National Capital Region
Transportation Planning Board

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TPB Technical Committee, February 3, 2017
Item 12X 5 SPOTS

MEMORANDUM

TO: TPB Technical Committee

FROM: Eric Randall, TPB Transportation Engineer

SUBJECT: Overview of Preliminary Analysis of Transportation Impacts of WMATA SafeTrack Program

DATE: January 27, 2017

This memorandum provides an overview of a preliminary analysis of the transportation impacts of WMATA's SafeTrack program. This analysis examined SafeTrack Surges 1 through 10, beginning June 4 and lasting through November 22, 2016. The analysis focused on the conditions for each mode across all surges, not at each surge separately.

TPB staff collected a range of transportation data from multiple sources in order to assess each Surge for the changes in traffic, transit, and other modes of travel, in order to provide an overview of the changes in travel experienced during this significant safety work on the WMATA Metrorail system. This analysis focuses on observed data from the transportation system in terms of traffic congestion and mode counts; it does not reflect the experience of the individual traveler and any longer or less reliable travel times experienced. Overall, the analysis found that while there were local impacts from each surge, the overall regional transportation system is resilient and the impact of any choices made by individual travelers largely fell within the normal day-to-day variation of travel in the region.

METHODOLOGY

TPB staff pursued four lines of inquiry in assessing transportation impacts during SafeTrack.

1. Traffic Congestion Impacts – TPB staff continued previous traffic analysis using INRIX data to quantify the impact of traffic congestion due to the surges.
2. Transit Usage – TPB staff collected ridership data from WMATA and other transit providers in an effort to quantify the use of Metrorail, Metrobus, and local transit services during each Surge.
3. Traffic Counts – TPB staff collected highway traffic count data from the region's permanent count stations to quantify any information on traffic volumes, overall and hourly, on major highways near Surge work zones.
4. Bike Impacts – TPB staff collected bikeshare use information and data from the region's bicycle counter stations to quantify any information on bikeshare use and overall bicycle travel during the Surges.

The overall goal of the analysis was to attempt to quantify the number (and percentage) of travel mode choices made by travelers during the WMATA SafeTrack Surges. The hypothesis was that fewer people would ride Metrorail. Instead they could travel by auto, transit, or bicycle, for which the above data collection would provide some information. or not make the trip at all.

There are examples of alternative travel choices during SafeTrack surges that cannot be measured in this analysis. Persons could avoid travelling at all by taking leave or teleworking, or could still

travel but head to different destinations. They could also carpool or rideshare if traveling by auto. Trips shifted out of the peak travel times may not be captured through available data collection. Additionally, if Metrorail users changed to stations on a different Metro line, they may not have been captured. Finally, people's alternative choices may vary during the surge period (e.g., telework one day, bus instead of Metrorail one day, carpool instead of Metrorail another day, etc.). It should also be kept in mind that WMATA and many other transportation agencies undertook mitigating actions, ranging from public service announcements to replacement shuttle bus service for the SafeTrack surges. By and large the data found few significant regional impacts, which demonstrates the value of providing options for travelers.

Table 1 summarizes the ten surges analyzed. Six of the surges took place during July and August, or in September leading up to Labor Day. Fewer or more flexible trips and lighter overall traffic congestion during this period, when schools are closed and many people take vacation, may have reduced the impact of the SafeTrack surges.

Table 1 - SafeTrack Schedule and Locations (Surges 1 -10)

	Dates	Weekdays*	Type	Location	Immediate Jurisdictions Affected
1	June 4 - 16	9	Single Tracking	Ballston to East Falls Church	Fairfax, Arlington, Falls Church
2	June 18 - July 3	10	Line Segment S/D	Eastern Market to Minnesota Ave/Benning	DC, Prince George's
3	July 5* – 11	4	Line Segment S/D	Reagan National Airport to Braddock Road	Alexandria, Fairfax
4	July 12 - 18	5	Line Segment S/D	Reagan National Airport to Pentagon City	Alexandria, Fairfax
5	July 20 - 31	8	Single Tracking	Ballston to East Falls Church	Fairfax, Arlington, Falls Church
6	August 1 - 7	5	Single Tracking	Takoma to Silver Spring	DC, Montgomery
7	August 9 - 21	9	Single Tracking	Shady Grove to Twinbrook	Montgomery
8	Aug 27 - Sep 11	9	Single Tracking	Franconia-Springfield to Van Dorn Street	Fairfax, Alexandria
9	Sep 15 - Oct 26	30	Single Tracking	Vienna to West Falls Church	Fairfax, Falls Church
10	Oct 29 - Nov 22	16	Line Segment S/D	Fort Totten to NoMa-Gallaudet	DC, Montgomery

* Holidays or partial work days not included

TRAFFIC CONGESTION IMPACTS

TPB staff continued previous traffic analysis (July 2016) using INRIX data to quantify the impact of traffic congestion around Surge work zones. Previous findings were that traffic is somewhat worse in the proximity of each work zone, but there was no definitive significant regional impact.

The methodology used roadway travel time and speed data reported by INRIX, Inc., for the I-95 Corridor Coalition Vehicle Probe Project to analyze the impact of traffic conditions in the TPB Planning Area during the SafeTrack Surges. Staff downloaded 1-hour speed data on 9,491 Traffic Message Channel (TMC) links in the region comprising all the freeways, expressways and major roads in the region.

