



MEMORANDUM

Date: October 12, 2017, updated December 6, 2017
To: Dan Iglhaut
Organization: Northern Virginia Regional Park Authority
From: Christina Fink, P.E.
Emily Koehle, EIT
Sheila Borkar, EIT
Project: W&OD Parallel Trail Shared Use Path LOS Update
Re: Counts and Results Summary

INTRODUCTION

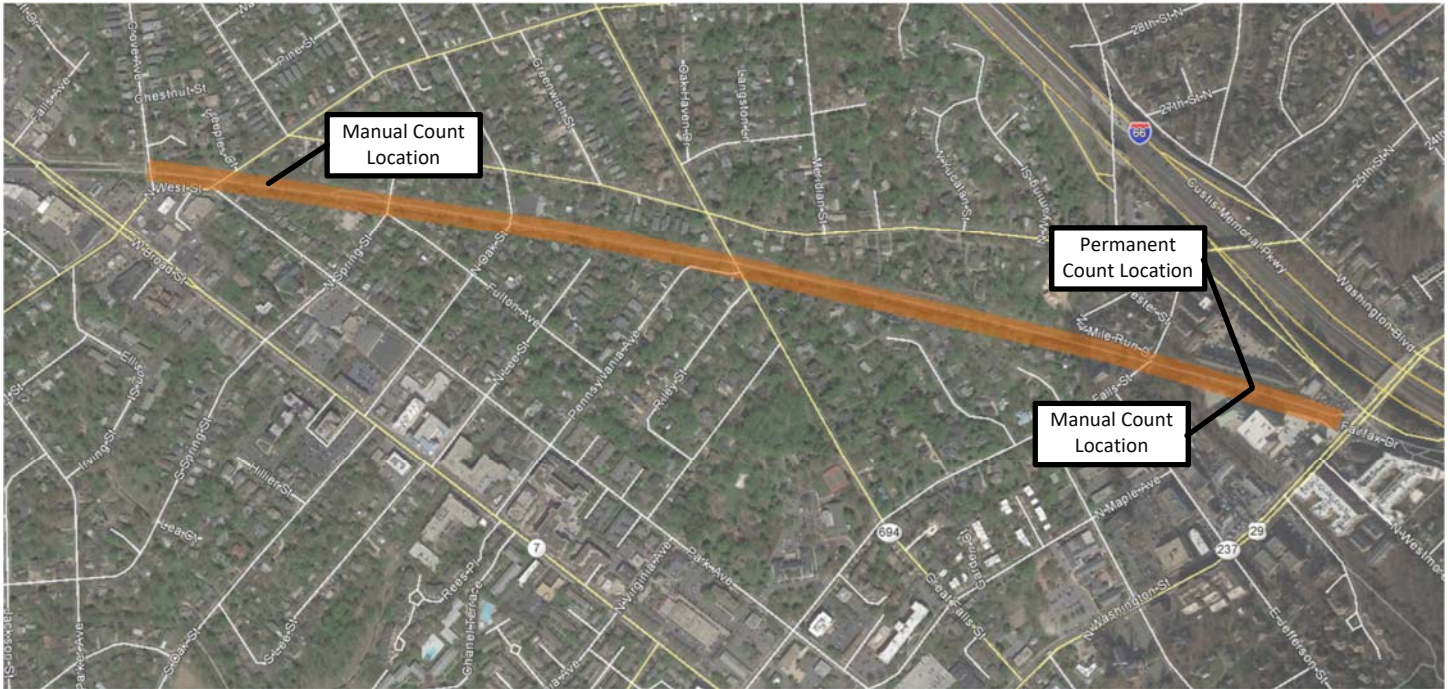
The Northern Virginia Regional Park Authority's (NVRPA) Washington & Old Dominion (W&OD) Trail serves a wide range of users, including bicyclists, walkers, joggers and skaters that use the trail for both transportation and recreational purposes. During times of peak activity, the trail can become busy with various users competing for space. NVRPA is completing applications for funding for the design and construction of a parallel trail (i.e. separate trails for bicycles and pedestrians) to provide improved service and experience for trail users in Falls Church, VA. As a part of the funding applications, NVRPA asked Toole Design Group, (TDG) to perform a Shared Use Path Level of Service (SUP LOS) analysis for the Washington & Old Dominion (W&OD) Trail between the planned VDOT bridge over Lee Highway/Washington Street (Rt. 29) and Grove Avenue. This SUP LOS analysis is an update to the analysis performed by TDG in 2015 which evaluated the SUP LOS along the W&OD Trail at Columbia Pike, Custis Trail, and Lee Highway. The approach and results of the SUP LOS analysis are outlined below.

