NATIONAL CAPITAL REGION TRANSPORTATION PLANNING BOARD

National Capital Region Congestion Report

2nd Quarter 2014

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

Interstate System

TTI 2nd Quarter 2014:	1.25	↓2.9% or 0.04[1]
TTI Trailing 4 Quarters:	1.23	↓3.0% or 0.04[2]

Non-Interstate NHS[3]

TTI 2nd Quarter 2014:	1.20	↑1.6% or 0.02
TTI Trailing 4 Quarters:	1.18	↑0.5% or 0.01

Non-NHS

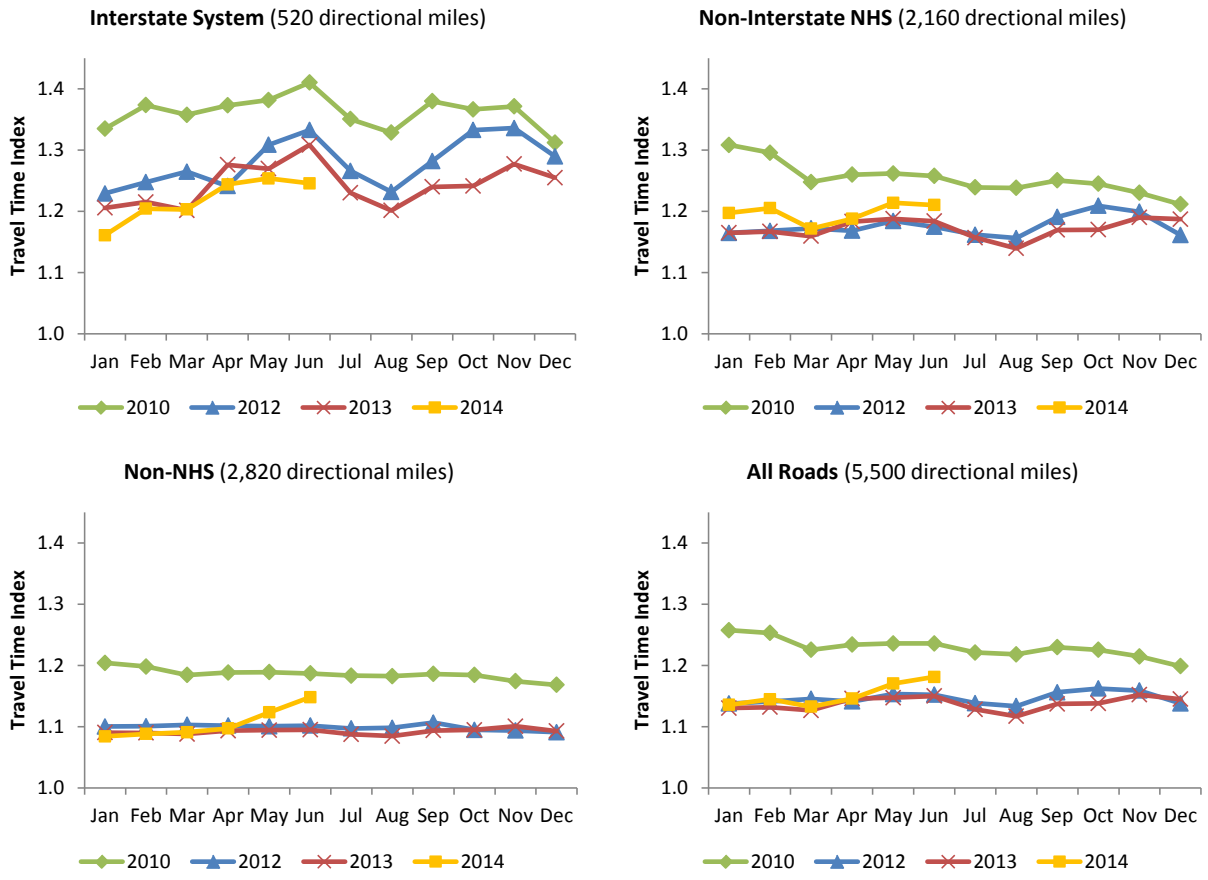
TTI 2nd Quarter 2014:	1.12	↑2.6% or 0.03
TTI Trailing 4 Quarters:	1.10	↑0.4% or 0.004

All Roads

TTI 2nd Quarter 2014:	1.17	↑1.6% or 0.02
TTI Trailing 4 Quarters:	1.14	↑0.1% or 0.001

[1] Compared to 2nd 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)



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.

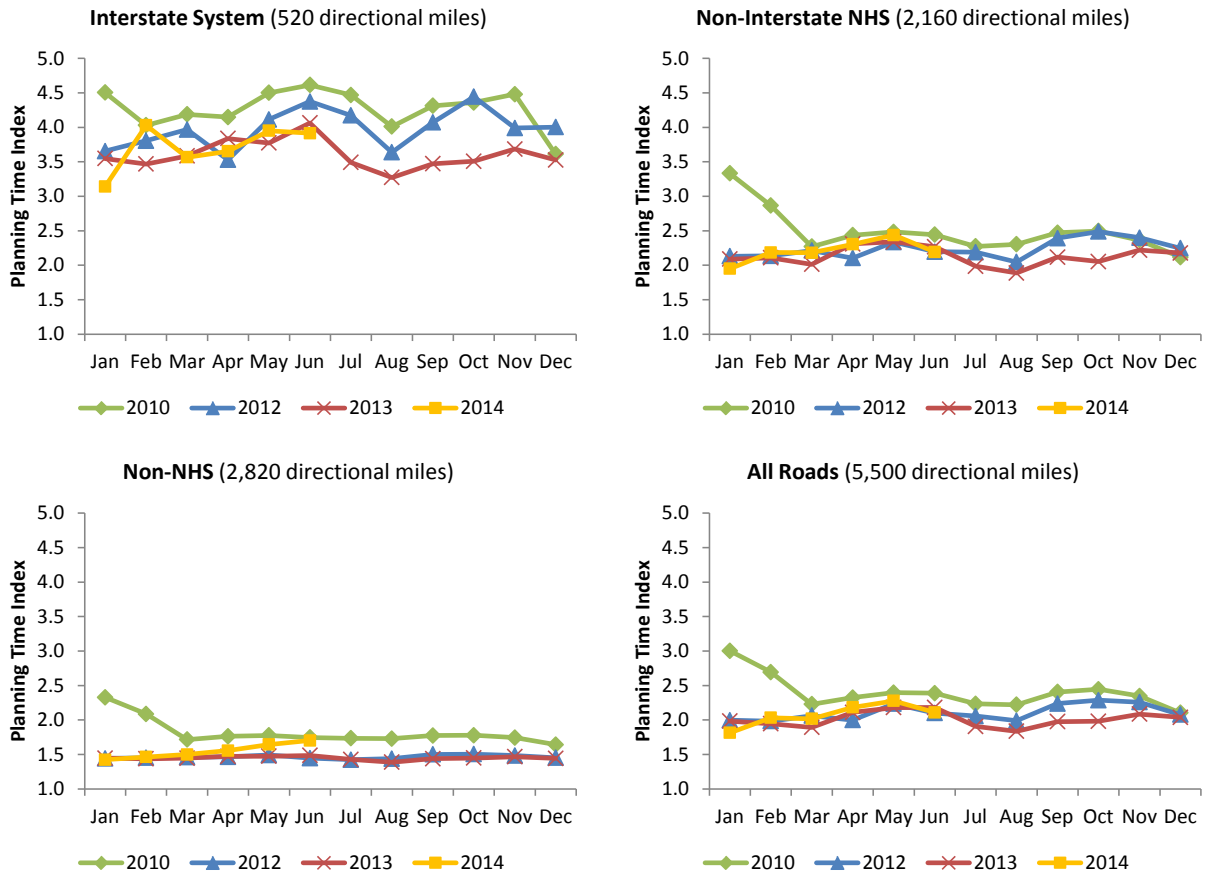
Reliability – Planning Time Index (PTI)

