CONGESTION REPORT
1st Quarter 2016

A quarterly update of the National Capital Region's traffic congestion, travel time reliability, top-10 bottlenecks and featured spotlight

April 20, 2016

National Capital Region
Transportation Planning Board

ABOUT TPB

Transportation planning at the regional level is coordinated in the Washington area by the National Capital Region Transportation Planning Board (TPB). Members of the TPB include representatives of the transportation agencies of the states of Maryland and Virginia, and the District of Columbia, local governments, the Washington Metropolitan Area Transit Authority, the Maryland and Virginia General Assemblies, and nonvoting members from the Metropolitan Washington Airports Authority and federal agencies. The TPB is staffed by the Department of Transportation Planning of the Metropolitan Washington Council of Governments.

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1st Quarter 2016

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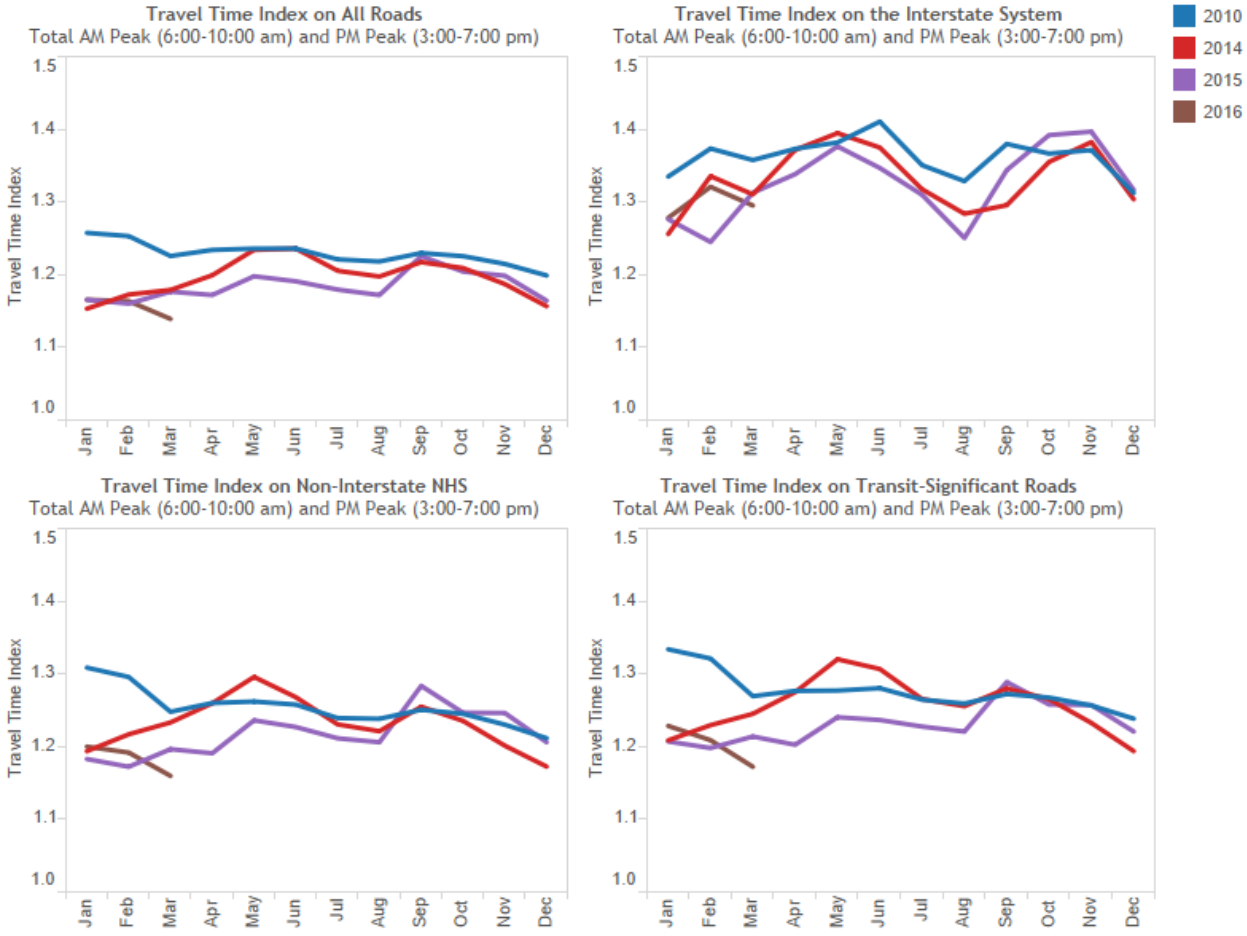
CONGESTION – TRAVEL TIME INDEX (TTI)

Interstate System		
TTI 1st Quarter 2016:	1.30	↑1.6% or 0.02[1]
TTI Trailing 4 Quarters:	1.33	↑0.3% or 0.004[2]
Transit-Significant[4]		
TTI 1st Quarter 2016:	1.20	↓0.3% or 0.003
TTI Trailing 4 Quarters:	1.23	↓1.7% or 0.02
Non-Interstate NHS[3]		
TTI 1st Quarter 2016:	1.18	↑0.0% or 0.00
TTI Trailing 4 Quarters:	1.22	↓0.6% or 0.01
All Roads		
TTI 1st Quarter 2016:	1.16	↓1.0% or 0.01
TTI Trailing 4 Quarters:	1.18	↓1.2% or 0.01

[1] Compared to 1st Quarter 2015; [2] Compared to one year earlier; [3] NHS: National Highway System; [4] See "Background" section.

Figure 1. Monthly Travel Time Index for Total AM peak (6:00-10:00 am) and PM peak (3:00-7:00 pm)



