Appendix E: Count Program Guidance

The prevailing practice for collecting short-duration bicycle and pedestrian traffic data has been to focus on targeted locations where interest in travel patterns is the highest. Although this non-random site selection may not yield a statistically representative regional estimate on facility usage, it provides a more efficient use of limited data collection resources (e.g., random samples could possibly result in many locations with low or very low non-motorized use).

Why Count?

Count data can be applied in a variety of ways. Some of the applications commonly cited by local agencies performing counts in the NFRMPO region include:

- To estimate facility or community usage and demand
- To justify the need for improvements or additional facilities
- To quantify the impact of new investments along a corridor (and compare it with neighboring corridors)
- To support grant applications
- To understand trailhead or access point usage patterns
- To plan maintenance activities around the busiest times
- To understand the impact of special events (races, festivals, etc.) or abnormal periods (COVID-19, unseasonable weather, etc.)

General Count Location Selection

Short-duration counts (with mobile counters) and long-duration counts (with permanently installed counters) can complement one another. Long-duration counts are great at locations where data is desired on trends over long periods of time. Short-duration counts are more often used to answer more specific questions. NFRMPO staff are available to assist with location selection.

Although the following criteria were developed as recommendations for short-duration count location selection, they can also apply to permanent long-duration count location selection:

- Pedestrian and bicycle activity areas or corridors (downtowns, near schools, parks, etc.);
- Representative locations in urban, suburban, and rural locations;
- Key corridors that can be used to gauge the impacts of future improvements (i.e. corridors of regional significance);
- Locations where counts have been conducted historically;

- Locations where ongoing counts are being conducted by other agencies through a variety of means, including videotaping;
- Gaps, pinch points, and locations that are operationally difficult for bicyclists and pedestrians (potential improvement areas);
- Locations where either bicyclist and/or pedestrian collision numbers are high; and
- Select locations that meet as many of the criteria as possible.

The number of count locations will depend on the available budget and the planned uses of the count data. For most regions getting started with counting active mode users, a count program is best developed by working with other key stakeholders interested in collecting and using this data. By discussing needs and budgets, this group can identify and prioritize short- and long-duration count locations. **Table AE-1** summarizes counter placement recommendations for the Regional Active Transportation (RATC) Network and other shared-use paths with high usage and/or serving regional traffic.

Table AE-1: Counter Placement Recommendations for Regional and High-Usage Facilities

Permanent Counts	
Consideration	**Guidance**
Spacing	Rural = 5 miles, Suburban = 2 miles, Urban/Park = 1 mile, or between major access points
Short-Duration Counts	
Consideration	**Guidance**
Spacing	Rural = 5 miles, Suburban = 2 miles, Urban/Park = 1 mile, or between major access points
Duration	1-2 weeks minimum
Period	April - October (year round if facilities are well-maintained)
Timing	Before and after construction or improvement of a facility, a typical week across each season, during special events

Site-Specific Positioning Considerations

Once general locations have been identified, the most suitable counter positioning should be determined. The NBPD Project recommended the following guidance for counter positioning:

General

- Point away from direct sunlight
- Narrower paths are usually better for counter accuracy
- Test cellular network coverage if automatic data upload is desired
- Be discrete where possible

- Consider vegetation growth and other potential activity within the sensor's line of sight
- Avoid gathering spots

Based on surrounding uses

- For multi-use paths and parks, locations near the major access points are best.
- For on-street bikeways, locations where few if any alternative parallel routes are best.
- For traditional downtown areas, a location near a transit stop or in the center of downtown is best.
- For shopping malls, a location near the main entrance and transit stop is best. Count at one access point.
- For employment areas, either on the main access roadway or near off-street multi-use paths is best. Count at one access point, typically a sidewalk and street.
- For residential areas, locations near higher density developments or near parks and schools are the best. Count at one access point, typically a sidewalk or street.

In many cases, these recommended counter-positioning locations will result in the highest non-motorized traffic volumes. Given limited data collection resources and specific data uses, this focus on high-use locations may be appropriate. However, one should recognize that these high-use locations might represent a biased estimate of use levels and trends. High or low usage may only be indicative of the presence or absence of infrastructure. A high count on one route may not necessarily indicate adequate infrastructure; it may just mean that particular route is the only option. Conversely, a low count does not mean there is not demand; it may mean the existing infrastructure is not viewed as safe. This relates to the saying, "You do not determine the demand for a bridge by the number of people swimming across the river."

Data Collection and Analysis

Many count systems allow for automatic data upload to web-based service that allows users to log into a paid account and analyze data in a variety of ways. Other count systems require manual data collection or the user has opted for manual data collection to save money. Regular manual data collection can be incorporated into normal maintenance activities by local agency staff. Once the data has been collected, the most commonly produced reports include:

- Daily averages by week, month, or year
- Daily averages by weekday and weekend day
- Hourly time series across an average weekday or weekend day

- Year-to-year comparison: daily averages annually or monthly
- Average mode split (bicycles vs pedestrians)
- Daily counts compared with weather

Different types of reports are appropriate for different formats such as table, line graph, bar graph, or pie chart. NFRMPO staff are available to assist with count data analysis and report production. Prior to analysis, the data must be cleaned and checked for quality.

