



# Highway Safety Improvement Program Orange County Grant Workshop

*August 1, 2018*



# *Key Application Parameters*

# HSIP Priorities for Cycle 9

- Safety Performance Targets
- Strategic Highway Safety Plan
- 9 Proven Safety Countermeasures
- Data Improvements
- Ped/Bike Crashes



The screenshot shows the Caltrans website's "Local Assistance" section. The header includes the Caltrans logo and navigation links: Home, Travel, Business, Engineering, News, Maps, Jobs, About Caltrans, Online Service, A to Z, and Contact Us. The main content area is titled "HSIP Cycle 9 Call for Projects" and includes the following text:

Caltrans announced HSIP Cycle 9 Call for Projects on April 30, 2018. The application due date is May 15, 2018. Applicants must submit the applications before the deadline. Any submittal after midnight of May 15, 2018 will be considered late.

All applicants are expected to review the HSIP Guidelines and Local Roadway Safety Manual for California Local Road Owners.

- [HSIP Guidelines](#) provide overall guidance and general information for the HSIP program.
- [Local Roadway Safety Manual for California Local Road Owners](#)

This manual is intended to assist local agencies in preparing a proactive safety analysis and safety countermeasures. The local agencies are expected to utilize the concepts in this manual.

**Below are the documents you must have in order to prepare and submit an application:**

**Note:** Both the Application Form and the HSIP Analyzer are dynamic forms. At a minimum, you will need a PDF viewer (e.g., Adobe Acrobat Reader DC for free at <https://acrobat.adobe.com/us/en/acrobat/pdf-reader.html>).

6/20/18: The documents have been updated for the purpose of adding a new safety countermeasure. If you are currently interested in proposing LPIs in your HSIP applications, please re-download the below documents.

- [HSIP Cycle 9 Call for Projects Announcement](#) provides more details regarding this call.
- [HSIP Cycle 9 Application Form](#) and [Instructions for HSIP Cycle 9 Application Form](#) (PDF). The applicants must complete the application form and attach the documents to the application.

See Recorded Webinar & Slides from Caltrans here:

[http://www.dot.ca.gov/hq/LocalPrograms/HSIP/apply\\_nowHSIP.htm](http://www.dot.ca.gov/hq/LocalPrograms/HSIP/apply_nowHSIP.htm)

# What's New in Cycle 9

- \$140-160 million available
  - Min/Max: \$100k/\$10M per application
  - No limit on applications per agency
- Electronic-only application submittal
- Use PDF “HSIP Analyzer” tool
- Minimum 3.5 B/C Ratio (BCR)
  - Cycle 8 (2016) Average BCR was 12.4 (where BCR applicable)
- 6 Application Categories

Version Date: May 11, 2018 HSIP Analyzer

**HSIP ANALYZER**  
Cost Estimate, Crash Data and Benefit Cost Ratio (BCR) Calculation  
for Highway Safety Improvement Program (HSIP) Application

**Important:** Review and follow the step-by-step instructions in [Manual for HSIP Analyzer](#). Completing the HSIP Analyzer without referencing to the manual may result in an application with fatal flaws that will be disqualified from the ranking and selection process.

All yellow highlighted fields must be filled in. The gray fields are calculated and read-only. This is a dynamic form (later steps vary depending on the data entered in earlier steps). If any error messages in red appear, fix the errors prior to proceeding to the next steps.

I. Application ID, Project Location and Project Description (copy from the HSIP Application Form):

Application ID:   
Save this file using the Application ID plus 'Calc' as the file name (e.g. '07-Los Angeles-01Calc.pdf').

Project Location:   
(limited to 250 characters)

Project Description:   
(limited to 250 characters)

2. Application Category (Check one):

Application Categories that require a Benefit Cost Ratio (BCR):  
 Common BCR Application  Set-aside for High Friction Surface Treatment

Application Categories that do NOT require a Benefit Cost Ratio (BCR):  
 Set-aside for Guardrail Upgrades  Set-aside for Horizontal Curve Signing  
 Set-aside for Pedestrian Crossing Enhancements  Set-aside for Tribes

**Dual consideration?**  
If an Application Category that does not require a BCR is selected above, check this box to indicate your desire that this application will be considered as a Common BCR Application as well in case it does not get selected for funding under the set-aside category. If this box is checked, a benefit cost analysis is required so the project will have a BCR.

A safety benefit cost analysis is required for this application. This tool will guide through cost estimate, safety benefit evaluation and Benefit Cost Ratio (BCR) calculation.

Page 1 of 9 Application ID: Typology\_1\_Commercial

# Summary of Application Categories

No.	Application Category (AC)	Statewide Funding Level	Max Amount Per Agency	BCR Required?	Project Selection Criteria
AC #1	Common BCR Application	≥75% of HSIP Cycle 9 Funding	\$10 million (AC #1 and #2 combined.)	Yes, minimum 3.5	BCR
AC #2	Set-Aside for High Friction Surface Treatment	≤\$5 million		Yes, minimum 2.5	BCR
AC #3	Set-Aside for Guardrail Upgrades	≤\$20 million	\$1 million	No	1. No funding for this set-aside in Cycle 8; 2. Agency's total Fatal and Severe Injury (F+SI) crashes in the last three years from Statewide Integrated Traffic Records System (SWITRS)
AC #4	Set-Aside for Horizontal Curve Signing	≤\$5 million	\$250 thousand	No	1. Agency's total F+SI crashes in the last three years from SWITRS
AC #5	Set-Aside for Pedestrian Crossing Enhancements	≤\$8 million	\$250 thousand	No	1. No funding for this set-aside in Cycle 8; 2. Agency's total Pedestrian and Bike F+SI crashes in the last three years from SWITRS
AC #6	Set-Aside for Tribes	≤\$2 million	\$250 thousand	No	

Note: AC #2 through #6: Maximum Federal Reimbursement Ratio is 100%



# *Tips & Guidance*

# Understanding Crash Reduction Factors

- Crash Reduction Factor (CRF): an indication of the effectiveness of a particular treatment, measured by the percentage of crashes it is expected to reduce.
  - E.g. 25% reduction in crashes
- Crash Modification Factor (CMF): a multiplicative factor used to compute the expected number of crashes after implementing a given countermeasure
  - $CRF = 1 - CMF$
- Local Roadway Safety Manual includes approved list of countermeasures for HSIP with associated CRF
  - Not an exhaustive list
  - New research continues to provide more data on effectiveness



**Install bicycle lanes**

**Description:**  
**Prior Condition:** No dedicated on-road painted cycle lane  
**Category:** Bicyclists  
**Study:** [The Effect of Cycle Lanes on Cycling Numbers and Safety, Koorey and Parsons, 2016](#)

Star Quality Rating: ★★★★ [\[View score details\]](#)

Crash Modification Factor (CMF)	
Value:	0.77
Adjusted Standard Error:	
Unadjusted Standard Error:	0.24

Crash Reduction Factor (CRF)	
Value:	23 (This value indicates a decrease in crashes)
Adjusted Standard Error:	
Unadjusted Standard Error:	24

