Berkeley SafeTREC

SAFE TRANSPORTATION RESEARCH AND EDUCATION CENTER

PS21033

CITY OF COSTA MESA

COMPLETE STREETS SAFETY ASSESSMENT

Issues, Opportunities, and Suggested Strategies

Assessment Team

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This report was produced in cooperation with the City of Costa Mesa. Funding for this program was provided by a grant from the California Office of Traffic Safety, through the National Highway Traffic Safety Administration. Opinions, findings, and conclusions are those of the authors and not necessarily those of the University of California and/or the agencies supporting or contributing to this report.

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FINAL REPORT

NOVEMBER 2021

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EXECUTIVE SUMMARY

The City of Costa Mesa requested that SafeTREC at the University of California, Berkeley conduct a Complete Streets Safety Assessment (CSSA) study for various locations within the City. A team of two safety experts conducted the CSSA. One of the experts visited the City of Costa Mesa and conducted a walking audit on June 17 and 18, 2021. The objectives of the CSSA are to improve pedestrian and bicycle safety and to enhance walkability and accessibility for all pedestrians and bicyclists in Costa Mesa.

Based on the OTS 2018 statistics, Costa Mesa ranked 24 out of 59 California cities in Group B, which includes cities with population of 100,001-250,000, in total fatal and injury collisions (with a ranking of "1" being the worst and "59" the best). It ranked 23 for pedestrian collisions, and 29 for bicyclist collisions. This ranking is based on a number of weighted factors including population, daily vehicle miles traveled, collision records, collision trends, and others. For more information on OTS rankings, please refer to https://www.ots.ca.gov/media-and-research/crash-rankings-results/

This report is organized into the following chapters:

- Chapter 1 is an introduction to the Complete Streets Safety Assessment for City of Costa Mesa.
- Chapter 2 presents background information on bicyclist and pedestrian safety in the City and collision history.
- Chapter 3 presents benchmarking analysis results and suggestions for potential improvement from the benchmarking analysis.
- Chapter 4 presents field walking audit results and suggestions for potential improvements from the audit.

Benchmarking Analysis of Policies, Programs, and Practices

To assess pedestrian safety conditions in Costa Mesa, the expert team conducted a benchmarking analysis to understand how the City's existing conditions compared with current best practices. Through a pedestrian and bicycle safety assessment survey conducted with City staff, the expert team identified the City's pedestrian and bicycle policies, programs, and practices and categorized them into three groups:

- Key strengths (areas where the City is exceeding national best practices)
- Enhancement areas (areas where the City is meeting national best practices)
- Opportunity areas (areas where the City appears not to meet national best practices)

While suggestions are provided for each category, cities have differing physical, demographic, and institutional characteristics that may make certain goals or policies more appropriate in some jurisdictions than others. Ultimately, City staff may determine where resources and efforts are best placed for meeting local development and infrastructure goals for pedestrians and bicyclists.

A discussion of the City's pedestrian and bicycle safety policies, programs, and practices, and suggestions for potential improvement or further enhancement to the City's existing programs and policies are presented in *Chapter 3*.

Walking Audit Focal Areas

Per City's request, the following six (6) corridors were studied in this assessment:

1. Placentia Avenue: Joann Street - Adams Street, Swan Drive / Swan Circle, Shalimar Drive
2. Placentia Avenue / Joann Street Path connection
3. Pomona Avenue: 19th Street – Wilson Street
4. Wilson Street: Wilson Street Park (Fordham Drive), Newport Boulevard
5. Del Mar Avenue: Newport Boulevard – Elden Ave, Elden Avenue – Santa Ana Avenue
6. Bristol Street: Irvine Avenue – Sunflower Avenue

Many of the strategies suggested in this report are appropriate for grant applications, including Office of Traffic Safety (OTS) or Active Transportation Program (ATP) funding. The strategies may also be incorporated into a bicycle or pedestrian master plan, documents that could set forth bicycle, pedestrian and streetscape policies for the City, identify, and prioritize capital improvement projects.

The suggestions presented in this report are based on limited field observations and time spent in Costa Mesa by the CSSA evaluator. These suggestions, which are based on general knowledge of best practices in pedestrian and bicycle design and safety, are intended to guide City staff in making decisions for future safety improvement projects in the City, and they may not incorporate all factors which may be relevant to safety issues in the City.

As this report is conceptual in nature, conditions may exist in the focal areas that were not observed and may not be compatible with suggestions in this report. Before finalizing and implementing any physical changes, City staff may choose to conduct more detailed studies or further analysis to refine or discard the suggestions in this report, if they are found to be contextually inappropriate or appear not to improve bicycling safety or accessibility due to conditions including, but not limited to, high vehicular traffic volume or speeds, physical limitations on space or sight distance, or other potential safety concerns.

1. INTRODUCTION

1.1. OBJECTIVE OF THE ASSESSMENT

The City of Costa Mesa (the City) requested that the Safe Transportation Research and Education Center (SafeTREC) at University of California, Berkeley conduct a Complete Streets Safety Assessment (CSSA) for the City. The objective of the CSSA is to improve safety and accessibility for all people walking and biking in the City of Costa Mesa. This assessment emphasizes safety and mobility issues associated with pedestrians and bicyclists.

1.2. ASSESSMENT APPROACH

The SafeTREC Safety experts conducted a pre-visit telephone interview with City staff on June 04, 2021. One of the SafeTREC experts met with City staff and members of the City's Bikeway and Walkability Committee, and conducted a walking audit at various locations in Costa Mesa on June 18, 2021. Positive practices, as well as pedestrian and bicycle safety and accessibility issues were identified at the field audit.

1.3. DISCLOSURES

The benchmarking analysis aims to provide the City with information on current best practices and how the city compares. Cities have differing physical, demographic, and institutional characteristics that may make certain goals or policies more appropriate in some jurisdictions than others. Ultimately, City staff will determine where resources and efforts are best utilized to meet local development and infrastructure goals for people walking and biking.

The suggestions presented in this report are based on limited field observations and limited time spent in the City of Costa Mesa by the CSSA evaluator. These suggestions, which are based on general knowledge of best practices in pedestrian and bicycle design and safety, are intended to guide City staff in making decisions for future safety improvement projects in the city, and they may not incorporate all factors, which may be relevant to the pedestrian and bicycle safety issues in the city.

As this report is conceptual in nature, conditions may exist in the focal areas that were not observed and may not be compatible with suggestions in this report. Before finalizing and implementing any physical changes, City staff may conduct more detailed studies or further analysis to refine or discard the suggestions in this report if they are found to be contextually inappropriate or appear not to improve pedestrian and bicyclist safety or accessibility due to conditions including, but not limited to, high vehicular traffic volume or speeds, physical limitations on space or sight distance, or other potential safety concerns.

2. BACKGROUND AND COLLISION HISTORY

The City of Costa Mesa is located in Orange County. Per Office of Traffic Safety, as of 2018, with a population of approximately 114,634, it is categorized as one of the 59 cities in Group B, population 100,001 – 250,000, as shown in Table 2-1.

Table 2-1: Costa Mesa Summary Statistics

Year	County	Population	Population Group	Daily Vehicle Miles Traveled (VMT)
2018	Orange	114,634	B	1,671,469

Source: California Office of Traffic Safety, https://www.ots.ca.gov/media-and-research/collision-rankings/

2.1. PEDESTRIAN AND BICYCLIST SAFETY OVERVIEW

The Office of Traffic Safety (OTS) collision rankings facilitate funding decisions and identify emerging traffic safety problem areas. The rankings allow cities to compare themselves to other cities with similar-sized populations and help them identify potential disproportionate traffic safety issues. OTS rankings are indicators of historical collisions; there are many factors that affect collisions in a city.

Victim and collision data for the rankings were acquired from the California Highway Patrol (CHP) Statewide Integrated Traffic Records System (SWITRS), California Department of Transportation (Caltrans), California Department of Justice (DOJ), and the Department of Finance (DOF).

The 2018 OTS safety rankings for Costa Mesa are shown in Table 2-2. Based on the OTS 2018 statistics, Costa Mesa ranked 24 out of 59 California cities in Group B, in total fatal and injury collisions (with a ranking of “1” being the worst and “59” the best). It ranked 23 for pedestrian collisions, and 29 for bicyclist collisions.

Table 2-2: Costa Mesa Traffic Collisions and Rankings 2018

Type of Collision	Victims Killed & Injured	OTS Ranking (of 59 cities)
Total Fatal and Injury	693	24/59
Alcohol Involved	99	7/59
Motorcycles	32	18/59
Pedestrians	32	23/59
Pedestrians < 15	4	19/59
Pedestrians 65+	0	54/59
Bicyclists	25	29/59
Bicyclists < 15	3	35/59

2.2. PEDESTRIAN AND BICYCLIST COLLISION DATA

The collision data for Costa Mesa from January 2015 to the end of 2019 was taken from the SafeTREC Transportation Injury Mapping System (TIMS) database. During this five-year period, 3,849 collisions occurred in Costa Mesa, 47 of which were fatal. There were 175 collisions involving pedestrians and 228 involving bicyclists.

Pedestrian Collisions

Within the 5-year period analyzed from TIMS data, 175 collisions involved pedestrians, 12 of which were fatal. Of the 175 collisions, 80 involved pedestrian crossing in crosswalk at an intersection, 4 were crossing in crosswalk, not at intersection, and 51 crossing not in crosswalk. 21 were in road, including shoulder. The following charts depict this data:

Chart 2.1: Number of Pedestrian Collisions by Collision Severity, Costa Mesa

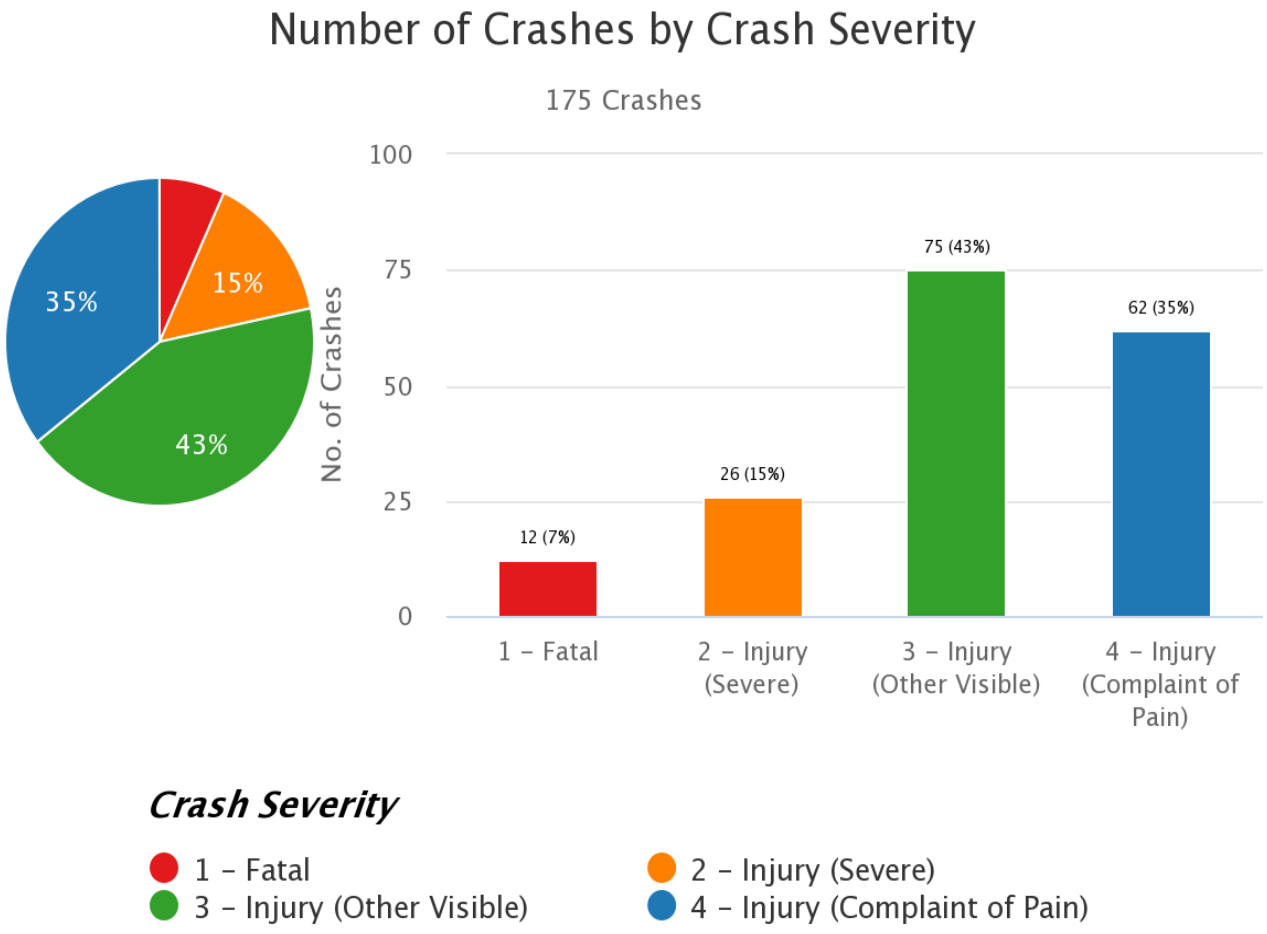


Chart 2.2: Number of Pedestrian Collisions per Day of Week per Time, Costa Mesa

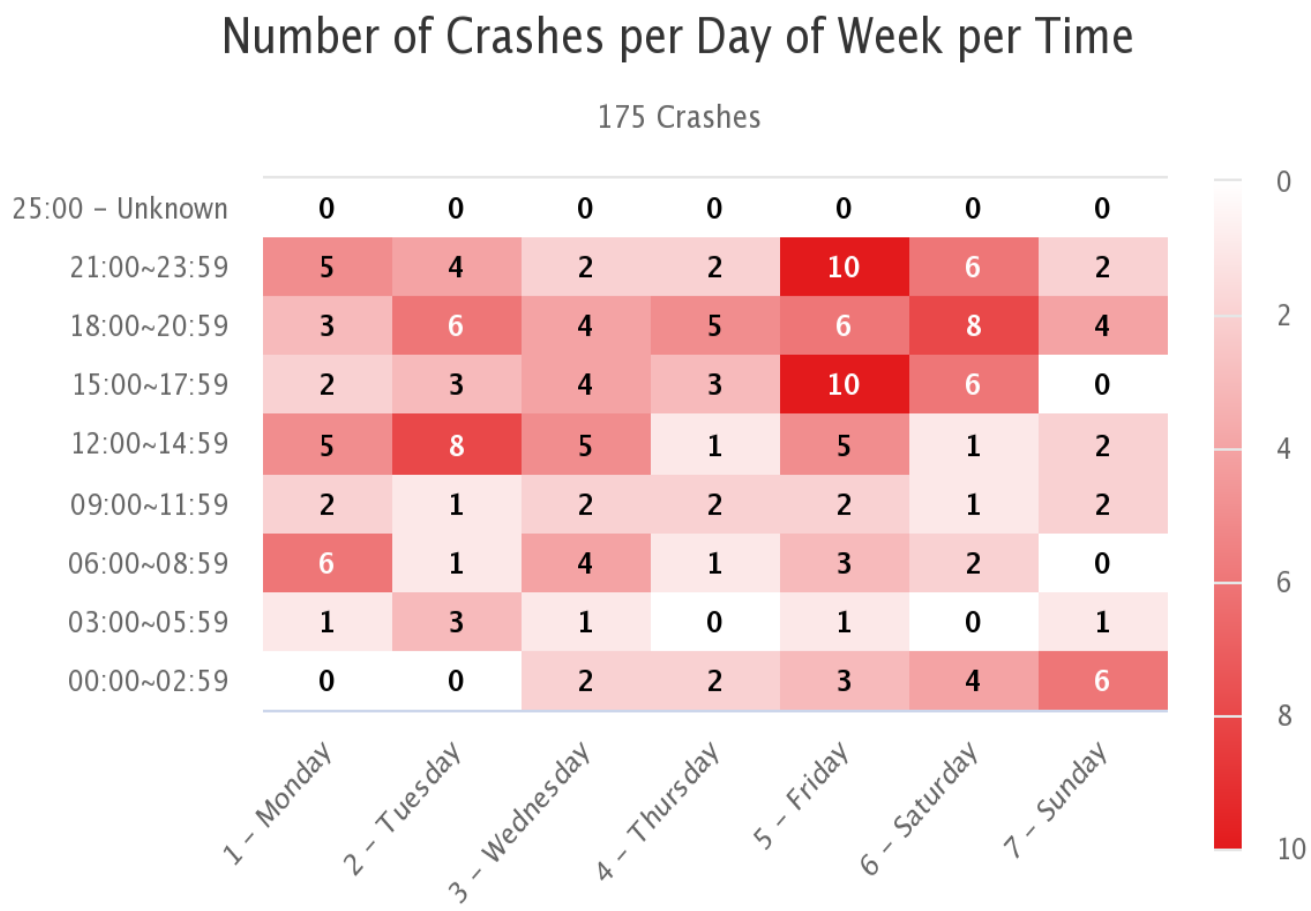
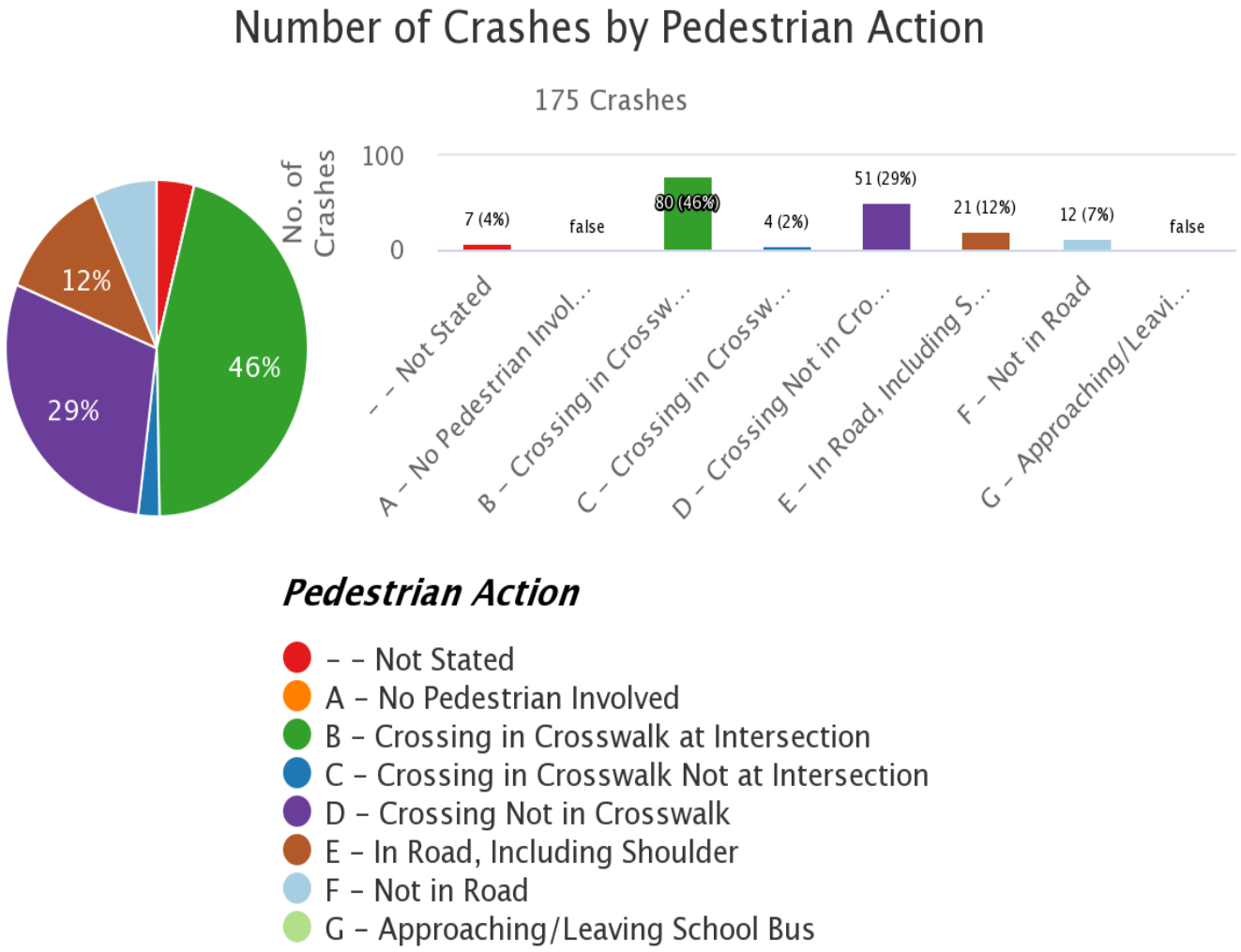


Chart 2.3: Number of Pedestrian Collisions by Pedestrian Action, Costa Mesa



Pedestrian Action	Count	%
- - Not Stated	7	4.00%
B - Crossing in Crosswalk at Intersection	80	45.71%
C - Crossing in Crosswalk Not at Intersection	4	2.29%
D - Crossing Not in Crosswalk	51	29.14%
E - In Road, Including Shoulder	21	12.00%
F - Not in Road	12	6.86%

Bicycle Collisions:

Based on the TIMS data, within the 5-year (2015-2019) period, there were 228 collisions involving bicyclists, one of which was fatal and 11 were with severe injury. A total of 45 collisions happened due to the bicyclist riding on the wrong side of road. The highest number of collisions happened on Thursdays. The following charts depict this data.

