Guide to Bicycle and Pedestrian Count Programs

2014

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HOW TO USE THIS GUIDE

Interested in understanding bicycle and pedestrian traffic in your area? This resource is for you! While there are many ways to quantify bicycling and walking, this guide focuses on bicycle and pedestrian count programs. Counting provides information on the level of intersections, paths and roadways; a dataset already available for motor vehicles, but lacking for non-motorized travelers. **Agencies who show clear evidence of use are more likely to receive funding for projects.** Here we summarize information on how to create or improve a bicycle and pedestrian count program. We use the basic outline provided by FHWA's 2013 Traffic Monitoring Guide (TMG), Chapter 4 Traffic Monitoring for Non-Motorized Traffic. As more agencies begin counting biking and walking, we'll learn more about bicycle and pedestrian counting and add more to the site.

ACKNOWLEDGEMENTS

CONTENTS

GETTING STARTED

The main purpose of a bicycle and pedestrian count program is to measure bicycle and pedestrian traffic at all times in all locations on a system. To accomplish this goal, a robust and cost effective bicycle and pedestrian count program is needed. Such a program is composed of two basic elements: a permanent count program and a short duration count program.

If we had all the money in the world, we could install permanent counters at every location where we'd ever want to know bicycle and pedestrian traffic volumes. Since we are budget constrained, we instead use the continuous count data from the permanent count sites to create monthly, daily and even hourly expansion factors which can be applied to short duration counts. These factors allow us to estimate the annual average daily bicycle and/or pedestrian traffic (AADB/P) at locations where counts are only available for anywhere from one hour to several months. Of course, there are many sources of error in such estimates, but we can't create these factors without permanent count sites. This is why a cost effective and robust bicycle and pedestrian count program includes both a permanent and a short duration count program. The diagram on the right details the key elements of creating a bicycle and pedestrian count program. Specific guidance for each element is provided in the pages that follow.
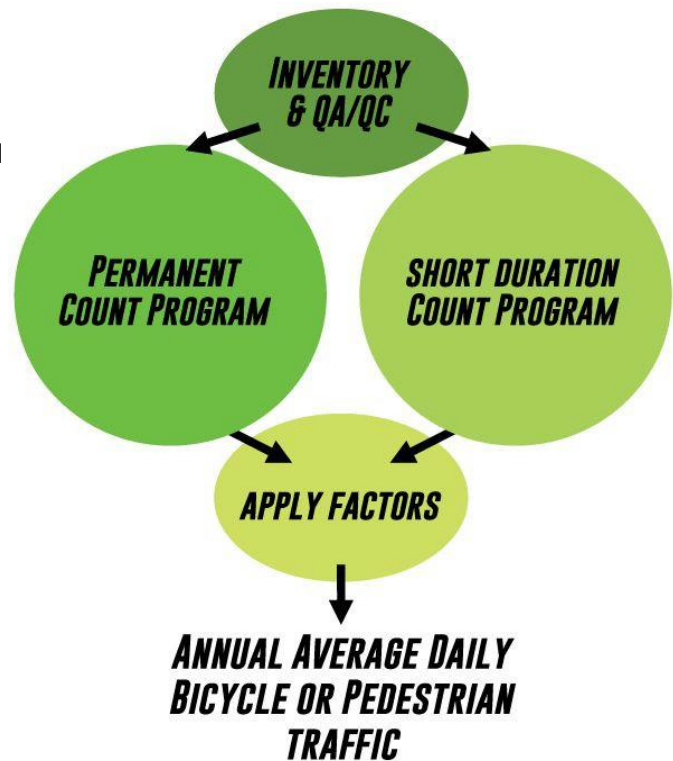
Most sections in this guide include a list of resources, including research and published reports on the topic. All the resources are compiled together at the end. Join the discussion! Share what you know with others by joining the walk-bike-count discussion Google group.

> Finally, you'll find excerpts from Chapter 4 of the Federal Highway Administration's 2013 Traffic Monitoring Guide, set off with orange sidebars like this.

INVENTORY DATA

The first step is to identify what bicycle and pedestrian count data you have. If you're not aware of any bicycle and pedestrian count programs in your area, ask around. Bicycle and pedestrian count data can be found in some of the most unexpected places.

Review your existing bicycle and pedestrian count program and create an inventory. In addition to transportation staff, reach out to parks departments, business districts and health departments in your area. All are potential data collectors.

As data sources are found, categorize them into permanent count stations and short duration counts: Short duration counts can be from one hour to multiple months and can be collected by hand or machine.

Permanent count stations are automated counters that count continuously 24-hours per day for at least one year at a given location. Below are the essential questions to ask:

- Where are they counting?

- What are they counting?

- What technology do they use?

- How long have they been counting there?

- When, how often, and for how long do they count?

- Are these intersection counts or counts on a road or path segment?

- Has count accuracy been evaluated?

Once you have inventoried the count data, the next step is to assemble it into one useable format. Multiple regions are working on web-based bicycle and pedestrian clearinghouses which can share and accept data.

GUIDANCE FROM THE TRAFFIC MONITORING GUIDE 2013, SECTION 4.4.1

4.4.1 STEPS 1 AND 2: REVIEW THE EXISTING CONTINUOUS COUNT PROGRAM; DEVELOP AN INVENTORY OF AVAILABLE CONTINUOUS COUNT LOCATIONS AND EQUIPMENT

The first two steps are to inventory, review, and assess what your agency currently has (in regard to permanent monitoring locations and equipment). This may be a short exercise for some agencies, as permanent continuous counts are much less common than short-duration pedestrian and bicyclist counts.

However, these first two steps should not be bypassed simply because your own agency does not have permanent count locations. Because non-motorized traffic levels are typically higher on lower-volume and lower functional class roads/streets as well as shared use paths and pedestrian facilities, city and county agencies and metropolitan planning organizations (MPOs) have often been more active than State DOTs in monitoring non-motorized traffic.

Therefore, if a State DOT traffic data collection program will monitor non-motorized traffic, they should coordinate with local and regional agencies as they inventory and review existing continuous counts. Additionally, they should inquire with departments other than the transportation or public works department. The following lists possible agencies and/or departments that may have installed permanent pedestrian and bicyclist counters:

- City or county parks and recreation department (e.g., on shared use paths);

- National or State parks (e.g., on internal or connector paths);

- Public health departments (e.g., monitoring physical activity);

- Retail or business associations (e.g., on pedestrian malls or plazas); and

- Pedestrian and/or bicyclist advocacy groups.

The process outlined in Section 3.2.1 for motorized traffic volume is equally applicable for non-motorized traffic.

BICYCLE AND PEDESTRIAN COUNT DATA

There are quite a few clearinghouses in development:

At Portland State University, TREC is developing a national clearinghouse of bike-ped data, called BikePed Portal.

The Minnesota Department of Transportation published a report in 2013, which describes its inventory of the state's bicycle and pedestrian count programs and offers recommendations.

The Los Angeles metropolitan area has a bicycle count data clearinghouse which recommends manual count formats, allows partner agencies to upload data and makes the data publicly available

In the Philadelphia metropolitan area, the Delaware Valley Regional Planning Commission (DVRPC) provides online access to its bicycle and pedestrian counts.

Similarly, Arlington, Virginia offers access to their count data through an online site which allows data to be sorted by weather and time.

Many other jurisdictions are offering their bicycle and pedestrian count data in various formats online. Below is a partial list:

- Boulder, Colorado

    o More Boulder, Colorado data.

- Eugene, Oregon

- Minneapolis, Minnesota

- New York City, New York

- Portland, Oregon

- Seattle, Washington

Unfortunately, many of the sites above to do not show all of the count data available in a given city or region. For example, the Boulder site only shows short-duration bicycle and pedestrian counts collected as part of the regularly motor vehicle counting program, and does not provide access to data from their many permanent bicycle count stations.

GUIDANCE FROM THE TRAFFIC MONITORING GUIDE 2013, SECTION 4.4.1

The review of existing continuous counts should review and assess the following:

Overall Program Design

Existing monitoring locations and why they were chosen.

Existing equipment and any noted performance/accuracy limitations.

Who is using existing data, and for what decisions?

Is the existing data sufficient? If not, what are the additional needs and their priorities?

If there is no existing data, who would like data and for what decisions?

Traffic Patterns

If existing continuous count data is available, it should be analyzed to determine typical traffic patterns and profiles:

How do counts vary throughout the day?

How do counts very by day of week?

How do counts very by month or season?

How do counts vary for inclement weather and other special events?

How does traffic vary by street functional class and the presence of bike or pedestrian facilities?

How do traffic patterns and profiles compare at different locations in areas with different land use and demographic characteristics?

Note that the count magnitude may not be similar, but the time-of-day, DOW, or month-of-year patterns may be similar in shape or overall profile. These patterns of variation will ultimately be used to create groups of similar locations (called factor groups) that can be used to factor (i.e., annualize) short-duration counts to an annual volume estimate. If continuous non-motorized count data is not available, short-duration counts can be used to estimate the traffic patterns that may be typical. However, because of the higher variability of pedestrian and bicyclist count data, short-duration counts should be used with great caution. Short-duration counts cannot be used to determine monthly variability and, depending on the duration of the counts, may not be indicative

of typical DOW variability. In addition, inclement weather or other special events may skew the time-of-day patterns in short-duration counts. In most cases, some data is better than no data in establishing typical traffic patterns.

Data Processing

In reviewing the current program and existing non-motorized data, one should also understand the basics of how data is processed by the field equipment and loaded into its final repository, whether that be a stand-alone spreadsheet, a mode-specific database, or a traffic monitoring data warehouse. The following elements should be considered:

What formats (e.g., data structure, time intervals, metadata) are available and/or being reported from the field equipment?

What quality assurance and quality control processes are applied to the field data?

Are suspect or erroneous data flagged and/or removed?

What summarization or adjustment procedures are applied to the field data?

How does the current process/system address missing data (e.g., due to equipment hardware, software, or communications errors)?

Are estimated or imputed values flagged or documented with metadata?

Are the non-motorized data stored/integrated with motorized data? Alternatively, is there an entirely separate process?

Are data summarization processes automated to the fullest extent possible? At what points are manual review and/or intervention required?

Subjective data manipulation or editing should be avoided. Instead, appropriate business rules and objective procedures can be used in combination with supporting metadata to address missing or invalid data.

Summary Statistics

The final step in reviewing the existing program is to consider summary statistics, both those that are currently computed as well as those that may be needed. Permanent count locations should be providing count data 24 hours per day, 365 days per year; however, this continuous data stream is often summarized into a few basic summary statistics, like annual average daily traffic. Because of

the greater monthly variability of non-motorized traffic, other summary statistics may be more relevant:

Seasonal average daily traffic (includes those months that contain at least 80 percent of the annual traffic) (seasonal average daily traffic SADT) is a traffic statistic used by the National Park Service in recreational areas that have very high seasonal peaking (e.g., very high use in summer with low use in winter));

Average daily traffic by month and day of week; and

Peak hour volumes for peak seasons (i.e., different user types in summer and winter for shared use paths).

The review of existing and needed summary statistics should be based on those users and uses that have been identified earlier in the process. In this way, one can ensure that that variety of users has the required information to make decisions.

Count Data Resources

In "Institutionalizing Bicycle and Pedestrian Monitoring Programs in Three States," Lindsey and others summarize the bicycle and pedestrian count inventory process conducted in three states.

QA/QC OF DATA

Unfortunately, much of the bicycle and pedestrian count data available today has received little or **no quality assurance and quality control (QA/QC).** Here we provide some guidance on how to set up such a program.