# HSIP Eligible Countermeasures

## Local Roadway Safety A Manual for California's Local Road Owners

Table 1. Countermeasures for Signalized Intersections

No.	Type	Countermeasure Name	Crash Type	CRF	Expected Life (Years)	Federal Funding Eligibility	Systemic Approach Opportunity?
S1	Lighting	Add intersection lighting (S.I.)	Night	40%	20	100%	Medium
S2	Signal Mod.	Improve signal hardware: lenses, back-plates, mounting, size, and number	All	15%	10	100%	Very High
S3	Signal Mod.	Improve signal timing (coordination, phases, red, yellow, or operation)	All	15%	10	50%	Very High
S4	Signal Mod.	Provide Advanced Dilemma Zone Detection for high speed approaches	All	40%	10	100%	High
S5	Signal Mod.	Install emergency vehicle pre-emption systems	Emergency Vehicle	70%	10	100%	High
S6	Signal Mod.	Provide protected left turn phase (left turn lane already exists)	All	30%	20	100%	High
S7	Signal Mod.	Convert signal to mast arm (from pedestal-mounted)	All	30%	20	100%	Medium
S8	Operation/ Warning	Install raised pavement markers and striping (Through Intersection)	All	10%	10	100%	Very High
S9	Operation/ Warning	Install flashing beacons as advance warning (S.I.)	All	30%	10	100%	Medium
<del>S10</del>	<del>Operation/ Warning</del>	<del>Install cameras to detect red light running</del>	<del>N/A</del>	<del>N/A</del>	<del>N/A</del>	<del>N/A</del>	<del>N/A</del>
S11	Operation/ Warning	Improve pavement friction (High Friction Surface Treatments)	All	40%	10	100%	Medium
S12	Geometric Mod.	Install raised median on approaches (S.I.)	All	25%	20	90%	Medium
S13	Geometric Mod.	Create directional median openings to allow (and restrict) left-turns and u-turns (S.I.)	All	50%	20	90%	Medium
<del>S14</del>	<del>Geometric Mod.</del>	<del>Install right turn lane (S.I.)</del>	<del>N/A</del>	<del>N/A</del>	<del>N/A</del>	<del>N/A</del>	<del>N/A</del>
<del>S15</del>	<del>Geometric Mod.</del>	<del>Install left turn lane (signal has no left turn phase—before and after)</del>	<del>N/A</del>	<del>N/A</del>	<del>N/A</del>	<del>N/A</del>	<del>N/A</del>
<del>S16</del>	<del>Geometric Mod.</del>	<del>Install left turn lane (signal has a left turn phase—before and after)</del>	<del>N/A</del>	<del>N/A</del>	<del>N/A</del>	<del>N/A</del>	<del>N/A</del>
S17	Geometric Mod.	Install left-turn lane and add turn phase (signal has no left-turn lane or phase before)	All	55%	20	90%	Low
S18	Geometric Mod.	Convert intersection to roundabout (from signal)	All	Varies	20	100%	Low
S19	Ped and Bike	Install pedestrian countdown signal heads	P & B	25%	20	100%	Very High
S20	Ped and Bike	Install pedestrian crossing (S.I.)	P & B	25%	20	100%	High
S21	Ped and Bike	Install advance stop bar before crosswalk (Bicycle Box)	P & B	15%	10	100%	Very High
<del>S22</del>	<del>Ped and Bike</del>	<del>Install pedestrian overpass/underpass</del>	<del>N/A</del>	<del>N/A</del>	<del>N/A</del>	<del>N/A</del>	<del>N/A</del>
S23	Geometric Mod.	Install pedestrian median fencing on approaches	P & B	35%	20	90%	Low

Struck-through countermeasures are not eligible in the current HSIP call for projects.

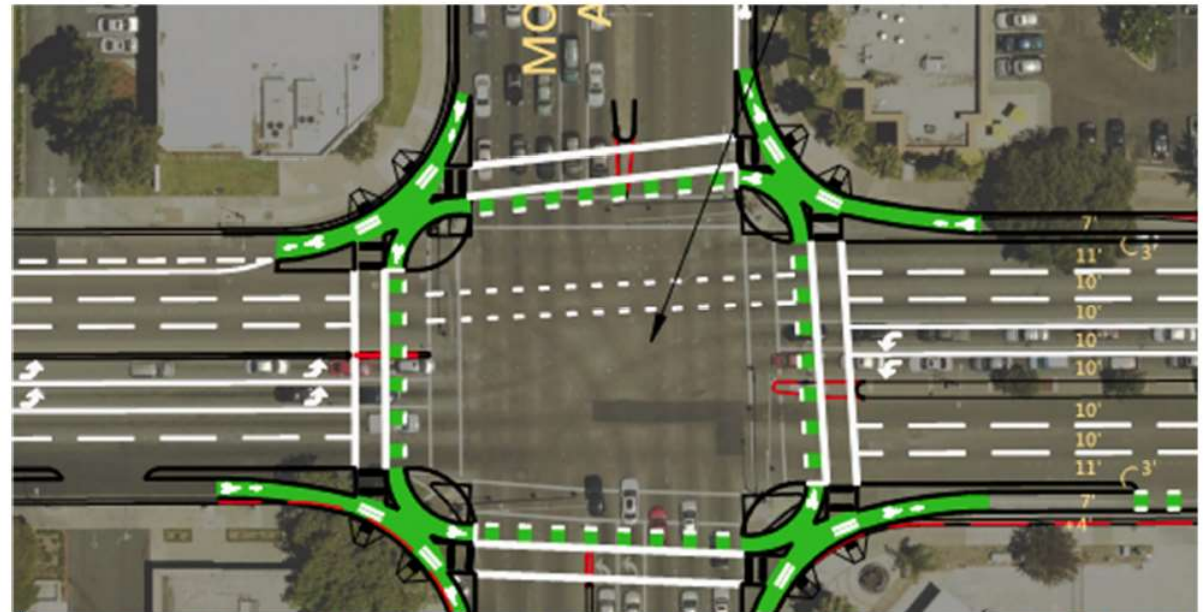
### S19, Install pedestrian countdown signal heads

For HSIP Calls-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
100% federal funding	Pedestrian and Bicycle	25%	20 years
Notes:	This CM only applies to "Ped & Bike" crashes occurring in the intersection/crossing with the new countdown heads.		
General information			
<b>Where to use:</b>			
Signals that have signalized pedestrian crossing with walk/don't walk indicators and where there have been pedestrian vs. vehicle crashes.			
<b>Why it works:</b>			
A pedestrian countdown signal contains a timer display and counts down the number of seconds left to finish crossing the street. Countdown signals can reassure pedestrians who are in the crosswalk when the flashing "DON'T WALK" interval appears that they still have time to finish crossing. Countdown signals begin counting down either when the "WALK" or when the flashing "DON'T WALK" interval appears and stop at the beginning of the steady "DON'T WALK" interval. These signals also have been shown to encourage more pedestrians to use the pushbutton rather than jaywalk.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Costs and time of installation will vary based on the number of intersections included in this strategy and if it requires new signal controllers capable of accommodating the enhancement. When considered at a single location, these low cost improvements are usually funded through local funding by local crews. However, This CM can be effectively and efficiently implemented using a systematic approach with numerous locations, resulting in moderate cost projects that are more appropriate to seek state or federal funding.			
<b>FHWA CMF Clearinghouse:</b>	<b>Crash Types Addressed:</b>	Pedestrian, Bicycle	<b>CRF:</b> 25%