APPROACH

TDG incorporated two (2) data sources in the SUP LOS analysis to collect pedestrian and bicycle volumes along the W&OD Trail: a permanent counter and manual counts. The permanent counter is located on the W&OD Trail near the Lee Highway/Washington Street crossing and is maintained by Arlington County. The manual counts were collected on the W&OD Trail at two (2) locations: east of Little Falls Street and east of West Street. These count locations are shown on the Study Area in Figure 1.

These counts, along with FHWA's SUP LOS for bicyclists and HCM's SUP LOS for pedestrians were used to determine the SUP LOS for bicyclists and pedestrians.

FIGURE 1: STUDY AREA MAP



DATA COLLECTION & COUNTY SUMMARY

Permanent Counter

The permanent counter was not fully functional at the time of the analysis, but several years of historical count data was available. TDG coordinated with Arlington County's count program and used historical count data to gather information about trends in usage on the trail including month-to-month variation, weekday versus weekend trial use profiles and yearly growth trends. The counts cover the period from December 2010 through June 2017 and separates bikes and pedestrians by direction in 15-minute intervals. The raw data was adjusted to remove errors due to malfunctioning count equipment or unusual activity patterns. Data were eliminated if they were part of a stretch of three (3) or more days of zero (0) counts, or if they were far outside normal ranges. Data was averaged to produce hourly, daily and monthly average usages for weekday and weekend. Figures 1-5 below summarize the data from the continuous counter.

Figures 2 and 3, the Average Trail Usage by Month, show that the busiest months on the trail are May through September on weekdays and April through September on weekends. Figures 1 and 2 also indicate that pedestrian (orange) and bikes (blue) have similar usage in winter months and bikes have much higher usage in summer months. Pedestrians daily use ranges from about 200 users in the winter to about 800 daily users in the summer. Bike daily use ranges from about 200 users in winter to about 1,800 in the summer. This suggests that bike usage is much more sensitive to climate because the usage dropping off significantly in the winter. These figures also show higher weekend usage than weekday usage throughout the year for both modes.

Figure 2: Weekday Average Trail Usage by Month

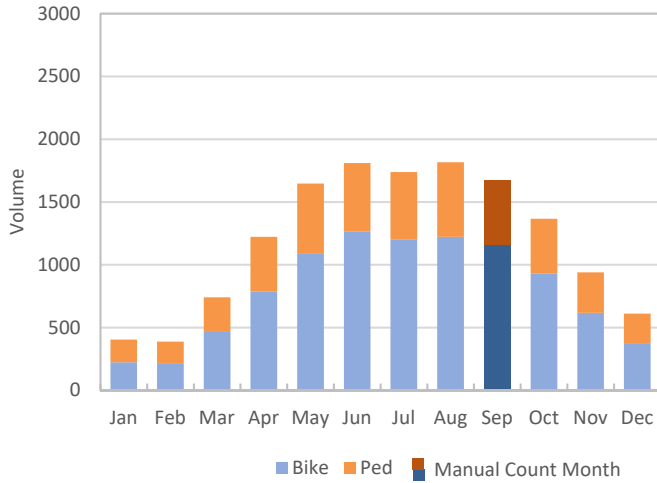
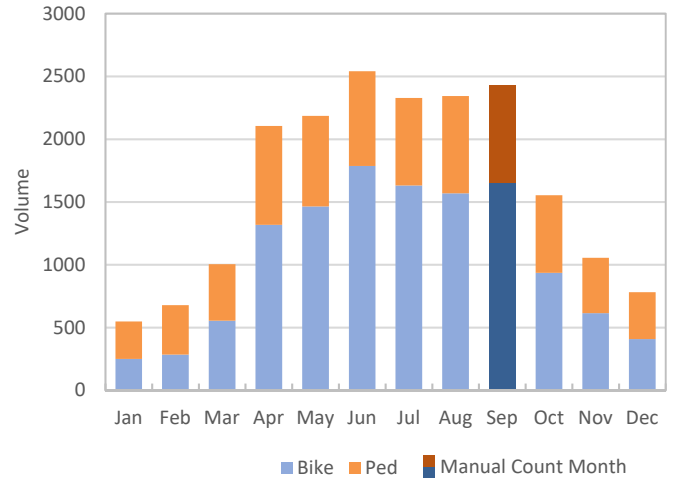


Figure 3: Weekend Average Trail Usage by Month



Figures 4 and 5, the Average Hourly Distribution by Mode, shows strong commute patterns with weekday AM and PM peaking for both pedestrians and bikes while the weekend peak occurs mid-day. The data also showed that the weekend peak shifts later during colder months. As shown in Figure 6, any growth in usage over time is not easily distinguished from general year-to-year fluctuations and there is not an easily discernible pattern of growth in usage.

