NATIONAL CAPITAL REGION TRANSPORTATION PLANNING BOARD

National Capital Region Congestion Report

4th Quarter 2013

Metropolitan Washington Council of Governments
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www.mwcog.org

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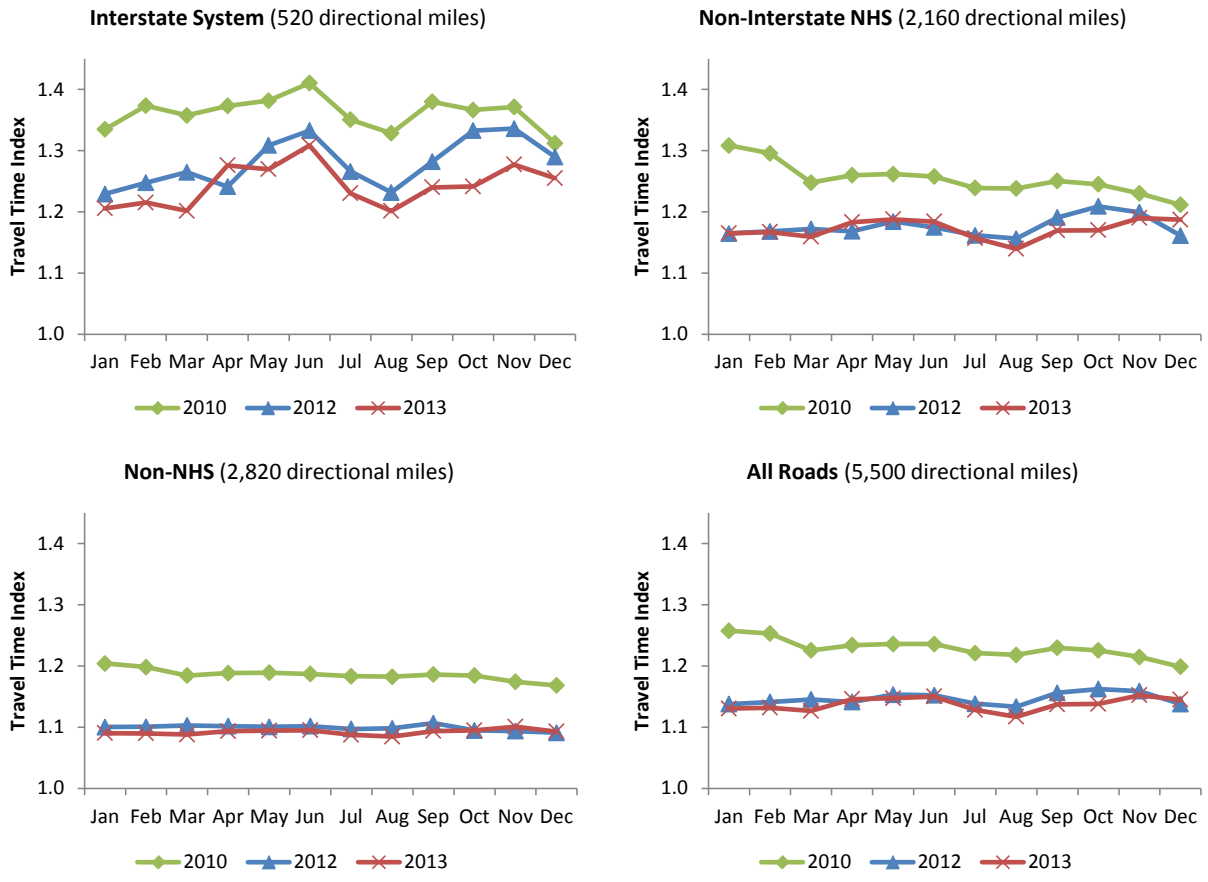
Table of Contents

Congestion – Travel Time Index (TTI)

Interstate System		
TTI 4th Quarter 2013:	1.26	↓4.7% or 0.06[1]
TTI 2013:	1.24	↓2.9% or 0.04[2]
Non-Interstate NHS[3]		
TTI 4th Quarter 2013:	1.18	↓0.6% or 0.01
TTI 2013:	1.17	↓0.4% or 0.004
Non-NHS		
TTI 4th Quarter 2013:	1.10	↑0.3% or 0.003
TTI 2013:	1.09	↓0.6% or 0.01
All Roads		
TTI 4th Quarter 2013:	1.15	↓0.7% or 0.01
TTI 2013:	1.14	↓0.8% or 0.01

[1] Compared to 4th quarter 2012; [2]Compared to 2012; [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

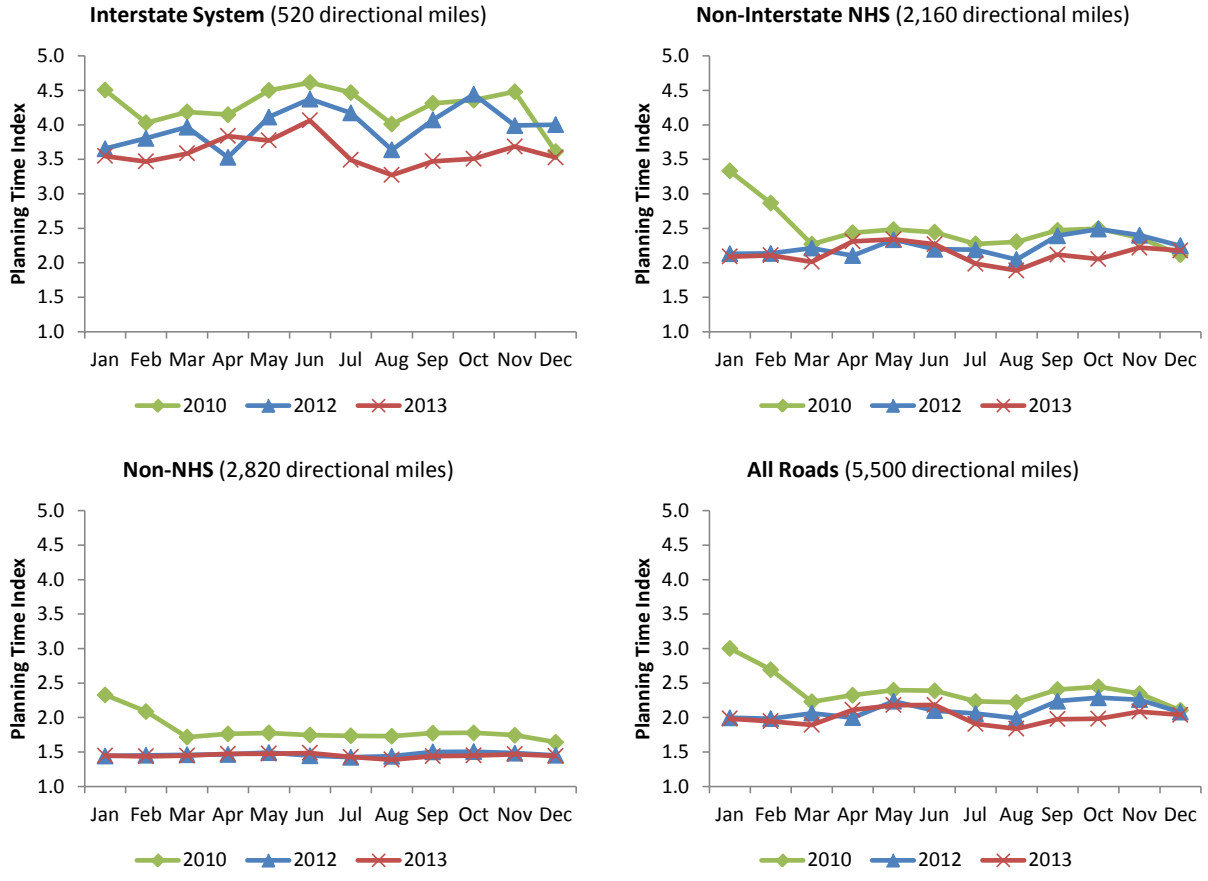
Travel Time Index (TTI), defined as the ratio of actual travel time to free-flow travel time, measures the intensity of congestion. The higher the index, the more congested traffic conditions it represents, e.g., TTI = 1.00 means free flow conditions, while TTI = 1.30 indicates the actual travel time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

