NATIONAL CAPITAL REGION TRANSPORTATION PLANNING BOARD

National Capital Region Congestion Report

2nd Quarter 2015

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

Interstate System

TTI 2nd Quarter 2015:	1.35	↓1.9% or 0.03[1]
TTI Trailing 4 Quarters:	1.32	↑0.4% or 0.005[2]

Non-Interstate NHS[3]

TTI 2nd Quarter 2015:	1.22	↓4.4% or 0.06
TTI Trailing 4 Quarters:	1.21	↓0.4% or 0.01

Transit-Significant[4]

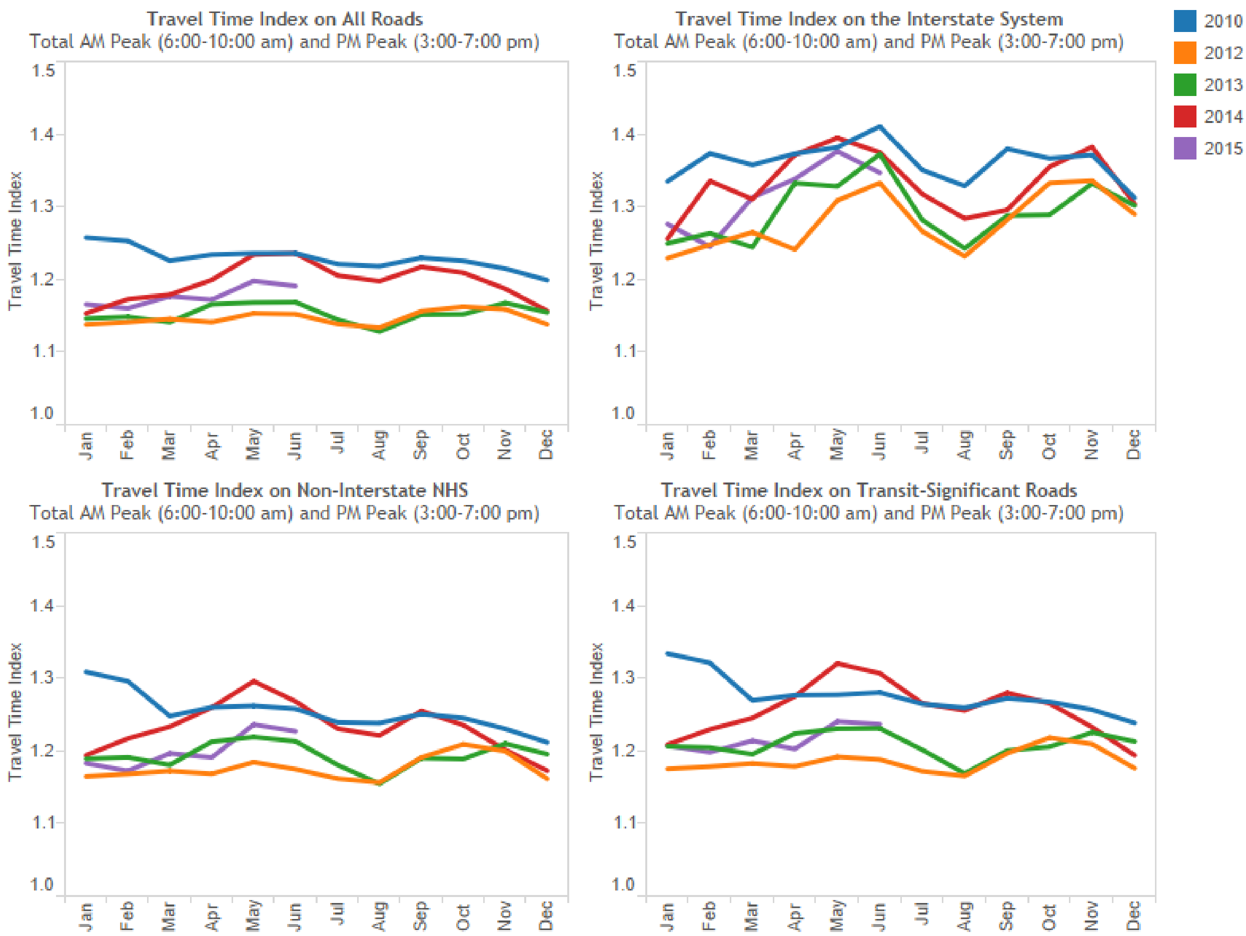
TTI 2nd Quarter 2015:	1.23	↓5.7% or 0.07
TTI Trailing 4 Quarters:	1.23	↓0.1% or 0.001

All Roads

TTI 2nd Quarter 2015:	1.19	↓3.0% or 0.04
TTI Trailing 4 Quarters:	1.19	↑1.2% or 0.01

[1] Compared to 2nd 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

PTI 2nd Quarter 2015:	4.21	↓5.2% or 0.23[1]
PTI Trailing 4 Quarters:	4.05	↓1.1% or 0.05[2]

Non-Interstate NHS[3]

PTI 2nd Quarter 2015:	2.62	↓2.0% or 0.05
PTI Trailing 4 Quarters:	2.41	↑2.4% or 0.06

Transit-Significant[4]

