



MEMORANDUM

TO: TPB Travel Forecasting Subcommittee
FROM: Yu Gao, Transportation Engineer
SUBJECT: Findings of Arlington County Bike and Pedestrian Continuous Count Data by Trail Types in 2021 and 2022
DATE: Jan 10, 2023

PURPOSE

This memo documents the findings from an analysis of Arlington County Bike and Pedestrian continuous count data in 2021 and 2022 for two different types of trails: trails primarily serving during peak period and the trails primarily serving during off-peak period. The findings reveal how the usage of trails changed after the first year of COVID (2020). The findings can also be used to supplement the previous study of 2020 trail usage¹ and the existing COVID-19 Travel Monitoring Snapshot.

BACKGROUND

Arlington has a robust system of continuous bicycle and pedestrian counting equipment. As of December 2020, there were 39 automatic bicycle and pedestrian counting stations available in Arlington County. The installation of this equipment dates back to 2009; some of the equipment was installed more recently. The data quality and data availability was imperfect for most stations and required cleansing before use.

In 2021, COG staff reviewed and assessed the historical data as well as the 2020 data for all Arlington County Bike and Pedestrian counting stations and developed a memo to document the assessment of the quality of data². Based on the assessment, it was found that the raw data from all the stations need to be cleansed for future data applications. During the data assessment, it was also observed that the trails primarily serving during peak period and the trails primarily serving during off-peak period were showing different usage patterns before and during COVID. According to the 2017/2018 Regional Travel Survey, across all travel modes, the most common purpose for trips during peak period (5:30 – 9:30 am and 3:00 – 7:00 pm on weekdays) includes work, shop/meal, and drop off/pick up. While, for off-peak period, the most common purpose for trips included shop/meal, work, personal business, and social/recreation.

In early 2022, COG staff conducted an analysis comparing the pre-pandemic historical data and 2020 data for trails primarily serving during peak period and the trails primarily serving during off-peak period. A memo was then developed to document the findings. In November 2022, after reviewing the 2021 and 2022 data, COG staff decided to conduct a similar analysis for this time period. This analysis includes data reported through October of 2022.

For most of the stations before 2020, the hourly data was only available during 2011-2016; therefore, the pre-pandemic historical hourly volume is based on the 2011-2016 average hourly data from all available stations. Additionally, the historical daily volume was based on the 2011-2019 average daily data from all available stations. The post-2020 daily and hourly volume is defined as the 2021-2022 average data from all available stations.

¹. Yu Gao. "Findings of Arlington County Bike and Pedestrian Counters Data by Trail Types in 2020." Memorandum, September 06, 2022.

². Yu Gao. "Arlington County Bike and Pedestrian Data Assessment." Memorandum, August 11, 2021.

PROCEDURE

Data Preparation

Similar to the analysis of 2020 data, the raw 2021 and 2022 data was thoroughly cleansed with the following steps:

- The reporting period sufficiency was firstly checked. If any hour did not have 4 15-minute records or any day did not have 24-hour records, it indicates insufficient data for that day and the data were excluded.
- The monthly volume of each station was summarized and compared with the baseline counts or the historical counts. If the monthly volume was substantially different from the historical volume for the same month of year, it indicates questionable data quality for that month. The questionable data was reviewed and excluded if it appeared to be bad.
- The monthly volume for a particular month of the year was also compared with the other monthly volumes in the same year. If any monthly volume was inconsistent throughout the year, then it is an indicator of questionable data. The questionable data was reviewed and excluded after confirming the data was bad.
- The daily volume was summarized. If the entire day's volume is zero, then it indicates the counter was not working properly and the data was excluded.
- The daily volume was also compared with the average day of week (DOW) volume of the same month of year. If any daily volume was 50 percent higher or 50 percent lower than the average DOW volume of the same month, then it is an indicator of questionable data. The outliers were reviewed and excluded after confirming that the data was bad.
- The daily volume was then compared with the Annual Average Daily Volume (AADT). If the daily volume was 10 times higher or 20 times lower than AADT, then it is an indicator of questionable data. The outliers were reviewed and excluded after confirming that the data was bad.
- The volume recorded during each hour was compared with the average hourly volume of the station, if a volume 30 times higher than the average hourly volume for an hour was recorded, then the volume was flagged as questionable. The outliers were reviewed and excluded after confirming that the data was bad.

Data analysis

In the analysis of 2020 data, the trail type for each station was determined based on the key factors including weekday and weekend volume comparisons, and time of day volume distributions (see Table 1). Out of all Arlington County automatic bicycle and pedestrian counting stations, 20 stations primarily serve during peak period (Peak Trail), and 13 stations primarily serve during off-peak period (Off-peak Trail). The stations using Mobile PyroBox were not assigned trail types due to the possibility that they were deployed in multiple locations. Figure 1 and Figure 2 show respectively the stations primarily serving during peak period and the stations primarily serving during off-peak period.

2020-2022 Availability	Counting Station	Data Type	Peak or Off-peak Trail	Pre-pandemic Volume Weekday vs Weekend
	Location 1 – Custis Rosslyn	Bike/Ped	Peak Trail	Weekday Higher
	Location 2 – Four Mile Run (FMR) Pyro 04	Total	Off-peak Trail	Weekend Higher
	Location 3 – Four Mile Run (FMR) Piezo	Total	Off-peak Trail	Weekend Higher
	Location 5 – Washington and Old Dominion (W&OD) East Falls Church	Bike/Ped	Off-peak Trail	Weekend Higher
	Location 6 – Custis Bon Air	Bike/Ped	Peak Trail	Similar
Yes	Location 7 – Washington and Old Dominion (W&OD) Bon Air East	Bike/Ped	Off-peak Trail	Weekend much Higher
	Location 8 – Key Bridge West	Bike/Ped	Peak Trail	Similar
	Location 9 – Key Bridge East	Bike/Ped	Peak Trail	Similar
	Location 10 – Mount Vernon Trail (MVT) Airport South	Bike/Ped	Off-peak Trail	Weekend Higher
	Location 11 – Crystal City Connector	Bike/Ped	Peak Trail	Similar
	Location 12 – Theodore Roosevelt (TR) Island Bridge	Bike/Ped	Off-peak Trail	Weekend Higher
	Location 13 – Eads SB	Total	Peak Trail	Weekday is a little higher
	Location 14 – Washington and Old Dominion (W&OD) Columbia Pike	Bike/Ped	Off-peak Trail	Weekend Higher
Yes	Location 15 – Fairfax WB Bike Lane	Total	Peak Trail	Weekday Higher
Yes	Location 16 – Fairfax EB Bike Lane	Total	Peak Trail	Weekday Higher
	Location 17 – Quincy SB Bike Lane	Total	Peak Trail	Weekday Higher
Yes	Location 18 – Quincy NB Bike Lane	Total	Peak Trail	Similar
Yes	Location 19 – Eads NB	Total	Peak Trail	Weekday is a little higher
Yes	Location 20 – Crystal NB Bike Lane	Total	Peak Trail	Weekday Higher
	Location 21 – Wilson WB Bike Lane	Total	Peak Trail	Weekday is a little higher
	Location 22 – Clarendon EB Bike Lane	Total	Peak Trail	Similar
	Location 23 – Military SB Bike Lane	Total	Off-peak Trail	Weekend Higher
Yes	Location 24 – Military NB Bike Lane	Total	Off-peak Trail	Weekend Higher
	Location 25 – Bluemont Connector	Bike/Ped	Peak Trail	Weekday a little Higher
	Location 26 – Ballston Connector	Bike/Ped	Peak Trail	Weekday Higher
Yes	Location 27 – Washington and Old Dominion (W&OD) Bon Air West	Bike/Ped	Off-peak Trail	Weekend Higher
	Location 28 – Joyce SB	Bike/Ped	Off-peak Trail	Weekend Higher
	Location 29 – Joyce NB	Bike/Ped	Off-peak Trail	Weekend Higher
	Location 30 – Mobile PyroBox 07 (Possible multiple locations)	Total	Mobile PyroBox	Weekend Higher
	Location 31 – Bikeometer	Total	Peak Trail	Weekday Higher
	Location 32 – Mobile PyroBox 08 (Possible multiple locations)	Total	Mobile PyroBox	Weekend Higher
	Location 33 – Mobile PyroBox 09 (Possible multiple locations)	Total	Mobile PyroBox	Weekend Higher
	Location 34 – Mobile PyroBox 10	Total	Mobile PyroBox	Weekday Higher
	Location 35 – 14th St Bridge	Bike/Ped	Peak Trail	Weekday Higher
	Location 36 – Roosevelt Bridge	Bike/Ped	Peak Trail	Weekday Higher
	Location 37 – 110 Trail	Bike/Ped	Peak Trail	Similar
	Location 38 – Arlington Mill	Bike/Ped	Off-peak Trail	Weekend Higher

