NATIONAL CAPITAL REGION TRANSPORTATION PLANNING BOARD

National Capital Region Congestion Report

1st Quarter 2015

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Release date: May 5, 2015
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Congestion – Travel Time Index (TTI)

Interstate System

TTI 1st Quarter 2015:	1.28	↓1.7% or 0.02[1]
TTI Trailing 4 Quarters:	1.33	↑1.6% or 0.02[2]

Non-Interstate NHS[3]

TTI 1st Quarter 2015:	1.18	↓2.5% or 0.03
TTI Trailing 4 Quarters:	1.22	↑2.0% or 0.02

Transit-Significant[4] (New)

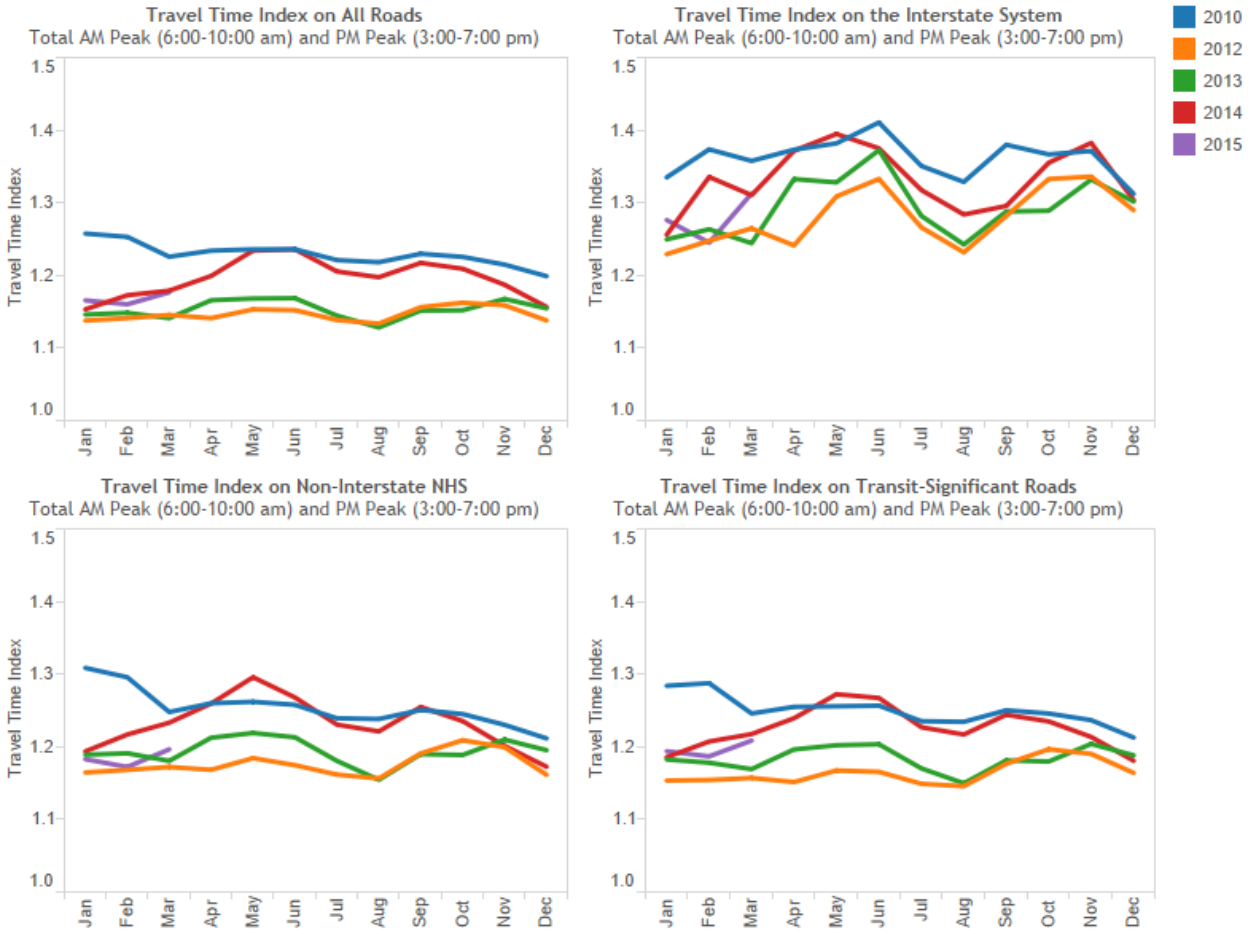
TTI 4th Quarter 2015:	1.21	↓1.7% or 0.02
TTI Trailing 4 Quarters:	1.25	↑3.0% or 0.04

All Roads

TTI 1st Quarter 2015:	1.17	↓0.1% or 0.001
TTI Trailing 4 Quarters:	1.20	↑3.2% or 0.04

[1] Compared to 1st quarter 2014; [2]Compared to one year earlier; [3] NHS: National Highway System; [4]See page 11.

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 1st Quarter 2015:	3.93	↓7.5% or 0.32[1]
PTI Trailing 4 Quarters:	4.11	↑1.1% or 0.05[2]

Non-Interstate NHS[3]

PTI 1st Quarter 2015:	2.25	↓3.9% or 0.09
PTI Trailing 4 Quarters:	2.42	↑4.5% or 0.10

Transit-Significant[4] (New)

