NATIONAL CAPITAL REGION TRANSPORTATION PLANNING BOARD

National Capital Region Congestion Report

3rd Quarter 2014

Metropolitan Washington Council of Governments
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Congestion – Travel Time Index (TTI)

Interstate System

TTI 3rd Quarter 2014:	1.20	↓1.8% or 0.02[1]
TTI Trailing 4 Quarters:	1.22	↓2.8% or 0.03[2]

Non-Interstate NHS[3]

TTI 3rd Quarter 2014:	1.19	↑2.8% or 0.03
TTI Trailing 4 Quarters:	1.19	↑1.5% or 0.02

Non-NHS

TTI 3rd Quarter 2014:	1.13	↑4.0% or 0.04
TTI Trailing 4 Quarters:	1.11	↑1.7% or 0.02

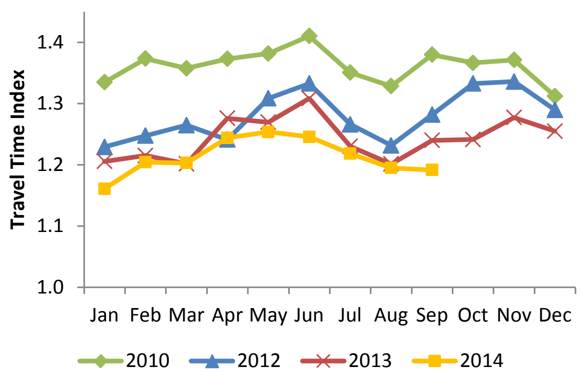
All Roads

TTI 3rd Quarter 2014:	1.16	↑2.9% or 0.03
TTI Trailing 4 Quarters:	1.15	↑1.1% or 0.01

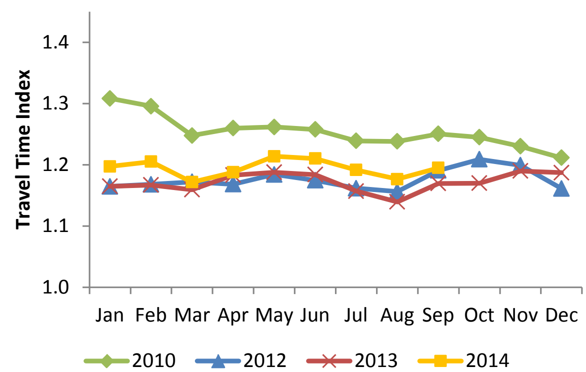
[1] Compared to 3rd quarter 2013; [2] Compared to one year earlier; [3] NHS: National Highway System.

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

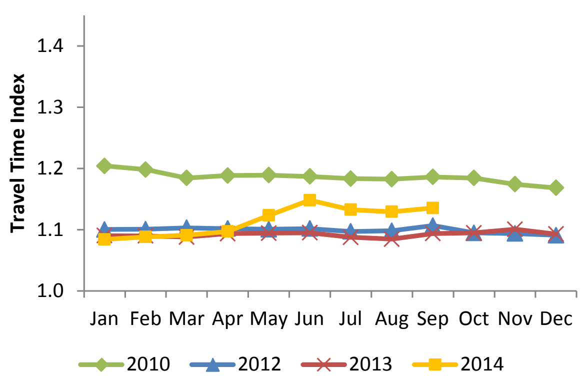
Interstate System (520 directional miles)



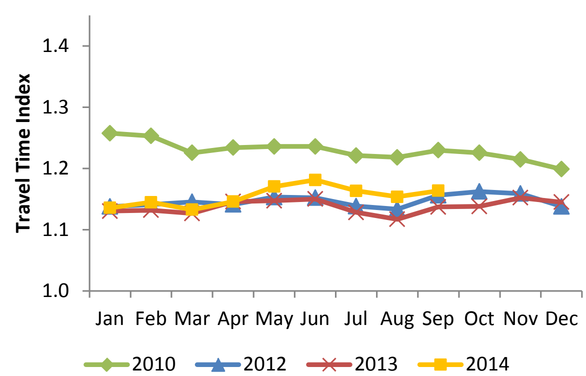
Non-Interstate NHS (2,160 directional miles)



Non-NHS (2,820 directional miles)



All Roads (5,500 directional miles)



> ***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.*

Reliability – Planning Time Index (PTI)

Interstate System

PTI 3rd Quarter 2014:	3.50	↑2.5% or 0.09[1]
PTI Trailing 4 Quarters:	3.62	↓3.3% or 0.12[2]

Non-Interstate NHS[3]

PTI 3rd Quarter 2014:	2.08	↑4.0% or 0.08
PTI Trailing 4 Quarters:	2.16	↓1.2% or 0.03

Non-NHS

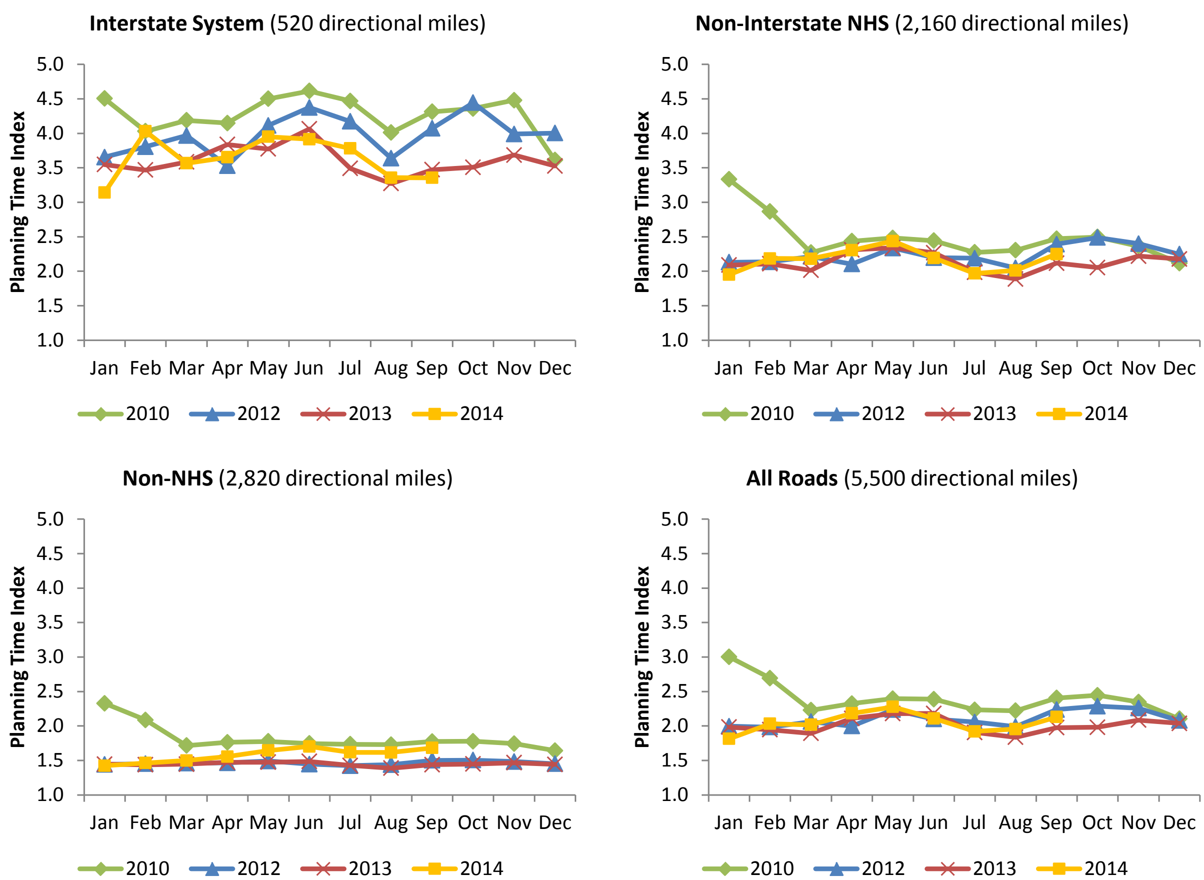
PTI 3rd Quarter 2014:	1.64	↑15.5% or 0.22
PTI Trailing 4 Quarters:	1.55	↑6.3% or 0.09