# HSIP TIPS: Getting Creative

- Work with Caltrans on applying for innovative treatments
- Additional CM & CRF resources:
  - FHWA Toolbox of Countermeasures and Their Potential Effectiveness for Pedestrian Crashes
  - PBIC Evaluation of Bicycle-Related/Pedestrian-Related Roadway Measures
  - NCHRP Application of Pedestrian Crossing Treatments for Streets and Highways

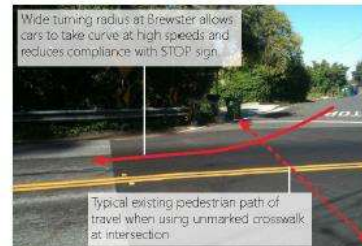
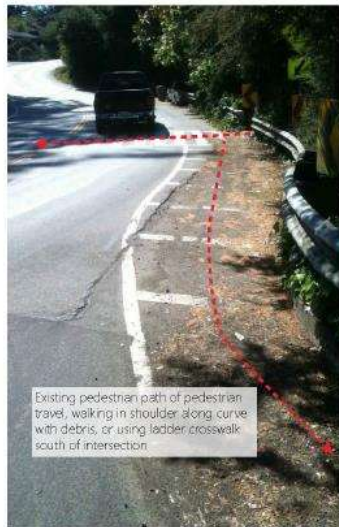


*Proposed Fremont Boulevard Protected Intersection and Separated Bikeway Design at Mowry Avenue per the City's Successful HSIP Grant Application*

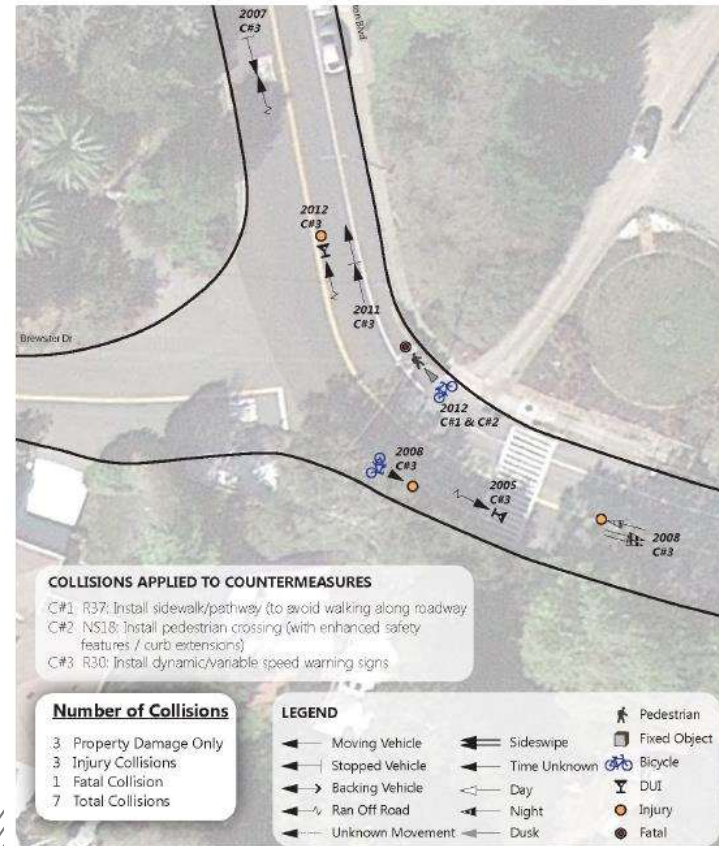
# HSIP TIPS: Key Constraints

- Federal Reimbursement Rate and local match
- Applicants with Delayed HSIP Projects
- Non-safety project components
- Countermeasure constraints
- High-cost countermeasures
- \$100k minimum

# HSIP TIPS: Example Applications

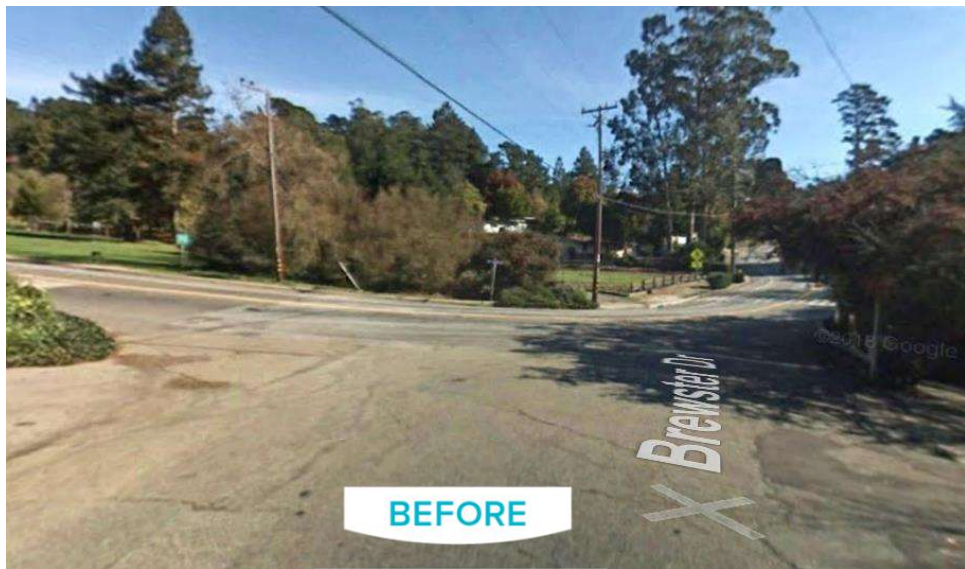


Existing conditions photos with key issues highlighted.



Collision diagram with countermeasure connections.

# HSIP TIPS: Example Applications





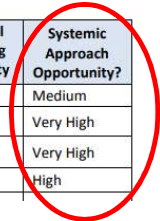
# HSIP TIPS: Application Checklist

- Project location and project description
- Location map, plans, and photos of existing conditions
- Roadway characteristics (classification, speed, ADT)
- Share of benefit to motorized and non-motorized travel
- Narrative (identification of need, potential to address safety issues, crash data evaluation, prior attempts)
- Project cross-section (if applicable)
- Collision diagrams and collision lists
- HSIP Analyzer (countermeasure selection, cost estimate, B/C calculation)
- Warrants (if applicable)
- Letters of support (required for state highways)
- Engineer's checklist

# Leveraging OCTA Systemic Safety Plan

Table 1. Countermeasures for Signalized Intersections

No.	Type	Countermeasure Name	Crash Type	CRF	Expected Life (Years)	Federal Funding Eligibility	Systemic Approach Opportunity?
S1	Lighting	Add intersection lighting (S.I.)	Night	40%	20	100%	Medium
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S3	Signal Mod.	Improve signal timing (coordination, phases, red, yellow, or operation)	All	15%	10	50%	Very High
S4	Signal Mod.	Provide Advanced Dilemma Zone Detection for high speed approaches	All	40%	10	100%	High




3. How were the safety needs and potential countermeasures for this project first identified?

4. California established [Systemic Safety Analysis Report Program](#) (SSARP) in 2016. Was this project identified through the

5. What is the primary mode of travel intended to be benefited by this project?

6. Approximate percentage of project cost going to improvements related to motorized travel:  %

7. Approximate percentage of project cost going to improvements related to non-motorized travel:  %

8. Provide the number of intersections and the length of roadways included in the project (enter 0 if not applicable):

**COLLISION TYPHOLOGY I**  
**Safety Solutions**

**ABOUT THE PROJECT**  
This project is focused on crashes where pedestrians were hit in the crosswalk by drivers turning or proceeding straight. Recommended projects reduce turn conflicts, shorten the crossing distance and lengthen crossing time, and help to organize the street.