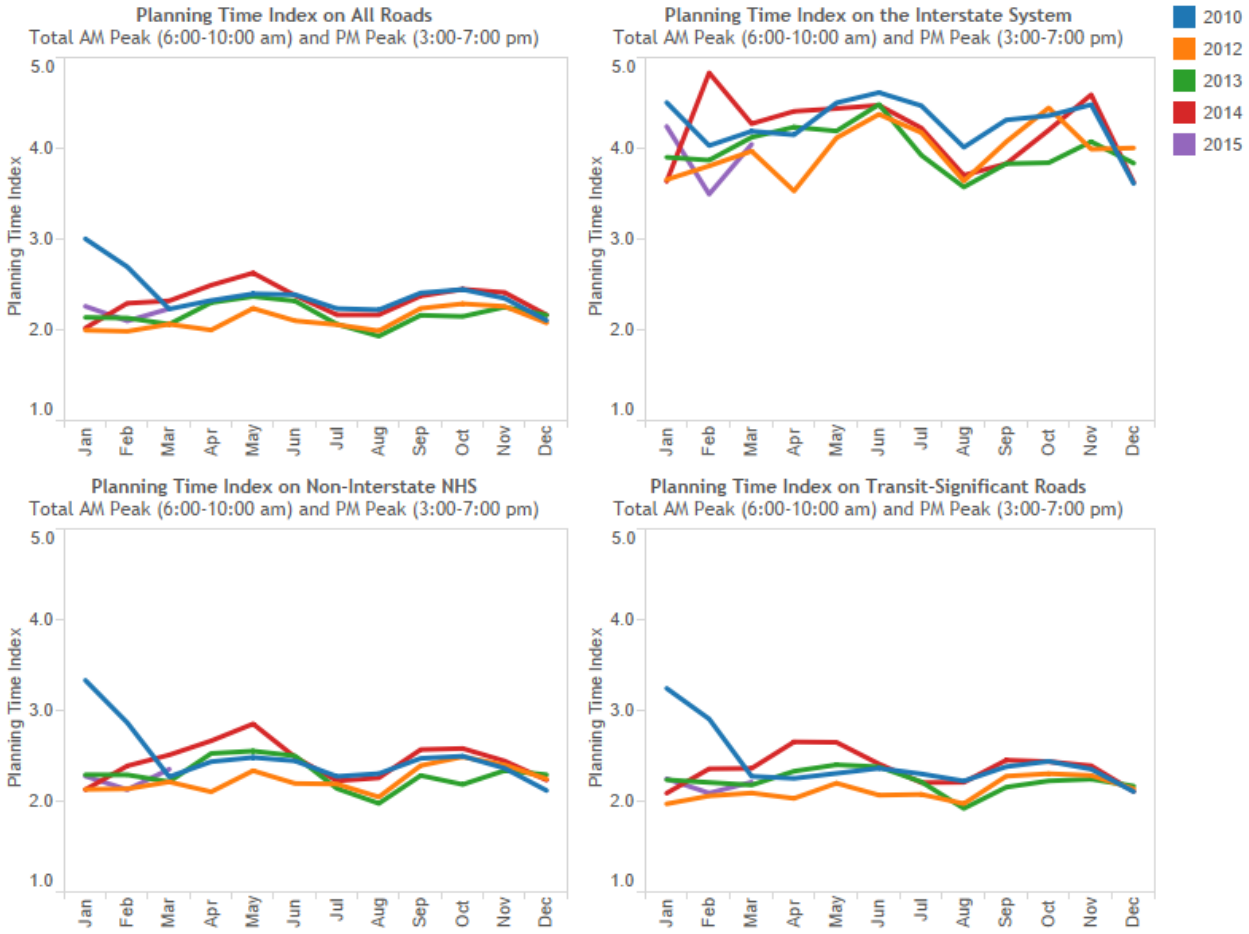
PTI 1st Quarter 2015:	2.18	↓3.8% or 0.09
PTI Trailing 4 Quarters:	2.34	↑4.5% or 0.10

All Roads

PTI 1st Quarter 2015:	2.20	↓0.6% or 0.01
PTI Trailing 4 Quarters:	2.32	↑5.6% or 0.12

[1] Compared to 1st quarter 2014; [2]Compared to one year earlier; [3] NHS: National Highway System; [4]See page 11.

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



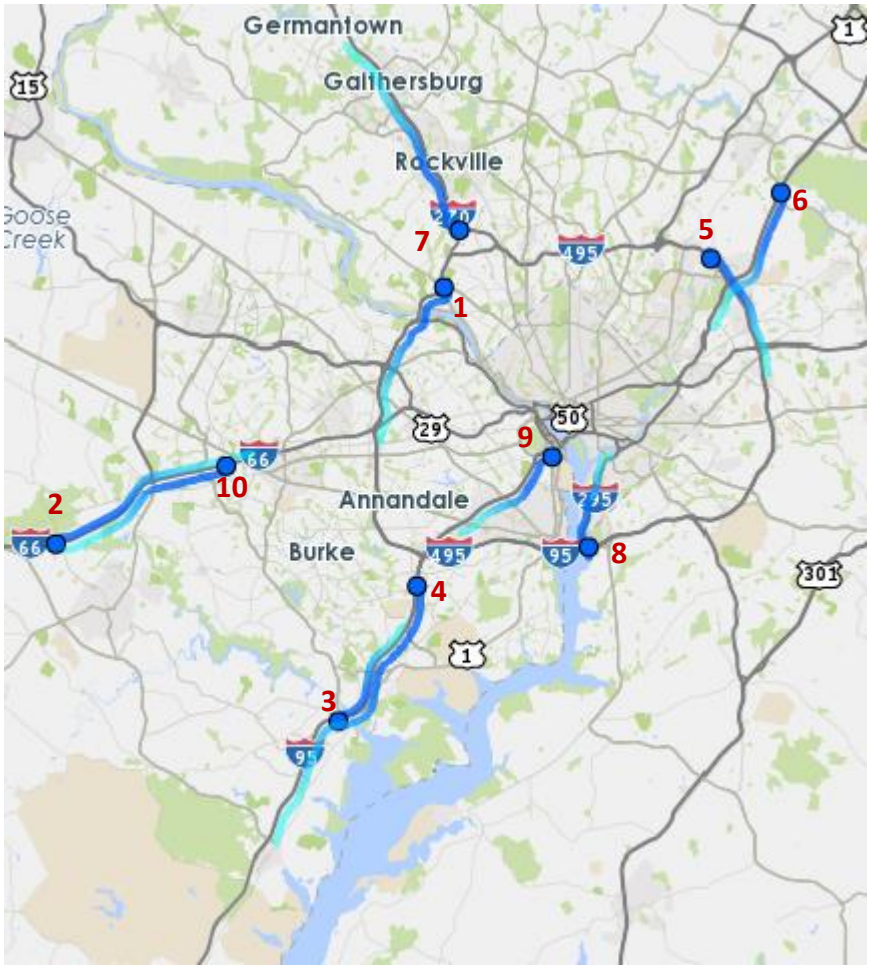
Planning Time Index

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).

