**Category A: Improve Management of Access**

**A1 – Implement driveway closures/relocations**  
Why? Intersections with high crash frequency related to driveway crossings. Driveways should be removed or relocated to a safer location.

**A2 – Design continuous medians**  
Why? Provide a continuous barrier between opposing traffic streams to prevent head-on collisions.

**A3 – Install stop signs**  
Why? Where conflicts exist between opposing traffic streams.

**A4 – Install guardrails**  
Why? Protect vehicles and pedestrians from leaving the roadway.

**A5 – Implement speed humps**  
Why? To reduce vehicular speeds and improve pedestrian safety.

**A6 – Implement bypass lanes on shoulders at adjacent interchanges**  
Why? Provide an alternative route for vehicles to bypass the intersection and reduce traffic volume.

**A7 – Convert offset T-intersections to four-legged T-intersections**  
Why? Improve sight lines and reduce conflicts at T-intersections.

**A8 – Convert one-lane approach to two-lane approach**  
Why? Provide an additional lane to improve safety and flow.

**A9 – Create new intersection by converting overlapping roadways**  
Why? Provide a new intersection to improve safety and traffic control.

**A10 – Implement roundabouts at appropriate locations**  
Why? Improve safety and traffic flow at roundabouts.

**A11 – Install flashing beacons at stop-controlled intersections**  
Why? Enhance visibility and alert drivers of the stop-controlled intersection.

**A12 – Provide all-way stop control at appropriate intersections**  
Why? Implement all-way stop control to reduce conflicts at intersections.

**A13 – Use shoulder squeeze at intersections**  
Why? Provide a smaller road width to reduce speeds and improve safety.

**A14 – Convert single-lane approach to two-lane approach**  
Why? Improve safety and flow by adding an additional lane.

**A15 – Implement vehicle access restrictions**  
Why? Reduce conflicts and improve safety by restricting vehicle access.

**A16 – Provide targeted enforcement to reduce speed**  
Why? Implement enforcement strategies to reduce speed violations.

**A17 – Provide targeted public information and education on safety problems at specific intersections**  
Why? Educate drivers and pedestrians about safety issues at specific intersections.

**A18 – Reduce operating speeds**  
Why? Implement speed reduction strategies to improve safety.

**Category B: Reduce Conflict through Geometric Design Improvements**

**B1 – Provide left-turn lanes at intersections**  
Why? Provide left-turn lanes to improve safety and reduce conflicts.

**B2 – Provide long left-turn lanes at intersections**  
Why? Provide longer left-turn lanes to improve safety and reduce conflicts.

**B3 – Provide left-turn offsets at intersections**  
Why? Provide left-turn offsets to improve safety and reduce conflicts.

**B4 – Provide bypass lanes on shoulders at adjacent interchanges**  
Why? Provide an alternative route for vehicles to bypass the intersection and reduce traffic volume.

**B5 – Provide short left-turn offsets at intersections**  
Why? Provide short left-turn offsets to improve safety and reduce conflicts.

**B6 – Provide right-turn lanes at single-lane approaches**  
Why? Provide right-turn lanes to improve safety and reduce conflicts.

**B7 – Provide right-turn acceleration at at-grade intersections**  
Why? Provide right-turn acceleration lanes to improve safety and reduce conflicts.

**B8 – Provide right-turn acceleration at at-grade intersections**  
Why? Provide right-turn acceleration lanes to improve safety and reduce conflicts.

**B9 – Use isolated left-turn treatment at low-speed intersections**  
Why? Use isolated left-turn treatment to improve safety and reduce conflicts.

**B10 – Provide short right-turn offsets at intersections**  
Why? Provide short right-turn offsets to improve safety and reduce conflicts.

**B11 – Install countdown signals at four-legged intersections**  
Why? Provide countdown signals to improve safety and reduce conflicts.

**B12 – Provide signalized left-turn offset treatment at at-grade intersections**  
Why? Provide signalized left-turn offset treatment to improve safety and reduce conflicts.

**B13 – Provide left-turn offset at grade-separated intersections**  
Why? Provide left-turn offset treatment at grade-separated intersections.

