Transportation and Storm Water Department

The Complete Street Myth: Can we get to AAA?

ITE San Diego February Luncheon Meeting, February 2, 2017

Brian Genovese, PE, PTOE

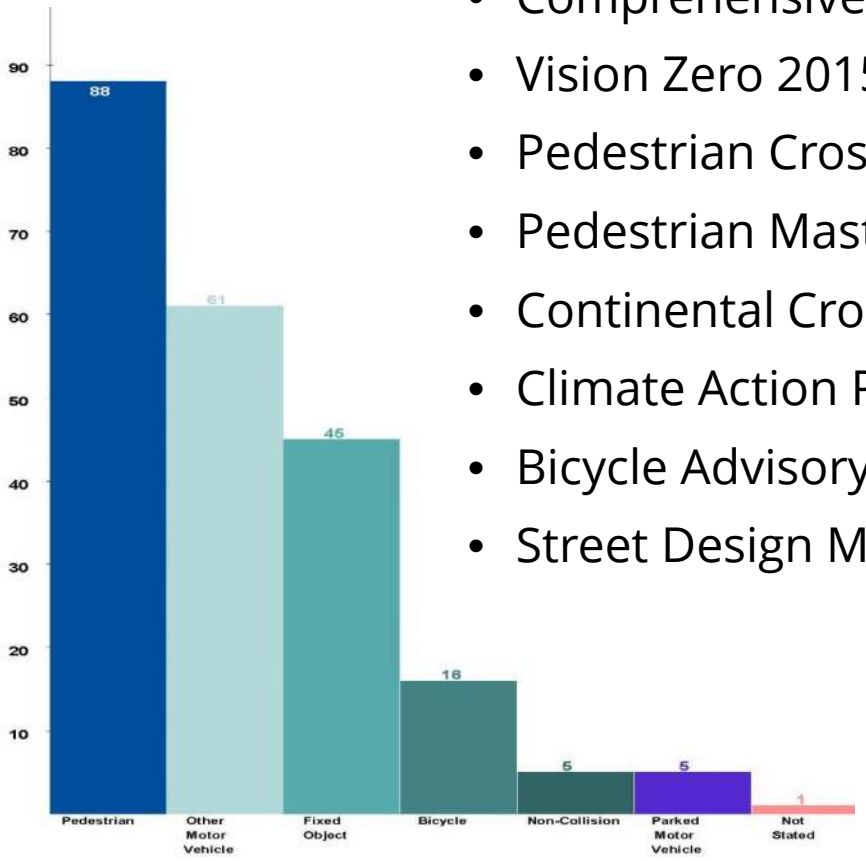
City of San Diego Bicycle Program

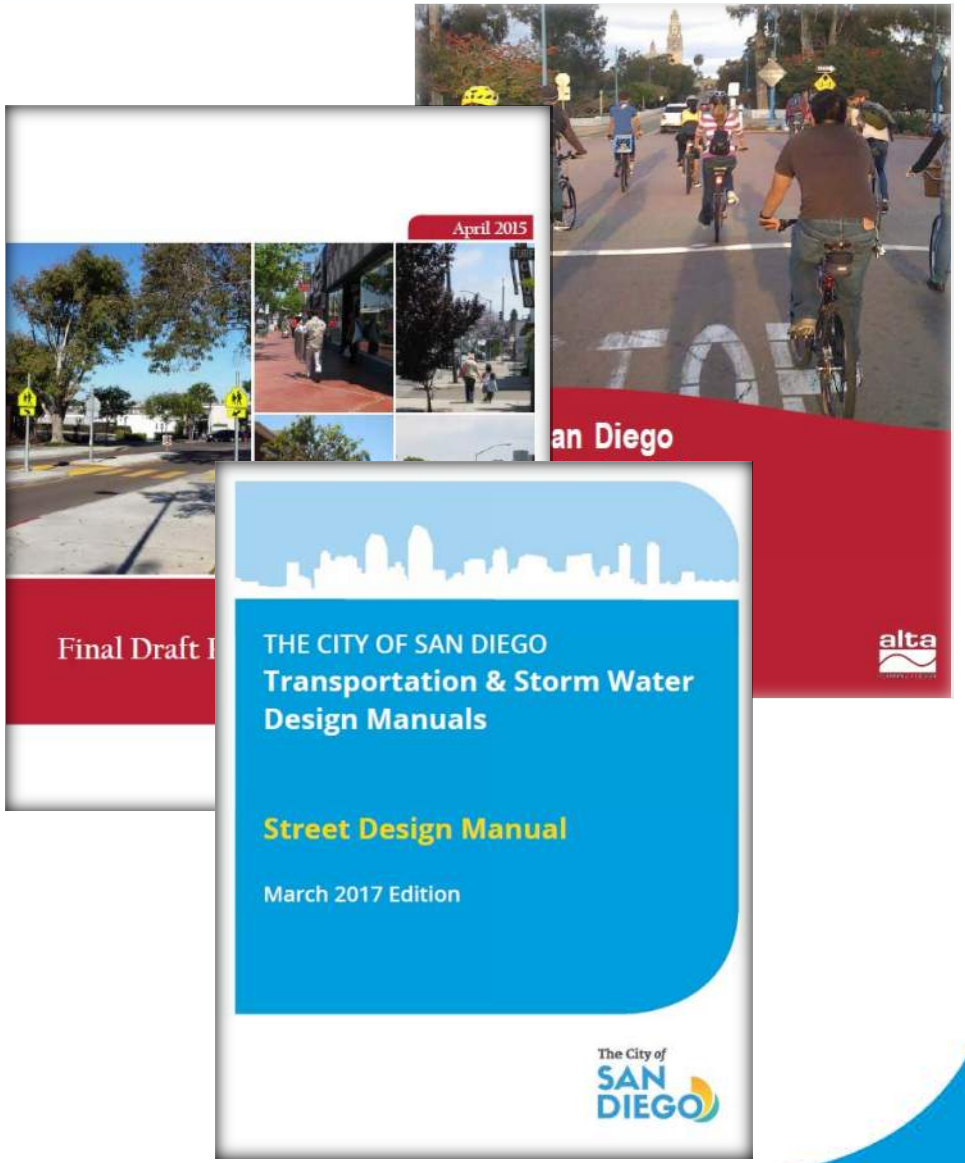
The City of SAN DIEGO

Complete Streets is a transportation policy and design approach that requires streets to be planned, designed, operated, and maintained to enable safe, convenient and comfortable travel and access for users of all ages and abilities regardless of their mode of transportation. Complete Streets allow for safe travel by those walking, cycling, driving automobiles, riding public transportation, or delivering goods.

Transportation and Storm Water Department

- Bicycle Master Plan 2013
- Bicycle Advisory Committee 2014
- Comprehensive Sidewalk Assessment 2015
- Vision Zero 2015
- Pedestrian Crosswalk Policy update 2015
- Pedestrian Master Plan 2015
- Continental Crosswalk Standard 2015
- Climate Action Plan 2015
- Bicycle Advisory Board 2016
- Street Design Manual Update 2017





Transportation and Storm Water Department

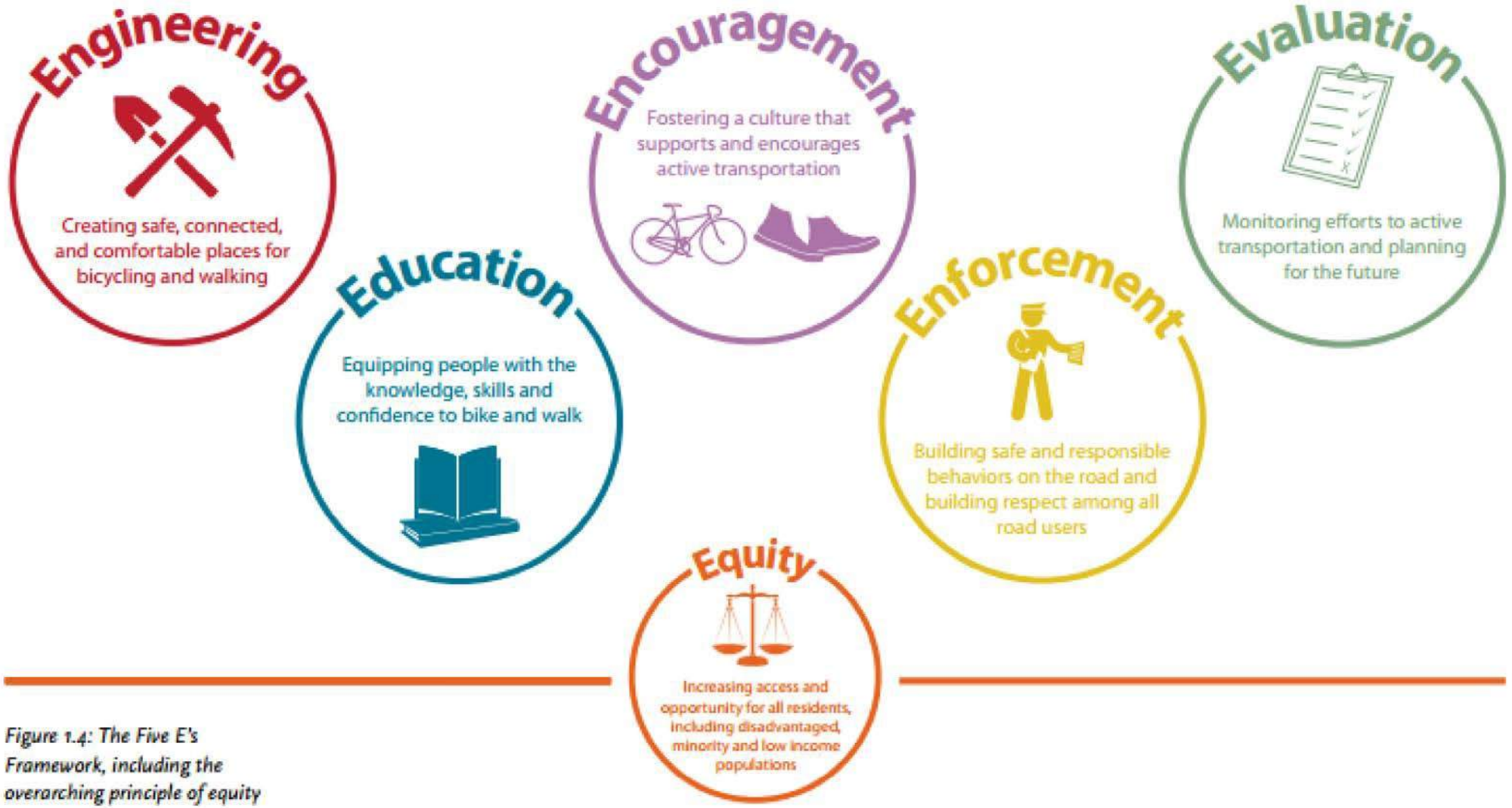


Figure 1.4: The Five E's Framework, including the overarching principle of equity

Celebrating 50 Years!

Davis, CA

The Small City Responsible for America's First Bike Lane in 1967

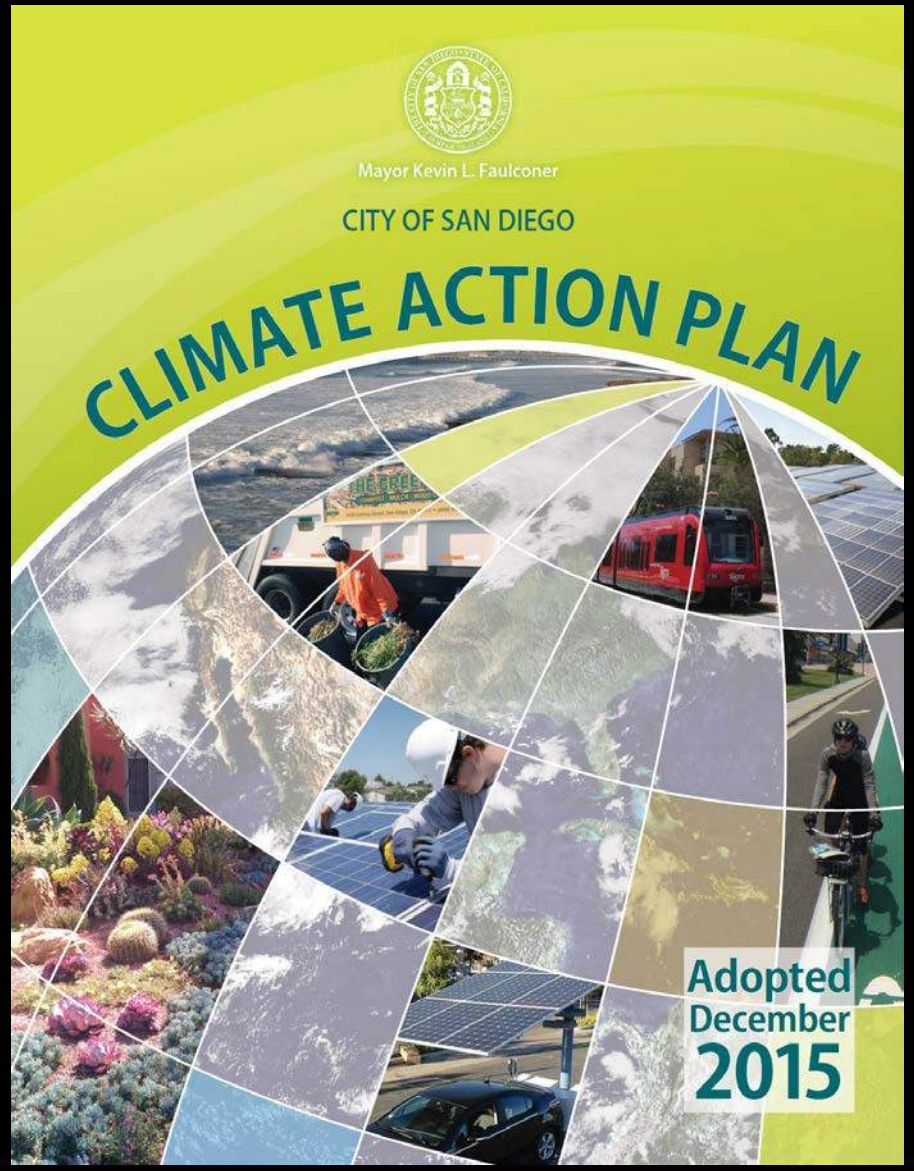
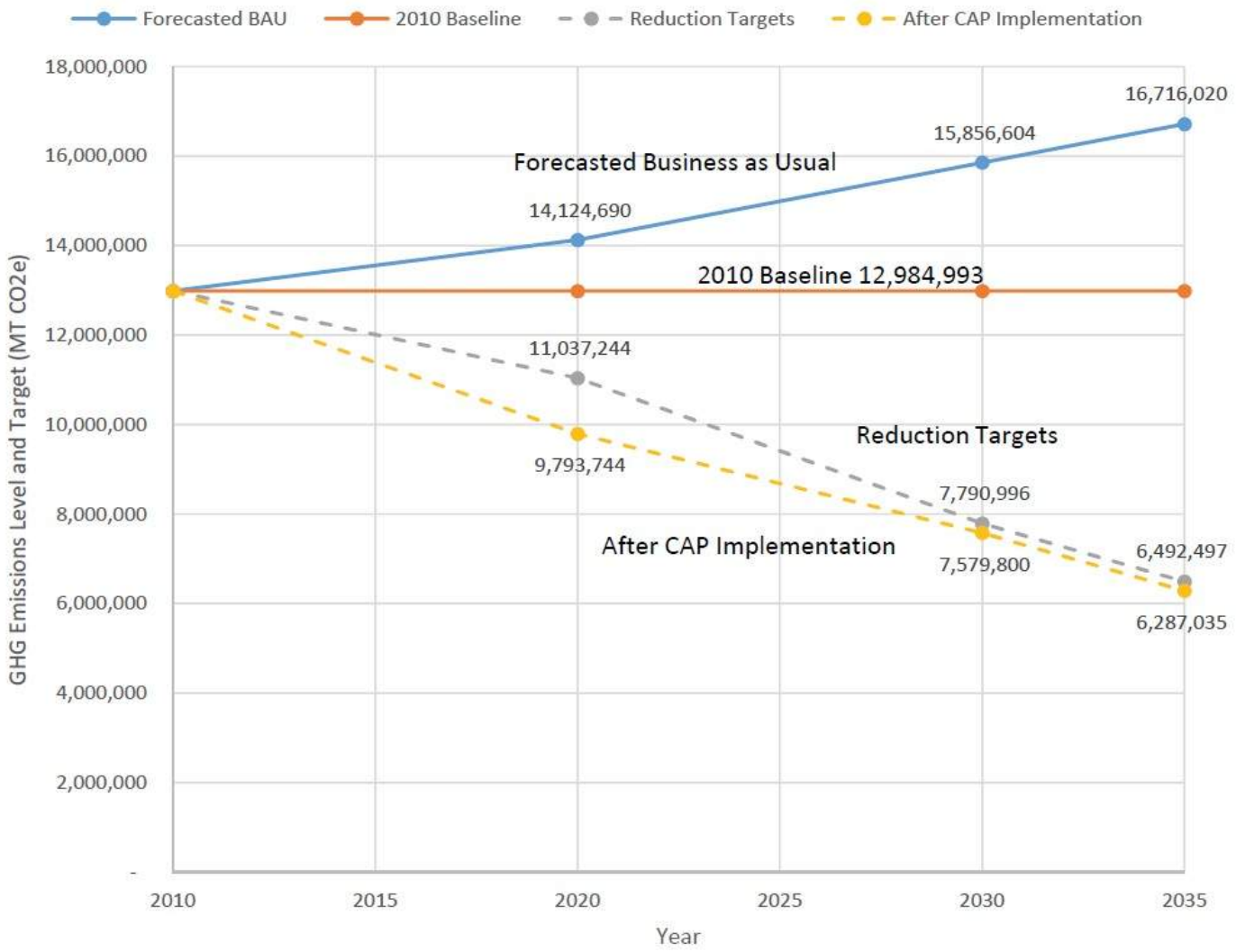


Figure 2.2: City Projected GHG Emission Levels and Reduction Targets.