All Roads

PTI 3rd Quarter 2014:	2.00	↑5.0% or 0.10
PTI Trailing 4 Quarters:	2.04	↓0.4% or 0.01

[1] Compared to 3rd quarter 2013; [2] Compared to one year earlier; [3] NHS: National Highway System.

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



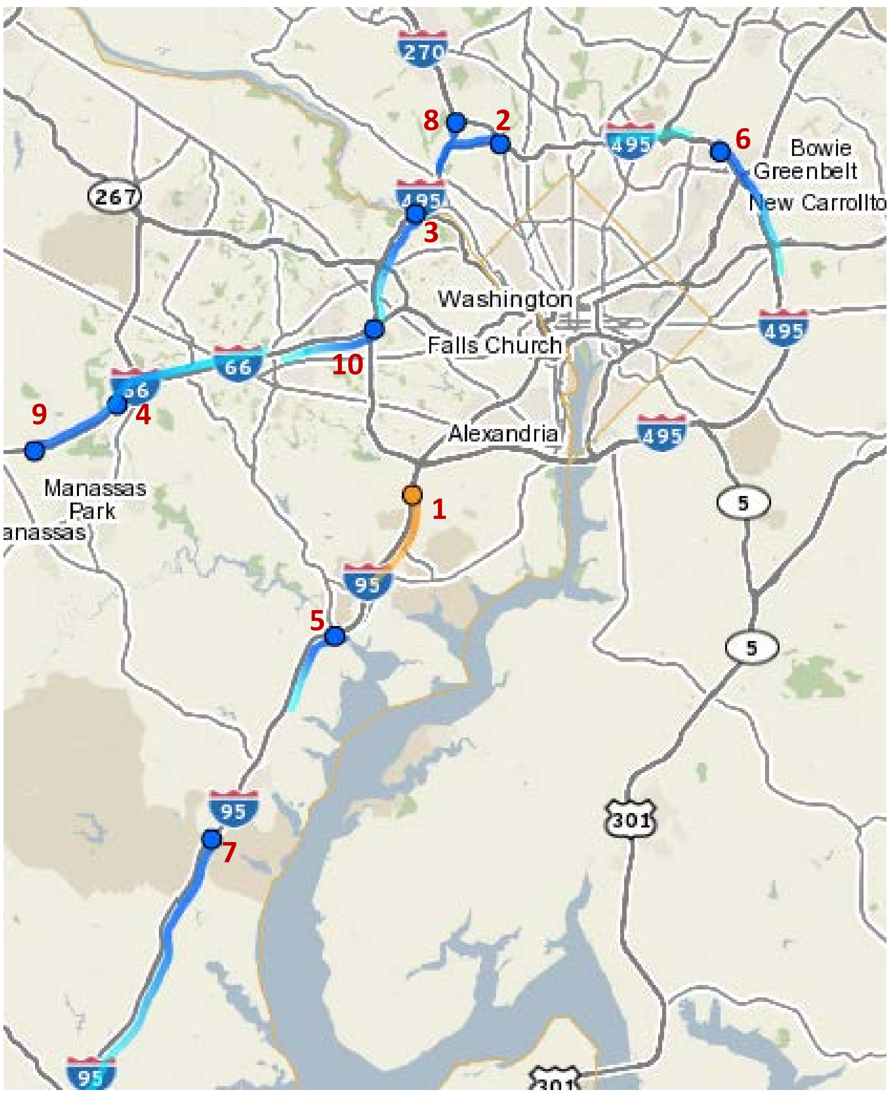
Planning Time Index

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), 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.

