Analysis of 2019 Trail Usage Patterns along the Great Allegheny Passage

Final Report
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In addition, I would like to acknowledge the support of the Fayette, Somerset, and Westmoreland Counties' Tourism Grants, which help to fund this research project.

Executive Summary

- The Great Allegheny Passage trail system is well used. I estimate the total number of visits to be in the range of 931,252 to 1,055,419 in 2019, with a mid-range estimate of 989,455. This represents an increase in trail use of 4.6% compared to 2018, which had a mid-range trail use estimate of 946,284.

- The data collection in 2019 was the most complete of any year since 2015. The TrafX counters generated the highest number of usable counts ever, and volunteers produced an almost full data set of synchronized counts (58 of 60 possible observations). The high quantity and quality of data this year improves the reliability of this year's trail use estimate.

- Volunteers identified "thru-riders" when conducting their synchronized counts. Based on this data, I estimate a total of 63,213 thru-riders on the GAP in 2019.

- This year's report is the fifth report since 2015, when the TrafX locations and synchronized count protocol changed substantially. Trail use estimates have varied considerably year-to-year since 2015, but overall, the linear trend shows an increase in trail use of approximately 3.3% per year.

Summary of Methodology

This report estimates trail use patterns along the Great Allegheny Passage (GAP), from Cumberland to Pittsburgh. These estimates are based on two primary data sources. The first is information gathered from TrafX counters, infrared counters that track trail use at fixed locations along the trail. The second is information gathered from synchronized manual counts conducted at TrafX counter locations. These counts occurred on five dates in 2019: Saturday, June 1, Sunday, July 14, Thursday, August 15, Friday, September 13, and Saturday, October 19. In each case, counts were conducted over a two-hour period (10-noon, 11-1, noon-2, or 1-3 pm).

I have conducted similar GAP trail use reports in previous years (2010, 2011, 2012, 2013, 2015, 2016, 2017, and 2018). The 2010-13 reports also relied heavily on information gathered from TrafX counters and synchronized manual counts, but significant changes in data collection occurred in 2015. To start, three TrafX counters were added, and several existing counters were relocated. In addition, the method for conducting synchronized counts changed substantially in 2015. Previously, synchronized counts were conducted close to trailhead locations, but the synchronized counts were moved to the TrafX counter locations starting in 2015. In addition, synchronized counts are now conducted at fewer locations (12 locations starting in 2015 versus 18 in prior to 2015). **As a result of different data collection methods, trail count numbers for 2015 and later years are not directly comparable to those of previous years.**

I use the following methodology to estimate trail use along the GAP. First, I report raw TrafX counts by location and month for March through December (Table 2). Next, I adjust these raw counts to account for the fact that the TrafX counters typically under-count the actual number of people passing by the counters. I use the 2019 synchronized counts to derive a Count-to-Pass Factor (CP Factor) for each location (Tables 3 and 5). I then apply these CP Factors to derive adjusted TrafX counts (Table 6) and use these adjusted TrafX counts to derive low-, middle-, and high-range estimates of total trail use along the GAP.

TrafX Data

In 2019, TrafX counters collected data at 12 locations along the Great Allegheny Passage. Table 1 provides information on these counters and the data that they gathered.[1]

Table 1: Summary of TrafX Count Data (2019)

Location	Counter milepost	# Usable Count Days	First Date	Last Date
Cumberland	1.5	292	1-Mar	22-Dec
Frostburg	16.5	206	22-Apr	21-Dec
Deal	22.5	244	19-Apr	21-Dec
Garrett	34.5	234	19-Apr	21-Dec
Rockwood	45.5	244	19-Apr	21-Dec
Ohiopyle	69.0	292	1-Mar	19-Dec
Connellsville	85.0	292	1-Mar	19-Dec
Perryopolis	102.0	292	1-Mar	19-Dec
West Newton	111.5	292	1-Mar	19-Dec
Boston	122.0	291	2-Mar	19-Dec
Rankin Bridge	138.0	291	2-Mar	19-Dec
Hot Metal Bridge	146.0	291	2-Mar	20-Dec

[1] The milepost locations of the TrafX counters were provided by David Cotton in an email dated June 2, 2016.