The City has identified FIVE BOLD STRATEGIES to reduce GHG emissions to achieve the 2020 and 2035 targets:

1. ENERGY & WATER EFFICIENT BUILDINGS
2. CLEAN & RENEWABLE ENERGY
3. BICYCLING, WALKING, TRANSIT & LAND USE
4. ZERO WASTE
5. CLIMATE RESILIENCY

STRATEGY 3: BICYCLING, WALKING, TRANSIT & LAND USE

GOAL:

Increase commuter bicycling opportunities.

ACTION 3.3: **PHASES 1, 2 & 3**

Implement the City of San Diego's Bicycle Master Plan to increase commuter bicycling opportunities.

TARGET:

Achieve 6% bicycle commuter mode share by 2020 and 18% mode share by 2035 in Transit Priority Areas.

GHG REDUCTIONS:

2020	2035
19,077 MT/CO_2e	50,574 MT/CO_2e

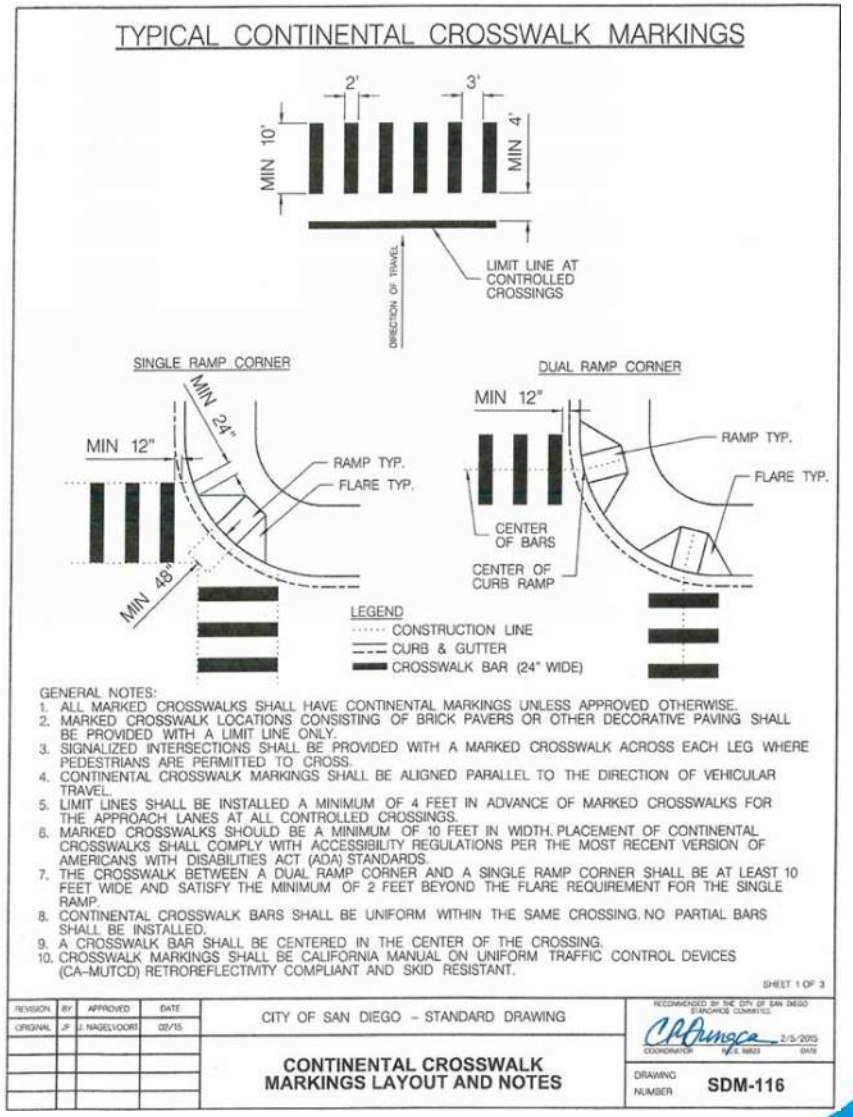
Table 18 Key Assumptions and Results for Commuter Bicycling[96]

Year	Labor Force in TPAs[97]	Mode Share Goals in TPAs (%)	Projected Number of Commuters Commuting by Bike	Round-trip Commute Distance (Miles)	VMT Avoided Due to Bicycle Commuters (Miles)	GHG Reduced (MT CO_2e)
2020	433,128	6.0%	25,988	8	53,016,150	19,077
2035	482,540	18.5%	89,270	8	182,110,596	50,574

New Crosswalk Policy

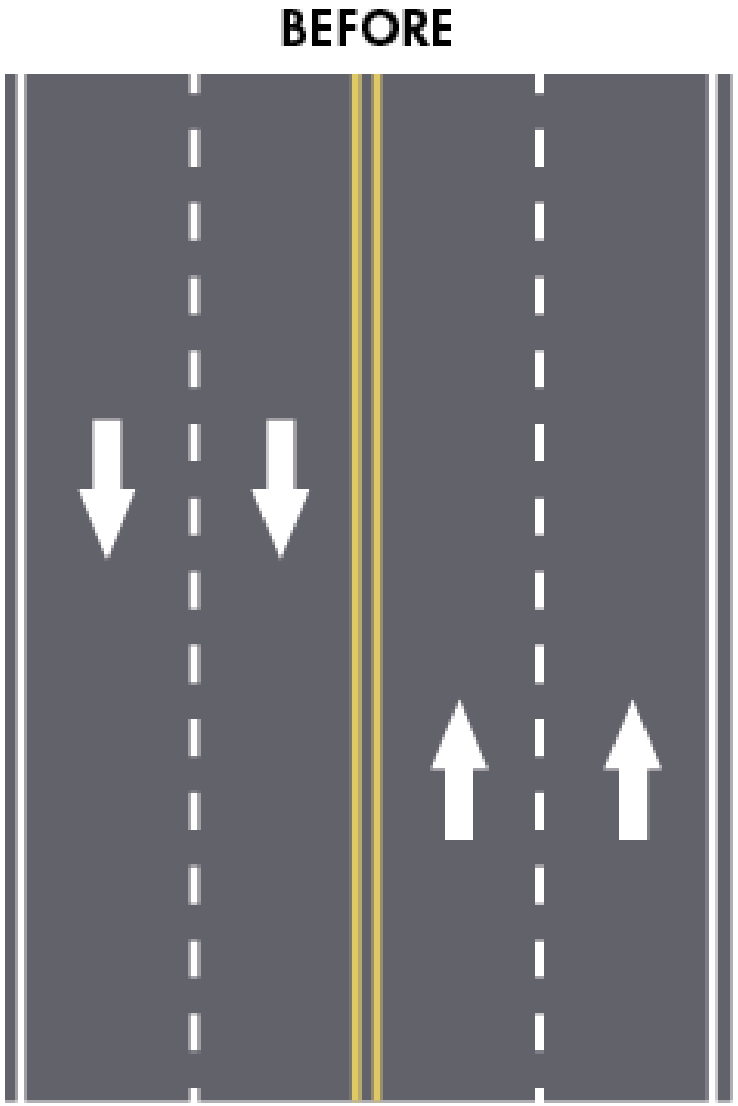
CROSSING TREATMENTS					
Crossing Distance	Roadway ADT (vehicles per day)				
	< 1,500	1,501 – 5,000	5,001 – 12,000	12,001 – 15,000	> 15,000
< 40’	A	B	B	C	C / D
40’ to 52’	A	B	C	C / D	D
> 52’	A	B / C	C / D	D	D

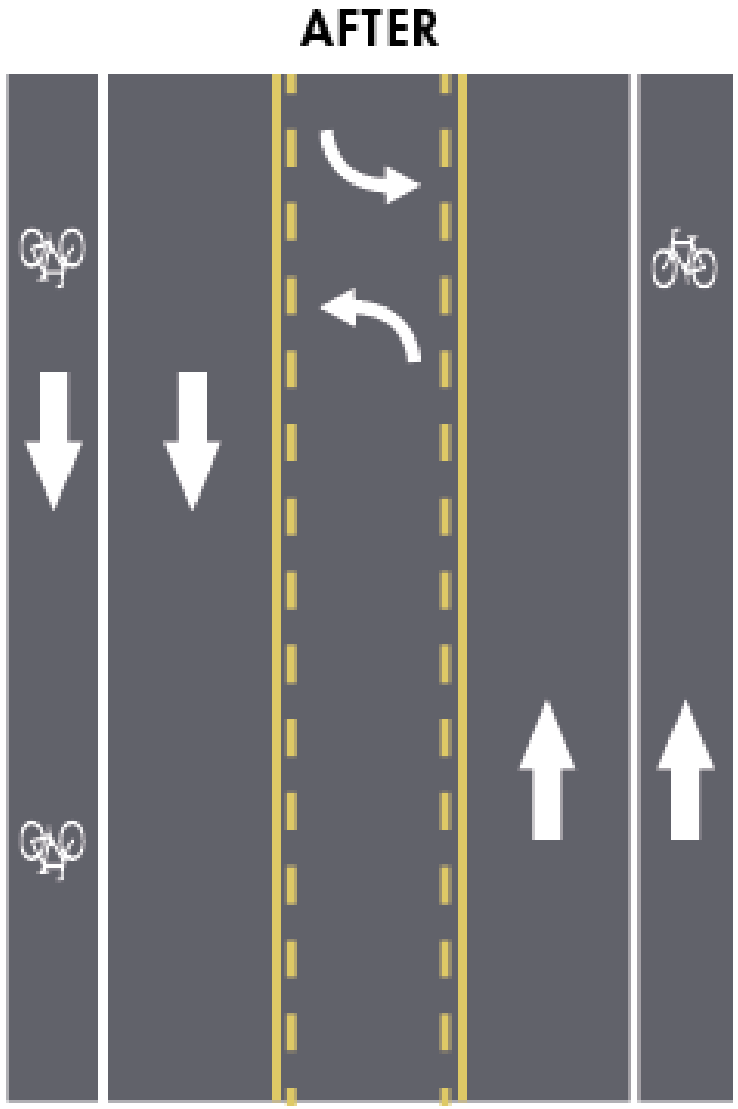
A	Standard Signage Only
B	One Additional Treatment
C	Two Additional Treatments
D	Signal or Combination of Treatments



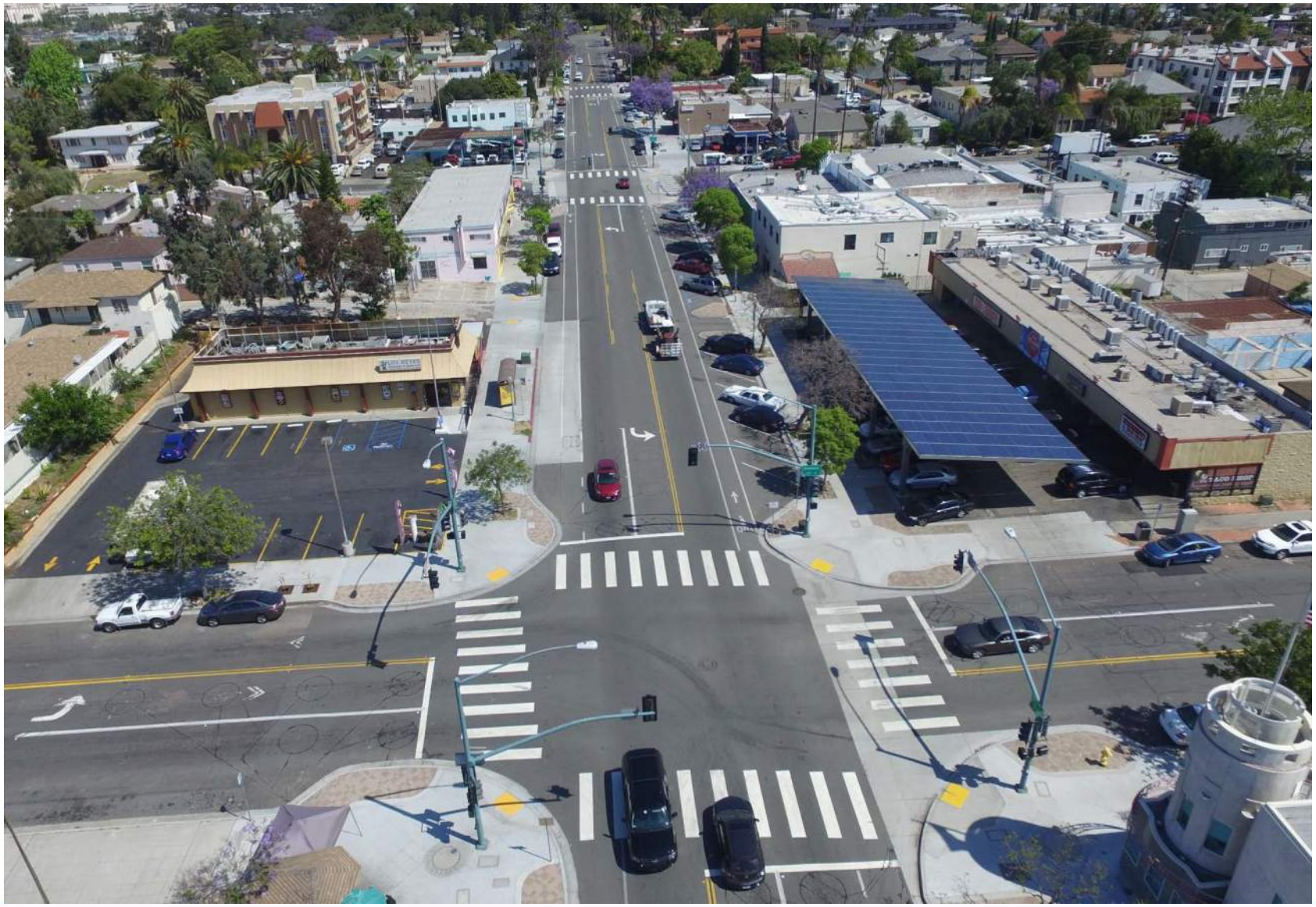
Green Zones & Diets

- Improve Roadway Safety
- Highlight Conflict Areas
- Assign More Space for Bikeways
- Increase Bike Mode Share with Low Cost Quick Deployment Efforts