Reliability – Planning Time Index (PTI)

Interstate System		
PTI 4th Quarter 2013:	3.57	↓13.8% or 0.57[1]
PTI 2013:	3.60	↓9.5% or 0.38[2]
Non-Interstate NHS[3]		
PTI 4th Quarter 2013:	2.15	↓9.6% or 0.23
PTI 2013:	2.13	↓4.9% or 0.11
Non-NHS		
PTI 4th Quarter 2013:	1.45	↓1.9% or 0.03
PTI 2013:	1.45	↓1.0% or 0.02
All Roads		
PTI 4th Quarter 2013:	2.03	↓7.9% or 0.17
PTI 2013:	2.01	↓4.6% or 0.10

[1] Compared to 4th quarter 2012; [2]Compared to 2012; [3] NHS: National Highway System, 10/01/2012 definition.

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

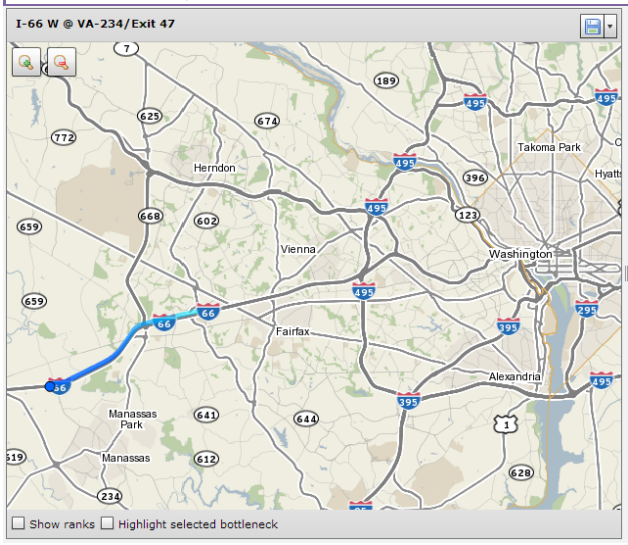


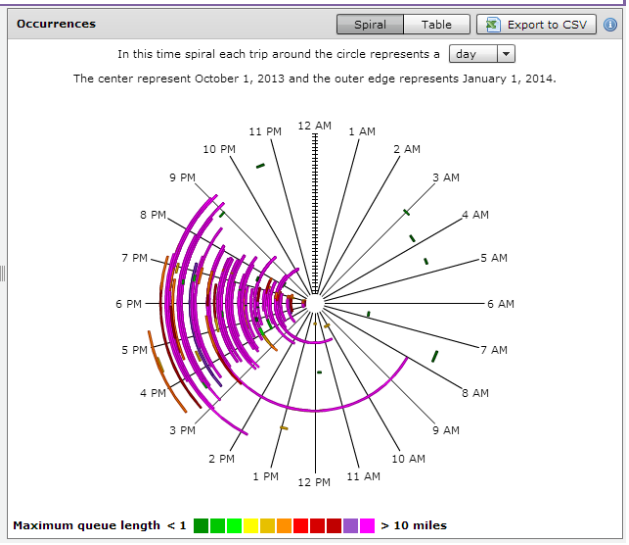
Planning Time Index

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

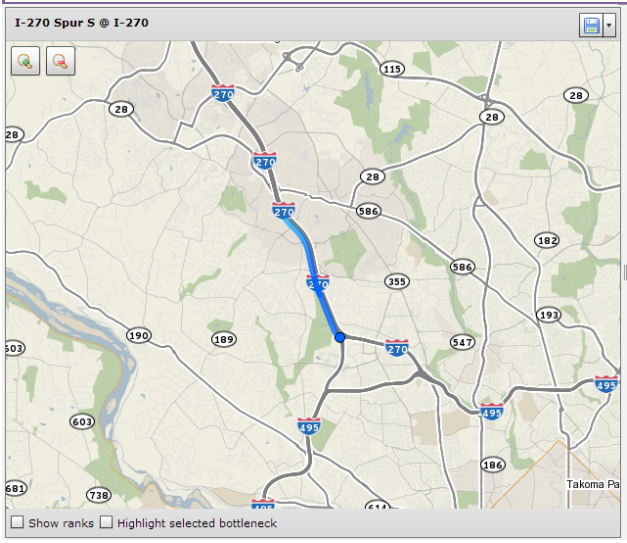
Rank	Location	Average duration	Average max length (miles)	Occurrences	Impact factor*
1	I-66 W @ VA-234/Exit 47	2 h 40 m	11.33	122	221,249

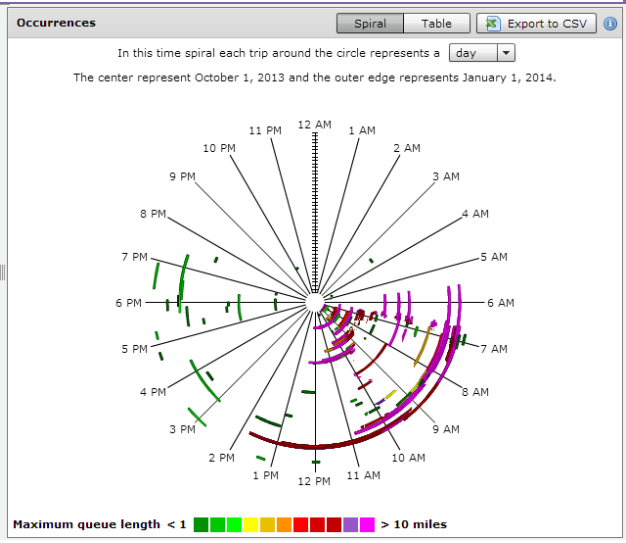




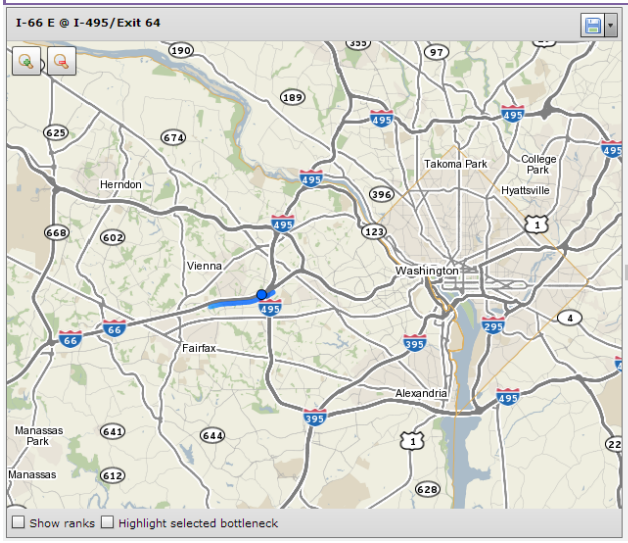
** The Impact Factor of a bottleneck is simply the product of the Average Duration (minutes), Average Max Length (miles) and the number of occurrences.*

