December 2017

Safe Streets Evaluation Handbook

SFMTA
Municipal Transportation Agency

Safe Streets
Evaluation Handbook

The San Francisco Municipal Transportation Agency (SFMTA) is committed to understanding and reporting on how projects affect neighborhoods and work toward achieving City and agency goals through the Safe Streets Evaluation Program.

This handbook is a step-by-step guide for SFMTA project managers to complete evaluations of projects that are being implemented. While the Handbook's primary intended users are SFMTA staff and project consultants, the guidance presented can benefit other City agencies and agency partners.

This handbook is available digitally with supplemental electronic files. The handbook was funded in part with a Prop K grant, and created in association with Kittelson & Associates, Inc.

Contents

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Why Evaluate?

The San Francisco Municipal Transportation Agency (SFMTA) is working towards achieving Vision Zero, an initiative to prioritize street safety and eliminate traffic deaths in San Francisco by 2024. To meet this goal, the City needs to track progress and measure project performance. Specifically, Safe Streets evaluations seek to accomplish the following:

Inform opportunities to refine a project's design.
By collecting location-specific data related to transportation behaviors, project design elements are analyzed for their effectiveness and areas are targeted for refinement.

Communicate the effects of a project to the public, decision makers and other transportation professionals.
Evaluation results are shared with members of the public so they may understand the impact of the SFMTA's work on their experience of the city, or with decision makers who want to understand the effects of safety-related infrastructure investments.

Support the use of design treatments at other locations.
Also referred to as "proof-of-concept," project evaluations are often used to analyze innovative design treatments that are new to San Francisco. The data associated with proof-of-concept project evaluations are used to demonstrate the applicability of national or international best practices to the local context.

Streamline the design of future projects that incorporate similar elements.
Project evaluations use consistent metrics and analysis techniques to allow for tracking trends over time.

Evaluation Process

Depending on the scale and importance,evaluation may or may not be needed for a project. If it is determined that a formal evaluation is required, a standard Safe Streets evaluation process is described in this section.

Step 1: Create Evaluation Plan

The first step in the evaluation process is create an Evaluation Plan. The Evaluation Plan includes evaluation goals and objectives, desired metrics, pre- and post data collection plans, and summarized key findings. These components are described below.

Develop Goals and Objectives

Evaluation goals and objectives should define the specific questions or issues where data are needed to show the project's goals are being met. The goals will inform several key elements of the evaluation process, including the metrics used and method of communicating findings. Generally, the following topic areas/questions should be considered when identifying project goals:

Safe Behavior – Are people behaving safely as travel through the project area?
Effective Design – Are the new design treatments effective in directing transportation behaviors?
Mobility/Ease of Navigation – How have mobility trends changed and are all street users able to travel easily through the project area?
Perceived Safety and Comfort – Do people feel safer when traveling through the project area?

Identify Evaluation Metrics

A Safe Streets Evaluation Toolbox (shown on following page) has been generated to provide guidance on identifying available metrics and how they can be used to meet a project's evaluation objectives. For many of the metrics, specific templates and standard operating procedures (SOPs) have been developed to ensure consistent data collection even when observing qualitative metrics such as yielding and conflict behavior or "close calls". These SOPs/templates are included in the "Data Collection Guidelines" section of the handbook.

Safe Streets Evaluation Toolbox

Metric/Tool	Description
Transportation Context (for use in all project evaluations)	
Bicyclist Volumes**	This metric analyzes bicyclist volumes for one or more peak periods.
Average Daily Traffic (ADT)**	This metric analyzes vehicular volumes for a 24-hour or 48-hour period.
Vehicle Speeds**	This metric analyzes average and 85th percentile vehicle speeds.
Transit Speed and Reliability**	This metric analyzes transit travel time savings or losses.
Changes in Transportation Behaviors (as needed based on evaluation objectives)	
Bicyclist Positioning*	This metric analyzes the location of bicyclists within the street cross section (i.e., within a bike facility, in a vehicle lane, or on the sidewalk).
Vehicle Blockage of Bike Lanes*	This metric analyzes whether stopped vehicles obstruct the bike lane for parking, pickup/dropoff, or commercial loading/unloading activities.
Vehicle Loading	This metric analyzes passenger and/or commercial loading/unloading activities for compliance and duration.
Vehicle Diversion *	This metric analyzes whether motorists use alternate routes after project implementation.
Driver Yielding to Pedestrians at Crosswalks*	This metric analyzes whether motorists yield to pedestrians at midblock crosswalks and at intersections when making a right turn.
Bicyclist Compliance at Intersections	This metric analyzes whether bicyclist comply with traffic signals and stop signs.
Close Calls*	This metric documents the number of observed close calls between motorists, bicyclists, and/or pedestrians.
Transit Operator Feedback	This tool uses direct feedback from transit operators on changes to transit.
Proof of Concept Analysis (as needed based on design elements and evaluation objectives)	
Bicyclist Speeds	This metric uses bicyclist speeds to understand the potential for bicyclists to reach to other street users.
Driver Yielding to Bicyclists at Mixing Zones*	This metric analyzes whether motorists yield to bicyclists at a mixing zone when merging to enter the right turn lane.
Bicyclist Path of Travel for Two-Stage Turn Boxes	This metric analyzes whether bicyclists use two-stage turn boxes to complete left turns.
Vehicle Approach Angle,Turning Path and Speed	This metric analyzes motorists turning approach angle, distance from the curb or painted line, and turning speed.
Public Perception (for use in all project evaluations)	
Public Opinion Surveys*	This tool uses surveys to analyze the perceptions of transportation users including pedestrians, bicyclists, motorists, and transit users.
Special Case Metrics (for longer-term analyses)	
Collision Rates**	This metric analyzes reported collisions before and after implementation, with a minimum of one year of post-implementation data.
Economic Benefit Analysis	This tool addresses changes in business activity before and after implementation, with a minimum of one year of post-implementation data.
Demographic and Equity Analysis	This tool addresses demographic conditions associated with the surrounding neighborhood and/or those using the implemented improvements.

Source: Kittelson & Associates, Inc. 2017

***Best practice data collection guidelines and reduction forms currently exist and are used widely by the SFMTA and other transportation agencies*

**Data collection guidelines, templates and reduction forms are available in this Handbook.*

Fill out Evaluation Plan Matrix

The Safe Streets Evaluation Program has developed an excel template Evaluation Plan Matrix for all Safe Street projects that serves as the Evaluation Plan deliverable. The Plan Matrix includes written documentation of the evaluation goals and objectives, desired metrics and tools, pre- and post-data collection activities, and key findings. The Evaluation Plan Matrix is intended to be record of evaluation work for a project through time with the ability to be easily understood by staff or consultants, as many projects take years to complete and often are managed by multiple staff members.

A sample Evaluation Plan Matrix is shown below and the excel document template for the matrix is located with the digital version of this Handbook.

Evaluation Plan Matrix (Sample)

Project Name	Polk Street Streetscape Project
Project Manager	Leng, Thalia

Project Scope	Streetscape project including bicycle facilities north and sound bound on Polk Street, pedestrian safety upgrades at all intersections, signal improvements, transit stop changes, and public realm improvements.
Project Limits	Polk Street, from McAllister Street to Union Street
Project Timeline	Construction start: Fall 2017, Construction complete: Spring 2019

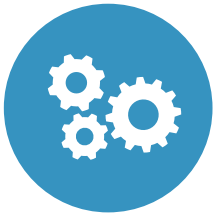
Intended Outcome		Metrics	Evaluation Tools	Data Collection Time Periods	Data Collection Timeframe		Resources
Goal	Objective/Question				Pre-Project	Post-Project	
Mobility	Has the number of cyclists increased?	Bike Volumes on Lower Polk Street	Video data collection with manual reduction	Weekday AM/ PM Peak Hours (8:00-10:00 AM; 4:00-6:00 PM)	2 months prior	6 months after	Contractor
Effective Design	Are the new merge zones effective at reducing conflict?	Right Hook Bike Conflicts at Polk Street/ Ellis Street	Manual data collection and reduction	Weekday AM/ PM Peak Hours (8:00-10:00 AM; 4:00-6:00 PM)	2 months prior	6 months after	Staff
Safe Behavior	Are vehicles traveling at safer speeds?	Vehicle Speeds	Pneumatic tubes with manual reduction	Weekday; 48 hrs.	2 months prior	6 months after	Contractor
Perceived Safety	Do people feel safer?	User Survey	Online survey with promotion in the field	Four 2-hr. promotion periods; survey online 2 weeks	2 months prior	6 months after	Contractor

Step 2: Collect Data

The Evaluation Plan outlines the different aspects of data collection, such as specific data collection time periods, collection timeframes (pre- and post-project), and whether staff or contractors are responsible for obtaining the data.

In general, contractors should be used to both collect and reduce data after given a clear Evaluation Plan Matrix with any supplemental instructions, as well as data collection guidelines for the different metrics (i.e. bike position or vehicle blockage of bike lanes).