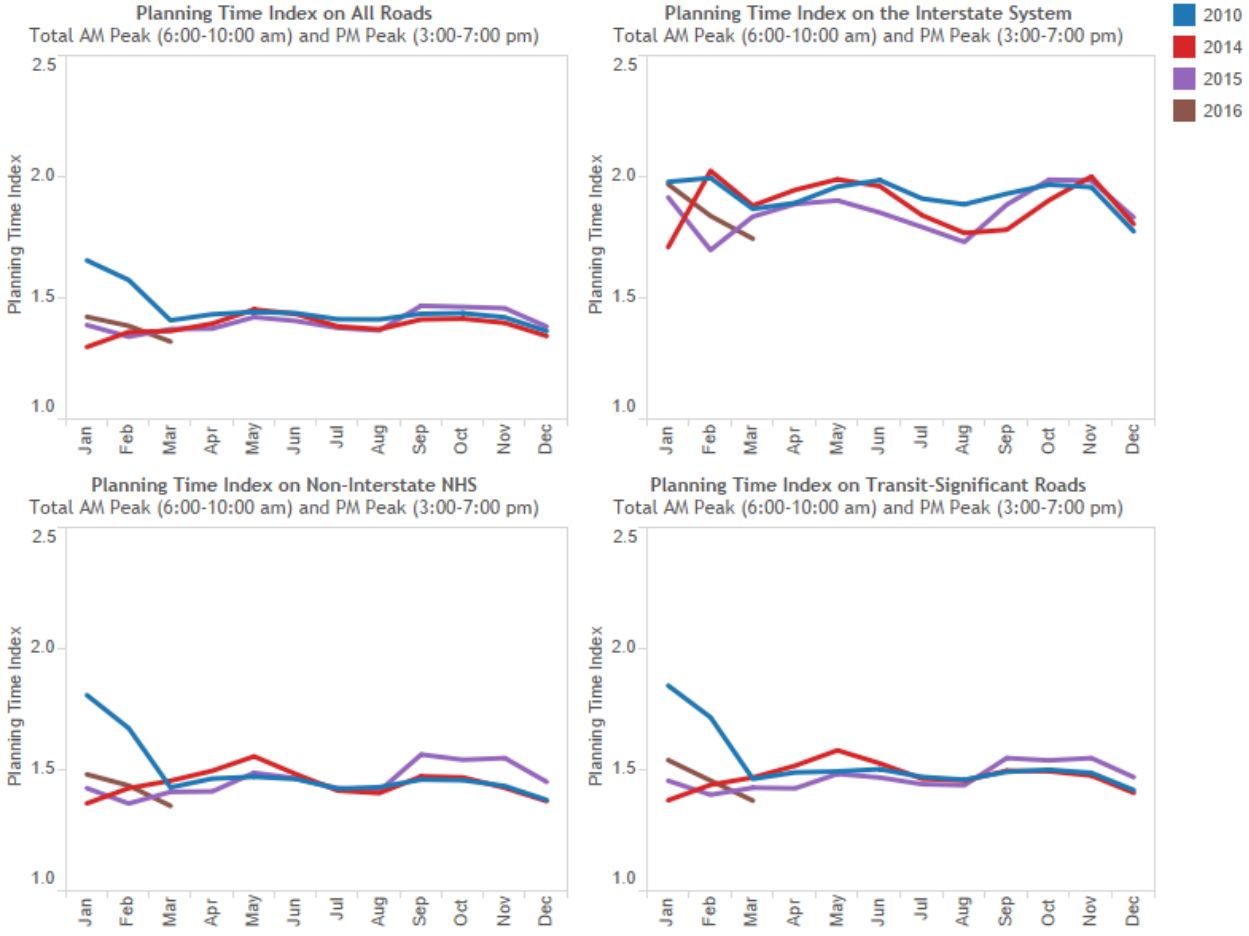
Travel Time Index (TTI), defined as the ratio of actual travel time to free-flow travel time, measures the intensity of congestion. The higher the index, the more congested traffic conditions it represents, e.g., TTI = 1.00 means free flow conditions, while TTI = 1.30 indicates the actual travel time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

UNRELIABILITY – PLANNING TIME INDEX (PTI)

Interstate System		
PTI 1st Quarter 2016:	1.85	↑1.9% or 0.03[1]
PTI Trailing 4 Quarters:	1.87	↓0.2% or 0.003[2]
Transit-Significant[4]		
PTI 1st Quarter 2016:	1.46	↑2.1% or 0.03
PTI Trailing 4 Quarters:	1.48	↑0.2% or 0.003
Non-Interstate NHS[3]		
PTI 1st Quarter 2016:	1.42	↑1.8% or 0.02
PTI Trailing 4 Quarters:	1.46	↑1.7% or 0.02
All Roads		
PTI 1st Quarter 2016:	1.38	↑0.7% or 0.01
PTI Trailing 4 Quarters:	1.40	↑0.8% or 0.01

[1] Compared to 1st Quarter 2015; [2] Compared to one year earlier; [3] NHS: National Highway System; [4] See "Background" section.

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

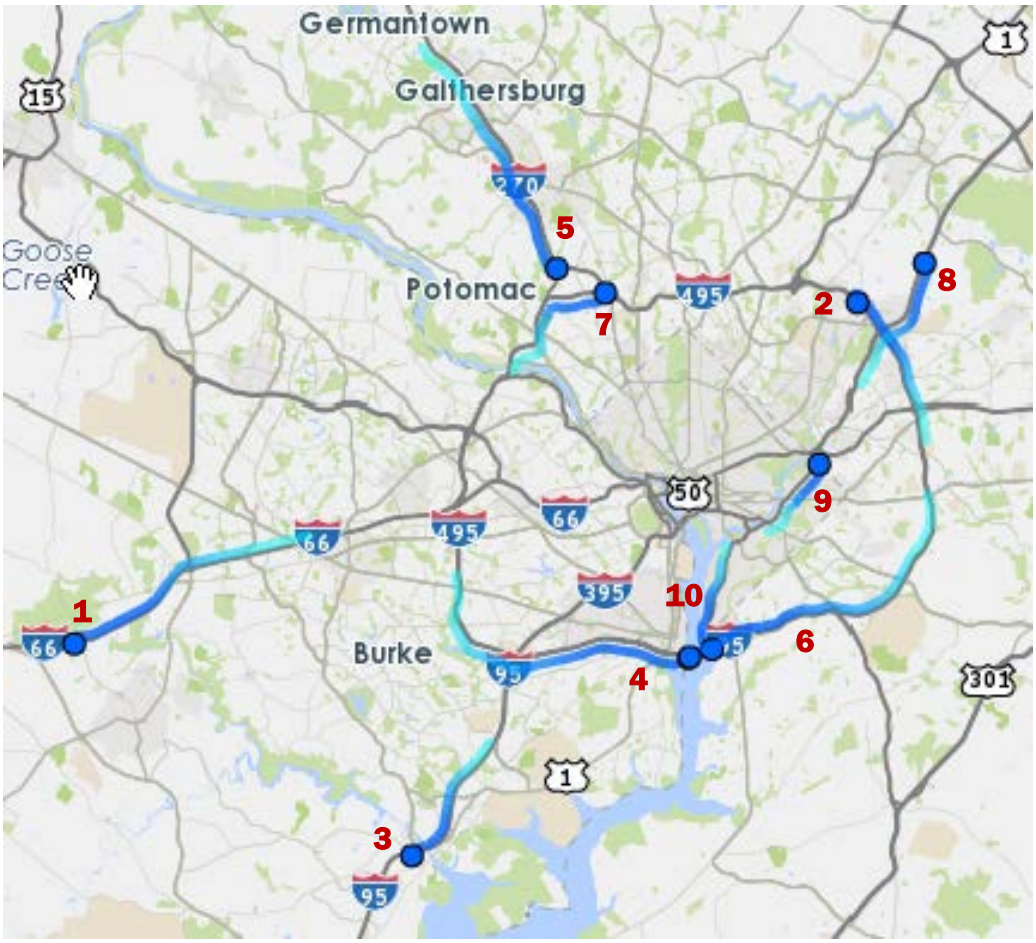


> ***Planning Time Index*** *(PTI), defined as the ratio of 95th percentile travel time to free flow travel time, measures travel time reliability. The higher the index, the less reliable traffic conditions it represents, e.g., PTI = 1.30 means a traveler has to budget 30% longer than the uncongested 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 (1)*	I-66 W @ VA-234/EXIT 47	2 h 36 m	11.23	109	190,919
2 (6)	I-495 CCW @ GREENBELT METRO DR/EXIT 24	2 h 3 m	6.05	245	182,414
3 (8)	I-95 S @ VA-123/EXIT 160	2 h 57 m	5.81	176	181,081
4 (>20)	I-495 CCW @ WOODROW WILSON MEMORIAL BRIDGE	2 h 32 m	13.07	90	178,829
5 (2)	I-270 S @ I-270 (SPUR)	2 h 7 m	11.15	120	169,904
6 (>20)	I-495 CW @ WOODROW WILSON MEMORIAL BRIDGE	2 h 29 m	12.11	88	158,824
7 (18)	I-495 CW @ I-270/EXIT 35	1 h 58 m	5.29	209	130,359
8 (16)	MD-295 N @ POWDER MILL RD	2 h 6 m	4.63	223	130,118
9 (9)	DC-295 N @ EASTERN AVE	3 h 6 m	3.51	196	127,854
10 (15)	I-295 S @ I-495/I-95/EXIT 2A-B	2 h 25 m	4.53	168	110,393