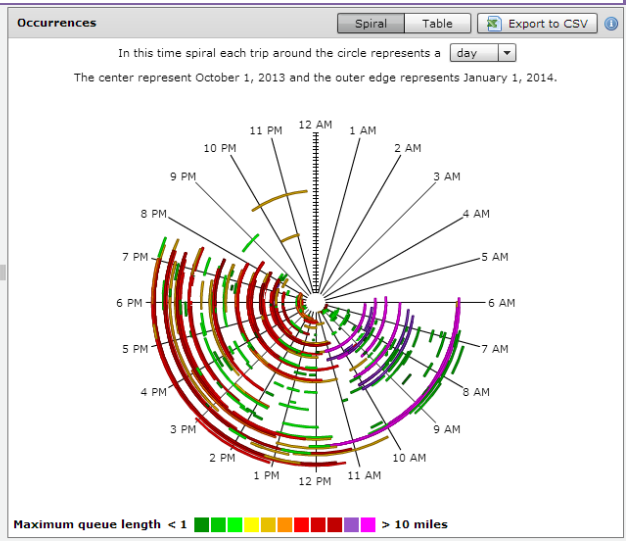
Rank	Location	Average duration	Average max length (miles)	Occurrences	Impact factor
2	I-270 Spur S @ I-270	1 h 49 m	7.35	241	192,962



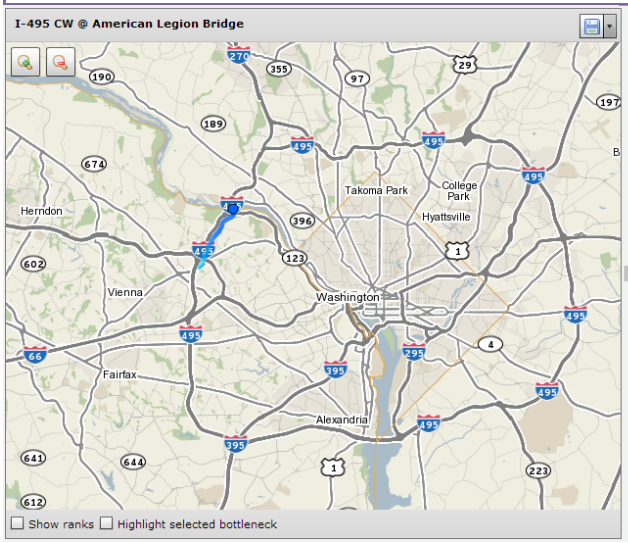


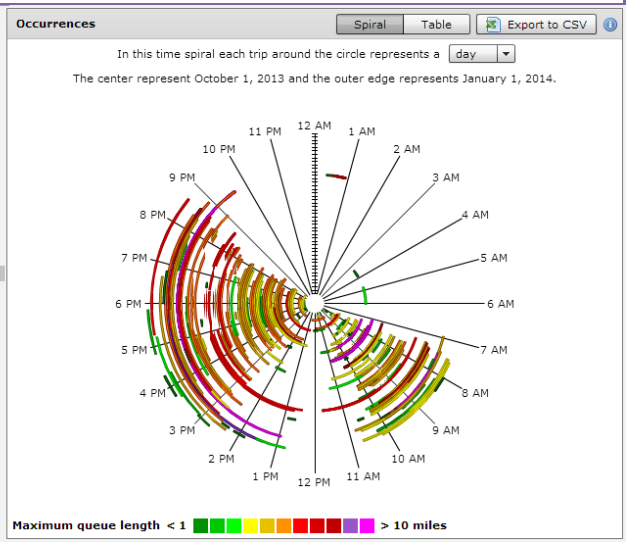
Rank	Location	Average duration	Average max length (miles)	Occurrences	Impact factor
3	I-66 E @ I-495/Exit 64	2 h 5 m	5.18	249	161,128



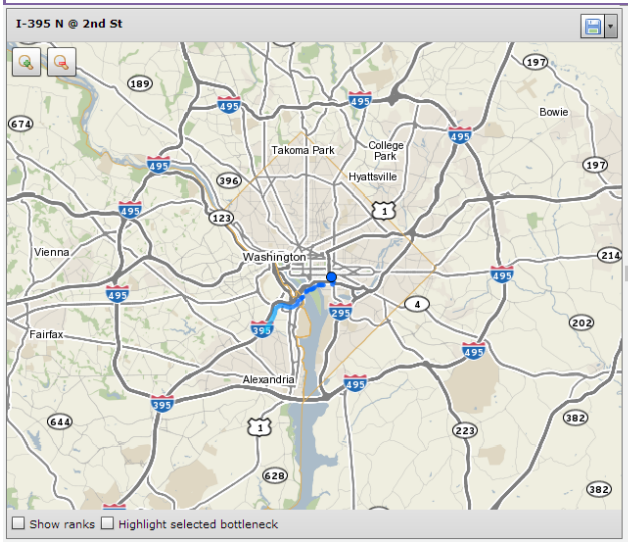


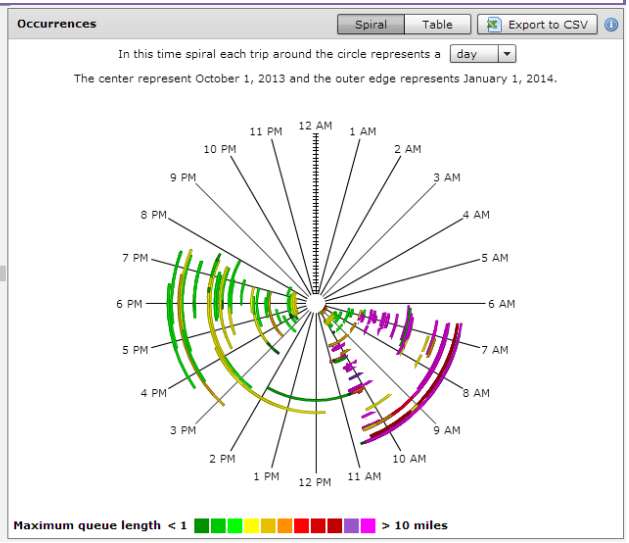
Rank	Location	Average duration	Average max length (miles)	Occurrences	Impact factor
4	I-495 CW @ American Legion Bridge	2 h 47 m	4.63	190	146,875