**KEY CONSIDERATIONS**  
The countermeasure to improve signal timing has a 50% Federal Reimbursement Rate, which limits all application costs to 50% reimbursement and requires a larger local match.

**BEHAVIORAL FACTORS**  
N/A

**COMMERCIAL FACTORS**  
A Roadway adjacent to Commercial & Services land use category, as defined by SCAC

**COLLISION STATISTICS**  
36% Of all pedestrian crashes occur in commercial areas  
25% Of all bicycle crashes occur in commercial areas  
36% Of bicycle KSI crashes occur in commercial areas  
19% Of pedestrian crashes on commercial corridors are KSI  
5% Of OC land is defined as Commercial & Services

**COUNTERMEASURES**

COUNTERMEASURE	CRASH REDUCTION FACTOR
S2: Improve signal timing (All)	15%
S17: New left turn lane & phase (All)	55%
S19: Pedestrian countdowns (P&B)	25%

**LOW COST \$403,900**  
Signal retiming ✓  
New left-turn lane & phase ✓ \$1,000  
Pedestrian countdowns ✓ \$18,770  
Other construction costs \$189,220  
Other project costs \$79,100

**LOW COST \$9,162,799**  
Benefit spread across **two** intersections.

**LOW COST 22.69**











**POTENTIAL COUNTERMEASURES AND EFFICACY\***

- Protected left turns
- Prohibit left turns
- Leading pedestrian interval
- Carb extensions
- Road diet
- Extend pedestrian crossing time

**OCTA SYSTEMIC SAFETY PLAN**

\*Source: and Other Potential Effectiveness for Pedestrian Crashes. IHSI Strategic Mobility 2016. OCTA Approval of Pedestrian


# Top 15 Crash Typologies

-   1. Commercial Corridor
-   2. Signalized Intersections, Angle Crashes
-   3. Contra-Flow Bicycle Riding
-   4. Crossing at Unsignalized Intersection
-   5. Dual Right Turn/High Right Turn Volume















# Top 15 Crash Typologies

-   6. Freeway On-Ramp
-   7. Single-Family Residential Area
-   8. MPAH Serving Bicyclists
-   9. Trail Crossing
-   10. Driveway Turns



# Top 15 Crash Typologies

-   11.Senior and Children-Serving Land Uses
-   12.Skewed Intersection
-   13.Coastal Uncontrolled Pedestrian Crossing
-   14.Unsafe Speed on Limited Access Arterial
-   15.Parallel Option to High-Volume Arterial

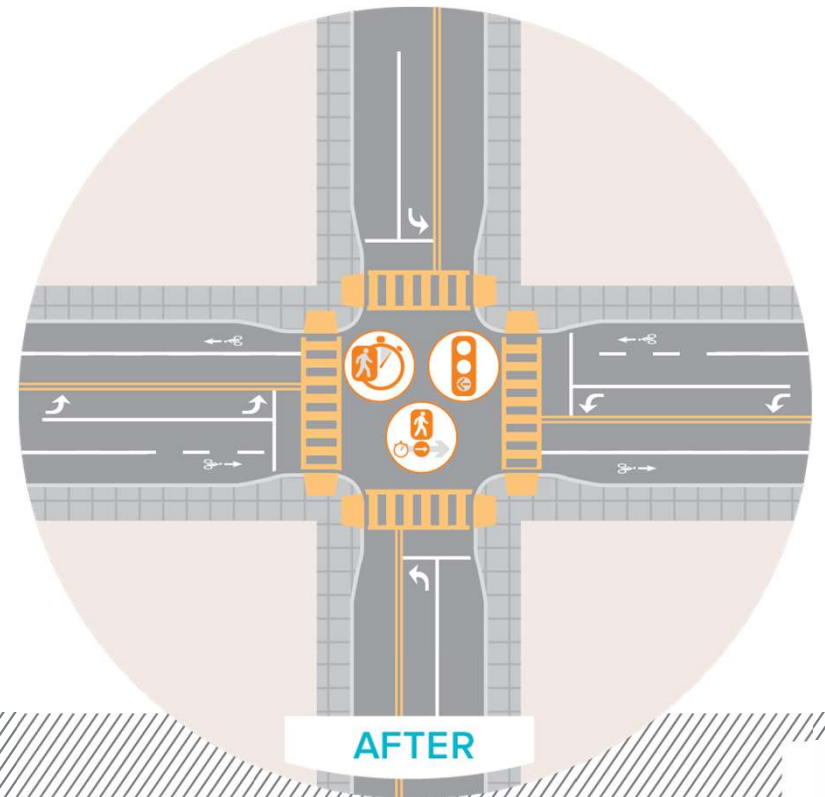
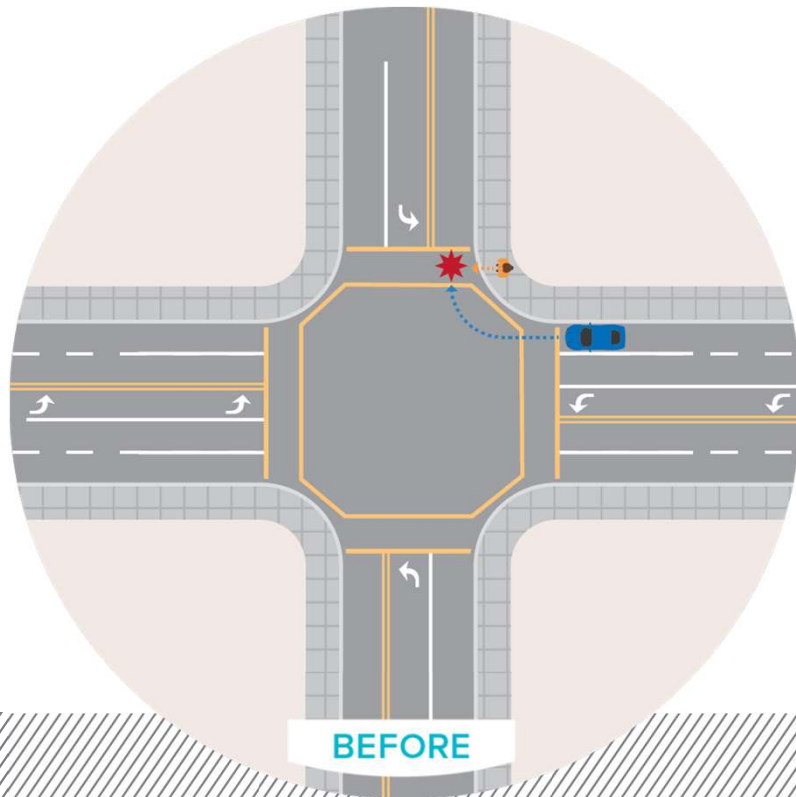