In 2019, the TrafX counters provided a total of 3,261 usable count days, an average of 272 per counter location. This is the largest number of usable count days recorded more usable count days since the TrafX locations were reorganized in 2015.

Table 2 displays counts by month (March-December) at the 12 TrafX counter locations, with slight modifications for days in which a counter registers no data or registers a count that is unreasonably high or low. For each counter, I calculate an average weekday and weekend count for each month.[2] On days in which a counter has missing or "bad" data, I insert the average count for that location and month.[3]

It is worth noting that four TrafX counters (Frostburg, Deal, Garrett, and Rockwood) did not begin recording data until mid- to late-April. As a result, I had to estimate March TrafX counts for these locations. I did this by comparing the April-December counts at these locations to the average counts of a reference group of TrafX locations (the 8 locations other than Frostburg, Deal, Garrett, and Rockwood) for the April-December time period. For example, consider Frostburg. For the April-December time period, the Frostburg TrafX counter recorded a total of 9,868 weekday passes and 5,985 weekend passes. On average, the reference group recorded 27,071 weekday passes and 21,360 weekend passes. Using these numbers, Frostburg's traffic was 36.5% of the reference group's traffic on weekdays (9,868 ÷ 27,071) and 28.0% on weekends (5,985 ÷ 21,360). On average, the reference group had traffic of 1,656 on weekdays and 1,153 on weekends in March. Using these numbers, I calculate Frostburg's weekday and weekend counts as 604 (36.5% of 1,656) and 323 (28.0% of 1,153), respectively. I carried out similar calculations to estimate March counts for Deal, Garrett, and Rockwood.

Finally, it should be noted that the counters are intentionally located away from the trailheads, sometimes as much as 2 miles away. Because of this, many walkers are not included in the count. With these caveats in mind, Table 2 summarizes the raw TrafX counts for each location by month.

Synchronized Counts

Volunteers conducted synchronized counts on five dates in 2019: Saturday, June 1, Sunday, July 14, Thursday, August 15, Friday, September 13, and Saturday, October 19. In each case, these counts were conducted over a two-hour period (10-noon, 11-1, noon-2, or 1-3 pm).

Given 12 locations and 5 synchronized count dates, a full set of data would include 60 synchronized count observations. In fact, 58 observations occurred. The missing observations are Connellsville on September 13 and Rockwood on October 19. In addition, only one hour of synchronized counts (rather than two) were gathered at West Newton on October 19.

Table 3 summarizes the Synchronized Count and TrafX count at each counter for each count day. The last column calculates the overall Count-to-Pass Factor (CP Factor) for each location. The CP Factor equals the manual count divided by the TrafX count.

It is worth noting that the data collection in 2019 was the most complete of any year since 2015. The TrafX counters generated the highest number of usable counts ever, and there were fewer "bad" counts compared to previous years. In addition, volunteers produced an almost full data set of synchronized counts (58 of 60 possible observations). The high quantity and quality of the data improves my confidence in the accuracy of my trail use estimate.

[2] I define "weekday" as Monday through Friday and "weekend" as Saturday and Sunday. I also count holidays as "weekend" days, even if they occur during the week. In 2019, I counted the following holidays as weekend days: Memorial Day, July 4th, July 5th (a Friday), Labor Day, Thanksgiving day, and the day after Thanksgiving.

[3] Specifically, I interpolated counts in this manner for 3 days (June 3, 4, and 19) at the Cumberland counter and for 10 days (July 27-August 5 at the Garrett counter.