Interstate System		
PTI 2nd Quarter 2014:	3.84	↓1.3% or 0.05[1]
PTI Trailing 4 Quarters:	3.60	↓7.3% or 0.28[2]
Non-NHS		
PTI 2nd Quarter 2014:	1.63	↑10.6% or 0.16
PTI Trailing 4 Quarters:	1.49	↑1.9% or 0.03

Non-Interstate NHS[3]		
PTI 2nd Quarter 2014:	2.31	↑0.3% or 0.01
PTI Trailing 4 Quarters:	2.14	↓4.5% or 0.10
All Roads		
PTI 2nd Quarter 2014:	2.19	↑1.6% or 0.03
PTI Trailing 4 Quarters:	2.02	↓3.7% or 0.08

[1] Compared to 2nd 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)



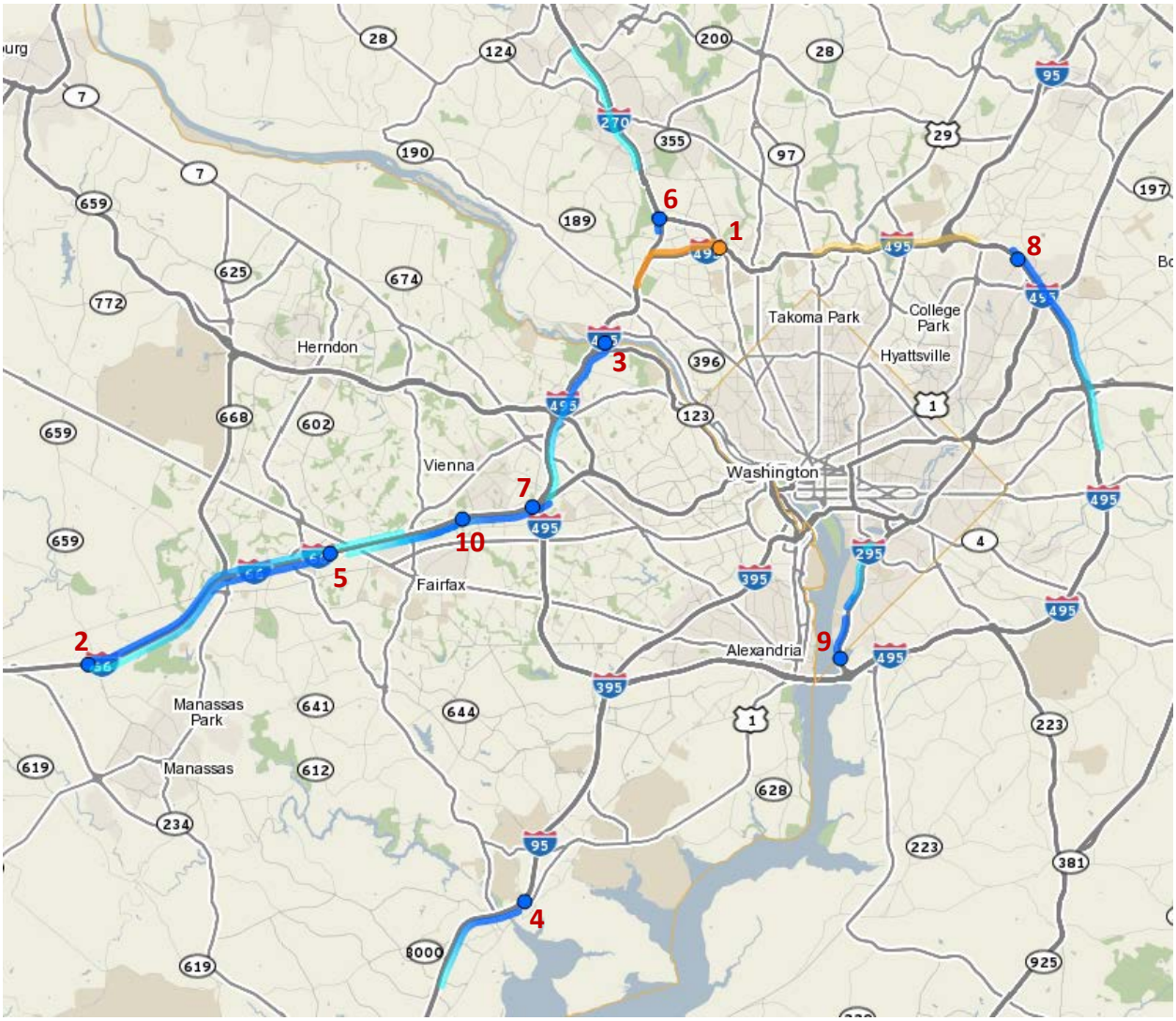
Planning Time Index

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.