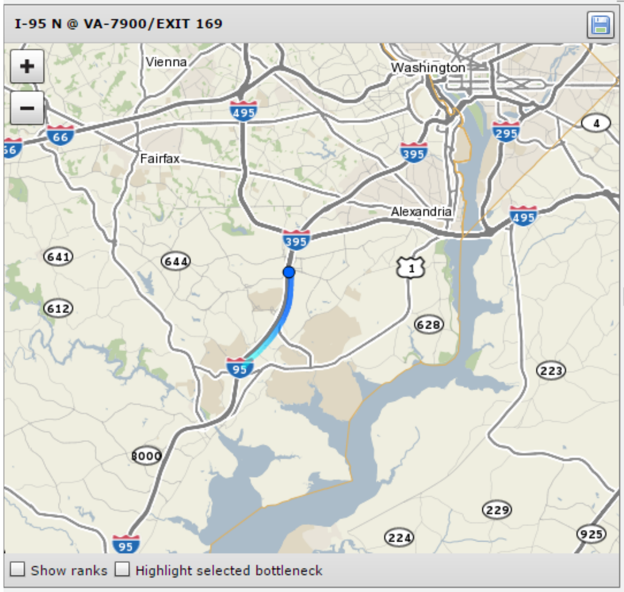
Top 10 Bottlenecks

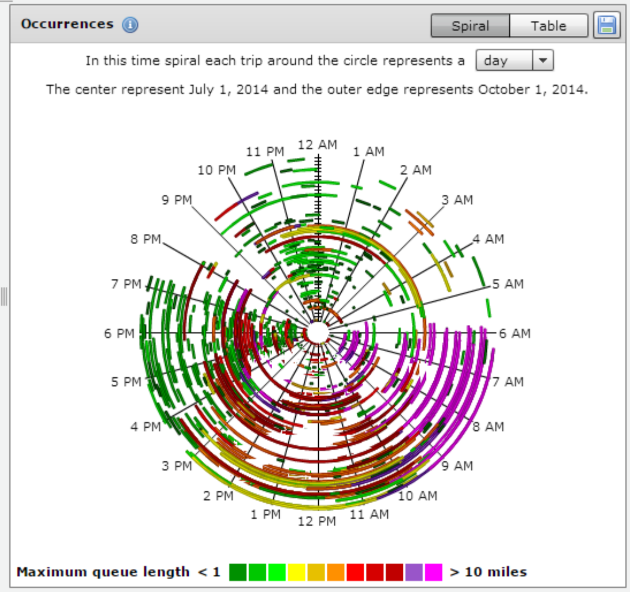
Rank (Last Quarter Rank)	Location	Average duration	Average max length (miles)	Occur-rences	Impact factor
1 (>30)*	I-95 N @ VA-7900/EXIT 169	1 h 27 m	3.7	732	235,538
2 (1)	I-495 CW @ I-270/EXIT 35	3 h 21 m	6.94	160	223,109
3 (3)	I-495 CW @ AMERICAN LEGION BRIDGE	3 h 28 m	5.15	193	206,571
4 (16)	I-66 W @ US-29/EXIT 52	2 h 20 m	7.27	137	139,359
5 (18)	I-95 N @ VA-123/EXIT 160	1 h 42 m	4.05	296	122,247
6 (8)	I-495 CCW @ GREENBELT METRO DR/EXIT 24	2 h 12 m	6.84	125	112,901
7 (>30)	I-95 N @ RUSSELL RD/EXIT 148	2 h 13 m	10.26	78	106,386
8 (6)	I-270 SPUR S @ I-270	1 h 14 m	5.08	265	99,692
9 (2)	I-66 W @ VA-234/EXIT 47	2 h 3 m	9.83	70	84,606
10 (7)	I-66 E @ I-495/EXIT 64	1 h 45 m	4.09	187	80,293

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



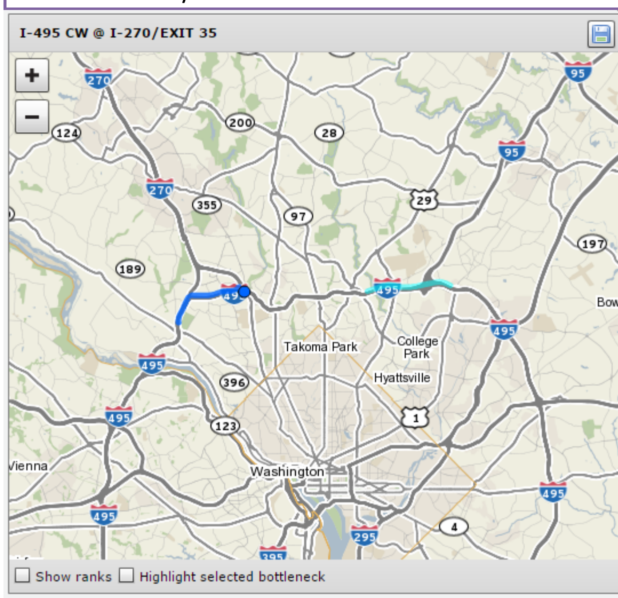
Rank	Location	Average duration	Average max length (miles)	Occurrences	Impact factor*
1	I-95 N @ VA-7900/EXIT 169	1 h 27 m	3.7	732	235,538

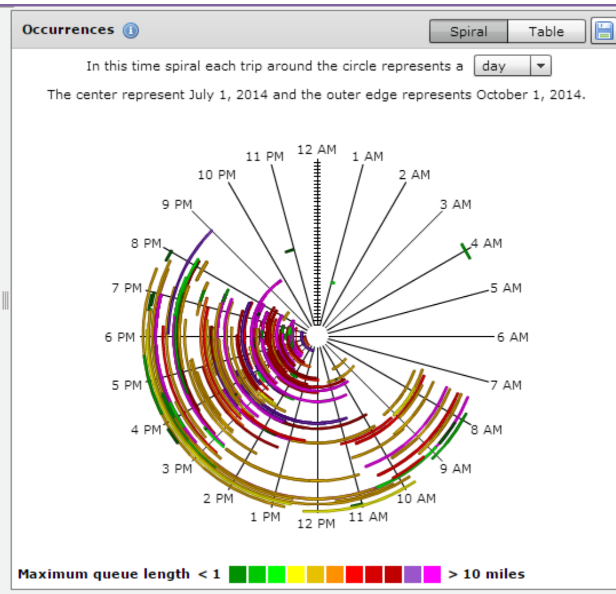




** The Impact Factor of a bottleneck is simply the product of the Average Duration (minutes), Average Max Length (miles) and the number of occurrences.*

Rank	Location	Average duration	Average max length (miles)	Occurrences	Impact factor
2	I-495 CW @ I-270/EXIT 35	3 h 21 m	6.94	160	223,109





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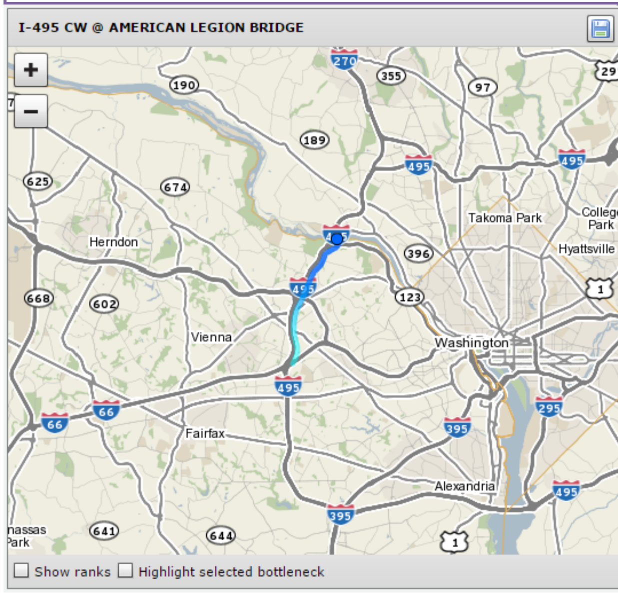