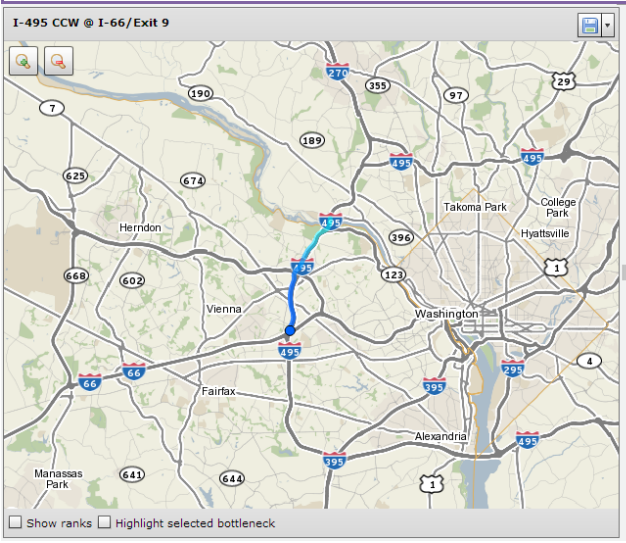


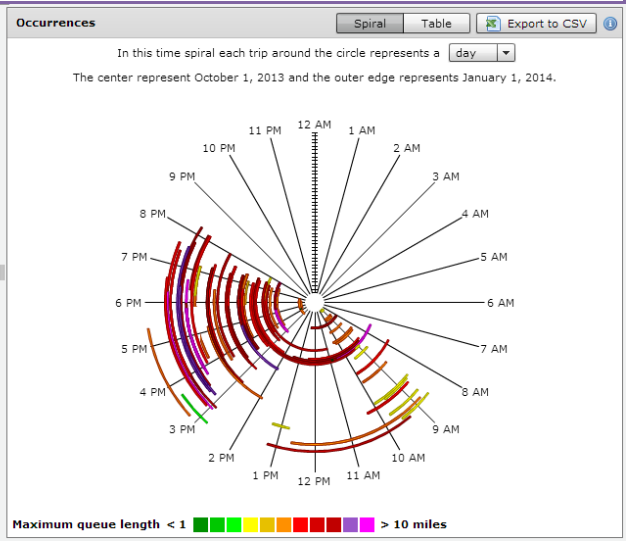
Rank	Location	Average duration	Average max length (miles)	Occurrences	Impact factor
5	I-395 N @ 2nd St	2 h 34 m	6.88	129	136,752



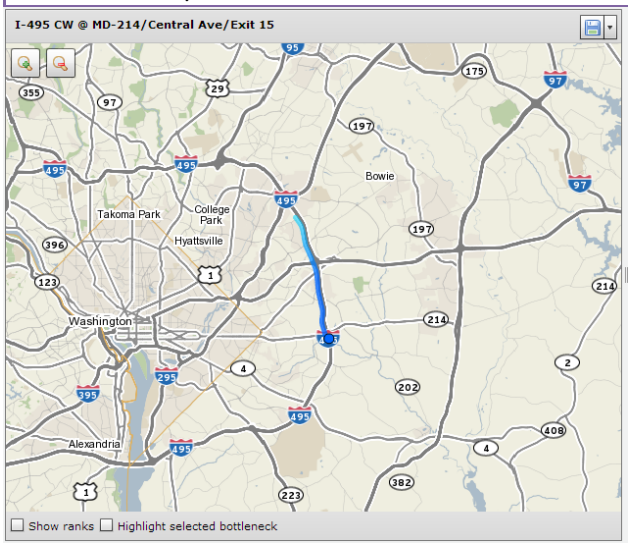


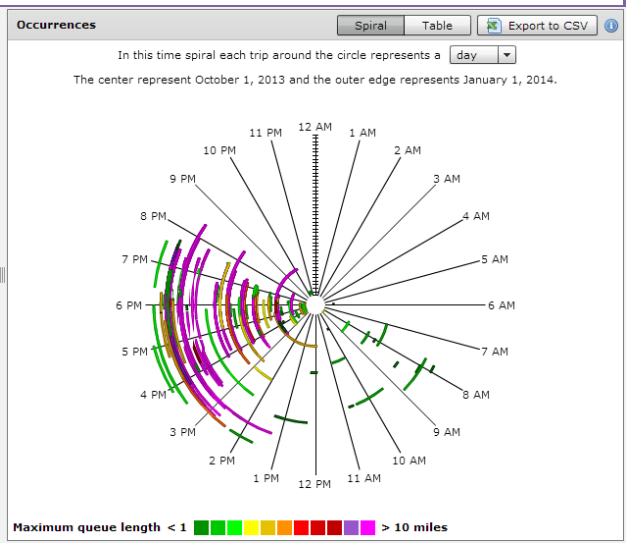
Rank	Location	Average duration	Average max length (miles)	Occurrences	Impact factor
6	I-495 CCW @ I-66/Exit 9	2 h 59 m	8.39	90	135,236



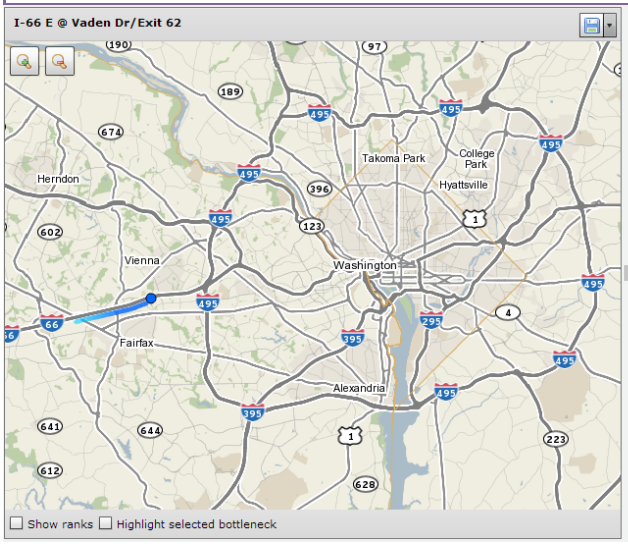


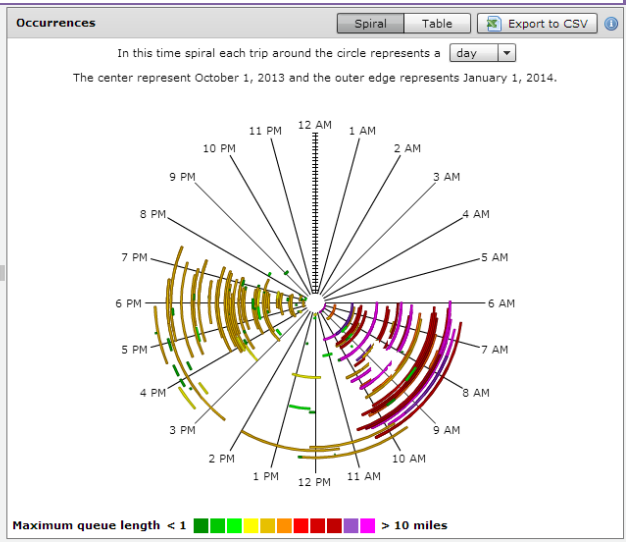
Rank	Location	Average duration	Average max length (miles)	Occurrences	Impact factor
7	I-495 CW @ MD-214/Central Ave/Exit 15	2 h 3 m	8.52	129	135,225