Ideally, pre-project data should be collected approximately two months and no more than a year prior to project implementation. Post-project data should be collected at least three months after project completion.



Step 3: Perform Analysis

After all necessary data is collected and entered into the Matrix, the results can be analyzed and key findings should be recorded in last column of the Evaluation Plan Matrix or a separate Summary Matrix (templates are provided in the digital version of this Handbook). Key findings should highlight the majority behavior or outcome and not outliers. Key findings should also highlight changes in conditions before and after implementation.

Step 4: Report Back

Based on the goals and scale of an evaluation, different formats may be necessary to communicate key findings to managers, the public, or elected officials. The digital version of this Handbook provides templates for the three types of communication listed below.

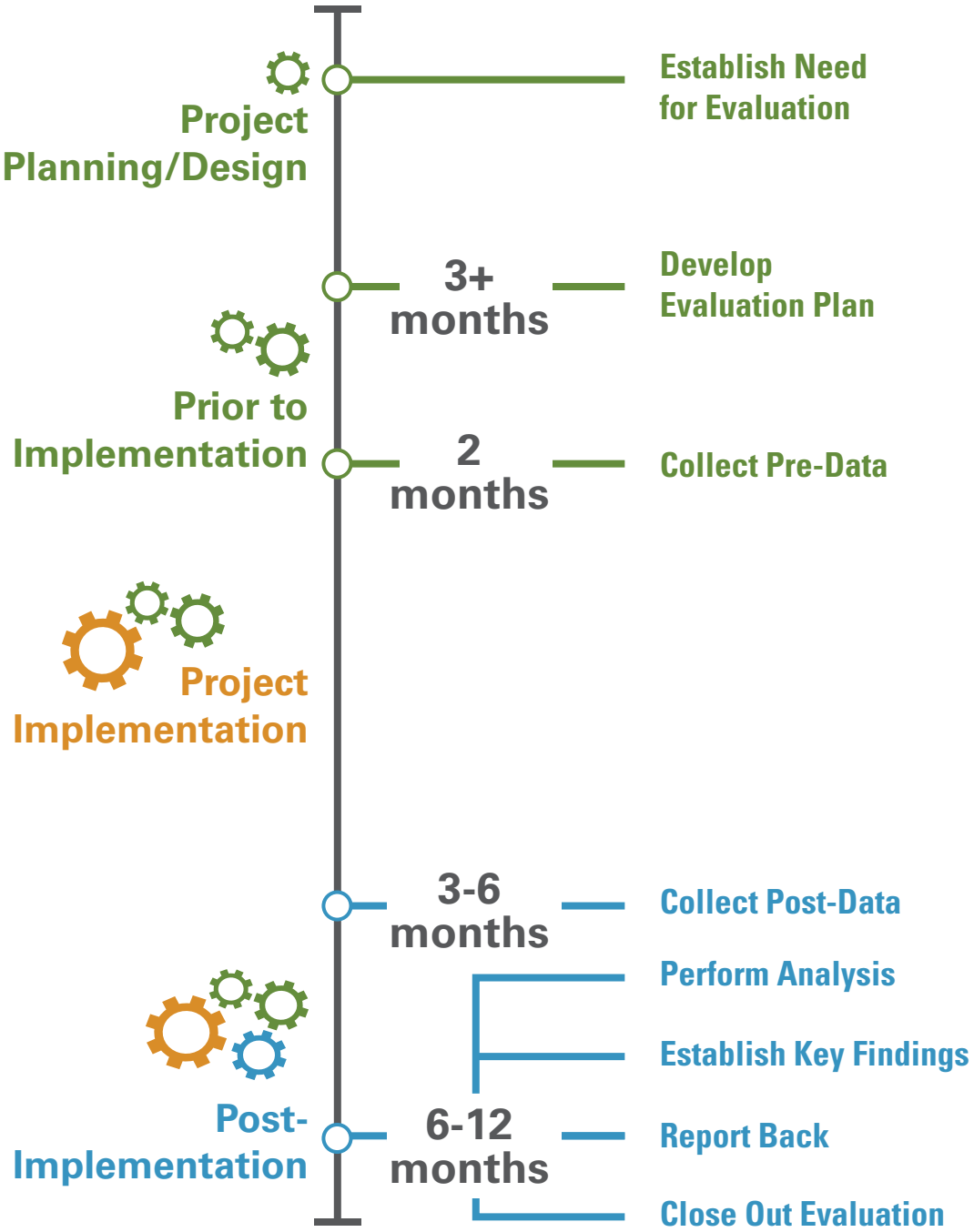
Blog post – A blog post is an effective online communications tool for quickly sharing the key findings of a project evaluation with the public.

Fact sheet – A fact sheet is a printable handout that provides an overview of the project and a high-level summary of key findings from the evaluation.

Evaluation Summary Report – An evaluation summary report is a longer-format document that presents the analysis results for each metric with supporting tables and charts.

Evaluation Timeline

Below is the recommended timeline for evaluation activities once the need for a project evaluation is established. Evaluation activities conclude at project closeout once the analysis is complete and the findings are communicated to others.



Source: Kittelson & Associates, Inc. 2017

Data Collection Guidelines

To ensure evaluations are performed with a uniform approach across projects, the Handbook includes data collection guidelines, or standard operating procedures (SOPs) for several of the most commonly used metrics in the Evaluation Toolkit. These SOPs will be key to seeking consistent data collection from SFMTA staff as well as from contractors who record, observe and report back data to the SFMTA.

Each SOP has the following components:

Standard operating procedure (SOP) summary – a document outlining procedures for data collection and evaluation.

Data collection form – an Excel sheet for use by data collection firms or SFMTA staff in collecting raw data.

Data reduction form – an Excel sheet for use by data collection firms or SFMTA staff in providing data results.

Data analysis form – an Excel form for use by SFMTA project managers in analyzing and summarizing data for project evaluations.

Currently, the Handbook includes SOPs for the following metrics:

- **Bicyclist Positioning**
- **Vehicle Blockage of Bike Lanes**
- **Vehicle Diversion (Travel Time Runs and Digital Data)**
- **Driver Yielding Behavior at Crosswalks and Mixing Zones**
- **Qualitative Observation of Close Calls**
- **Public Opinion Surveys**

The SOP summaries developed to date for these metrics are included in the following pages. Data collection, reduction and analysis forms are included in the digital version of the Handbook within the "SOP Excel Workbook".

Future SOPs will be included in the digital version of the Handbook. As new SOPs are developed for specific metrics (i.e. observations at Rectangular Rapid Flashing Beacon crossings), a summary will be created in correlation with data collection, reduction, and analysis worksheets.

Bicyclist Positioning – SOP Summary

Related Project Objective

Safer bicycling environment

SOP last updated July 25, 2017.

Bicyclist positioning refers to the location of a bicyclist within the cross section of the street (i.e., within a bike facility, in a vehicle lane, on the sidewalk, etc.).

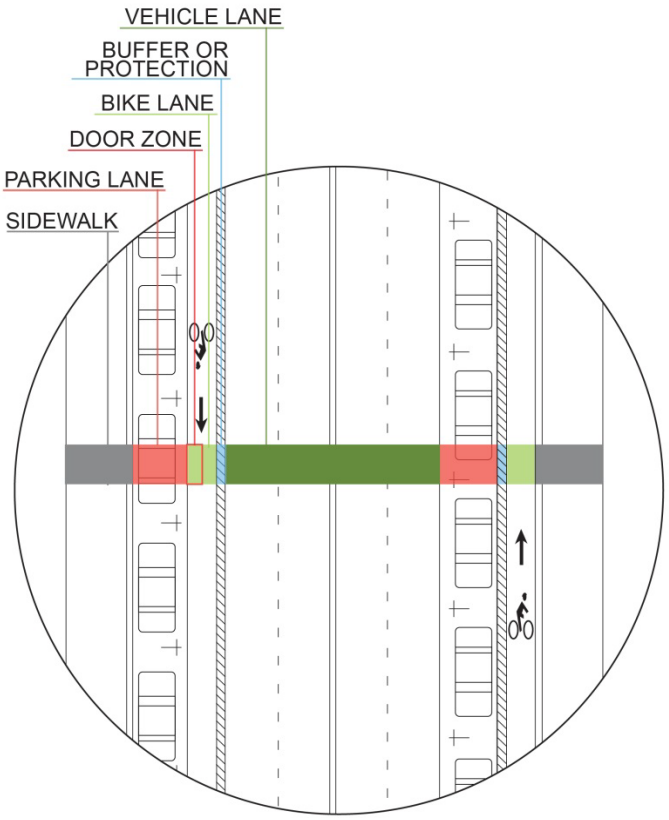
The SOP for bicyclist positioning standardizes where along a block the positioning data are collected, accounting for the type of bicycle facility and the presence of transitions between facility types.

