NATIONAL CAPITAL REGION TRANSPORTATION PLANNING BOARD

National Capital Region Congestion Report

1st Quarter 2014

Metropolitan Washington Council of Governments
777 North Capitol Street, N.E., Suite 300, Washington, DC 20002
www.mwcog.org

Author

Wenjing Pu
Transportation Engineer

Project Management

Andrew J. Meese
Systems Management Planning Director

Oversight

Kanti Srikanth
Director, Department of Transportation Planning

Gerald Miller
Acting Deputy Director, Department of Transportation Planning

Robert Griffiths
Acting Deputy Director, Department of Transportation Planning

Data and Tools Providers

I-95 Corridor Coalition Vehicle Probe Project
INRIX, Inc.
Center for Advanced Transportation Technology Laboratory, University of Maryland

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Available: www.mwcog.org/congestion
For more information please contact COG/TPB staff Wenjing Pu (wpu@mwcog.org)

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Congestion – Travel Time Index (TTI)

Interstate System

TTI 1st Quarter 2014:	1.19	↓1.5% or 0.02[1]
TTI Trailing 4 Quarters:	1.24	↓2.5% or 0.03[2]

Non-Interstate NHS[3]

TTI 1st Quarter 2014:	1.19	↑2.4% or 0.03
TTI Trailing 4 Quarters:	1.18	↑0.3% or 0.004

Non-NHS

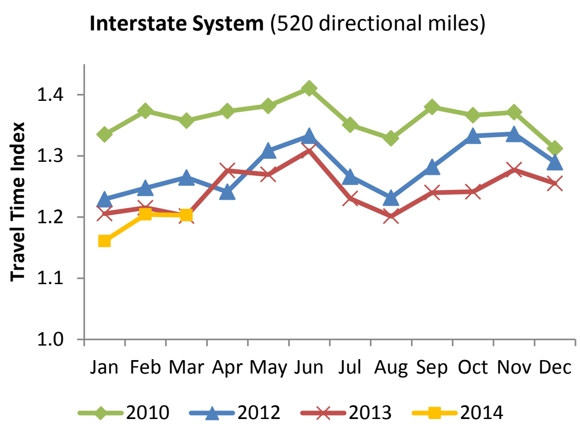
TTI 1st Quarter 2014:	1.09	↓0.2% or 0.002
TTI Trailing 4 Quarters:	1.09	↓0.4% or 0.004

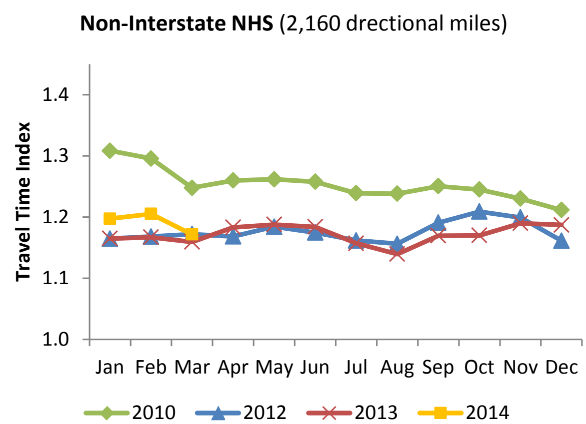
All Roads

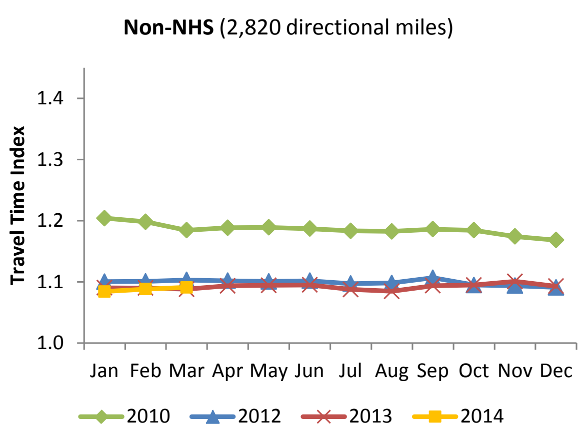
TTI 1st Quarter 2014:	1.14	↑0.7% or 0.01
TTI Trailing 4 Quarters:	1.14	↓0.4% or 0.004

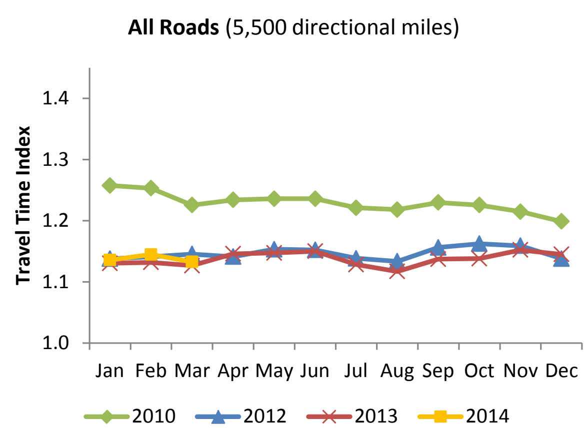
[1] Compared to 1st quarter 2013; [2] Compared to one year earlier; [3] NHS: National Highway System.

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

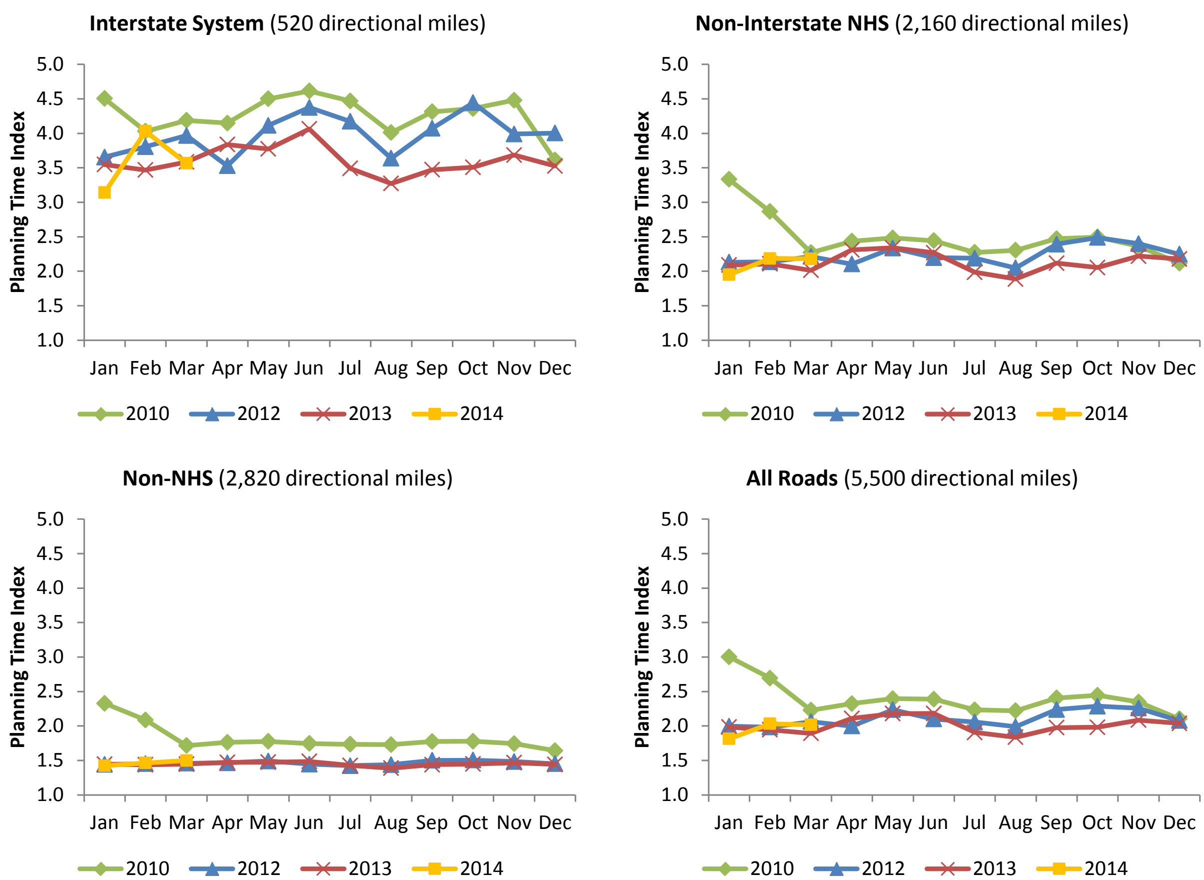
Travel Time Index (TTI), defined as the ratio of actual travel time to free-flow travel time, measures the intensity of congestion. The higher the index, the more congested traffic conditions it represents, e.g., TTI = 1.00 means free flow conditions, while TTI = 1.30 indicates the actual travel time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

