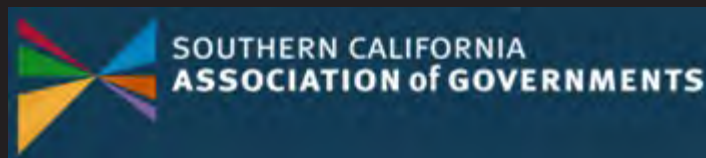


CONDUCTING BICYCLE AND PEDESTRIAN COUNTS

A Manual for Jurisdictions in Los Angeles County and Beyond



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Prepared For:

**The Southern California
Association of Governments (SCAG)**

818 West 7th Street, 12th Floor
Los Angeles, CA 90017
(213) 236-1800

**Los Angeles County
Metropolitan Transportation Authority**

One Gateway Plaza
Los Angeles, CA 90012

Funded By:

Caltrans Partnership Planning Grant

Prepared By:

Kittelson & Associates, Inc.

Ryan Snyder Associates

Los Angeles County Bicycle Coalition

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Introduction





PROJECT BACKGROUND

In Los Angeles County, 20 percent of all trips are on foot or by bike, yet these modes have historically not been included in traffic counts, creating an incomplete picture of our transportation system (FHWA, 2009). While 39 percent of roadway fatalities in LA County are pedestrians or bicyclists, the lack of count data makes it impossible to calculate relative exposure in high collision areas. In order to make informed transportation decisions, a more robust understanding of volumes and behavior for these modes is necessary to quantify costs and benefits associated with them. Only then can active transportation be considered alongside other modes.

As local jurisdictions grapple with limited budgets and constrained rights-of-way, it is important to invest in affordable, yet efficient modes of transportation, such as biking and walking. Additionally, there is growing interest in active transportation due to its health, environmental, and economic benefits. Counts are an essential tool for capturing active transportation's current and potential contribution toward achieving congestion reduction, air quality, and public health

objectives. Appropriately allocating resources for active transportation requires determining existing bicycle and pedestrian volumes such that the effectiveness of future investments can be measured against a baseline.

- Bicycle and pedestrian counts can be conducted in order to:
- Determine existing travel patterns and demand;
- Identify corridors where current use and potential for increased use is high;
- Track trends over time;
- Evaluate the effectiveness of programs and/or facilities to promote walking and biking (e.g., before and after studies);
- Improve pedestrian and bicycle safety and evaluate the impact of different design treatments on collision rates;
- Identify locations for pedestrian and bicycle facility improvements and design appropriate treatments;
- Measure demographic changes as facilities that increase user comfort and attract a wider range of pedestrians and bicyclists are developed;
- Assess future pedestrian and bicycle travel demand;
- Prioritize bicycle and pedestrian improvement projects.



PURPOSE OF THIS MANUAL

We hope this manual will deepen knowledge of bicycle and pedestrian counts so that more agencies in Los Angeles County and the rest of the SCAG region are empowered to conduct them. We also seek to maximize the value of existing and future count data by standardizing their format and approach. This manual presents a bicycle count protocol for the Southern California region that provides consistency and direction for bicycle and pedestrian counts as well as guidance for choosing count technologies. Currently, the differing time periods, choice of methodology, and other variables make it difficult to compare existing count data sets. This manual is intended to establish a standardized bicycle count methodology across the SCAG region so that counts are reliable and comparable across jurisdictions. Establishing a regional count protocol is essential to ensure data can be collected and referenced effectively.

This manual also directs agencies to enter their count data into the Bike Count Data Clearinghouse, a countywide database at bikecounts.luskin.ucla.edu. The website enables city staff and their affiliates to upload their bicycle count data, and it allows the public to view and download bike count data.

The focus of this manual is on bicycle counts, and Clearinghouse is designed exclusively for bicycle count data due to practical limitations. At the same time, this manual does include substantial discussion of pedestrian counts. Methods and technologies for pedestrian counts overlap with bicycle count methods and technologies. For example, manual counters often

have the capacity to count both modes at the same time using a single form. Pedestrian data may be incorporated into the Clearinghouse in the future.

This manual is divided up into five sections: A Count Primer, Before the Count, Count Technologies, During the Count, and After the Count. In addition, it contains an appendix of useful forms and information.

WHO CAN DO COUNTS?

Governments, developers, and transportation consultants conduct counts of vehicles frequently, but bicyclists and pedestrians less so (FHWA, 2012). Many for-hire firms specialize in transportation-related data collection. In reality, counts can be conducted by anyone who understands the steps involved to ensure the accuracy of the data collected. Advocacy groups, universities, and resident associations frequently organize students, volunteers, and stakeholders to conduct counts. As technologies evolve for mobile devices, counting and video recording has the potential to become more democratic. This manual will provide guidance to anybody interested in conducting accurate pedestrian and bicycle counts, but it is written primarily for SCAG member agencies.

WHAT TYPE OF COUNTS CAN BE DONE?

Traffic counts are conducted one of four ways, each of which is discussed in this manual. These are screen-line, intersection turning movements, occupancy, and on-off counts. The focus of this manual is on screen-

line and intersection turning movement counts, because these produce volumes data most suitable for the tracking of general use trends and travel behavior. The Bike Count Data Clearinghouse only includes screenline and intersection counts.

Screenline counts

Screenline counts are done by establishing a visible or invisible line across a roadway or sidewalk and counting the number of vehicles, bicyclists, and pedestrians who pass over that line. Often, screenline counts indicate direction of travel for bicyclists and vehicles, but not for pedestrians. They are used to determine general use trends for a segment of trail or roadway.

Intersection turning movement counts

Intersection turning movement counts are done where two or more roadways and/or major commercial driveways meet. At minimum, these counts capture vehicle turning movement counts. Many traffic counting firms can also capture bicycle turning movements and pedestrian crossing counts for little to no additional cost. They are generally conducted for safety or operational analyses under peak-hour conditions. The information from a turning movement count can also be converted to screenline equivalents for the purpose of analyzing general use trends or making comparisons to screenline count data.

Occupancy counts

Occupancy counts are typically done for parking data. Parking occupancy counts are generally conducted manually using a one-pass method of counting at specified times, although automated systems at parking garages and some on-street parking areas are enabling real-time, continuous occupancy information. Occupancy counts can be done for both vehicle and bicycle parking.

On-off counts

On-off counts are typically done on transit vehicles to count passengers who board and alight. On-off counts can also be done to count passengers who board the transit vehicle with their bicycles.



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A Primer for Bicyclist and Pedestrian Counts





WHY THIS PRIMER CHAPTER?

Your jurisdiction may have little to no experience with collecting bicycle and pedestrian count data. As a result, this manual may seem a bit daunting. This primer chapter provides brief and essential guidance to conduct manual bicycle and pedestrian counts in a cost-effective manner. Here we assume that the counts will be conducted either by your own personnel or by a professional traffic data collection firm, either of whom will require minimal training and guidance. The count method described here could also work with volunteers conducting the counts, though volunteers will require some training. Please see the end of the Count Technologies chapter for some guidance on volunteer training.

COUNT TYPES

There are two main count types for bicycle and pedestrian travel:

- **Screenline counts** are done by establishing a visible or invisible line across a roadway or sidewalk and counting the number of bicyclists, and

pedestrians who pass over that line. They are used to determine general use trends for a segment of trail or roadway.

- **Intersection turning movement counts** are done where two or more roadways and/or major commercial driveways meet. Bicycle turning movements through the intersection are counted as are the number pedestrian crossings by intersection leg. This type of count is often conducted for safety or operational analyses under peak-hour conditions.

If you are conducting manual counts in-house, we strongly encourage you to do screenline counts and to use the form provided in Appendix B.

Bicycle parking and bicyclists-on-transit-vehicles counts are also covered in this manual, but are not discussed in this primer. Sample count forms are found in Appendix D and E.

LEVERAGE EXISTING COUNT EFFORTS

Local jurisdictions often conduct or have control over existing motor vehicle count efforts. These efforts include regular monitoring and traffic impact analyses. The easiest way to obtain bicycle and pedestrian count data may be to leverage these existing efforts.



Add bicycle counts to screenline counts of motor vehicles

Screenline counts of motor vehicles are often collected from automated technologies. These technologies may include pneumatic tubes, inductive loop detectors, or video. Data is typically collected and summarized for one full day or more. Depending on the capabilities of the technology, bicycle counts may be conducted and summarized as part of these data collection efforts for little or no additional costs. It is suggested that local jurisdictions explore the opportunity to include bicycle counts for all automated screenline monitoring efforts.

Add bicycle and pedestrian counts to manual intersection counts

If your jurisdiction already conducts manual counts of vehicles at intersections, as most jurisdictions do, it is typically very cost-effective to collect bicycle and pedestrian data at the same time that vehicles are counted, because the same people who are counting vehicles can count bikes and pedestrians at the same time. Many professional traffic data collection firms will include pedestrian and bicyclist counts for little or no additional cost. Agencies should include pedestrian and bicyclist counts as part of their traffic monitoring efforts. Additionally, you should require that all intersection counts done for traffic impact studies include pedestrian and bicyclist counts and that the results are summarized in the report.

It is interesting to note that many traffic data collection firms are shifting to using cameras for the majority of their field observations and post-processing the data in video reduction centers. This allows for the opportunity to obtain recordings of the data for quality control and collecting other data (such as gender, helmet use, or children/seniors/mobility impaired) at a later date.

If you work with professional traffic data collection firms or conduct counts using in-house staff, the following should be made clear to all count staff when adding bicyclist and/or pedestrian counts (Appendix A is a self-contained version of these instructions):

1. Provide a diagram of the intersection with existing vehicle/bicycle lanes and pedestrian marked crosswalks and crossing prohibitions.
2. Count all bicyclists who pass through the intersection by turning movement, including those that approach or depart the intersection on the sidewalk or ride the wrong way. Indicate if at that location sidewalk or wrong way riding appears to be common. Optionally, make separate tallies of wrong way riding and sidewalk riding.
3. Count pedestrian crossings by roadway leg.
4. Mark people on skateboards, scooters, or skates, as well as joggers, children in strollers or being carried, and people in wheelchairs as pedestrians.
5. Count each bike passenger (children in trailers or seats, pedi-cab, etc.) as one bicyclist.

6. Count all pedestrian crossings that occur within 10 feet of the crosswalk (crosswalks exist on all legs of roadway intersections, whether they are striped or not, unless pedestrians are specifically prohibited from crossing at particular legs).
7. If applicable, report each diagonal crossing of a pedestrian scramble intersection. At regular intersections, count the diagonal crossing as 2 separate legs but note the number of pedestrians who cross diagonally.
8. Count bicyclists who walk their bikes through the intersection as you would pedestrians.
9. Summarize the total number of pedestrian crossings and the total bicycle turning movements for their respective peak-hours and for the entire count period.

CONDUCTING BICYCLIST AND PEDESTRIAN COUNTS

Leveraging existing vehicle count efforts may not serve your needs. Here is guidance on counting bicycles and pedestrians as a separate effort. The extent of the effort depends on the budget and/or the availability of in-house staff. This section provides guidance on choosing count locations, durations, and frequencies. It also provides suggestions for collecting other attributes as well as preparing and supervising the count. Finally, it provides guidance for submitting the data to the Bike Count Data Clearinghouse.

Count Locations

The decision of where to count can be determined by one or more of the following:

- Destinations that attract bicyclists and pedestrians: Schools, downtown, major retail or employment areas, high density residential areas, civic uses, and major transit stations or stops are some examples
- Public facilities for non-motorized travel: On-street bikeways (particularly where there are limited choices for parallel routes), trails, pedestrian and bicycle bridges
- Specific locations where there is already a history of non-motorized counts, collisions involving pedestrians or bicyclists, or planned facilities for non-motorized travel
- Locations where new bicycle and pedestrian facilities are planned, so that before and after counts may be conducted

If resources are limited, focus on locations where you expect to observe high bicycle volumes.

When choosing locations, you must consider whether you want to do an intersection or a screenline count. Again, if you are doing manual counts with your own labor, we strongly encourage you to perform a screenline count using the sample form provided in Appendix B. Perform intersection counts if:

- You are interested in bicycle turning movements (typically your interest will stem from an operational or safety analysis)
- You are contracting with a counting firm. Most of



these firms conduct vehicle counts at intersections, and intersections are the type of location where their work will be most cost-effective. See Appendix A for guidance in working with traffic counting firms

- You are specifically interested in volumes through a particular intersection or set of intersections rather than screenline volumes on a street or path

Count Duration

Given the variability in bicycle and pedestrian volumes, the ability to detect long-term changes in volumes with confidence depends on having a long enough count period to get a reliable sample of volumes. For manual data collection, the following is suggested:

1. Suggested duration at each location

- Three (3) consecutive counts from 7:00 AM to 9:00 AM on weekdays
- Three (3) consecutive counts from 4:00 PM to 6:00 PM on weekdays
- One (1) from 11:00 AM to 1:00 PM on a non-holiday weekend
- Additional off-peak counts, as needed

2. Minimum duration at each location

- Two (2) count periods from 7:00 AM to 9:00 AM on weekdays

- Two (2) count periods from 4:00 PM to 6:00 PM on weekdays
- One (1) count period from 11:00 AM to 1:00 PM on a non-holiday weekend

3. Selecting days

- Weekdays: Tuesdays, Wednesdays, and Thursdays best represent normal weekday traffic
- Either Saturday or Sunday can be taken as representative of weekend traffic, though Saturday is the more traditional choice for vehicle counts
- Conduct counts during the academic school year and try to avoid counting during school holidays
- Try to avoid counting during unusual weather conditions (rain or heat waves, for example) or during anomalous events (parades, voting days, and so on)

4. If possible, supplement manual counts with a smaller number of automatic count locations, done over a longer time period, in order to create locally-based adjustment factors.

Given that many agencies' resources are limited, it is important to note that some count data is better than none at all.

Count Frequency

Counts are best collected on a regular basis in order to determine trends in bicycling and walking activity. The following guidelines provide count frequency suggestions.

1. Suggested frequency

- a. Quarterly counts (September, January, May, and July), while requiring a greater effort, can provide valuable information about trends throughout the year
- b. Ideally, schedule counts to correspond with the dates suggested by the National Bicycle and Pedestrian Documentation project, which facilitates collection of consistent data nationwide (<http://bikepeddocumentation.org/>)
- c. Counts should be conducted during the same month each year, avoiding vacation/holiday periods, except when counting popular tourist routes

2. Minimum frequency

- a. Once per year, ideally on the mid-September date suggested by the National Bicycle and Pedestrian Documentation project
- b. Jurisdictions with fewer counting resources may count every other year

Data Attributes

Decide which data attributes are most important and which will be most useful for your jurisdiction. Asking counters to record too many data attributes has the potential to decrease accuracy, so consider assigning more than one counter to each location if you are seeking additional data. The most common attributes are below:

- Pedestrians (in addition to bicycles)
- People using wheelchairs or other special needs users (such as vision-impaired)
- Bicyclists riding on the sidewalk
- Bicyclists riding the wrong way on the street
- Female bicyclists
- Children on bicycles
- Bicyclists not wearing helmets
- Seniors or other age groups

Prepare for the Count

Whether you are using a professional data collection firm, in-house staff, or volunteers, you will need to prepare for the count in advance.

If you are using professional traffic counting firms to collect data and your data collection is fairly straight forward, it is often sufficient to communicate with the field supervisor a day or two before the count about your expectations for the data. You'll want to review the data upload screens at bikecounts.luskin.ucla.edu with the field supervisor to ensure that they collect the information required by the Clearinghouse, and

format the data for upload. If your data collection effort is expected to be more complicated, it is crucial that you meet with the firm's field staff and supervisor in advance of the data collection effort to ensure clear and consistent data collection. Ideally, it is beneficial to meet in the field or have the data collection sites viewable while discussing the data collection effort.

If you are using in-house staff to count, do the following in order to prepare for the data collection effort:

1. Prepare forms for each location (see Appendix B for sample forms) and time period.
2. Decide how many counters are needed at each location, noting that high volume locations may need multiple people. A general rule of thumb is that one counter should only be expected to accurately record about 200 data points per hour using pen and paper. This includes counting bicyclists and pedestrians as well as recording additional attributes, such as perceived gender or wrong way riding.
3. Assemble count technologies (pen, paper, and clipboards; count boards, clickers, or smart phone apps) to be used.
4. Meet with counting staff in advance of the data collection effort to ensure clear and consistent data collection and familiarity with count technologies to be used. Use the example training presentation in Appendix H as a template for the material that should be covered in counter training. It can also be beneficial to meet in the field or have the count

sites on display while discussing the data collection effort.

During the Count

It is important to monitor the data collection effort as it is occurring.

If you are using a professional data collection firm, check with the field supervisor by phone or in the field to ensure data collection quality and answer questions.

If you are using in-house staff or volunteers for the count effort, field supervisors need to be on duty during the count to assist staff, monitor the counting effort, and address any problems or questions that may arise. The number of field supervisors will be dictated by the total number of count volunteers and the degree of dispersal of the count locations. As a general guideline, provide one field supervisor per ten observers if count locations are fairly close together, allowing the field supervisor to visit all observers within a two-hour period, or one field supervisor per five observers if count locations are more dispersed.

Field Supervisor Duties

- Cover for volunteers during restroom breaks as necessary.
- Be available for questions during the count.
- Conduct quality control checks with each volunteer, by counting at the same location for a set period of time and then comparing the

supervisor's count to the volunteer's count.

- Collect count forms from volunteers at the completion of the count time period.

After the Count

The field supervisor is responsible for reviewing the data as soon as possible after it is collected and clarifying any issues with the traffic count firm's field supervisor or the in-house staff. Once the data quality has been verified, either in-house staff or counting firm staff are able to submit the data to the Bike Count Data Clearinghouse, located at bikecounts.luskin.ucla.edu. Staff will fill out a series of web forms containing information about the count locations and times, and then will fill in screenline volumes in 15-minute increments. The process is designed to be very streamlined if you have used the screenline count form in Appendix B. For intersection counts, staff will need to perform some simple conversions to get the data into the format required by the database. [The last sentence may be revised based on the final state of the intersection count interface.]

Once an agency has entered its data into the Bike Count Data Clearinghouse, staff will be able to view and download that data. This means that agencies need not digitize the data in their own files (e.g. usually Excel spreadsheets), unless they have a specific desire to do so.



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Before the Count





DATA COLLECTION PLAN

Before collecting bicycle or pedestrian counts, it's important to develop a data collection plan that answers these questions.

- What counts do we have already?
- How can we leverage existing and future count efforts?
- Whom do we want to count?
- What type of non-motorized travel should we count?
- Where should we count?
- How many locations should we count?
- What should be our count duration?
- How frequently should we count?
- Should we create a data collection form?
- What count technology should we use?
- Who should we use for the data collection effort?
- How do we check the quality of the data?
- How do we share the counts?

WHAT COUNTS DO WE HAVE ALREADY?

Your agency may already have a rich archive of pedestrian and bicycle counts. They may be contained in safety reports, traffic impact studies, environment impact reports, or in your regular monitoring program. It

would be worth a bit of time to compile these counts, particularly those that have occurred within the most recent five years. Ideally, use a mapping program to get a visual summary of the existing pedestrian and bicycle counts that you already have on hand. Entering the bicycle count data at bikecounts.luskin.ucla.edu will also provide a visual summary. Please note that all count data provided to SCAG between November 2012 and March 2013 is already entered and viewable on the website.

Additionally, there may be other departments or groups who have collected pedestrian and bicycle counts in your jurisdiction. It is suggested that you contact them to see if they have data that can be shared or on-going monitoring programs. These may include:

- Parks and recreation department
- Transit agencies
- Health department
- Regional agencies
- Congestion management programs
- School districts
- Bicycle and pedestrian advocacy groups
- Universities
- Retail or business associations



The Bike Count Data Clearinghouse will also allow you to see any other bicycle counts conducted in or near your jurisdiction.

In reviewing the counts that have already been collected, it is important to evaluate more than just the number of counts. The review should include the answers to the following questions, when possible:

- Why were these monitoring locations chosen?
- What count technology was used and what are its limitations?
- Who is currently using this data and for what purposes?
- Is there enough data to evaluate daily, weekly, and seasonal count variations?
- Was anything extrapolated from the collected data (average daily traffic, seasonal traffic, etc.)?
- What is the format of the data (count interval, structure, etc.)?
- What quality control processes were applied to the data collection and entry?

More details about these questions are found throughout the manual.

