Wrangell-St. Elias National Park and Preserve
Kennecott Mines National Historic Landmark
Traffic Volume Quantification, Summer 2025

Image Sources: National Park Service (Top Left and Bottom Images) and U.S. DOT Volpe Center (Top Right Image), 2025

FINAL REPORT

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Acronyms

ATV	All-Terrain Vehicle
KMS	Kennecott Mines National Historic Landmark Management Strategy for National Park Service Managed Lands
KOP	Kennecott Operations Plan
NHL	National Historic Landmark
NPS	National Park Service
OHV	Off-Highway Vehicle
SOP	Standard Operating Procedure
PTP	Preliminary Transportation Planning
U.S. DOT	United States Department of Transportation
Volpe Center	Volpe National Transportation Systems Center
WRST	Wrangell-St. Elias National Park and Preserve
FY	Fiscal Year

1. Introduction

Pre-Planning for Transportation

The purpose of this data collection project is to collect and analyze visitation data from the Kennecott Mines National Historic Landmark (NHL) in the Wrangell-St. Elias National Park and Preserve (WRST). In fiscal year (FY) 2026, the park will undertake a transportation study to address transportation-related issues and concerns in the NHL. This data collection effort, conducted in the summer of 2025, captures tourist and local volumes at key locations within the NHL and identifies visitation patterns and trends throughout the summer season to inform the upcoming transportation study. The effort analyzes mode share (pedestrians, bicyclists, and off-road vehicles), directionality, and visitation by month, day, and hour.

This data collection effort is a preliminary transportation planning (PTP) project. A PTP is an initial step in the transportation planning process to ensure planning efforts are thoroughly evaluated, feasible, and can be completed successfully within a reasonable timeframe. PTPs can clarify and confirm the scope of transportation issues and opportunities, identify data needs and availability, review previous guidance and management decisions, and assess readiness for and identify next steps to address transportation issues and opportunities.

Project Overview

The 2024 Kennecott Mines National Historic Landmark Management Strategy (KMS) notes that “New issues have arisen since the 2013 KOP [Kennecott Operations Plan] was completed, as well as recurring issues that have not come to a clean resolution. Three salient and pressing topics the park has identified that require careful thought and consideration are: commercial services, guest experience, and transportation.” With regards to transportation, the KMS identified three primary goals:

- Allow existing roads/trails to reflect historic land use patterns that are contributing resources to the historic landscape.
- Establish appropriate modes of transportation for National Park Service (NPS) guests (e.g., hiking, horses, e-bikes, etc.) and their requirements within the NHL (e.g., speed limits, stopping or turnarounds, etc.) that are consistent with law and policy.
- Ensure that there is reasonable access to the NPS-owned lots within the NHL that is consistent with law and policy.

This collaborative effort between the NPS Interior Region 11, Alaska Regional Office (AKRO), Kennecott Mines NHL, and the U.S. Department (U.S. DOT) of Transportation’s Volpe Center (Volpe) collects and analyzes data on tourist and local volumes at five key locations within the NHL as well as mode share (pedestrians, bicyclists, and off-road vehicles), directionality, and visitation by month, day, and hour and identifies visitation patterns and trends throughout the 2025 summer season to inform the FY26 transportation study. Transportation and public access in the NHL are complex due to multiple modes being used at various times, for various uses, and in various directions.

The project team and park staff worked together to collect, compile, and analyze the counter data to identify visitation patterns and trends throughout the summer season at Kennecott Mines. Volpe also compiled and analyzed observational data to a) verify the accuracy of the TRAFx counters, b) develop correction / calibration factors as needed, and c) calculate and extrapolate mode share, directionality, and count adjustments (due to groupings) throughout the summer season. Using this data, Volpe developed graphics that can be used in hand-outs and other mediums to be easily digested/understood by the public and other stakeholders and NPS staff. This report compiles all information from the previous tasks, serving as a record of the work conducted to ensure transparency of the methodology followed and to allow for the methodology to be followed, replicated, and perhaps improved upon in the future if desired.

Study Area

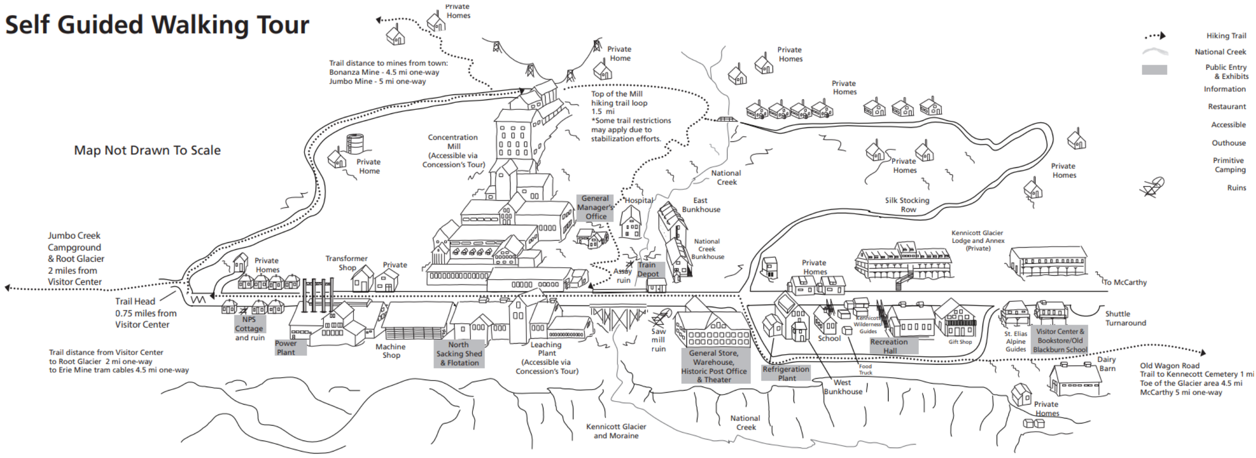
The Kennecott Mines NHL is in the center of WRST. The site is remote and only accessible by small planes, visitors in vehicles who pay to drive across a toll bridge over the Kennicott River, or visitors who walk across a pedestrian bridge over the river and take a shuttle to the site. The Kennecott Mill Town, the center of the NHL, is linear in plan, an orientation dictated by the glaciated, mountainous terrain and the railway that served the site. Currently, Kennecott Mines NHL is the most popular visitor destination in WRST.

Following the initial discovery of very pure copper ore in the area in 1900, the development of the site took considerable effort and financial commitment. Accessing the remote site required the construction of a 196- mile railroad from Cordova that included 44 miles of bridges and trestles, many of which were wiped out each spring and had to be rebuilt. The mill town and mine camps included over seventy-six buildings ranging in size from outhouses to a 14-story timber frame mill building. The fist-sized chunks of ore were mined from 77 miles of underground tunnels and transported to the mill building along three aerial tramways, totaling six miles in length.

Designated an NHL in 1986, the preservation efforts underway by the NPS have uncovered an illustrious history and logistical challenges. Today, Kennecott is considered the best remaining example of early 20th century copper mining in the country. In June 1998, NPS acquired the land, mineral rights, and associated holdings of the Kennecott Copper Mines. While the NHL district encompasses 7,700 acres of public and private lands, which NPS owns a large portion of, private residences and businesses are located throughout the district as well. There are also several hiking trails with varying lengths and degrees of difficulty. Visitors can enter the site via McCarthy Road, a narrow, bidirectional, north-south road with a speed limit of 10 miles per hour. There is also a narrow dirt road trail, Old Wagon Road, parallel to McCarthy Road. The Wagon Road terminates near the historic Dairy Barn on the South Side of Kennecott and about a half mile north of downtown McCarthy, Alaska.

There are numerous interpretive exhibits open to the public at the various structures throughout the study area including the General Store and Post Office, the General Manager's Office, the North Sacking Shed, the Flotation Plant, the Blackburn School (which now serves as the Park's Visitor Center), Recreation Hall, Refrigeration Plant, Railroad Depot, Power Plant, and a Residential Cottage (Figure 1). These NPS-managed properties are interspersed with privately owned property within a residential subdivision. Visitors can stay onsite at the Kennicott Glacier Lodge and Annex, which is a privately owned property. Additionally, visitors can book tours of the Concentration Mill or the Leaching Plant through the private concessionaire, St. Elias Alpine Guides, as well as guided hiking tours through the private concessionaire, Kennicott Wilderness Guides. Though the buildings and lands of the historic mining town of Kennecott are open for visitors to explore, Kennecott Mines NHL is a former industrial site with heavy metals in ground, deteriorated buildings, changing weather, and wildlife, such as bears.

Figure 1: Kennecott Mines NHL Study Area



Source: National Park Service, [Wrangell St. Elias National Park and Preserve – Self Guided Walking Tour](), 2022

2. Site Visit Summary and Methodology

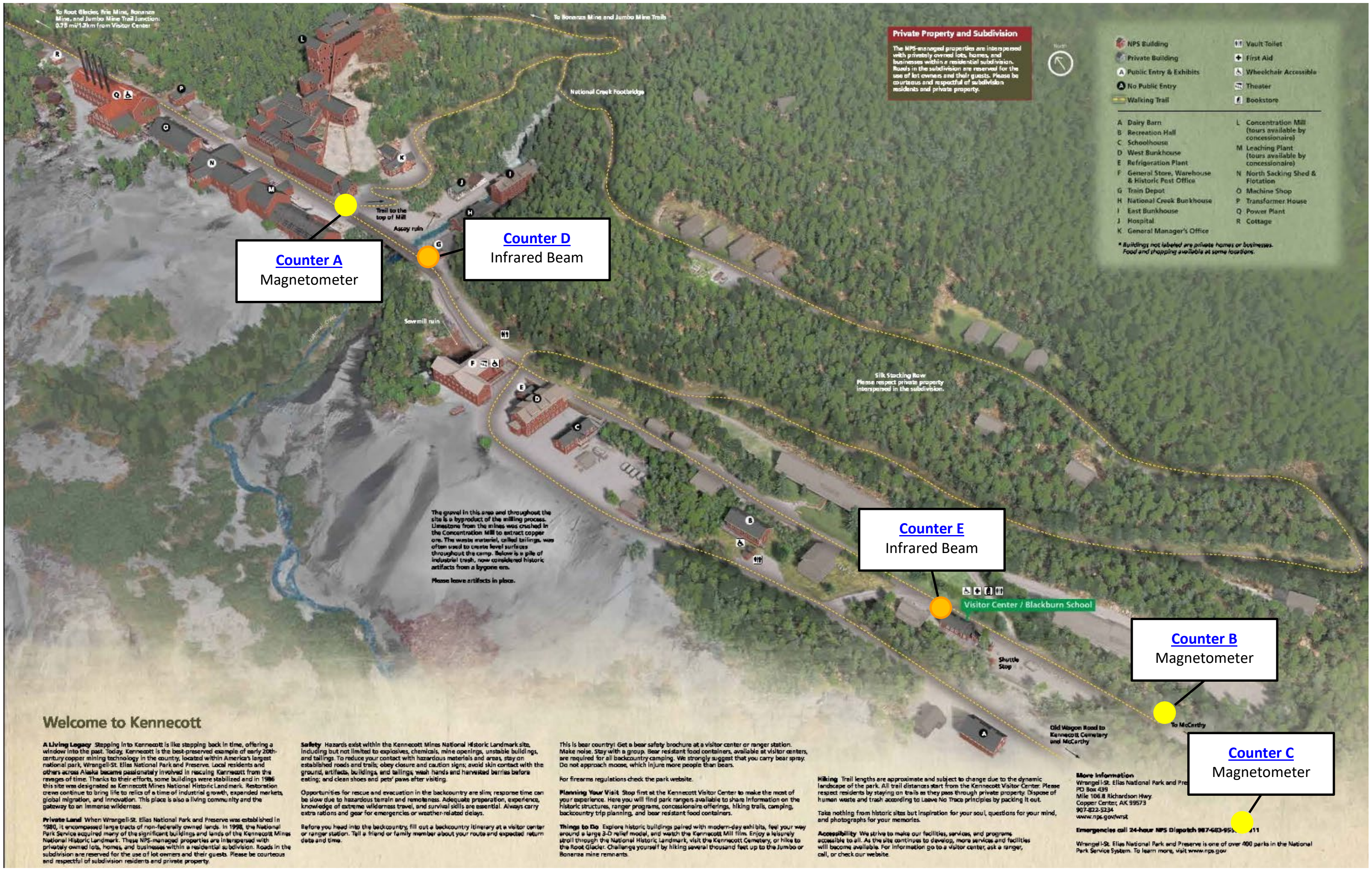
Throughout spring 2025, the project team, comprised of staff from AKRO, Kennecott Mines NHL, and the Volpe Center, worked together to determine what type of counters to install at which locations as well as how to install and configure the technology to effectively count visitors. During the planning phase, the project team faced several challenges with purchasing equipment, making it challenging to secure any new counters. However, AKRO had several counters available from a previous project that could be repurposed for use in this effort, which are described in further detail in the Methodology section of this report. While not the ideal counters to use at the NHL, the project team determined they would be useful as long as agency staff periodically collected observational data to calibrate the counter data at the end of the summer. Volpe developed a standard operating procedure (SOP) for the counter setup and maintenance process for NPS staff to follow in the field (Appendix A: Data Collection Standard Operating Procedures). Further information on the equipment and specifications is also included in the SOP.

Counter Set Up and Maintenance

In May 2025, NPS staff from AKRO and the park installed five TRAFx counters throughout the study area (Figure 2). The team installed TRAFx vehicle counters (magnetometers) at locations A, B, and C in off-highway vehicle (OHV) mode to detect and count OHVs such as all-terrain vehicles (ATVs), quads, motorcycles, jeeps, 4x4s, etc.[1] These counters use an aerospace-quality magnetometer and advanced embedded software to detect the metal in passing vehicles. Given the technology, theoretically, these counters would not capture people but would capture vehicles that pass through a radius around each counter location. The team installed the counters at locations A and B underground, buried approximately four inches deep in the center of McCarthy Road (see Appendix A for exact locations). The team also installed the counter at location C underground, buried approximately four inches deep in the center of Old Wagon Road. Volpe assisted NPS staff with changing these three counters from vehicle mode to OHV mode prior to installation.

[1] Note that these counters have three modes: mountain bikes, OHVs, and vehicles. The range of detection is proportionate to the size of what is being detected such that the range for detecting: mountain bikes is 3.3' radius, dirt bikes is 3.3' to 6' radius, quads is 6.6' to 10' radius, and highway vehicles is up to 20' radius *(TRAFx)*.

Figure 2: Counter Locations within Kennecott Mines NHL



Source: [Kennecott Mines NHL]

Note: The TRAFx magnetometer in the lower right-hand corner (Counter C) was actually placed even farther off the map along Old Wagon Road (aligned with the corner of a Fuel Locker).

The team installed TRAFx Infrared Trail Counters (infrared beams) at locations D and E to detect and count people – walkers, hikers, joggers, inline skaters, horseback riders, cyclists, etc. – on trails, paths and sidewalks. These counters sense and detect the infrared wavelength that people emit to count people as they traverse a road, walkway, trail, etc. in front of the counter. Given the technology, theoretically, these counters could capture people on OHVs and potentially wildlife that pass through the infrared beam at a given location. Ideally, the infrared beam counters must be positioned to adequately cover the width of the adjacent road/walkway. The team installed the counter at location D on the southeast side of the bridge railing, just north of the Train Deport on McCarthy Road, behind the weight limit sign using wiring. The team installed the counter at location E inside the NPS Kennecott Visitor Center in one of the open windows on the west side of McCarthy Road. Appendix A provides further details on these locations.

Almost all counter companies require their own proprietary/custom programs or applications to interface with their counters. TRAFx uses its TRAFx Communicator to program the docking station and counters and to upload data from the docking station to a computer as well as DataNet to view and analyze the data. Volpe worked with NPS to help provide access to these programs. Additionally, Volpe worked with staff from AKRO to set up /program the docking station and the five counters in advance of the installation. TRAFx provides a streamlined process for using their counting equipment; this "Quick Guide" and additional details are included in Appendix A

On-Site Support

In June 2025, project staff from the Volpe Center, the park, and AKRO conducted a second site visit for additional on-site support. During this visit, the project team validated the counters to ensure the devices were installed correctly and functioning properly. While in the field, Volpe showed NPS project team members how to download data from each of the five counters and upload it to DataNet, collected observational data over more than eight hours of manual counts, processed and analyzed the downloaded counter data and the observational data collected, and trained both volunteers and more than 10 Kennecott Mines NHL staff for additional future observational data collection using the data collection plan and worksheets developed by Volpe. Volpe provided additional guidance in the SOP on how and when to conduct manual counts, as well as how best and frequently to download counter data (see Table 1 and Table 2 in Appendix A). WRST park staff was responsible for downloading data from the five sensors on a monthly basis and sending that data to Volpe to upload onto DataNet.

During the June site visit, and throughout the duration of this effort, Volpe was available to help troubleshoot issues with counters or counter programs that the NPS encountered during installation, download, or any miscellaneous occurrence (i.e., storm or accident damage, vandalism, etc.); answer questions; and provide further guidance on best practices to manage data.

Counter Augmentation, Training, and Verification

Because of the complex nature of the data collection effort at Kennecott Mines NHL, Volpe developed a plan to periodically verify and augment counter data with volunteers or staff collecting observational data on a bi-weekly basis. Volpe provided guidance and recommendations on the frequency and duration of these counts based on the availability/bandwidth of staff and/or volunteers (see Table 3 in Appendix A). This manual data collection effort included recording hourly counts by mode type, direction, and groups for two-hour increments since the counters cannot capture this information. Volpe also used the observational data to determine the likely range of each of the counters.

Along with this planned schedule, Volpe also trained NPS staff and volunteers on how to collect this information using Volpe-developed worksheets (Appendix B) during the June 2025 site visit. The project team conducted training for a group of students from the Youth Conservation Corps at park headquarters in Copper Center on Wednesday, June 11, 2025, and a second training for WRST staff at Kennecott on Friday, June 13, 2025.

NPS staff and volunteers conducted manual counts on sixteen different days throughout the season for a total of 186 manual count shifts across the five counters (Table 1). WRST staff oversaw the manual count shifts and sent completed data collection worksheets to Volpe at the end of each cycle. Volpe compared the observational data collected to counter data periodically throughout the summer season to ensure that the counters were functioning consistently.

Table 1: Manual Counts Data Collection Schedule for Volunteers

Counter Location	Total Number of Counts Conducted
A	36
B	38
C	36
D	36
E	40
TOTAL	**186**

Source: U.S. DOT Volpe Center, 2025

Accuracy of the TRAFx Counters

Counters (both vehicle/OHV and trail counters) yield estimates; they are rarely 100% accurate. This holds true for all types and brands. Counter calibration is recommended to improve accuracy, especially if the counting environment is complex (i.e., multiple modes involved, multiple intersections, etc.). Further, as previously mentioned, there were several limitations with the counters used for this project as follows:

- TRAFx Vehicle Magnetometer counters and TRAFx Infrared Trail counters cannot quantify modal share and directionality from the counter data without insights gained from the observational data.
- The devices provide counts in one-hour increments (i.e., 8 AM – 9 AM, 12 PM – 1 PM, etc.), making it challenging for the project team to match the counts from the devices with manual count periods if the human counter showed up late or left early for a given manual count shift, which happened on several occasions throughout the season.

As such, the project team made the following assumptions for estimating the traffic volumes as part of the data analysis.

- Visual/manual counts are the “gold standard.”
- Infrared counters and magnetometers have different characteristics.
- Magnetometer counters will count metal objects but should not count pedestrians.[2]
- Infrared counters will count any object but may undercount objects in large groups.
- Counters cannot distinguish between travel modes (e.g. bicycle, ATV, motorcycle, etc.) or directionality.

[2] Note: It appeared as if the magnetometers may have been picking up metal on pedestrians (e.g., certain water bottles, laptops, etc.) who walk over or close to the counters, specifically at Location A.

Correction / Calibration Factors and Count Adjustments

Counter calibration involves determining an adjustment factor and then applying this to data collected by the counter. In most instances, calibration involves comparing counter totals with those observed by a person, ideally over several hours. It is also a good opportunity to collect additional data (people per vehicle, vehicle type/mode share, directionality, etc.). For example, if a counter records 93 counts over an hour and an attentive observer using a clipboard records 105, then an adjustment or correction coefficient can be easily derived.

