Complete Streets

Retrofit of Mid Century Auto Centric Corridors
San Juan Avenue
Elk Grove Boulevard
Watt Avenue
West Capitol Avenue
Sacramento County Arterial Standard
Elk Grove Arterial Standards
City of Sacramento Arterial Standard

NOTES:
1. Street section to be used in areas with mixed traffic types and volume of 18,000 - 27,000 ADT.
2. Parking will only be allowed in limited cases, per Section 15.13.
3. Additional right-of-way required at expanded intersections.
4. ADT is Average Daily Traffic.
5. A two way left turn lane may be constructed in lieu of a landscaped median, if approved by the City Traffic Engineer.
Roadway Design Concepts
Traveled Lanes
Travel Lane Width

> **Highway Design Manual**

“For conventional State highways with posted speeds less than or equal to 40 mph and truck volumes less than 250 per lane, **minimum lane width shall be 11 feet.**”

> **AASHTO**

“For urban areas, lane widths “may vary from 10 to 12 ft (3.0 to 3.6 m) for arterials."

“For lower speed, lower volume rural roads and highways with little or no truck traffic, lane widths as low as 9 ft (2.7 m) may be acceptable; lane widths substantially less than 12 ft (3.6 m) are considered adequate for a wide range of volume, speed, and other conditions.”

> **ITE CSS for Urban Thoroughfares**

“Target speed—on the lower-speed urban thoroughfares addressed in this report (target speeds of 35 mph or less), a range of lane widths from **10 to 12 feet** on arterials and 10 to 11 feet on collectors is appropriate.

> **NACTO Urban Street Design Guide**

“Lane width should be considered within the overall assemblage of the street. Travel lane widths of **10 feet** generally provide adequate safety in urban settings while discouraging speeding. Cities may choose to use **11-foot lanes** on designated truck and bus routes (one 11-foot lane per direction) or adjacent to lanes in the opposing direction.”

“Lanes **greater than 11 feet should not be used** as they may cause unintended speeding and assume valuable right of way at the expense of other modes.”
Travel Lane Width

- Why it matters: speed and safety
- Traditional concern: narrower travel lanes = increase in crash rates
- Reducing travel lane widths tends to reduce travel speeds
- Recent research: narrower travel lanes do not compromise safety
- Thus, revised HDM standard


Source: “Design Factors that Affect Driver Speed on Suburban Arterials”, Fitzpatrick, Kay et al.
Travel Lane Width

“A safety evaluation of lane widths for arterial roadway segments found no indication, except in limited cases, that the use of narrower lanes increases crash frequencies.”

It is recommended that narrower lane widths be used cautiously in these situations unless local experience indicates otherwise."

• lane widths of 3.0 m (10 ft) or less on four-lane undivided arterials.
• lane widths of 2.7 m (9 ft) or less on four-lane divided arterials.
• lane width of 3.0 m (10 ft) or less on approaches to four-leg STOP-controlled arterial intersections.

Travel Lane Width

- Advantages and appropriateness of narrower lanes
- Factors that affect vehicular capacity

<table>
<thead>
<tr>
<th>Lane Width</th>
<th>Reduction in Saturation Flow Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 feet</td>
<td>NA</td>
</tr>
<tr>
<td>11 feet</td>
<td>3 %</td>
</tr>
<tr>
<td>10 feet</td>
<td>7 %</td>
</tr>
</tbody>
</table>

Source: Highway Capacity Manual
Travel Lane Width

• The presence of heavy vehicles is important when considering travel lane widths of less than 12 feet.

• Bus mirror-to-mirror width is 10.5 feet.

Source: Fehr & Peers
Road Diets

- Road Diets: typically conversion of four-lane, undivided roads into three lanes (two through lanes and a center turn lane)
- Often have minimal effect on vehicle capacity because left-turning vehicles are moved into a common two-way left-turn lane
- Above 20,000 ADT, greater likelihood that traffic congestion will cause traffic diversion

Source: “Evaluation of Lane Reduction “Road Diet” Measures and Their Effects on Crashes and Injuries”, Highway Safety Information System
Road Diets

• HSIS research findings:
  • 4-lane to 3-lane conversion likely to reduce total crashes by 6 percent or less
  • Road diet conversions did not affect crash severity
  • Road diet conversions did not result in a significant change in crash types

• Other research findings:
  • Pedestrian crash risk reduced when pedestrians cross two- and three-lane roads compared to roads with four or more lanes (FHWA Marked vs. Unmarked Crosswalks at Uncontrolled Locations study)

Source: Evaluation of Lane Reduction “Road Diet” Measures and Their Effects on Crashes and Injuries, Highway Safety Information System
On-Street Parking

- Types of Layout
  - Parallel Parking
  - Angled Parking
  - Back-in Angled Parking
Bicycle Infrastructure
Changing Travel Preferences of Constituency

1% STRONG AND FEARLESS
Riding is a strong part of my identity, and I am undeterred by traffic speed, volume, or other roadway conditions.