Reliability – Planning Time Index (PTI)

Interstate System			**Non-Interstate NHS**[3]		
PTI 1st Quarter 2014:	3.58	↑1.3% or 0.04[1]	PTI 1st Quarter 2014:	2.11	↑1.7% or 0.04
PTI Trailing 4 Quarters:	3.61	↓7.6% or 0.30[2]	PTI Trailing 4 Quarters:	2.14	↓3.5% or 0.08
Non-NHS			**All Roads**		
PTI 1st Quarter 2014:	1.46	↑1.3% or 0.02	PTI 1st Quarter 2014:	1.95	↑0.7% or 0.01
PTI Trailing 4 Quarters:	1.45	↓0.6% or 0.01	PTI Trailing 4 Quarters:	2.01	↓3.6% or 0.08

[1] Compared to 1st 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)

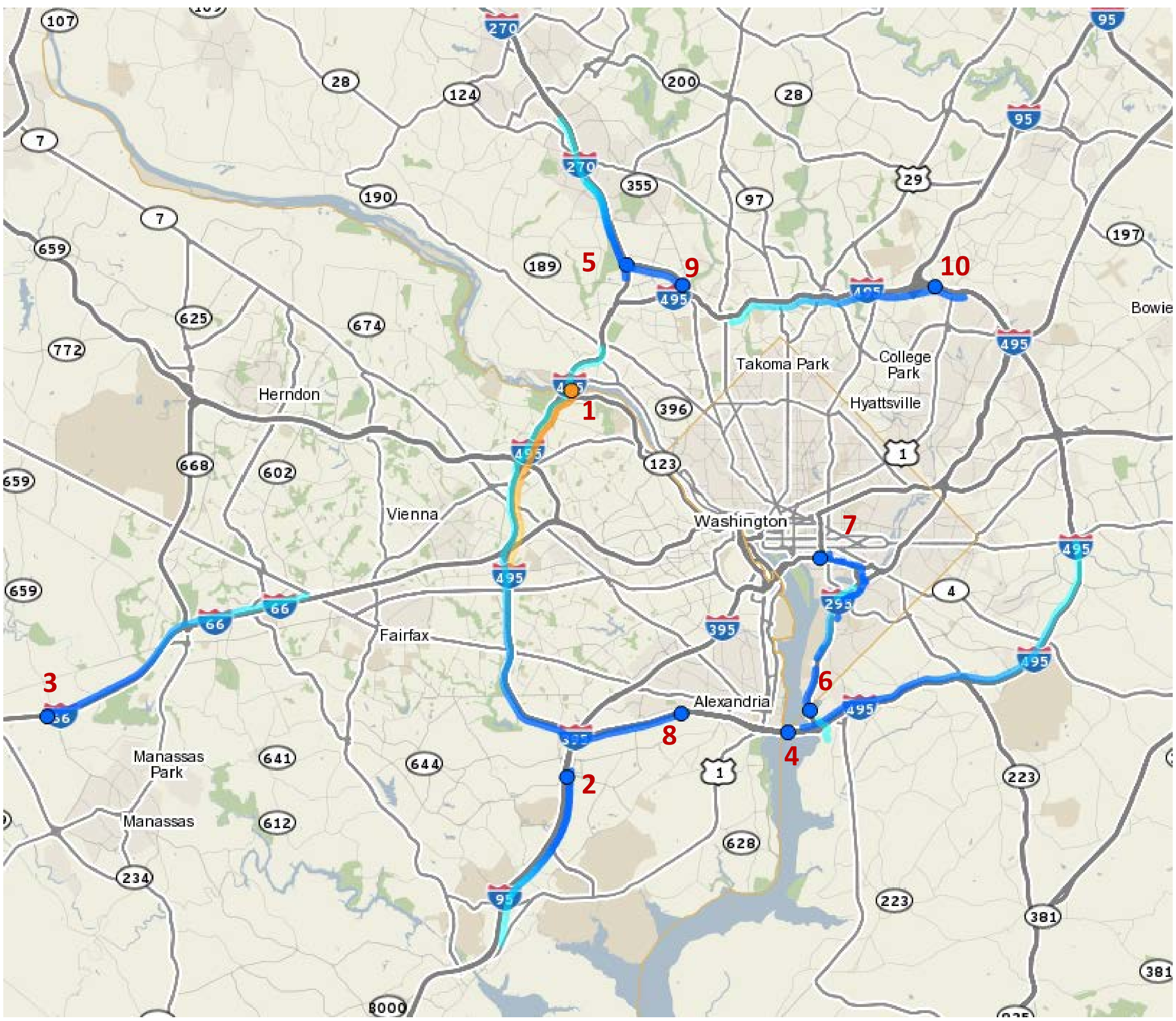


Planning Time Index

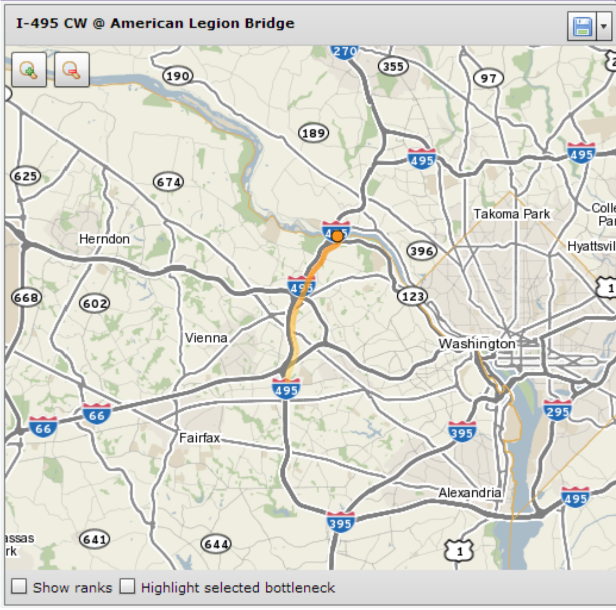
Planning Time Index (PTI), defined as the ratio of 95th percentile travel time to free flow travel time, measures travel time reliability. The higher the index, the less reliable traffic conditions it represents, e.g., PTI = 1.30 means a traveler has to budget 30% longer than the uncongested travel time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

