Complete Streets for Cities

Road Safety Mini Series
National League of Cities
Barbara McCann
Brooke Struve, PE
Why are we doing this? **Safety Focus**

These disparities are awful, but we know how to fix them. It’s time to reverse these patterns of exclusion and invest in safer, equitable streets. smartgrowthamerica.org/dangerous-by-d...
What are Complete Streets?

• “A complete street is safe and feels safe for everyone using the street.” -- Stephanie Pollack

• A complete streets approach means routinely improving safety and access for all road users.
The Safe System Approach: 6 Core Principles

- Death/Serious Injury is Unacceptable
- Humans Make Mistakes
- Humans are Vulnerable
- Responsibility is Shared
- Safety is Proactive
- Redundancy is Crucial
The Safe System Approach: Complete Streets

- Death/Serious Injury is Unacceptable
- Humans Make Mistakes
- Humans are Vulnerable
- Responsibility is Shared
- Safety is Proactive
- Redundancy is Crucial

Source: FHWA
Massachusetts Approach

- Training & Grant program for locals:
  - Training and technical assistance
  - Grant programs for communities with policies

- Changing the way Massachusetts DOT builds its projects
  - Updated project development guide
  - Clearing barriers
MADOT: Work with Local communities

- Technical Assistance
- Provide consulting grants to identify barriers to CS in project development process
- Require a prioritization plan based on local needs and travel patterns
  - Plans were approved by state DOT
- Provided capital funds to communities with policies and prioritization plans
- Result: Dramatic increase in CS policies (250 jurisdictions) and 160 construction grants ($70 million grants total)
MADOT: Changing the way it builds projects

- Basic principle: Make the things you want easier, and the things you don’t want, harder.
- Systematically eliminate barriers
- Massachusetts eliminated all existing design exceptions, created 3 new scenarios requiring exceptions:
  - Failure to provide safe travel for pedestrians, bicyclist, and (when present), transit vehicles.
Complete Streets Policy
Policy adoption has spread for 20 years across the United States.
A Complete Streets Policy

"... ensures that the entire right of way is planned, designed, and operated to provide safe access for all users."
An ideal complete streets policy

1) Sets a **vision**
2) Includes **all users and modes**
3) All **projects and phases**
4) Clear, accountable **exceptions**
5) Other **jurisdictions**, involved in the process
6) Inclusive **design guidelines - flexible**
7) Is **context-sensitive**
8) Sets **performance measures**
9) Provides **project selection criteria**
10) Includes **implementation** steps
Resources:
The Best Complete Streets Policies of 2018
https://smartgrowthamerica.org/resources/the-best-complete-streets-policies-of-2018/
Types of Complete Streets Policies

- Council-driven
  - Ordinance
  - Resolution

- Council-approved
  - Plans
  - City policies
  - Design guidelines

- Directives
  - Departmental policy
  - Executive order

- Citizen vote
  - Tax levy
  - Ballot measure
Poll Question

Do you have a complete streets policy?

- Yes
- No
- Under development
- I don’t know
Implementation – From Policy to Practice

- Planning for Implementation
- Changing procedure and process
- Offering training and education
- Reviewing and updating design guidance
- Measuring Performance

Source: National Complete Streets Coalition CS Implementation Guidebook
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Pedestrian Fatality Hot Spots

- Multilane roadways (97%)
- Pedestrians crossing 5+ lanes (70%)
- Speed limits 30 mph or higher (3/4)
- Volumes exceeding 25,000 vehicles per day (62%)
- Bordered by low-income neighborhoods (3/4)
- Adjacent commercial land uses (nearly all)

Multimodal Networks
Who are you accommodating?
How will you accommodate them safely?

Graphic Credit: FHWA Achieving Multimodal Networks, 2016
What about Scooters and E-Bikes?
Complete Network

- Network for each mode
- Equity for all populations
- Not all users are prioritized on all corridors
- Always provide access:
  - Across low-comfort corridors
  - Along key links

Source: METRANS Transportation Center
Complete Streets Create a Safe Network

Safety  Comfort  Connectivity

Resources:
Multimodal Connectivity Newsletter
https://www.fhwa.dot.gov/livability/newsletter/
Guidebook for Measuring Multimodal Connectivity
https://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/
Complete Streets for Freight
- Employment
- Tax benefits
- Economic output

https://ops.fhwa.dot.gov/publications/fhwahop12006/
Land Use and Transportation Planning

Source: Cambridge Systematics, Inc., 2010
Manufacturing District

- Prevent encroachment of incompatible land uses
- Buffer sub-zones
- Performance criteria for each zone

Source: City of Chicago.
Defining Truck and Emergency Routes

- Benefits
  - Informs street design to accommodate larger vehicles and greater turning radii
  - Encourages Complete Streets networks with modal priorities varying by street
Defining Truck and Emergency Routes