Table 1. Trail Type

- Counters**
- 110 Trail
 - 14th Street Bridge
 - Ballston Connector
 - Bluemont Connector
 - CC Connector
 - Clarendon EB bike lane
 - Crystal NB bike lane
 - Custis Bon Air Park
 - Custis Rosslyn
 - Eads NB
 - Eads SB
 - Fairfax EB bike lane
 - Fairfax WB
 - Key Bridge East
 - Key Bridge West
 - Quincy NB bike lane
 - Quincy SB bike lane
 - Roosevelt Bridge
 - Rosslyn Bikeometer
 - Wilson WB bike lane

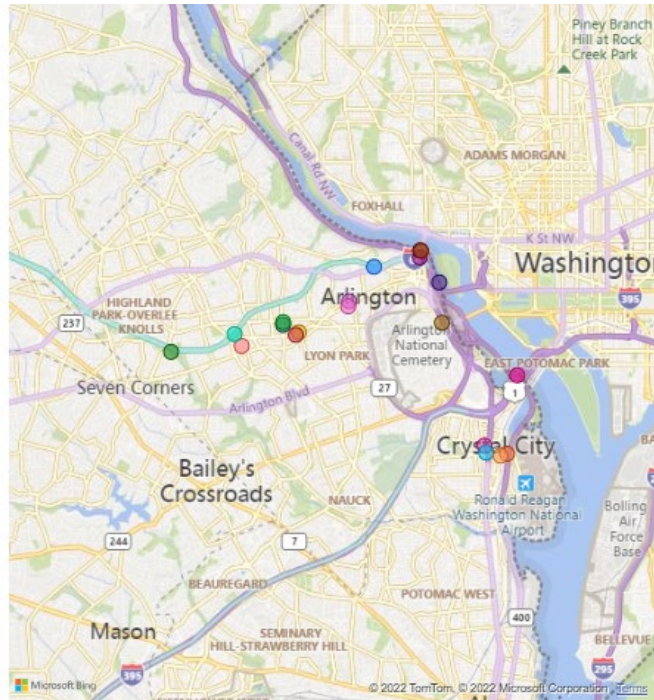


Figure 1. Stations Primarily Serving during Peak Period

- Counters**
- Arlington Mill Trail
 - Four Mile Run (piezo)
 - Four Mile Run (pyro)
 - Joyce St NB
 - Joyce St SB
 - Military NB bike lane
 - Military SB bike lane
 - MVT Airport South
 - TR Island Bridge
 - W&OD Bon Air Park
 - W&OD Bon Air West
 - W&OD Columbia Pike
 - W&OD East Falls Church

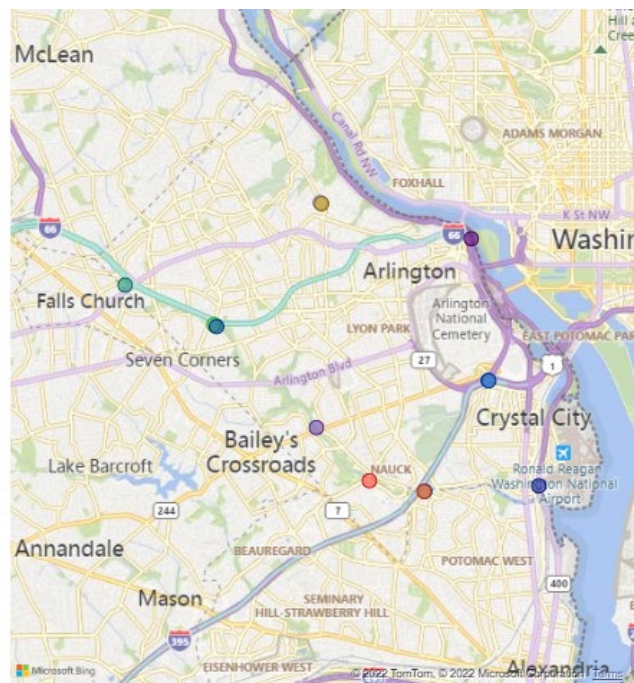


Figure 2. Stations Primarily Serving during Off-peak Period

For this analysis, only the eight stations with complete 2020 to 2022 data were selected. Five of the eight stations belong to the Peak Trail group and three of the eight stations belong to the Off-peak Trail group. The data from these stations was firstly summarized at the daily and hourly level by weekday and weekend for each trail group. Then the post-2020 trail usage patterns were compared with 2020 and the pre-2020 period. A list of comparison charts was developed (See Figure 3 through Figure 14).

SUMMARY OF FINDINGS OF POST-2020 DATA

Weekday and Weekend Daily Volume Comparison for Peak and Off-peak Trail Groups: Pre2020 to Post-2020

- Peak Trail group during weekdays (See Figure 3):
 - The daily volumes of post-2020 are similar to 2020 levels.
 - The daily volumes of post-2020 are still much lower than pre-2020 levels.
 - This aligns with a reduction in trips during the peak period across all modes triggered by stay at home orders and increased telework due to COVID-19 from March 2020 until today.
- Peak Trail group during weekends (See Figure 4):
 - The daily volumes of post-2020 returned to pre-2020 levels for all the months.
 - Both pre-2020 and post-2020 daily volumes are much lower than 2020.
 - While the primary use of these trails is during the peak-period on weekdays, the types and kinds of trips may be different on the weekends. Weekend use increased during the first year of the pandemic. Use returned to pre-pandemic levels a year later.
- Off-peak Trail group during weekdays (See Figure 5):
 - The daily volumes of post-2020 returned to pre-2020 levels for all months.
 - Both pre-2020 and post-2020 daily volumes are much lower than 2020.
 - COVID corresponded with an increase in Off-peak Trail usage in 2020, however, after the first year of the pandemic Off-peak Trail usage returned to pre-pandemic levels.
- Off-peak Trail group during weekends (See Figure 6):
 - The daily volumes of post-2020 returned to pre-2020 levels for all the months, similar to the observation from weekdays.
 - Both pre-2020 and post-2020 daily volumes are much lower than 2020.
 - COVID corresponded with an increase in Off-peak Trail usage in 2020, however, after the first year of the pandemic Off-peak Trail usage returned to pre-pandemic levels.