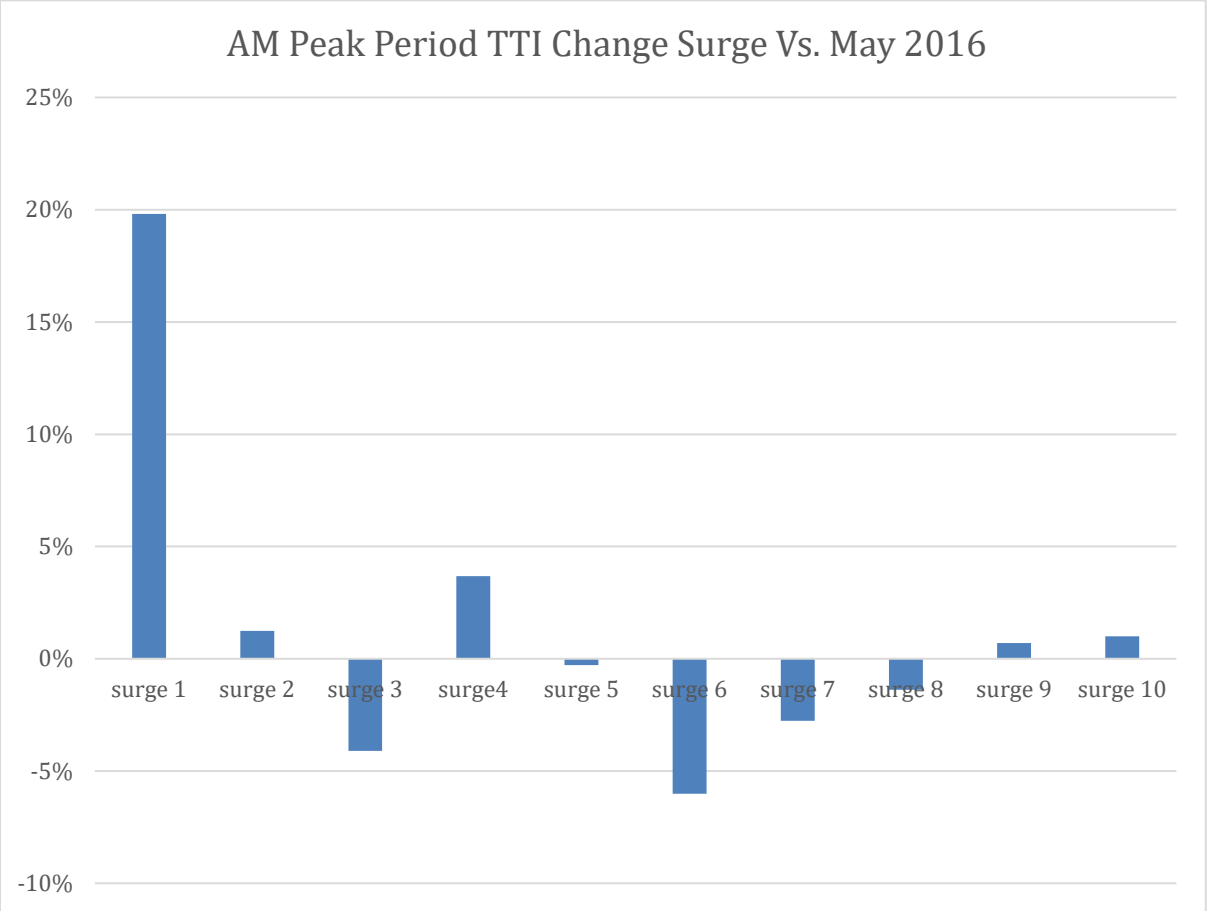
For analyzing traffic impacts the Travel Time Index (TTI) was used as the performance measure. Travel time Index (TTI) is the ratio of the observed speed against a reference speed which is similar to the free flow speed. The analysis compared the average TTI on Tuesday, Wednesday, and Thursday of the surge weeks against the TTI on Tuesday, Wednesday, and Thursday of a typical week during May 2016 as a baseline. This was done at a regional level for all the 9,491 TMC links in the region. TTI ratios – the TTI during surge versus the TTI during May - were calculated for every hour of every Tuesday, Wednesday, and Thursday of surges 1 through 10. To get an overall view of the impact of each surge, the percentage TTI variation charts for AM peak period (6 to 9 AM) for every Tuesday, Wednesday and Thursday of Surges 1 through 10 were developed. If the percentages were positive, it meant the surge probably increased travel times in the region. If the percentages were

negative it meant the surge probably did not impact travel times in the region assuming the faster travel time is due to normal day-to-day variation.

The initial analysis that staff performed during the beginning of the surge work in July 2016 compared conditions to comparable days in the previous year 2015. However, for this analysis staff used May 2016 to minimize the impact of annual increase in VMT. Other factors, such as seasonal variation or impacts from incidents, weather, etc., were not taken into account.

Chart 1 shows the average TTI variation for the morning peak period (6 to 9 AM) as compared to the average variation for the morning peak period in May 2016. As can be seen from the chart only surge 1 had a high variation (20%); the rest of the surges had minimal impact which cannot with certainty be linked to the surge. Several of the surges took place during summer when morning peak period traffic is lighter, which likely contributed to the TTI ratios being negative in comparison to May.

Chart 1 – Changes in Travel Time Index (TTI) During AM Peak Period for All Surges