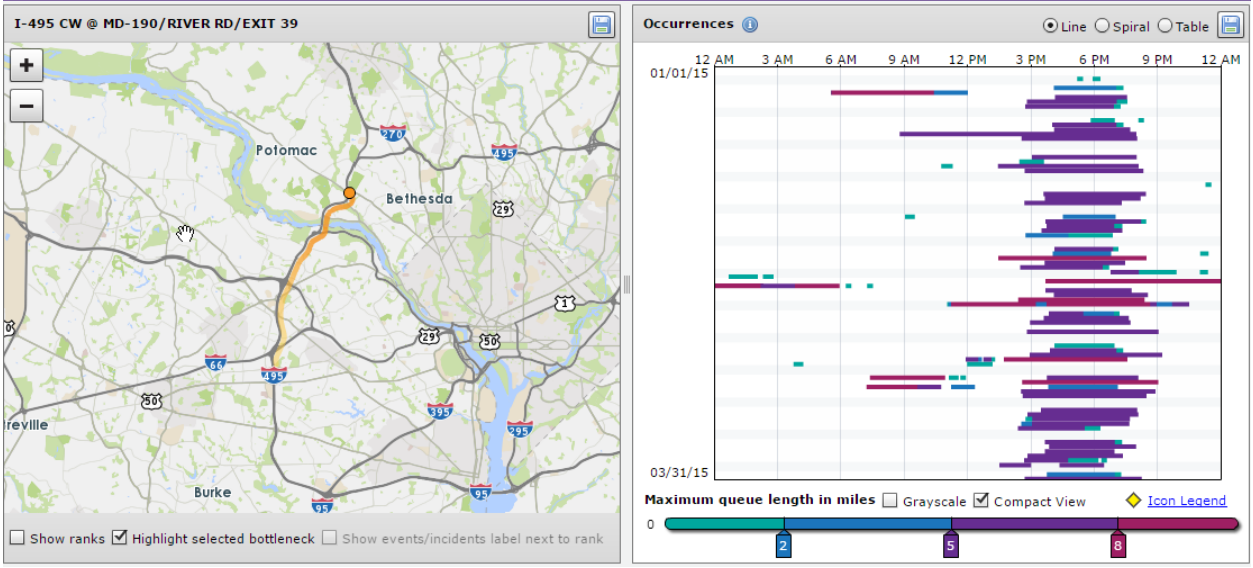
Top 10 Bottlenecks

Rank (Last Quarter Rank)	Location	Average duration	Average max length (miles)	Occur-rences	Impact factor
1 (3)*	I-495 CW @ MD-190/RIVER RD/EXIT 39	2 h 37 m	8.86	181	251,720
2 (1)	I-66 W @ VA-234/EXIT 47	2 h 16 m	10.93	144	214,036
3 (11)	I-95 S @ VA-123/EXIT 160	2 h 26 m	5.42	216	170,914
4 (2)	I-95 N @ VA-7900/EXIT 169	1 h 43 m	16.11	96	159,334
5 (6)	I-495 CCW @ GREENBELT METRO DR/EXIT 24	1 h 39 m	6.85	208	140,995
6 (>30)	MD-295 N @ MD-197/EXIT 11	3 h 17 m	7.04	101	140,118
7 (5)	I-270 S @ I-270	1 h 55 m	10.8	106	131,672
8 (10)	I-295 S @ I-495/I-95/EXIT 2A - B	2 h 22 m	5.02	178	126,770
9 (20)	I-395 N @ EADS ST	1 h 50 m	6.18	186	126,388
10 (23)	I-66 E @ MONUMENT DR	1 h 46 m	8.1	130	111,673

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

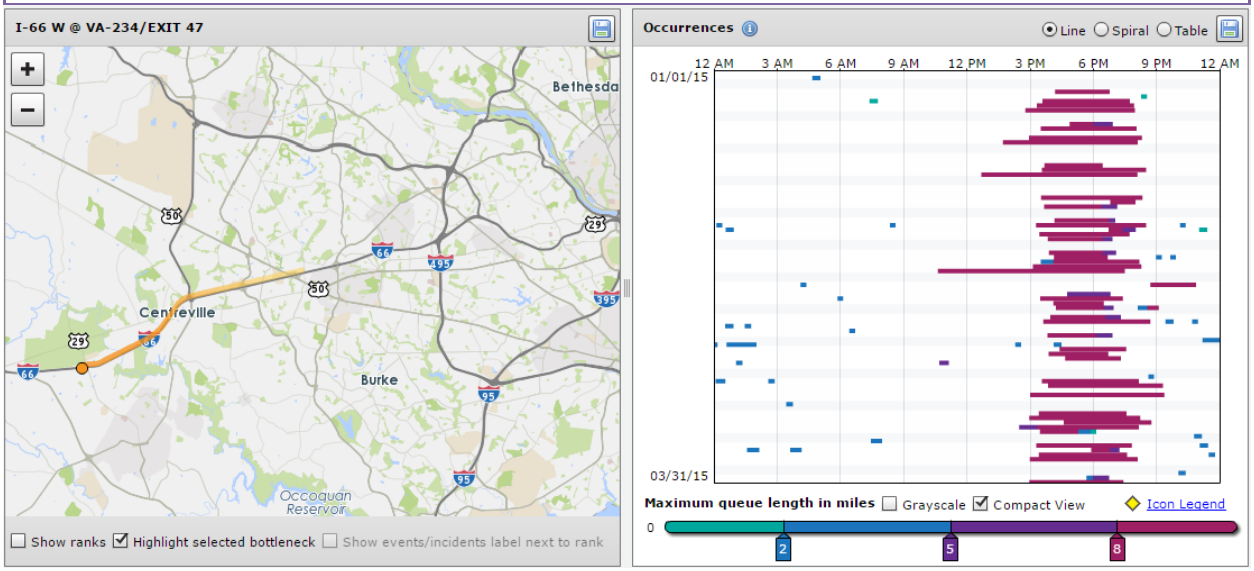


Rank	Location	Average duration	Average max length (miles)	Occurrences	Impact factor*
1	I-495 CW @ MD-190/RIVER RD/EXIT 39	2 h 37 m	8.86	181	251,720