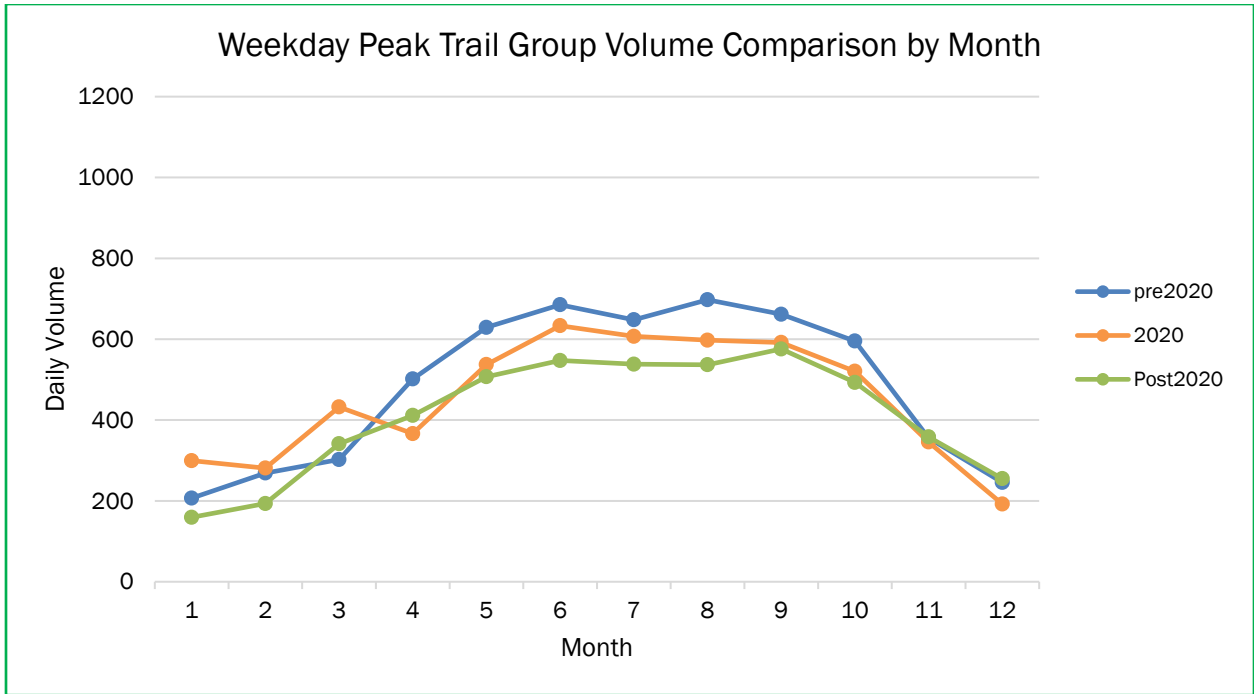


Figure 3. Weekday Volume Comparison by Month for Peak Trails: Pre-2020 to Post-2020