105 visual counts / 93 counter counts = 1.12903 adjustment factor

Essentially, the visual total divided by the counter's total equals the adjustment factor (also called correction coefficient). In TRAFx DataNet, the user can apply an adjustment factor to data. There are numerous factors that have the potential to affect how a counter counts, including traffic density/spacing, trail or road width, speed of travel, counter settings (e.g., delay), installation distance, sensor variations, environmental influences, user attention to installation details, etc. Therefore, when calibrating the counters, the user is calibrating the counter to a particular installation location or site. For this reason, each counter should be calibrated for each site and the adjustment factor from one site should not be used for a different site.

In order to estimate the adjustment factor, Volpe fit a regression model to the data. Volpe used counter data to predict the corresponding visual count data. Using a regression approach for the analysis allows for the inclusion of some of the relevant control factors described above, such as date, time, and location. Additionally, it allows for evaluating potentially non-linear relationships between visual and counter data, rather than assuming that the relationship between the two remains identical at all traffic volumes.

3. Data Analysis

Volpe compiled and analyzed the counter data to identify visitation patterns and trends throughout the summer season at Kennecott Mines. In addition, Volpe compiled and analyzed all observational data to a) verify the accuracy of the TRAFx counters, b) develop correction/calibration factors if needed, and c) calculate and extrapolate mode share, directionality, and count adjustments (due to groupings) throughout the summer season. Volpe created the following tables and figures to more easily summarize the analysis for NPS staff, the general public, and other stakeholders.

NPS staff and volunteers collected observational data in two-hour increments on 15 days between the dates June 12, 2025 and September 26, 2025. This data is provided in Appendix C: Data Collection – Manual Count Data. A total of 5,990 objects were counted. These consisted of a total of 4,937 pedestrians; 191 bicyclists; 287 OHVs; 204 passenger vehicles; 370 vans/shuttles; and 1 "other". The project team assumed that magnetometers would count vehicles, but not pedestrians; apart from this distinction, the counters were unable to distinguish between travel modes. Therefore, pedestrians and bicyclists were grouped together into one "pedestrian" category for the purposes of regression modelling. Based on the above numbers, one could estimate that 96% of the counts in the "pedestrian" category consists of pedestrians and the remaining 4% consist of bicyclists. OHVs, passenger vehicles, and vans/shuttles were grouped into a second "vehicle" category. Based on the above numbers, one could estimate that 33% of the counts in the "vehicles" category consists of OHVs, 24% are passenger vehicles, and 43% are vans/shuttles.

Unlike the observational data, the automatic counters collected data at all hours of the day. While the terms "daytime" or "day" are unsuited to long Alaskan summer light hours, it is used here in reference to typical waking and business times. As summarized in Table 2, the vast majority of the automatic counts (from May 14, 2025 to October 1, 2025) occurred during daytime hours (94% of all the traffic counts were between 8 AM and 8 PM), especially around midday (Table 2). Naturally, these daytime hours were also the same times of day selected to conduct manual counts. Therefore, since one of the goals of the analysis was to adjust the counter data to match the visual data, the project team excluded data outside these hours from the analysis for the purposes of modeling the data.

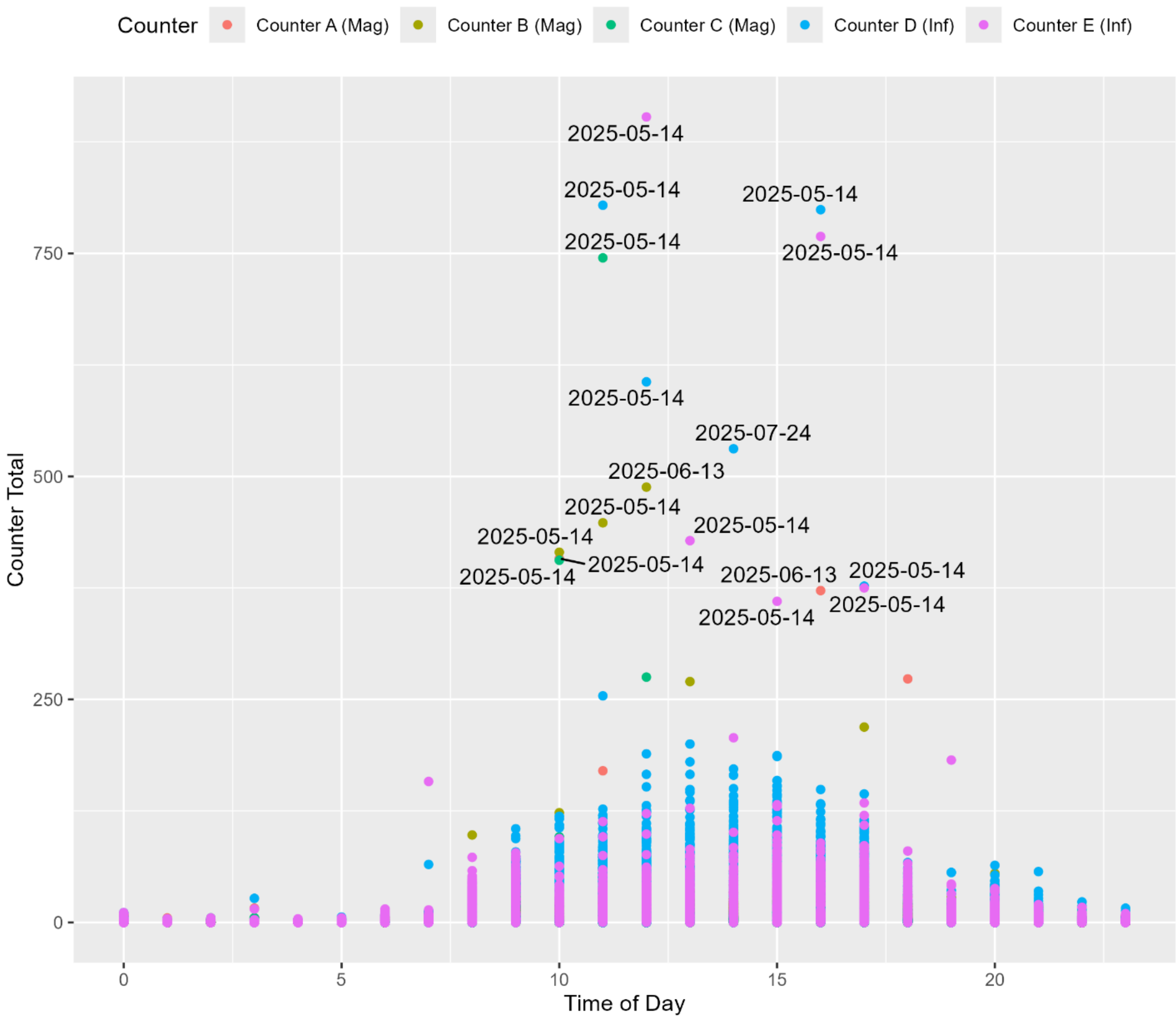
Table 2. Distribution of Counter Data by Hour of the Day

Time	Avg. Hourly Count	Total Hourly Count	% of Total Count
00:00:00	0.66	369	0%
01:00:00	0.24	136	0%
02:00:00	0.26	143	0%
03:00:00	0.35	194	0%
04:00:00	0.16	89	0%
05:00:00	0.29	164	0%
06:00:00	1.84	1,031	1%
07:00:00	2.74	1,536	1%
08:00:00	12.82	7,191	4%
09:00:00	21.35	11,997	7%
10:00:00	20.49	11,516	7%
11:00:00	26.30	14,808	9%
12:00:00	28.77	16,226	10%
13:00:00	28.42	15,943	9%
14:00:00	28.71	15,994	9%
15:00:00	34.80	19,350	11%
16:00:00	29.97	16,783	10%
17:00:00	30.30	16,876	10%
18:00:00	14.26	7,945	5%
19:00:00	7.63	4,271	3%
20:00:00	7.59	4,234	2%
21:00:00	3.91	2,178	1%
22:00:00	1.99	1,117	1%
23:00:00	0.89	501	0%

Note: Blue lines (08:00:00 through 19:00:00) = 94% of the data.
Source: U.S. DOT Volpe Center, 2025

Figure 3 summarizes the magnitude of the counter data by location and time of day and highlights some obvious outliers. These outliers were primarily on May 14th, the first day after the installation of the counters. Comparing these outliers to the observational data, the highest visual count collected at any location, date, or time was 273. Rounding up, the project team selected 300 observations at the upper limit for the counter data. The project team treated all observations above this threshold as outliers and excluded them from the analysis.

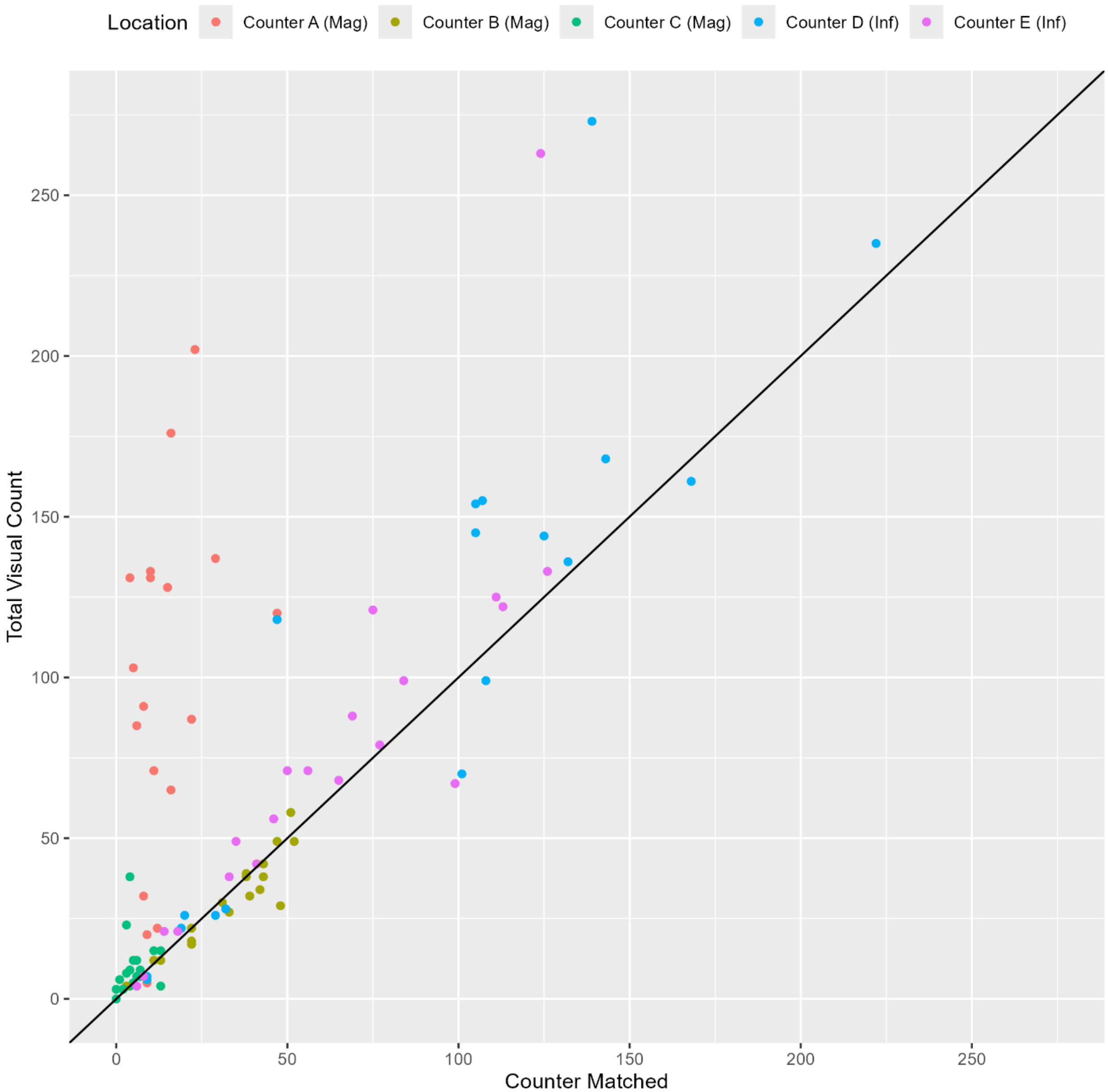
Figure 3: Distribution of Counter Data by Location and Time of Day



Source: U.S. DOT Volpe Center, 2025

Figure 4 and Figure 5 provide a side-by-side comparison of the counter data and the manual counts, matched by date, time, and location. Figure 4 provides a scatter plot illustrating the correlation between the two data sources. Each point represents a date and time for which the project team collected both counter data and observational data; the project team excluded times where only counter data was collected. Unlike the counter data, NPS staff collected observational data over two-hour windows of time; therefore, the project team had to aggregate counter data into the same two-hour windows to directly compare the two. The black line on the figure is included for reference; this is where points would fall if counter data were equal to observation data.

Figure 4. Scatter Plot of Counter Data and Visual Counts, Matched by Location



Source: U.S. DOT Volpe Center, 2025

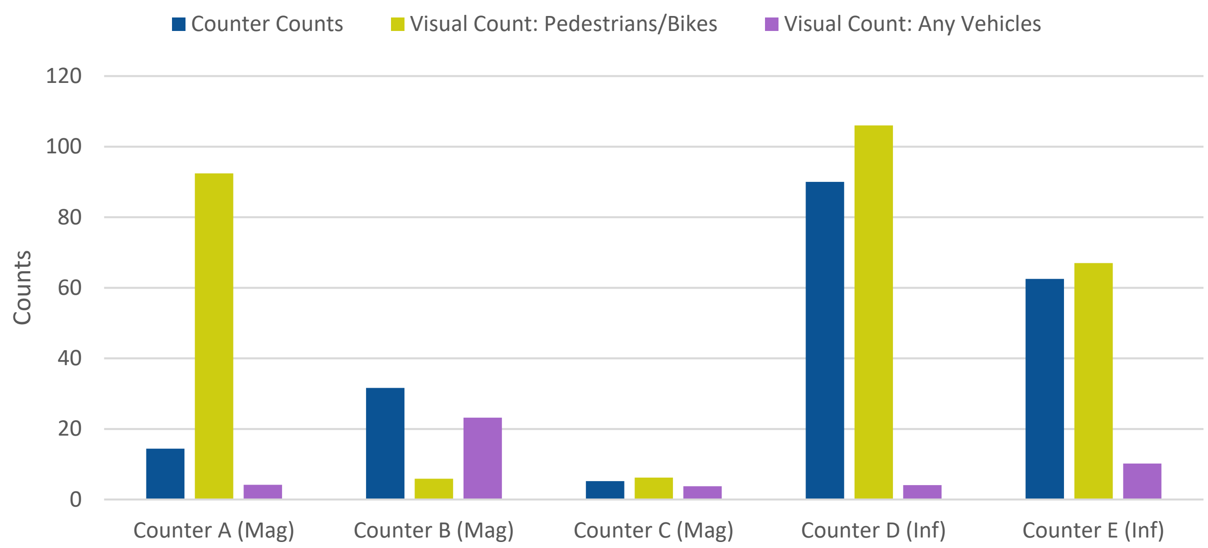
For the most part, counter data and observational data are strongly correlated (r = 0.72). For most of the counters, the majority of the points fall near the line. However, Counter A differed; the observational counts are consistently much higher than the corresponding counter data. There is also a wide range of variance in observational values with little relationship to variance in counter values. Excluding Counter A, the correlation between counter and observational data rises (r = 0.92).

Figure 5 provides an explanation for why these counts differ from one another. In this figure, the project team provides counter data as averages and separates observational data into averages of pedestrians versus vehicles. The project team matched counter data with the dates and times NPS staff collected observational data. This figure helps illustrate how, at Counter B (magnetometer) the counts are primarily driven by vehicle traffic. In contrast, at Counters D and E (both infrared counters) the counts are primarily driven by pedestrian traffic.

Counter C (magnetometer) has so little traffic compared to the other locations that it is not immediately obvious from the figure which type of traffic is driving the counts, although based on the counter type it should most likely be the vehicle traffic. In contrast to the other locations, Counter A (magnetometer) is an anomaly. Based on the counter type, it should be almost entirely driven by vehicle traffic, but the counter counts are too high for vehicles to be the only source of count data. On the other hand, the value is far too low to reflect anything but a small fraction of the pedestrian traffic at this location. Accordingly, the project team excluded Counter A and associated observational data from the analysis.

In summary, all observation data was used, but not all count data. Count data was limited to the data best matching the attributes of the observation data; that is, data collected during the daytime hours; data excluding extremely high outliers; and data aggregated into two-hour windows of data collection.

Figure 5: Average Two-Hour Volume by Traffic Type and Location



Source: U.S. DOT Volpe Center, 2025

Based on this preliminary exploration of the data, the project team created separate models for vehicle traffic and pedestrian traffic. The relationship between visual and counter data differs by counter type, by location, and by magnitude. The following possible relationships were identified in the preliminary data exploration and evaluated in the regression models:

- There appears to be a positive, linear relationship between the counter counts and the observational counts of traffic; that is, as counter counts go up, so do the observational counts.
- There may be an interaction between counter counts and counter type such that:
  - As infrared counts and magnetometer counts increase, so do observational counts of vehicles;
  - As infrared counts increase, so do observational counts of pedestrians; and
  - As magnetometer counts increase, there is little or no relationship with observational counts of pedestrians.
- There is, potentially, a curvilinear relationship between counter counts and observational counts of traffic; that is, in crowded, high traffic conditions, counters may no longer count every single member of a large group or of a continuous stream of pedestrians or vehicles.

Regression Model Results

The project team fit a series of linear regression models (with a Gaussian distribution) to the data. The project team fit one model using observational counts of pedestrians as the dependent variable, while the team fit a second model using observational counts of vehicles as the dependent variable. The model considered linear and curvilinear effects of counter count, counter type, counter location, month, day of the week, and time of day as predictors in the model; the model also considered the effects of the interaction between counter count and counter type. The project team added model parameters in a stepwise fashion. The project team used model fit statistics (Akaike Information Criteria) to guide model selection. The best fitting final models for both pedestrians and vehicles included terms for counter count, counter type, and the interaction of counter count and counter type. The model for vehicles also included a curvilinear effect for the square root (Sqrt) of count. Table 3 and Table 4 summarize model parameter estimates.