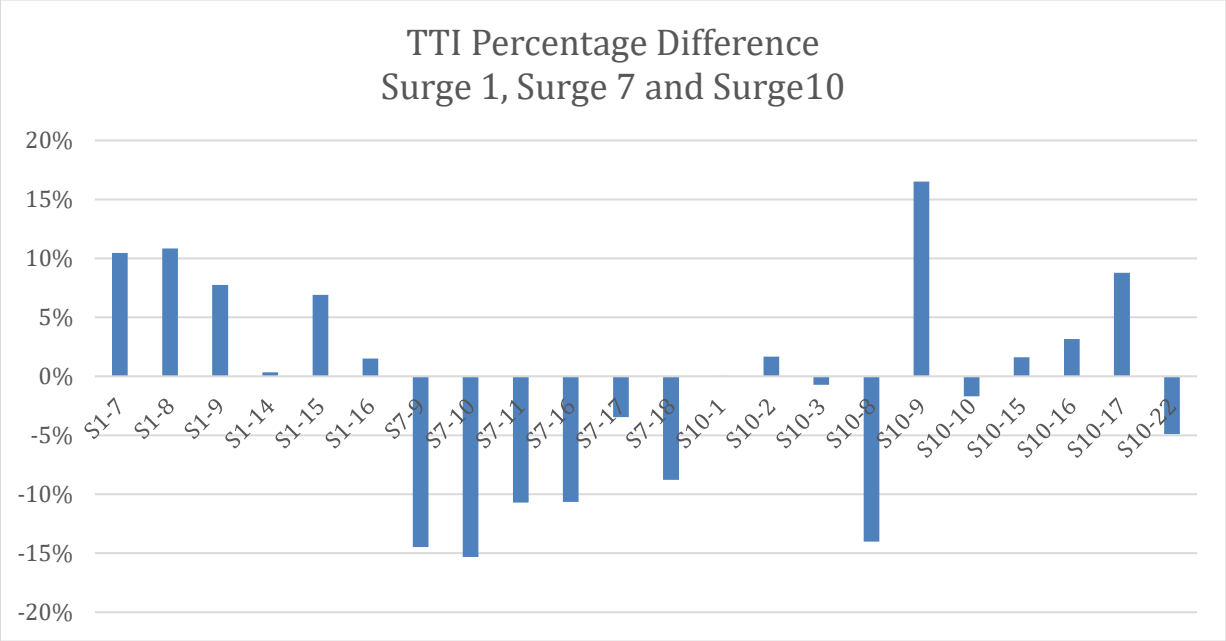


Observations:

- Surge 1 had the highest change in TTI, and over the course of the surge this diminished.
- Overall, at the regional level there were usually minimal traffic impacts, within normal day-to-day variation. If there were any impacts, they occurred during the AM peak period.

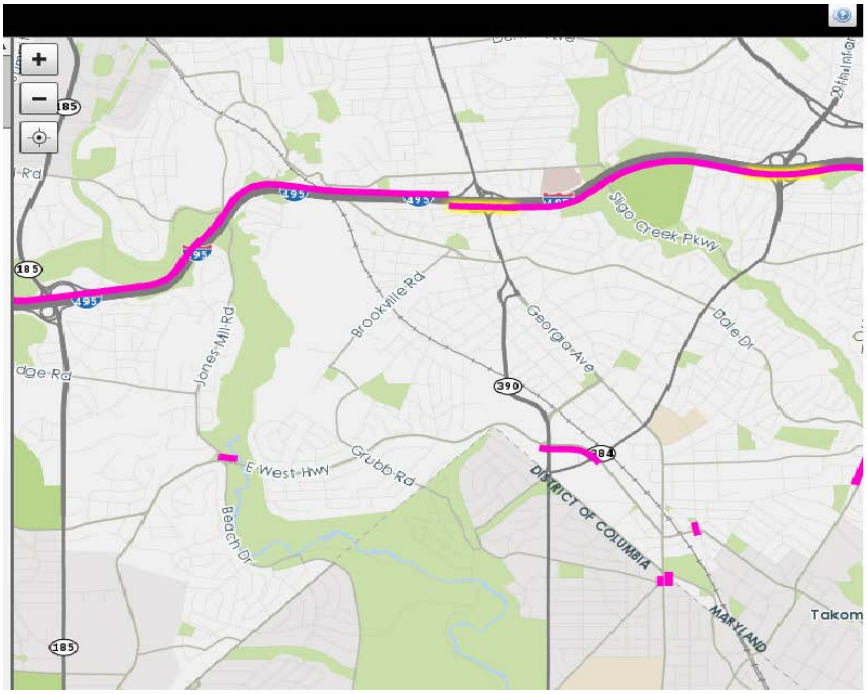
Chart 2 shows the TTI for the AM peak period of every Tuesday, Wednesday, and Thursday during three surges (e.g., S1-7 is surge 1, day of the month 1). It can be observed Surge 1 had some definite traffic impacts four out of six days. There was hardly any traffic impact during Surge 7 in August, with a negative TTI ratio every day. Data during Surge 10 in November, however, had highly variable TTI ratios.

Chart 2 – Changes in TTI Tuesday – Thursday for Surge 1, 7, and 10 (by Surge, Day of the Month)



Since data is available at the TMC level, staff did a TTI comparison at the TMC level similar to the regional analysis to gauge the local impacts of the surges. The TMC links which had an increase of 100% or more - that is a doubling of travel times compared to the base day in May 2016 - are shown in Figure 1 on roads in the immediate vicinity of the surge impacted stations during Surge 6 on the Metrorail Red Line near Silver Spring.

Figure 1 – Roadway Sections (TMCs) with a Doubling of TTI for Surge 6

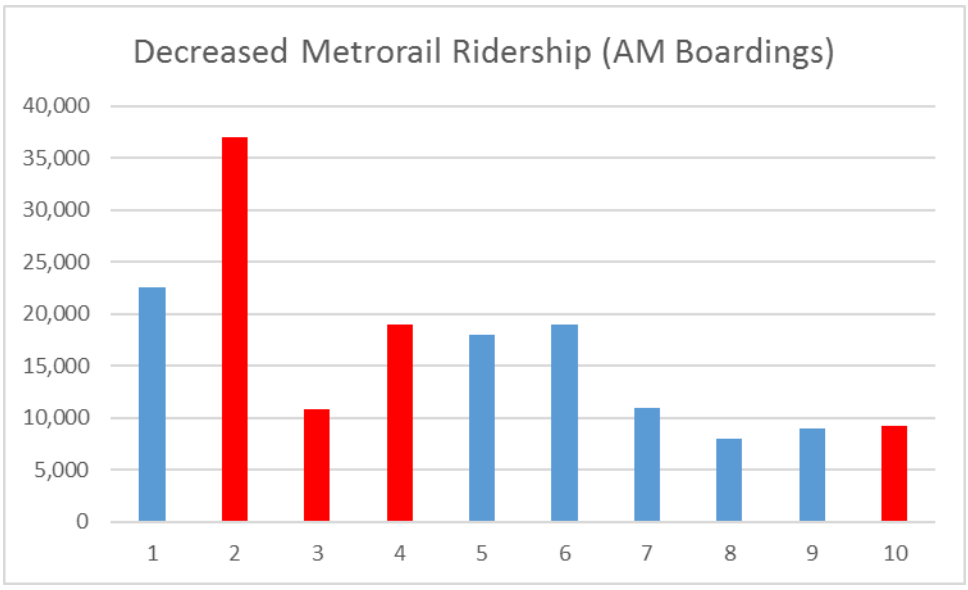


Surge 6 TMC's with
TTI > 2
compared to May

TRANSIT USAGE

TPB staff collected ridership data from WMATA and other transit agencies in an effort to quantify the use of Metrorail, Metrobus, and local transit services during each Surge. Metrorail data was obtained in the form of reduced AM boardings at transit stations proximate to the surge work area, shown in Chart 3.