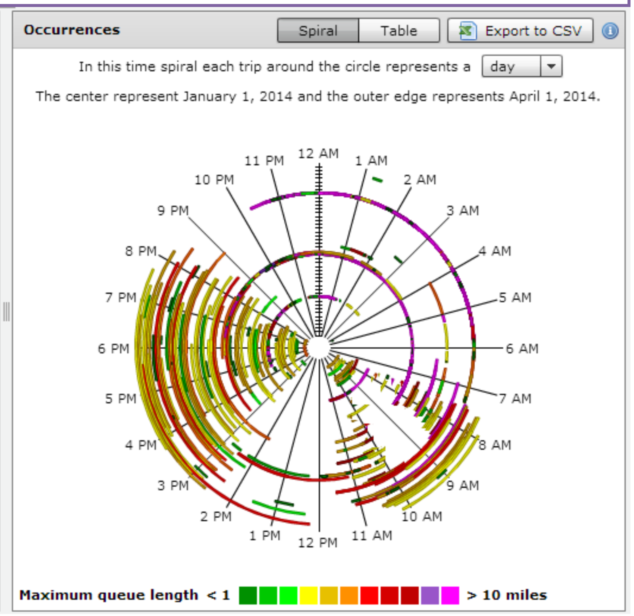
Top 10 Bottlenecks

Rank (Last Quarter Rank)	Location	Average duration	Average max length (miles)	Occur-rences	Impact factor
1 (04)	I-495 CW @ American Legion Bridge	2 h 41 m	6.88	225	249,155
2 (10)	I-95 N @ VA-7900/Exit 169	1 h 24 m	9.43	283	224,222
3 (01)	I-66 W @ VA-234/Exit 47	2 h 9 m	10.46	145	195,710
4 (54)	I-495 CW @ Woodrow Wilson Memorial Bridge	1 h 40 m	10.48	147	154,074
5 (02)	I-270 Spur S @ I-270	1 h 31 m	5.22	282	134,077
6 (14)	I-295 S @ DC-MD State Border	1 h 56 m	4.66	188	101,685
7 (23)	I-295 N @ I-395	1 h 17 m	3.82	341	100,241
8 (>60)	I-495 CCW @ Eisenhower Ave/Exit 3	2 h 47 m	20.49	28	95,816
9 (60)	I-270 S @ I-495/MD-355	1 h 21 m	6.58	165	87,876
10 (>60)	I-495 CW @ US-1/Baltimore Ave/Exit 25	2 h 1 m	6.55	109	86,439



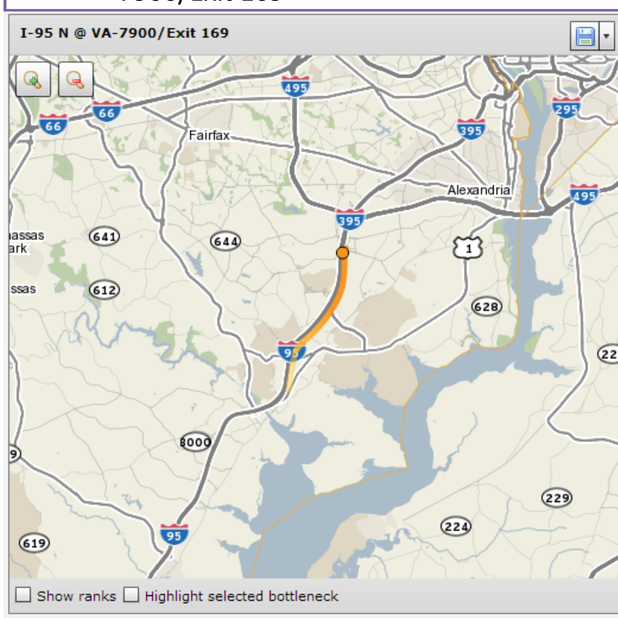
Rank	Location	Average duration	Average max length (miles)	Occurrences	Impact factor*
1	I-495 CW @ American Legion Bridge	2 h 41 m	6.88	225	249,155

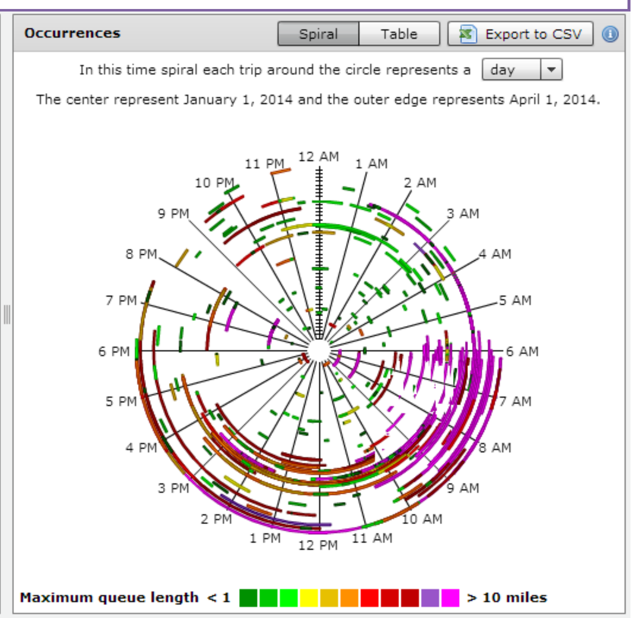




** The Impact Factor of a bottleneck is simply the product of the Average Duration (minutes), Average Max Length (miles) and the number of occurrences.*

Rank	Location	Average duration	Average max length (miles)	Occurrences	Impact factor
2	I-95 N @ VA-7900/Exit 169	1 h 24 m	9.43	283	224,222





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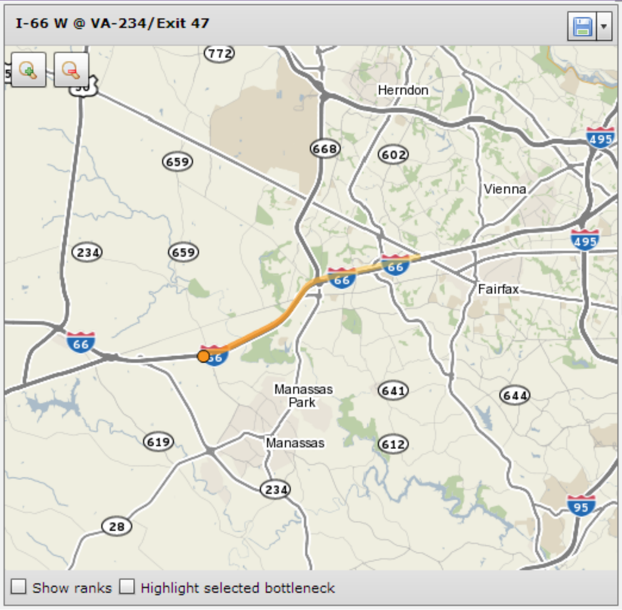