Road Diets

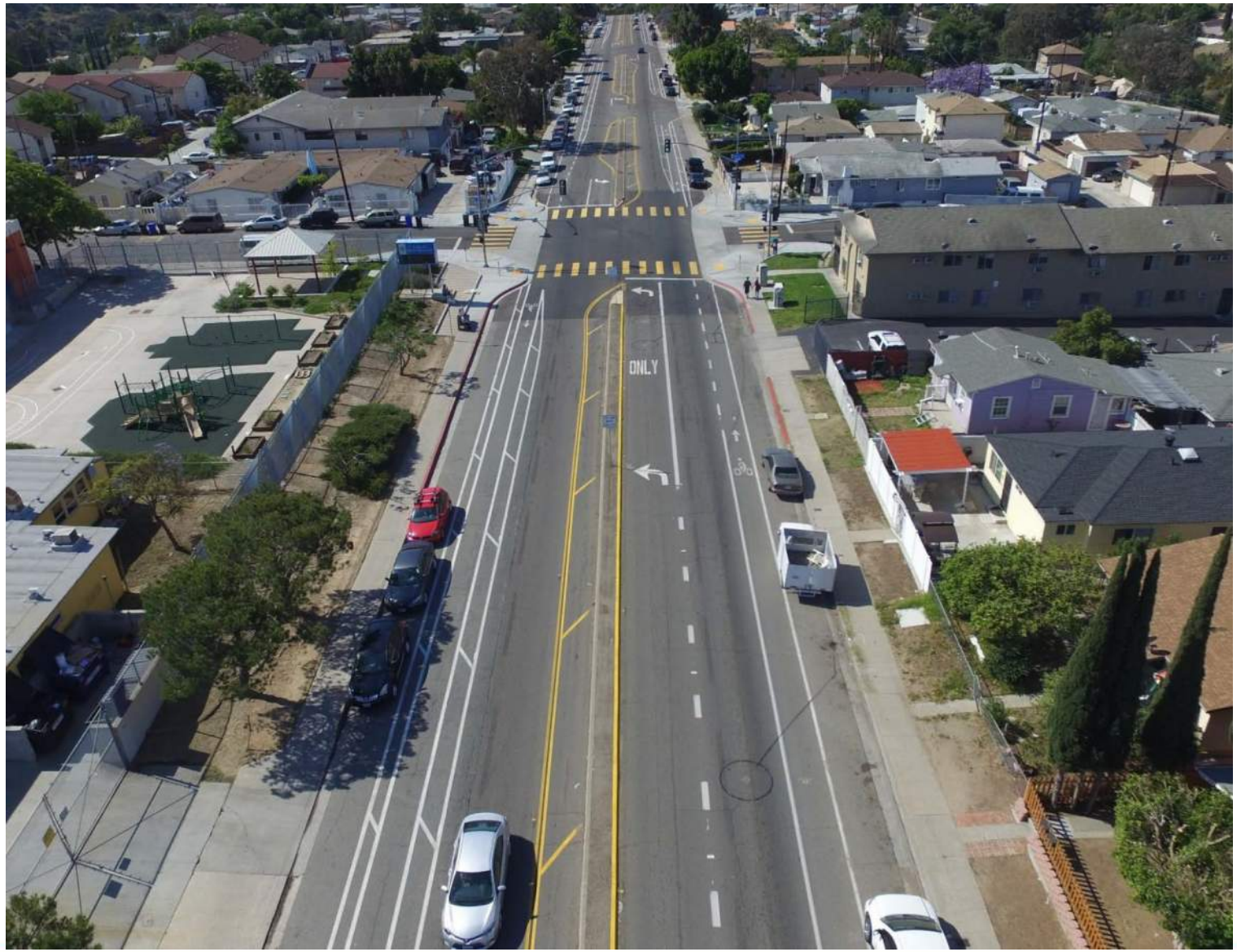


Road Diet

Pop-Outs

RAP

25th Street at Broadway



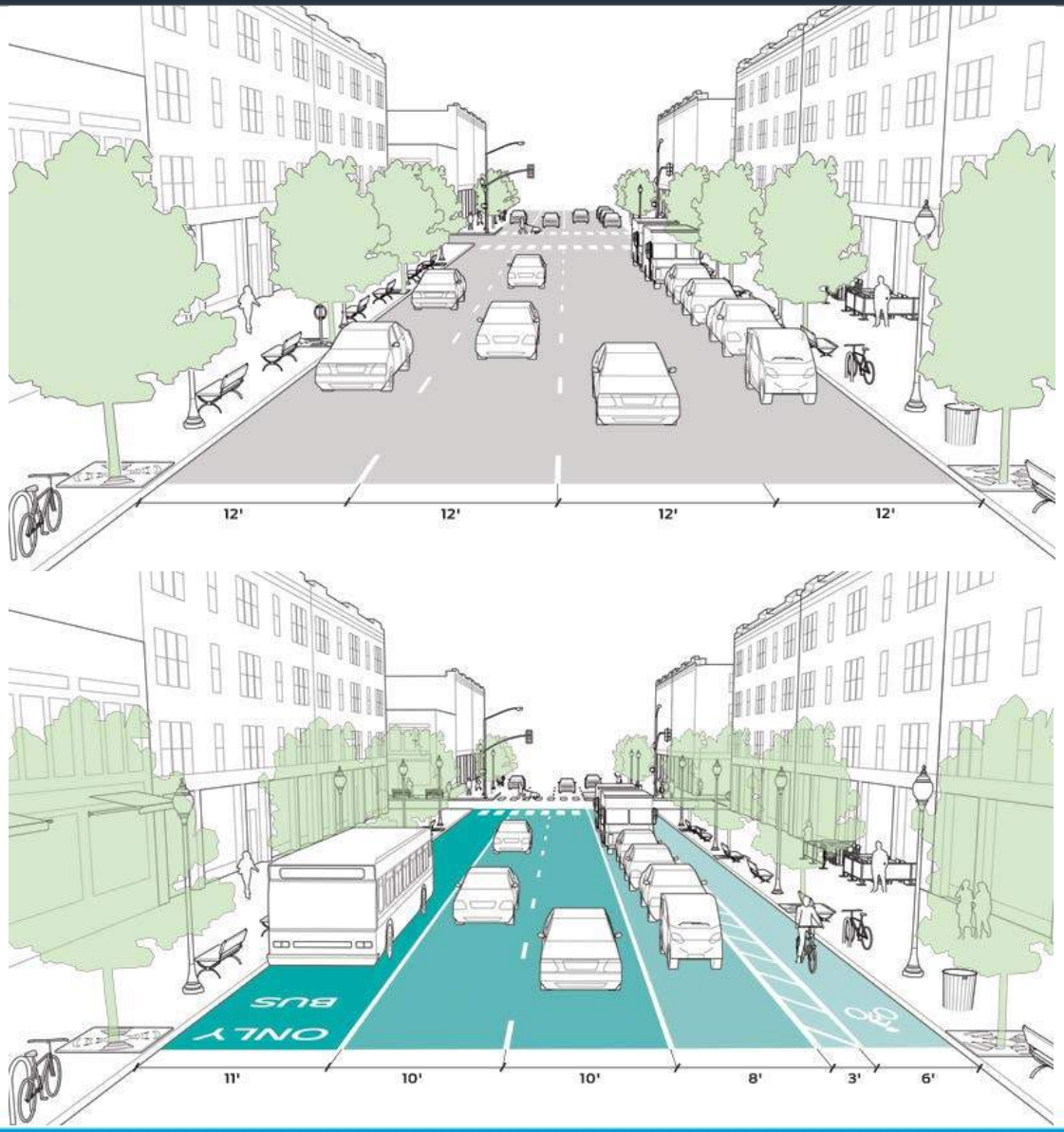
Fairmount Avenue at Olive Street

Clairemont Drive

Ulric Street

Madison Avenue

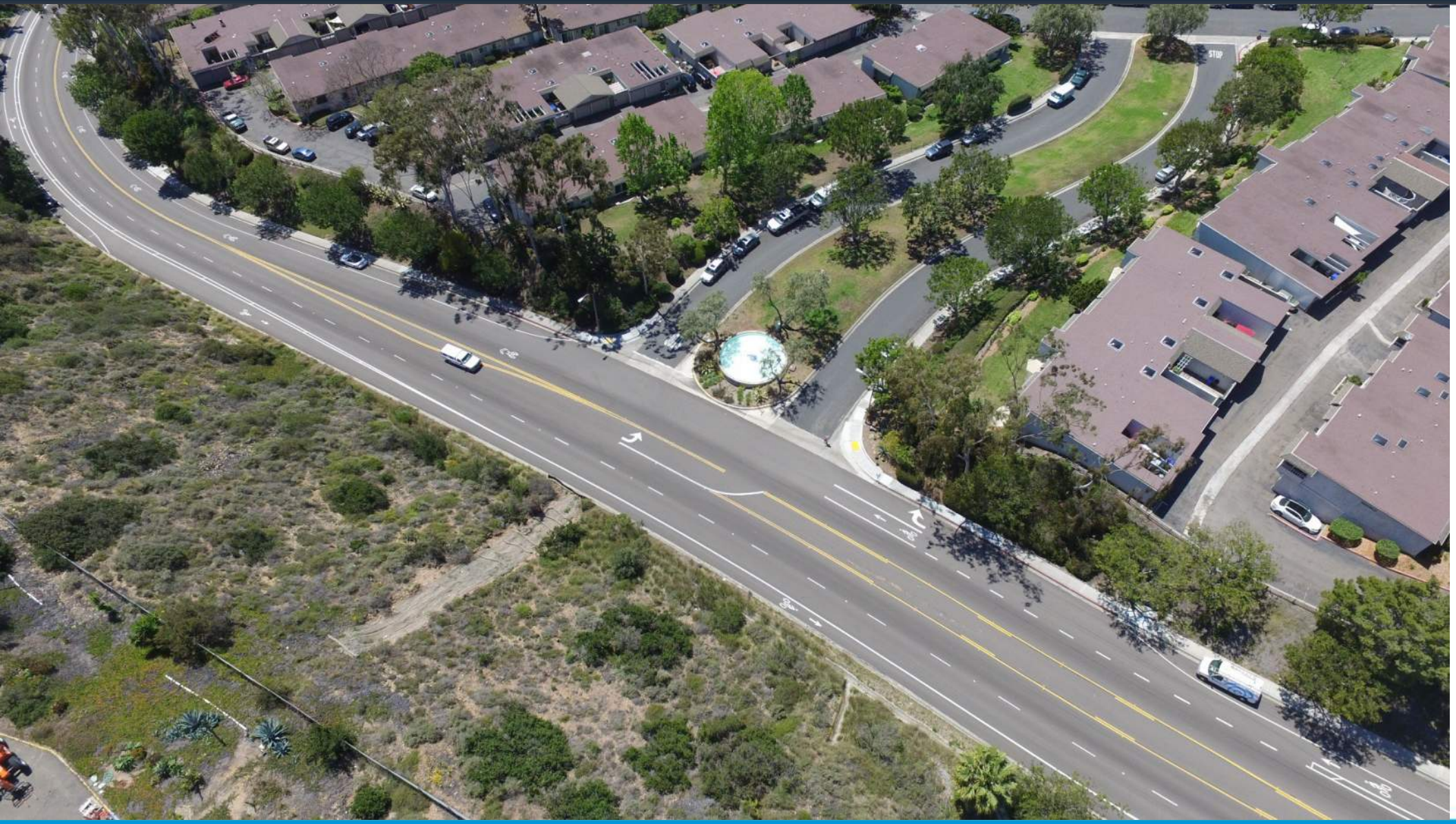
5th Avenue at Laurel Street



Lane Diets

Uphill Bike Lanes and Downhill Shared Use Lanes

Narrow Lanes with Consistent Right Edge Control



Uphill Bike Lanes and Downhill Shared Use Lanes

Via Las Cumbres

Uphill Bike Lanes and Downhill Shared Use Lanes

Voltaire Street at Bolinas Street

Design Guidance

Colored Bike Facilities

Required Features

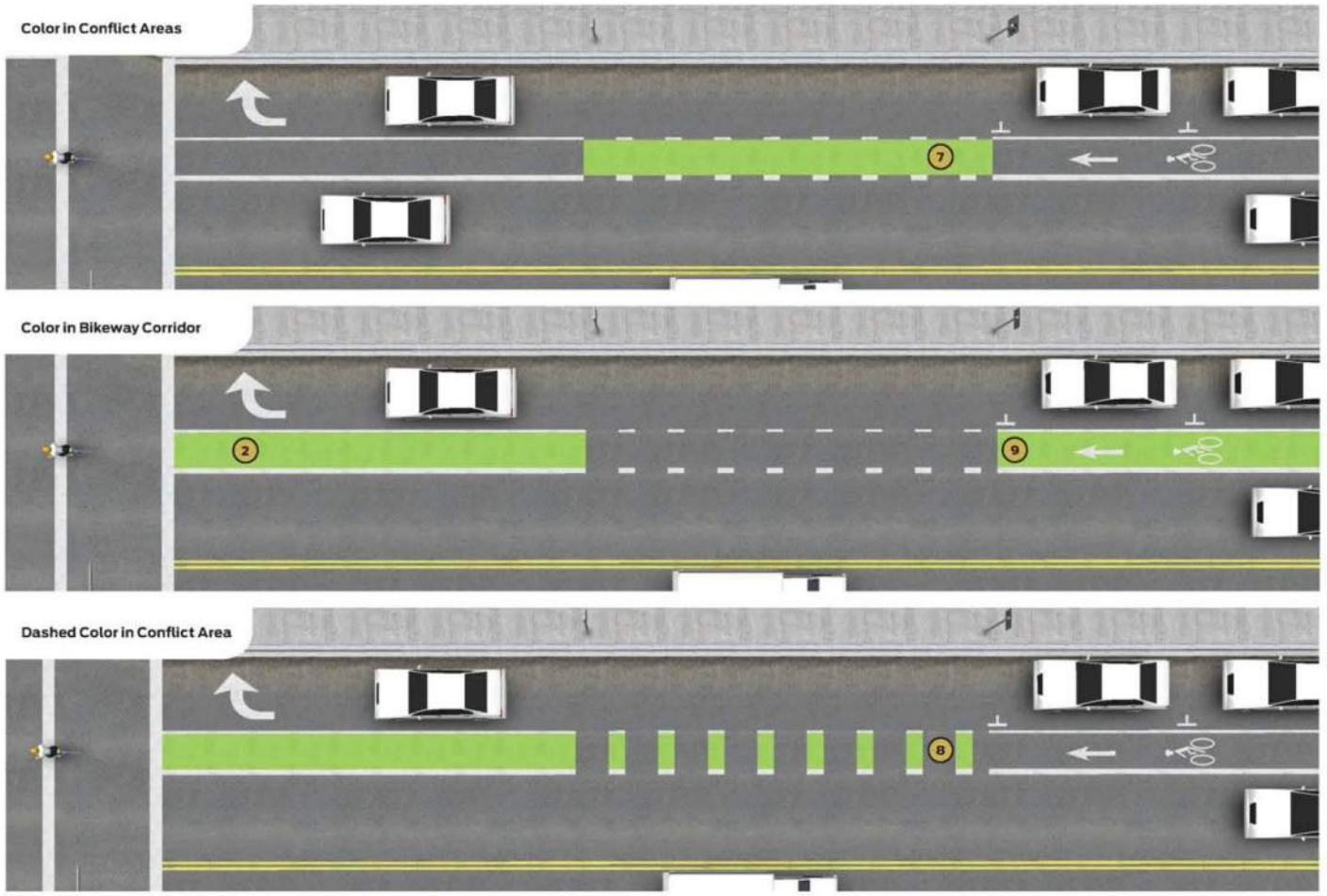
1. The color green shall be used to minimize confusion with other standard traffic control markings.[97]
2. Color shall be applied to the road surface to delineate space, increase visibility, and emphasize proper vehicle priority.[98]
3. Normal white bike lane lines shall be provided along the edges of the colored lane to provide consistency with other facilities and to enhance nighttime visibility.