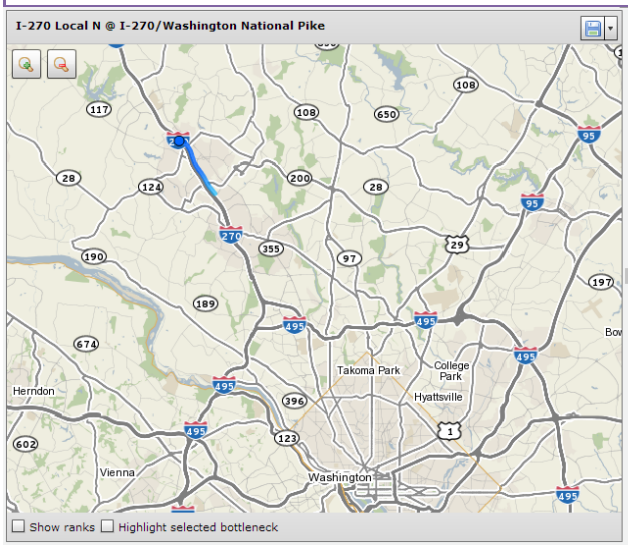


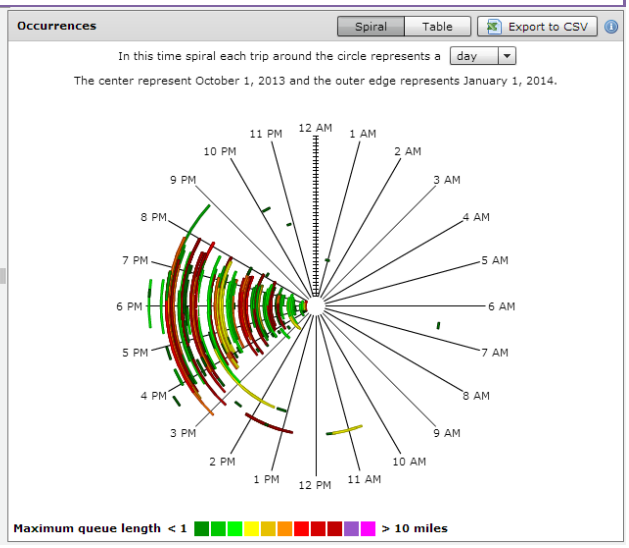
Rank	Location	Average duration	Average max length (miles)	Occurrences	Impact factor
8	I-66 E @ Vaden Dr/Exit 62	1 h 48 m	5.21	156	87,859



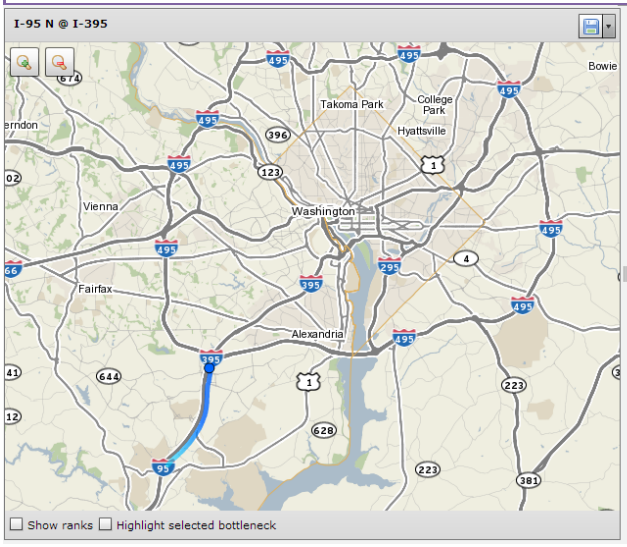


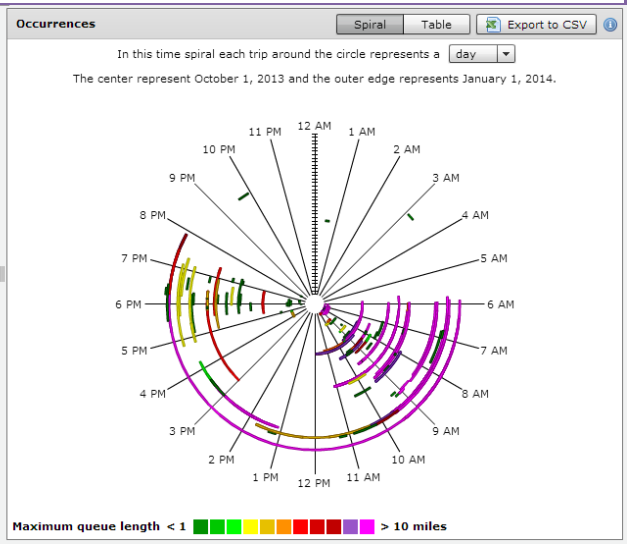
Rank	Location	Average duration	Average max length (miles)	Occurrences	Impact factor
9	I-270 Local N @ I-270/Washington National Pike	2 h 6 m	4.28	159	85,730





Rank	Location	Average duration	Average max length (miles)	Occurrences	Impact factor
10	I-95 N @ I-395	1 h 38 m	7.94	109	84,822