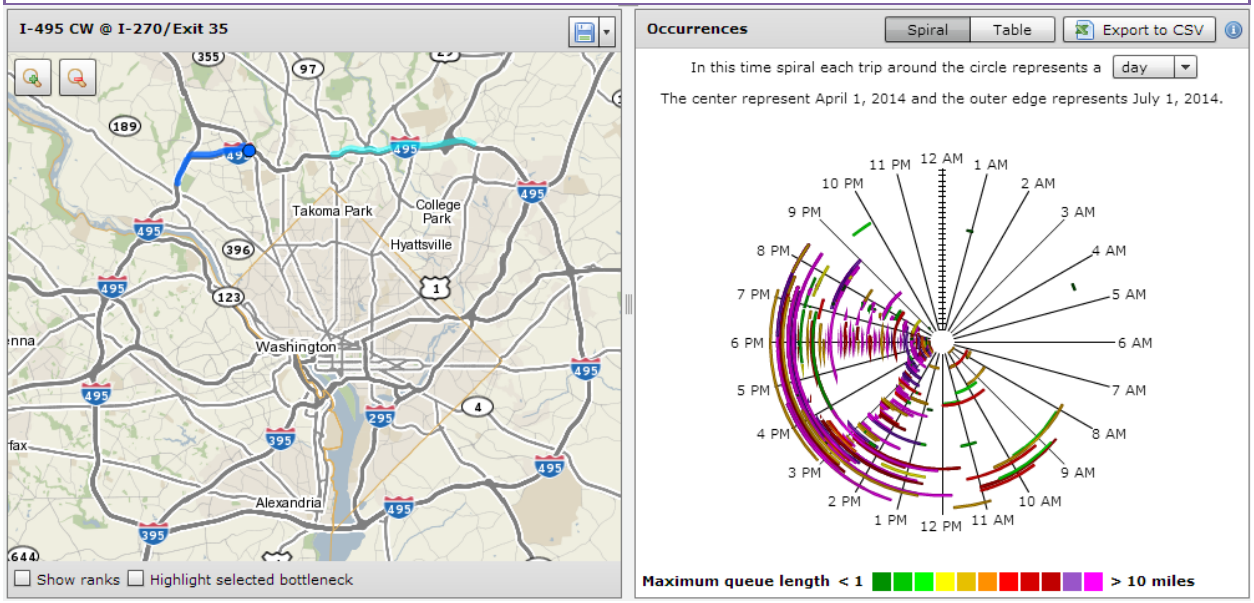
Top 10 Bottlenecks

Rank (Last Quarter Rank)	Location	Average duration	Average max length (miles)	Occur-rences	Impact factor
1 (>60)*	I-495 CW @ I-270/Exit 35	3 h 17 m	9.05	201	358,493
2 (03)	I-66 W @ VA-234/Exit 47	2 h 57 m	12.12	145	311,031
3 (01)	I-495 CW @ American Legion Bridge	3 h 14 m	5.65	225	246,593
4 (29)	I-95 HOV N @ US-1/Exit 161	1 h 21 m	4.89	580	229,646
5 (16)	I-66 E @ Monument Dr	2 h 39 m	9.73	104	160,937
6 (05)	I-270 Spur S @ I-270	1 h 35 m	5.53	292	153,319
7 (11)	I-66 E @ I-495/Exit 64	2 h	4.25	244	124,542
8 (>60)	I-495 CCW @ Greenbelt Metro Dr/Exit 24	2 h 5 m	7.22	137	123,708
9 (06)	I-295 S @ DC-MD State Border	2 h 11 m	4.33	180	102,055
10 (14)	I-66 E @ Vaden Dr/Exit 62	2 h 9 m	3.91	201	101,297

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

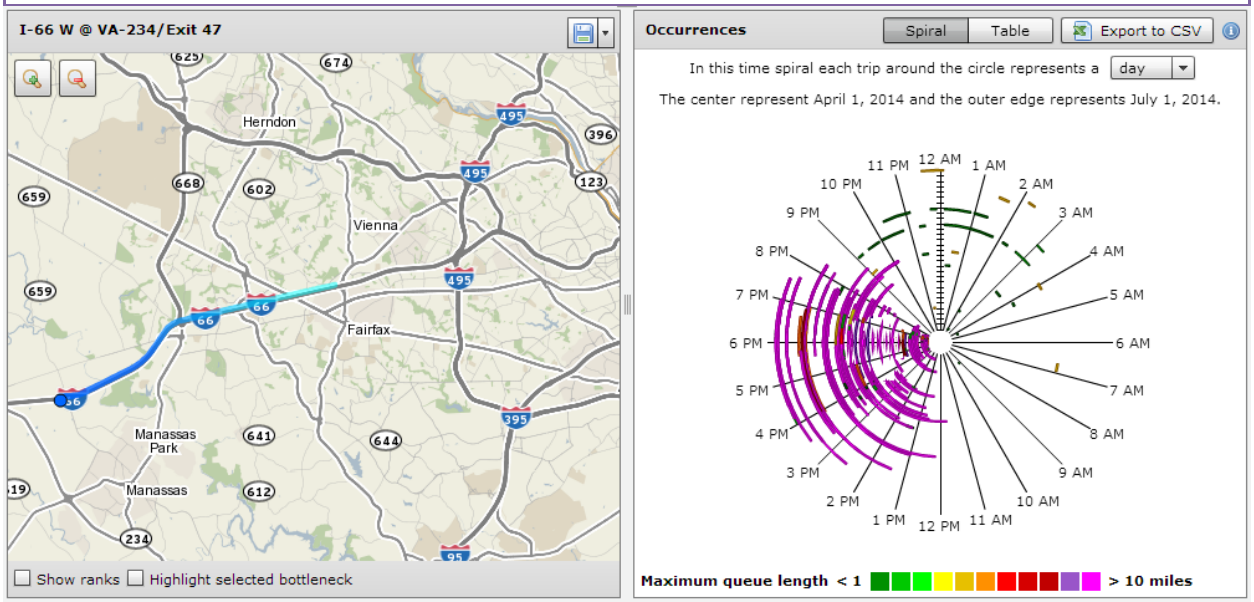


Rank	Location	Average duration	Average max length (miles)	Occurrences	Impact factor*
1	I-495 CW @ I-270/Exit 35	3 h 17 m	9.05	201	358,493