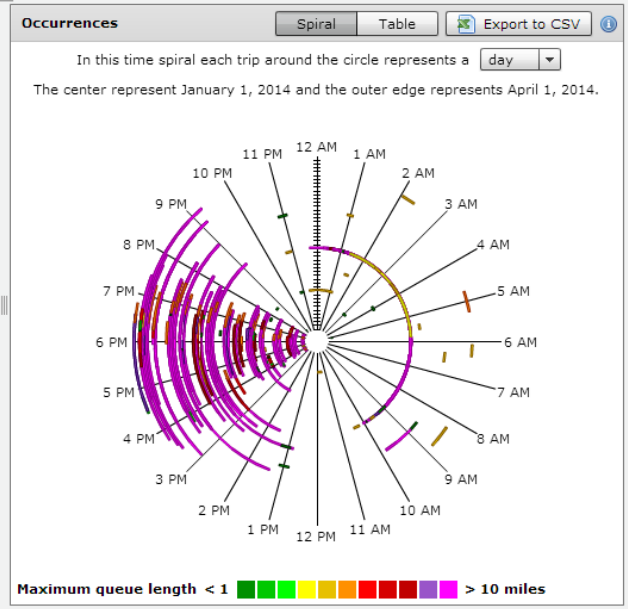

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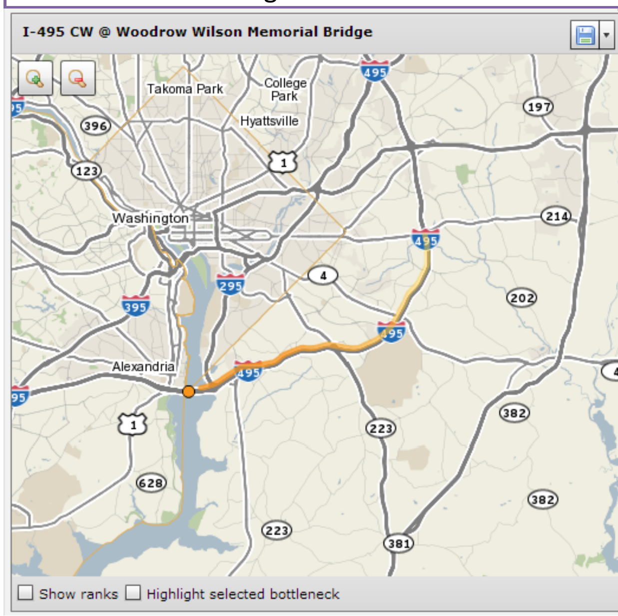

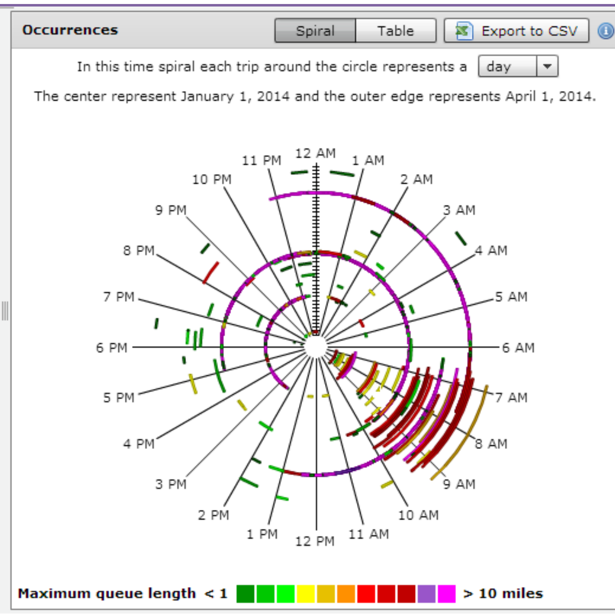

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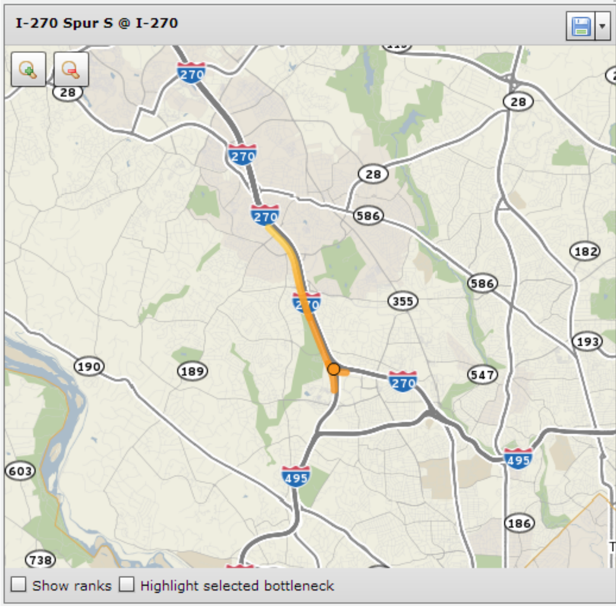

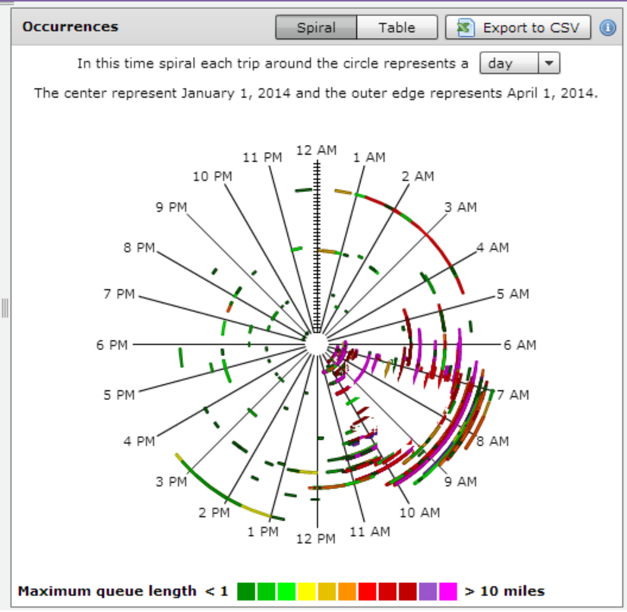

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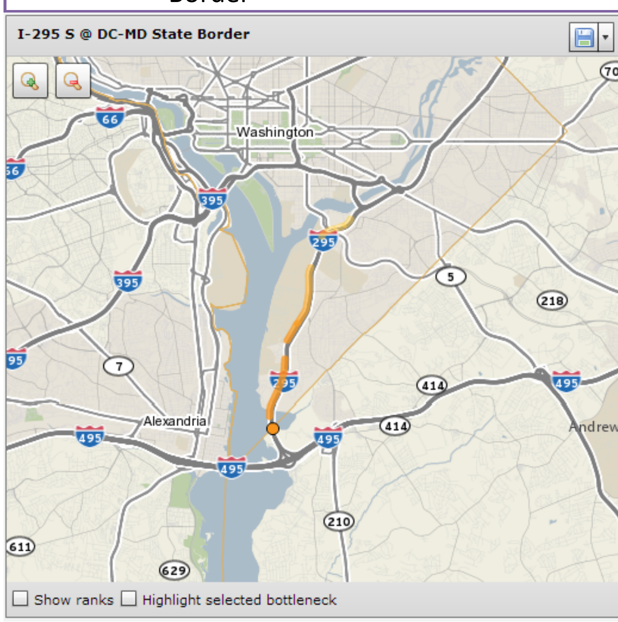