Congestion Maps

Figure 3. Travel Time Index during weekday 8:00-9:00 AM in 4th Quarter 2013

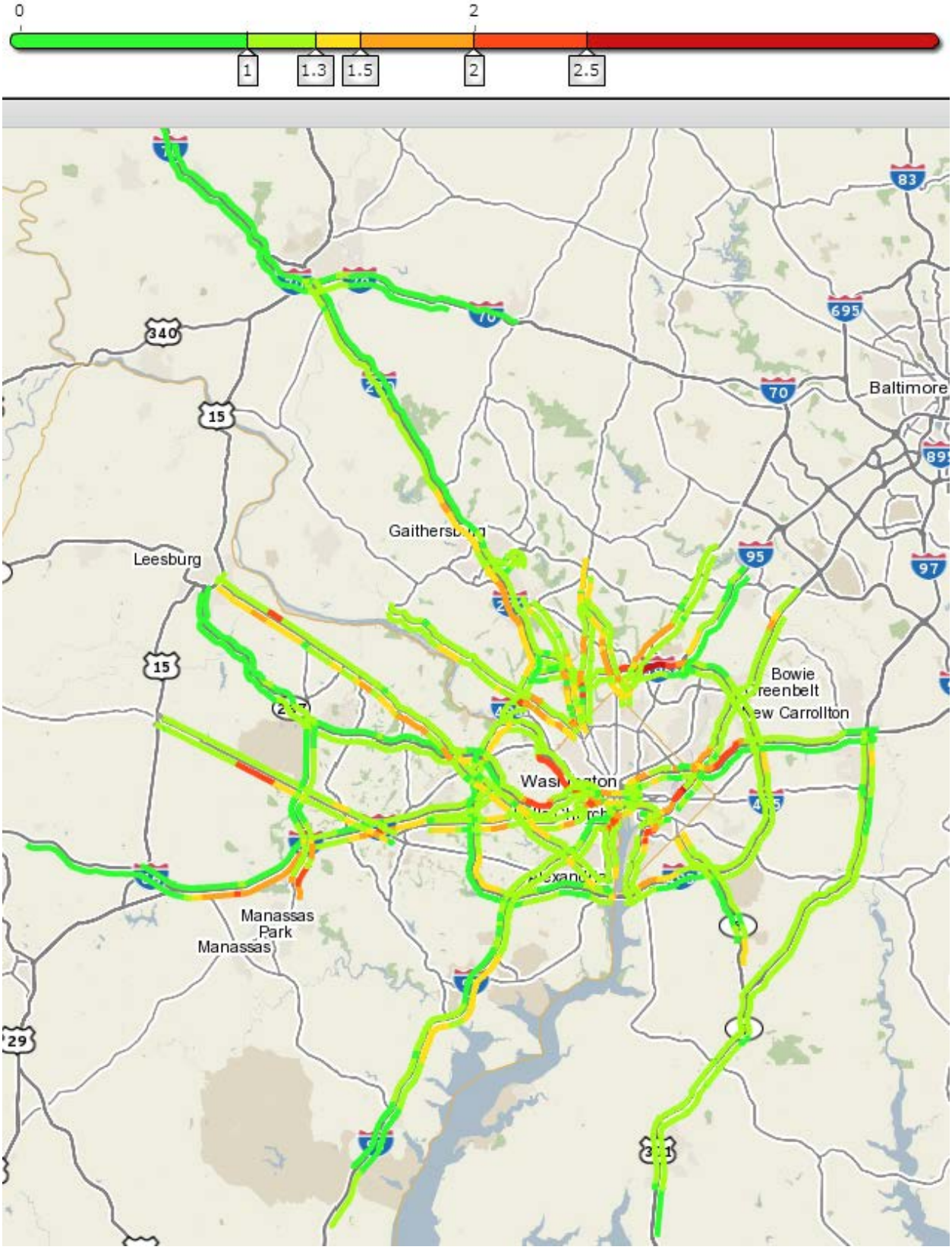
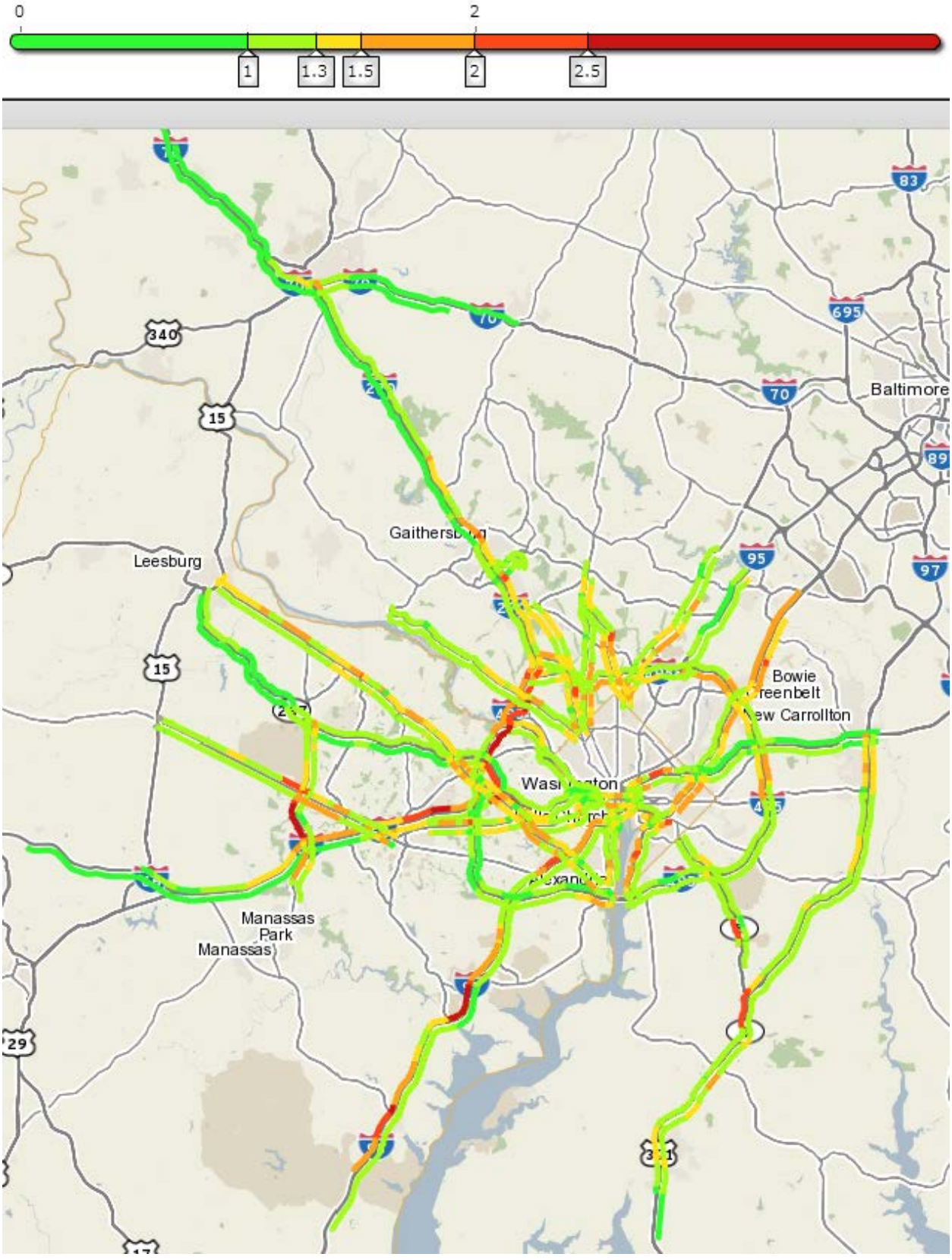


Figure 4. Travel Time Index during weekday 5:00-6:00 PM in 4th Quarter 2013



4th Quarter 2013 Spotlight – Federal Government Shutdown

From October 1 through 16, 2013, the United States federal government entered into a shutdown. This event provided a unique opportunity to investigate the traffic impact of federal employees in the Washington area. Changes in traffic conditions from before to during and to after the shutdown were analyzed regionally and facility-specifically.

According to the 2008-2012 American Community Survey data, there are 2.9 million workers in the TPB Planning Area, 17.0%, or half a million, of them are federal government workers. Out of the half a million federal workers, 67.4% use highways (excluding taxicab and motorcycle users) and 26.5% use public transportation (6.1% use other modes such as walk, bike or work at home). The federal government highway users account for 15.0% of all workers who use highways; the federal government public transportation users account for 30.3% of all workers who use public transportation.

Analysis

This analysis focused on the AM Peak (6:00-10:00 am) and PM Peak (3:00-7:00 pm) on the Interstate system and the non-Interstate NHS for the following weekdays (the 2012 data are provided as a reference):

- Before Shutdown: for 2013, 10 weekdays between Sep. 16 (Mon.) and Sep.27 (Fri.); for 2012, 10 weekdays between Sep. 17 (Mon.) and Sep.28 (Fri.).
- Shutdown: for 2013, 10 weekdays between Oct. 1 (Tue.) and Oct. 14 (Mon.); for 2012, 10 weekdays between Oct. 1 (Mon.) and Oct. 12 (Fri.).
- After Shutdown: for 2013, 10 weekdays between Oct. 21 (Mon.) and November 1 (Fri.); for 2012, 10 weekdays between Oct. 22 (Mon.) and Nov. 2 (Fri.).
- 2013 Average: all weekdays (Mon. through Fri.) in 2013.
- 2012 Average: all weekdays (Mon. through Fri.) in 2012.