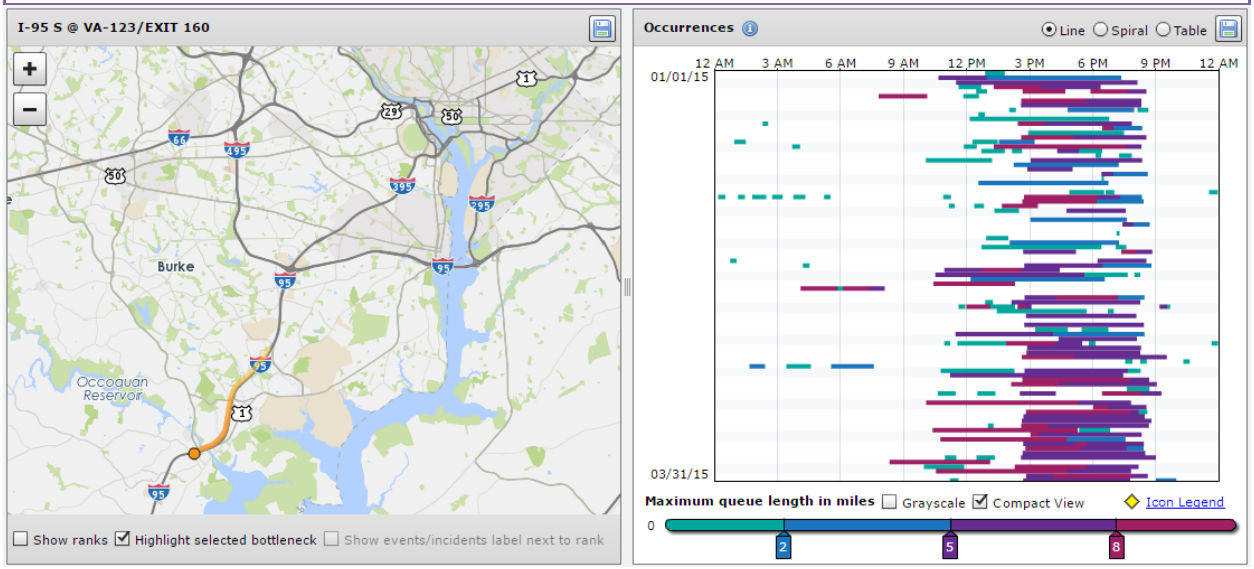


** The Impact Factor of a bottleneck is simply the product of the Average Duration (minutes), Average Max Length (miles) and the number of occurrences.*

Rank	Location	Average duration	Average max length (miles)	Occurrences	Impact factor
2	I-66 W @ VA-234/EXIT 47	2 h 16 m	10.93	144	214,036



Rank	Location	Average duration	Average max length (miles)	Occurrences	Impact factor
3	I-95 S @ VA-123/EXIT 160	2 h 26 m	5.42	216	170,914



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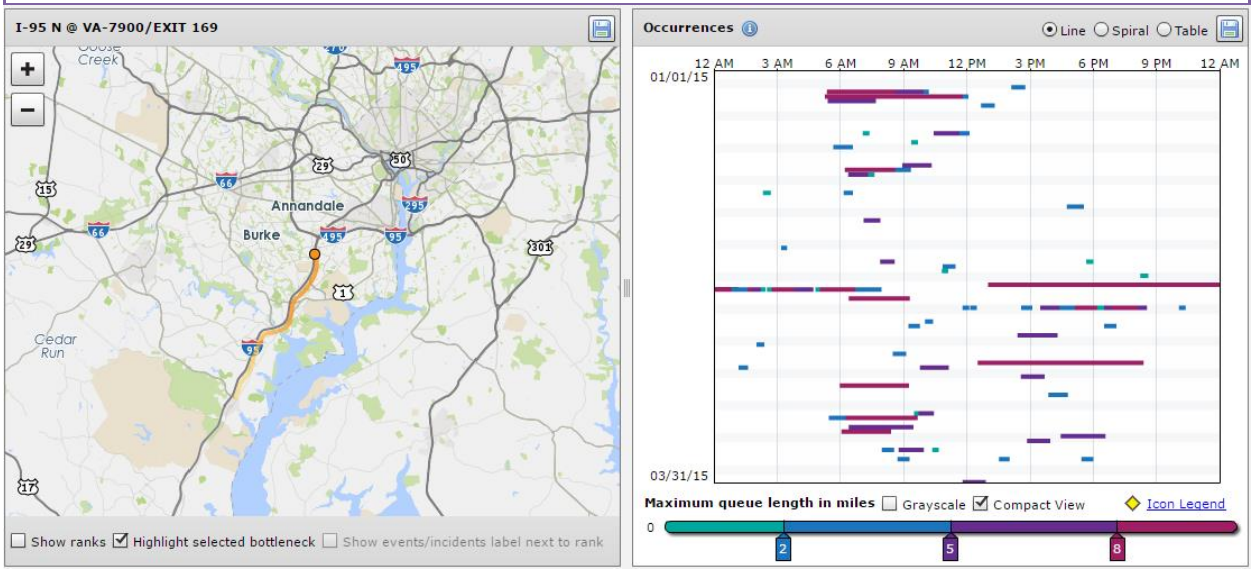

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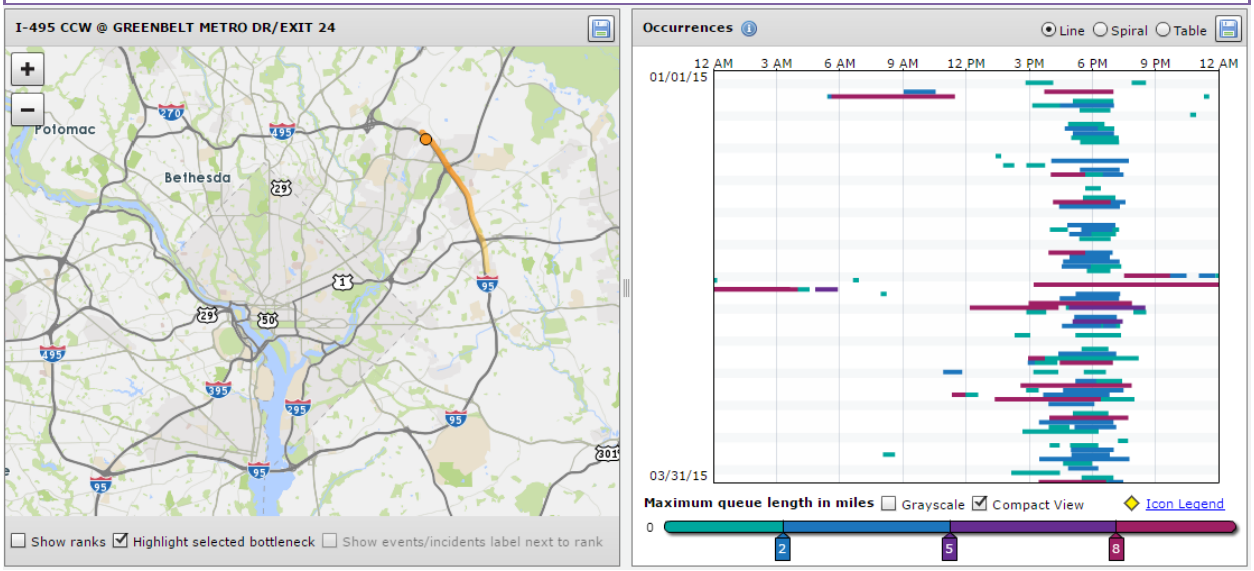
5	I-495 CCW @ GREENBELT METRO DR/EXIT 24	1 h 39 m	6.85	208	140,995