While there is a growing body of bicycle and pedestrian count data, there is little documentation of how or if the quality of the data has been assessed and controlled. Here we offer a discussion of what a Quality Assurance/Quality Control (QA/QC) program might involve for a permanent bicycle and pedestrian count program. There are different levels of data validation and cleaning. We separate out these levels into the following three steps.

1. **Validation at equipment set up:** This important step may take multiple iterations to make sure the continuous counting technology is operating properly and correctly located.

   a. Manually observe at least 10 bicyclists and/or pedestrians and, if possible, verify in the field that each is counted. If some are not counting, contact the manufacturer, adjust the equipment settings, or otherwise problem solve. Once most are being counted, continue on to Step B.

   b. Create adjustment factors. Observe at least 100 bicyclists and/or pedestrians. For sites with high to medium volumes, this can usually be done by counting bicyclists and/or pedestrians for 1 or 2 peak hours. The observation can be by video or manually in the field. Video observation has the advantage that it can be checked by others later. Compare the manual counts to the automated detector counts. If possible, trouble shoot what might be causing any under or overcounting observed. If it can be fixed, make changes and redo this Step. If there are not obvious problems or the problems can't be fixed moved on to Step C.

   c. Compute a correction factor (actual /automated count) to account for under or overcounting.

2. **Maintenance validation**: At least once per year and any time changes that might impact the counting technology are made to the location, do a quick verification that the equipment is working. To catch any big problems with the equipment, observe at least 10 bicyclists and/or pedestrians and compare to the automated count.

   a. If adequate bicycle traffic is not available at the location during counting, generate counts by walking or bicycling across the detector. Generated counts are not as good as natural

counts for validation purposes because they may not behave the same as the general public. For example, they could be slower or faster than normal traffic, use a slightly different bicycle type, or take a slightly different travel path. However, using generated counts is better than not doing any maintenance validation.

   b. If the maintenance validation finds that equipment is not working correctly, contact the manufacturer, adjust the equipment settings, or otherwise problem solve. After attempting to fix the problem, return to Step B, above. The adjustment factor (Step C) will need to be recomputed. Make sure to note when any changes were made.

3. **Data validation:** Check for unusually high counts and suspect zero counts. It's best to create an automated process for doing this, but either way, flag suspect counts. Check to see if high counts may have been caused by an organized event, and if so, leave them in the record. Delete days with zero counts if these are not explainable by weather events or other causes such as holidays. If equipment malfunction is the cause, delete these data from the record.

QA / QC Resources

Turner and Lasley discuss QA for non-motorized counts and give an example of how they cleaned data from an infrared bicycle and pedestrian counter in their 2013 paper, [Quality Counts for Pedestrians and Bicyclists: Quality Assurance Procedures for Nonmotorized Traffic Count Data](#).

2019 update: McNeil and Tufte also offer methods for [Quality Counts: Developing Accuracy Checks for Bike and Pedestrian Count Data](#).

GUIDANCE FROM THE [TRAFFIC MONITORING GUIDE 2013](#), [SECTION 4.4.1](#)

Data Processing

In reviewing the current program and existing non-motorized data, one should also understand the basics of how data is processed by the field equipment and loaded into its final repository, whether that be a stand-alone spreadsheet, a mode-specific database, or a traffic monitoring data warehouse. The following elements should be considered:

What formats (e.g., data structure, time intervals, metadata) are available and/or being reported from the field equipment?

What quality assurance and quality control processes are applied to the field data?

Are suspect or erroneous data flagged and/or removed?

What summarization or adjustment procedures are applied to the field data?

How does the current process/system address missing data (e.g., due to equipment hardware, software, or communications errors)?

Are estimated or imputed values flagged or documented with metadata?

Are the non-motorized data stored/integrated with motorized data? Alternatively, is there an entirely separate process?

Are data summarization processes automated to the fullest extent possible? At what points are manual review and/or intervention required?

PERMANENT COUNT PROGRAM

A permanent counter is an automated device in place 24 hours per day, 365 days per year. Its purpose is to gather a continuous record of how bicycling and walking changes over time. Permanent counters provide a record that allows us to understand how volumes change with weather and season.

If cyclist and pedestrian travel patterns were the same everywhere, we could get by with just one permanent counter for the whole country! But in reality, many factors affect our travel patterns, from climate to culture. For this reason, a permanent count program of multiple bicycle and pedestrian counters is needed to help us understand the time-related patterns of bicycling and walking in a region, county, city or state.

If your region has no permanent counters, consider installing one as soon as possible. Without this, one cannot compute seasonal adjustment factors, and without those one cannot estimate Annual Average Daily Bicycle and Pedestrian Traffic (AADBP) from shorter duration counts.

Creating a permanent count program is an iterative process. At least once a year review the data, look for patterns, group the sites, compute factors and evaluate if and where additional counters are needed. This series of web pages will discuss the steps in setting up a bicycle and pedestrian count program, following the general outline in the Traffic Monitoring Guide, Chapter 4. If you have no permanent counters, start with **the Select Sites & Install** section. If you have counters, start with **Look for Patterns**.

This is an area of ongoing research and the field is still working on answering some of the questions. We'll update this website as new information and resources become available, so check back for the latest.
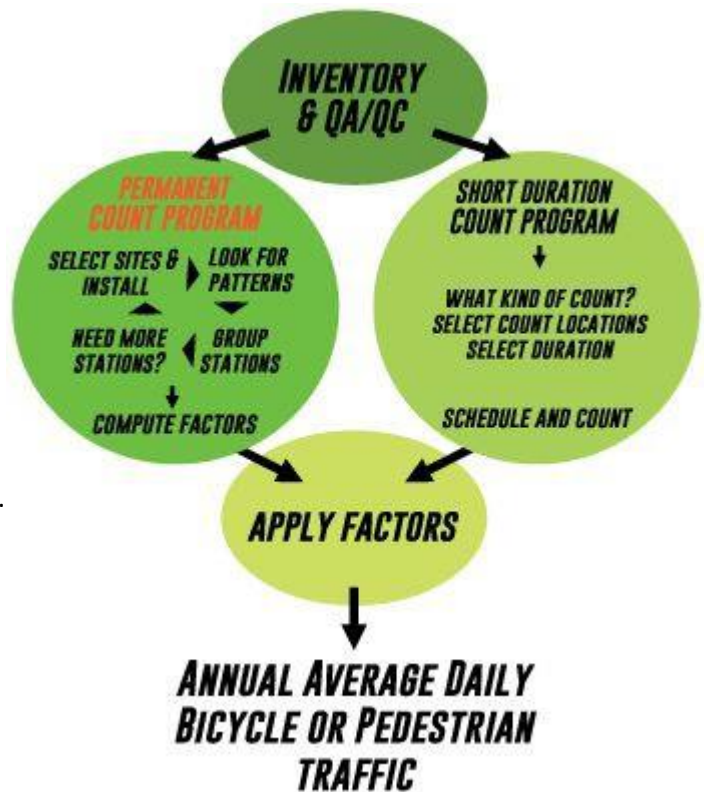
GUIDANCE FROM THE TRAFFIC MONITORING GUIDE 2013, SECTION 4.5

PERMANENT DATA PROGRAM

The process for collecting continuous non-motorized traffic data should follow the steps already outlined for motorized traffic in Chapter 3, as follows:

Review the existing continuous count program;

Develop an inventory of available continuous count locations and equipment;

Determine the traffic patterns to be monitored;

Establish pattern/factor groups;

Determine the appropriate number of continuous monitoring locations;

Select specific count locations; and

Compute monthly, DOW, and hour-of-day (if applicable) factors to use in annualizing short-duration counts.

The following sections provide additional detail for implementing these steps.
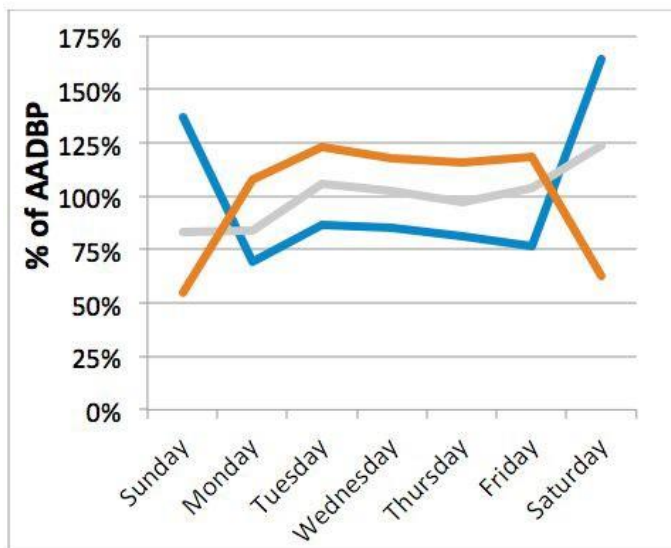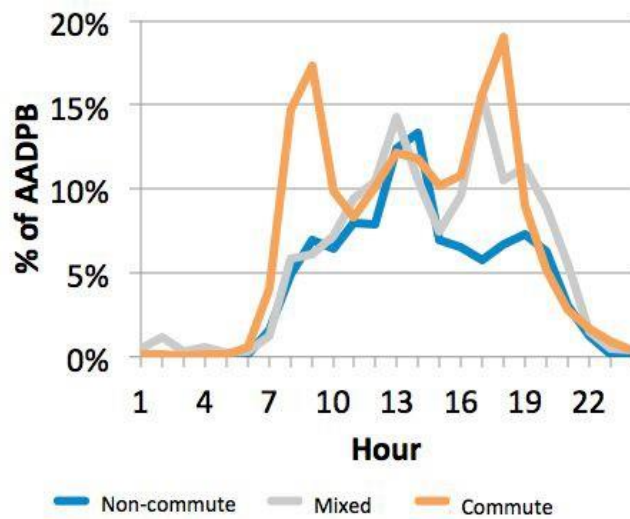
In this edition of the Traffic Monitoring Guide, pedestrians and bicyclists are grouped together as non-motorized traffic. There will be differences in these two types of facility users that may affect the monitoring approach.

However, the known distinctions and differences between pedestrian and bicyclist traffic will be pointed out in each combined section. As ongoing research identifies the best approach for each, future editions of the Guide may provide additional information for separate monitoring of pedestrian traffic and bicyclist traffic.

Look for Patterns

Once you have the continuous count data, the next step is to plot it by time of day, day of week, and month of the year and look for patterns over the course of the day, the week, and the year. Do you see weekday peaks in traffic during the typical commuting times (7:00 AM to 9:00 AM and 4:00 PM to 6:00 PM)? Do you see higher traffic on weekdays or on weekends? Do you see very low volumes in winter and relatively high volumes in summer, or is traffic relatively consistent independent on season?

Below are some typical patterns of bicycle and pedestrian traffic volumes over the day and week as a percent of the Annual Average Daily Bicyclists/Pedestrians (AADBP).

Computing AADBP

This [document](#) details how to compute AADBP according to the AASHTO method in order to create traffic pattern plots.