Chart 2.4: Number of Bicycle Collisions by Collision Severity, Costa Mesa

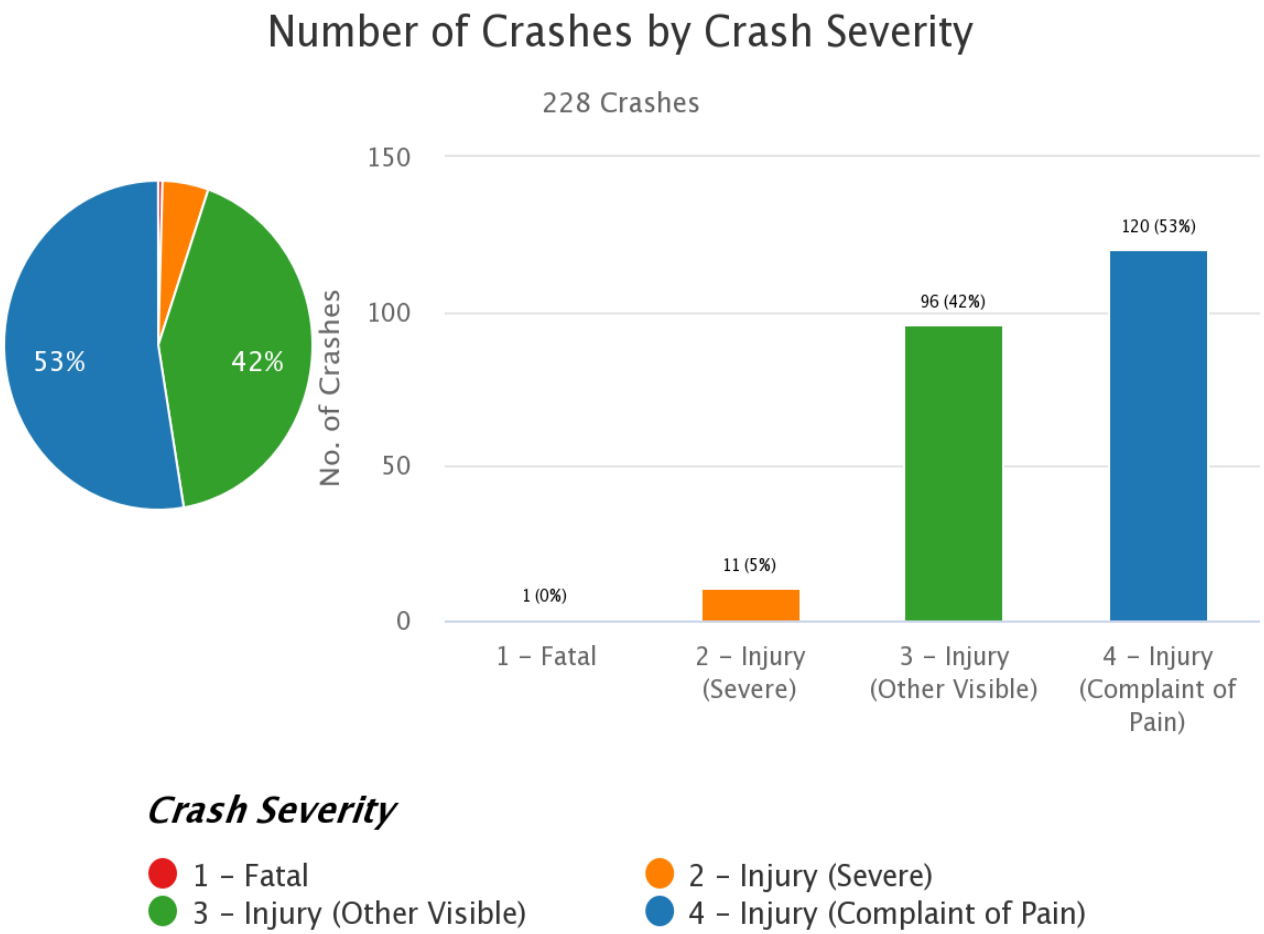


Chart 2.5: Number of Bicycle Collisions per Day of Week per Time, Costa Mesa

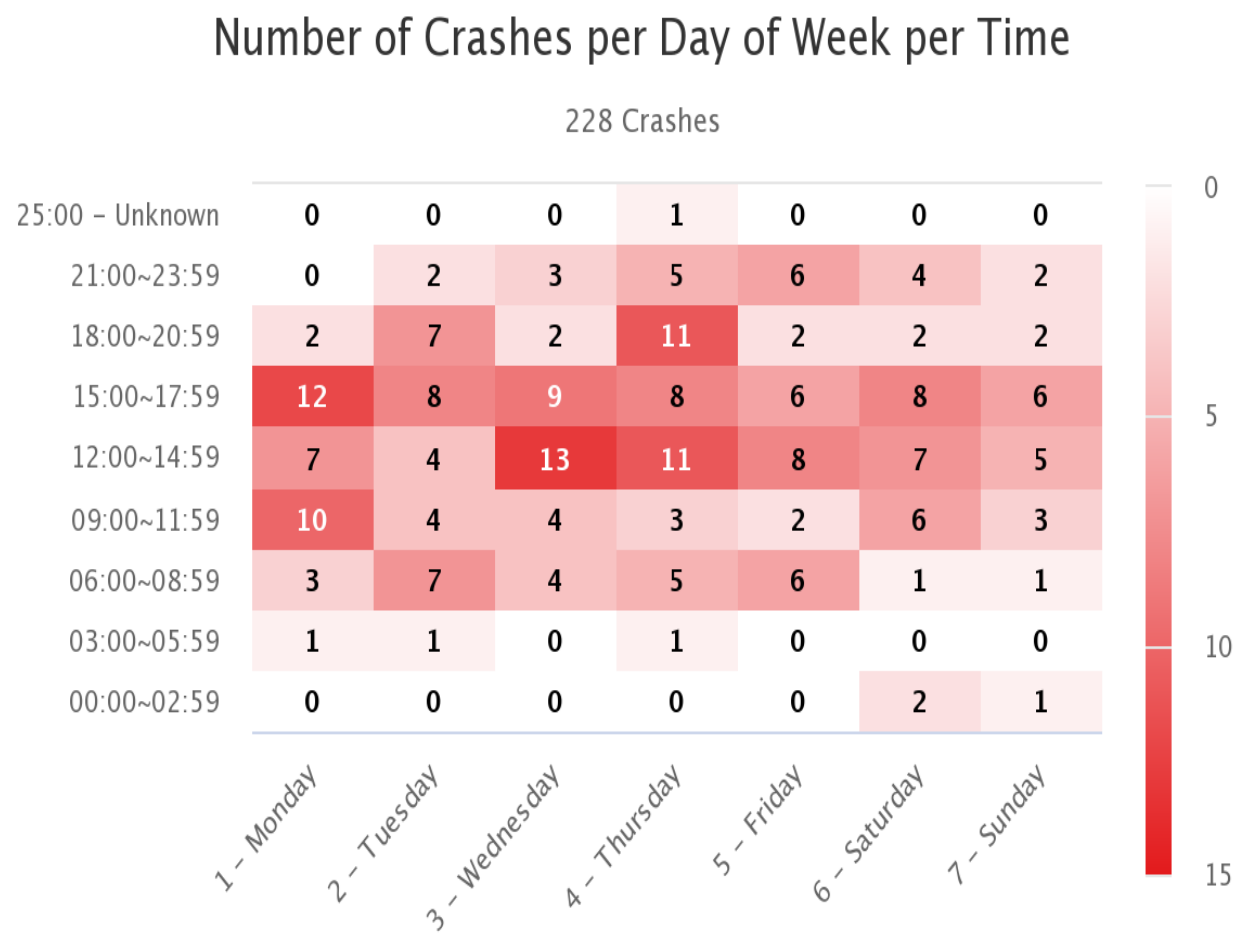
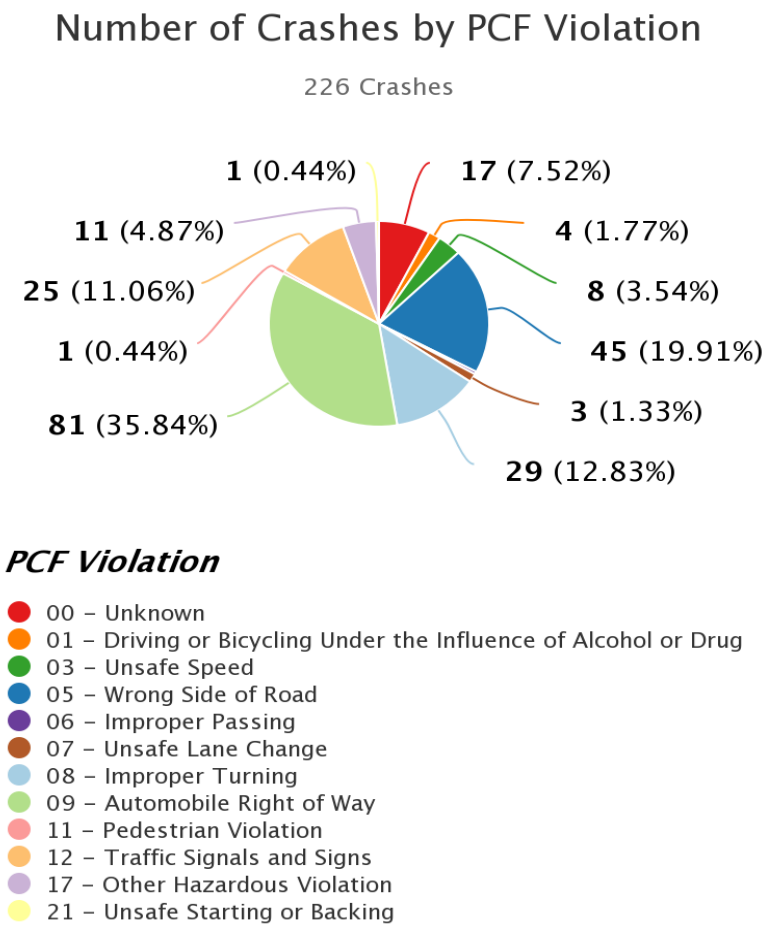


Chart 2.6: Number of Bicycle Collisions by Primary Collision Factor (PCF) Violation, Costa Mesa



PCF Violation	Count	%
00 - Unknown	17	7.52%
01 - Driving or Bicycling Under the Influence of Alcohol or Drug	4	1.77%
03 - Unsafe Speed	8	3.54%
05 - Wrong Side of Road	45	19.91%
06 - Improper Passing	1	0.44%
07 - Unsafe Lane Change	3	1.33%
08 - Improper Turning	29	12.83%
09 - Automobile Right of Way	81	35.84%
11 - Pedestrian Violation	1	0.44%
12 - Traffic Signals and Signs	25	11.06%
17 - Other Hazardous Violation	11	4.87%
21 - Unsafe Starting or Backing	1	0.44%

The type of information provided above was obtained from SafeTREC's TIMS (https://tims.berkeley.edu/) can help the enforcement department in decision-making regarding their enforcement efforts.

2.3. STREET STORY

The Street Story program (https://streetstory.berkeley.edu/) is a relatively new tool developed by UC Berkeley's Safe Transportation Research and Education Center (SafeTREC) with OTS support. Street Story is a community engagement tool that allows residents, community groups and agencies to collect information about transportation collisions, near-misses, general hazards and safe locations to travel. To promote access to the tool, SafeTREC conducts technical assistance sessions with communities and organizations on using Street Story. Street Story is free to use and publicly accessible.

Street Story features a survey where people can record travel experiences. Once a record has been entered, the information is publicly accessible on the website with maps and tables that can be downloaded.

It is suggested that City staff use this free tool to collect information from their residents for local needs assessments, transportation safety planning efforts, safety programs and project proposals.

3. BENCHMARKING ANALYSIS RESULTS AND SUGGESTIONS

3.1. BENCHMARKING ANALYSIS OF POLICIES, PROGRAMS, AND PRACTICES

To assess pedestrian and bicycle safety conditions in the City, the CSSA team first conducted a benchmarking analysis to understand how the City's existing conditions compared with current nationwide best practices. Responses were analyzed using a benchmarking matrix, as shown in Table 3-1, which lists the benchmarking topics that fall under the following categories:

- Implementation of Americans with Disabilities Act (ADA) Improvements
- Policies and Programs
- Funding
- Data Collection
- Pedestrian and Bicycle Network Implementation
- Pedestrian and Bicycle Support Programs

The CSSA team also reviewed the City's website and relevant documents. Through a pedestrian and bicycle safety assessment interview conducted with City's staff, the CSSA team identified the City's pedestrian and bicycle policies, programs, and practices and categorized these into three groups:

- Key strengths (areas where the City is exceeding nationwide best practices)
- Enhancement areas (areas where the City is meeting best practices)
- Opportunity areas (areas where the City appears not to meet best practices)

While suggestions are provided for each category, cities have differing physical, demographic, and institutional characteristics that may make certain goals or policies more appropriate in some jurisdictions than others. Ultimately, City staff may determine where resources and efforts are best placed for meeting local development and infrastructure goals for pedestrians.

Each topic receives one of those three ratings and is highlighted in green in the table below. This analysis shares information on current best practices and how the City compares. With differing physical, demographic, and institutional characteristics, certain goals or policies may be more appropriate in some jurisdictions than others. Ultimately, City staff may determine where resources and efforts are best placed for meeting local development and infrastructure goals for pedestrians.

The items in Table 3-1 are further elaborated in the following sections, which provide a description for each benchmarking topic, the City's current practices, and ideas for improvement or further enhancement. The City staff may select strategies for implementation based on local priorities.

Table 3-1: Summary of Programs, Policies, and Practices Benchmarking Analysis for the City of Costa Mesa

Benchmark Topic	Key Strength	Enhancement	Opportunity
Implementation of Americans with Disabilities Act (ADA) Improvements			
Implementation of Americans with Disabilities Act (ADA) Improvements	Uses state-of-the-practice (PROWAG) ADA improvements with consistent installation practices	Has clear design guidelines but no regular practices for ADA compliance	Has minimal design guidelines and practices related to ADA requirements
ADA Transition Plan for Streets and Sidewalks	Has ADA transition plan in place and an ADA coordinator	Partial or outdated ADA transition plan or an ADA coordinator	No transition plan or ADA coordinator
Policies and Programs			
Pedestrian/Bicycle Coordinator	Has a Coordinator on staff who manages the agency's pedestrian and bicycle programs	Occasionally uses a part-time contract coordinator	Does not have a pedestrian/bicycle coordinator
Formal Advisory Committee	Has a formal, active Transportation Advisory Committee that address bicycle/pedestrian issues	Has an ad-hoc Transportation Advisory Committee. Note: City's Planning Commission may act as Transportation Advisory Committee.	Does not have a Transportation Advisory Committee
Traffic Calming Program	Has a significant traffic calming program with a dedicated funding source	Has a traffic calming program but no dedicated funding source	Explores other traffic calming features other than speed humps
Speed Limits and Speed Surveys	Employs comprehensive practice to proactively review speed limits such as USLIMITS2[1]. Considers traffic calming before raising speed limits in pedestrian or bicycle zones	Reviews data only in response to reported concerns or frequent collisions	Reviews speed limits by following CA MUTCD and CA Vehicle Code.

[1] https://safety.fhwa.dot.gov/uslimits/

Benchmark Topic	Key Strength	Enhancement	Opportunity
Safe Routes to Schools	Has an ongoing Safe Routes to Schools program and funding for recent projects.	Has obtained funding for recent projects, but has no community-wide Safe Routes to Schools program	Does not have a Safe Routes to Schools program and has not obtained recent funding
Crosswalk Installation, Removal, and Enhancement Policies	Has a crosswalk policy that reflects best practices for signalized and uncontrolled crosswalk treatments (FHWA Field Guide), including consideration of Pedestrian Hybrid Beacons	Has no policy, but has an established crosswalk installation, removal, and enhancement practice in place	Does not have a policy or set practices for addressing crosswalk installation, removal, or enhancement
Shared Mobility Services	Has curbside management, shared mobility, or micromobility policies (e.g., permitting, enforcement) in place that prioritize pedestrian and bicyclist safety	Has curbside management, shared mobility, or micromobility policies in place, but without a focus on safety	No curbside management, shared mobility, or micromobility policies in place
Funding			
Funding	Has a dedicated annual funding stream for pedestrian and bicycle projects and local grant matches	Depends on grant funding for projects, and is successful in obtaining grants	Only moderately successful in obtaining grant funding or has trouble spending funds when given grants
Data Collection			
Collection of Pedestrian and Bicyclist Volumes	Collects pedestrian and bicyclist volumes routinely with intersection counts and has a GIS database of counts	Collects some pedestrian and bicyclist volumes, but not routinely	Does not collect pedestrian and bicycle volumes
Inventory of Bikeways, Parking, Informal Pathways, and Key Bicycle Opportunity Areas	Maintains an inventory of missing and existing bikeways in GIS and includes bikeway projects in the CIP	Maintains an inventory of missing facilities and opportunity areas	Does not have an inventory of missing/existing bikeways, parking, informal pathways, or key bicycle areas
Inventory of Sidewalks, Informal Pathways, and Key Pedestrian Opportunity Areas	Maintains an inventory of missing and existing sidewalks in GIS and includes sidewalk projects in the CIP	Maintains an inventory of missing sidewalks, informal pathways, or pedestrian opportunity areas	Does not have an inventory of missing sidewalks, informal pathways, or pedestrian opportunity areas

Benchmark Topic	Key Strength	Enhancement	Opportunity
Pedestrian and Bicycle Traffic Control Audit (Signs, Markings, and Signals)	Maintains an inventory of pedestrian and bicycle signs, markings, and signals in GIS	Has some inventories of signs, markings, and signals	Does not have an inventory of signs, markings, and signals
Collision History and Collision Reporting Practices	Employs a data-driven systemic safety or Vision Zero approach to regularly analyze collision data citywide	Reviews data only following fatalities or other high-profile incidents	Does not have set practices for data review
Pedestrian and Bicycle Network Implementation			
Complete Streets Policy	Has a Complete Streets policy that includes all users and modes, affects new construction and maintenance, considers local context, and provides guidance for implementation	Has a Complete Streets policy that is narrow in scope or applies only to public works projects	Does not have a Complete Streets policy
Active Transportation Plans	Has a recently-updated Active Transportation Plan (or similar) with strategic prioritized list of projects that reflects current best practices (e.g. Level of Traffic Stress analysis, inclusion of Class IV protected bicycle facilities)	Has a Pedestrian or Bicycle Master Plan but it may be outdated and/or no recent projects from the Plan have been completed	Does not have a Pedestrian or Bicycle Master Plan
Existing bike network	Includes current best practice features such as separated bikeways, bicycle boulevards, intersection treatments, and/or buffered bike lanes	Includes Class I, II, and III only	Includes only bicycle routes or no designation
Existing pedestrian facilities	Includes current best practice ADA and safety features such as high visibility crosswalks and advance stop bars, PHBs or RRFBs, bulbouts, etc.	Narrow sidewalks or sidewalk gaps, crosswalks with few or no safety enhancements, with some pedestrian countdown signals	Missing key marked crosswalks and sidewalks, with few ADA improvements and no safety enhancements, and no pedestrian countdown signals

Benchmark Topic	Key Strength	Enhancement	Opportunity
Bike Network Implementation Practices	Age 8 to 80 bicyclist considerations are applied and/or level of traffic stress is considered	Some traffic calming measures are implemented in conjunction with bikeway installation	Treatments are implemented where they fit within the right-of-way and vehicle LOS is not affected
Design guidelines and standards	Uses national best practices focused on bicycle and pedestrian safety for roadway and facility design guidelines and standards	Local standards reference national best practices, but are static or out of date, with minimal customized design policies for pedestrian and bicycle accommodations	Does not have a comprehensive design guidelines or standards for pedestrian or bicyclist treatments
Roadway Surfaces	Roadway resurfacing projects and debris removal are prioritized for bicycle routes.	Roadway surface is acceptable on bicycle routes and routine maintenance, including debris removal, occurs.	Roadway surface conditions are poor on some bicycle facilities and maintenance is not prioritized for bicycle facilities
Attention to Bicycle Crossing Barriers	Colored bike lanes and other innovative treatments, including geometric enhancements, are provided at intersections and interchanges	Bike treatments are installed at some intersections and interchanges	Bike treatments are not installed at intersections or through interchanges
Attention to Pedestrian Crossing Barriers	Has a recently updated policy and comprehensive inventory of barriers. Has design guidelines for addressing barriers	Has no policy, but has identified some barriers and taken steps to improve pedestrian access	Does not have a policy or practices for pedestrian crossings at railroads, freeways, and so on
Traffic Signal	Uses relaxed warrants for traffic signals and/or all-way stops	Uses relaxed warrants for traffic signals or all-way stops	Uses MUTCD Warrants
Pedestrian and Bicycle Support Program			
Bicycling Supportive Amenities and Wayfinding	Bicycle supportive amenities (parking, routing/wayfinding, water fountains, repair stations) are found community-wide	Some bicycle supportive amenities are found in key areas	Bicyclist supportive amenities are not provided in the community

Benchmark Topic	Key Strength	Enhancement	Opportunity
Pedestrian and Bicycle Safety Education Program	Pedestrian and bicycle education programs are data-driven and focused on local safety context; education programs are customized for different groups	Has some traffic safety education programs that include pedestrians and bicyclists	Does not have pedestrian and bicycle safety education programs
Enforcement	Police Department conducts sustained and data-driven enforcement efforts focused on behavior and locations related to most severe bicycle and pedestrian crashes; enforcement activities are designed to consider equity implications	Police Department conducts some enforcement activities related to bicyclist and pedestrian safety	Police Department does not have Traffic Safety Officer(s)

Implementation of Americans with Disabilities Act (ADA) Improvements

Implementation of ADA improvements is key to making walking accessible and safe for everyone, regardless of ability or age.

Suggestions for Potential Improvement

- Continue adding ADA ramps at intersections that currently lack them and upgrade non-complaint ramps
- Develop an ADA improvement program for items such as dual curb ramps, truncated domes, and audible pedestrian signals that applies consistent treatments. The program may provide an inventory, prioritization plan, and funding source for such improvements.

ADA Transition Plan for Streets and Sidewalks

ADA Transition Plans identify gaps and issues in the City's current ADA infrastructure, prioritize projects for implementation, and set forth the process for bringing public facilities into compliance with ADA regulations. Transition Plans typically include a range of locations, such as public buildings, sidewalks, ramps, and other pedestrian facilities. Some cities also have ADA Coordinators, who are responsible for administering the Plan and reviewing projects for accessibility considerations.

Suggestions for Potential Improvement

- Consider prioritizing sub-areas within the City that exhibit greatest pedestrian activity.
- Expand the ADA Transition Plan to include the public right-of-way, particularly the downtown area, other priority development areas, bus stops, and schools.
- Consider having a part-time, trained ADA coordinator to review projects for accessibility and implement the ADA Transition Plan.
- Provide ADA standards and best practice training for engineering staff at all levels.

Pedestrian/Bicycle Coordinator

A pedestrian/bicycle coordinator provides guidance for pedestrian/bicycle planning efforts and oversees implementation of plans. In a sampling of pedestrian-oriented California cities, a common denominator among cities (with a population over 100,000) is a full-time pedestrian/ bicycle coordinator.

Suggestion for Potential Improvement

- Include dedicated time for the pedestrian and bicycle staff person to write grants for both capital projects and ongoing funding for walking and biking related programs and optics as well as to liaison with local non-profit, advocacy groups, and schools.

Formal Advisory Committee

Advisory committees serve as important sounding boards for new policies, programs, and practices. Responding to public concerns through public feedback mechanisms represents a more proactive and inclusive approach to bicycle and pedestrian safety compared to a conventional approach of reacting to collisions.

City of Costa Mesa has a Bikeway and Walkability Committee whose members are appointed by the City Council and meets regularly on the first Wednesday of each month.

Public Involvement and Feedback Process

Having multiple touch points with the community creates transparency and open lines of communication between the City staff, residents, and businesses. Different kinds of formats and venues for public involvement and feedback allows for broader participation from the community. Consideration of local demographics (e.g., languages spoken) and the easiest formats for people to participate (e.g., online, in person but in the course of their daily activities, or at City-organized meetings) are important for meaningful and productive community dialogue.

Suggestion for Potential Improvement

- Provide quarterly or annual updates to the community on the “state of walking and biking”, including recently completed projects, anticipated timeline for upcoming projects, and what the City plans to fund.

- Provide notices and interpretation in the most commonly spoken languages.

Traffic Calming Program

Traffic calming programs and policies set forth a consensus threshold on neighborhood requests and approvals, as well as standard treatments and criteria.

Suggestion for Potential Improvement

- Increase the amount of dedicated funding available for traffic calming each year.