- Process
  - Coordinate with freight carriers and emergency service providers
  - Conduct network analysis to determine travel sheds
  - Establish and communicate truck routes and emergency service routes
  - Update street design as opportunities arise
Turning Radii

DESIGN VEHICLE

CONTROL VEHICLE

MANAGED VEHICLE

Source: NACTO, Don’t Give Up at the Intersection
Truck Apron

- Provide space for design and control vehicles
- Minimize turning radius for managed vehicle
Loading Zones

Resources:
Separated Bike Lane Planning and Design Guide
https://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/
Loading Zones
Complete Streets for Pedestrians
Shoulders

- Enhance safety for all users
- Reduce walking along the roadway pedestrian crashes by 70%
  (Gan et al study)
Sidewalks

- Reduce walking along the roadway pedestrian crashes by 88%
  (McMahon Study)

- “Sidewalks are an integral part of city streets.”
  (2011 AASHTO Green Book 4.17.1)
Sidewalk Zone System

- Curb zone
- Furniture zone
- Pedestrian zone
- Frontage zone
Driveways

Source of most conflicts between pedestrians and motor vehicles
Driveways

- Those built like intersections encourage high-speed turns
- Those built like driveways encourage slow-speed turns
Crosswalk Markings

- Indicate to pedestrians where to cross
- Indicate to motorists where to expect pedestrians
- At mid-block, legally establish a crosswalk
Where to Mark Crosswalks

Consider origins and destinations
Uncontrolled Pedestrian Crossings

- High Visibility Markings
- Illumination
- Signing
- Advance Stop Bars
- Median Islands

- Raised Crosswalks
- Curb Extensions
- RRFB
- PHB
- Pedestrian Signals
- Road Diets
Uncontrolled Pedestrian Crossings

Resources:

Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations
https://www.pedbikeinfo.org/resources/resources_details.cfm?id=5119

Evaluation of Pedestrian-related Roadway Measures:
A Summary of Available Research

Safe Transportation for Every Pedestrian (STEP)
https://safety.fhwa.dot.gov/ped_bike/step/resources/
## Selecting Design Treatments

### Table 1. Application of pedestrian crash countermeasures by roadway feature.

<table>
<thead>
<tr>
<th>Roadway Configuration</th>
<th>Posted Speed Limit and AADT</th>
<th>Vehicle AADT &lt;9,000</th>
<th>Vehicle AADT 9,000–15,000</th>
<th>Vehicle AADT &gt;15,000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>≤30 mph</td>
<td>35 mph</td>
<td>≥40 mph</td>
</tr>
<tr>
<td>2 lanes</td>
<td>(1 lane in each direction)</td>
<td>1</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>3 lanes with raised median</td>
<td>(1 lane in each direction)</td>
<td>1</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>3 lanes w/o raised median</td>
<td>(1 lane in each direction with a two-way left-turn lane)</td>
<td>1</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>4+ lanes with raised median</td>
<td>(2 or more lanes in each direction)</td>
<td>1</td>
<td>4</td>
<td>2</td>
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<td>2</td>
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</tbody>
</table>

Given the set of conditions in a cell:

- **#** Signifies that the countermeasure is a candidate treatment at a marked uncontrolled crossing location.
- **•** Signifies that the countermeasure should always be considered, but not mandated or required, based upon engineering judgment at a marked uncontrolled crossing location.
- **○** Signifies that crosswalk visibility enhancements should always occur in conjunction with other identified countermeasures.*

The absence of a number signifies that the countermeasure is generally not an appropriate treatment, but exceptions may be considered following engineering judgment.

1. High-visibility crosswalk markings, parking restrictions on crosswalk approach, adequate nighttime lighting levels, and crossing warning signs
2. Raised crosswalk
3. Advance Yield Here To (Stop Here For) Pedestrians sign and yield (stop) line
4. In-Street Pedestrian Crossing sign
5. Curb extension
6. Pedestrian refuge island
7. Rectangular Rapid Flashing Beacon (RRFB)**
8. Road Diet
9. Pedestrian Hybrid Beacon (PHB)**

*Ref to Chapter 4. Using Table 1 and Table 2 to Select Countermeasures, for more information about using multiple countermeasures.

