Pedestrian and Bicycle Crash Types and Countermeasures

Traffic Topics
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Overview

- Crashes
  - Who
  - Common types
- Design features that affect safety
- Countermeasure options
  - Research on safety
  - MUTCD compliant?
Pedestrian and Bicycle Crashes in 2013

- 868 pedestrian injuries or fatalities
- 35 pedestrians killed
- 822 bicyclist injuries or fatalities
- 6 bicyclists killed
Most at Risk

- Persons under 25
- Male

7 KILLED on Minnesota roads

Persons under 25 years old account for 18% of pedestrians killed and 40% of pedestrians injured.

Males account for 73% of pedestrian fatalities.

875 injured on Minnesota roads

73% males, 27% females

25 years old account for nearly 50% of cyclists injured.
Common Pedestrian Crashes

- Dart-Out
- Dash
- Midblock crossing
- Walking along roadway
- Turning vehicle
- Nighttime crashes more severe
Common Bicyclist Crashes

- Stop controlled intersections
- Alleys/driveways
- Motorist taking a left
- Cyclist taking a left
- Right hook
Roadway Features

- General roadway factors that affect safety:
  - Lack of sidewalks
  - High traffic volumes
  - High vehicle speeds
  - Wide roads
  - Lack of medians on multi-lane roads
  - Lighting
  - Intersection geometrics
Vehicle Speeds

- Higher speeds are more likely to be fatal
Countermeasure Options

- Along the road
  - Sidewalks/Trails
  - Street furniture/other improvements
- Shared lane markings
- Bike lanes
- Buffered bike lanes
- Cycle tracks
- Contra flow lanes
Countermeasure Options

- Crossing locations
  - Curb extensions
  - Islands
  - Raised pedestrian crossings
  - Crosswalk enhancements
  - Lighting
  - Parking restrictions
  - Overpasses/underpasses
  - Automated pedestrian detection
  - Leading pedestrian intervals
  - Bike boxes
  - Bike signals
  - Green paint
Countermeasure Options

- **Roadway Design**
  - Lane narrowing
  - **Road diets**
  - Driveway improvements
  - Raised medians
  - Improved right-turn slip lanes
  - **Drainage**

- **Intersection Design**
  - Roundabouts
  - Curb radius reduction
  - Modify skewed intersections
  - Modify complex interchanges
Countermeasure Options

- Traffic Calming Devices
  - Temporary traffic control devices
  - Chokers
  - Chicanes
  - Mini-circles
  - Speed humps
  - Speed tables
  - Gateways
  - Landscaping
  - Paving treatments
  - Serpentine design
Countermeasure Options

- Traffic Management Measures
  - Diverters
  - Full street closure
  - Partial street closure
  - Bike boulevards
  - Left turn prohibition
Countermeasure Options

- Signs and Signals
  - Traffic signals
  - Pedestrian signals
  - Pedestrian signal timing
  - Traffic signal enhancements
  - RTOR restrictions
  - Advanced stop signs/markings
  - Leading pedestrian interval
  - Left-turn phasing
  - Push buttons and signal timing
  - Pedestrian hybrid beacon
  - RRFB
  - Puffin crossing
Countermeasure Options

- Others
  - School zone treatments
  - Neighborhood identity
  - Speed monitoring
  - **On-street parking enhancements**
  - Pedestrian & driver education
  - Police enforcement
  - Automated enforcement
  - Pedestrian streets and malls
  - Work zone measures
  - RR crossing treatments
  - Shared streets
# Crash Type Matrix

View the Performance Objective Matrix [here](#).