Recommended Features

4. The colored surface should be skid resistant and retro-reflective.
5. A "Yield to Bikes" sign should be used at intersections or driveway crossings to reinforce that bicyclists have the right-of-way at colored bike lane areas.[99]
6. The configuration of color should be consistently applied throughout the corridor.

Optional Features

7. Color may be applied within conflict areas for increased visibility of bicyclists.
8. Color may be applied along a dashed pattern within a dashed bicycle lane to indicate merging areas. Dashed application of colored pavement mimics typical traffic striping layouts, where dashed markings indicate areas where merging maneuvers are permitted.[100]
9. Color may be applied along a corridor, with gaps in coloring to denote crossing areas. When used in this fashion, color can distinguish the bicycle facility along its entire length. This is particularly useful in high traffic situations or areas where traffic may encroach into the bike facility.[101]
10. Color may be used to supplement shared lane markings for added visibility.[102]



TUSCON, AZ

SAN FRANCISCO, CA (PHOTO: SFSTREETSBLOG)

CHICAGO, IL

Best estimates for safety effects of one blue cycle crossing in a junction are a reduction of 10% in accidents and 19% in injuries.

Jensen, S. U. (2008). Safety effects of blue cycle crossings: A before-after study. Accident Analysis & Prevention, 40(2), 742-750.

Conflict Zone Treatments – Green Zones

Conflict Zone, Bike Lane and Cycle Track

Friars Road at Napa Street

Uphill Bike Lanes

Downhill Shared Use Lanes

Conflict Zone Treatment

Voltaire Street at Mendocino Blvd

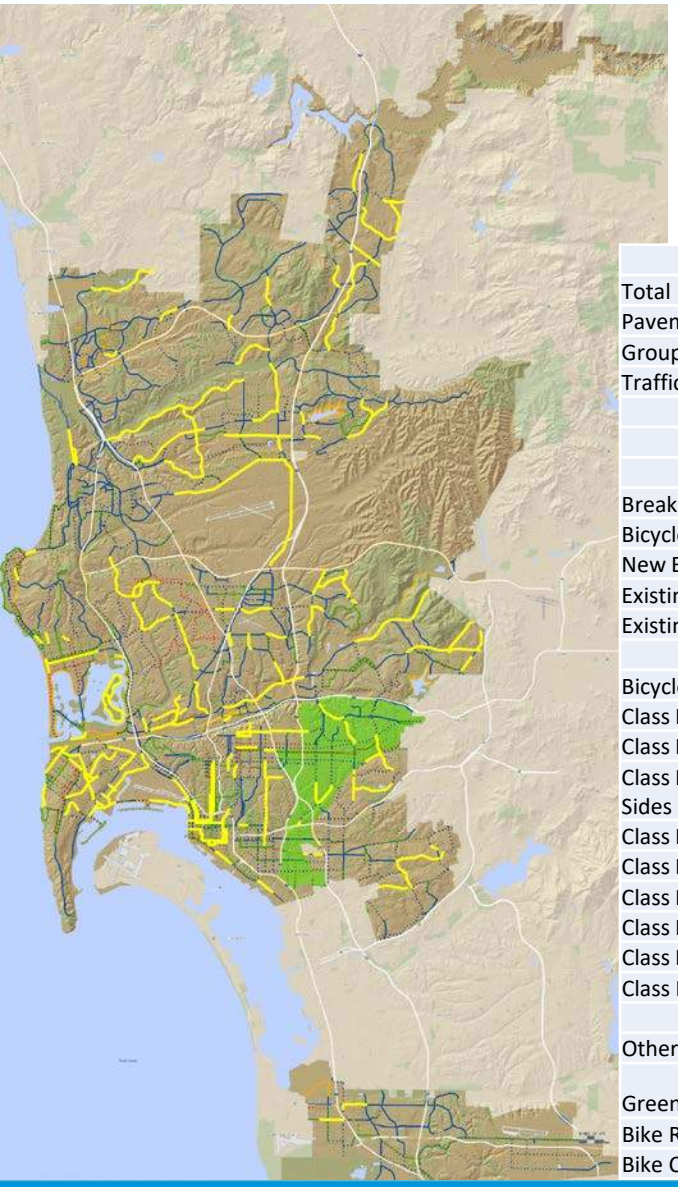
Conflict Zone at Free Right

W Morena Blvd at Morena Blvd

Morena Blvd at Linda Vista Road

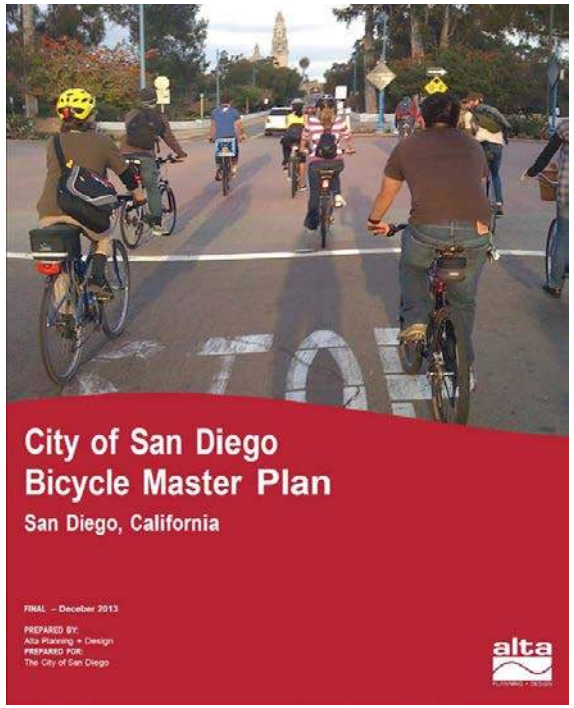
Wabaska Drive Parking Buffered Cycle Track

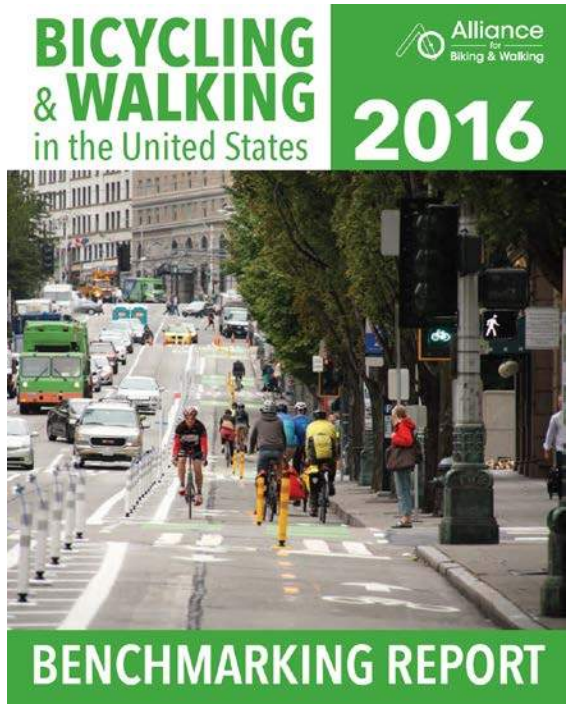
Transportation and Storm Water Department



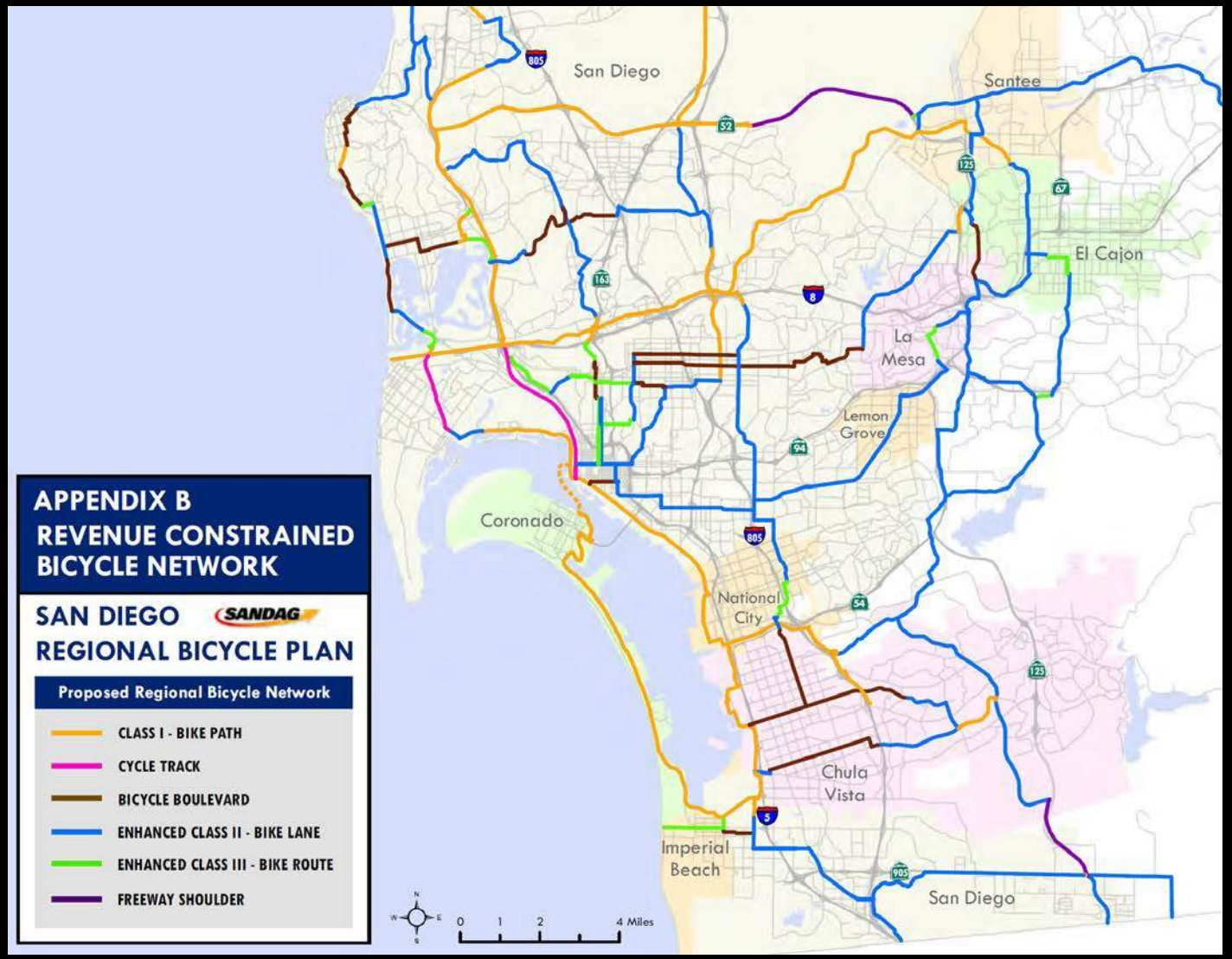
Total Bicyle Lane Miles Designed	
Pavement Preservation	193.0
Group Job	26.9
Traffic Request	13.0
Total (mi)	232.9
Breakdown:	
Bicycle Facility Improvement Type	
New Bicycle Facility (Class II)	57.1
Existing Bicycle Facility Improvements	171.9
Existing Bicycle Facility Replaced In Kind	4.0
Total (mi)	232.9
Bicycle Facility Category Type	
Class I - Bicyle Path	0.0
Class II - Painted Bicycle Lane	1.3
Class II - Bicycle Lane Buffered on Both Sides	2.4
Class II - Outside Buffered Bicycle Lane	197.0
Class II - Inside Buffered Bicycle Lane	0.5
Class II - Standard Bicycle Lane	9.4
Class III - Standard Bicycle Route	1.6
Class III - Bicycle Route with Sharrows	17.7
Class IV - Two Way Cycle Track w/Barrier	3.0
Total (mi)	232.9
Other Bicycle Facility Improvements	
Green Painted Conflict Zone Treatment	92
Bike Racks	637
Bike Corrals	13

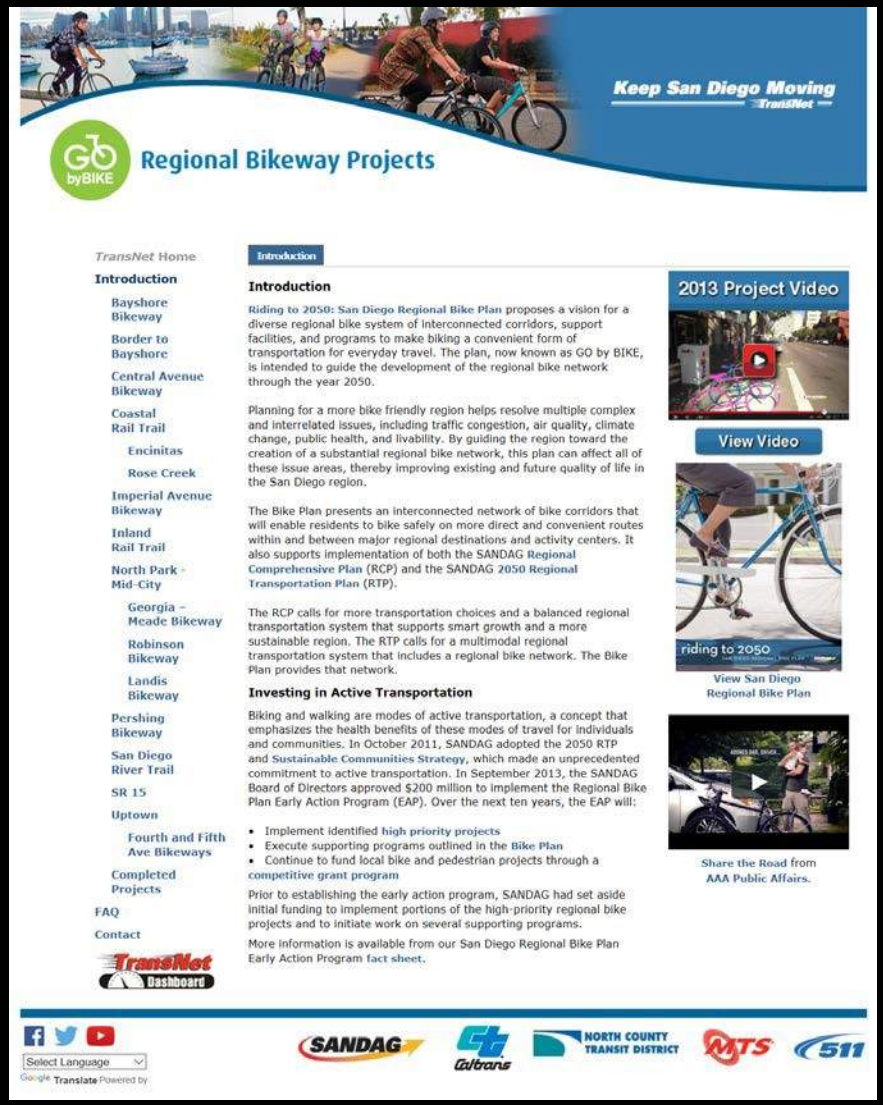
Bikeway	Existing	Improved	% Improved	Proposed	Implemented	% Implemented	Total
Class I - Bike Path	74.0	--	--	90.6	--	--	164.6
Class II - Bike Path	638.1	154.0	22.2%	307.9	57.1	18.5%	946
Class III - Bike Route	278.6	17.7	6.4%	347	--	--	625.6
Class II or III (TBD)	--	--	--	285.4	--	--	285.4
Freeway Shoulder	16.1	--	--	--	--	--	16.1
Bicycle Boulevard	--	--	--	78.8	--	--	78.8
Cycle Track	4.3	3.1	61.0%	18.3	0.5	2.7%	22.6
Totals	1011.1	175.3	17.3%	1123.7	45.6	4.1%	2134.8