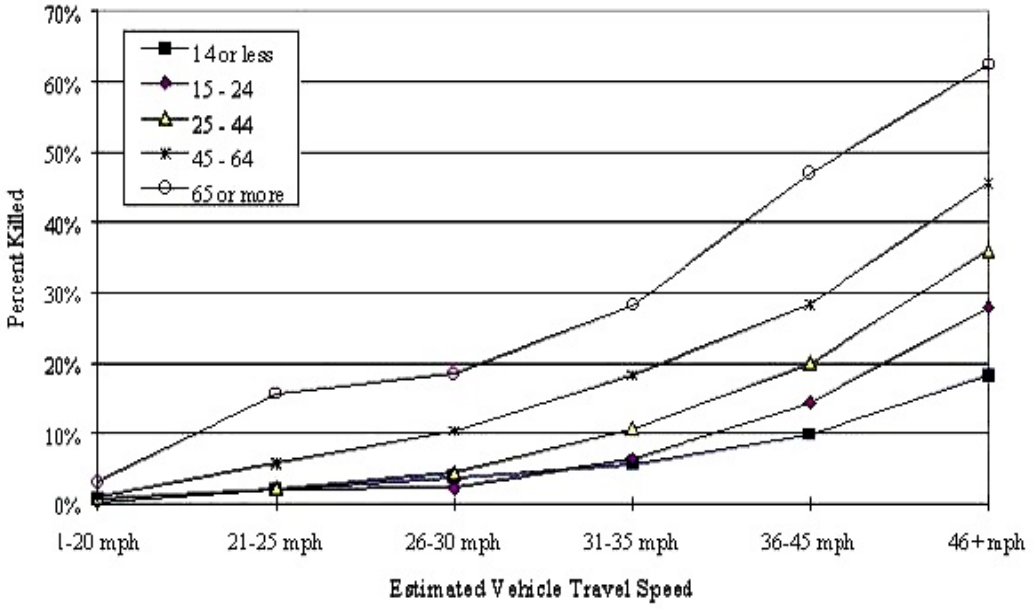
- Expand the City's traffic calming toolbox to include other tools, such as raised crosswalks, raised intersections, chicanes, and traffic diverters. The City could secure additional dedicated funding streams as part of the Bicycle and Pedestrian Plan buildout to accommodate these sometimes costlier (but highly effective) improvements.

- Expand the City's practices to include proactive traffic calming measures instead of only responding to community requests. The City could consider allocating a portion of funding to proactive traffic calming, such as on bicycle boulevard streets or safe routes to schools, and then allocate the remaining funding to react to specific community requests.

Speed Limits and Speed Surveys

Local municipalities have the authority to set the posted speed limit based on current speed data. The speed limit is rounded to the nearest five mile per hour (MPH) increment based on the 85th percentile speed of free-flowing traffic. School zone speed limits in California are a de facto 25 miles per hour or less, where specified. Speed is also critical for complete streets safety. Pedestrian fatality rates increase exponentially with vehicle speed. Thus, controlling vehicle speeds is one of the most important strategies for enhancing pedestrian and bicyclist safety.

Figure 3-1. Relationship between Vehicle Speed, Victim Age, and Fatalities



Suggestions for Potential Improvement

- Install traffic calming measures, signal coordination, and similar tools to maintain slower speeds appropriate for an urban community, particularly on streets that will be reviewed in the next speed survey.
- After complete streets improvement and other safety improvements are installed, conduct off-cycle speed surveys to review the speed limit and see if it needs to be reduced based on the improvements.
- Consider pedestrian volumes and known complete streets safety issues when setting speed limits and employ traffic calming strategies in locations where speed surveys suggest traffic speeds are too high for pedestrian and bicyclist safety.
- Ensure complete streets design standards have appropriate target design speeds for urban areas and do not contribute to a routine need for traffic calming.
- Consider the use of 15 MPH school zones.

Safe Routes to Schools

Safe Routes to School (SRTS) programs encourage children to safely walk or bicycle to school. The Marin County Bicycle Coalition was an early champion of the concept, which has spread nationally (refer to best practices at www.saferoutestoschools.org). SRTS programs are important both for increasing physical activity (and reducing childhood obesity) and for reducing morning traffic associated with school drop-off (as much as 30% of morning peak hour traffic).

Suggestion for Potential Improvement

- Form an ongoing steering committee for the program (or each school) comprised of City staff, school district staff, PTA leaders, and other stakeholders that meets regularly to monitor efforts and identify new opportunities.

- Consider updating the safe route to school plan for all schools to conduct walk audits, identify recommended safety improvements, and secure funding for those improvements.

Crosswalk Installation, Removal, and Enhancement Policies

A formal policy for crosswalk installation, removal, and enhancement provides transparency in decision-making and adopts best practices in pedestrian safety and accommodation. It includes consideration of all kinds of crosswalks, including uncontrolled and controlled locations.

Suggestion for Potential Improvement

- Develop a Citywide crosswalk policy for the installation, removal, and enhancement of crosswalks at controlled and uncontrolled location. Ensure that it is consistent with best practices and recent research. This includes removing crosswalks only as a last resort and providing midblock crossings where they serve pedestrian desire lines.
- Consider developing a treatment selection "tool" to assist staff with the identification of applicable treatments in a given context.
- When crosswalk enhancements are identified, add them to a prioritized list that will be upgraded over time as funding is available.

Crosswalk policy resources include:

- Federal Highway Administration Study Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations: https://www.fhwa.dot.gov/innovation/everydaycounts/edc_4/guide_to_improve_uncontrolled_crossings.pdf
- National Cooperative Highway Research Program Application of Pedestrian Crossing Treatments for Streets and Highways: http://www.trb.org/Publications/Blurbs/175419.aspx

Shared Mobility Services

Shared mobility services are transportation services — typically offered by private companies — that offer ride-hail services (e.g., Lyft or Uber) for both solo and pooled trips, bike share, and scooter share. Policies for shared mobility services can allow agencies to encourage, prohibit, or direct how they want shared mobility to work in their agency. They can allow for curb space management, clear organization of sidewalk space, and encourage (or discourage) private vendors to come to the City. Curb space management is a practice that requires curb access to be planned, designed, operated, and maintained to enable curb utilization with safe, convenient, and multimodal access for all transportation users.

Suggestion for Potential Improvement

- Consider micromobility policies (e.g., permitting, enforcement) in place to prioritize pedestrian and bicyclist safety and keep the sidewalk organized and usable for people of all abilities.

Funding

A dedicated, annual funding stream for bicycle and pedestrian projects ensures that these types of projects will be implemented regularly. Bicycle and pedestrian projects can also be integrated in the other work that the City does, including repaving and other routine maintenance of the roadway network.

Suggestion for Potential Improvement

- Partner with other agencies and continue applying for grant funding for both infrastructure and non-infrastructure projects.
- Integrate bicycle and pedestrian projects into the site plan review process for new development.
- Secure additional funding for repaving projects to allow for “quick build” projects and other bicycle and pedestrian safety improvements to be integrated into those projects.
- Establish a dedicated funding source for pedestrian and bicycle projects.

Collection of Pedestrian and Bicyclist Volumes

Pedestrian and bicyclist volume data is important for understanding where people walk and bike. This establishes baseline data prior to project implementation and can help prioritize projects, develop collision rates, and determine appropriate bicycle and pedestrian infrastructure.

Suggestions for Potential Improvement

- Routinely collect pedestrian and bicycle volumes by requiring them to be counted in conjunction with manual intersection turning movement counts.
- Geocode pedestrian volume data with GIS software along with other data such as pedestrian control devices and collisions to analyze data for trends or hotspots related to pedestrian safety.

Inventory of Bikeways, Parking, Informal Pathways, and Key Bicycle Opportunity Areas and Inventory of Sidewalks, Informal Pathways, and Key Pedestrian Opportunity Areas

A GIS-based sidewalk and bicycle facilities inventory enables project identification and prioritization, as well as project coordination with new development, roadway resurfacing, and so on. This data set can be available on the City’s website for knowledge sharing with the public as well as agencies.

The City of Costa Mesa maintains an inventory of existing and proposed bike facility and includes bike projects in their CIP. It also maintains an inventory of missing sidewalks, and informal pathways, and sidewalk projects in CIP, although they are not in GIS.

Suggestion for Potential Improvement

- Migrate the inventory of bikeways, bike parking, and future bike improvements into a GIS format for quick mapping and sharing.
- Migrate the inventory of existing and missing sidewalks, and informal pathways into a GIS format for quick mapping and sharing.
- Consider establishing a program to work with property owners to repair damaged sidewalks outside their property.
- Identify a staff person responsible for maintaining the GIS data set.

Pedestrian and Bicycle Traffic Control Audit (Signs, Markings, and Signals)

Cities have a wide variety of traffic control devices that regulate how bicyclist and pedestrians should use the street and interact safely with drivers. However, some cities do not have inventories how, when, and where this is installed. Creating a database of this information allows the City's staff to know where infrastructure may be out of date or in needed of updates. For example, countdown signals are important pedestrian safety countermeasure. The 2012 California *Manual of Uniform Traffic Control Devices* (MUTCD) requires the installation of countdown pedestrian signals for all new signals. Likewise, the CA MUTCD also requires installation of bike detection at all actuated signals. Bike detection is a basic building block of the bike network to make sure that bikes can trigger the traffic signal. Inventorying bike detection and countdown signals allows the City's staff to approach safety from a systems perspective and develop projects to close gaps in biking and walking infrastructure over time.

Suggestion for Potential Improvement

- Consider developing a Citywide crosswalk inventory in GIS and maintain it over time. This would allow for a systemic safety approach to enhancing crosswalks, and allow the City to prioritize all crosswalk enhancement projects Citywide for implementation over time and as money is available. Include maintenance records within the GIS database inventory of signs, markings and signals.
- Ensure that locations with pedestrian desire lines have safe crosswalks. An updated crosswalk policy can help determine the appropriate crossing treatment at uncontrolled locations without marked crosswalks.
- Develop a proactive monitoring program for ensuring the quality and proper functioning of traffic control devices.

Collision History and Collision Reporting Practices

Safety is typically approach through both proactive and reactive measures. Identifying and responding to collision patterns on a regular basis is an important reactive approach to bicycle and pedestrian safety, which may be combined with other proactive measures. This is the traditional way most cities have approached safety. However, many are now looking to proactive safety to address safety issues on a system wide basis. This is often paired with a policy goal of getting to zero fatality or severe injury collisions (commonly referred to as “Vision Zero”).

Suggestion for Potential Improvement

- Adopt a data driven systemic safety approach, which would include a systems approach to identifying, prioritizing, and ultimately implementing safety countermeasure and/or a formal commitment to Vision Zero.
- Work with elected officials and department heads to adopt a Vision Zero policy formally stating the City’s commitment to reducing the number of traffic-related fatalities and severe injuries to zero.
- Additionally, with sufficient pedestrian volume data, the City could prioritize collision locations based on collision rates (i.e., collisions/daily pedestrian volume), a practice that results in a more complete safety needs assessment. Treatments could then be identified for each location and programmatic funding allocated in the City’s Capital Improvements Program (CIP).

Complete Streets Policy

Complete Streets Policies are formal statements showing a City’s commitment to planning and designing for all modes of travel and travelers of all ages and abilities.

City of Costa Mesa already has a Complete Streets Policy.

Active Transportation Plan

This type of plan includes a large menu of policy, program, and practice suggestions, as well as site-specific (and prototypical) engineering treatment suggestions. Bicycle and Pedestrian Master Plan(s) documents a jurisdiction’s vision for improving walkability, bikeability, and bicycle and pedestrian safety; establish policies, programs, and practices; and outline the prioritization and budgeting process for project implementation.

Suggestion for Potential Improvement:

- Implement the low-hanging projects in the Bicycle and Pedestrian Master Plan and seek grant funding for major projects
- Pursue additional funding opportunities for programs identified by the Plan.
- Provide regular updates to the Plan, including bicycle and pedestrian facilities and design guidelines that address the needs of bicyclists and pedestrians of all ages and abilities

- Develop high injury networks for walking and biking to identify routes with the highest incidences of fatal and severe injuries for pedestrians and bicyclists. This will create a systematic safety analysis that can help in prioritizing limited resources.

- Consider identifying existing and missing bicycle and pedestrian infrastructure for safety improvement.

Existing Bike Network

Innovative features such as separated bikeways, bicycle boulevards, and buffered bike lanes can decrease the level of traffic stress experienced by bicyclists, make biking more comfortable, and — in so doing — appeal to a wide range of bicyclists. Level of traffic stress refers to the level of comfort or discomfort a bicyclist might experience. Research conducted by the Mineta Institute in San Jose establishes levels of traffic stress on a scale for 1 to 4 with LTS 1 at the level that most children can tolerate and LTS 4 at the level characterized by "strong and fearless" cyclists (see: http://transweb.sjsu.edu/project/1005.html). A bicycle network that is attractive to the majority of the population would have low stress and high connectivity.

Suggestion for Potential Improvement:

- Continue to identify funding sources and implement the proposed projects identified in the Bicycle and Pedestrian Master Plan and Local Road Safety Plan.

- Develop design standards for bike boulevards, trails, paths, and landscaping for bicycle network.

- Create a GIS data for existing bike network to identify gaps and opportunities for improvements.

Existing Pedestrian Facilities

Suggestion for Potential Improvement:

- Continue to identify funding sources and implement the proposed projects identified in the Bicycle and Pedestrian Master Plan and Local Road Safety Plan.

- Create a GIS database for existing pedestrian infrastructure to identify gaps, inventory assets, and create opportunities for systemic safety analysis of all crosswalks.

Bike Network Implementation Practices

Considering the safety and comfort of people biking leads to better bikeway projects that can encourage new biking trips and enhance safety for people biking today and in the future.

Bicycle Level of Traffic Stress (LTS) was originally developed by researchers at the Mineta Transportation Institute. LTS assesses the comfort and connectivity of bicycle networks.

Suggestion for Potential Improvement:

- Prioritize bicycle projects to align with roadway resurfacing and projects that are near school sites.
- Secure enough funding for repaving and other complete streets projects to allow for installation of protected bike facilities and intersection improvements.
- Strategically implement bikeways and traffic calming treatments that would improve LTS of existing bikeways.

Design Guidelines and Standards

Design guidelines and development standards create a clear set of documents that guide how all transportation improvements should be installed Citywide. As a result, they can create a consistent, high-quality biking and walking experience.

Suggestion for Potential Improvement

- Consider utilizing national bicycle and pedestrian safety best practices for roadway and facility design guidelines and standards:
    - NACTO Urban Street Design Guide: http://www.nyc.gov/html/dot/downloads/pdf/2012-nacto-urban-street-design-guide.pdf
    - CROW Design Manual for Bicycle Traffic
    - FHWA Separated Bike Lane Planning and Design Guide https://nacto.org/wp-content/uploads/2016/05/2-4_FHWA-Separated-Bike-Lane-Guide-ch-5_2014.pdf
    - MassDOT Separated Bike Lane Planning & Design Guide https://www.mass.gov/lists/separated-bike-lane-planning-design-guide
    - ITE Recommended Practice for Accommodating Pedestrians and Bicyclists at Interchanges
    - AASHTO Guide for the Development of Bicycle Facilities https://nacto.org/wp-content/uploads/2015/04/AASHTO_Bicycle-Facilities-Guide_2012-toc.pdf

AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities https://transops.s3.amazonaws.com/uploaded_files/Update%20of%20the%20AASHTO%20Guide%20for%20the%20Planning%2C%20Design%2C%20and%20Operation%20of%20Pedestrian%20Facilities.pdf

Roadway Surfaces

The quality of a roadway surface along bikeways is an important consideration when choosing to bike. Rough surface in a bike lane creates an uncomfortable bicycling experience and may also pose safety hazards.

Suggestion for Potential Improvement:

- Prioritize maintenance of roadways where bicycle facilities are present, particularly for closing gaps in the bikeway network or where improved pavement quality is needed on popular bicycle routes.
- Prioritize debris removal on roadways where bicycle facilities are present.
- Assess the needs for new and enhanced crosswalks and curb ramps with each repaving project. Include consideration of lane reductions and quick build projects such as paint and plastic median refuges and bulb outs; high-visibility crosswalks; and advanced yield markings.

Attention to Bicycle Crossing Barriers

Crossing barriers — such as railroads, freeways, and major arterials — may discourage or even prohibit bicycle access and are often associated with vehicle-bicycle collisions. Large intersections and interchanges and uncontrolled crossings can often deter bicyclists due to high speeds, high number of conflict points with vehicles, and high level of exposure. Identifying and removing barriers and preventing new barriers is essential for improving bicyclist safety and access.

The City of Costa Mesa has bicycle boxes, bicycle crosswalks or conflict markings through the intersections.

Suggestion for Potential Improvement:

- Continue using green routinely to highlight conflict zones at large intersection and interchanges.
- To slow speeds at critical intersections, use smaller corner radii using small design vehicles appropriate for urban areas and updated standard plans to reflect this.
- Review design of slip/trap-right lanes at intersections and implement improvements.
- Implement best practice guidance on bicycle accommodation through interchanges and expressways, as appropriate, using the ITE's *Recommended Practice: Guidelines to Accommodate Bicyclist and Pedestrians at Interchanges* plus consideration of protected bike lane design.

Attention to Pedestrian Crossing Barriers

Crossing barriers discourage or even prohibit pedestrian access and can create safety challenges for pedestrians. These can be similar to the biking barriers or present additional challenges.

Suggestion for Potential Improvement:

- Identify and create an inventory of pedestrian barriers with targeted recommendations for phased improvements.

- Consider pedestrian barriers and needs in doing bicycle barriers assessment.

Sidewalk Furniture or Other Sidewalk Zone Policies

Street furniture encourages walking by accommodating pedestrians with benches to rest along the route or wait for transit; trash receptacles to maintain a clean environment, street trees for shade, and so on. Uniform street furniture requirements also enhance the design of the pedestrian realm and may improve economic vitality.

Suggestion for Potential Improvement

Adopt a Street Furniture Ordinance to include locations and furniture amenities other than those associated with transit stops, as appropriate.

Street Tree Requirements

Street trees enhance the pedestrian environment by providing shade and a buffer from vehicles, which increase pedestrian safety. Street trees may also enhance property values, especially in residential neighborhoods. However, street trees, when improperly selected, planted, or maintained, may cause damage to adjacent public utilities.

Suggestion for Potential Improvement

- Update the Street Tree Ordinance to provide guidance on permissible tree types and permitting requirements, also specifying a requirement for new trees plantings associated with development projects.

Bicycling Supportive Amenities and Wayfinding

In addition to designating roadway or paths in a bicycle network, supportive amenities (including parking, water fountains, and maintenance stations) can encourage bicycling. Wayfinding can both encourage bicycling and enhance safety by navigating cyclists to facilities that have been enhanced for bicyclist use or to local retail opportunities for economic growth.

Suggestion for Potential Improvement:

- Create and deploy a bicycle wayfinding strategy Citywide as recommended in the Bicycle and Pedestrian Master Plan, as well as a Biking Guide.

- Develop a Biking Guide that includes a bike map and bicycle locker and rack locations.

Bicycle Parking Requirements

Safe and convenient bicycle parking is essential for encouraging bicycle travel (especially in-lieu of vehicle travel). Bicycle parking can also facilitate last-mile connections between two modes, such as bicycle parking at a transit station. To be effective, bicycle parking needs to be visible

and secure and have enough capacity to accommodate bicycle demand, both long-term and short-term. Long-term and short-term parking can be implemented through a bicycle parking ordinance.

Suggestion for Potential Improvement:

- Implement short-term and long-term, secured bicycle parking at all new development, consistent with the Bicycle and Pedestrian Master Plan and the APBP Bicycle Parking Guidelines, 2nd edition.
- Site bicycle racks to be convenient for bicyclists, out of the way of pedestrians, and with good visibility for security, consistent with the APBP Bicycle Parking Guidelines, 2nd edition.
- Consider implementation of "branded" racks for the City (with a unique design or City's symbol).

Pedestrian and Bicycle Safety Education Program

Engineering treatments are often not enough on their own to realize full safety benefits associated with the treatment. Safety education programs complement engineering treatments and increase compliance. Education campaigns target people of all ages, especially school-age children where safe walking and biking habits may be instilled as lifelong lessons.

Suggestion for Potential Improvement

- Conduct a formal education campaign targeting people driving, walking, and biking about street safety. This includes: advertisements on buses and bus shelters, an in-school curriculum, community school courses, public service announcements, and many other strategies. Consider a focus on speed and safe driving.
    - The Street Smarts program in San Jose, CA, provides a model pedestrian safety

Enforcement

Enforcement of pedestrian and bicycle right-of-way laws and speed limits is an important complement to engineering treatments and education programs.

Suggestion for Potential Improvement

The 3-E's of Pedestrian Safety:

Engineering

Education

- Implement sustained pedestrian safety enforcement efforts and involve the media. Use enforcement as an opportunity for education by distributing pedestrian safety pamphlets in-lieu of, or in addition to, citations.
- Train officers in pedestrian safety enforcement principles. The Madison, Wisconsin Department of Transportation has developed a DVD in collaboration

with the Madison Police Department to train traffic officers in pedestrian and bicycle issues (for more information see *http://www.walkinginfo.org/library/details.cfm?id=2865*).

Pedestrian Walking Audit Program

Walking audits provide an interactive opportunity to receive feedback from key stakeholders about the study area and to discuss the feasibility of potential solutions. They can be led by City staff, advocacy groups, neighborhood groups, or consultants.

Suggestion for Potential Improvement

- Include regular walking audits in Citywide pedestrian safety program, based on the suggestions of this CSSA. This effort may complement other "green" or health-oriented programs within the City.

Bicycling Safety Audit Program

When City staff and key stakeholders ride along study corridors and experience key route and crossing challenges and best practices, consensus is more readily reached on a vision and action plan for safety enhancements.

- Include regular bicycling audits in the Citywide bicycle safety programs. Encourage interdepartmental participation.
- Routinely conduct bicycle safety audits of key corridors throughout the City, including those with recent improvements, those with heavy bicycle demand, and those with high collision rates.
- Collaborate with schools on projects beyond the school district boundaries.

Bike Ordinances (Sidewalk Riding)

Suggestion for Potential Improvement:

- Consider an optional helmet ordinance for adults.
- Consider allowing for context-specific flexibility in sidewalk riding policies and enforcement.

Transportation Demand Management (TDM) Programs

TDM programs encourage multimodal travel by incentivizing non-automobile options. As new development occurs, TDM programs can be expanded, formalized, and strengthened.

Suggestions for Potential Improvement

As part of a comprehensive TDM program:

- Create a TDM program and accompanying website with separate pages for employees, residents, and visitors.

General Plan: Densities and Mixed-Use Zones

Planning principles contained in a City's General Plan can provide an important policy context for developing bicycle-oriented and walkable areas. Transit-oriented development, higher densities, and mixed uses are important planning tools for pedestrian-oriented areas.