**It should be noted that the PHB and RRFB are not both installed at the same crossing location.

### Selecting Design Treatments

#### Table 2. Safety issues addressed per countermeasure.

<table>
<thead>
<tr>
<th>Pedestrian Crash Countermeasure for Uncontrolled Crossings</th>
<th>Safety Issue Addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Conflicts at crossing locations</td>
</tr>
<tr>
<td>Crosswalk visibility enhancement</td>
<td></td>
</tr>
<tr>
<td>High-visibility crosswalk markings*</td>
<td></td>
</tr>
<tr>
<td>Parking restriction on crosswalk approach*</td>
<td></td>
</tr>
<tr>
<td>Improved nighttime lighting*</td>
<td></td>
</tr>
<tr>
<td>Advance Yield Here To (Stop Here For) Pedestrians sign and yield (stop) line*</td>
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</tr>
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<td></td>
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<tr>
<td>Rectangular Rapid-Flashing Beacon</td>
<td></td>
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</table>

*These countermeasures make up the STEP countermeasure “crosswalk visibility enhancements.” Multiple countermeasures may be implemented at a location as part of crosswalk visibility enhancements.
Advance Stop/Yield

First car stops for pedestrian, too close to crosswalk, blocking visibility to second lane

Pedestrian steps out, doesn’t see second car not stopping

First car stops for pedestrian opening up sign triangle to include second lane

Pedestrian steps out, sees second car not stopping, steps back
Lighting Crosswalks
Lighting Crosswalks

Figure 13. Drawing. Traditional intersection lighting layout.

Figure 14. Drawing. New design for intersection lighting layout for crosswalks.
Intersection Geometry

- Small, tight intersections are best for pedestrians
  - Simple
  - Fewer conflicts
  - Slower speeds
Mitigation for Large Intersections
Curb Extensions

- Improve sight distance
  - Pedestrians and motorists
  - Motorists and signs
- Curb ramps
- Slow-speed turns
- Pedestrian storage
Channelizing & Crossing Islands

High speed, head turner = low visibility of pedestrians

Slow speed, good angle = good visibility of pedestrians

Wide angle

Tighter angle

55 to 60 degree angle between vehicle flows
Transforming an Intersection (Makati, The Philippines)

Image source: Arvin Estrada, PGAA Creative Design

https://m.facebook.com/story.php?story_fbid=10161162517024488&id=772454487
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Complete Streets for Bicyclists
Key Factors for Bicyclist Safety

- Speed
- Number of lanes
- Traffic volume & composition
- Conflict points
- Visibility/Conspicuity
- Proximity
- Bike control
- Connectivity

Speed

Vehicle traveling at 20 MPH

9 out of 10 pedestrians survive.

Vehicle traveling at 30 MPH

5 out of 10 pedestrians survive.

Vehicle traveling at 40 MPH

1 out of 10 pedestrians survive.
Number of Lanes
Traffic Volume & Composition
Conflict Points

Image source: Bike Walk Encinitas
Visibility and Conspicuity
Proximity
Bike Control
Connectivity

Corridor 1: I-680, Contra Costa County

Out of Direction Travel
- < 1/3 Mile (High Permeability)
- 1/3 Mile to 2/3 Mile
- 2/3 Mile to 1 Mile
- 1 Mile to 1 1/3 Mile
- > 1 1/3 Mile (Low Permeability)

Existing Bicycle Network

Facility Type
- Class I Shared Use Path
- Class II Bike Lane
- Class III Bike Route/Shared Lane
Key Factors for Bicyclist Safety

- Speed
- Number of lanes
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- Conflict points
- Visibility/Conspicuity
- Proximity
- Bike control
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Bicyclist Design User Profiles

**BICYCLIST DESIGN USER PROFILES**

**Interested but Concerned**

- 51%-56% of the total population
- Often not comfortable with bike lanes, may bike on sidewalks even if bike lanes are provided; prefer off-street or separated bicycle facilities or quiet or traffic-calmed residential roads. May not bike at all if bicycle facilities do not meet needs for perceived comfort.

**Somewhat Confident**

- 5-9% of the total population
- Generally prefer more separated facilities, but are comfortable riding in bicycle lanes or on paved shoulders if need be.

**Highly Confident**

- 4-7% of the total population
- Comfortable riding with traffic; will use roads without bike lanes.

Resources:
Bikeway Selection Guide
https://safety.fhwa.dot.gov/ped_bike/tools_solve/
Conventional Bike Lanes (High Speed and Volume Environments)
Conventional Bike Lanes (Low Speed Environments)
Buffered Bike Lanes (High Speed and Volume Environments)
Separated Bike Lane - Reconstruction
Shared Use Paths
Neighborhood Greenways (aka Bike Boulevards)
Low-stress Bicycle Network

- Separated bike lanes and shared use paths
- Low-speed and low-volume streets with characteristics of bicycle boulevards
- By serving a broad audience, maximize system use
- Bicycling rates of 5 to 15% in the United States.
Bikeway Selection
City, Small Town, and Suburban Roadways

Identifies the **preferred** bikeway type.