Transportation & Storm Water Department

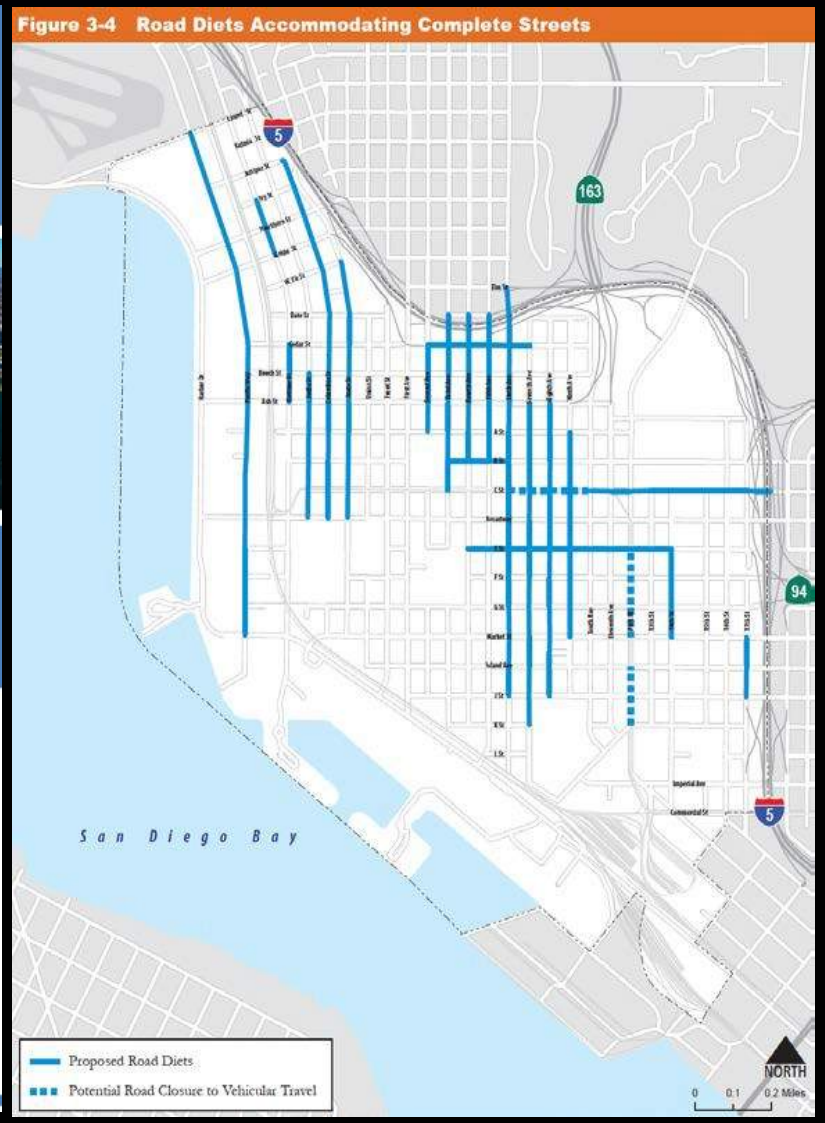


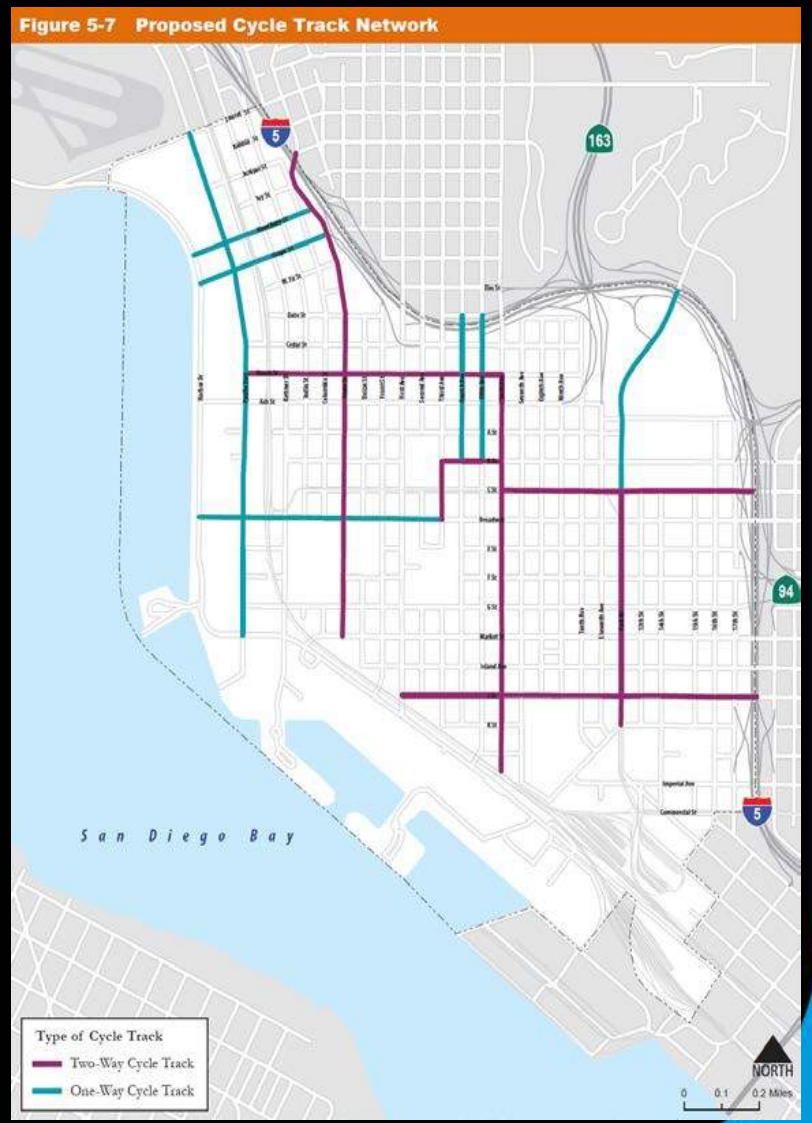


Downtown San Diego Mobility Plan

June 2016

The City of SAN DIEGO | CIVIC san diego





Downtown San Diego Mobility Plan

- 1-Way Cycle Tracks:
  3.8 lane miles
- 2-Way Cycle Tracks:
  10.8 lane miles

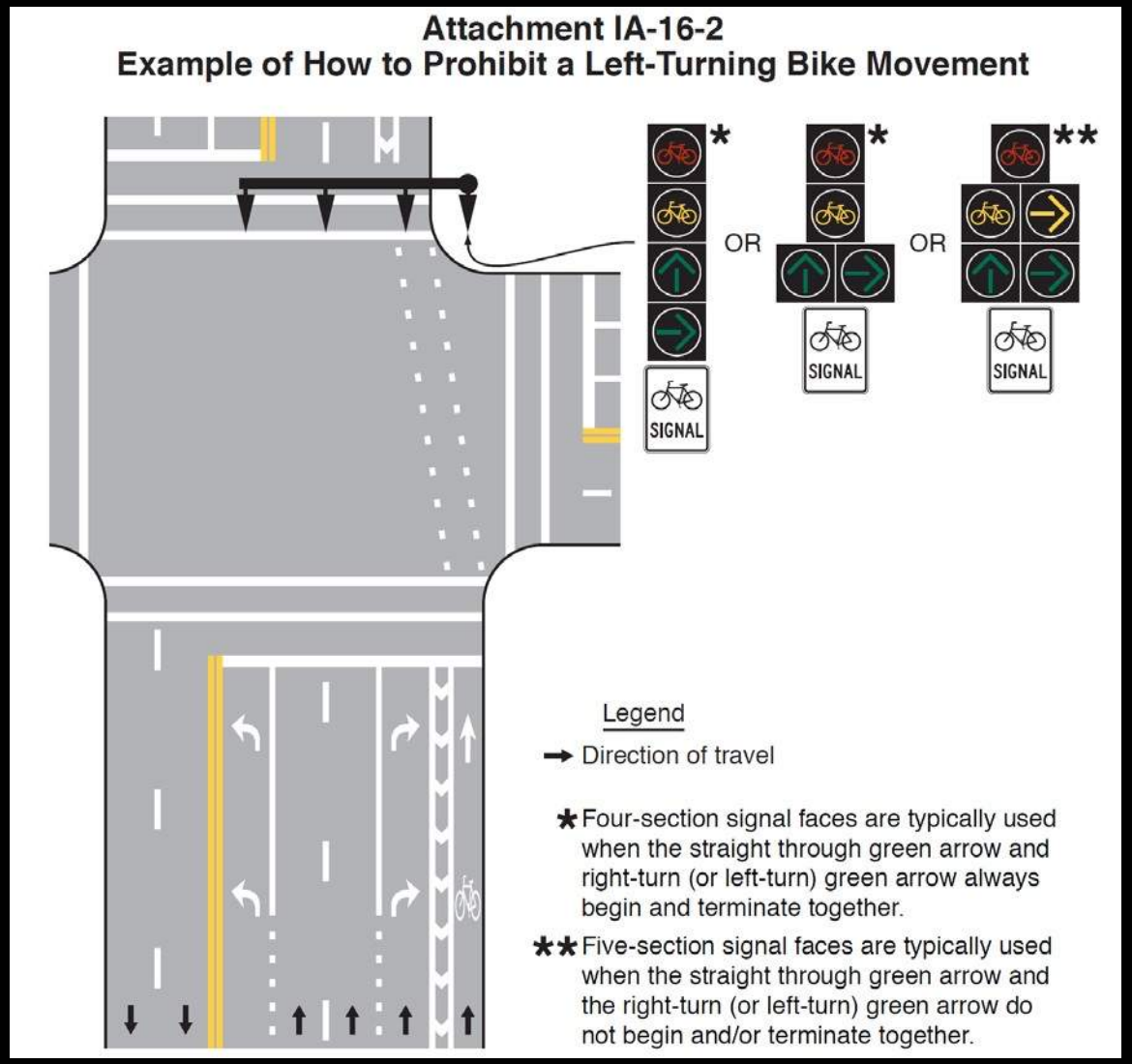
Table 13-4
Planning Level Cost Estimation

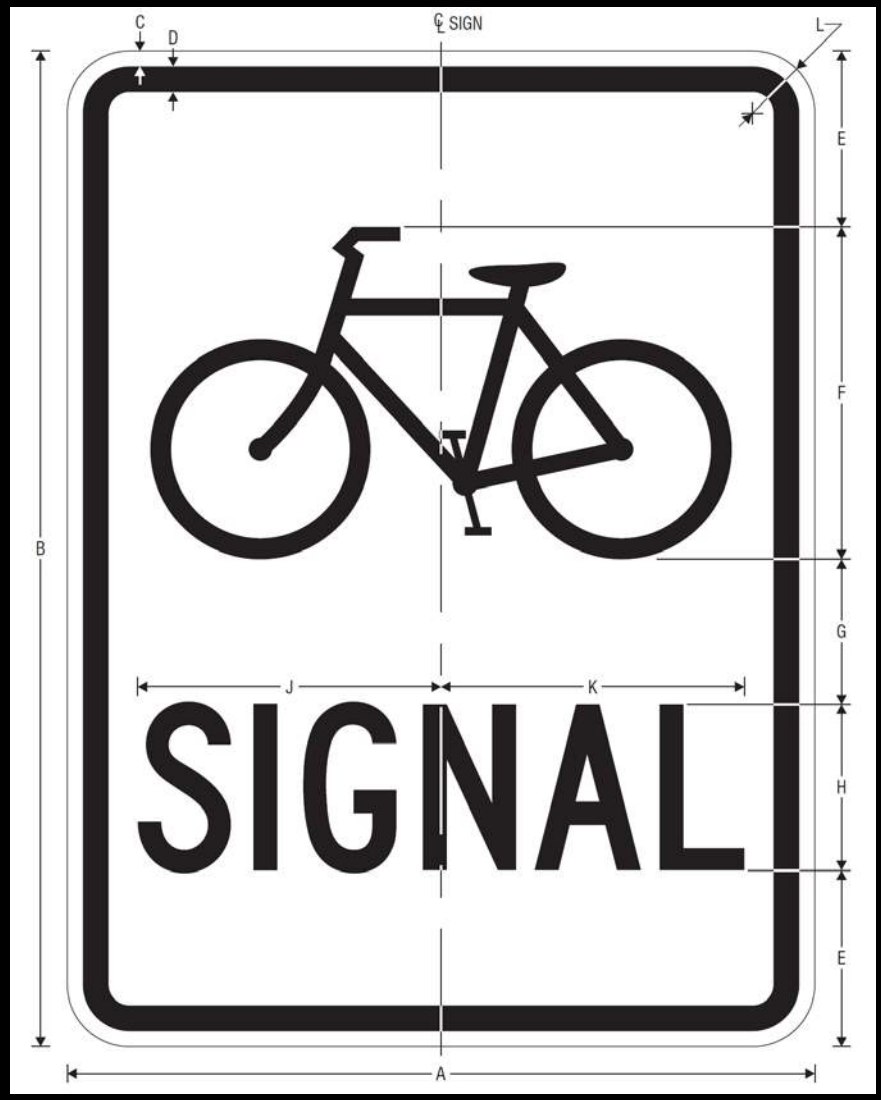
Improvement Type	Cost (in Millions)
Greenways	$25.75
Pedestrian Improvements	$7.22
Bicycle Improvements	$10.50
Roadway Improvements	$19.32
Total Cost	**$62.79**

Class IV Bikeway (Cycle Track) – Also referred to as separated or protected bikeways, cycle tracks provide a right-of-way designated exclusively for bicycle travel within the roadway and physically protected from vehicular traffic. Types of separation include, but are not limited to, grade separation, flexible posts, or on-street parking.

Table 9-1
Short-Range Parking Changes

Improvement	Spaces Lost/Gained[1]
Cycleways	-331
14th St. & E St. Greenways	-242
Angled Parking Conversion	+600
East Village Green Garage	+200
Net Change	**+227**


Attachment IA-16-2
Example of How to Prohibit a Left-Turning Bike Movement
*
OR
*
OR
**
SIGNAL
SIGNAL
SIGNAL
Legend
Direction of travel
* Four-section signal faces are typically used when the straight through green arrow and right-turn (or left-turn) green arrow always begin and terminate together.
** Five-section signal faces are typically used when the straight through green arrow and the right-turn (or left-turn) green arrow do not begin and/or terminate together.