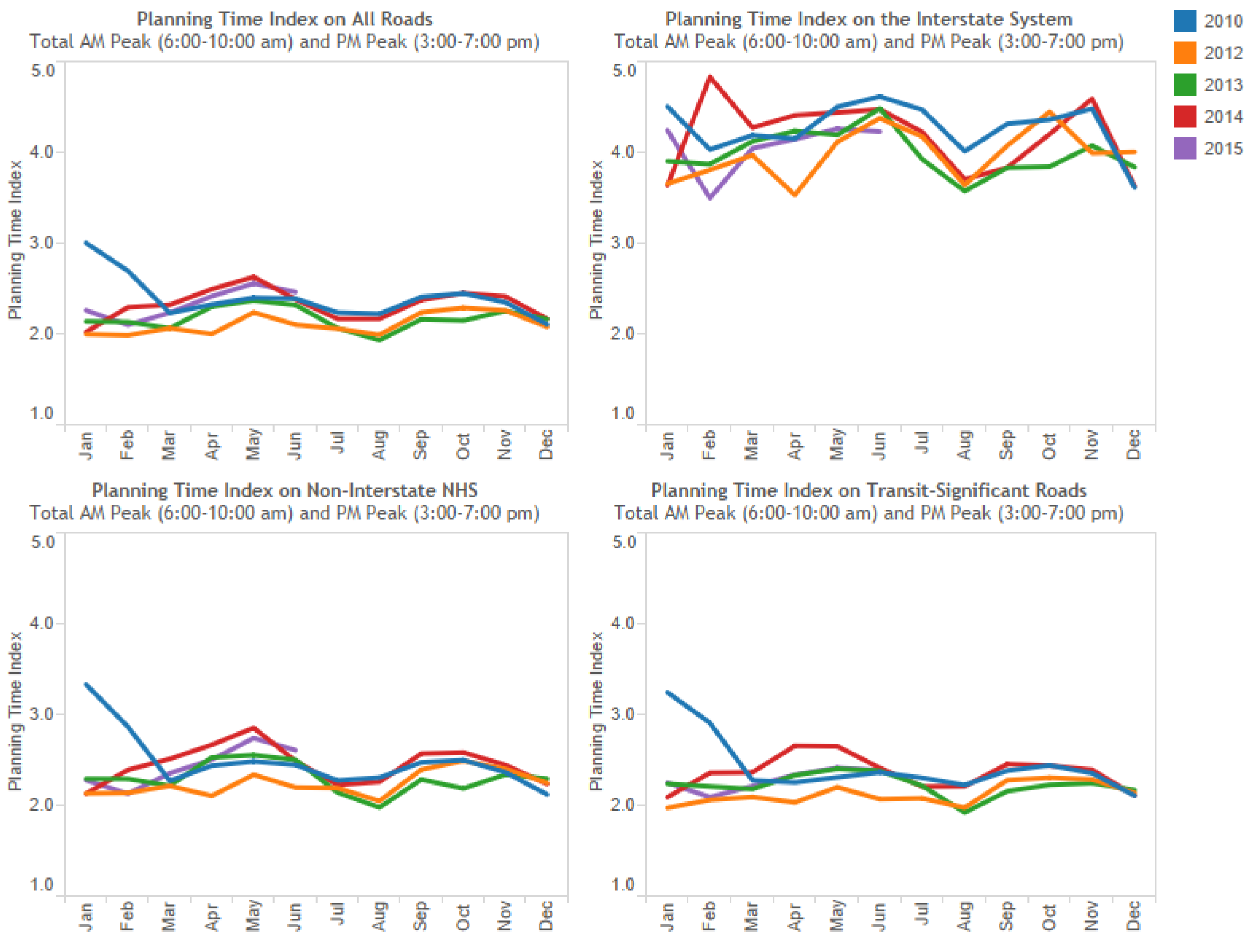
PTI 2nd Quarter 2015:	2.38	↓7.5% or 0.19
PTI Trailing 4 Quarters:	2.29	↑0.1% or 0.0.03

All Roads

PTI 2nd Quarter 2015:	2.48	↓0.9% or 0.02
PTI Trailing 4 Quarters:	2.31	↑3.4% or 0.08

[1] Compared to 2nd 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)

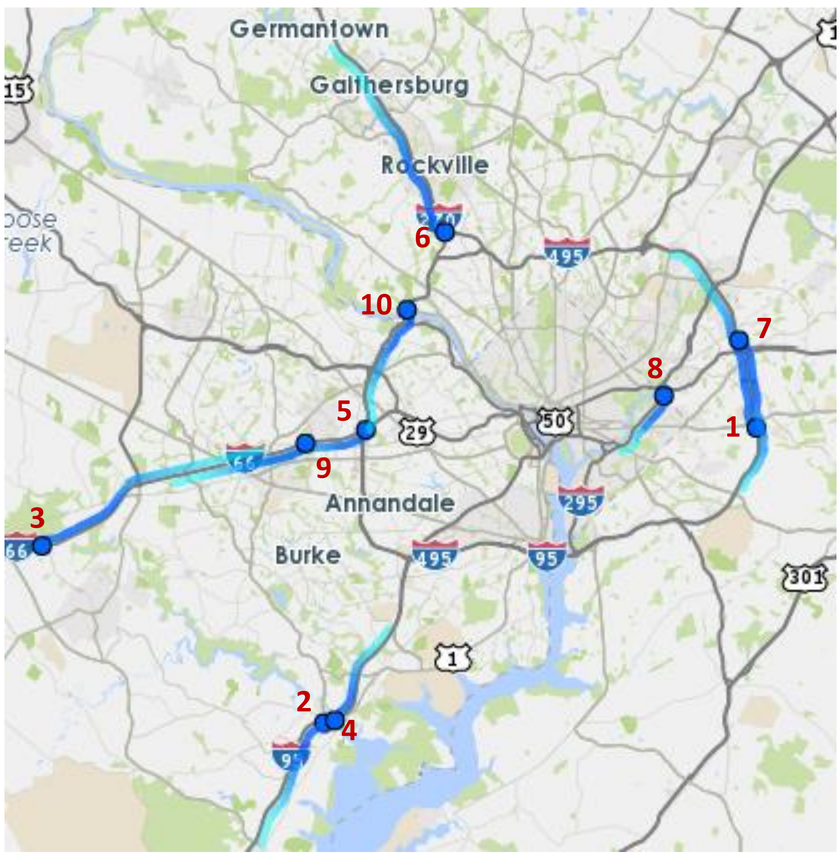


> ***Planning Time Index***
> *Planning Time Index (PTI), defined as the ratio of 95th percentile travel time to free flow travel time, measures travel time reliability. The higher the index, the less reliable traffic conditions it represents, e.g., PTI = 1.30 means a traveler has to budget 30% longer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