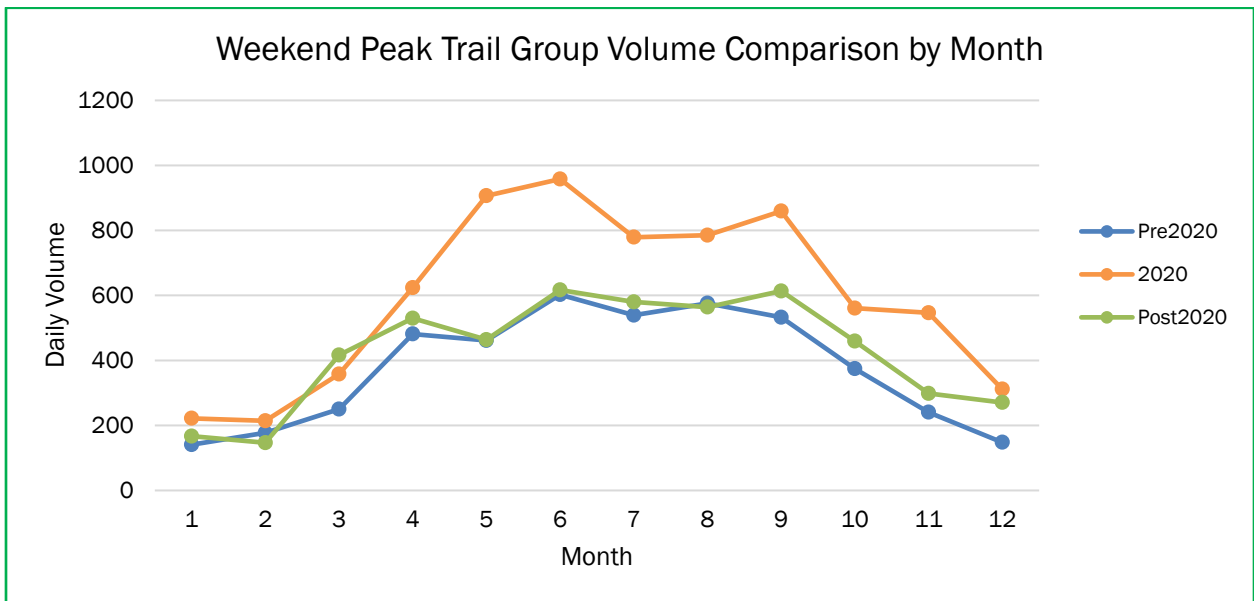


Figure 4. Weekend Volume Comparison by Month for Peak Trails: Pre-2020 vs 2020

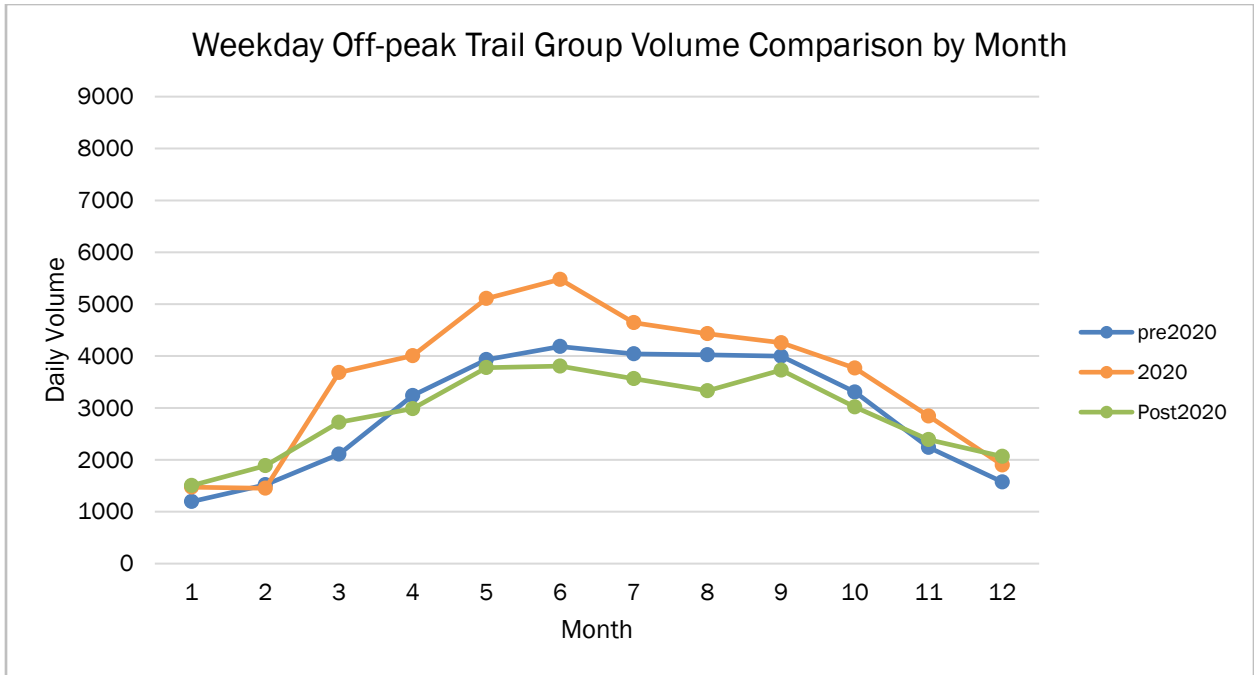


Figure 5. Weekday Volume Comparison by Month for Off-peak Trails: Pre-2020 to Post-2020

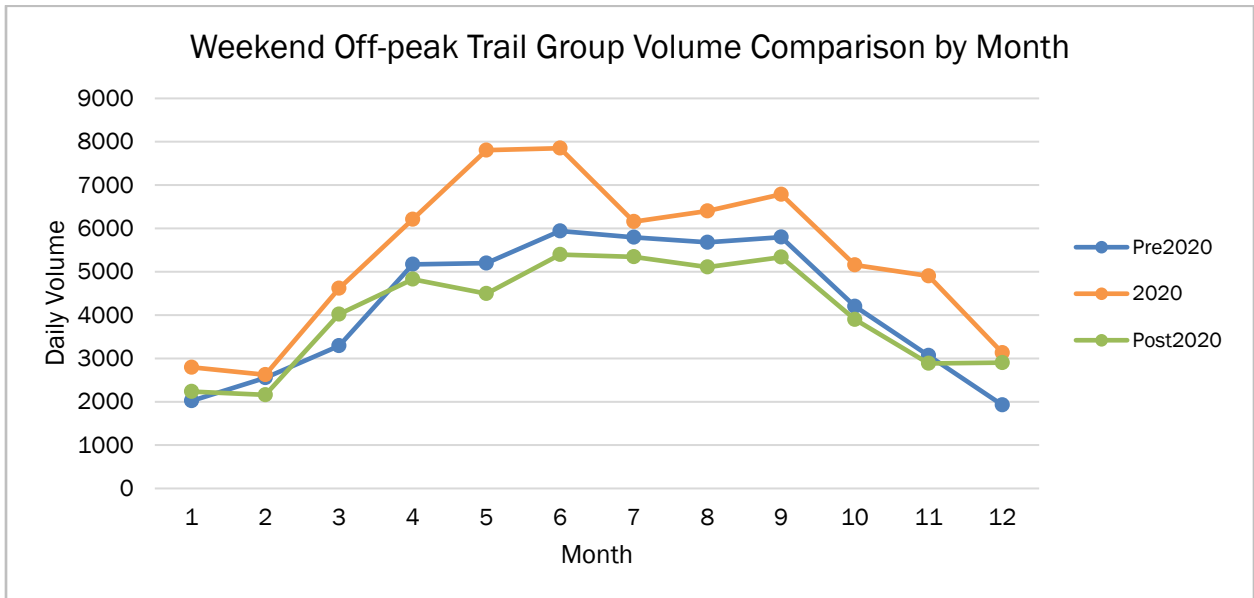


Figure 6. Weekend Volume Comparison by Month for Off-peak Trails: Pre-2020 to Post-2020

Weekday and Weekend Hourly Volume Comparison for Peak and Off-peak Trail Groups: from Pre-2020 to Post-2020

- Peak Trail group during weekdays (See Figure 7):
 - The hourly volume distribution of post-2020 is similar to 2020.
 - The hourly volumes of both 2020 and post-2020 are more evenly distributed compared with pre-2020.
 - The AM peak period and PM peak period volumes in 2020 and post-2020 are much lower than pre-2020.
 - The mid-day (11am-3pm) volumes in 2020 and post-2020 are higher than pre-2020.
 - Fewer people used these trails during peak periods and more people used these trails during off-peak periods from 2020 due to COVID.

- Peak Trail group during weekends (See Figure 8):
 - The hourly volume distributions of post-2020 return to the pre-2020 pattern.
 - The hourly volumes of pre-2020 and post-2020 are lower than 2020 for most hours (especially 11am-6pm).
 - While there were fewer weekday trips, more trips occurred on weekends in 2020. COVID-19 corresponded with an increase in weekend trips in 2020, however, use returned to pre-pandemic levels during the next two years.

- Off-peak Trail group during weekdays (See Figure 9):
 - The hourly volumes of post-2020 are more evenly distributed compared to pre-2020 and 2020
 - The hourly volumes of post-2020 are lower than 2020 for all the hours.
 - The hourly volumes of post-2020 are higher than pre-2020 between 9 am and 4 pm.
 - The hourly volumes of post-2020 are lower than pre-2020 between 5 pm and 9 pm.
 - Following the emergence of COVID, hourly usage of the Off-peak Trails during weekdays gradually became more evenly distributed.

- Off-peak Trail group during weekends (See Figure 10):
 - The hourly volume distributions of post-2020 returned to the pre-2020 pattern.
 - The hourly volumes of post-2020 are similar to pre-2020 for all hours
 - COVID-19 corresponded with an increase in the use of the Off-peak Trail group for the first year (2020), but the Off-peak Trail usage returned to pre-pandemic levels after 2020.