GUIDANCE FROM THE [TRAFFIC MONITORING GUIDE 2013](#), [SECTION 4.4.2](#)

> 4.4.2 STEP 3: DETERMINE THE TRAFFIC PATTERNS TO BE MONITORED
>
> After reviewing the existing non-motorized program (both what is being done and what is needed), Step 3 is to determine those traffic patterns that are to be monitored. Part of this determination will depend upon the functional road classes and bicyclist and pedestrian facilities of interest. For example, do State DOTs want to collect pedestrian and bicyclist count data on local streets, shared use paths, and pedestrian facilities that are considered off-system (i.e., not included on the State highway system)? In some cases, State DOT funding has been used for non-motorized projects on local streets and shared use paths through the Transportation Enhancements (TE) or Congestion Mitigation and Air Quality (CMAQ) funding categories.
>
> Once the non-motorized network to be monitored has been defined, one should determine the most likely types of traffic patterns that are expected on this network. In most cases, the non-motorized network will include facilities that have a mix of commute, recreational, and utilitarian trips. Depending upon the relative proportions of these different trip types, distinct traffic patterns will emerge. These patterns should be used in the Step 4 to establish seasonal pattern groups.
>
> The most common way to determine typical traffic pattern groups is through the visual analysis and charting of existing data. Continuous count data is preferred for this step, but short-duration counts (multiple full days, but not two-hour counts on a single day) may also be used with caution.

Group Stations

Group count stations by pattern types. For example, commute, non-commute and mixed.1

There are many ways to group count stations, including by visual interpretation of graphs, statistically based criteria2 and cluster analysis.3 On this page we present the simplest method, grouping by visual interpretation of graphs. This is also known as the traditional or intuitive approach.

Below is an example from Colorado of how stations can be grouped by the monthly and daily patterns.4 In the example, the counters are divided into two groups:

- Commute

- Non-commute

Commute locations typically have higher counts on weekdays then weekends and show weekday peaks during morning and evening commute hours. Non-commute locations may have higher weekend counts than weekday and typically have one peak in the middle of the day. Here we describe patterns as "non-commute" instead of "recreational" or "utilitarian" because trip purpose is hard to determine from count data. For example, shopping patterns and recreational patterns can be similar.

The factors computed for each group are shown as the thick black line. Each of the other lines shown represent a unique permanent count station.

Monthly Patterns (Source: Colorado Department of Transportation)

Commute

Non-commute
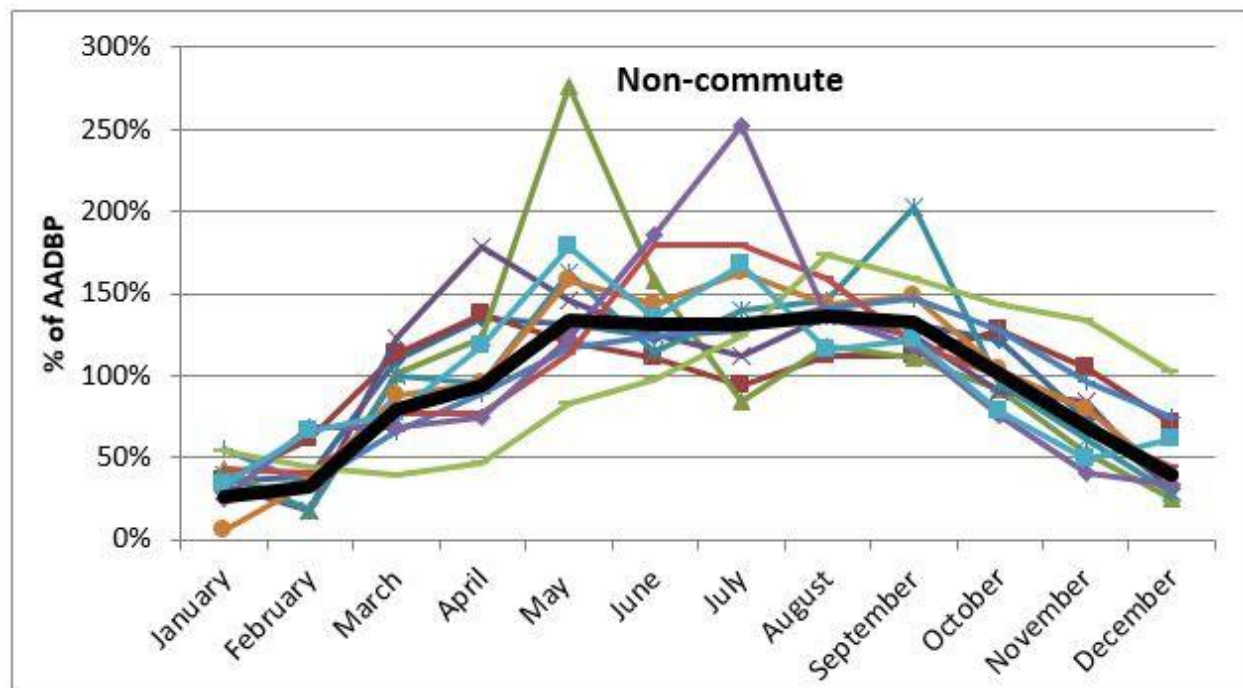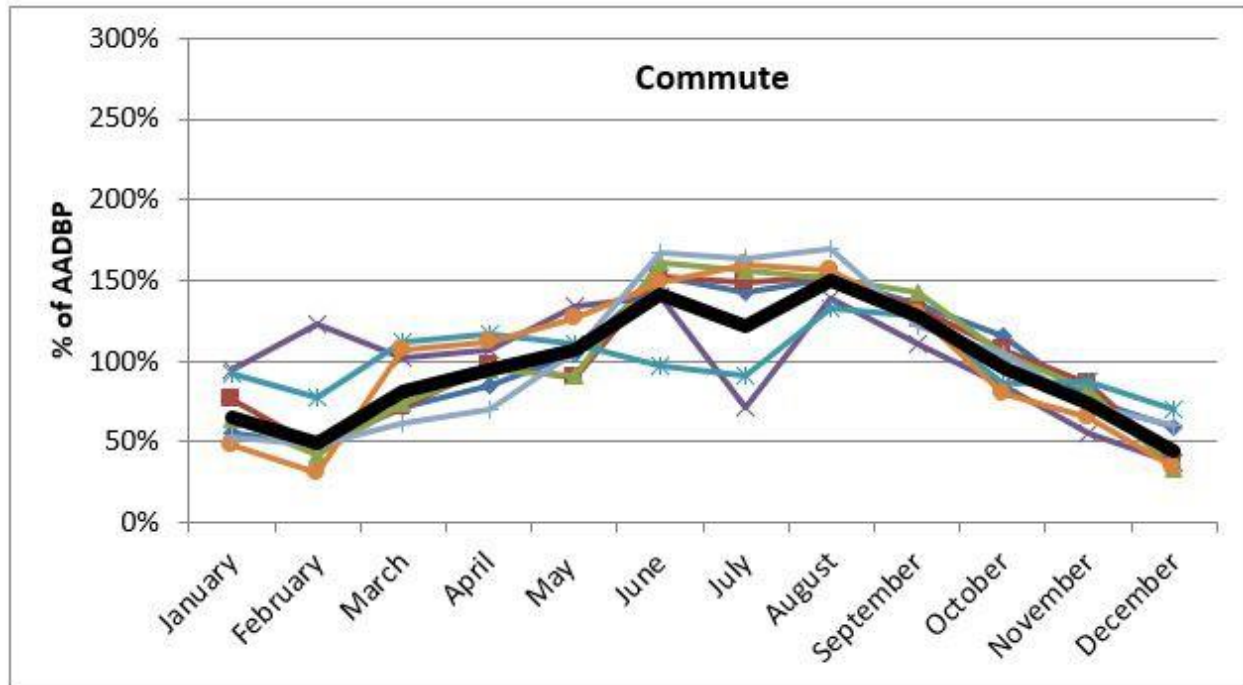
Daily Patterns (Source: Colorado Department of Transportation)
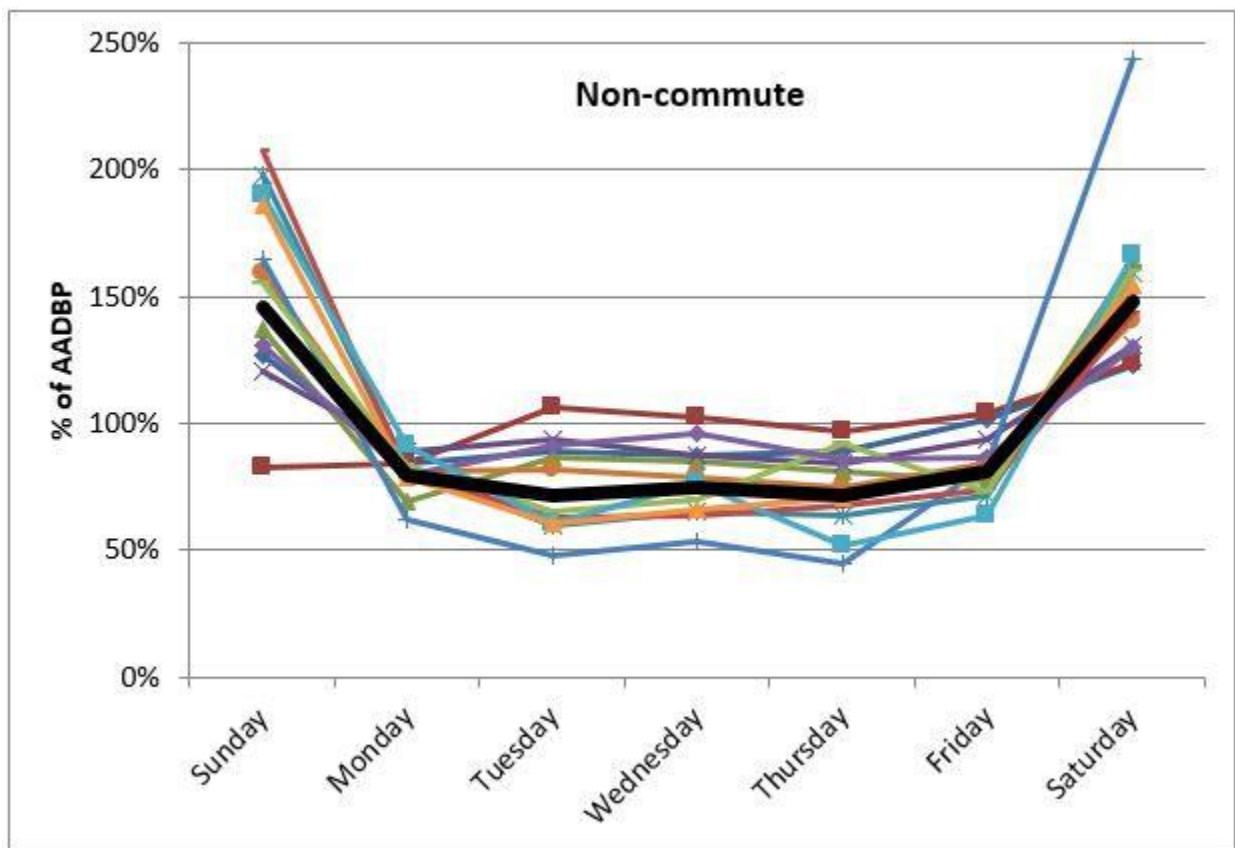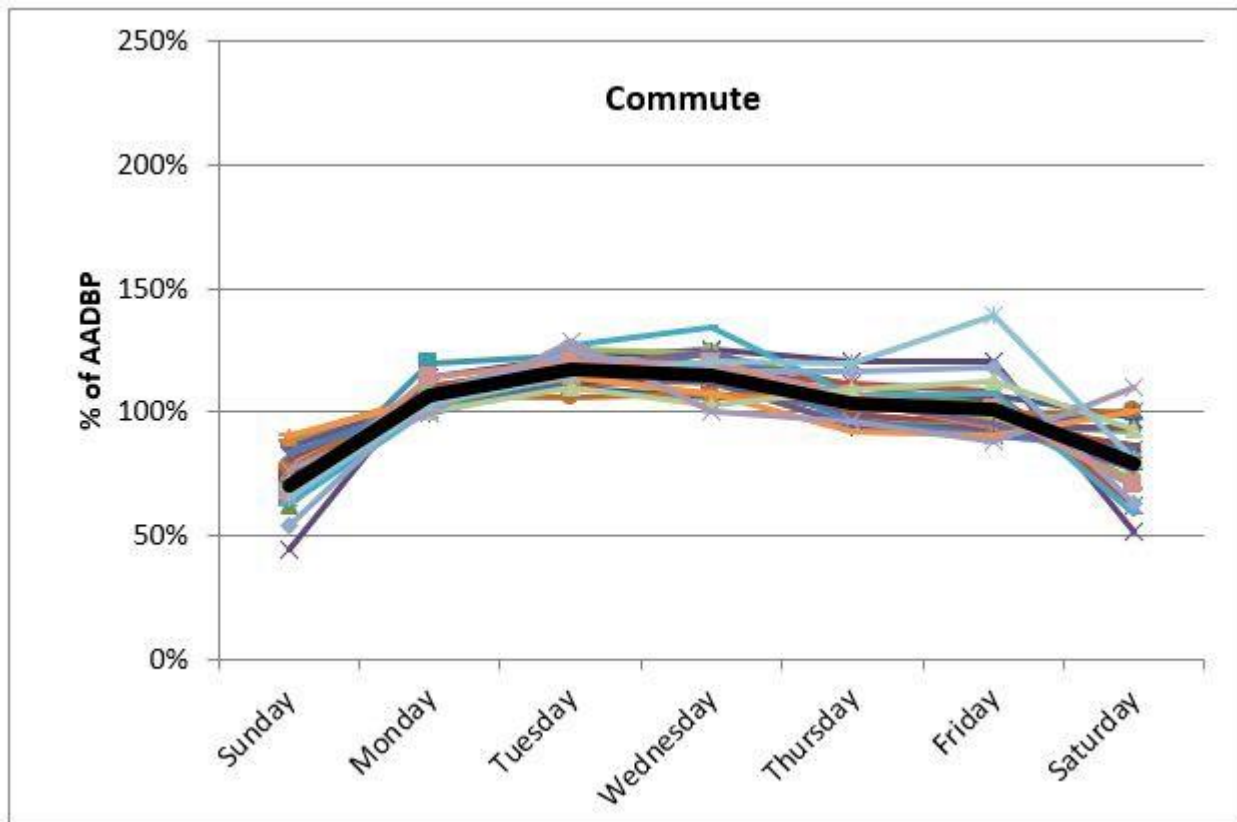
Hourly Patterns for Workdays (Sources: City of Boulder5   and Douglas County, Colorado)
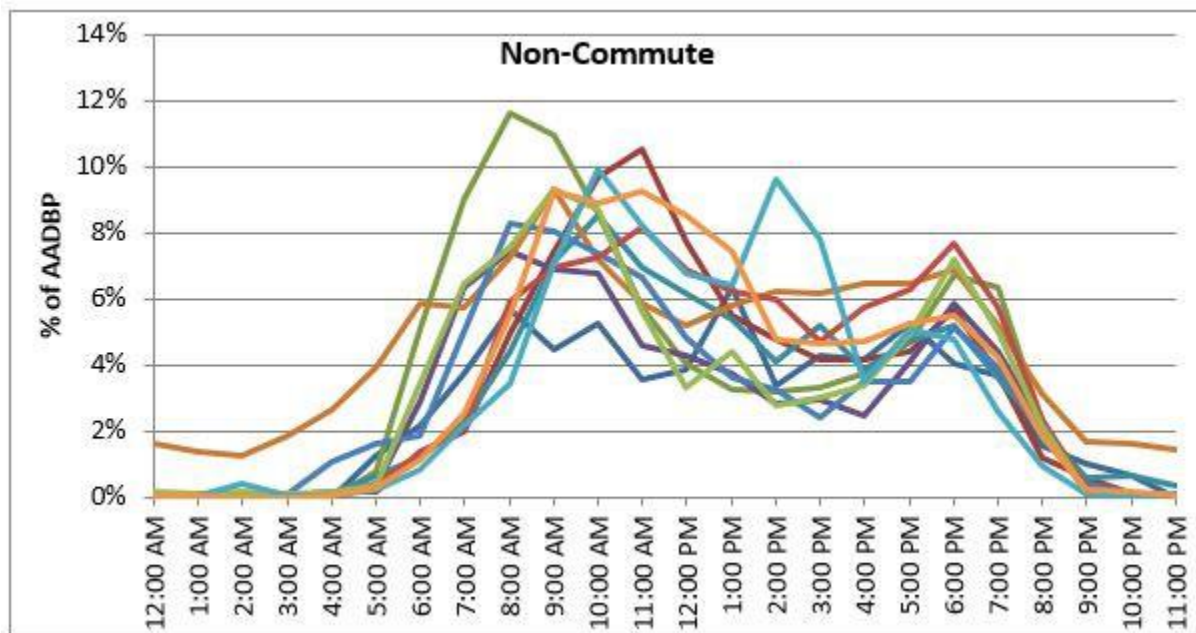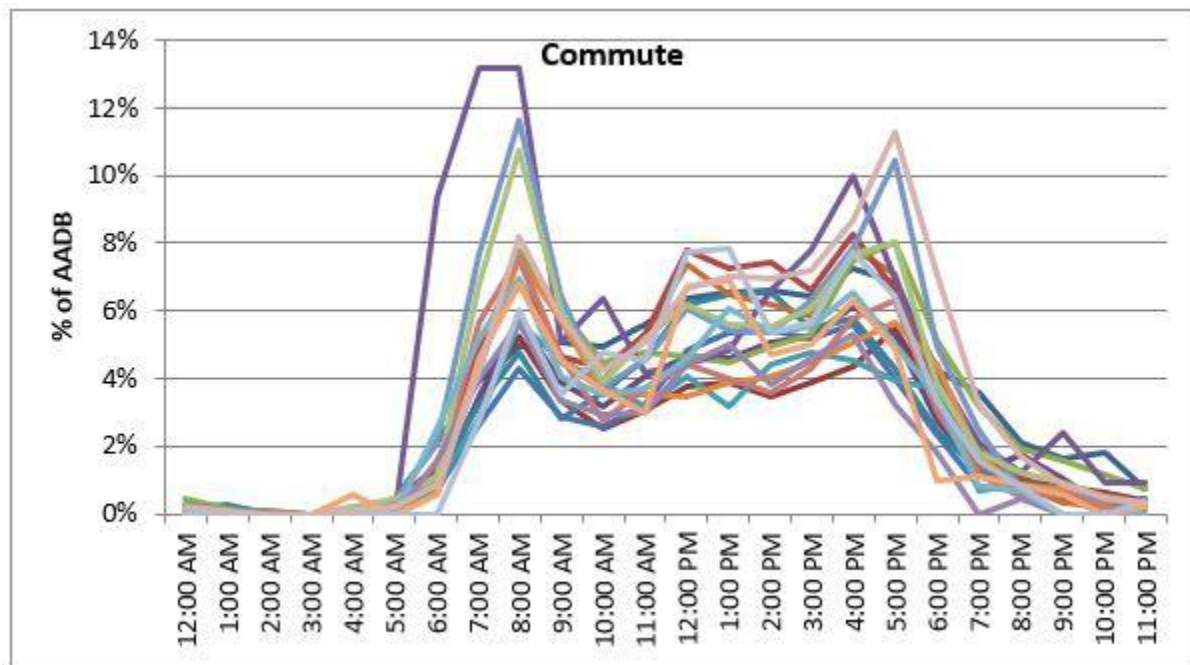
Guidance for Grouping

