

Improving Access and Safety for Pedestrians & Bicyclists on State Highways



Beth Thomas
Pedestrian & Bicycle Coordinator
Caltrans District 4

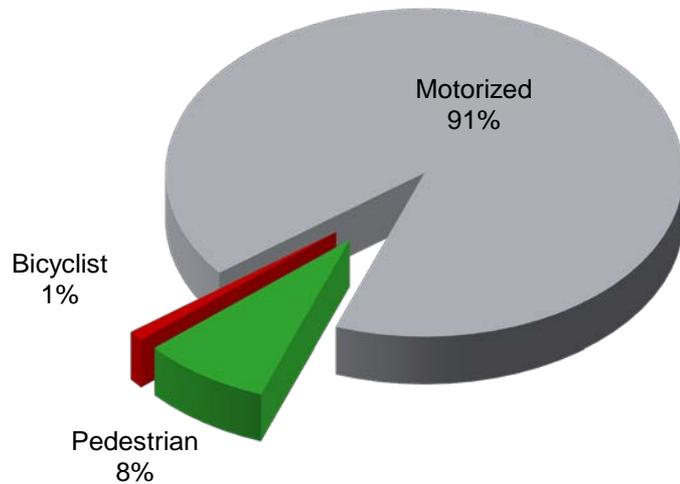
Bicycle & Pedestrian Coordinators - What Do They Actually Do?

- Review and comment on various internal project planning and design documents for impacts on pedestrian and bicycle access and safety and compliance with DD-64-R1
- Review and comment on projects done by others on State highways, i.e. local development projects and encroachment permits

Bicycle & Pedestrian Coordinators - What Do They Actually Do?

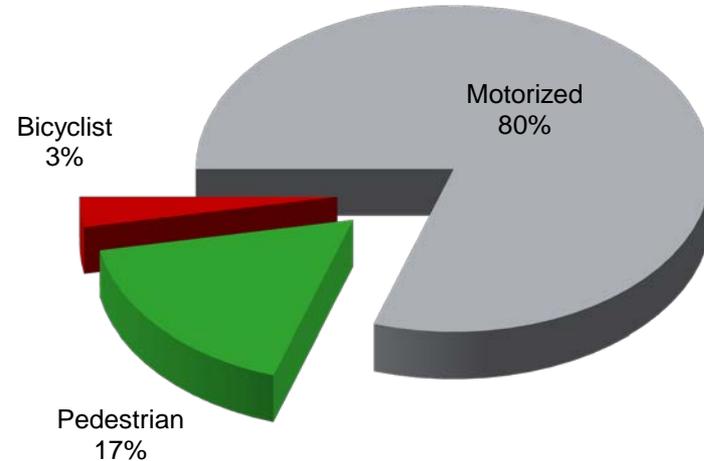
- Outreach and Interface with the Public
 - Ped and Bike Advisory Committee coordination
 - Bike-to-Work Day activities such as D4 energizer station and info table at DT Oakland's event
 - External presentation of Caltrans' Complete Streets Implementation and other efforts
 - Respond to external request for
 - ✦ **roadway maintenance**
 - ✦ **safety treatments**
 - ✦ **traffic signal detection**
 - ✦ **information on bike routes and shuttle services**
 - ✦ **bike access on freeways and bridges**

Why focus on pedestrians?