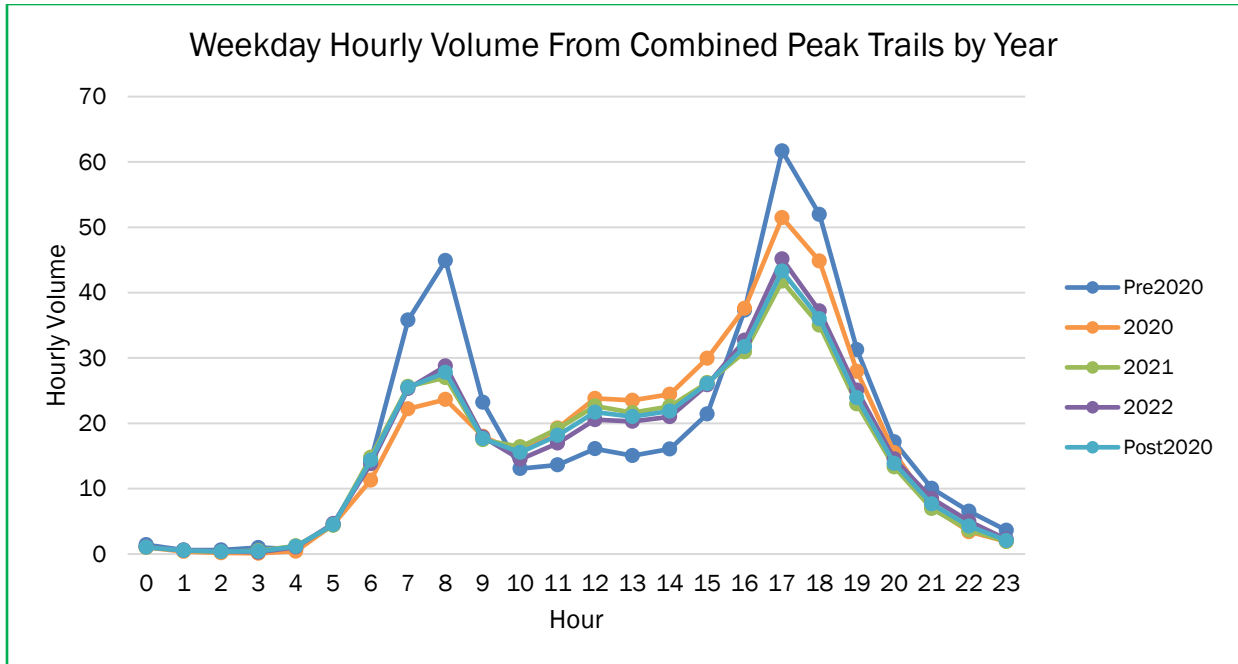


Figure 7. Weekday Hourly Volume Comparison for Peak Trails: Pre-2020 to Post-2020

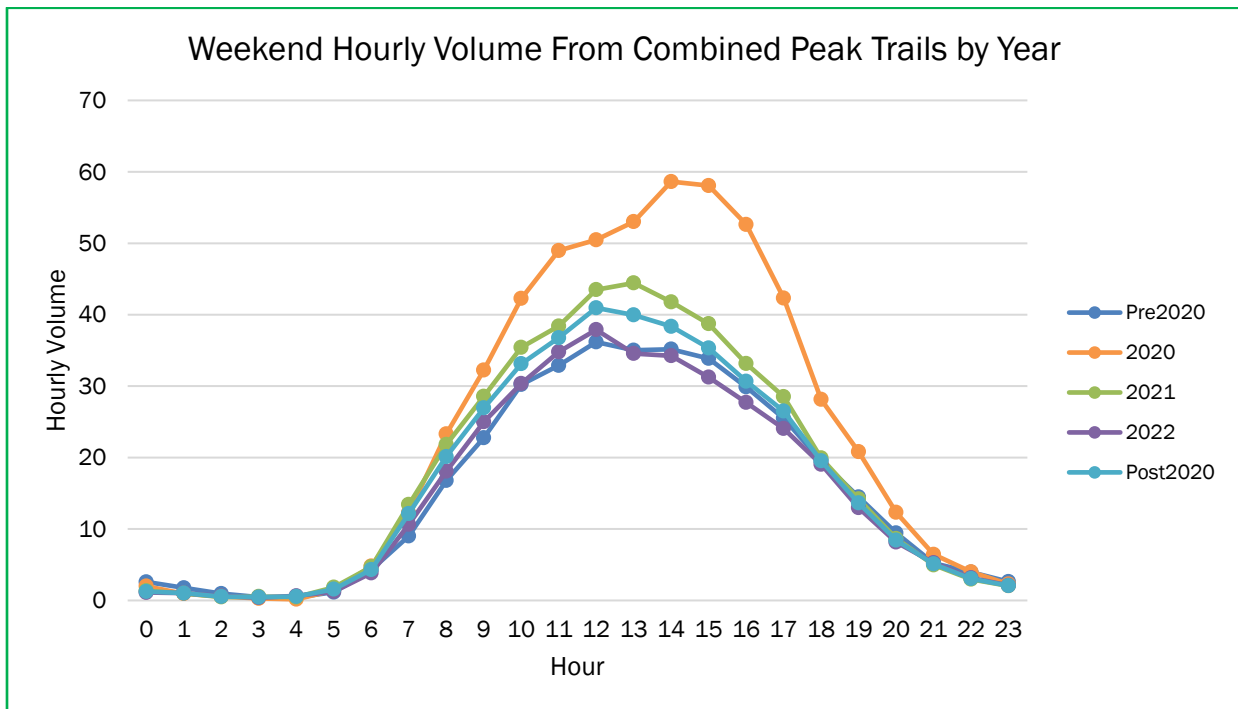


Figure 8. Weekend Hourly Volume Comparison for Peak Trails: Pre-2020 to Post-2020

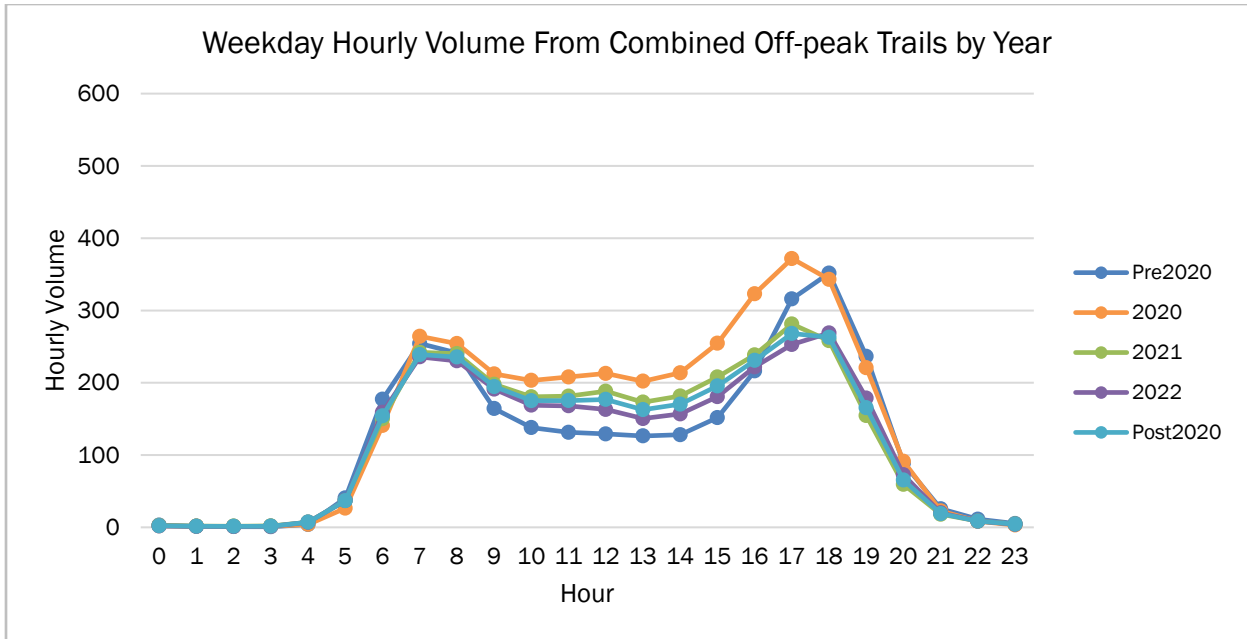


Figure 9. Weekday Hourly Volume Comparison for Off-peak Trails: Pre-2020 to Post-2020