C
D
℄ SIGN
L
E
B
F
G
J
K
SIGNAL
H
E
A

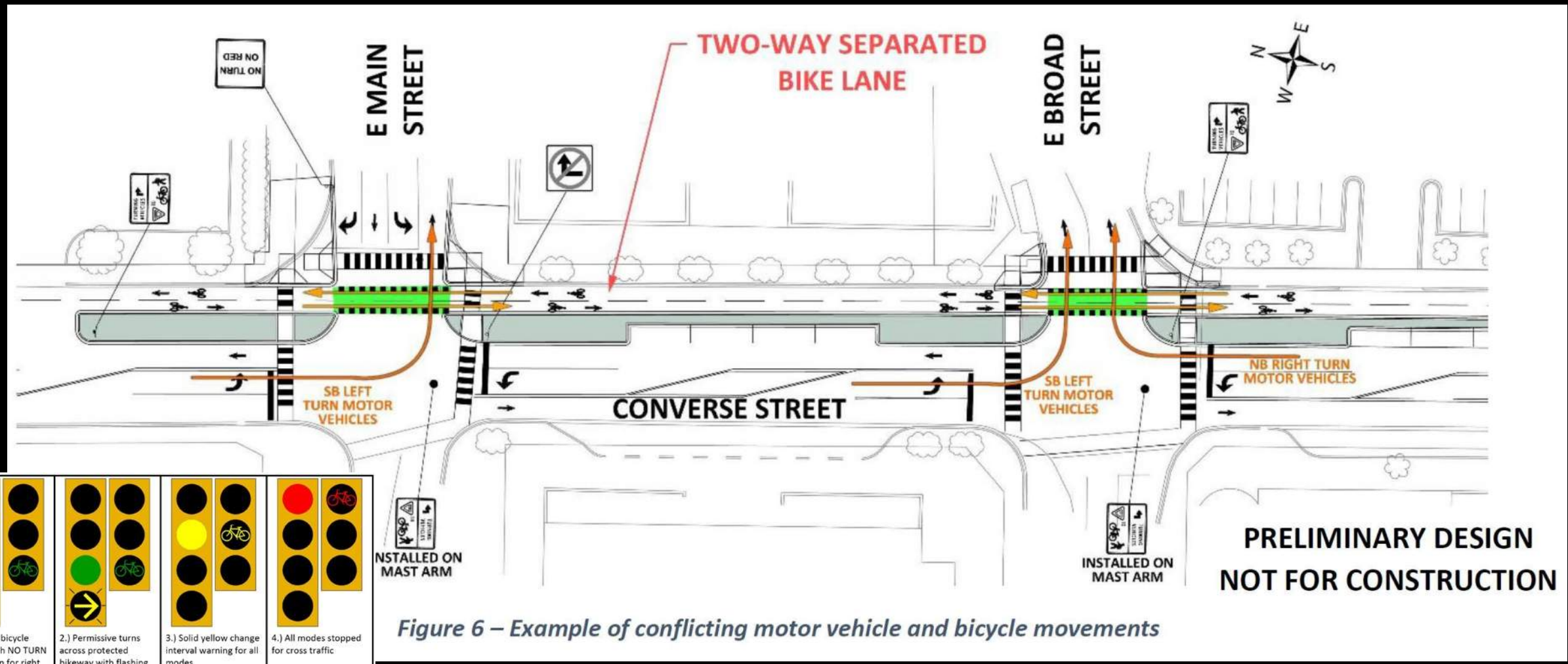
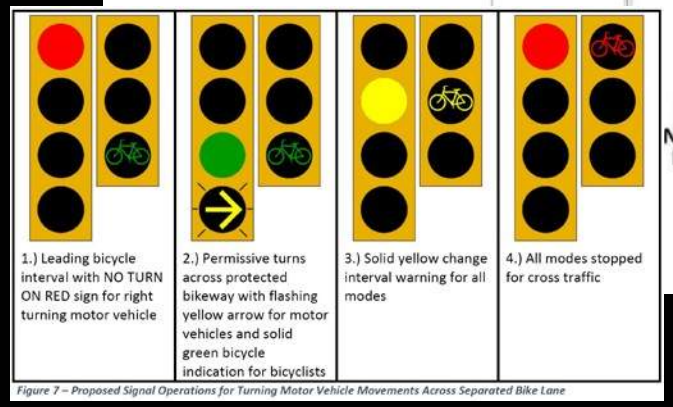


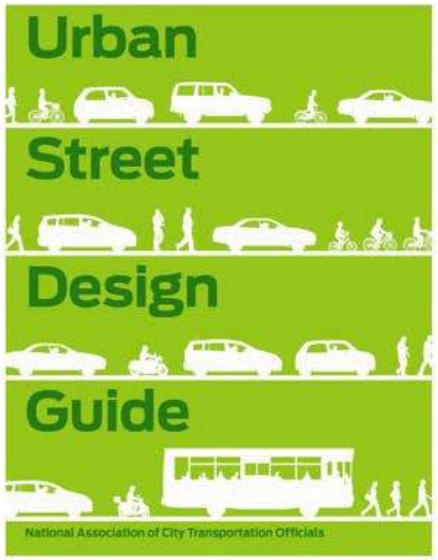
Figure 6 – Example of conflicting motor vehicle and bicycle movements

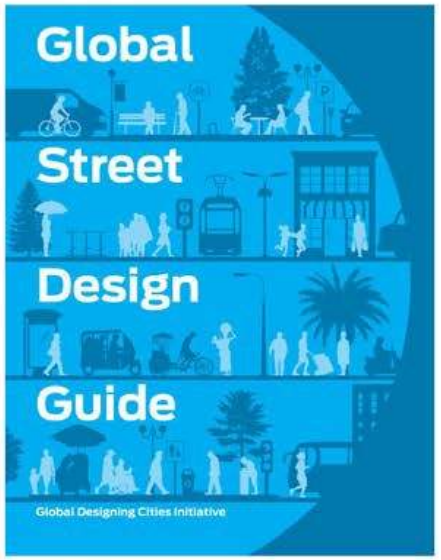


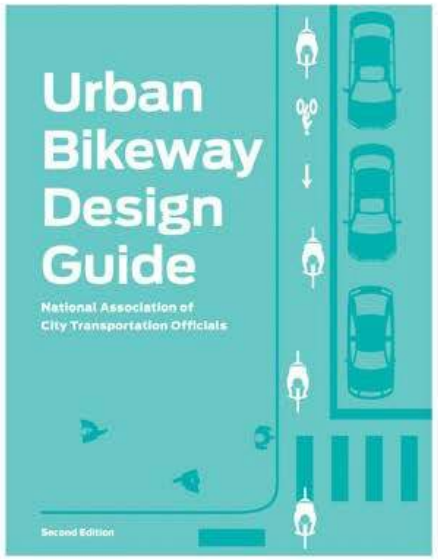
1.) Leading bicycle interval with NO TURN ON RED sign for right turning motor vehicle	2.) Permissive turns across protected bikeway with flashing yellow arrow for motor vehicles and solid green bicycle indication for bicyclists	3.) Solid yellow change interval warning for all modes	4.) All modes stopped for cross traffic

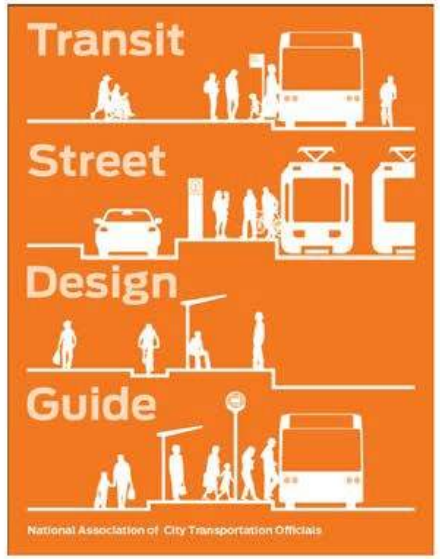
Figure 7 – Proposed Signal Operations for Turning Motor Vehicle Movements Across Separated Bike Lane

National
Association
of
City
Transportation
Officials










Bike Lanes

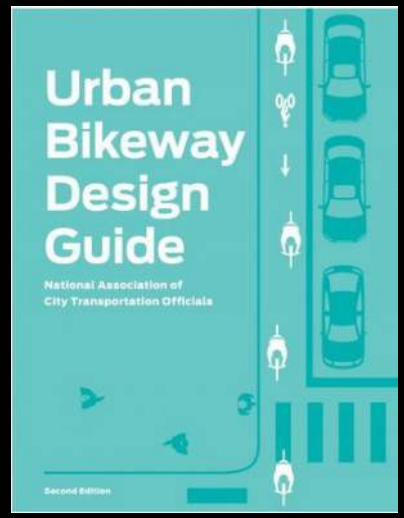

Cycle Tracks


Intersection Treatments

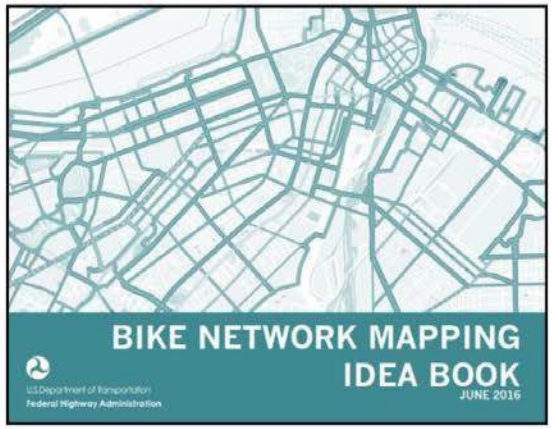

Bicycle Signals

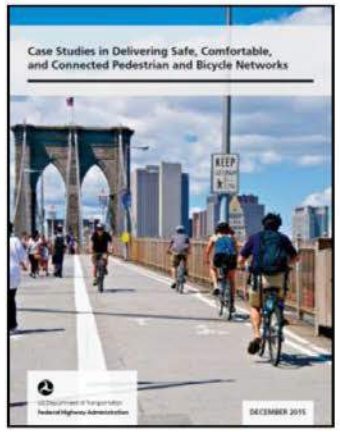

Bikeway Signing & Marking
EXCEPT
BICYCLES

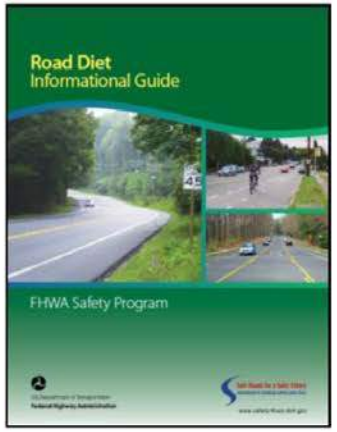

Bicycle Boulevards
BLVD

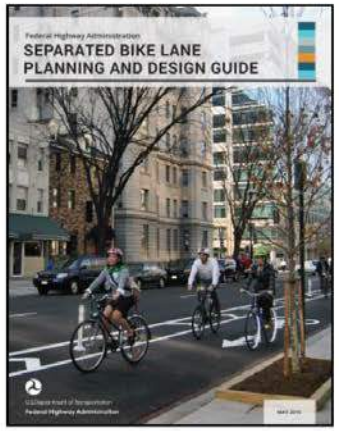

Urban
Bikeway
Design
Guide
National Association of
City Transportation Officials
Second Edition

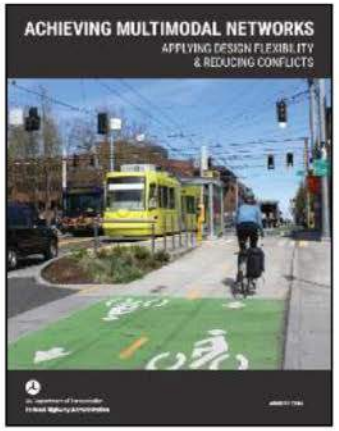
Recent FHWA Pedestrian and Bicycle Resources