Suggestion for Potential Improvement

- Consider allowing moderate to high densities in the downtown and mixed-use zones as well progressive parking policies, such as shared parking and demand-based pricing.
- Consider multi-modal trade-offs in the transportation impact analysis for new development, so that the safety and needs of people walking and biking is weighed heavily and vehicular delay is not the primary performance measure.
- Ensure that wide sidewalks, high quality, protected bike lanes, and intersection safety improvements are included with all new development projects, particularly where densities are higher
- Strongly weigh walking and biking performance measures as well as safety metrics in determining appropriate intersection improvements and street design.

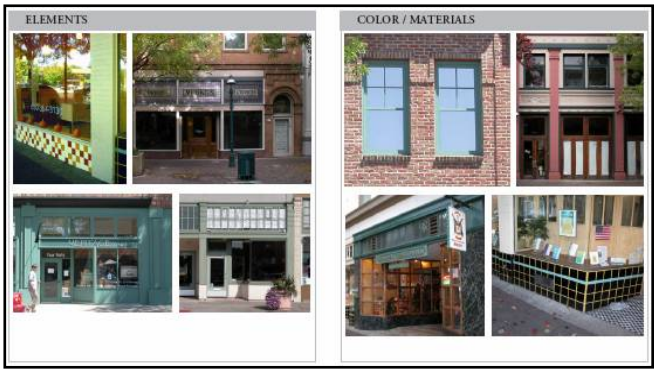
Specific Plans, Overlay Zones, and Other Area Plans

Suggestion for Potential Improvement

- Emphasize bicyclist and pedestrian-oriented design, walkability, and/or placemaking in all new specific plans, overlay zones, and other area plans.

Economic Vitality

Improving bicycle and pedestrian safety and walkability can enhance economic vitality. Similarly, enhancing economic vitality through innovative funding options such as Business Improvement Districts (BIDs), parking management, and facade improvement programs can lead to more active areas and encourage walking and bicycling.



Sample store facades

Suggestion for Potential Improvement

- Activate the built environment in business areas through BIDs and façade improvement programs.
- Use wayfinding, walking routes, and events to direct pedestrians to commercial areas throughout the area.

- Install bicycle parking in commercial areas and provide safe, comfortable bike facilities in commercial areas to make it convenient and fun to get to local businesses.

Proactive Approach to Institutional Coordination

Institutional coordination associated with multiple agencies is a critical part of the work of any municipality. Non-local control of right-of-way and differing policies regarding pedestrian and bicyclist accommodation can make the work complex.

Coordination with Schools

Neighborhood-sized schools, as opposed to mega schools on the periphery, are a key ingredient for encouraging walking and bicycling to school. In addition, pedestrian and ADA improvements could be prioritized near schools.

Suggestion for Potential Improvement

- Work with the local school districts to establish a policy on neighborhood-sized and oriented schools as part of a Safe Routes to School policy.
- Work with the school districts to establish suggested walking routes and address potential barriers to pedestrian or bicycle access.

Coordination with Emergency Response

Emergency response requires special roadway design considerations that sometimes conflict with bicycle and pedestrian treatments. One example is the design of turning radii at intersections. Bicyclists and pedestrians benefit from the reduced vehicle speeds of smaller radii, but larger vehicles, such as fire trucks, have more difficulty performing the turn within the smaller space. These conflicts require consensus building between the City and the respective departments. Consensus building could include pilot testing of alternative treatments, such as a model traffic circle in an open field.

Suggestion for Potential Improvement:

- Include the Fire Department early in the process as a stakeholder to ensure access needs are accommodated.
- Balance the trade-off between traffic calming safety treatments such as roundabouts or partial street closures and longer emergency response times.
- Encourage emergency and transit responders to participate in test runs of roadway designs that are aimed to reduce speed and improve bicycling access.

Coordination with Health Agencies

Involving non-traditional partners such as public health agencies, pediatricians, etc., in the planning or design of pedestrian and bicycle facilities may create opportunities to be more proactive with pedestrian and bicycle safety, identify pedestrian and bicycle safety challenges and education venues, and secure funding. Additionally, under-reporting of pedestrian-vehicle and

bicycle-vehicle collisions could be a problem that may be partially mitigated by involving the medical community in pedestrian and bicycle safety planning.[2]

Coordination with Transit Agencies

Providing safe and comfortable biking and walking routes to transit stops and stations, and the ability to take bicycles on-board transit vehicles increases the likelihood of multi-modal trips.

Suggestion for Potential Improvement:

- Work with transit agencies, Caltrans, and other relevant partners to improve access and safety to stations and bus stops.

[2] Sciortino, S., Vassar, M., Radetsky, M. and M. Knudson, "San Francisco Pedestrian Injury Surveillance: Mapping, Underreporting, and Injury Severity in Police and Hospital Records," *Accident Analysis and Prevention*, Volume 37, Issue 6, November 2005, Pages 1102-1113

4. COMPLETE STREETS AUDIT RESULTS AND SUGGESTIONS

4.1. OVERVIEW

Complete Streets audits are typically conducted as an initial step to improve the street environment for all travel modes within the selected area. Many individuals can participate: residents, stakeholders, and affiliated individuals. During the audits, positive practices are observed and issues and opportunity areas are noted. Observations are made of the interactions among motorists, pedestrians, and bicyclists. Observations are based on the behavior of these different road users, particularly at intersections. For each opportunity area, the group discusses possible suggestions to address safety and operational concerns. Complete Streets audits are highly interactive, with many field observations. The audits are a means to observing and learning how to “see through the eyes of pedestrians and bicyclists.”

This chapter presents observations and suggestions made during field observations conducted on June 17 & 18, 2021.

Suggestions in this chapter are based on best practices and discussions with participants regarding local needs and feasibility. These suggestions are based on limited field observations and time spent in Costa Mesa by the CSSA evaluator. These suggestions are intended to guide City staff in making decisions for future safety improvement projects in the City; they may not incorporate all factors relevant to pedestrian and bicycling safety issues in the City. This report is conceptual in nature, and conditions may exist in the focal areas that were not observed and may not be compatible with suggestions presented below. Before finalizing and implementing any physical changes, City staff may choose to conduct more detailed studies or further analysis to refine or discard the suggestions in this report, if they are found to be contextually inappropriate or appear not to improve bicycling or pedestrian safety or accessibility due to conditions including, but not limited to, high vehicular traffic volume or speeds, physical limitations on space or sight distance, or other potential safety concerns.

4.2. FOCAL AREAS

City staff originally requested reviews of five focal areas — #1, 3, 4, 5 and 6 below. #2 is actually on the Placentia Avenue corridor (#1) but was made a separate subchapter (and numbered focal area) because of its length.

Table 4-1: Focal Areas

#	Focal area	Segments	Issues
1	Placentia Avenue	Joann Street - Adams Street	Speeding, bicyclist comfort
		Shalimar Drive	southbound bicycle access
2	Placentia Avenue / Joann Street Path connection	Wilson Street – Estancia High School south traffic signal	Safety, comfort, guidance
3	Pomona Avenue	19th Street – Wilson Street	Speeding, bicyclist comfort
4	Wilson Street	Wilson Street Park (Fordham Drive)	Crosswalk location & details
		Newport Boulevard*	Pedestrian
5	Del Mar Avenue	Newport Boulevard – Elden Ave	Add bike lanes
		Elden Avenue – Santa Ana Avenue	Bicyclist comfort
6	Bristol Street	Irvine Avenue – Sunflower Avenue	Bicycle accommodation

** Added by evaluator*

Figure 4-1 highlights these focal areas in yellow on a map; the base is Figure 4-1 (Existing Bicycle Facilities Map) from the City's adopted 2018 Active Transportation Plan.

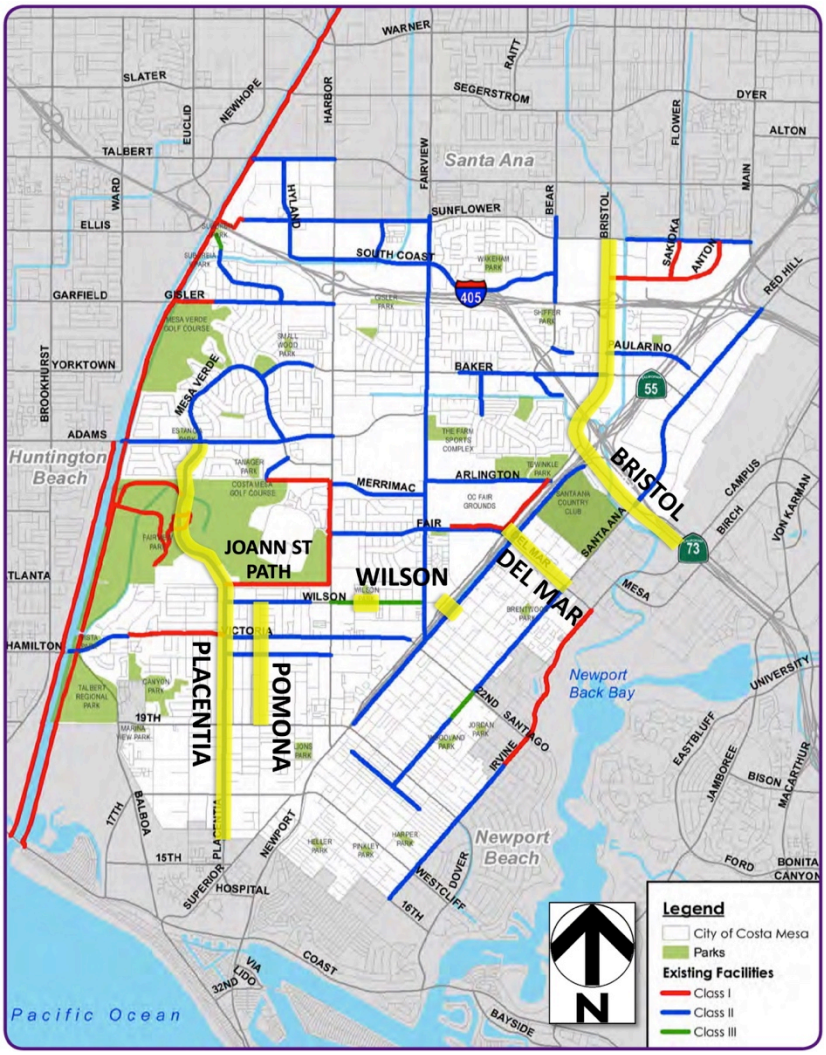


Figure 4-1: Map of focal areas

Section 4.3 presents several treatments relevant to the focal areas that could also be considered for city-wide application. Subsequent sections address each focal area, with figures that illustrate the suggestions.

4.3. GENERAL CITYWIDE SUGGESTIONS

The following general suggestions for physical enhancements may be appropriate City-wide or in the focal areas. These are discussed in detail below.

Table 4-2: General Suggestions for Physical Enhancements

Pedestrian	Details
Advance Limit Lines	Install 4' in advance of the limit line or first crosswalk line on signal-controlled approaches, to deter motorists from encroaching into the crosswalk or blocking sightlines to low pedestrians such as wheelchair users.
Corner curb extensions	Enable pedestrians to make a starting decision where they can see and be seen. Calm inbound right turns by reducing the physical radius. Shorten crossing distances.
Interim curb extensions	Consider Painted Safety Zone / Interim Curb Extension treatments at locations where the need is current but hardscape curb extensions are subject to future funding.
High visibility crosswalk markings	At uncontrolled crosswalks, incorporate wide longitudinal elements (e.g., "ladder rungs") to enable approaching drivers to recognize the crosswalk earlier.
Leading Ped. Interval	Display WALK phase (typically) 3 seconds before same-direction green indication, so pedestrians can occupy the curb lane.
Center islands on side streets	Calm inbound turns. May enable bicyclists preparing to turn left or proceed through to wait further forward than they otherwise would.
Left-side warning signs: symbol orientation	Pedestrian symbol (W11-2) or trail crossing signs (W11-15) installed on the left side of street may depict users approaching, just as the W16-7p Downward Pointing Arrow always points into the approach. (MUTCD 2A.06 Design of Signs specifically allows mirror images. However, sign catalogs may not designate a unique product code.)
Left-side signs on medians	At uncontrolled locations where it is feasible to add a raised median to protect a sign, do this so that each approach sees a pair of warning signs on its side of the street.
Upstream sightlines	Prohibit parking for at least 1 car length upstream of crosswalk, to keep sightlines open to approaching traffic. A curb extension can ensure compliance and is a good place for crosswalk warning signs. "Bike corrals" (in-street racks) can also utilize this area.
Yield Lines	Install on single-lane or multi-lane approaches to uncontrolled crosswalks, 20'-50' before the crosswalk.
Directional curb ramps	Where feasible, provide two ramps per corner, aligned with sidewalks, rather than a single diagonal ramp.
Accessibility	Ensure that signal actuation is ADA compliant, including pushbutton height.
Centerline	Install no-passing (double yellow) centerline 50' back from crosswalk.

Advance Limit (Stop) Lines

On approaches to crosswalks that are controlled by signals, installing an advance limit line a short distance (typically 4 feet) before the crosswalk can remind motorists to stop far enough back that their vehicle's front end does not encroach into the crosswalk. Such encroachment can be a safety issue at multi-lane approaches when the front end of a vehicle waiting can hide a low pedestrian (child or wheelchair user) approaching across another lane.

MUTCD Section 3B.16 Stop and Yield Lines applies. Guidance Paragraph #10 states:

> *10 If used, stop and yield lines should be placed a minimum of 4 feet in advance of the nearest crosswalk line at controlled intersections, except… at mid-block crosswalks.*

Corner curb extensions

At intersections with conventional corners and no curb extensions, pedestrians preparing to cross a street typically make their crossing decisions before stepping off the curb, i.e., while on the sidewalk. Due to substantial corner radii at most intersections, this places them over 10 feet outside of the first travel lane they will enter. Corner curb extensions (bulb-outs) enable pedestrians to safely make their decision near the outside travel lane, where they are more visible to approaching motorists and also have a considerably shorter distance to cross. Raised curb extensions also enable crosswalk warning sign assemblies to be installed closer to the travel lanes where they are more visible to motorists. One resource for curb extensions is NACTO's Urban Street Design Guide section: https://nacto.org/publication/urban-street-design-guide/street-design-elements/curb-extensions/

Curb extensions attached to the street's existing curb can be expensive to construct because they must preserve drainage along the street and provide accessible slopes and curb ramps. However, the same safety benefits can be obtained with less expense and without modifying drainage if the extension area is segmented into "floating" islands between which pedestrians including wheelchair users travel at existing street grade.

"Temporary Traffic Calming Curbs" (Calgary, AB)

Figure 4-2: Segmented floating corner island treatment

Interim curb extensions

Many cities are now deploying treatments consisting only of painted lines, colored paint or epoxy fill, and tubular delineators to rapidly and inexpensively create corner-bulb installations in advance of funding availability for hardscape versions (Figure 4-3). These go by various names such as "Painted Safety Zones" (San Francisco), "Painted Curb Extensions" (Pasadena), "Painted Bulbouts" (Denver) and "Interim curb bulbs" (Seattle).

San Francisco MTA writes:

> Painted safety zones are painted road areas that wrap around sidewalk corners to make pedestrian crossing intersections more visible to people driving. Painted safety zones are often flanked by delineators (white posts) and encourage people who drive to slow down, especially when making turns.
>
> https://www.sfmta.com/getting-around/walk/pedestrian-toolkit

Seattle DOT (SDOT) writes:

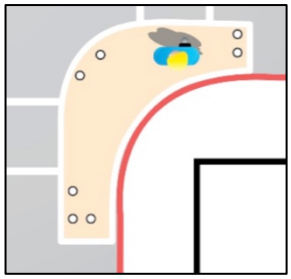
> Interim curb bulbs may be appropriate in locations where there is a safety need and a permanent solution is not feasible in the short term, and/or where there is a planned capital improvement within 5 years. At intersections with curb and gutter, an interim curb bulb can only be done [where] there are existing curb ramps. In some cases, curb bulbs may also be integrated with bioretention to manage storm water runoff from the right-of-way.
>
> https://streetsillustrated.seattle.gov/urban-design/adaptive-design/intersection-treatments/

Crosswalk marking patterns – high visibility and contrast edge

The standard crosswalk-marking scheme at controlled approaches has 2 transverse lines and no fill pattern. Many cities use the standard pattern at controlled approaches and a high-visibility pattern at uncontrolled approaches. The following description from San Francisco MTA's crosswalk design guidelines describes the safety advantages of high-visibility markings:

> *Because of the low approach angle at which drivers view pavement markings, the use of longitudinal stripes in addition to or in place of the standard transverse markings can significantly increase the visibility of a crosswalk to oncoming traffic. While research has not shown a direct link between increased crosswalk visibility and increased pedestrian safety, high-visibility crosswalks have been shown to increase motorist yielding and channelization of pedestrians, leading the Federal Highway Administration (FHWA) to conclude that high-visibility pedestrian crosswalks have a positive effect on pedestrian and driver behavior.*

Los Angeles (Cesar Chavez & St Louis)



Pasadena Street Design Guide

Los Angeles – Pico & Curson

San Francisco (16th St & Kansas St)

Seattle (Burke-Gilman Trail & 40th Ave NE & NE 52nd Pl)

Figure 4-3: Paint-and-delineator curb extensions

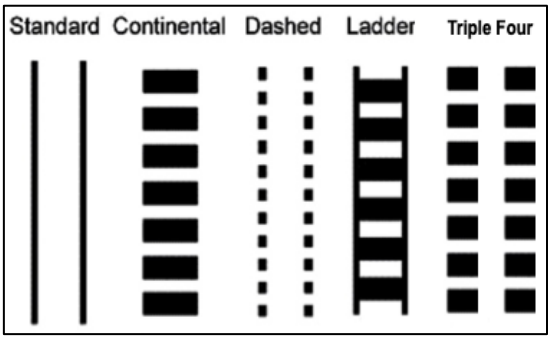


Figure 4-4: Selected crosswalk marking patterns

Table 4-3 lists suggested treatments for several crosswalk elements.

Table 4-3: Suggested Crosswalk Treatments

	Approach	Controlled		Uncontrolled	
Elements	**Median**	**None or painted**	**Raised**	**None or painted**	**Raised**
Crosswalk markings		Standard or high-visibility		High-visibility	
Warning signs at crosswalk		None		Curbside, 2-sided ("2-sign")	Curbside: 1-sided Median: 2-sided ("4-sign")
RRFBs on crosswalk signs		None		If needed	
Advance markings & signs		On signal-controlled approaches, advance limit line 4' upstream		Yield line 20'-50' upstream R1-5 Yield Here signs at yield lines	
Advance warning signs		None		If needed, per MUTCD	

Visually-impaired pedestrians (persons who are not completely blind) benefit from a continuous "contrast edge" for guidance when crossing streets. The "standard" and "ladder" patterns depicted above have this; "continental", "dashed" and "Triple Four" patterns do not.

In prior years, "artistic" crosswalks were constructed in which the transverse border was a wide cast concrete strip with no retroreflective white marking (12-inch line). Over time the contrast between these strips and the middle of the crosswalk is reduced so the strips no longer provide an effective contrast edge for low-vision pedestrians. To address this, 12-inch transverse lines (white for non-school crosswalks, yellow for school crosswalks) may always be incorporated.

Leading Pedestrian Interval

Leading Pedestrian Interval (LPI) signal phasing displays the pedestrian WALK indication for 3-7 seconds before the green indication for same-direction traffic. LPI gives pedestrians a head start to occupy the crosswalk before turning vehicles. A 2000 Insurance Institute for Highway Safety (IIHS) study found that LPI reduces conflicts between turning vehicles and pedestrians.

Field Evaluation of a Leading Pedestrian Interval Signal Phase at Three Urban Intersections. Van Houten, Retting, Farmer, Van Houten. Transportation Research Record (TRR) 2000.

It is suggested that the city consider implementing LPI at signals with high pedestrian activity, prohibiting right-turn-on-red as needed per recent research findings.

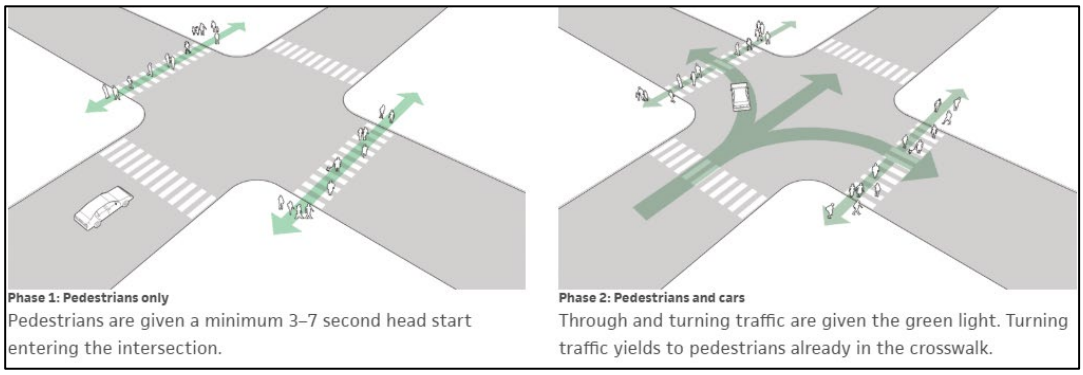


Figure 4-5: Leading Pedestrian Interval phases

Center islands on side streets

Adding pill-shaped center islands behind side-street crosswalks can improve safety by:

- Calming right turns from the major street
- Calming left turns onto the major street
- Calming through movements on the side street
- Providing a modest refuge for pedestrians crossing the side street, especially slow ones
- Enabling the limit lines to be moved forward for better sightlines
- Providing a sheltered place for bicycle users on the side street to prepare to enter the major street

Figure 4-6 shows such an island on a 40-foot residential street in Sunnyvale CA (Canary Drive, at Inverness Way). The island is 6 feet wide and 20 feet long.

Figure 4-6: Median island on residential street (Canary at Inverness, Sunnyvale CA)

4.4. FOCAL AREAS

The following sections address the focal areas listed in Section 4.2.

The evaluator explored the vicinity of each focal area with county health staff on the field visit day. Staff observations and notes appear in each subsection. Because of the Covid-19 pandemic, what was observed may not reflect typical (non-pandemic) peak period operation.

4.4.1. Focal Area #1: Placentia Avenue

Overview

Placentia Avenue runs generally north-south for 3 miles between Hospital Road near the southern city limit and Adams Avenue in the northern Mesa Verde portion of the city. The 2.0-mile segment between Superior Avenue and Joann Street runs due north-south; to the north along Fairview Park the alignment is curvilinear. Figure 4-7 is an overview of the corridor.

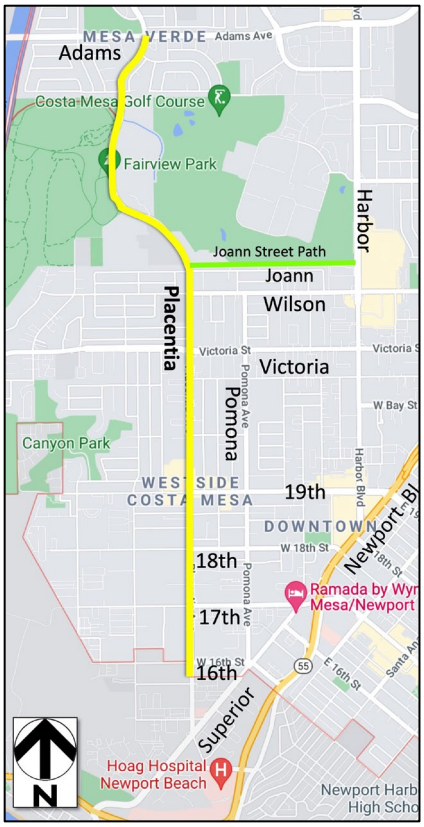


Figure 4-7: Placentia Avenue context

Observations

The evaluator bicycled Placentia in both directions between Wilson Street and Adams Street. On the field audit day, the team also visited the vicinity of Shalimar Drive (between 18th and 17th Streets). These observations are discussed below in north-to-south order.