Table 2: Raw TrafX Counts by Location and Month (2019)

Location	March	April	May	June	July	August	September	October	November	December	Total
Cumberland	2,059	3,672	4,646	5,193	4,988	5,304	4,977	5,878	2,522	1,951	41,190
Frostburg	927	1,520	1,941	2,556	2,127	2,110	2,010	2,198	946	445	16,779
Deal	548	554	1,714	2,191	1,365	1,200	999	1,219	181	34	10,005
Garrett	660	616	1,697	2,535	1,990	1,903	1,484	919	167	21	11,991
Rockwood	474	744	1,583	1,820	1,145	847	693	1,076	181	58	8,622
Ohiopyle	274	1,350	3,183	5,160	5,182	6,886	4,828	3,151	303	64	30,381
Connellsville	542	1,499	2,789	4,005	2,863	3,574	3,636	2,481	462	158	22,009
Perryopolis	450	1,030	2,187	2,102	1,365	1,719	1,933	1,516	385	111	12,798
West Newton	1,501	3,185	5,825	6,810	4,540	6,252	5,770	2,422	840	402	37,547
Boston	1,239	3,402	5,329	6,885	5,488	6,446	6,824	4,422	1,079	304	41,418
Rankin Bridge	3,413	6,604	9,293	11,941	8,684	9,466	8,595	5,937	2,365	942	67,240
Hot Metal Bridge	12,997	20,113	21,000	19,114	18,011	18,128	17,641	16,840	8,660	4,836	157,340
Total	25,084	44,289	61,187	70,312	57,748	63,835	59,390	48,059	18,091	9,326	**457,321**

Table 3: Synchronized Trail Counts (2019)

	1-Jun-19		14-Jul-19		15-Aug-19		13-Sep-19		19-Oct-19		Total		
Location	Manual	TrafX	Manual	TrafX	Manual	TrafX	Manual	TrafX	Manual	TrafX	Manual	TrafX	CP
Cumberland	50	45	83	53	44	21	17	4	41	36	235	159	1.478
Frostburg	49	36	52	21	18	4	24	4	68	34	211	99	2.131
Deal	101	50	76	40	31	4	12	4	106	39	326	137	2.380
Garrett	51	31	70	22	7	11	22	11	25	5	175	80	2.188
Rockwood	13	7	12	5	25	9	18	2	-----	-----	68	23	2.957
Ohiopyle	175	54	181	73	50	18	72	22	209	114	687	281	2.445
Connellsville	35	25	83	40	21	18	-----	-----	36	27	175	110	1.591
Perryopolis	26	18	25	8	22	6	16	7	51	24	140	63	2.222
West Newton	134	56	178	54	59	8	47	8	53	29	471	155	3.039
Boston	136	114	101	67	39	32	30	27	74	57	380	297	1.279
Rankin Bridge	238	170	267	148	54	28	49	24	132	96	740	466	1.588
Hot Metal Bridge	601	269	333	169	79	42	75	19	197	169	1,285	668	1.924
Total	**1,609**	**875**	**1,461**	**700**	**449**	**201**	**382**	**132**	**992**	**652**	**4,893**	**2,538**	**1.928**

CP Factors

By their nature, the TrafX counters do not count trail users perfectly. Specifically, when cyclists ride side-by-side, follow close behind one another, or travel in a group, TrafX counters tend to undercount the number of riders. Thus, the accuracy of a TrafX counter declines when trail use is heavy.

In order to gauge the accuracy of each TrafX counter, volunteers have conducted manual counts at the TrafX counters for many years. These manual counts can be compared to the counts registered by the TrafX counters during the same time period. I use this data to calculate a CP Factor by dividing the manual count by the TrafX count and then use the CP Factors to derive adjusted TrafX counts at each location. Table 4 exhibits this data for 2010-2019.[4] Note that the CP Factor in 2019 (1.928) is similar to the average CP Factor since 2010 (1.937).

Table 4: Historic CP Factors (2010-2019)

Year	Manual	TrafX	CP
2010	2,564	1,524	1.682
2011	1,821	1,000	1.821
2012	882	468	1.885
2013	1,123	633	1.774
2014	NA	NA	NA
2015	2,345	1,324	1.771
2016	5,858	3,107	1.885
2017	3,169	1,593	1.989
2018	3,405	1,270	2.681
2019	4,893	2,538	1.928
Total	26,060	13,457	1.937

Table 5 lists the CP Factors by location for 2019. Note that the CP Factors range from 1.279 at Boston to 3.039 at West Newton, with an average of 1.928.