7% ENTHUSED AND CONFIDENT
I am comfortable sharing the road with motor vehicles, but I prefer to use bike lanes and bike friendly streets.

60% INTERESTED BUT CONCERNED
I like riding a bike, but I don’t ride much. I would like to feel safer when I do ride, with less traffic and slower speeds.

33% NO NO NO
I don’t bike at all due to inability, fear for my safety, or simply a complete and utter lack of interest.

Source: Fehr & Peers
Bicycle Infrastructure

Class I: Bike Path

Class II: Bike Lane

Class III: Bike Route

Class IV: Separated Bike Lane

Sources: Fehr & Peers, Metro & LA EcoVillage
Bicycle Infrastructure

Class II: Bike Lane

Design Criteria

• Bike lane width shall be 4 feet, except where --
  • Adjacent to on-street parking, the minimum bike lane width: 5 feet
  • Posted speeds are greater than 40 miles per hour, the minimum bike lane width: 6 feet
  • On highways with concrete curb and gutter, a minimum width: 3 feet, measured from bike lane stripe to shoulder pavement/gutter joint

Bike lane in Del Mar, CA.
Source: Pedbikeimages.org
Bicycle Infrastructure

Buffered Bike Lanes

18” Min. / 3’ Preferred

5’ Min. / Preferred

Door Zone Buffer

Source: Davis Enterprise
Bicycle Infrastructure

Green Colored Bike Lanes (Class II)

- Approved for use in CA based on FHWA Interim Approval
- Guidance in FHWA Interim Approval Memo
- Caltrans example at Alpine Rd/I-280 (District 4)
Bicycle Infrastructure

Conflict Area Markings

Source: NACTO

Source: Fehr & Peers
Bicycle Infrastructure

Class III: Bike Route

Design Criteria

• Intended to provide continuity to the bikeway system
• Facilities are shared with motor vehicles on the street

Source: LA EcoVillage
Bicycle Infrastructure

Class III: Bike Route

• Where to use
  • <=35 mph*
  • With parking: outside of door zone
    • CAMUTCD says min. 11’ from curb, sufficient
    • Door zone is typically 4’ wide
  • Without parking: min 4’ from curb
  • ADT of ~3,000

• Where not to use
  • >35 mph*
  • Shoulders
  • Designated bike lanes

*There are exceptions
Signalized Intersection Treatments

Bicycle Signal Faces

• Federal Interim Approval
  • Issued December 2013
  • For an exclusive phase for bicyclists
• No warrants; but does outline applications where bicycle signal faces are not permitted:
  • In conjunction with a Pedestrian Hybrid Beacon
  • At signalized approaches with marked shared lanes
  • In conjunction with bicycle scramble phases
Pedestrian Facilities
Pedestrian Facilities

Source: NACTO
Pedestrian Facilities

Source: NACTO
Pedestrian Facilities

Sidewalks and Walkways

- Highway Design Manual (HDM):
  - Minimum width is 8’ between a curb and a building in Main Street place types
  - Otherwise, 6’ when contiguous to a curb or 5’ when separated by a planting strip
- Minimum clear width of 4’ within overall width
- Local agencies may require greater widths
- Pedestrian LOS not determined just by sidewalk width
- New HDM guidance & standard for curb extensions/ corner bulbouts
  - 35 mph or less posted speed
  - With on-street parking

Source: www.pedbikeimages.com, Dan Burden, 2006
Pedestrian Facilities

Accessibility Requirements

• Legislation and Policy

• Caltrans Design Information Bulletin (DIB) 82-05 incorporates:
  • ADA Accessibility Guidelines (ADAAG)
  • Parts of Draft Public Rights of Way Accessibility Guidelines (PROWAG)
Pedestrian Facilities