Weekday Travel in California, 2001

Statewide Household Travel Survey

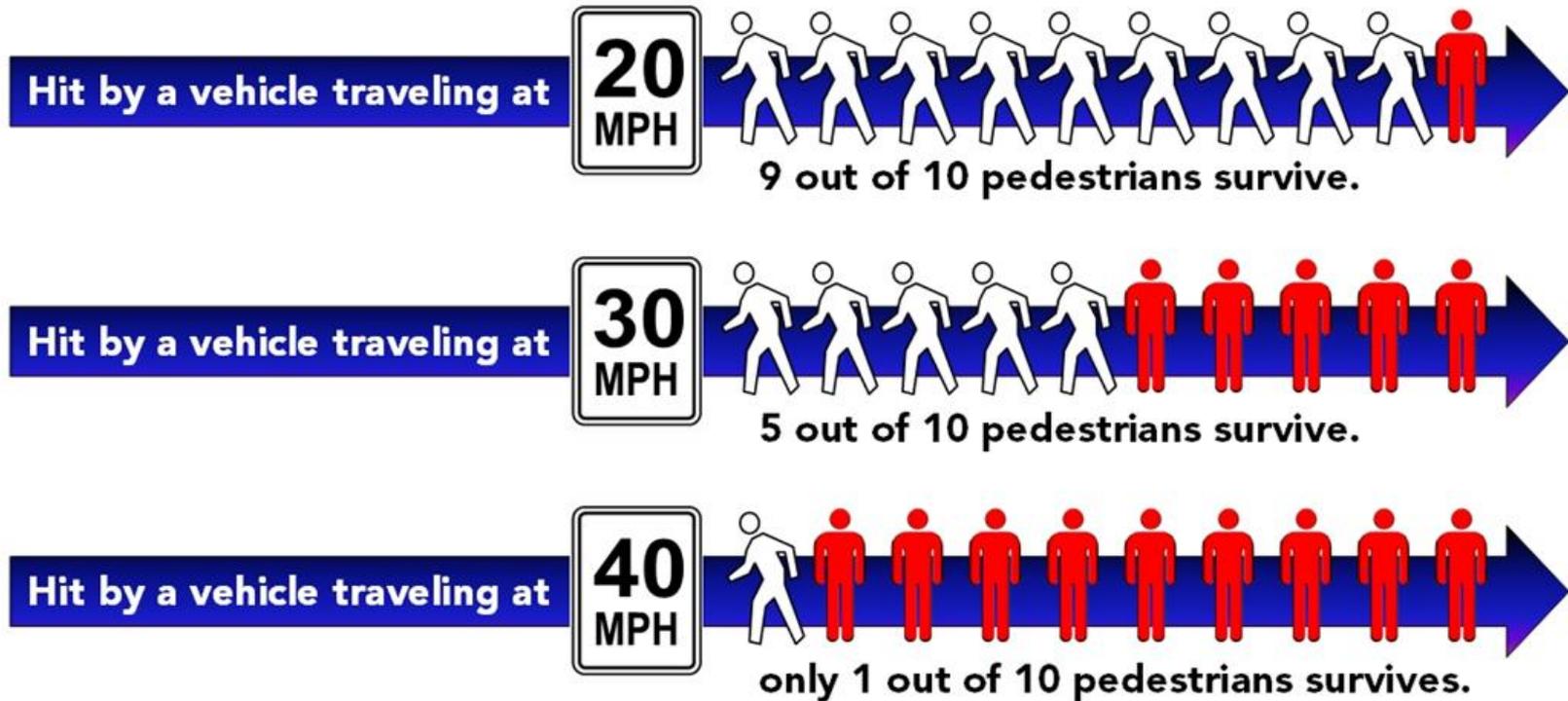


Fatalities in California, 2001

Fatality Analysis Reporting System

Driving Speed & Pedestrian Fatalities

Pedestrian Fatal Injury Rates by Vehicle Speed and Age



Pedestrian Exposure at Uncontrolled Crossing Locations

- **Marked crosswalks alone may increase collisions when:**
 - Speed > 40 mph
 - 4+ lane roads with AADT >12,000 and no median
 - 4+ lane road with ADT >15,000 and raised median
- **Additional treatments should be provided in these cases**
 - High-visibility striping, medians, beacons, etc.



Pedestrian Treatments for Uncontrolled Crossings

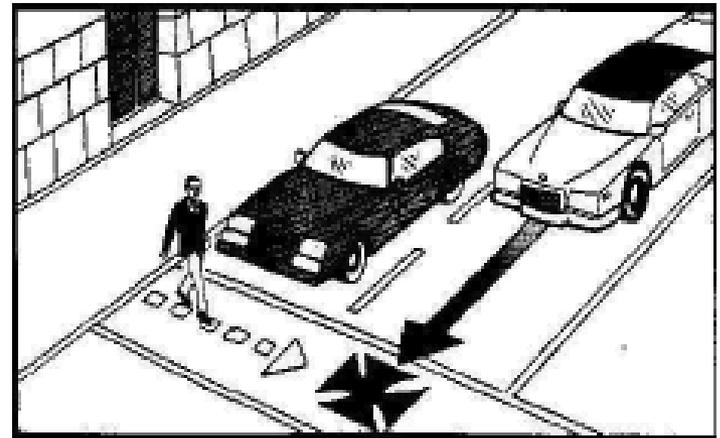
- **Raised Medians / Pedestrian Refuge Islands**
 - **Crash Reduction*:**
 - ✦ With marked crosswalk: -46%
 - ✦ With unmarked crosswalk: -39%
- **High-Visibility Crosswalks**
- **Fluorescent yellow-green pedestrian signage**

* Zegeer et al., Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations, 2002



Pedestrian Treatments for Uncontrolled Crossings

- Two-Lane Streets
 - In-street yield signage
- Multilane Streets
 - Multiple Threat Collision Type
 - ✦ Difficult to find gap
 - ✦ Yielding vehicle blocks view of pedestrian from other lanes



From Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations, FHWA-RD-04-100, 2005.