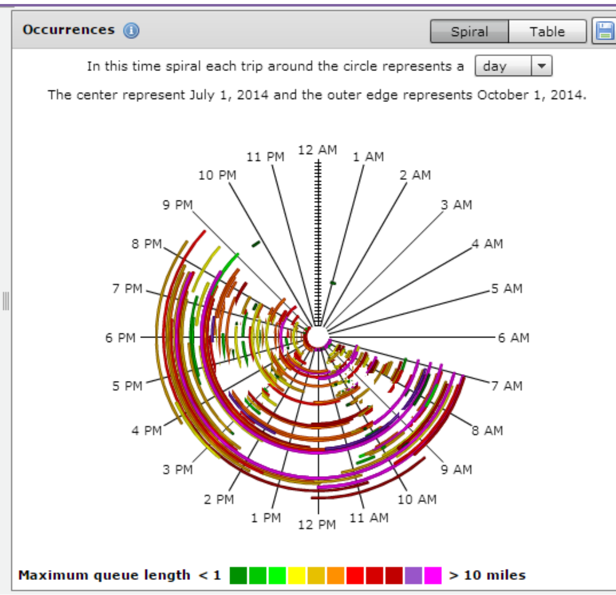

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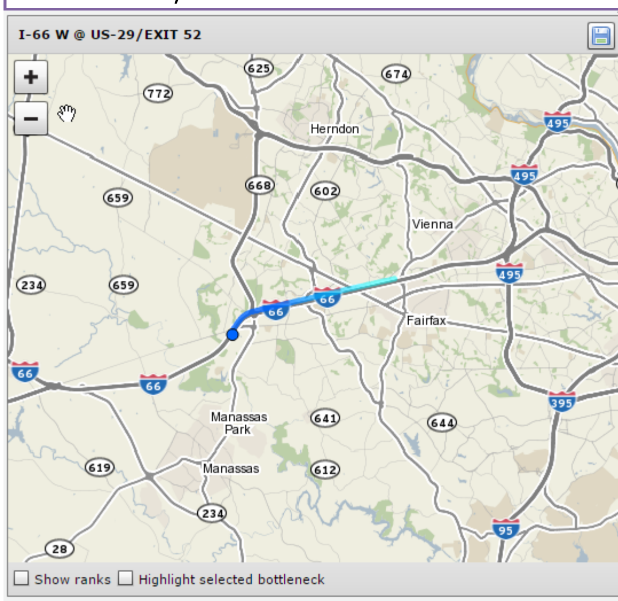

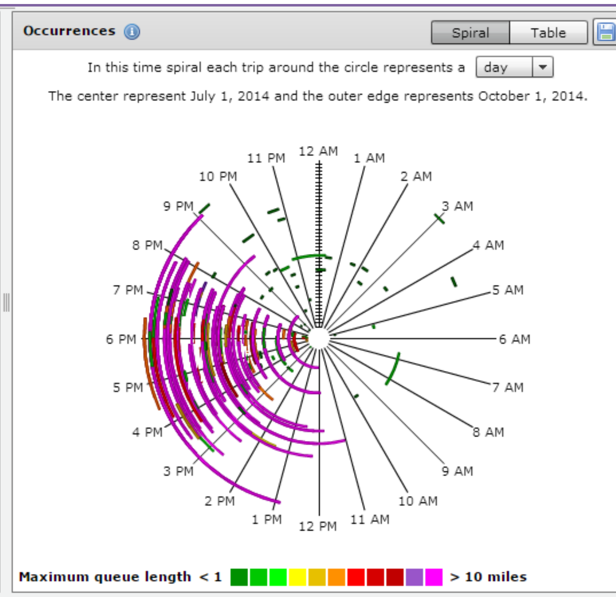

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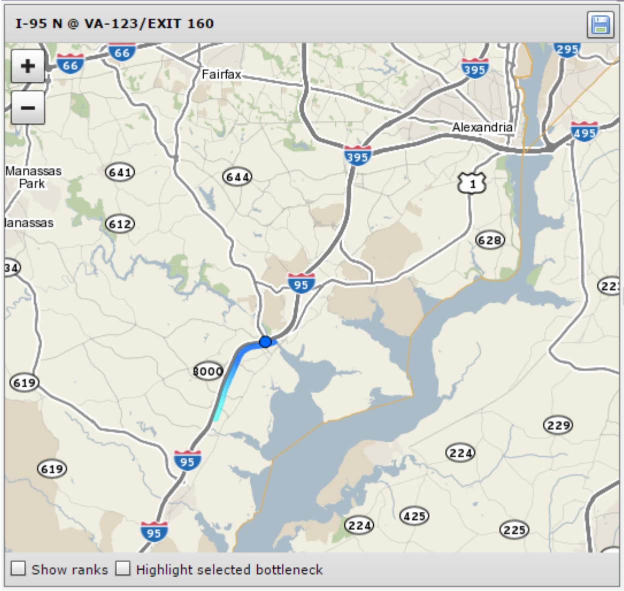

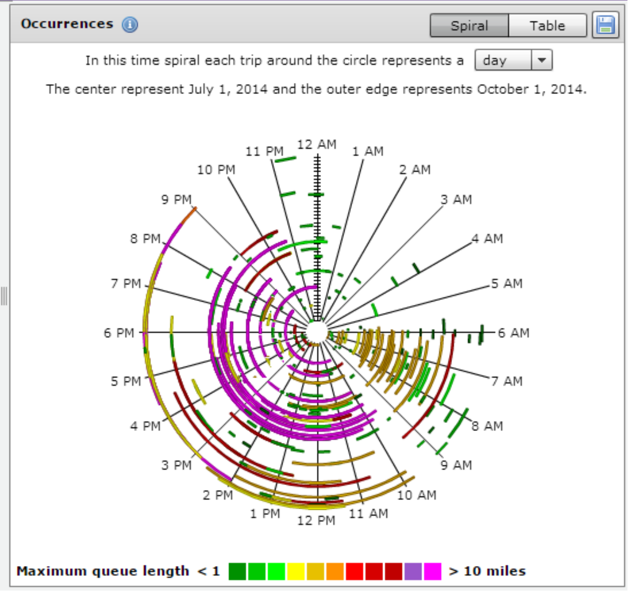

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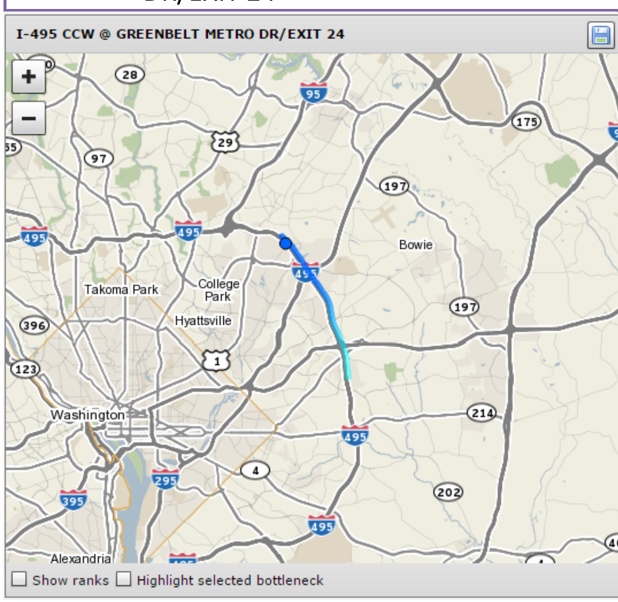

