UNSIGNALIZED INTERSECTION SAFETY STRATEGIES

CATEGORY A: IMPROVE MANAGEMENT OF ACCESS

A1 – Implement driveway closures/relocations
WHERE TO USE – Unsignalized intersections with high crash frequencies related to driveways adjacent to the intersection. Generally, driveways within 250 feet of the intersection are the greatest concern.
TIME – ● ● ○ Ⓣ

A2 – Implement driveway turn restrictions
WHERE TO USE – Driveways located near unsignalized intersections that experience high crash frequencies but that cannot practically be closed or relocated.
TIME – ● ○ ○ Ⓣ

CATEGORY B: REDUCE CONFLICTS THROUGH GEOMETRIC DESIGN IMPROVEMENTS

B1 – Provide left-turn lanes at intersections
WHERE TO USE – Unsignalized intersections with a high frequency of crashes resulting from the conflict between (1) vehicles turning left and following vehicles and (2) vehicles turning left and opposing through vehicles.
TIME – ● ● ○ Ⓟ

B2 – Provide longer left-turn lanes at intersections
WHERE TO USE – Unsignalized intersections with existing left-turn lanes that are not long enough to store all left-turning vehicles and have a high frequency of rear-end crashes resulting from the conflict between vehicles waiting to turn left and following vehicles.
TIME – ● ● ○ Ⓣ

B3 – Provide offset left-turn lanes at intersections
WHERE TO USE – Unsignalized intersections with a high frequency of crashes between vehicles turning left and opposing through vehicles, as well as rear-end crashes between through vehicles on the opposing approach. Also at intersections on divided highways with medians wide enough to provide the appropriate offset but can be implemented on approaches without medians if sufficient width exists.
TIME – ● ● ○ Ⓣ

B4 – Provide bypass lanes on shoulders at T-intersections
WHERE TO USE – At three-legged unsignalized intersections on two-lane highways with moderate through and turning volumes, especially intersections that have a pattern of rear-end collisions involving vehicles waiting to turn left from the highway.
TIME – ● ○ ○ Ⓣ

B5 – Provide left-turn acceleration lanes at divided highway intersections
WHERE TO USE – Unsignalized intersections on divided highways that experience a high proportion of rear-end crashes related to the speed differential caused by vehicles turning left onto the highway. Also where intersection sight distance is inadequate or where there are high volumes of trucks or recreational vehicles entering the divided highway.
TIME – ● ● ○ Ⓣ

B6 – Provide right-turn lanes at intersections
WHERE TO USE – Unsignalized intersections with a high frequency of rear-end crashes resulting from conflicts between (1) vehicles turning right and following vehicles and (2) vehicles turning right and through vehicles coming from the left on the cross street.
TIME – ● ● ○ Ⓟ

B7 – Provide longer right-turn lanes at intersections
WHERE TO USE – Unsignalized intersections with an existing right-turn lane that is not long enough to store all right-turning vehicles and that are experiencing a high frequency of rear-end crashes resulting from the conflict between vehicles waiting to turn right and following vehicles.
TIME – ● ● ○ Ⓣ

B8 – Provide offset right-turn lanes at intersections
WHERE TO USE – Unsignalized intersections with a high frequency of crashes between vehicles on the minor road that are turning left, turning right, or proceeding straight through, and vehicles on the major road.
TIME – ● ● ○ Ⓣ

B9 – Provide right-turn acceleration lanes at intersections
WHERE TO USE – Unsignalized intersections that experience a high proportion of rear-end and/or sideswipe crashes related to the speed differential caused by vehicles making a right-turn maneuver onto the highway.
TIME – ● ● ○ Ⓣ

B10 – Provide full-width paved shoulders in intersection areas
WHERE TO USE – Unsignalized intersections on divided highways with no shoulder or shoulder widths less than 8 feet that experience a high proportion of run-off-road crashes as a result of avoidance maneuvers or a high proportion of rear-end crashes that could have been avoided had a full-width paved shoulder been provided.
TIME – ● ● ○ Ⓣ

B11 – Restrict or eliminate turning maneuvers by signing
WHERE TO USE – Unsignalized intersections with patterns of crashes related to particular turning maneuvers where it is impractical to reduce that pattern of crashes by improving sight distance or providing a left-turn or shoulder bypass lane.
TIME – ● ○ ○ Ⓣ