Miranda-Moreno and others have created a statistically-based method for grouping bicycling patterns using data from 40 North American locations. They classified these locations into four groups: utilitarian, mixed utilitarian, recreational and mixed recreational.

In 2013, Colorado Department of Transportation released a [report](#) detailing the process of inventorying, grouping, and computing seasonal adjustment factors for the state. Locations are classified into three groups: mountain non-commute, urban plains non-commute and commute.

A 2012 Colorado Department of Transportation [report](#) discusses the topic of grouping sites and more generally recommends three basic groups: commute, non-commute and mixed.

Cluster analysis offers a more statistically based option to grouping locations based on daily and monthly factors. For motor vehicles, the [Traffic Monitoring Guide](#) Section 3.2 discusses the pros and cons of cluster analysis compared to other methods for grouping stations, and Appendix G gives an example of cluster analysis applied to North Carolina motor vehicle data. For non-motorized traffic, the [2013 report for the Colorado Department of Transportation](#) (page 95) includes an example of how cluster analysis was applied to bicycle and pedestrian count data.

GUIDANCE FROM THE [TRAFFIC MONITORING GUIDE 2013](#), [SECTION 4.4.3](#)

STEP 4: ESTABLISH SEASONAL PATTERN GROUPS

In the previous step (Step 3), existing non-motorized data was used to determine the traffic patterns that are to be monitored. In Step 4, this information is used to establish unique traffic pattern groups that will be used as the foundation for the monitoring program.

In some cases, non-motorized count data may not be available in Step 3 to determine the most likely traffic pattern groups. In these cases, previous analyses of non-motorized data from previous studies or of similar locations should be used as a starting point. Once more non-motorized data is gathered in your region, these traffic pattern groups can be refined based on your local data.

Previous (but limited) research indicates that non-motorized traffic patterns can be classified into one of these three categories (each with their own unique time-of-day and DOW patterns):

Commuter and work/school-based trips – typically have the highest peaks in the morning and evening;

Recreation/utilitarian – may peak only once daily, or be evenly distributed throughout the day;

Mixed trip purposes (both commuter and recreation/utilitarian) – has varying levels of these two different trip purposes, or may include other miscellaneous trip purposes.

[1]Turner, S., Qu, T., & Lasley, P. (2012). Strategic Plan for Non-Motorized Traffic Monitoring in Colorado (pp.

99). College Station, TX: Texas Transportation Institute.

[2]Miranda-Moreno, L. F., Nosal, T., Schneider, R. J., & Proulx, F. (2013). Classification of bicycle traffic patterns in five North American Cities. Paper presented at the Annual Meeting of the Transportation Research Board, Washington, DC.

[3]Federal Highway Administration. (2013). Traffic Monitoring Guide. Washington, DC: U.S. Department of Transportation.

[4]Nordback, K., Marshall, W. E., & Janson, B. N. (2013). Development of Estimation Methodology for Bicycle and Pedestrian Volumes Based on Existing Counts (pp. 157). Denver, CO: Colorado Department of Transportation (CDOT).

[5]Nordback, K. L. (2012). Estimating Annual Average Daily Bicyclists and Analyzing Cyclist Safety at Urban Intersections. Ph.D., University of Colorado Denver, Denver.

Need More Stations?

After grouping the permanent counters by pattern, consider if additional counters would be beneficial.