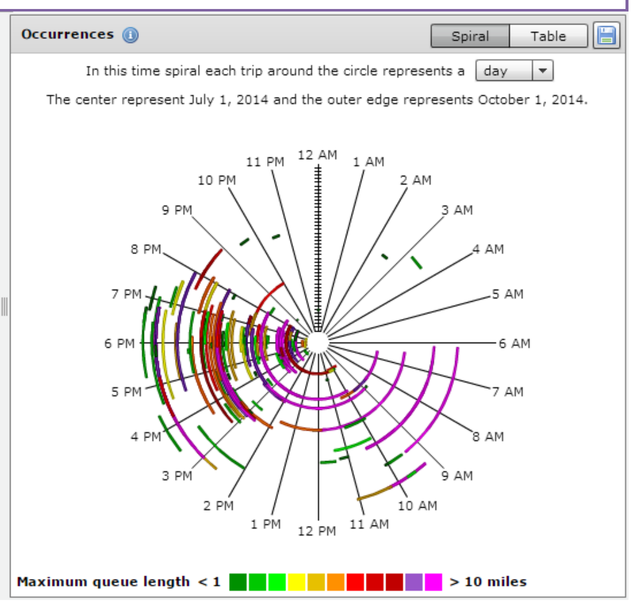

Rank	Location	Average duration	Average max length (miles)	Occurrences	Impact factor
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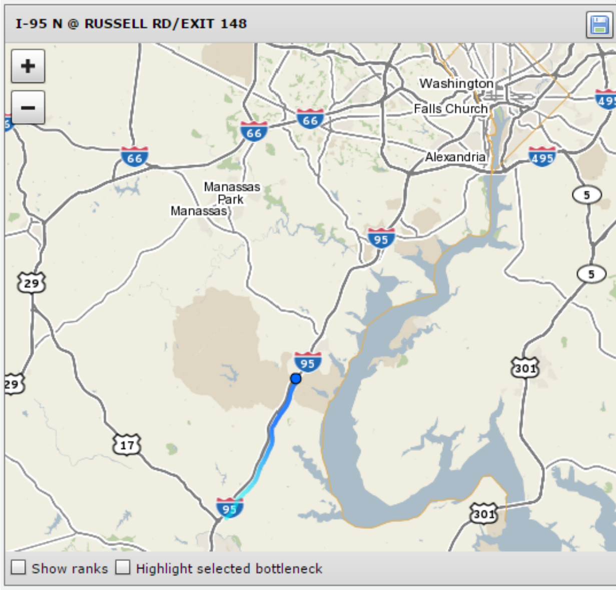

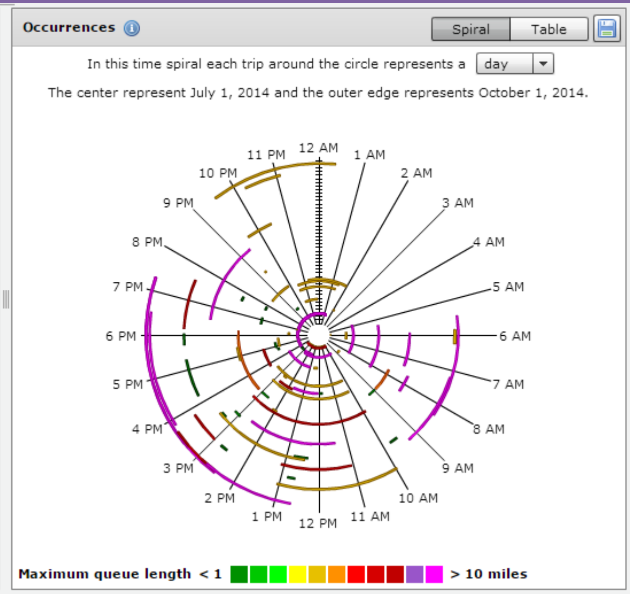

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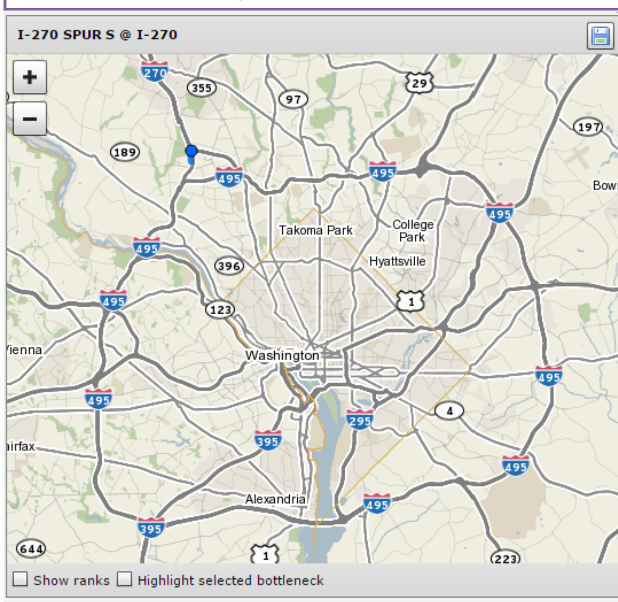