B12 – Restrict or eliminate turning maneuvers by providing channelization or closing median openings
WHERE TO USE – Unsignalized intersections with patterns of crashes related to particular turning maneuvers where it is impractical to reduce that pattern of crashes by improving sight distance or providing a left-turn or shoulder bypass lane. Also, at locations where it is possible to restrict or eliminate turning maneuvers by providing channelization or by closing the median opening.
TIME – ● ○ ○ Ⓣ

B13 – Close or relocate "high-risk" intersections
WHERE TO USE – Unsignalized intersections with high levels of intersection-related crashes that other strategies have not been successful in reducing or for which other strategies are not considered appropriate. Also at locations where a particular strategy such as installing a turn lane or increasing sight distance is impractical at the current location, but could be applied if the intersection were moved.
TIME – ● ● ● Ⓣ

B14 – Convert four-legged intersections to two T-intersections
WHERE TO USE – Unsignalized four-legged intersections with very low through volumes on the cross street.
TIME – ● ● ○ Ⓣ

B15 – Convert offset T-intersections to four-legged intersections
WHERE TO USE – Unsignalized offset T-intersections where through volumes on the cross street are very high.
TIME – ● ● ○ Ⓣ

B16 – Realign intersection approaches to reduce or eliminate intersection skew
WHERE TO USE – Unsignalized intersections with a high frequency of crashes resulting from insufficient intersection sight distance and awkward sight lines at a skewed intersection.
TIME – ● ● ○ Ⓟ

COST

SAFETY CONCERN	Low	Moderate	Moderate-High	High
High frequency of right-angle crashes attributed to:				
nearby driveways	A2,B12,C1,C2,C4	A1	B8	
traffic from minor street	B12,C1,C2,C4,D2	D1	B8	B13,F3
skewed intersection				B16,C3,F3
poor sight distance	C1,C2,C4,H3	D1		C3, F3
drivers misjudging gaps	D2,H3	D1		F3
not enough gaps for drivers	D3			B14, F3
driver unaware of intersection	E1,E5-E9,E10,E11	E3		
nighttime conditions	E10		E2	
failure to yield at stop or yield sign	E1,E4-E9,E11	G1		F3
possible signal location				F1,F3
heavy but balanced traffic flow	F2			F3
speed differentials of vehicles	H3	H1,H2		F3
High frequency of rear-end crashes attributed to:				
left turning vehicles hit from behind	B4	B1,B2		F3
left opposing vehicles hit from behind			B3	F3
trucks and RVs entering divided highway		B5		
speed differential of entering vehicles		B5,B9		F3
right turning vehicles hit from behind		B6,B7		B16,F3
appoaching vehicles hit from behind		B10		
no left turn lane and high opposing traffic	B11,B12			B13
driver unaware of intersection	E1,E5-E9,E10,E11	E3		
nighttime conditions	E8,E10		E2	
speed differentials of vehicles	H3	H1,H2		F3
High frequency of left-turn crashes attributed to:				
left turn vehicles hit by opposing traffic	C2	B1,B17	B3	B15,F3
trucks and/or RVs entering divided highway		B5		
no left turn lane and high opposing traffic	B11,B12	B17		B13
nighttime conditions	E10		E2	
heavy but balanced traffic flow	F2			F3
Poor sight distance	C2, B11, B12	B17		B13
High frequency of sideswipe crashes attributed to:				
speed differential of entering vehicles		B9		F3
vehicles within intersection	I1,I2			
vehicles approaching intersection	I3			
High frequency of run off road crashes:				
approaching intersection		B10		
High frequency of pedestrian/bicycle crashes:				
			B18,H2	
Address overall safety issues:				
violation of traffic laws	G2			

Counter measures indicated on the table are *possible* treatments for individual crash problems. Implementation should be based on individual circumstances and studies.

B17 – Use indirect left-turn treatments to minimize conflicts at divided highway intersections
WHERE TO USE – Unsignalized intersections with operational and safety problems that can be traced to difficulties of accommodating left-turn demand.
TIME – ● ● ○ Ⓣ

B18 – Improve pedestrian and bicycle facilities to reduce conflicts between motorists and nonmotorists
WHERE TO USE – Unsignalized intersections that experience crashes involving pedestrians and/or bicyclists with motor vehicles or that have the potential for such crashes.
TIME – ● ● ○ Ⓣ Ⓟ

CATEGORY C: IMPROVE SIGHT DISTANCE

C1 – Clear sight triangles on stop- or yield-controlled approaches to intersections
WHERE TO USE – Unsignalized intersections with restricted sight distance and patterns of crashes related to lack of sight distance, where sight distance can be improved by clearing roadside obstructions without major construction.
TIME – ● ○ ○ Ⓣ