HOW CAN WE LEVERAGE EXISTING AND FUTURE COUNT EFFORTS?

Local jurisdictions can utilize their regulatory capabilities to collect pedestrian and bicycle counts at little to no extra cost to them. To their existing count efforts, they can add pedestrian and bicycle counts whenever vehicle counts are being collected manually. There

may also be instances where vehicle counts using automated technologies can also collect bicycle and pedestrian counts. Two common instances that may readily allow for the inclusion of pedestrian and bicyclist counts are 1) existing traffic monitoring programs and 2) counts collected for traffic impact studies.

As a local jurisdiction, you can require the collection of pedestrian and bicycle count data whenever traffic counts are being conducted. In particular, you can develop traffic impact study guidelines and revise your traffic monitoring protocol to include pedestrian and bicycle counts. Further, you can require the original count data as part of any traffic study submittal.

The following provides more detail about leveraging existing data collection efforts to obtain bicycle and pedestrian counts.

Screenline counts

Many jurisdictions and regional agencies have a vehicle traffic monitoring program that makes use of screenline data collected from automated technologies. These technologies may include pneumatic tubes, inductive loop detectors, or video. Data is typically collected and summarized for one full day or more. Local jurisdictions may also require that this type of data is collected and summarized for traffic impact studies.

Depending on the capabilities of the technology, bicycle counts may be conducted and summarized as part of these data collection efforts for little or no additional cost. It is suggested that local jurisdictions

explore the opportunity to include bicycle counts for all screenline monitoring efforts. It is generally more challenging to add the collection of pedestrian count data.

Intersection turning movement counts

If your jurisdiction already conducts manual counts of vehicles at intersections, as many jurisdictions do, it is typically very cost-effective to collect bicycle and pedestrian data at the same time that vehicles are counted. Many professional traffic data collection firms will include pedestrian and bicyclist counts for little or no additional cost. Adding bicycle and pedestrian counts to manual vehicle counts generally does not require additional observers or resources for most traffic data collection firms, unless non-motorized volumes are high. Each traffic data collection firm may have different standard procedures for counting pedestrians (two-way total in each crosswalk, directional crosswalk volumes) and bicycles (turn movements, only totals on each intersection approach, only bicycles conflicting with motor vehicles) so the desired level of detail should be clarified and specified prior to counting.

SCAG agencies should include pedestrian and bicyclist counts wherever intersection counts are conducted as part of their traffic monitoring efforts. Additionally, they should require that all intersection counts done for traffic impact studies include pedestrian and bicyclist counts and that the results are summarized in the report. Ideally, the raw traffic data, including pedestrian and bicycle counts, are either

included in the traffic impact report appendices or provided to the jurisdiction(s) electronically, so that staff can have access to the complete data set.

Intersection turning movement counts are generally conducted on weekdays during the morning and evening peak commute hours (typically 7:00 to 9:00 and 4:00 to 6:00 PM, although the City of Los Angeles does 3-hour counts from 7:00 to 10:00 AM and 3:00 to 6:00 PM). The volumes are usually summarized for a morning peak-hour and an evening peak-hour for purposes of analysis. Data may be collected at other times for traffic impact studies, depending on the proposed project's expected peak vehicle trip generation. For example, a proposed church would conduct counts on a Sunday morning, a proposed movie theater would conduct counts on Saturday night, and so on, in order to analyze the project's biggest effect on local traffic conditions.

Professional traffic data collection firms are well-practiced in collecting intersection turning movement counts because many jurisdictions require the analysis of traffic operations at intersections as part of traffic impact studies. It is important to note that many traffic count firms already include pedestrian and bicycle counts for the purpose of analyzing vehicle impedance. This means that, without specific instructions, only certain bicyclist movements might be counted (i.e., those proceeding straight through the intersection, which would impede a right turning vehicle). It also means that, without further instructions, the summarized pedestrian and bicyclist volumes would be those counted during the peak-hour for vehicles, not

during the peak-hour for bicyclists or the peak-hour for pedestrians.

Most traffic data collection firms are flexible and can collect and summarize data in such a way as to meet their clients' needs. Thus, most firms will collect all bicyclist turning movement counts and pedestrian crossing counts at intersections upon request. The manner in which they summarize and report the data is also often open to requests.

Appendix B includes a ready-made form request to traffic data collection firms for including bicyclist and pedestrian counts at intersections. Appendix B also includes instructions that will need to be read in advance of the count in order to streamline the process of uploading intersection count data to the Bike Count Data Clearinghouse.

Occupancy counts

Manual parking occupancy counts that are being done for vehicles can easily include a bike parking occupancy count if public bike parking is found in the study area. A sample form conducting bike parking inventory and occupancy counts is contained in Appendix D.

On-off counts

Many transit vehicles are now equipped with automatic passenger count technology that captures boarding and alighting, which can be used to supplement pedestrian counts. This data can also be used

to determine potential locations for roadway counts of pedestrians and bicyclists. You can coordinate with transit agencies to obtain this boarding and alighting data. Additionally, you could partner with transit agencies to have vehicle operators count the number of passengers who board with their bicycles. Appendix E contains a form for conducting on-off counts of bicycles on transit.

Bicycle Signal Detection

Since 2009, Caltrans Directive 09-06 requires agencies to install bicycle signal detection whenever a new signal is installed or an existing signal is modified. When bicycle detection is installed, this may be an opportune time to install a bicycle counter. Depending on the method of detection (e.g. inductive loop in pavement, video detection) it may be possible to use the same device to both detect and count bicyclists. It may also be possible and cost-effective to install a counting device at the same time that the detection device is installed.

WHOM DO WE WANT TO COUNT?

The first step is to determine whom you want to count. You may want to count only bicyclists, only pedestrians, both together, or both separately. This section is focused on capturing non-motorized travel on streets (including sidewalks), trails, and public stairways.

Who counts as a pedestrian?

This seemingly rhetorical question can, in truth, be difficult to answer once one is out in the field. It's very clear that people walking would be counted as pedestrians. But, what about joggers, wheelchair users, babies in strollers, roller-bladers, skateboarders, and so on? If the count methodology allows, it's ideal to separate true pedestrians from most wheeled or other powered forms of transportation (except for those who need it for mobility reasons). Otherwise, all of the following can be counted as pedestrians.

Count the following as a "Pedestrian":

- A person walking or jogging
- Wheelchair or assistive power scooter user
- Passenger on wheelchair or assistive power scooter
- Person using an assistive walking device (walker, cane, knee walker)
- Baby in a stroller
- Baby being carried

Knee roller		Source: Preferred Health Choice
Non-motorized scooter		Source: Bruce W. Landis, FHWA
Rollerblader		Source: Bruce W. Landis, FHWA
Segway		Source: Bruce W. Landis, FHWA
Assistive power scooter		Source: Bruce W. Landis, FHWA
Assistive walker		Source: Homecare.com

Count the following as "Other", if possible. If not, include in the pedestrian count:

- A skateboarder
- A rollerblader
- Non-motorized kick scooter rider
- Segway rider
- A bicyclist walking his/her bicycle on the sidewalk
- An equestrian
- Person on toy transportation (pull cart, mini-car, big wheel, bicycle with training wheels, etc.)

Who counts as a bicyclist?

Counting bicyclists is a bit clearer, although it should not be restricted to two-wheeled pedalcycles. Unicycles, pedi-cabs, tandem cycles, electric bicycles, bicycle trailers, and recumbent cycles should all be included in a bicycle count. If the count methodology allows, it's ideal to capture the number of people on a cycle as opposed to the number of bicycles.

Count the following as a bicyclist:

- Unicyclist
- Bicyclist (including electric)
- Tandem cyclists (count each person, if possible)
- Pedicab operator and passengers

Passenger in bicycle trailer (would count as 2 bicyclists)		Source: transitionwheeler.blogspot.com
Unicyclists		Source: Fairhope Middle School, AL Unicycle Club
Hand cyclist		Source: Mobility International USA
Pedicab with passengers (would count as 3 bicyclists)		Source: Homecare.com
Recumbent Bike		Source: Ab-Bike

(count each person, if possible)

- Human passenger on a cycle (count each person, if possible)
- Human passenger in bicycle trailer (count each person, if possible)
- Cyclist on three or four-wheeled cycle
- Recumbent bicyclist
- Hand cyclist
- A cyclist who dismounts in order to cross as a pedestrian at an intersection, then remounts after crossing

Counting bicyclists and pedestrians together

In some instances, you may want to know only the total number of non-motorized users and you do not need to distinguish between bicyclists and pedestrians. This is common on trails when automated counters are used. When automated counters are used on trails, it is common to count the total number of users, without differentiating between bicyclists, pedestrians, and other users. For most on-street counts, agencies will be interested in separate totals for bicyclists and pedestrians.

Baby in stroller		Source: Born Angels
Baby being carried (would count as 2 pedestrians, if possible)		Source: Tribe Magazine
Equestrian		Source: City of Vancouver, WA
Toy transportation		Source: speeduptraffic.org
Skateboarder		Source: Tokyo Times

Counting bicyclists and pedestrians separately

In most instances, you may need to count bicyclists separately from pedestrians at the same locations during the same time periods. In this case, counts are done manually or using automated technologies that allow for the ability to distinguish bicyclists from pedestrians.

Counting other demographic or behavioral variables

When conducting manual counts, it is common for counters to tally several other variables along with the volumes. These include, for example, the number of female bicyclists or the number of bicyclists riding the wrong way. There is a limit to how many of these variables a counter should be tasked with tracking, especially if high volumes are anticipated. Counting tasks that are simple and focused have a higher degree of accuracy than those that require observers to collect a variety of information. The more types of data that an observer needs to collect above and beyond the count tally, the less time that his or her mind and eyes

are focused on the observation areas. Please see Appendix I for some suggested behavioral and demographic variables.

Appendix I establishes a common definition to be used countywide for each variable, so that, for example, all counters are marking a “child” when they perceive someone to be younger than 12. The variables that appear on the right side of the screenline count form in Appendix B will be stored in the bicycle count database at bikecounts.luskin.ucla.edu. Other variables may be entered into the database, but they will not have standard fields, because of practical limitations.

WHAT TYPE OF NON-MOTORIZED TRAVEL SHOULD WE COUNT?

Your data collection plan will need to address the predominant type of travel you hope to capture with your counts, which will help determine count times and locations. The type of travel

Tandem bike (would count as 4 bicyclists)	 Source: popscreen.com
Electric Bicycle	 Source: Electric Bike Toronto
Bike operator and passengers (count as 3 bicyclists, if possible)	 Source: howtopedia.org, Bicycle Taxi
Quadcycle (count as 5 bicyclists, if possible)	 Source: Eric Staller's Conference Bike

you want to capture can be characterized according to trip purpose, e.g. commuter trips, recreational trips, and other utilitarian trips. Each of these trip types has a different distribution across time and space. Commuter trips are concentrated in the peak hour and end at places of employment, which will have a specific geography. Recreational trips and other utilitarian trips typically take place in off-peak hours, and have similarly distinct geographies. Although counting at any given time and place will capture a mix of these trip types, you will have a sense of the expected patterns in your community. Multiple windows of observation are suggested to allow the data to confirm suspected trends. For example, you may suspect an off-street trail to have off-peak patterns. However, unless you count the location in question during both peak and non-peak hours, the trend cannot be confirmed.

WHERE SHOULD WE COUNT?

The next step is to determine where you want pedestrian and bicycle counts. Ideally, counts should be conducted where there are destinations and facilities for bicyclists and pedestrians. When aiming to capture data for a specific location, such as a project-specific before and after count, consider counting on adjacent routes in order to examine behavioral shifts in both mode choice and route choice. Keep in mind that neighborhood streets may have significant pedestrian and bicycle vol-

umes if they provide access to the same destinations that busy arterial streets do. This is due to the fact that pedestrians and bicyclists often prefer to travel on low-stress streets where vehicle volumes and speeds are lower, if given a choice (FHWA, 2012).

Destinations that attract bicyclists and pedestrians

- Schools: Count on streets that lead to the school's main entrances and near bike parking areas
- Central Business Districts or Other Major Retail Area: Count near transit stops or at gateways
- Shopping Malls: Count near transit stops, bike parking, and the primary entrances
- Major Employment Areas: Count near gateways, main entrances, or transit stops
- Residential Areas: Count on streets or trails near high-density residential or concentrated senior/disabled housing, particularly those close to parks and schools
- Civic uses, such as libraries, community centers, and sports facilities: Count on main streets leading to entrances, bike parking, or near transit stops
- Major Transit Stations or Stops: On primary access streets, near bike parking, or at entrances

Public facilities for pedestrians and bicyclists

- On-Street Bikeways: Count where there are limited choices of parallel routes
- Multi-Use Trails: Count at, or near major access points

- Overcrossings and Undercrossings: Count at a point that captures all users of the facility
- Bike Parking: Count where there is a lot of bike parking installed, or where there's high demand for bike parking
- Transit Vehicles: Count where bicycles are allowed on the vehicle and you expect significant demand

Specific locations

- A history of pedestrian and bicyclist counts
- Significant walking or biking activity
- Choose locations to cover urban, suburban, and/or rural contexts in your jurisdiction
- High number of pedestrian-involved or bicyclist-involved collisions
- Planned future pedestrian and/or bicycle facilities

You'll also want to reference bikecounts.luskin.ucla.edu to review locations where counts have been done in or near your jurisdiction.

HOW MANY LOCATIONS SHOULD WE COUNT?

In reality, the number of count locations depends on several factors. These include:

- Budget
- Jurisdiction's size and population
- The number of destinations that attract bicyclists and pedestrians (see *Where Should We Count?*)
- The number of bikeway and trail facilities (see

Where Should We Count?)

- The data collection technology (see For How Long Should We Count?)

As a general rule of thumb, the National Bicycle & Pedestrian Documentation Project (NBPD) recommends 1 per 15,000 residents for short-duration (finite) counts, assuming that counts occur annually over a sequential 1 to 3-day period using manual technologies. In small communities, this may not be enough locations to generate a robust data set, while in large communities it may be many more locations than can be practically counted using limited resources.

Recommendations for the number of locations for continuous monitoring using automatic technologies are contained in FHWA's 2012 Draft Traffic Monitoring Guide. According to the Guide, more research is needed to identify statistically representative counting sites for bicycles and pedestrians. If budget allows, agencies may attempt to assess overall usage by counting at a variety of locations, including neighborhood streets and places where high volumes are not expected.

When assessing long-term trends in non-motorized volumes, agencies should be aware of the variability in bicycle and pedestrian volumes. Bicycling and walking volumes have been shown to be more variable than motor vehicle volumes (FHWA, 2012). Among other factors, bicycle and pedestrian volumes are more sensitive to weather. Additionally, the widespread reliance on manual data collection efforts means that often only a few hours of data are collected, sometimes a single peak period on a single day. The small sample

combined with the high variability creates a challenge when trying to detect changes in volumes over a longer period of time.

To get a sense of this challenge, a study of biking and walking rates was conducted in two cities in Sweden, Lund and Jönköping (population of 105,300 and 89,400, respectively). Counts were conducted at geographically dispersed locations for two to four week periods using automated technologies. They were supplemented by at least one permanent count station and travel surveys. It was found that counts from 5 sites resulted in a 36%-39% error when estimating year-to-year changes in bicycle traffic whereas counts from 200 sites resulted in a 6% error.

Intersection vs. Screenline Locations

If you are conducting a manual count, when choosing locations you must consider whether you want to do an intersection or a screenline count (see "Types of Manual Counts" section). If you are doing manual counts with your own labor, we strongly encourage you to perform a screenline count using the sample form provided in Appendix B. Screenline counts are much simpler to perform, and they are easier to enter into the Bike Count Data Clearinghouse. They typically take place at midblock locations. Screenline counts may also be performed immediately adjacent to an intersection. We recommend that you only perform intersection counts if:

- You are interested in bicycle turning movements (typically your interest will be in performing an

operational or safety analysis)

- You are contracting with a counting firm. Most of these firms conduct vehicle counts at intersections, and intersections are the type of location where their work will be most cost-effective
- You are specifically interested in volumes through a particular intersection or set of intersections rather than screenline volumes on a street or path

WHAT SHOULD BE OUR COUNT DURATION?

The data you need should determine the duration of the counts, which will then inform the count technology. Estimations of annual average daily bicycle or pedestrian traffic would require a combination of continual and short-duration or finite counts. Counts of peak-hour bicycle or pedestrian volumes result in the need for counts of a few hours. If your access to count technologies is limited, the duration of your count may be determined by that technology. For example, if you can only use on-site observers, there's a limit to their capacity to remain in the field and their accuracy recording the data.

Some locations warrant a continuous, permanent station for counting bicyclists and pedestrians. In current practice, these are typically placed at trails, bridges, or undercrossings, designated bikeways, or signalized intersections that represent areas of high use by non-motorized travelers. These year-round counts have a number of potential functions. They are a yardstick that can be used to check the quality of finite or short-duration count data. They can provide data

about seasonal usage patterns. They provide a more accurate picture of walking and biking in a jurisdiction overall. When the counts are captured in real time and displayed on a barometer, permanent count stations have the added benefit of promoting non-motorized travel.

For short duration or finite counts, accuracy increases with count duration for automated technologies. A study done by the Danish Road Directorate study found significant differences in error for calculating average annual daily bicycle traffic. Count durations of 1 week led to a 34%-39% error, whereas count durations of 8 weeks resulted in a 12%-14% error. Fiscal constraints may limit the data collection effort from automated technologies, but a minimum of 7 to 14 days should be considered.

Although increasing the duration of a count reduces the expected error in extrapolated volumes, it's important to note that manual observers are less accurate the longer the count they perform. On-site observers should not count for more than 3 hours at a stretch, with 2 hours being preferable. Manual counts are generally done for times when bicyclist and pedestrian volumes are highest, which depend on the type of travel (commute, utilitarian/recreational, or mixed, as discussed in "What type of non-motorized travel should we count?" section). This is true for counting non-motorized travel as well as bike parking occupancy counts and bikes on transit counts.

Manual counts done using video-recorded data can have a longer duration, provided that observers are not counting for stretches of more than 2 hours. The

limitation of duration for these type of counts result from the camera's battery and data storage capacities, as well as budget or time limitations for post-processing. However, longer count durations provide a more comprehensive picture of bicycle and pedestrian travel.

HOW FREQUENTLY SHOULD WE COUNT?

If your data collection effort is related to a project-specific effort, such as a new bikeway designation or trail, counts should be done before project construction begins and then at least 3 to 6 months after the completion of the project and its availability for general use.

If your data collection is focused on regular monitoring, the National Bicycle & Pedestrian Documentation Project (NBPD) suggests a count frequency of at least once per year, in September, for on-site manual counts. If budget is constrained, once every other year may suffice for regular monitoring. If your jurisdiction experiences significant changes in weather or trip types (commute, recreational travel, etc.) throughout the year, counts should be done at least once per quarter (September, January, May, July) to capture these changes. Automated count technologies can enable local jurisdictions to conduct counts more frequently and for longer durations.

WHERE DO WE OBTAIN A DATA COLLECTION FORM?

Depending on the type of data that you're collecting and summarizing, you could opt to use the forms that are contained in the appendices or develop your own. The forms provided in the appendix were developed to accommodate a wide array of needs and include critical data fields. Again, the screenline count form in Appendix B in particular is designed to make data entry and upload to the Bike Count Data Clearinghouse very straightforward, and we strongly encourage its use for most manual count applications. However, if you have unusual data collection needs, you may want to create your own form. Here is a brief list of the information you'll want to include:

- Data collection date(s)
- Data collection day(s), i.e., Monday, Tuesday, etc.
- Data collection weather (either on-site observations or using archived weather data)
- Observer or analyst name
- Data collection location
- Data collection type (intersection, screenline, etc.)
- Count technology used (on-site observers, video recorded data, type of automated technology)
- Land uses and pedestrian/bicycle facilities in close proximity to count site
- Sketch of the trail or roadway configuration, along with north arrow
- Notes section

Agencies are advised to use the forms contained in the appendices as guides.

WHAT COUNT TECHNOLOGY SHOULD WE USE?

The decision to use manual or automated technologies will be borne out of your data needs. Because of the vast array of available count technologies, the next chapter of this manual is devoted to helping you decide on the count technology that meets your needs.

WHO SHOULD COLLECT THE DATA?

The decision to use manual or automated technologies will also feed into the types of people you might use for the data collection effort. Local jurisdictions have the option of using professional data collection firms, existing staff, temporary workers, college students, or volunteers.