Data Collection Procedures

Location

- Bicyclist positioning data are collected across a screen line located midblock, as shown in Figure 1.
- Data should be recorded by zone or area within the street:
  - On the sidewalk
  - Within the bike lane and within the door zone (The door zone is within 2'-3' of the edge of parked vehicles. The width of the door zone within the bike lane will vary based on the width of the adjacent parking stall.)
  - Within the bike lane and outside the door zone
  - Within the vehicle travel lane
- For each zone, wrong-way travel should be recorded (e.g., a bicyclist traveling northbound in the southbound lane).
- The data collection line should be drawn within the area of interest for evaluation. For example, if the evaluation is assessing the use of bike boxes, then the data collection line should be at the intersection approach.
- Separate data collection lines may be appropriate for each direction of travel.
- The data collection line should be located away from bike facility transition points (e.g., at the transition from a protected bike lane to a shared lane) unless the project evaluation specifically addresses bicyclists' behavior at these locations.

Figure 1: Example Data Collection Screen Line



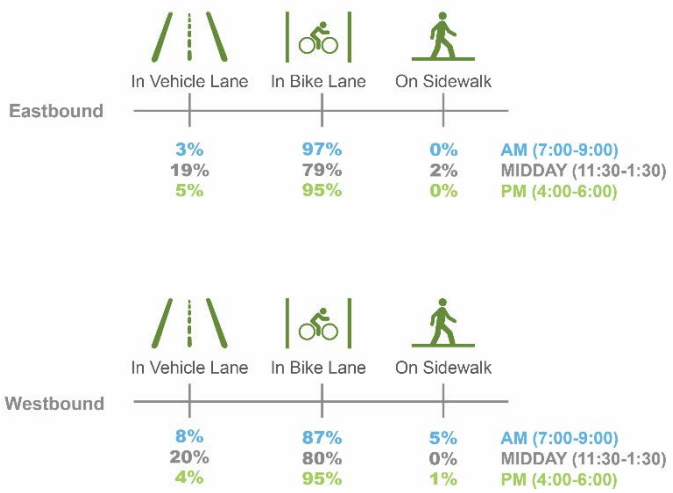
Time Period

- Bicyclist positioning data should be collected for a period of at least two hours.
- The time of day and day of the week should be selected based on bicyclists' existing and anticipated future travel patterns. Consider when volumes are highest and when special user groups (e.g., commuters, tourists or students) are likely present. Typical weekday AM/PM peak periods for bicyclists are 8:00-10:00 AM and 5:00-7:00 PM.

Data Evaluation Procedures

- If data are collected for multiple periods (e.g., AM and PM peak periods), the default practice is to aggregate the data for all periods before performing analysis.
- Bicyclist positioning data should be analyzed and reported as percentages by location for each data collection screen line, as shown in Figure 2.

Figure 2: Data Summary Example



Tools and Templates

- Video data collection is preferred for bicyclist positioning data as it allows for more detailed review of bicyclists' behaviors, as needed.
- Manual field observation is acceptable if video data collection is not possible. A field data collection sheet template is included in the SOP Excel workbook. Data should be recorded by period, day of week, and direction of travel.
- The SOP Excel workbook includes a data summary template. The data collection team would use this template to summarize the observations made either in the field or by reducing video footage.
- The SOP Excel workbook includes a data analysis template.

Clarifications for Data Collection Team

- Provide an exhibit showing the data collection line(s) marked clearly, such as in Figure 1. This will ensure the data collection team orients video recording equipment and/or people correctly.
- The Handbook digital files include an example KMZ file for indicating to the data collection team where to collect bicyclist positioning data.

Resources

Vehicle Blockage of Bike Lane – SOP Summary

Related Project Objectives

Safer bicycling environment

SOP last updated June 2017.

Vehicle blockage of a bike lane refers to stopped or parked vehicles obstructing a bike lane and preventing use of the lane by cyclists. Blockage can occur for a short duration for passenger pickup and dropoff, or for a longer duration when a driver parks and leaves the vehicle.

The SOP for vehicle blockage standardizes where data is collected and how blockage events are recorded. This SOP and the diagram included may be adapted to observe double parking in vehicle travel lanes.

Data Collection Procedures

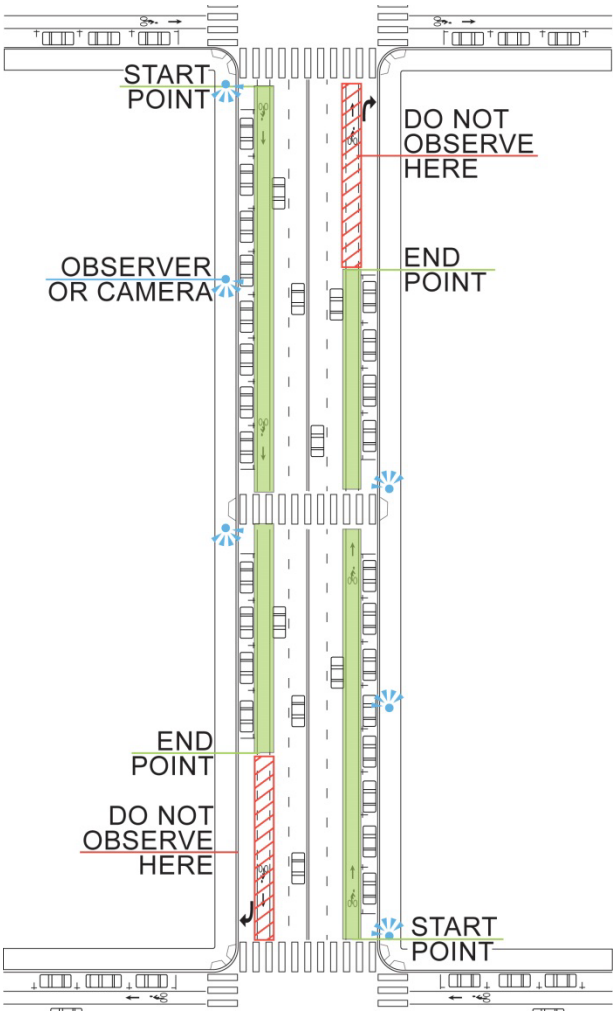
Location

- Vehicle blockage data are collected along a continuous segment of a block, as shown in Figure 1.
- In most cases, the full length of the bike lane along a block should be observed.
- Mixing zones (where a bike lane temporarily converges with a right-turn lane) should be excluded from the observation area.

Time Period

- Vehicle blockage data should be collected for a period of at least two hours.
- The time of day and day of the week should be selected based on bicyclists' existing and anticipated future travel patterns. Consider when volumes are highest and when special user groups (e.g., commuters, tourists, or students) are likely present. Typical weekday AM/PM peak periods for bicyclists are 8:00-10:00 AM and 5:00-7:00 PM.

Figure 1: Observation Area



Definition of Blockage Events

- Blockage events to be counted include:
  - Personal vehicle, taxi or transportation network company vehicle (TNC) stopped or parked in the bike lane to drop off or pick up passengers
  - Personal vehicle or delivery truck parked in the bike lane while the driver is away from the vehicle
- Blockage events not to be counted include:
  - Bus partially obstructing the bike lane while at a transit stop
  - Bus fully obstructing the bike lane at a transit stop because the stop is blocked

Data Evaluation Procedures

- Vehicle blockage data should be analyzed and reported for a given block by 1) frequency for a given time period; 2) duration of the blockage; and 3) vehicle type. Examples of data evaluation are shown in Figure 3, Table 1, and Table 2.

Tools and Templates

- Video data collection is preferred as it allows for more detailed review of drivers' behaviors, as needed. If data are being collected along both sides of the street, two cameras are recommended – one placed on each side of the street.
- Manual field observation is acceptable if video data collection is not possible. A field data collection sheet template is included in the SOP Excel workbook. Data should be recorded by period, day of week, and direction of travel.
- The SOP Excel workbook includes a data summary template. The data collection team would use this template to summarize the observations made either in the field or by reducing video footage.

Figure 2: Example Vehicle Blockage Summary

- The SOP Excel workbook includes a data analysis template.

