Analysis of 2022 Trail Usage Patterns along the Great Allegheny Passage

Final Report to the Great Allegheny Passage Conservancy
March 8, 2023

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Acknowledgments

This research would not be possible without the hard work and generous support of number of people and organizations.

First, I would like to recognize Doug Riegner of the Great Allegheny Passage Conservancy for his heroic efforts in maintaining and collecting data from the TRAFx counters along the Great Allegheny Passage, as well as organizing volunteers for the manual counts, which is a substantial and critical task. I would also like to thank the 25 volunteers who generously contributed their time – many on several occasions -- to conduct the manual counts.

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 is well used. I estimate the total number of visits to be in the range of 849,857 to 963,171 in 2022, with a mid-range estimate of 902,973.

- Volunteers identified "thru-riders" when conducting their synchronized counts. Based on this data, I estimate a total of 134,666 thru-riders on the GAP in 2022.

- This year's report is the seventh report since 2015, when the TRAFx locations and synchronized count protocol changed substantially. Trail use estimates have varied year-to-year since 2015, but the overall trend is an increase in trail use of approximately 4% 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 2022: Thursday, May 19, Monday, June 20, Sunday, July 24, Saturday, August 13, and Thursday, September 15. A sixth count was scheduled on Wednesday, October 19 but was canceled due to inclement weather. 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 (2010–2013 and 2015–2021). 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. 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 2022 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 2022, 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.

Table 1: Summary of TRAFx Count Data (2022)

Location	Counter milepost	# Usable Count Days	First Date	Last Date
Cumberland	1.5	275	1-Mar	30-Nov
Frostburg	16.5	275	1-Mar	30-Nov
Deal	22.5	275	1-Mar	30-Nov
Garrett	34.5	275	1-Mar	30-Nov
Rockwood	45.5	275	1-Mar	30-Nov
Ohiopyle	69.0	274	1-Mar	30-Nov
Connellsville	85.0	275	1-Mar	30-Nov
Perryopolis	102.0	275	1-Mar	1-Dec
West Newton	111.5	253	1-Mar	1-Dec
Boston	122.0	301	1-Mar	26-Dec
Rankin Bridge	138.0	303	1-Mar	28-Dec
Hot Metal Bridge	146.5	303	1-Mar	28-Dec

In 2022, the TRAFx counters provided a total of 3,359 usable count days, an average of 280 per counter location.

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, a count of 0, or a count that is unreasonably high or low, indicating a possible malfunctioning of equipment.[1] For each counter, I calculate an average weekday and weekend count for each month.[2] On days in which a counter has missing or unreliable data, I insert the average count for that location and month.[3] In addition, 9 of the 12 counters collected either no data or just one day of data for the month of December. For these locations, I use the Rankin Bridge counter (which gathered data through December 28) as a basis to estimate December counts. Specifically, for the March through November time period, I calculate the ratio of Weekday and Weekend TraFx counts of each location relative to the Rankin Bridge TraFx counts for the same time period. I then estimate the December Weekday and Weekend count for each location as the product of this ratio and the Rankin Bridge count for December.

For example, for the March through November time period, Cumberland's Weekday and Weekend TraFx counts were 93.6% and 72.3%, respectively, of the Rankin Bridge TraFx count. In December, the Rankin Bridge TraFx counts averaged 44.8 during Weekdays and 52.3 on Weekends. Based on this, I estimated the Cumberland Weekday and Weekend counts as 41.9 (= 44.8 x 0.936) and 37.8 (= 52.3 x 0.723), respectively.

Finally, it is worth noting that the counters are intentionally located away from the trailheads, sometimes as far as two miles away, in order to reduce the number of walkers 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 2022: Thursday, May 19, Monday, June 20, Sunday, July 24, Saturday, August 13, and Thursday, September 15. In each case, counts were conducted over a two-hour period (10-noon, 11-1, noon-2, or 1-3 pm).[4]

Given 12 locations and 5 synchronized count dates, a full set of data would include 60 synchronized count observations. In fact, we have 58 observations. We lost the data from one count (Ohiopyle on August 13), and we have no observation from West Newton on September 15, when the volunteer did not show up.

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.

[1] Despite frequent testing, the TRAFx counters can return bad data due to moisture, spider webs, insect infestations, vandalism, battery failure, or a sweatshirt hanging over the lens.
[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 2022, I counted the following holidays as weekend days: Memorial Day, Labor Day, July 4th (a Monday in 2022), Thanksgiving day, and the day after Thanksgiving.
[3] Specifically, I discounted the following data: Ohiopyle on June 1, when no TraFx count was recorded, and West Newton from August 31 through September 21, when a spider web blocked the eye hole where the beam is emitted.
[4] Recall that we canceled the sixth count date on October 19 due to inclement weather.