Table 3. Regression Model for Pedestrian Traffic

	Estimate	Std. Error	t value	*p*	sig.
Count	1.17	0.08	14.45	<0.001	***
Infra	-3.05	7.39	-0.41	0.68	
Mag	3.91	6.18	0.63	0.53	
Count X Mag	-1.05	0.25	-4.14	<0.001	***

Significance codes: *** 0.001, ** 0.01, * 0.05

Source: U.S. DOT Volpe Center, 2025

Table 4. Regression Model for Vehicle Traffic

	Estimate	Std. Error	t value	*p*	sig.
Count	-0.12	0.06	-2.26	0.03	*
Infra	-2.10	3.35	-0.63	0.53	
Mag	-2.45	1.68	-1.46	0.15	
Sqrt (Count)	2.33	0.88	2.64	0.01	*
Count X Mag	0.52	0.07	7.60	<0.001	***

Significance codes: *** 0.001, ** 0.01, * 0.05

Source: U.S. DOT Volpe Center, 2025

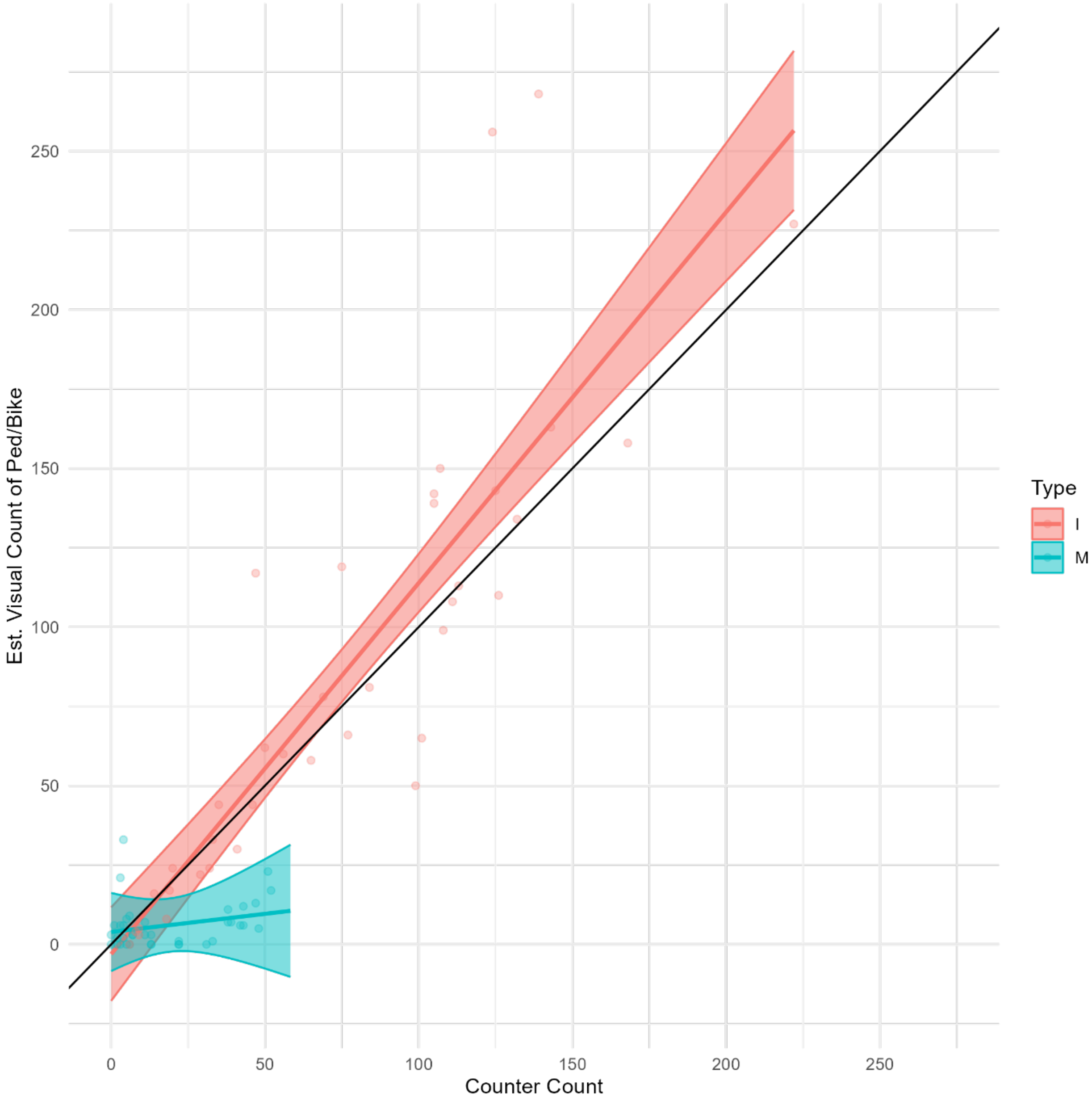
The project team considered a negative binomial distribution as an analysis approach, given that this is generally an appropriate statistical model for count data. However, while these models fit well for small counts, they produced distorted estimates for higher traffic counts compared to a Gaussian distribution.

The best fitting models did not include parameters for month, day of the week, or time of day. The variation in traffic across these times is already sufficiently captured by the variation in the counts. In other words, while the amount of traffic at the park may differ by day of the week or month of the year, the calibration factor does not differ based on day of the week or month of the year.

Taken together, the model for pedestrian traffic and the model for vehicle traffic essentially achieve two things. First, for each counter type, they estimate what proportion of the count is pedestrians and what proportion of the count is vehicles. Second, for each counter type, they estimate the adjustment factor, if one is needed due to a counter overcounting or undercounting pedestrians or vehicles.

Figure 6 illustrates these model estimates for pedestrian counts overlaid on top of a scatter plot of the actual data on which the model is based. The relationship between infrared counter counts and visual observation counts of pedestrians is the simplest to explain; counter data at the infrared counts should be multiplied by an adjustment factor of 1.17 to estimate the visual count of pedestrians, with a slight offset (the intercept of -3.05). This adjustment factor is most likely above 1 because the infrared counters are tending to undercount pedestrians in groups. Counter data at magnetometers mostly represents vehicles; magnetometer data should be multiplied by an adjustment factor of 0.12 to estimate the visual count of pedestrians and bicycles, with a slight offset.

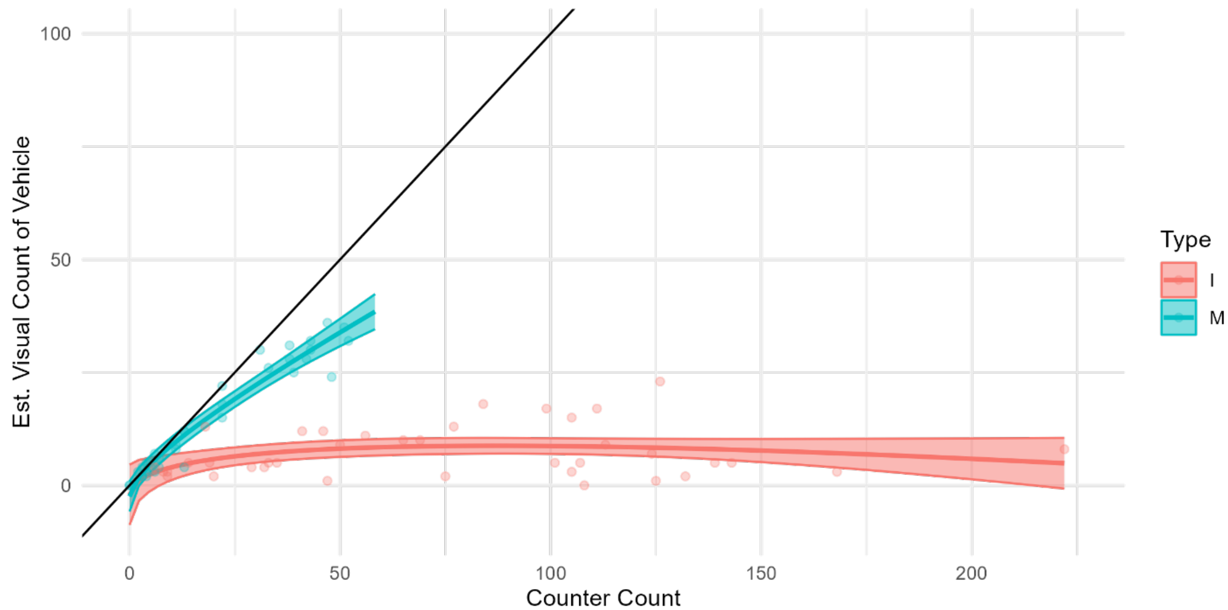
Figure 6: Estimation of Visual Counts Derived from Sensor Counts (Bike/Ped)



Source: U.S. DOT Volpe Center, 2025

Figure 7 illustrates the model estimates for vehicle counts overlaid on top of a scatter plot of the actual data on which the model is based. In general, the data from the counters needed to be adjusted by an adjustment factor well below 1 to estimate the visual count of vehicles, because most of the counts are from pedestrian traffic rather than vehicles traffic. Given the presence of a curvilinear effect in the model, the relationship between counter data and vehicle counts cannot be easily explained in terms of a single adjustment factor; the adjustment factor varies as the count increases. Magnetometer data should be multiplied by an adjustment factor ranging from about 0.7 to 0.9 to get an estimate of the number of vehicles. The remaining proportion of the count consists of pedestrians and bicycles. Infrared counter data should be multiplied by an adjustment factor ranging from about 0.2 to 0.4 to get an estimate of the number of vehicles. The majority of the counts at the infrared counters were from pedestrians and bicycles, so vehicles only represent a small proportion of these counts.

Figure 7: Estimation of Visual Counts Derived from Sensor Counts (Vehicles)



Source: U.S. DOT Volpe Center, 2025

4. Results

After fitting regression models to predict the visual counts from the corresponding counter data, the project team fit these same models to the full set of counter data. In other words, the project team used a subset of the counter data to derive a set of adjustment factors, then the project team applied these same adjustment factors to the remainder of the counter data. The resulting adjusted dataset is too large to reproduce in its entirety in this report; it consists of a spreadsheet (available from the authors upon request) containing all the hours from 8 AM to 8 PM, from each day May through October, for each of the four counter locations, with values before and after adjustment. The project team presents these data in summary here.

Table 5, Table 6, Table 7, Table 8, Figure 8, Figure 9, Figure 10, Figure 11, Figure 12, and Figure 13 summarize the total volume of traffic, before and after adjusting them based on the model estimates, as summed across several different timeframes. These summaries include month of the year, day of the week, and hour of the day. The project team calculated totals separately for pedestrians and for vehicles. Note that the project team presented totals in each table independently of one another. In other words, the total for pedestrians for each month in Table 5 includes all pedestrians for each month, regardless of time of day or day of the week. Similarly, the total for pedestrians in Table 7 includes all pedestrians visiting on each day, regardless of month or time of day.

As a limitation to these results, note that the project team excluded data outside of 8 AM to 8 PM from these totals. As described above in Table 2, this excluded data may represent an additional 4% traffic.

As an additional limitation to these results, models could only be fit to estimate the number of pedestrians (that is, pedestrians on foot or bicyclists) or the number of vehicles (any type). There were some differences between the infrared counters and magnetometers in their ability to count vehicles compared to pedestrians, but neither type of counter was able to distinguish between types of vehicles (or pedestrians and bicyclists). Based on the percentages in the manual counts, one could estimate that 96% of estimated pedestrians/bikes total are pedestrians and the remaining 4% are bicyclists. Based on the percentages in the manual counts, one could estimate that 33% of the counts in the estimated vehicle totals are OHVs, 24% are passenger vehicles, and 43% are vans/shuttles.

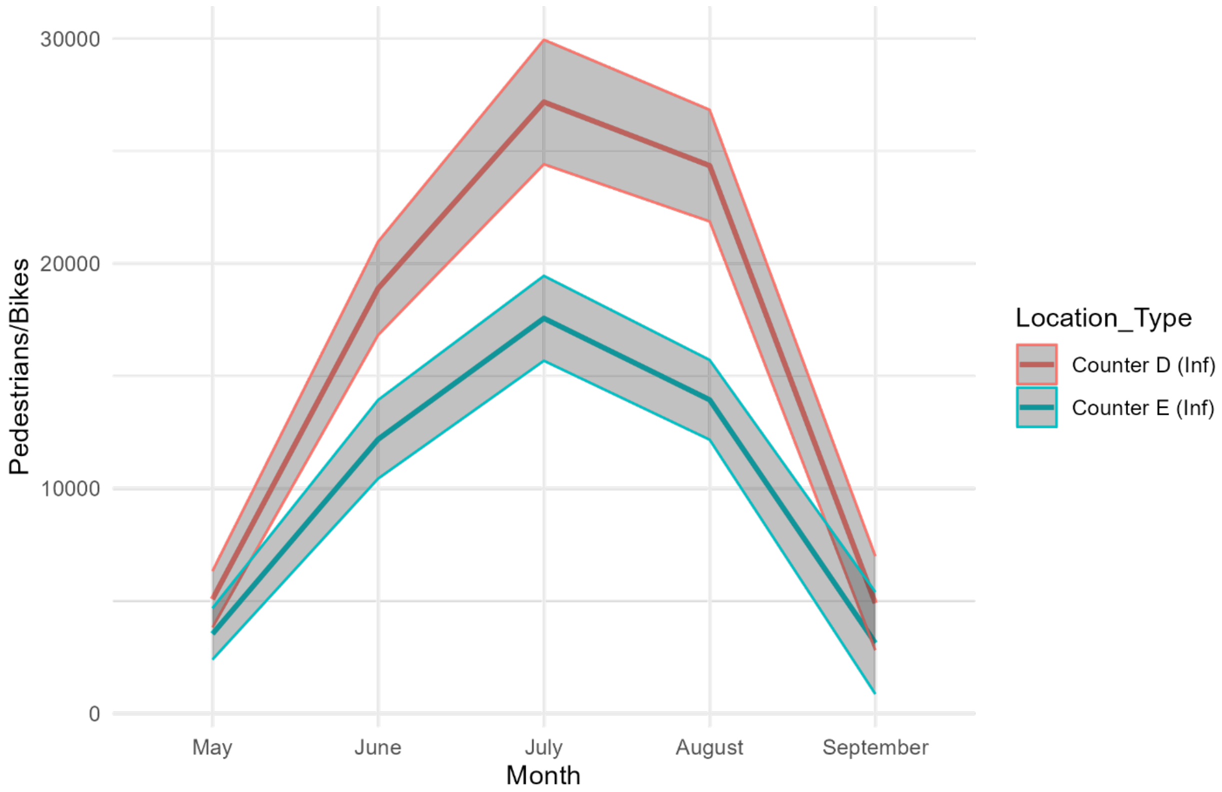
Table 5 and Figure 8 summarize the estimated totals for pedestrian and bike traffic by month of the year at locations D and E, the two locations with infrared counters. Although there was a greater volume of pedestrian traffic at location D than at location E, both locations show the same pattern: traffic increased from May to June, peaked for the year in July, and tapered back off through August and September.

Table 5. Estimated Pedestrian/Bike Totals by Month

Counter Type	Location	Month	Counter Total	Estimated Pedestrians/Bikes Total	95% CI
Infrared	Counter D	May	4,607	5,076	(3,825, 6,327)
		June	16,633	18,900	(16,822, 20,978)
		July	23,731	27,181	(24,413, 29,949)
		August	21,313	24,354	(21,873, 26,835)
		September	4,636	4,903	(2,812, 6,993)
Infrared	Counter E	May	3,279	3,535	(2,393, 4,678)
		June	10,894	12,189	(10,440, 13,939)
		July	15,508	17,566	(15,679, 19,454)
		August	12,409	13,943	(12,170, 15,715)
		September	3,142	3,128	(862, 5,395)

Source: U.S. DOT Volpe Center, 2025

Figure 8: Estimated Pedestrian/Bike Totals by Month



Source: U.S. DOT Volpe Center, 2025

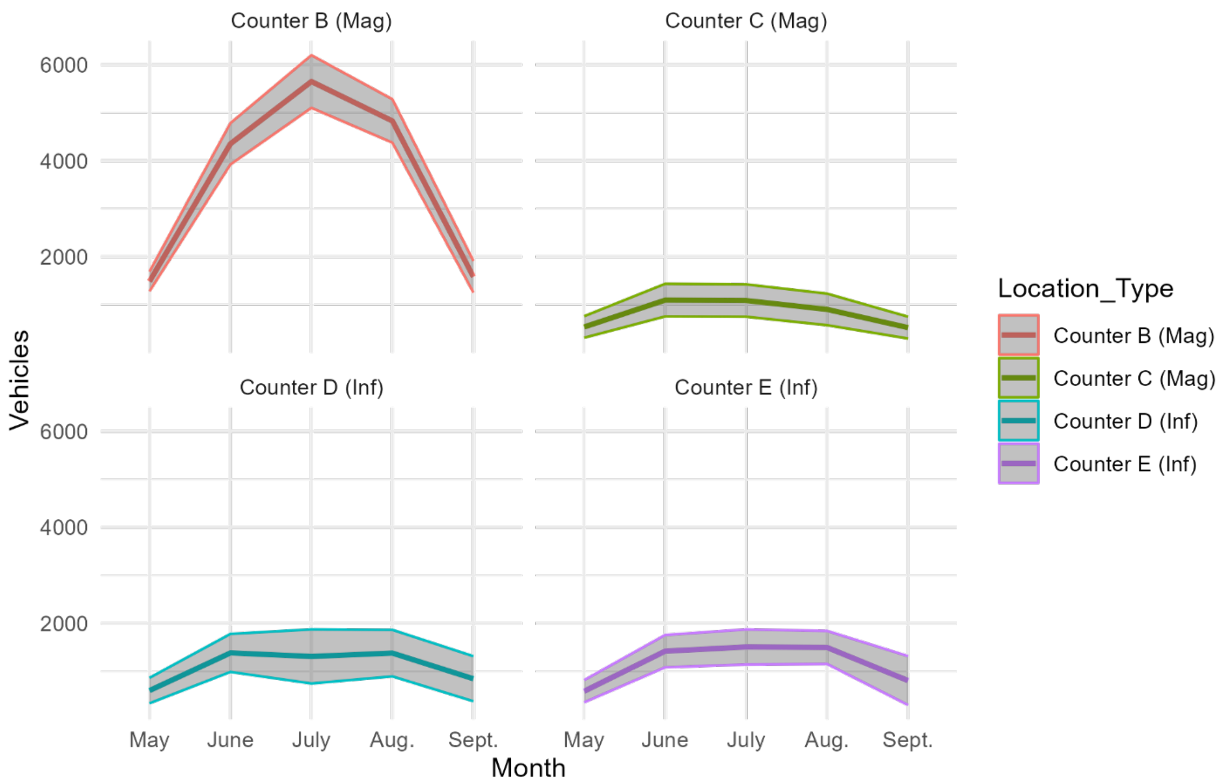
Table 6 and Figure 9 summarize the estimated totals for vehicle traffic by month of the year at locations B, C, D, and E. There was a much greater volume of vehicle traffic at location B than at the other locations. All locations showed a similar pattern: vehicle traffic was greatest in June, July, and August. There was a noticeable peak in vehicle traffic at location B in July, although this was not the case at the other locations.

Table 6. Estimated Vehicle Totals by Month

Counter Type	Location	Month	Counter Total	Estimated Vehicles Total	95% CI
Infrared	Counter D	May	4,607	601	(335, 866)
		June	16,633	1,385	(989, 1,781)
		July	23,731	1,312	(748, 1,876)
		August	21,313	1,381	(896, 1,866)
		September	4,636	847	(378, 1,317)
Infrared	Counter E	May	3,279	587	(355, 819)
		June	10,894	1,422	(1,085, 1,758)
		July	15,508	1,509	(1,144, 1,875)
		August	12,409	1,499	(1,154, 1,843)
		September	3,142	809	(300, 1,318)
Magnetometer	Counter B	May	1,930	1,486	(1,281, 1,691)
		June	6,119	4,354	(3,922, 4,785)
		July	8,264	5,651	(5,102, 6,199)
		August	6,855	4,829	(4,377, 5,282)
		September	1,915	1,584	(1,256, 1,913)
Magnetometer	Counter C	May	721	538	(314, 762)
		June	1,298	1,097	(758, 1,437)
		July	1,236	1,089	(752, 1,427)
		August	1,018	904	(575, 1,233)
		September	600	525	(297, 753)

Source: U.S. DOT Volpe Center, 2025

Figure 9: Estimated Vehicle Totals by Month



Source: U.S. DOT Volpe Center, 2025

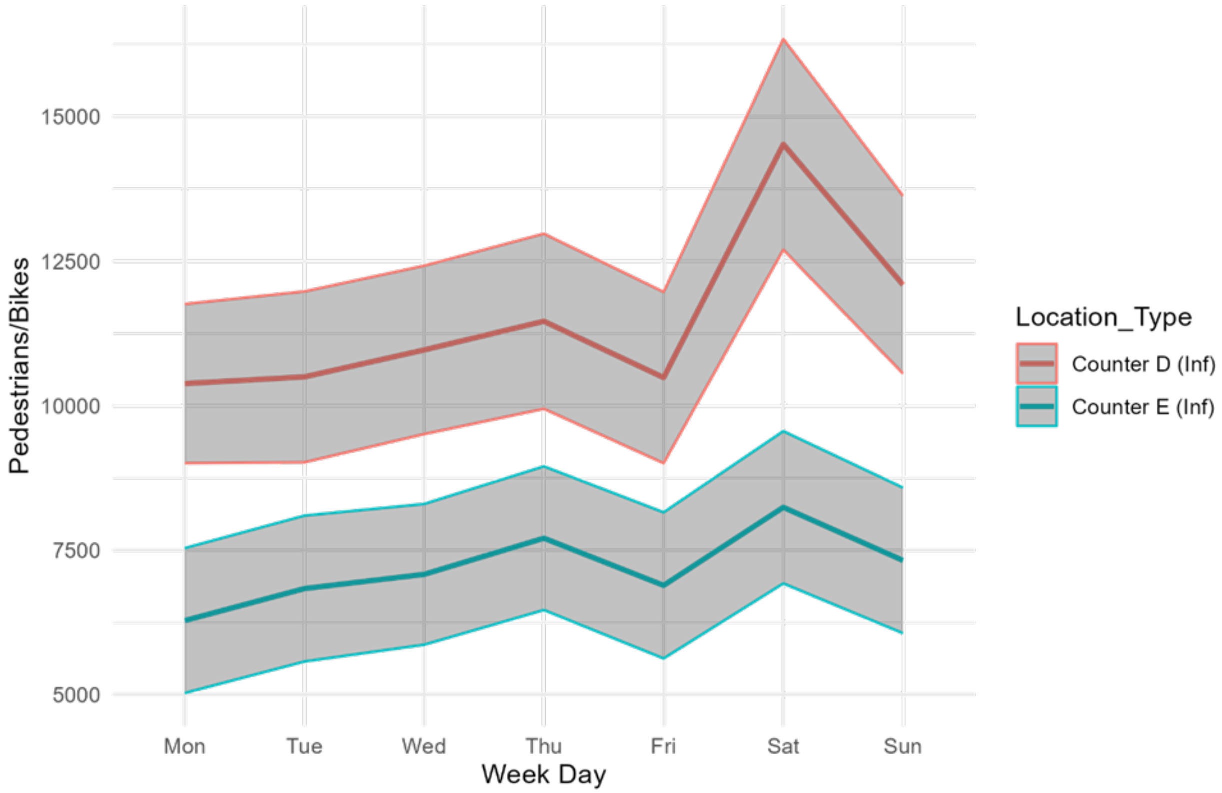
Table 7 and Figure 10 show the estimated pedestrian and bike traffic by the day of the week at locations D and E, the two locations with infrared counters. Although there was a greater volume of pedestrian traffic at location D than at location E, both locations showed a similar pattern: traffic was highest on a Saturday and lowest on a Monday.