# *HSIP Analyzer & Application*

# Typology 11: Senior and Children-Serving Land Uses

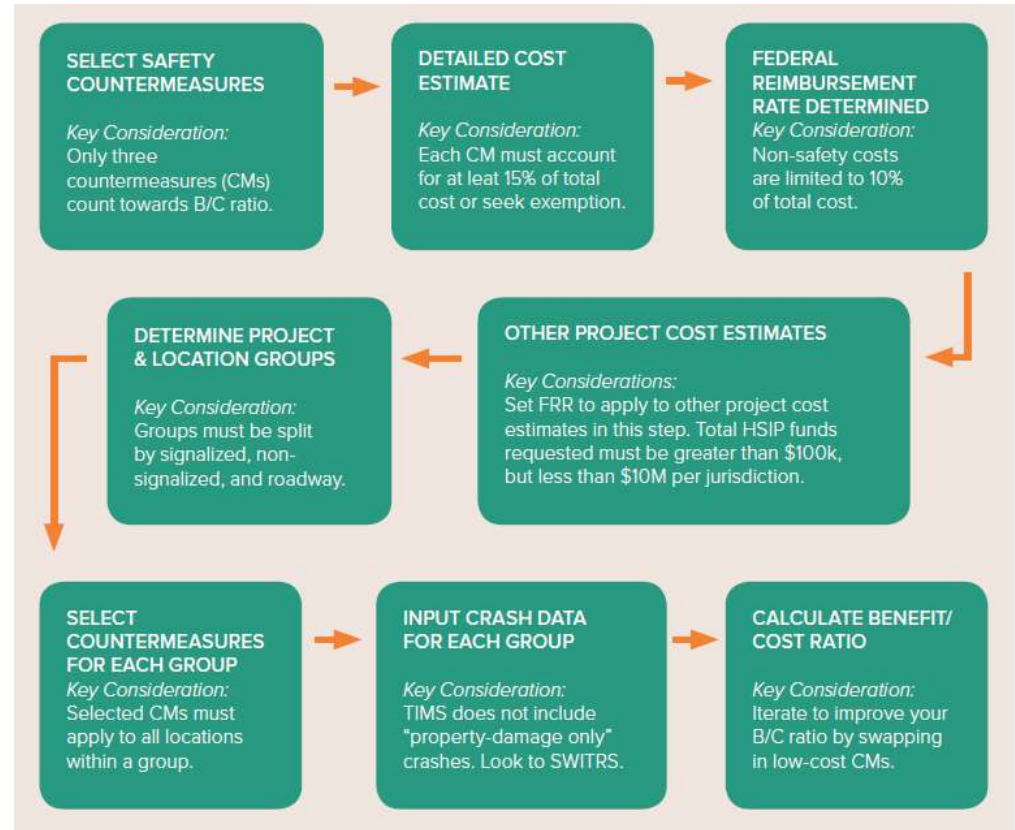
With Pedestrian Crashes



# Benefit/Cost Calculations

## Project Characteristics

- 5 signalized intersections and approx. 1 mile corridor
- History of fatal and severe injury collisions



# Benefit/Cost Calculations

## Select Safety Countermeasures

I.1 Select up to 3 countermeasures (CMs) to be tested in the Engineer's Estimate:

Number of CMs to be used in this project:

CM No. 1:	S6: Provide protected left turn phase (left turn lane already exists)	▼
CM No. 2:	R36: Install bike lanes	▼
CM No. 3:	S21: Install advance stop bar before crosswalk (Bicycle Box)	▼

# Benefit/Cost Calculations

## Cost Estimate

### 1.2 Detailed Engineer's Estimate for Construction Items:

**Cost breakdown by CMs.** For each item, enter a cost percentage for each of the CMs and 'Other Safety-Related' (OS) components. (e.g. enter 10 for 10%). The cost % for 'Non-Safety-Related' (NS) components is calculated.

No.	Item Description	Unit	Quantity	Unit Cost	Total	% for CM#1 (\$6)	% for CM#2 (R36)	% for CM#3 (\$21)	% for OS*	% for NS**
1	High Visibility Crosswalks	lf	1,100	\$70.00	77,000	%	%	%	100%	0
2	Curb Extensions	sf	8,000	\$21.00	168,000	%	%	%	100%	0
3	Curb Ramp	each	40	\$1272.00	50,880	%	%	%	100%	0
4	Ped Push Buttons on Posts	each	40	\$1400.00	56,000	%	%	%	100%	0
5	Signal mod for protected left turn	apprp	10	\$55000.00	550,000	100%	%	%	%	0
6	Extend ped crossing time	locatic	5	\$500.00	2,500	%	%	%	100%	0
7	Class II Bike Lane Striping	lf	10,560	\$1.95	20,592	%	100%	%	%	0
8	Bikeway Route Signage	each	22	\$200.00	4,400	%	100%	%	%	0
9	Bike Lane Pavement Marking	each	52	\$125.00	6,500	%	100%	%	%	0
10	Remove Paint Stripe	lf	10,560	\$2.50	26,400	%	100%	%	%	0
11	Solid Double Yellow Centerline	lf	10,560	\$1.40	14,784	%	%	%	100%	0
12	Stop bar	lf	300	\$2.00	600	%	%	100%	%	0
13	Mobilization	ls	1	\$97765.60	97,766	33%	33%	1%	33%	0
14	Traffic control	ls	1	\$97765.60	97,766	33%	33%	1%	33%	0
Weighted Average (%) Total (\$)					\$1,173,187	52%	10%	0%	37%	

Project's maximum Federal Reimbursement Ratio (FRR) (from Section I, rounded up to integer)  %

To set all 'HSIP/Total (%)' in the below table to the above maximum FRR, click 'Set':

Description	Total Cost	HSIP/Total (%)	HSIP Funds	Local/Other Funds
Preliminary Engineering (PE) Phase				
Environmental	\$97,800	90 %	\$88,020	\$9,780
PS&E	\$146,700	90 %	\$132,030	\$14,670
<b>Subtotal - PE</b>	<b>\$244,500</b>	<b>90 %</b>	<b>\$220,050</b>	<b>\$24,450</b>
Right of Way (ROW) Phase				
Right of Way Engineering	\$0	90 %	\$0	\$0
Appraisals, Acquisitions & Utilities	\$0	90 %	\$0	\$0
<b>Subtotal - Right of Way (ROW)</b>	<b>\$0</b>	<b>%</b>	<b>\$0</b>	<b>\$0</b>
Construction (CON) Phase				
Construction Engineering (CE)	\$97,800	90 %	\$88,020	\$9,780
Construction Items	\$1,407,900 <small>(Read only - from Section I)</small>	90 %	\$1,267,110	\$140,790
<b>Subtotal - Construction</b>	<b>\$1,505,700</b>	<b>90 %</b>	<b>\$1,355,130</b>	<b>\$150,570</b>
<b>PROJECT TOTAL</b>	<b>\$1,750,200</b>	<b>90 %</b>	<b>\$1,575,180</b>	<b>\$175,020</b>

# Benefit/Cost Calculations

## Countermeasure Groups

### III.1 List of Project Locations and Location Groups

List all locations/sites included in this project by groups. The locations entered in Table III.1 below will be automatically populated in the crash data tables in III.2.

Based on the criteria described on the last page, the locations/sites need to be divided into  groups.