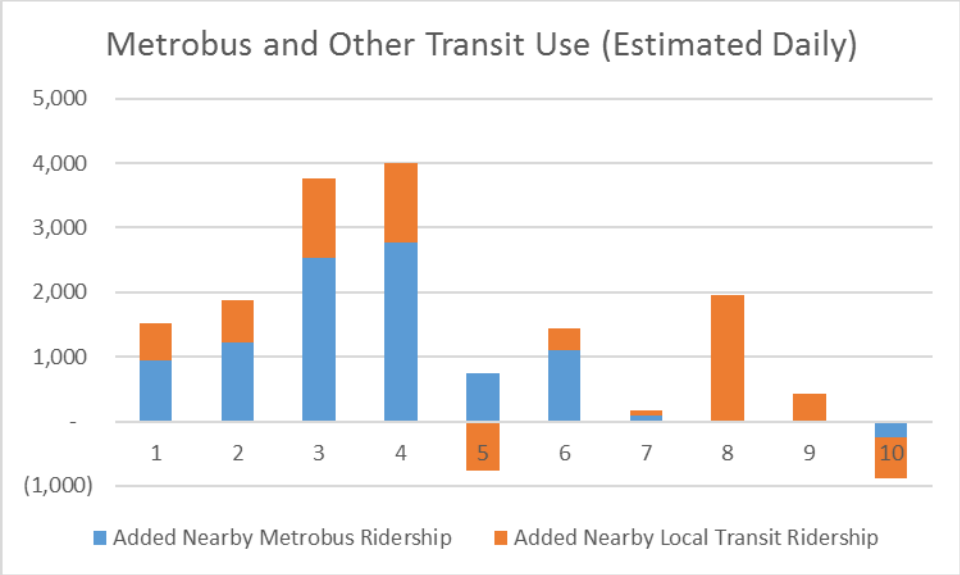
Chart 3. Reduced Metrorail Ridership, by Surge, Weekday Average



Red = rail line segment shut
Blue = single-tracking

Data on transit alternatives to Metrorail was collected for Metrobus and local transit services. Metrobus data was obtained for changes in daily ridership on bus routes proximate to each surge work area. An assumption was made that reduced changes in AM boardings was equivalent to numbers of people traveling (or making other choices) per day, and that to normalize Metrobus ridership it should be divided in half. Local transit ridership for surges in their area of operations was provided by the City of Alexandria (DASH), District of Columbia (Circulator and Streetcar), Fairfax County (Connector), Montgomery County (RideOn), Prince George's County (TheBus) and Virginia Railway Express. Local bus and commuter rail ridership was typically provided for AM boardings. The results are displayed in Chart 4, which shows that most surges experienced increases in other transit ridership, but with considerable variation across the different surges.

Chart 4. Changes in Metrobus and Other Transit Use, by Surge, Weekday Average



The available data for transit ridership during the surges in tabulated in Table 2. Aside from the Metrorail, Metrobus, and local transit information, the table includes information on how many riders switched modes or trips from Metrorail versus WMATA's forecast for riders that would have service impacted during each surge. Finally, shuttle service was provided during all surges; with extensive service during the surges for which rail segments were shut. Most shuttle users also used Metrorail, with the shuttle bus acting as a supplemental leg to their trip, not a substitute mode. There may have been some travelers that only used the shuttle buses, but this type of data cannot be determined.

Table 2. Transit Ridership Data, by Surge, Weekday Average.

	Surge	Weekday Averages								Single-tracking Shutdowns	
	1	2	3	4	5	6	7	8	9	10	AVERAGE
TRANSIT											
Metrorail Ridership (AM Boardings)	-22,500	-37,000	-10,800	-19,000	-18,000	-19,000	-11,000	-8,000	-9,000	-9,200	-16,350
Added Nearby Metrobus Ridership	1,900	2,454	5,063	5,526	1,508	2,204	166	14	-7	-513	
Divided by 2 for Round Trips	950	1,227	2,532	2,763	754	1,102	83	7	-4	-257	
% Metrorail Switched to Metrobus	4%	3%	23%	15%	4%	6%	1%	0%	0%	-3%	5%
Added Nearby Local Transit Ridership	574	656	1,233	1,233	-767	344	97	1,951	421	-629	
% Metrorail Switched to Local Transit	3%	2%	11%	6%	-4%	2%	1%	24%	5%	-7%	4%
WMATA Estimate of Affected Trips from SafeTrack Plan	73,000	61,000	50,000	86,000	73,000	94,000	32,200	18,000	30,000	108,000	
Didn't Ride Diversion %	-31%	-61%	-22%	-22%	-25%	-20%	-34%	-44%	-30%	-9%	-32%
Shuttle ridership	1,238	18,460	17,871	26,115	1,575	1,734	1,727	2,083	5,612	11,883	
Divided by 2 for Round Trips	619	9,230	8,936	13,058	788	867	864	1,042	2,806	5,942	

Observations:

- Metrorail ridership decreased by an average of 16,350 over the ten surges, varying based on the location of the surge. This represents about 2.6% of daily Metrorail boardings, with most of the rail system continuing to provide standard or moderately reduced service.
- Across the ten surges, an average of 5% of travelers switched to Metrobus routes. WMATA, and some local transit providers, usually added buses to bus routes paralleling or providing an alternative to the affected rail segments, offering more frequent service and more capacity. In the case of Surges 3 and 4, Metrobus ridership was up much more due to the high level of service, both frequency and travel time, offered by the Metroway BRT service operating on the Potomac Yard and Crystal City Transitways.
- Across the ten surges, 4% of travelers switched to local transit, including buses as well as commuter rail. Again for Surges 3 and 4 and also for Surge 8, VRE saw significant increases in ridership.
- Based on ridership data, WMATA had forecast how many riders would be affected by each Surge. Many of these riders continued to use Metrorail and/or the provided shuttle bus service, despite reduced frequencies and/or longer travel times. Overall, an average of 32% of regular Metrorail travelers decided to not make a trip on Metrorail during each surge. (N.B. unweighted average of 26%.)

TRAFFIC COUNTS

TPB staff collected highway traffic count data from the region's permanent count stations to quantify any information on traffic volumes, overall and hourly, on major highways in Surge work zones.

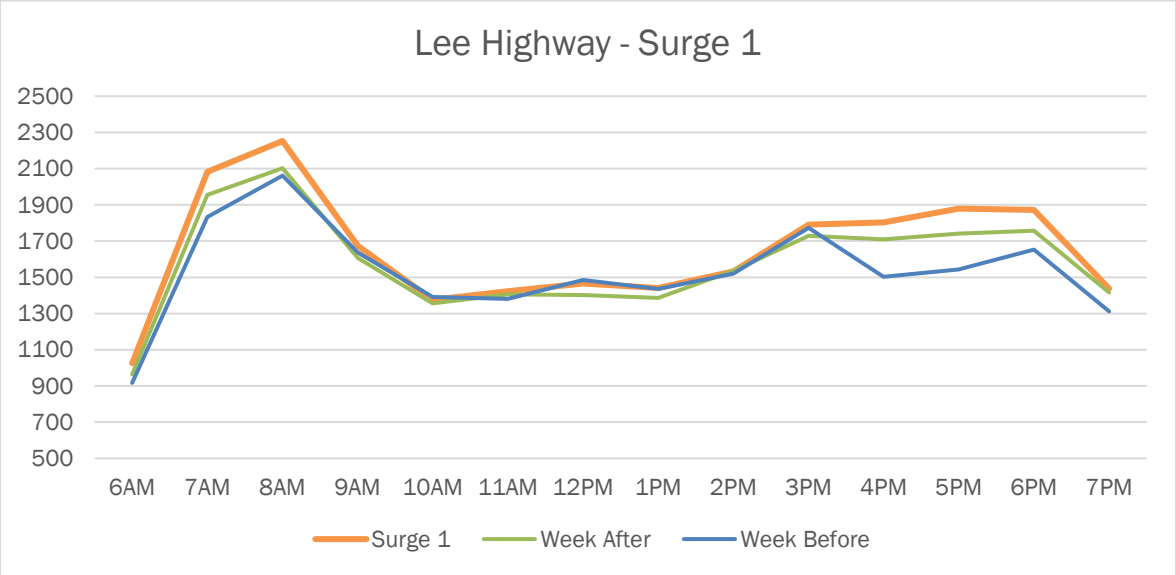
Hourly traffic volumes at each continuous counting station were analyzed for each of the ten surges. The mid-week (Tuesday through Thursday) volumes for each hour were averaged for the duration of each surge. These hourly averages were plotted against the mid-week hourly averages for the week preceding and the week following each surge.

Average mid-week daily totals for each surge were compared to the average of the mid-week daily totals for the week prior to and the week following each surge. In places where permanent traffic

counters were operational in very close proximity to Metrorail segments affected by the surge, traffic was found to increase.

Chart 5 shows the hourly traffic at Lee Highway (US 29) and Washington Boulevard (VA 237) during Surge 1 as compared to the traffic during the week prior to Surge 1 and the week following Surge 1. The traffic at this station increased by 5.5 % over the average of the preceding week and the following week. Traffic at US 29 and VA 237 increased by 2.9% over the surrounding weeks during Surge 5. The station on US 29 is one block away from the East Falls Church Metro station, and the roadway serves the same area as the Orange and Silver Lines between East Falls Church and Ballston.

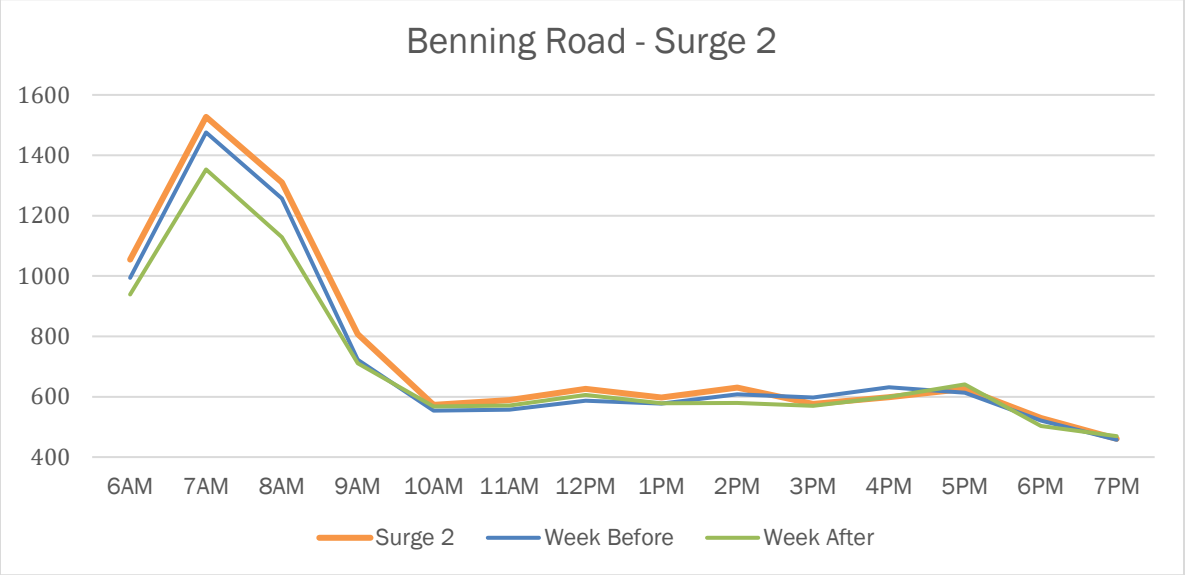
Chart 5 - Hourly traffic at Lee Highway (US 29) and Washington Boulevard (VA 237) during Surge 1



Further along the corridor that the Orange and Silver Lines serve, the traffic on I-66 at Quincy Street in Arlington actually decreased slightly during Surges 1 and 5.