Figure 4: Weekday Average Hourly Distribution by Mode

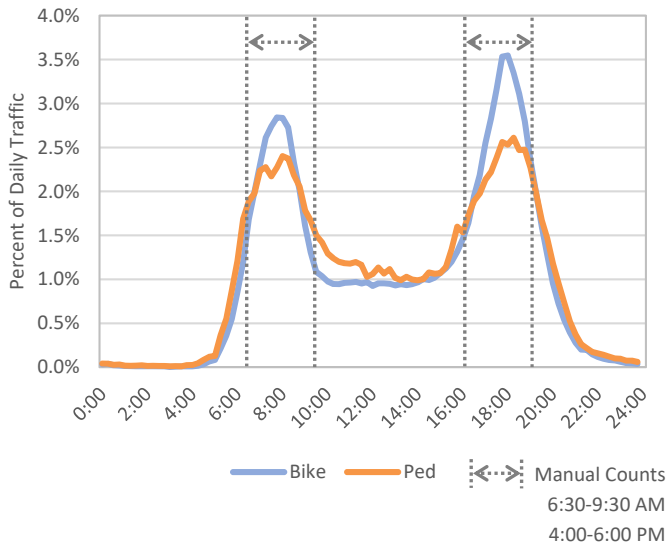


Figure 5: Weekend Average Hourly Distribution by Mode

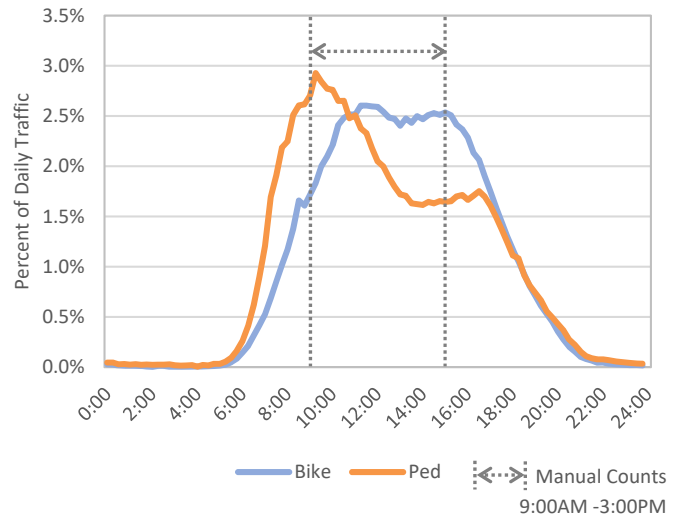
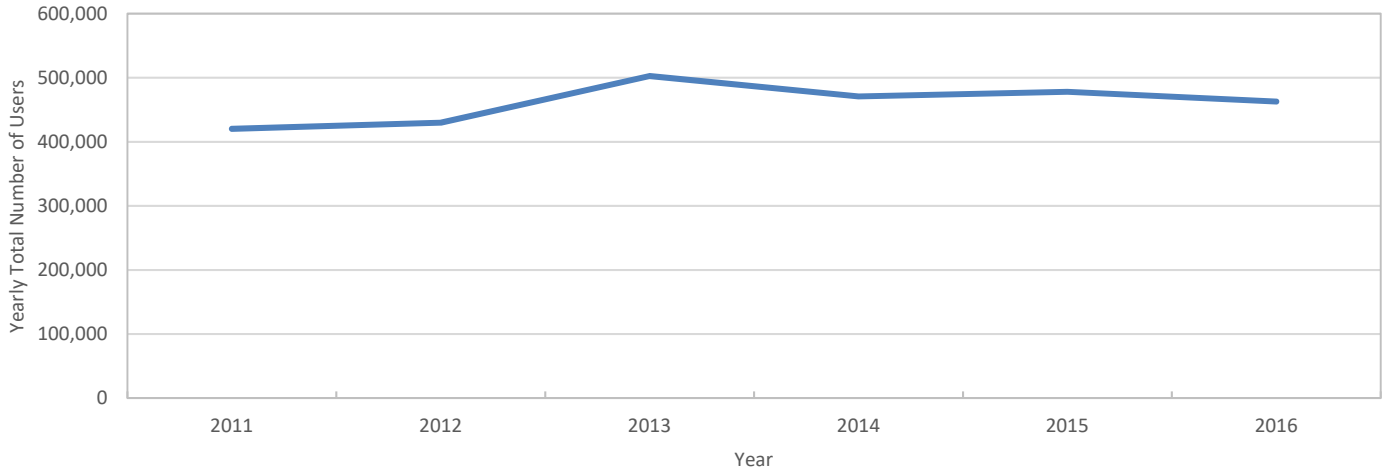