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



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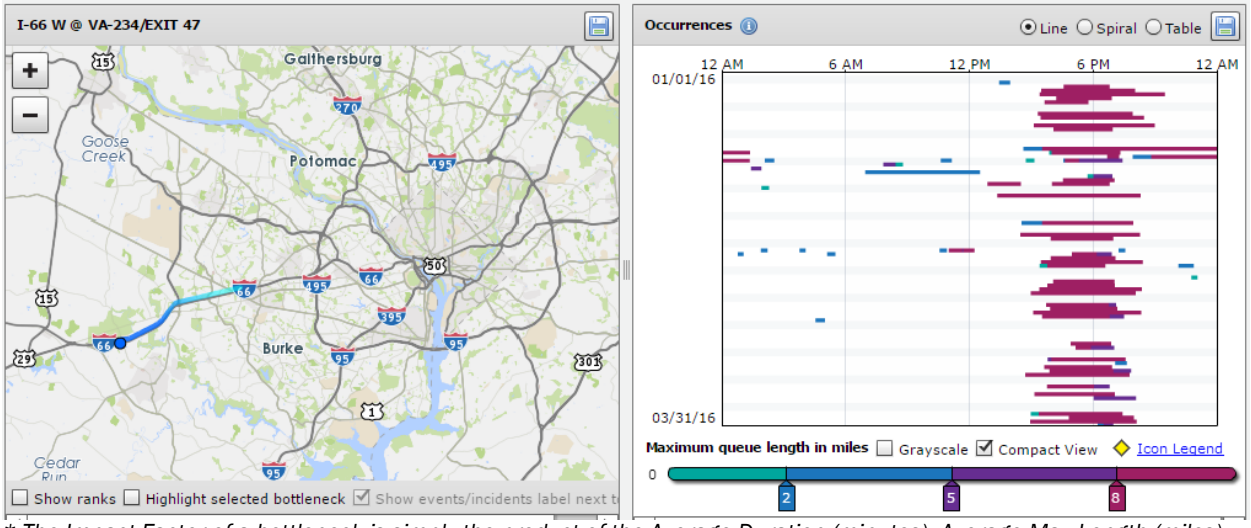

** The Impact Factor of a bottleneck is simply the product of the Average Duration (minutes), Average Max Length (miles) and the number of occurrences.*

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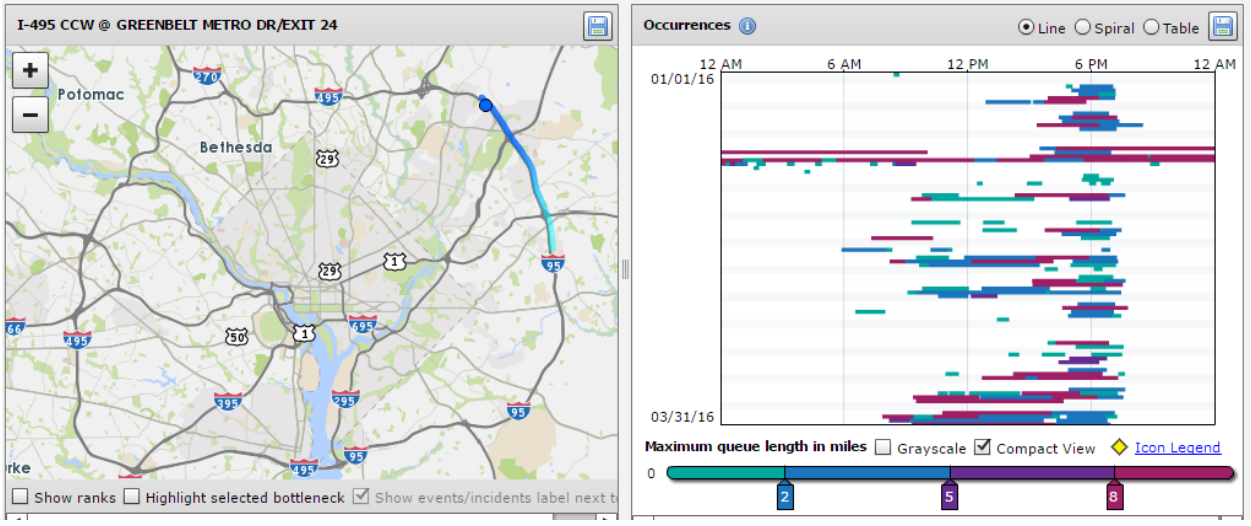

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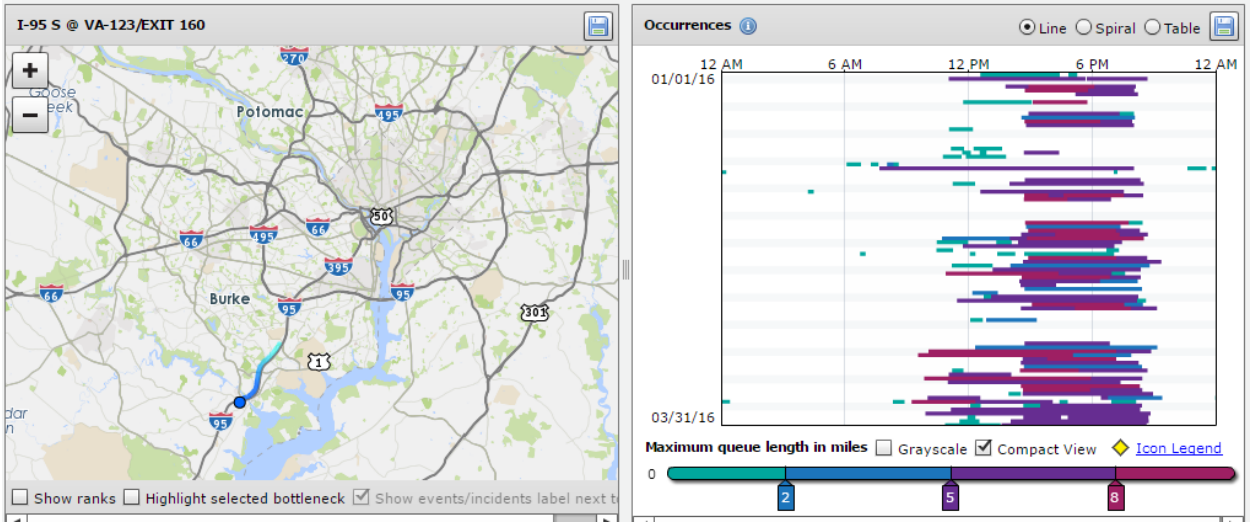