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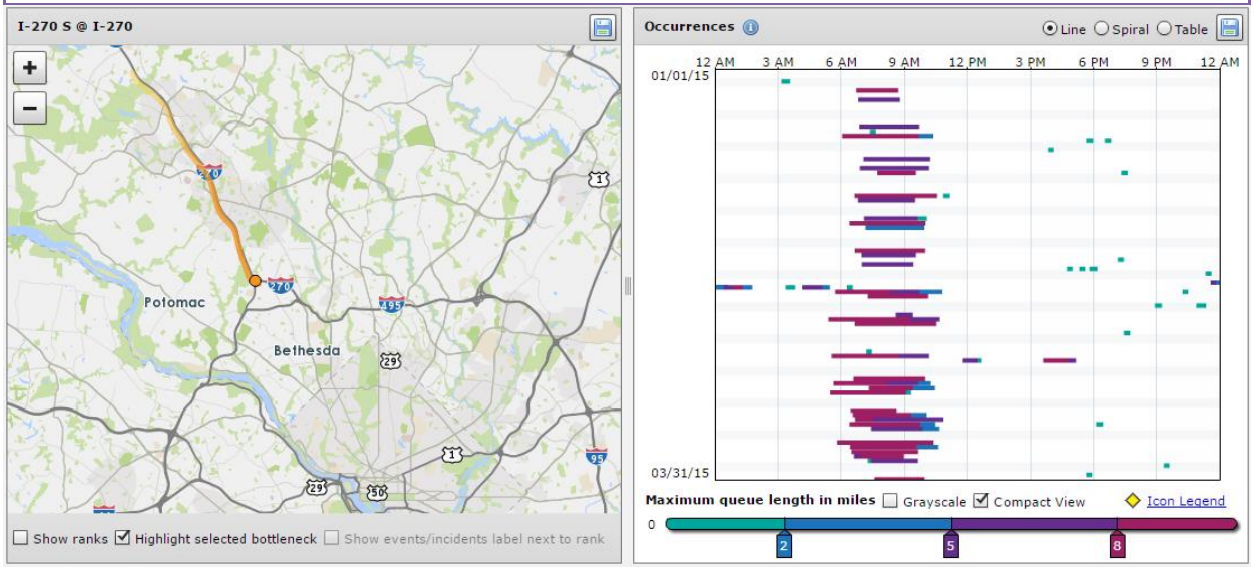
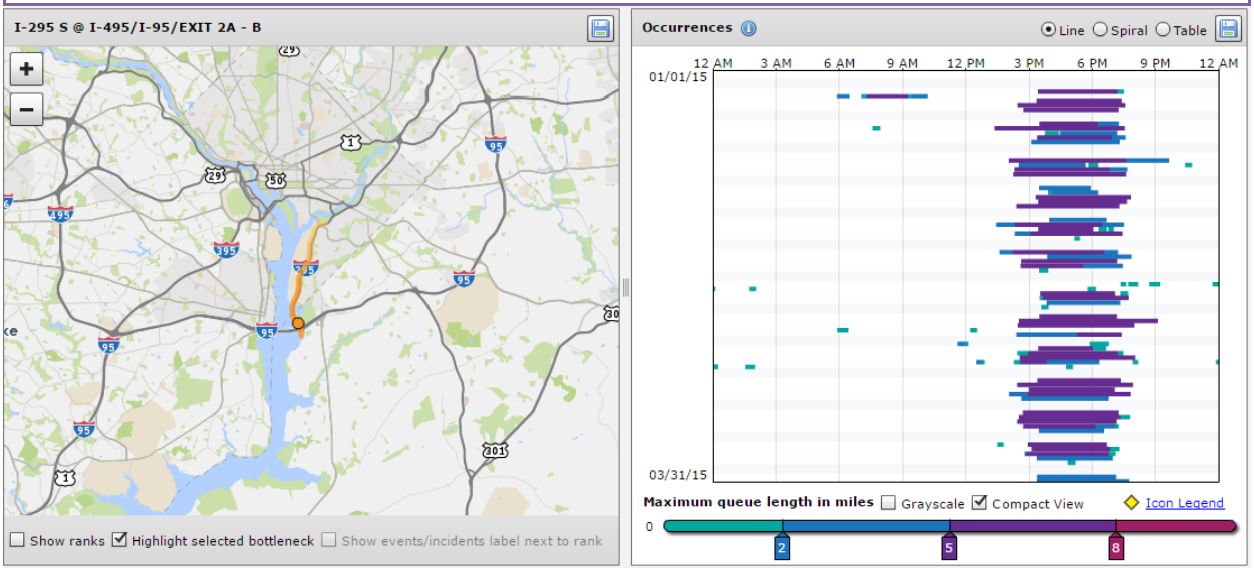


Rank	Location	Average duration	Average max length (miles)	Occurrences	Impact factor
8	I-295 S @ I-495/I-95/EXIT 2A - B	2 h 22 m	5.02	178	126,770



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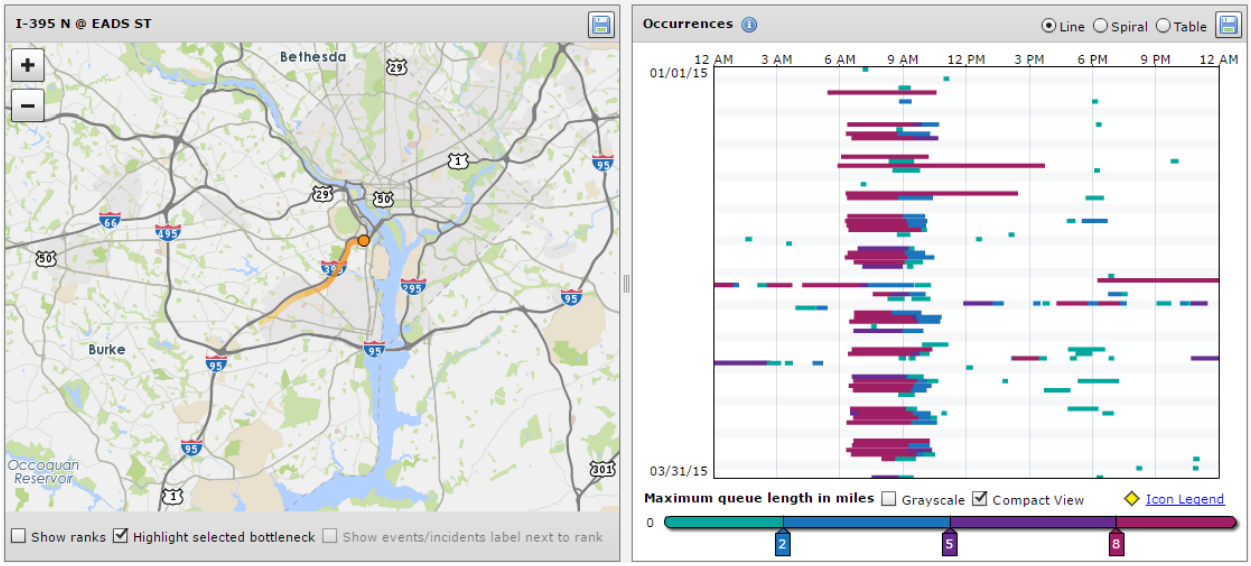