Pedestrian Treatments for Uncontrolled Crossings

- **Multilane Streets**

- **Advanced Yield Markings with “YIELD HERE TO PEDESTRIANS” Signage**
 - ✦ Increase Pedestrian Visibility
 - ✦ Avoid most common “multiple threat” collision
- **Overhead “STATE LAW: YIELD TO PEDESTRIANS” Signage**



Pedestrian Treatments for Uncontrolled Crossings

- **Rectangular Rapid Flashing Beacon**
 - Increases yield rates to between 74% and close to 100%*
 - Locations with mid- to somewhat high traffic volumes
 - Blanket approval for CA
 - Inform Caltrans of location



* FHWA, Interim Approval for Optional Use of Rectangular Rapid Flashing Beacons (Memo 1A-11), 2008

Rectangular Rapid Flashing Beacon

- Does not have to meet signal warrants
- Relatively inexpensive
 - About \$10,000 per beacon
 - \$20,000 to \$40,000 per crossing
 - ✦ One on each side of street
 - ✦ With median: one to two mounted there depending on width
- Cheaper, more reliable & more effective than in-roadway warning lights



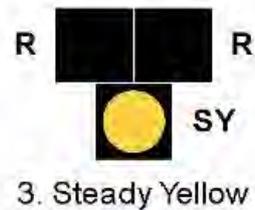
Pedestrian Hybrid Beacon

- Formerly called High-intensity Activated crossWalk (HAWK)
- Pedestrian activated
- In 2012 CA Manual on Uniform Traffic Control Devices
- Ped crashes reduced 69%*
 - All crashes down 29%
 - Severe crashes down 15%

* Safety Effects of the HAWK Pedestrian Crossing Treatment, FHWA-HRT-10-042, July 2010



Pedestrian Hybrid Beacon



Legend

- SY** Steady yellow
- FY** Flashing yellow
- SR** Steady red
- FR** Flashing red

From: Caltrans *Complete Intersections: A Guide to Reconstructing Intersections and Interchanges for Pedestrians and Bicyclists*

Pedestrian Hybrid Beacon

- **Guidelines for use**
 - Does not have to meet signal warrants
 - Based on posted speed, vehicles & peds per hour, crosswalk length
 - At least 100 feet from intersection
 - ✦ FHWA likely to approve for intersections
- **About \$200,000 per location**

Pedestrian Crossing Treatments for Controlled or Uncontrolled Crossings (with or without signal or stop sign)

- **Corner Radius / Sizing in new CA Highway Design Manual (HDM)**
 - Smaller radii of 15 to 25' appropriate at minor cross streets where few trucks or buses are turning.
 - Local agency standards may be appropriate in urban and suburban areas.



www.walkinginfo.org

Pedestrian Crossing Treatments for Controlled or Uncontrolled Crossings (with or without signal or stop sign)

- **Curb Extensions / Bulbouts**

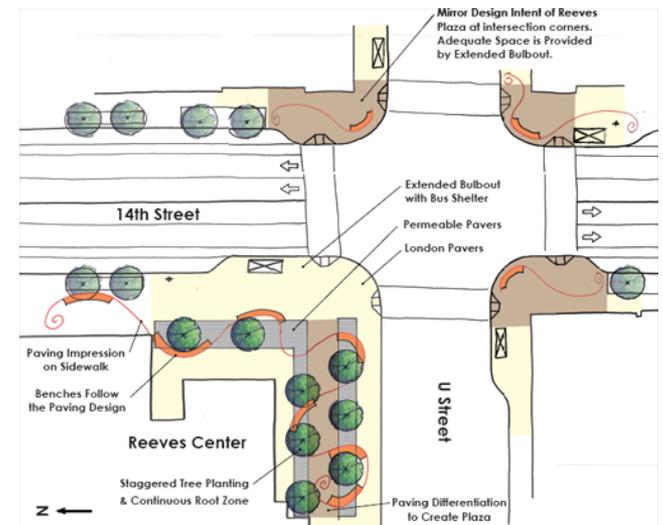
- Increase yield rates by about 40% (reduced avg # of vehicles passing before ped crossed) *
- Improve pedestrian visibility
- Shorten crossing distance
- Reduce effective corner radius/
vehicle turning speed