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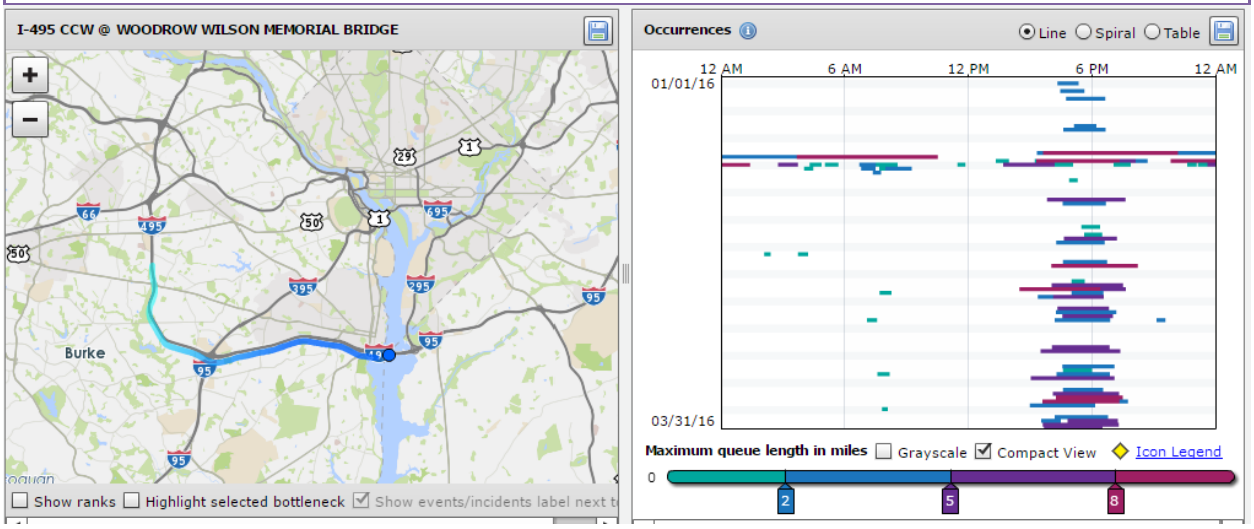

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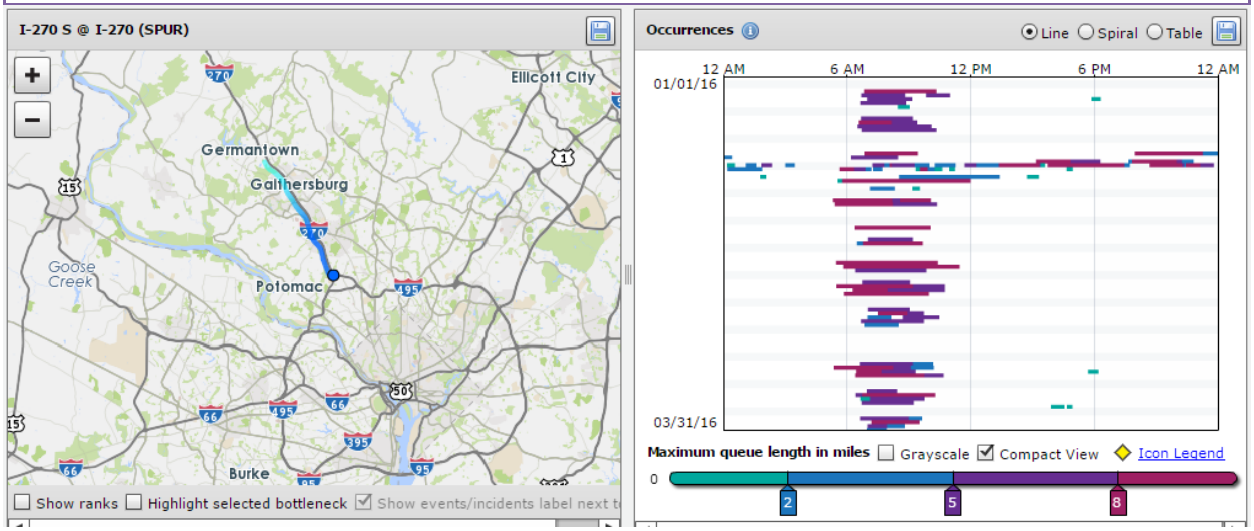

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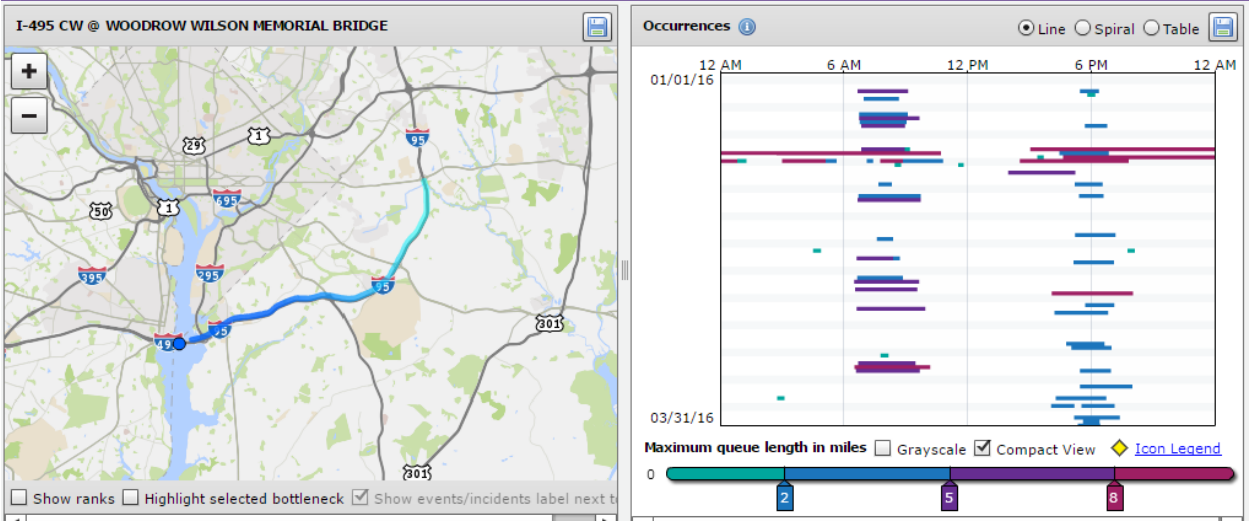

