B3 – Provide left-turn control at intersections
TIME
WHERE TO USE
– Unsignalized intersections with high frequency of right-angle crashes related to lack of driver awareness of the presence of the intersection.

B4 – Provide left-offense vehicle facilities
TIME
WHERE TO USE
– Unsignalized intersections where installation of signals is being considered.

B5 – Provide longer right-turn lanes at intersections
TIME
WHERE TO USE
– Medium- to high-volume unsignalized

B6 – Provide right-turn control at intersections
TIME
WHERE TO USE
– Unsignalized intersections with high frequency of right-angle crashes related to lack of driver awareness of the presence of the intersection.

C1 – Clear sight triangles on stop- or yield-controlled approaches to intersections
TIME
WHERE TO USE
– Unsignalized intersections with operational and traffic laws.

C2 – Clear sight triangles in the median of divided high-speed highways
TIME
WHERE TO USE
– Unsignalized intersections with restricted sight distance and patterns of crashes related to lack of sight distance due to narrowed vehicle width or height.

C3 – Provide horizontal and/or vertical alignment of approaches to provide more sight distance
TIME
WHERE TO USE
– Unsignalized intersections with restricted sight distance and patterns of crashes related to lack of sight distance due to narrowed vehicle width or height.

C4 – Eliminate parking that restricts sight distance
TIME
WHERE TO USE
– Unsignalized intersections with restricted sight distance and patterns of crashes related to lack of sight distance due to narrowed vehicle width or height.

C5 – Install split signing on the minor-road approach
TIME
WHERE TO USE
– Medium to high-volume unsignalized

C6 – Provide a stop bar or provide a wider stop bar on minor-road approaches
TIME
WHERE TO USE
– Where stop-controlled approaches to unsignalized

C7 – Install large regulatory and warning signs
TIME
WHERE TO USE
– Unsignalized intersections with restricted sight distance and patterns of crashes related to lack of sight distance due to narrowed vehicle width or height.

C8 – Civil attention to the intersection by installing roadside signs
TIME
WHERE TO USE
– Extremely high-volume unsignalized

B7 – Provide longer right-turn lanes at intersections
TIME
WHERE TO USE
– Unsignalized intersections that experience a high proportion of run-off-road crashes as a result of driver error or reaction time limitations.

B8 – Provide longer right-turn lanes at intersections
TIME
WHERE TO USE
– Unsignalized intersections with high frequency of right-angle crashes related to lack of driver awareness of the presence of the intersection.

B9 – Provide longer right-turn lanes at intersections
TIME
WHERE TO USE
– Unsignalized intersections with operational and traffic laws.

C9 – Install horizontal and/or vertical alignment
TIME
WHERE TO USE
– Unsignalized intersections with restricted sight distance and patterns of crashes related to lack of sight distance due to narrowed vehicle width or height.

C10 – Provide a stop bar or provide a wider stop bar
TIME
WHERE TO USE
– Where stop-controlled approaches to unsignalized

C11 – Bracket or eliminate turning maneuvers by
TIME
WHERE TO USE
– Unsignalized intersections with operational and traffic laws.

C12 – Bracket or eliminate turning maneuvers by
TIME
WHERE TO USE
– Unsignalized intersections with restricted sight distance and patterns of crashes related to lack of sight distance due to narrowed vehicle width or height.

C13 – Bracket or eliminate "high-risk" intersection
TIME
WHERE TO USE
– Unsignalized intersections with high levels of intersection-related crashes that allow alternative or different turning maneuvers that do not resolve the problem of high crashes or that are not feasible or not acceptable.

C14 – Convert four-legged intersections to two
TIME
WHERE TO USE
– Unsignalized intersections with high volumes.

C15 – Convert four-legged intersections to two
TIME
WHERE TO USE
– Unsignalized intersections with high volumes.

C16 – Reduce offset intersections to four-legged intersections
TIME
WHERE TO USE
– Unsignalized intersections where through traffic or access streets are very heavy.

C17 – Convert four-legged intersections to three
TIME
WHERE TO USE
– Unsignalized intersections with high volumes.

C18 – Convert four-legged intersections to two
TIME
WHERE TO USE
– Unsignalized intersections with high volumes.

C19 – Convert four-legged intersections to two
TIME
WHERE TO USE
– Unsignalized intersections with high volumes.

B10 – Provide full-width paved shoulders in
TIME
WHERE TO USE
– Unsignalized intersections with existing left-turn facilities on major roads.

B11 – Provide left-turn and high-offense traffic
TIME
WHERE TO USE
– Unsignalized intersections with restricted sight distance and patterns of crashes related to lack of sight distance due to narrowed vehicle width or height.

B12 – Provide left-turn and high-offense traffic
TIME
WHERE TO USE
– Unsignalized intersections with restricted sight distance and patterns of crashes related to lack of sight distance due to narrowed vehicle width or height.