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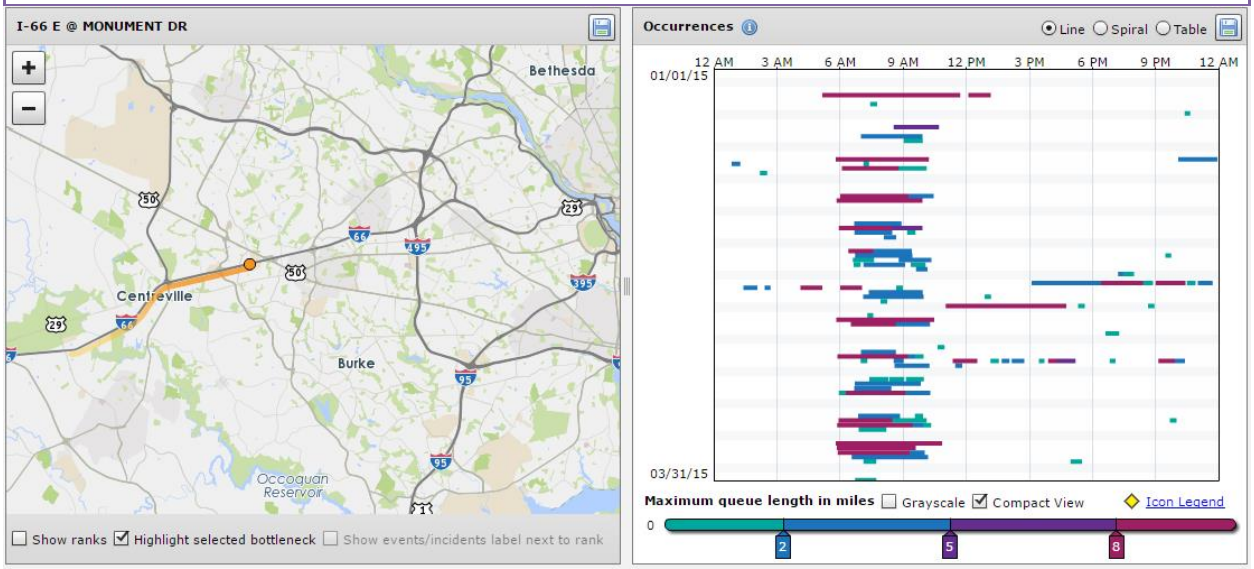
10	I-66 E @ MONUMENT DR	1 h 46 m	8.1	130	111,673



Congestion Maps