Adams Avenue intersection

Several issues and opportunities were noted at the Adams intersection (Figure 4-8):

- Vehicles were seen encroaching into the south crosswalk, which can hide wheelchair users and short pedestrians from next-lane motorists — a hazard for a slow pedestrian on a fresh green. It is suggested to install advance limit lines on all controlled crosswalks at this intersection.
- The south crosswalk is not centered on the corner curb ramps. It is suggested to shift it northward accordingly. (This will also enable installing a northbound advance limit line.)
- At the southwest corner, the button for eastbound bicyclists has a pedestrian-oriented sign. See Figure 4-10 for alternatives.
- Also, at the southwest corner, the "Use Crosswalk" plaque is mounted less than 7' from the sidewalk surface, presenting a hazard for tall pedestrians

a) Encroaching into south crosswalk

b) South crosswalk offset relative to ramp

c) Bike crossing button

d) Signs not mounted high enough

Figure 4-8: Observations at Placentia / Adams

- At all four corners the curb ramps at all four corners are diagonal — presumably due to the relatively large corner radii — and there are no level resting areas behind the ramps.

- The west leg has no crosswalk, presumably because the northbound left turn volume is substantial. This forces pedestrians traveling between the northwest and southwest corners to traverse three crosswalks (N, E, S) instead of one (W), exposing them to significantly more vehicular conflicts than if they could cross directly. It is suggested to reconsider this, and install the west crosswalk.

- The northbound approach has a "combo" bike lane overlapping the west side of the right turn lane. However, due to the heavy northbound right turn volume, bicyclists may be reluctant to use the combo lane even if they arrive when the right turn area is briefly vacant. It is suggested to consider replacing the combo lane with the following:

    - (a) modify the east sidewalk and its landscape along the right turn lane (i.e., between the upstream KEEP CLEAR area and the southeast corner) to facilitate shared use by northbound bicyclists.

    - (b) control the northbound right turn movement with a red arrow

    - (c) install a northbound bicycle signal whose through movement does not coincide with the right turn arrow indication.

Figure 4-9: "Combo" bike lane in northbound right turn lane at Adams

Figure 4-10 shows California MUTCD signs available for informing bicyclists to press a button to obtain a green indication. The R10-24 and R10-26 clearly indicate that they are for bicyclists, and differ only in that the R10-26 incorporates an arrow – an appropriate choice when the sign is mounted in a location where the arrow will actually point in the bicycle travel direction.

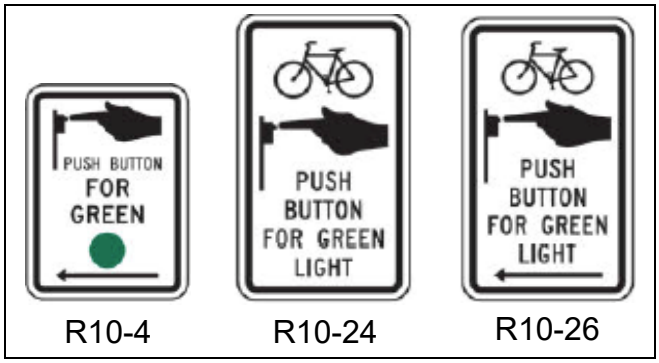


Figure 4-10: CA MUTCD signs for bicycle crossing buttons

Fairview Park driveway - warning signs

Two sequential warning signs are posted on the northbound and southbound approaches to Fairview Park's signalized driveway (Figure 4-11). The first uses six words to convey a message whose need is unclear, given that the park's entry is a typical signalized intersection and becomes visible with adequate decision sight distance (its mast arms have illuminated "Fairview Park" street name signs).

a) Advance warning sign 1

b) Advance warning sign 2 (W3-3 + plaque)

Figure 4-11: Fairview Park entrance warning signs

The function of a warning sign (black on yellow) is to alert travelers to otherwise-unexpected hazards. Because their purpose is to urge caution, the word "CAUTION" is generally redundant on them. Redundant words detract from comprehension in the limited time available to the approaching roadway user. In a similar vein, the W3-3's pictogram means "Signal Ahead, so the "SIGNAL AHEAD" plaque is redundant.

Placentia access to Joann Street Path

The Joann Street Path intersects Placentia from the east approximately 300' south of Estancia High School's south traffic signal (600' north of Wilson Street). Discussion of issues and opportunities appears in Section 4.4.2, which follows this section.

Placentia / 19th Street intersection, northbound approach

Placentia has un-buffered bike lanes for most of its length. On certain intersection approaches the bike lane is dropped to fit in a right turn lane. Some of these turn lanes are wide enough that a through bike lane could potentially be added by narrowing the lane. One example is the northbound approach to 19th Street, where the right turn lane appears to be 14.5' wide. Narrowing the turn lane would enable installation of a 4' or slightly wider through bike lane. Similar opportunities may exist at other intersections along Placentia and other streets.

4.4.2. Focal Area #2: Placentia Avenue access to Joann Street Path

Overview

The Joann Street Path parallels Joann Street along the north (backyard) fences of the houses on the north side of Joann Street, along the south edge of Costa Mesa Golf Course. It extends 3/4 mile between Placentia Avenue and Harbor Boulevard, which has a west-side path that extends 3/4 mile north to Tanager Drive / Merrimac Way (the southern half of the Harbor Boulevard path is along the golf course's east edge).

The Joann Path's western terminus at Placentia is 300' south of the traffic signal that serves Estancia High School's south driveway (west leg) and the City of Costa Mesa Corporation Yard (east leg), and approximately 100' north of Joann Street and 640' north of the traffic signal at Wilson Street.

City staff requested input for improved connections between the path and Placentia Avenue, for all bicycle and pedestrian movements:

Segment	Request
Placentia Avenue between Wilson Street and Estancia High School's south driveway.	Improved connection between Joann Street Path and both directions of Placentia, for all bicycle and pedestrian movements.

Figure 4-12: Placentia Avenue / High School / Joann Street Path context

Observations and analysis

At the path junction Placentia has unbuffered bike lanes and five traffic lanes — two each way plus a center lane. There are no crosswalk markings, signs or other traffic controls on Placentia related to the junction, and no median refuge. To the north the center lane serves northbound left turns into the high school; to the south it serves southbound left turns into Joann Street.

a) Facing west (approaching Placentia)

b) Facing east (departing Placentia)

c) Facing north: curb cut and fences, sidewalk crossings of two city yard driveways

d) Placentia cross section at path intersection (visible at upper right)

Figure 4-13: Joann Street Path at Placentia Avenue - details

Pedestrians access the path from Placentia's east sidewalk, and can cross Placentia at the signal-controlled intersections 300' north (high school / Corporation Yard) and 640' south (Wilson).

Bicycle movements

Northbound Placentia to eastbound path

Bicyclists approaching northbound on Placentia simply turn right from Placentia's northbound bike lane into the path. Because of the curb ramp geometry this turn could be challenging for a long bicycle, an adult tricycle, or a bike-and-trailer configuration. (Operators of such bicycle configurations may choose to shift leftward into the outside traffic lane before turning.)

Southbound Placentia to eastbound path

Bicyclists southbound on Placentia may legally turn left directly into the path, but this is difficult in the presence of vehicle traffic in either direction because there is no median refuge at the path junction and the center lane north of the path junction serves northbound left turns. Instead, most southbound bicyclists bound for the path probably use the high school's signal in one of several ways:

a) Merge across the two southbound through lanes and use the southbound left turn lane (one bicyclist was observed doing this)

b) 2-stage turn: Proceed through in southbound bike lane to southwest corner while there is still green time, rotate bicycle to face east, await a green indication to cross

c) Jug-handle turn: Turn right into school, make a *safe* U-turn, approach Placentia eastbound, await a green indication.

d) Pedestrian turn: Dismount at southwest corner. Use pedestrian button to cross Placentia, or dismount at northwest corner and walk through west and south crosswalks.

Westbound path to northbound Placentia

Bicyclists approaching westbound who intend to travel north on Placentia have three options:

a) enter the northbound bike lane at the path's curb ramps

b) turn right onto Placentia's east sidewalk, enter the bike lane from a driveway

c) turn right onto Placentia's east sidewalk, enter the bike lane at the High School signal

High school-bound bicyclists probably use option (c) and then use the signal to cross Placentia.

Northward turns from the path onto the east sidewalk (b and c) are constrained by the path's north fence, which protects an adjacent raised electrical vault.

a) View from north

b) View from south

Figure 4-14: Raised vault behind path's north fence

Westbound path to southbound Placentia

Bicyclists approaching on the path and intending to travel south on Placentia can:

a) Turn left into the southbound bike lane at the path junction. This requires obtaining simultaneous safe gaps in both directions of traffic (four lanes total), which can involve a long wait.

b) Ride south on Placentia's east sidewalk to the Wilson Street signal and cross there. This would be awkward due to the east sidewalk's restricted width south of the path junction, the need to cross Joann Street, and conflicts at several house driveways.

c) Detour north to the high school signal and cross there. Although this requires out-of-direction travel, the detour time including the signal delay may be comparable to waiting for safe gaps at the path junction (option a), and is arguably safer.

Median refuge concept

Because at the path junction Placentia has a center lane whose assignment changes from southbound to northbound at that location, and sight-lines to the north and south appear (at first glance) to be adequate, it might be geometrically feasible to install a median refuge to facilitate three active transportation movements:

a) Pedestrian crossing to/from west sidewalk

b) WB (path) bicyclist left turn to SB Placentia

c) SB Placentia bicyclist left turn onto EB path

A median refuge would require traffic control appropriate for Placentia's conditions and also a west-side bicycle waiting area. Regarding traffic control, Placentia's combination of lane count (two-lane approaches in both directions), volume (significant) and prevailing speed (moderate to high) may mean that an warning-only device (Rectangular Rapid Flashing Beacon / RRFB) would not produce adequate motorist yielding, thus necessitating a traffic-stopping Pedestrian Hybrid Beacon (PHB) installation. This would involve considerable expense and would need to be coordinated with the high school traffic signal just 300' north.

Even if this could be achieved, southbound bicyclists preparing to turn left into the path (i.e., movement "c") would need an area on the west side of the crossing to pull out of the southbound bike lane and wait for the PHB to stop traffic and enable crossing. But there is no width available behind the west sidewalk to create such a waiting area, or to shift the west sidewalk westward to create a bicycle "jug-handle" turn lane.

For these reasons the evaluator did not consider a median refuge crossing at the path intersection as likely to be feasible, and focused instead on improving the safety and convenience of the east-side connection between the path and the high school signal, where all movements that involve crossing Placentia can be performed safely.

Improving east-side sidewalk connection to high school traffic signal

Bicyclists connecting between the path terminus and northbound and southbound Placentia already travel on Placentia's east sidewalk between the path and the high school signal. Several

enhancements could create a safe and comfortable connection with ample capacity for all users, including at high school arrival and dismissal times.

- Substantially widen the sidewalk to create a sidepath that comfortably accommodates two-way pedestrian and bicycle use
- Buffer the sidepath from the street by shifting it eastward (away from the curb) and replacing the existing curb-attached sidewalk with a landscape buffer
- Modify the two driveway crossings between the path junction and the signal to eliminate grade changes and diagonal movements, and to highlight the sidepath
- Modify the path's sidewalk intersection to enable comfortable turns by wheeled traffic, by removing an adjacent obstacle and pulling back the north fence
- Enhance the markings of the high school signal's south crosswalk
- Install a north-facing sign on the west (southbound) side of Placentia, a sufficient distance north of the high school signal, to inform southbound Placentia bicyclists to use the high school signal and the east sidepath between it and the path, with the aim of deterring direct southbound bicycle left turns at the path junction.

Widening

The east sidewalk between the path and the signal is only 7' wide and is attached to the curb. To support substantial northbound and southbound bicycle traffic and also pedestrian traffic, a sidepath at least 13' wide is suggested (bicycles require 4' per direction and pedestrians require 2.5' per direction). Additionally, on the inboard (east) side, a minimum 2' unpaved clear width should be provided to obstructions such as trees, posts and signs. The total 15' needed width between curb face and large-caliper trees appears to be available, though several small-caliper trees would need to be removed or relocated.

Modifying driveway crossings, adding a landscape buffer

The existing sidewalk crossing of the Fire Station's south driveway has diagonal curb ramps, as if there was also a crossing of Placentia. These force bicyclists and ramp-dependent pedestrians to change direction, increasing conflicts. In contrast, the middle driveway provides a level bypass behind the angled portion of the apron and its small-radius corners, and aligns the west edge of the traveled way away from the curb by the depth of the curb return. That design is preferable for all users, and setting back the sidepath from the street increases reaction distance for northbound motorists turning into the driveways.

It is suggested to widen the bypass (path travelway) of the middle driveway, reconstruct the south driveway crossing to match the middle driveway and its widened crossing, and replace the curb-attached sidewalk with a landscape buffer. Consideration could also be given to installing high-visibility markings aligned with the sidepath edges, similar to a crosswalk.

a) South driveway – diagonal ramps

b) North driveway – level bypass (good)

Figure 4-15: East sidewalk crossings of south and middle driveways

Modifying the path-street intersection

Where the path intersects the sidewalk, the north fence currently extends to the sidewalk edge, requiring a sharp turn by bicyclists, skaters, scooter users and skateboarders. A large raised electrical vault adjacent to the fence on the north side currently precludes pulling back the fence to create a wider effective radius for that turning movement (Figure 4-14). However, during the field walk city staff thought it might be feasible to lower the vault to sidewalk grade, enabling the fence to be pulled back.

If this is accomplished and the sidewalk between the path and the high school traffic signal is widened and enhanced as suggested above, it is suggested to install a curved solid yellow centerline of appropriate radius around to cue safe turns between the path and sidewalk. North of the conflict area the centerline would be dashed to allow passing by bicyclists.

Enhancing the crosswalk at the high school signal

At the high school's south driveway traffic signal, installing high-visibility markings on the south leg could help to raise motorist awareness of the combined pedestrian and bicycle crossing movement.

Encouraging southbound Placentia bicyclists to use the sidepath

To inform bicyclists southbound on Placentia of the enhanced east sidepath route accessible at the high school's south traffic signal, and to deter direct southbound bicycle left turns at the path/street junction, it is suggested to install a bicycle-specific guide sign (white text on green background) on the west side of Placentia a sufficient distance north of the signal, encouraging bicyclists to use the south crosswalk at the signal and follow the east sidepath.

Encouraging bicyclists entering southbound Placentia to detour north to the high school signal

It is suggested to install an east-facing guide sign to advise bicyclists approaching Placentia on the path and intending to proceed south on Placentia that it is suggested to proceed north on the (proposed) east sidepath and cross Placentia at the high school signal. A potential message could be "Bicyclists advised to enter southbound Placentia at traffic signal 300' (right arrow)". Conveying such a message with a guide sign (white on green) rather than a regulatory sign (black on white)

will preserve the legal option for a bicyclist to turn left out of the path whenever s/he determines that it is safe to do so.

Extending the sidepath to Fairview Park

North of the high school's south signal, Placentia's east sidewalk continues as a meandering wide path that has no driveway or cross-street conflicts. As a longer-term improvement it is suggested to widen that east-side facility to support shared use with bicycles between the high school signal and the Fairview Park pedestrian crossing signal, to enable traffic-averse bicyclists to avoid Placentia's high-speed curvilinear segment along the high school frontage where buffered bike lanes may not be feasible.

Suggestions

Table 4-4 summarizes the suggested enhancements:

Table 4-4: Suggestions for Joann Street Path and Nearby Placentia Avenue

#	Location	Item	Issue	Suggestion
1	Path junction, north side	Raised electrical vault	Prevents widening junction for bicycle right turns onto sidewalk	Reconstruct vault flush with sidewalk
2		Chain-link fence	Constrains bicycle right turns onto sidewalk	If vault can be made flush, cut back fence to second post
3	East sidewalk between path and high school signal	Width	7’ inadequate for shared use	a) Reconstruct 12’-13’ wide, buffered 4’-5’ from curb.
		Alignment	Attached to curb	b) Offset 4’-5’ from curb
		Markings	Centerline	c) Install yellow centerline, dashed except solid at turning movement to/from path
4	Fire station south driveway	Diagonal curb ramps	Angled relative to sidewalk travel	a) Reconstruct in line with sidewalk axis
			Rideable width	b) Reconstruct to new sidepath width
5	Fire station north driveway	Ramps	Rideable width	Reconstruct to new sidepath width
6	Chevron sign (curve warning) on streetlight pole, east sidewalk	Mounting height	Too low — not detectable with long cane	Relocate elsewhere, or raise so bottom edge is at least 7’ above sidewalk
7	Southbound bike lane north of high school signal	Guidance to Joann Path	Need to inform bicyclists of east-side path option	Install guide sign suggesting that bicyclists bound for path use signal crosswalk to cross Placentia and follow east sidewalk
8	High school signal	South crosswalk	Markings	Consider high visibility markings after east sidewalk is widened between signal and path
9	Placentia east sidewalk north of high school signal	Width	Opportunity for off-street shared use path to Fairview Park	Consider widening sidewalk for shared use up to Fairview Park

4.4.3. Focal Area #3: Pomona Avenue between 19th Street and Wilson Street

Overview

Pomona Avenue runs due north-south between 16th Street and Wilson Street (1.6 miles). On the segment north of 19th it is a 2-lane 40' wide street with well-used parking on both sides except near intersections. Land use is a mix of single-family and multifamily residential except for Pomona Elementary School on the west side just south of Hamilton Street.

There are traffic signals at 19th Street, Victoria Street and Wilson Street (north end). The intersection with Hamilton Street, approximately 500' south of Victoria, is all-way STOP controlled. All other intersecting streets have STOP signs (Pomona does not stop for them).

The posted speed limit is 30 mph south of Victoria and 25 mph between Victoria and Wilson.

Figure 4-16: Pomona Avenue – overview

Observations and analysis

Within the focal area Pomona has continuous sidewalks, generally well-designed crosswalks at intersections, and a pedestrian-activated RRFB-enhanced uncontrolled crosswalk on the south leg at Sterling Avenue, which intersects from the west just south of Pomona Elementary.

The 40' width is too narrow to install bike lanes without removing parking, and parking demand is high. The door zone along parallel-parked vehicles extends approximately 10' from curb face. On 40' wide Pomona this produces an "effective lane" (safe riding width) of 10' on either side of the centerline. Because 10' is too narrow for motor vehicles to pass bicycles without crossing the centerline, the objective for bicycle accommodation is to make it as comfortable as possible for bicyclists to occupy the full effective lane, avoiding the door zone, and to make it clear to motorists that they should pass across centerline with the state law-required 3' clearance.

The existing dashed (not solid) centerline supports these objectives. Adding Shared Lane Markings ("sharrows") centered in the effective lane (i.e., 5 feet from the centerline) would further support them.

Additionally, keeping vehicle speeds comfortably low will require less distance for passing of bicyclists. Currently the segment has no vertical- or horizontal-deflection traffic calming. The City's current Speed Hump Guidelines, linked from the Traffic Planning / Development webpage (document undated), has 13 criteria for consideration:

Criterion		**Pomona**
a)	Streets must not be more than one lane in each direction.	Y
b)	Streets must not be Master Plan designated higher than a commuter on City of Costa Mesa or Orange County Master Plan of Arterial Highways.	Y
c)	… not on a street segment adjacent to [a] (police or fire station).	Y
d)	Streets must not be on an established Orange County Transit District Route.	Y
e)	Streets must be in a "residence district." CVC: an area with contiguous property on both sides of the street consisting of sixteen (16) or more separate dwelling houses or business structures per one-quarter mile (or ratio thereof), with not less than 51 percent of the structures occupied by residents.	Y
f)	The posted or prima facie speed limit shall be no greater than 25 miles per hour (MPH)~	25 N. of Victoria 30 S. of Victoria
g)	The 85th percentile speed … equal to or greater than 30 miles per hour (MPH).	?
h)	The average daily traffic volume must be equal to or greater than 3,500 vehicles, total in both directions, in a 24-hour period, on an average weekday.	?
i)	… at least 200 feet of clear visibility on approaches …, … humps located not less than 200 feet or more than 450 feet apart; … at least 200 feet away from intersections and sharp horizontal curves; … grades of less than five percent at hump locations; … raised curbs to physically discourage motorists from driving off the street …; [no] utility manholes, fire hydrants, or driveways at hump locations.	Y
j)	…not recommended in… communities [with a] grid [street] pattern where paralleling streets may be used … as an alternate route to avoid the street with … humps.	SEE DISCUSSION
k)	Use of speed humps should not be interrupted within a segment unless a distinct change occurs in terms of roadway designation, speed limit, number of lanes, and other geometrics and roadway characteristics.	(Y)
1)	The City… Fire and Police Departments will be consulted on candidate streets...	(Y)
m)	At least 50 percent of households (one signature per household) within 75 feet of face of curb along a "qualifying street segment" …[as] identified by Transportation Services Manager on basis of through traffic patterns… must sign a petition to install ….	TBD

During the field audit, city staff said that the City's current position regarding the focal area segment of Pomona is that criterion "J" (no grid-pattern bypass options) is deemed to apply. However, the only parallel through alternatives on the focal area segment (19th – Wilson) are:

Street	Segments	E-W detour	Notes
Placentia Ave	19th-Wilson	1,300' W	Bike lanes. Congestion and signal delays
Wallace Ave	19th-Hamilton	660' W	NB requires left turn from Hamilton
Meyer Place	19th-Hamilton, Victoria-Joann	875' E	NB requires left turn from Hamilton Wilson-Victoria segment has cul-de-sac at Victoria.
Maple St	19th-Hamilton, Victoria-Wilson	1,750' E	NB requires left turn from Hamilton
Harbor Blvd	19th-Wilson	2,600' E	High traffic, no bikeway

If Meyer Place was not discontinuous between Hamilton and Victoria it could be an ideal alternative, especially because it continues north of Wilson to Joann and the Joann Street Path. However, it would need enhanced crossings at Hamilton, Victoria and Wilson.

It is suggested that several of the speed hump criteria be reconsidered in the case of Pomona, for these reasons:

a) Pomona is the only north-south collector street available as a low-stress bicycle route in its part of the city. Placentia has bike lanes, but its Level of Traffic Stress is much higher than a calmed 2-lane street — stressful enough to dissuade "Interested but Concerned" adults from using it. Harbor Boulevard is busier than Placentia and has no bike lanes.

b) Two lower-traffic streets that could potentially function as bypass routes for Pomona -- Wallace and Meyer -- only extend north to Hamilton.

c) Lowering Pomona's speed distribution to bicycle-comfortable levels (20 mph) would also make it safer and more comfortable to cross the street away from the few controlled intersections and the only enhanced uncontrolled crosswalk (at Sterling). At 20 mph approach speeds, most conflicts can be resolved with braking and stopping instead of near-misses or collisions.

d) Criterion F, 85th Percentile speed of at least 30 mph, is arguably too high if the target speed range is closer to 20 mph.