Table 2: Raw TRAFx Counts by Location and Month (2022)

Location	March	April	May	June	July	August	September	October	November	December	Total
Cumberland	3,266	3,765	7,025	9,154	7,933	6,973	5,585	8,091	4,418	1,261	57,471
Frostburg	1,007	1,737	2,944	3,885	3,189	3,080	3,420	3,171	1,127	533	24,093
Deal	146	698	1,244	1,750	1,179	1,335	1,483	1,769	255	219	10,078
Garrett	217	841	2,215	2,754	2,247	2,005	2,195	1,733	268	325	14,800
Rockwood	275	873	2,374	2,804	2,392	2,224	2,733	1,958	277	357	16,268
Ohiopyle	276	521	1,290	2,340	2,144	1,733	1,346	1,575	221	239	11,686
Connellsville	713	1,323	2,608	2,854	1,590	1,698	2,087	2,282	854	355	16,364
Perryopolis	675	1,280	2,657	2,780	2,125	2,028	2,226	1,971	640	358	16,740
West Newton	2,060	3,200	6,012	6,415	3,379	1,530	1,401	1,295	204	554	26,049
Boston	718	1,748	2,536	3,233	2,011	2,114	2,045	2,024	832	227	17,488
Rankin Bridge	4,480	6,006	9,548	11,638	8,263	8,644	8,073	7,264	2,891	1,455	68,262
Hot Metal Bridge	6,122	5,910	4,947	5,092	2,554	3,459	5,398	8,176	4,888	2,803	49,349
Total	**19,955**	**27,902**	**45,400**	**54,699**	**39,006**	**36,823**	**37,992**	**41,309**	**16,875**	**8,688**	**328,648**

Table 3: Synchronized Trail Counts (2022)

	19-May-22		20-Jun-22		24-Jul-22		13-Aug-22		15-Sep-22		19-Oct-22		Total		
Location	Man.	TrafX	Man.	TrafX	Man.	TrafX	Man.	TrafX	Man.	TrafX	Man.	TrafX	Man.	TrafX	CP
Cumberland	81	68	79	81	42	69	88	113	61	73	Canceled		351	404	0.869
Frostburg	34	28	73	49	38	20	78	60	70	53			293	210	1.395
Deal	35	15	66	34	26	2	105	58	50	23			282	132	2.136
Garrett	12	4	38	24	22	12	35	21	31	6			138	67	2.060
Rockwood	25	58	45	28	29	22	58	43	47	32			204	183	1.115
Ohiopyle	31	4	125	29	156	24	NA	NA	74	17			386	74	5.216
Connellsville	107	21	41	53	64	15	77	34	44	22			333	145	2.297
Perryopolis	31	36	50	30	39	9	98	72	35	15			253	162	1.562
West Newton	33	24	102	53	112	4	154	34	NA	NA			401	115	3.487
Boston	35	37	99	50	103	16	153	74	74	12			464	189	2.455
Rankin Bridge	57	48	125	86	118	62	260	229	77	82			637	507	1.256
Hot Metal Bridge	108	11	158	19	187	14	275	107	82	29			810	180	4.500
Total	**589**	**354**	**1,001**	**536**	**936**	**269**	**1,381**	**845**	**645**	**364**			**4,552**	**2,368**	**1.922**

Count-to-Pass (CP) Factors

By their nature, the TRAFx counters do not count trail users perfectly. For example, 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, because they do not have enough time to reset themselves between cyclists. Thus, the accuracy of a TRAFx counter declines when trail use is heavy.

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 Count-to-Pass (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 2010-2022.[5]

Table 4: Historic CP Factors (2010-2022)

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
2020	4,093	1,780	2.299
2021	3,554	1,336	2.660
2022	4,552	2,368	1.922
Total	38,259	18,941	2.020

[5] No manual counts were conducted in 2014.

Table 5 lists the CP Factors by location for 2022. These factors range from 0.869 at Cumberland[6] to 5.216 at Ohiopyle.

Table 5: CP Factors by Location (2022)

Location	Manual	TraFx	CP Factor
Cumberland	351	404	0.869
Frostburg	293	210	1.395
Deal	282	132	2.136
Garrett	138	67	2.060
Rockwood	204	183	1.115
Ohiopyle	386	74	5.216
Connellsville	333	145	2.297
Perryopolis	253	162	1.562
West Newton	401	115	3.487
Boston	464	189	2.455
Rankin Bridge	637	507	1.256
Hot Metal Bridge	810	180	4.500
Total	4,552	2,368	1.922

Adjusted 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 0.869, and its raw count for March (listed in Table 2) is 3,266. Thus, the adjusted count for Cumberland in March in Table 6 is 2,838 (= 0.869 x 3,266). The other counts listed for March through December in Table 6 are calculated in a similar manner.