Table 1: Example Vehicle Blockage Duration Summary

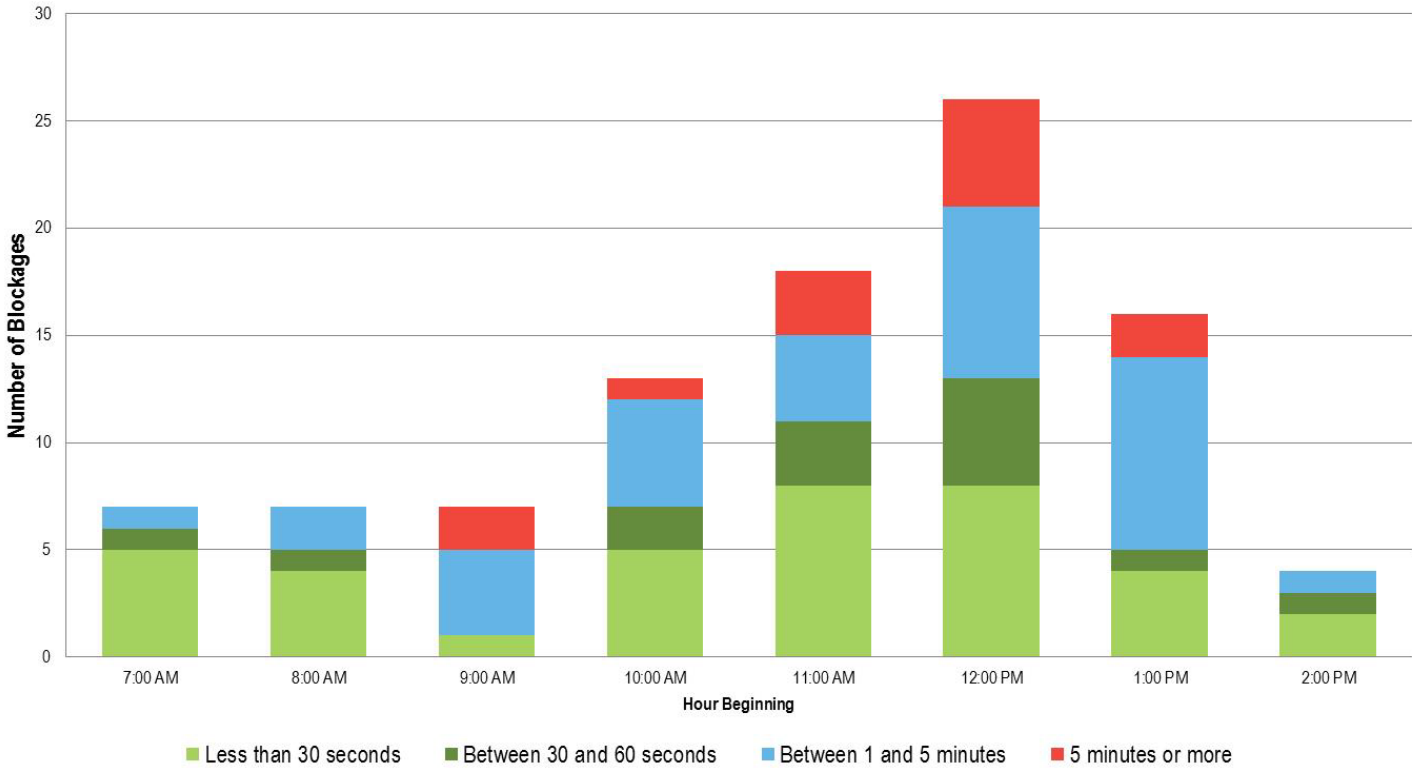
Average Length (seconds)	< 30 seconds	Between 30 and 60 seconds	Between 1 and 5 minutes	5 minutes or more
148	38%	14%	35%	13%

Table 2: Example Vehicle Type Summary

Delivery Vehicle	TNC (Uber/Lyft)	Taxi	Other
30%	44%	17%	9%

Clarifications for Data Collection Team

- Provide a graphic showing the start and end points of the bike lane segment of interest, such as in Figure 1. This will ensure the data collection team orients video recording equipment and/or people correctly.



- The Handbook digital files include an example KMZ file for indicating to the data collection team where to collect vehicle blockage of bike lane data.
- If data will be collected via direct observation in the field, indicate on the graphic which sections of the bike lane segment each person is responsible for observing. This will ensure the full segment is observed and minimize the risk of double counting blockages.
- The project manager may conduct a site visit in advance to check for visibility constraints.
- Inform the data collection team of the type of blockages that constitute vehicle blockage of a bike lane.

Vehicle Diversion: Bluetooth/Digital Data – SOP Summary

Related Project Objectives

Consistent travel times

Minimized congestion and delay

SOP last updated July 25, 2017.

Vehicle diversion refers to instances of drivers taking an alternate route to avoid congestion or other undesirable conditions along a given street or corridor. Vehicle diversion analysis may be performed using Bluetooth or other digital data purchased from a vendor.

Companies such as HERE, INRIX, StreetLight Data, Google, and AirSage collect, aggregate, archive, and sell digital data from probe data sources for transportation planning purposes. (Probe data sources include mobile phones, commercial fleets, and passenger vehicles with connected capabilities.) These data provide a sample of trips that can be used to estimate existing travel patterns.

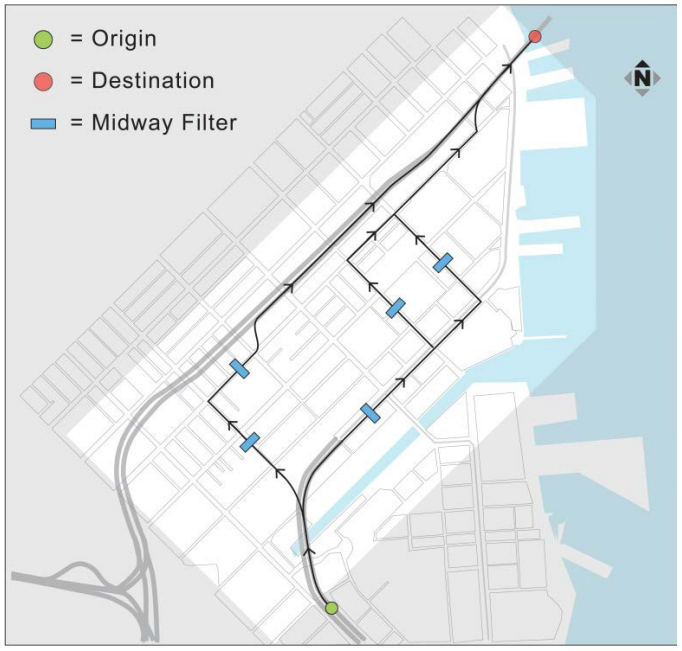
The Vehicle Diversion: Travel Time Runs SOP is related to this SOP and summarizes a related, alternate analysis option.

Data Collection Procedures

Location

- The use of Bluetooth data is best suited for regional travel patterns, as the data have a margin of error of 100' – 200', which could be equivalent to a small city block.
- Select origin-destination pairs to capture vehicles passing through the general study area, as shown in Figure 1. The origin-destination pairs should have a single common beginning or end point.
- Select midway filter points to capture vehicles traveling along the main route versus the alternate route(s).

Figure 1: Example Origin-Destination Pair



Duration

- Typically, data are available for a period covering one or more months.
- The days of the week should be selected based on drivers' existing and anticipated future travel patterns. Consider when volumes are highest and when special user groups (e.g., commuters, tourists, or students) are likely present.
- Potential day types are:
  - Set of Weekdays: Tuesday to Thursday
  - Weekend Days: Saturday and Sunday

Evaluation

- Request data be summarized in one-hour increments and a 24-hour increment.
- Request data be summarized by direction of travel.

Tools and Templates

- Digital data vendors establish their own data summary formats.
- Before contracting with a vendor, request sample data summary reports to confirm they will provide the desired level of detail.

Clarifications for Data Collection Team

- Upon reviewing sample data summary files from the vendor, establish any special provisions for the data summary report.

Handbook Digital Files

The Handbook digital files include the InDesign file used to develop Figure 1. This file is a template for illustrating for data collection firm the origins, destinations, and midway filter points.

Resources

- *Estimating Route Choice and Travel Time Reliability with Field Observations of Bluetooth Probe Vehicles* by Alexander M. Hainen et al., 2011
  https://pdfs.semanticscholar.org/71b5/996c9aa8887c99a8166eac304d814c9fa098.pdf?_ga=2.48373670.1417302189.1494342667-1230285200.1494342667

Vehicle Diversion: Travel Time Runs – SOP Summary

Related Project Objectives
Consistent travel times
Minimized congestion and delay

SOP last updated July 26, 2017.

Vehicle diversion refers to instances of drivers taking an alternate route to avoid congestion or other undesirable conditions along a corridor. Vehicle diversion analysis may be performed by comparing travel times for two or more routes. This travel time comparison is then used to understand the likelihood of drivers diverting to alternative routes after a project is implemented.

Travel time runs are most beneficial as part of pre-project data collection, although they may also be completed post project. To validate the travel time runs, consider collecting and comparing 24-hour tube counts on the primary and alternate route(s) before and after the project is implemented.

The Vehicle Diversion: Digital Data SOP is related to this SOP and summarizes a related, alternate analysis approach.

Data Collection Procedures

Location

- Identify the primary route and one or more alternate routes, as shown in Figures 1 and 2.
- For each route, select start and end points that are easy to identify in the field. The points should be as specific as possible – for example, at the stop bar of an intersection versus the intersection name only.
- For each route, select one or more locations to serve as interim time points.

Duration

- Data from travel time runs should be collected for a period of at least two hours.
- Conduct at least three runs in both directions of travel, for six runs in total.
- Use a stopwatch to measure the duration of each run.
- Travel time runs should be conducted during a peak period and an off-peak period. Typically these periods are AM peak (7:00-9:00 AM) and midday off-peak (11:00 AM-1:00 PM).
- The times of day and day of the week should be selected based on drivers' existing and anticipated future travel patterns. Consider when volumes are highest and when special user groups (e.g., commuters, tourists, or students) are likely present.