Travel Time Index for the above analysis periods is shown below in Figure 5 and the changes from "Before" to "Shutdown" are summarized in Table 1:

Figure 5. Travel Time Index of Analysis Periods

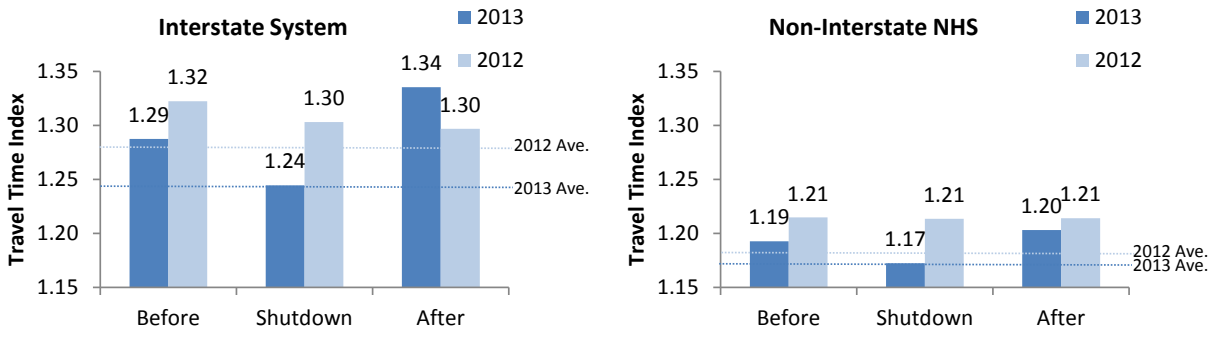


Table 1. Summary of Travel Time Index Changes from "Before" to "Shutdown"

		Travel Time Index	
		2013	2012
Interstate System	Before	1.29	1.32
	Shutdown	1.24	1.30
	Change	***-3.3%***	***-1.5%***
Non-Interstate NHS	Before	1.19	1.21
	Shutdown	1.17	1.21
	Change	***-1.7%***	***-0.10%***
Overall (NHS)	Before	1.21	1.24
	Shutdown	1.19	1.23
	Change	***-2.0%***	***-0.4%***

Regional Findings

Traffic congestion, measured by the Travel Time Index, decreased by about 2% on the region's National Highway System from "Before" to "Shutdown", including a 3.3% drop on the Interstate system and a 1.7% drop on the non-Interstate NHS. Given that the same period change in 2012 was only a 1.5% drop on the Interstate system and a 0.1% drop on the non-Intestate NHS, the congestion changes from "Before" to "Shutdown" in 2013 are considered significant. Traffic congestion "After" the shutdown marched higher than that of the "Before" (which was in September) in 2013 and was also higher than the "2013 Average", because October usually is more congested than the annual average. Overall, 2013 was less congested than 2012 as indicated by the annual averages in Figure 5.

Facility-Specific Findings

Segments with more than 10% improvement in congestion from "Before" to "Shutdown" were plotted in Figures 6 and 7 for AM Peak and PM Peak respectively.

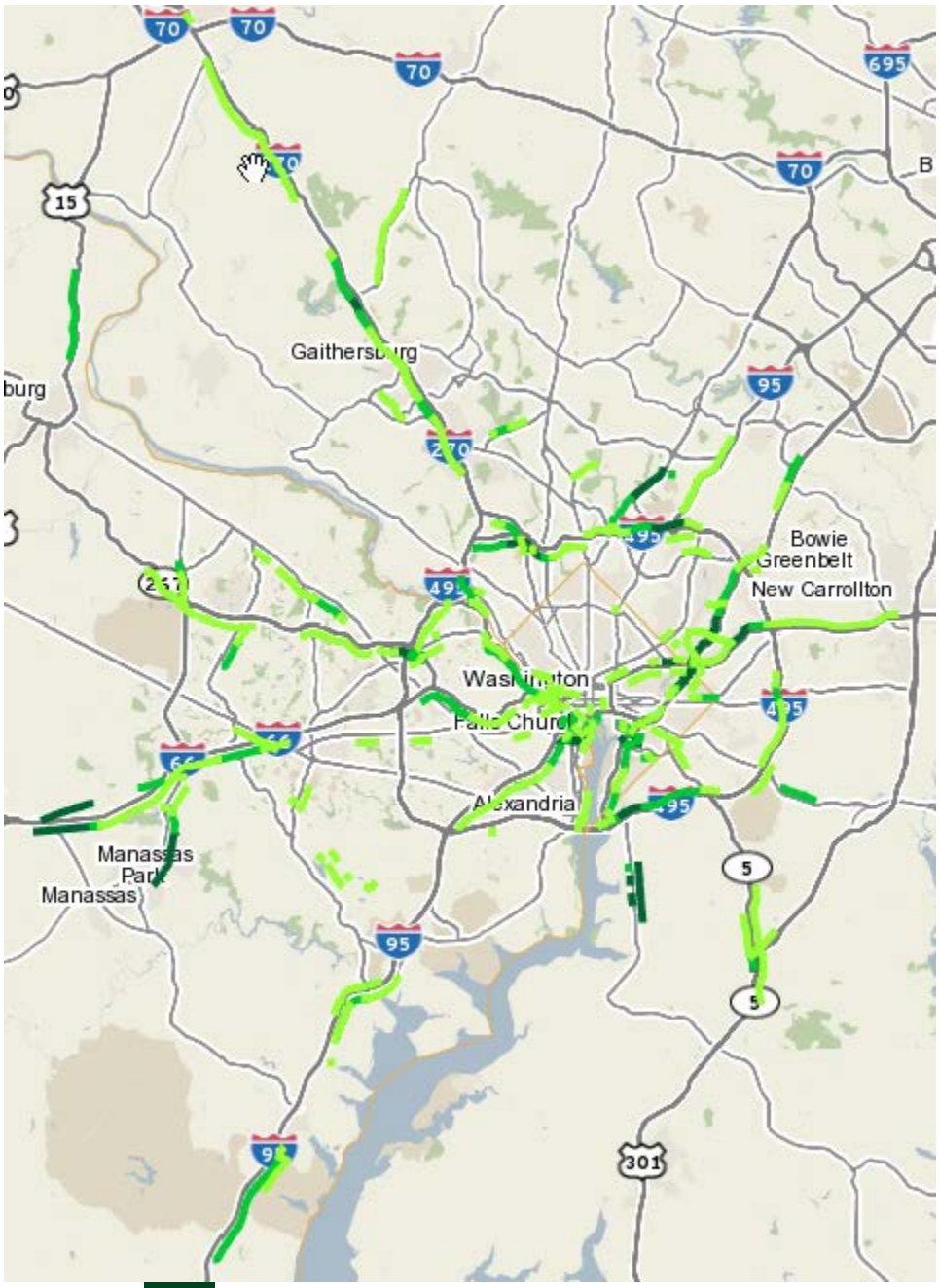
In the morning (Figure 6), freeway inbound traffic, both outside and inside the Beltway, generally experienced more than 10% improvement, with notable exceptions on I-270 southbound from Exit 5/Falls Road to the Spur, I-66 eastbound from Exit 57/US-50 to Exit 66/VA-7, I-95 northbound in Virginia from Exit 161/US-1 to I-495/Springfield interchange, and MD-5 from Surratts Road to I-495.

In the afternoon (Figure 7), improvement scattered mainly on the northwest Beltway around the American Legion Bridge (both directions) and the northeast Beltway (inner loop only). Southbound GW Parkway from the Beltway to the TR Bridge also experienced noticeable improvement. Compared to the morning, the afternoon experienced less improvement; only a small portion of outbound traffic on the freeways improved, including I-66 WB from the Beltway to Exit 57/US-50, BW Parkway northbound around the Beltway, GW Parkway northbound approaching the Beltway, and a few segments on northbound I-270 and I-95 in Maryland.