Staff from the Great Allegheny Passage Conservancy remove the TRAFx counters each winter to prevent damage from freeze-thaw cycles and, therefore, they do not operate during the months of January and February. I estimated 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 6.9% of total trail use. So for January and February, I estimate trail use at Cumberland as 6.9% of 1,200, which is 83. I do a similar calculation for all 12 locations.

Table 6 reports total adjusted trail use in 2022 as 722,378. This represents a 36.5% decrease compared to 2021, when total adjusted trail use was at 1,136,833.

[6] A CP Factor less than one indicates that the TraFx count exceeds the manual count. This rarely happens; however, it happened in four of the five counts at Cumberland in 2022. We are looking into why this may have happened.

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.

Given the data available, I view the last column of Table 6 as the best estimate of 2022 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.

Total Trail Use Estimate

The bottom row of Table 6 estimates that trail users passed by the 12 TRAFx counter locations a total of 722,378 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%.[7] 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 902,973 = (722,378 ÷ 0.80). The low-range and high-range estimates are 849,857 = (722,378 ÷ 0.85) and 963,171 = (722,378 ÷ 0.75), respectively. I estimate that trail use along the GAP decreased by 36.5% between 2021 and 2022.

[7] These estimates are based on input and estimates by the Great Allegheny Passage Conservancy.

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Table 6: Adjusted Monthly TRAFx Counts (2022)

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
Cumberland	83	83	2,838	3,271	6,103	7,953	6,892	6,058	4,852	7,030	3,838	1,096	**50,098**
Frostburg	56	56	1,405	2,424	4,108	5,421	4,449	4,297	4,772	4,424	1,572	743	**33,727**
Deal	36	36	312	1,491	2,658	3,739	2,519	2,852	3,168	3,779	545	469	**21,603**
Garrett	51	51	447	1,732	4,562	5,672	4,628	4,130	4,521	3,569	552	670	**30,585**
Rockwood	30	30	307	973	2,646	3,126	2,666	2,479	3,047	2,183	309	398	**18,195**
Ohiopyle	102	102	1,440	2,718	6,729	12,208	11,184	9,040	7,021	8,216	1,153	1,249	**61,159**
Connellsville	63	63	1,637	3,038	5,989	6,554	3,652	3,900	4,793	5,241	1,961	816	**37,706**
Perryopolis	44	44	1,054	1,999	4,150	4,341	3,319	3,167	3,476	3,078	1,000	560	**26,230**
West Newton	151	151	7,183	11,158	20,964	22,370	11,782	5,333	4,885	4,516	711	1,930	**91,136**
Boston	72	72	1,763	4,291	6,226	7,937	4,937	5,190	5,021	4,969	2,043	558	**43,077**
Rankin Bridge	143	143	5,629	7,546	11,996	14,622	10,382	10,860	10,143	9,127	3,632	1,828	**86,051**
Hot Metal Bridge	370	370	27,549	26,595	22,262	22,914	11,493	15,566	24,291	36,792	21,996	12,614	**222,810**
Total	**1,200**	**1,200**	**51,563**	**67,237**	**98,392**	**116,856**	**77,903**	**72,872**	**79,990**	**92,923**	**39,312**	**22,930**	**722,378**

Thru-Riders

The GAP offers the opportunity for cyclists to take lengthy, multi-day trips. Starting in 2018, the form that volunteers use to tally synchronized manual counts has included a section to mark "thru-riders." The Great Allegheny Passage Conservancy asked volunteers to use their judgment to determine whether a passing cyclist was on an extended ride, and provided examples, such as a cyclist riding with a substantial pack, one with two loaded panniers, or one carrying camping gear might be a thru-rider. Some volunteers take initiative to ask cyclists as they pass by.

Table 7 summarizes the number of riders identified as a thru-rider during manual counts for the years 2018-2022 and calculates a percentage of thru-riders relative to the total number of trail users. The data is broken down by weekday manual counts (Mon-Fri) versus weekend manual counts (Sat and Sun).