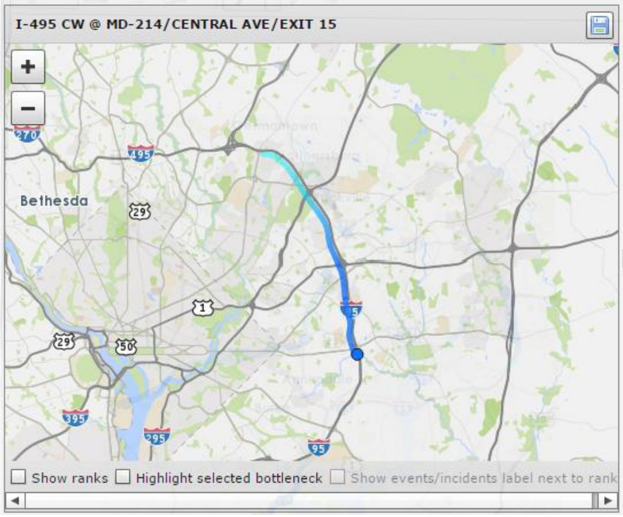
Top 10 Bottlenecks

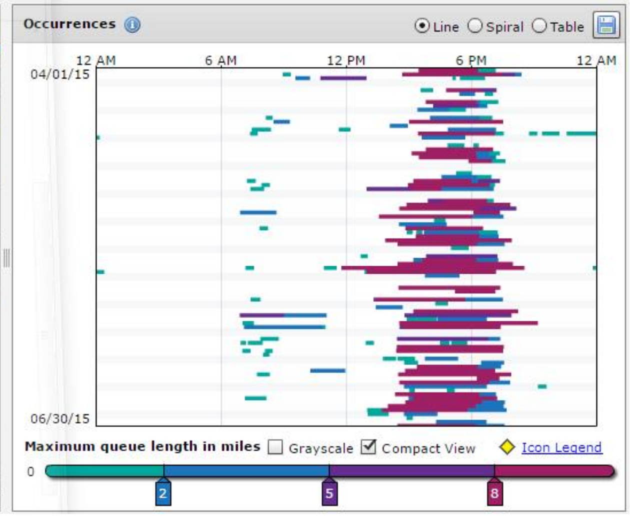
Rank (Last Quarter Rank)	Location	Average duration	Average max length (miles)	Occur-rences	Impact factor
1 (17)*	I-495 CW @ MD-214/CENTRAL AVE/EXIT 15	2 h 23 m	10	251	359,102
2 (3)	I-95 S @ VA-123/EXIT 160	2 h 56 m	5.48	243	234,333
3 (2)	I-66 W @ VA-234/EXIT 47	2 h 50 m	11.89	104	210,132
4 (30)	I-95 N @ VA-123/EXIT 160	2 h 28 m	6.44	200	190,609
5 (31)	I-66 E @ I-495/EXIT 64	2 h 14 m	5.1	265	181,131
6 (7)	I-270 S @ I-270	2 h	11.01	131	173,116
7 (23)	I-495 CCW @ US-50/EXIT 19	2 h 11 m	7.62	169	168,684
8 (12)	DC-295 N @ EASTERN AVE	3 h 36 m	3.51	214	162,030
9 (>30)	I-66 E @ VADEN DR/EXIT 62	2 h 28 m	6.42	162	153,987
10 (>30)	I-495 CW @ CLARA BARTON PKWY/EXIT 41	2 h 15 m	6.31	179	152,453

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



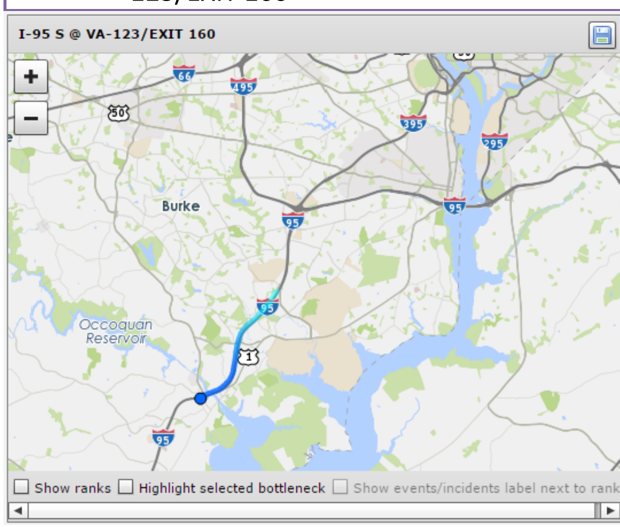
Rank	Location	Average duration	Average max length (miles)	Occurrences	Impact factor*
1	I-495 CW @ MD-214/CENTRAL AVE/EXIT 15	2 h 23 m	10	251	359,102

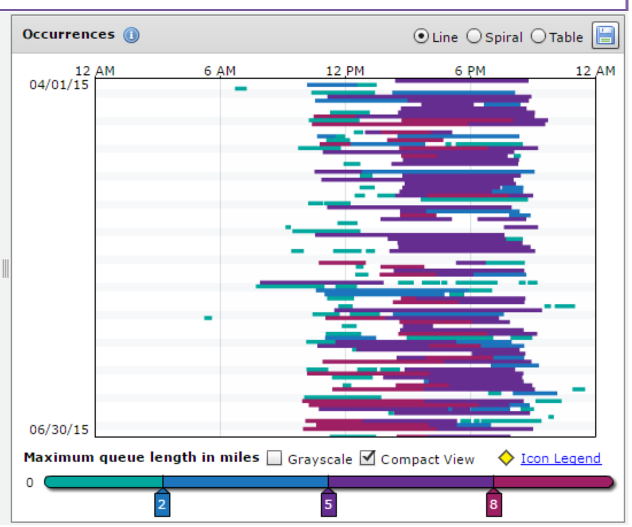




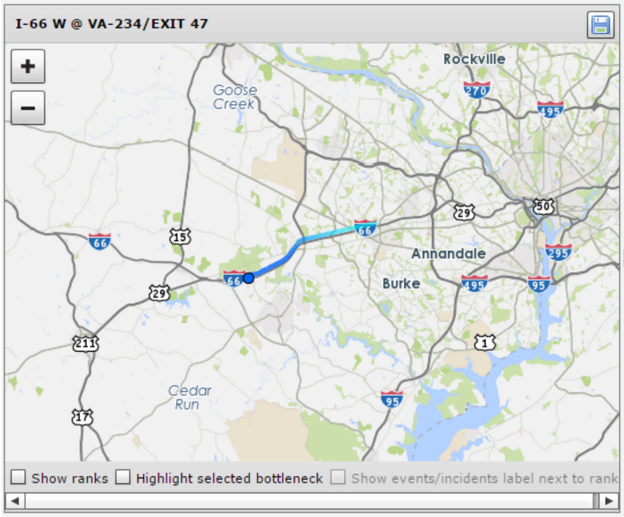
** The Impact Factor of a bottleneck is simply the product of the Average Duration (minutes), Average Max Length (miles) and the number of occurrences.*

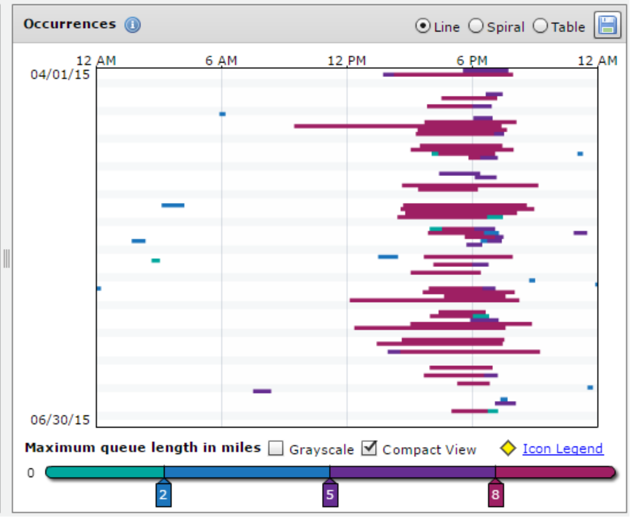
Rank	Location	Average duration	Average max length (miles)	Occurrences	Impact factor
2	I-95 S @ VA-123/EXIT 160	2 h 56 m	5.48	243	234,333





Rank	Location	Average duration	Average max length (miles)	Occurrences	Impact factor
3	I-66 W @ VA-234/EXIT 47	2 h 50 m	11.89	104	210,132