Figure 1: Example Eastbound Routes

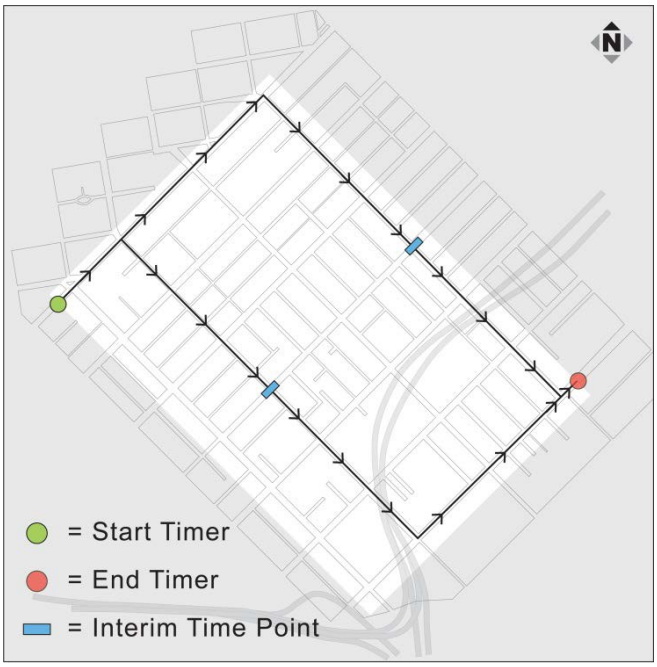
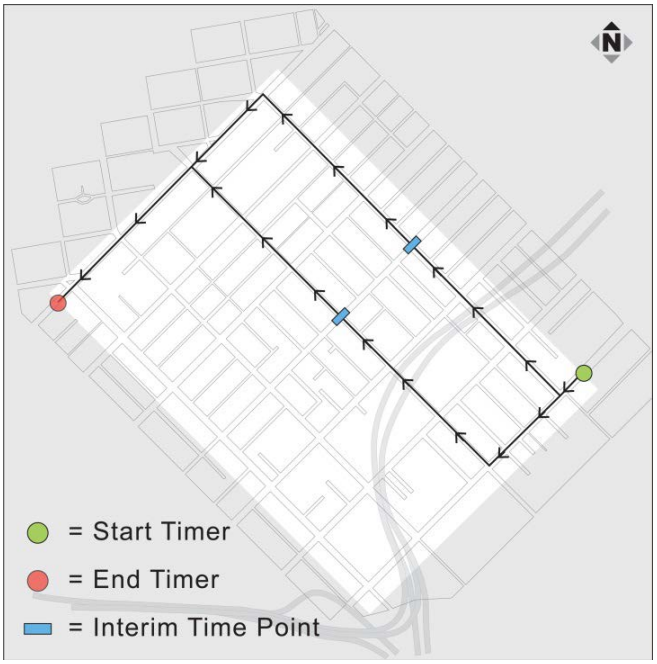


Figure 2: Example Westbound Routes



Evaluation

- Travel time runs should be summarized as an average travel time by direction, time of day, and day of week, as shown in Table 1. The SOP Excel workbook includes tabs for data summary and analysis.
- A GPS-enabled app on a mobile device may be able to collect additional data beyond travel time; e.g., average speed, maximum speed, and number of stops. If these data can be collected, then they should be included in the evaluation.

Table 1: Example Travel Time Summary

Route	Average Travel Time (minutes)	
	Weekday AM Peak	Weekday PM Peak
1E (eastbound)	6.5	7
2E (eastbound)	7	7.5
1W (westbound)	6	7
2W (westbound)	6.5	7

Tools and Templates

- A GPS tracking app such as "Speed Tracker" may be used to record travel times, average speeds, maximum speeds, and number of stops.
- As an alternative, the SOP Excel workbook includes a data collection sheet that may be used to record travel times. Data should be recorded by time period, day of week, and direction of travel.
- The SOP Excel workbook includes a data summary template. The data collection team would use this template to summarize travel time data.
- The SOP Excel workbook includes a data analysis template.

Clarifications for Data Collection Team

- To ensure the data are collected consistently, provide graphics showing the start and end points of the travel time run routes, such as Figures 1 and 2.
- Instruct data collectors to make note of unexpected events, such as an emergency vehicle passing, a vehicle parked in the travel lane, or construction along the route.

Handbook Digital Files

The Handbook digital files include the InDesign file used to develop Figures 1 and 2. This file is a template for illustrating for the data collection firm the routes to drive.

Resources

- *Analysis of a Traffic Diversion Strategy Using Corism Traffic Micro-Simulation Software* by Daniel Ryan Abedon, 2000
  http://digitalcommons.uri.edu/cgi/viewcontent.cgi?article=1794&context=theses

Driver Yielding Behavior: Crosswalk- SOP Summary

Related Project Objective

Increased pedestrian visibility

SOP last updated July 25, 2017.

Driver yielding behavior refers to drivers yielding to pedestrians at midblock and intersection crosswalks.

Collecting data on driver yielding behavior can indicate the degree of safety that pedestrians experience when crossing the street. The SOP for this data collection type specifies the boundaries of the crosswalk observation areas and standardizes what constitutes a driver yielding behavior in the presence of pedestrians.

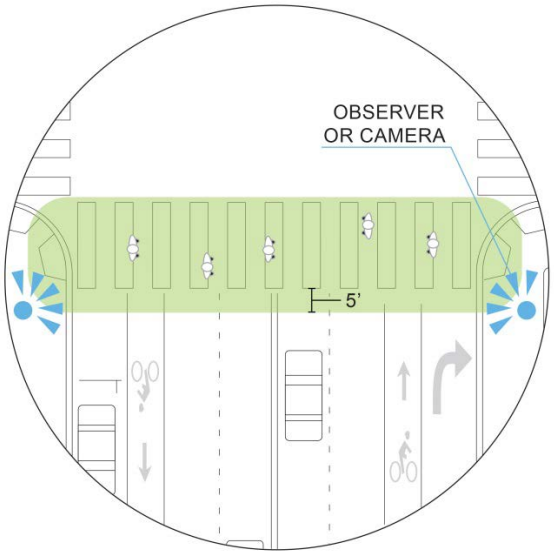
The Qualitative Observation of Close Calls SOP is a related type of analysis. Driver yielding behavior data are collected at the same time as close call data. As such, the same tools and templates are used to collect, summarize, and analyze both sets of data.

Data Collection Procedures

Location

- The observation area consists of the curb ramps, the full length and width of the crosswalk, plus an additional five feet in advance of the crosswalk as shown in Figure 1.
- Curb ramps are included in the observation area because approaching drivers are expected to yield to pedestrians waiting on or approaching a curb ramp.
- The observation area includes space in advance of the crosswalk to allow for pedestrians that leave the curb in advance of the crosswalk markings. While five feet is recommended, this distance may be increased for high-volume crosswalks.

Figure 1: Example Crosswalk Observation Areas



Duration

- Driver yielding behavior data should be collected for a period of at least two hours.
- The time of day and day of the week should be selected based on pedestrians' existing and anticipated future travel patterns. Consider when volumes are highest and when special user groups (e.g., commuters, tourists, or students) are likely present.
- Typical weekday AM/PM peak periods for pedestrians are 8:00-10:00 AM and 5:00-7:00 PM.

Definition of Yielding Behaviors

- Yielding behavior should be recorded when a driver is approaching the crosswalk and a pedestrian attempts to cross (also referred to as an interaction).
- Driver yielding occurs when a driver stops in advance of a crosswalk and waits until the pedestrian has cleared the travel lanes on the driver's side of the street.
- A pedestrian attempt to cross occurs when a pedestrian is within five feet of the edge of the street, is either stopped or walking toward the crossing, and is looking for a gap in traffic to cross.
- A person standing on the curb ramp without a clear intention of crossing the street should not be recorded as a pedestrian attempt to cross.

- When the first driver in a platoon of vehicles does not yield, subsequent drivers also tend not to yield. Each non-yielding driver in a platoon should be counted. For example, four vehicles in a platoon that do not yield to a pedestrian count as four instances of non-yielding behavior.
- However, when the first driver in a platoon of vehicles yields to a pedestrian, it should be recorded as only one instance of yielding behavior (even though subsequent drivers may yield behind the first vehicle).

Evaluation

- If data are collected for multiple periods (e.g., both AM and PM peak), the default practice is to aggregate the data for all periods before performing analysis.
- Data should be analyzed and summarized as follows:
  - Intersection Crosswalks: Report vehicle yields as percentage of total number of pedestrian-vehicle interactions
  - Midblock Crosswalks: Report vehicle yields as percentage of total number of vehicles passing (the sum of observed yielding and non-yielding vehicles) when a pedestrian is present
  - Close Calls: Close calls are reported separately and are also classified as either driver yielding or pedestrian yielding; see Table 1.