1. Are there any major types of patterns not represented?

2. Is each geographic or climate region represented?

3. Would adding permanent counters to any of the factor groups improve the quality of the factors?

To answer Question 1, one might look at the patterns found at the short duration locations (you can start to see these if you have at least 12 hours of data per site). Are most of the patterns found in your short duration sites represented by permanent counters? If not, consider adding more permanent counters where these types of patterns might exist. If no short duration counts longer than 12 hours exist, consider the patterns found by others: commute, recreational, and mixed.1 Are each of these represented by your permanent counters? Are there other patterns in your community that should be represented, such as school patterns?

Answering Question 2 might require little more than mapping the locations and overlaying the climate and geography of the study area. Is each major climatic zone or geographic area that is likely to impact cycling and walking behavior represented?

To answer Question 3, the Traffic Monitoring Guide provides guidance that generally – for motorized traffic – five to eight permanent counters are needed per factor group. Since bicycle and pedestrian traffic is more variable, more counters might be required to compute reliable factors. While further research is needed to answer this question, research conducted in Colorado recommends at least seven permanent count stations per factor group.2

Precision of Factors

A graph from the 2013 Colorado Department of Transportation report is reproduced below showing the normalized precision interval of the monthly factors for various numbers of counters. The Traffic Monitoring Guide recommends analyzing the precision of the factors in order to judge the grouping of counters. The smaller the normalized interval, the tighter the precision. The average precision interval shown for the Colorado bicycle count data seems to suggest that to achieve reasonably accurate factors at least seven continuous counters per factor group are needed.
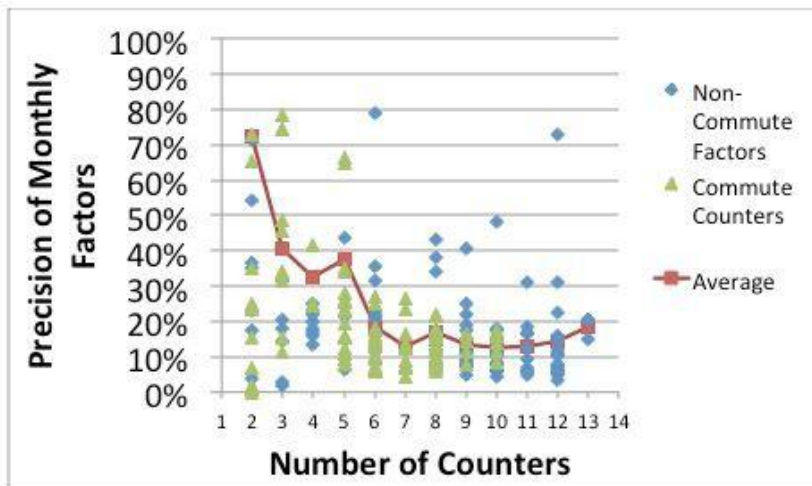
Source: [Colorado Department of Transportation](#).

GUIDANCE FROM THE TRAFFIC MONITORING GUIDE 2013, SECTION 4.4.4

> 4.4.4 STEP 5: DETERMINE APPROPRIATE NUMBER OF CONTINUOUS MONITORING LOCATIONS
>
> Very little is known about spatiotemporal variation of non-motorized traffic, and what is known is very location-specific and difficult to generalize nationwide. In most cases (where no non-motorized counting currently exists), the number of count locations will be based on what is feasible given existing traffic monitoring budgets.
>
> If equipment budgets are not constrained, then a rule of thumb is that about three to five continuous count locations should be installed for each distinct factor group (based on trip purpose and seasonality). The number of permanent count locations can be refined and/or increased as more data is collected on non-motorized traffic.
>
> [1]Turner, S., Qu, T., & Lasley, P. (2012). Strategic Plan for Non-Motorized Traffic Monitoring in Colorado (pp. 99). College Station, TX: Texas Transportation Institute.
>
> [2]Nordback, K., Marshall, W. E., & Janson, B. N. (2013). Development of Estimation Methodology for Bicycle and Pedestrian Volumes Based on Existing Counts (pp. 157). Denver, CO: Colorado Department of Transportation (CDOT).

Select Sites & Install

If you find more permanent count sites are needed or desired, the next step is to determine where to put them and what technology to install.

Select Sites

Selecting sites deserves a book of its own, as there are many approaches and each jurisdiction will have its own priorities and values. Most agencies choose based on a multitude of criteria including:

- Geography

- Climate

- Non-motorized traffic volume

- Facility type

- Level of urbanization

- Interest of local community

- Convenience

- Appropriate location for counting technology

Install stations

There is much to say about automated continuous bicycle and pedestrian counters. We won't try to list all of the technologies here. The Traffic Monitoring Guide, Section 4.2, provides a good summary of the technologies available and offers a useful graphic to help choose an appropriate technology. This graphic is reproduced below for your convenience.

Equipment Maintenance

Just released in 2015, NCHRP 797 Guidebook on Pedestrian and Bicycle Volume Data Collection provides useful advice on bicycle and pedestrian counting equipment, validation and maintenance.

 Also available is an online document detailing how the NCHRP project team's testing of counting equipment and analysis: http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_w205.pdf

References

Burbidge, Shaunna K. "Developing a Rubric and Best Practices for Conducting Counts of Non-Motorized Transportation Users." 52. Salt Lake City, Utah: Active Planning, LLC, 2016.

Ryus, Paul, Erin Ferguson, Kelly M. Lausten, Robert J. Schneider, Frank R. Proulx, Tony Hull, and Luis Miranda-Moreno. NCHRP 797 Guidebook on Pedestrian and Bicycle Volume Data Collection. Washington, DC: NCHRP, 2015.

Ryus, Paul, Frank R. Proulx, Robert J. Schneider, Tony Hull, and Luis Miranda-Moreno. Methods and Technologies for Pedestrian and Bicycle Volume Data Collection. Washington, DC: National Cooperative Highway Research Program, 2015.

The Los Angeles metropolitan area hosts a Bike Count Data Clearinghouse and provides guidance on selecting sites and counting technologies as shown in this figure.

Source: http://www.bikecounts.luskin.ucla.edu/

Figure 1: Decision Flow Chart for Automatic Counters

Decision Flow Chart for Automatic Counters

Not all automatic counters work in all situations. Use this flowchart as a guideline to find a counter(s) that works in your situation.

Figure 4.24 Decision Tree of Count Technologies

KEY:
1. Pneumatic Tubes
2. Inductive Loops
3. Piezoelectric Strips
4. Pressure Pads
5. Acoustic Pads
6. Active Infrared
7. Passive Infrared
8. Laser Scanning
9. Radio Waves
10. Radio Signals
11. Micro Radar
12. Video Image
13. Magnetometers
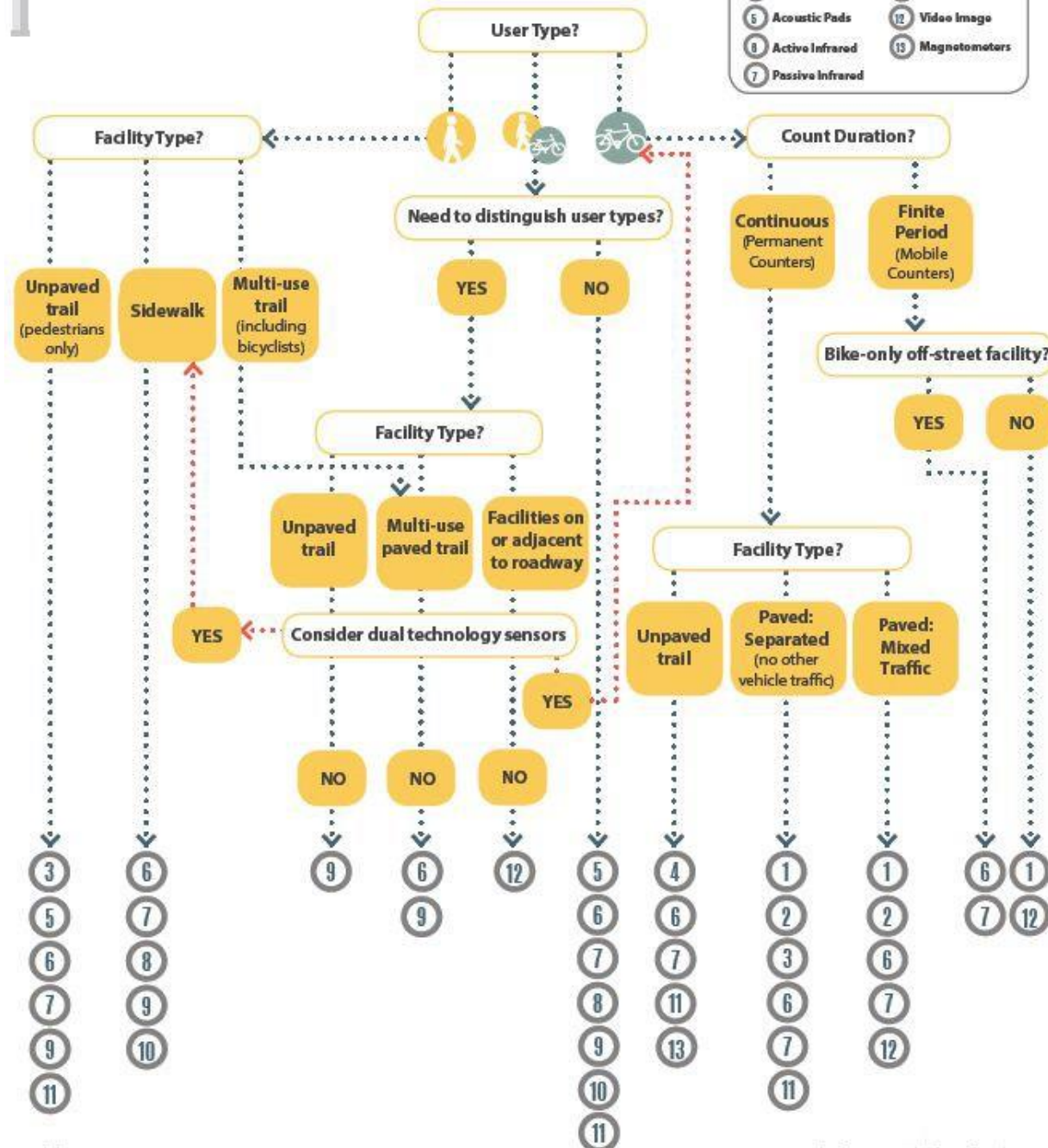
Source: Developing a Rubric And Best Practices for Conducting Counts of Non-Motorized Transportation Users, Utah DOT

GUIDANCE FROM THE [TRAFFIC MONITORING GUIDE 2013](), [SECTION 4.4.5]()

FIGURE 4-1 SIMPLIFIED FLOWCHART FOR SELECTING NON-MOTORIZED COUNT EQUIPMENT

1. What Are You Counting?

	Technology	Bicyclists Only	Pedestrians Only	Pedestrians & Bicyclist Combined	Pedestrians & Bicyclist Separately	Cost
Permanent ↑	Inductance Loops[1]	●				◐	$$
	Magnetometer[2]	○					$-$$
	Pressure Sensor[2]	○	○	○	○	$$
	Radar Sensor	○	○	○		$-$$
	Seismic Sensor	○	○	○		$$
2. How Long?	Video Imaging: Automated	○	○	○	○	$-$$
	Infrared Sensor (Active or Passive)	○[3]	●	●	◐	$-$$
	Pneumatic Tubes	●			◐	$-$$
Temporary/ Short Term ↓	Video Imaging: Manual	○	○	○	●	$-$$$
	Manual Observers	●	●	●	●	$$-$$$

○ Indicates what is technologically possible.
● Indicates a common practice.
◐ Indicates a common practice, but must be combined with another technology to classify pedestrians and bicyclists separately.
$, $$, $$$: Indicates relative cost per data point.
[1] Typically requires a unique loop configuration separate from motor vehicle loops, especially in a traffic lane shared by bicyclists and motor vehicles.
[2] Permanent installation is typical for asphalt or concrete pavements; temporary installation is possible for unpaved, natural surface trails.
[3] Requires specific mounting configuration to avoid counting cars in main traffic lanes or counting pedestrians on the sidewalk.