** 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-66 W @ VA-234/Exit 47	2 h 57 m	12.12	145	311,031



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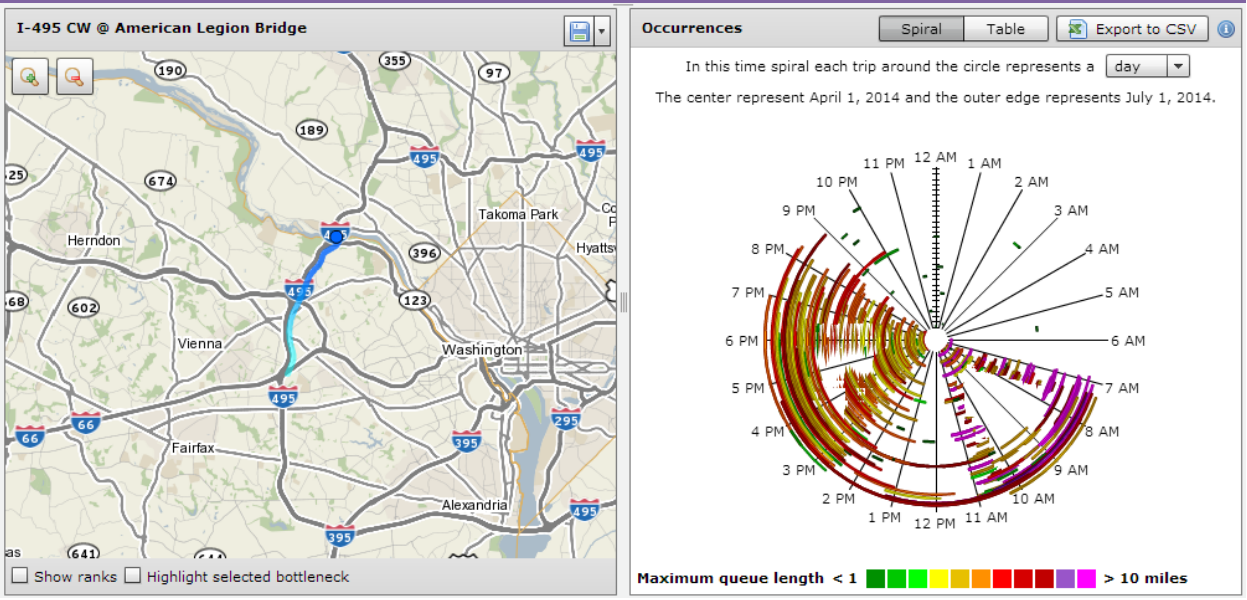
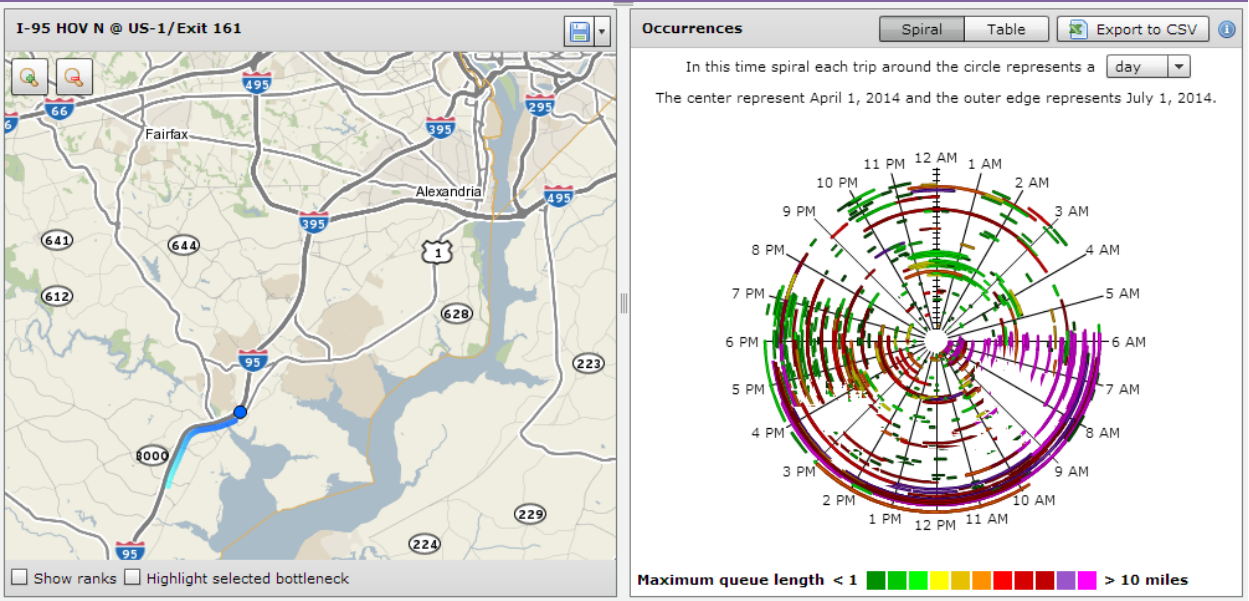
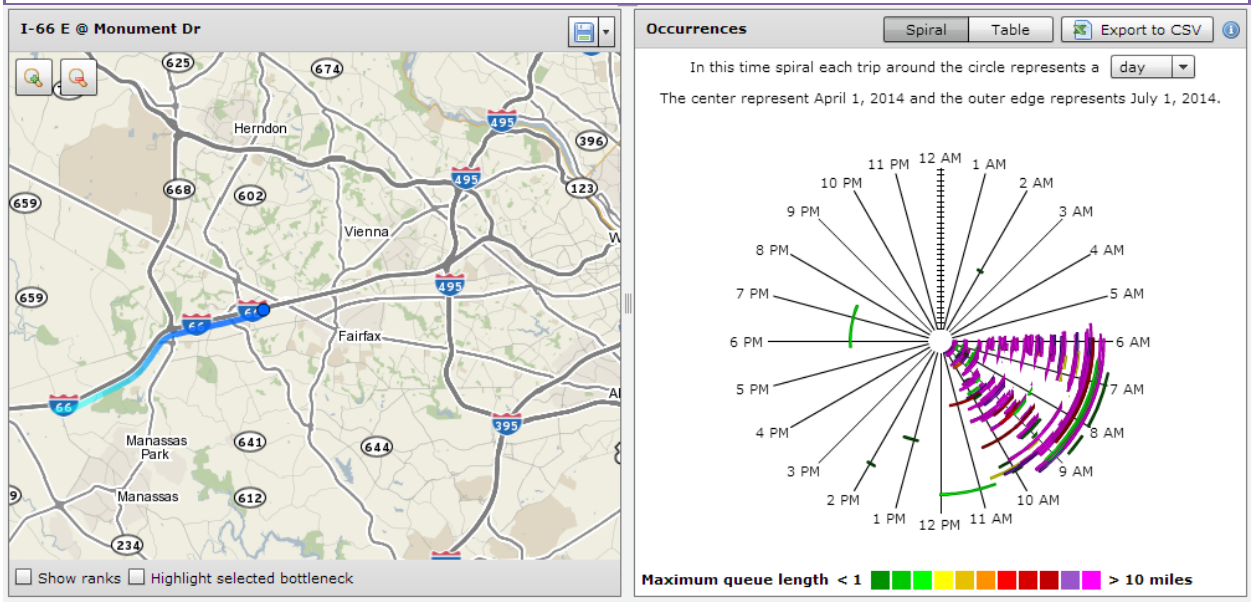


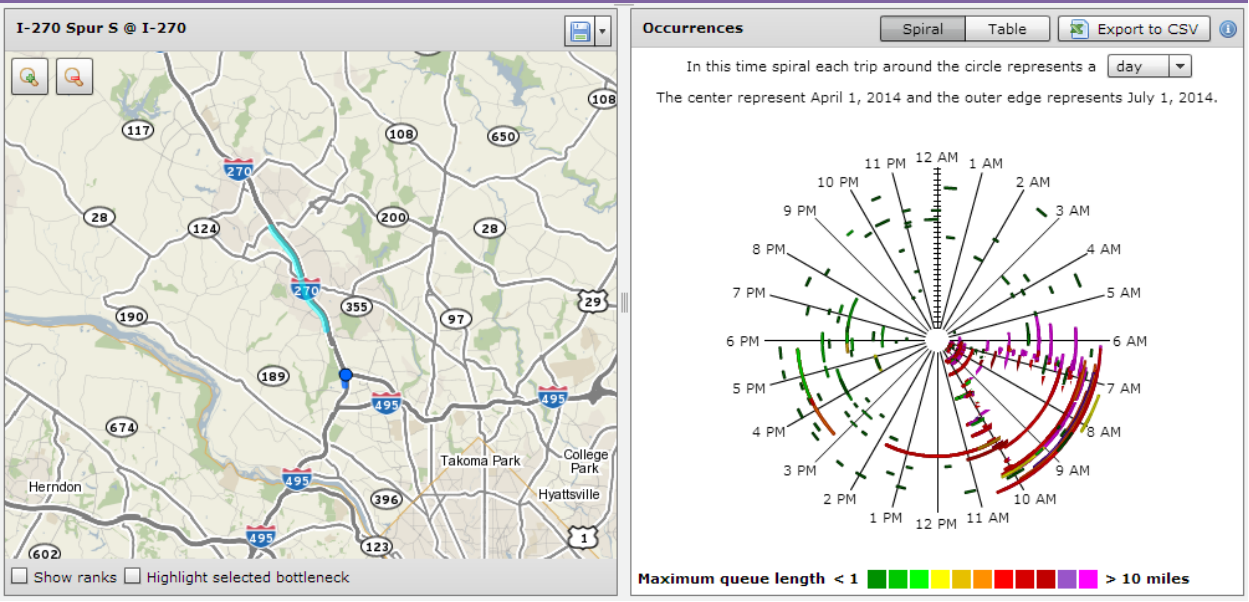
Rank	Location	Average duration	Average max length (miles)	Occurrences	Impact factor
4	I-95 HOV N @ US-1/Exit 161	1 h 21 m	4.89	580	229,646