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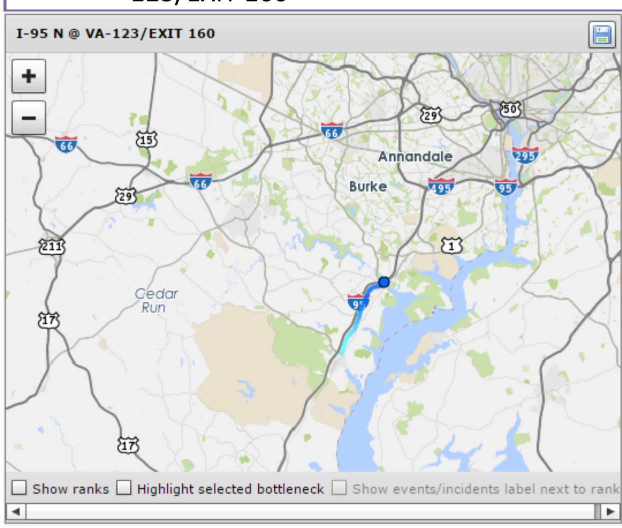

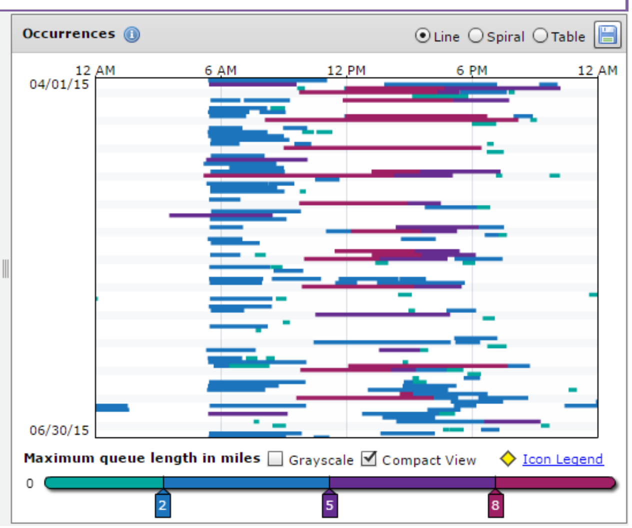

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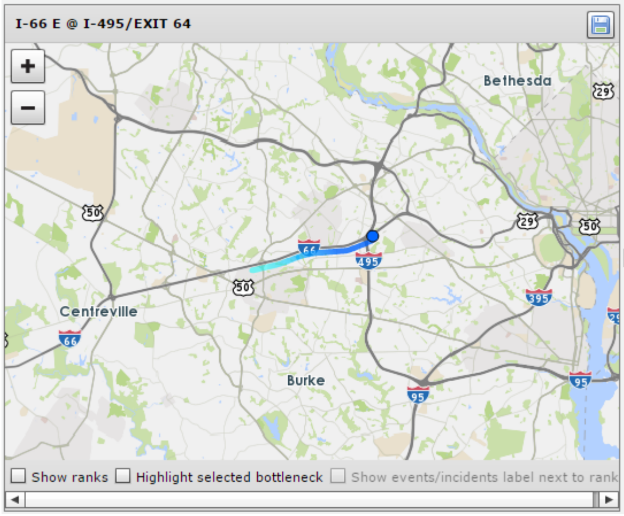

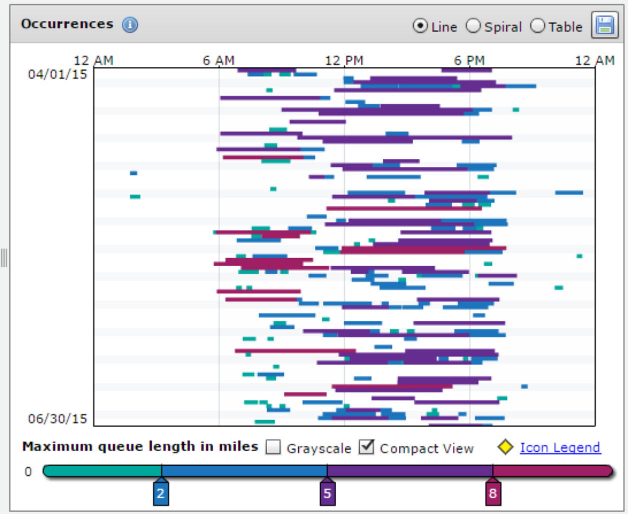

Rank	Location	Average duration	Average max length (miles)	Occurrences	Impact factor
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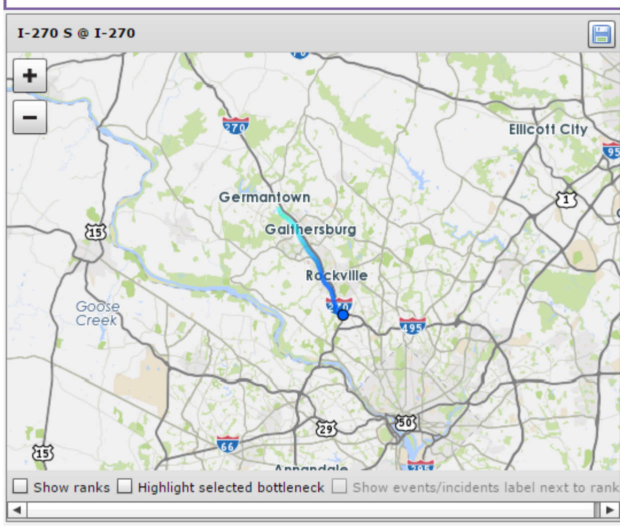

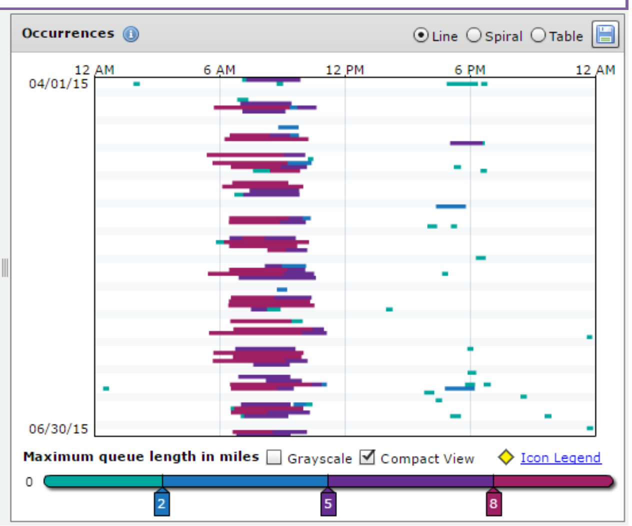

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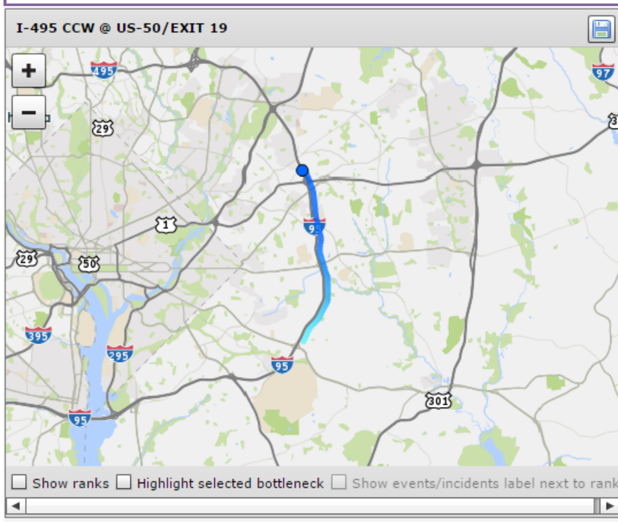