More Information

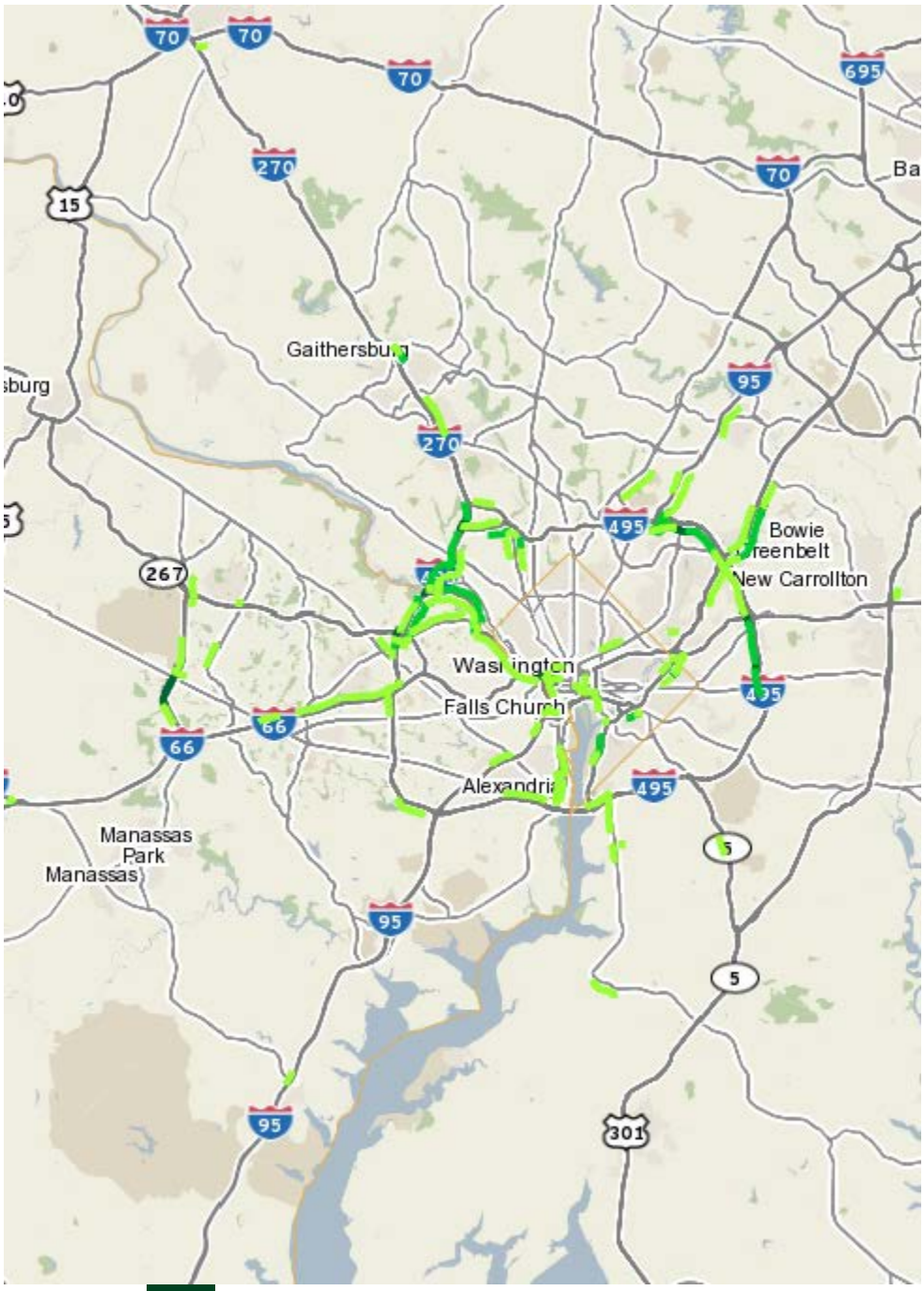
More comprehensive analysis of the transportation impact of the Federal government shutdown is currently carried out by COG/TPB staff. This analysis looks at both traffic congestion and transit ridership in the region, and the full report will be released in the near future.

Figure 6. AM Peak Most Significant Decrease of Congestion from "Before" to "Shutdown"



Note: Dark green: TTI decreased more than 30%
Medium green: TTI decreased 20-30%
Light green: TTI decreased 10-20%
Screen shot was captured in the VPP Suite.

Figure 7. PM Peak Most Significant Decrease of Congestion from "Before" to "Shutdown"



Note:
- Dark green: TTI decreased more than 30%
- Medium green: TTI decreased 20-30%
- Light green: TTI decreased 10-20%

Screen shot was captured in the VPP Suite.

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

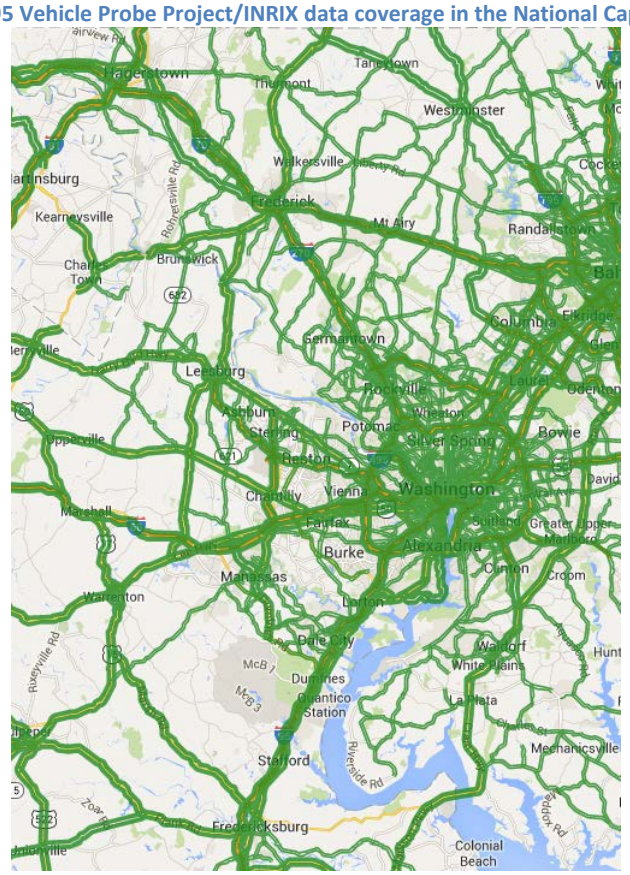
Highway Administration and produced by the Texas Transportation Institute with Cambridge Systematics, Inc. This report uses the following method to calculate PTI:

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

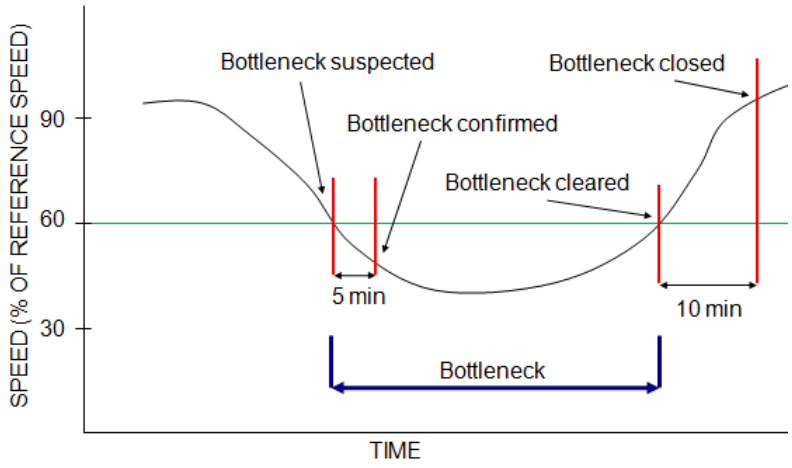


Bottlenecks

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.

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.