The only other station where continuous counting equipment was operational in close proximity to a surge location was Benning Road at 44th St. NE in the District. This station was operational in the westbound direction during Surge 2 which affected the Blue and Orange Lines between Benning Road and Eastern Market. Vehicular traffic increased during Surge 2 by 5.9% over the average of the preceding week and the following week at this station, as shown in Chart 6.

Chart 6 – Hourly Traffic at Benning Road and 44th St. NE during Surge 2



Observations:

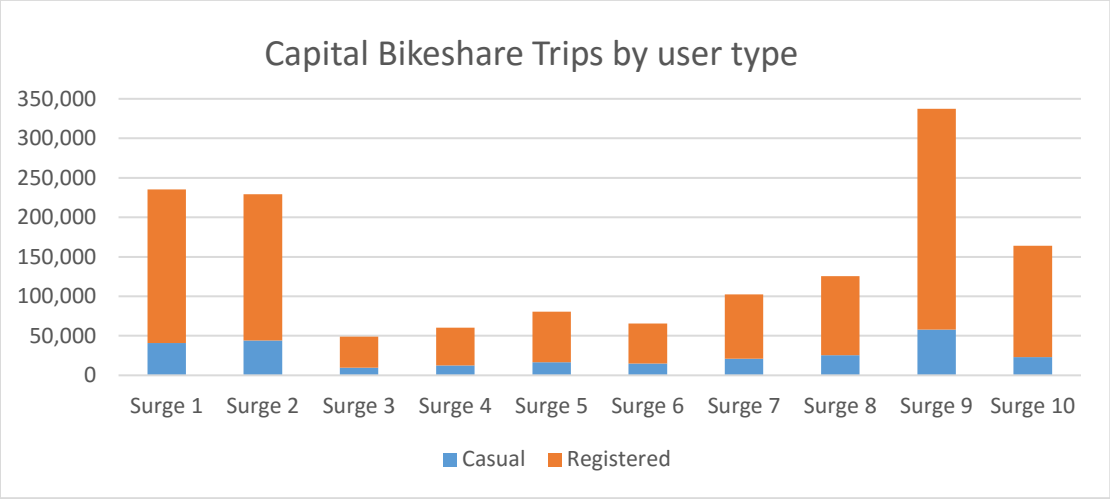
- This analysis showed localized increases in vehicular traffic where counting stations were coincident with the surge locations. There were several variations in volumes at more distant counting stations, but these may be explained by the natural fluctuations in traffic patterns from day to day and during the summer months.

This analysis was limited by the availability of operational permanent counting stations in the corridors were the surges took place. There were very few continuous counting stations that were coincident with the surge locations.

BIKE IMPACTS

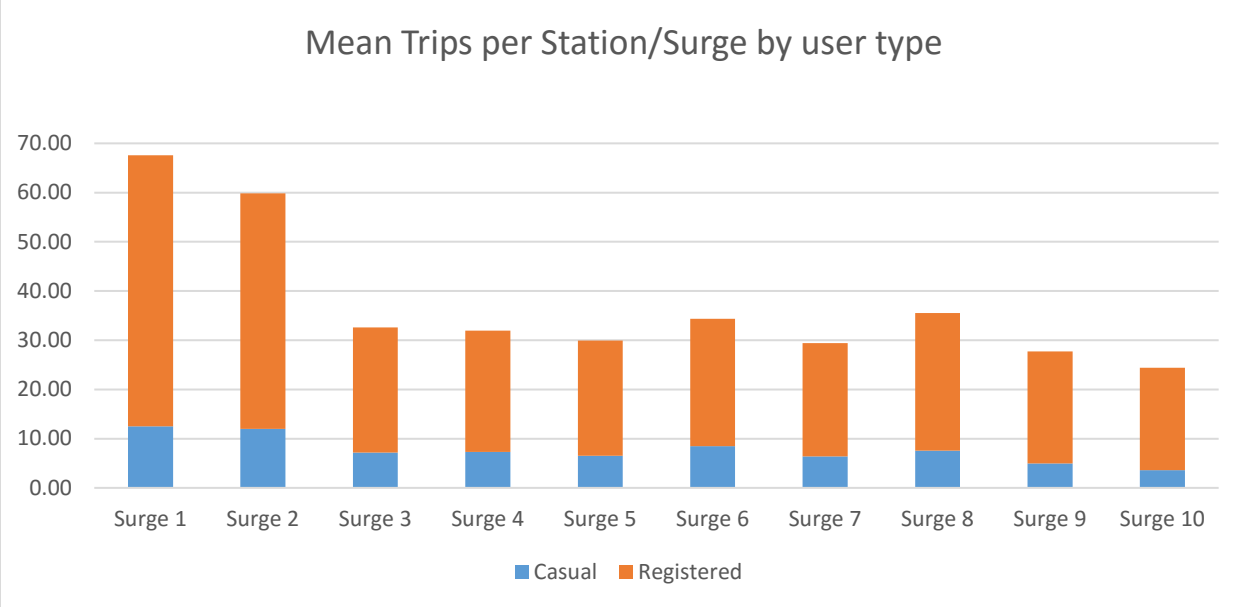
Cyclists in the Washington region took over a million trips (1,449,292) with Capital Bikeshare during Surges 1 through 10. The greatest number of those trips (337,406) occurred during the 29-day long Surge 9 and the fewest (48,947) during the 4-day Surge 3. Most of the trips were taken by registered users of the system (81.6%) versus casual users (18.4%). Chart 7 summarizes Capital Bikeshare Trips by user type.