For the automated technologies, it's generally best to use professional data collection firms or staff members who have the tools and skills to install the equipment and analyze the data.

For manual data collection efforts, the decision to use professionals or volunteers depends on the scope of the count effort. It is generally more cost-effective to use professional count firms or existing staff for count efforts of short duration and limited geographic scale, such as a corridor. However, for count efforts

of longer duration or a wider geographic scale, it may be more cost-effective to train temporary workers, college students, or volunteers to conduct the counts. The next chapter, Count Technologies, discusses strategies for recruiting and training non-professionals to conduct manual counts.

WHAT WILL HAPPEN AFTER THE COUNT?

The data collection plan should cover a number of elements that will take place during and after the count. These are important to consider early because they may influence the data collection approach. The data collection plan should include:

- an approach to checking the data quality
- an outline of the purpose of these data and their uses
- a staffing and coordination plan for sharing the data at bikecounts.luskin.ucla.edu

More details on each of these items can be found in the “After the Count” chapter.

4

COUNT TECHNOLOGIES





COUNT TECHNOLOGIES

Count technologies can be organized into two categories: Automatic and Manual. For the purposes of collecting pedestrian and bicycle count data, manual technologies are more familiar to many agencies. However, both kinds of technologies should be considered for collecting complete and accurate bicyclist and pedestrian count information.

Automatic count technologies make use of devices that are installed in a set location. These devices collect data and are able to collate the information using developed algorithms. Generally, the information collected is stored either on-site or transmitted to a remote, centralized location. Up until recently, automatic technologies were only able to collect screenline data, but software has been developed that automatically collects vehicle, pedestrian, and bicyclist movements at intersections from video-recorded data. Automatic count technologies are often used to capture long and continuous data collection efforts.

Manual count technologies involve the use of people in the data collection process. Organizations, advocacy groups, local agencies, and count firms post observers on-site for set periods of time. Less commonly, the manual process can also involve the use of data that are captured by cameras for set periods of time and are summarized by video image observers who post-process the data.

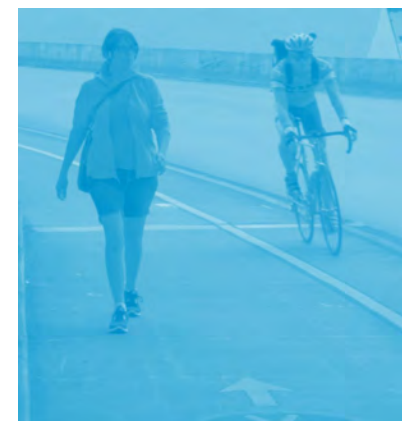
Appendix F contains a list of vendors that supply count technologies for manual and automatic counts as of April of 2013. It should be noted that vendors will change over time and this list may not be entirely accurate or comprehensive.

AUTOMATIC COUNTS

This section provides guidance and information about automatic count technologies. Whether you are an agency who is looking to operate automatic count equipment or you are using a professional data collection firm, the information presented will help you understand the technologies and how they work. Appendix G contains some sample data outputs by automatic count data technologies.

Advantages and drawbacks

Automatic count technologies have several advantages. They can provide ongoing and consistent data collection for less cost and time than manual counts. Longer duration counts help identify usage for larger sample sizes, which is crucial for pedestrians and bicyclists whose volumes are generally smaller and more variable than the vehicle volumes. Longer duration counts also provide more accuracy for extrapolation purposes, such as estimating annual average daily bicycle counts, as discussed in the Before the Count chapter. The minimal person-hours needed for



deploying devices to count bicyclists and pedestrians means that more data can be collected, and daily, weekly, seasonal, and annual trends may be identified.

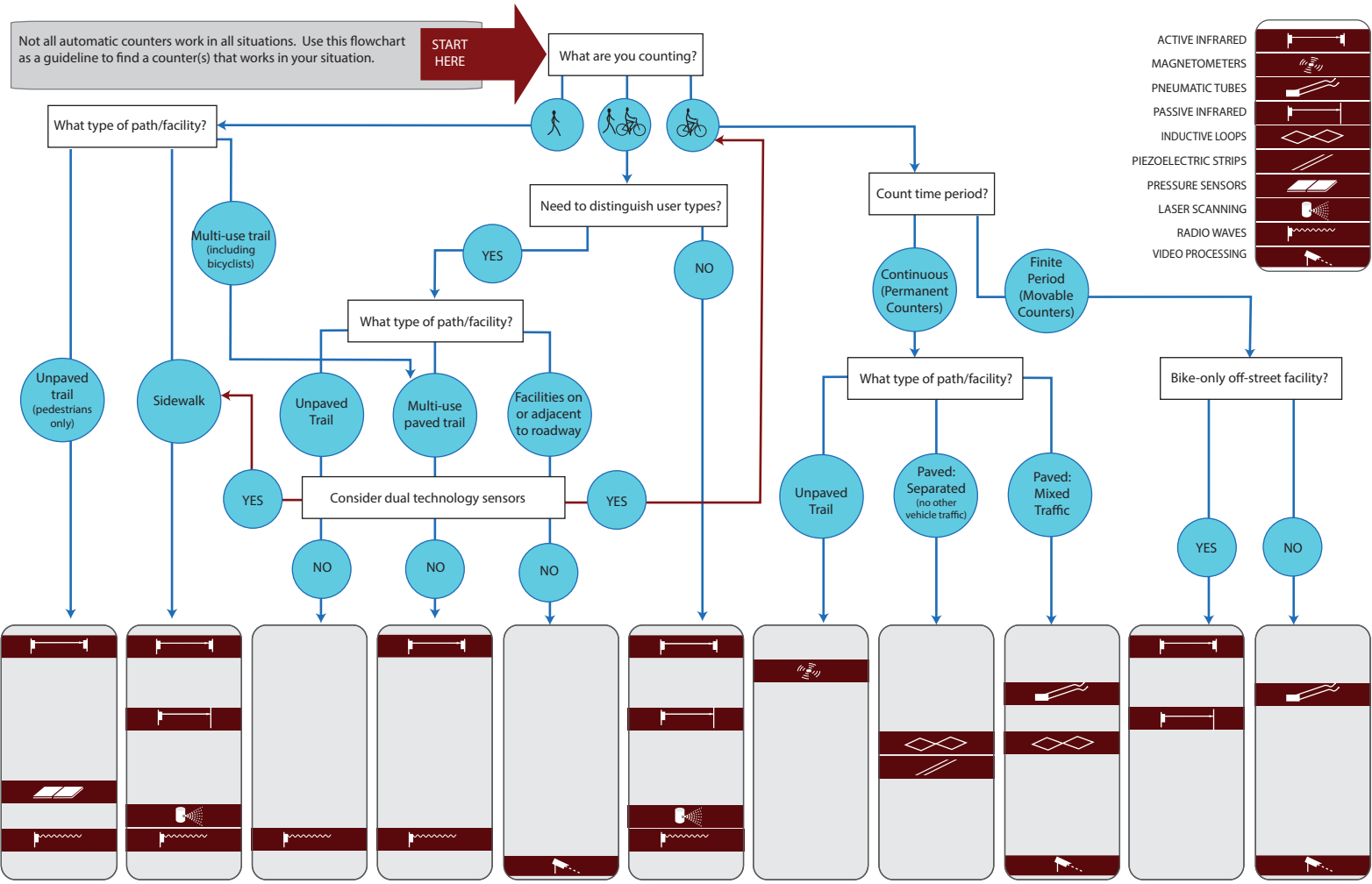
Automatic count technologies have some drawbacks. Most devices can provide only counts of pedestrians and bicyclists, not their behaviors or demographic attributes. Thus, data about gender, wrong way riding, age, or disability would not be captured. Some technologies may not be able to differentiate between bicyclists and pedestrians. Each technology must be installed in such a way that both the security of the device and the accuracy of the data collected are maximized, which may require some trial and error as well as the use of a paired technology. The accuracy of count technologies vary, as some may undercount (as is often the case when groups of pedestrians or bicyclists pass), or over count (as is often the case when the device includes animals or falling foliage in the count).

It should be noted that some emerging technologies use video recordings and software recognition programs to automatically summarize traffic counts. They are able to collect intersection movements and screenline data for pedestrians, bicyclists, and vehicles, and would work well in a mixed traffic environment. Additionally, the video recording provides an opportunity to capture some pedestrian and bicyclist attributes, although much of that ability depends on the quality of the recording.

Types of technologies

There is a large array of automatic count technologies that can be used to count bicyclists and/or pedestrians for screenline counts. Many of these technologies were developed primarily with motor vehicle counting and detection in mind, but they can be adjusted as needed to count non-motorized travel. Figure 1 is a flowchart that you can use to determine an automated count technology for collecting counts of non-motorized travel. What follows is a summary of each type.

Figure 1: Decision Flow Chart for Automatic Counters





Pneumatic tubes

What it counts: Bicycles

What it is: Two rubber tubes are stretched across the right-of-way, and record when a bicyclist passes over them.

How it works: When a bicycle or other vehicle passes over the tubes, pulses of air pass through to a detector which deduces the vehicle's axle spacing and thus classifies the vehicle type.

Advantages: Familiar technology to most jurisdictions; Widespread use by data collection firms; Portable, easy to set up, and inexpensive; Battery powered; Captures directionality.

Drawbacks: Susceptible to theft, vandalism, and wear-and-tear; May be a tripping hazard for pedestrians; Not appropriate in cold weather conditions; Can deteriorate under high bicycle or vehicular traffic, thus reducing accuracy; On-site data downloading. May not detect side-by-side riding.

Typical location: On-road bikeways and exclusive bike paths

Best installation: Paved surface, minimal pedestrians, above freezing weather conditions

Count duration: One day to several months

Accuracy: Error rate is 4% or less for 24-hour counts, a higher error rate for 15-minute intervals

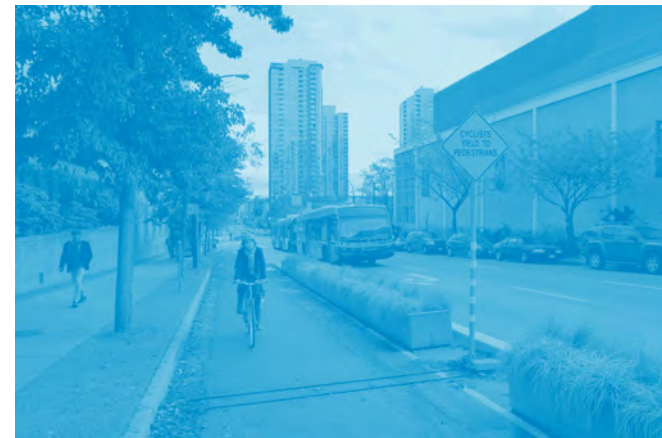


Photo Source: Paul Kreuger

Pneumatic tubes on cycle track in Vancouver, BC



Inductive loop detectors

What it counts: Bicycles

What it is: Loops of wire with a current running through them. Devices can be placed on top of the roadway or paved trail surface (temporary) or under the surface (embedded).

How it works: Detects bicycles through their disruption of an electromagnetic field.

Advantages: Flexibility to be portable or permanent installations; Novel inductive loops are capable of distinguishing bicyclists from vehicles; Familiar technology to most jurisdictions; May store data on-site or at a remote, centralized location.

Drawbacks: Cannot be installed near sites of high electromagnetic interference; Embedded detectors are expensive to install; Requires a nearby source of electric power; Need to be calibrated to detect bicycles; May not detect side-by-side riding or bicycles with non-metal frames.

Typical location: Paved locations such as on-road bikeways and mixed-use paths

Best installation: Mid-segment and channelized location where bicyclists will

travel single file and will not generally stop, exclusive bike use or mixed-traffic environment

Count duration: Weeks to permanent

Accuracy: Error rate is 4% or less for longer duration counts, a higher error rate for shorter intervals



Photo Source: Ecocounter

Embedded inductive loop detector in bike lane



Piezoelectric strips

What it counts: Bicycles

What it is: Two piezoelectric strips that are laid across the right-of-way embedded within a paved surface

How it works: Emits an electric signal when they are physically deformed by tires

Advantages: Provide bicyclist speed data and directionality; Low profile and not susceptible to tampering; Can be battery-powered or externally powered; Data can be stored on-site or transmitted wirelessly.

Drawbacks: Cannot distinguish bicycles in mixed flow traffic or adjacent to vehicle traffic; Cannot detect pedestrians; Detectors require careful installation

Typical location: Paved locations with no vehicle traffic, such bicycle and multi-use paths

Best installation: Two strips across entire width of path or bikeway

Count duration: Permanent

Accuracy: Unknown for bicycle counts



Photo Source: Metrocount

Installation of embedded piezoelectric strips



Photo Source: Metrocount

Piezoelectric strips on bike path



Pressure or acoustic pads

What it counts: Pedestrians, pedestrians and bicyclists together

What it is: A pad installed at or under the surface

How it works: Pressure pads detect the weight when they come in contact with pedestrians or bicyclists; Acoustic pads detect the sound waves from footsteps of pedestrians only.

Advantages: They work well for counting pedestrians on unpaved trails; Low profile and not susceptible to tampering; Battery-powered; Data can be stored onsite or transmitted wirelessly, depending on vendor.

Drawbacks: Bicyclists and pedestrians must come in direct contact with the pads to be detected; Susceptible to detection problems when ground freezes; Pressure pads do not distinguish between pedestrians and bicyclists; Acoustic pads only count pedestrians; High cost to install on paved paths; lack of mobility.

Typical location: Unpaved trails, unpaved walkways, and public stairways

Best installation: Channelized areas where pedestrians and bicyclists must travel single file and they will not linger, above freezing weather conditions

Count duration: Permanent

Accuracy: Unknown for bicycle or pedestrian counts



Photo Source: Scottish National Heritage

Pressure pads on unpaved path before being covered



Active infrared

What it counts: Bicycles and pedestrians

What it is: A device on one side of the count corridor transmits a pulsed infrared beam to a receiver at the other side of the right-of-way.

How it works: Pedestrians and bicycles are detected when the infrared beam is broken. A specifically designed algorithm can differentiate between bicycles and pedestrians.

Advantages: Can count bicycles and pedestrians with one device; Portable; Relatively low cost; Battery-powered.

Drawbacks: Cannot be used in mixed vehicle locations; Can be triggered by other objects, such as falling leaves, snow, animals, or insects; Visible and thus susceptible to vandalism; May not accurately count groups or side-by-side pedestrians or bicyclists; Installation requires mounting devices to fixed objects on each side of the trail; On-site data downloading.

Typical location: Off-street paved or unpaved paths.

Best installation: About two to three feet above ground, set to capture data at a 45 degree angle to the path of travel, receiver and transmitter should be no more than 90 feet apart, locate where pedestrians or bicyclists will not linger

Count duration: Several weeks to permanent

Accuracy: Error rate varies considerably based on installation site and ranges from 12-48% in published studies.

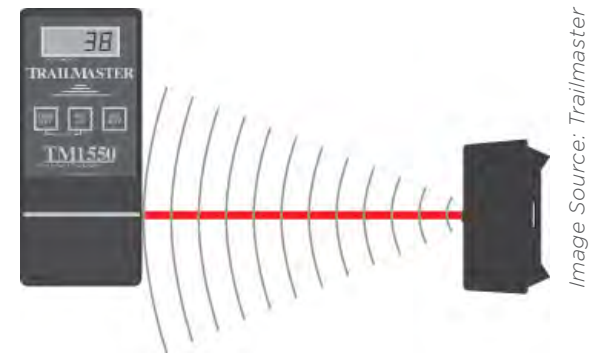


Image Source: Trailmaster

Active Infrared Receiver (left) and Transmitter (right)



Passive infrared (aka Pyroelectric)

What it counts: Bicycles and pedestrians together

What it is: A device positioned on one side of the count corridor. It can be disguised inside a post or existing infrastructure.

How it works: Identifies the heat differential of bicyclists or pedestrians when they pass through the detection area.

Advantages: Movable and easy to install; Can be used with a bicycle-only count technology to differentiate users; Battery-powered; May store data on-site or transmit data wirelessly, depending on vendor.

Drawbacks: Cannot be used in mixed vehicle locations; Is prone to error due to changes in the background (e.g. sun reflection); Dual sensors are needed to detect directionality; May not perform as well in cold weather conditions.

Typical location: Sidewalks or urban pedestrian-only corridors; Off-street paved or unpaved paths

Best installation: About two to three feet above ground, set to capture data at a 45 degree angle to the path of travel, receiver and transmitter should be

no more than 90 feet apart, locate where pedestrians or bicyclists will not linger

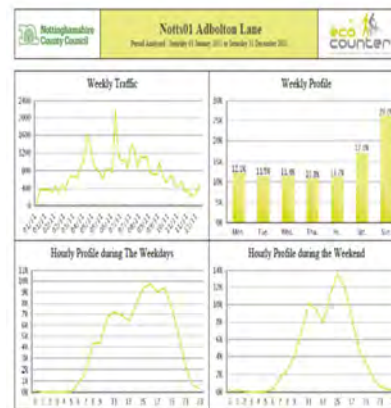
Count duration: Several weeks to permanent

Accuracy: Error rate varies considerably based on installation site and ranges from 1-36% in published studies.



Photo Source: Ecocounter

Installed passive infrared sensor



Sample output from passive infrared sensor

Image Source: Ecocounter



Photo Source: Ecocounter

Bi-directional passive infrared sensor



Laser scanning

What it counts: Bicycles and pedestrians

What it is: A horizontally or vertically scanning device at the side or above the detection area.

How it works: Laser pulses are sent out in a range of directions, and pedestrians and bicyclists are recorded based on reflected pulses.

Advantages: Can cover a large detection area;
Can be used in mixed traffic areas;
Battery-powered

Drawbacks: Does not function well in rain, fog, or snow; Can be triggered by other objects, such as falling leaves, snow, animals, or insects; Expensive; Heavy computational loads; May not capture side-by-side walking or biking.

Typical location: Large detection areas of non-motorized travel, such as a transit station or plaza.

Best installation: Horizontal scanners are best located where there are no obstructions, vertical scanners must be mounted above detection area

Count duration: Weeks to permanent

Accuracy: 5% or more error, may be more in highly crowded environments



Horizontal Laser Scanner

Photo Source: LogObject



Radio waves

What it counts: Bicycles and pedestrians

What it is: A radio transmitter and receiver positioned on opposite sides of the count corridor.

How it works: Detects bicycles and pedestrians when a radio signal between a source and a receiver is broken. Dual beams with different frequencies can be used to differentiate between bicycles and pedestrians.

Advantages: Can differentiate between bicyclists and pedestrians; Movable and easy to install; Can be hidden within wood or stone posts; Battery powered.

Drawbacks: On-site data collection; Does not accurately count groups or side-by-side pedestrians

Typical location: Off-street trails or on-street detection for bicycles and vehicles.

Best installation: About two to three feet above ground, set to capture data at a 45 degree angle to the path of travel. Locate where pedestrians or bicyclists will not linger and they will travel single file

Count duration: Months to permanent

Accuracy: Unknown

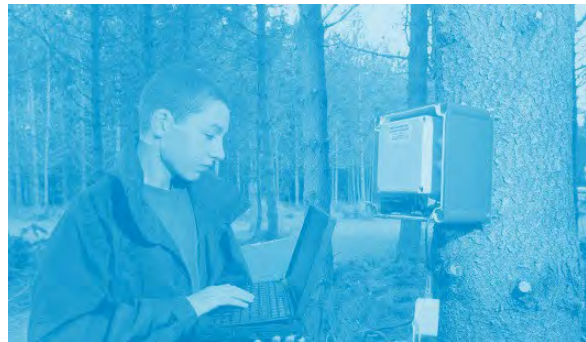


Photo Source: Trail Counters

Radio wave detection box and data download



Video image processing

What it counts: Bicycles, pedestrians, and vehicles.

What it is: Video recorders mounted above the count area to record movements coupled with a software program that processes the video to produce counts.

How it works: Uses visual pattern recognition technology and computerized algorithms to detect bicyclists, pedestrians, and vehicles.

Advantages: Can count in mixed traffic situations; can provide full intersection turning movement counts as well as screenline counts; Portable and easy to install; Can be rented.

Drawbacks: More expensive to purchase and process data than other devices; Not practical for long-term counts; Lighting and weather conditions affect accuracy; Umbrellas result in detection problems; Video must be manually submitted for processing.