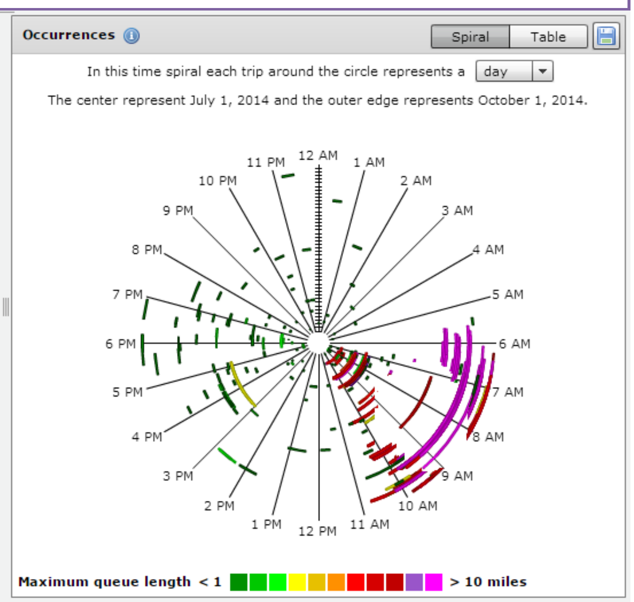

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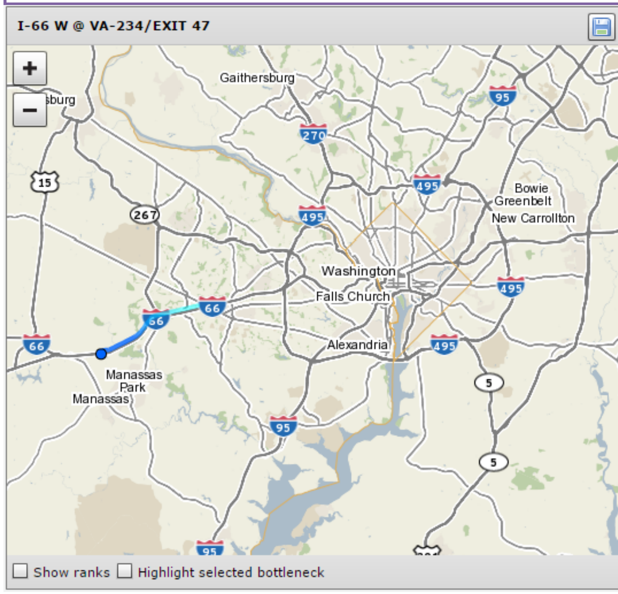

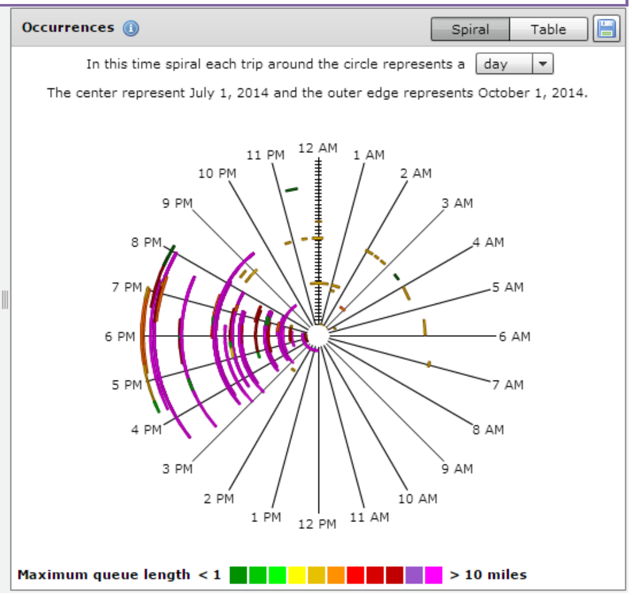

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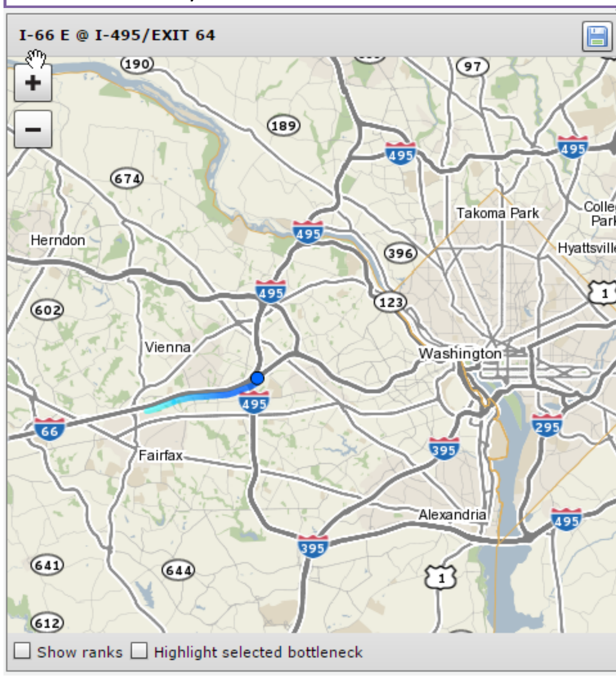
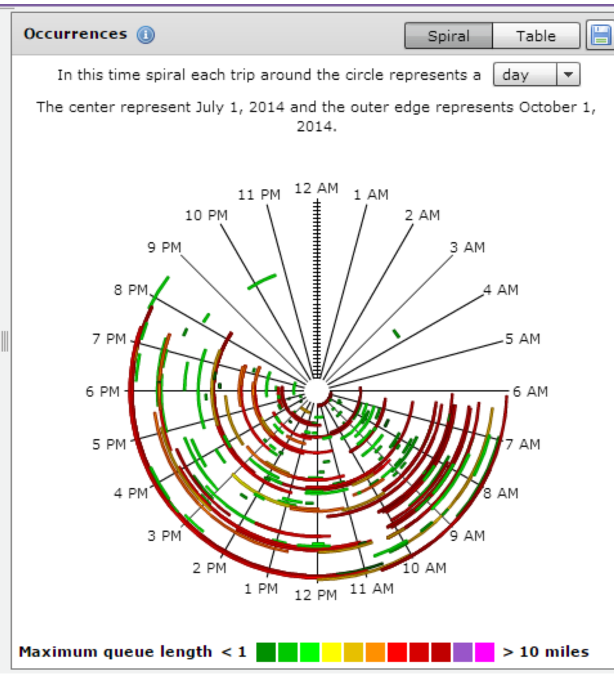