Caltrans A88A

- Builds in flexibility for construction tolerances
- Shows slopes and clearances for curb ramps that are less than the maximum
- Warning grooves have recently been removed from the federal standards

Source: Caltrans
Pedestrian Facilities

DIB 82-05
• Now allows ramps to be orientated perpendicular to a gutter grade break
• Alternative to orientation perpendicular to curb face
• Facilitates crosswalk with directional ramps at corners

Midblock crossing in Sacramento, CA.
Source: US Access Board

Grade break is Perpendicular to Direction of travel
Signalized Intersection Treatments

Operations

- Leading Pedestrian Interval (LPI)
- Short Cycle Lengths
- Pedestrian Scramble Phase
- No Right-Turn on Red
  - LED blankout sign can be coordinated with push button to reduce traffic delay
- Pedestrian Recall
Uncontrolled Crossings

Crosswalk Research

• “The Zegeer Study”, 2002
• Marked vs. unmarked
• Two-lane roads - no difference in pedestrian crash rate
• Multilane roads - marked crosswalk, without other measures, associated with higher crash rate on roadways with higher ADT and speed

Source: FHWA
Uncontrolled Crossings – FHWA Guidance

Table 1. Recommendations for installing marked crosswalks and other needed pedestrian improvements at uncontrolled locations.*

<table>
<thead>
<tr>
<th>Roadway Type (Number of Travel Lanes and Median Type)</th>
<th>Vehicle ADT ≤ 9,000</th>
<th>Vehicle ADT &gt; 9,000 to 12,000</th>
<th>Vehicle ADT &gt; 12,000 - 15,000</th>
<th>Vehicle ADT &gt; 15,000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>≤ 30 mi/h 35 mi/h 40 mi/h</td>
<td>≤ 30 mi/h 35 mi/h 40 mi/h</td>
<td>≤ 30 mi/h 35 mi/h 40 mi/h</td>
<td>≤ 30 mi/h 35 mi/h 40 mi/h</td>
</tr>
<tr>
<td>2 Lanes</td>
<td>C C P</td>
<td>C C P</td>
<td>C C P</td>
<td>C P N</td>
</tr>
<tr>
<td>3 Lanes</td>
<td>C C P</td>
<td>C P P</td>
<td>P P P</td>
<td>P N N</td>
</tr>
<tr>
<td>Multi-Lane (4 or More Lanes) With Raised Median***</td>
<td>C C P</td>
<td>C P N</td>
<td>P P N</td>
<td>N N N</td>
</tr>
<tr>
<td>Multi-Lane (4 or More Lanes) Without Raised Median</td>
<td>C P N</td>
<td>P P N</td>
<td>N N N</td>
<td>N N N</td>
</tr>
</tbody>
</table>

Key:
C = Candidate sites for marked crosswalks
P = Possible increase in pedestrian crashes may occur if crosswalks are marked without other pedestrian enhancements
N = Marked crosswalks alone are insufficient.

Source: Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations
Uncontrolled Crossings

Crosswalk Research

• “NCHRP 562”, 2006

• Researches effectiveness of different crosswalk treatments
  • Red beacon displays
  • Flashing beacons
  • In-roadway lights
  • Warning signs/markings
  • Crosswalk markings

• Measured yield compliance
Uncontrolled Crossings

Tools
1. High-visibility Markings
2. Curb Extensions
3. Advanced Yield Lines

Source: Model Design Manual for Living Streets, Weisbart, Michele

Source: walkinginfo.org
Uncontrolled Crossings

RRFBs
• FHWA issued Interim Approval (IA-11) in July 2008
• Caltrans requested and received blanket approval in California in August 2011

Pedestrian Hybrid Beacon
• CAMUTCD includes Guidelines for the Installation of Pedestrian Hybrid Beacons
• Minimum pedestrian volume = 20 (but depends on major street traffic volume and crossing distance)
Group Activity!
Group Activity

• What Complete Streets goals are being met?
• Who are key stakeholders?
• What are potential roadblocks?
• What are potential trade-offs?
• What are potential feasibility/constructability opportunities and challenges?
80’ Right of Way Mid Century Corridor
Applied Standard – (needs 22’ of right of way)
Restriping with maintenance
Buffered Bike Lanes
Raised Median
Undivided 4-lane Arterial
Typical Road Diet
Folsom Boulevard
Riverside Avenue