Typical location: Roadway intersections or corridors

Best installation: Attach unit to street furniture or tripod and raise camera far enough up to capture the desired area, not during rainy conditions.

Count duration: Finite time periods up to one-week counts

Accuracy: 2% to 14% error rate



Video image recording by the Scout

Photo Source: Miovision Technologies



Magnetometers

What it counts: Bicycles

What it is: A small device that is buried under or next to a bike trail.

How it works: Detects bicycle activity through changes in the normal magnetic field.

Advantages: Invisible after installation, and not susceptible to tampering; Battery-powered; Easy installation

Drawbacks: On-site data downloading; relatively small detection radius of approximately three feet.

Typical location: Mountain bike trails or 6-ft wide off-street trails.

Best installation: Unpaved or paved trails in rural or remote locations where bicyclists must travel single file.

Count duration: Permanent

Accuracy: Unknown



Image Source: Trafax

Magnetometer

Bicycle Barometer

What it counts: Bicycles

What it is: A high visibility display of the number of bicycles counted at a particular location.

How it works: The barometer can be linked to various automatic count technologies, such as inductive loops or pneumatic tubes, and displays the number of bicycles passing that location each day.

Advantages: Increases awareness of bicyclists.

Drawbacks: Additional cost and installation.

Typical location: A high bicycle volume corridor in a high visibility area.

Count duration: Permanent

Accuracy: Depends on count technology used



Photo source: Kittelson & Associates, Inc.

Bicycle Barometer

Other automated technologies

There are a number of other technologies and techniques that are available for gathering data, but their applicability is peripheral to the focus of this manual. As such, we provide a brief discussion of them here but do not go into the level of detail provided for the other technologies.

Bluetooth detectors, GPS data collection, smart phone applications, pedestrian signal actuation buttons, radio-frequency (RF) tags, and surveys have all been used to gather sample data and establish minimum bicycle volumes on various facilities. These technologies have been growing but they have not yet been successfully used for estimating total bicycle or pedestrian volumes. They are better suited to developing origin-destination travel patterns, investigating route choice, and developing system-wide mode share estimates. However, it is currently not possible to reliably convert this sample data to total counts due to the influence of multiple location-specific factors (e.g. smart phone usage, transit mode share).

Automated Passenger Counting (APC) Systems can provide accurate counts of boarding and alighting of public transit buses. Similarly, fare gate data can also provide information about entries and exits at rail stations and bus rapid transit stations. This information can help agencies decide at which transit stops they should focus counting efforts. However, these systems have not been used for capturing bicycle or pedestrian count information.

For more information

For more information on automated count technologies please refer to the literature review created in conjunction with this manual, which is posted at bikecounts.luskin.ucla.edu.

MANUAL COUNTS

Manual counts make use of people as observers to record when bicyclists or pedestrians cross a screen-line or enter or exit an intersection or area of interest. Count forms may be used to tally users with pencil and paper. Count boards allow observers to press a variety of buttons to track users. Research has found that accuracy of the manual count increases as the number of data collection tasks is reduced. Observers can be tasked with bicycle tallies, pedestrian tallies, and noting characteristics about the pedestrians or bicyclists, such as age, helmet use, or gender. Use of pencil and paper for counting may also lead to undercounting where bicycle or pedestrian counts are high (over 400 an hour), so other counting devices or multiple observers may be used at locations of high usage.

Manual counts are usually recorded for one to four hours in discrete time intervals, generally 15 minutes. Some count boards are also capable of timestamping all data points. Manual counts can be done in conjunction with automobile counts and have the flexibility to gather additional information desired about travelers, such as directional and turning information, gender,

helmet usage (for cyclists), or behaviors, such as use of mobile devices. However, each individual data collector can only observe and record a certain amount of information accurately, so more personnel are needed to collect more types of data. Manual counts can be performed at screenline, intersection, or mid-block locations.

Many jurisdictions currently rely on manual counts taken on an annual basis at strategically chosen and distributed locations, either with the assistance of hired professional consultants or volunteers. Care must be taken with volunteers to mitigate the effects of ulterior motives, in which the volunteer may discretionarily bias counts upwards or downwards. To reduce error, data collectors should be trained so they have a clear understanding of the count methodology. In addition, managers should plan data collection efforts carefully, ensuring that there are enough data collectors at high-volume locations so that each person can do their portion of the counts accurately.

This section is focused on the types of manual counts that may be done, technologies that aid manual counts, and recruiting and training observers for manual counts.

Types of manual counts

This manual is concerned with four main types of counts: screenline, intersection turning movements, on-off, and occupancy. For the purposes of assessing general use levels, screenline counts are the recommended methodology. The Bike Count Data Clearing-

house and the form in Appendix B were developed to enable easy collection of screenline count data, and easy upload and sharing via the Clearinghouse website.

The use of observers to conduct each of these types of counts manually is discussed below. Sample count forms for each type of count are found in Appendix B through E.

Screenline counts

When conducting a manual screenline count on-site, observers are posted typically in a mid-segment or mid-trail location. They are directed to count pedestrians and bicyclists as they cross in front of them and record their directionality. On sidewalks, one observer should be posted on each side of the roadway. To minimize the potential for error, intervals should be tallied in increments of 15 minutes or less. (The Clearinghouse is configured to accept data in 15-minute intervals). On-site observers should not be expected to collect more than three hours of data at a time.

Intersection turning movement counts

When conducting a manual intersection count, observers are posted at an intersection and they record bicycle turning movements by approach and pedestrian crossing counts by intersection leg. Intervals should be tallied in increments of 15 minutes or less. (The Clearinghouse is configured to accept data in 15-minute intervals). On-site observers should not be expected to collect more than three hours of data at

one time. Please reference Appendix A when working with a counting firm or designing your own intersection count effort.

If the volunteers or traffic counting firm is able to collect more data due to the focus on only pedestrian and bicycle counts, the use of video, and/or available staffing, some additional attributes or counts could be requested. Below are some ideas:

- Count all pedestrian movements, even those who remain on the sidewalk and don't cross the roadway.
- Record the number of children, wheelchair users, and other users with special needs.
- For bicyclists, track the number of female riders, sidewalk riders, wrong-way riders, and/or riders without helmets (Please see Appendix I).

On-off counts for bikes on transit

On-off counts are typically done when counting bicyclists on transit. Observers can either be posted at a station or on a transit vehicle, depending on the data needs. Bus drivers may be enlisted to conduct a count of the number of bicyclists who board or alight, as well as the number of bicyclists who are turned away due to carrying capacity constraints. Metro implemented this procedure in December 2012 for their bus operations.

If observers are located on transit, they should capture the transit vehicle's route and direction, the times and locations where bicyclists board and alight, the crowding conditions on board if bicyclists are

brought into the transit vehicle, and if bicyclists were prevented from boarding by capacity constraints. One observer should be posted in each transit car. If observers are posted at a station, they should capture the transit route and direction for each observation, the times when bicyclists board and alight, the crowding conditions on board if bicyclists are brought into the transit vehicle, and if bicyclists were prevented from boarding by capacity constraints. One observer should be posted near the doors for each transit car on every platform.

Occupancy counts for bike parking

Occupancy counts are typically done for parking data. Generally, counts are conducted when parking occupancies are highest, although occupancy counts are also done to demonstrate before and after conditions. They can also include an inventory of the parking that exists in an area. Occupancy counts are generally conducted manually using a one-pass method of counting at specified times. Occupancy counts can be done for both vehicle and bicycle parking.

Occupancy counts should indicate bikes parked in designated areas, such as at bike racks, as well as those parked in undesignated areas, such as parking meters, poles, and chain-link fences. The bike occupancy counts should also indicate the number of bikes or bike parts that appear to have been abandoned.

Manual count technologies

There are multiple ways of collecting and recording the count data, which range from paper and pencil to electronic devices and the use of video imagery. These technologies for manual counts are discussed below.

Tally Sheets

This is the most cost-effective manner to gather data manually, particularly when many sites are being observed at the same time. People on-site or people who are post-processing videos use forms to record their counts and other observations. It is important to note that using only tally sheets for recording data tends to lead to errors and limits in the number of bicyclists and pedestrians that can be counted by a



Photo source: Herbie Huff

Using a tally sheet for counting

single observer because they must take their eyes off of the study area to record the count. Using only tally sheets work well when pedestrian and bicycle volumes are light and there are no other attributes being tallied. A general rule of thumb is that observers should be expected to collect no more than 400 data points (counts, attributes, etc.) per hour using only paper and pencil. Examples of tally sheets are contained in Appendix B through E.

Mechanical Counting Devices

Mechanical counting devices are tools used by on-site or video observers to keep track of counts. They include a hand tally counter or mechanical counting board. They enable trained observers to keep track of counts while minimizing the amount of time they take their eyes off of the study area. A general rule of thumb for accurate manual observations using mechanical counting devices is no more than 800 data points (counts, attributes, etc.) per hour for each observer.

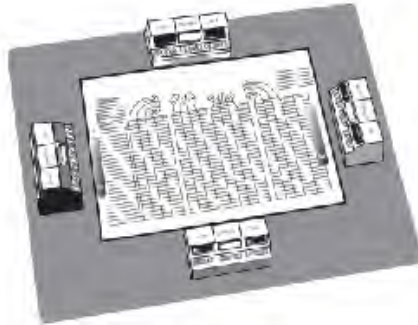
A hand tally counter can be used most effectively for screen-line counts, on-off counts, bike parking occupancy counts, or for counting total numbers of bicyclists



Photo source: Gindart

Hand tally counter

Image Source: Iowa State University,
Traffic Volume Counts



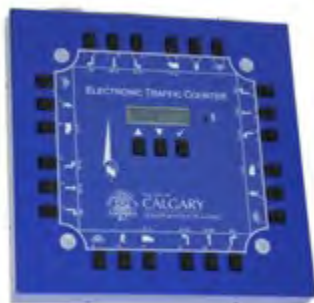
Mechanical counting board

or pedestrians at a location. Observers push the clicker for each pedestrian or bicyclist observed. For directionality, two hand tally counters can be used, one in one hand and one in the other. Interval data would be recorded on tally sheets.

A mechanical counting board is often used for 4-legged intersection turning movement counts. Tally counters are screwed into place on a wooden board in a square for keeping track of turning movements. For counting vehicles, pedestrians, and bicyclists, the tally counters are often tiered, where each tier represents the travel mode. Boards often have a place in the center where the tally sheet is located for recording interval counts.

Electronic Counting Devices

There are two primary electronic counting devices, the electronic counting board and the tablet/smart phone applications.



Electronic counting board

Image source:
Barnett Engineering Ltd.

Electronic counting boards are designed for counting intersection turning movements, but can also be used for screenline counts. Most electronic counting boards timestamp each data point and tallies the data automatically. A single observer should not be expected to accurately capture more than 800 data points per hour using an electronic counting board.

Tablet and smart phone applications have become generally more prevalent, and as such, applications specific to counting traffic data have been developed.



Image source: Transport Xtra

iCount application for tablet from Trans-Plan, Inc.

Most applications focus on collecting intersection turning movement counts. The biggest drawback for the tablet and smart phone applications is the lack of tactile indicators that the counting boards and hand tally counter have that help keep observers eyes on the study area. As such, a single observer should not be expected to accurately capture more than 400 data points per hour using a tablet or smart phone application. However, these applications have many of the post-processing advantages of the electronic counting board for summarizing the results.

Video Observations

Video observations are closely related to manual counts, in that humans collect the data and use a variety of tools to record the data. However, field data is collected first by camera then the information is processed by technicians in a video lab or volunteers. The technologies used to record the data are similar to the ones discussed previously.

The capability of conducting counts accurately increases due to the ability for technicians to rewind/review and for supervisors to conduct quality control. Depending on the recording quality, video data also enables the collection of bicyclist characteristics more readily, such as helmet use and gender. Using cameras can provide a permanent record of the count for future verification and for collecting additional data that was not specified in the original count. It can also record longer periods of observations for which human observers in the field would not be suggested due to fatigue. Much of the research to assess counting accuracy by field technicians used video observations as the ground truth.

Video observations tend to cost more in high use locations, because data processing can take up to 3 hours for each hour of observation. Cameras can only capture a limited area as opposed to human field technicians who have a wider visual range. Cameras must be mounted in such a way that maximizes its scope while also maximizing video quality, which can be a challenge in some locations. Cameras are prone to theft and vandalism as well as occasional malfunctions and vary in video quality due to the cameras

themselves, mounting procedures, or weather/lighting factors.

Recruiting and Training Volunteers

In the case that an agency chooses to use volunteers to conduct counts, it takes effort to recruit, train, and coordinate them. The success of the count depends on the number of volunteers and their dedication to the project. In general, volunteer bandwidth can be spread across three areas: duration of counts; data attributes to be collected; and number of locations. The number of volunteer shifts is equal to the number of locations to be counted multiplied by the number of time periods, plus any additional shifts for locations with high volumes that will require more than one volunteer.



When staffing a volunteer count, the number of available volunteers can be hard to predict. To deal with this, an agency may want separate the volunteer shifts into batches, and then open these batches one at a time. For example, if an agency aims to count twenty locations, each for three time periods (total of 60 volunteer slots), it can open them up to volunteers five locations at a time (15 volunteer slots). The agency should group the locations so that the most important ones will be staffed first, and so that all time periods at a given location are filled before new locations are

opened up. This ensures completeness of the data. Organize the location batches so that if volunteers become scarce after only five or ten locations are staffed, the resulting data set still provides geographic variety. A similar batching process could be done with time periods, staffing the most important time periods first.

Agencies can partner with community organizations and civic institutions to staff volunteer counts. These could include senior centers, community colleges, and local bike advocacy groups. Incentives, such as t-shirts, snacks, or the chance to win raffle prizes, can aid in volunteer recruitment.

Volunteers will need to attend a training session in addition to their count shift. Depending on how many volunteers are involved, it may be necessary to schedule several training sessions, and to make training materials available online. The training session also provides an opportunity to distribute count forms.

Appendix H contains an example presentation that shows what content needs to be covered in volunteer training. This content includes:

- What to bring to the count site
- Definitions of demographic variables to be counted, like child or special needs pedestrian
- Special cases, such as two people on a bike

5

DURING THE COUNT





DURING THE COUNT

AUTOMATIC COUNTS

This section discusses the steps needed during the count in order to ensure the quality of the data collected using automatic technologies.

Check the functionality

Once the automatic count technology has been deployed, it is important to check that the technology is functioning properly early on in the counting effort, within a couple of days. This may involve a field visit and/or reviewing some of the data collected.

Check the data

At the same time that the functionality of the technology is being assessed, it is also important to collect and download the data that has been collected to see if there are early warning signs for inaccuracy.

The best way to check for errors or inaccuracies is to have a finite period of time when a second count technology is used to collect the same data. This may involve setting up a video camera or conducting manual counts in the field and comparing the results to the data being collected by the automatic counter. Pick a time frame that captures high usage by bicyclists and pedestrians or one where the weather may impede the automatic counter. Doing so will help you

calibrate the automatic counter to local conditions and provide more accurate results.

MANUAL COUNTS

This section discusses the steps needed during the count in order to ensure the quality of the data collected using people to conduct the counts either on-site or from video recordings.

Preparing for the count

These are the steps needed just in advance of starting the manual counts:

- Check functionality of equipment to be used
- Remind observers of the count goals and use of counting equipment
- Ensure that observers synchronize timing equipment
- Make sure that all observers have the field supervisor's mobile phone number

During the count

A field supervisor will need to be available during the count. He or she can answer any questions counters may have and provide breaks as needed. The field supervisor should be familiar with the count methodology and should know all of the locations that are

being counted. During the count, the field supervisor should perform quality checks, counting alongside another counter in order to verify that he or she is performing the count correctly.

In order for the field supervisor to be available to perform these duties, he or she must be supervising a manageable number of locations. About ten locations per supervisor is the recommended maximum, although this number may vary a bit depending on the distance between the locations.

Immediately after the count

The field supervisor should collect and review the data immediately after the count. He or she should ensure that all the data has been received, and inquire into any unusual marks or notes while they are still fresh in the minds of the counters.

6

After the Count





AFTER THE COUNT

POST-COUNT PROCEDURES

This section is dedicated to the steps that could and should be taken to ensure the data quality, extrapolate information from the counts, and share the count data.

How do we check the quality of the data?

There are some key steps to be done that can ensure the highest quality of your data collection.

- **Map it out:** Writing the total number of bicyclists and pedestrians counted at each location for each time period on a map is a quick step to see if there are any unusual data points. For example, one count location showing significantly more volume than an adjacent count location warrants further investigation.
- **Directional data:** Review the counts by travel direction of bicyclists and pedestrians in relation to the count locations to ensure that the directional travel volumes make sense.
- **Dual technologies:** If you used two count technologies during the same count periods, such as an on-site observer paired with an automated count technology, compare and contrast the results for the peak-hours of data collection.
- **Camera recording:** If your data collection involved using video cameras, these recordings offer the

ability to spot check the count data. Aim to review about 25% of the data by using the recorded count intervals.

- **Historic data:** If you have previously collected data at the count location, use this data to compare your current count. Keep in mind that pedestrian and bicycle volumes will vary more than vehicle volumes.

What can we do with the count data?

Once you've checked the count data, you can analyze it in a number of ways to obtain meaningful information.

Summarize

The data may be summarized in a number of ways. First, one can calculate the total volumes by time period at each location, as well as the overall total at each location. Totals per time period can also be examined, and weekday and weekend volumes compared. An analyst can calculate summary statistics for demographic and behavior variables, and examine differences in these variables across locations and time periods.

Extrapolate (with Caution)

The data that you collect may be extrapolated, if appropriate data is available to represent conditions during a variety of time periods, seasons and weather conditions. For example, a peak one-hour count can be extrapolated to an estimated daily volume, which enables comparisons with other known daily volumes. A count collected during a summer weekday could be used to estimate counts for other seasons. At this time, there is very little data available in Southern California to represent a variety of time and seasonal conditions. As these data sets are accumulated, it will become more feasible to extrapolate counts.

For motorized vehicles, extrapolation is often used to calculate average daily traffic (ADT) and annual average daily traffic (AADT). The ADT is a calculation of the number of vehicles passing a certain point on a roadway and is generally based on data collection using automated counters that may be temporary or permanent. The ADT can be an average for weekdays, weekend days, various seasons, or is sometimes used to refer to an average of as few as two days of traffic counts. The AADT represents the average for an entire year, encompassing all seasons and types of days, and is ideally calculated using multiple count locations and using permanently installed automated counters. Permanent counters produce results that can be summed for the year and divided by 365 days. The Federal Highway Administration's "Traffic Monitoring Guide" has adopted a preferred method for estimating AADTs using temporary counts that requires 84 days of collection. This method adopts an average of averages in order to remove skewing of the

data due to seasonal biases. In reality, most agencies can only afford to collect data and analyze data for short time periods (2 weeks or less). In these cases, factors that have been developed locally, regionally, or nationally are applied to the data in order to reduce seasonal bias.

Because calculation and estimation of vehicle volumes is tied to funding for roadway construction and maintenance, many jurisdictions have access to vehicle counts that cover a variety of time periods, durations, and locations. These can be used to accurately estimate volumes for different time periods other than the ones measured in a statistically sound manner. The same, however, cannot be said for bicyclist and pedestrian volume data. Some cities and regions, such as Portland, Oregon; San Francisco, California; and the San Diego Association of Governments, have instituted city-wide pedestrian and bicyclist count data collection efforts that incorporate the use of permanent and temporary counters. As such, these cities have the capability to extrapolate non-motorized count data.

Most jurisdictions in Southern California have yet to develop and pursue a concerted and sustained data collection effort for non-motorized travel. Most pedestrian and bicycle volume collection done in the region has been manual counts of short duration with little consistency between jurisdictions, or even counting efforts in the same jurisdiction. Because pedestrian and bicycle volumes tend to be significantly lower and more variable than vehicle counts, the addition or subtraction of a nominal number of users

can have a dramatic effect on extrapolated results. For example, peak-hour counts done on a day when it rained early in the morning will likely result in fewer bicyclists and pedestrians than normal, even if it did not rain during the count period. Another example is a 24-hour count of bicyclists using pneumatic tubes at a location where and on a day that the local bicycling club has its monthly group ride. This would result in a much higher bicycle volume than normal, and the large volume would be further magnified by extrapolation.