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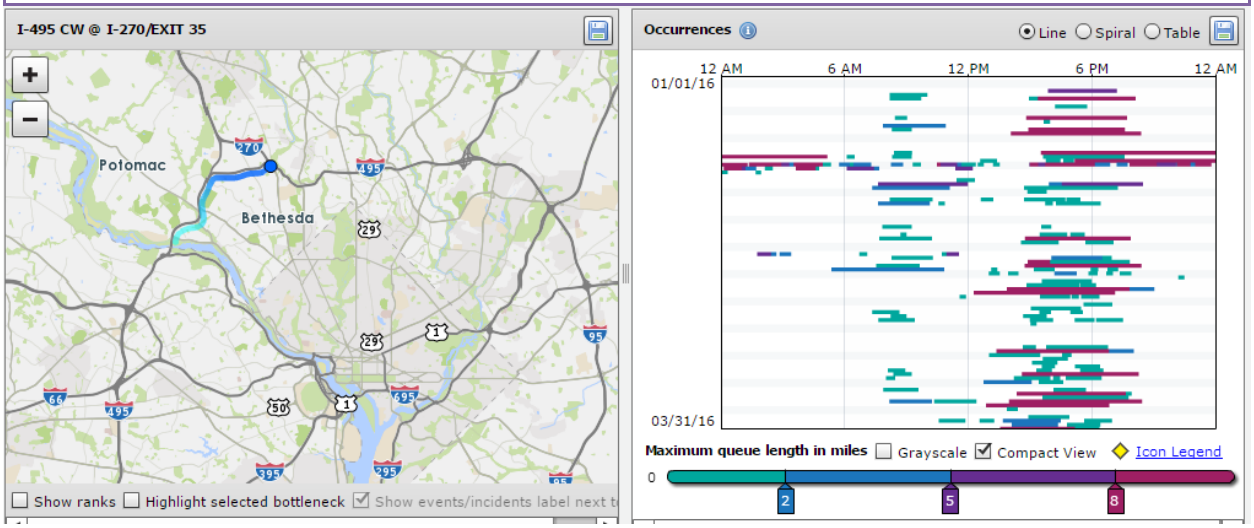

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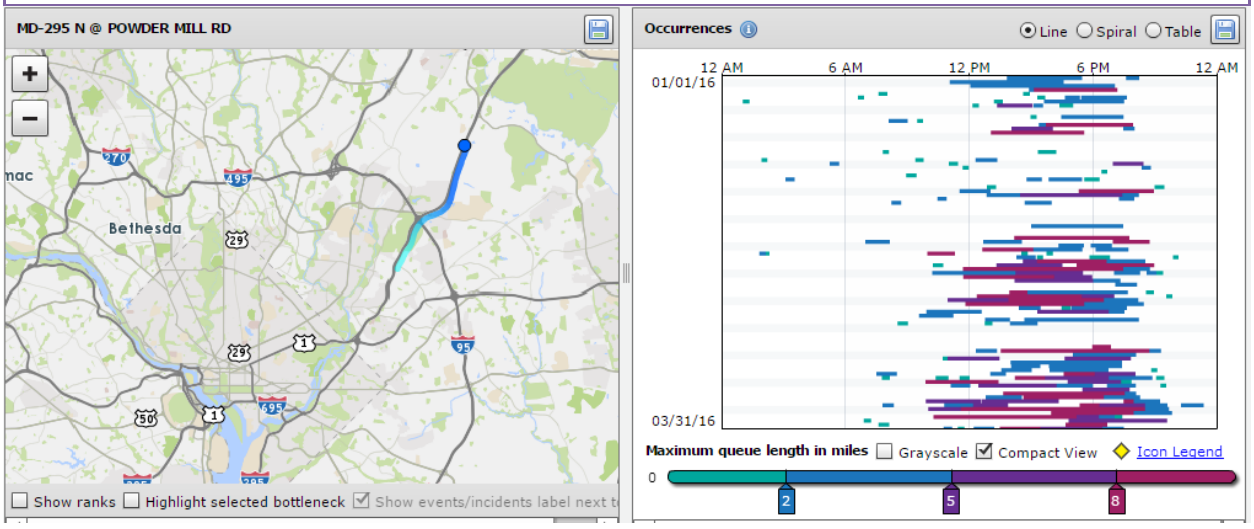

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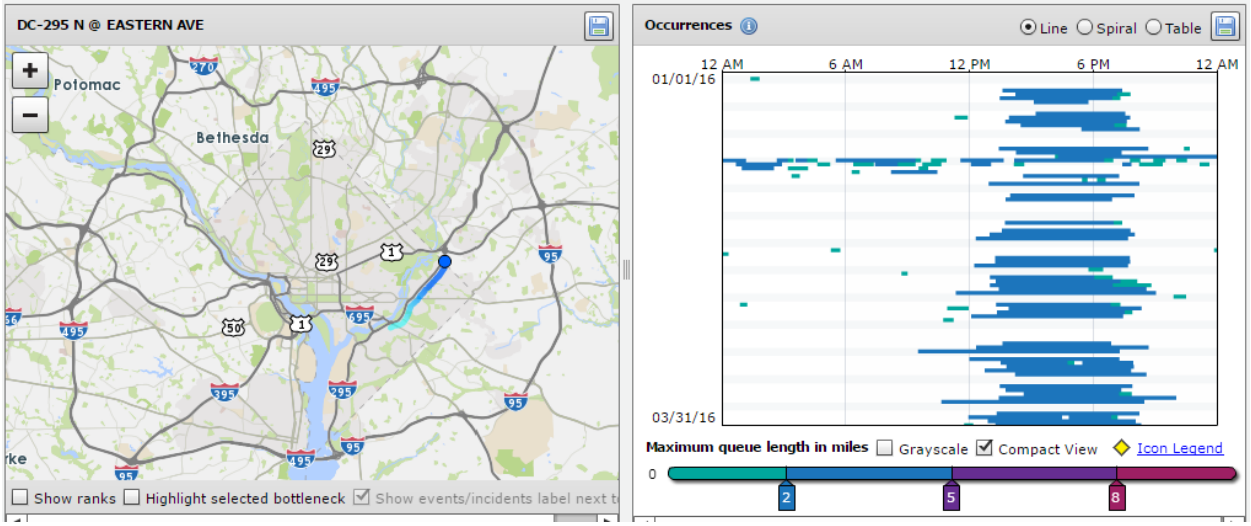