Chart 7 – Capital Bikeshare Trips by User Type, for the ten Surges



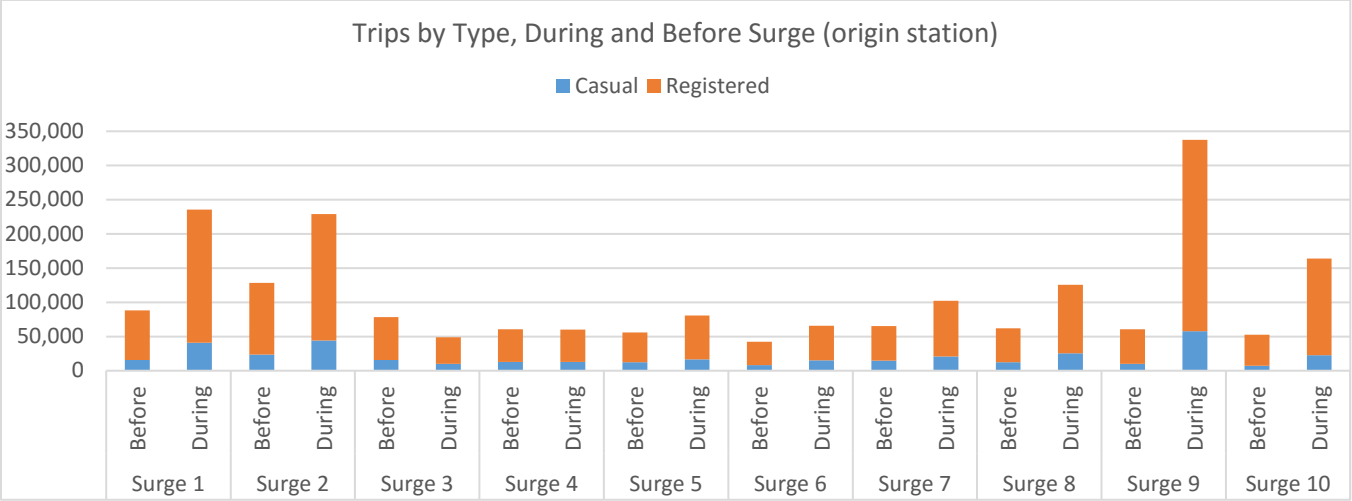
Staff also examined the mean number of Capital Bikeshare trips per station for each surge period. Surge 6 saw the greatest percentage (25.4%) of trips taken by casual users. The greatest percentage of trips taken by registered users (86.2%) occurred during Surge 10. Both of these surges involved Red Line disruptions. Chart 8 shows the mean trips per station and per Surge by user type.

Chart 8 – Capital Bikeshare Mean Trips per Station by User Type



Additionally, staff compared Capital Bikeshare usage for the week period immediately before each surge by type of user. Four surges (1, 4, 5, 7) had a greater percentage of casual users the week before each surge with Surge 7 having the highest percentage (22.8% versus 20.5% during surge). Surge 10 had the lowest percentage of casual users (13.6%) versus during the surge (14%). Chart 9 summarizes trips by type before and during each surge.

Chart 9 - Capital Bikeshare Trips by Type, Week Before Surge vs. During Surge

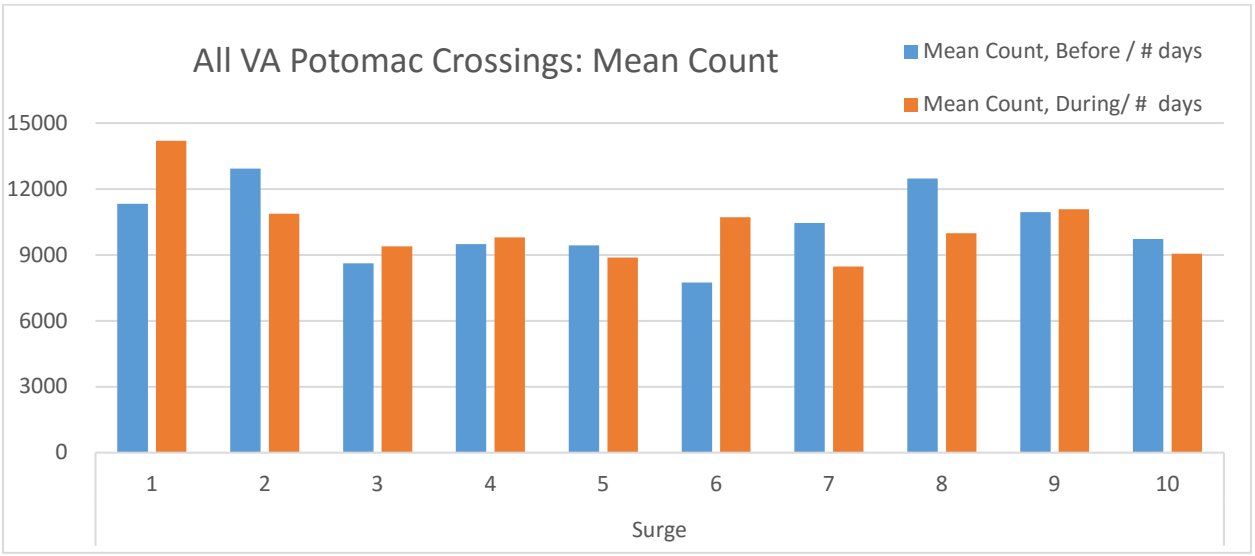


In addition to Capital Bikeshare data, staff also examined data provided by Arlington County for their bike/pedestrian counters at bridges crossing the Potomac River (Key Bridge, Roosevelt Bridge, Memorial Bridge, and the 14th Street Bridge complex). These data were obtained from the Bike Arlington Counter Dashboard (http://www.bikearlington.com/pages/biking-in-arlington/counting-bikes-to-plan-for-bikes/counter-dashboard/) to provide another data point for travel to and from the downtown area.