The Bike Count Data Clearinghouse provides some of the initial steps toward meaningful extrapolation, by establishing count protocols and archiving bicycle and pedestrian volumes. The Clearinghouse serves as a one-stop shop to access non-motorized counts for a variety of locations, time periods, and durations. This will help agencies identify data needs and begin to analyze geographic and temporal factors that influence count volumes.

In addition, local jurisdictions could work towards developing locally-based factors that allow for accurate extrapolation by developing a data collection plan. The data collection plan should include:

- At least one permanent count station, installed at locations for exclusive non-motorized access or where bicyclist and/or pedestrian volumes are relatively high;
- Automated counts of at least a two-week duration conducted four times per year to capture seasonal variation. Locations should be chosen where

bicyclist facilities are found and parallel routes are limited or non-existent;

- Manual peak-hour counts done at least 4 times per year;
- Bicycle and pedestrian counts required as part of all manual vehicle counts;
- Bicycle counts required as part of all pneumatic tube counts;
- Bike detectors (embedded and video) that provide counts; and
- Count data uploaded to the Bike Count Data Clearinghouse.

Only when significant data has been collected can jurisdictions in Southern California develop locally-based factors to extrapolate the results of more limited bicycle and pedestrian counts. In the meantime, in some cases it may be possible to borrow factors from other locations with more continuous counts of non-motorized travel. However, these factors can only be applied if they represent highly comparable conditions in terms of weather and travel destinations. For example, factors derived from counts that took place near a college could be used to extrapolate counts near a college. Similarly, seasonal factors can only be derived from areas with similar frequency of rain or other weather that may affect bicycle use.

Compare to Other Data

To put the volumes in context, they may be analyzed alongside several other data sources. Here are some suggestions.

Other travel behavior data often provides insight into the overall magnitude of the count volumes. Vehicle counts, or average daily vehicle traffic data, provide a basis for comparison and suggest the rough biking or walking mode split at the count location. Commute mode split data from the Census provide an alternative measure of biking and walking, with the important difference that count volumes include all trips, while the Census data only includes the trip to work. Comparing the two data sources can illuminate the difference between work travel patterns and overall travel behavior. This variance between work travel patterns and overall travel behavior illustrates that bicycle and pedestrian trips are typically non work related, rather than commute oriented.

Mapping count volumes alongside crash data provides insight into crash risk levels at different locations and where there are safety problems. Although the number of crashes at two locations may be the same, the location with the lower count volume has a higher rate of crash incidence, which probably points to greater safety issues at that location. Looking at transit ridership near count locations can uncover the extent to which bicyclists are riding for transit access and egress.

Infrastructure data may also have much explanatory power with regards to count volumes. Agencies will want to examine the relationship between the presence and design of bikeways and count volumes, as well as the effect of changes in infrastructure over time.

How do we share the counts?

You can upload your count data to the Bike Count Data Clearinghouse, located at bikecounts.luskin.ucla.edu. The Clearinghouse provides a single central location for the uploading, viewing, and downloading of bicycle count data. As of July 2013, the Clearinghouse includes all count data submitted by local agencies for locations in Los Angeles County. These data are for counts that took place in November 2012 or earlier. Going forward, agencies will submit their data directly via an upload interface in order to keep the Clearinghouse up-to-date.

By collecting many agencies' bicycle count data in one place, the Clearinghouse creates a large county-wide data set. This enables more in-depth analysis of bicycle travel behavior and bicycle volumes.

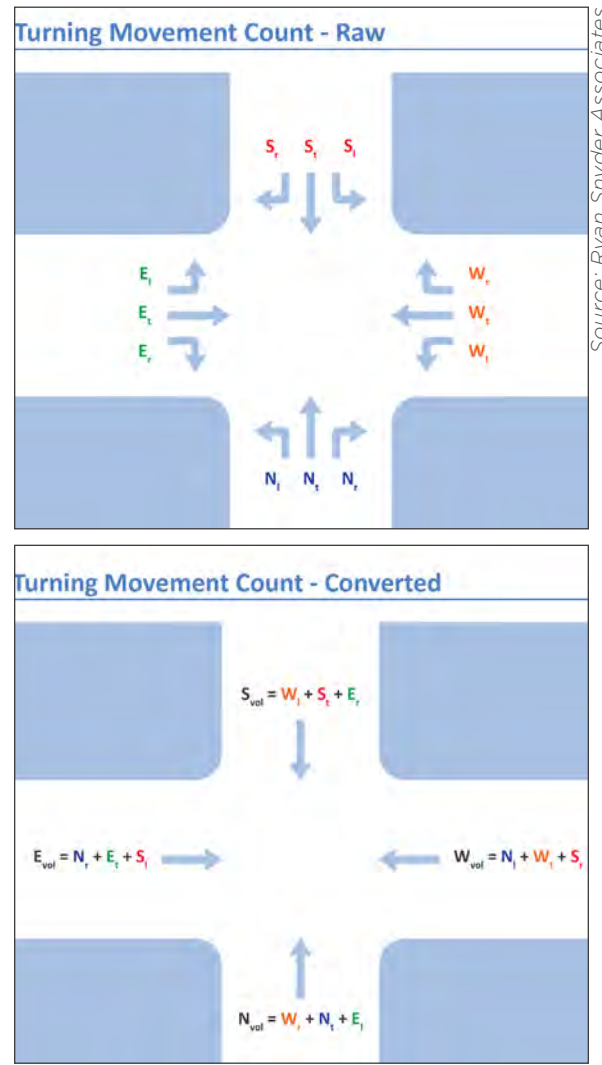
Compiling and uploading data from manual counts

The Clearinghouse website contains a sequence of screens that facilitate the entering and uploading of bicycle count data. They are as follows, with notes on special circumstances. For agencies using the screen-line count methodology and guidance in the "Primer" section of this manual, upload will be relatively straightforward. For agencies or their consultants using intersection count methods, upload will require a small amount of advance planning and some calculations, as described below. Appendix A reiterates the considerations for intersection counts in the form of a request to counting firms.

- Add to an Existing Data Set or Create a New Data Set. Users create named data sets for each batch of counts they are uploading. This enables users to remember distinct count efforts (e.g. “Los Angeles Bike Count 2009” or “Spring St. Counts 2013”). It also enables users to save their progress when they have partially completed the data entry, and resume where they left off later.
- Add Locations: Users select the location at which counts were conducted. Users may select an existing count location as shown on a map, or they may create a new location.
- Add Count Periods and Count Volumes. For each location, the user will then enter the times and dates during which that location was counted, and the volumes by 15-minute increment. For turning movement counts and intersection counts, agencies will need to sum the relevant movements in order to enter them as screenline volumes. Turning movement counts will need to be summed according to the following formula shown in the diagram.

Uploading data from automatic counters

Uploading data from automatic counters will be a more complicated process that will involve back-end work by SCAG staff. To add data from automatic counters, please contact Alan Thompson, thompson@scag.ca.gov or email activetransportation@scag.ca.gov.



Formula to convert turning movement counts to screenline equivalents

7

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REFERENCES

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A

Instructions to Traffic Data Collection Firms

INSTRUCTIONS TO TRAFFIC DATA COLLECTION FIRMS

The instructions below are intended for a traffic data collection consultant. Agencies should consider this a list of the key issues that need to be discussed with a consultant in order to obtain high quality bicycle and pedestrian count data from a firm whose operations and expertise are geared towards vehicle counting. Common intersection counting methodologies exclude large shares of bicycle or pedestrian travel, for example counting only bicyclists in the roadway, or counting bicyclists and pedestrians in a crosswalk. Agencies should ensure that consultants are employing a methodology that captures all (or nearly all) bicycle and pedestrian travel through the intersection.

To the Consultant:

In addition to counting vehicles, our jurisdiction is interested in collecting data regarding the numbers of bicyclists and pedestrians using our roadways and sidewalks. We would like to request that your firm collect this additional data at the same time you collect vehicle count data. Please follow the instructions below.

1. Please review the data upload screens at bikecounts.ucla.edu to ensure that the necessary information about the built environment and weather are collected at each location. You may use the Supervisor Form in Appendix B of *Conducting Bicycle and Pedestrian Counts in Southern California: A Manual for Jurisdictions in the Los Angeles County and Beyond*.
2. Provide a diagram of the intersection with existing vehicle/bicycle lanes and pedestrian marked crosswalks and crossing prohibitions.
3. REQUEST TO COUNT BICYCLES:
 - a) Count **all** bicyclist turning movements through the intersection, including those that approach or depart the intersection on the sidewalk or ride the wrong way.
 - i. Please indicate in the notes if there appears to be a lot of sidewalk or wrong way riding.
 - ii. Optional: keep separate tallies of sidewalk riding
 - iii. Optional: keep separate tallies of wrong way riding
 - iv. Optional: keep separate tallies of female riders
 - b) Count the following as **bicyclists**:
 - i. Each rider on a tandem bicycle
 - ii. Each passenger on a bicycle, including children in bike trailers and seats
4. REQUEST TO COUNT PEDESTRIANS:

- a) Count pedestrian crossings by roadway leg.
- b) Count the following as **pedestrians**:
 - i. Skaters and push-scooter users of any kind
 - ii. Joggers
 - iii. Wheelchair user and their passengers
 - iv. Children in strollers or being carried
- c) Count all pedestrian crossings that occur within **10 feet** of a marked or unmarked crosswalk.
 - i. Please note: crosswalks exist on all legs of roadway intersections, whether they are striped or not, unless pedestrians are specifically prohibited from crossing at particular legs of the intersection
- d) If applicable: Report each diagonal crossing of a pedestrian scramble intersection. At regular intersections, count the diagonal crossing as 2 separate legs but note the number of pedestrians who cross diagonally.
- e) Count bicyclists who walk their bikes through the intersection as pedestrian crossings.

5. DATA SUMMARIES FOR BIKE AND PED COUNTS

- a) Report bicycle turning movements (12, typically) and pedestrian crossing counts (4, typically) for each 15 minute increment counted.
- b) For each location, summarize the total number of pedestrian crossings and the total bicycle turning movements for their respective peak-hours and for the entire count period.

6. ALTERNATIVE METHODOLOGY FOR COUNTING BICYCLISTS AND PEDESTRIANS AT AN INTERSECTION

- a) Another option is to establish two imaginary screenlines immediately adjacent to the intersection and use the count forms in Appendix B. One screenline will capture north/south travel, and will be located either just north of the intersection or just south of the intersection. The choice is arbitrary. Another screenline will capture east/west travel.

AFTER THE COUNT: REQUEST TO UPLOAD THE BIKE COUNT DATA:

Please enter the data into the Bike Count Data Clearinghouse at bikecounts.ucla.edu, following the upload screens and directions provided there. We will assist you in working with SCAG to be a validated user of the Clearinghouse so that you may enter data for our agency.

Thank you for your help in monitoring bicyclist and pedestrian activity!



Recommended Screenline Count Form

Bicycle/Pedestrian Data Collection - Screenline Supervisor Form



Date

DAY MONTH YEAR 20



Location

STREET
PATH

BETWEEN AND



Count
Periods
at This
Location

① : AM : AM
START END
② : AM : AM
START END
③ : AM : AM
START END



Pages

PAGE OF TOTAL

Show Them Where to Count...



Mark where the counter should be located with an "X" on the Count Location Schematic below. Then, draw in the counter's screenline.



Label the street the counter will be counting on, as well as the nearest cross streets, as they will appear from the count location.



Indicate which way will be "left to right" and "right to left" on the arrows below.
Also mark cardinal directions (N, S, E, or W. Note that NW, SE, etc. are not allowed) as they will appear to the counter.
If you are not sure which cardinal direction to assign because the street does not run exactly north-south or east-west, please consult any previous counts and be consistent with what has been chosen in the past.

Count Location Schematic

LEFT TO RIGHT N / S / E / W

CROSS STREET/PATH NAME

COUNT STREET/PATH NAME

CROSS STREET/PATH NAME

N / S / E / W RIGHT TO LEFT

Bikeway Type at This Location

Record the bikeway type present at this location, if any, including sub-options.

☐ BIKE PATH ☐ BIKE LANE ☐ BIKE ROUTE ☐ BIKE BOULEVARD ☐ NONE
☐ COLORED ☐ PAINTED BUFFER ☐ PHYSICAL BUFFER ☐ SHARROWS ☐ SHARROWS

Additional Variables to Count

Indicate any additional attributes the counter should count using the checkboxes below.

Bicycle ☐ FEMALE ☐ WRONG WAY RIDING ☐ SIDEWALK RIDING ☐ OTHER: ☐ OTHER:
Pedestrian ☐ WHEELCHAIR/SPECIAL NEEDS ☐ SKATEBOARD/SCOOTER/SKATES ☐ CHILD ☐ OTHER: ☐ OTHER:

Bicycle/Pedestrian Data Collection - Screenline Count Form

 Date
DAY MONTH YEAR 20
.....
.....
.....

 Location
..... STREET PATH
BETWEEN AND

 This Page
FROM : : AM PM TO : : AM PM

 Count Period
START : : AM PM END : : AM PM

 Pages
PAGE OF TOTAL

 Rain
☐ YES ☐ NO

Bicyclists

Count bicyclists when they cross this imaginary line ➔

 Bikes - Right to Left



TOTAL



 Bikes - Left to Right

TOTAL

▼ Make additional marks to count other characteristics

Female
..... TOTAL

Sidewalk Riding
..... TOTAL

Wrong Way Riding
..... TOTAL

Other:
..... TOTAL

Other:
..... TOTAL

Pedestrians

Count pedestrians when they cross this imaginary line ➔

 Pedestrians - Right to Left



TOTAL



 Pedestrians - Left to Right

TOTAL

▼ Make additional marks to count other characteristics

Wheelchair/Special Needs
..... TOTAL

Skateboard/Scooter/Skates
..... TOTAL

Child
..... TOTAL

Other:
..... TOTAL

Other:
..... TOTAL



Sample Intersection Turning Movement Count Form

Bicyclist Intersection Turning Movement Count Form and
Instructions from the National Bicycle and Pedestrian
Documentation Project

COUNT AND SURVEY INSTRUCTIONS

Please review these instructions before going to the count or survey site.

Items you should bring to the site include:

1. These instructions
2. Safety vest
3. Location map
4. Count/Survey forms
5. Clipboard
6. Pen or pencil and a spare
7. Watch or time to record 15 minute intervals
8. Count/survey manager business cards
9. Optional: hat, sunscreen, jacket, snacks, water

Once you've reached the site please ensure your safety. Be aware of your surroundings.

It is best to arrive at the site 15 minutes before the count period. Once you've arrived:

1. Find a safe location to conduct the survey or counts.
2. Record the background information at the top of the count/survey form.

If conducting a survey, be sure to approach the bicyclists or pedestrians in a friendly engaging manner. A suggested script is:

"Hello, do you have time to answer a few questions about walking and biking?"

If yes:

"My name is _____ and I'm conducting this survey for _____.
The information will be used to better understand why people walk and bike where they do. The survey will take about 5 minutes.

"You don't have to answer all the questions, and you can stop taking the survey at any time. I won't ask for any personal information. Would you like to take the survey?"

After completing your count or survey period, return your forms to the count/survey manager as soon as possible.

STANDARD BICYCLE INTERSECTION COUNT FORM

Name: _____ Location: _____

Date: _____ Start Time: _____ End Time: _____

Weather: _____

Please fill in your name, count location, date, time period, and weather conditions (fair, rainy, very cold).
Count all bicyclists crossing through the intersection under the appropriate categories.

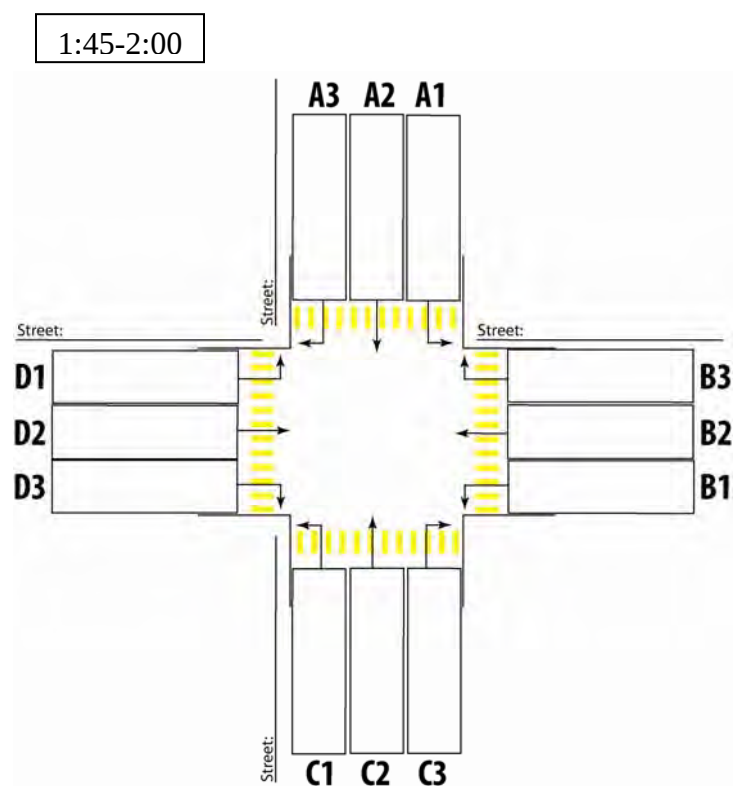
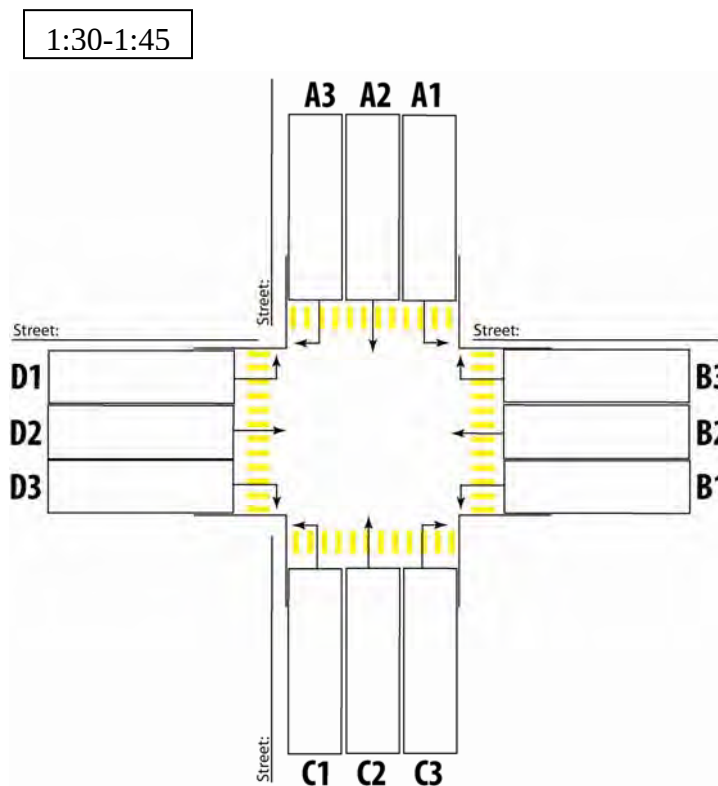
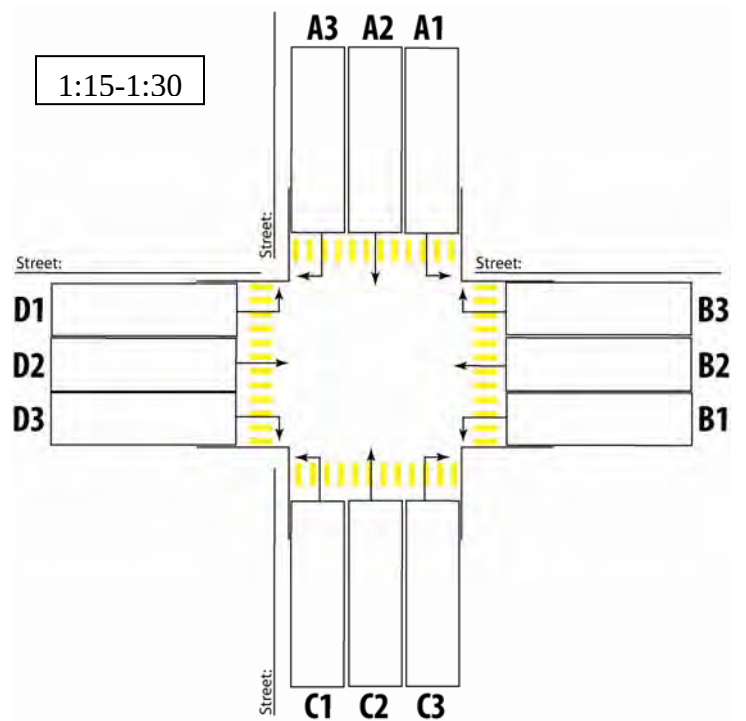
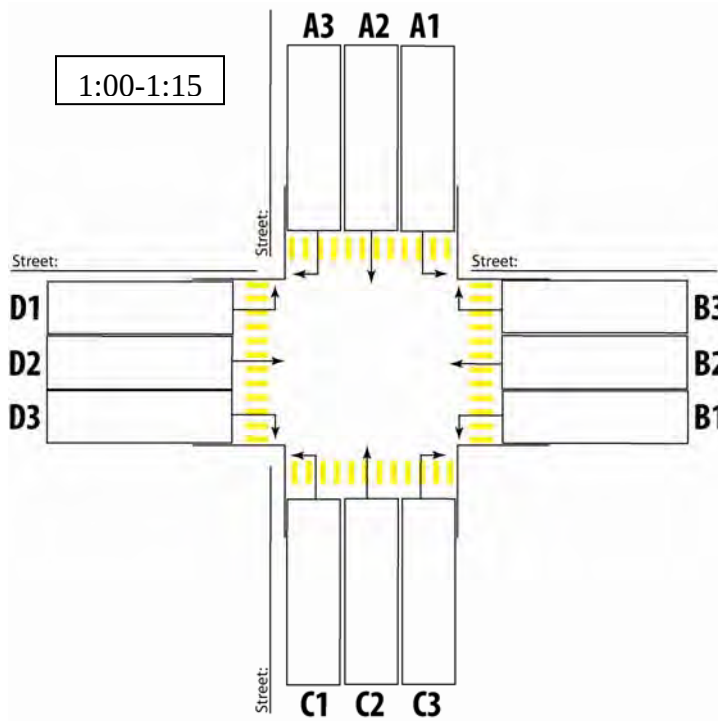
- Count for two hours in 15-minute increments.
- Count bicyclists who ride on the sidewalk.
- Count the number of people on the bicycle, not the number of bicycles.
- Use one intersection graphic per 15-minute interval.