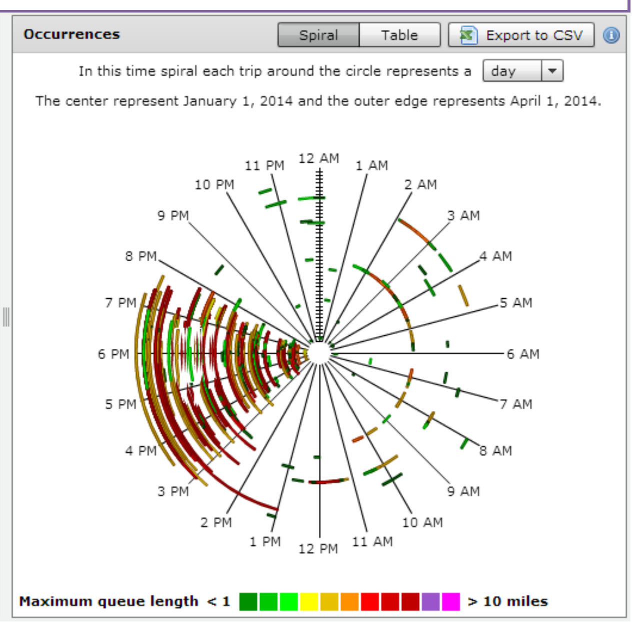

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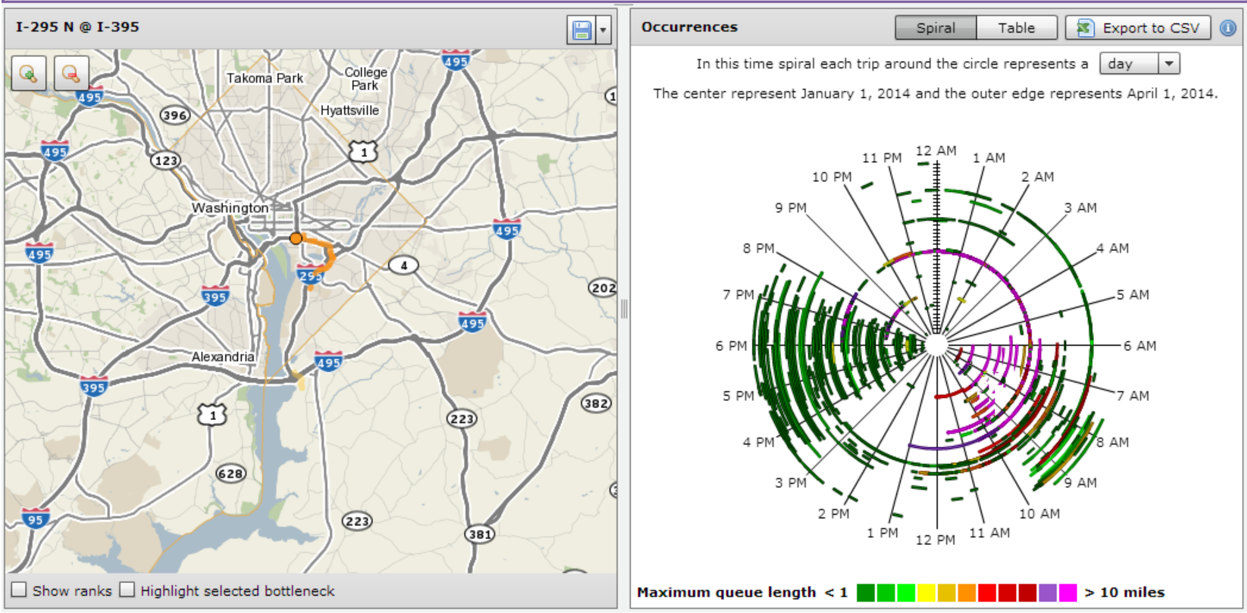

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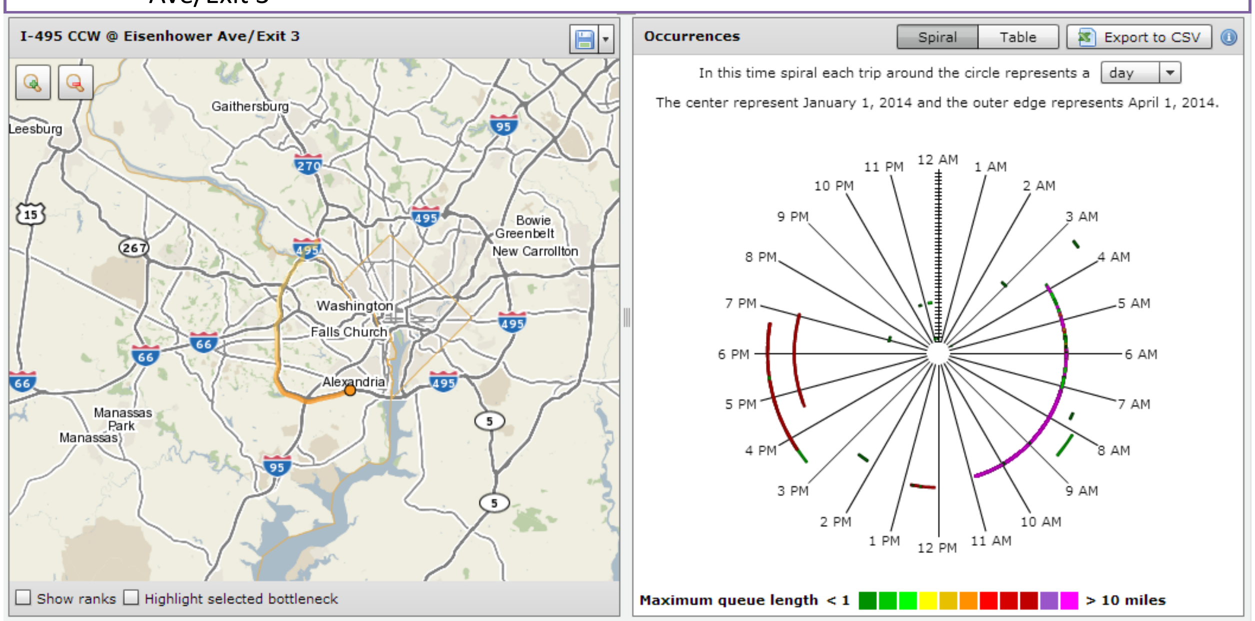

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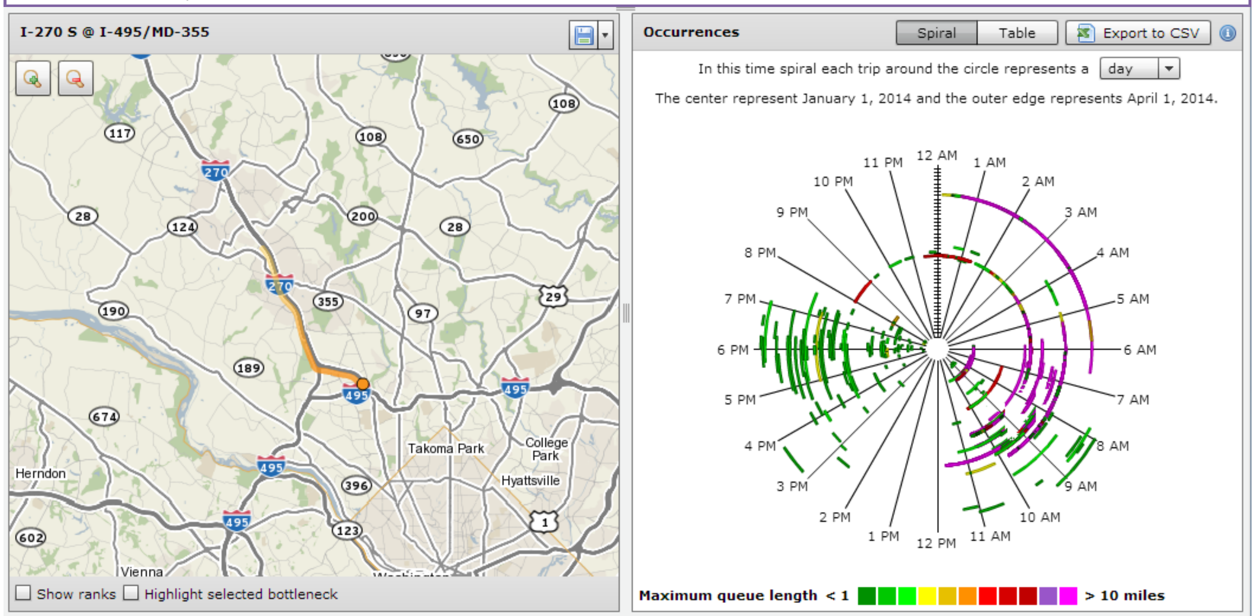