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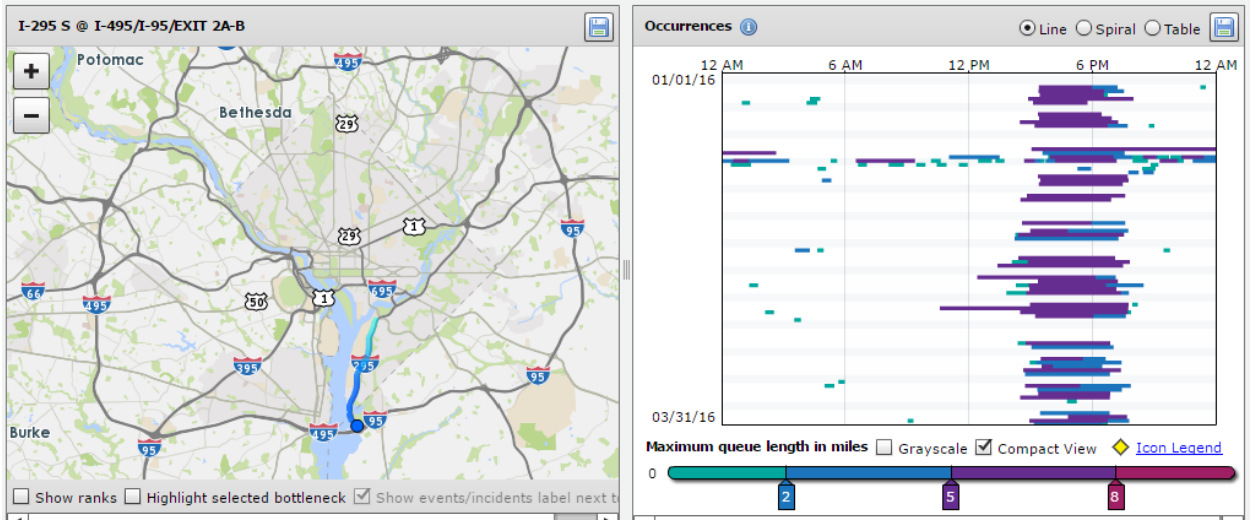


CONGESTION MAPS

Figure 3. Travel Time Index during weekday 8:00-9:00 A.M. in 1st Quarter 2016

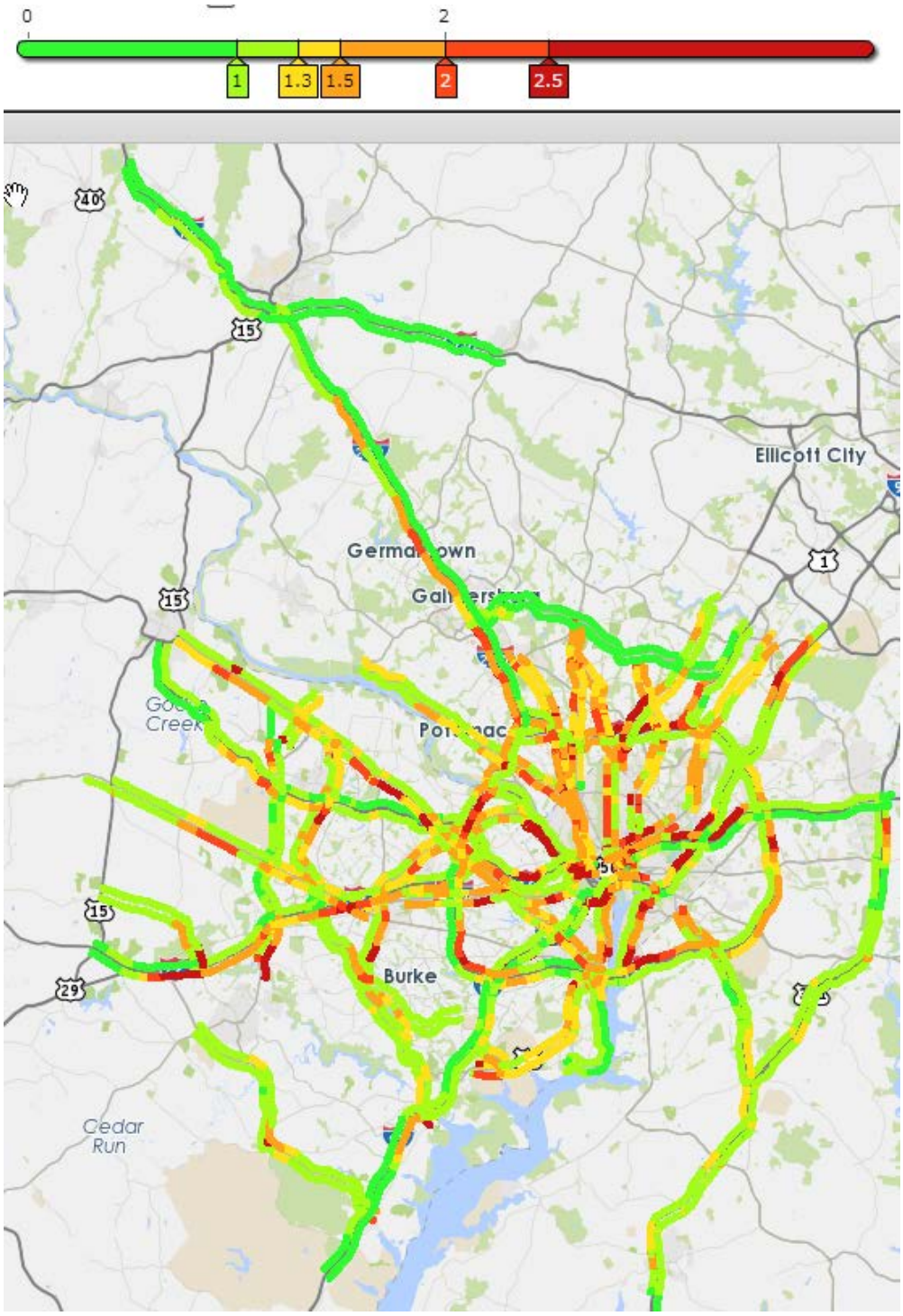
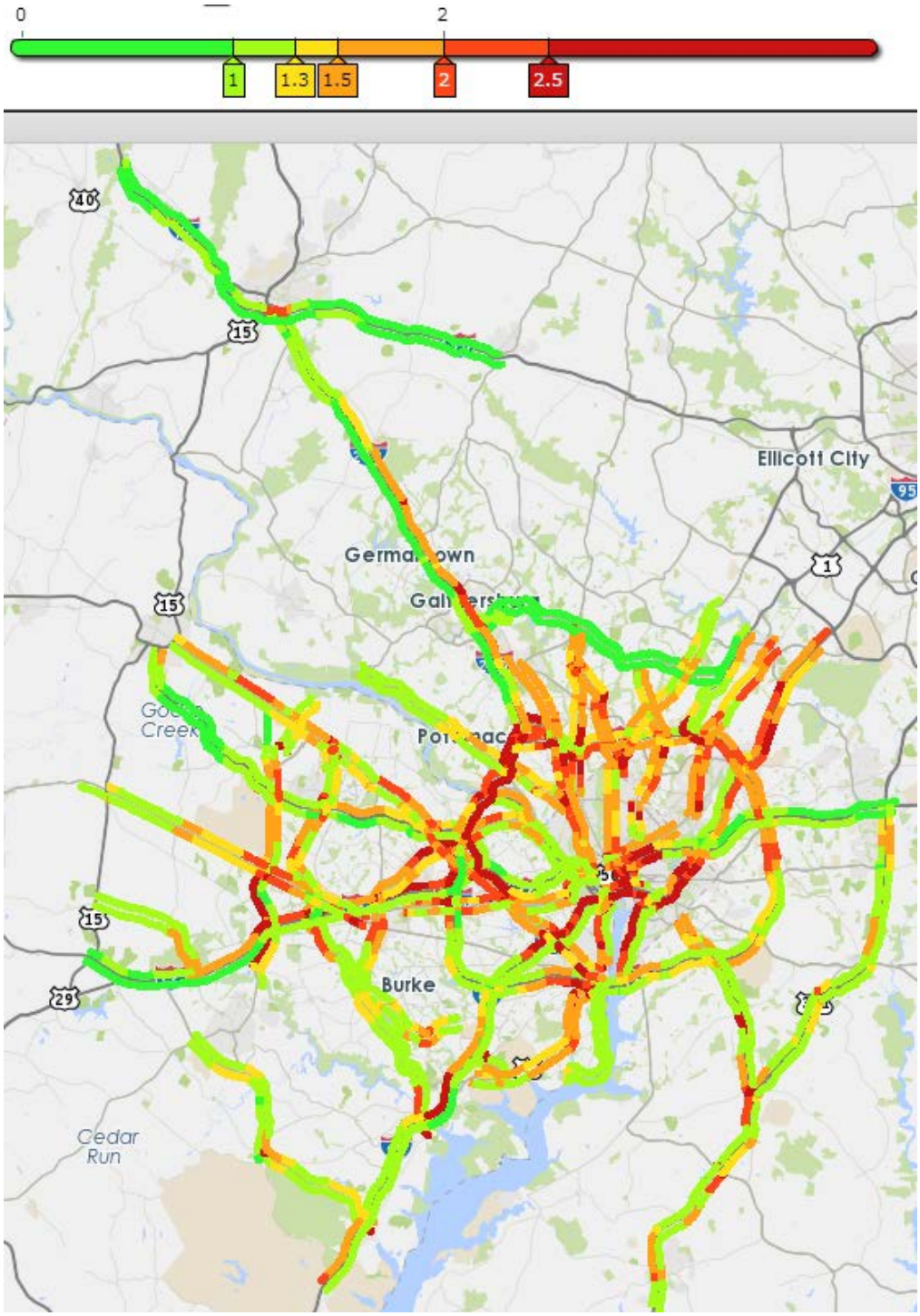