Table 7. Estimated Pedestrian/Bike Totals by Day of the Week

Counter Type	Location	Day	Counter Total	Estimated Ped/Bikes Total	95% CI
Infrared	Counter D	Monday	9,185	10,383	(9,007, 11,760)
		Tuesday	9,292	10,499	(9,021, 11,977)
		Wednesday	9,678	10,966	(9,509, 12,422)
		Thursday	10,110	11,462	(9,947, 12,977)
		Friday	9,279	10,487	(9,005, 11,969)
		Saturday	12,726	14,524	(12,700, 16,347)
		Sunday	10,650	12,093	(10,555, 13,631)
Infrared	Counter E	Monday	5,685	6,282	(5,028, 7,535)
		Tuesday	6,159	6,836	(5,573, 8,098)
		Wednesday	6,359	7,082	(5,864, 8,300)
		Thursday	6,897	7,708	(6,465, 8,951)
		Friday	6,198	6,891	(5,626, 8,155)
		Saturday	7,359	8,242	(6,924, 9,560)
		Sunday	6,575	7,322	(6,063, 8,582)

Source: U.S. DOT Volpe Center, 2025

Figure 10: Estimated Pedestrian / Bike Totals



Source: U.S. DOT Volpe Center, 2025

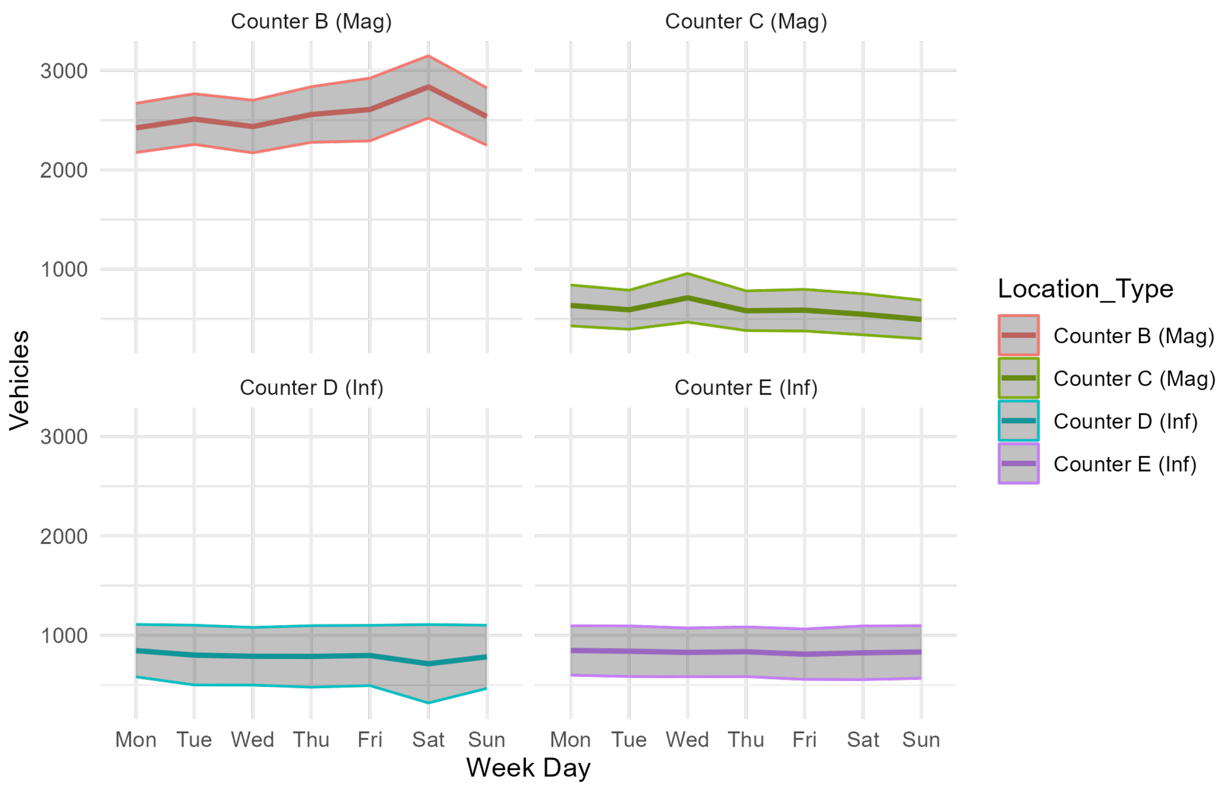
Table 8 and Figure 11 show the estimated total vehicle traffic by the day of the week at locations B, C, D, and E. Vehicle traffic at location B followed a similar pattern to pedestrian traffic with the most traffic on Saturdays and the least on Mondays. Vehicle traffic at location C follows a different pattern with the most traffic on Wednesdays and the least on Sundays. However, at all locations, the amount of variance in vehicle traffic across days of the week is relatively small (i.e., without a large difference between the total traffic on the day with the most and the day with the least amount of traffic).

Table 8. Estimated Vehicle Totals by Day of the Week

Counter Type	Location	Month	Counter Total	Estimated Vehicles Total	95% CI
Infrared	Counter D	Monday	9,185	847	(584, 1,111)
		Tuesday	9,292	802	(501, 1,103)
		Wednesday	9,678	790	(500, 1,081)
		Thursday	10,110	789	(480, 1,099)
		Friday	9,279	798	(495, 1,101)
		Saturday	12,726	715	(320, 1,110)
		Sunday	10,650	785	(467, 1,102)
Infrared	Counter E	Monday	5,685	849	(600, 1,098)
		Tuesday	6,159	841	(586, 1,096)
		Wednesday	6,359	829	(584, 1,074)
		Thursday	6,897	836	(586, 1,086)
		Friday	6,198	811	(557, 1,065)
		Saturday	7,359	825	(555, 1,095)
		Sunday	6,575	834	(569, 1,098)
Magnetometer	Counter B	Monday	3,308	2,422	(2,175, 2,670)
		Tuesday	3,471	2,511	(2,256, 2,766)
		Wednesday	3,373	2,436	(2,171, 2,701)
		Thursday	3,582	2,557	(2,277, 2,837)
		Friday	3,714	2,607	(2,291, 2,923)
		Saturday	4,066	2,835	(2,521, 3,148)
		Sunday	3,569	2,536	(2,247, 2,825)
Magnetometer	Counter C	Monday	723	636	(430, 842)
		Tuesday	674	593	(396, 789)
		Wednesday	918	713	(468, 958)
		Thursday	655	583	(383, 782)
		Friday	720	588	(378, 798)
		Saturday	621	547	(340, 754)
		Sunday	562	495	(300, 690)

Source: U.S. DOT Volpe Center, 2025

Figure 11: Estimated Vehicle Totals by Day of the Week



Source: U.S. DOT Volpe Center, 2025

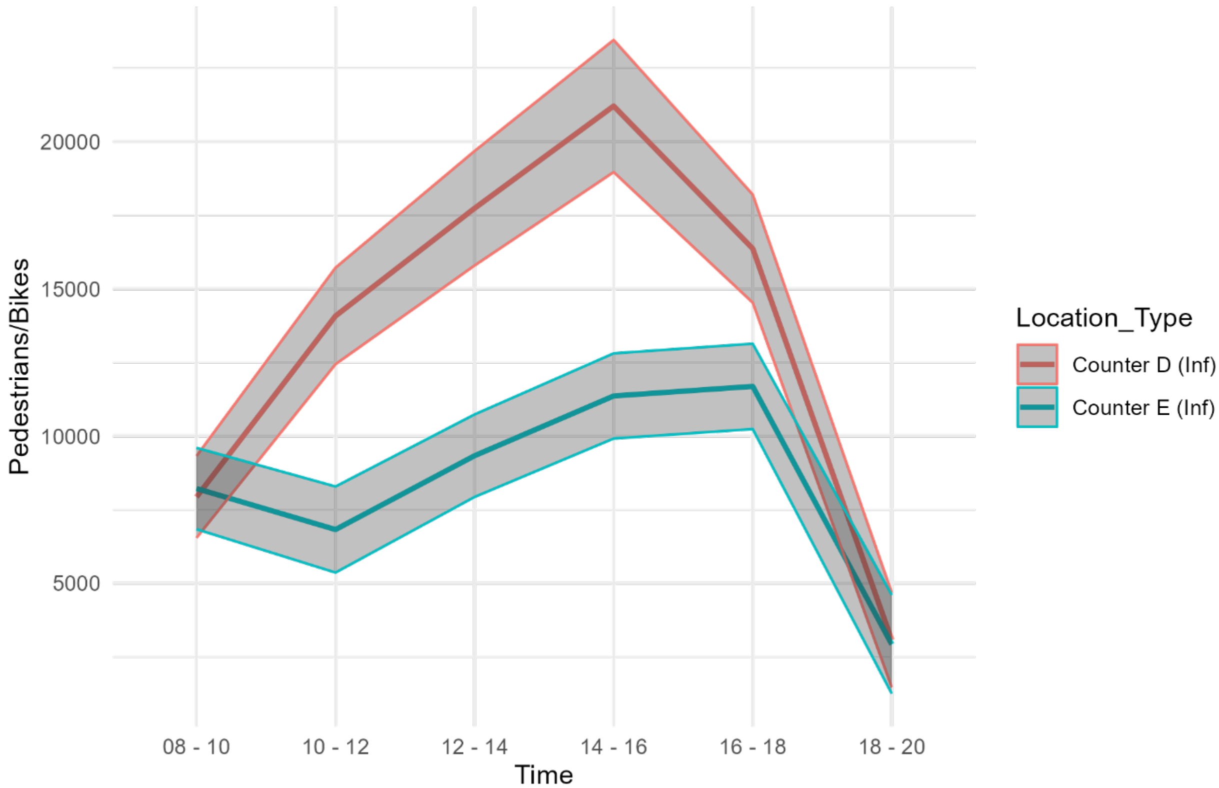
Table 9 and Figure 12 show the estimated total pedestrian and bike traffic by time of day (in two-hour increments) at locations D and E with infrared counters. In general, there was a greater volume of pedestrian traffic at location D than at location E. Each location showed a slightly different pattern: at location D, pedestrian traffic steadily increases through the morning, peaks between 14:00 and 16:00, and then sharply decreases from 16:00 to 20:00. At location E, pedestrian traffic peaks slightly later, between 16:00 and 18:00, with a smaller local peak earlier in the day from 8:00 to 10:00. This may be explained by a larger number of pedestrians entering and exiting the site through location E as the site opens and closes for the day.

Table 9. Estimated Pedestrian/Bike Totals by Time of Day

Counter Type	Location	Time of Day	Counter Total	Estimated Ped/Bikes Total	95% CI
Infrared	Counter D	8:00 - 10:00	7,142	7,933	(6,542, 9,325)
		10:00 - 12:00	12,398	14,082	(12,442, 15,722)
		12:00 - 14:00	15,537	17,740	(15,795, 19,686)
		14:00 - 16:00	18,504	21,213	(18,967, 23,458)
		16:00 - 18:00	14,363	16,371	(14,533, 18,208)
		18:00 - 20:00	2,976	3,074	(1,466, 4,683)
Infrared	Counter E	8:00 - 10:00	7,390	8,220	(6,839, 9,602)
		10:00 - 12:00	6,203	6,826	(5,364, 8,288)
		12:00 - 14:00	8,343	9,335	(7,932, 10,737)
		14:00 - 16:00	10,079	11,365	(9,918, 12,811)
		16:00 - 18:00	10,357	11,690	(10,239, 13,140)
		18:00 - 20:00	2,860	2,927	(1,251, 4,602)

Source: U.S. DOT Volpe Center, 2025

Figure 12: Estimated Pedestrian/Bike Totals by Time of Day



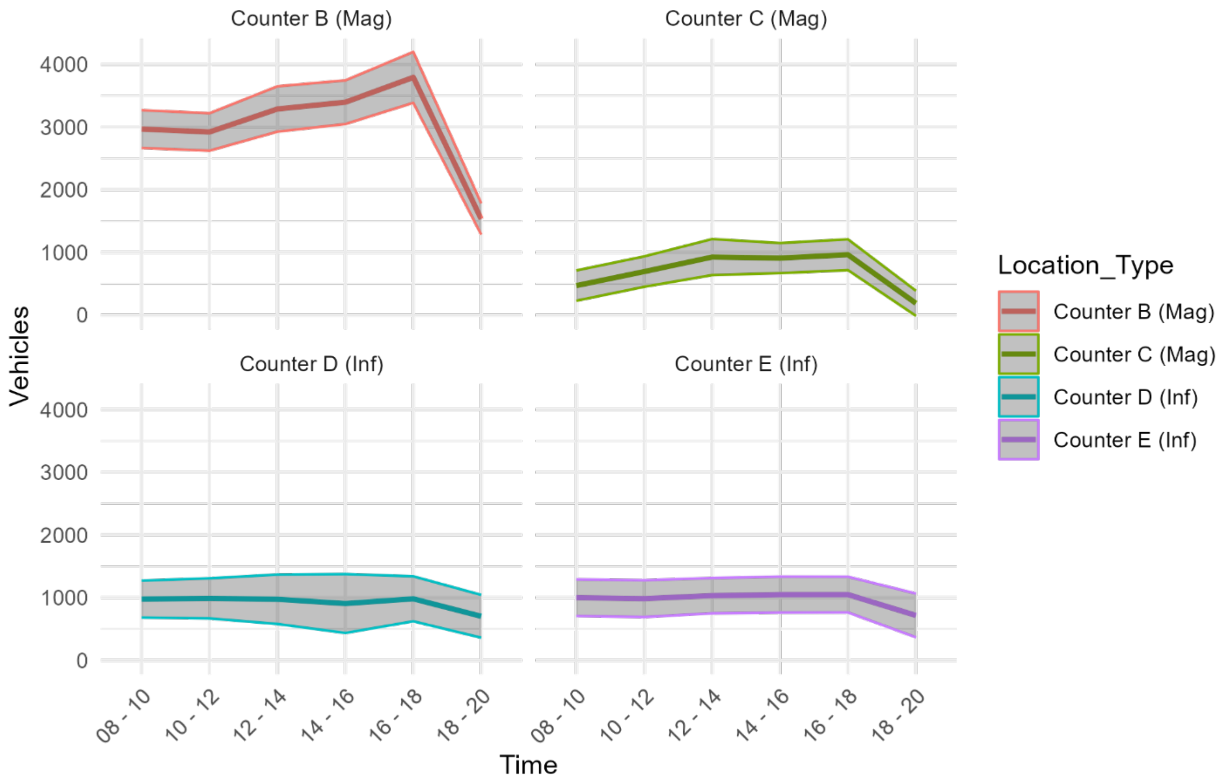
Source: U.S. DOT Volpe Center, 2025

Table 10 and Figure 13 summarize the estimated total vehicle traffic by the time of day at locations B, C, D, and E. Location B has a much greater volume of vehicle traffic than the other locations with the most traffic towards the end of the day from 16:00 to 18:00 before reaching the lowest volume of traffic from 18:00 to 20:00, presumably as vehicles visiting the park leave at the end of the day. Vehicle traffic at other locations lack an obvious trend across the day, although at all locations the volume of vehicle traffic is lowest at the end of the day.

Table 10. Estimated Vehicle Totals by Time of Day

Counter Type	Location	Time of Day	Counter Total	Estimated Vehicles Total	95% CI
Infrared	Counter D	8:00 - 10:00	7,142	976	(682, 1,271)
		10:00 - 12:00	12,398	988	(668, 1,308)
		12:00 - 14:00	15,537	973	(579, 1,368)
		14:00 - 16:00	18,504	905	(436, 1,375)
		16:00 - 18:00	14,363	981	(622, 1,340)
		18:00 - 20:00	2,976	702	(360, 1,043)
Infrared	Counter E	8:00 - 10:00	7,390	999	(707, 1,290)
		10:00 - 12:00	6,203	984	(690, 1,277)
		12:00 - 14:00	8,343	1,031	(749, 1,313)
		14:00 - 16:00	10,079	1,048	(761, 1,334)
		16:00 - 18:00	10,357	1,048	(763, 1,333)
		18:00 - 20:00	2,860	716	(367, 1,065)
Magnetometer	Counter B	8:00 - 10:00	4,123	2,968	(2,667, 3,270)
		10:00 - 12:00	4,025	2,922	(2,624, 3,221)
		12:00 - 14:00	4,692	3,289	(2,928, 3,651)
		14:00 - 16:00	4,838	3,397	(3,049, 3,746)
		16:00 - 18:00	5,526	3,794	(3,388, 4,200)
		18:00 - 20:00	1,879	1,534	(1,284, 1,783)
Magnetometer	Counter C	8:00 - 10:00	522	471	(229, 712)
		10:00 - 12:00	834	695	(452, 937)
		12:00 - 14:00	1,162	926	(639, 1,214)
		14:00 - 16:00	1,032	910	(670, 1,150)
		16:00 - 18:00	1,093	964	(718, 1,210)
		18:00 - 20:00	230	189	(-11, 389)

Figure 13: Estimated Vehicle Totals by Time of Day



Source: U.S. DOT Volpe Center, 2025

5. Conclusion

NPS staff collected traffic data at multiple locations across the site, both through observation and through counters. The project team analyzed data using regression analyses to estimate how to adjust/calibrate counter data to best estimate the observational counts of pedestrian and bicycle traffic as well as counts of vehicle traffic. Although some of the adjustments/calibrations predicted by these statistical models were substantial, these models can be applied to several months of counter data to bring the data in-line with observational counts and to allow for the estimation of upper and lower bounds on the range of expected traffic volume.

This report summarizes total traffic volumes by pedestrians and bikes as well as by vehicle, by location at the park, by month of the year, by day of the week, and by time of day. The full set of adjusted/calibrated data will contribute to the site's future transportation study.