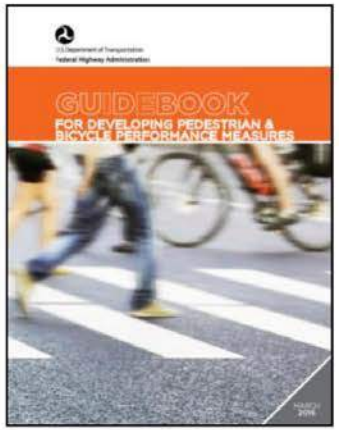




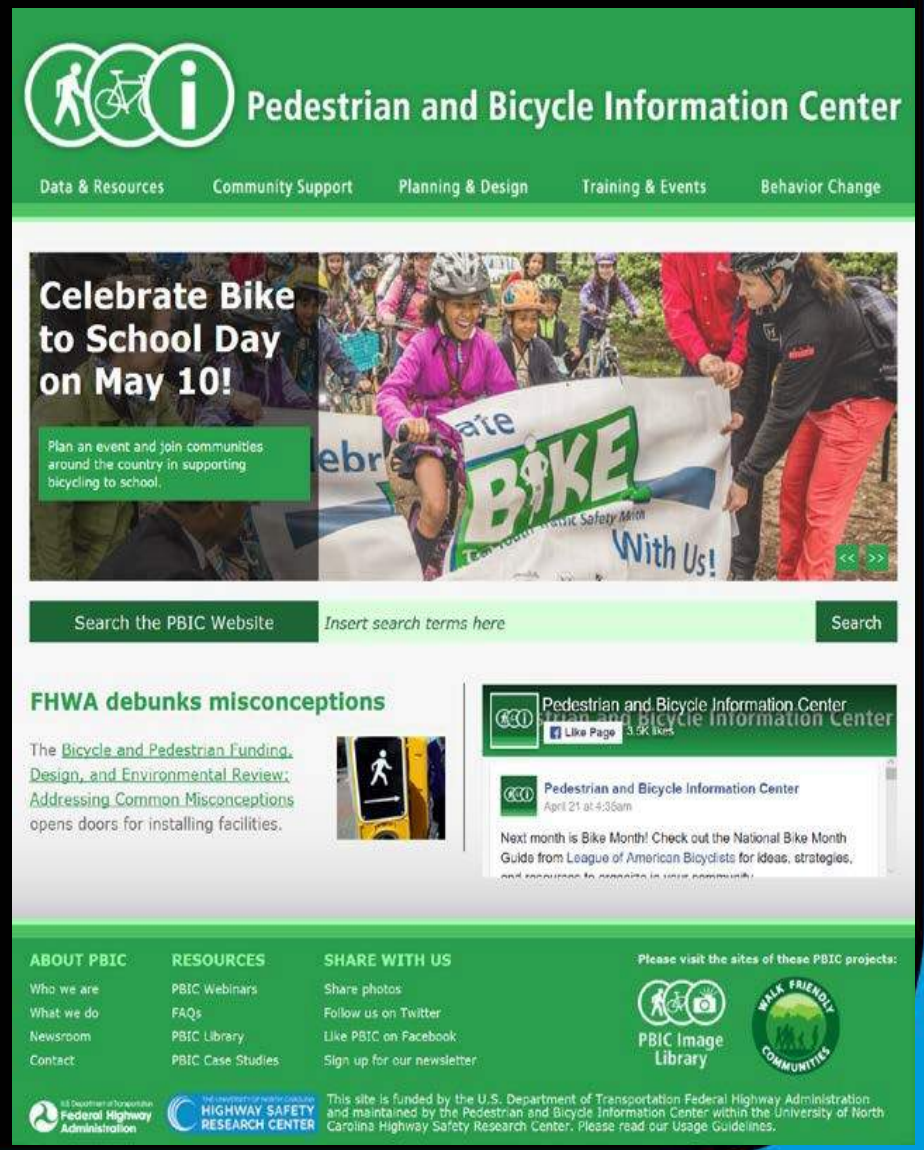


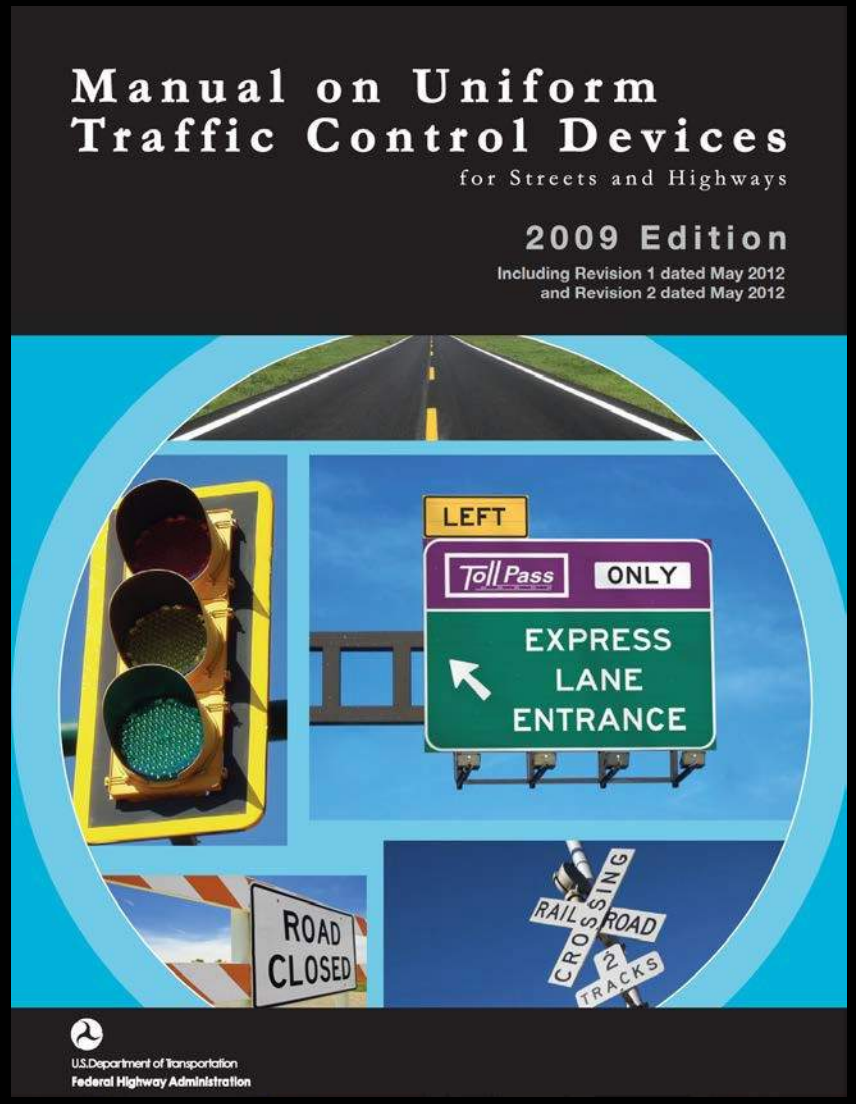




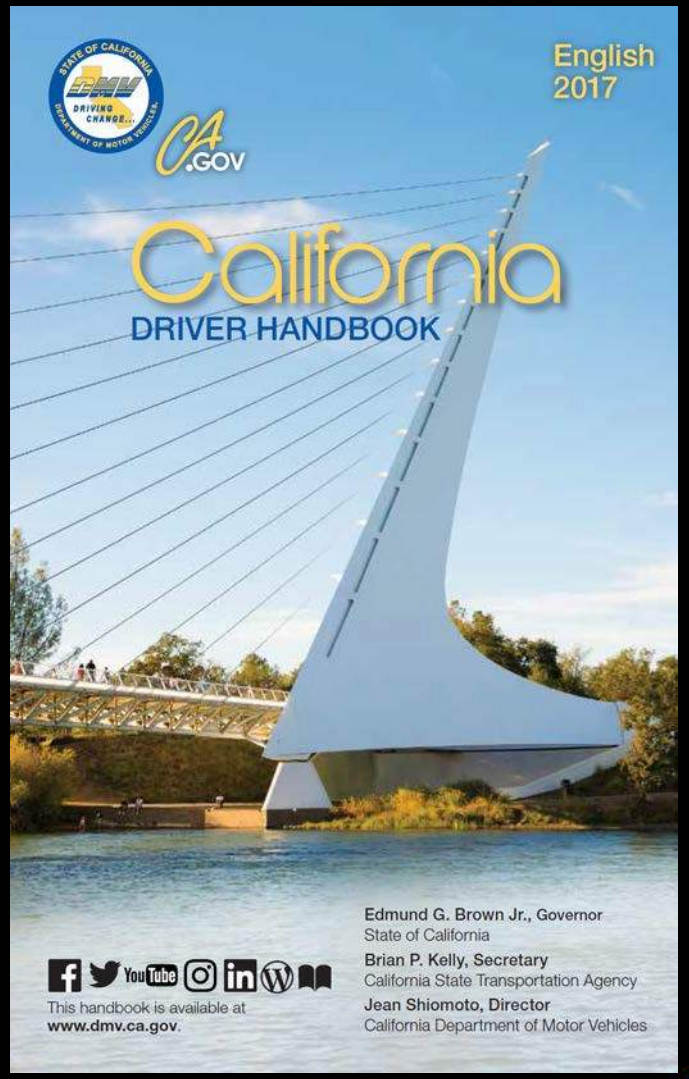


Available at www.fhwa.dot.gov/environment/bicycle_pedestrian




Manual on Uniform Traffic Control Devices
for Streets and Highways
2009 Edition
Including Revision 1 dated May 2012
and Revision 2 dated May 2012
LEFT
Toll Pass
ONLY
EXPRESS LANE ENTRANCE
ROAD CLOSED
RAIL ROAD CROSSING
2 TRACKS
U.S.Department of Transportation
Federal Highway Administration


California Manual on Uniform Traffic Control Devices
FHWA's MUTCD 2009 Edition, including Revisions 1 & 2 as amended for use in California.
2014 Edition
Revision 2 (April 7, 2017)
State of California
California State Transportation Agency
Department of Transportation
Caltrans
CalSTA
CALIFORNIA STATE TRANSPORTATION AGENCY
STOP


English
2017
CA.GOV
California
DRIVER HANDBOOK
This handbook is available at
www.dmv.ca.gov.
Edmund G. Brown Jr., Governor
State of California
Brian P. Kelly, Secretary
California State Transportation Agency
Jean Shiomoto, Director
California Department of Motor Vehicles

Achieving Multimodal Networks:
Design Speed

"The severity of pedestrian crashes, a significant concern in urban areas, is greatly increased as speeds increase."

AASHTO Flexibility Guide 2004, p. 19

MINETA TRANSPORTATION INSTITUTE

Low-Stress Bicycling and Network Connectivity

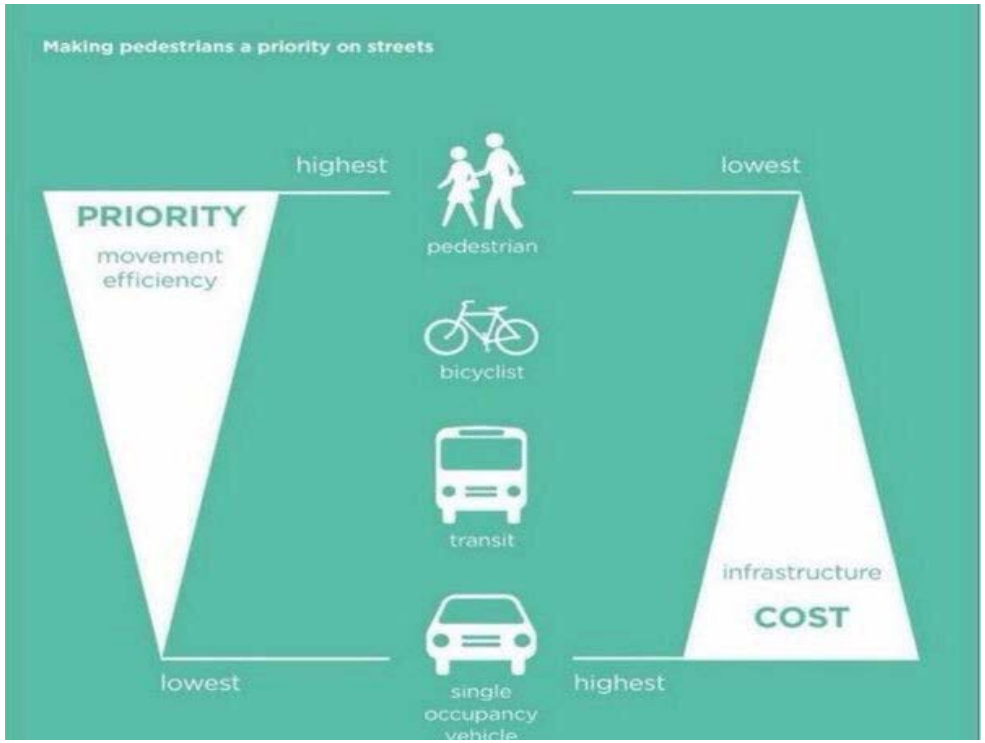
MTI Report 11-19

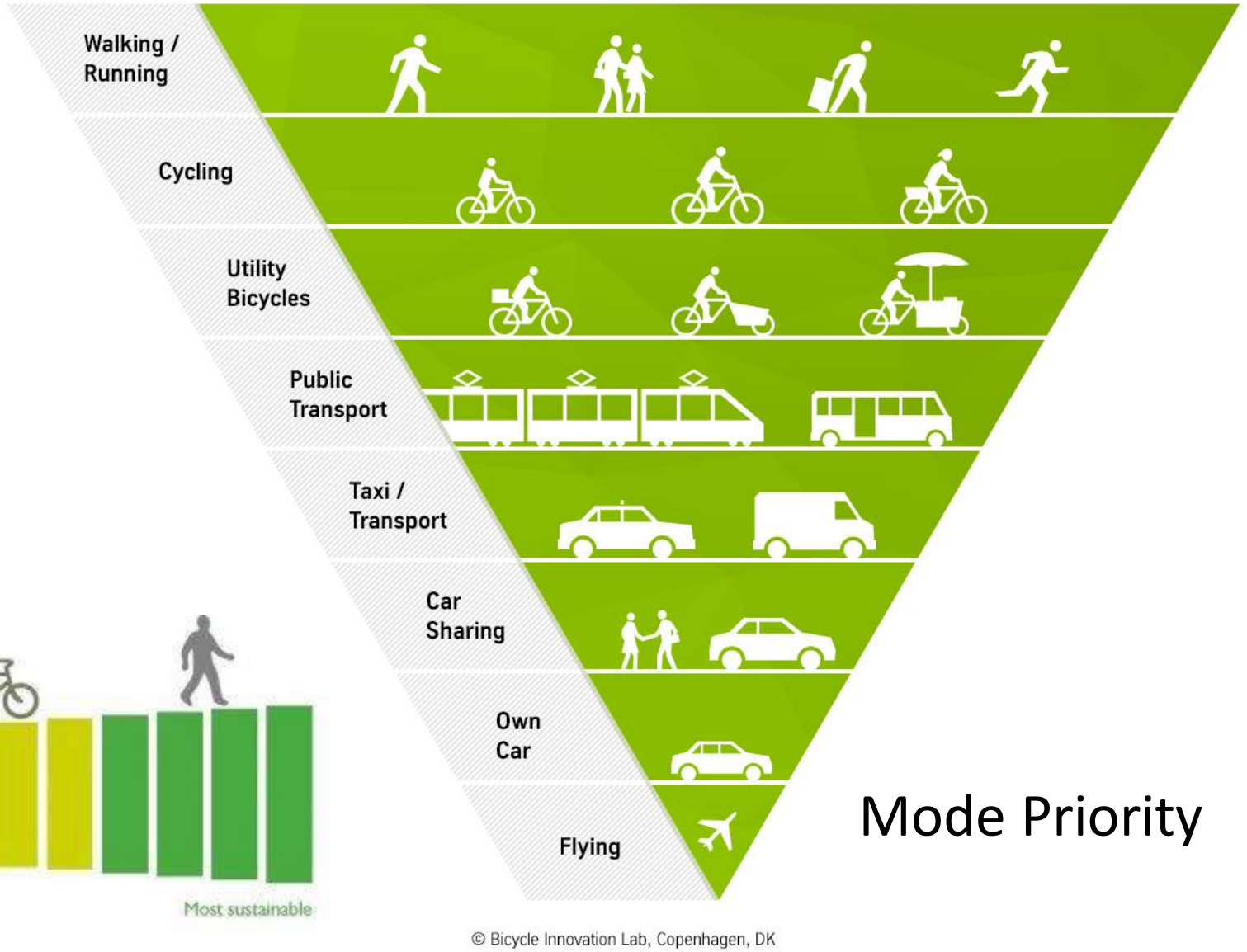
MINETA MTI

Table 1. Levels of Traffic Stress (LTS)

LTS 1	Presenting little traffic stress and demanding little attention from cyclists, and attractive enough for a relaxing bike ride. Suitable for almost all cyclists, including children trained to safely cross intersections. On links, cyclists are either physically separated from traffic, or are in an exclusive bicycling zone next to a slow traffic stream with no more than one lane per direction, or are on a shared road where they interact with only occasional motor vehicles (as opposed to a stream of traffic) with a low speed differential. Where cyclists ride alongside a parking lane, they have ample operating space outside the zone into which car doors are opened. Intersections are easy to approach and cross.
LTS 2	Presenting little traffic stress and therefore suitable to most adult cyclists but demanding more attention than might be expected from children. On links, cyclists are either physically separated from traffic, or are in an exclusive bicycling zone next to a well-confined traffic stream with adequate clearance from a parking lane, or are on a shared road where they interact with only occasional motor vehicles (as opposed to a stream of traffic) with a low speed differential. Where a bike lane lies between a through lane and a right-turn lane, it is configured to give cyclists unambiguous priority where cars cross the bike lane and to keep car speed in the right-turn lane comparable to bicycling speeds. Crossings are not difficult for most adults.
LTS 3	More traffic stress than LTS 2, yet markedly less than the stress of integrating with multilane traffic, and therefore welcome to many people currently riding bikes in American cities. Offering cyclists either an exclusive riding zone (lane) next to moderate-speed traffic or shared lanes on streets that are not multilane and have moderately low speed. Crossings may be longer or across higher-speed roads than allowed by LTS 2, but are still considered acceptably safe to most adult pedestrians.
LTS 4	A level of stress beyond LTS3.

Complete Streets is a transportation policy and design approach that requires streets to be planned, designed, operated, and maintained to enable safe, convenient and comfortable travel and access for users of all ages and abilities regardless of their mode of transportation. Complete Streets allow for safe travel by those walking, cycling, driving automobiles, riding public transportation, or delivering goods.





Mode Priority

Children

Seniors

Women

Low-Income Riders

People of Color

People Riding Bike Share

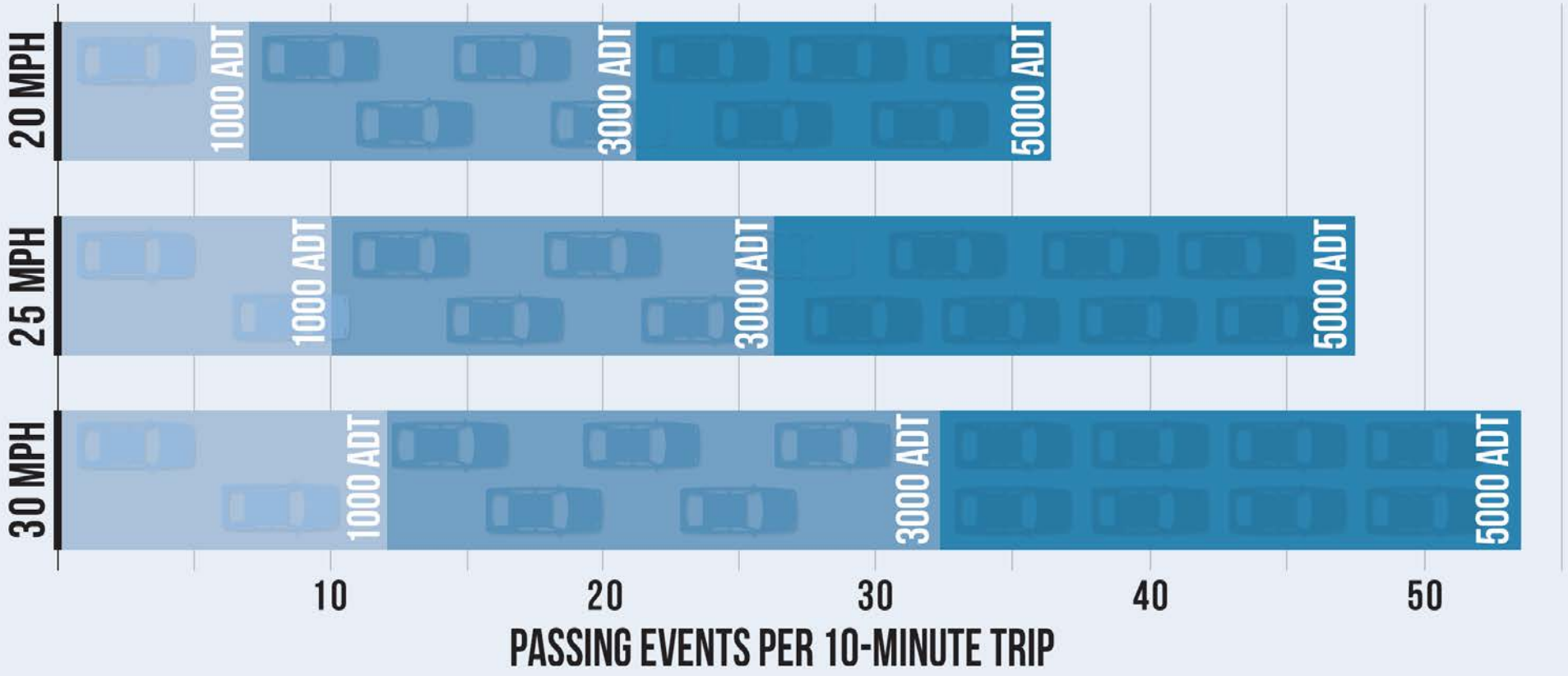
People Moving Goods or Cargo

People with Disabilities

Confident Cyclists

Conflicts Increase with Speed & Volume

This chart illustrates the number of passing events (at increasing motor vehicle average speed and volume) experienced over a 10-minute period by a bicyclist riding 10 mph. As motor vehicle speed and volume increase, they magnify the frequency of stressful events for people bicycling.