Rank	Location	Average duration	Average max length (miles)	Occurrences	Impact factor
5	I-66 E @ Monument Dr	2 h 39 m	9.73	104	160,937



Rank	Location	Average duration	Average max length (miles)	Occurrences	Impact factor
6	I-270 Spur S @ I-270	1 h 35 m	5.53	292	153,319



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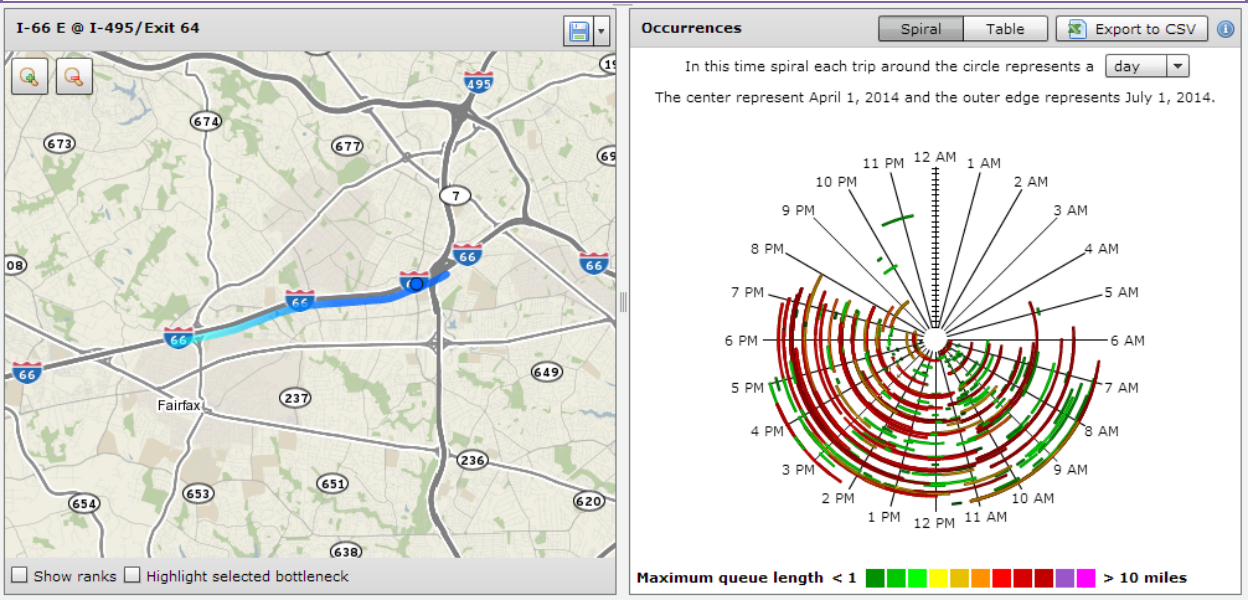
7	I-66 E @ I-495/Exit 64	2 h	4.25	244	124,542



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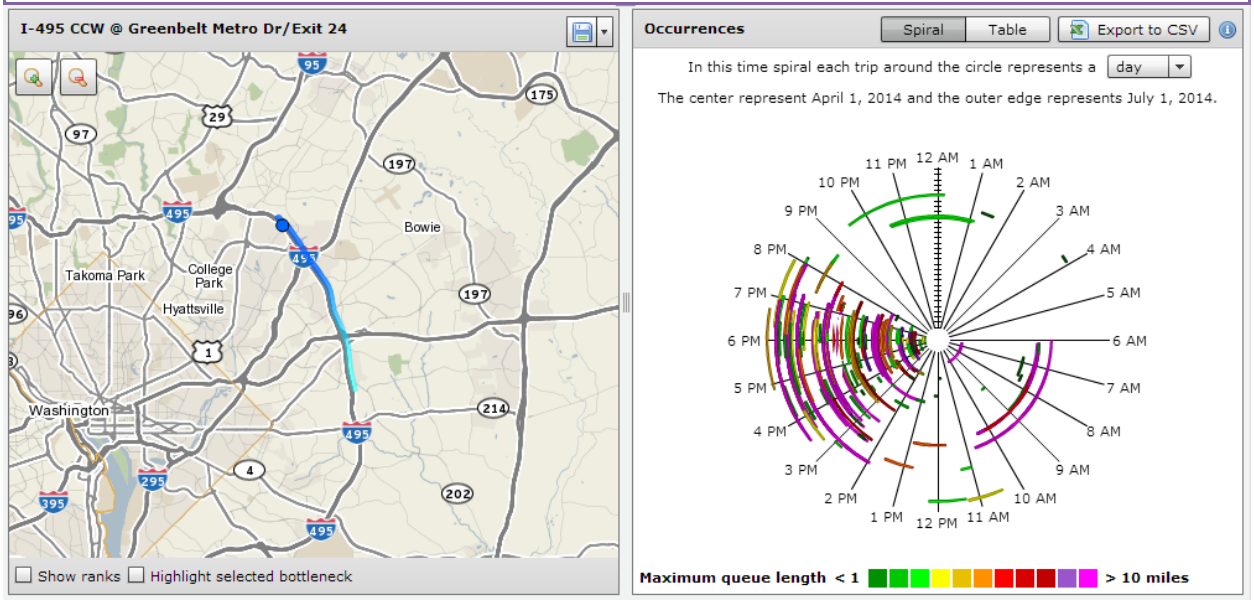