Congestion Maps

Figure 3. Travel Time Index during weekday 8:00-9:00 AM in 3rd Quarter 2014

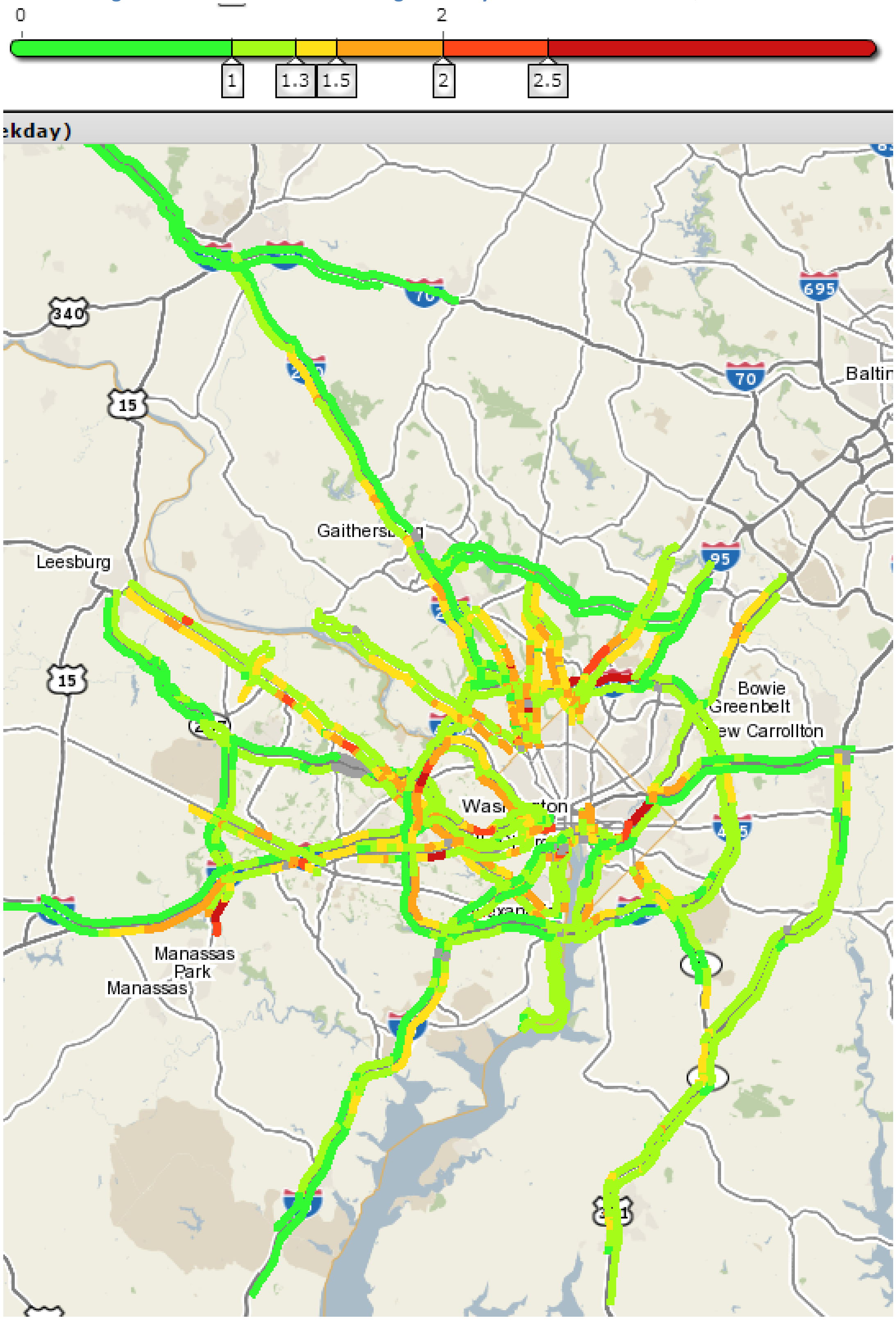
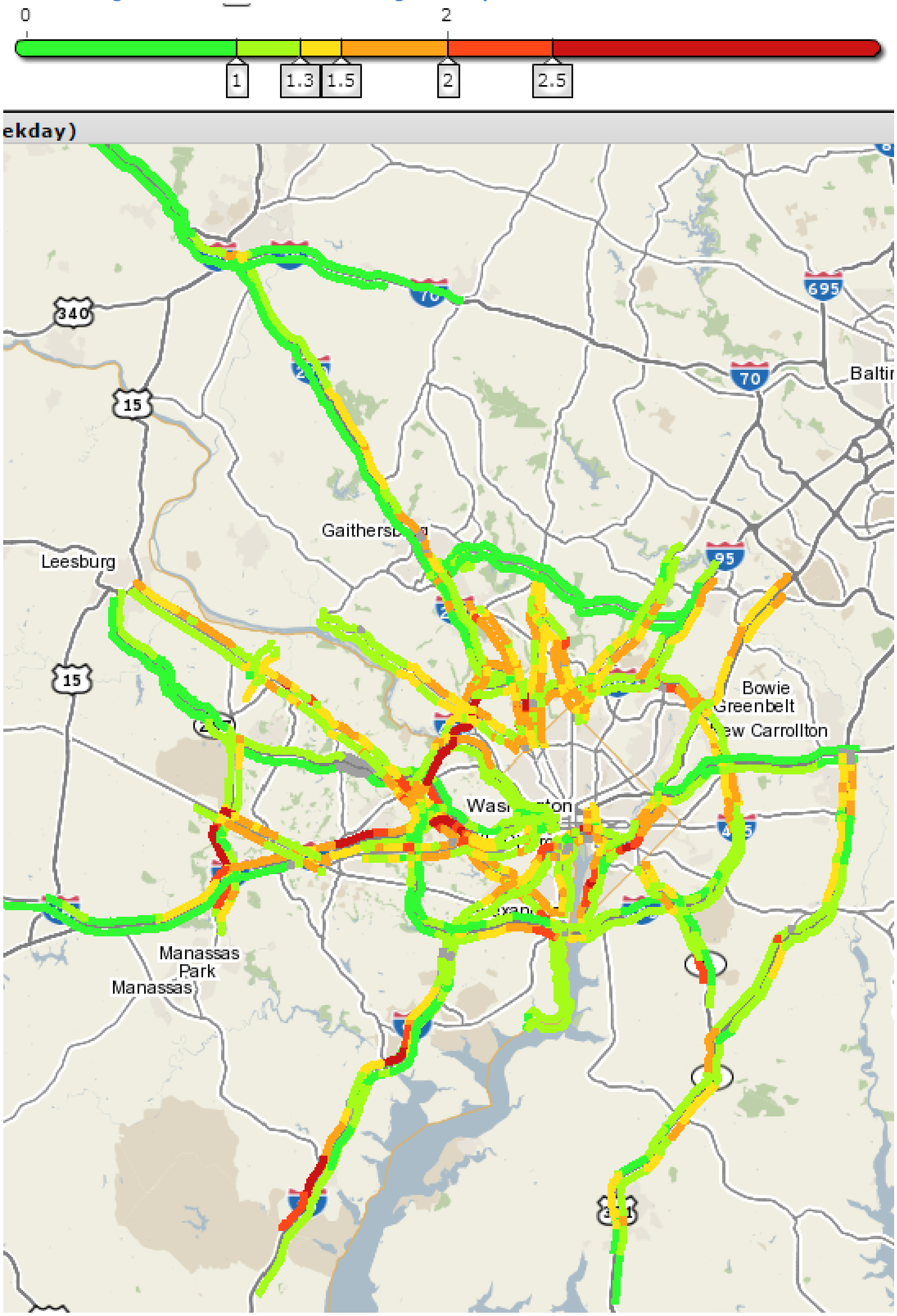