It should be noted that the Key Bridge West station was not in full operation for Surges 3-7 (no data for Surge 3 and cyclist only for Surges 4-7). For consistency across counter types, all data reported include all counts for all modes (cyclist/pedestrian).

Chart 10 compares mean counts before and during each Surge for the Potomac Bridges, in aggregate.

Chart 10 – Potomac Bridges Mean Daily Bike/Ped Counts, Week Before Surge vs. During Surge

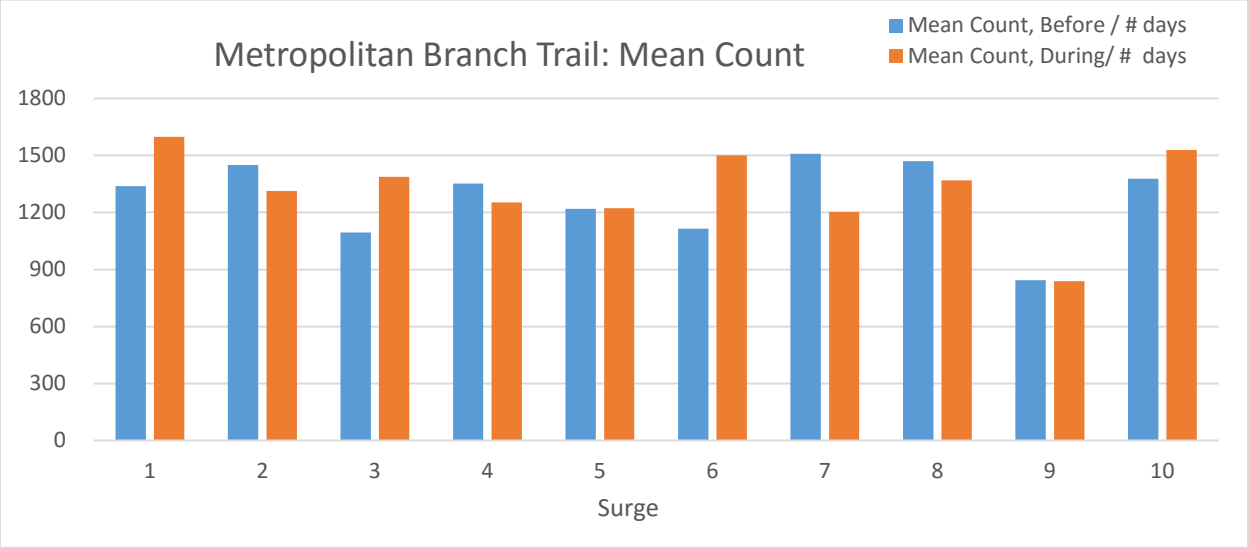


Observations:

- Five surges (1, 3, 4, 6 and 9) had an increase in mean counts compared to the before surge comparison period. Surge 6 showed the greatest increase (27.7%) followed by Surge 1 (20.2%); the other three surges (3,4,9) had more modest gains (8.2%, 3.2% and 1.1% respectively). All of these increases occurred during surges focused in Northern Virginia, with the exception of Surge 6 which occurred in Montgomery County.
- The notable increase during Surge 1 may have been due specifically in reaction to the single-tracking along the Orange/Silver Line. However, it could also be presumed that several commuters reacted to the beginning of SafeTrack by exploring alternative commute options even if the initial surge did not directly impact them.
- The proximity of the Mount Vernon Trail to the Blue/Yellow Line may have provided a convenient alternative for commuters seeking to bypass the line segment shutdowns during Surges 3 and 4.

Chart 11 compares mean counts before and during each surge at the Metropolitan Branch Trail counter, located in the District of Columbia between Rhode Island Avenue NE and Franklin Street NE.

Chart 11 – Metropolitan Branch Trail Bike/Ped Counts, Week Before Surge vs. During Surge



Observations:

- Again, five surges (1, 3, 5, 6, and 10) had increases in mean counts compared to the before surge periods. These increases correlate to the surges closest to the Metropolitan Branch Trail, which runs parallel to the Red Line in Northeast Washington and continues as an interim on-road trail to Silver Spring.
- Surge 6, Red Line single tracking between Takoma and Silver Spring, reported the highest increase (25.7%).
- The Surge 10 Red Line shutdown between Fort Totten and NoMa stations also produced a notable increase (10%).
- Other significant increases included Surge 3 (21.2%) and Surge 1 (16.1%).

- On the whole, over a million counts (1,197,976) were recorded by the six count locations (5 Virginia Potomac River bridge crossings, one District of Columbia) during the 10 surges. Interestingly, this is a comparable number to the total trips taken by Capital Bikeshare users (1,449,292). However, it is not known how many Capital Bikeshare trips may have been captured by these counters

FURTHER RESEARCH

TPB staff were challenged in assembling this multi-modal analysis, the first time some of this information has been assembled to examine a multi-day event. Data collection presented some challenges, as did choosing an appropriate baseline against which to compare the SafeTrack data. Different baselines were appropriate for different modes, but this reduced the accuracy of comparison across modes and types of analysis.

Time and resources permitting, TPB staff will evaluate the potential for further analysis once all sixteen SafeTrack surges are completed in June 2017. Building on this preliminary analysis, a more focused data collection process could take place. In addition, there remain unexplored sources of data, for example Commuter Connections carpool applications and placement rates, which could shed additional light on the choices made by affected travelers. Additional analysis of the impacts by hour of the day or for reverse commuters could also take place. TPB staff look forward to working with regional staff, especially WMATA staff, in considering further research efforts.