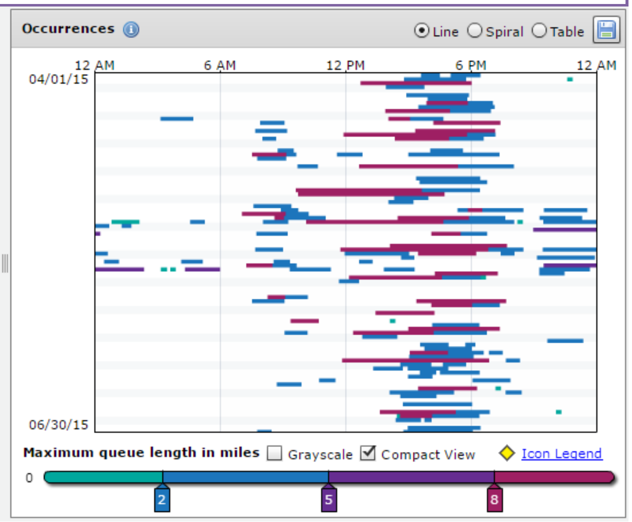

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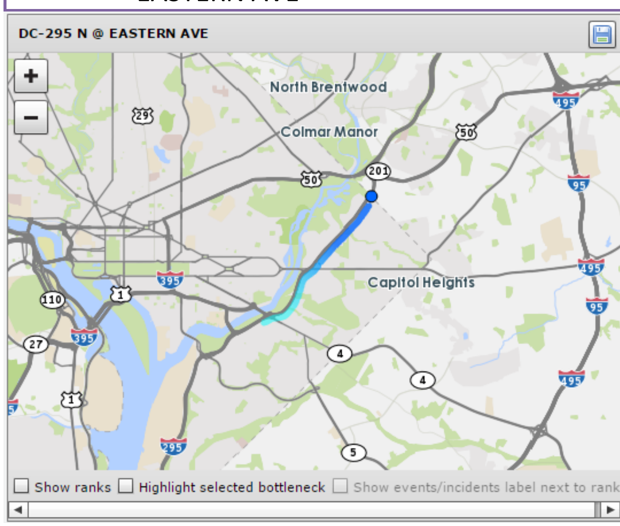

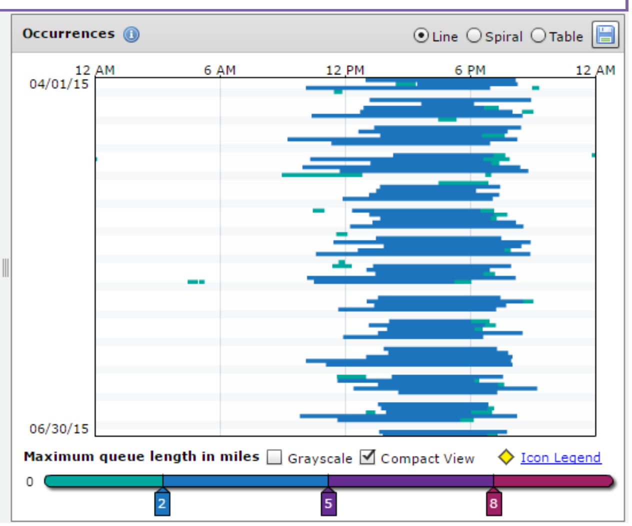

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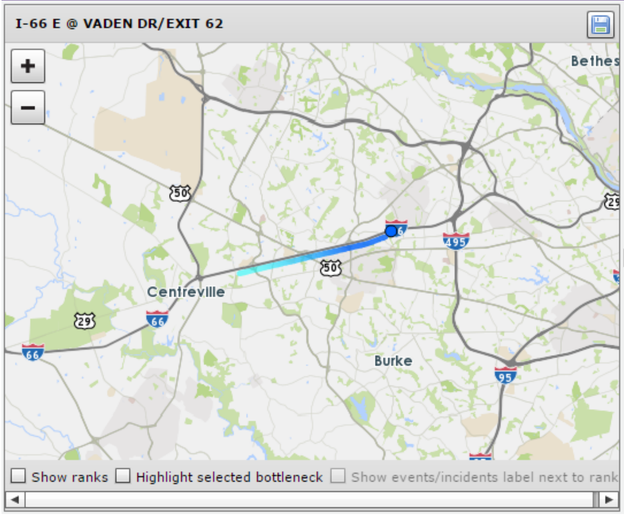

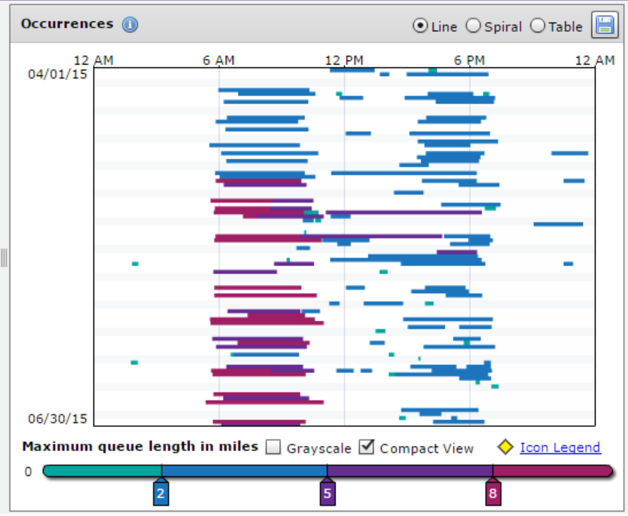

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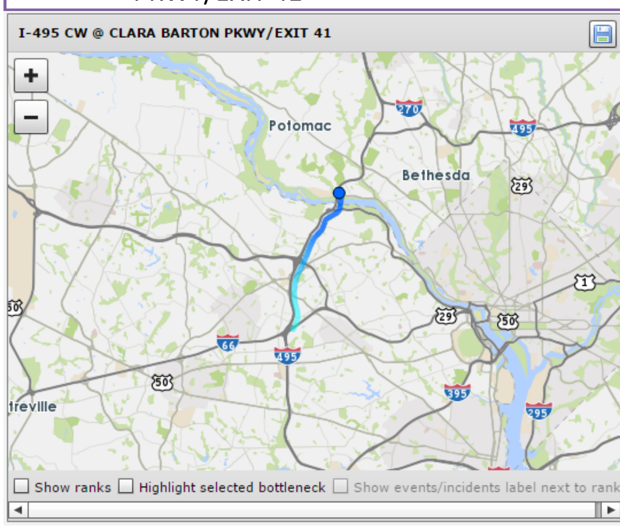
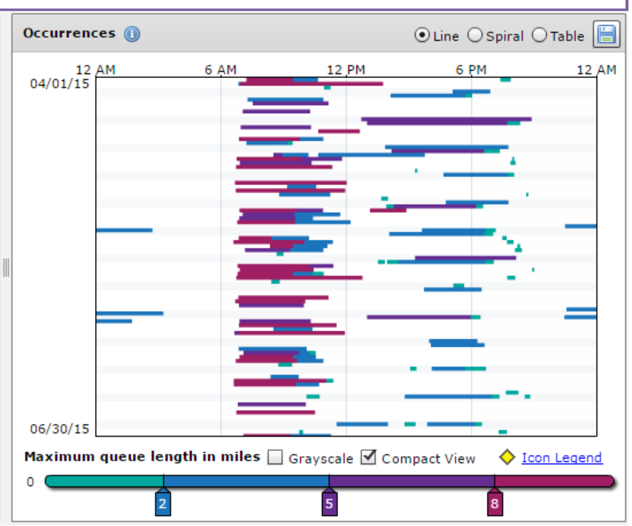




