexandria DASH, Fairfax Connector, Montgomery County RideOn, Prince George's County TheBus, and the Potomac and Rappahannock Transportation Commission.

More details about the analysis can be found in the October 21 TPB Weekly Report and in a technical memorandum.

Background

Motivation

Inspired by various agency and jurisdictional dashboard efforts around the country (e.g., the Virginia Department of Transportation Dashboard), driven by the MAP-21 legislation and the emerging probe-based traffic speed data from the I-95 Corridor Coalition Vehicle Probe Project, this quarterly updated National Capital Region Congestion Report takes advantage of the availability of rich data and analytical tools to produce customized, easy-to-communicate, and quarterly updated traffic congestion and travel time reliability performance measures for the Transportation Planning Board (TPB) Planning Area. The goal of this effort is to timely summarize the region's congestion and the programs of the TPB and its member jurisdictions that would have an impact on congestion, to examine reliability and non-recurring congestion for recent incidents/occurrences, in association with relevant congestion management strategies, and to prepare for the MAP-21 performance reporting.

Methodology

Travel Time Index (TTI)

TTI is defined as the ratio of actual travel time to free-flow travel time, measures the intensity of congestion. The higher the index, the more congested traffic conditions it represents, e.g., TTI = 1.00 means free flow conditions, while TTI = 1.30 indicates the actual travel time is 30% longer than the free-flow travel time. For more information, please refer to Travel Time Reliability: Making It There On Time, All The Time, a report published by the Federal Highway Administration and produced by the Texas Transportation Institute with Cambridge Systematics, Inc. This report uses the following method to calculate TTI:

1. Download INRIX 5-minute raw data from the I-95 Traffic Monitoring website (http://i95.inrix.com) or the VPP Suite website (https://vpp.ritis.org).
2. Aggregate the raw data to monthly average data by day of the week and hour of the day. Harmonic Mean was used to average the speeds and reference speeds (Harmonic Mean is only used here; other averages used are all Arithmetic Mean). For each segment (TMC), the monthly data have 168 observations (7 days in a week * 24 hours a day) in a month.
3. Calculate TTI = reference speed / speed in the monthly data. If TTI < 1 then make TTI = 1. If constraint TTI >= 1 was not imposed, some congestion could be cancelled by conditions with TTI < 1.
4. Calculate regional average TTI for the Interstate system, non-Interstate NHS, non-NHS, and all roads for AM peak (6:00-10:00 am) and PM Peak (3:00-7:00 pm) respectively, using segment length as the weight.
5. Calculate the average TTI of the AM Peak and PM Peak to obtain an overall congestion indicator.

Planning Time Index (PTI)

PTI is defined as the ratio of 95th percentile travel time to free flow travel time, measures travel time reliability. The higher the index, the less reliable traffic conditions it represents, e.g., PTI = 1.30 means a traveler has to budget 30% longer than the uncongested travel time to arrive on time 95% of the times (i.e., 19 out of 20 trips), while TTI = 1.60 indicates that one has to budget 60% longer than the uncongested travel time to arrive on time most of the times. For more information, please refer to Travel Time Reliability: Making It There On Time, All The Time, a report published by the Federal

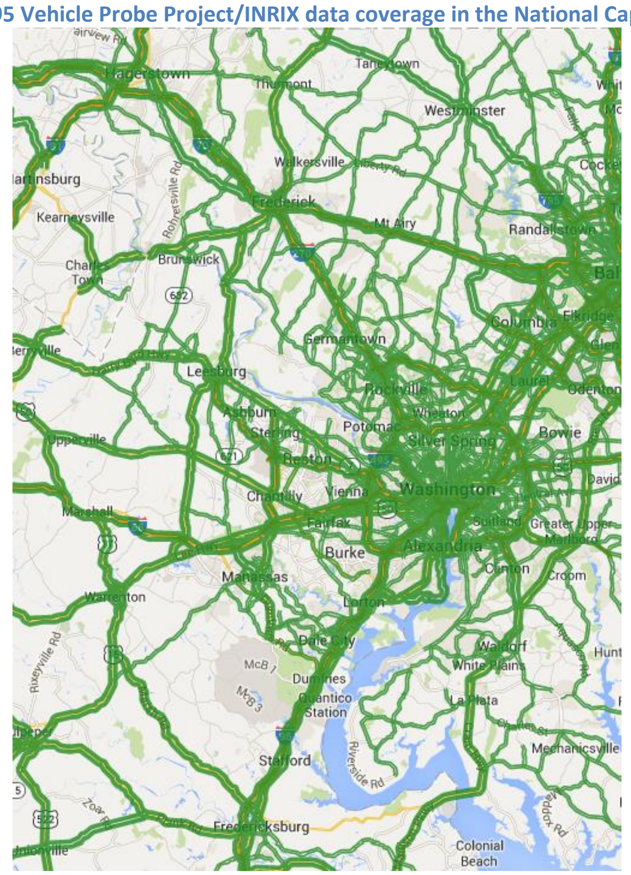
Highway Administration and produced by the Texas Transportation Institute with Cambridge Systematics, Inc. This report uses the following method to calculate PTI:

1. Calculate TTI = reference speed / speed in the monthly data obtained in step 2 of the above TTI methodology. Do not impose constraint TTI >= 1, since the purpose of this calculation is to rank the TTIs to find the 95th percentile, not to average the TTIs.
2. Calculate monthly average PTI: including sorting the data obtained in step 1 by segment, peak period, and month, finding the 95th percentile TTI and this TTI is PTI by definition, and averaging the PTIs using segment length as the weight to get regional summaries (for the Interstate system, non-Interstate NHS, non-NHS, and all roads for AM peak (6:00-10:00 am) and PM Peak (3:00-7:00 pm) respectively).
3. Calculate yearly average PTI: including sorting the data obtained in step 1 by segment and peak period, finding the 95th percentile TTI and this TTI is PTI by definition, and averaging the PTIs using segment length as the weight to get regional summaries.
4. Calculate the average PTI of the AM Peak and PM Peak to obtain an overall travel time reliability indicator.

National Highway System (NHS) – the October 1, 2012 designation of NHS was used in this report. In compliance with the MAP-21 requirements, [all principal arterials have been added to the NHS](#).

All Roads (in Figures 1 and 2) – are the roads covered by the I-95 Corridor Coalition Vehicle Probe Project/INRIX data, as shown below.

Figure 5. I-95 Vehicle Probe Project/INRIX data coverage in the National Capital Region

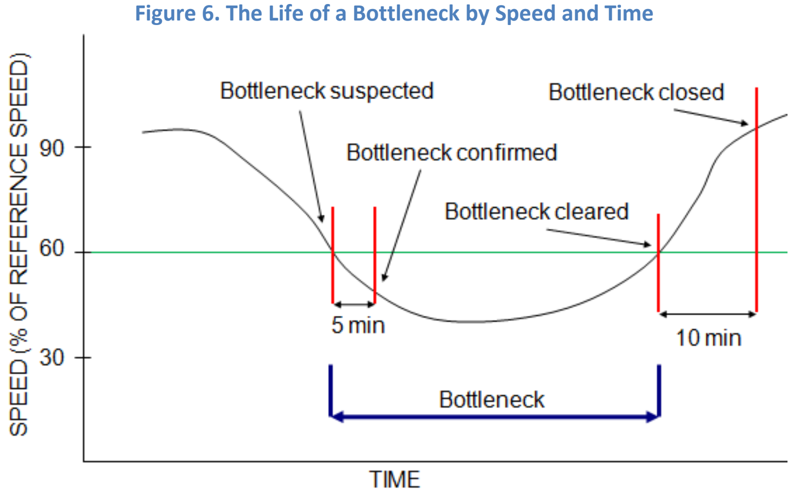


Bottlenecks

This report uses the "Bottleneck Ranking" tool in the VPP Suite to get the top 10 most significant bottleneck in the TPB Planning Area for a quarter. The VPP Suite uses the following methodology to track bottlenecks:

Bottleneck conditions are determined by comparing the current reported speed to the reference speed for each segment of road. **Reference speed** values are provided by INRIX, Inc. for each segment and represent the 85th percentile observed speed for all time periods with a maximum value of 65 mph. If the reported speed falls below 60% of the reference, the road segment is flagged as a potential bottleneck. If the reported speed stays below 60% for five minutes, the segment is confirmed as a bottleneck location. Adjacent road segments meeting this condition are joined together to form the bottleneck queue. When reported speeds on every segment associated with a bottleneck queue have returned to values greater than 60% of their reference values and remained that way for 10 minutes, the bottleneck is considered cleared. The total **duration** of a bottleneck is the difference between the time when the congestion condition was first noticed (prior to the 5 minute lead in) and the time when the congestion condition recovered (prior to the 10 minute lead out). Bottlenecks whose total queue length, determined by adding the length of each road segment associated with the bottleneck, is less than 0.3 miles are ignored.

Figure 6. The Life of a Bottleneck by Speed and Time



This report uses the **Impact Factor** to rank the bottlenecks. The Impact Factor is simply the product of the Average Duration (minutes), Average Max Length (miles) and the number of occurrences.

The University of Maryland CATT Lab is currently reviewing the bottleneck ranking methodology and it may soon be improved given the observed variability from quarter to quarter. Nonetheless, the identified bottlenecks by the current methodology represent significant choke points along traffic flows.

Bottleneck location maps and spiral charts are all screen shots from the VPP Suite.

Congestion Maps

The maps were generated by the "Trend Map" tool in the VPP Suite. Since the VPP Suite limits the total number of segments of a query, the maps only show the freeways and some major arterials.