Table 1: Driver Yielding Behavior Summary

Driver Yields	Pedestrian Yields	Total Interactions	Close Calls
600 (99.5%)	3 (0.5%)	603	6 (1.0%)

Tools and Templates

- Video data collection is preferred for driver yielding behavior data as it allows for more detailed review of drivers' behaviors, as needed.
- Manual field observation is acceptable if video data collection is not possible. A field data collection sheet template is included in the SOP Excel workbook. Data should be recorded by period, day of week, and direction of travel.
- The SOP Excel workbook includes a data summary template. The data collection team would use this template to summarize the observations made either in the field or by reducing video footage.
- The SOP Excel workbook includes a data analysis template.

Clarifications for Data Collection Team

Midblock Crosswalks

- Provide an exhibit showing the crosswalk with a line marking the location at which drivers have sufficient sight distance to 1) see a pedestrian arriving at a crosswalk; and 2) stop while the person crosses the street. (The AASHTO Green Book provides guidance for identifying this stopping sight distance.)
- The Handbook digital files include an example KMZ file for indicating to the data collection team where to collect driver yielding behavior data.
- Driver yielding behavior should be observed and recorded for all vehicle lanes in both directions of travel.
- If data will be collected directly in the field, then the project manager should visit the study area in advance to identify the appropriate places for data collectors to stand while making observations.
- Data collectors should be positioned inconspicuously so that drivers do not mistake them for pedestrians waiting to cross the street.
- For locations with low pedestrian crossing volumes, mock-crossing attempts may be used to collect data.

Intersection Crosswalks

- If data will be collected directly in the field, then the project manager should visit the study area in advance to identify the appropriate places for data collectors to stand while making observations.
- Data collectors should be positioned inconspicuously so that drivers do not mistake them for pedestrians waiting to cross the street.

Yielding Behavior versus a Close Call

- Close calls are described in the SOP for Qualitative Observations of Close Calls.

- Provide guidance to the data collection team on the difference between yielding behaviors and indicators of a close call.

Resources

A Policy on Geometric Design of Highways and Streets, 6th Edition, Table 3-1 and Table 3-2

NCHRP Report 562: Improving Pedestrian Safety at Unsignalized Crossings – See "Protocol for Data Collection" on pages 34-42

Driver Yielding Behavior: Mixing Zone – SOP Summary

Related Project Objective

Increased bicyclist visibility

SOP last updated June 2017.

Driver yielding behavior refers to drivers yielding to bicyclists as the driver crosses a mixing zone to make a right turn.

Collecting data on driver yielding behavior can indicate the degree of safety that bicyclists experience at mixing zones. The SOP for this data collection type specifies the boundaries of the mixing zone and standardizes what constitutes a driver yielding behavior in the presence of bicyclists.

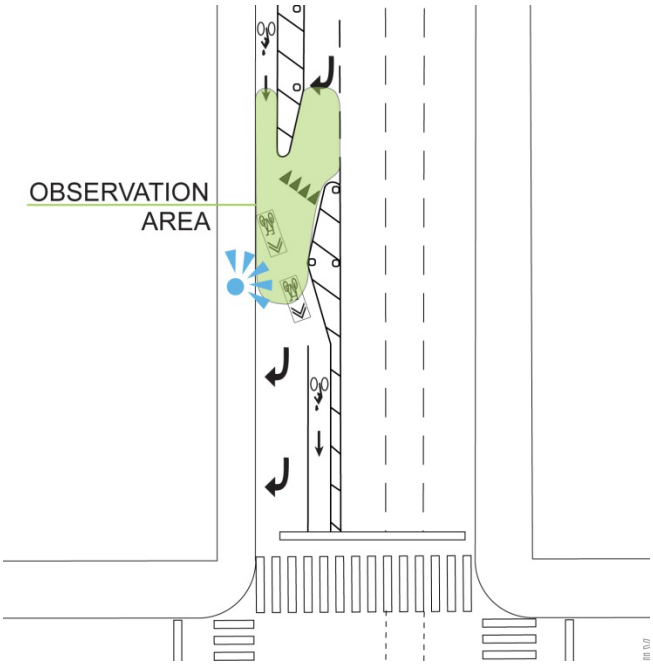
The Qualitative Observation of Close Calls SOP is a related type of analysis. Driver yielding behavior data are collected concurrent to close call data. The same tools and templates are used to collect, summarize, and analyze driver yielding behavior and close call data.

Data Collection Procedures

Location

- The observation area is the mixing zone, as shown in Figure 1, where a vehicle crosses the protected bike lane to enter a dedicated right-turn lane.

Figure 1: Example Mixing Zone Observation Area



Duration

- Driver yielding behavior data should be collected for a period of at least two hours.
- The time of day and day of the week should be selected based on bicyclists' existing and anticipated future travel patterns. Consider when volumes are highest and when special user groups (e.g., commuters, tourists, or students) are likely present.
- Typical weekday AM/PM peak periods for bicyclists are 8:00-10:00 AM and 5:00-7:00 PM.

Definition of Yielding Behaviors

- Yielding behavior should be recorded when both the driver and the bicyclist have entered the observation area and are moving toward each other (also referred to as an interaction).
- Driver yielding occurs when the driver slows, allows the bicyclist to pass, and then merges into the right-turn lane.

Evaluation

- If data are collected for multiple periods (e.g., both AM and PM peak), the default practice is to aggregate the data for all periods before performing analysis.
- Data should be analyzed and reported as percentages of driver yielding and non-yielding relative to total bicyclist-driver interactions; see Table 1.
- Close calls are reported separately and are also classified as either driver yielding or bicyclist yielding; see Table 1.

Table 1: Driver Yielding Behavior Summary

Driver Yields	Bicyclist Yields	Close Calls	Total Interactions	Right-Turns	Total Bicyclists
33 (58%)	16 (28%)	8 (14%)	57	121	102

Tools and Templates

- Video data collection is preferred for driver yielding behavior data as it allows for more detailed review of drivers' behaviors, as needed.
- Manual field observation is acceptable if video data collection is not possible. A field data collection sheet template is included in the SOP Excel workbook. Data should be recorded by period, day of week, and direction of travel.
- The SOP Excel workbook includes a data summary template. The data collection team would use this template to summarize the observations made either in the field or by reducing video footage.
- The SOP Excel workbook includes a data analysis template.

Clarifications for Data Collection Team

Mixing Zones

- Provide an exhibit showing the extents of the mixing zone observation area, such as in Figure 1. This will ensure the data collection team orients video recording equipment and/or people correctly.
- The Handbook digital files include an example KMZ file for indicating to the data collection team where to collect driver yielding behavior data.

Yielding Behavior versus a Close Call

- Close calls are described in the SOP for Qualitative Observations of Close Calls.
- Provide guidance to the data collection team on the difference between yielding behaviors and indicators of a close call.

Resources

- NCHRP Report 562: Improving Pedestrian Safety at Unsignalized Crossings – See "Protocol for Data Collection" on pages 34-42

Qualitative Observations of Close Calls – Summary SOP

Related Project Objective

Increased pedestrian visibility

Increased bicyclist visibility

SOP last updated July 25, 2017.

Close calls refer to instances when drivers and bicyclists or pedestrians make sudden, reactive moves to avoid a collision with one another. Close calls can occur either at mixing zones (between drivers and bicyclists) or at crosswalks (between drivers and pedestrians). This SOP does not provide guidance for close calls between bicyclists and pedestrians.

Collecting data on close calls can indicate the degree of safety that bicyclists experience at mixing zones and pedestrians experience when crossing the street. The SOP for this data collection type specifies the observable behaviors of drivers, bicyclists, and pedestrians that indicate a close call involving a vehicle has occurred.

The two Driver Yielding Behavior SOPs are related types of analyses. Close call data are collected at the same time as driver yielding data. As such, the same tools and templates are used to collect, summarize, and analyze both sets of data.

Data Collection Procedures

Mixing Zone Location

- The observation area consists of the mixing zone, as shown in Figure 1, where a vehicle crosses the bike lane to enter a dedicated right-turn lane.

Crossing Location

- The observation area consists of the curb ramps, the full length and width of the crosswalk, plus an additional five feet in advance of the crosswalk, as shown in Figure 2.
- Curb ramps are included in the observation area because approaching drivers are expected to yield to pedestrians just approaching or waiting on a curb ramp.
- The observation area includes space in advance of the crosswalk to allow for pedestrians that leave the curb in advance of the crosswalk markings. While five feet is recommended, this distance may be increased for high-volume crosswalks.