Congestion Maps

Figure 3. Travel Time Index during weekday 8:00-9:00 AM in 2nd Quarter 2015

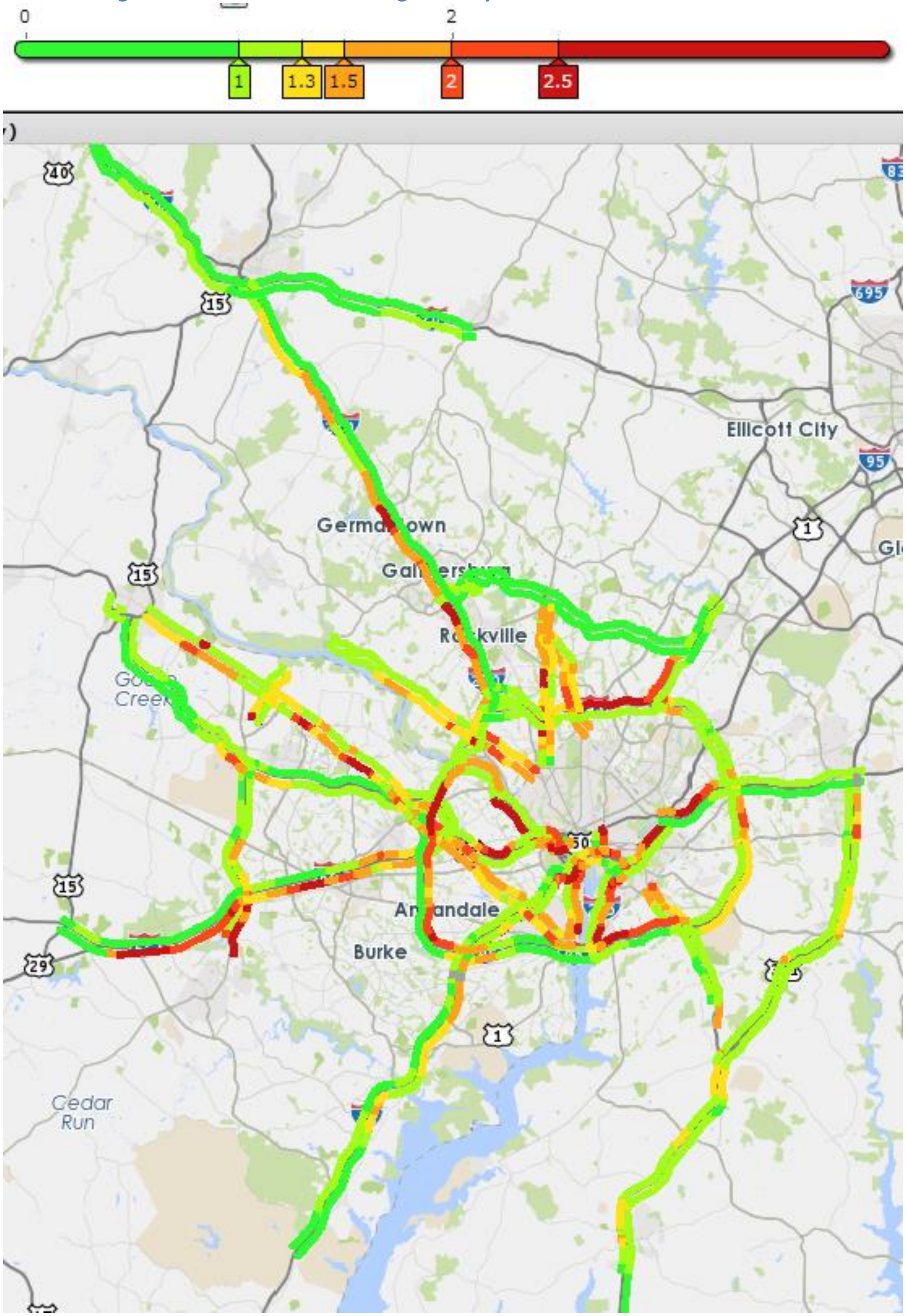
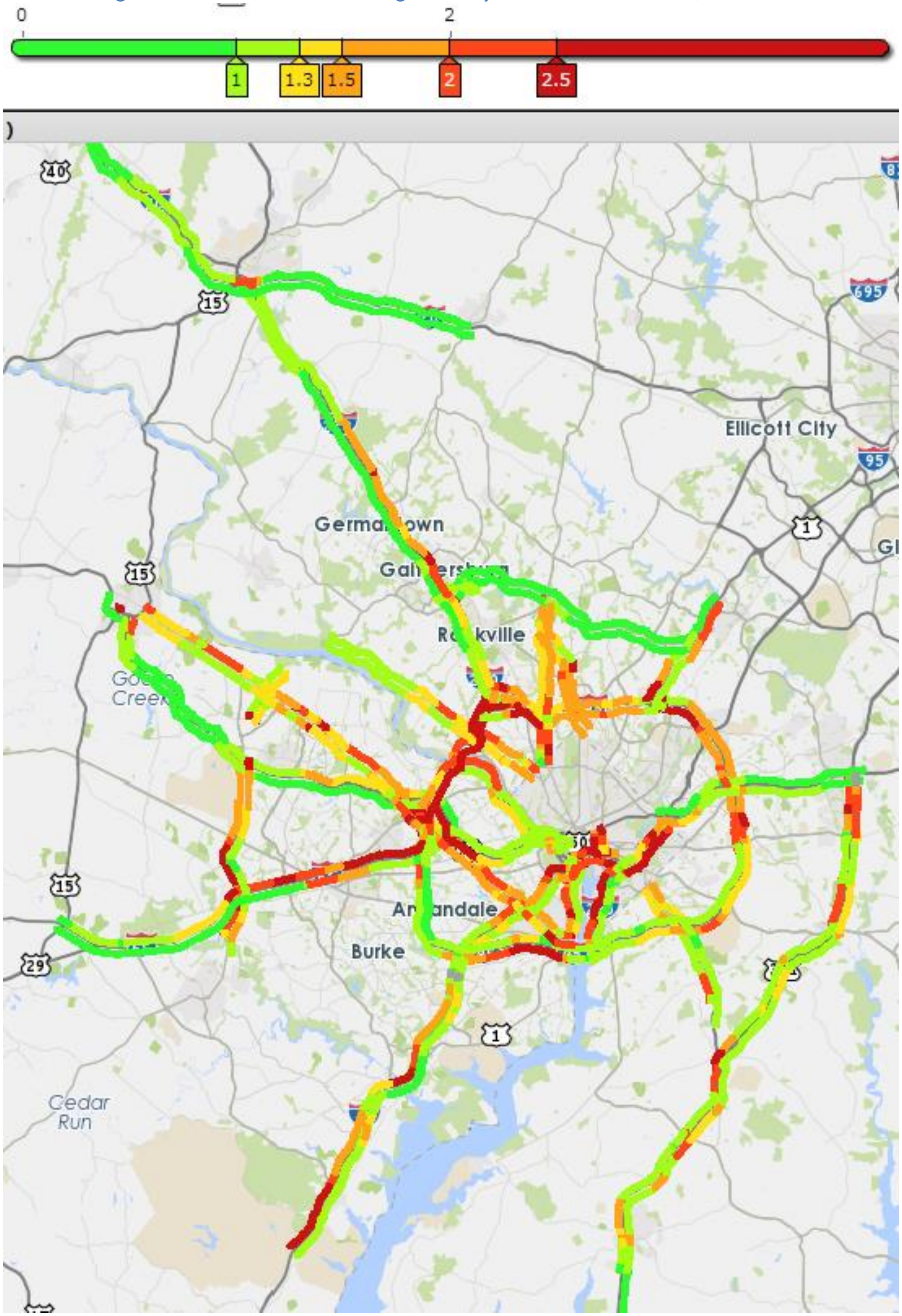