B13 – Provide longer right-turn lanes at intersections
TIME
WHERE TO USE
– Unsignalized intersections where the presence of the intersection or the stop sign is not readily visible to approaching motorists. The strategy is particularly appropriate for intersections where the presence of the intersection or the stop sign is not readily visible to approaching motorists. The strategy is particularly appropriate for intersections where motorists are not familiar with the location of the intersection.

B14 – Provide improved sight distance at
TIME
WHERE TO USE
– Unsignalized intersections with restricted sight distance and patterns of crashes related to lack of sight distance due to narrowed vehicle width or height.

B15 – Provide improved sight distance at
TIME
WHERE TO USE
– Unsignalized intersections with restricted sight distance and patterns of crashes related to lack of sight distance due to narrowed vehicle width or height.

B16 – Provide improved sight distance at
TIME
WHERE TO USE
– Unsignalized intersections with restricted sight distance and patterns of crashes related to lack of sight distance due to narrowed vehicle width or height.

B17 – Provide improved sight distance at
TIME
WHERE TO USE
– Unsignalized intersections with restricted sight distance and patterns of crashes related to lack of sight distance due to narrowed vehicle width or height.

B18 – Provide pedestrian and bicycle facilities
TIME
WHERE TO USE
– Unsignalized intersections where crash data has been collected and analyzed.

C10 – Provide a stop bar or provide a wider stop bar
TIME
WHERE TO USE
– Where stop-controlled approaches to unsignalized

C11 – Bracket or eliminate turning maneuvers by
TIME
WHERE TO USE
– Unsignalized intersections with operational and traffic laws.

C12 – Bracket or eliminate turning maneuvers by
TIME
WHERE TO USE
– Unsignalized intersections with restricted sight distance and patterns of crashes related to lack of sight distance due to narrowed vehicle width or height.

C13 – Bracket or eliminate "high-risk" intersection
TIME
WHERE TO USE
– Unsignalized intersections with high levels of intersection-related crashes that allow alternative or different turning maneuvers that do not resolve the problem of high crashes or that are not feasible or not acceptable.

C14 – Convert four-legged intersections to two
TIME
WHERE TO USE
– Unsignalized intersections with high volumes.

C15 – Convert four-legged intersections to two
TIME
WHERE TO USE
– Unsignalized intersections with high volumes.
**Signalized Intersection Safety Strategies**

**Category A: Reduce Frequency and Severity of Intersection Crashes Through Traffic Control and Operational Improvements**

- **A1**: Employ Multiple Signal Operation
- **A2**: Optimize Change Intervals
- **A3**: Restrict or Eliminate Turning Maneuvers (including right-turn on red)
- **A4**: Improve Operation of Pedestrian and Bicycle Facilities
- **A5**: Use Right-Angle Intersections
- **A6**: Create Dynamic Traffic Signal

**Category B: Reduce Intersection Crashes Through Geometric Improvements**

- **B1**: Provide/improve left-turn channelization
- **B2**: Improve geometry of pedestrian and bicycle facilities
- **B3**: Construct special solutions

**Category C: Improve Sight Distance at Signalized Intersections**

- **C1**: Change sight angles
- **C2**: Realign intersection approaches

**Category D: Improve Driver Awareness of Intersection Signals and Signal Control**

- **D1**: Improve visibility of intersections on approaches
- **D2**: Improve visibility of signals and signs at intersection

**Category E: Improve Driver Compliance with Traffic Control Devices**

- **E1**: Promote public information and education
- **E2**: Improve compliance with traffic control devices

**Category F: Improve Access Management Near Signalized Intersections**

- **F1**: Restrict access to property by using driveway/crossover
- **F2**: Provide/improve right-turn channelization
- **F3**: Restrict or eliminate parking on intersection approaches

**Category G: Improve Safety Through Other Infrastructure Treatments**

- **G1**: Improve drainage in intersection and on approaches
- **G2**: Provide/skid resistance in intersection and on approaches
- **G3**: Coordinate closely spaced signals near grade separation crossings