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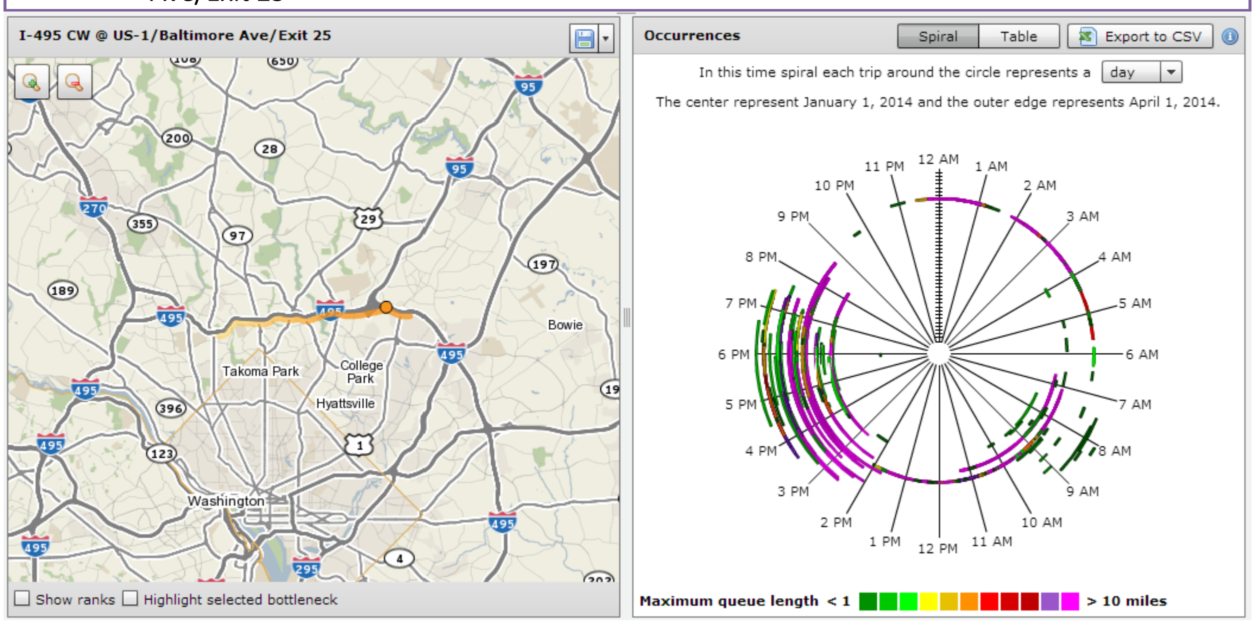


Congestion Maps

Figure 3. Travel Time Index during weekday 8:00-9:00 AM in 1st Quarter 2014

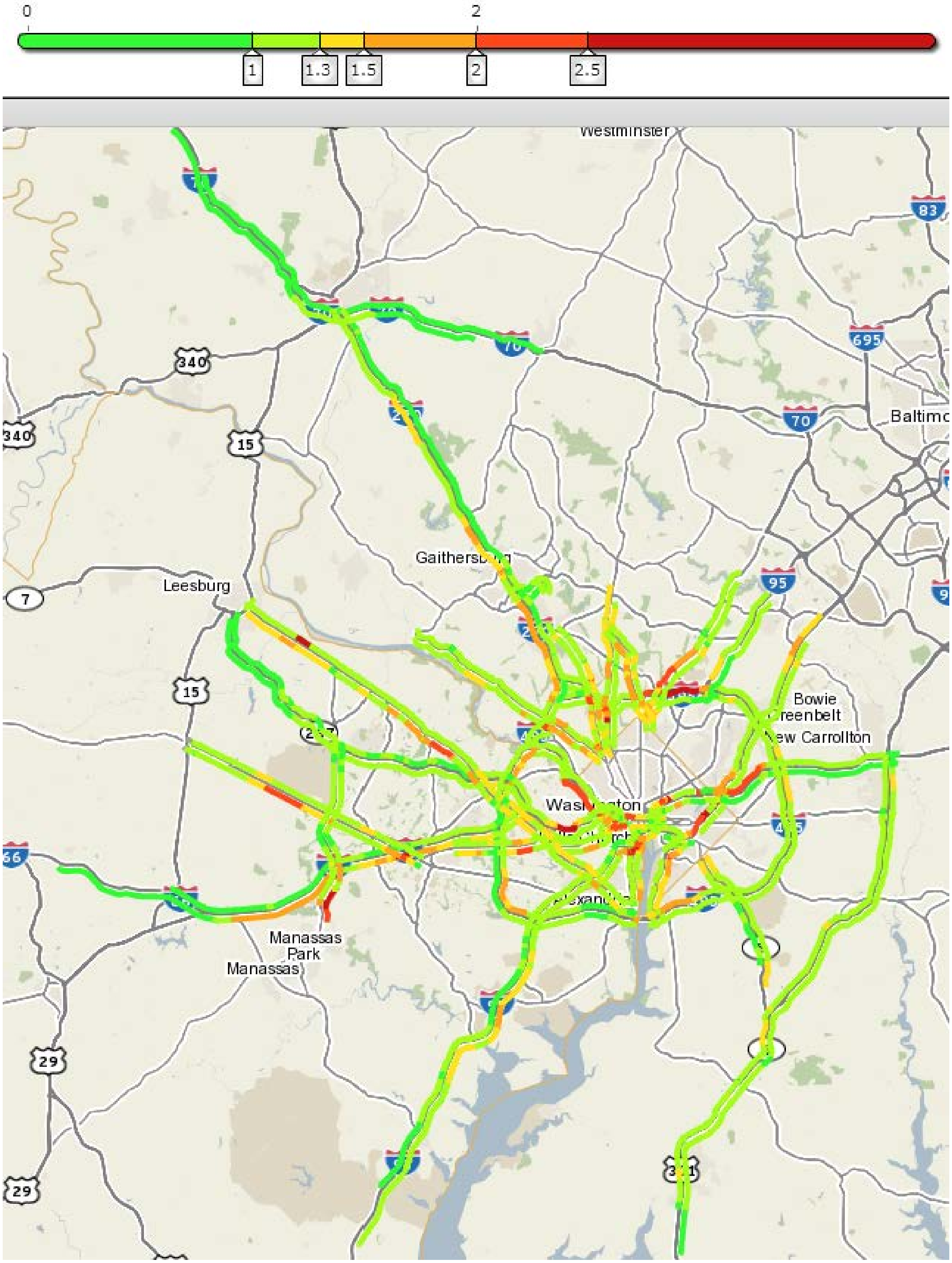
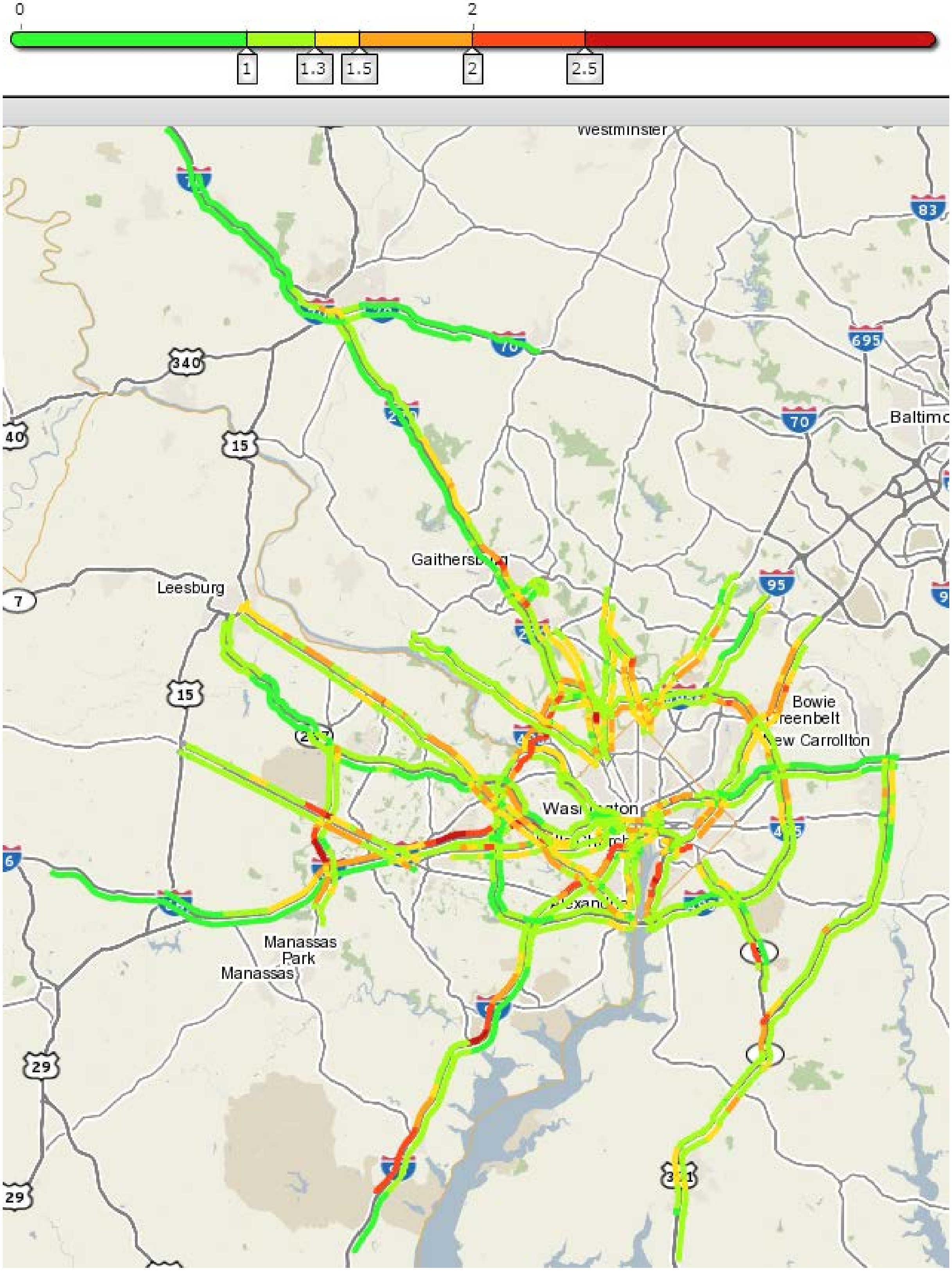