Table III.1 List of Project Locations by Groups

Highlighted fields must be filled in. For each group:

- 1) Must select a Location Type;
- 2) Initially each group has one location line. Click "+/-" to add a new line/delete an existing line;
- 3) Enter location description for each line. The same descriptions will be auto-populated in III.2.

\*Note: If your project has a large number of locations, please aggregate some locations into one description, e.g. 10 stop controlled intersections, 5 horizontal curves, etc., as long as they have similar features and the safety improvements to be implemented are the same.

	No.	No. in Group	Location Description (Intersection Name or Road Limit or General Description)	
	GROUP 1		Select Location Type:	S (Signalized Intersections)
+ -	1	G1-1	Intersections	
	GROUP 2		Select Location Type:	R (Roadways)
+ -	2	G2-1	Corridor	



# Benefit/Cost Calculations

## Crash Data

Please check the CMs for this location group. All the CMs that have passed the test in Section I AND match the location type of this group are listed below.

	No.	Countermeasure (CM) Name	CM Type*	Crash Reduction Factor (CRF)	Expected Life (Years)	Crash Type	Federal Funding Eligibility
<input checked="" type="checkbox"/>	1	R36: Install bike lanes	R	0.35	20	Ped & Bike	90%
*CM Type: S-Signalized Intersection; NS-Non-Signalized Intersection; R-Roadway.							

### Step 2: Provide crash data.

2.1 Crash Data Period: must be between 3 and 5 years.

from (MM/DD/YYYY):  To (MM/DD/YYYY):  Crash Data Period (years) = 5

2.2 Fill out the crash data table(s) for the crash type(s) as required by the selected countermeasure(s) in Step 1.

Based on the countermeasures selected in Step 1, the crash data types to be provided are:

(1) Ped & Bike

Crash Data Table for Crash Type: <u>Pedestrians and Bicyclists Involved (P&amp;B)</u>							
No.	Location (from Table III.1)	Fatal (P&B)	Severe Injury (P&B)	Other Visible Injury (P&B)	Complaint of Pain (P&B)	PDO (P&B)	Total
1	Corridor	3	3	5	7	20	38
	Total	3	3	5	7	20	38

# Benefit/Cost Calculations

## Results

IV.1 Benefit Summary by location groups					
Group No.	Group Info/Data*	Benefit from CM #1	Benefit from CM #2	Benefit from CM #3	Total Benefit of the group
1	Location type: S (Signalized Intersections) Number of location(s): 1 Number of selected countermeasure(s): 2 ( S6 S21) Crash Data Information: Crash data period (years): 5 Number of crashes(F/SI/OVI/I-CP/PDO)*: All: 1,0,16,40,100 Ped & Bike: 1,0,8,9,20	\$9,048,001	\$0	\$704,572	\$9,752,573
2	Location type: R (Roadways) Number of location(s): 1 Number of selected countermeasure(s): 1 ( R36) Crash Data Information: Crash data period (years): 5 Number of crashes(F/SI/OVI/I-CP/PDO)*: Ped & Bike: 3,3,5,7,20	\$0	\$18,720,520	\$0	\$18,720,520
Sum		\$9,048,001	\$18,720,520	\$704,572	\$28,473,093
*Number of crashes: five crash numbers are for Fatal (F), Severe Injury (SI), Other Visible Injury (OVI), Injury - Complaint of Pain (I-CP), and Property Damage Only (PDO), respectively.					
IV.2. Project Benefit and BCR Summary					
No.	Countermeasure Name	Benefit	Cost	Resulting B/C	
1	S6	\$9,048,001	\$1,454,422	6.2	
2	R36	18,720,520	\$289,730	64.6	
3	S21	\$704,572	\$6,048	116.5	
	Entire Project	28,473,093	\$1,750,200	16.3	

# Benefit/Cost Calculations

TOTAL COST

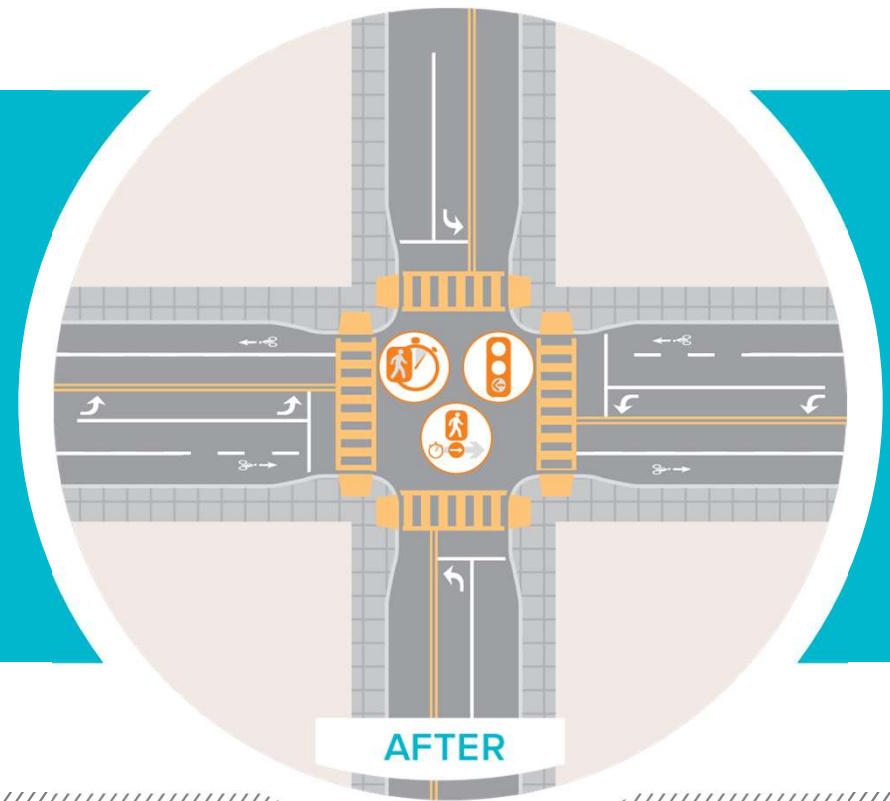
**\$1,750,200**

TOTAL BENEFIT

**\$28,473,093**

B/C RATIO

**16.3**



# Benefit/Cost Calculations: CM Swap

## Select Safety Countermeasures

I.1 Select up to 3 countermeasures (CMs) to be tested in the Engineer's Estimate:

Number of CMs to be used in this project:

CM No. 1:	S6: Provide protected left turn phase (left turn lane already exists)	▼
CM No. 2:	R36: Install bike lanes	▼
CM No. 3:	S21: Install advance stop bar before crosswalk (Bicycle Box)	▼



CM No. 1:	S6: Provide protected left turn phase (left turn lane already exists)	▼
CM No. 2:	R15: Road Diet (Reduce travel lanes from 4 to 3 and add a two way left-turn and bike lanes)	▼
CM No. 3:	S21: Install advance stop bar before crosswalk (Bicycle Box)	▼

# Benefit/Cost Calculations: CM Swap

## Cost Estimate

### I.2 Detailed Engineer's Estimate for Construction Items:

**Cost breakdown by CMs.** For each item, enter a cost percentage for each of the CMs and 'Other Safety-Related' (OS) components. (e.g. enter 10 for 10%). The cost % for 'Non-Safety-Related' (NS) components is calculated.