* Johnson, R., Pedestrian Safety Impacts of Curb Extensions: A Case Study, 2005

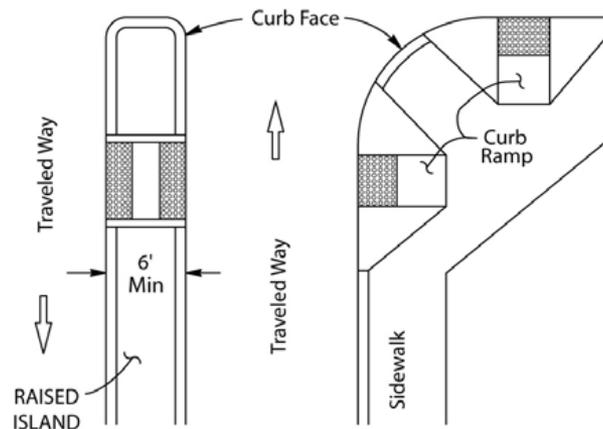
Pedestrian Treatments for Controlled or Uncontrolled Crossings

- **Curb Extensions / Bulbouts in new HDM**
 - Routes with posted speed of 35 mph or less
 - Without bike lanes, 3' setback from traffic lane to gutter pan seam or curb if without gutter pan, OR
 - 2' setback from bike lane to curb



Pedestrian Treatments for Controlled or Uncontrolled Crossings

- Raised medians: 25% reduction in crashes *
- Pedestrian Refuge Islands in new HDM
 - “Where pedestrians are allowed to cross 4 or more lanes at a marked or unmarked crosswalk, a pedestrian refuge island should be provided”
 - Should provide a min. of 6’ in direction of ped travel



* Lang, 1993

Pedestrian Treatments for Signalized Intersections

- **Pedestrian Countdown Signals**

- Nearly 50% decline in pedestrian injury crashes *
- Judge ability to get across in time
- Low cost
- No impact on motorized traffic
- Required in 2012 CA MUTCD at all new signal heads with ped change interval > 7 seconds



* Markowitz et al., Pedestrian Countdown Signals:
Experience with an Extensive Pilot Installation, 2006

Pedestrian Treatments for Signalized Intersections

- Protected left turns (left-turn arrow)
- Leading Pedestrian Interval
 - Head start to cross before right-turning vehicles get green light
- Pedestrian Scramble (all way ped phase)
 - With high volume of turning traffic



Pedestrian Treatments for Intersections



- **Modern Roundabouts**

- Entering vehicles yield
- Deflection angle
 - ✦ Slows traffic
 - ✦ Eliminates broadside collision type - most common source of urban traffic fatalities
- Crosswalk back from entry – less distraction
- Significant reduction in injury crashes
- Single-lane: nearly without fatal crashes
- 2-lane:
 - ✦ May still be safer than signalized intersections
 - ✦ Ped Hybrid Beacon recommended for visually impaired

Pedestrian Treatments for Intersections

- **Traffic Circles**
 - Usually low volume residential streets
 - With or without stop control
 - Reduces traffic speed through intersection
 - Reduces broadside collisions



Pedestrian Treatments for Corridors & Segments

- **Sidewalks (urban, suburban, town) or Shoulders (rural)**
 - Prevent walking in or on edge of traffic lane
 - 88% reduction in walking-along-roadway crashes*
 - Especially important for rural school zones

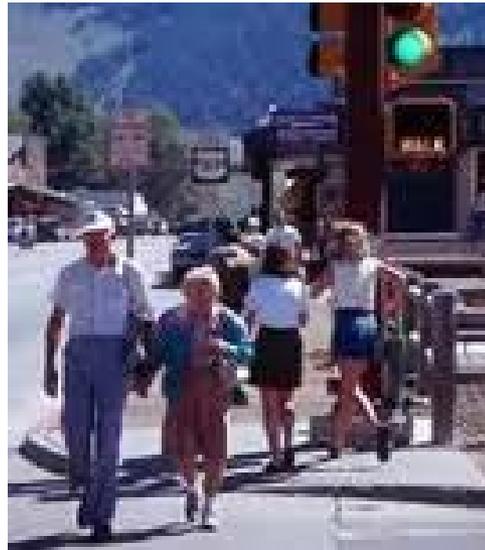
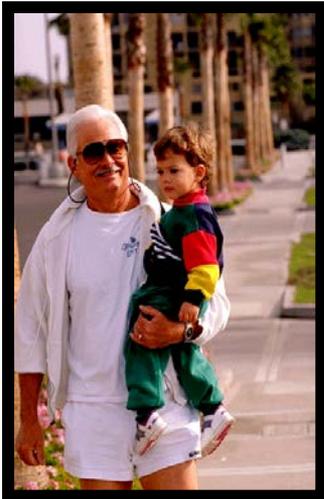


UK Guardian

* McMahon, P., Zegeer et al., "An Analysis of Factors Contributing to 'Walking Along Roadway' Crashes", FHWA-RD-01-101, 2002