**B14 – Convert four-legged intersection to two-lane intersection**  
Why? Convert four-lane intersections to two-lane intersections to improve safety and reduce conflicts.

**B15 – Convert offset T-intersections to four-legged T-intersections**  
Why? Convert offset T-intersections to four-legged T-intersections to improve safety and reduce conflicts.

**B16 – Provide targeted speed enforcement**  
Why? Implement enforcement strategies to reduce speed violations.

**B17 – Provide targeted public information and education on safety problems at specific intersections**  
Why? Educate drivers and pedestrians about safety issues at specific intersections.

**B18 – Reduce operating speeds**  
Why? Implement speed reduction strategies to improve safety.

**Category C: Improve Sight Distance**

**C1 – Close sight triangles on stop- and yield-controlled approaches to intersections**  
Why? Improve safety by reducing sight distance and increasing recognition of the traffic control device.

**C2 – Close sight triangles in the median of divided highway approaches**  
Why? Improve safety by reducing sight distance and increasing recognition of the traffic control device.

**C3 – Close horizontal and/or vertical alignment of approaches to provide more sight distance**  
Why? Improve safety by reducing sight distance and increasing recognition of the traffic control device.

**C4 – Eliminate parking that restricts sight distance**  
Why? Remove parking spaces that restrict sight distance.

**Category D: Improve Availability of Gaps and Reduction ofGap Lengths**

**D1 – Provide an automated real-time system to identify gaps and associated availability of safe gap size for making turning and crossing maneuvers**  
Why? Provide an automated system to identify safe gap sizes for turning and crossing maneuvers.

**D2 – Provide innovative signal and markings to assist drivers in making turning and crossing maneuvers**  
Why? Provide innovative signal and markings to assist drivers in making turning and crossing maneuvers.

**D3 – Retime adjacent signals to create gaps at stop-controlled intersections**  
Why? Retime adjacent signals to create safe gap sizes for turning and crossing maneuvers.

**D4 – Implement pedestrian refuge refuge islands on major roads**  
Why? Provide pedestrian refuge islands on major roads to improve safety.

**Category E: Improve TRAFFIC CONTROL**

**E1 – Improve visibility of intersections by providing enhanced signing and delineation**  
Why? Improve visibility by providing enhanced signing and delineation.

**E2 – Improve visibility of the intersections by providing appropriate TRAFFIC CONTROL**  
Why? Implement appropriate traffic control to improve visibility.

**E3 – Install split islands on the minor-road approach to an intersection**  
Why? Install split islands to improve safety at intersections.

**E4 – Provide a stop bar (or provide a wider stop bar) on a minor-road approach**  
Why? Provide stop bars on minor-road approaches to improve safety.

**E5 – Provide additional lanes at intersections**  
Why? Provide additional lanes to improve safety and reduce conflicts.

**E6 – Provide extra-long turning lanes at intersections**  
Why? Provide extra-long turning lanes to improve safety and reduce conflicts.

**E7 – Provide enhanced signing and delineation at intersections**  
Why? Provide enhanced signing and delineation to improve visibility.

**E8 – Post appropriate speed limit on intersection approaches**  
Why? Post appropriate speed limits to improve safety.

**E9 – Provide targeted speed enforcement**  
Why? Implement enforcement strategies to reduce speed violations.

**E10 – Reduce operating speeds**  
Why? Implement speed reduction strategies to improve safety.

**Category F: Reduce Operating Speeds**

**F1 – Avoid signaling through real right-angle intersections**  
Why? Avoid signaling through real right-angle intersections.

**F2 – Provide all-way stop control at appropriate intersections**  
Why? Implement all-way stop control to reduce conflicts.

**F3 – Provide roundabouts at appropriate locations**  
Why? Implement roundabouts at appropriate locations to improve safety.

**F4 – Provide targeted speed enforcement**  
Why? Implement enforcement strategies to reduce speed violations.

**F5 – Provide targeted public information and education on safety problems at specific intersections**  
Why? Educate drivers and pedestrians about safety issues at specific intersections.

**F6 – Post appropriate speed limit on intersection approaches**  
Why? Post appropriate speed limits to improve safety.

**Category G: Improve TRAFFIC CONTROL TOOLS AND TIMING**

**G1 – Provide targeted enforcement to reduce stop sign violations**  
Why? Implement enforcement strategies to reduce stop sign violations.