Suggestions

The following suggestions are offered for consideration:

Table 4-5: Suggestions for Pomona Avenue

Item	Suggestion	Notes
1 Centerline	Retain dashed centerline	Encourage passing with adequate clearance
2 Markings	Install Shared Lane Markings centered 5' from centerline	Encourage bicyclists to ride in the middle of the safe area, with right handlebar outside door zone.
3 Signs	Install periodic R117 (CA) "PASS [BIKES] 3 FT MIN" signs	Inform motorists of legally required behavior. Inform bicyclists to expect this.
4 Speed humps	Revisit policy in light of Pomona's unique attributes	Only available low-stress N-S bike route in vicinity No actual motorist bypass options (Criterion J) Goal: 20 mph speeds, to also benefit pedestrians

4.4.4. Focal Area #4: Wilson Street

Overview

Wilson Street runs east-west through Costa Mesa for 2.3 miles between the western city limit and the Costa Mesa Freeway (CA-55), then angles toward the southeast and continues 1/2 mile to the eastern city limit at Santa Ana Avenue.

For most of its length west of the freeway, Wilson is typically 40' wide with one travel lane in each direction, a center turn lane, and parallel parking on one or both sides. For most of this distance it does not appear feasible to add bike lanes unless parking is removed from at least one side of the street.

The City's 2017 Draft Active Transportation Plan proposes bike lanes on Wilson between Fairview Road and Newport Boulevard (0.22 miles).

City staff requested suggestions for the location and design of a crosswalk to serve Wilson Street Park, which occupies the north side of the street just west of Fordham Drive.

Wilson Street Park (at Fordham Drive)

Context

Fordham Drive intersects Wilson from the north approximately 0.3 miles east of Harbor Boulevard; Wilson does not stop at this intersection. Wilson Street Park occupies the northwest quadrant and has approximately 300' of frontage. Land use is multifamily south of Wilson and on the north side west of the park, and small-lot single-family north of Wilson to the east.

City staff requested suggestions for locating an enhanced crosswalk across Wilson to connect south-side residents to the north-side park and its westbound bus stop.

Figure 4-17: Wilson Street Park - context

Analysis

Due to Wilson's high traffic volumes, pedestrian-active warning signage (i.e. Rectangular Rapid Flashing Beacons / RRFBs) may not produce adequate yielding levels. A Pedestrian Hybrid Beacon (PHB), which stops traffic with a solid red phase, may be needed.

Also providing a raised median refuge will assist pedestrians who either travel slowly or who do not activate the crossing device. This appears feasible except where the center lane is needed for left turns at streets and driveways, and along the bus "duck-out" that is roughly centered on the park frontage, beginning approximately 66' west of Fordham Drive's northwest curb return.

The Fordham Drive intersection has legal crosswalks across Wilson on its east and west legs. On the east leg the center turn lane is used for westbound left turns into the west driveway of the apartment complex directly opposite Fordham's east sidewalk. On the west leg the center lane is used for eastbound left turns into Fordham, however it is likely that only one or two cars will wait to make that turn at any given time, and the first car can wait within the intersection.

West of the bus duck-out, closely-spaced driveways on the south side appear to preclude installation of a median refuge.

Suggestions

The following enhancements are suggested:

Table 4-6: Suggestions for Wilson Street Park Crosswalk

#	Item	Suggestion	Rationale
1	Crosswalk location	Approximately 60' west of Fordham's curb return, east of the bus duck-out's curb return.	In the center turn lane, provide 1-2 cars of EB left turn queue length to the east, and 1 car length of WB left turn length to the west
2	Refuge	Consider 2 half-round islands at least 5' diameter	Minimize use of center lane while protecting mid-street pedestrians
3	Curb extension	Install curb extension in south-side parking lane at crosswalk and 1 car length upstream (to the west)	Enable northbound pedestrians to wait at the edge of the traffic lane for sight-lines. Prevent parking immediately upstream
4	Crosswalk markings	High-visibility ("ladder")	Appropriate for any uncontrolled crosswalk
5	Warning signage	a) 2-sided assemblies on north curb and south curb extension: W11-2 Pedestrian Symbol & W16-7p Downward Pointing Arrow	Appropriate for any uncontrolled crosswalk
		b) Optional Rectangular Rapid Flashing Beacon (RRFB)	Suggest evaluating motorist yielding with passive measures first
		c) 2-sided W1-6 Yield To Pedestrian In Crosswalk / State Law, on median island	To improve yielding compliance (opportunity because a median island is present)

6	Center lane marking	a) Define EB left turn lane b) Install 2 left turn arrows	Appropriate for left turn area

Figure 4-18 illustrates an RRFB concept with a median refuge. However, a Pedestrian Hybrid Beacon may be needed due to Wilson's traffic volume.

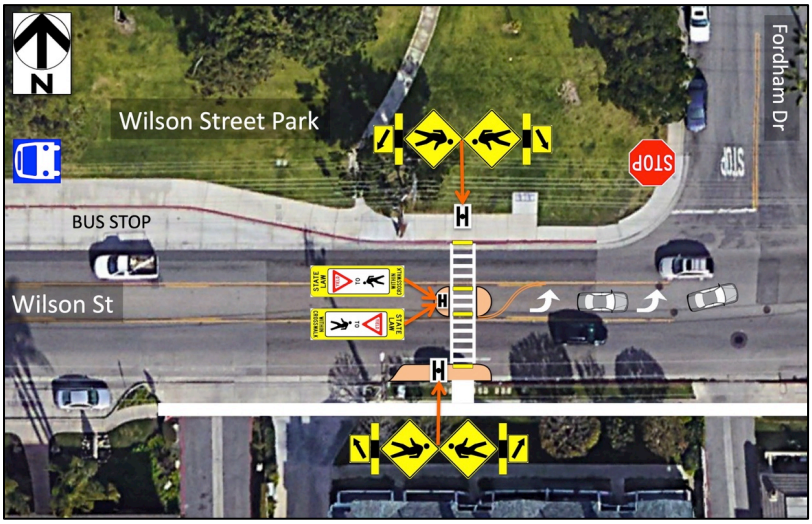


Figure 4-18: RRFB and median refuge concept

Wilson Street at Newport Boulevard

The evaluator rode Wilson Street eastbound from Placentia Avenue to Newport Boulevard. Two enhancement opportunities were noted at Newport Boulevard:

Table 4-7: Suggestions for Wilson Street at Newport Boulevard

#	Location	Item	Issue	Suggestion
1	West signal	North leg	Pedestrian crossing prohibition signs. No markings, buttons, ramps or pedestrian displays.	Remove prohibition. Install crosswalk
2	East signal	North leg	Pedestrian crossing prohibition signs. No markings, buttons, ramps or pedestrian displays.	Remove prohibition. Install crosswalk.

Regarding these suggestions, there are pedestrian origins and destinations on the north side of Wilson west and east of the freeway. For trips between those quadrants, pedestrians must currently cross Wilson twice, incurring substantial delay and needless additional traffic conflicts. Providing crosswalks for the bridge's north sidewalk could help to level the playing field between active transportation and motor vehicle travel.

Figure 4-19: Wilson Street at Newport Boulevard – issues and opportunities

4.4.5. Focal Area #5: Del Mar Avenue, Newport Boulevard – Santa Ana Avenue

CONTENT SUPERSEDED BY CITY-PROPOSED IMPROVEMENTS

Per City staff communication dated November 2021, the subsections of the Analysis section below that address street and intersection configurations between southbound Newport Boulevard and Elden Avenue have been superseded by the following proposed improvements:

Eastbound (eliminates need to modify raised median east of northbound Newport Boulevard)

- *On the approach to southbound Newport Boulevard, convert the through/right lane to a RT only lane.*
- *On the SR-55 bridge, convert the #2 (outside) through lane to a buffered bike lane*
- *Continue that buffered bike lane across northbound Newport Boulevard, to Elden.*

Westbound

- *Between Elden and northbound Newport Boulevard, convert the north shoulder to a buffered bike lane.*
- *Approaching northbound Newport Boulevard, remove the right turn channelization ("pork chop") island, relocate the signal pole to the northeast corner of the intersection, convert the right turn slip lane to a conventional right turn lane, and convert the painted chevron-marked painted buffer to a through bike lane.*

Overview

State Route 55 (Costa Mesa Freeway) runs in a depressed section for approximately 2.5 miles south of its interchange with State Route 73, returning to the surface north of 19th Street. On this segment the freeway is flanked by one-way frontage roads (southbound on west side, northbound on east side), together named Newport Boulevard. The following streets (listed in north-to-south order) cross the depressed section: Mesa Drive, Fair Drive / Del Mar Avenue, Vanguard Way / Santa Isabel Avenue, Wilson Street, Fairview Road, Victoria Street / 22nd Street, and Bay Street. Except for Fairview's east junction, all of these crossings have traffic signals at southbound and northbound Newport Boulevard.

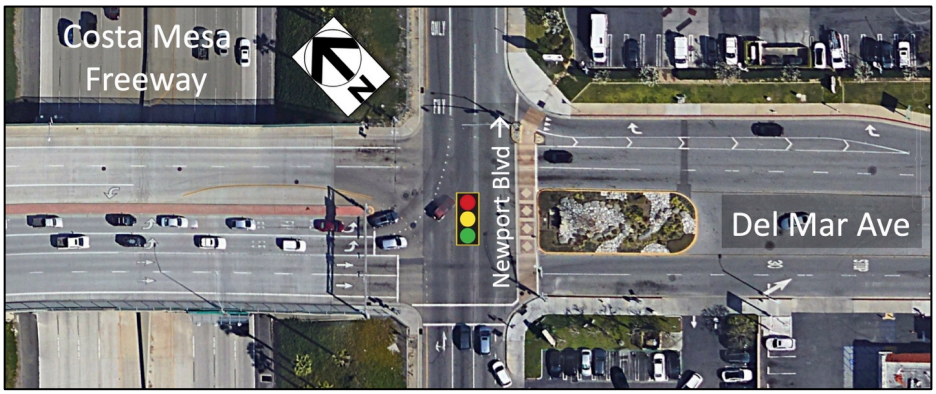


Figure 4-20: Del Mar Avenue at northbound Newport Boulevard

Del Mar extends approximately 2,600 feet (1/2 mile) east of Newport Boulevard to Costa Mesa's eastern city limit at Santa Ana Avenue, where Perez Park, a popular community destination, is located on the northeast corner. To the east the street continues as University Avenue.

Elden Avenue intersects Del Mar one block east of northbound Newport Boulevard. Land use on both sides of this block is commercial, including a large shopping plaza on the south side. On this block Del Mar is classified as a Proposed Class II bike lane (there are currently no bike lanes). Between Elden and the eastern city limit at Santa Ana Avenue, Del Mar is classified as a Proposed Class III Bike Boulevard/Route. On that narrower segment there is no width available for adding bike lanes without removing well-used parallel parking.

At its east signal with northbound Newport Boulevard, Del Mar's west leg has one westbound receiving lane and four eastbound approaching lanes — two left turn lanes and two through lanes. The east leg has three (westbound) approach lanes — two through lanes and a right turn lane separated by a wide buffer that ends at a pair of small channelization islands. South of the approach is a three-lane-wide landscaped median and two eastbound receiving lanes. Currently the approaching and receiving lanes are aligned across the intersection with no offsets (lateral shifts).

On the bridge across SR-55 Del Mar's westbound direction has a wide buffer that becomes a left-turn lane, two through lanes, and a bike lane or striped shoulder. The eastbound direction has a bike lane or striped shoulder, two through lanes and two left turn lanes. A narrow island separates the two directions.

Analysis

There are bike lanes or striped shoulders in both directions on Del Mar across SR-55. The city wishes to add bike lanes between northbound Newport Boulevard and Elden.

Westbound at Newport Boulevard [SUPERSEDED]

The existing wide buffer between the outer westbound through lane and the right turn lane could be reused for a through bike lane or buffered bike lane. The only obstacles are the two small channelization islands at the east crosswalk.

The inner and outer approach lanes are both 12' wide. It is suggested to change them to 11', making 2' available for a through bike lane, and to modify the channelization islands to create 5' of rideable width on their south side. A narrowed striped buffer can remain between the bike lane and the right turn lane.

To free up additional width for the bike lane, the wide raised median could also be narrowed several feet on its north side and the two westbound through lanes shifted to the south and then angled slightly across the intersection (see "shifting taper" discussion in "eastbound" section that follows).

Eastbound at Newport Boulevard [SUPERSEDED]

The existing width on the east leg between the landscaped median's south curb and Del Mar's south curb only accommodates the two existing eastbound receiving lanes — the width of the eastbound bike lane on the freeway bridge is not carried beyond the intersection. Installing an eastbound receiving bike lane would involve either widening to the south (reconstructing the south

curb and sidewalk), or narrowing the median on the south side by the bike lane width and shifting the two eastbound travel lanes northward. Widening would involve relocating a large mast arm pole, a fire hydrant and two equipment cabinets.

Shifting the through lanes would involve a "shifting taper", whose minimum length L depends on the shift amount W and vehicle speed S. The MUTCD shifting taper formula for speeds below 45 mph is **L = W x S^2 / 60**. Del Mar's posted speed east of Newport Boulevard is 30 mph. Assuming W=5 (bike lane width), L = 5 x 30 x 30 / 60 = 75 feet, however the MUTCD sets a minimum shifting taper length of 100' in urban areas. The distance from the eastbound limit line *of the two left turn lanes* to the east side of the east crosswalk is 92', which is close to 100', so this shift may indeed be feasible with a bit of design work, if the limit line for the two through lanes is moved back to match the left turn lanes.

Between Newport Boulevard and Elden Avenue [SUPERSEDED]

Midway along the block between northbound Newport Boulevard and Elden, eastbound Del Mar's outer travel lane is dropped (with merge arrows); its downstream width becomes a 12' right turn only lane approaching Elden. The eastbound approach to Elden also has a painted median with a STOP sign, a left turn lane, and an 11' through lane.

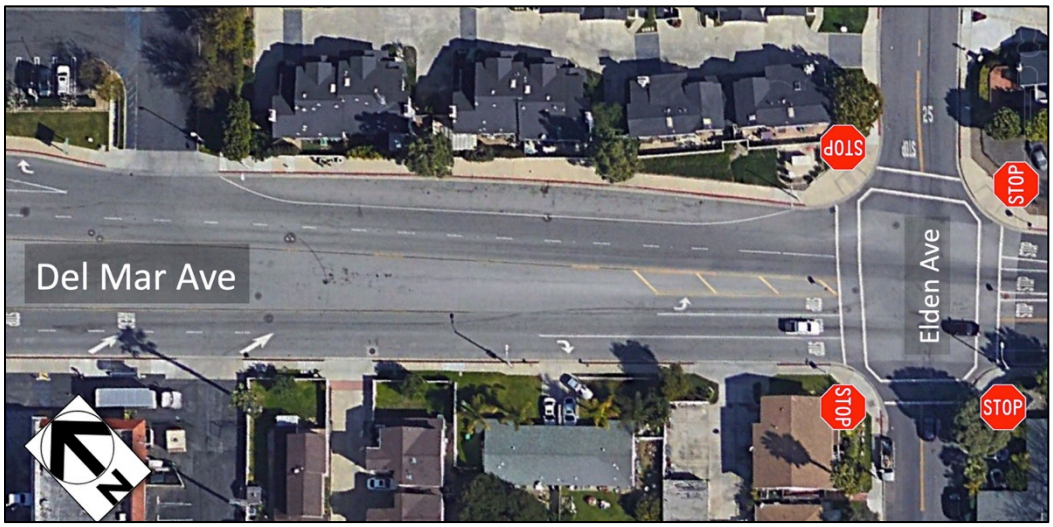


Figure 4-21: Del Mar Avenue near Elden Avenue

If the wide landscaped median at Newport Boulevard is narrowed on its south side as suggested above and the two eastbound travel lanes are shifted northward, the new eastbound bike lane can be continued to the start of the right turn lane that serves Elden. At that point it is suggested to either:

a) Replace the right turn lane with a wide bike lane, skip-striped to indicate that right-turning motorists should merge into the bike lane before turning (as required by California Vehicle Code 21717), or

b) Install Shared Lane Markings ("sharrows") left-justified in the right turn lane. These could optionally be backed with green pavement color for emphasis.

East of Elden Avenue

East of Elden, Del Mar is between 36’ and 40’ wide and has two traffic lanes, two striped parking lanes, and a dashed (passing permitted) centerline. There is no width available for bike lanes. Perez Park, located on the northeast corner at Santa Ana Avenue (the eastern city limit), is a popular destination for bicyclists who use Del Mar to reach it.

If parking is retained on both sides of Del Mar between Elden and Santa Ana, it is suggested to:

a) Install Shared Lane Markings (“sharrows”), optionally backed with green pavement color, centered in the traffic lanes or offset slightly toward the centerline (for increased door-zone clearance), and

b) Install periodic R117 (CA) “PASS [BIKES] 3 FT MIN” regulatory signs, optionally with a black-on-yellow “STATE LAW” plaque above, to remind motorists of state law and encourage them to wait for safe passing gaps.

Figure 4-22: R117 (CA) sign with optional “STATE LAW” plaque

Suggestions

Table 4-8 summarizes the above suggestions.

Table 4-8: Suggestions for Del Mar Avenue [gray items SUPERSEDED]

#	Location	Item	Issue	Suggestion
1	EB at NB Newport Boulevard	Adding a bike lane	Insufficient width between median island and south curb	a) Narrow the median island by 5' on its south side b) Move back the limit line for the two through lanes to match the limit line for the left turn lanes c) Shift the through lanes 5' northward on the east side of the intersection. d) Install lane extension lines through the intersection for the through lanes and the bike lane.
2	WB approaching NB Newport Boulevard	Adding a bike lane	Reuse existing buffer along right turn lane	a) Restripe the existing buffer along the right turn lane, as a bike lane. b) Modify the right turn channelization islands at the northeast corner of the intersection, so the bike lane can proceed through.
3	EB approaching Elden Avenue	Supporting bicycle through movement	No existing through bike lane	Replace right turn lane with a wide dashed bike lane.
4	Between Elden Avenue and Santa Ana Avenue	Bicycling conditions	Raising motorist awareness	a) Install Shared Lane Markings ("sharrows"), optionally backed by green pavement color, centered in the travel lanes, or slightly offset toward the centerline. Consider green pavement color backing. b) Wherever possible, dash the centerline to encourage motorists to pass bicyclists with adequate clearance. c) Install R117 (CA) "PASS [BIKES] 3 FT MIN" signs, with "STATE LAW" plaques above.

4.4.6. Focal Area #6: Bristol Street, Irvine Avenue – Sunflower Avenue

Overview

Bristol Street is a multi-lane arterial that traverses the northeast corner of Costa Mesa. Figure 4-23 depicts its alignment. In left-to-right (north-to-east) order, Bristol:

- Crosses Sunflower Avenue (the northern city limit) from the City of Santa Ana
- Passes between the superblocks of the South Coast Plaza retail/office complex
- Continues south across I-405 (San Diego Freeway) through a Type L-9 (Partial Cloverleaf) interchange,
- Passes under CA-73 (Corona Del Mar Freeway),
- Passes under CA-55 (Costa Mesa Freeway),
- Continues southeast along the CA-73 to Santa Ana Avenue, then
- Splits into one-way segments and continues across the eastern city limit to Irvine Avenue.

Potential trail (shared use path) alignments along flood control channels, shown in green, intersect at Bear Street and midway between Santa Ana Avenue and northbound Newport Boulevard (orange).

Figure 4-23: Bristol Street context

Sidewalks are present on both sides for most of this distance.

The City's adopted 2018 Active Transportation Plan proposes the following bikeways on Bristol:

- Paularino Avenue - Bear Street (0.53-mile): bike lanes
- Bear Street – Newport Boulevard (0.33 mile): cycle track
- Santa Ana Avenue – City Boundary (east) [midway to Irvine Street, on one-way segments]: bike lanes

The Plan proposes shared use paths (Caltrans Class I Bikeways) on three corridors that intersect Bristol:

- Paularino Channel, which intersects near Bear Street
- Southbound Newport Boulevard (Bristol – Arlington)
- Santa Ana River channel, which intersects midway between northbound Newport Boulevard and Santa Ana Avenue

The Plan proposes bike lanes on several streets that cross Bristol:

- Sunflower Avenue, Park Center Drive – Fairview Road (1.45 miles)
- Paularino Avenue, Bear Street - Red Hill Avenue (0.36 miles)
- Baker Street, Bristol Street – Red Hill Avenue (0.61 miles)
- Santa Ana Avenue, Bristol Street – Mesa Drive (0.5 miles)

Observations and analysis

Detailed planning and design of bikeway improvements for Bristol is beyond the scope of this report. However, the evaluator bicycled the Costa Mesa segment of Bristol Street in both directions on a weekday and had several observations and suggestions for future discussion based on his initial understanding of the 2017 draft Active Transportation Plan and its proposed network connections to Bristol, summarize above.

On several segments south of I-405 it appeared that bike lanes could potentially be added by reducing travel lane widths, though in some cases the excess width vanishes on approaches to intersections as turn lanes are inserted.

Northbound Newport Boulevard – Santa Ana Avenue / Red Hill Avenue (0.4 miles)

On this segment the evaluator wondered whether widening the south sidewalk (and possibly the north sidewalk) for two-way shared use could be a viable alternative to on-street bike lanes. The south side has more destinations than the north side, especially because Ganahl Lumber occupies a considerable distance along the north side without driveways. Both directions of appear to have excess width along this segment. Reconstructing the south curb and gutter several feet to the north would enable construction of a wide south-side sidepath.

The south sidewalk has at least 10 driveway conflicts on this segment, so such a sidepath would require site-specific design at those conflict areas. On this segment Bristol's center lane currently has no islands or turn restrictions, so all of the south-side driveways are full-movement (right turn in/out and left turn in/out). Some level of access control (i.e., prohibiting certain left turns into and

out of south-side driveways) could help to reduce driveway conflict levels. To implement such access control the painted center lane could be replaced with a raised median incorporating turn pockets, enabling left-turn restrictions on a per-driveway basis. The center lane is currently 12' wide; some additional width reallocated from travel lanes would enable installation of minimum-width (2') channelization islands and turn pockets (10'), as well as landscaping including trees. Many landscaped medians throughout California use a 14' cross section, enabling 10' turn lanes and 4' channelization islands.

Northbound Newport Boulevard – Southbound Newport Boulevard (0.14 miles)

On the next segment to the west (under the CA-55 structure), the south sidewalk is 7' wide and the southbound Bristol is 40' wide with three travel lanes. Narrowing those lanes to 11' could free up an additional 7', which if combined with the existing 7' sidewalk would provide sufficient width for a two-way sidepath on the south side.