Figure 1: Example Mixing Zone Observation Area

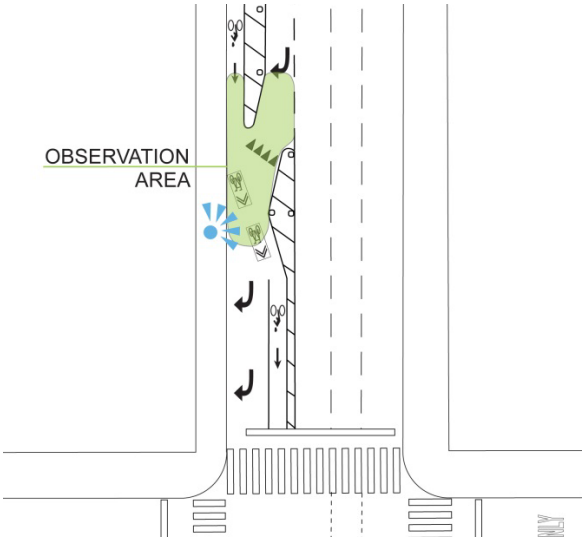
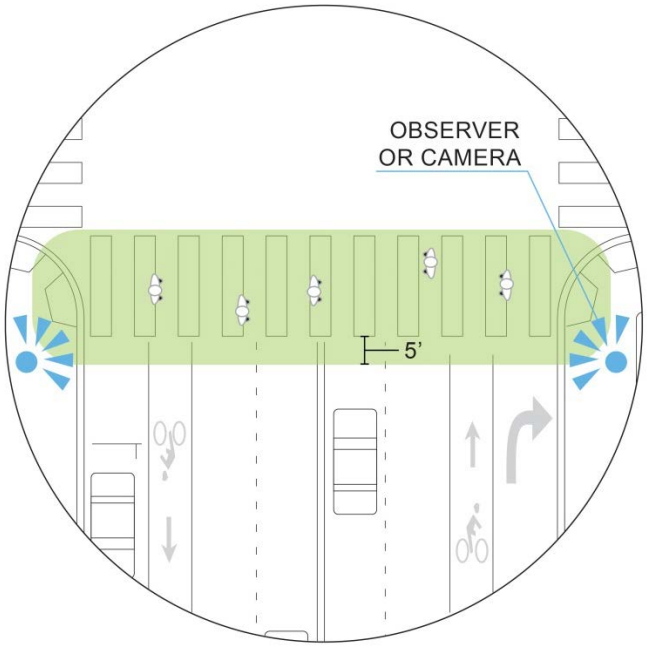


Figure 2: Example Crosswalk Observation Areas



Duration

- Close call data should be collected for a period of at least two hours.
- The time of day and day of the week should be selected based on bicyclists' and pedestrians' existing and anticipated future travel patterns. Consider when vehicular volumes are highest and when special user groups (e.g., commuters, tourists, or students) are likely present.

- Typical weekday AM/PM peak periods for bicyclists are 8:00-10:00 AM and 5:00-7:00 PM.

Close Call Measurement through Observed Behaviors

- The following are observable behaviors that constitute a close call between a driver and a bicyclist or pedestrian:
  - Driver brakes hard, evidenced by brake lights illuminating, the vehicle stopping abruptly, and sometimes tires screeching
  - Driver swerves suddenly
  - Bicyclist brakes hard, evidenced by the bicyclist stopping abruptly or by the bicyclist slowing and falling to the ground
  - Bicyclist swerves suddenly
  - Pedestrian stops suddenly within the crosswalk
  - Pedestrian leaps away from an approaching vehicle or bicycle

Close Call by Proximity

- In addition to the above list of observable behaviors, a close call also refers to an instance when the vehicle passes the bicyclist or pedestrian within ten feet (i.e., close enough that a collision was missed by less than one second). Close calls by proximity apply only if both the vehicle and bicyclist/pedestrian are moving and their paths cross.

Evaluation

- If data are collected for multiple periods (e.g., both AM and PM peak), the default practice is to aggregate the data for all periods before performing analysis.
- Summarize data as total number of bicyclist-involved and total number of pedestrian-involved close calls.

Tools and Templates

- Video data collection is preferred for close call data as it allows for more detailed review of people's behaviors, as needed.
- Manual field observation is acceptable if video data collection is not possible. A field data collection sheet template is included in the SOP Excel workbook. Data should be recorded by period, day of week, and direction of travel.
- The SOP Excel workbook includes a data summary template. The data collection team would use this template to summarize the observations made either in the field or by reducing video footage.
- The SOP Excel workbook includes a data analysis template.

Clarifications for Data Collection Team

Mixing Zones

- Provide an exhibit showing the extents of the mixing zone observation area, such as in Figure 1. This will ensure the data collection team orients video recording equipment and/or people correctly.
- The Handbook digital files include an example KMZ file for indicating to the data collection team where to collect close calls data.

Crosswalks

- If data will be collected directly in the field, then the project manager should visit the study area in advance to identify the appropriate places for data collectors to stand while making observations.

Yielding Behavior versus a Close Call

- Provide guidance to the data collection team on the difference between indicators of a close call and yielding behaviors.
- Yielding behaviors are described in the SOPs for Driver Yielding Behavior.

Resources

- *The Near Miss Project*, www.NearMiss.bike

Public Opinion Surveys – Summary SOP

Related Project Objective
Increased pedestrian comfort
Increased bicyclist comfort

SOP last updated July 26, 2017.

Project evaluations incorporate public opinion surveys to accomplish the following:

- **Inform evaluation measures** – Feedback from surveys completed during the planning phase or immediately prior to implementation can be used to identify any community concerns. This in turn can inform evaluation measures and post-implementation data collection activities.
- **Understand perceived impacts** – A project's design elements are intended to affect individuals' behavior as well as their perception of conditions (for example, feelings of safety). Opinion surveys provide a way to understand how individuals perceive project-related conditions.
- **Understand opinions across stakeholder groups**– When projects affect a broad range of stakeholders, there is the potential for uneven representation among stakeholder groups. Public opinion surveys allow for the majority sentiment to be documented. Depending on the design of the survey instrument, surveys also allow for the opinions of special populations or underrepresented groups to be documented.

Survey Mode

There are four primary modes for administering a survey: field, online, phone, and mail. A survey is considered 'mixed-mode' or 'multimodal' if the same survey is administered by more than one mode. Survey instruments and questions are tailored to the mode(s) in which they will be administered. Therefore the survey mode(s) should be determined at the beginning of the survey development process.

Table 1 (at the end of the SOP) summarizes the different survey modes and the advantages and disadvantages of each. In general, price and response rate are the two primary considerations in selecting a survey mode. Price (direct cost for the actual survey) can range from over $20,000 to virtually free with an online hosted platform.

The response rate and the expected number of respondents also vary greatly by mode. In general, project evaluations should utilize field surveys or online surveys unless project-specific considerations warrant utilizing a different survey mode.

Field Surveys

Field surveys are best suited for instances when there is a need to ensure an adequate number of respondents who are familiar with a specific Area of Interest. Field surveys are also cost-effective, as it may cost a few thousand dollars to obtain hundreds of responses. Field surveys are usually brief, as it is difficult to intercept respondents for longer than one to two minutes. The use of field surveys is often the best approach if a long, detailed survey is not required.

Online Surveys

Online surveys allow respondents to complete the survey at their leisure, meaning that the survey instrument can be longer than those used for field surveys. Additionally, the survey can be made available online over several weeks, allowing for more responses. A shortcoming of online surveys is that they provide limited control over whether respondents are familiar with the Area of Interest. One way to address this is to hand out paper cards to passers-by in the Area of Interest and ask them to complete the online survey later.

Phone Surveys

Phone surveys are best suited for projects that are implemented citywide or are testing general perceptions about transportation. Phone surveys are conducted by random sample and usually require over 300 responses to be statistically significant. For projects with a smaller Area of Interest, it is difficult to obtain this level of response.

Mail Surveys

Mail surveys are sometimes used to supplement other modes – for example, a card can be sent to physical addresses with a link to an online survey. Standalone mail surveys are rarely used, as they normally have low response rates and high administrative costs due to postage and return postage.

Mixed-Mode Surveys

Often multiple modes are used for the same survey instrument; a typical example is an online survey to

supplement a field survey or a phone survey. This approach balances the limitations and benefits of each of the modes; however, it is important that the questions in the different modes match exactly. This ensures that respondents for each mode perceive the survey the same way and no bias is introduced.

Special Considerations

The following issues should be considered in developing the survey methodology for a project evaluation. These issues may affect the survey mode, survey length, and/or survey administration:

Equity and Communities of Concern

If multiple demographic and/or socioeconomic groups are affected by a project, then it will be important to understand differences of opinion among these groups. From an equity standpoint, public opinion surveys may be used to 1) document the needs and concerns of disadvantaged groups; and to 2) highlight how disadvantaged group members perceive a project's impacts.

The Metropolitan Transportation Commission's Communities of Concern provide a starting point for when equity considerations should be integrated into project evaluations. Communities of Concern are defined as low-income communities, communities of color, seniors, and people who rely on walking and transit as their primary means of transportation. A map of San Francisco Communities of Concern can be found at http://geocommons.com/maps/129203.