**G2 – Provide targeted public information and education on safety problems at specific intersections**  
Why? Educate drivers and pedestrians about safety issues at specific intersections.

**G3 – Provide roundabouts at appropriate locations**  
Why? Implement roundabouts at appropriate locations to improve safety.

**G4 – Provide targeted speed enforcement**  
Why? Implement enforcement strategies to reduce speed violations.

**G5 – Provide targeted public information and education on safety problems at specific intersections**  
Why? Educate drivers and pedestrians about safety issues at specific intersections.

**G6 – Post appropriate speed limit on intersection approaches**  
Why? Post appropriate speed limits to improve safety.

**Category H: Improve Motorists More Effectively**

**H1 – Provide targeted speed enforcement**  
Why? Implement enforcement strategies to reduce speed violations.

**H2 – Provide traffic calming on intersection approaches through a combination of geometric and traffic control features**  
Why? Implement traffic calming strategies to improve safety.

**H3 – Provide all-way stop control at appropriate intersections**  
Why? Implement all-way stop control to reduce conflicts.

**H4 – Provide targeted speed enforcement**  
Why? Implement enforcement strategies to reduce speed violations.

**H5 – Provide targeted public information and education on safety problems at specific intersections**  
Why? Educate drivers and pedestrians about safety issues at specific intersections.

**H6 – Post appropriate speed limit on intersection approaches**  
Why? Post appropriate speed limits to improve safety.

**H7 – Reduce operating speeds**  
Why? Implement speed reduction strategies to improve safety.

**H8 – Use safe stop signs at appropriate locations**  
Why? Use safe stop signs to improve safety.

**H9 – Use speed humps at appropriate locations**  
Why? Use speed humps to reduce speed and improve safety.

**H10 – Reduce operating speeds**  
Why? Implement speed reduction strategies to improve safety.

**H11 – Use stop signs at appropriate locations**  
Why? Use stop signs to improve safety.

**H12 – Provide all-way stop control at appropriate intersections**  
Why? Implement all-way stop control to reduce conflicts.

**H13 – Use roundabouts at appropriate locations**  
Why? Use roundabouts to improve safety.

**H14 – Provide targeted speed enforcement**  
Why? Implement enforcement strategies to reduce speed violations.

**H15 – Provide targeted public information and education on safety problems at specific intersections**  
Why? Educate drivers and pedestrians about safety issues at specific intersections.

**H16 – Post appropriate speed limit on intersection approaches**  
Why? Post appropriate speed limits to improve safety.

**H17 – Reduce operating speeds**  
Why? Implement speed reduction strategies to improve safety.

**H18 – Use safe stop signs at appropriate locations**  
Why? Use safe stop signs to improve safety.
**Category A: Reduce Frequency and Severity of Pedestrian/Bicycle Crashes Through Traffic Control and Operational Improvements**

A1 – Employ multiphase signal operation

A2 – Optimize change intervals

A3 – Restrict or eliminate turning maneuvers (including right-turn on red)