Figure 4. Travel Time Index during weekday 5:00-6:00 PM in 2nd Quarter 2015



2nd Quarter 2015 Spotlight – Performance of the Transit-Significant Road Network

In the previous (2015Q1) Congestion Report, a Transit-Significant Road Network was identified in the Washington region and the performance of the network began to show in the report (page 1&2). This quarter's spotlight will continue the topic by presenting the congestion and travel time reliability performance of this network during 2010-2014.

Background

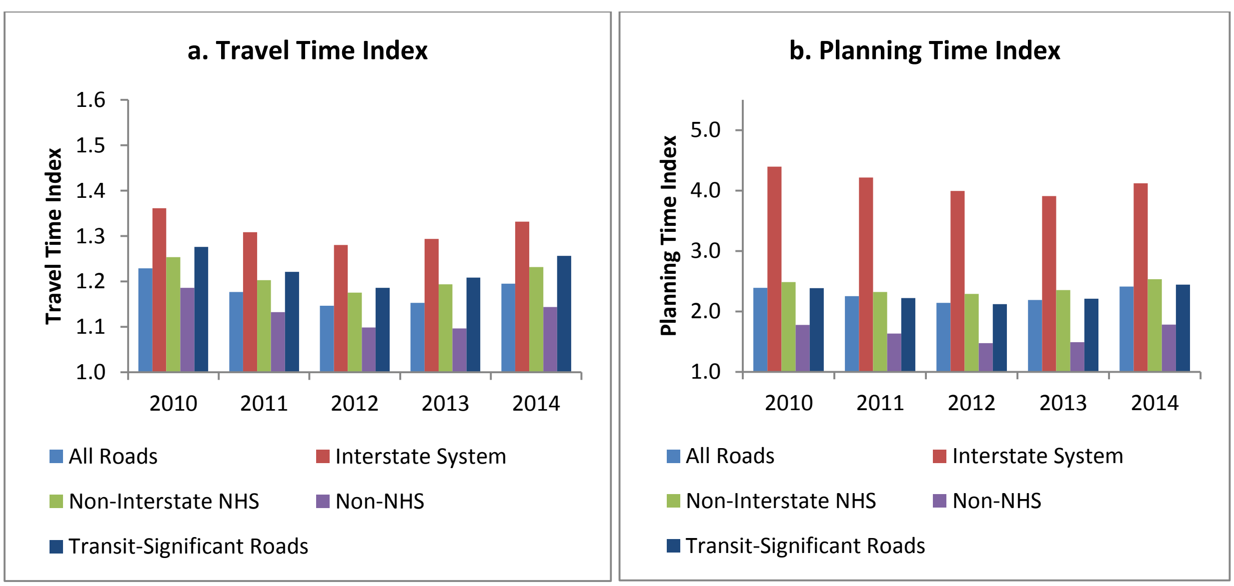
The goal to identify a Transit-Significant Road Network was to track the differential congestion, if any, between the regional average and the transit bus network, and keep decision makes and professionals informed. The identified transit network consists of road segments with at least 10 buses in the AM Peak Hour (equivalent to one bus in either direction in every 10 minutes) and the total length is about 1,400 directional miles in the Transportation Planning Board's planning area.

Performance

The Transit-Significant Road Network was more congested and more sensitive to change compared to the regional average of all roads, according to a study reported to the Regional Public Transportation Subcommittee on April 28, 2015.

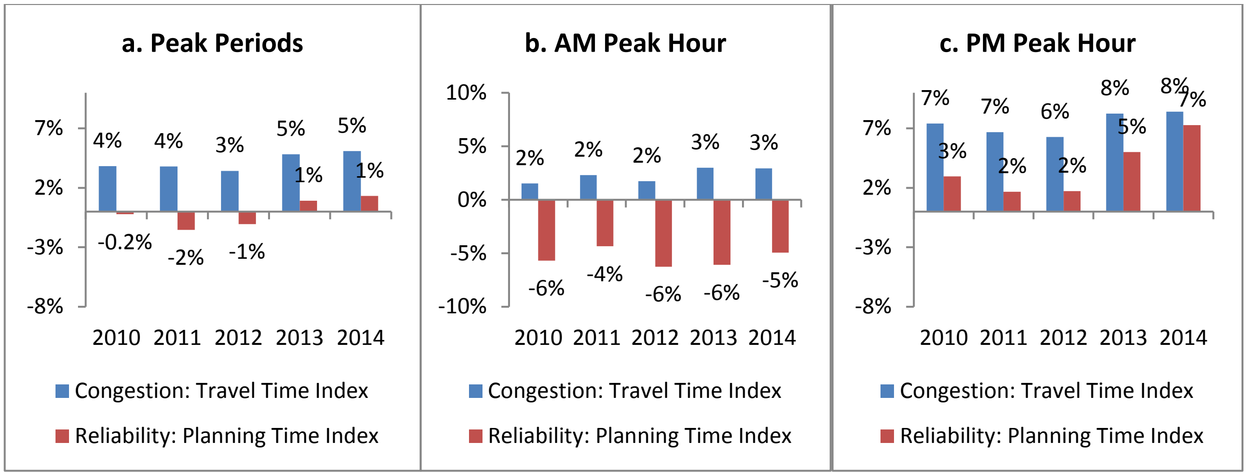
The transit network's congestion, expressed as annual average Travel Time Index, was 3 to 5 percent worse than the regional average ("All Roads" category) throughout 2010 -2014 during peak periods, i.e., 6:00-10:00 am and 3:00-7:00 pm (Figure 5a and 6a). It is not unexpected that the transit-significant network is congested, since buses are often routed in dense, urban corridors as a part of multi-modal transportation strategies. This network was also more congested than the non-Interstate National Highway System (NHS) and the non-NHS roads, but less congested than the Interstate System, which was still the most congested highway category (Figure 5a).