Appendix A: WRST Data Collection Standard Operating Procedures

Overview

The National Park Service (NPS) Interior Region 11 - Alaska Regional Office (AKRO), Wrangell-St. Elias National Park and Preserve, and the U.S. Department of Transportation's (U.S. DOT) Volpe Center (Volpe Center) developed this standard operating procedures (SOP) guide as part of a data collection project intended to collect and analyze visitation data from the Kennecott Mines NHL in the Wrangell-St. Elias National Park and Preserve (WRST). This document is intended to serve as a guide for this work to be replicated, either at the park or elsewhere, or improved upon / troubleshooted in future years. This contains SOPs for the following four topics:

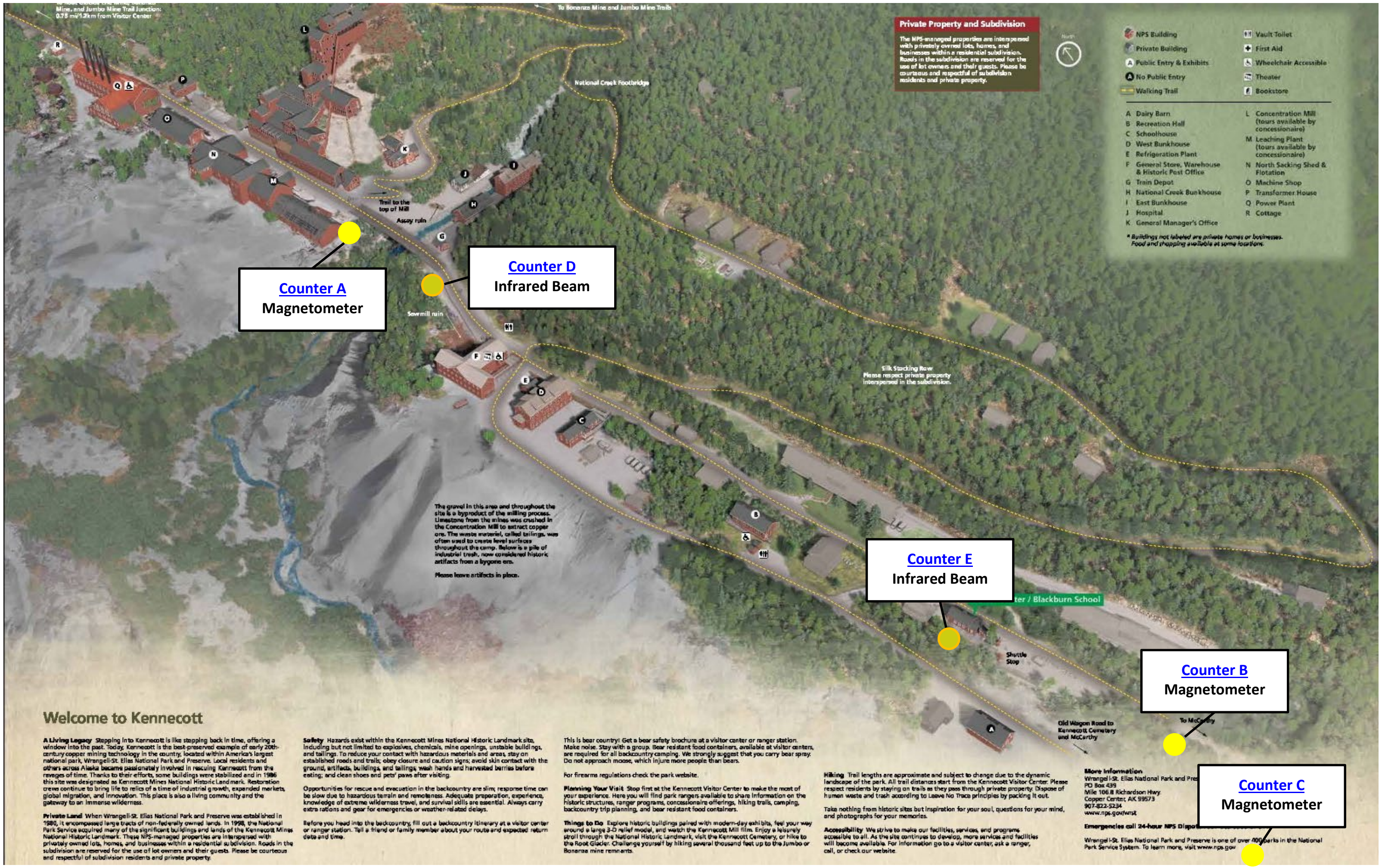
- Counter Installation
- High-Level Summary of Data Collection & Manual Counts
- Downloading the Data from the Sensors
- Calibrating the Sensors

As part of the effort, the project team collected and analyzed data on tourist and local volumes at five key locations within the NHL, as well as information on mode share (pedestrians, bicyclists, and off-road vehicles), directionality, and visitation by month, day, and hour, to identify visitation patterns and trends throughout the 2025 summer season to inform a fiscal year (FY) 26 transportation study. The project team and park staff worked together to install the counters, compile and analyze the counter data, and perform periodic observational counts throughout the summer season at Kennecott Mines. Volpe also compiled and analyzed all observational data to a) verify the accuracy of the TRAFx counters, b) develop correction / calibration factors as needed, and c) calculate and extrapolate mode share, directionality, and count adjustments (due to groupings) throughout the summer season.

The overall goal of this data collection effort was to inform a future transportation study. The project team deployed two types of counters to collect visitor movement data for the data analysis. This included three TRAFx vehicle/off-highway vehicle/mountain bike counters (magnetometers) and two TRAFx trail counters (infrared). The project team deployed the counters on May 14, 2025, for data collection through October 1, 2025. WRST staff maintained the counters after deployment and collected data at regular intervals throughout the season.

Counter Installation SOP

Locations

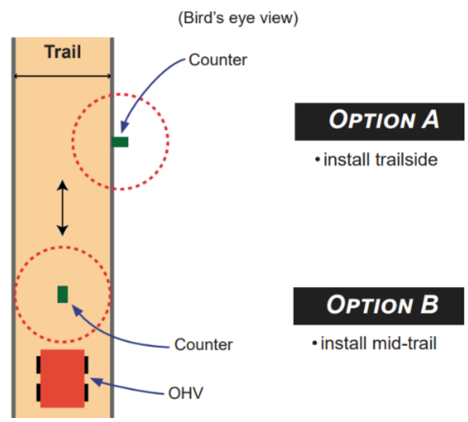


Source: [Kennecott Mines NHL]

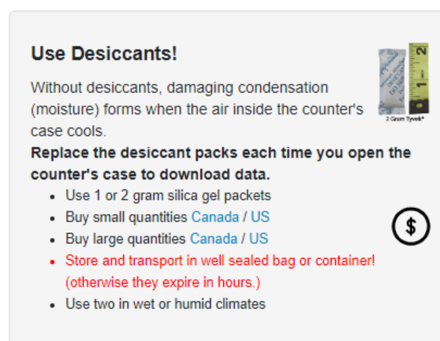
Note: The TRAFx magnetometer in the lower right-hand corner (Counter C) was actually placed even farther off the map along Old Wagon Road (aligned with the corner of the Fuel Locker).

TRAFx Vehicle Counters (Magnetometer)

General Overview and Key Information



- The project team installed three TRAFx Vehicle Counters in the OHV counter mode to detect and count off-highway vehicles such as ATVs, quads, motorcycles, jeeps, 4x4s, etc.
  - Sensors can be installed perpendicular to the road / trail *(Option A in the image to the right)* or in the middle of the trail / road *(Option B in the image to the right)*. The sensors can either be buried underground or locked in a weatherproof lockbox on the side of the road.
  - The TRAFx Vehicle Counter has three main modes: Vehicle, OHV, and mountain bike. See TRAFx Manual – Part I, p. 9 regarding how to select a mode. View and download it at trafx.net/support.
- Detection range is primarily a function of vehicle size.
  - Dirt bikes (and snowmachines) = 1 to 2 meters (3'3" to 6').
  - Quads = 2 to 3 meters (6'6" to 10').
  - Highway vehicles (e.g., jeeps) = up to 6 meters (20').
  - To detect both smaller OHVs (e.g., quads) and larger OHVs (e.g., jeeps), install the counter within range of the smaller vehicle type (i.e., quads). If necessary, create a constriction with rocks or logs to force OHVs near the counter.
  - The detection zone is spherical, extending out in all directions from the counter, whether the counter is placed above or below ground. If only a portion of an OHV enters the detection zone, it will be detected.
  - If burying the counter, bury it approximately 5 to 10cm (2 to 4in.) below the surface; it can also be placed above ground.
- Battery Life (G4 counter lasts up to 1.2 years).[3]
  - Counter uses 3 "C" batteries, Docking Station uses 3 triple A batteries.
- Built for outside: -40C (-40F) to 55C (131F).
- Set-Up: Counter and Dock were set up / installed using the "shuttle mode" which is further explained in the "Quick Guide" attached at the end of this document.
- You need to use desiccants in the Dock weatherproof case as well as the Counter weatherproof case or damage from moisture will occur (*see text box at right*).
- Support for the counters and data system can be found here: TRAFx Technical Support or via the troubleshooting wizard here: TRAFx Wizard. The full TRAFX Vehicle Counter Instructions Manual can be found here: TRAFx_Vehicle_Counter_Instructions.pdf. The full TRAFX OHV Counter Instructions Manual can be found here: TRAFx_OHV_Counter_Instructions.pdf.



Use Desiccants!

Without desiccants, damaging condensation (moisture) forms when the air inside the counter's case cools.

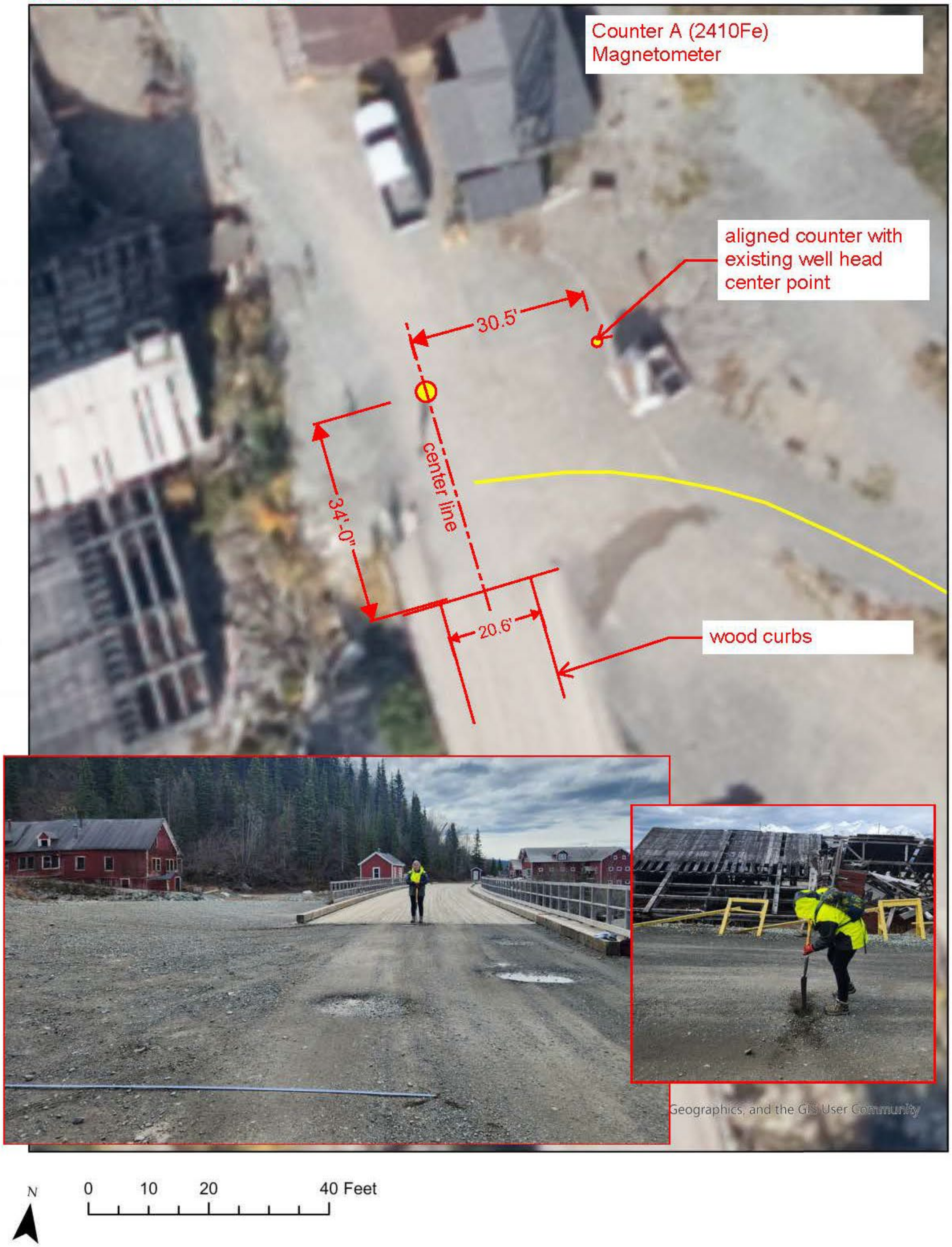
Replace the desiccant packs each time you open the counter's case to download data.

- Use 1 or 2 gram silica gel packets
- Buy small quantities Canada / US
- Buy large quantities Canada / US
- Store and transport in well sealed bag or container! (otherwise they expire in hours.)
- Use two in wet or humid climates

[3] G4 refers to the fourth generation of the counter technology, which is the one that was used for this effort.

Magnetometer Counter Locations

- **Counter A Sensor Serial Number:** 2410Fe (Counter was "named" Counter A in DataNet).
    - **Location:** [On the Historic Railway Bed](#).
        - This counter was installed underground; buried approximately four inches deep and in the center of McCarthy Road aligned with the existing well head center point as identified below.



Source: NPS, 2025

- **Counter B Sensor Serial Number:** 2410Fs (Counter was "named" Counter B in DataNet).
    - **Location:** On the trail off the Historic Railway Bed.
        - This counter was installed underground; buried approximately four inches deep and in the center of the trail aligned between the corner of the existing pipe and tree across from the trail as identified below.

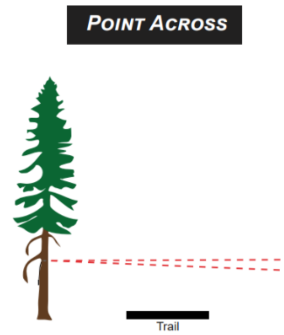
Source: NPS, 2025

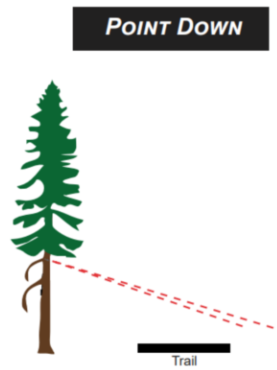
- **Counter C Sensor Serial Number:** 2504Dl (Counter was "named" Counter C in DataNet).
    - **Location:** [On Old Wagon Road](#).
        - This counter was installed underground; buried approximately four inches deep and in the center of the road aligned with the corner of the fuel locker as identified below.

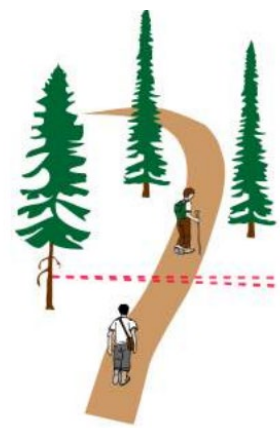
Source: NPS, 2025

TRAFx Infrared Trail Counters (Infrared Beam)

General Overview and Key Information

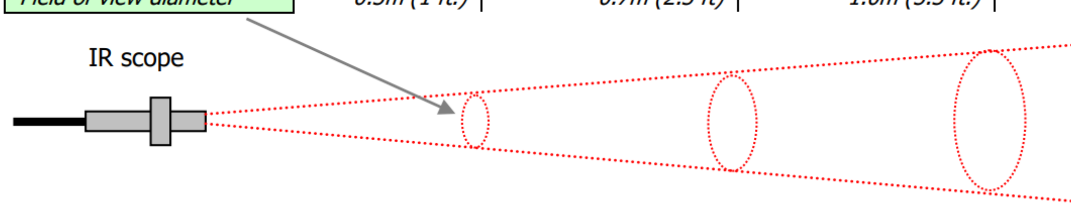






- The project team installed two [TRAFx Infrared Trail Counters]() to detect and count people – walkers, hikers, joggers, horseback riders, cyclists, etc. – on roads at Kennecott.
    - Senses and detects the infrared wavelength that people emit.
        - Continually monitors the amount of infrared energy within its field of view and when there is a significant change from the ambient amount, it records a count.
    - Sensors are flexible with regards to how they can be installed and can be mounted on a tree or post; put inside a low-cost, lockable electrical box attached to a tree or post; or fully embedded in a post.
        - Its small, high-quality IR scope can be pointed horizontal across (most common), or downwards and across (*see images at right*).
            - For “Point Across”: Install within 3 meters (10’) of where people pass (for best results); aim waist high (1 meter / 3’3”); point IR scope slightly down (so water drains out); do not point at wind-prone trees or branches.
            - For “Point Down”: Same installation as for “Point Across;” recommended for situations such as wind-prone trees or branches in the background, a road is in the background, hot climates (ground is an effective reference), or high snowfall areas (allows higher installation).
- The IR scope has a 10-degree field of view that widens with distance, like a narrow spotlight.
    - Maximum detection distance for people is approximately 6 meters (20’).

Distance away	2m (6.5 ft.)	4m (13 ft.)	6m (20 ft.)	Max.
Field of view diameter	*0.3m (1 ft.)*	*0.7m (2.3 ft)*	*1.0m (3.3 ft.)*	



- Battery Life (G4.1: up to 10 years).[4]
    - Counter uses 3 “AA” alkaline batteries, Docking Station uses 3 triple A batteries.
- Built for outside use: -40C (-40F) to 55C (131F).

[4] G4.1 refers to the fourth generation of the counter technology, which is the one that was used for this effort.

- Set-Up: Counter and Dock were set up / installed using the "shuttle mode" which is further explained in the "Quick Guide" attached at the end of this document.
- Use desiccants in the Dock weatherproof case as well as the Counter weatherproof case or damage from moisture will occur.
- Support for the counters and data system can be found at: TRAFx Technical Support or via the troubleshooting wizard at: TRAFx Wizard. The full TRAFX Infrared Trail Counter Instructions Manual can be found at: TRAFx_Infrared_Trail_Counter_Instructions.pdf.

Use Desiccants!

Without desiccants, damaging condensation (moisture) forms when the air inside the counter's case cools.

Replace the desiccant packs each time you open the counter's case to download data.

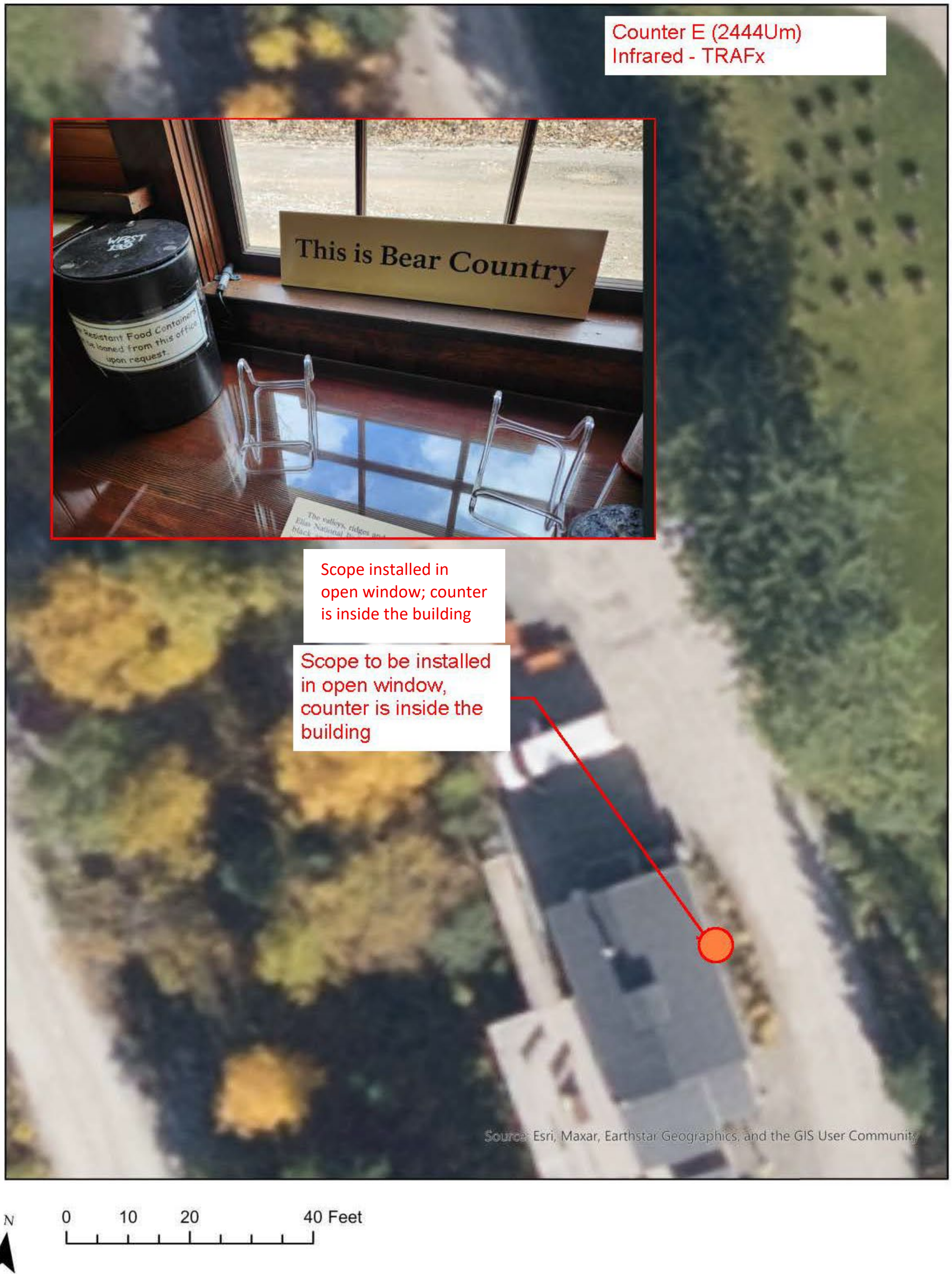
- Use 1 or 2 gram silica gel packets
- Buy small quantities Canada / US
- Buy large quantities Canada / US
- Store and transport in well sealed bag or container! (otherwise they expire in hours.)
- Use two in wet or humid climates

Infrared Trail Counter Locations

- **Counter D Sensor Serial Number:** 2444Uj (Counter was "named" Counter D in DataNet).
    - **Location:** [On the bridge railing located next to the Train Depot](#).
        - The counter was installed the bridge railing behind the weight limit sign using wire as identified below.