A4 – Enhance emergency vehicle preemption

A5 – Employ multiphase signal operation

A6 – Improve operation of pedestrian and bicycle facilities

A7 – Implement automated enforcement of red-light running

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

B1 – Provide/improve left-turn channelization

B2 – Provide/improve right-turn channelization

B3 – Provide/improve pedestrian safety

B4 – Provide/improve safety for vulnerable road users

B5 – Enhance geometric safety

B6 – Construct special solutions

**Cost**

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<thead>
<tr>
<th>Safety Concern</th>
<th>Low</th>
<th>Moderate</th>
<th>Moderate-High</th>
<th>High</th>
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<td>A2, A3</td>
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<td></td>
<td>traffic from cross street</td>
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<td>B4, B5, C2</td>
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<td>advanced intersection</td>
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<td>B4, B5, C2</td>
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<td>poor sight distance</td>
<td>A1, C1, G5</td>
<td>B4, B5, C2</td>
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<td>drivers misjudging gaps</td>
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<td></td>
<td>high speed for drivers</td>
<td>A1</td>
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<td>driver unfamiliarity of intersection</td>
<td>D1, D2, G4</td>
<td>B4, C2</td>
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<td>nighttime conditions</td>
<td>D1, D2</td>
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<td></td>
<td>right-turning vehicles hit by a pedestrian</td>
<td>A3, C1, G5</td>
<td>B2, G4</td>
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<td><strong>High-frequency of rear-end crashes</strong> at street intersections</td>
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<td>A1</td>
<td>B1, B5</td>
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<tr>
<td></td>
<td>right-turning vehicle hit by a pedestrian</td>
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<td>B2, G4</td>
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<td>standing water on roadway</td>
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<td>vehicles unable to stop safely (skidding)</td>
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<td></td>
<td>nighttime conditions</td>
<td>D1, D2</td>
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<td>speed differentials of vehicles</td>
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<td><strong>High-frequency of left-turn crashes</strong> at street intersections</td>
<td>left-turning vehicle hit by opposing traffic</td>
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<td>B1</td>
<td>B4, B5</td>
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<td><strong>High-frequency of side-impact crashes</strong> at street intersections</td>
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<td>B1</td>
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<td>high-frequency of pedestrian/bicycle crashes</td>
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<td>high-frequency of right-angle crashes</td>
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<td>vehicle/bicycle side-impact on pedestrian</td>
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<td>with left-turning vehicles</td>
<td>A1, A3</td>
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<td><strong>Address overall safety issues</strong></td>
<td>violation of traffic laws</td>
<td>E1</td>
<td>E2</td>
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<td>intersection near railroad crossing</td>
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<td>intersection near fire station</td>
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<td>pedestrian facilities</td>
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<td>distracted by traffic signal</td>
<td>A7</td>
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</table>

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

C1 – Clear sight triangles

C2 – Renovation of crosswalks across signalized intersections

C3 – Improve visibility of signals and signs at intersection

C4 – Improve driver awareness of intersection

C5 – Provide public information and education

C6 – Improve driver compliance with traffic control devices

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

D1 – Improve drainage in intersection and on approaches

D2 – Provide/modify turning maneuvers

D3 – Coordinate closely spaced signals near grade separation crossings

D4 – Improve intersection design and operations

D5 – Reduce signalized crossings

D6 – Improve signal decision

D7 – Enhance pedestrian safety

D8 – Enhance emergency vehicle preemption

D9 – Improve visibility of intersections on approach(es)

D10 – Improve pedestrian safety

D11 – Improve drainage in intersection

D12 – Provide/modify turning maneuvers

D13 – Improve intersection design and operations

D14 – Improve visibility of intersections on approach(es)

**Key to the Brochure**

- Cost: Cost is 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 strategies described. Three descriptors are used to identify to what degree the strategy has been evaluated:
  - Tried: Those strategies that have been implemented in a number of locations and may be even be accepted as standards or standard approaches, but for which there have not been found valid evaluations. These strategies, while frequently or even generally used, should be applied with caution; users should carefully consider the attribute cited in the guide and relate it to the specific conditions for which they are being considered. There can be some degree of assurance that implementation will not likely have a negative impact on safety and will very likely have a positive one. Since this strategy has been reported, other recent research may be needed to evaluate the effectiveness of the strategy.
  - 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 be employed with a high degree of confidence, but with the understanding that any application can lead to results that vary significantly from those found in previous evaluations. Crash reduction data reported are typically based on valid research methods.
  - Implemented: Those strategies that have been implemented in a number of locations and may be even be accepted as standards or standard approaches, but for which there have not been found valid evaluations. These strategies, while frequently or even generally used, should be applied with caution; users should carefully consider the attribute cited in the guide and relate it to the specific conditions for which they are being considered. There can be some degree of assurance that implementation will not likely have a negative impact on safety and will very likely have a positive one. Since this strategy has been reported, other recent research may be needed to evaluate the effectiveness of the strategy.


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United States Department of Transportation Federal Highway Administration

**2006 Intersection Fatalities**

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<thead>
<tr>
<th>Source of Fatality</th>
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<th>2005</th>
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<td>1512</td>
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<tr>
<td>Bicyclist</td>
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<td>459</td>
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<tr>
<td>Other</td>
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