00-:15

15-:30

30-:45

45-1:00



Notes:

STANDARD BICYCLE INTERSECTION COUNT TALLY SHEET

Time Period	Bicycle Counts											
	Leaving Leg A			Leaving Leg B			Leaving Leg C			Leaving Leg D		
	A1	A2	A3	B1	B2	B3	C1	C2	C3	D1	D2	D3
00-:15												
15-:30												
30-:45												
45-1:00												
1:00-1:15												
1:15-1:30												
1:30-1:45												
1:45-2:00												
Total												
Total Leg:												
Street Name A to C:							Location 1 (Total Leg A + Total Leg C) =					
Street Name B to D:							Location 2 (Total Leg B + Total Leg D) =					

Intersection Count Forms and Instructions for
Pedestrians and Bicyclists from UC Berkeley Safe
Transportation Research and Education Center
(SafeTREC)

Pedestrian and Bicyclist Intersection Counts (2-hour counts, 1 sheet per 15-minute period)

Data Collector Instructions

Robert Schneider, Lindsay Arnold, and David Ragland
UC Berkeley Safe Transportation Research & Education Center (SafeTREC)
April 2011

This document describes the procedure that you will use to count pedestrians and bicyclists at intersections¹. Review this document before visiting the field, and refer to it when you have questions in the field. Ideally, you will be trained on the counting methods described below before taking counts. However, it is not necessary to have formal training to follow these procedures.

SAFETY FIRST: You will be standing near roadway intersections to take counts. Use caution traveling to the count locations, including crossing roadways near the sites. Follow traffic laws at all times. Maintain a constant awareness of your surroundings, including traffic conditions and social situations, and ensure that data collection does not interfere with your attention to safety. If you feel unsafe, uncomfortable, or threatened, stop data collection and move to a safer location.

BRING COUNT MATERIALS:

- Data Collection Sheets (8 total sheets; 1 for each 15-minute period)
- Pencil or Pen
- Clipboard (or something to write on)
- Watch (or other timing device that can identify 15-minute periods)
- Short letter from the agency that is sponsoring the counts. This letter should have the name, e-mail, and phone number of someone at the agency so that you can tell people with questions about the counting effort who they can contact (See attached Example Agency Letter).

FILL IN GENERAL INFORMATION ON FIRST SHEET (See top of attached Data Collection Sheet):

- Arrive at the count intersection at least 15 minutes before the count period is scheduled to find a location where you can see all of the intersection crossings and to fill in general information
- Record the name of the mainline roadway (roadway with more traffic) and intersecting roadway
- Label the intersection diagram with the names of each roadway
- Add an arrow to indicate which direction is NORTH
- Record your name as the observer
- Record the date and time period of the count
- Estimate the current temperature (°F) and weather (sunny, cloudy, rainy, etc.)
- Describe the intersection, including surrounding buildings (e.g., restaurants, single-family houses, offices, etc.), roadway characteristics (traffic signals, median islands, fast traffic, etc.)
- Record the appropriate 15-minute time period in the upper left corner of each sheet

¹ These instructions describe how to count pedestrians and bicyclists at intersections. There are many other ways that pedestrians and bicyclists can be counted at intersections, but this method is designed to gather counts in the most accurate, efficient, and consistent manner. Gender is captured using this methodology, but age, helmet use, jaywalking, wrong-way riding, and other characteristics are not included so that data collectors can focus on counting accurately. In addition, it is also possible to count pedestrians and bicyclists at locations such as trail, sidewalk, and bicycle lane segments and building entrances. However, different methodologies are used to capture counts at these other locations.

FOLLOW PEDESTRIAN COUNTING PROCEDURE (See Side 1 of Data Collection Sheet):

- Tally each time a pedestrian crosses each leg of the intersection from either direction.
- Pedestrians should be counted whenever they cross within the crosswalk or when they cross an intersection leg within 50 feet of the intersection.
- Do NOT count pedestrians who do not cross the street (e.g., turn the corner on the sidewalk without crossing the street).
- If the pedestrian is female, mark an "O"; if male, mark an "X"; if unknown, mark a "+". If the pedestrian volume is so high that it is difficult to count by gender, use standard line tally marks.
- If the pedestrian is using a wheelchair or other assistive device, underline the "O", "X", or "+".
- Count for two hours. Use a new sheet for each 15-minute period.
- If the intersection is a "T" intersection with only three legs, you should still count four sides of the intersection. Pedestrians using the "sidewalk side" of the intersection should be counted when they travel along the sidewalk for at least half of the width of the intersection. Label the "sidewalk side" on the intersection diagram.
- Pedestrians include people in wheelchairs, people using canes and other assistive devices, children being carried by their parents, children in strollers, runners, skateboarders, people walking with a bicycle, etc., but do NOT include people riding bicycles, people in cars, etc.

FOLLOW BICYCLIST COUNTING PROCEDURE (See Side 2 of Data Collection Sheet):

- Tally each time a bicyclist approaches from each leg of the intersection and arrives at the intersection (this includes turning left, going straight, or turning right)
- Count bicyclists who may be riding on the wrong side of the street (against traffic)
- Count bicyclists who ride on the sidewalk (i.e., if a bicyclist on the sidewalk turns right without crossing the street, they should still be counted as turning right)
- If the bicyclist is female, mark an "O"; if male, mark an "X"; if unknown, mark a "+". If the bicycle volume is so high that it is difficult to count by gender, use standard line tally marks.
- If the bicyclist is wearing a helmet, underline the "O", "X", or "+".
- Count for two hours. Enter tally marks in a new row after each 15-minute period. Record totals at the bottom of the sheet after the two hours are completed.
- Bicyclists include people riding bicycles. They do NOT include people who are walking their bicycles across the intersection.

UNDERSTAND DATA PRIORITY:

If you do not feel like you (or you and your fellow data collectors at the intersection) may not be able to keep up with all observations at a location, collect the data according to the following priority ranking:

1. Count of Pedestrians
2. Count of Bicyclists
3. Gender
4. Helmet Use
5. Pedestrian Crossing Direction
6. Bicyclist Turning Movement

GIVE DATA COLLECTION SHEET TO THE COUNT MANAGER:

- Give your data sheets to the count manager as soon as possible after completing the counts.
- Keep the completed data collection sheet in a safe place until you have an opportunity to turn it in.

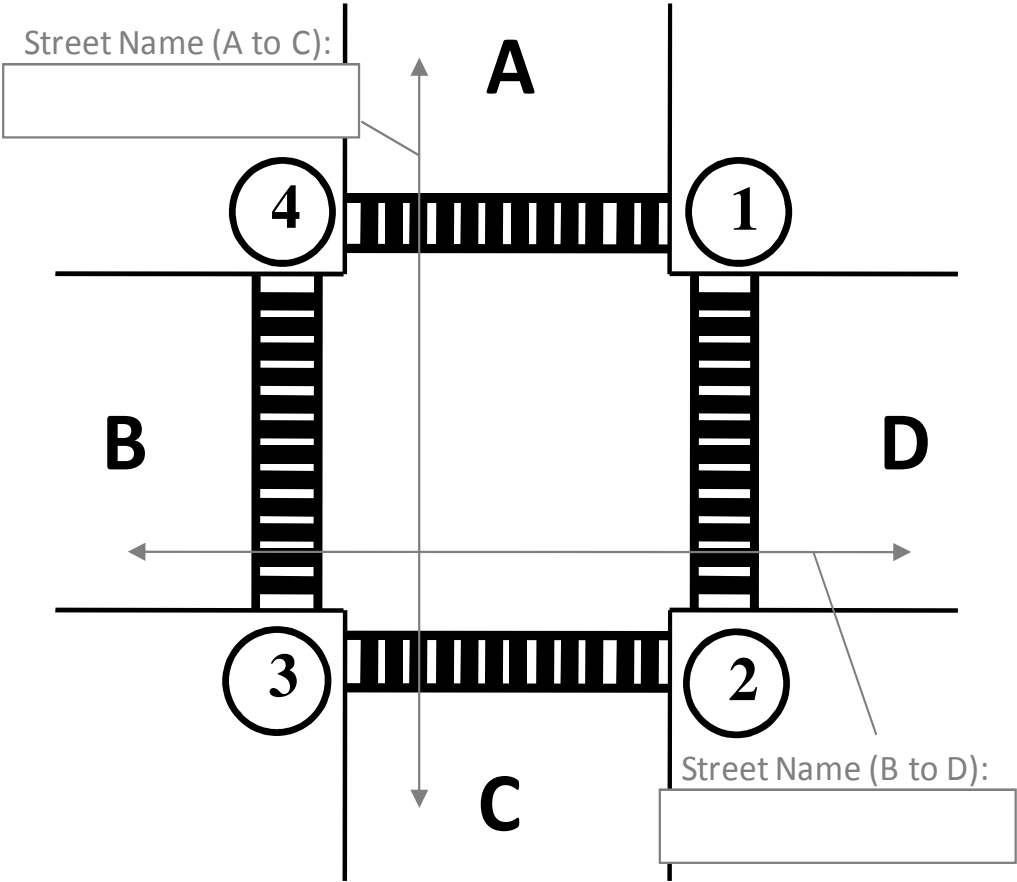
15-Minute Period:

4 to 1 OR 1 to 4

Side 1: Intersection Pedestrian Count Sheet

Mainline Roadway: _____
Intersecting Roadway: _____
Observer Name(s): _____
Date: _____ Observation Time: (Start) _____ (End) _____
Temp. (°F): _____ Sunny, cloudy, rainy, etc.: _____
Description of Specific Observation Location: _____

4 to 3 OR 3 to 4



2 to 1 OR 1 to 2

Tally each time a pedestrian crosses each leg of the intersection (count all crossings within 50 ft. of the crosswalk). If the pedestrian is female, mark an "O"; if male, mark an "X"; unknown, mark a "+".

3 to 2 OR 2 to 3

Please give completed form to:
Name: _____
Address: _____

Tel: _____
Fax: _____
Email: _____

15-Minute Period:

A to B OR A to C OR A to D

(Right) ← (Straight) ↓ (Left) →

Side 2: Intersection Bicyclist Count Sheet

Mainline Roadway: _____

Intersecting Roadway: _____

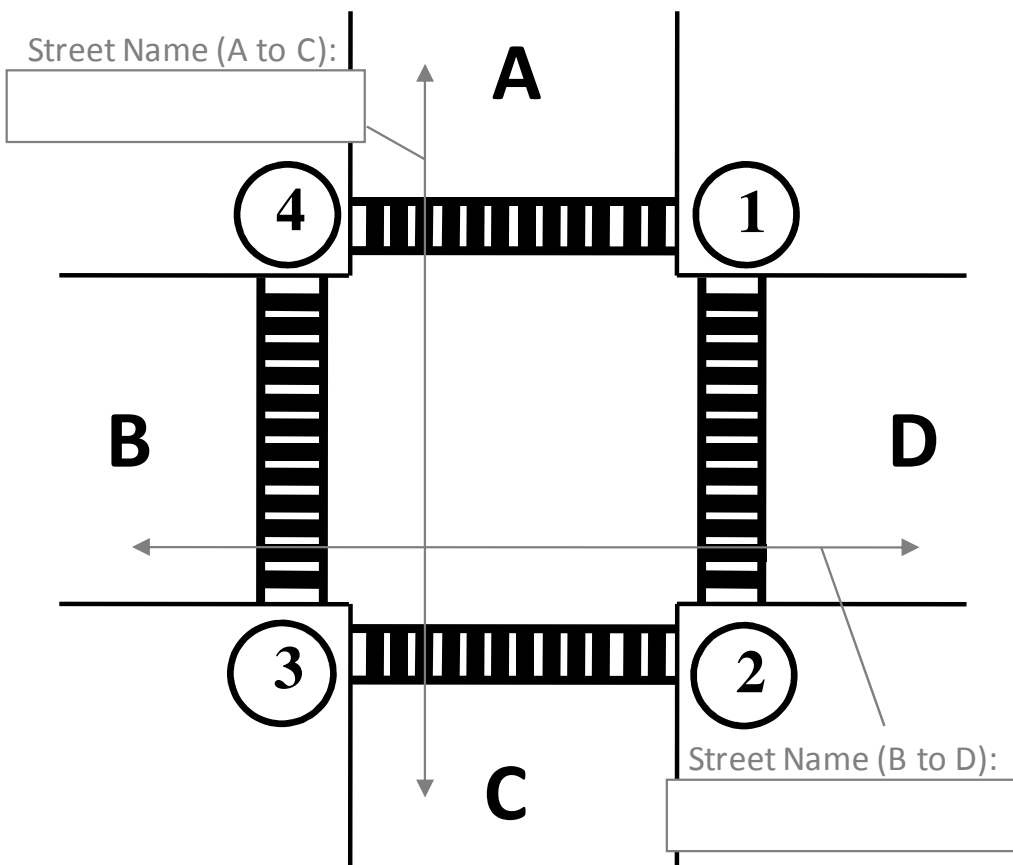
Observer Name(s): _____

Date: _____ Observation Time: (Start) _____ (End) _____

Temp. (°F): _____ Sunny, cloudy, rainy, etc.: _____

Description of Specific Observation Location: _____

Street Name (A to C):



(Left) → (Straight) ↓ (Right) →
B to A OR B to D OR B to C

D to C OR D to B OR D to A

(Right) → (Straight) ↑ (Left) →

Tally each time a bicyclist arrives at the intersection from each leg (include bicyclists on sidewalks). If the bicyclist is female, mark an "O"; if male, mark an "X"; unknown, mark a "+".

C to B OR C to A OR C to D

(Left) ← (Straight) ↑ (Right) →

Please give completed form to:

Name:

Address:

Tel:

Fax:

Email:



Sample Bike Parking Inventory and Occupancy Count Form

Bicycle Parking Counts

Your Name: _____

 Date

DAY

MONTH

20
YEAR

 Time of Day

1st pass

2nd pass (optional)

:

:

AM
PM

AM
PM

 Pages

PAGE

OF

TOTAL

Count Location

Your count location may be located at a transit station, a block of a city street, or at a particular destination, like a school or a shopping center. Use the space below to illustrate the location of your bike parking count. Label streets, buildings, and other landmarks as well as the location of the bike parking facilities.

Photo and Notes:

Please take a photo of the bike parking facility and attach it to this form or submit it via email. Make sure the photo shows the whole rack or set of racks clearly.

Note if the racks are damaged or obstructed (too close to a building; too close to parked cars; etc):

What to Count

1st pass

of parking spaces

Assume two spots per loop rack

.....

TOTAL

of parked bikes on racks

Don't include bikes parked elsewhere

.....

TOTAL

of bikes locked to other objects

Include bikes within ~100 feet of the rack or count location

.....

TOTAL

of bikes that appear abandoned

Count bikes that are vandalized.

.....

TOTAL

Weather during your count:

.....

SUNNY, RAINY, WINDY?

TEMP

2nd pass (optional)

of parking spaces

Assume two spots per loop rack

.....

TOTAL

of parked bikes on racks

Don't include bikes parked elsewhere

.....

TOTAL

of bikes locked to other objects

Include bikes within ~100 feet of the rack or count location

.....

TOTAL

of bikes that appear abandoned

Count bikes that are vandalized.

.....

TOTAL

Weather during your count:

.....

SUNNY, RAINY, WINDY?