Figure 3. Travel Time Index during weekday 8:00-9:00 AM in 1st Quarter 2015

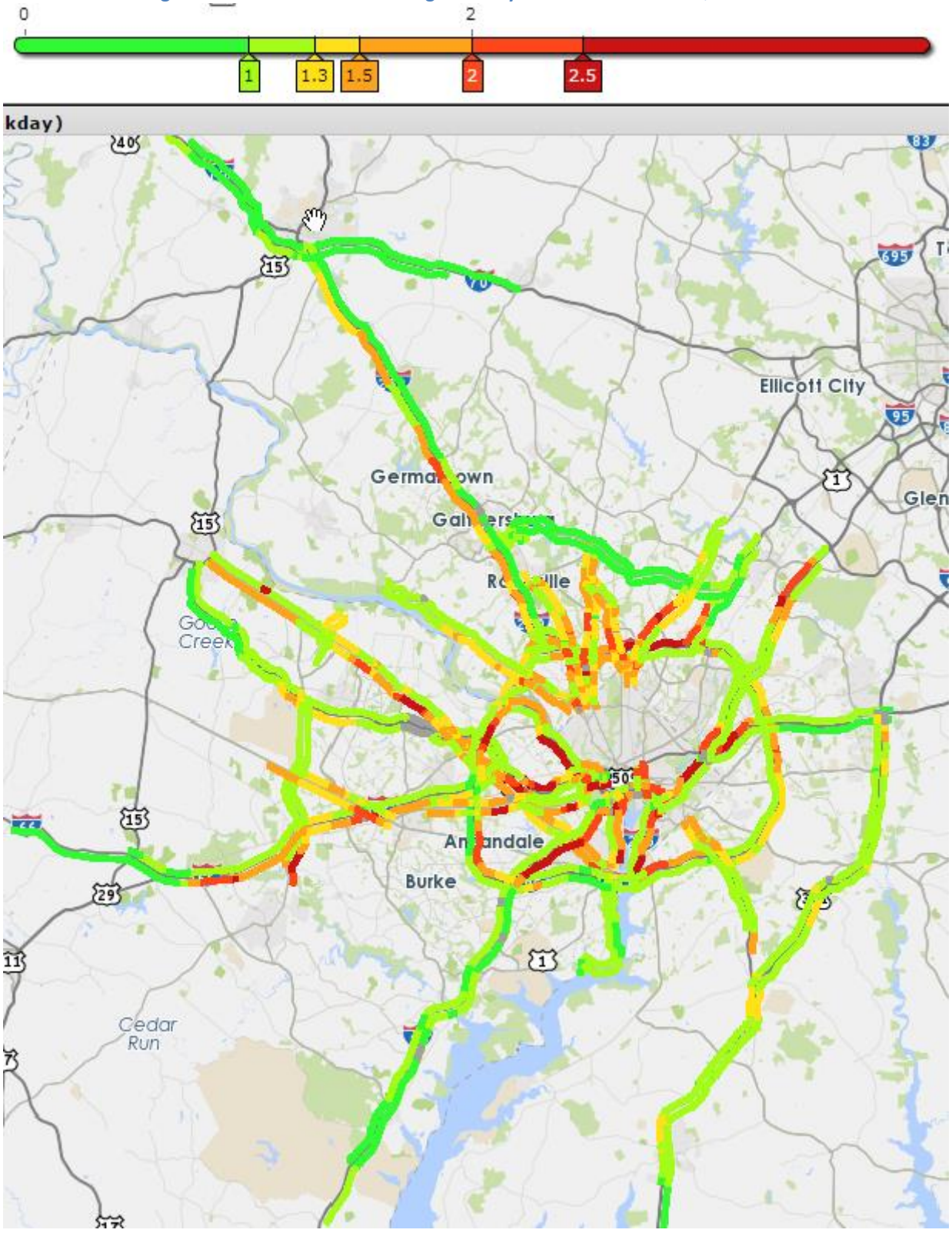
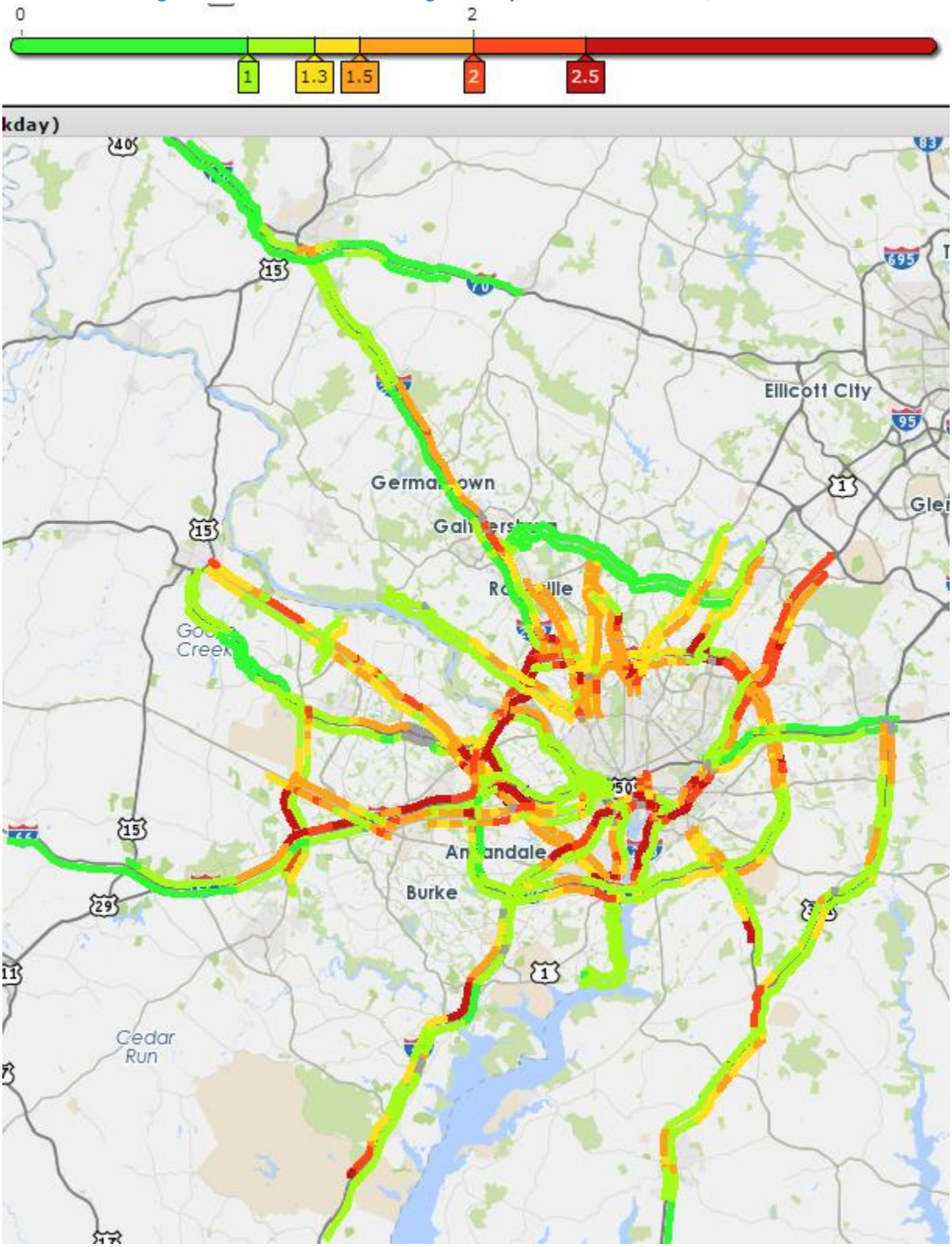