Figure 4. Travel Time Index during weekday 5:00-6:00 PM in 1st Quarter 2014

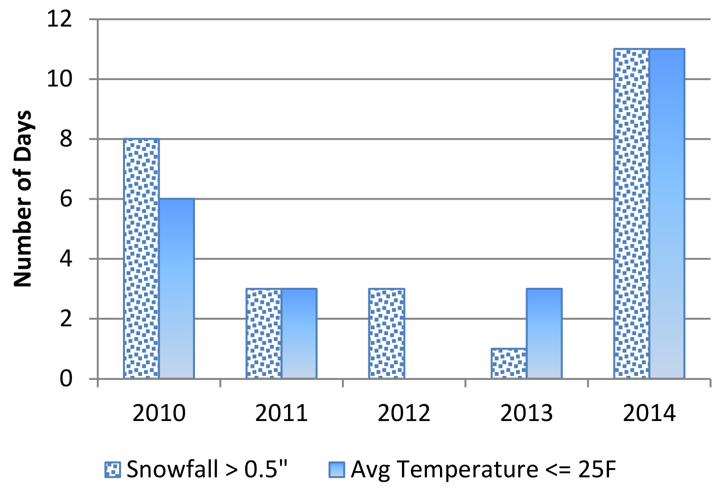


1st Quarter 2014 Spotlight – Snowy & Cold Weather

The 2013-2014 winter was one of the snowiest winters on record, and one of the coldest and longest winters in recent decades in the Washington region. People traveled less and experienced less freeway traffic congestion but a bit more arterial slowdown compared to previous years, as suggested by traffic data provided by the I-95 Corridor Coalition Vehicle Probe Project/INRIX, Inc.

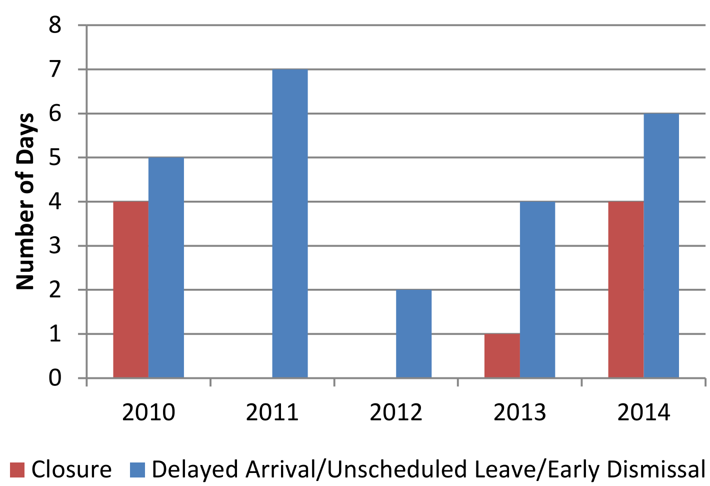
From January through March 2014, there were 11 days with snowfall greater than half an inch, compared to only eight days in the same time period in 2010, another snowiest quarter (Figure 5). This time period also had 11 days whose average daily temperatures were equal to or below 25 F, compared to only 6 days in the same quarter in 2010.

Figure 5. Number of days with snowfall > 0.5 inch or average temperature <= 25 F, 1st quarter, 2010-2014



Source: "NowData – NOAA Online Weather Data". National Oceanic and Atmospheric Administration. Retrieved 6/16/14.

Figure 6. OPM decisions on closures, delays/leaves/dismissals, 1st quarter, 2010-2014

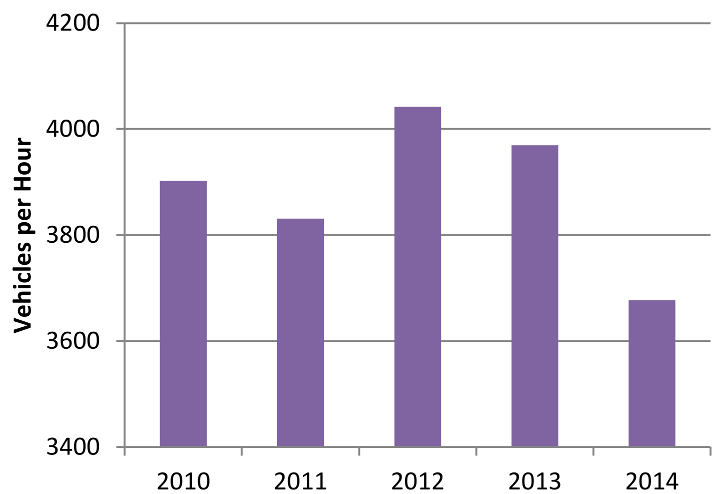


Source: Office of Personnel Management, Snow & Dismissal Procedures. Retrieved 6/16/14.

Based on the weather conditions, the Office of Personnel Management (OPM) announced four days with office closure and another six days with delayed arrival, unscheduled leave and/or early dismissal for the region's federal workers (Figure 6). Many other agencies, such as schools, in the region followed the decisions made by the OPM.