Figure 6: Historical Trail Use



Manual Counts

TDG coordinated with Quality Counts to collect manual bi-directional pedestrian and bicycle counts. The counts were conducted for five (5) weekdays from 6:30AM to 9:30AM and 4:00PM to 7:00PM and two (2) weekend days from 9:00AM to 3:00PM. Table 1 lists the dates that these counts were conducted. The weather on these count days was overcast, partly cloudy, or mostly cloudy. The volumes for Wednesday and Thursday were re-counted from the original week due to rain on the initial count days. The daily results from these counts were reviewed and an average of the Weekday (Monday through Friday), and Weekend (Saturday through Sunday) volumes were used to perform the analysis at the two locations. The peak hours at each location are shown in Table 2.

TABLE 1: BI-DIRECTIONAL PEDESTRIAN AND BICYCLE COUNT DATES

Day of Week	Date
Saturday	September 9, 2017
Sunday	September 10, 2017
Monday	September 11, 2017
Tuesday	September 12, 2017
Wednesday	September 20, 2017
Thursday	September 21, 2017
Friday	September 15, 2017

TABLE 2: PEAK HOURS

	East of West Street	East of Little Falls Street
AM	7:15-8:15 AM	7:15-8:15 AM
PM	6:00-7:00 PM	5:45-6:45 PM
Weekend	10:30-11:30 AM	1:00-2:00 PM

Figures 7-12, Volume Comparison, below summarize the data from the bi-directional pedestrian and bicycle counts. These figures show the hourly volumes for the full data collection periods. Therefore, the actual peak hour may not be represented on these figures.

As shown in these figures, the eastbound direction during the AM (Figures 6 and 7) and the westbound direction during the PM (Figures 8 and 9) are the peak directions of travel, which aligns with commuter trends. During the weekend (Figures 10 and 11), the directional traffic is more balanced. During the weekday counts, the volumes at the two locations are comparable. During the weekend, the trail East of West Street has greater volumes than the trail East of Little Falls Street.