Figure 5 Annual Average Travel Time Index and Planning Time Index for Peak Periods



The difference in congestion between the transit network and the regional average was more pronounced during PM peak hour, with 6-8 percent difference, compared to the AM peak hour's 2-3 percent divergence (Figure 6b & 6c).

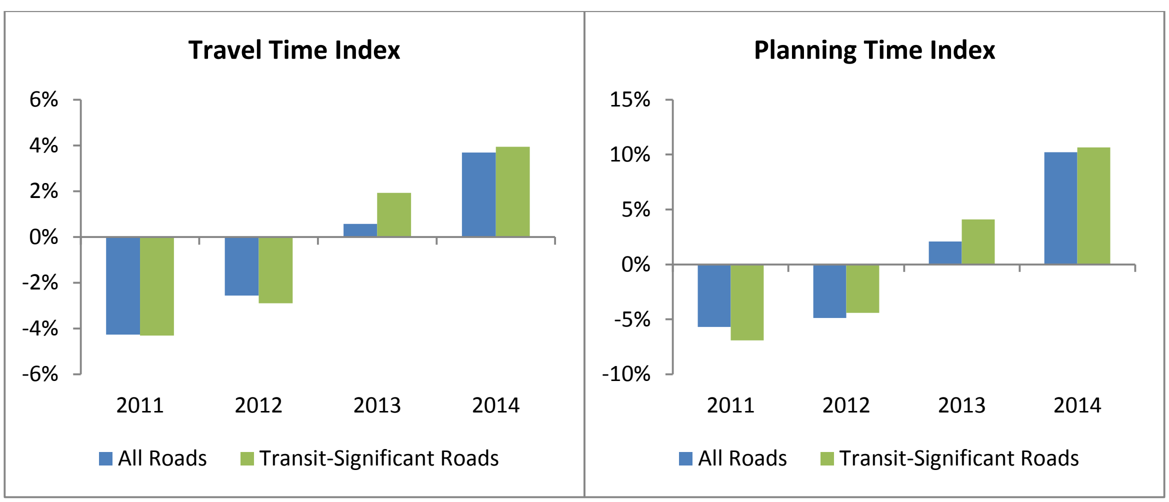
Figure 6 Transit-Significant Road Network Compared to All Roads



In terms of travel time relibility, expressed as Planning Time Index, mixed results were found between the transit network and the regional average (Figure 6). The transit bus network was 4-6 percent more reliable than the regional average in the AM peak hour, but 2-7 percent less reliable in PM peak hour.

Performance of the Transit-Significant Network varied in accordance with regional average; but the year-to-year changes in the transit network tended to be slightly larger than that of the regional average (Figure 7).

Figure 7 Year-To-Year Changes in Congestion and Reliability



TPB staff will continue to track the transit-significant network in future congestion reports, and discuss results with the Regional Public Transportation Subcommittee as needed to advise future transit planning.

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

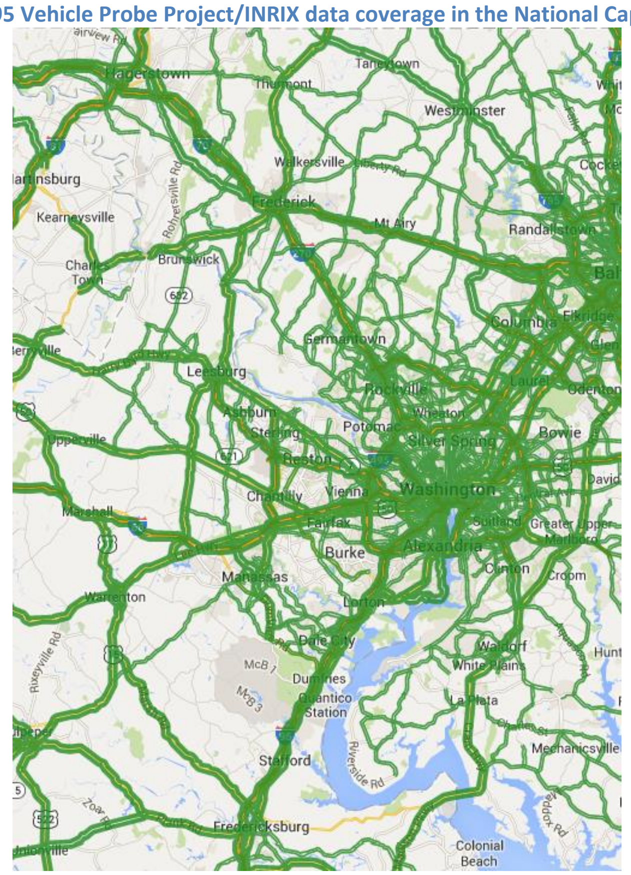
Highway Administration and produced by the Texas Transportation Institute with Cambridge Systematics, Inc. This report uses the following method to calculate PTI:

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

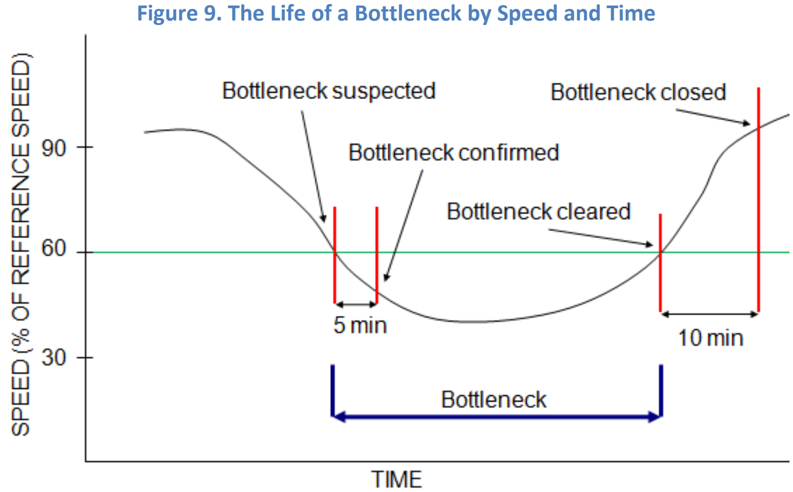


Bottlenecks

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.