No.	Item Description	Unit	Quantity	Unit Cost	Total	% for CM#1 (S6)	% for CM#2 (R36)	% for CM#3 (S21)	% for OS*	% for NS**
1	High Visibility Crosswalks	If	1,100	\$70.00	77,000	%	%	%	100%	0
2	Curb Extensions	sf	8,000	\$21.00	168,000	%	%	%	100%	0
3	Curb Ramp	each	40	\$1272.00	50,880	%	%	%	100%	0
4	Ped Push Buttons on Posts	each	40	\$1400.00	56,000	%	%	%	100%	0
5	Signal mod for protected left turn	approp	10	\$55000.00	550,000	100%	%	%	%	0
6	Extend ped crossing time	locatio	5	\$500.00	2,500	%	%	%	100%	0
7	Class II Bike Lane Striping	If	10,560	\$1.95	20,592	%	100%	%	%	0
8	Bikeway Route Signage	each	22	\$200.00	4,400	%	100%	%	%	0
9	Bike Lane Pavement Marking	each	52	\$125.00	6,500	%	100%	%	%	0
10	Remove Paint Stripe	If	10,560	\$2.50	26,400	%	100%	%	%	0
11	Solid Double Yellow Centerline	If	10,560	\$1.40	14,784	%	%	%	100%	0
12	Stop bar	If	300	\$2.00	600	%	%	100%	%	0
13	Mobilization	ls	1	\$97765.60	97,766	33%	33%	1%	33%	0
14	Traffic control	ls	1	\$97765.60	97,766	33%	33%	1%	33%	0
Weighted Average (%)						52%	10%	0%	37%	
Total (\$)					\$1,173,187					



### I.2 Detailed Engineer's Estimate for Construction Items:

**Cost breakdown by CMs.** For each item, enter a cost percentage for each of the CMs and 'Other Safety-Related' (OS) components. (e.g. enter 10 for 10%). The cost % for 'Non-Safety-Related' (NS) components is calculated.

No.	Item Description	Unit	Quantity	Unit Cost	Total	% for CM#1 (S6)	% for CM#2 (R15)	% for CM#3 (S21)	% for OS*	% for NS**
1	High Visibility Crosswalks	If	1,100	\$70.00	77,000	%	%	%	100%	0
2	Curb Extensions	sf	8,000	\$21.00	168,000	%	%	%	100%	0
3	Curb Ramp	each	40	\$1272.00	50,880	%	%	%	100%	0
4	Ped Push Buttons on Posts	each	40	\$1400.00	56,000	%	%	%	100%	0
5	Signal mod for protected left turn	approp	10	\$55000.00	550,000	100%	%	%	%	0
6	Extend ped crossing time	locatio	5	\$500.00	2,500	%	%	%	100%	0
7	Class II Bike Lane Striping	If	10,560	\$1.95	20,592	%	100%	%	%	0
8	Bikeway Route Signage	each	22	\$200.00	4,400	%	100%	%	%	0
9	Bike Lane Pavement Marking	each	52	\$125.00	6,500	%	100%	%	%	0
10	Remove Paint Stripe	If	10,560	\$2.50	26,400	%	100%	%	%	0
11	Solid Double Yellow Centerline	If	10,560	\$1.40	14,784	%	100%	%	%	0
12	Stop bar	If	300	\$2.00	600	%	%	100%	%	0
13	Mobilization	ls	1	\$97765.60	97,766	33%	33%	1%	33%	0
14	Traffic control	ls	1	\$97765.60	97,766	33%	33%	1%	33%	0
Weighted Average (%)						52%	12%	0%	36%	
Total (\$)					\$1,173,187					

# Benefit/Cost Calculations: CM Swap

## Crash Data

Please check the CMs for this location group. All the CMs that have passed the test in Section I AND match the location type of this group are listed below.

No.	Countermeasure (CM) Name	CM Type*	Crash Reduction Factor (CRF)	Expected Life (Years)	Crash Type	Federal Funding Eligibility
<input checked="" type="checkbox"/>	1 R36: Install bike lanes	R	0.35	20	Ped & Bike	80%
*CM Type: S-Signalized Intersection; NS-Non-Signalized Intersection; R-Roadway.						

Step 2: Provide crash data.

2.1 Crash Data Period: must be between 3 and 5 years.

from (MM/DD/YYYY):  To (MM/DD/YYYY):  Crash Data Period (years) = 5

2.2 Fill out the crash data table(s) for the crash type(s) as required by the selected countermeasure(s) in Step 1.

Based on the countermeasures selected in Step 1, the crash data types to be provided are:

(1) Ped & Bike

No.	Location (from Table III.1)	Fatal (P&B)	Severe Injury (P&B)	Other Visible Injury (P&B)	Complaint of Pain (P&B)	PDO (P&B)	Total
1	Corridor	3	3	5	7	20	38
	Total	3	3	5	7	20	38

Please check the CMs for this location group. All the CMs that have passed the test in Section I AND match the location type of this group are listed below.

No.	Countermeasure (CM) Name	CM Type*	Crash Reduction Factor (CRF)	Expected Life (Years)	Crash Type	Federal Funding Eligibility
<input checked="" type="checkbox"/>	1 R15: Road Diet (Reduce travel lanes from 4 to 3 and add a two way left-turn and bike lanes)	R	0.3	20	All	80%
*CM Type: S-Signalized Intersection; NS-Non-Signalized Intersection; R-Roadway.						

Step 2: Provide crash data.

2.1 Crash Data Period: must be between 3 and 5 years.

from (MM/DD/YYYY):  To (MM/DD/YYYY):  Crash Data Period (years) = 5

2.2 Fill out the crash data table(s) for the crash type(s) as required by the selected countermeasure(s) in Step 1.

Based on the countermeasures selected in Step 1, the crash data types to be provided are:

(1) All

No.	Location (from Table III.1)	Fatal (ALL)	Severe Injury (ALL)	Other Visible Injury (ALL)	Complaint of Pain (ALL)	PDO (ALL)	Total
1	Corridor	4	6	28	51	200	289
	Total	4	6	28	51	200	289

# Benefit/Cost Calculations: CM Swap

## Results

IV.1 Benefit Summary by location groups

Group No.	Group Info/Data*	Benefit from CM #1	Benefit from CM #2	Benefit from CM #3	Total Benefit of the group
1	Location type: S (Signalized Intersections) Number of location(s): 1 Number of selected countermeasure(s): 2 ( S6 S21) Crash Data Information: Crash data period (years): 5 Number of crashes(F/SI/OVI/I-CP/PDO)*: All: 1,0,16,40,100 Ped & Bike: 1,0,8,9,20	\$9,048,001	\$0	\$704,572	\$9,752,573
2	Location type: R (Roadways) Number of location(s): 1 Number of selected countermeasure(s): 1 ( R36) Crash Data Information: Crash data period (years): 5 Number of crashes(F/SI/OVI/I-CP/PDO)*: Ped & Bike: 3,3,5,7,20	\$0	\$18,720,520	\$0	\$18,720,520
Sum		\$9,048,001	\$18,720,520	\$704,572	\$28,473,093

\*Number of crashes: five crash numbers are for Fatal (F), Severe Injury (SI), Other Visible Injury (OVI), Injury - Complaint of Pain (I-CP), and Property Damage Only (PDO), respectively.

