Design Considerations

JUNE 5TH, 2018
Design Considerations

• Design Flexibility
• Pedestrian and bicycle design concepts and tools
• How to make it fit
Design Flexibility
Design Flexibility

• 2010 USDOT Policy Statement

“...DOT encourages transportation agencies to **go beyond the minimum requirements**, and proactively provide convenient, safe, and **context-sensitive facilities** that foster **increased use by bicyclists and pedestrians of all ages and abilities**, and utilize universal design characteristics when appropriate.”

http://www.fhwa.dot.gov/environment/bicycle_pedestrian/overview/policy_accom.cfm
Design Flexibility

• 2016 FHWA resource
  “Achieving Multimodal Networks”

Design Flexibility

• 2013 FHWA Memo
  • Supports “taking a flexible approach to bicycle and pedestrian facility design”
  • Recommends using AASHTO, ITE and NACTO guidance

• AASHTO Greenbook 2011, p xii:
  • “This policy is therefore not intended to be a detailed design manual that could supersede the need for the application of sound principles by the knowledgeable design professional. Sufficient flexibility is permitted to encourage independent designs tailored to particular situations.”

http://www.fhwa.dot.gov/environment/bicycle_pedestrian/guidance/design_guidance/design_flexibility.cfm
Design Flexibility

• IDOT BDE Manual, pg i:
  “The designer should develop roadway designs that meet the Department’s operational and safety requirements while preserving the environmental resources of an area. Designers must exercise good judgment on individual projects and, frequently, they must be innovative in their approach to roadway design. This may require, for example, additional research into the highway literature or use of other Department Manuals.”

• MODOT Engineering Policy Guide 136.7.2.1.1
  “To maximize the value of the project the LPA should strive for as much flexibility in geometric design as possible.

http://www.fhwa.dot.gov/environment/bicycle_pedestrian/guidance/design_guidance/design_flexibility.cfm
Motorist Speeds and Vulnerable Users
• 2017 National Traffic Safety Board Safety Study “Reducing Speeding-Related Crashes Involving Passenger Vehicles” p ix
  • “Speed – and therefore speeding—increases crash risk in two ways: 1) it increases the likelihood of being involved in a crash, and 2) it increases the severity of injuries sustained by all road users in a crash.”
  • “The relationship is especially critical for pedestrians involved in a motor vehicle crash, due to their lack of protection.”
Design Concepts: Speed

Speed Increases Crash Risk

Speed increases the distance to stop.

- 40 feet
- 75 feet
- 118 feet

- Source: UK Department for Transport, Highway Code Stopping Distances Quiz

Speed narrows a driver’s perspective.

- Source: National Association of City Transportation Officials, Urban Street Design Guide, Design Speed

As vehicle speed increases, the driver’s field of vision narrows and limits the view of the street.
Design Concepts: Speed

Speed Increases Crash SEVERITY

Higher speeds pose a greater risk to people walking.

Higher speeds are of a greater risk to people driving.

DRIVER’S RISK OF DEATH

- 80%
- 25%

in a side impact crash, with a seat belt fastened.

RISK OF DEATH TO A PERSON WALKING

- 10%
- 40%
- 80%


Design Concepts: Speed

• As speed and/or volume increase, separation between bicyclists and pedestrians and motor vehicle traffic should increase

• By extension, where spaces are shared, speeds and/or volumes should be kept low
Pedestrian Design Concepts & Tools
Sidewalks for safety

• Adding a sidewalk reduces pedestrian crashes by 88%

• Adding a paved shoulder reduces pedestrian crashes by 70%

• 5’ width recommended (4’ minimum throughway required by ADA)
Designing for safety

Complete sidewalk networks
Pedestrian space design
Furniture Zone

• Buffers pedestrians with plantings, furniture
• Provides snow storage space
• Aids in meeting ADA curb ramp requirements
• Plantings may calm speeds
Throughway Zone

• Guidelines:
  • 5’ – 7’ width in residential areas
  • 8’ – 12’ width in commercial areas
  • Absolute minimum of 4’ at pinch points
Throughway Zone - Driveways

Every driveway introduces a conflict point

• Limit # of driveways
• Maintain level path for pedestrians
• Accessible driveway requires level pedestrian access route:
  • Cross slope: 2% max
  • Width: 4 ft. min
Designing for accessibility

Driveway design
Pedestrian Crossing Concepts

• Speed management
• Visibility & predictability
• Crossing distance
• Convenience (network)
Managing Motorist Speeds

- Normal travel:
  - Design street for the max speeds you want, not the speeds you have
  - Reallocate excess capacity to improve accommodations for all users
  - Provide adequate delineation and frame the traveled way
  - Narrow travel lanes (less than 11’)
  - Chicaning and skinny streets (residential treatment)

- Turning:
  - Compact intersections
  - Tight curb radii
  - Raised crosswalks
Visibility tools

Markings & signs
Visibility tools

RRFB
Tools to reduce distance

Curb extensions
Tools to reduce distance

Curb extensions + stormwater
Tools to reduce distance

Median refuge islands
Bikeway Concepts & Tools
Safety in Numbers

Figure 2.3 - Estimated city-wide bicyclist crash rate, 1993-2010. Source: U.S. Census Bureau 1990-2000 Decennial Census, 2005-2011 American Community Survey
Bikeway Types
On-road Bikeway Types