TEMP



Sample Bicycles on Transit Count Form

Bicycles on Transit Count Form

Your Name:

Observer counting on transit vehicle - one observer per car or bus

 Date

DAY MONTH YEAR

Count
Period

:

AM
PM

:

AM
PM

START

END

 Pages _____ OF _____
PAGE TOTAL

 Transit Line _____ Car # _____ Direction _____
 (Lead car is "1", count back from lead car. Buses are "1")

USE MARKINGS:

- = Female
- ✕ = Male
- ⊕ = Unknown

Station or Transit Stop	# Boarding with Bike	# Alighting with Bike
Total:	MALE FEMALE UNKNOWN	MALE FEMALE UNKNOWN

Folding Bike:

Other:

	TOTAL
--	-------

	TOTAL
--	-------

Your Name:

Observer counting at transit station or stop

 Date

DAY MONTH YEAR

Count
Period

START : AM PM

END : AM PM

 Pages _____ OF _____
PAGE TOTAL

Stop or station _____ # of lines using stop _____

USE MARKINGS:

- = Female
- × = Male
- ⊕ = Unknown

[illegible]

Folding Bike:	Other:
TOTAL	TOTAL



Vendors for Count Technologies

Company Name	Product Name	Classification	Technology	Contact	Website	Description	Extent of data
Aanderaa	DATAREC 7 SIGNATURE	Vehicles, Bicycles	Inductive Loop	Post Box 34, Slatthaug 5851, Bergen, Norway Tel: +47 55 60 48 00 Fax : +47 55 60 48 01 Email: info@aadi.no	http://www.aadi.no	Inductive loop system for vehicles and bicycles with built-in web server to transmit data in real time.	Count data and direction only. No velocity
Chambers Electronics/Trail Counter	RadioBeam Bicycle-People Counter RBBP7, RadioBeam Bicycle Counter RBB7, RadioBeam Pedestrian Counter RBX7	Bicycles and Pedestrians, Bicycles, Pedestrians	Radio	A & P Chambers Ltd. Kaluna House, Nairnside, Inverness IV2 5BU, UK Tel: +44 (0) 1463 790400 E-mail: sales@chambers-electronics.com	www.chambers-electronics.com ; www.trailcounters.com	Beam-breaking system in which direction and classification is derived from pattern of broken beam and direction is from differential between two sensors. Different types of sensors are used in different scenarios simultaneously, such as: pedestrian, bicycle, horse, etc.	Count data and direction only. No velocity
Cognimatics	TrueView Bicycle Counter, TrueView People Counter	Bicycles, Pedestrians	Video Analysis Software	Australia Tel: +61 3 9458 4955 Fax: +61 3 9458 4966 Email: info@cognimatics.com	www.cognimatics.com	Video-based software tool to use overhead IP camera video to detect bicycle and pedestrian volumes. Software installs on embedded video camera and performs counts locally, reducing network bandwidth and allowing for real-time counts over the internet.	Count data and direction only. No velocity
Counters and Accessories Ltd.	CA Traffic Bicycle Recorder	Bicycles	Inductive Loop	CA Traffic Ltd Griffin Lane, Aylesbury, HP19 8BP, UK Tel: +44 (0) 1296 333 499 Fax: +44 (0) 1296 333 498 E-mail: sales@c-a.co.uk	www.ca-traffic.com		Count data and direction only. No velocity
Eco-Counter	PYRO Zoom	Pedestrians	Infrared	715-3981 Boul. Saint-Laurent, Montreal, QC, H2W 1Y5, Canada Tel: +1-514-849-9779	www.eco-compteur.com	Using differential infrared sensors, the Pyro is able to count and deduce direction of single passing pedestrians. It uses GSM communication to transmit data in 15 minute or hourly intervals for viewing on a web service (Eco-Visio).	Count data and direction only. No velocity
Eco-Counter	ZELT	Bicycles	Inductive Loop	715-3981 Boul. Saint-Laurent, Montreal, QC, H2W 1Y5, Canada Tel: +1-514-849-9779	www.eco-compteur.com	ZELT Selective: Calibrated for use on shared roads to discriminate large vehicles from interfering with cyclist counts. ZELT Greenways: Calibrated for use on cyclist-only paths. Easy ZELT: temporary counter installed on roadway surface.	Count data and direction only. No velocity
Eco-Counter	Eco-MULTI	Pedestrians and Bicycles, Other trail users	Infrared + Inductive Loops	715-3981 Boul. Saint-Laurent, Montreal, QC, H2W 1Y5, Canada Tel: +1-514-849-9779	www.eco-compteur.com	Uses a combination of technologies to differentiate between different trail user groups.	Count data and direction only. No velocity

Eco-Counter	Tubes	Bicycles	Pneumatic Tubes	715-3981 Boul. Saint-Laurent, Montreal, QC, H2W 1Y5, Canada Tel: +1-514-849-9779	www.eco-compteur.com	TUBES Selective: designed for use in mixed traffic, counts only bicycles. TUBES Greenways: designed for use on dedicated lanes or off-street paths.	Count data and direction only. No velocity.
Jamar Technologies Inc.	TDC Ultra	Vehicles, Bicycles, Pedestrians	Manual input	151 Keith Valley Road Horsham, PA, 19044 USA Phone: +1-215-491-4899 Email: paul@jamartech.com	www.jamartech.com	Manual key input for multi-lane intersections with user selectable keys for vehicle classification (including pedestrians and bicycles). Functional for roundabouts	Count data and direction only. No velocity
LASE	LD PeCo 3100 LASER	Pedestrians	Laser (Class 1 eye-safe)	LASE PeCo Systemtechnik GmbH Am Schornacker 59 D-46485 Wesel, Germany Tel: +49 281 - 9 59 90 - 0 Fax: +49 281 - 9 59 90 - 111 Email: peoplecounter@lase.de	www.peoplecounter.de	Double laser curtain which pedestrians pass through. Algorithms in place to deal with multiple people. Wide passageway up to 26m. RS-232 connectivity. Ethernet/GSM interface for realtime data collection also possible	Count data and direction only. No velocity
MetroCount	MetroCount MC5720 Advanced Bicycle Counter	Cyclists	Piezo-electric	P.O. Box 1182 Fremantle, W.A., 6959 Australia Tel: +61 8 9430 6164 Email: sales@metrocount.com	http://www.metrocount.com/	Two piezo-electric sensors are embedded in the pavement. Direction and speed can easily be determined	Count data, direction and velocity
Miovision	Scout	Pedestrians, Cyclists, Vehicles	Video Analysis	USA Tel: 1-877-646-8476	www.miovision.com	A camera is mounted above the study area and the video is analyzed to provide counts. Advertised as capable of intersection counts, ADT, roundabouts, gaps, OD, travel time, ALPR, Parking	Count data, direction
Reno A&E	Bicycle Detector C-1101-B, C-1201-B	Cyclists, vehicles	Inductive loop	4655 Aircenter Circle Reno, Nevada 89502 USA Tel: +1-775-826-2020	http://www.renoae.com/traffic/	Detector is connected to parallelogram-shaped inductive loops. Primarily used for signal actuation/phase time extension, but bicycle counts are also recorded.	Count data, no direction or velocity
Reveal	Computer Vision Technology	pedestrians	Video Analysis	P.O Box 5907, Willesey St, Auckland, New Zealand Tel: + 64 9 303 3190	http://www.reveal.co.nz/index.html	Overhead cameras feed images to a computer for processing. "Counting zones" are set in the frame, and pedestrians are registered when they pass through. Multiple zones can be set in each frame. Multiple cameras can be tied together to cover large areas. The company claims to be capable of handling variable lighting conditions, shadows, high volumes, and loitering.	Direction, count data, average time spent in counting zone
Sensource	Thermal Imaging IP People Counter PC-THI60-N-S	Pedestrians	Infrared	3890 Oakwood Ave. Youngstown, OH 44515 USA Tel: 1-800-239-1226	www.sensourceinc.com	Mounts above entryways to count people entering and exiting. Multiple counters can be networked to cover wide openings and various traffic patterns. Can be used outdoors. Data are transmitted wirelessly.	Count data, direction

Sensource	AccuTrac Series PC-VID3-2.5-N	Pedestrians	Video Analysis	3890 Oakwood Ave. Youngstown, OH 44515 USA Tel: 1-800-239-1226	www.sensourceinc.com	Uses stereo video tracking technology to count people as they enter and exit the count area. Can distinguish between adults, children, and other objects. Can monitor queues with added software.	Count data, direction, wait time.
Sensys Networks	MicroRadar	Cyclists, Vehicles	Magnetic (GMR)	1608 Fourth St., Suite 200 Berkeley, CA 94710 USA Tel: +1-510-548-4620 Fax: +1-510-548-8264 info@sensysnetworks.com	http://www.sensysnetworks.com/products/microradar/	Battery-powered device (10 year battery life) that is embedded in the road and detects objects using GMR sensors. It is able to detect bicycles and ignore vehicles due to their different magnetic intensities. It transmits information either over wired ethernet or wirelessly using wifi.	Count data
TDC Traffic Systems	HI-TRAC CMU	Cyclists, Pedestrians	Piezo-electric and pyro-electric	30 Lynx Crescent Weston Industrial Estate Weston-super-Mare North Somerset BS24 9BP UK Tel: +44 (0) 1934 644255	www.tdcsystems.co.uk	The system monitors up to 2 dedicated or mixed-traffic cycle lanes (with piezo-electric sensors) and 2 pedestrian lanes (with pyro-electric sensors). Both GSM and GPRS are supported for automatic transmission of count data.	Count data, direction, speed and gap/headway
TrafData	TurnCount	Vehicles, Cyclists, Pedestrians	Manual counts		http://www.trafdata.com/index.html	iPhone and tablet application that can be used to count traffic, primarily at intersections	Focused on intersection counts
TRAF-SYS	Thermal Sensor	Pedestrians	Infrared	190 Industry Drive Pittsburgh, PA 15275 USA Tel: 1-888-815-6568	www.trafsys.com	Thermal imaging technology. Multiple sensors can be networked together for wide areas, and detection patterns are customized to each location. Data from multiple counters can be transmitted to a TRAF-SYS data controller.	Count Data and Direction. No velocity
TRAFx	Infrared Trail Counter	"General trail traffic", i.e. pedestrians, cyclists, snowmobiles, horseback riders, etc.	Passive Infrared	TRAFx Research Ltd. 64 Riverstone Road, Canmore, Alberta T1W 1J5 Canada Tel: 1-403-678-1802 Email: info@trafx.net	www.trafx.net	Similar to the Pyro, a thermal infrared sensor is used to log counts. No receiver or reflector is necessary. Discreet set-up.	Count data only. No direction or velocity
TRAFx	Mountain Bike Counter	Bicycles	Magnetometer	TRAFx Research Ltd. 64 Riverstone Road, Canmore, Alberta T1W 1J5 Canada Tel: +1-403-678-1802 Email: info@trafx.net	www.trafx.net	The counter is buried below the surface of a narrow mountain bike trail or bike path (up to 6.5 feet wide), and counts bicycles as they pass.	Count data only. No direction or velocity
TrailMaster	TM1550	All trail traffic, including wildlife	Active Infrared	10614 Widmer Lenexa, KS 66215 USA	http://www.trailmaster.com/	A transmitter on one side of the trail sends an infrared beam to a receiver on the other side. Trail users are counted when they break the beam.	Count data, no direction or velocity.
Trans-Plan Inc	iCount Traffic app	Vehicles, Cyclists, Pedestrians	Manual counts	200-1920 Yonge Street, Toronto, ON M4S 3E2 Canada Tel: +1-647-931-7383	http://www.trans-plan.com/welcome.php	iPhone and tablet application that can be used to count traffic, primarily at intersections	Focused on intersection counts



Sample Outputs from Automatic Count Technologies

AUTOMATIC COUNTER DATA OUTPUTS

A number of vendors now offer automatic count technologies for bicycles and pedestrians. Most of these companies also offer accompanying software that can be used to download, interpret, and analyze the data. A few examples are provided in this appendix. These are not intended to be a comprehensive group of all automatic count software outputs available today, but simply as some examples that begin to show the capabilities of automatic count technologies.

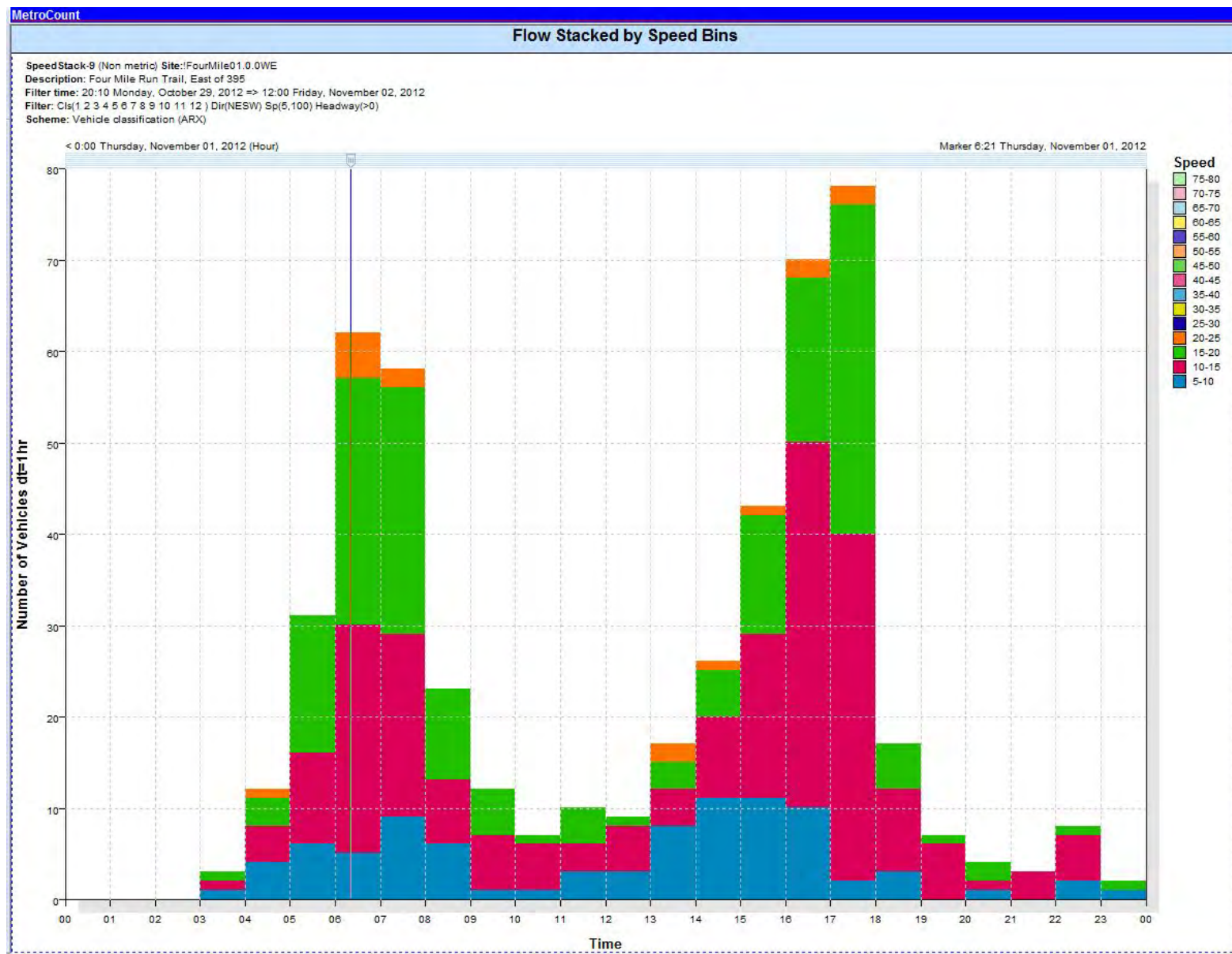


Figure 1: The bars on this chart from MetroCount show bicycle volumes over a single 24-hour period. The different colors in the bars show the speed of each bicycle as it crossed over the counting sensors, in 5 mph increments, with the blue representing 5-10mph and the orange at the top 20-25mph. The peak volumes occur during the morning and evening commute hours.

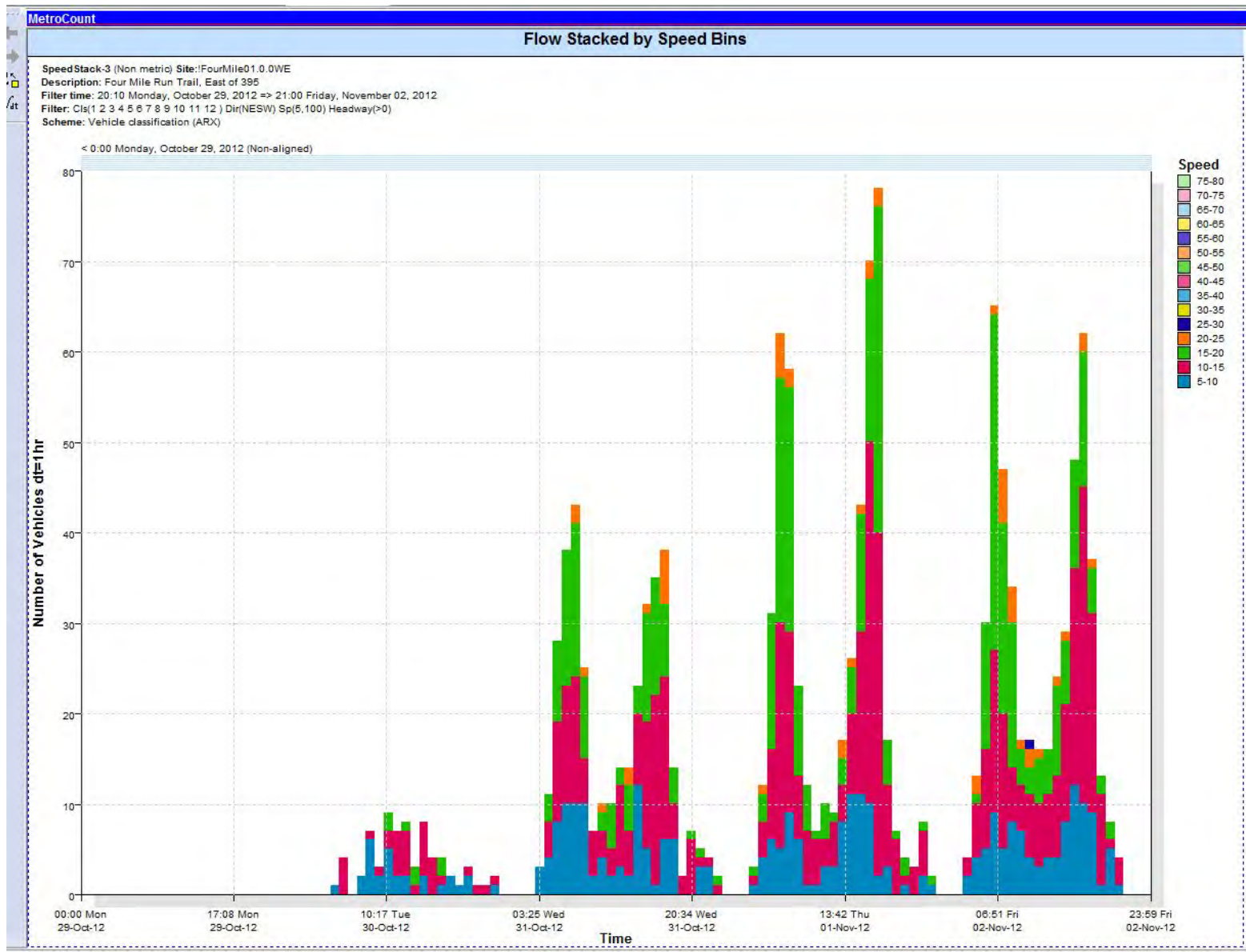


Figure 2: This chart, also from MetroCount, shows the same information over a four-day time period, Tuesday through Friday. MetroCount's software enables users to input the raw data from the counter and then customize the data display by volumes, time of day, length of time period, speed, direction, time gaps between cyclists, and others.

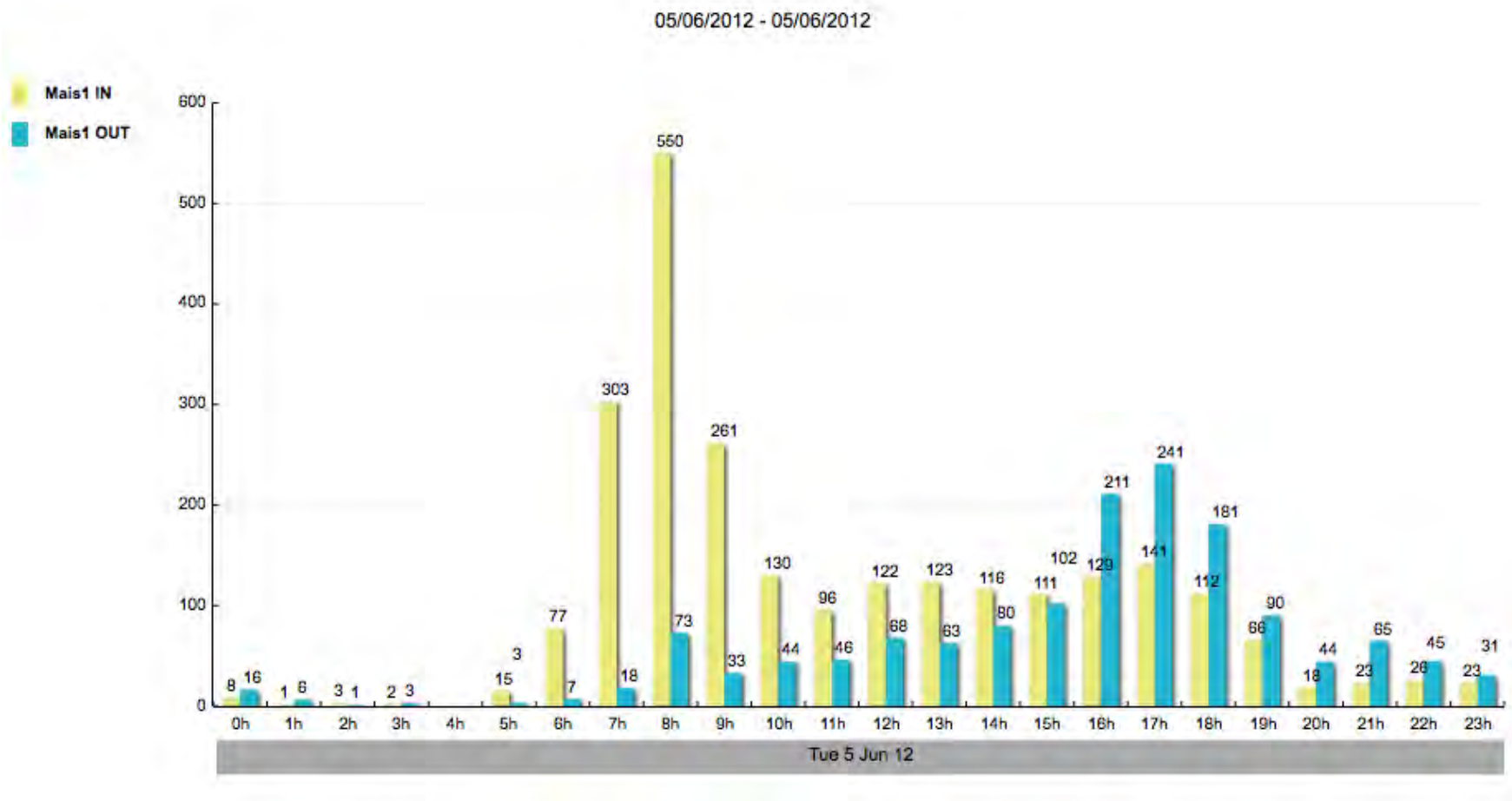


Figure 3: This chart from Eco-Counter shows bi-directional bicycle volumes over a 24-hour time period. The yellow bars represent an inbound direction and the blue are outbound from the city center.