Table 7: Thru Riders Compared to All Users, Weekday and Weekend (2018-2022)
Calculated by Volunteer Judgment

	Weekday			Weekend		
Year	Thru	Total	% Thru	Thru	Total	% Thru
2018	121	783	15.5%	334	2,622	12.7%
2019	162	831	19.5%	208	4,064	5.1%
2020	351	2,918	12.0%	166	1,437	11.6%
2021	848	3,779	22.4%	NA	NA	NA
2022	539	2,235	24.1%	210	2,317	9.1%
Total	**2,021**	**10,546**	**19.2%**	**918**	**10,440**	**8.8%**

The data in Table 7 show that the percentage of thru riders is approximately twice as large during the week as compared to the weekend. This makes intuitive sense. By definition, thru-riders have set aside several days for their long trek. In contrast, day riders would more likely use the trail before work, after work, or on the weekend. Thus, it is reasonable to assume that weekday manual counts conducted in the middle of the day would count a higher percentage of thru riders than weekend counts.

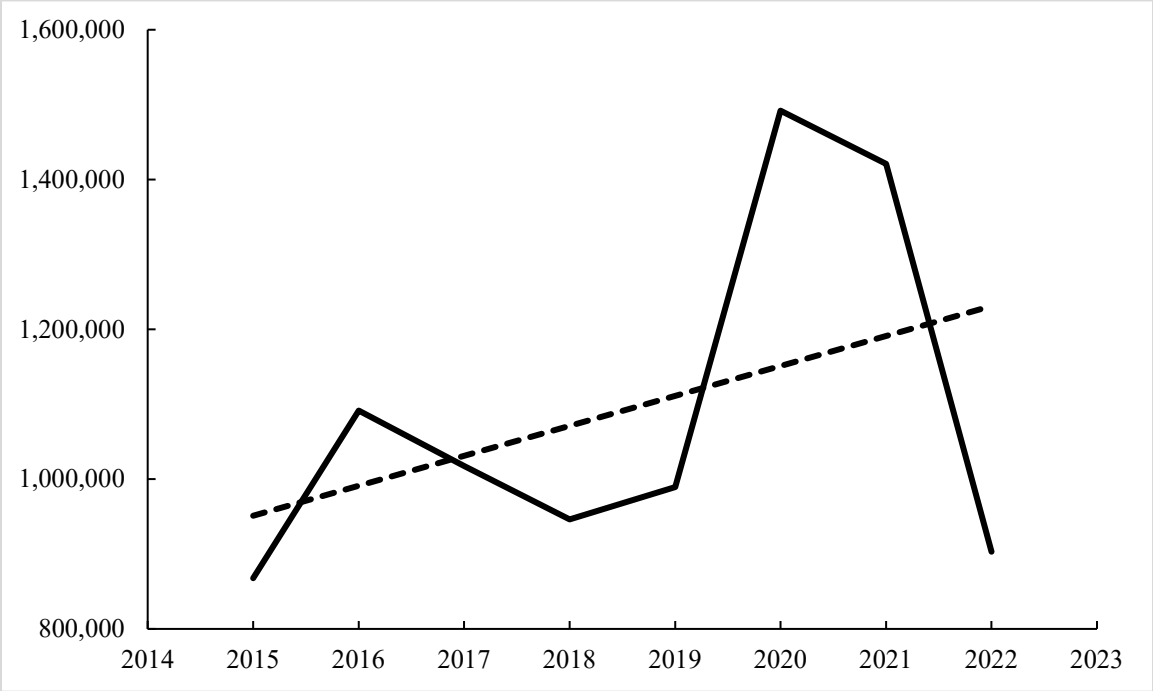
The mid-range estimate of total trail use is 902,973 for 2022. The raw TRAFx count data indicates that 59.0% of trail use occurs during the week compared to 41.0% on the weekend. This implies that the total trail in 2022 breaks down to 424,920 during the week and 295,058 on the weekend. Applying the thru riders percentages from Table 7 (19.2% weekday and 8.8% weekend) to these numbers yields an estimate of 102,127 thru riders during the weekdays and 32,539 on the weekends, for a total estimate of 134,666 for 2022.

Historical Perspective

This year's report is the eighth report since 2015, when the TRAFx locations and synchronized count protocol changed substantially.

Figure 1 shows the mid-range total trail use estimates for 2015-2022 along with a linear trendline. Clearly, trail use estimates have varied considerably year-to-year. Some of the fluctuation is likely due to fluctuations in the quality of data generated by the TRAFx counters, and some is likely due to true year-to-year fluctuations caused by factors such as the weather. The dramatic increase in trail use in 2020 and 2021 undoubtedly reflects the impact of the COVID-19 pandemic, when people increasingly engaged in outdoor recreational activities. Overall, the linear trendline shows an increase in trail use of approximately 4% per year from 2015-2022.

Figure 1: Total GAP Trail Use (2015-2022)



Year	Total Trail Use
2015	867,719
2016	1,091,706
2017	1,017,662
2018	946,284
2019	989,455
2020	1,491,963
2021	1,421,963
2022	902,973