Marked shared lanes

Bicycle boulevard/shared streets

Advisory shoulders/lanes

Bike lanes

Buffered bike lanes

Cycle tracks/Protected bike lanes (PBL)
Marked Shared Lanes

• Placement indicates desired path of cyclist
• Denotes a priority street for bicycling
• Minimally affect traffic patterns
• Simple to implement
• Appropriate for lower volume/lower speed streets
• Improve motorists awareness of cyclists
• Of limited appeal to many cyclists
Bicycle Boulevard

- Shared street
- Appropriate for low volumes and speeds
- Comfortable for all levels of cyclists
Bicycle Boulevard
Advisory Shoulders & Lanes

• Separate bicyclist from vehicle traffic
• Vehicles share space
• Vehicles yield to bicyclists
• Suitable on lower volume (< 6,000 ADT) roads
• More dedicated space than SLMs provide
Standard Bike Lanes

• Separate bike from vehicle traffic
• More comfortable on higher speed (> 25 mph), higher volume (> 3,000 ADT) roads
• Greater visibility than SLMs
• Appealing to more cyclists than SLMs
Standard Bike Lanes With Parking

• Safer than no bike lane
• Door zone hazards
Standard Bike Lanes

- 5’ minimum recommended width
- 6’ also OK
- 7’ or wider – consider a buffered bike lane
Buffered Bike Lanes

• May require using an existing travel or parking lane

• Appropriate for higher volume/higher speed streets (>30 mph)

• Appealing to a range of cyclists. The cyclist’s path is clearly delineated and riders are away from car traffic
Buffered Bike Lanes

• Buffer can be between bike lane and travel lane, parking lane, or both
Cycle Tracks/SBLs/PBLs

- Provides a physical separation between travel lane and bike lane
- Appropriate for higher traffic volumes and speeds
- Appealing to a wide range of cyclists
- May be at-grade or raised
- Bigger change and requires more space and potentially changes to utilities/ drainage
Cycle Tracks/PBLs
Cycle Tracks/PBLs
Off-street facilities/shared-use paths

• 10’ minimum width
• when to separate users
• materials to separate users
**Sidepaths**

- Separated from roadway
- Shared with pedestrians
- Carefully design the intersections
Intersection Design Considerations
Compact Intersections

• Reduce visual size of intersection and provide improved accommodations for people walking, biking, and taking transit
• Eliminate open, underutilized, unprogrammed space
• Tighten curb-radii
Tools to reduce distance & manage speed

Reclaim Space
Daylighting

• Remove parking and visual obstacles 20-25 feet from cross-street

SFMTA, “Daylighting” Makes San Francisco Crosswalks Safer
Intersection Markings

• Indicates the intended path for the cyclist
• Provides more visibility and increases predictability of cyclist movements
Separation in time

• Ped Hybrid Beacon (77-95% compliance)

• Signal
  • Automatic vs. actuated (esp. for mainline)
  • Pedestrian timing
    • 7 sec. min. Walk
    • 3.5 ft/sec Flashing Don’t Walk
    • Use maximum time available
Signal Tools

- Countdown signals
- Leading pedestrian intervals (LPI)
- Lagging left turn
- Reduce curb radius
Roundabouts

• Designing for People

July 10, 2018
Design Considerations - Rightsizing
# Passive vs. Proactive Design

<table>
<thead>
<tr>
<th>Passive Design</th>
<th>Proactive Design</th>
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<tbody>
<tr>
<td>• Uses past or present as basis of design</td>
<td>• Designs toward desired future conditions</td>
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<tr>
<td>• Designs for worst-case scenario</td>
<td>• Designs for realistic scenario</td>
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<tr>
<td>• Form follows standards</td>
<td>• Form follows function</td>
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<tr>
<td>• Self-fulfilling prophesies (clear zones, 85% speed, etc)</td>
<td>• Design flexibility/discretion (context-sensitivity)</td>
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Passive vs. Proactive Design

Perception of Risk

Risky Behavior
Passive vs. Proactive Design

Perception of Risk

Risky Behavior
Don’t ask “How much do we need?”

Ask:
• How much do we have?
• What do we want?
• How do we design it to fit?
No curb work required but bike facilities are tight. Requires curb work but comfortable for bicyclists of all ages/abilities.
Cross Section Example

Current State

17 ft. of extra space to work with

Community Residential Baseline
Cross Section Example

**Street Modifications** (for bike priority streets)

1. Bike facilities
   - Protected bike lane
   - Buffered bike lane
   - Standard bike lane

2. Traffic calming elements
Constrained corridor? Rightsize it!

• Convert 4-lane to 2 lanes, TWLTL, & bike lanes
• 29% crash reduction for ALL users
FHWA proven safety countermeasure

“Road diets can be low cost if planned in conjunction with reconstruction or simple overlay projects, since a road diet mostly consists of restriping. Roadways with Average Daily Traffic (ADT) of 20,000 or less may be good candidates for a road diet and should be evaluated for feasibility.”
Rightsizing tool: Narrower travel lanes

Ten feet should be the default width for general purpose lanes at speeds of 45 mph or less.

- *ITE Traffic Engineering Handbook, 7th Edition*
Rightsizing tools

On-street parking
Rightsizing tools
Add bikeway
Rightsizing tools

Parklets
Additional Questions/Discussion?