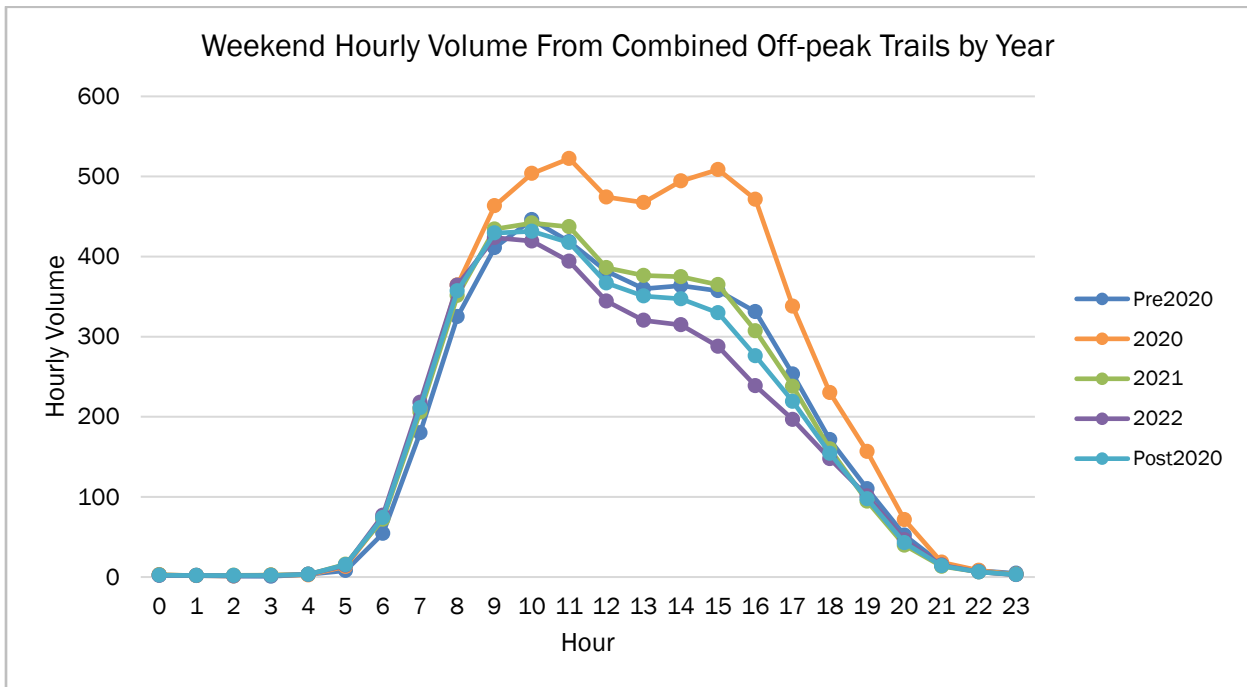


Figure 10. Weekend Hourly Volume Comparison for Off-peak Trails: Pre-2020 to Post-2020

Weekday and Weekend Hourly Volume Comparison for Peak and Off-peak Trail Groups: by Month of Year: 2020 vs 2021 vs 2022

- Peak Trail group during weekdays (See Figure 11):
 - In January to March, the post-2020 data shows a more even hourly volume distribution compared with the hourly volume distributions in 2020. It reflects the pre-COVID pattern before April 2020.
 - From April to December, the AM hourly volumes of post-2020 are higher than 2020 and the PM hourly volumes of post-2020 are slightly lower than 2020; the mid-day hourly volumes of post-2020 are generally lower than 2020. This suggests that in 2020 fewer people used these trails during peak periods and more people used these trails for during off-peak period. It also shows in 2021/2022 more people used these trails in AM peak hours compared to 2020.
 - The hourly volume distributions in 2021 and 2022 are similar.
- Peak Trail group during weekends (See Figure 12):
 - The hourly volumes for post-2020 are much lower than 2020 for daytime hours for all months, especially April to December.
 - The hourly volume distributions in 2021 and 2022 are similar.
 - COVID-19 corresponded with an increase in trips on weekends, especially for the initial year (2020). The usage gradually returned to pre-pandemic levels in 2021 and 2022.
- Off-peak Trail group during weekdays (See Figure 13):
 - In January and February, the hourly volume distribution for post-2020 and 2020 are very similar, and the hourly volumes of post-2020 are slightly higher than 2020 especially between 6 am and 6 pm.
 - From March to December, the hourly volume distributions for post-2020 and 2020 are very similar, and the hourly volumes of post-2020 are lower than 2020 for all daytime hours.
 - The hourly volume distributions in 2021 and 2022 are similar, and the 2021 hourly volumes are slightly higher than 2022 for most months.
 - COVID-19 corresponded with an increase in use of the Off-peak Trail group, especially for the initial year (2020). The usage gradually returned to pre-pandemic levels in 2021 and 2022.
- Off-peak Trail group during weekends (See Figure 14):
 - The hourly volumes of post-2020 are lower than 2020, especially for PM hours.
 - The hourly volume distributions in 2021 and 2022 are similar, and the 2021 hourly volumes are slightly higher than 2022 for most months.
 - COVID-19 corresponded with an increase in use of the Off-peak Trail group, especially for the initial year (2020). The usage gradually returned to pre-pandemic levels in 2021 and 2022.