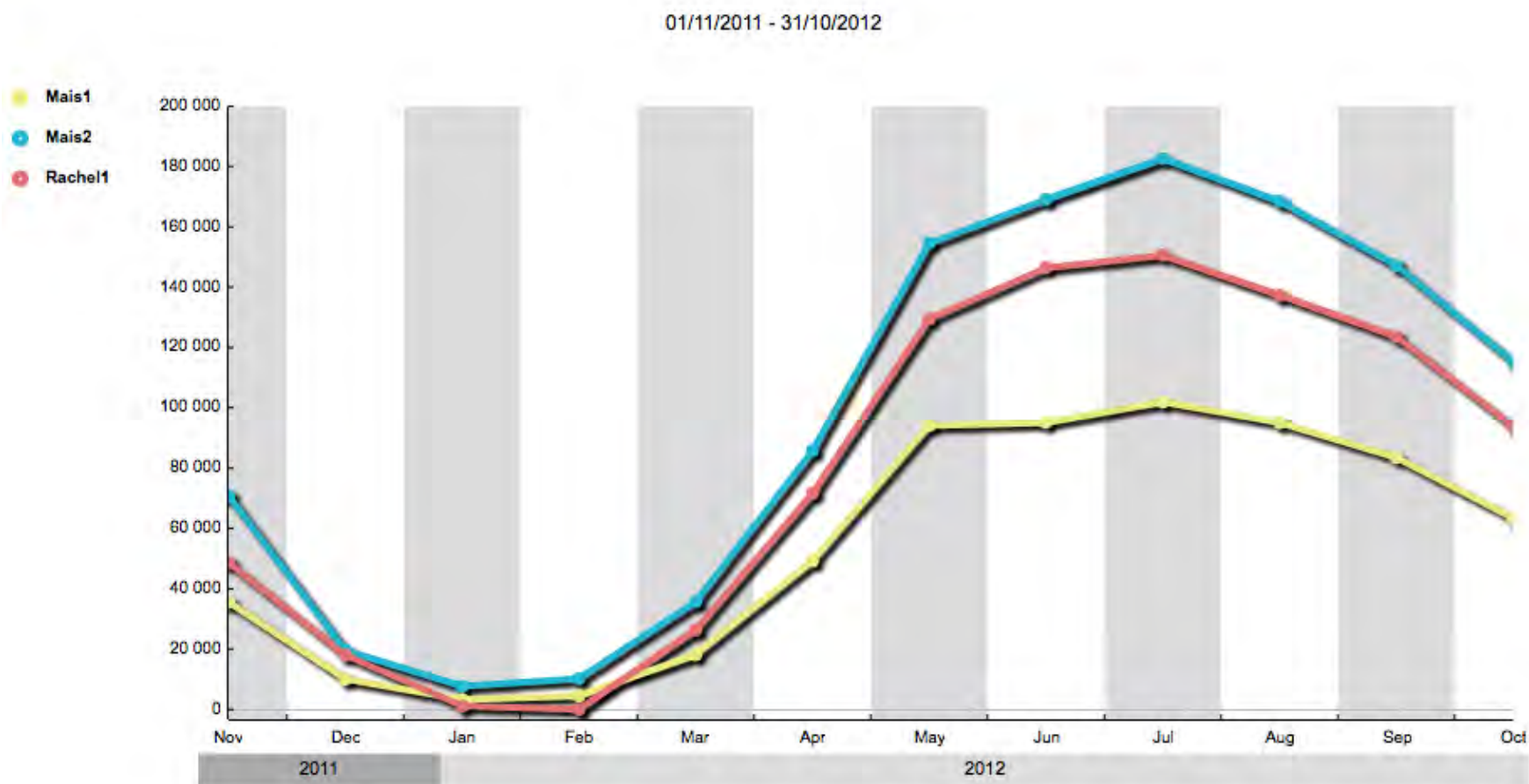


Figure 4: This chart from Eco-Counter compares volumes on three different bicycle routes across a year-long period. It shows a clear peak in the summer months of June, July, and August.

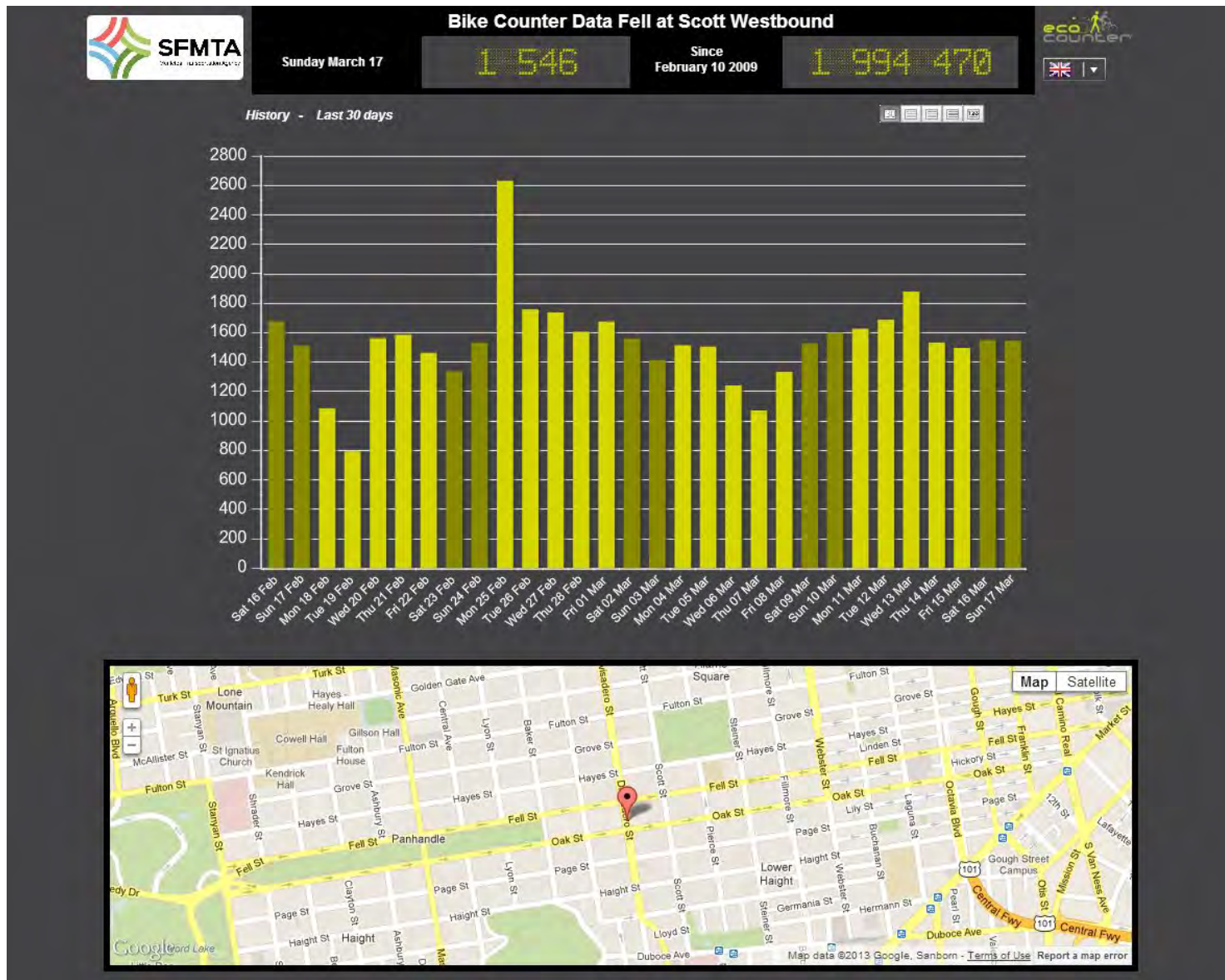


Figure 5: The San Francisco Municipal Transportation Agency has live bicycle count data continuously on display online from Eco-Counter automatic counters that are installed in the city. The chart shows the daily bicycle volumes over a month-long period, and numbers at the top of the screen show the daily count as well as the total cumulative count since February 2009.

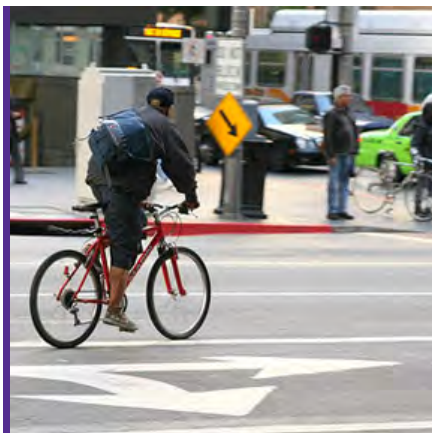


Presentation and Handout
for Count Volunteers



LOS ANGELES COUNTY
BICYCLE
COALITION

WWW.LA-BIKE.ORG



Bicycle and Pedestrian Count Training Template

Prepared by the Los Angeles County Bicycle
Coalition and Ryan Snyder Associates
March 2013



What to Bring



Bicycle and Pedestrian Count
Training Template

- Instructions
- Location map
- Count forms
- Clipboard
- Pen or pencil and spares
- Watch or timer so you can record 15-minute intervals
- Hat, sunscreen, folding chair, snacks, water
- Contact number for questions: _____



At the Intersection



Bicycle and Pedestrian Count
Training Template



It is best to arrive at the site 15 minutes before the count period so you can park, lock your bike, get situated, etc..

Once you've arrived:

- Find a safe location to conduct the count.
 - Consider the location that provides you with the best view of the people you'll be counting
 - Reference the supervisor form to determine where to situate yourself. If you need to choose a different location, you'll need to tell the supervisor you did so.
 - *Use safety as your primary guide.*



At the Intersection



Bicycle and Pedestrian Count Training Template

It is best to arrive at the site 15 minutes before the count period so you can park, lock your bike, get situated, etc..

Once you have arrived:

- Complete the top of each of your count forms
- If necessary, fill in the name of any “Other” variables on the right side of the forms
- Make note of any unusual conditions like road construction, crashes, etc.

Make additional marks to count other characteristics

Female TOTAL

Sidewalk Riding TOTAL

Wrong Way Riding TOTAL

Other: TOTAL

Other: TOTAL

Make additional marks to count other characteristics

Wheelchair/Special Needs TOTAL

Skateboard/Scooter TOTAL

Child TOTAL

Other: TOTAL

Other: TOTAL

Bicycle/Pedestrian Data Collection - Count Form

Date: MM/DD/YYYY

Location: STREET AND

This Page: FROM TO

Count Period: START END

Pages: PAGE OF TOTAL



How to Count:

Completing the Count Form

- Count in 15 minute intervals.
 - Use one page for each 15 minute interval.
 - You will have completed 8 pages at the end of your 2 hour shift.
 - Please start your count and end your count promptly at the top of the hour.



Bicycle and Pedestrian Count
Training Template





How to Count:

Completing the Count Form

- Count bicyclists and pedestrians as they approach the intersection.
- Use simple hash-marks in groups of five.
- Count the cyclists and pedestrians in the box that corresponds to the direction they were traveling.

The diagram illustrates the layout of the count form for bicyclists and pedestrians. It is divided into two main sections: **Bicyclists** and **Pedestrians**. Each section features a vertical dashed line representing an imaginary counting line. To the left of the line, there is a box for 'Bikes - Right to Left' and 'Pedestrians - Right to Left'. To the right of the line, there is a box for 'Bikes - Left to Right' and 'Pedestrians - Left to Right'. Each box has a 'TOTAL' field at the bottom right. Arrows indicate the direction of travel for the subjects being counted. The form is designed to be used with hash-marks to record counts.



How to Count:

Completing the Count Form



Bicycle and Pedestrian Count
Training Template

- Pretend there is an imaginary line, and count each bicyclist or pedestrian who crosses it
 - It does not matter where on the street or sidewalk a bicyclist or pedestrian crosses the line
 - Transit riders who bike or walk across the line on their way to or from a bus or station are counted as usual.



How to Count:

Completing the Count Form



Bicycle and Pedestrian Count
Training Template

- Anyone who you perceive to be under 12 is counted as a child.
- Determine if a bicyclist is “wrong way riding” or “sidewalk riding” based on what they are doing when they cross the screenline.
- Count anyone on a wheelchair or electric scooter as “wheelchair/special needs.”
- Anyone traveling on foot is counted as a pedestrian.
 - If the person is using a wheelchair or motorized chair/cart, mark them as a pedestrian and also mark the wheelchair/special needs box.
 - Count joggers as pedestrians.
 - Count people on roller skates as “skateboard/scooter”



How to Count:

Completing the Count Form



Bicycle and Pedestrian Count
Training Template

- Count the number of people on bikes.
 - Two people riding a tandem bike? Count as 2 bicyclists.
- Mark bicyclists by direction, not by the side of the street they're on.
 - A bicyclist traveling west (either “right to left” or “left to right” depending on how the counter is oriented) against the flow of traffic is still marked as traveling west.



How to Count:

Completing the Count Form



Bicycle and Pedestrian Count
Training Template

■ Count the People: Examples of Special Circumstances

- Two people on a bike (one on the handlebars) – count as 2 bicyclists
- Person walking while carrying an infant – count as 2 pedestrians
- Person walking with two infants in a stroller – count as 3 pedestrians
- Person on a unicycle – count as 1 bicyclist
- Person on a segway – count as 1 pedestrian



How to Count:

Completing the Count Form



Bicycle and Pedestrian Count
Training Template

- Multiple pass situation.
 - A multiple pass is when someone walks (or rides) through your intersection, then time goes by (say 5 or 10 minutes) and then they come through again.
 - In this case, you count them again.
 - If time goes by and they walk (or ride) by a third time, count them again.
 - If you see the same person 3 or more times, please notate that.





How to Count:

Completing the Count Form



Bicycle and Pedestrian Count
Training Template

■ Be Accurate

- Remember that the goal is to be accurate, not to turn in high numbers.
- Your numbers may be low at your location. That's okay.



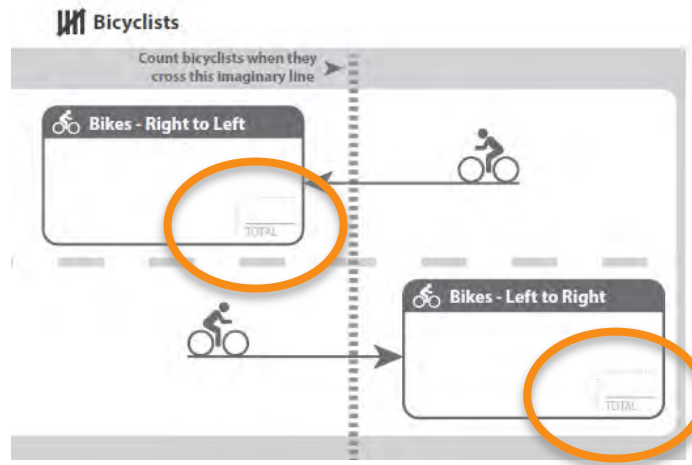
How to Count:

Tallys



Bicycle and Pedestrian Count
Training Template

- Once your count period is finished, enter totals for each period into the “totals” boxes.





End of Count



Bicycle and Pedestrian Count
Training Template

When you have completed all of your count shifts, please return **all of your count forms**:

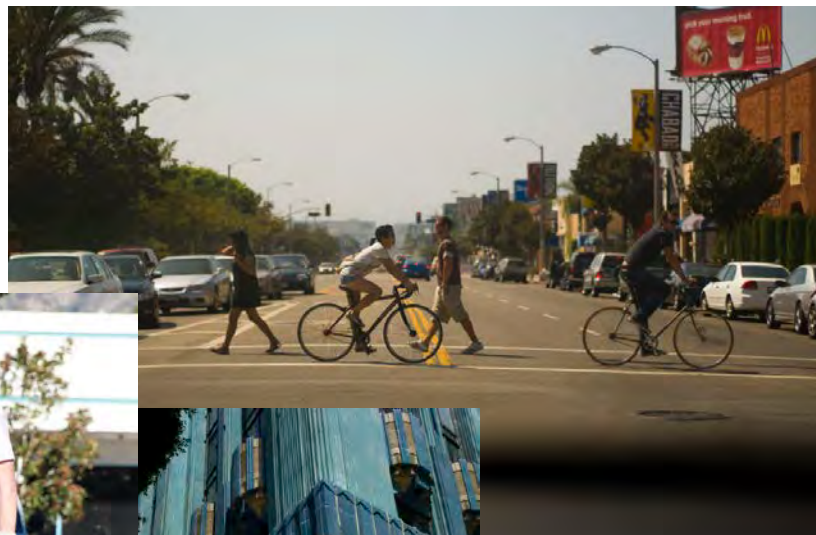
- Drop off your forms at [place] during [time interval]
- If you are unable to drop off your count forms off at one of the above locations please either fax them to [name and number] or scan and email them to **[email address]** or mail them to [physical address]

Thank You for Participating!

+ Who to Count



Bicycle and Pedestrian Count Training Template



+ Acknowledgements



Bicycle and Pedestrian Count
Training Template

- Many thanks and much credit to Alta Planning+Design and the National Bicycle and Pedestrian Documentation Project (NBPD). The NBPD inspired many to conduct bicycle and pedestrian counts.
- The counts training presentation at <http://bikepeddocumentation.org/downloads> inspired early drafts of this presentation, which has been edited by several people over the years.

Standard Definitions for Behavioral and Demographic Variables

APPENDIX I

This appendix provides consistent definitions for behavioral and demographic variables that are commonly included in manual bicycle counts. The intention is to ensure that the data produced by separate count efforts are comparable, which is important because the SCAG bicycle data clearinghouse website will facilitate data comparisons.

Bicycle Count Variables Included in SCAG Database

Because of database limitations, only a select number of behavioral and demographic variables have a standard field in the SCAG database. These and their definitions are listed below. When counting these variables, the definitions below should be incorporated into counter training material and consultant instructions, as applicable.

Female: When a bicyclist crosses the screenline who you perceive to be female, make a mark in the “Female” box.

Sidewalk riding: When a bicyclist crosses the screenline while riding on the sidewalk, make a mark in the “Sidewalk Riding” box. Determination of whether or not a bicyclist is riding on the sidewalk is done at the screenline. A bicyclist riding on the sidewalk at the point of the screenline who later merges into the street is marked as sidewalk riding. Conversely, a bicyclist riding on the sidewalk who merges onto the street before crossing the screenline is not marked as sidewalk riding.

Wrong way riding: When a bicyclist riding in the street is traveling against the direction of traffic, make a mark in the “Wrong Way Riding” box. As with sidewalk riding, determination of whether a bicyclist is riding the wrong way is done at the screenline. Please note that there is no wrong way to ride on the sidewalk. Please note that bicyclists can travel against the direction of traffic in a mixed-flow lane or a bike lane; either way, this would be marked as wrong way riding.

Child Bicyclist

Due to practical constraints, “child” is not a standard field in the SCAG Database. Since many agencies may be interested in counting children, it is beneficial to have a standard definition for all counts taking place in the SCAG region. The recommended definition is below.

Child: When a bicyclist crosses the screenline who you perceive to be under the age of 12, make a mark in the “Child” box.

Pedestrian Variables Included on the Screenline Form in Appendix B

Wheelchair/Special Needs: When someone crosses the screenline in a wheelchair or an electric cart, make a mark in the “Wheelchair/Special Needs” box.

Skateboard/Scooter/Skates: When someone crosses the screenline on a skateboard, a scooter, or roller skates, make a mark in the “Skateboard/Scooter/Skates” box. When someone crosses the screenline on a unicycle or any other wheeled device aside from a wheelchair or electric cart, make a mark in this box.

Child: When a pedestrian crosses the screenline who you perceive to be under the age of 12, make a mark in the “Child” box.