Figure 4. Travel Time Index during weekday 5:00-6:00 PM in 1st Quarter 2015



1st Quarter 2015 Spotlight – Identifying the Transit-Significant Road Network

Starting from this quarter (2015Q1), the Congestion Report will be reporting the performance of a Transit-Significant Road Network (TSRN) as shown on page 1-2. This quarter's spotlight is dedicated to the process undertaken by TPB staff and the Regional Public Transportation Subcommittee (RPTS) to define such a TSRN.

Background

The Moving Ahead for Progress in the 21st Century Act (MAP-21) legislation calls for reporting highway performance by category, namely the Interstate System and the non-Interstate National Highway System (NHS). In preparation for meeting such requirements, staff of the TPB reported traffic congestion and travel time reliability by four highway categories (Interstates, non-Interstate NHS, non-NHS, and All roads) in the 2014 Congestion Management Process Technical Report and the quarterly updated Congestion Dashboard. A comment on such reporting was received at a TPB Board Meeting, asking staff to explore the performance of a to-be-defined Transit-Significant Road Network on which running a certain number of buses. The goal is to track the differential congestion, if any, between the regional average and the TSRN, and keep decision makes and professionals informed.

Selection

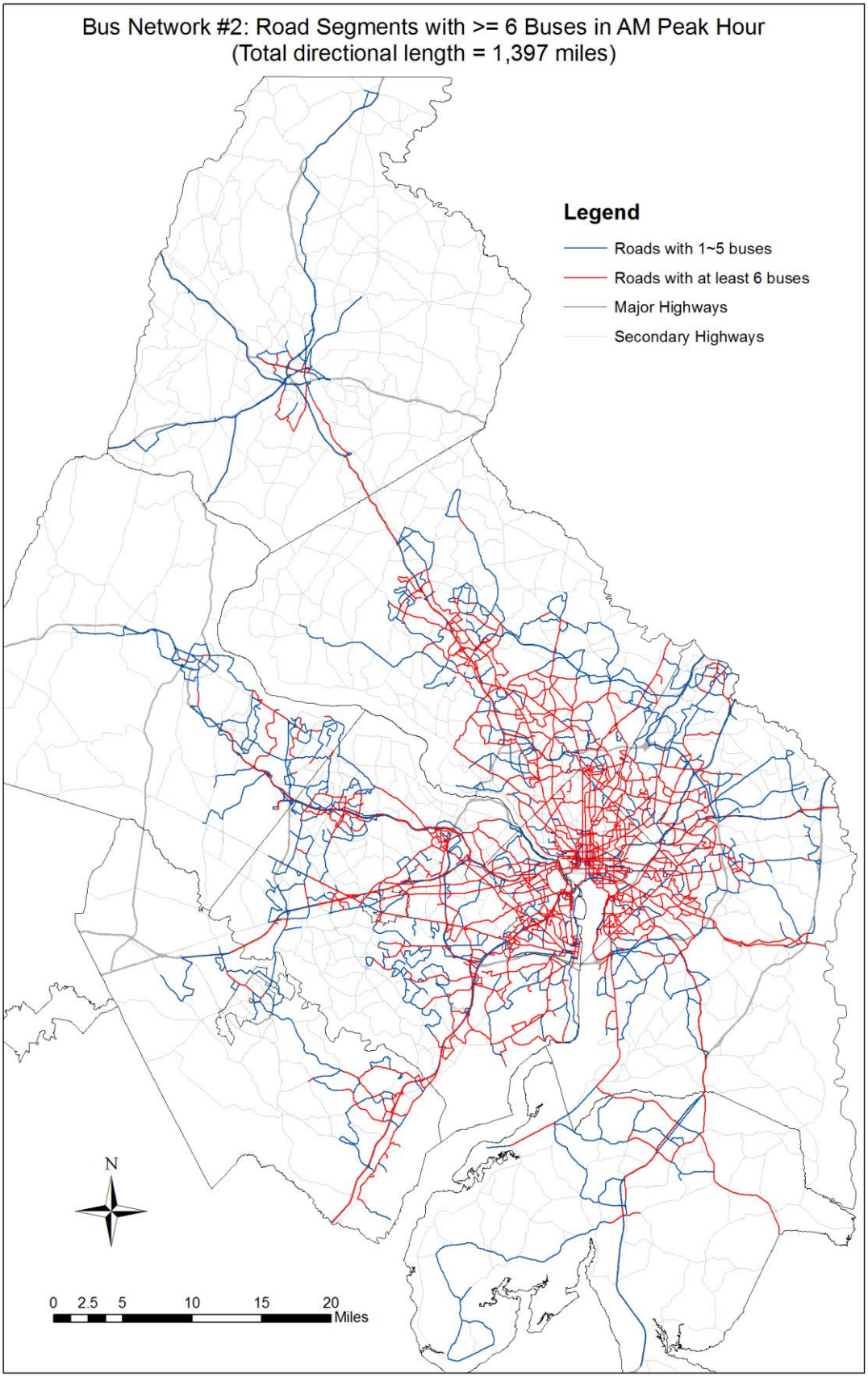
Based on the TPB's travel forecasting model network, which includes a transit bus network and bus running schedules, staff proposed five options to the RPTS to define the TSRN. The main differential factor among the five straw-man options was the number of buses running on a road segment during the AM Peak Hour, ranging from at least one bus to at least 20 buses. The smaller the number of buses, the larger the transit network, for example, the network with at least one bus has a total directional length of 2,660 miles while the one with at least 20 buses is only 283 miles.

Staff and the subcommittee members sought a transit-significant network that was sufficiently detailed yet at the same time was sufficiently differentiated from the overall network. After a close examination of the five options, it has been agreed to select the following network as the designated TSRN (figure 5 on the next page; an 11x17" map can be found here): 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.

Note that this TSRN defined by the above approach is somewhat a segmented network, meaning that the connectivity of this network could be lost at certain locations especially in suburban areas. However, because the goal of finding such a transit network is to track the differential congestion, if any, between the regional average and the TSRN, the loss of connectivity could be ignored for this purpose.

More detailed TSRN analysis results will be provided in the next quarter's spotlight. A similar freight-significant network is also being developed and this Congestion Report will highlight the process and analysis results once they become available.

Figure 5, Transit-Significant Road Network



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

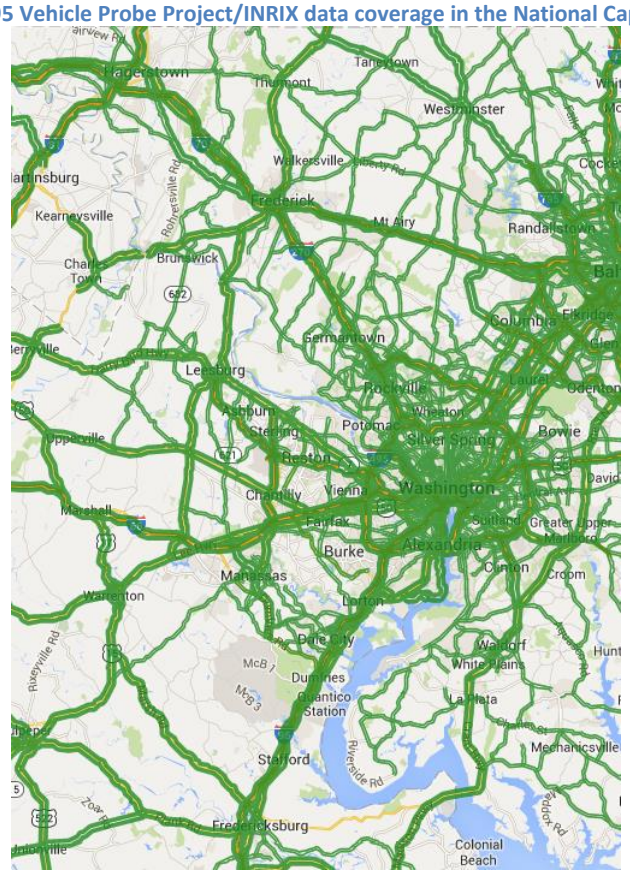
Highway Administration and produced by the Texas Transportation Institute with Cambridge Systematics, Inc. This report uses the following method to calculate PTI:

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

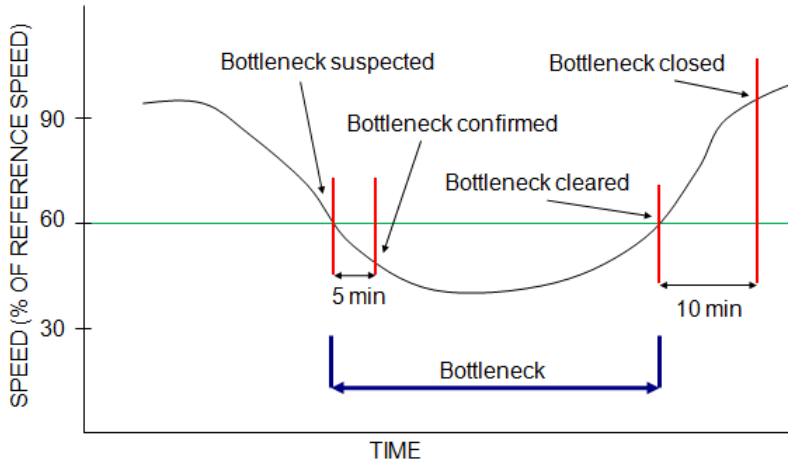


Bottlenecks

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 7. 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.