Table 5: CP Factors by Location (2019)

Location	Manual	TrafX	CP Factor
Cumberland	235	159	1.478
Frostburg	211	99	2.131
Deal	326	137	2.380
Garrett	175	80	2.188
Rockwood	68	23	2.957
Ohiopyle	687	281	2.445
Connellsville	175	110	1.591
Perryopolis	140	63	2.222
West Newton	471	155	3.039
Boston	380	297	1.279
Rankin Bridge	740	466	1.588
Hot Metal Bridge	1,285	668	1.924
Total	4,893	2,538	1.928

[4] No manual counts were conducted in 2014.

Adusted TrafX Counts

As mentioned previously, the TrafX counters tend to undercount trail users, particularly when cyclists ride side-by-side or in groups. For this reason, it is appropriate to apply CP Factors to the raw TrafX counts to obtain a more accurate estimate of actual trail use.

Table 6 lists the adjusted TrafX counts by location and month after applying the CP Factors. For the months of March through December, each count listed in Table 6 equals the corresponding count in Table 2 multiplied by the CP Factor for each location. For example, Cumberland's CP Factor is 1.478, and its raw count for March (listed in Table 2) is 2,059. Thus, the adjusted count for Cumberland in March in Table 6 is 3,043 = (1.478) x (2,059). All other counts listed for March through December in Table 6 are calculated in a similar manner.

The TrafX counters did not operate during the months of January and February. I estimate trail use for these months by assuming total trail use at all locations is 1,200. This is the same assumption that I have made for several years in this report. I then allocate the trail use at each location according to the patterns observed during the March-December period. For example, during the months of March through December, Cumberland accounted for 7.7% of total trail use. So for January and February, I estimate trail use at Cumberland as 7.7% of 1,200, which is 93. I do a similar calculation for all 12 locations.

Table 6 reports total adjusted trail use in 2019 as 791,564. This represents a 4.6% increase compared to 2018, when total adjusted trail use was at 757,027. ***Thus, my analysis indicates that trail use along the Great Allegheny Passage (GAP) increased by 4.6% between 2018 and 2019.***

Interpreting the Adjusted TrafX Counts

The adjusted TrafX counts in Table 6 are derived by multiplying the raw TrafX counts by the CP Factor for each location. As such, the adjusted TrafX counts are a best estimate of the number of times a trail user passes a TrafX counter. Moreover, the adjusted TrafX counts at any location also represents a reasonable estimate of trail usage by those who enter at the trailhead closest to that counter.

Consider, for example, Ohiopyle. The TrafX counter is located a couple miles down the trail toward Confluence. A rider traveling from Ohiopyle to Confluence and back will pass the counter twice, and the adjusted TrafX count would, on average, double-count this trail user. But other trail users at Ohiopyle will go the opposite direction, toward Connellsville. These trail users will not pass the TrafX counter at Ohiopyle. Some might be counted by the Connellsville counter, but some will not be counted by any TrafX counter. In addition, most walkers who enter at Ohiopyle will not pass a TrafX counter, even if they walk toward Confluence. As a result, we must balance those trail users who will double-counted with those who are not counted at all. It seems reasonable to assume that these two groups are roughly equal. If this is the case, then the adjusted TrafX count provides a good estimate of trail usage at Ohiopyle.

So, given the data available, I view the last column of Table 6 as the best estimate of 2019 trail use at each of the trailheads listed. These estimates will be better for some locations than others depending on how far the TrafX counter is from the trailhead and the proportion of trail users who go in the direction toward the counter. These two factors vary between trailheads, so the estimates in Table 6 likely overestimate trail use at some trailheads and underestimate at others.