Rank	Location	Average duration	Average max length (miles)	Occurrences	Impact factor
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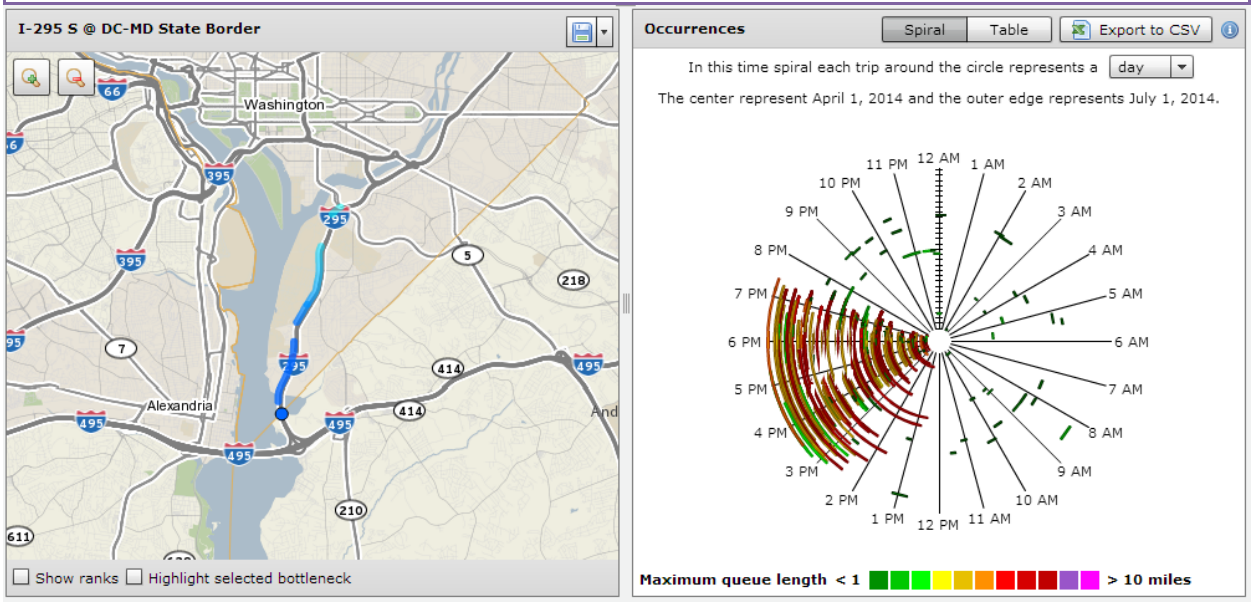
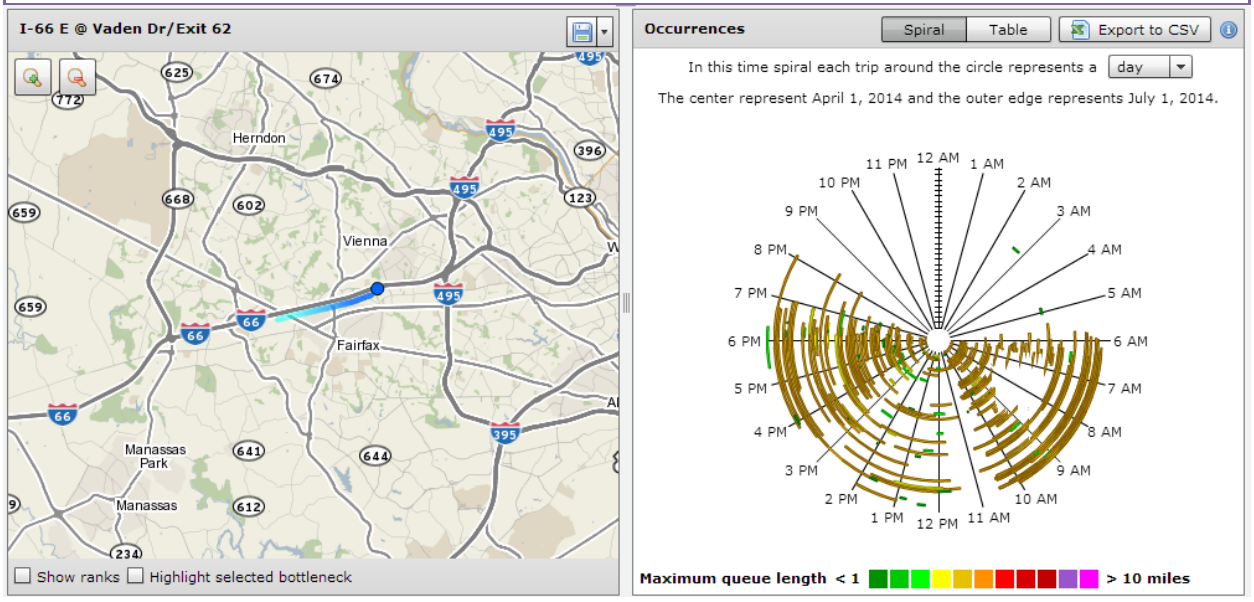


Rank	Location	Average duration	Average max length (miles)	Occurrences	Impact factor
10	I-66 E @ Vaden Dr/Exit 62	2 h 9 m	3.91	201	101,297