GUIDANCE FROM THE [TRAFFIC MONITORING GUIDE 2013](#), [SECTION 4.4.5](#)

4.4.5   STEP 6: SELECT SPECIFIC COUNT LOCATIONS

Once the number of locations within factor groups has been established, the next step is to identify specific monitoring locations. Several considerations should be addressed in this step.

Differentiating pedestrian and bicyclist traffic - Will pedestrian and bicyclist traffic be separately monitored at each permanent count location? In the case of shared use paths, pedestrians and bicyclists will be traveling in the same space, and specialized equipment should be used to differentiate these different user types. In other situations, it may be preferable to monitor bicyclists separately from pedestrians. Exclusive bicycle lanes or separated bicycle paths can be instrumented with inductance loops (permanent) or pneumatic tubes (short-duration) that will not count larger/heavier motorized vehicles. Pedestrian malls, sidewalks or walkways can be instrumented with a single-purpose infrared counter if bicyclists are not typically present.

Selecting representative permanent count locations – Although it may be tempting to select the most heavily used locations for permanent monitoring, one should focus primarily on selecting those locations that are most representative of prevailing non-motorized traffic patterns (while still having moderate non-motorized traffic levels). In some cases, permanent count locations may be installed at low-use locations if higher use is expected after pedestrian or bicycle facility construction. The primary purpose of these continuous monitoring locations is to factor/annualize the other short-duration counts. Continuous counts at a high-pedestrian or high-bicyclist location may look impressive, but may not yield accurate results when factoring short-duration counts.

Selecting optimal installation locations – Once a general site location is identified, the optimal installation location should be chosen for the specific monitoring technology and equipment. In most cases, the optimal location is:

On straight, level sections of road or trail, not on curves or on or near a steep grade; On smooth pavement or other compacted surface;

Where the traveled way is clearly delineated and deviation is not common; For infrared sensors, not near water or in direct sunlight;

For infrared sensors, not directly facing the roadway unless a vertical barrier exists; and

For inductance loop detectors, not near high-power utility lines that could disrupt or distort the detection capability.

Compute Factors

If you want to estimate Annual Average Daily Bicyclists/Pedestrians (AADBP) at locations where less than 12 months of count data is available, expansion factors are a helpful way to do it. These adjust short duration counts to the average. For example, if a short duration count is collected in June, expansion factors allow us to account for the fact that a day in June might be expected to have higher volumes than an average day. Compute these factors annually, if possible.

There is a growing literature on how best to compute expansion factors for bicyclists and pedestrians. Some methods are based on similar methods used for motor vehicles; other methods include weather variables; and still other methods compute separate factors for each day of the week. Here we offer a list of resources to help you compute factors for a single permanent counter or a group of permanent counters.

Resources for Computing Factors

Alex Hyde-Wright has created an example of a simple method for estimating factors for one permanent count station. This example can be downloaded here.

A traditional method for computing factors is documented in this PDF. Similar methods are described in the Traffic Monitoring Guide.

If no permanent bicycle or pedestrian count data are available in your region or state, the National Bicycle and Pedestrian Documentation Project, a joint effort by Alta Planning and Design and the Institute of Transportation Engineers, provides a set of factors that can be downloaded from their website (see the Extrapolation Workbook). Since bicycle and pedestrian traffic patterns vary greatly by geography and climate, applying these national factors can result in large error and may only be appropriate for very rough estimates.

El Esawey and others, working with data from Vancouver, British Columbia, have investigated the details of how to estimate hourly, daily and monthly factors, including investigating how to include weather factors. Their first paper, available here, discusses the best approaches to computing daily factors specifically. Their second paper analyzes both daily and monthly factors and can be found here in addition to their TRB presentation.

Others have also investigated factoring including how weather might be included:

- Sears, Flynn, Autlman-Hall and Dana 2012

- Nordback 2012

- [Dowds and Sullivan 2012](#)

- [Figliozzi, Johnson, Monsere, Nordback 2014](#)

- Nordback and others have created a set of Colorado-specific factors published in their [2013 report](#).

Recent work presented at the 2014 annual meeting of the Transportation Research Board by two independent teams, Hankey, Lindsey and Marshall in Minneapolis[1], and Nosal, Miranda-Moreno and Krstulic in Montreal[2], found that using factors for each day of the year could outperform traditional seasonal adjustment factors even when weather was specifically factored in. [The Montreal study is available here](#).

GUIDANCE FROM THE [TRAFFIC MONITORING GUIDE 2013](#), [SECTION 4.4.6](#)

4.4.6 STEP 7: COMPUTE ADJUSTMENT FACTORS

The computation of adjustment factors should follow a similar process as motorized traffic volumes outlined in Section 3.2.1. These adjustment factors will be calculated for each unique non-motorized traffic factor group as determined in Step 4.

In practice, very few agencies have applied monthly or DOW adjustment factors to short-duration non-motorized counts. The current prevailing practice is to collect short-duration counts during those dates and times that are believed to be average, thereby reducing the perceived need for adjustment. However, this practice should evolve to a more traditional traffic monitoring approach as more permanent non-motorized count locations are installed.

[1]Hankey, S., G. Lindsey, et al. (2014). Day-of-Year Scaling Factors and Design Considerations for Non-motorized Traffic Monitoring Programs. 93rd Annual Meeting of the Transportation Research Board. Washington, D.C., National Academies.

[2]Nosal, T., L. Miranda-Moreno, et al. (2014). Incorporating weather: a comparative analysis of Average Annual Daily Bicyclist estimation methods. 93rd Annual Meeting of the Transportation Research Board. Washington, D.C., National Academies.

SHORT DURATION COUNT PROGRAM

Short duration bicycle and pedestrian traffic counts can last from five minutes to multiple months. They can be collected manually by volunteers or by portable automated equipment. Short duration count programs tend to be more common than permanent count programs because they don't require special equipment. However, without corresponding permanent counters these short duration counts cannot be adjusted to an annual average.

How-To Guides and Templates

The National Bicycle and Pedestrian Documentation Project offers a standard procedure for collecting manual short duration counts.

Boulder County, Colorado conducts a short duration bicycle counting program as part of its motor vehicle count program using pneumatic tube counters. Through extensive testing using various equipment configurations, the county determined that bicycles were being counted as trucks. To improve the accuracy of the off-the-shelf pneumatic tube counter, the county modified the counter's vehicle classification scheme so that fewer cyclists were misclassified.1 Below is a presentation from Alex Hyde-Wright and Brian Graham of Boulder County as well as instructions for the classification scheme and a copy of the classification scheme.

Presentation by Alex Hyde-Wright and Brian Graham of Boulder County

Instructions for Classification Scheme

Classification Scheme 📄 Boulder County (BOCO) Classification Scheme.sch_.docx (Download and change the file extension to *.sch. If this is problematic, just open the file and copy the text to a text editor - like Notepad - and save the file as BOCO.SCH)

Davis and Wicklatz used a random stratified sampling approach with a short duration count program to estimate bicycle miles traveled in the Twin Cities area of Minnesota.

Dowds and Sullivan applied a similar approach to estimate bicycle miles traveled in Chittenden County, Vermont

GUIDANCE FROM THE [TRAFFIC MONITORING GUIDE 2013](), [SECTION 4.5]()

> 4.5   SHORT DURATION DATA PROGRAM
>
> Similar to motorized traffic monitoring, the majority of non-motorized locations will be monitored using short-duration counts. However, in some non-motorized monitoring programs the distinction between
>
> short-duration counts and special needs counts is not clearly defined. Short-duration counts are performed on specific facilities based on certain needs for that facility (e.g., before-after), but it is not known whether that specific facility is representative of other facilities and can therefore be expanded to a sub-area or regional estimate of overall non-motorized travel.
>
> Unfortunately, clear guidance does not yet exist on this statistical representation issue and one will have to use their best judgment in determining which special needs counts also can be used to represent sub-area or regional travel estimates and trends.

[1]Hyde-Wright, A., B. Graham, et al. (2014). "Counting Bicyclists with Pneumatic Tube Counters on Shared Roadways." ITE Journal.

What Kind of Count?

As explained in the [Traffic Monitoring Guide](), there are two types of counts: counts at an intersection and counts along a road or path segment. Counts at intersections often include turning movements. Counts along a road segment are also known as screenline counts because any bicyclist or pedestrian who crosses an imaginary line drawn perpendicularly across the segment should be counted. The illustrations below depict these two types of counts.

Intersection Counts with Turning Movements
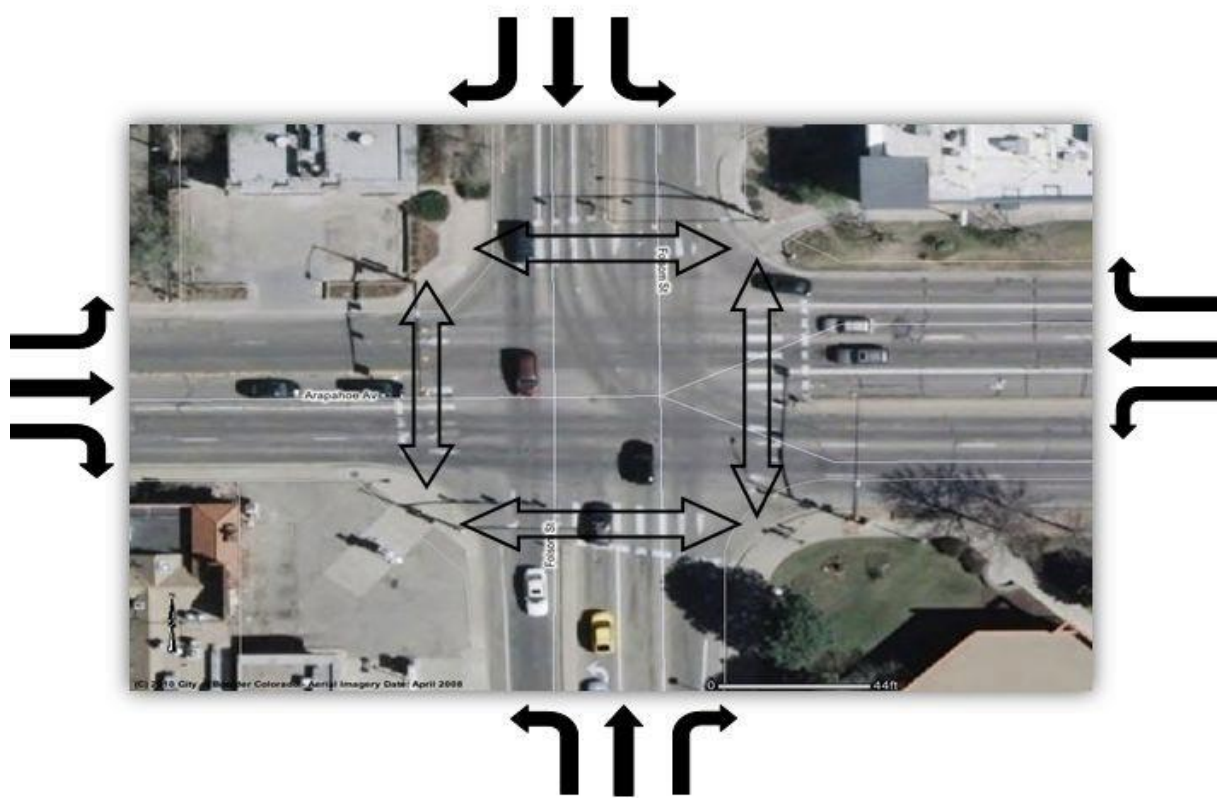
Segment Counts (also known as "Screenline" counts)
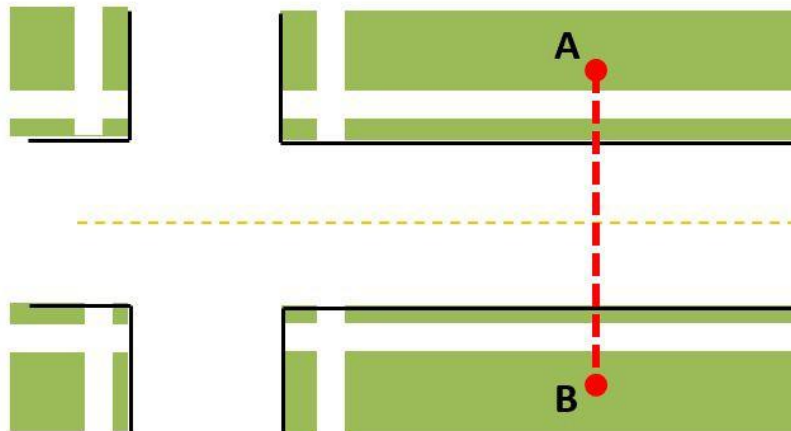
Turning movement counts at intersections are typically collected for signal timing efforts and are desirable for traffic impact studies and safety studies. The complexity of counting multiple directions at one time usually requires more staff and/or volunteer time than segment counts and can compromise data quality if volunteers or staff are not adequately trained or if the counting task it too demanding for a single person. Additionally, Turning Movement Counts are much more difficult or expensive to collect using currently available off-the-shelf automated technologies.