Pedestrian Treatments for Corridors & Segments

- **New HDM Sidewalk Standards**
 - 8' minimum for urban & rural main streets
 - Elsewhere: 6' minimum contiguous to curb, 5' minimum next to planting strip



Pedestrian & Bicycle Treatments for Corridors & Segments

- **Lane Width in New HDM**

- Decreased minimum from 12' to 11' if:

- ✦ Conventional highway
- ✦ Posted speed $< \text{or} = 40$ mph
- ✦ Average daily trucks < 250 per lane
- ✦ Urban areas, city or town centers (rural main streets)

- Reduction provides more space for ped & bike facilities

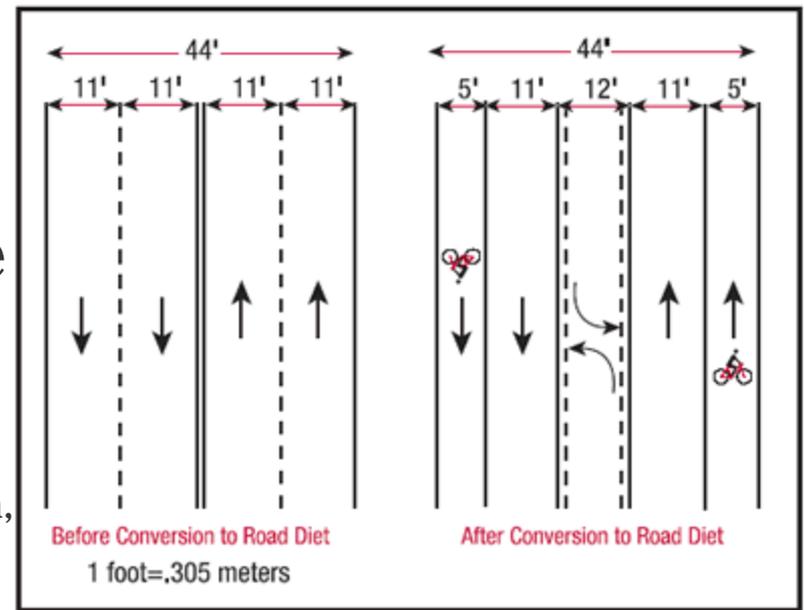


Pedestrian & Bicycle Treatments for Corridors

- **Road Diets**

- Provide space for bike lanes and wider sidewalks
- Typically convert 4 thru-lanes to 2 thru-lanes with a center left-turn lane or median with turn pockets
- Reduces crashes *
- Reduces crossing distance exposed to traffic

* FHWA Highway Safety Information System, Evaluation of Lane Reduction "Road Diet" Measures on Crashes, 2006



Bicycling on State Highways

Bicyclists are legal users on conventional State highways and expressways, and on about 25 percent of California's freeways.

Provisions for bicycling have to be made on all State highways, expressways, and accessible freeways. On freeways where access is prohibited, a feasible alternative route in the corridor has to be available.



Photo by: Aaron Bialick

Bikeway Classifications in the HDM

- **Class I**
 - Bike path
 - Two way: 8 foot width min, 10 foot preferred
 - One way: 5 foot width min
 - Design street intersections carefully (see HDM chapter 1000)
- **Class II**
 - Bike lane
 - 4 foot min width except:
 - ✦ Next to on-street parking: should be 4 feet
 - ✦ > 40 mph posted speed: should be 6 feet

Bikeway Classifications in the HDM

- **Class III**
 - Bike route
 - A roadway designation, not a bicycle facility
 - Signage
 - Shared lane markings (sharrows) in some cases
 - ✦ In CA MUTCD
 - ✦ Indicate position of cyclist outside door zone of parked cars
 - ✦ Where space not set aside for bike lanes
 - ✦ Also used on bike boulevards
 - Traffic-calmed bike preferential streets, also called greenways (Berkeley, Portland)



New & Experimental Treatments

- **Green bike lanes**
 - Blanket approval for CA from FHWA
- **Green lane within traffic lane**
 - Alternative to sharrows
 - Experiment: being evaluated in Long Beach, CA
- **Bike boxes**
 - Position cyclist ahead of waiting traffic at intersection
 - Experiment: being evaluated in Columbus, OH



Photo: Greg Raisman (Flickr)

New & Experimental Treatments

● Cycle Tracks

- Physically separated bikeway on city street
- Between motorized traffic lane and sidewalk
- Can be protected by on-street parking or curb
- Intersection treatments:



- ✦ Eliminating parking
- ✦ Converting to bike lane
- ✦ Raised crossing
- ✦ Bike-only signal phase

- Widely used in Northern Europe
- Not in HDM other than Class I
- Not a traffic control device so no MUTCD restriction
- Push from CA Bicycle Coalition for official experimentation under Div of Design
- CA Examples: Long Beach and San Francisco



Long Beach. Source: Orange20bikes.com

Rural Context: Shoulder Widening Benefits Bicyclists



Photos by: Caltrans

**Before and After:
(although not
exactly the same
location)**

Urban Context: Restriping with Bike Lanes



Bike lanes striped to the left of a right-turn only lane reduce the risk of a weaving-related collision.