Source: NPS, 2025

- **Counter E Sensor Serial Number:** 2444Um (Counter was "named" Counter E in DataNet).
  - **Location:** In the Kennecott Visitor Center.
    - The counter was installed inside the building in an open window as identified below.



Source: NPS, 2025

High-Level Summary of Data Collection & Manual Counts SOP for TRAFx Counters

- Table 1 provides a high-level summary of how to pull and validate the data, as well as additional notes to be aware of, for each counter.
- For all five sensors, conduct the initial validation immediately then download data one week after installation to ensure the counters are working properly.
- After the initial validation to ensure the counters are functioning correctly, WRST staff should pull data from the counters ideally bi-weekly, but at least once a month, through the end of the season as identified in Table 2.
    - Download data from the counter in the field using the TRAFx docker (in shuttle mode).
    - Upload data to the computer using USB and TRAFx docker (in shuttle mode) and save the data for each site in the appropriate DataNet site location folder.
- Ask volunteers to conduct manual counts at the five locations on a bi-weekly or monthly basis to help validate the counters' monthly data collection (in line with the schedule noted in Table 3).
    - Email manual count worksheets from volunteers to Volpe on a bi-weekly basis for us to track.
- Figure 1 provides a streamlined way to use TRAFx counting equipment.

Table 11: WRST Deployed Counters (Appendix A)

Counter	Pulling Data	Validation	Notes
TRAFx Vehicle Counters (Magnetometers) Set to Off-Highway Vehicle (OHV) Counter Mode	USB Download	After 1 week, download data and check results. If okay, pull data from counters on a monthly basis through the end of the season. Ask volunteers to conduct manual counts on a bi-weekly basis in alignment with the schedule in Table 3 to validate the data at the end of the season.	**Counters A, B, and C:** • Need to replace silica gel packets in counter and dock once checked (and after each monthly data collection). • **Counter Limitations:** Two or more OHVs in the detection zone at the same time may be counted as one. • Magnets near the counters can cause problems. Do not put the counter near car audio-speakers; as much as possible, use the counter outside/away from parked or idle vehicles or at places where a driver might linger (*i.e.,* a stop sign).
TRAFx Trail Counters (Infrared Beams)	USB Download	After 1 week, download data and check results. If okay, pull data from counters on a monthly basis through the end of the season. Ask volunteers to conduct manual counts on a bi-weekly basis in alignment with the schedule in Table 3 to validate the data at the end of the season.	**Counters D and E:** • Need to replace silica gel packets in counter and dock once checked (and after each monthly data collection). • **Counter Limitations:** (a) two or more people clustered or passing side by side are typically undercounted; (b) fast moving bicycles might be missed (pre-G4.1 design). • Ensure the three dots engraved on the cable point skywards when installing these counters. Also ensure the line engraved on the cable, next to the three dots, is positioned (+/- 2mm) at the point where the cable enters the scope for proper focusing. • The IR scope has a white optical lens or "eye;" ensure it stays clean; do not scratch or damage it! • The sensor and its circuitry are located inside the scope, at the end of the black cable. • Ensure the water-tight fittings are tight on the cable; these prevent water from entering. • Ensure all the connecting wires are in their proper location and securely clamped down. Test each one of them by gently tugging them. If loose, use provided small screwdriver to firmly connect.

Source: U.S. DOT Volpe Center, 2025

Figure 14: TRAFx Quick Guide (Appendix A)

5 Part I

Quick Guide

This guide presents a streamlined way to use TRAFx counting equipment. Do 1 to 5 before going to the field. After counter installation, do 8 to 10 each time.

This page also serves as a handy reference for the overall process.

1 Connect up using PC

PC Dock Counter

Before starting read page 6 --- these are important words of wisdom.

Then, carefully do pages 7 and 8. Here's a summary.

1. Put batteries in your counter and dock
2. Confirm dock is in PC Mode
3. Connect: ***PC---cable(s)---dock---counter*** *--if using the USB cable, install its driver first!*
4. Open TRAFx Communicator and click GO!

2 Name counter/select mode

Using your PC's keyboard, enter "N" to name a counter and "S" to select mode. Remember to press the PC's **Enter** key (↵). See page 9.

3 Set Dock's time

PC Dock 24h

See page 13 to configure the dock's time. Here's a summary.

1. Connect: ***PC---cable(s)---Dock*** in Shuttle Mode
2. Open TRAFx Communicator and click GO!
3. Enter "C" to configure (yy-mm-dd and 24hr time)
4. Press **Enter** (↵)

4 Print counter instructions

Now, jump ahead to page 16 and print out the required instructions that correspond to your counter type (e.g., vehicle, OHV, mountain bike, infrared trail counter).

5 Read counter instructions

After printing, follow the counter's instructions; the specified distances and other details are very important.

6 Install counter

Install counter in the field as per its instructions. Take a couple of photos of the site.

7 Launch counter

Dock Counter

After installation, launch the counter otherwise no data will be recorded. Launching and downloading involve the exact same steps. Do steps 1 to 5 below.

8 Download counter

Dock Counter

Here's how to use the dock's Shuttle Mode to download (and launch) a counter in the field after collecting data for a day, a week, a month, or more.

1. Confirm that the dock is in Shuttle Mode
2. Connect to a counter. "Downloading" should blink
3. Disconnect when "Finished" blinks
4. After disconnecting, the counter's red **Status LIGHT** should be blinking rapidly; this confirms a successful launch. If not, disconnect and repeat 2 and 3
5. Put a fresh desiccant pack inside the counter's case and close it

Go to the next counter. Repeat 1 to 5.

Before going to the field to download, confirm dock's: (1) time is correct, (2) battery voltage is 3.4V or higher, (3) old data is erased. See pages 13 to 15 for details.

9 Transfer data from Dock to PC

PC Dock

In your office, do as follows. See page 14 for details.

1. Connect: ***PC---cable(s)---Dock*** in Shuttle Mode
2. Open TRAFx Communicator and click GO!
3. Click **Download+** to save Shuttle file –Save to your PC's desktop
4. Find Shuttle file (double click it to view it)
5. Lastly, enter "E" to erase dock

10 Use DataNet

The last step is to use DataNet to view your data. Go to pages 20 and 21 to learn how. Here's a summary.

1. Go to trafx.net to log in
2. **UPLOAD** Shuttle file and assign data to a counter site
3. **ANALYZE** and report data (i.e., generate totals, etc)

TRAFx MANUAL (2024) — **PART I** — www.trafx.net

Source: TRAFx_Manual_Part_I.pdf, page 5.

Downloading the Data from the Sensors SOP

WRST park staff is responsible for downloading the data from the five sensors on a monthly basis (as outlined in Table 2 below) and uploading that data to DataNet.[5]

Table 12: TRAFx Data Collection and Maintenance Schedule (Appendix A)

Date	Tasks	Who?
Saturday, 5/31/2025 or Monday, 6/2/2025	Data Validation (All Counters)	Jonathan *(NPS WRST)*
Friday, 6/13/2025	Data Collection (All Counters)	Emily and Laura
Week of 7/7/2025	Data Collection (All Counters)	Jonathan *(NPS WRST)*
Week of 8/4/2025	Data Collection (All Counters)	Jonathan *(NPS WRST)*
Week of 9/1/2025	Data collection and pull counters; check wear and tear of counters; store at WRST	Jonathan *(NPS WRST)*
Week of 9/29/2025	Data collection and pull counters; check wear and tear of counters; store at WRST	Jonathan *(NPS WRST)*

Note: TRAFx recommends downloading the data monthly, if possible. This greatly reduces the risk of losing large amounts of data due to possible human error (e.g., incorrect installation), environmental conditions (e.g., a squirrel attacks the counter), technological issues (e.g., loose wire connection or weak batteries), and security issues (e.g., someone tampers with the equipment). Source: U.S. DOT Volpe Center, 2025.

In order to download data, have two software systems downloaded onto the computer: TRAFx Communicator V4.1 and the USB to Serial Driver Adapter Installer. USB to Serial Driver Adapter Instructions can be found here: How to install driver software for USB-to-serial adapter (230213) (trafx.net). Steps for downloading the data from the sensors are as follows:

1. **Download Data from Counters[6] –** WRST staff goes out into the field to collect data, which is downloaded from each of the counters onto the dock.
    a. Confirm that the dock is in Shuttle Mode.
    b. Connect the dock to a counter. "Downloading" should blink.
    c. Disconnect when "Finished" blinks.
    d. After disconnecting, the counter's red **Status LIGHT** ★ should be blinking rapidly; this confirms a successful launch. If not, disconnect the dock from the counter and repeat steps 1b and 1c.
        i. Note: Launching and downloading the counters involve the same steps. If the counter is not "launched," no data will be recorded.
    e. Put a fresh desiccant pack inside the counter's case and close it.
    f. Go to the next counter and repeat steps 1a – 1e.

    Note: Before going into the field to download, confirm dock's: (1) time is correct, (2) battery voltage is 3.4V of higher, and (3) old data is erased. (See pages 13 to 15 in the TRAFx Manual Part I for further details.)

2. **Transfer Data from Dock to PC** – Bring the dock back to the office and complete the following steps:
    a. Connect: ***PC---cable(s)---Dock*** in Shuttle Mode**.**
    b. Open TRAFx Communicator and click GO!
    c. Click **Download+** to save Shuttle file.

[5] TRAFx recommends that one person in your organization responsible for learning how to operate TRAFx equipment well. This experienced person can then assist and supervise others, if necessary. Having several users who rotate or only occasionally use the equipment is a formula for grief and trouble. Avoid making short-term personnel (students, volunteers, seasonal staff, etc.) responsible for operating TRAFx equipment. *(Source:* TRAFx_Manual_Part_I.pdf*, page 6).*

[6] When downloading a counter, **always use** the checklists in the counter manuals *(**OHV Counters:** TRAFx OHV Counter Instructions, page 5; **Infrared Trail Counters:** TRAFx Infrared Trail Counter Instructions, page 6).*

i. Save the file to your PC's desktop.

d. Find Shuttle file (double click it to view it).

e. Lastly, enter "E" to erase the dock (once all the data from the five counters has been downloaded onto your PC).

Note: See page 14 in the TRAFx Manual Part I for additional details on transferring data.

3. **Use DataNet** – Use DataNet to view your data. Five (5) accounts are available for this software.[7]
   a. Go to trafx.net to log in.
   b. **UPLOAD** Shuttle file and assign data to a counter site.
      i. The **UPLOAD** page is where *data files* are uploaded, and *data sets* (counter data) are assigned to specific counter sites (i.e., locations). In short, this is how users can get their data into DataNet. Each counter should have its own site. The five sites for this project are already set up in DataNet. Steps for uploading the data can be found in the DataNet Manual.
   c. **ANALYZE** and report data (i.e., generate totals, etc.).
      i. The **ANALYZE** page is where all users (Administrators and Viewers) can view their "counts," and create charts (graphs), reports, and summary tables. In other words, this is where users can slice and dice their data. Steps for analyzing the data can be found in the DataNet Manual.

Note: See pages 20 and 21 in the TRAFx Manual Part I for additional details on using DataNet.

[7] Three accounts are already in use [one for Volpe (Emily); one for the NPS Regional Office (Laura); one for NPS WRST (Jonathan)], but two accounts remain available for use at the NPS Regional Office's discretion.

Collecting Validation Data through Manual Counts SOP

WRST park staff is responsible for conducting manual counts at each of the five sensor site locations to validate the sensor data collected month to month. WRST staff anticipate having volunteers conduct these manual counts on a **bi-weekly basis** (as outlined in Table 3 below).

Table 13: Manual Counts Data Collection Schedule for Volunteers (Appendix A)

Date	Tasks	Who?	Actual Date(s) of Completion
Week of 6/23/25	Manual Counts – Two Hour Sessions (One AM and one PM) (All Counters)	Jonathan *(NPS WRST)* or Volunteers	Thursday, 6/12/25 (All Counters) Friday, 6/13/25 (A, E)
Week of 7/7/25	Manual Counts – Two Hour Sessions (One AM and one PM) (All Counters)	Jonathan *(NPS WRST)* or Volunteers	Tuesday, 7/1/25 (All Counters) Wed., 7/2/25 (All Counters) Thursday, 7/3/25 (All Counters)
Week of 7/21/25	Manual Counts – Two Hour Sessions (One AM and one PM) (All Counters)	Jonathan *(NPS WRST)* or Volunteers	Friday, 7/18/25 (All Counters)
Week of 8/4/25	Manual Counts – Two Hour Sessions (One AM and one PM) (All Counters)	Jonathan *(NPS WRST)* or Volunteers	No available staffing
Week of 8/18/25	Manual Counts – Two Hour Sessions (One AM and one PM) (All Counters)	Jonathan *(NPS WRST)* or Volunteers	Friday, 8/1/25 (All Counters) Monday, 8/4/25 (B Only)
Week of 9/1/25	Manual Counts – Two Hour Sessions (One AM and one PM) (All Counters)	Jonathan *(NPS WRST)* or Volunteers	Friday, 8/15/25 (A, E) Saturday, 8/16/25 (D Only) Sunday, 8/17/25 (B, C)
Week of 9/15/25	Manual Counts – Two Hour Sessions (One AM and one PM) (All Counters)	Jonathan *(NPS WRST)* or Volunteers	Friday, 8/29/25 (A, B, C, E) Sunday, 8/31/25 (E Only)
Week of 9/29/25	Manual Counts – Two Hour Sessions (One AM and one PM) (All Counters)	Jonathan *(NPS WRST)* or Volunteers	Friday, 9/12/25 (All Counters) Saturday, 9/13/25 (D Only)

Source: U.S. DOT Volpe Center, 2025.

WRST staff or volunteers should conduct these manual counts using the *"WRST: Counts for TRAFx Magnetometer Counters"* and the *"WRST: Counts for TRAFx Infrared Beam Counters"* worksheets. Each manual count at each site will require its own completed worksheet. WRST staff should collect the completed worksheets and email them to the Volpe Center (Emily.Maciejak@dot.gov and Benjamin.Rasmussen@dot.gov) so that the Volpe Center can keep track of the data for validation purposes.

Step-by-step instructions are provided in the individual worksheets and are included below.

WRST: Counts for TRAFx Magnetometers Counters Worksheet Instructions

1. Fill in the correct information on the worksheet for "counter number," "date," "shift time," and "name of data collector" for each count shift.
2. Record **hourly counts** for two hours[8] at each counter at two points in time throughout the week on the table included in the worksheet (once in the AM, either between 8 AM and 10 AM or 10 AM and 12 PM, and once in the PM, either between 1 PM and 3 PM or 3 PM and 5 PM) and note the following:
    a. Mode type (e.g., pedestrian, vehicle, commercial van/vehicle or tour bus, bicycle, ATV/Quad, etc.).
    b. Direction that the person, vehicle, bicycle, etc. is traveling (i.e., North or South).
    c. The approximate distance that each person/vehicle passes by the counter (to determine/identify the range of the counter by mode). ***Note:** The magnetometer counters are set to OHV mode,*

[8] Since the counters only provide hourly counts and are unable to break down counts by smaller time increments, it is crucial for manual counts to begin right on time and go through the full two hours to accurately compare these counts with the counter data collected.

which according to the specs has a detection range of approximately 1 to 2 meters (3.3' to 6') for dirt bikes and snow machines, 2 to 3 meters (6.6' to 10') for quads, and up to 6 meters (20') for highway vehicles (e.g., Jeeps). Given this, the radius of the counter is likely going to be up to 10' in any given direction and conservatively 6.6', but the trail / road is wider in some instances (i.e., the road where Counter A is located is 20'6'' wide), therefore, doing manual counts help fill in the additional data that may not have been picked up by the counters, especially for pedestrians who are not going to be detected by the magnetometer counters at all. As such, make sure to count everything in all "zones" manually to be able to compare it to the sensor data.

WRST: Counts for TRAFx Infrared Beam Counters Worksheet Instructions

1. Fill in the correct information on the worksheet for "counter number," "date," "shift time," and "name of data collector" for each count shift.
2. Record **<u>hourly counts</u>** for two hours[9] at each counter at two points in time throughout the week on the table in page 2 (once in the AM, either between 8 AM and 10 AM or 10 AM and 12 PM, and once in the PM, either between 1 PM and 3 PM or 3 PM and 5 PM) and note the following:
    a. Mode type (e.g., pedestrian, vehicle, commercial van/vehicle or tour bus, bicycle, ATV/Quad, etc.).
    b. Direction that the person, vehicle, bicycle, etc. is traveling (i.e., North or South).
    c. The approximate distance that each person/vehicle passes by the counter (to determine/identify the range of the counter by mode). ****Note:*** *According to the specs, the infrared beam counters have a detection range of up to 6 meters (20') for people – walkers, hikers, joggers, inline skaters, horseback riders, cyclists, etc. – on trails, paths and sidewalks. Given this, the detection range is likely going to be 20' but the trail / road is wider in some instances; therefore, doing manual counts help fill in the additional data that may not have been picked up by the counters.*
    d. For the infrared counters, also record the number of people in the group if they are walking abreast by circling the tally that represents the group in the table on the worksheet.

[9] Since the counters only provide hourly counts and are unable to break down counts by smaller time increments, it is crucial for counts to begin right on time and go through the full two hours to accurately compare the manual counts with the counter data collected.

Calibrating the Sensors SOP

Counters (both vehicle/OHV and trail counters) yield estimates; they are rarely 100% accurate. This holds true for all types and brands. Counter calibration is recommended when higher accuracy is desired, especially if the counting environment is complex (i.e., multiple modes involved, multiple intersections, etc.).

Counter calibration involves determining an adjustment factor and then applying this to data collected by the counter. In most instances, calibration involves comparing counter totals with those observed by a person, ideally over several hours. It is also a good opportunity to collect additional data (people per vehicle, vehicle type, etc.). For example, if a counter records 93 counts over an hour and an attentive observer holding a clipboard records 105, then an adjustment or correction coefficient can be easily derived.

105 visual counts / 93 counter counts = 1.12903 adjustment factor

Essentially, the visual total divided by the counter's total equals the adjustment factor (also called correction coefficient). In TRAFx DataNet, the user can apply an adjustment factor to data (see Step 6 below for how to calibrate a counter). Always use an adjustment factor with at least five decimal places, as shown above.

Below are step-by-step instructions to calibrate a counter. These instructions assume the counter is currently installed in the field, collecting data, has been operating smoothly for at least a few weeks, and its date/time was properly set (note: beware of daylight savings time).