**Cost**

<table>
<thead>
<tr>
<th>Safety Concern</th>
<th>Low</th>
<th>Moderate</th>
<th>Moderate-High</th>
<th>High</th>
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<tbody>
<tr>
<td>High frequency of right-angle crashes attributed to:</td>
<td></td>
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<tr>
<td>nearby driveways</td>
<td>F1, F2</td>
<td>A2, A3</td>
<td>B1, B2</td>
<td>E2, E3</td>
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<td>traffic from cross street</td>
<td>A2, A3</td>
<td>B4, B5, C2</td>
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<tr>
<td>close intersections</td>
<td>A1, C1, G5</td>
<td>B4, B5, C2</td>
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<tr>
<td>drivers misjudging gaps</td>
<td>A1</td>
<td></td>
<td></td>
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<tr>
<td>red-light for drivers</td>
<td>A1</td>
<td></td>
<td></td>
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<tr>
<td>driver unaware of intersection</td>
<td>D1, D2</td>
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<tr>
<td>nighttime conditions</td>
<td>D1, D2</td>
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<tr>
<td>right-turning vehicles hit from side</td>
<td>A3, C1, G5</td>
<td>B2, G4</td>
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<tr>
<td>High frequency of rear-end crashes attributed to:</td>
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</tr>
<tr>
<td>left-turning vehicles hit from behind</td>
<td>A1</td>
<td>B1, B2</td>
<td>B4, B5</td>
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<tr>
<td>opposing vehicles hit from behind</td>
<td>A1</td>
<td>B1</td>
<td></td>
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<tr>
<td>standing water on roadway</td>
<td>G1</td>
<td></td>
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<tr>
<td>vehicles unable to stop safely (skidding)</td>
<td>G2</td>
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<tr>
<td>driver error at intersection</td>
<td>D1, D2</td>
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<tr>
<td>nighttime conditions</td>
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<tr>
<td>speed differentials of vehicles</td>
<td>A4, E4, E5</td>
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<td>sudden stops</td>
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<tr>
<td>High frequency of left-turn crashes attributed to:</td>
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<tr>
<td>left-turn vehicles hit by opposing traffic</td>
<td>A1, A2, C1</td>
<td>B1</td>
<td>B4, B5</td>
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<tr>
<td>nighttime conditions</td>
<td>D1, D2</td>
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<tr>
<td>High frequency of jaywalking crashes attributed to:</td>
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<tr>
<td>vehicles within intersection</td>
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<td>B1</td>
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<tr>
<td>High frequency of pedestrian/bicycle crashes:</td>
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<td>pedestrian crashes vs. crashes involving vehicles</td>
<td>A4, B5</td>
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<tr>
<td>vehicle/pedestrian signal conflicts</td>
<td>G1</td>
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<tr>
<td>with left-turning vehicles</td>
<td>A1, A3</td>
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<td>Address overall safety issues:</td>
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<tr>
<td>violation of traffic laws</td>
<td>E1</td>
<td>E2</td>
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<tr>
<td>intersection near railroad crossing</td>
<td>G3</td>
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<tr>
<td>intersection near fire station</td>
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<tr>
<td>stop signs</td>
<td>A5</td>
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<tr>
<td>red-light for drivers</td>
<td>A1</td>
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</table>

**2006 Intersection Fatalities**

<table>
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<tr>
<th>Category</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signalled</td>
<td>3184</td>
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<tr>
<td>Unsignalled</td>
<td>5,735</td>
</tr>
<tr>
<td>Other/Unknown</td>
<td>364</td>
</tr>
</tbody>
</table>

For more information contact:

FHWA Office of Safety Design
1200 New Jersey Avenue SE, E71
Washington, D.C. 20590
(202) 380-8630
http://safety.fhwa.dot.gov

FHWA Resource Center - Safety and Design Team
1900 Government Drive Suite 301
Olympia Fields, IL 60461
(708) 283-2945
http://safety.fhwa.dot.gov/resourcecenter

United States Department of Transportation
Federal Highway Administration

**Key to the Brochure**

**Time frame:**
- Time frames will naturally vary based on numerous factors (agency procedures, number of stakeholders, need for additional right-of-way). The scale is meant as a general guide. One circle indicates a short time frame for implementation perhaps in as little as a few months or up to 1 year. Examples include short-term strategies that work to improve signal geometries, signal timing changes, and short distance improvements. Two circles indicate a medium time frame of 1-2 years. Some strategies require channel improvements, system-wide signal improvements, and minor geometric improvements. Three circles indicate a longer time frame of over 2 years. Strategies that may require major construction or right-of-way acquisition.

**Costs:**
- Costs will also vary considerably and are affected by local conditions. Costs are ranked as low, moderate, moderate to high, and high. The scale is meant to reflect costs relative to the other strategies described in the category (signalized or unsignalized).

**Effectiveness:**
- This section will discuss any research or evaluations that have been done to ascertain the effectiveness of the particular strategies. Three descriptors are used to identify to what degree the strategy has been evaluated:
  - Proven: Those strategies that have been used in one or more locations and for which properly designed evaluations have been conducted that show it to be effective. These strategies may have a medium degree of confidence, but with the understanding that any application can lead to results that vary widely.
  - Potential: Strategies that are believed to be ineffective and that at least one agency has considered sufficiently promising to try on a small scale at at least one location. These strategies should be considered only after the others have been determined to be inappropriate or ineffective. Even where they are considered, their implementation should initially occur using a very carefully controlled and limited pilot study that includes a properly designed evaluation component.

**Project Evaluation:**
- This brochure is a quick reference to the countermeasures described in the NCHRP Report 500 series on reducing crashes at unsignalized (Volume 5) and signalized (Volume 12) intersections and is a supplement to individual guide sheets for each of the 77 countermeasures. These documents describe and illustrate the countermeasures in greater detail.

CONTINUED ON BACK PANEL