If automated counting technologies are to be used, segment counts are usually the preferred option, unless the automated counting technology used is contained in the signal detection equipment.[1]

While automated counts have many advantages in terms of reducing budget per hour spent of counting and allowing much longer time periods for data collection, manual counts also have advantages in terms of raising community awareness of cycling and walking through volunteer count programs and allowing additional data such as gender or helmet use to be collected.

Short Duration Count Resources

Multiple smartphone apps are available for counting bicyclists and pedestrians including Bike And Walk.

Kothuri and others describe how pedestrian activity and bicycle volume data can be collected using existing signal detection equipment.

GUIDANCE FROM THE TRAFFIC MONITORING GUIDE 2013, SECTION 4.5.2

4.5.2   SCREENLINE VERSUS INTERSECTION COUNTS

The two basic location types for non-motorized traffic monitoring are:

1. Screen line counts that are taken at a mid-segment location along a non-motorized facility (e.g. sidewalk, bike lane, cycle track, shared use path); and,

2. Intersection crossing counts that are taken where a non-motorized facility crosses another facility of interest.

Screen line counts are typically used to identify general use trends along a facility, and are analogous to most short duration motorized traffic counts. Although taken at a specific location, screen line counts are sometimes applied to the full segment length to calculate vehicle-miles of travel, pedestrian-miles of travel, and bicyclist-miles of travel.

Intersection crossing counts are typically used for safety and/or operational purposes, and are most analogous to motorized intersection turning movement counts. Example applications include using intersection counts to determine exposure rates at high collision crossings, as well as to retime or reconfigure traffic signal phasing. Intersection counts are typically more complicated than screen line counts and may require additional counters, primarily because multiple intersection approaches are being counted at once.

The uses of the data will dictate which types of counts are most appropriate.

[1]Kothuri, S. M., T. Reynolds, et al. (2012). Preliminary Development of Methods to Automatically Gather Bicycle Counts and Pedestrian Delay at Signalized Intersections. 91st Annual Meeting of the Transportation Research Board. Washington, DC, National Academies.

Select Count Locations

It is desirable to count in a variety of locations around the area to be studied. Ideally, a random sample of all possible locations would be chosen to provide a representative sample. Truly random samples are rare for multiple reasons: convenience, to continue previous count sites, because of upcoming projects where counts are desired, and other compelling reasons. But whatever your site selection strategy, selecting a variety of location types around your study area is advantageous if understanding spatial variation is important.

If your program is small, choosing to focus on known high-volume bicycle and pedestrian facilities is a good

start. But to get a more representative sample, including lower volume facilities is necessary. This is especially true if your goal is to eventually estimate miles traveled on a network.

If a robust set of permanent counters is in place with which to compute factors, it may not be necessary to count the same location every year. For example, a given site might only be counted once every three years, as is common in motor vehicle short duration count programs. This can greatly increase the number of sites that can be measured.

GUIDANCE FROM THE TRAFFIC MONITORING GUIDE 2013, SECTION 4.5.1

4.5.1   SELECTION OF COUNT LOCATIONS

For motorized traffic, State DOTs have a short-duration data program that provides traffic data for all roads on their State highway system. The same goal for non-motorized traffic data may not be feasible, especially since most non-motorized travel occurs off the State highway system and on lower-volume and lower-speed city streets, shared use paths, and pedestrian facilities.

The prevailing practice for collecting short-duration non-motorized traffic data has been to focus on targeted locations where activity levels and professional interest are the highest. Although this non-random site selection may not yield a statistically representative regional estimate, 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).

The following National Bicycle and Pedestrian Documentation (NBPD) Project criteria are recommended for short-duration counts:

- Pedestrian and bicycle activity areas or corridors (downtowns, near schools, , etc.);

- Representative locations in urban, suburban, and rural locations;

- Key corridors that can be used to gauge the impacts of future improvements;

- 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 short-duration count locations will depend on the available budget and the planned uses of the count data. To date, there has been no definitive analysis of, or guidance for, determining the required number of short-duration count locations. For most regions getting started with counting non-motorized travel, the short 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 the special needs short count locations which the available data collection budget can afford to collect. (These same discussions should also identify those key regional facilities that should be used for early deployment of permanent counters that will then be used to expand the short count data into estimates of annual and peak use.) The special needs counts will then provide the data needed to guide the development of a more statistically valid sample of short count locations. These more statistically rigorous sample designs will become possible in the future as more data is collected and as research is performed in the coming years.

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

- 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 for an entire city or State.

Select Duration

If the counts are being collected manually in the field, the length of time a human can reasonably be expected to accurately count is generally limited to about two hours. This greatly reduces the possible duration of manual counts. Unfortunately, estimates of Annual Average Daily Bicyclists/Pedestrians (AADBP) based on just two hours of counts have been shown to have as much as 60 percent error on average. Fortunately, such estimates can be much more accurate if based on counts taken during peak hours in mid-September (assuming a Midwestern climate) as recommended by the National Bicycle and Pedestrian Documentation Project.

However, if video is collected and watched later, this can increase the time a human can collect data manually. Even better, if automated counters are used, counts of 24 hours or longer are not unreasonable. Multiple studies show that collecting at least one week of counts per location results in much increased accuracy. 123 Below is a graph illustrating how AADB estimation error decreases with increasing duration of short counts. For this reason, we recommend one week of counts, if possible.
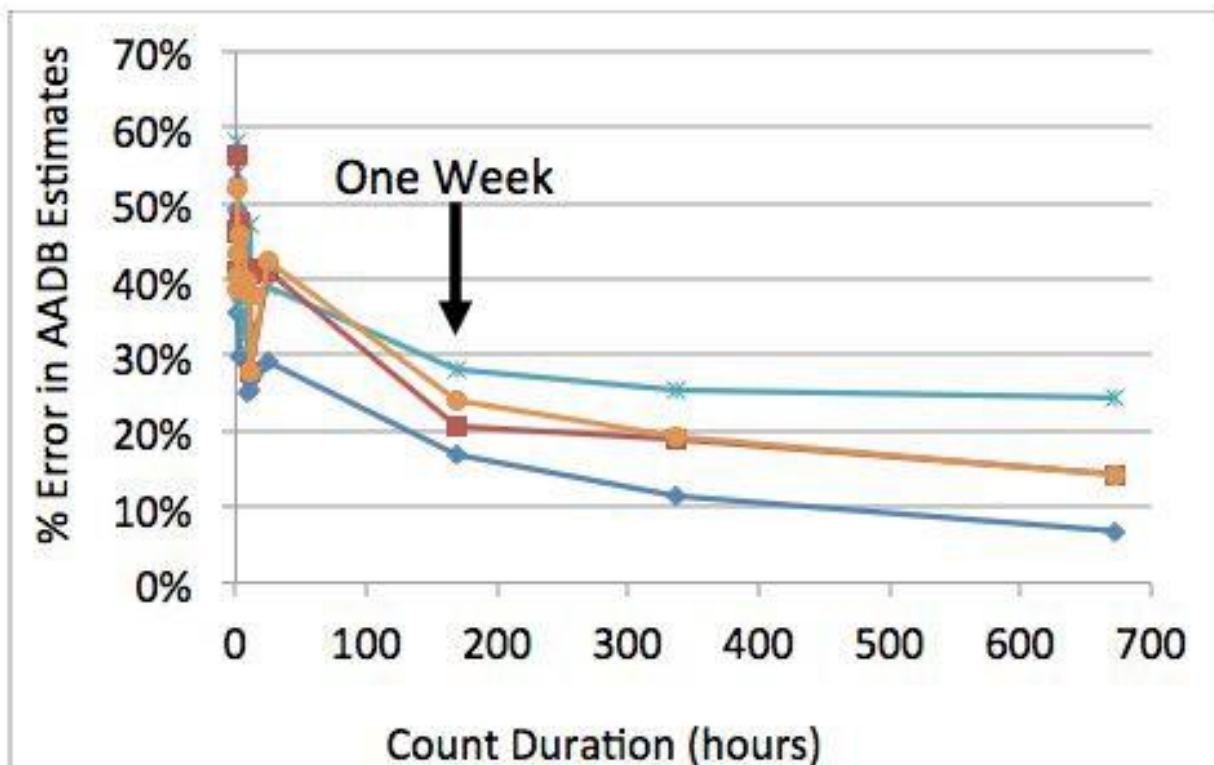
Guidance for selecting duration:

Hankey and others provide useful guidance in their 2014 presentation at the Transportation Research Board Annual Meeting.

Nosal and others report similar findings in their 2014 presentation at the Transportation Research Board Annual Meeting.

Nordback and others recommend one week of short duration counts as optimal.

GUIDANCE FROM THE TRAFFIC MONITORING GUIDE 2013, SECTION 4.5.3

1.1.1 DURATION OF COUNTS

There is no definitive guidance on the minimum required duration of short-duration counts. The prevailing practice has been two consecutive hours on a single day, but that practice is evolving as more public agencies use automatic counters and become aware of the inherent variability of non-motorized traffic. The following paragraphs discuss several factors that agencies should consider when determining the duration of their short-duration counts.

Manual Versus Automated Collection

The use of automatic counter equipment can dramatically extend the duration of short-duration counts. If automatic counters are used, then the minimum suggested duration is 7 days (such that all weekday and weekend days are represented). Depending on several other factors (e.g., day-to-day count variability, the total number of short-duration monitoring sites, and the number of automatic counters), the preferred duration of automatic counts could be as long as 14 days at each location.