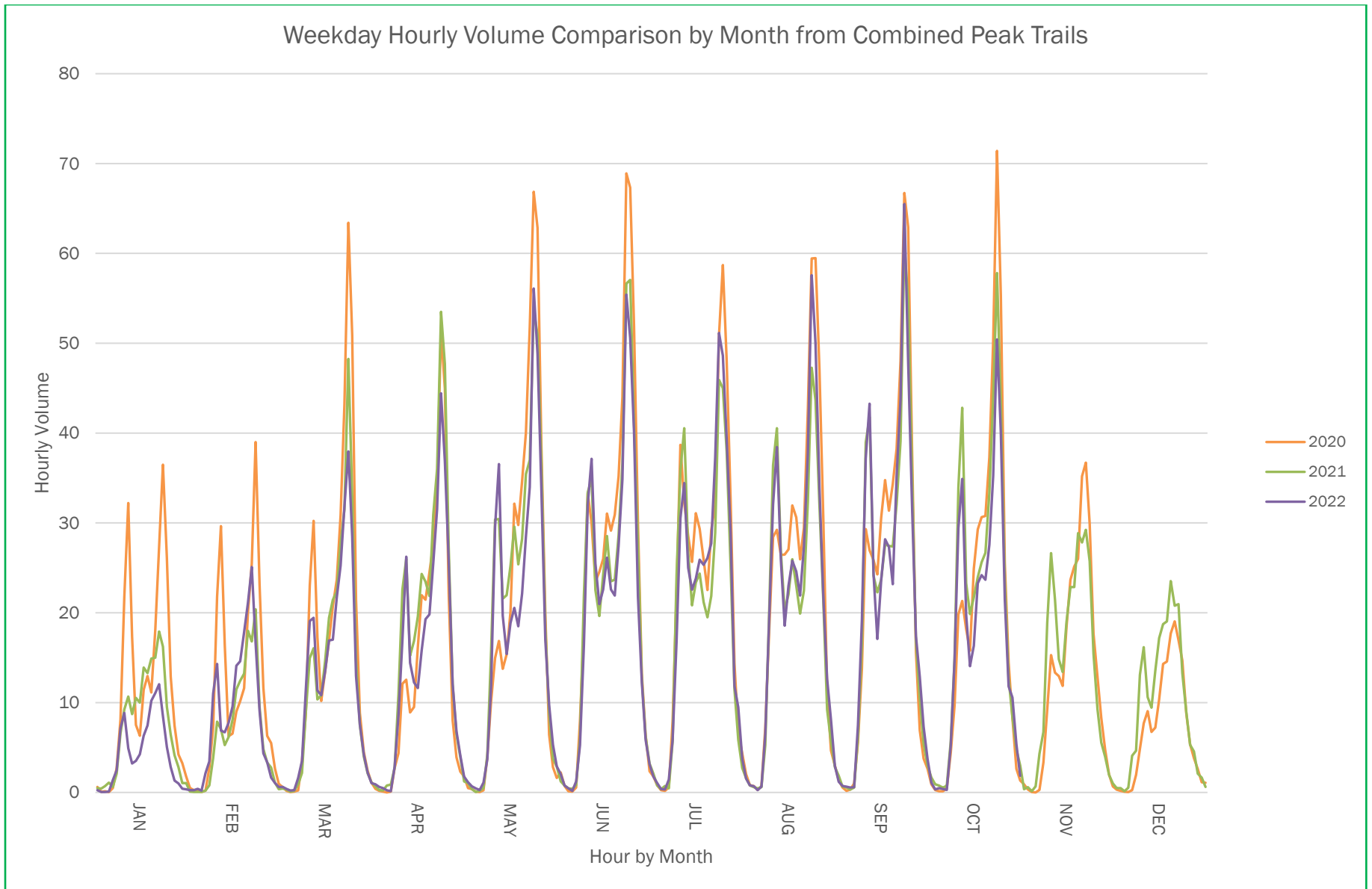


Figure 11. Weekday Hourly volume comparison for Peak Trails by month of year: 2020 vs 2021 vs 2022

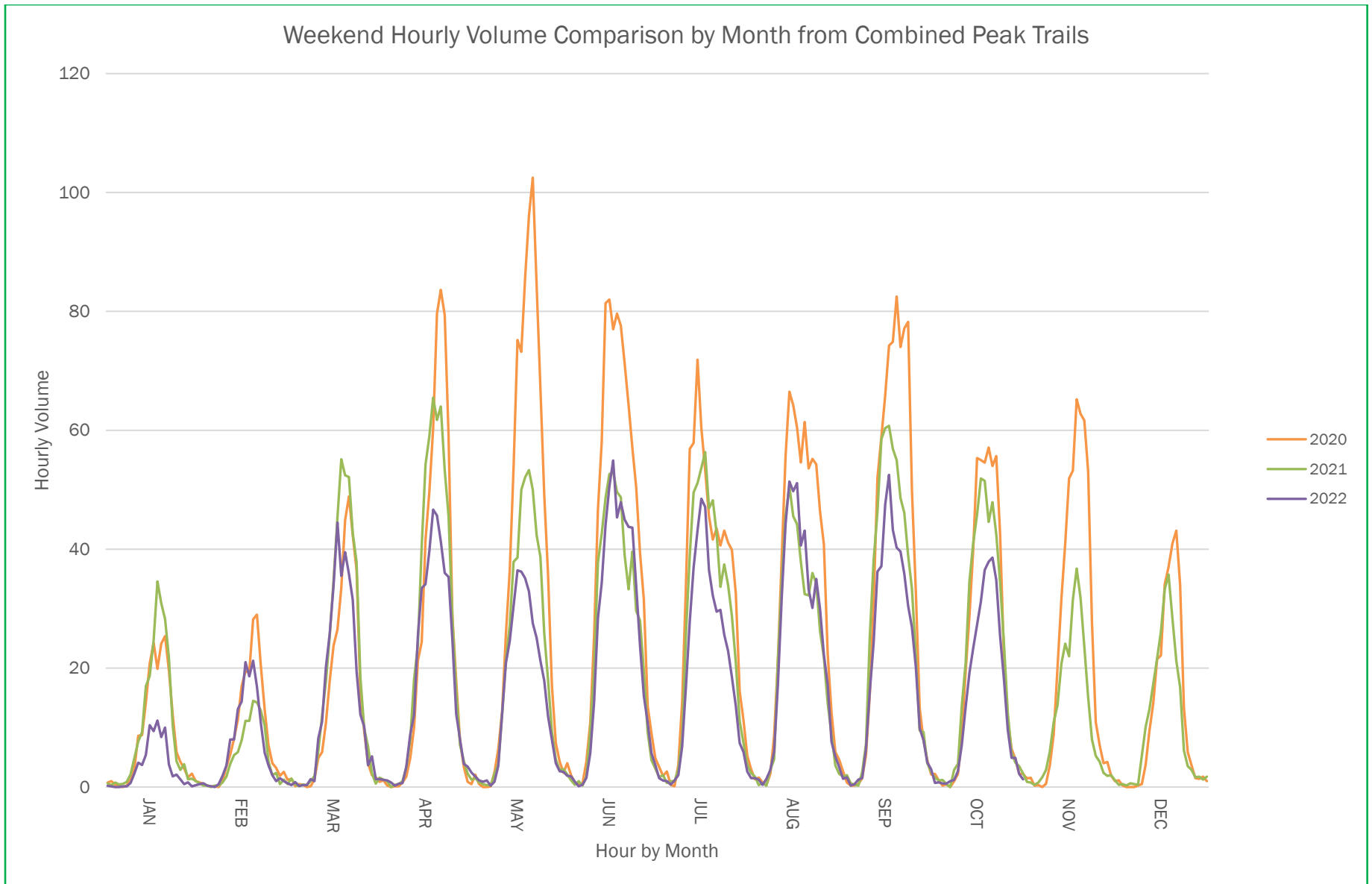


Figure 12. Weekend Hourly volume comparison for Peak Trails by month of year: 2020 vs 2021 vs 2022