Figure 4. Travel Time Index during weekday 5:00-6:00 PM in 3rd Quarter 2014



3rd Quarter 2014 Spotlight – Vehicle Probe Data Users Group

Transportation is entering a "Big Data" era. Crowd-sourced vehicle probe data is one of the examples that are transforming the means by which transportation planning and operations are carried out. Since 2009, the Transportation Planning Board (TPB) has been taking advantage of the growing availability of vehicle probe data in a number of programs and activities, such as to better understand congestion and travel time reliability on area roadways (June 10, 2014 TPB Weekly Report).

As an affiliate member of the I-95 Corridor Coalition, the TPB obtains the vehicle probe data through the Coalition's Vehicle Probe Project (VPP). As an emerging data source, vehicle probe data come with some technical challenges, anomalies, and a still-evolving state of practice among analysts. Even starting from the same set of data, analysis results could vary, sometimes to a great extent, depending on different assumptions or methodologies. The level of experience with the data also differs in the Washington region with some jurisdictions or agencies still do not have access to the data.

In order to enhance regional coordination, consistency, and capabilities in the use of vehicle probe-based traffic data toward performance-based transportation planning and programming, a Vehicle Probe Data Users Group has recently been established at the Transportation Planning Board, Metropolitan Washington Council of Governments (COG).

The Users Group aims to bring together TPB member jurisdictions and other relevant agencies and stakeholders to discuss, explore, and act on how the emerging data can shape the future of transportation planning and operations.

For agencies still unfamiliar with the data, this Group can be a resource for them to catch up in data utilization; for other users, this group is a regional platform for probe data information exchange, user experience sharing, and professional skills development. Together, this group could develop or compile technical guidelines for probe data processing and performance measure calculation for the region. It can also provide feedback to data vendors and analytical tools developers to help them to improve their products and ultimately to benefit users.

The first meeting of the Vehicle Probe Data Users Group took place on October 9, 2014. The meeting attracted 26 participants from a number of TPB member jurisdictions, other public or private organizations within or outside of the National Capital Region, including attendees from Baltimore Metropolitan Council and Virginia Department of Transportation Central Office in Richmond, VA. The main meeting agenda items included a VPP Suite (a web-based analytical and visualization tool kit) live demo and ongoing transition from a single-vendor to a multi-vendor VPP, COG/TPB's user of vehicle probe data and lessons learned and a roundtable discussion.

Participants expressed high interests and expectations for the Vehicle Probe Data Users Group. Among the challenges that participants are facing in the use of vehicle probe data, data quality concerns ranked the highest, especially on arterials. Therefore, arterial data quality will be the main topic of the next Users Group meeting, which is tentatively scheduled in mid-January 2015.

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

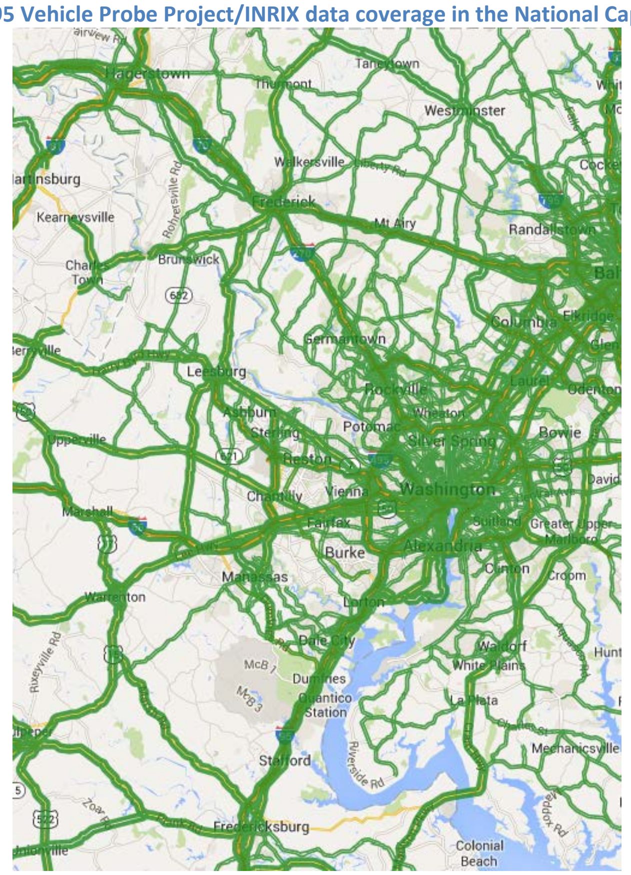
Highway Administration and produced by the Texas Transportation Institute with Cambridge Systematics, Inc. This report uses the following method to calculate PTI:

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

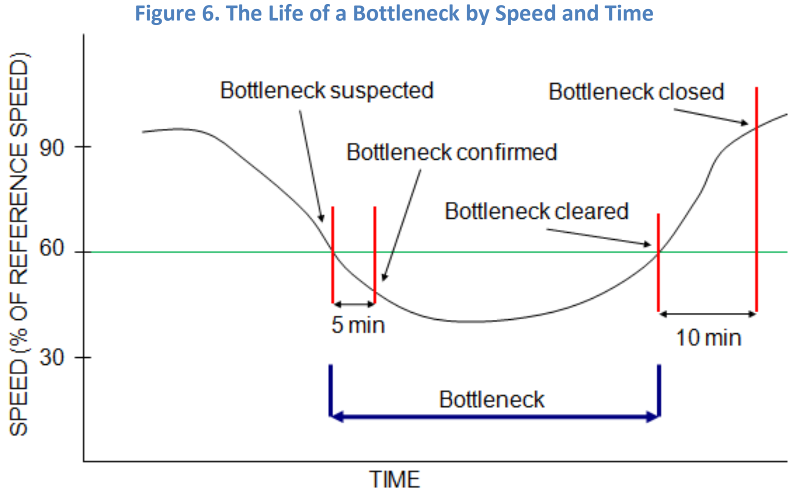


Bottlenecks

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.