### IV.2. Project Benefit and BCR Summary

No.	Countermeasure Name	Benefit	Cost	Resulting B/C
1	S6	\$9,048,001	\$1,454,422	6.2
2	R36	18,720,520	\$289,730	64.6
3	S21	\$704,572	\$6,048	116.5
	Entire Project	28,473,093	\$1,750,200	16.3



IV.1 Benefit Summary by location groups

Group No.	Group Info/Data*	Benefit from CM #1	Benefit from CM #2	Benefit from CM #3	Total Benefit of the group
1	Location type: S (Signalized Intersections) Number of location(s): 1 Number of selected countermeasure(s): 2 ( S6 S21) Crash Data Information: Crash data period (years): 5 Number of crashes(F/SI/OVI/I-CP/PDO)*: All: 1,0,16,40,100 Ped & Bike: 1,0,8,9,20	\$9,048,001	\$0	\$704,572	\$9,752,573
2	Location type: R (Roadways) Number of location(s): 1 Number of selected countermeasure(s): 1 ( R15) Crash Data Information: Crash data period (years): 5 Number of crashes(F/SI/OVI/I-CP/PDO)*: All: 4,6,28,51,200	\$0	\$35,482,681	\$0	\$35,482,681
Sum		\$9,048,001	\$35,482,681	\$704,572	\$45,235,254

\*Number of crashes: five crash numbers are for Fatal (F), Severe Injury (SI), Other Visible Injury (OVI), Injury - Complaint of Pain (I-CP), and Property Damage Only (PDO), respectively.

### IV.2. Project Benefit and BCR Summary

No.	Countermeasure Name	Benefit	Cost	Resulting B/C
1	S6	\$9,048,001	\$1,425,915	6.3
2	R15	35,482,681	\$318,355	111.5
3	S21	\$704,572	\$5,929	118.8
	Entire Project	45,235,254	\$1,750,200	25.8

# Benefit/Cost Calculations: CM Swap

TOTAL COST

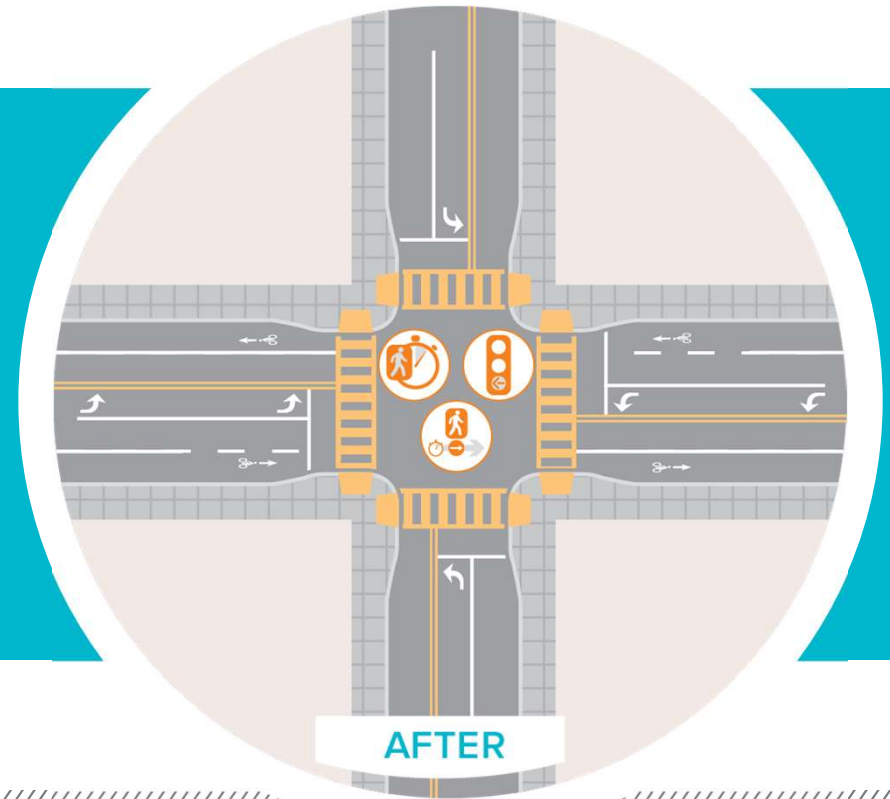
**\$1,750,200**

TOTAL BENEFIT

**\$45,235,254**

B/C RATIO

**25.8**



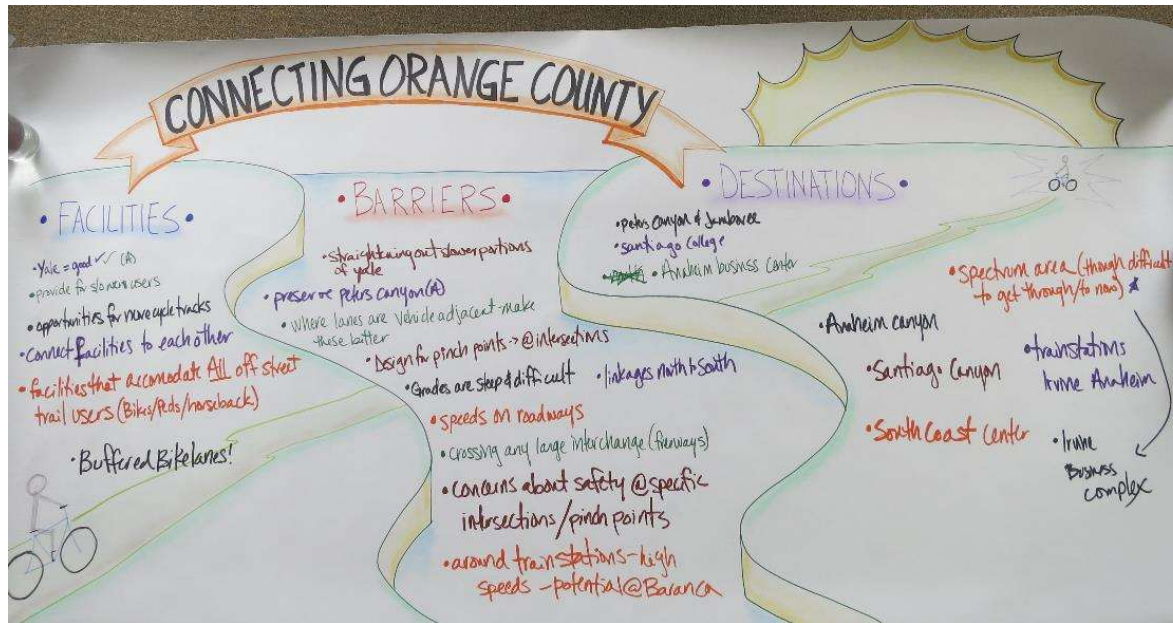


# Lean on Prior Planning Efforts

- Projects have been strategically selected, so you are not starting from scratch → opportunities to build on previous work
- ATP applications
- Collision data analysis
- Outreach efforts



# Thank You!



**Paul Martin**  
Active Transportation Coordinator  
(714) 560-5386  
[pmartin@octa.net](mailto:pmartin@octa.net)  
[www.octa.net/bike](http://www.octa.net/bike)