Southbound Newport Boulevard – Bear Street (0.2 miles)

On the next segment to the west the south sidewalk is also 7' wide and southbound Bristol also has three travel lanes with excess total width. Narrowing those lanes to 11' could free up an additional 7', which if combined with the existing sidewalk would provide sufficient width for a two-way sidepath on the south side.

Suggestions

The following suggestions are offered for further discussion and development of a south sidepath concept:

Table 4-9: Suggestions for Bristol Street

#	Segment	Suggestion
1	Bear Street – Santa Ana Avenue (0.75 miles)	Consider installing a wide south-side sidepath by narrowing the southbound lanes and reconstructing curb and gutter several feet to the north.
2	Northbound Newport Boulevard – Santa Ana Avenue	Consider converting the painted center lane to a raised median with landscaping and turn pockets, to enable driveway access control (left-turn restrictions) especially on the south side.
3	At northbound Newport Boulevard	Provide a westbound U-turn lane, to enable westbound traffic to access south-side driveways to the east without having to make mid-block left turns from the center lane.
4	At flood control channel midway between Newport Boulevard and Santa Ana Avenue	If the channel levee is built out with a path, consider installing a Pedestrian Hybrid Beacon to convey pedestrians and bicyclists across Bristol at this location instead of their having to detour to the signals at Santa Ana Avenue or Newport Boulevard.

Figure 4-28 illustrates the south sidepath concept (blue line).

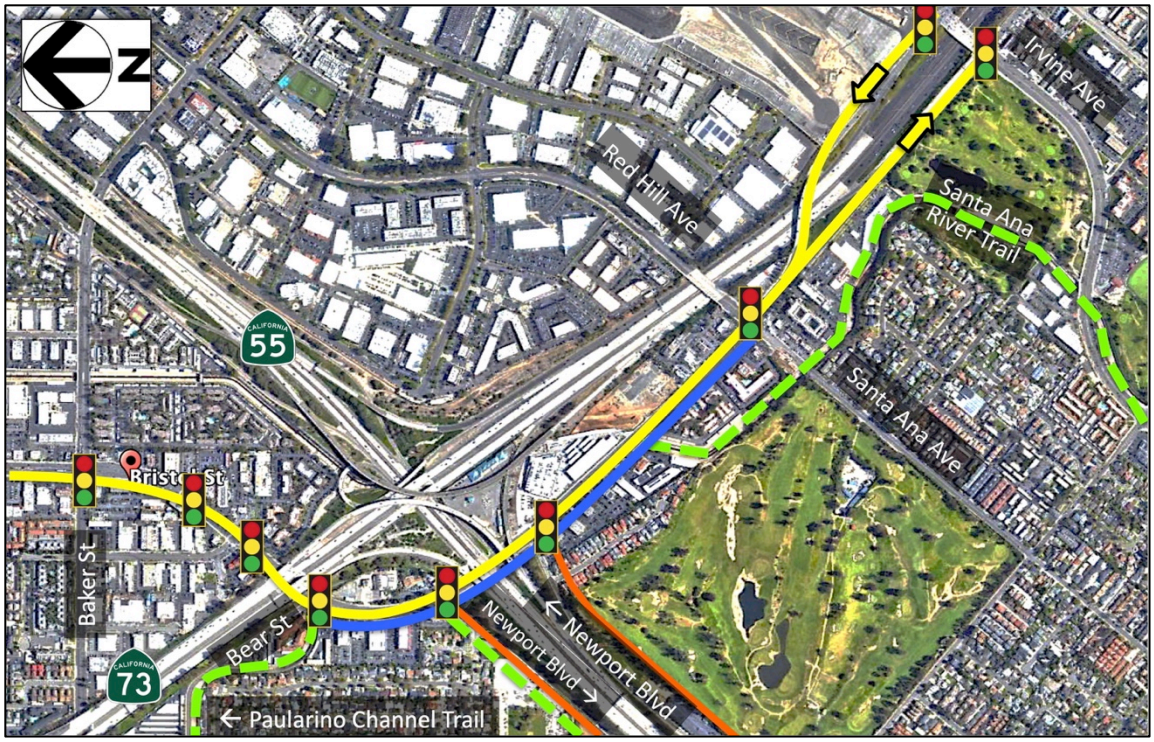


Figure 4-24: Concept for south sidepath between Bear Street and Santa Ana Avenue

APPENDIX A: GLOSSARY OF PEDESTRIAN IMPROVEMENT MEASURES

Pedestrian Improvement Measures			
Measure	**Description**	**Benefits**	**Application**
Traffic Control Countermeasures			
Traffic Signal or All-Way Stop	Conventional traffic control devices with warrants for use based on the Manual on Uniform Control Devices (MUTCD).	Reduces pedestrian-vehicle conflicts and slows traffic speeds.	Must meet warrants based on traffic and pedestrian volumes; however, exceptions are possible based on demonstrated pedestrian safety concerns (collision history).
HAWK Beacon Signal	HAWKs (High Intensity Activated Crosswalks) are pedestrian-actuated signals that are a combination of a beacon flasher and a traffic control signal. When actuated, HAWK displays a yellow (warning) indication followed by a solid red light. During pedestrian clearance, the driver sees a flashing red “wig-wag” pattern until the clearance interval has ended and the signal goes dark.	Reduces pedestrian-vehicle conflicts and slows traffic speeds.	Useful in areas where it is difficult for pedestrians to find gaps in automobile traffic to cross safely, but where normal signal warrants are not satisfied. Appropriate for multi-lane roadways.
Stutter Flash (includes Rectangular Rapid Flashing Beacon / RRFB)	The Overhead Flashing Beacon is enhanced by replacing the traditional slow flashing incandescent lamps with rapid flashing LED lamps. The beacons may be push-button activated or activated with pedestrian detection.	Initial studies suggest the stutter flash is very effective as measured by increased driver yielding behavior. Solar panels reduce energy costs associated with the device.	Appropriate for multi-lane roadways.

Pedestrian Improvement Measures			
Measure	**Description**	**Benefits**	**Application**
High-Visibility Signs and Markings	High-visibility markings include a family of crosswalk striping styles including the “ladder” and the “triple four.” One style, the zebra-style crosswalk pavement markings, were once popular in Europe, but have been phased out because the signal-controlled puffin is more effective (see notes). High-visibility fluorescent yellow green signs are made of the approved fluorescent yellow-green color and posted at crossings to increase the visibility of a pedestrian crossing ahead.	FHWA recently ended its approval process for the experimental use of fluorescent yellow crosswalk markings and found that they had no discernible benefit over white markings.	Beneficial in areas with high pedestrian activity, as near schools, and in areas where travel speeds are high and/or motorist visibility is low.
In-Street Pedestrian Crossing Signs	This measure involves posting regulatory pedestrian signage on lane edge lines and road centerlines. The In-Street Pedestrian Crossing sign may be used to remind road users of laws regarding right of way at an unsignalized pedestrian crossing. The legend STATE LAW may be shown at the top of the sign if applicable. The legends STOP FOR or YIELD TO may be used in conjunction with the appropriate symbol.	This measure is highly visible to motorists and has a positive impact on pedestrian safety at crosswalks.	Mid-block crosswalks, unsignalized intersections, low-speed areas, and two-lane roadways are ideal for this pedestrian treatment. The STOP FOR legend shall only be used in states where the state law specifically requires that a driver must stop for a pedestrian in a crosswalk.
Advanced Yield Lines	Standard white stop or yield limit lines are placed in advance of marked, uncontrolled crosswalks.	This measure increases the pedestrian’s visibility to motorists, reduces the number of vehicles encroaching on the crosswalk, and improves general pedestrian conditions on multi-lane roadways. It is also an affordable option.	Useful in areas where pedestrian visibility is low and in areas with aggressive drivers, as advance limit lines will help prevent drivers from encroaching on the crosswalk. Addresses the multiple-threat collision on multi-lane roads.
Geometric Treatments			

Pedestrian Improvement Measures			
Measure	**Description**	**Benefits**	**Application**
Pedestrian Overpass/ Underpass	This measure consists of a pedestrian-only overpass or underpass over a roadway. It provides complete separation of pedestrians from motor vehicle traffic, normally where no other pedestrian facility is available, and connects off-road trails and paths across major barriers.	Pedestrian overpasses and underpasses allow for the uninterrupted flow of pedestrian movement separate from the vehicle traffic.	Grade separation via this measure is most feasible and appropriate in extreme cases where pedestrians must cross roadways such as freeways and high-speed, high-volume arterials. This measure should be considered a last resort, as it is expensive and visually intrusive.
Road Diet (aka Lane Reduction)	The number of lanes of travel is reduced by widening sidewalks, adding bicycle and parking lanes, and converting parallel parking to angled or perpendicular parking.	This is a good traffic calming and pedestrian safety tool, particularly in areas that would benefit from curb extensions but have infrastructure in the way. This measure also improves pedestrian conditions on multi-lane roadways.	Roadways with surplus roadway capacity (typically multi-lane roadways with less than 15,000 to 17,000 ADT) and high bicycle volumes, and roadways that would benefit from traffic calming measures.
Median Refuge Island	Raised islands are placed in the center of a roadway, separating opposing lanes of traffic with cutouts for accessibility along the pedestrian path.	This measure allows pedestrians to focus on each direction of traffic separately, and the refuge provides pedestrians with a better view of oncoming traffic as well as allowing drivers to see pedestrians more easily. It can also split up a multi-lane road and act as a supplement to additional pedestrian tools.	Recommended for multi-lane roads wide enough to accommodate an ADA-accessible median.

Pedestrian Improvement Measures			
Measure	**Description**	**Benefits**	**Application**
Staggered Median Refuge Island	This measure is similar to traditional median refuge islands; the only difference is that the crosswalks in the roadway are staggered such that a pedestrian crosses half the street and then must walk towards traffic to reach the second half of the crosswalk. This measure must be designed for accessibility by including rails and truncated domes to direct sight-impaired pedestrians along the path of travel.	Benefits of this tool include an increase in the concentration of pedestrians at a crossing and the provision of better traffic views for pedestrians. Additionally, motorists are better able to see pedestrians as they walk through the staggered refuge.	Best used on multi-lane roads with obstructed pedestrian visibility or with off-set intersections.
Curb Extension	Also known as a pedestrian bulb-out, this traffic-calming measure is meant to slow traffic and increase driver awareness. It consists of an extension of the curb into the street, making the pedestrian space (sidewalk) wider.	Curb extensions narrow the distance that a pedestrian has to cross and increases the sidewalk space on the corners. They also improve emergency vehicle access and make it difficult for drivers to turn illegally.	Due to the high cost of installation, this tool would only be suitable on streets with high pedestrian activity, on-street parking, and infrequent (or no) curb-edge transit service. It is often used in combination with crosswalks or other markings.
Reduced Curb Radii	The radius of a curb can be reduced to require motorists to make a tighter turn.	Shorter radii narrow the distance that pedestrians have to cross; they also reduce traffic speeds and increase driver awareness (like curb extensions) but are less difficult and expensive to implement.	This measure would be beneficial on streets with high pedestrian activity, on-street parking, and no curb-edge transit service. It is more suitable for wider roadways and roadways with low volumes of heavy truck traffic.
Curb Ramps	Curb ramps are sloped ramps that are constructed at the edge of a curb (normally at intersections) as a transition between the sidewalk and a crosswalk.	Curb ramps provide easy access between the sidewalk and roadway for people using wheelchairs, strollers, walkers, crutches, handcarts, bicycles, and also for pedestrians with mobility impairments who have trouble stepping up and down high curbs.	Curb ramps must be installed at all intersections and mid-block locations where pedestrian crossings exist, as mandated by federal legislation (1973 Rehabilitation Act and 1990 Americans with Disabilities Act). Where feasible, separate curb ramps for each crosswalk at an intersection should be provided rather than having a single ramp at a corner for both crosswalks.

Pedestrian Improvement Measures			
Measure	**Description**	**Benefits**	**Application**
Raised Crosswalk	A crosswalk whose surface is elevated above the travel lanes.	Attracts drivers' attention; encourages lower travel speeds by providing visual and tactile feedback when approaching the crosswalk.	Appropriate for multi-lane roadways, roadways with lower speed limits that are not emergency routes, and roadways with high levels of pedestrian activity, such as near schools, shopping malls, etc.
Improved Right-Turn Slip-Lane Design	Right-turn slip lanes (aka channelized right-turn lanes) are separated from the rest of the travel lanes by a pork chop-shaped striped area. This measure separates right-turning traffic and streamlines right-turning movements. Improved right-turn slip lanes would provide pedestrian crossing islands within the intersection and be designed to optimize the right-turning motorist's view of the pedestrian and of vehicles to his or her left.	This measure reduces the pedestrian's crossing distance and turning vehicle speeds.	Appropriate for intersections with high volumes of right-turning vehicles.
Chicanes	A chicane is a sequence of tight serpentine curves (usually an S-shape curve) in a roadway, used on city streets to slow cars.	This is a traffic-calming measure that can improve the pedestrian environment and pedestrian safety.	Chicanes can be created on streets with higher volumes, given that the number of through lanes is maintained; they can also be created on higher-volume residential streets to slow traffic. Chicanes may be constructed by alternating parallel or angled parking in combination with curb extensions.
Pedestrian Access and Amenities			
Marked Crosswalk	Marked crosswalks should be installed to provide designated pedestrian crossings at major pedestrian generators, crossings with significant pedestrian volumes (at least 15 per hour), crossings with high vehicle-pedestrian collisions, and other areas based on engineering judgment.	Marked crosswalks provide a designated crossing, which may improve walkability and reduce jaywalking.	Marked crosswalks alone should not be installed on multi-lane roads with more than about 10,000 vehicles/day. Enhanced crosswalk treatments (as presented in this table) should supplement the marked crosswalk.

Pedestrian Improvement Measures			
Measure	**Description**	**Benefits**	**Application**
Textured Pavers	Textured pavers come in a variety of materials (for example, concrete, brick, and stone) and can be constructed to create a textured pedestrian surface such as a crosswalk or sidewalk. Crosswalks are constructed with the pavers or can be made of stamped concrete or asphalt.	Highly visible to motorists, this measure provides a visual and tactile cue to motorists and delineates a separate space for pedestrians, as it provides a different texture to the street for pedestrians and motorists. It also aesthetically enhances the streetscape.	Appropriate for areas with high volumes of pedestrian traffic and roadways with low visibility and/or narrow travel ways, as in the downtown area of towns and small cities.
Anti-Skid Surfacing	Surface treatment is applied to streets to improve skid resistance during wet weather. This is a supplementary tool that can be used to reduce skidding in wet conditions.	Improves driver and pedestrian safety.	Appropriate for multi-lane roadways and roadways with higher posted speed limit and/or high vehicle volumes or collision rates.
Accessibility Upgrades	Treatments such as audible pedestrian signals, accessible push buttons, and truncated domes should be installed at crossings to accommodate disabled pedestrians.	Improves accessibility of pedestrian facilities for all users.	Accessibility upgrades should be provided for all pedestrian facilities following a citywide ADA Transition Plan.
Pedestrian Countdown Signal	Displays a “countdown” of the number of seconds remaining for the pedestrian crossing interval. In some jurisdictions the countdown includes the walk phase. In other jurisdictions, the countdown is only displayed during the flashing don’t walk phase.	Increases pedestrian awareness and allows them the flexibility to know when to speed up if the pedestrian phase is about to expire.	The forthcoming 2009 MUTCD is expected to require all pedestrian signals to incorporated countdown signals within ten years. The signals should be prioritized for areas with pedestrian activity, roadways with high volumes of vehicular traffic, multi-lane roadways, and areas with elderly or disabled persons (who may walk slower than others may).
Transit			

Pedestrian Improvement Measures			
Measure	**Description**	**Benefits**	**Application**
High-Visibility Bus Stop Locations	This measure should include siting bus stops on the far side of intersections, with paved connections to sidewalks where landscape buffers exist.	Provides safe, convenient, and inviting access for transit users; can improve roadway efficiency and driver sight distance.	Appropriate for all bus stops subject to sight distance and right-of-way constraints.
Transit Bulb	Transit bulbs or bus bulbs, also known as nubs, curb extensions, or bus bulges are a section of sidewalk that extends from the curb of a parking lane to the edge of the through lane.	Creates additional space at a bus stop for shelters, benches, and other passenger amenities.	Appropriate at sites with high patron volumes, crowded city sidewalks, and curbside parking.
Enhanced Bus Stop Amenities	Adequate bus stop signing, lighting, a bus shelter with seating, trash receptacles, and bicycle parking are desirable features at bus stops.	Increase pedestrian visibility at bus stops and encourage transit ridership.	Appropriate at sites with high patron volumes.

APPENDIX B: GLOSSARY OF BICYCLING IMPROVEMENT MEASURES

Bicycling Improvement Measures			
Measure	**Description**	**Benefits**	**Application**
LINKS /ROADWAY SEGMENTS			
A. Road Design and Operations to Slow Traffic			
Traffic Calming	There are a variety of measures too numerous to list here. See ITE Institute of Transportation Engineers, "Traffic Calming: State of the Practice".	Reduces motor vehicle speeds, which improves safety for all modes and increases bicyclist's comfort.	Urban and suburban settings; suggested for urban major streets with prevailing speeds of 35 mph and higher and for suburban major streets with prevailing speeds 45 mph or higher; and for all local streets with speeds of 30+ mph.
Bicycle Boulevard	A minor street on which traffic control devices are designed and placed to encourage cycling; these include unwarranted stop signs along bike route are removed; crossing assistance at major arterials is provided (see examples in Nodes-Section E below).	Allows cyclists to maintain their travel speeds, significantly reducing their travel time; provides cyclists with a low volume, low speed street where motorists are aware that it is a bicycle-priority street.	On minor streets with less than 3000 vehicles per day especially useful when Bike Blvd is parallel to and within ¼ mile of a major arterial with many desirable destinations.
Signal Coordination at 15 -25 mph	The signal timing along a corridor is set so that traffic which receives a green light at the first intersection will subsequently receive a green light at all downstream intersections if they travel at the design speed; aka a "green wave."	Encourages motorists to travel at slower speeds, provides a more comfortable experience for cyclists and increases overall traffic safety; also allows cyclists to hit the green lights, so that they can maintain their travel speeds, significantly reducing their travel time.	Urban settings, typically downtown and other areas with relatively short blocks and with traffic signals at every intersection.
Woonerf/Shared Space	A shared space concept where the entire public right of way is available for all modes, often with no sidewalks, and with no lane striping, and little if any signage.	Access for motor vehicles is maintained, unlike a pedestrian zone, but motor vehicle speeds are constrained to 5 mph by design and the presence of other modes. Safety for all modes is improved.	Low volume residential streets where families can gather and children are encouraged to play; also commercial areas with high pedestrian volumes, bicyclists and transit.

B. Road Design to Provide Bicycle Infrastructure			
Bike Lanes	A painted lane for the exclusive use of bicyclists; it is one-way and is 5 feet minimum in width. They can be retrofitted onto an existing street by either a) narrowing existing wide travel lanes; b) removing a parking lane; c) removing a travel lane, or d) widening the roadway. A common method to retrofit bike lanes is described below.	Provides cyclists with their own travel lane so that they can safely pass and be passed by motor vehicles.	Roadways with over 4000 vehicles per day (if less than 4000 vehicles per day see Bicycle Boulevards above).
Road Diet (aka Lane Reduction)	One to two travel lanes are replaced with a bike lane in each direction, and in most cases by also adding left-turn lanes at intersections or a center two-way left-turn lane; variations include widening sidewalks, and replacing parallel parking with angled or perpendicular parking.	Improves traffic safety for all modes by: a) eliminating the double-threat to pedestrians posed by the two or more travel lanes in each direction; b) providing bike lanes for cyclists; c) providing a left-turn pocket for motorists, reducing rear-end collisions and improving visibility to oncoming traffic.	Classic application is a four-lane undivided roadway with less than 15,000 to 17,000 ADT though conversions of four-lane streets may work up to 23,000 ADT. Also applies to three-lane roadways and to 5 or 6-lane undivided roadways
Buffer adjacent to bike lanes	A three to five-foot buffer area is provided on one or both sides of the bike lane.	Right-side buffer (between bike lane and on-street parking): Removes cyclists from the door zone; Left-side (between bike lane and adjacent travel lane): provides greater separation from passing motor vehicle traffic.	This measure is particularly beneficial in the following conditions: Right-side: on streets with parallel on-street parking particularly in cities with a collision history of dooring; Left-side: on streets with traffic with prevailing speeds of 40 mph and higher.
Cycle Tracks	A bikeway within the roadway right of way that is separated from both traffic lanes and the sidewalks by either a parking lane, street furniture, curbs or other physical means.	Reduces sidewalk riding, provides greater separation between motorists and cyclists.	Urban settings with parallel sidewalks and heavy traffic.
C Other Traffic Control Devices			
Except Bicycles placard	A Regulatory sign placard for use with other regulatory signs.	Increases or maintains the access and circulation capabilities of bicyclists.	Used at locations where the restriction in question does not apply to bicyclists, such as No Left Turn or Do Not Enter.

Sharrows	A pavement legend that indicates the location within the travel lane where bicyclists are expected to occupy.	The sharrow encourages cyclists to ride outside of the door zone and studies have shown that sharrows reduce the incidence of cyclists riding on the sidewalk and wrong-way riding.	Two or more lane city streets where the right-most lane is too narrow for a motor vehicle to safely pass a cyclist within the travel lane.
Bike Lanes May Use Full Lane sign (MUTCD R4-11)	Regulatory Sign	Informs motorists and cyclists that cyclists may be travelling in the center of a narrow lane.	Two or more lane city streets where the right-most lane is too narrow for a motor vehicle to safely pass a cyclist within the travel lane.
Share the Road sign (MUTCD W-11/ W16-1p)	Warning sign and placard	Informs motorists to expect cyclists on the roadway.	Two-lane roads particularly in rural areas where shoulders are less than four-feet.
Bike Directional Signs (MUTCD D1 series or similar)	Informational signs indicating place names and arrows, with distances as a recommended option (D1-2C)	Informs bicyclists of the most common destination served by the bike route in question.	Particularly useful to direct cyclists to a facility such as a bike bridge or to use a street to access a major destination that might not otherwise be readily apparent.
D. New infrastructure to improve bicycle connectivity			
Bike Path	A paved pathway for the exclusive use of non-motorized traffic within its own right of way;	Provides additional connectivity and route options that otherwise would not be available to bicyclists.	Wherever a continuous right of way exists, typically found along active or abandoned railroad ROW, shorelines, creeks, and river levees.
Pathway connections	Short pathway segments for non-motorized traffic, for example, that join the ends of two cul-de-sac or provide other connectivity not provided by road network.	Provides short-cuts for bicyclists that reduce their travel distance and travel time.	Varies by community; suggested at the end of every newly constructed cul-de-sac.
Bicycle Overpass/ Underpass	A bicycle overpass or underpass is a bridge or tunnel built for the exclusive use of non-motorized traffic and is typically built where at-grade crossings cannot be provided such as to cross freeways, rivers, creeks and railroad tracks. They can also be built to cross major arterials where, for example, a bike path must cross a major roadway.	A bike bridge / tunnel complements a local roadway system that is discontinuous due to man-made or natural barriers. They reduce the distance traveled by cyclists, and provide a safer conflict-free crossing, particularly if it is an alternative to a freeway interchange.	Grade separation via this measure is most feasible and appropriate when it would provide direct access to major bicyclist destinations such as a school or college, employment site, major transit station or would reduce the travel distance by one mile or more.