Figure 4. Travel Time Index during weekday 5:00-6:00 P.M. in 1st Quarter 2016



2016Q1 SPOTLIGHT – JANUARY SNOW EVENTS

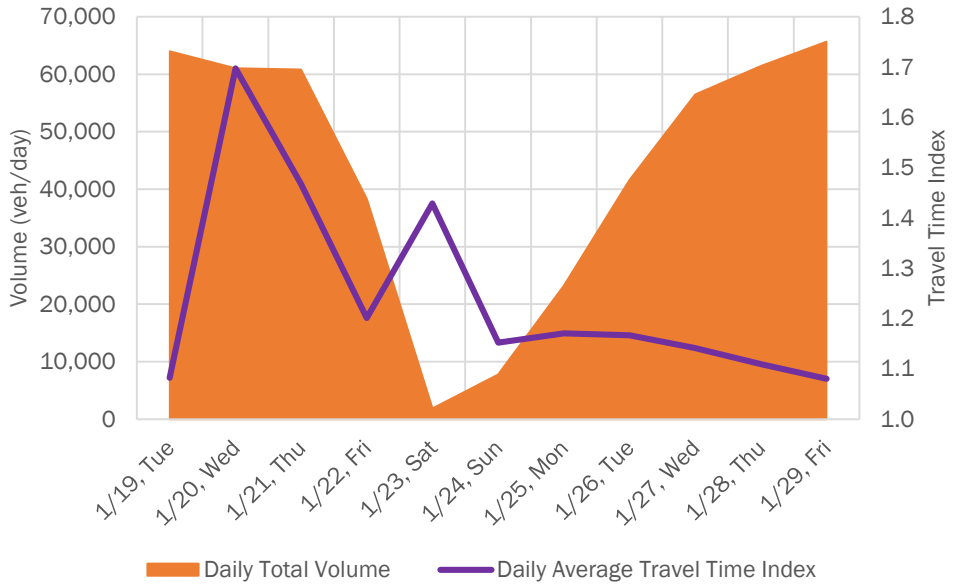
Introduction

From January 22-23, 2016, the Washington metropolitan area experienced a major blizzard that was rated as category 4 or crippling winter storm by the National Oceanic and Atmospheric Administration (NOAA). This blizzard produced 2-3 feet of snow across much of the region after a 36-hour nonstop snowfall. Transportation systems including aviation, highway, rail and transit canceled or suspended services. While preparing for this upcoming major blizzard, an unexpected snowfall of around one inch hit the region in the afternoon peak hours and the evening of Wednesday, January 20, which created a travel nightmare for many travelers. Some effects of the snow events are visible in the top-10 bottleneck plots shown earlier in this report. The following summaries the transportation impacts of the two snow events, including variations of traffic volumes, speeds and travel times on the region's freeways.

Findings

Impacts of unexpected versus expected snow events contrast significantly: extremely high delay and normal demand were found in the unexpected, over-performing January 20 snow; only moderate to high delay but extremely low vehicle volume featured the expected and well-prepared January 22-23 blizzard. These differences highlight the importance of timely, accurate weather forecasting and opportune preparation for adverse weather events (Figure 5).

Figure 5. Freeway Daily Volume and Travel Time Index

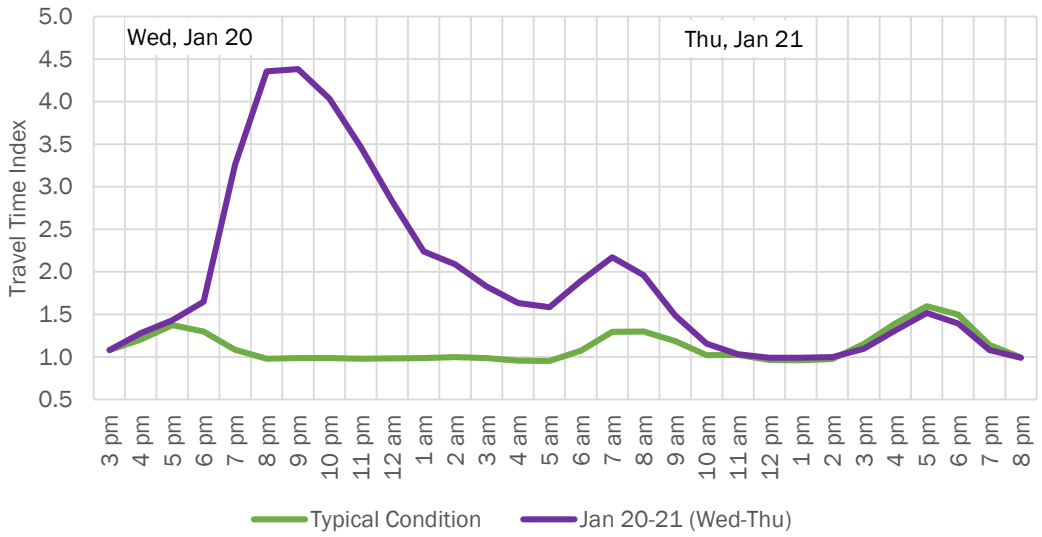


Freeway volumes' sharp decline beginning noon Friday, January 22 and extremely low volumes on January 23-24 showed good public compliance with government personnel and school decisions, and the calls to action to stay off the road during dangerous conditions and during the period of major snow clearance. There was a week-long recovery from the January 22-23 blizzard and the impacts were clearly visible in the data all the way through January 29.