Congestion Maps

Figure 3. Travel Time Index during weekday 8:00-9:00 AM in 2nd Quarter 2014

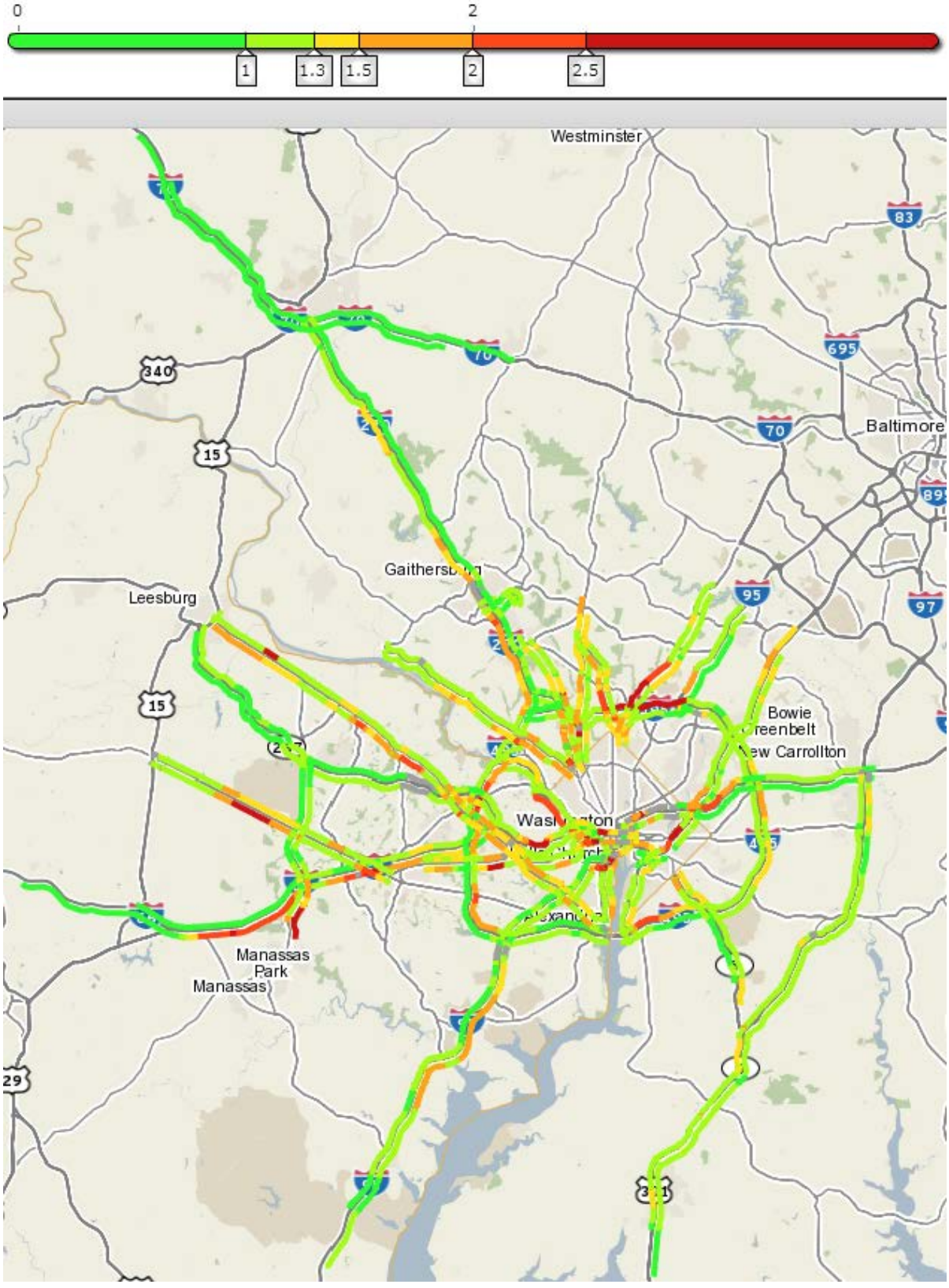
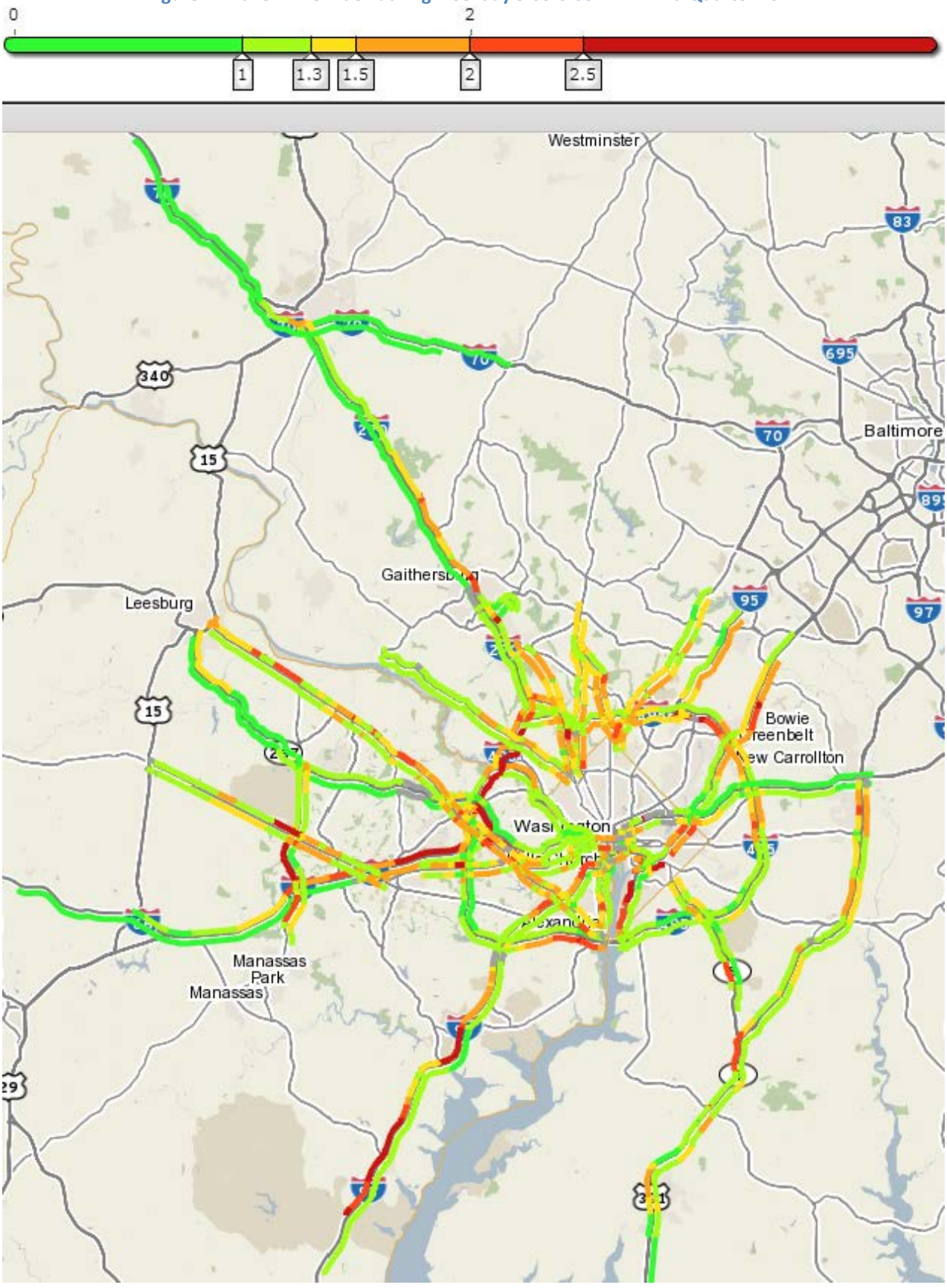


Figure 4. Travel Time Index during weekday 5:00-6:00 PM in 2nd Quarter 2014



2nd Quarter 2014 Spotlight – 2014 CMP Technical Report

On June 27, 2014, the TPB Technical Committee finalized the 2014 Congestion Management Process Technical Report. Based on the results and methodologies of the quarterly National Capital Region Congestion Report, the CMP Technical Report summarized the 2010-2013 congestion trends in the region. It also compiles information from a wide range of metropolitan transportation planning activities in congestion management areas. Highlights of the 2010-2013 regional congestion trends are briefly introduced as follows.

2010-2013 Congestion Trends

The Washington region experienced decreasing congestion during peak periods from 2010-2013; but the pace of decrease had slowed down significantly in 2013. The decrease in Travel Time Index from previous year was 4.3%, 2.6% and 0.8% in 2011, 2012 and 2013, respectively; the annual average decrease was 2.6% (Figure 5). The decrease in Percent of Congested Miles from previous year was 37%, 22% and 3% in 2011, 2012 and 2013, respectively; the annual average decrease was 21% (Figure 6).

Figure 5. Travel Time Index

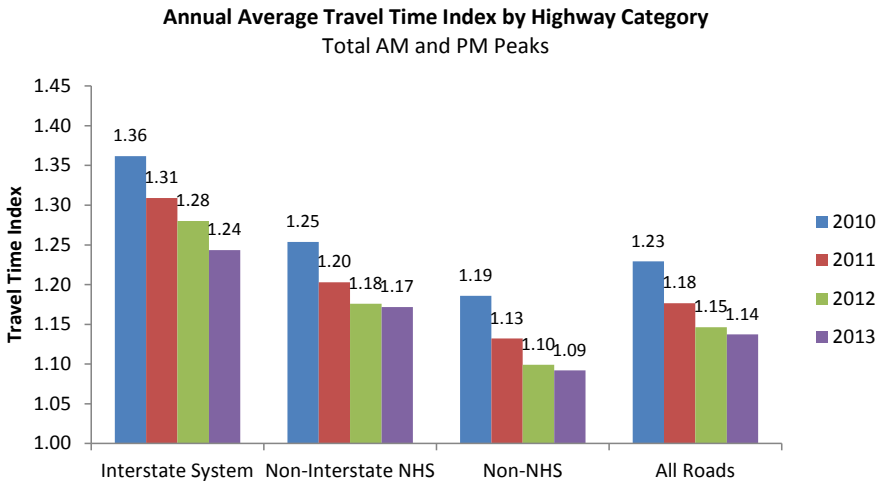
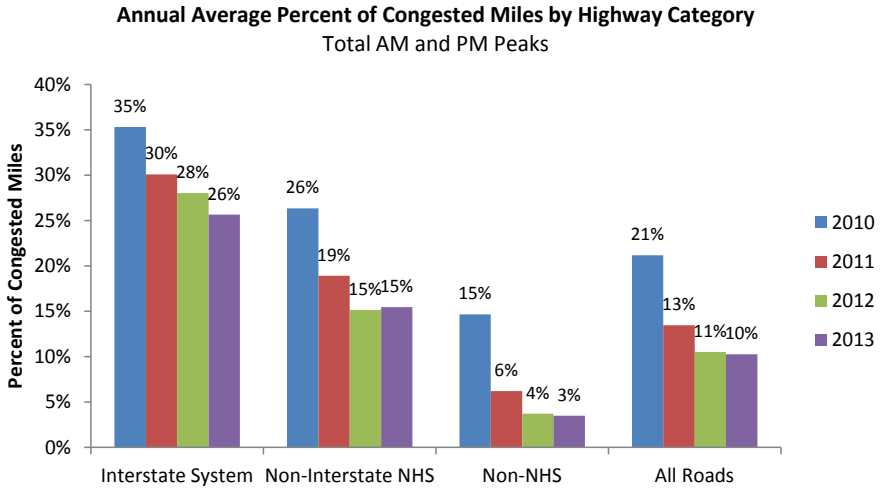