Figure 7: Volume Comparison
AM Peak - East of West Street

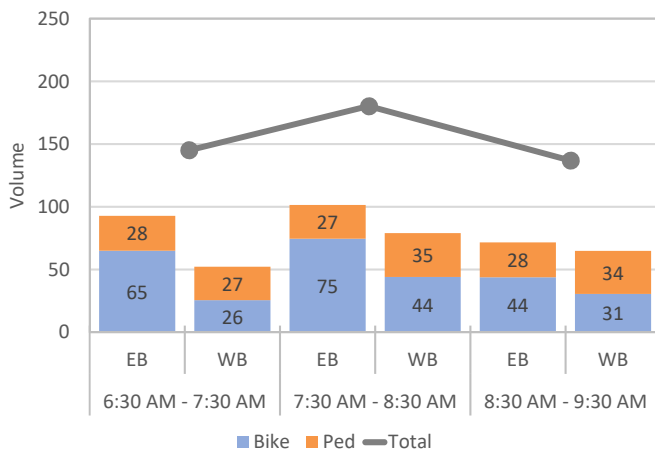


Figure 8: Volume Comparison
AM Peak - East of Little Falls Street

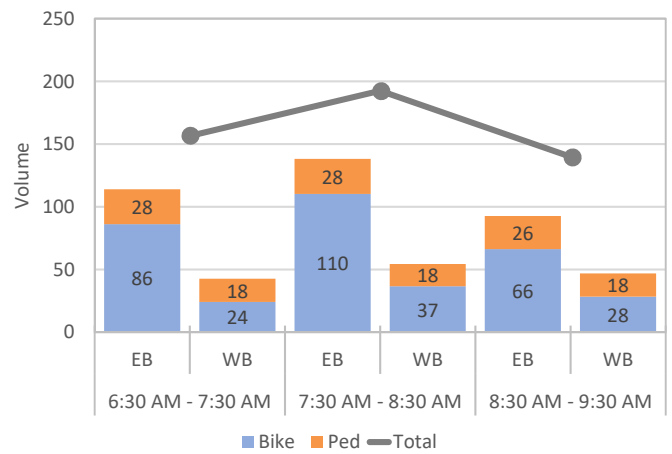


Figure 9: Volume Comparison
PM Peak - East of West Street

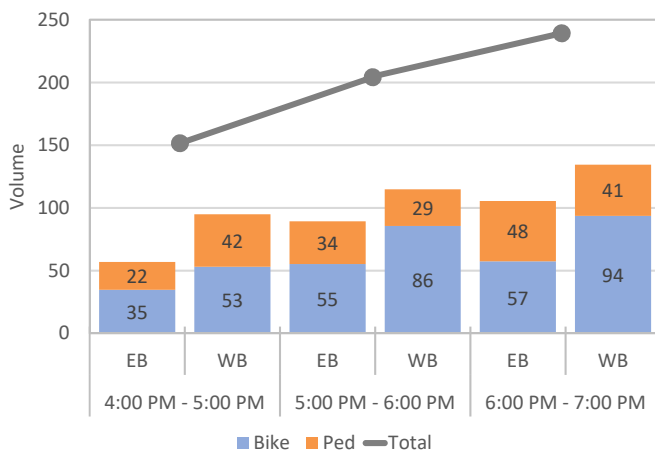


Figure 10: Volume Comparison
PM Peak - East of Little Falls Street

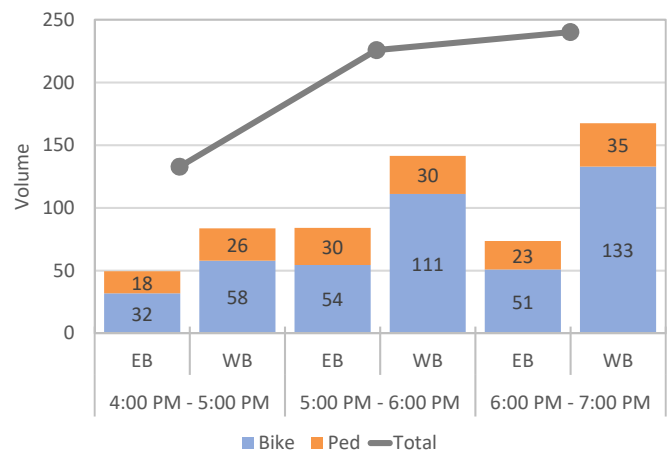


Figure 11: Volume Comparison
Weekend - East of West Street

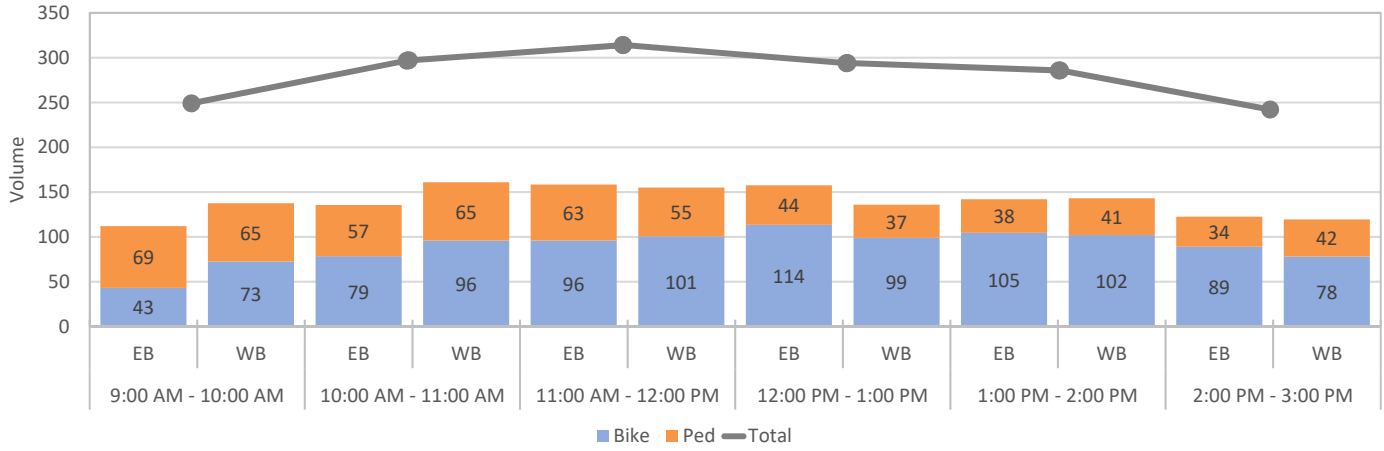
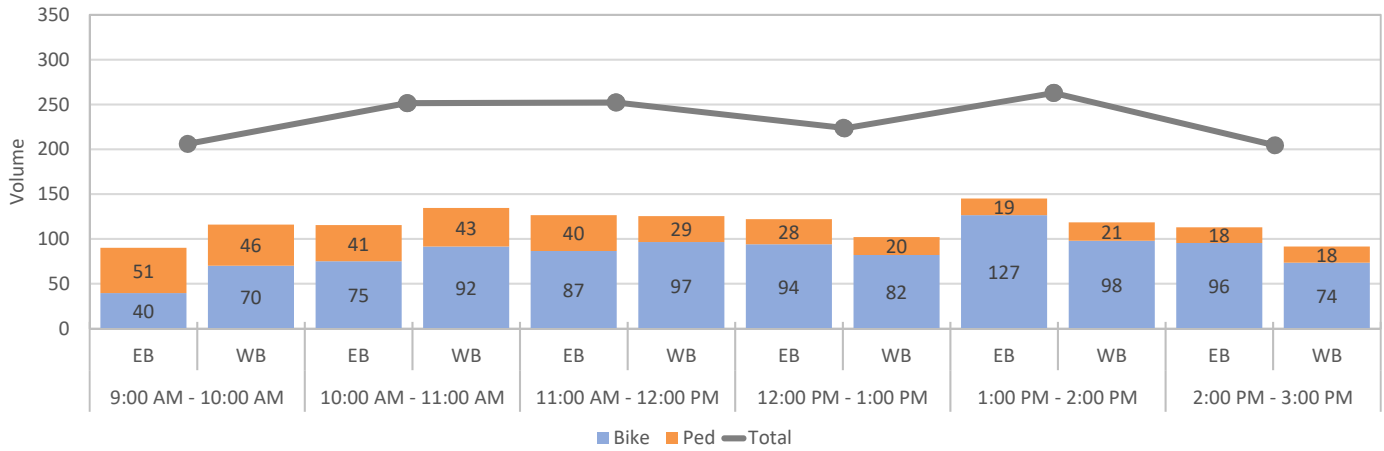


Figure 12: Volume Comparison
Weekend - East of Little Falls Street



Shared-Use Path Level of Service

TDG assessed Level of Service for both bicyclists and pedestrians on the existing 10-foot shared-use path to determine if each mode would benefit from separation of modes on a parallel trail.

FHWA's Shared-Use Path Level of Service (SUP LOS) for Bicycles

The SUP LOS provides a measure of quality of service for bicyclists on paved shared-use paths. Quality of service for bicyclists measures the ability of a bicyclist to maintain an optimum speed with freedom to maneuver around other users (i.e. type of meetings and ability to pass). The SUP LOS is a link-based analysis, meaning that it evaluates a segment of a trail only, not intersections, rest areas or trail heads. The score received is affected by several factors concerning the trail's use, including the mode split, trail width, and presence of a centerline. Generally, a trail used by fewer pedestrians will result in a more desirable LOS score. Using these variables, the method outlined by the FHWA estimates the number of conflicts between users along the trail and uses this number to determine the LOS score. SUP LOS scores range from A to F, with A being the most desirable score and F being the least desirable. LOS A represents optimal conditions for bicyclists with space to move around other modes, at LOS D, a is reaching its functional capacity. Once a trail reaches LOS F, the trail does not effectively serve most bicyclists and that conflicts between trail users should be expected.

Highway Capacity Manuals Shared-Use Path Level of Service (SUP LOS) for Pedestrians

TDG utilized the Highway Capacity Manual's (HCM) Shared-Used Path Level of Service for Pedestrians (found in Chapter 23 of the HCM). This quality of service measure focuses on the frequency that a pedestrian meets or is overtaken by a bicyclist. The methodology does not take into account pedestrian volume, trail width or interactions between pedestrians. For SUP LOS for pedestrians, LOS A represents optimum conditions where conflicts with bicycles are rare, at LOS D there are frequent conflicts with bicyclist and at LOS F there are significant conflicts with a diminished experience for pedestrians.