Table 6: Adjusted Monthly TrafX Counts (2019)

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
Cumberland	93	93	3,043	5,427	6,867	7,675	7,372	7,839	7,356	8,688	3,727	2,884	**61,063**
Frostburg	54	54	1,975	3,239	4,137	5,448	4,533	4,497	4,284	4,685	2,016	948	**35,870**
Deal	36	36	1,305	1,318	4,079	5,214	3,248	2,855	2,377	2,901	431	82	**23,881**
Garrett	40	40	1,443	1,348	3,712	5,545	4,352	4,164	3,246	2,010	365	45	**26,311**
Rockwood	39	39	1,403	2,200	4,680	5,381	3,385	2,504	2,049	3,181	535	171	**25,567**
Ohiopyle	113	113	670	3,301	7,782	12,615	12,669	16,835	11,804	7,704	741	156	**74,502**
Connellsville	53	53	862	2,385	4,437	6,372	4,555	5,686	5,785	3,947	735	252	**35,121**
Perryopolis	43	43	1,000	2,289	4,860	4,671	3,033	3,820	4,296	3,369	856	247	**28,527**
West Newton	173	173	4,561	9,678	17,700	20,694	13,796	18,998	17,533	7,360	2,553	1,223	**114,443**
Boston	81	81	1,585	4,353	6,818	8,809	7,022	8,247	8,731	5,658	1,381	388	**53,153**
Rankin Bridge	162	162	5,420	10,487	14,757	18,962	13,790	15,032	13,649	9,428	3,756	1,495	**107,101**
Hot Metal Bridge	312	312	10,427	20,173	28,388	36,477	26,527	28,916	26,255	18,136	7,224	2,876	**206,024**
Total	1,200	1,200	33,695	66,197	108,217	137,861	104,283	119,394	107,364	77,065	24,319	10,767	**791,564**

Total Trail Use Estimate

The bottom row of Table 6 estimates that trail users passed by the 12 TrafX counter locations a total of 791,564 times. As I have argued above, this number is a reasonable estimate of the number of trail usage by those who enter the trail at the trailheads closest to the TrafX counters. But these 12 locations are not the only places where users may enter the trail. As such, this number likely *underestimates* total trail use.

The locations of the TrafX counters were chosen to capture as many as possible while minimizing the occurrence of trail users passing multiple counters on a single trip. I will assume as a midpoint estimate that 80% of trail visits begin at the trailheads closest to the TrafX counters, with a range of 75% to 85%.[5] Put another way, I estimate that somewhere between 15% and 25% of trail visits begin at a trailhead other than the 12 trailhead locations where TrafX counters are located.

If we assume the midpoint estimate of 80%, then the resulting mid-range estimate of total trail use is 989,455 = (791,564 ÷ 0.80). The low-range and high-range estimates are 931,252 = (791,564 ÷ 0.85) and 1,055,419 = (791,564 ÷ 0.75), respectively. I estimate that trail use along the GAP decreased by 4.6% between 2018 and 2019.

Thru-Riders

The GAP offers the opportunity for cyclists to take lengthy, multi-day trips. The form that volunteers used when tallying the synchronized manual counts in 2019 provided a section to mark "thru-riders." The volunteer was asked to use his or her judgment to determine whether a passing cyclist was on an extended ride. For example, a cyclist riding with a substantial pack might be a thru-rider.

Table 7 summarizes the number of riders identified by a volunteer as a thru-rider relative to the total number of trail users. The hours in parentheses next to each location indicates the total number of manual count hours for each location. The last column of Table 7 estimates the total number of Thru-Riders at each location by applying the % of Thru-Riders at that location times the adjusted TrafX count at that location (from Table 6).