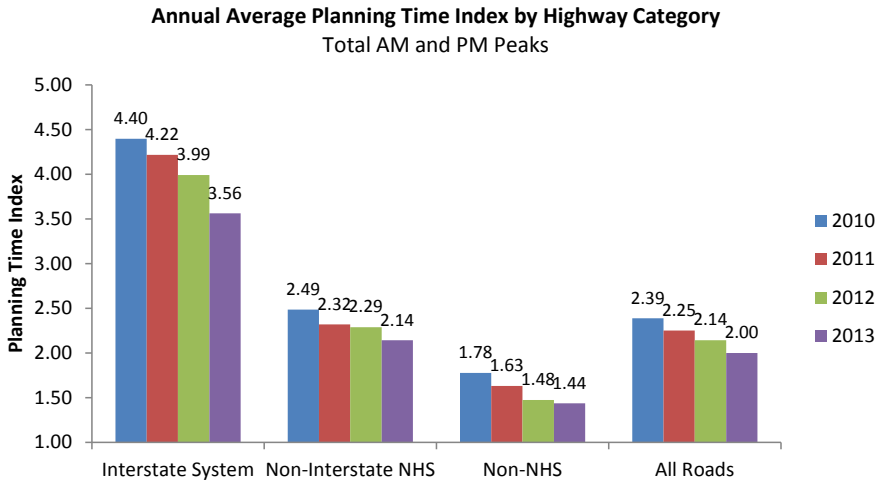
Figure 6. Percent of Congested Miles



2010-2013 Travel Time Reliability Trends

The Washington region experienced steady improvement in travel time reliability during peak periods from 2010-2013. The improvement in reliability, measured by Planning Time Index, from previous year was 6%, 5% and 7% in 2011, 2012 and 2013, respectively; the annual average improvement was 6% (Figure 7).

Figure 7. Average volumes on the Interstate system in peak periods, 1st quarter, 2010-2014



Bottlenecks

The CMP Technical Report also summarized the region's top 10 bottlenecks. Long queues along southbound I-95 in Virginia, northbound I-95 in Maryland and northbound MD-295 were partially due to bottlenecks outside of the TPB Planning Area. In particular, bottlenecks in Fredericksburg and Stafford County, Virginia generated queues as long as 30 miles, with tremendous impact on the southbound travel along I-95 in the region. Addressing these bottlenecks involves coordination with jurisdictions outside the TPB Planning Area.

Recommendations

The 2014 CMP Technical made a total of 15 recommendations for future improvements:

1. Refine CMP to meet MAP-21 requirements
2. Continue Commuter Connections
3. Enhance MATOC
4. Invest in existing transportation system
5. Congestion management during construction
6. Consider variable pricing
7. Encourage transit
8. Encourage non-auto travel modes
9. Integrated operations management/demand management strategies
10. Multimodal traveler information
11. Safely interface with social media
12. Regional Activity Centers connectivity
13. Regional congestion monitoring program with multiple data sources
14. Continue to monitor recent trends in congestion
15. Monitor freight movement

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

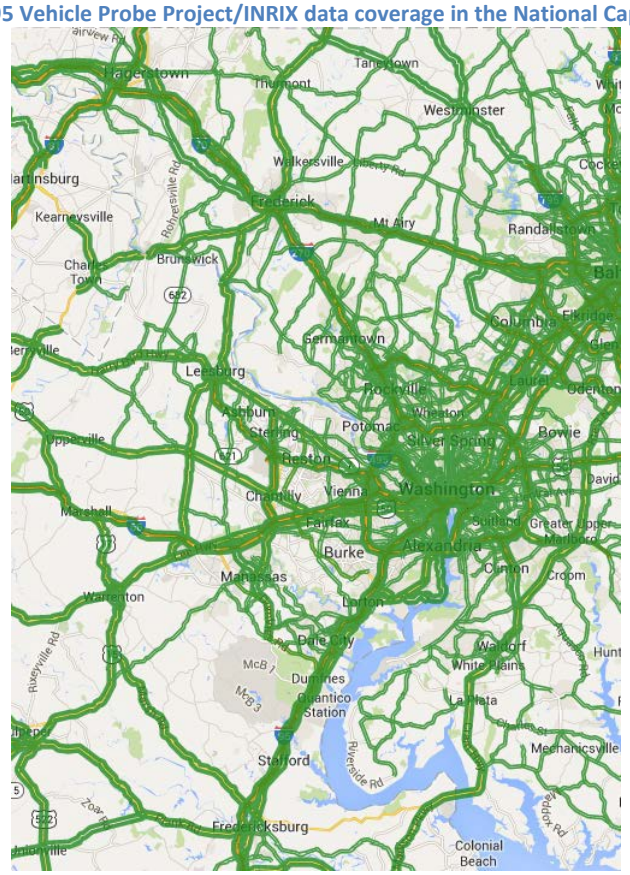
Highway Administration and produced by the Texas Transportation Institute with Cambridge Systematics, Inc. This report uses the following method to calculate PTI:

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

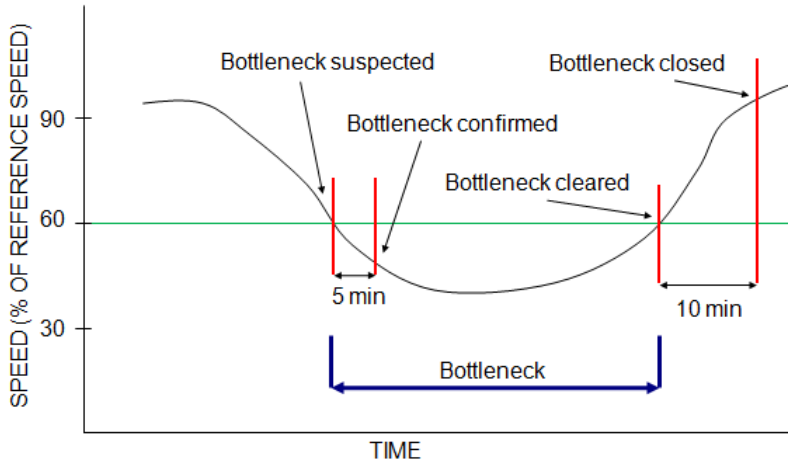


Bottlenecks

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 9. 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.