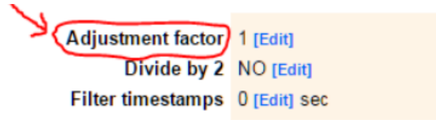
1. **Arrive at the counter in the field about 10 minutes before the top of the hour (e.g., 10:50 AM)** ***(In Field)***. Find a safe and comfortable location near the counter. Have your clipboard and form ready. (At this point, there is no need to do anything with the counter.)
2. **Start your calibration session at the top of the hour** ***(In Field)***. At the top of the hour (e.g., 11:00 AM), begin recording information on your form (see previous page). It is easiest to make tick marks. If the road or trail is busy with higher traffic volume, an hour-long session is usually sufficient. On quiet, lower volume roads and trails it may take several hours. The rule of thumb is that you should manually record at least 100 events for calibration purposes. For this project, the team collected more manual data counts than likely necessary because it was a short data collection period and the more data collected, the more accurate the calibration. The project team also needed to collect more data since some of the locations were particularly complex and they wanted to see if there was any monthly variability to the data.
3. **Download your counter** ***(In Field)***. At five minutes after the top of the next hour (e.g., 12:05 PM) download / launch the counter with your dock (in Shuttle mode). Your field session is now finished. *Caution: Do not download before the top of the hour! Also, your watch's time and the counter's time might be a little out of sync so wait about five minutes after the top of the hour (e.g., 12:05 PM) before downloading.*
4. **Transfer data from dock to PC** ***(In Office)***. Return to your office and download the dock as you normally would.
5. **Tally up tick marks and compare to counter** ***(In Office)***. Back in your office, tally up the counts you wrote down on the form (e.g., 128). Next, open the data file you downloaded (double click it) and find the hourly total for the calibration session (e.g., 113). To figure out the adjustment factor, divide your visual counts by the counter counts. Example:

Start time: 11:00:00 End time: 12:00:00

Total visual counts	Counter counts (from downloaded data file)
128	yy-mm-dd,hr:mm,total 17-05-24,08:00,00051 17-05-24,09:00,00083 17-05-24,10:00,00096 17-05-24,11:00,00113 Hourly totals *Note that "11:00" means 11:00 to 12:00* *In other words, hours project forward.*

$$\frac{\text{128 visual counts}}{\text{113 counter counts}} = \text{1.13274 adjustment factor/correction coefficient}$$

6. **In TRAFx DataNet, specify an adjustment factor for the particular counter site (e.g., Pine Road) *(In Office)***.
Now that you have determined the adjustment factor you can apply it. Login to your DataNet account, click on the **MANAGE** tab, and then on the particular counter site. Now, look for Data Options and "Adjustment Factor".



Click Edit and enter an adjustment factor with at least five digits after the decimal point (for mathematical reasons). This adjustment factor will be applied to all the data associated with the particular counter site and you are finished!

<u>When Do I Calibrate the Sensors?</u>

There are numerous factors that have the potential to affect how a counter counts, including traffic density/spacing, trail or road width, speed of travel, counter settings (e.g., delay), installation distance, sensor variations, environmental influences, user attention to installation details, etc. Therefore, when calibrating the counters, the user is calibrating the counter to a particular installation location or site. For this reason, each counter should be calibrated for each site and the adjustment factor from one site should not be used for a different site. For detailed instructions, download "How to Calibrate a Counter" at trafx.net/support.

"Calibrating a counter takes time, effort and diligence to do well. Only do it if your specific management questions require a higher level of data precision. Do not calibrate just for the sake of calibrating. An important question to ask is: What level of accuracy do I need to answer my management-related questions? Generally, acceptable accuracy can be defined as the level sufficient to detect changes that are significant to management decisions (Hendee et al. 1990)."[10]

In general, the counters have default settings. Normally, a user will only change these default settings if a star ★ applies to the particular situation as outlined in the counter instruction guidance as follows:

- **OHV Counters:**
  - **DELAY** Setting:
    - If there are many very long or very slow vehicles (<20 kilometer/hour or 12 miles per hour) use a two second **DELAY** value of **032**.
    - If traffic is dense (vehicles less than 2 seconds apart) use a half-second delay (value of **008**).
    - If OHVs typically move slowly, increase **DELAY** to **016**.
    - If OHVs typically are very closely spaced, decrease **DELAY** to **004**.
  - **THRESHOLD** Setting:
    - If using VEH-4d, and vehicles are up to 8 meters (26') away, use **THRESHOLD 006** (G4 counters only).
    - Use **THRESHOLD 006** (G4 counters only) if you are missing OHVs. 006 is maximum sensitivity.
    - The other way to increase sensitivity is simply to move the counter closer to where OHVs pass.
    - A **THRESHOLD** value greater than **012** is **<u>not recommended</u>**.
  - **RATE (FAST/SLOW)** Setting:
    - If estimated <u>average</u> vehicle speed is above 50 kilometer/hour (30 miles per hour), use **FAST** with a **DELAY** value of **008** or lower
  - See p. 4 of TRAFx's OHV Trail Counter Instructions and p. 4 of TRAFx's Vehicle Counter Instructions for additional details).

[10] Source: TRAFx, How to Calibrate a Counter, page 1.

- **Infrared Trail Counters:**
    - **DELAY** Setting:
        - If trail traffic typically moves very slowly, increase **DELAY** to **035** or **040**.
        - If trail traffic is dense and/or fast (e.g., busy walking or bicycle path) decrease **DELAY** to **020** or **025**.
    - See p. 4 of TRAFx's Infrared Trail Counter Instructions for additional details.

That said, TRAFx does sometimes recommend counter calibration to resolve common issues (as outlined in Table 4 below) and for **infrared trail counters** for the following situations:

1. Trails where people often travel side by side and/or in tight groups.
2. Busy, wide trails.
3. When higher accuracy is desired.

Table 14: Troubleshooting the Counters (Appendix A)

Counter Type	Issue	Solution
TRAFx Vehicle Counters (Magnetometers) Set to Off-Highway Vehicle (OHV) Counter Mode	Higher than Expected Counts	If counts are moderately higher than expected, do the following: a. Increase **DELAY** (see p. 4 of TRAFx's OHV Counter Instructions). b. Increase **THRESHOLD** (see p. 4 of TRAFx's OHV Counter Instructions).
TRAFx Vehicle Counters (Magnetometers) Set to OHV Counter Mode	Lower than Expected Counts	If counts are moderately lower than expected, do the following: a. Confirm counter is not too far away (this is usually the problem; see p. 3 of TRAFx's OHV Counter Instructions). b. If "a" does not apply, then decrease **THRESHOLD** (see p.4 of TRAFx's OHV Counter Instructions).
TRAFx Vehicle Counters (Magnetometers) Set to OHV Counter Mode	Extremely High Counts, Even at Night	If counts are extremely high, even at night when there is little traffic, increase **THRESHOLD** to 012 (p. 4 of TRAFx's OHV Counter Instructions). If the problem persists, see "Implausible or Strange Counts" below.
TRAFx Vehicle Counters (Magnetometers) Set to OHV Counter Mode	Implausible or Strange Counts	Review installation "don't" on p. 6 of TRAFx's OHV Counter Instructions. Do any of these apply to you? Also, see "Maintenance" on p. 9 of TRAFx's OHV Counter Instructions. Causes may include: wind gusts (counter shakes in the wind), nearby powerlines (overhead or buried), counter inside a steel box (reduces detection distance), moisture (see maintenance below).
TRAFx Vehicle Counters (Magnetometers) Set to OHV Counter Mode	Calibration Light ON	After Launch, if counter's **Calibration LIGHT** is permanently **ON** (i.e., solid), (a) rotate the counter 180 degrees; or (b) remove and reinsert all its batteries, and Download / Launch it again; or (c) move it farther away from large metal objects (e.g., large steel beam) or magnets.
TRAFx Infrared Trail Counters (Infrared Beams)	Higher than Expected Counts	a. If they occur only during the day, it is likely an installation-related problem. Carefully review installation "don't" on p. 6 of TRAFx's Infrared Trail Counter Instructions. b. If they occur during day and night, it is likely a sensor problem. Email TRAFx via their support hub at trafx.net/support and attach your data file
TRAFx Infrared Trail Counters (Infrared Beams)	Lower than Expected Counts	a. Review installation "do and don't" on p. 6 of TRAFx's Infrared Trail Counter Instructions, particularly distance and three dots. b. Is there something in the IR scope's "eye" (spider nest, dirt, snow, etc.)? If yes, clean with cotton swab. c. Are there any punctures (holes) in the lens (vandalism)? If yes, please contact TRAFx via their support hub at trafx.net/support. You'll need a replacement part. d. If none of the above apply to you, email TRAFx some photos of your installation, via their support hub at trafx.net/support.
TRAFx Infrared Trail Counters (Infrared Beams)	No Counts (Only Zeros)	Regarding only zeros (00000) in your data file, day after day: a. Is there a loose wire? Check the IR scope's three wires (red, white, yellow). Are they securely connected (see wire guide on p. 2 of TRAFx's Infrared Trail Counter Instructions)? b. Is there a blockage in the IR scope's "eye" (insect, snow, cigarette butt, etc.)? c. Is the IR scope's lens punctured? If yes, please contact TRAFx via their support hub at trafx.net/support as you will need a replacement part.

Source: TRAFx, 2025.

Appendix B: Data Collection – Manual Count Worksheets

WRST: Counts for TRAFx Magnetometer Counters

Worksheet Instructions:

3. Fill in the correct information on the worksheet for “counter number”, “date”, “shift time”, and “name of data collector” for each count shift.
4. Record **hourly counts** for two hours[11] at each counter at two points in time throughout the week on the table in page 2 (once in the AM, either between 8 AM and 10 AM or 10 AM and 12 PM, and once in the PM, either between 1 PM and 3 PM or 3 PM and 5 PM) and note the following:
    a. Mode type (e.g., pedestrian, vehicle, commercial van/vehicle or tour bus, bicycle, ATV/Quad, etc.).
    b. Direction that the person, vehicle, bicycle, etc. is traveling (i.e., North or South).
    c. The approximate distance that each person/vehicle passes by the counter (to determine/identify the range of the counter by mode). ***Note:** *The magnetometer counters are set to OHV mode, which according to the specs has a detection range of approximately 1 to 2 meters (3.3’ to 6’) for dirt bikes and snow machines, 2 to 3 meters (6.6’ to 10’) for quads, and up to 6 meters (20’) for highway vehicles (e.g., Jeeps). Given this, the radius of the counter is likely going to be up to 10’ in any given direction and conservatively 6.6’, but the trail / road is wider in some instances (i.e., the road where Counter A is located is 20’6’’ wide), therefore, doing manual counts help fill in the additional data that may not have been picked up by the counters, especially for pedestrians who are not going to be detected by the magnetometer counters at all. As such, make sure to count everything in all “zones” manually to be able to compare it to the sensor data.*

Observation Notes:

[11] Since the counters only provide hourly counts and are unable to break down counts by smaller time increments, it is crucial for counts to begin right on time and go through the full two hours to accurately compare the manual counts with the counter data collected.

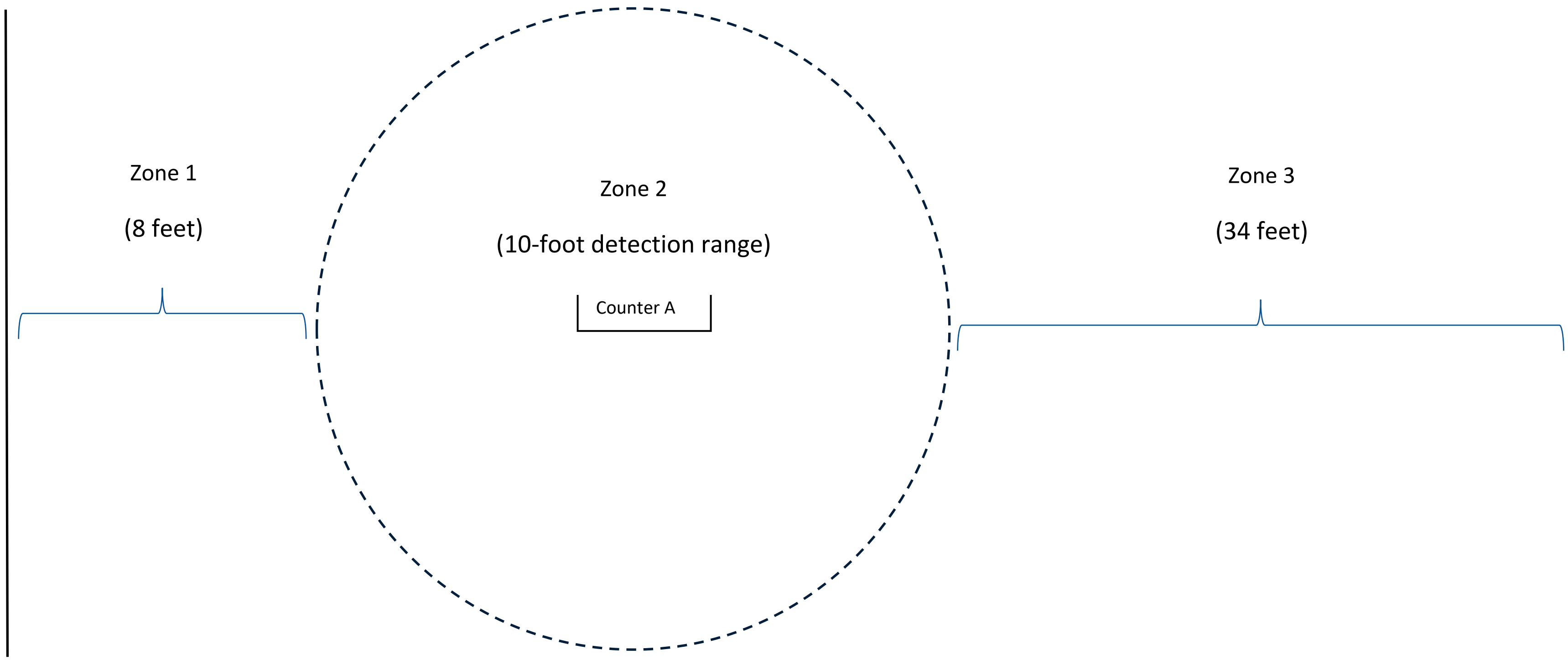
Counter Number: ________________ **Shift Time:** ____

Date: ____________________________ **Name of Data Collector:** ____________________________

Zone	Pedestrians		Bicyclists		OHVs (ATVs, Quads, Dirt Bikes)		Passenger Vehicles (Jeeps, Trucks)		Larger Passenger Vans & Shuttles	
	North	South	North	South	North	South	North	South	North	South
1										
2										
3										
Total										

Counter A:

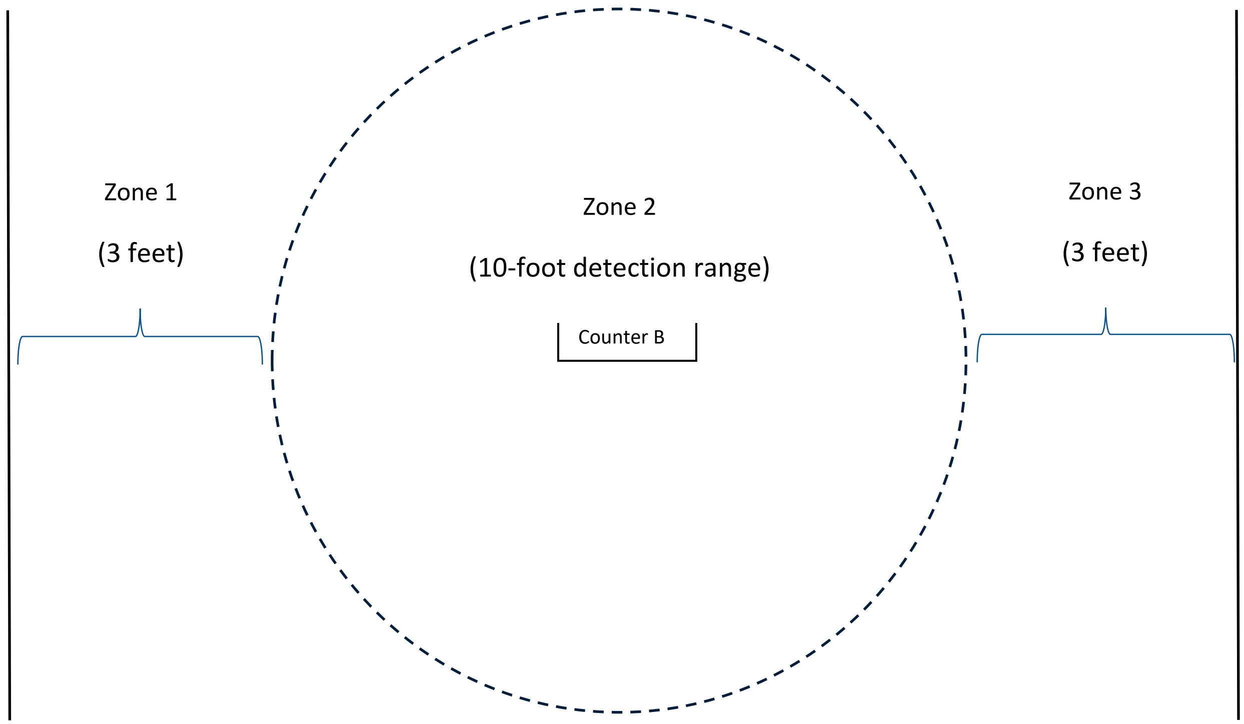
North ↑ (Looking towards the Mill Building)



South ↓ (Looking towards the Visitor Center)

Counter B:

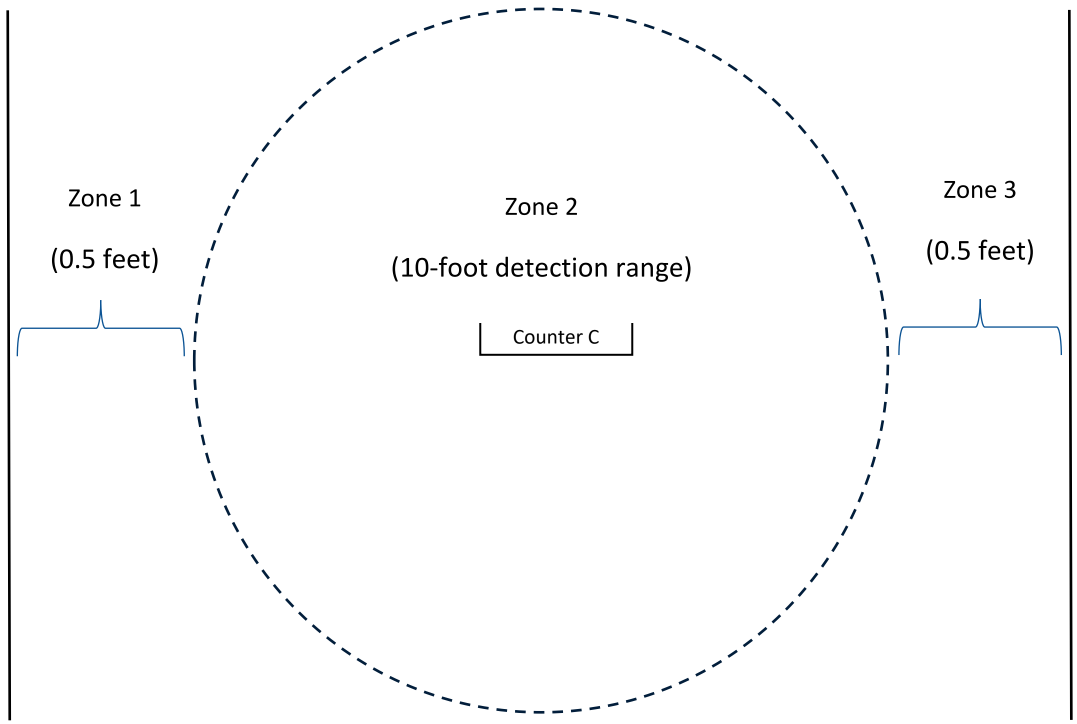
North ↑ (Looking towards the Visitor Center and the Mill Building)



South ↓ (Looking towards the Site Entrance)

Counter C:

North ↑ (Looking towards the Dairy Barn Building)



South ↓ (Looking down the road away from the Dairy Barn)

WRST: Counts for TRAFx Infrared Beam Counters

Worksheet Instructions:

1. Check off the correct box below for “counter number”, “date”, “shift time”, and “name of data collector” for each count shift.
2. Record **hourly counts** for two hours[12] at each counter at two points in time throughout the week on the table in page 2 (once in the AM, either between 8 AM and 10 AM or 10 AM and 12 PM, and once in the PM, either between 1 PM and 3 PM or 3 PM and 5 PM) and note the following:
    a. Mode type (e.g., pedestrian, vehicle, commercial van/vehicle or tour bus, bicycle, ATV/Quad, etc.).
    b. Direction that the person, vehicle, bicycle, etc. is traveling (i.e., North or South).
    c. The approximate distance that each person/vehicle passes by the counter (to determine/identify the range of the counter by mode). ***Note:** *According to the specs, the infrared beam counters have a detection range of up to 6 meters (20’) for people – walkers, hikers, joggers, inline skaters, horseback riders, cyclists, etc. – on trails, paths and sidewalks. Given this, the detection range is likely going to be 20’ but the trail / road is wider in some instances; therefore, doing manual counts help fill in the additional data that may not have been picked up by the counters.*
    d. For the infrared counters, also record the number of people in the group if they are walking abreast by circling the tally that represents the group in the table below.