Quickly-deteriorating conditions under normal levels of demand on January 20 caused some of the most extreme delays ever measured in the region. Freeways experienced a 37% sudden drop in vehicle throughput

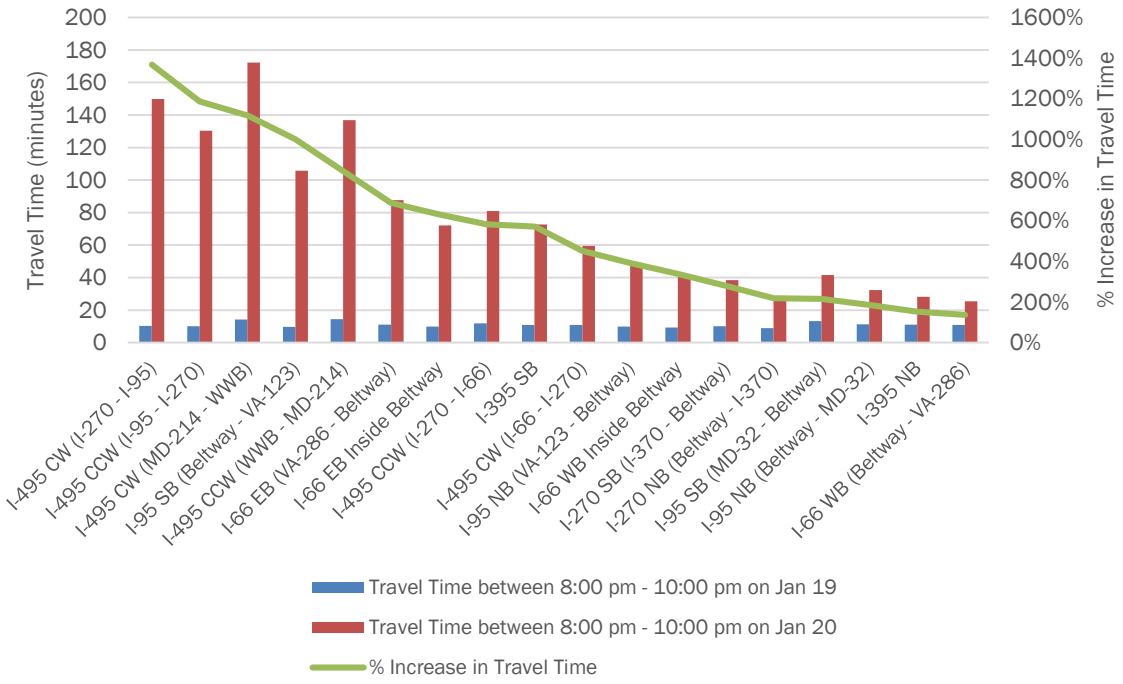
but a 300% increase in delay between 7-11 pm compared to typical conditions. Vehicles stuck in the slippery conditions or behind other snarled traffic continued crawling into the early morning of January 21, with a 36% increase in vehicle throughput and a 108% increase in delay between 1-4 am compared to typical conditions (Figure 6).

Figure 6. Freeway Travel Time Index: Jan 20-21 vs Typical Condition



January 20, 2016 was the worst day of travel since 2010 (when the vehicle probe data became available for the entire region), and 9:00-10:00 p.m. was the worst hour of travel since 2010. Some freeways in the region experienced delays of ten times or more versus free-flow travel times (Figure 7).

Figure 7. Travel Times between 8-10 pm on Jan 19 and Jan 20



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 and FAST legislations 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:

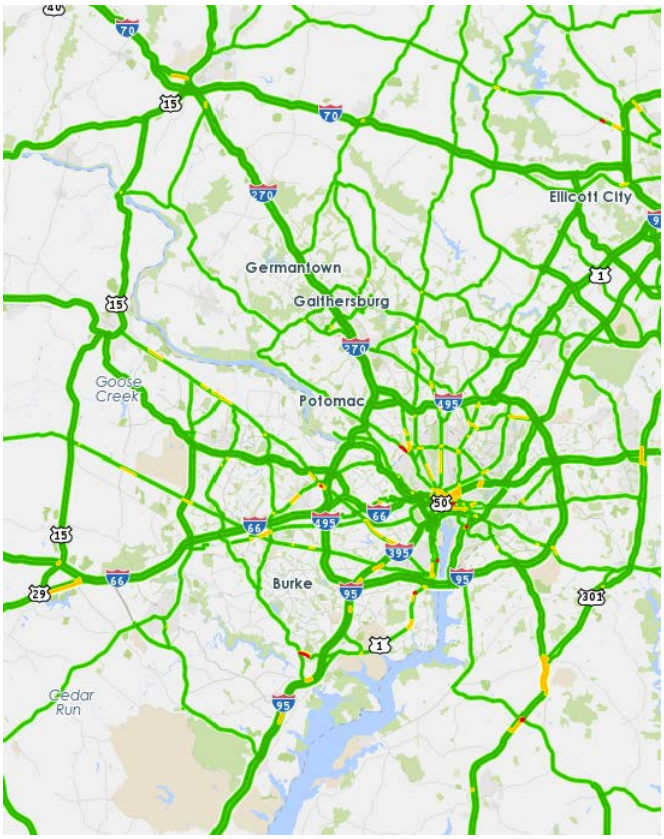
1. Calculate TTI = reference speed / speed in the monthly data obtained in step 2 of the above TTI methodology. Do not impose constraint TTI >= 1, since the purpose of this calculation is to rank the TTIs to find the 95th percentile, not to average the TTIs.
2. Calculate monthly average PTI: including 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.

Transit-Significant Roads –are road segments with at least 6 buses in the AM Peak Hour (equivalent to one bus in either direction in every 10 minutes). More detailed definition and analysis can be found in the 2015Q1 and 2015Q2 Congestion Reports.

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

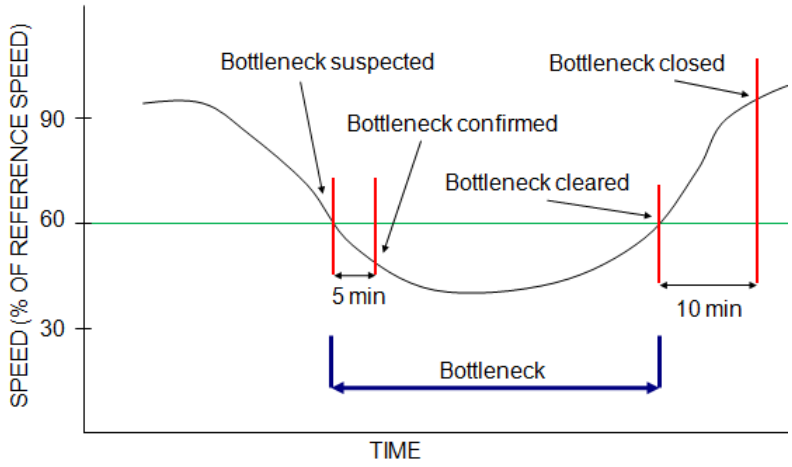


Bottlenecks

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.

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