Results

TDG completed a SUP LOS analysis for the weekday AM, weekday PM peak hour and weekend peak hours based on directional average volumes at both count locations Table 3 shows the resulting SUP LOS for bicyclists and pedestrians.

TABLE 3: SUP LOS

		East of West Street		East of Little Falls Street	
		Eastbound	Westbound	Eastbound	Westbound
Weekday AM	Total Volume	105	79	149	56
	% Ped	23%	45%	20%	32%
	% Bike	77%	55%	80%	68%
	SUP LOS (Bicycle)¹	D	D	D	C
	SUP LOS (Pedestrian)²	C	C	D	D
Weekday PM	Total Volume	105	134	81	174
	% Ped	46%	30%	31%	20%
	% Bike	54%	70%	69%	80%
	SUP LOS (Bicycle)¹	D	D	C	D
	SUP LOS (Pedestrian)²	D	D	D	E
Weekend	Total Volume	155	172	145	119
	% Ped	39%	40%	13%	17%
	% Bike	61%	60%	87%	83%
	SUP LOS (Bicycle)¹	F	F	C	C
	SUP LOS (Pedestrian)²	E	E	F	F

1- Based on FHWA SUP LOS for bicycles

2- Based on HCM SUP LOS for pedestrians

TDG recommends that NVRPA strive to achieve a LOS C for bicyclists on the W&OD trail. Once a trail reaches LOS D, users experience poor trail conditions and frequent conflicts with other trail users. At LOS E, the trail has reached its functional capacity and has steady occurrence of conflicts. LOS F signifies a diminished user experience and a significant number of conflicts. Based on the results shown in Table 3, during the AM, PM, and weekend peak hours, many trail users experience worse than LOS C, highlighted in yellow, orange and red.

Table 3 shows that at each location and during each peak at least one mode in each direction experience LOS D or worse. Both bicyclists and pedestrian experience worse LOS on the weekend compared to the weekday due to due higher overall trail use. Level of Service for bicyclists near West Street is worse than for bicyclist near Little Falls Street due to the higher proportion of pedestrians near West Street. Level of service for pedestrians is worse for pedestrians near Little Falls Street due to higher proportion of bicyclists near Little Falls Street.

Forecasted Shared-Use Path Level of Service

The purpose of the Forecasted Shared-Use Path Level of Service analysis is to determine the future capacity of the trail by answering two questions:

- 1) For the current trail, what increase in trail user volumes (pedestrians and bicyclists) would result in each location degrading below the recommended quality of service (LOS C) during all hours studied? TDG applied the same SUP LOS methodologies in a sensitivity analysis to determine the increase in total trail volume that would result in a pedestrian or bicycle level of service D for each direction and analysis hour at both West Street and Little Falls Street that aren't already experiencing LOS D or worse. The increases were calculated separately for each mode and trail direction as a percentage of the current volumes, and the same modal and directional splits for each location and peak hour were held constant.
- 2) For the planned parallel trail, how many bicyclists can be accommodated before degrading below the recommended quality of service (LOS C)? This was evaluated using the SUP LOS calculator for bicycles on the planned 11-foot bike-only section of the parallel trail. There are limitations to the tools for evaluating quality of service for a pedestrian only trail, so the pedestrian-only portion of the trail was not used in this analysis.

Results

Question 1:

The increases in volume required to result in LOS D conditions, shown as a percentage increase of 2017 volume, are presented in Table 4. As mentioned previously, TDG recommends NVRPA strive to achieve LOS C for bicyclists on the W&OD Trail with future improvements. Therefore, LOS D represent conditions worse than the recommended quality of service on the trail. Many of the hours and directions evaluated are already operating worse than LOS C, the % volume at LOS D is not applicable.