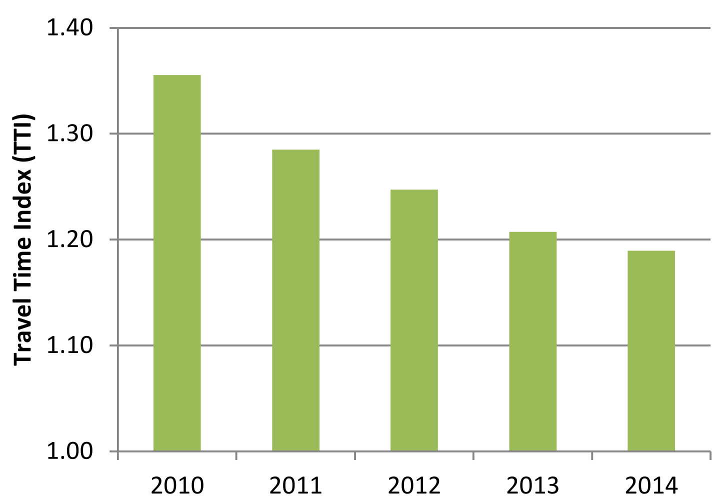
One of the significant impacts of the snowy and cold weather was reduced travel and congestion on the region's freeway system. As indicated by Figure 7, the average hourly volume on the Interstate and freeway system during the first quarter's peak periods[1] was the lowest in the last five years since 2010.

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



Source: Vehicle volumes were obtained from 221 stations along the interstates in the Washington region via the stakeholder website enabled by the FHWA Transportation Technology Innovation and Demonstration program.

Figure 8. Average Travel Time Index on the Interstate system in peak periods, 1st quarter, 2010-2014



Source: I-95 Corridor Coalition Vehicle Probe Project/INRIX data.

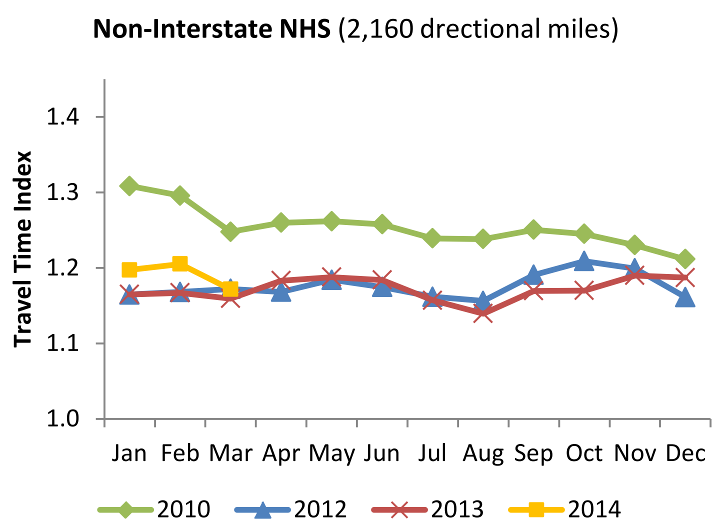
[1] 6:00 am – 10:00 am and 3:00 pm – 7:00 pm, Monday through Friday, federal holidays excluded.

Consistently, reduced traffic congestion was observed on the region's Interstate system in the first quarter 2014 (Figure 8). Such reduction was a likely result of people avoiding travel on the freeways during heavy snow or very cold days. Commuters were able to do so partially because of the OPM decisions as mentioned above. However, to fully understand the effectiveness of the OPM decisions is beyond the scope of this report.

Hourly volumes did not necessarily correlate with traffic congestion, as suggested in Figure 7 and 8. This is because: 1) the volumes and travel time indices were regional averages, not for a specific location; 2) congestion was highly dependent on the distribution of travel, higher average hourly volumes in the eight-hour peak periods did not necessarily coincide with highly concentrated travel during a subset of the eight hours; and 3) the relationship between volume and speed (congestion) is nonlinear, there could be a wide range of volume corresponding to a specific speed.

Different from the freeway system where reduced travel and congestion were observed, this region's major arterials, which could be roughly represented by the non-Interstate National Highway System, experienced more slowdown compared to two previous years (Figure 9). Such slowdown could be caused by snow accumulations that were not removed as quickly as on freeways where most snow removal efforts were concentrated on; it could also be a result of increased arterial travel. More data (such as volumes) are needed for further investigation.

Figure 9. Travel Time Index on Non-Interstate National Highway System



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

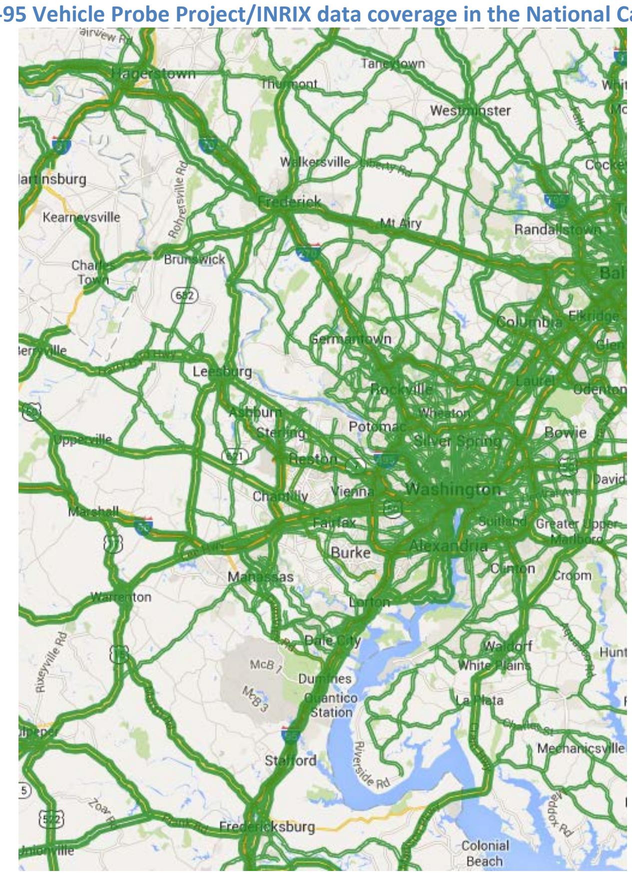
Highway Administration and produced by the Texas Transportation Institute with Cambridge Systematics, Inc. This report uses the following method to calculate PTI:

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

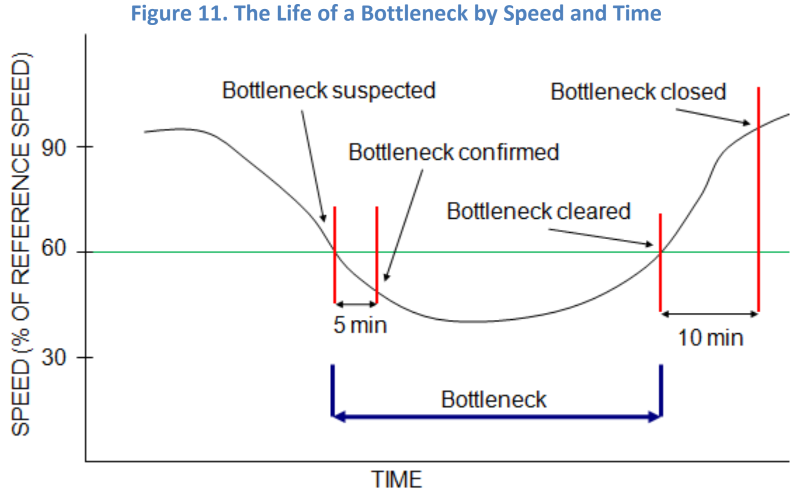


Bottlenecks

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 11. 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.

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.