**Design User Assumption:**
Interested but concerned cyclist

**Analysis:**
Bicycle Level of Traffic Stress
## Bikeway Traffic Control Devices

### Bicycle Facilities and the Manual on Uniform Traffic Control Devices

#### Background
The Federal Highway Administration receives occasional inquiries about what bicycle facilities, signals, and markings are permitted in the [Manual on Uniform Traffic Control Devices (MUTCD)](https://www.fhwa.dot.gov/environment/bicycle_pedestrian/guidance/mutcd/). The table below lists various bicycle-related signs, markings, signals, and other treatments and identifies their status (e.g., can be implemented, currently experimental) in the 2009 version of the MUTCD.

If you have MUTCD related questions, please contact [David Krueger](mailto:David.Krueger@FHWA.dot.gov), MUTCD Team.

<table>
<thead>
<tr>
<th>Subject to Experimentation</th>
<th>Available through Interim Approval</th>
<th>Interpretations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two-Stage Turn Box</td>
<td>Green-Colored Pavement</td>
<td>Use of RA-11 Sign on Roads with Speed Limits Above 35mph</td>
</tr>
<tr>
<td>Dashed Bicycle Lanes</td>
<td>Alternate Design for the U.S. Bicycle Route MTI-51 Sign</td>
<td>Modified Bicycle Destination Sign</td>
</tr>
</tbody>
</table>

Resources:
Bicycle Facilities and the Manual on Uniform Traffic Control Devices
Bike Lane Extension Lines

7th Ave, Seattle, WA

14th Ave, Denver, CO
Bike Lane Extension Lines
Bike Box

- Reduced conflicts between bicyclists and turning vehicles
- Reduced avoidance maneuvers
- Reduced encroachment into crosswalks
- Use clearly understood by motorists and bicyclists
Two-stage Turn Boxes

Typical left turn movements by cyclists through an intersection

2- Stage Turn Box formalizes left turn movement currently allowed by traffic laws
Two-stage Turn Boxes
Transforming an Intersection (Scheveningen, The Netherlands)

Image source: Dutch Cycling Embassy https://www.
https://www.facebook.com/dutchcyclingembassy/posts/4490328967725464
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Complete Streets for Transit
Goal of Transit

- Carry passengers between residences, employment, and other destinations in a safe, efficient, and reliable manner
- Physical safety of ALL passengers is vital to the success of any transit system- not only to retain riders, but to encourage new riders
Agency Considerations

- Focus Resources on Needs
  - High usage
    - Busy corridors
    - Stops for key generators and transfers
  - Infrastructure gaps
    - Sidewalks
    - Crossings
    - ADA
  - Safety
    - High crash or high risk
Passenger Demand
Key Generators

- Understand activities and locations that generate demand
- Understand pedestrian paths
Catchment Area

- Bus Stop
- Bus Stop Catchment Area
- Corridor Catchment Area

¼ mile
Bus Stop Locations

- Bus stops near intersections encourage crossings at the intersection
- Mid-block bus stops create demand for mid-block crossings
Bus Stop Locations

Bus stops at transfer locations—avoid street crossings
Putting it all together with Implementation Strategies
Implementation – from policy to practice

Prioritization

- Complete Streets projects should receive higher scores
Poll Question

Do you have an implementation plan?

- Yes
- No
- Under development
- I don’t know

In the chat: what kind of implementation plan do you have?
Implementation – From Policy to Practice

Design standard updates
Optimum for all modes
Considerations
Implementation – From Policy to Practice

Checklist for project development

- Modal Plans
- Historic Zone
- Urban Tree Plan
- Lighting Requirements
- Utility Plans
- Overlay Zones
- Greenway & Open Space Plans
Implementation – from policy to practice

Modal Plans
- Transit Plan
- Freight Plan
- Bike Plan
- Pedestrian Plan
Implementation – from policy to practice

New performance measures

Example:

Measure the success of this complete streets policy using the following performance measures:

a. Total miles of on-street bicycle routes defined by streets with clearly marked or signed bicycle accommodation
b. Linear feet of new pedestrian accommodation
c. Number of new curb ramps installed along city streets
d. Number of new street trees planted along city streets
Considerations for Successful Implementation

- Cross-jurisdictional and regional coordination
- Internal project development processes and protocols
- External partners including utility companies, private developers, emergency services, transit providers, etc.
- Dedicated staff and funding sources
- Street typology vs. functional classification
- Synergy with Vision Zero, SRTS, etc.
- Quick-build and pilot projects
Implementation – from policy to practice

Consultants

- Ensure that RFPs require expertise in planning and designing for all modes
Implementation – From Policy to Practice

Training for Planners, Designers and Engineers
Coming Soon

- Complete Streets Web portal under development for
  - New CS introductory products
  - Links to existing resources
Coming Soon

- CS Transformations fact sheet with simple arterial conversion scenarios
- Complete Streets At-A-Glance for planners
- Resources on performance measures, operational considerations, and more
Poll Question

In the chat:
What can FHWA do to support you in your efforts to implement complete streets?