TABLE 4: FORECASTED INCREASES IN VOLUME AT LOS D OR E

			East of West Street		East of Little Falls Street	
			Eastbound	Westbound	Eastbound	Westbound
Weekday AM	SUP LOS (Bicycle)¹	Current LOS	D	D	D	C
		% Volume at LOS D	N/A*	N/A*	N/A*	142%
	SUP LOS (Pedestrian)²	Current LOS	C	C	D	D
		% Volume at LOS D	107%	110%	N/A*	N/A*
Weekday PM	SUP LOS (Bicycle)¹	Current LOS	D	D	C	D
		% Volume at LOS D	N/A*	N/A*	104%	N/A*
	SUP LOS (Pedestrian)²	Current LOS	D	D	D	E
		% Volume at LOS D	N/A*	N/A*	N/A*	N/A*
Weekend Midday	SUP LOS (Bicycle)¹	Current LOS	F	F	C	C
		% Volume at LOS D	N/A*	N/A*	104%	107%
	SUP LOS (Pedestrian)²	Current LOS	E	E	F	F
		% Volume at LOS D	N/A*	N/A*	N/A*	N/A*

1- Based on FHWA SUP LOS for bicycles

2- Based on HCM SUP LOS for pedestrians

*- Approach at LOS D or worse with current volumes

Table 4 shows that near West Street, bicyclist LOS is D or worse in both directions during each peak hour, indicating that the trail is already operating below the recommended quality of service for bicyclists. Near Little Falls Street, bicyclists are operating at LOS C during several of the hours studied. An increase of 42% would degrade the westbound direction during the Weekday AM peak; a moderate increase of 4-7% would degrade LOS D in the Weekday PM peak (eastbound only) and Weekend Midday (both directions).

At each location, pedestrian conditions operate at LOS D or worse with existing volumes during most of the hours studied. Pedestrians near West Street in the Weekday AM are the only pedestrians experiencing LOS C. An increase in approximately 10% of volumes would result in a LOS D.

Trail use has generally been steady between 2011 and 2016 and no consistent growth rate has been observed. Therefore, TDG did not forecast the number of years before the studied segments of the W&OD Trail would reach the percentage increases presented in Table 4. For reference, both Arlington County and Fairfax County have been experiencing population growth around 0.5% to 1% growth per year. Additionally, throughout the country, in locations where high-quality bicycle facilities are constructed, communities are seeing significant increase in bicycle volumes. It is likely that once the W&OD Trail is improved to provide separate pedestrian and bicycle trails, it would also attract additional users.

Question 2:

Once separate pedestrian and bicycle trails are provided, the SUP LOS for bicyclist is based only on bicycle volume and width of the trail so the capacity of the trail is the same at both locations. Approximately 822 bicyclists can be accommodated at LOS C in each direction at both location. This represents a significant increase (e.g. as much as 600 bicycles additional per hour) in bicyclist volumes during all peak hours. It should be noted that the SUP LOS tool evaluates segment of the trail, not intersections, so this value is a measure of the quality of service in between intersections.

Conclusions

There is a high volume of trail users on the W&OD Trail in Falls Church, creating congested conditions where trail users experience frequent conflicts with other trails users both on weekdays and weekends. TDG used FHWA's Shared-Use Path Level of Service (SUP LOS) for Bicyclists and HCM's SUP LOS for pedestrians to evaluate conditions for both modes along the existing 10-foot trail and assess the need for a parallel trail. TDG recommends that NVRPA strives to achieve LOS C for trail users along the W&OD trail. At both locations studied, trail users experience LOS D or worse for least one mode for all the peak hours studied. These results indicate that both pedestrian and bicyclists would benefit from a parallel trail with separate trails for pedestrian and bicyclists. Additionally, forecasted LOS analysis reveals that only a moderate increase in volume will degrade the quality of service below LOS C for both pedestrians and bicyclists all times of day, directions, and locations studied. Once a separate, 11-foot bicycle-only trail is provided, the capacity of the trail for bicyclists increases by a factor of at least 4.5. Although the increase in capacity for pedestrians on a parallel, 8-foot pedestrian-only trail could not be quantified, the construction of a parallel trail will improve pedestrian conditions, which already operate below the recommended level of service.

SUP LOS was calculated for one hour during morning commuter peak, afternoon/evening commuter peak and weekend recreational peak during September. A similar level of volume extends outside these peak hours which indicates that the trail is congested during several hours of both weekday and weekend days. On weekdays, trail use follows a commuter traffic pattern with an increase in volumes in the morning and the afternoon/evening that lasts two (2) to three (3) hours. On weekends, trail use is more recreational with a longer peak period from mid-morning through early afternoon that last approximately six (6) hours. Historical data shows that the September volumes analyzed are typical of the busy months of the trail (April through September) which indicates that the trail is congested during these peak periods for at least half of the year.