FHWA’s 2017 Update of the Proven Safety Countermeasures

Make Your Mark
A Local Safety Peer Exchange
March 26, 2019
Life Cycle of a Safety Countermeasure

- Experimental
- Tried
- Proven

- Pilot
- High Crash Location
- Systemic
- Policy
<table>
<thead>
<tr>
<th>Intersection</th>
<th>Roadway Departure</th>
<th>Pedestrian</th>
<th>Crosscutting Strategies</th>
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</table>
| • Left- and Right-Turn Lanes at Two-Stop Controlled Intersections  
• Backplates with Retroreflective Borders  
• Corridor Access Management  
• Yellow Change Interval  
• Roundabouts  
• Systemic Application of Multiple Low Cost Countermeasures at Stop-Controlled Intersections*  
• Reduced Left-Turn Conflict Intersections* | • Longitudinal Rumble Strips and Stripes along Two-Lane Highways  
• Median Barrier  
• SafetyEdgeSM  
• Enhanced Delineation and Friction for Horizontal Curves  
• Roadside Design Improvements at Curves* | • Medians and Pedestrian Crossing Islands in Urban and Suburban Areas  
• Pedestrian Hybrid Beacon  
• Road Diet  
• Walkways  
• Leading Pedestrian Intervals* | • Road Safety Audits  
• Local Road Safety Plans*  
• US Limits* |
PSCi – Intersections

- Left- and Right-Turn Lanes at Two-Way Stop-Controlled Intersections
- Backplates with Retroreflective Borders
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- Systemic Application of Multiple Low-Cost Countermeasures at Stop-Controlled Intersections
- Reduced Left-Turn Conflict Intersections
Left and Right Turn Lanes at Two-Way Stop-Controlled Intersections

SAFEy BENEFITS:

LEFT-TURN LANES
28-48%
Reduction in total crashes

RIGHT-TURN LANES
14-26%
Reduction in total crashes

Source: Highway Safety Manual
Backplates with Retroreflective Borders

Safety Benefit:
15% Reductions in total crashes

Source: CMF Clearinghouse, CMF ID 1410.
Corridor Access Management

SAFETY BENEFITS:

5-23%
Reduction in total crashes along 2-lane rural roads

25-31%
Reduction in injury and fatal crashes along urban/suburban arterials

Source: Highway Safety Manual
Safety Benefits of Well-Timed Yellow Change Intervals:

- 36-50% Reduction in red light running
- 8-14% Reduction in total crashes
- 12% Reduction in injury crashes

Roundabouts

Two-Way Stop-Controlled Intersection to a Roundabout

Signalized Intersection to a Roundabout

82% Reduction in severe crashes

78% Reduction in severe crashes

Source: Highway Safety Manual
Systemic Application of Multiple Low Cost Countermeasures at Stop-Controlled Intersections

• Mostly signing & pavement marking enhancements.
• Strategy relies on cost economy and treatment saturation.
• Best suited for intersections with under 20,000 AADT Total Entering.

Average Benefit/Cost Ratio
12:1
Systemic Approach for Stop Intersections

Evaluation Results from LCSI-PFS Study:
• Sample consisted of 434 treated sites and 568 reference sites across South Carolina.
• Included 2X2 (3-leg, 4-leg) and 4X2 (3-leg, 4-leg) sites.
• Range of 3-5 years before and after data.

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<th></th>
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<th>Right Angle</th>
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<tr>
<td>CMF</td>
<td>0.917</td>
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<td>0.933</td>
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Source: SCDOT
Reduced Left-Turn Conflict Intersections (MUT and RCUT)

• Geometric designs that alter how left-turn movements occur.
• Simplify and reduce or modify conflicts related to turning.
• Proven safety and operational benefits.
# Reduced Left-Turn Conflict Intersections

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<td>Crossing</td>
<td>16</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Merging</td>
<td>8</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Diverging</td>
<td>8</td>
<td>6</td>
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</tr>
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<td>Total</td>
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Sources: FHWA-SA-14-069, FHWA-SA-14-070
Reduced Left-Turn Conflict Intersections

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**MUT Safety Performance**
- 30% decrease F&I Crashes.
- 16% decrease All Crashes.

**RCUT Safety Performance**
- 54% decrease F&I Crashes.
- 35% decrease All Crashes.

Sources: FHWA-SA-14-069, FHWA-SA-14-070
PSCI – Roadway Departure

- Longitudinal Rumble Strips and Stripes along Two-Lane Highways
- Median Barrier
- SafetyEdge℠
- Enhanced Delineation and Friction for Horizontal Curves
- Roadside Design Improvements at Curves
Longitudinal Rumble Strips and Stripes

SAFETY BENEFITS:

Center Line Rumble Strips 44-64%
Head-on, opposite-direction, and sideswipe fatal and injury crashes

Shoulder Rumble Strips 13-51%
Single vehicle, run-off-road fatal and injury crashes

Source: NCHRP Report 641, Guidance for the Design and Application of Shoulder and Centerline Rumble Strips
Median Barrier

SAFETY BENEFITS:
Median Barriers Installed on Rural Four-Lane Freeways
97%
Reduction in cross-median crashes

Source: NCHRP Report 794, Median Cross-Section Design for Rural Divided Highways

Median cable barrier prevents a potential head-on crash.
SAFETY BENEFIT:

11%
Reduction in fatal and injury crashes

Source: Safety Effects of the SafetyEdge<sub>SM</sub>, FHWA-SA-17-044

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<td>Drop-Off</td>
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<tr>
<td>ROR</td>
<td>0.790</td>
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<tr>
<td>Head-on</td>
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<tr>
<td>F+I</td>
<td>0.892</td>
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<tr>
<td>Total</td>
<td>0.989</td>
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Enhanced Delineation and Friction for Curves

SAFETY BENEFITS:
Chevron Signs
25%
Reduction in nighttime crashes
16%
Reduction in non-intersection fatal and injury crashes
Source: CMF Clearinghouse, CMF IDs 2438 and 2439

SAFETY BENEFITS:
High Friction Surface Treatment
52%
Reduction in wet road crashes
24%
Reduction in curve crashes
Source: CMF Clearinghouse, CMF IDs 7900 and 7901
Roadside Design Improvements at Curves

• Increase clear zone at curves.
  – Recommended by AASHTO RDG.
  – Proven to reduce crashes.

• Improve traversability.
  – Adding or widening shoulders in curves.
  – Flatter slopes at curves than in tangent sections.

• Reconsider when to install barrier
  – Reduce severity.
Roadside Design Improvements at Curves

Increase Clear Zone on the Outside of Curves

27% of all fatal crashes occur at curves
80% of all fatal crashes at curves are roadway departure crashes

Source: Leidos. Data Source: CMF Clearinghouse (CMF IDs 35 and 36)
PSCi – Pedestrians & Bicycles

- Medians and Pedestrian Crossing Islands in Urban and Suburban Areas
- Pedestrian Hybrid Beacon
- Road Diet
- Walkways
- Leading Pedestrian Intervals
Medians and Pedestrian Crossing Islands

SAFETY BENEFITS:

Raised Median
46%
Reduction in pedestrian crashes

Pedestrian Crossing Island
56%
Reduction in pedestrian crashes

Source: Desktop Reference for Crash Reduction Factors, FHWA-SA-08-011, September 2008, Table 11
Pedestrian Hybrid Beacons

Safety Benefits:

- **69%**
  Reduction in pedestrian crashes

- **29%**
  Reduction in total crashes

- **15%**
  Reduction in serious injury and fatal crashes

Source: CMF Clearinghouse, CMF IDs: 2911, 2917, 2922
Road Diets

SAFETY BENEFIT:

4-Lane → 3-Lane Road Diet Conversions
19-47% Reduction in total crashes

Source: Evaluation of Lane Reduction "Road Diet" Measures on Crashes, FHWA-HRT-10-053.
Walkways

SAFETY BENEFITS:

Sidewalks 65-89%
Reduction in crashes involving pedestrians walking along roadways

Paved Shoulders 71%
Reduction in crashes involving pedestrians walking along roadways

Source: Desktop Reference for Crash Reduction Factors, FHWA-SA-08-011, Table 11
Leading Pedestrian Interval

- Pedestrians get “WALK” signal before vehicles get green light.
- Provides pedestrians a 3-7 second head start before vehicles are given a green indication.
- Allows pedestrians to establish presence in crosswalk before vehicles have priority to turn left.
Leading Pedestrian Interval

Benefits:

- 60% reduction in pedestrian-vehicle crashes at intersections.
- Increased visibility of crossing pedestrians.
- Reduced conflicts between pedestrians and vehicles.
- Increased likelihood of motorists yielding.
PSCi – Crosscutting Strategies

- Road Safety Audits
- Local Road Safety Plans
- USLIMITS2
Road Safety Audits

A road safety audit is a proactive formal safety performance examination of an existing or future road or intersection by an independent and multi-disciplinary team.

SAFETY BENEFIT:

10-60% Reduction in total crashes

Source: Road Safety Audits: An Evaluation of RSA Programs and Projects, FHWA-SA-12-037; and FHWA Road Safety Audit Guidelines, FHWA-SA-06-06.
Local Road Safety Plans

• Developing an LRSP is an effective strategy to improve local road safety.

• Local roads experience 3X the fatality rate of the Interstate Highway System.
USLIMITS2

• Free Web-based Tool
• Designed to help practitioners assess and establish safe, reasonable and consistent speed limits
• Supports customary engineering studies
• Produces unbiased and objective suggested speed limit value based on:
  – 50th and 85th percentile speeds
  – Traffic volumes
  – Roadway characteristics
  – Crash data
PSCi – Available Resources

http://safety.fhwa.dot.gov/provencountermeasures

- 1-pager marketing flyers.
- Slides from webinar and link to recorded session.
- Links to additional FHWA resources for each item.
Contacts for Further Information

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  USLIMITS2 – Guan Xu  guan.xu@dot.gov  (202) 366-5892
Additional Resources

• Crash Modification Factors Clearinghouse
  – http://www.cmfclearinghouse.org

• Systemic Safety Project Selection Tool
  – http://safety.fhwa.dot.gov/systemic

• US Roadway Assessment Program
  – http://www.usrap.org/

• Pedestrian and Bicycle Crash Analysis Tool
  – http://www.pedbikeinfo.org/pbcat_us/
Time to Share!!!

• Which of these countermeasures have you tried in your jurisdiction?
  – Successes?
  – Challenges?

• Have adopted any of these countermeasures into agency policies or design standards?

• What other proven safety countermeasures have you tried in your jurisdiction?