Observation Notes:

[12] Since the counters only provide hourly counts and are unable to break down counts by smaller time increments, it is crucial for counts to begin right on time and go through the full two hours to accurately compare the manual counts with the counter data collected.

Counter: ____________________

Shift Time: ____

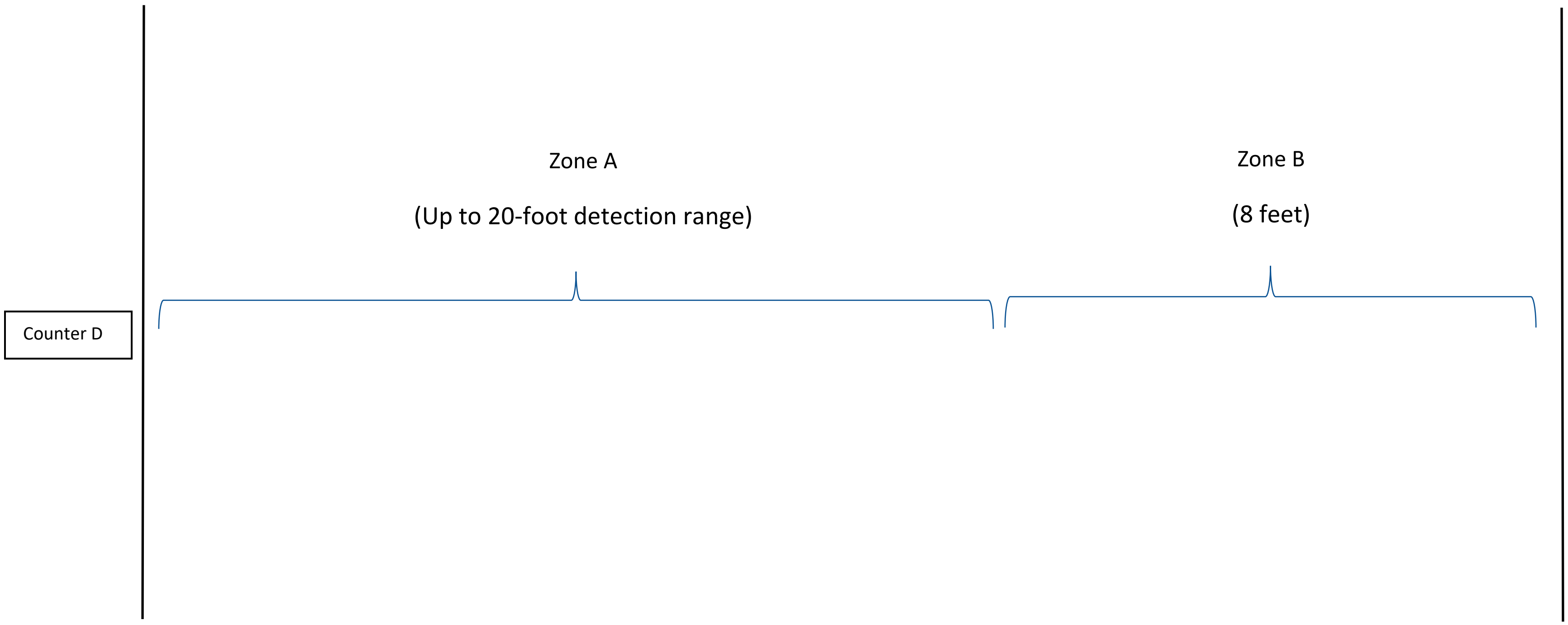
Date: _______________________

Name of Data Collector: ______________________________

Zone	Pedestrians		Bicyclists		OHVs (ATVs, Quads, Dirt Bikes)		Passenger Vehicles (Jeeps, Trucks)		Larger Passenger Vans & Shuttles	
	North	South	North	South	North	South	North	South	North	South
A										
B										
Total										

Counter D:

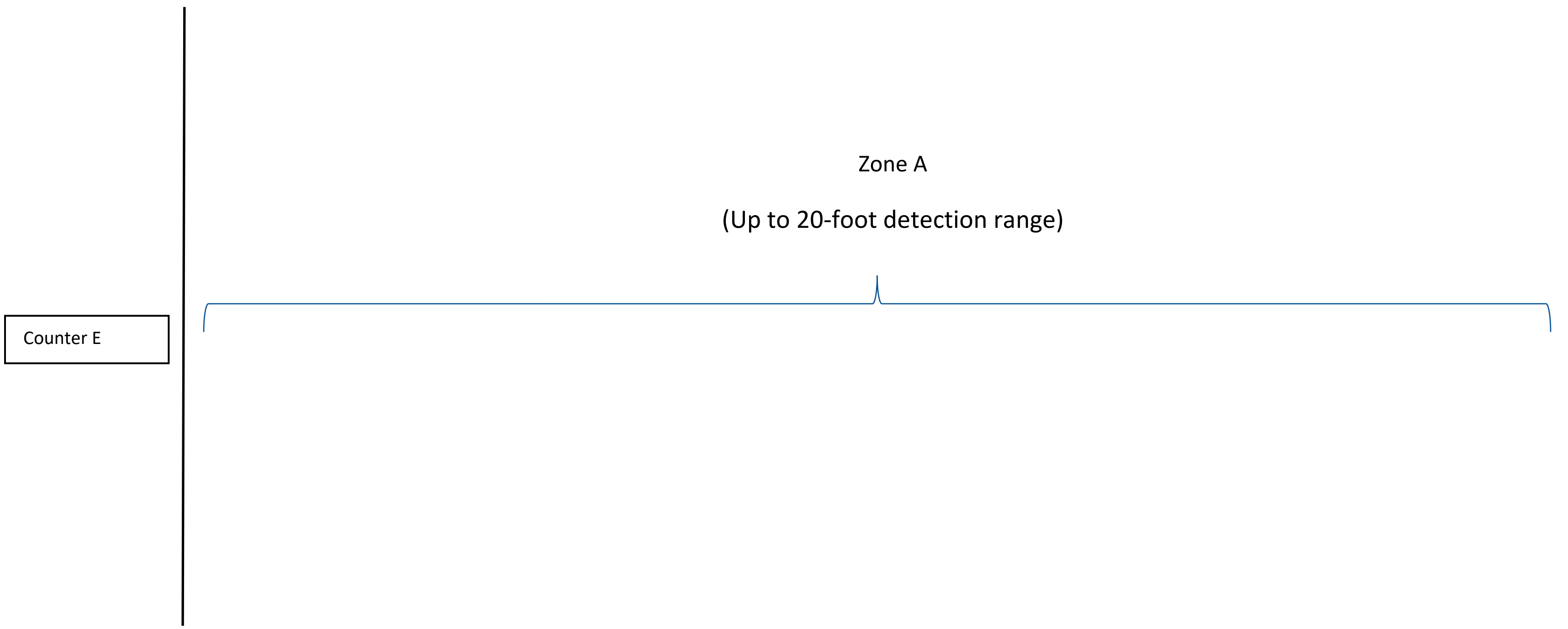
North ↑ (Looking towards the Mill Building)



South ↓ (Looking towards the Visitor Center)

Counter E: (Note: There is only a "Zone A" for this counter).

North ↑ (Looking towards the Mill Building)



South ↓ (Looking towards the Site Entrance)

Appendix C: Data Collection – Manual Count Data

Month	Date	Day of the Week	Time	Counter Location	Counter Type	Pedestrians	Bicyclists	OHVs	Passenger Vehicles	Larger Passenger Vans/Shuttles	Other	Total Visual Count	Groups
June	12	Thursday	AM Shift 1: 8:00 AM - 10:00 AM	A	M	56	0	8	0	1	0	65	
June	13	Friday	PM Shift 1: 1:00 PM - 3:00 PM	A	M	82	1	4	0	0	0	87	
June	12	Thursday	AM Shift 2: 10:00 AM - 12:00 PM	B	M	1	0	2	3	10	1	17	
June	12	Thursday	PM Shift 2: 3:00 PM - 5:00 PM	B	M	5	0	6	2	16	0	29	
June	12	Thursday	AM Shift 1: 8:00 AM - 10:00 AM	C	M	0	0	4	0	0	0	4	
June	12	Thursday	PM Shift 1: 1:00 PM - 3:00 PM	C	M	3	0	10	0	2	0	15	
June	12	Thursday	AM Shift 2: 10:00 AM - 12:00 PM	D	I	65	0	4	1	0	0	70	10
June	12	Thursday	PM Shift 2: 3:00 PM - 5:00 PM	D	I	162	1	5	0	0	0	168	26
June	12	Thursday	PM Shift 1: 1:00 PM - 3:00 PM	E	I	50	0	11	3	3	0	67	11
June	13	Friday	AM Shift 2: 10:00 AM - 12:00 PM	E	I	30	0	9	0	3	0	42	10
July	1	Tuesday	PM Shift 2: 3:00 PM - 5:00 PM	A	M	130	3	2	2	0	0	137	
July	2	Wednesday	AM Shift 2: 10:00 AM - 12:00 PM	A	M	100	7	8	5	0	0	120	
July	2	Wednesday	PM Shift 1: 1:00 PM - 3:00 PM	A	M	193	2	6	1	0	0	202	
July	3	Thursday	AM Shift 1: 8:00 AM - 10:00 AM	A	M	78	6	1	0	0	0	85	
July	18	Friday	AM Shift 2: 10:00 AM - 12:00 PM	A	M	100	2	1	0	0	0	103	
July	18	Friday	PM Shift 1: 1:00 PM - 3:00 PM	A	M	168	2	5	1	0	0	176	
July	1	Tuesday	PM Shift 2: 3:00 PM - 5:00 PM	B	M	8	9	5	4	23	0	49	
July	2	Wednesday	AM Shift 2: 10:00 AM - 12:00 PM	B	M	0	7	6	2	17	0	32	
July	2	Wednesday	PM Shift 1: 1:00 PM - 3:00 PM	B	M	21	2	4	5	26	0	58	
July	3	Thursday	AM Shift 1: 8:00 AM - 10:00 AM	B	M	7	6	1	10	25	0	49	
July	18	Friday	AM Shift 2: 10:00 AM - 12:00 PM	B	M	11	0	6	7	15	0	39	
July	18	Friday	PM Shift 1: 1:00 PM - 3:00 PM	B	M	2	5	7	5	19	0	38	
July	1	Tuesday	PM Shift 2: 3:00 PM - 5:00 PM	C	M	7	0	8	0	0	0	15	
July	2	Wednesday	AM Shift 2: 10:00 AM - 12:00 PM	C	M	8	0	4	0	0	0	12	
July	2	Wednesday	PM Shift 1: 1:00 PM - 3:00 PM	C	M	33	0	3	0	2	0	38	
July	3	Thursday	AM Shift 1: 8:00 AM - 10:00 AM	C	M	0	0	5	0	0	0	5	
July	18	Friday	AM Shift 2: 10:00 AM - 12:00 PM	C	M	5	4	0	2	1	0	12	
July	18	Friday	PM Shift 1: 1:00 PM - 3:00 PM	C	M	4	2	2	0	1	0	9	
July	1	Tuesday	PM Shift 2: 3:00 PM - 5:00 PM	D	I	148	2	3	2	0	0	155	32
July	2	Wednesday	AM Shift 2: 10:00 AM - 12:00 PM	D	I	137	2	8	5	2	0	154	26
July	2	Wednesday	PM Shift 1: 1:00 PM - 3:00 PM	D	I	265	3	4	1	0	0	273	68

July	3	Thursday	AM Shift 1: 8:00 AM - 10:00 AM	D	I	110	7	1	0	0	0	118	18
July	18	Friday	AM Shift 2: 10:00 AM - 12:00 PM	D	I	132	2	2	0	0	0	136	23
July	18	Friday	PM Shift 1: 1:00 PM - 3:00 PM	D	I	223	4	7	1	0	0	235	31
July	1	Tuesday	PM Shift 2: 3:00 PM - 5:00 PM	E	I	102	8	12	3	8	0	133	26
July	2	Wednesday	AM Shift 2: 10:00 AM - 12:00 PM	E	I	60	6	6	1	6	0	79	15
July	2	Wednesday	PM Shift 1: 1:00 PM - 3:00 PM	E	I	106	2	4	7	6	0	125	31
July	3	Thursday	AM Shift 1: 8:00 AM - 10:00 AM	E	I	77	4	5	7	6	0	99	17
July	18	Friday	AM Shift 2: 10:00 AM - 12:00 PM	E	I	60	0	3	4	4	0	71	9
July	18	Friday	PM Shift 1: 1:00 PM - 3:00 PM	E	I	106	7	3	3	3	0	122	11
August	1	Friday	AM Shift 2: 10:00 AM - 12:00 PM	A	M	91	0	0	0	0	0	91	
August	1	Friday	PM Shift 1: 1:00 PM - 3:00 PM	A	M	107	18	0	3	0	0	128	
August	15	Friday	AM Shift 2: 10:00 AM - 12:00 PM	A	M	129	0	0	4	0	0	133	
August	15	Friday	PM Shift 1: 1:00 PM - 3:00 PM	A	M	127	1	1	2	0	0	131	
August	29	Friday	AM Shift 2: 10:00 AM - 12:00 PM	A	M	130	0	0	1	0	0	131	
August	29	Friday	PM Shift 1: 1:00 PM - 3:00 PM	A	M	67	0	1	3	0	0	71	
August	1	Friday	AM Shift 2: 10:00 AM - 12:00 PM	B	M	5	7	6	6	18	0	42	
August	1	Friday	PM Shift 1: 1:00 PM - 3:00 PM	B	M	0	6	3	10	15	0	34	
August	4	Monday	AM Shift 2: 10:00 AM - 12:00 PM	B	M	4	2	3	8	21	0	38	
August	17	Sunday	AM Shift 2: 10:00 AM - 12:00 PM	B	M	1	0	4	2	20	0	27	
August	17	Sunday	PM Shift 1: 1:00 PM - 3:00 PM	B	M	0	0	2	5	23	0	30	
August	29	Friday	AM Shift 2: 10:00 AM - 12:00 PM	B	M	0	0	0	2	16	0	18	
August	29	Friday	PM Shift 1: 1:00 PM - 3:00 PM	B	M	0	0	0	4	18	0	22	
August	1	Friday	AM Shift 2: 10:00 AM - 12:00 PM	C	M	21	0	2	0	0	0	23	
August	1	Friday	PM Shift 1: 1:00 PM - 3:00 PM	C	M	6	0	1	0	1	0	8	
August	17	Sunday	AM Shift 2: 10:00 AM - 12:00 PM	C	M	6	0	0	0	0	0	6	
August	17	Sunday	PM Shift 1: 1:00 PM - 3:00 PM	C	M	3	0	2	4	0	0	9	
August	29	Friday	AM Shift 2: 10:00 AM - 12:00 PM	C	M	0	3	4	0	0	0	7	
August	29	Friday	PM Shift 1: 1:00 PM - 3:00 PM	C	M	2	0	1	0	1	0	4	
August	1	Friday	AM Shift 2: 10:00 AM - 12:00 PM	D	I	92	7	0	0	0	0	99	5
August	1	Friday	PM Shift 1: 1:00 PM - 3:00 PM	D	I	133	9	0	3	0	0	145	10
August	16	Saturday	AM Shift 2: 10:00 AM - 12:00 PM	D	I	143	0	0	1	0	0	144	39
August	16	Saturday	PM Shift 1: 1:00 PM - 3:00 PM	D	I	156	2	0	3	0	0	161	31
August	1	Friday	AM Shift 2: 10:00 AM - 12:00 PM	E	I	67	11	2	4	4	0	88	15
August	1	Friday	PM Shift 1: 1:00 PM - 3:00 PM	E	I	38	6	1	8	3	0	56	7
August	15	Friday	AM Shift 2: 10:00 AM - 12:00 PM	E	I	60	2	5	2	2	0	71	13
August	15	Friday	PM Shift 1: 1:00 PM - 3:00 PM	E	I	58	0	4	6	0	0	68	2
August	29	Friday	AM Shift 2: 10:00 AM - 12:00 PM	E	I	33	0	3	0	2	0	38	6
August	29	Friday	PM Shift 1: 1:00 PM - 3:00 PM	E	I	44	0	0	2	3	0	49	6
August	31	Sunday	AM Shift 1: 8:00 AM - 10:00 AM	E	I	118	1	1	1	0	0	121	18
August	31	Sunday	PM Shift 2: 3:00 PM - 5:00 PM	E	I	251	5	4	3	0	0	263	59
September	12	Friday	AM Shift 2: 10:00 AM - 12:00 PM	A	M	15	0	2	3	0	0	20	
September	12	Friday	PM Shift 1: 1:00 PM - 3:00 PM	A	M	28	0	1	3	0	0	32	

September	26	Friday	AM Shift 2: 10:00 AM - 12:00 PM	A	M	19	0	2	1	0	0	22	
September	26	Saturday	PM Shift 1: 1:00 PM - 3:00 PM	A	M	2	0	2	1	0	0	5	
September	12	Friday	AM Shift 2: 10:00 AM - 12:00 PM	B	M	0	0	2	3	7	0	12	
September	12	Friday	PM Shift 1: 1:00 PM - 3:00 PM	B	M	0	3	1	3	5	0	12	
September	26	Friday	AM Shift 2: 10:00 AM - 12:00 PM	B	M	0	0	2	2	0	0	4	
September	26	Friday	PM Shift 1: 1:00 PM - 3:00 PM	B	M	0	0	2	1	0	0	3	
September	12	Friday	AM Shift 2: 10:00 AM - 12:00 PM	C	M	0	0	7	0	0	0	7	
September	12	Friday	PM Shift 1: 1:00 PM - 3:00 PM	C	M	2	0	1	0	0	0	3	
September	26	Friday	AM Shift 2: 10:00 AM - 12:00 PM	C	M	3	0	0	0	0	0	3	
September	26	Friday	PM Shift 1: 1:00 PM - 3:00 PM	C	M	0	0	0	0	0	0	0	
September	12	Friday	AM Shift 2: 10:00 AM - 12:00 PM	D	I	17	0	2	0	3	0	22	0
September	12	Friday	PM Shift 1: 1:00 PM - 3:00 PM	D	I	22	0	0	2	2	0	26	0
September	13	Saturday	AM Shift 1: 8:00 AM - 10:00 AM	D	I	24	0	0	0	2	0	26	4
September	13	Saturday	PM Shift 2: 3:00 PM - 5:00 PM	D	I	22	2	3	0	1	0	28	1
September	26	Friday	AM Shift 2: 10:00 AM - 12:00 PM	D	I	3	0	2	1	0	0	6	0
September	26	Friday	PM Shift 1: 1:00 PM - 2:00 PM	D	I	5	0	1	1	0	0	7	0
September	12	Friday	AM Shift 2: 10:00 AM - 12:00 PM	E	I	8	0	7	3	3	0	21	3
September	12	Friday	PM Shift 1: 1:00 PM - 3:00 PM	E	I	16	0	1	3	1	0	21	1
September	26	Friday	AM Shift 2: 10:00 AM - 12:00 PM	E	I	0	0	2	2	0	0	4	0
September	26	Friday	PM Shift 1: 1:00 PM - 3:00 PM	E	I	4	0	2	1	0	0	7	0