Quality Check Procedures

Periodically ensuring counters functional and are accurately and consistently monitoring bicycle and/or pedestrian patterns is an important part of any count program. Some count systems with automatic data upload capabilities are able to perform automated tests and flag abnormal counts daily. Alternatively, manual quality checks should be conducted whenever data is collected before reporting any summaries.

The following procedures are adapted from the Non-Motorized Traffic Data Quality Control Procedures used by CDOT and methods used within the NFRMPO bicycle and pedestrian count program. Although the following checks help flag abnormalities in the dataset, those abnormalities may not necessarily be inaccuracies. Additional context about the site, such as time of day, weather conditions, special events, maintenance activities, and other factors should be considered as possible contributors to abnormal counts.

Consecutive Zeros Check

For warmer weather months (April 1 to October 30), any count site exhibiting more than two continuous days of zero values may be a candidate for inspection or maintenance. Consecutive zero days are common in the colder weather months and recent weather events should be taken into consideration.

Data Gaps

Counts should be flagged if there is more than one hour of missing data in a 24-hour reporting period. If a counter fails to record or transmit data, it may signify a failing battery or otherwise faulty power supply.

Maximum Daily Total Check

The user can choose to flag counts that are abnormally high, exceeding a maximum daily threshold. For permanent sites, a good starting point is to flag any daily count that is more than 3 times the previous year's average daily traffic (ADT) value. These counts can be examined further to determine and removed if necessary. The threshold can be adjusted as needed.

Directional Split

If your counter distinguishes user direction of travel, it is important to check for abnormal splits. Most count sites (other than bike lanes) will capture close to a 50/50 directional split between the primary and secondary direction of travel. This can vary by site and the "normal" split should be adjusted accordingly if accurate historic data is available. If 50/50 is considered normal, any count site exhibiting a direction split greater than 70/30 should be flagged for further analysis or count verification.

Interquartile Range (IQR)

This check uses a statistical algorithm to identify suspect values on a quarterly/seasonal basis. This formula specifies the maximum deviation from typical conditions based on statistical parameters. If daily counts exceed the IQR then they will be removed from the data set. The maximum recommended analysis period is 3 months within the same/similar season, due to the significant variations in counts between seasons. The interquartile range (IQR) formula is:

$$\boldsymbol{IQR = 2.5(Q_3 - Q_1) + Q_3}$$

Where: Q_3 = Third quartile of quarterly data

Q_1 = First quartile of quarterly data

If daily counts exceed the IQR then they will be removed from the data set.

Manual Validation and Adjustment

After performing checks such as the ones listed in the previous section, going to the site for a manual validation or verification count can be helpful in diagnosing why the counts are abnormal. This can also be done on a semi-regular basis as good practice. If any of the following practices are used, it is important to note them and include what assumptions were made before distributing the data.

Adjustment Factors

Most counters will slightly undercount based on their sensitivity setting, physical characteristics of the count site, travel patterns at the site (many people walking side by side), or other factors. Other counters may overcount for various reasons. Performing a manual count at the site and comparing it to the abnormal data the counter is collecting can help

identify the extent to which a counter is undercounting. The longer these validation counts, the better. If after a validation count, it is determined the counter is undercounting users by 5 percent, an adjustment factor of 1.05 can be applied to count totals (recorded count multiplied by 1.05) to inflate them to a more realistic estimate.

Reference Counter Association (RCA)[24]

Reference Counter Association (RCA) is a technique of using data from other count locations to validate, reconstruct, and/or extrapolate count data at another counter (target counter) location where information is missing, incomplete, or inaccurate. Compared with the target counter, potential reference counters include counters within close proximity, same user type(s), similar facility type. Correlation tests can be used to determine how similar the sites actually are on an hourly and/or daily basis. Correlations where r >= .80 indicate good reference counter candidates. Once reference counters have been identified and estimation model can be build using regression and/or ratio analysis. The results can then be used for:

- **Validation and Reconstruction** – flagging counts that are abnormal according to the estimation model, or missing altogether, and substituting in estimation model values
- **Extrapolation** – taking a short-term count (at least two weeks) at a target counter location and using the estimation model to make long-term estimates

For simple applications, less advanced variations of RCA can be employed by generating a reference factor for the target counter compared with the reference counters (as explained above) on days when count values are known for all counters. The reference counter represents the ratio of the target count value to the average of the reference counters for a given day. This reference factor can then be applied for reconstruction or extrapolation (as explained above). This method should only be employed for "order of magnitude" estimations and should be used cautiously since it is less statistically sound than a true estimation model.

Additional Resources

The list below covers additional resources which outline the proper selection of non-motorized count locations.

Guide to Bicycle and Pedestrian Count Programs (Portland State University)

Conducting Bicycle and Pedestrian Counts: A Manual for Jurisdictions in Lose Angeles County and Beyond (Southern California Association of Governments)

[24] Adapted from guidance by Barrett Hedges, Head of Data Services at Eco-Counter.

Bicycle and Pedestrian Data Collection Manual (MnDOT)

Bicycled and Pedestrian Count Programs: Summary of Practice and Key Resources (PBIC)