NODES / INTERSECTIONS			
Measure	**Description**	**Benefits**	**Application**
E. Intersection Design for Motor Vehicles			
Reduced Curb Radii	The radius of a curb is reduced to require motorists to make the turn at slower speeds and to make a tighter turn.	Shorter curb radii reduce the speed of turning traffic thereby enabling a more comfortable weave between through cyclists and right-turning motorists.	This measure is suitable for downtown settings, at all cross streets with minor streets, all residential streets and all roadways that are not designated truck routes.
Remove/Control Free Right-Turn Lanes	Where a separate right-turn lane continues as its own lane after the turn, it may be redesigned to eliminate the free turn. A short-term solution is to control the turning movement with a stop sign or signal control and to redesign the island as discussed below.	Improves bicyclist safety since this design forces through cyclists on the cross street to end up in between two lanes of through motor vehicle traffic.	All locations where there are free right-turn lanes except those leading onto freeway on-ramps.
Remove/Redesign Right-Turn Slip-Lane Design	Right-turn slip lanes (aka channelized right-turn lanes) are separated from the rest of the travel lanes by a pork chop-shaped raised island that is typically designed to facilitate fast right turns, and right-turning vehicles are often not subject to the traffic signal or stop sign.	Improves bicyclist safety by slowing right-turning motorists and facilitates the weave between through bicyclists and right-turning motorists.	All locations with a channelized right-turn.
Remove Optional Right-Turn Lane in Combination with a Right-Turn Only Lane	At locations where there is an optional right-turn lane in combination with a right-turn only lane, convert the optional right-turn lane to a through-only lane.	Improves bicyclist safety since cyclists have no way of knowing how to correctly position themselves in the optional (through /right turn) lane.	All locations where there is an optional right-turn lane in combination with a right-turn only lane per HDM 403.6(1) (except on freeways).
Redesign Ramp Termini	Redesign high speed free flow freeway ramps to intersection local streets as standard intersections with signal control.	Improves bicyclist and pedestrian safety on intersections of local streets with freeway ramps.	All freeway interchanges with high speed ramps

F. Intersection Design Treatments - Bicycle-Specific			
Bicycle Signal Detection and Pavement Marking	Provide signal detectors that also detect bicyclists in the rightmost through lane and in left-turn lanes with left-turn phasing. Provide pavement marking to indicate to cyclists where to position themselves in order to activate the detector.	Enables cyclists to be detected when motor vehicles are not present to trigger the needed signal phase. Improves bicyclists' safety.	Per CA MUTCD 4D.105 and CVC 21450.5, all new and modified traffic detection installations must detect bicyclists; All other traffic-actuated signals may be retrofitted to detect bicyclists as soon as feasible.
Bicycle Signal Timing	Provides signal timing to account for the speed of cyclists to cross an intersection.	Improves bicyclists' safety by reducing the probability of a bicyclist being in an intersection when the phase terminates and being hit by traffic that receives the next green phase.	Signal timing that accounts for cyclists is particularly important for cyclists on a minor street approach to a major arterial which crosses a greater distance due to the width of the arterial, hence requiring a longer time interval.
Bicycle Signal Heads	A traffic signal indication in the shape of a bicycle, with full red, yellow green capability.	Improves bicyclist safety by providing a bicycle -only phase, where appropriate, given the geometry and phasing of the particular intersection.	Where intersection geometry is such that a bicycle-only phase is provided and/or bicycle signal heads would improve safety at the intersection. See also CA MUTCD for warrants for bicycle signal heads.
Widen Bike Lane at Intersection Approach	Within the last 200 feet of an intersection, widen the bike lane and narrow the travel; for example from 5-foot bike lane and 12 feet travel lane would become a 7-foot bike lane and 10-foot travel lane.	Improves cyclist safety by encouraging right-turning motorists to enter the bike lane to turn right, (as required by the CVC), which reduces the chance of a right-turn hook collision in which a through cyclist remains to the right of a right-turning motorist.	On roads with bike lanes approaching an intersection without a right-turn only lane and there is noncompliance with right-turning vehicles merging into the bike lane as required by the CVC and UVC.
Bike Lane inside Right-Turn Only Lane ("Combined Bicycle/Right-Turn Lane")	Provide a bike lane line inside and on the left side of a right-turn only lane.	Encourages cyclists to ride on the left side of the right-turn only lane thus reducing the chance of a right hook collision, where a cyclist remains to the right of a right-turning motorist.	On roads with bike lanes approaching an intersection with a right-turn only lane and there is not enough roadway width to provide a bike lane to the left of the right-turn lane.

Bike Boxes	Area between an Advance Stop Line and a marked crosswalk designated as the queue space for cyclists to wait for a green light ahead of queued motor vehicle traffic; sometimes painted green.	Primary benefits are to reduce conflicts between bicyclists and right-turning traffic at the onset of the green signal phase, and to reduce vehicle and bicyclist encroachment in a crosswalk during a red signal phase.	Locations where there are at least three cyclists at the beginning of the green phase and moderate to high pedestrian volumes.
Marked Crosswalk with Distinct Marked Area for Bicyclists separate from Pedestrians	A marked crosswalk that has two distinct areas, one for pedestrians and one for bicyclists.	Reduces conflicts between bicyclists and pedestrians by indicating the part of the crosswalk intended for the two different modes.	At a typical intersection, cyclists would not be riding within the crosswalk, so this measure is intended for those few locations where the intersection design is such that bicyclists are tracked into a crosswalk such as at a midblock bike path crossing or possibly a cycle track.
Pedestrian Countdown Signal	Displays a “countdown” of the number of seconds remaining for the pedestrian crossing interval. In some jurisdictions the countdown includes the walk phase. In other jurisdictions, the countdown is only displayed during the flashing don’t walk phase.	While designed for pedestrians, this measure also assists bicyclists in knowing the time remaining to cross the intersection.	The 2012 MUTCD requires all pedestrian signals to incorporated countdown signals within ten years
Measure	**Description**	**Benefits**	**Application**
G. Geometric Countermeasures to Assist crossing a Major Street			
Median Refuge Island	A raised island placed in the center of a roadway, separating opposing lanes of traffic, with ramps for cyclists and ADA accessibility	This measure allows bicyclists to cross one direction of traffic at a time; it allows drivers to see bicyclists crossing from the center more easily.	Suggested for multilane roads at uncontrolled crossings where an 8-foot (min.) wide by 15-foot (min.) long median can be provided.
Staggered Refuge Pedestrian Island	This measure is similar to traditional median refuge islands; the only difference is that the crosswalk is staggered such that a pedestrian crosses one direction of traffic street and then must turn to their right facing oncoming to reach the second part of the crosswalk. This measure must be designed for accessibility by including rails and truncated domes to direct sight-impaired pedestrians along the path of travel.	Benefits of this measure include forcing the bicyclists and pedestrians to face the oncoming motorists, increasing their awareness of the impending conflict. Additionally, can improve motorists’ visibility to those persons in the crosswalk.	Best used on multilane roads with obstructed pedestrian visibility or with off-set intersections

Raised Crosswalk/Speed Table	A crosswalk whose surface is elevated above the travel lanes at the same level as the approaching sidewalk. For bicyclists, a typical location would be at a bike path crossing, where the bike path elevation would remain constant while roadway cross traffic would experience a speed-hump type effect.	Attracts drivers' attention to the fact there will be non-motorized users crossing the roadway, and slows traffic by providing a speed-hump effect for motorists approaching the crosswalk.	Appropriate for multi-lane roadways, roadways with lower speed limits that are not emergency routes, and roadways with high levels of pedestrian activity, such as near schools, shopping malls, etc.
Measure	**Description**	**Benefits**	**Application**
H. Traffic Control Countermeasures to Assist Crossing a Major Street			
Traffic Signal or All-Way Stop Sign	Conventional traffic control devices with warrants for use based on the Manual on Uniform Control Devices (MUTCD)	Provides the gap needed in traffic flow so that cyclists can cross the street, reducing bicycle-vehicle conflicts and risk-taking by cyclists to	Must meet warrants based on traffic/ pedestrian / bicycle volumes, collision history, and/ or other factors.
Modern Roundabout	A traffic circle combined with splitter island on all approaches and entering traffic must YIELD to traffic within the roundabout; typically designed for traffic speed within the roundabout of between 15 and 23 mph.	Slows traffic on cross street so that cyclists can more easily cross.	Roundabouts are a better alternative than an All-Way Stop signs when the side street volume is approximately 30 % of the total intersection traffic volume and total peak hour volume is less than 2300 vehicles per day.
Hawk Beacon Signal	HAWK (High Intensity Activated Crosswalks) are pedestrian-bicyclist actuated signals that are a combination of a beacon flasher and a traffic control signal. When actuated, HAWK displays a yellow (warning) indication followed by a solid red light. During the cross street phase, the driver sees a flashing red “wig-wag” pattern until the clearance interval has ended and the signal goes dark.	Provides the need gaps in traffic so bicyclists can safely cross the street, can be timed separately for bicycles and pedestrians. Reduces pedestrian-vehicle conflicts and slows traffic speeds	Useful in areas where it is difficult for bicyclists /pedestrians to find gaps in automobile traffic to cross safely, but where normal signal warrants are not satisfied. Appropriate for multilane roadways.
Rectangular Rapid Flashing Beacon (RRFB/Stutter Flash)	A warning sign that also contains rapid flashing LED lamps. The beacon may be push-button activated or activated with pedestrian detection.	Initial studies suggest the stutter flash is very effective as measured by increased driver yielding behavior. Solar panels reduce energy costs associated with the device.	Locations not controlled by any measures listed above. Appropriate for multi-lane roadways.

In-Roadway Warning Lights	Both sides of a crosswalk are lined with pavement markers, often containing an amber LED strobe light. The lights may be push-button activated or activated with pedestrian detection.	This measure provides a dynamic visual cue of the uncontrolled crosswalk and is especially effective at night and in bad weather.	Locations not controlled by any measures listed above. Best in locations with low bicycle ridership on the cross street, as the raised markers may present difficulty to bicyclists. May not be appropriate in areas with heavy winter weather due to high maintenance costs. May not be appropriate for locations with bright sunlight.
Bicycle Crossing Sign (MUTCD W11-1) or Trail Crossing sign (MUTCD W11-15/W11-15p)	Warning Sign and placard.	Alerts motorists to a location where bicyclists or bicyclists and pedestrians will be crossing the roadway at an uncontrolled location.	Typical application is at bike path crossing of a roadway. (At a typical pedestrian crosswalk at an intersection, use the Pedestrian warning sign W11-2)
In-Street Pedestrian Crossing Signs (MUTCD R1-6)	This measure involves posting this regulatory sign on road centerlines that read, “YIELD for Pedestrians in crosswalk”. (Depending on state law, the word STOP may replace the word YIELD).	This measure improves the visibility of the crossing to motorists and has a positive impact on pedestrian safety at crosswalks.	Mid-block crosswalks, unsignalized intersections, low-speed areas, and two-lane roadways.
Advanced Yield Lines	Standard white stop or yield limit lines are placed 20-50 feet in advance of marked, uncontrolled crosswalks.	This measure increases the pedestrian’s visibility to motorists, reduces the number of vehicles encroaching on the crosswalk, and improves general pedestrian conditions on multi-lane roadways. It is also an affordable option.	Useful in areas where pedestrian visibility is low and in areas with aggressive drivers, as advance limit lines will help prevent drivers from encroaching on the crosswalk. Addresses the multiple-threat collision on multi-lane roads.
Transit			
Bike Racks on Buses	A rack on the front of the bus that typically holds two or three bicycles.	Increases the trip length distance that a person can make.	Appropriate for all buses; most urban transit agencies have already implemented this measure.
Bikes allowed inside buses when bike rack is full	A policy adopted by a transit agency that allows passengers to bring bicycles inside the bus when the bike rack is full and there is room inside.	Prevents cyclists from needless being left behind to wait for the next bus if the bike rack is full yet there is room inside the bus.	Appropriate for all buses; most urban transit agencies have already implemented this measure.

Folding bikes allowed inside buses	A policy adopted by a transit agency that treats a folding bicycle as luggage, thereby allowing it inside the bus at all times.	Removes cyclists' uncertainty as to whether they will be able to fit their bike either on the bike rack or inside the bus; thus they can reliably plan on being able to catch their intended bus.	Appropriate for all buses; most urban transit agencies have already implemented this measure.

APPENDIX C: RESOURCE LIST AND REFERENCES

Resource List and References	
➔ Pedestrian and Bicycle Information Center ("PBIC") http://www.bicyclinginfo.org	Along with walkinginfo.org, a resource site maintained by UNC Highway Safety Research Center (UNC-HSRC)
➔ Pedestrian and Bicycle Crash Analysis Tool ("PBCAT") http://www.walkinginfo.org/facts/pbcat/index.cfm	Crash typing software product intended to assist planners and engineers with improving walking and bicycling safety through the development and analysis of a database containing details of crashes between motor vehicles and pedestrians or bicyclists
➔ FHWA On-Demand Bicycle Safety Training Courses http://www.bicyclinginfo.org/training/ondemand-training.cfm	FHWA University Course on Bicycle and Pedestrian Transportation National Highway Institute Bicycle Facility Design Course Safe Routes to School National Course APBP National Complete Streets Workshops
➔ FHWA University Course on Bicycle and Pedestrian Transportation, Report No. FHWA-HRT-05-085 http://www.tfhrc.gov/safety/pedbike/pubs/05085	A detailed 24-lesson course in planning and design for non-motorized transportation.
➔ FHWA Official Rulings website http://mutcd.fhwa.dot.gov/orsearch.asp	List of FHWA communications regarding experiments, and interpretation of documents (Requests To Experiment / RTEs, response letters, progress reports, final reports, changes).
➔ FHWA Interim Approvals webpage http://mutcd.fhwa.dot.gov/res-interim_approvals.htm	List of all Interim Approvals granted by FHWA. Interim Approvals enable states and local agencies to request approval to use a new device without experimentation before the device is incorporated into a future edition of the MUTCD.
➔ FHWA "Bicycle Facilities and the Manual on Uniform Traffic Control Devices" webpage http://www.fhwa.dot.gov/environment/bicycle_pedestrian/guidance/design_guidance/mutcd_bike.cfm	Status in the 2009 US MUTCD of various bicycle-related signs, markings, signals, and other treatments (e.g., can be implemented, Interim Approval, currently experimental).
➔ FHWA DRAFT Accessibility Guidance for Bicycle and Pedestrian Facilities, Recreational Trails, and Transportation Enhancement Activities (2008) http://www.fhwa.dot.gov/environment/recreational_trails/guidance/accessibility_guidance/guidance_accessibility.cfm	Summary of current accessibility standards, pending standards, guidelines under development, program accessibility, accessibility design criteria for sidewalks, street crossings and shared use paths and trails
➔ FHWA Bollards, Gates and other Barriers (webpage) http://www.fhwa.dot.gov/environment/recreational_trails/guidance/accessibility_guidance/bollards_access.cfm	Current guidance on the hazards of bollards, gates, fences and other barriers to restrict unauthorized use of paths. Alternatives to bollards and gates.
➔ California Traffic Control Devices Committee (CTCDC) http://www.dot.ca.gov/hq/traffops/signtech/newtech/	Committee agendas, minutes, annual reports, experiment status and reports, experimentation guidelines and requests, implementation of FHWA-issued Interim Approvals.
➔ *Caltrans Complete Streets webpage http://www.dot.ca.gov/hq/tpp/offices/ocp/complete_streets.html*	*Complete Intersections guide and other resources*

➔ *Road Safety Audits: Case Studies (FHWA-SA-06-17)* *http://safety.fhwa.dot.gov/rsa/rsa_cstudies.htm*	
➔ *Bicycle Road Safety Audit Guidelines and Prompt Lists FHWA-SA-12-018* *http://safety.fhwa.dot.gov/ped_bike/tools_solve/fhwasa12018/*	
➔ *National Center for Safe Routes to School* *http://www.saferoutesinfo.org/*	*Resources for Infrastructure (engineering, safety, planning, design) and non-infrastructure (education, promotion, outreach) in support of Active Transportation in school commutes*

Adapted from FHWA Pedestrian Road Safety Audit Guidelines and Prompt Lists

Resources for Experimentation and Interim Approvals	
➔ FHWA "Bicycle Facilities and the Manual on Uniform Traffic Control Devices" webpage http://www.fhwa.dot.gov/environment/bicycle_pedestrian/guidance/design_guidance/mutcd_bike.cfm	Status in the 2009 US MUTCD of various bicycle-related signs, markings, signals, and other treatments (e.g., can be implemented, Interim Approval, currently experimental). Start here to determine whether a device requires experimentation.
➔ FHWA Interim Approvals webpage http://mutcd.fhwa.dot.gov/res-interim_approvals.htm	List of all Interim Approvals granted by FHWA. Interim Approvals enable states and local agencies to request approval to use a new device without experimentation before the device is adopted in a future edition of the MUTCD.
➔ FHWA Official Rulings website http://mutcd.fhwa.dot.gov/orsearch.asp	List of FHWA communications regarding experiments, and interpretation of documents (Requests To Experiment / RTEs, response letters, progress reports, final reports, changes).
➔ California Traffic Control Devices Committee (CTCDC) http://www.dot.ca.gov/hq/traffops/signtech/newtech/	Committee agendas, minutes, annual reports, experiment status and reports, experimentation guidelines and requests, implementation of FHWA-issued Interim Approvals.
➔ FHWA (U.S.) Manual on Uniform Traffic Control Devices (MUTCD) (2009), Section 1A.10 http://mutcd.fhwa.dot.gov/ *NOTE: All US MUTCD content appears in-line in the California MUTCD, with California differences shown in blue, and California tables and figures identified with (CA).*	Section 1A10 Interpretations, Experimentations, Changes and Interim Approvals covers the design, application and placement of traffic control devices other than those adopted in the MUTCD. Figure 1A.1 Process for Requesting and Conducting Experimentation for New Traffic Control Devices is a flowchart of the federal (FHWA) process. Figure 1A.2 Process for Incorporating New Traffic Control Devices into the MUTCD is a flowchart of the process after successful experimentation, a research study, or a request from a jurisdiction or interested party
➔ California Manual on Uniform Traffic Control Devices (MUTCD) (2012), Section 1A.10 http://www.dot.ca.gov/hq/traffops/signtech/mutcdsupp/ca_mutcd2012.htm NOTE: All US MUTCD content appears in-line in the California MUTCD	Figure 1A.1 (CA) Process for Requesting and Conducting Experimentation for New Traffic Control Devices in California is a flowchart of the California (CTCDC) process. Figure 1A.101 (CA) Process for the Use of Traffic Control Devices Approved as Interim Approval (IA) by FHWA is a flowchart of additional steps in California before a device granted Interim Approval by FHWA may be used.

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> *From the CROW English website, http://www.crow.nl/English*
>
> *CROW is The Netherlands technology platform for transport, infrastructure and public space. It is a not-for-profit organization in which the government and businesses work together in pursuit of their common interests through the design, construction and management of roads and other traffic and transport facilities. Active in research and in issuing regulations, CROW focuses on distributing knowledge products to all target groups.*

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APPENDIX D: STREET CONNECTIVITY

Importance of Street Connectivity

Providing direct paths for bicyclists and pedestrians via well-connected street networks is important for encouraging bicycling and walking by helping people overcome real and perceived senses of distance.

Street connectivity is also associated with public health benefits. The SMARTRAQ Project analysis in Atlanta, Georgia, found that doubling the current regional average intersection density, from 8.3 to 16.6 intersections per square kilometer was associated with a reduction in average per capita vehicle mileage of about 1.6 percent. Furthermore, the Frank et al. (2006) study of King County, Washington, found that per-household VMT declines with increased street connectivity, all else held constant.

Policies for Street Connectivity

A network of safe, direct, and comfortable routes and facilities: A 2004 PAS report recommends that pedestrian (and bicycle) path connections be every 300 to 500 feet; for motor vehicles, they recommend 500 to 1,000 feet.[3,4] For new development, such standards can be implemented through ordinances, like those of the regional government of Portland Oregon, Metro, which requires street connectivity in its Regional Transportation Plan and in the development codes and design standards of its constituent local governments.[5]

Measuring Connectivity

The following discussion of measuring street connectivity is provided as a resource and not officially a part of regular BSA processes. However, individuals are certainly encouraged to make such calculations.

[3] Susan Handy, Robert G. Paterson, and Kent Butler, 2004, *Planning for Street Connectivity: Getting from Here to There,* PAS Report #515 (Chicago: APA Planners Press).

[4] For more information on this topic, see American Association of State Highway and Transportation Officials (AASHTO), *AASHTO Guide for the Design of Pedestrian Facilities* (Washington, D.C., AASHTO, 2004); *AASHTO Guide for the Development of Bicycle Facilities* (Washington, D.C., AASHTO, 1999; updated 2009); Institute of Traffic Engineers (ITE), Traffic Calming Guidelines and ITE *Context-Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities*? (Washington, D.C.: ITE, 2006), http://www.ite.org/bookstore/RP036.pdf (accessed September 3, 2008).

[5] The regional government of Portland Oregon, Metro, requires street connectivity in its Regional Transportation Plan and in the development codes and design standards of its constituent local governments as follows: local and arterial streets be spaced no more than 530 feet apart (except where barriers exist), bicycle and pedestrian connections must be made (via pathways or on road right of ways) every 330 feet, Cul-de-sac (or dead-end streets) are discouraged and can be no longer than 200 feet, and have no more than 25 dwelling units.

Jennifer Dill (2004) presents the following measures of street connectivity:

- Intersection density
- Street density
- Average block length
- Link/node ratio
- Connected node ratio = intersections/ (intersections + cul-de-sac)
- Alpha index = number of actual circuits/ maximum number of circuits

  Where a circuit is a finite, closed path starting and ending at a single node
- Gamma index = number of links in the network/ maximum possible number of links between nodes
- Effective walking area = number of parcels within a one-quarter mile walking distance of a point/ total number of parcels within a one-quarter mile radius of that point
- Route directness = route distance/ straight-line distance for two selected points

Dill suggests that route directness (RD) is perhaps the best connectivity measure to reflect minimizing trip distances, but may be difficult to use in research and policy. However, it may be applied in practice by randomly selecting origin-destination pairs and calculating a sample for the subject area.

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About the Safe Transportation Research and Education Center (SafeTREC)

Founded in 2000, SafeTREC is part of the University of California, Berkeley, affiliated with the School of Public Health and the Institute of Transportation Studies, with additional partnerships with the Department of City and Regional Planning, Public Policy, and Transportation Engineering. SafeTREC helps the California Office of Traffic Safety (OTS) administer its Community Pedestrian and Bicycle Safety Training workshops and support various safety initiatives from other California agencies, including the California Department of Transportation (Caltrans), by providing programs such as:

- Community Pedestrian and Bicycle Safety Program
- Complete Streets Safety Assessments
- Global Road Safety
- Tribal Road Safety
- Collaborative Sciences Center for Road Safety

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