The use of manual observers will limit the duration of short-duration counts. However, the minimum suggested duration for manual observers is 4 to 6 hours and should be scheduled to coincide with the heaviest non-motorized use (typically mid-day for weekend/recreational trips and morning/evening commute times for other trips). Manual observers' counting accuracy declines after 2 hours, so observers should be given short breaks or replaced with other observers. The preferred length for short-duration counts is 12 hours, which permits calculation of time-of-day use profiles. However, it is recognized that available resources may limit the collection of 12-hour counts.

The prevailing practice for short-duration manual counts has been 2 hours, largely because of resource and manual observer limitations. There is recognition that 2 hours of count data is better

than no data; however, 2 hours of count data may lead to high error rates when annualizing counts and could lead to erroneous conclusions. If manual observers are the only possibility for short-duration counts, then agencies are encouraged to count for longer periods at fewer locations. Alternatively, the NBPD project (National Bicycle and Pedestrian Documentation Project: Instructions) has encouraged agencies to count multi-hour periods on several different days:

"We suggest that between 1 and 3 counts be conducted at every location on sequential days and weeks, based on the approximate levels of activity. Areas with high volumes (over 100 people per hour during mid-day periods) can usually be counted once on a weekday and weekend day, unless there is some unusual activity that day or land use nearby."

"Areas with lower activity levels and/or with unusual nearby land uses (with any irregular activity, such as a ball park) or activity (such as a special event) should be counted on sequential days or weeks at least one more and possibly two more times."

Count Magnitude and Variability

If non-motorized traffic levels are high and consistent from day-to-day, then shorter periods and/or fewer days may be considered. However, a longer-duration count period will be needed to determine how variable the non-motorized traffic is by time-of-day and DOW. Unfortunately, there is little quantitative guidance or consensus in this area, and ongoing research will improve future guidance.

Weather

Weather can be a significant factor in the level and variability of non-motorized traffic and should be considered when developing a short-duration monitoring program. Seasonal weather patterns (such as cold winters or hot/humid summers) are expected by pedestrians and bicyclists and will result in relatively consistent patterns from year to year. However, heavy precipitation or unexpectedly hot or cold weather may introduce abnormal variations on a given time of day or day of year. These variations can both generate unusually high levels of activity (e.g., a very nice day) or depress otherwise expected levels of activity (due to very bad weather.)

If automatic counter equipment is used for short-duration counts in typical weather, then the minimum suggested duration is 7 days (such that all weekday and weekend days are represented). This duration provides an average of 5 weekdays and 2 weekend days. However, if atypical heavy precipitation or inclement weather occurs during this entire 7-day period, agencies should consider extending the duration to 14 days.

When heavy precipitation or inclement weather occurs with manual observers, the counts should

be extended over multiple days at the same time. Local judgment should be used to determine whether to include inclement-weather days into a multi-day average.

Because of inclement weather's influence on non-motorized traffic, weather conditions should be recorded in a non-motorized traffic monitoring program. The non-motorized data submittal format in Chapter 7 recommends three weather-related attributes:

Precipitation (yes/no): Did measurable precipitation fall at some time during data collection.

High temperature: Approximate high temperature for either the day (if a day or longer count) or the duration of the count (if the count is less than a day in duration).

Low temperature: Approximate low temperature for either the day (if a day or longer count) or the duration of the count (if the count is less than a day in duration).

Historical weather data can be obtained from several different sources and does not necessarily have to be collected at the exact count location.

[1]Nordback, K., W. Marshall, et al. (2013). Estimating Annual Average Daily Bicyclists: Error and Accuracy. 92nd Annual Meeting of the Transportation Research Board. Washington, D.C., National Academies.

[2]Hankey, S., G. Lindsey, et al. (2014). Day-of-Year Scaling Factors and Design Considerations for Non-motorized Traffic Monitoring Programs. 93rd Annual Meeting of the Transportation Research Board. Washington, D.C., National Academies.

3Nosal, T., L. Miranda-Moreno, et al. (2014). Incorporating weather: a comparative analysis of Average Annual Daily Bicyclist estimation methods. 93rd Annual Meeting of the Transportation Research Board. Washington, D.C., National Academies.

Schedule the Count

When should short duration counts be conducted? Research suggests that the best time to count is when bicycle and pedestrian traffic volumes are highest.1 This should reduce error in estimating Annual Average Daily Bicyclists/Pedestrians (AADBP). For North American climates with severe to moderate winters, this time period is usually May through October as illustrated in the graph of annual average daily bicyclist (AADB) estimation error in Colorado below. This is likely to apply to typical Midwestern North American climates.
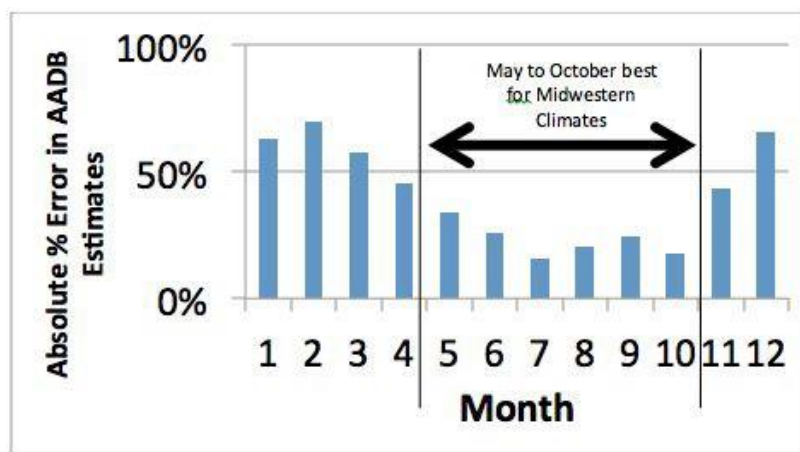
Because many programs have not included permanent bicycle and pedestrian counts, short count programs often choose to count on the same day of the year every year. For example, the National Bicycle and Pedestrian Documentation Project recommends counting in mid-September every year. However, if a robust set of permanent counters are in place with which to compute factors, it may not be necessary to count the same location every year. For example, a given site might only be counted once every three years, as is common in motor vehicle short duration count programs. This can greatly increase the number of sites that can be measured.

GUIDANCE FROM THE TRAFFIC MONITORING GUIDE 2013, SECTION 4.5.4

> 4.5.4   MONTHS/SEASONS OF YEAR FOR DATA COLLECTION
>
> The specific months/seasons of the year for short-duration counts should be chosen to represent average or typical use levels, which can be readily determined from permanent continuous counters (thereby underscoring the importance of these automatic continuous counters). In most climates in the U.S., the spring and fall months are considered the most representative of annual

average non-motorized traffic levels (e.g., the NBPD projects recommends mid-May and mid-September).

Short-duration counts may be collected during other months/seasons of the year that are not considered average or typical; however, a factoring process will be necessary to adjust these counts to best represent an annualized estimate of non-motorized traffic.

[1]Nordback, K., W. Marshall, et al. (2013). Estimating Annual Average Daily Bicyclists: Error and Accuracy. 92nd Annual Meeting of the Transportation Research Board. Washington, D.C., National Academies.

Apply Factors

After computing adjustment factors from the permanent counts, multiply the short duration counts by the appropriate factors to compute the estimated annual average daily bicycle/pedestrian traffic (AADBP).

In addition to the example given in the Traffic Monitoring Guide, Chapter 4, here is an example provided by Alexander Hyde-Wright.

Another example of how factors can be applied is provided on pages 120 to 124 in a 2013 report issued by the Colorado Department of Transportation.

GUIDANCE FROM THE TRAFFIC MONITORING GUIDE 2013, SECTION 4.5.5

4.5.5 FACTORING SHORT-DURATION COUNTS

As indicated in the previous section, a factoring process may be necessary to adjust short-duration counts to best represent an annualized estimate. The factoring process for

motorized traffic has been described in depth in Chapter 3. It is recommended that a similar factoring process be used to annualize non-motorized traffic counts.

Depending on the count duration, type of automated equipment used, and presence of inclement weather, there may be up to five factors that could be applied:

Time-of-day: If less than a full day of data is collected, this factor adjusts a sub-daily count to a total daily count.

DOW: If data is collected on a single weekday or weekend day, this factor adjusts a single daily count to an average daily weekday count, weekend count, or day of week count.

Month/season-of-year: If less than a full year of data is collected, this factor adjusts an average

daily count to an annual average daily count.

Occlusion: If certain types of automatic counter equipment are used, this factor adjusts for occlusion that occurs when pedestrian or cyclists passing the detection zone at the same time (i.e., side-by-side or passing from different directions).

Weather: If short-duration counts are collected during periods of inclement weather, this factor adjusts an inclement weather count to an average, typical count.

Adjustment factors are developed for distinct factor groups, which are groups of continuous counters that have similar traffic patterns. The continuous counters in the factor groups provide year-round non-motorized traffic counts and permit these short-duration counts to be annualized in a way that minimize error.

The non-motorized data submittal formats in Chapter 7 provide the capability to report these five types of adjustment factors in five separate factor groups.

Although factoring is a straightforward mathematical process, very few agencies are using factor groups for non-motorized traffic counts. There is no consensus yet on several aspects of the factoring process, such as the required type of factor adjustments, the number of factor groups for each adjustment type, and the number of continuous count locations within each factor group. It is hoped that future editions of the Guide will be able to provide additional guidance on this non-motorized count factoring process.

Many State DOTs do have data warehouse tools that already perform the factoring process for motorized traffic counts. Many of these tools and factoring processes could be used for non-motorized traffic factoring, given some adaptation as discussed in this section.

COMPREHENSIVE LIST OF RESOURCES

This page compiles all the links provided in each "resources" section throughout the Guide to Bicycle & Pedestrian Count Program.

- A Methodology to Characterize Ideal Short-term Counting Conditions and Improve AADT Estimation Accuracy Using a Regression-based Correcting Function, Figliozzi, Johnson, Monsere, Nordback
- Bike And Walk smart phone app
- Applying A Vehicle-Miles Of Travel Calculation Methodology To A County-Wide Calculation Of Bicycle And Pedestrian Miles Of Travel, Dowds and Sullivan
- Checklist for Creating a Robust Bicycle and Pedestrian Count Program
- Estimating AADB and Analyzing Cyclist Safety at Urban Intersections, Nordback
- Estimation Of Annual Average Daily Bicycle (AADB) Traffic Using Adjustment Factors
- FHWA Traffic Monitoring Guide
- Guidebook on Pedestrian and Bicycle Volume Data Collection, NCHRP 797
- Incorporating weather: a comparative analysis of Average Annual Daily 2 Bicyclist estimation methods, Thomas Nosal
- Institutionalizing Bicycle and Pedestrian Monitoring Programs in 3 States, Lindsey et al
- National Bicycle and Pedestrian Documentation Project
- Preliminary Development of Methods to Automatically Gather Bicycle Counts 2 and Pedestrian Delay at Signalized Intersections, Kothuri et al
- Quality Counts: Developing Accuracy Checks for Bike/Ped Count Data, McNeil and Tufte
- Quality Counts for Pedestrians and Bicyclists: Quality Assurance Procedures for Nonmotorized Traffic Count Data, Turner and Lasley.
- Simple Method for Estimating Factors, Alex Hyde-Wright
- Testing and Counting Equipment, NCHRP
- Traditional Method for Computing Factors
- "We Are Traffic" webinar, February 27, 2014