The need to understand equity-related opinions and impacts should be identified as part of the project evaluation plan and reflected in the survey mode and distribution. Phone and mail surveys provide the greatest ability to control for demographic representation, while online and field surveys provide the least. Once specific groups are identified, targeted outreach strategies should be developed as part of the survey methodology. Separate demographic analyses should also be considered to supplement data obtained through surveys.

Project Messaging

Public opinion surveys may be used to understand which project components are better received by the public. Messaging-related survey questions ask respondents about aspects of the project that have been approved or implemented. The responses are then used to inform how the project is communicated or messaged to the public. Surveys intended to inform project messaging typically require detailed opinion questions, resulting in a longer survey instrument.

Supplemental Research Tools

Economic and demographic data may be used to supplement public opinion research and to inform survey questions.

- Economic research is often a good supplement to direct public opinion research, particularly early in a project before surveys are conducted. Examples include retail tax data (from the SF Controller); business licenses (from the Assessor-Recorder); and commercial rent/vacancy data (from third-party sources).
- Demographic data can be used to compile a profile on who lives in the Area of Interest for a given project. Examples include Census data; DMV records; and political/electoral data sets.

Number of Responses and Response Rate

The target number of responses for a survey will vary based on the size of the Area of Interest. Similarly, the survey response rate will vary based on the survey mode. Both factors should be accounted for in developing a project's survey methodology:

- As a rule of thumb, 300 or more responses are desirable for a small Area of Interest such as a neighborhood or corridor. For larger areas, a reasonable target is 500 or more responses.
- For a brief (one-minute) field survey, it is possible for a canvasser to collect up to 30 responses per hour in a highly trafficked area.
- Online surveys have low response rates – for surveys distributed to email lists, rates can be 10 percent or less. To ensure a reasonable number of responses, significant outreach is needed. This can be accomplished through 1) handing out promotional cards in the field to direct respondents online to the survey; and/or 2) using large email lists of 3,000 to 5,000 addresses.

Survey Dates and Times (Field Surveys)

Day of Week

- Field surveys should be administered for at least two days to allow for nonstandard conditions while canvassers are in the field.
- The travel patterns of the target respondents should be considered in scheduling survey days. While most surveys are administered midweek (Tuesday through Thursday), project-specific issues may warrant Monday/Friday or weekend data collection.

Time of Day

- Most field surveys will have shifts during both the AM and PM peak hours, and possibly midday.
- Canvassers should be used only during daylight hours. Depending on the location, nighttime conditions may present safety risks for the canvasser, and respondents will be less interested in stopping for a survey. Daylight hours are a particularly important consideration during winter months and around the start and end of Daylight Saving Time.

Canvasser Locations

Canvasser locations for field surveys should be determined based on the travel mode of respondents:

- For pedestrians and transit users, bus stops or similar waiting areas are most effective for soliciting respondents. It is less effective to solicit responses from people while they are walking.
- For drivers, respondents can be captured at parking garages and parking lots.
- For bicyclists, canvassers should be stationed at locations where cyclists come to a stop or dismount; examples include signalized intersections and transit stations.

Survey Questions

Survey questions have three formats: multiple-choice, short answer and open-ended.

Multiple-Choice

Multiple-choice questions are preferred as they allow respondents to complete the survey more quickly. It is important that the range of choices include the likely majority sentiment(s) so that responses reflect distinct preferences.

Short Answer

Short answer questions should be used where responses cannot be constrained to four or five choices: for example, asking for the name of a street or bus route. Short answer questions should have one- or two-word answers to allow for straightforward analysis of responses.

Open-Ended

Open-ended questions should be used sparingly, and only when multiple-choice and short answer questions cannot provide adequate data. In part, this is because open-ended questions require significant effort to process and analyze responses, and this effort cannot be automated. Open-ended questions are best suited for online and mail surveys, where respondents record their own answers. For field and phone surveys, open-ended questions introduce a potential source of error in the recording of responses.

Survey Length

The survey length should be considered in terms of the time for a respondent to answer the questions. For each survey mode, the length is directly related to price and the respondent's attention span:

- Field surveys should be no more than two minutes, with one minute being ideal. This will allow for eight to nine questions.
- Online surveys should be no longer than five minutes (approximately 20 to 30 questions).
- Phone surveys should be five to ten minutes in length. Shorter surveys are not cost effective because of initial set-up costs of several thousand dollars, regardless of length.
- Mail surveys allow for longer survey instruments of five to ten minutes. While there is not a rule of thumb

for this mode, longer surveys result in increased costs and potentially a lower response rate.

Survey Administration

Each survey mode presents logistical issues that should be considered as part of the Project Evaluation Plan. Some of the more common issues are as follows:

Staffing/Canvassing Plan

Data collection for field surveys requires that a staffing plan be developed. The staffing plan should identify 1) how many canvassers are needed for each location; and 2) start and end times for canvassers' work shifts. If the survey will be administered in multiple languages, the staffing plan should also identify non-English speakers needed for the shifts. A staffing agency can be used to coordinate these logistics, but the need for this additional resource should be identified as early as possible.

Tablets

If a field survey will be administered using tablets, it will be necessary to ensure an adequate supply is available for the survey dates and set up in advance. Depending on the scale and location of the survey, risks associated with maintaining control of the tablets should be considered.

Language Translation

The need for language translation should be considered regardless of survey mode. Online and mail surveys may need to be read in other languages, while field and phone surveys may require canvassers to administer the survey in a non-English language. Potential language translation needs should be considered when evaluating the Area of Interest and the desired stakeholder groups for respondents.

Email Lists or Promotional Cards

For online surveys, there is a need to consider how respondents will be directed to access and complete the survey. Email lists, if available, may be used to target specific populations or stakeholder groups; however, they provide limited control over whether respondents are familiar with the Area of Interest. An alternate approach is to hand out cards to passers-by at the Area of Interest site, requesting that they complete the survey online. If this approach is used, printing costs should be considered in advance.

Post-Collection Processing

Once the surveys are administered, the data will be processed and made ready for analysis. As part of this process, it is important to maintain control of the surveys at all times so none are lost or altered. Additionally, the survey mode and length should be considered in estimating the required level of effort:

- Field survey responses may be entered manually (if hard copy forms are used) or processed automatically (if a tablet is used to administer the survey).
- Online surveys provide for the simplest data processing, as the data are automatically summarized in tables that can be exported.
- Phone surveys are typically administered through a market research vendor, who will provide responses in a data table.
- Mail survey responses must be entered manually into a spreadsheet or database.

Handbook Digital Files

The Handbook digital files include the following items:

- Example field survey and online survey instruments.
- Example online survey design via Survey Monkey, see SFMTA staff for credentials.
- Template for promotional cards.
- Template for "Survey In Progress" signs for use in the field.

Resources

San Francisco County Communities of Concern Map, http://geocommons.com/maps/129203

Table 1: Summary of Survey Modes

	Field Survey	Online Survey	Phone Survey	Mail Survey
Cost	Somewhat inexpensive. A $2,000 to $3,000 effort should yield several hundred responses. A large effort may be as much as $10,000.	Inexpensive. Free options may be used, with access to higher-level functions available through a subscription.	Very expensive. A random-sample poll can cost more than $20,000.	Somewhat expensive. Postage and return postage costs depend upon the number of surveys mailed.
Demographic/ quota control	Poor. It is difficult to ask extensive demographic questions in a field survey.	Poor. It is it is difficult to control for demographics unless the survey is sent to a small, targeted audience.	Excellent. Demographic quotas can be set as part of the phone list.	Moderate. Demographics can be controlled, but there is limited control over which household member completes the survey.
Instrument length	1 to 2 minutes	5 minutes	5 to10 minutes	5 to 10 minutes
Location control	Excellent. Surveys can be limited to people in the Area of Interest.	Moderate. Surveys can be distributed to limited groups, or cards can be handed out in the field.	Moderate. Phone list can be limited to people in the Area of Interest.	Varies. Excellent location control for those with a physical address in the Area of Interest. Less control for those traveling through the area.
Number of respondents	High. Possible to achieve 1,000+ respondents in a dense area.	Moderate. Response level varies with outreach, but typical response rate is less than 30%.	Poor. Low response rates could require multiple calls to reach desired quota.	Low. A typical response rate is less than 10%.
Survey administration	Difficult. Coordination is required to ensure adequate staffing. Additional coordination may be needed for language translation and tablets.	Easy. Survey can be advertised through email list or by handing out cards in the field.	Difficult. A phone bank is required to contact respondents	Difficult. An external vendor is required to print and mail surveys.
Data processing	Varies. If tablets are used, responses can be provided in data tables. If hard copy forms are used, responses must be entered manually.	Fastest. Online platforms provide responses in data tables.	Fast. Vendors provide responses in data tables.	Poor. Responses must be entered manually.
Best used for:	Projects with a small, defined Area of Interest	General perception surveys; Projects with a small, defined Area of Interest (if combined with outreach effort)	Citywide projects or general perception surveys about transportation	Supplementing other survey modes

Note: Characteristics of mixed-mode surveys will vary depending on the combination of modes selected.

Source: Kittelson & Associates, 2017