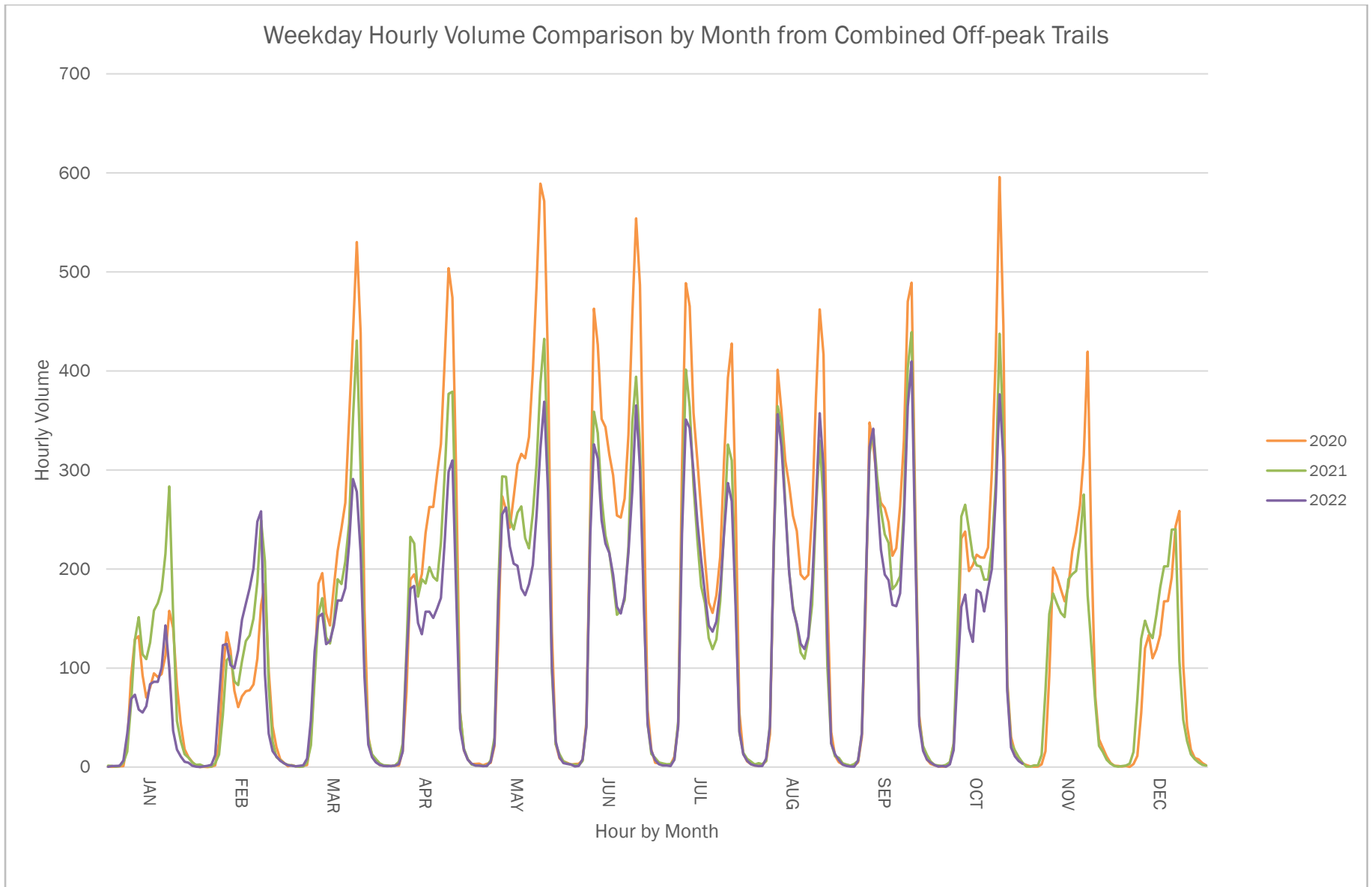


Figure 13. Weekday Hourly volume comparison for Off-peak Trails by month of year: 2020 vs 2021 vs 2022

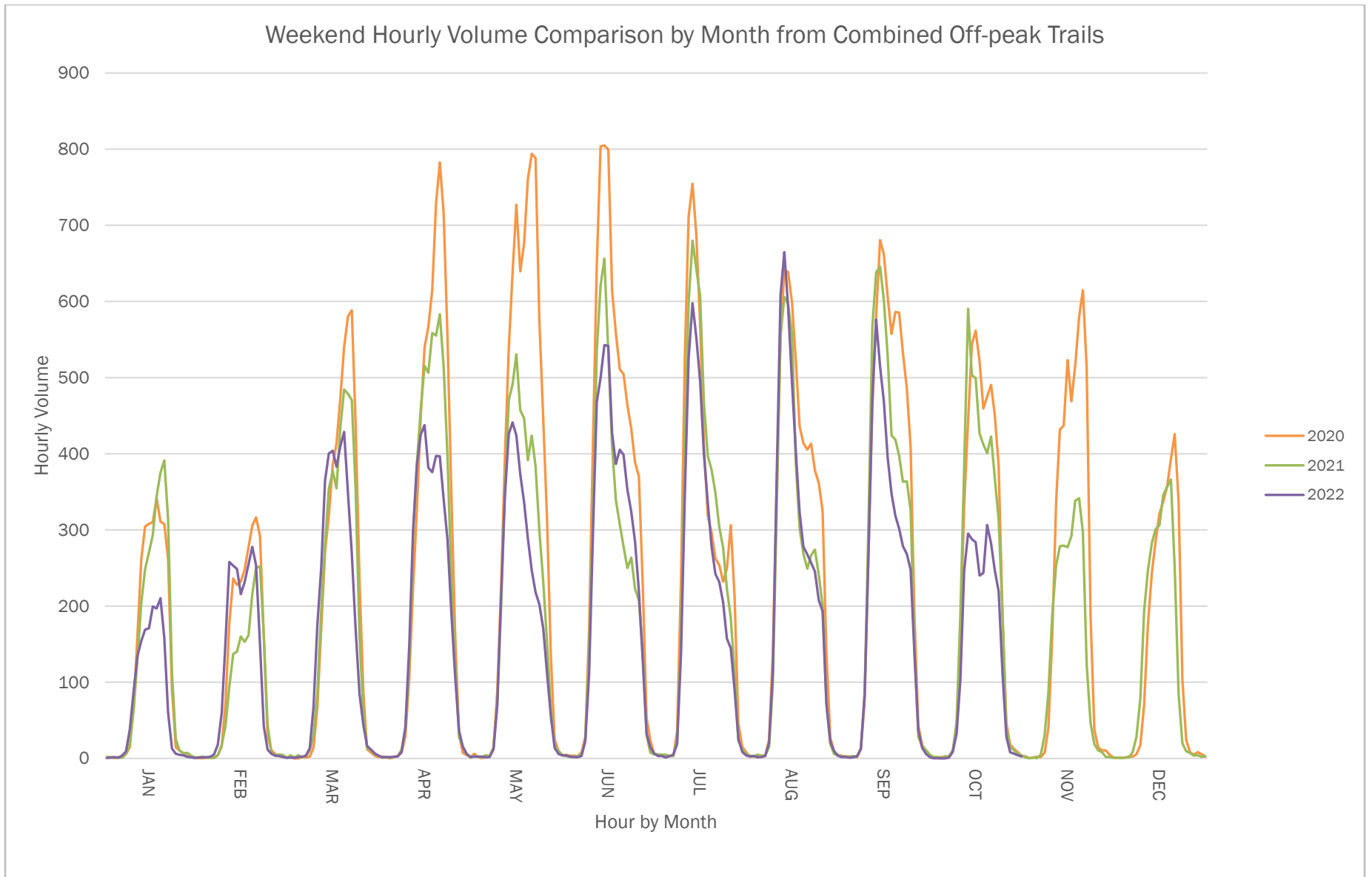


Figure 14. Weekend Hourly volume comparison for Off-peak Trails by month of year: 2020 vs 2021 vs 2022



ATTACHMENTS

1. Map of Arlington Automatic Bicycle and Pedestrian Counting Equipment

ATTACHMENT 1. ARLINGTON AUTOMATIC BICYCLE AND PEDESTRIAN COUNTING EQUIPMENT MAP