Table 7: Thru-Riders in Comparison to All Users (2019)

Location	Thru-Riders	All Riders	% Thru-Riders	Estimated # of Thru-Riders
Cumberland (10 hrs)	38	235	16.2%	9,874
Frostburg (10 hrs)	8	213	3.8%	1,347
Deal (10 hrs)	39	326	12.0%	2,857
Garrett (10 hrs)	32	175	18.3%	4,811
Rockwood (8 hrs)	7	68	10.3%	2,632
Ohiopyle (10 hrs)	38	687	5.5%	4,121
Connellsville (8 hrs)	20	175	11.4%	4,014
Perryopolis (10 hrs)	23	140	16.4%	4,687
West Newton (9 hrs)	46	471	9.8%	11,177
Boston (10 hrs)	51	380	13.4%	7,134
Rankin Bridge (10 hrs)	22	740	3.0%	3,184
Hot Metal Bridge (10 hrs)	46	1285	3.6%	7,375
Total	**370**	**4,895**	**7.6%**	**63,213**

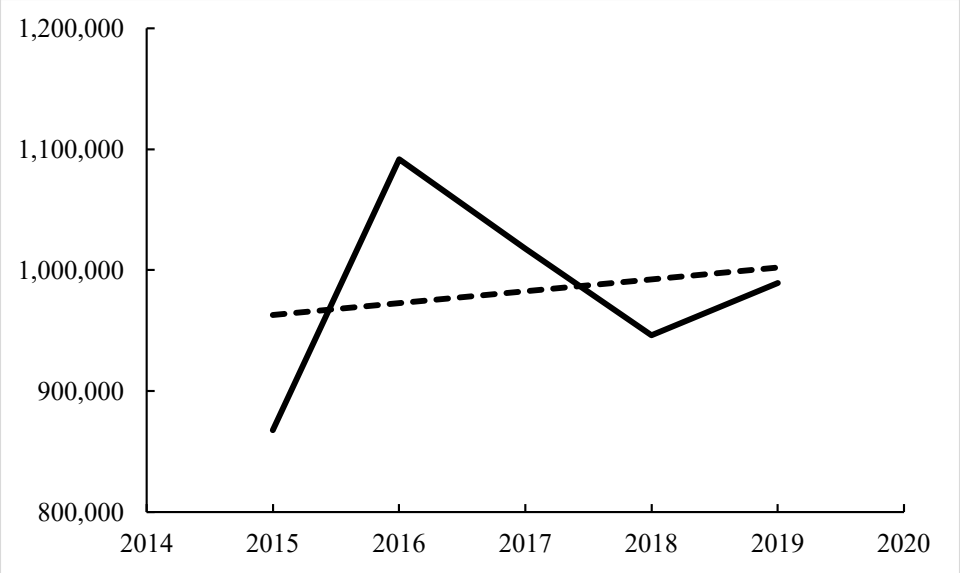
[5] These estimates are based on input and estimates by ATA.

The data in Table 7 show considerable variation in the percentage of thru-riders, ranging from 3.0% at Rankin Bridge to 18.3% at Garrett. One would expect some variation between locations arising from differences in the types of trail users at each location. In other words, some locations may attract a higher percentage of casual trail users, while other, more remote locations may naturally have a larger percentage of cyclists on longer journeys. However, some portion of the variation is almost certainly due to the judgment of the volunteers. Consider the difference between Garrett, with 18.3% thru-riders, and Rockwood (just 11 miles away) with 10.3% thru-riders. It is likely that some of the difference between these two locations is due to volunteers using different criteria to identify thru-riders. With this caveat in mind, the data in Table 7 suggest that there were 63,213 thru-riders on the GAP in 2019.

Historical Perspective

This year's report is the fifth report since 2015, when the TrafX locations and synchronized count protocol changed substantially. Given this, it worth looking back over the past five years for trends in GAP trail use.

Figure 1: Total GAP Trail Use (2015-2019)



Year	Total Trail Use
2015	867,719
2016	1,091,706
2017	1,017,662
2018	946,284
2019	989,455

Figure 1 shows the mid-range total trail use estimate for 2015-2019 along with a linear trendline. Clearly, trail use estimates have varied considerably year-to-year. This fluctuation is likely due in part to true year-to-year fluctuations caused by factors such as weather. However, some of the fluctuation is likely due to fluctuations in the quality of data generated by the TrafX counters. Overall, the linear trendline shows an increase in trail use of approximately 3.3% per year from 2015-2019.