<table>
<thead>
<tr>
<th>Crash Type</th>
<th>Along Roadway</th>
<th>Crossing Locations</th>
<th>Transit</th>
<th>Roadway Design</th>
<th>Intersection Design</th>
<th>Traffic Calming</th>
<th>Traffic Mgmt.</th>
<th>Signals</th>
<th>Other</th>
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<td>Through Vehicle at Unsignalized Location</td>
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<td>Through Vehicle at Signalized Location</td>
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<td>Working or Playing in Roadway</td>
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<td>Crossing an Expressway</td>
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<td>Crash Group</td>
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<td>1. Motorist failed to yield -- signalized intersection</td>
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<td>2. Motorist failed to yield -- non-signalized intersection</td>
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<td>3. Bicyclist failed to yield -- signalized intersection</td>
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<td>4. Bicyclist failed to yield -- non-signalized intersection</td>
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<td>5. Motorist drove out -- midblock</td>
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<td>6. Bicyclist rode out -- midblock</td>
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<td>7. Motorist turned or merged left into path of bicyclist</td>
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<td>8. Motorist turned or merged right into path of bicyclist</td>
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<td>9. Bicyclist turned or merged left into path of motorist</td>
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<td>10. Bicyclist turned or merged right into path of motorist</td>
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<td>11. Motorist overtaking bicyclist</td>
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<td>12. Bicyclist overtaking motorist</td>
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<td>13. Non-motor vehicle crashes</td>
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Drainage Considerations

4 Feet
Shared Lane Markings
Bicyclists may use the bike box to make left turns where permitted.

Bicyclists can ride into the bike box while waiting for a green signal.

Motorists must yield to thru bicyclists.

At red lights, motorists must stop and wait behind the stop bar.
Motorists should drive to the left of the buffer

Do not use the bike lane to pass other vehicles

Bicyclists ride in the bike lane
Bicyclists should watch for pedestrians exiting vehicles.
Road Diets

- Benefits
  - Adding bicycle lanes
  - Traffic calming/speed reduction
  - Crash reduction
  - Pedestrian safety
  - Turn lane space
Advanced Stop Lines

- Stop line and sign placed 20 to 50 feet ahead of unsignalized, mid-block marked crosswalk
  - Increases visibility of pedestrians
  - Great for multiple threat situations
  - If placed too far in advance of crossing, motorists may ignore the line
Leading Pedestrian Interval

- Walk signal given 3-7 seconds before parallel street green
- Minimizes conflicts by allowing pedestrians to enter the intersection before vehicles
- Right turn on red CAN be prohibited, or dynamically prohibited, but can still be effective without the prohibition
- CMF – 0.95 (ITE, 2004)
Leading Pedestrian Interval
Leading Pedestrian Interval

- Baseline
- 3 second LPI
- 3rd & Central Ave
- 4th & Central Ave
- 5th & Central Ave

Graph showing conflicts per 100 pedestrians (rest of cycle) vs. sessions.
RRFB
Why so effective?
- Rapid flashing sequence
- Brighter lights
- Ability to aim the LEDs

 Warns drivers of pedestrian presence
 Increased yielding from 18% to 81%
 Does not lose effectiveness – over 2 years effectiveness still over 80%
 Can go overhead for multilane roads, but no studies on effectiveness
Pedestrian Hybrid Beacon

- Creates a legal requirement to stop
  - APS
  - Countdown pedestrian signals
- Can be coordinated
- Better mid-block but can be used at intersections
- Pedestrian activated
- Addresses multiple threat crashes, can be used where signal warrants aren’t met
Pedestrian Hybrid Beacon at 12th Ave in St. Cloud EB
What Drivers See:  
Dark

What Pedestrians See:  
push the button

Flashing

Steady

Start Crossing

Alternating (like RxR)  
Stop then go if clear

Continued Crossing

Dark
Summary

- 95 percent compliance rate
- 29 percent reduction in total crashes
- 69 percent reduction in pedestrian crashes
- Installed mid-block or at least 100 ft from intersection
- No cross street indications
Flexible Bollards

- Creates temporary curb lines
- Visible
- Maintenance
Education

- Walk! Bike! Fun!
- Share the Road
- Share the Road
Enforcement

• Campaigns
• Automated
• Advertise
• Signs with fines listed
Questions?

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