“Road diets” or simply restriping wide lanes with bike lanes improves bicycle access and has overall safety benefits.



From: *Complete Intersections: A Guide to Reconstructing Intersections and Interchanges for Pedestrians and Bicyclists*, Draft 2010 prepared by Caltrans, Alta Planning + Design, Cambridge Systematics

“Road Diet” Example in SF

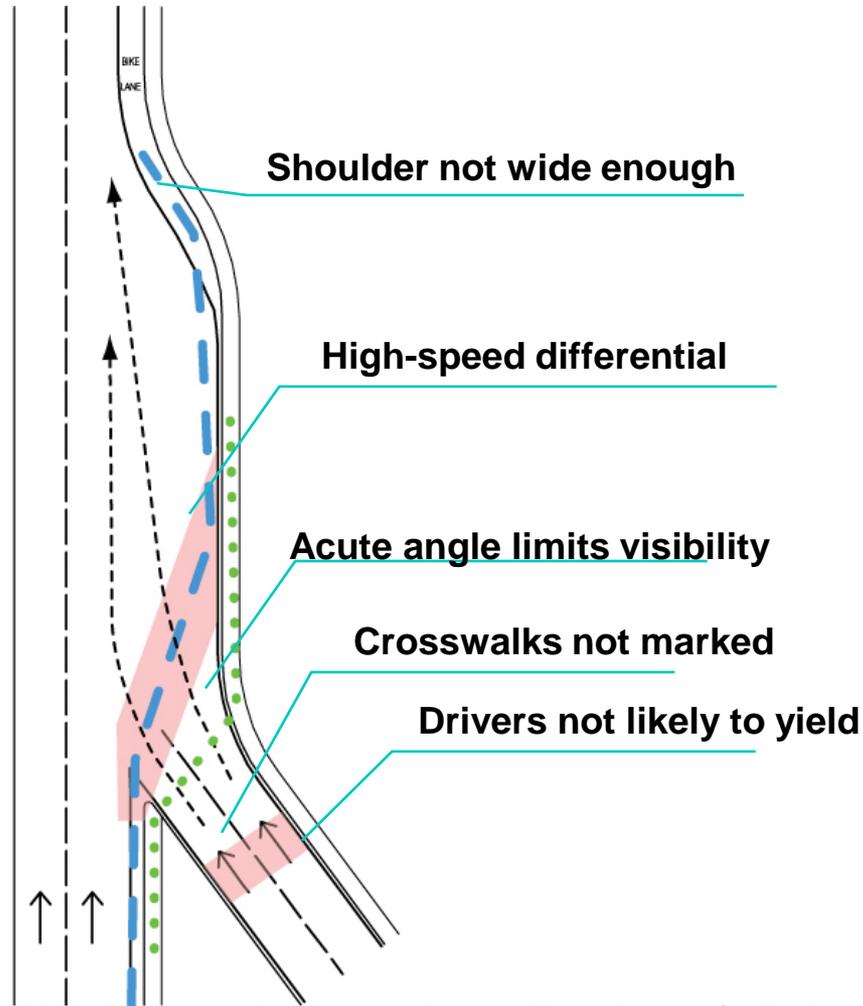


Photos by: Aaron Bialick

Freeways as Barriers

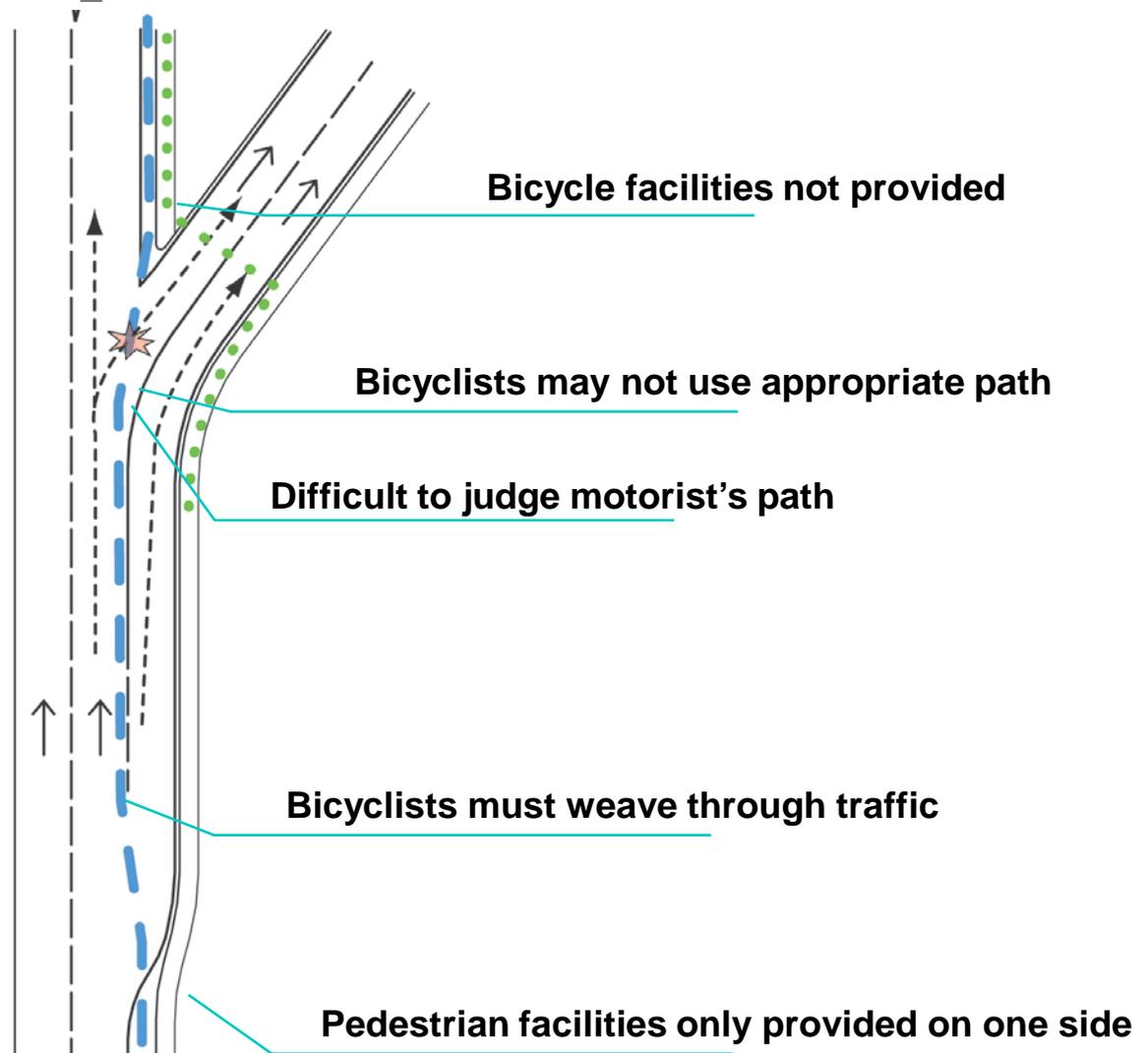


Free Flow Ramps: Common Issues

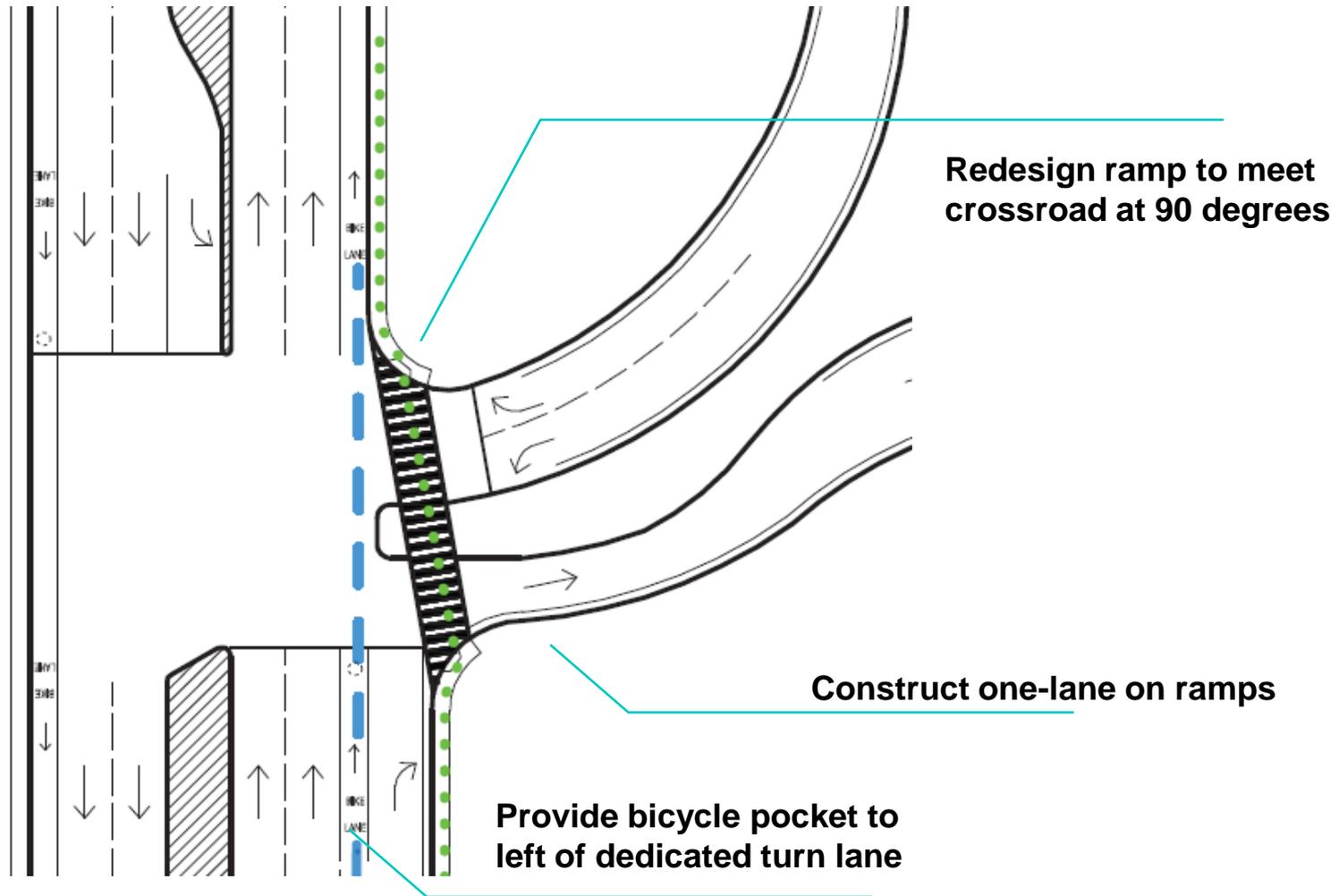


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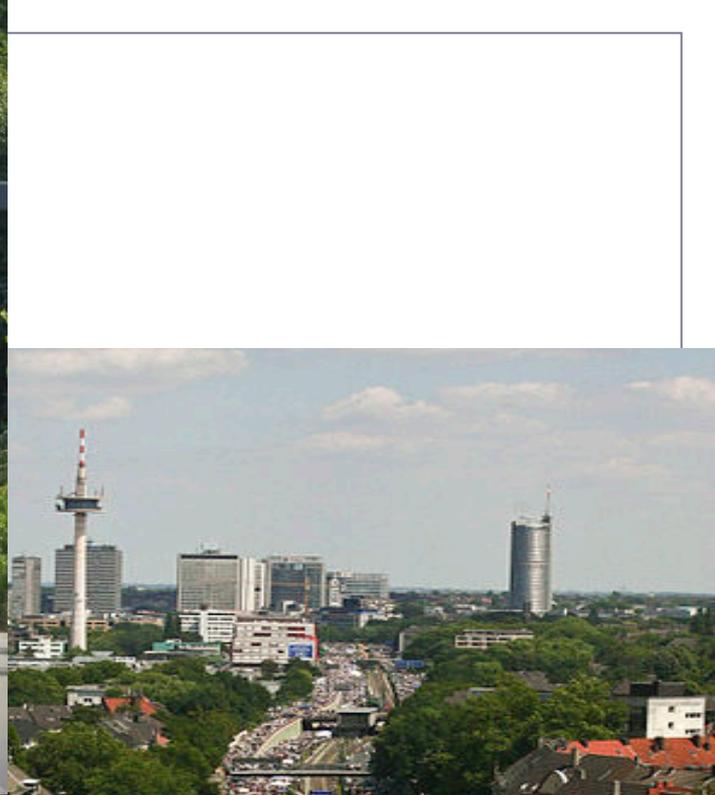
Free Flow Ramps: Common Issues, Cont.



Free Flow Ramps: Preferred Design



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There are other ways to use a freeway ...



Questions/Comments?



Beth Thomas
Pedestrian & Bicycle Coordinator
Caltrans District 4
Beth_thomas@dot.ca.gov
510-286-7227