Sources of Stress Change Throughout the Day

Large fluctuations in motor vehicle traffic volume between morning, mid-day, afternoon, and nighttime result in radically different bicycling conditions on the same street throughout the day. The example at right shows a street with roughly 500 vehicles per direction per hour during the peak. While queuing stress occurs at peak times, low off-peak volume results in dangerously high motor vehicle speeds.

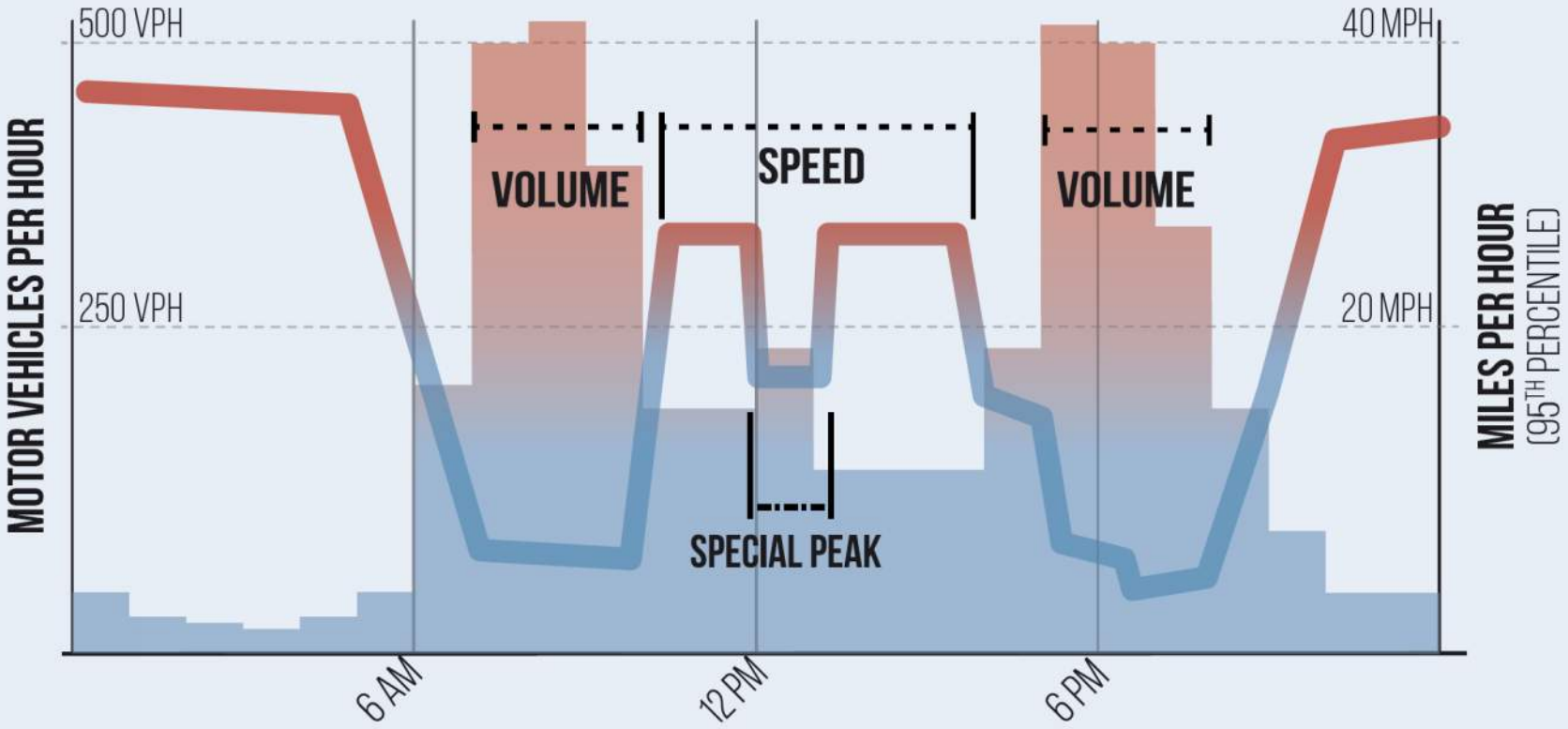


Table 2. Criteria for Bike Lanes Alongside a Parking Lane

	LTS ≥ 1	LTS ≥ 2	LTS ≥ 3	LTS ≥ 4
Street width (through lanes per direction)	1	(no effect)	2 or more	(no effect)
Sum of bike lane and parking lane width (includes marked buffer and paved gutter)	15 ft. or more	14 or 14.5 ft.[a]	13.5 ft. or less	(no effect)
Speed limit or prevailing speed	25 mph or less	30 mph	35 mph	40 mph or more
Bike lane blockage (typically applies in commercial areas)	rare	(no effect)	frequent	(no effect)

Note: (no effect) = factor does not trigger an increase to this level of traffic stress.

[a] *If speed limit < 25 mph or Class = residential, then any width is acceptable for LTS 2.*

Table 3. Criteria for Bike Lanes Not Alongside a Parking Lane

	LTS ≥ 1	LTS ≥ 2	LTS ≥ 3	LTS ≥ 4
Street width (through lanes per direction)	1	2, if directions are separated by a raised median	more than 2, or 2 without a separating median	(no effect)
Bike lane width (includes marked buffer and paved gutter)	6 ft. or more	5.5 ft. or less	(no effect)	(no effect)
Speed limit or prevailing speed	30 mph or less	(no effect)	35 mph	40 mph or more
Bike lane blockage (may apply in commercial areas)	rare	(no effect)	frequent	(no effect)

Note: (no effect) = factor does not trigger an increase to this level of traffic stress.

Table 4. Criteria for Level of Traffic Stress in Mixed Traffic

Speed Limit	2-3 lanes	4-5 lanes	6+ lanes
Up to 25 mph	LTS 1[a] or 2[a]	LTS 3	LTS 4
30 mph	LTS 2[a] or 3[a]	LTS 4	LTS 4
35+ mph	LTS 4	LTS 4	LTS 4

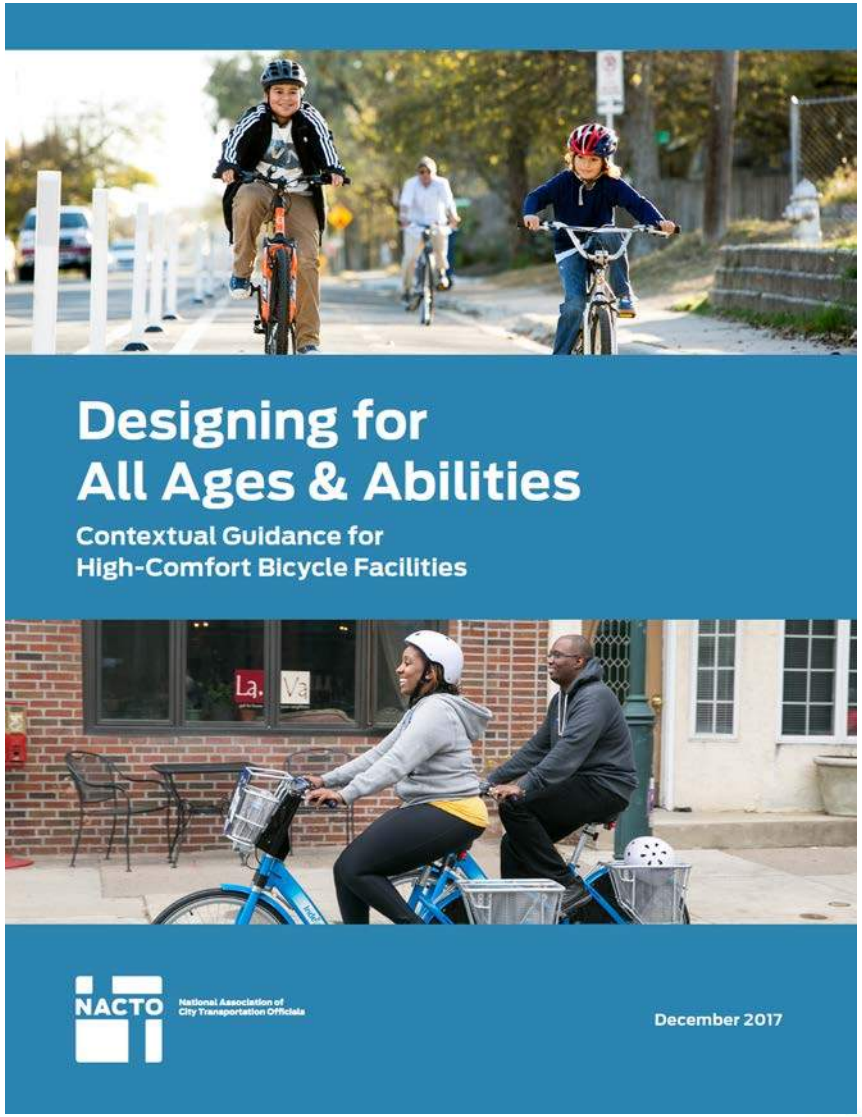
Note: [a] Use lower value for streets without marked centerlines or classified as residential and with fewer than 3 lanes; use higher value otherwise.

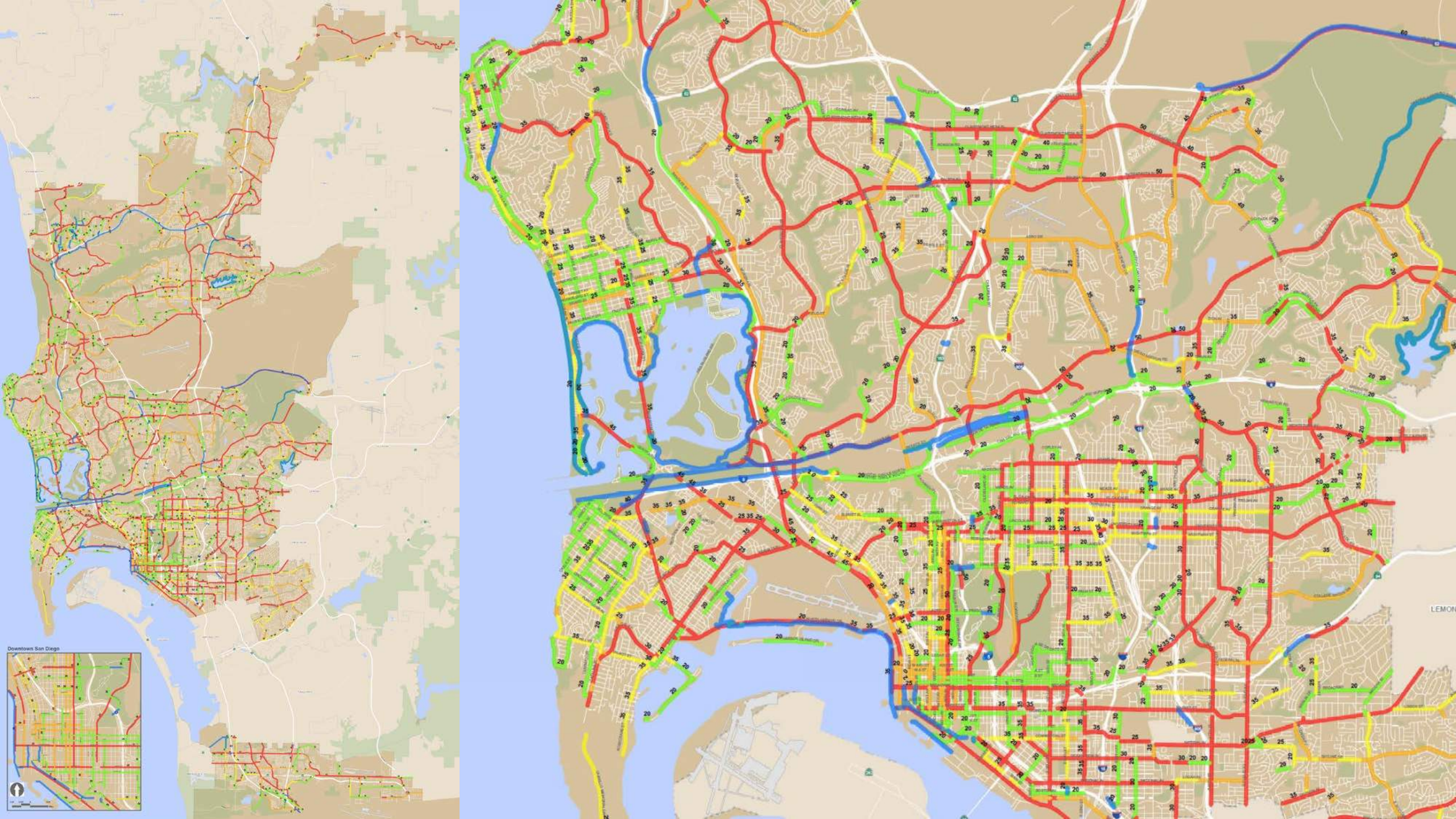
Table 5. Level of Traffic Stress Criteria for Pocket Bike Lanes

Configuration	Level of Traffic Stress
Single right-turn lane up to 150 ft. long, starting abruptly while the bike lane continues straight, and having an intersection angle and curb radius such that turning speed is ≤ 15 mph.	LTS ≥ 2
Single right-turn lane longer than 150 ft. starting abruptly while the bike lane continues straight, and having an intersection angle and curb radius such that turning speed is ≤ 20 mph.	LTS ≥ 3
Single right-turn lane in which the bike lane shifts to the left but the intersection angle and curb radius are such that turning speed is ≤ 15 mph.	LTS ≥ 3
Single right-turn lane with any other configuration; dual right-turn lanes; or right-turn lane along with an option (through-right) lane.	LTS = 4

Contextual Guidance for Selecting All Ages & Abilities Bikeways

Roadway Context				All Ages & Abilities Bicycle Facility
Target Motor Vehicle Speed*	Target Max. Motor Vehicle Volume (ADT)	Motor Vehicle Lanes	Key Operational Considerations	
Any		*Any*	*Any of the following:* high curbside activity, frequent buses, motor vehicle congestion, or turning conflicts‡	**Protected Bicycle Lane**
< 10 mph	Less relevant	No centerline, or single lane one-way	Pedestrians share the roadway	**Shared Street**
≤ 20 mph	≤ 1,000 – 2,000		< 50 motor vehicles per hour in the peak direction at peak hour	**Bicycle Boulevard**
≤ 25 mph	≤ 500 – 1,500			
	≤ 1,500 – 3,000	Single lane each direction, or single lane one-way	Low curbside activity, or low congestion pressure	**Conventional or Buffered Bicycle Lane, or Protected Bicycle Lane**
	≤ 3,000 – 6,000			**Buffered or Protected Bicycle Lane**
	Greater than 6,000			**Protected Bicycle Lane**
	Any	Multiple lanes per direction		
Greater than 26 mph†	≤ 6,000	Single lane each direction	Low curbside activity, or low congestion pressure	**Protected Bicycle Lane, or Reduce Speed**
		Multiple lanes per direction		**Protected Bicycle Lane, or Reduce to Single Lane & Reduce Speed**
	Greater than 6,000	*Any*	*Any*	**Protected Bicycle Lane, or Bicycle Path**
High-speed limited access roadways, natural corridors, or geographic edge conditions with limited conflicts		*Any*	High pedestrian volume	**Bike Path with Separate Walkway or Protected Bicycle Lane**
			Low pedestrian volume	**Shared-Use Path or Protected Bicycle Lane**




Downtown San Diego

Questions?

City of San Diego Bicycle Program