C2 – Clear sight triangles in the medians of divided highways near intersections
WHERE TO USE – Unsignalized intersections on divided highways with (a) fixed sight obstructions in the median near the intersection and (b) patterns of crashes related to the lack of sight distance.
TIME – ● ○ ○ Ⓣ

C3 – Change horizontal and/or vertical alignment of approaches to provide more sight distance
WHERE TO USE – Unsignalized intersections with restricted sight distance due to horizontal and/or vertical geometry and with patterns of crashes related to that lack of sight distance that cannot be ameliorated by less expensive methods.
TIME – ● ● ● Ⓣ

C4 – Eliminate parking that restricts sight distance
WHERE TO USE – Unsignalized intersections with restricted sight distance due to parking.
TIME – ● ○ ○ Ⓣ

CATEGORY D: IMPROVE AVAILABILITY OF GAPS AND ASSIST DRIVERS IN JUDGING GAPS

D1 – Provide an automated real-time system to inform drivers of the suitability of available gaps for making turning and crossing maneuvers
WHERE TO USE – Unsignalized intersections with a high frequency of right-angle collisions due to restricted sight distance.
TIME – ● ● ○ Ⓔ

D2 – Provide innovative signs and markings to assist drivers in judging the suitability of available gaps for making turning and crossing maneuvers
WHERE TO USE – Unsignalized intersections where crash data shows a high occurrence of crashes where vehicles on secondary roadways intersecting at grade misjudge the gap between approaching vehicles.
TIME – ● ● ○ Ⓔ

D3 – Retime adjacent signals to create gaps at stop-controlled intersections
WHERE TO USE – Unsignalized intersections (between signalized intersections) with a high frequency of right-angle or turning-related crashes due to a lack of sufficient gaps in through traffic on the major road.
TIME – ● ○ ○ Ⓣ

CATEGORY E: IMPROVE DRIVER AWARENESS

E1 – Improve visibility of intersections by providing enhanced signing and delineation
WHERE TO USE – Unsignalized intersections that are not clearly visible to approaching motorists, particularly approaching motorists on the major road. The strategy is particularly appropriate for intersections with patterns of rear-end, right-angle, or turning crashes related to lack of driver awareness of the presence of the intersection.
TIME – ● ○ ○ Ⓣ

E2 – Improve visibility of the intersection by providing lighting
WHERE TO USE – Unsignalized, unlit intersections with substantial patterns of nighttime crashes. In particular, patterns of rear-end, right-angle, or turning crashes on the major-road approaches to an unsignalized intersection may indicate that approaching drivers are unaware of the presence of the intersection.
TIME – ● ● ○ Ⓟ

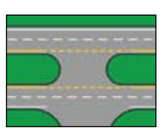
E3 – Install splitter islands on the minor-road approach to an intersection
WHERE TO USE – Minor road approaches to unsignalized intersections where the presence of the intersection or the stop sign is not readily visible to approaching motorists. The strategy is particularly appropriate for intersections where the speeds on the minor road are high.
TIME – ● ● ○ Ⓣ

E4 – Provide a stop bar (or provide a wider stop bar) on minor-road approaches
WHERE TO USE – Approaches to unsignalized intersections having traffic control devices that are not currently being recognized by some approaching motorists. Locations should be identified by patterns of crashes related to lack of driver recognition of the traffic control device (e.g., right-angle crashes related to stop sign violations).
TIME – ● ○ ○ Ⓣ

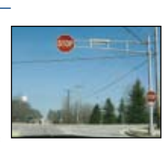
E5 – Install larger regulatory and warning signs at intersections
WHERE TO USE – Approaches to unsignalized intersections with patterns of rear-end, right-angle, or turning collisions related to lack of driver awareness of the presence of the intersection.
TIME – ● ○ ○ Ⓣ

E6 – Call attention to the intersection by installing rumble strips on intersection approaches
WHERE TO USE – Approaches to unsignalized intersections with traffic control devices that are not currently being recognized by some approaching motorists. Locations should be identified by patterns of crashes related to lack of driver recognition of the traffic control device (e.g., right-angle crashes related to stop sign violations). Rumble strips should be considered only after an adequate trial of less intrusive treatments.
TIME – ● ○ ○ Ⓣ

E7 – Provide dashed markings (extended left edgelines) for major-road continuity across the median opening at divided highway intersections
WHERE TO USE – Unsignalized intersections on divided highways. The strategy is particularly appropriate for intersections with patterns of rear-end, right-angle, or turning crashes related to lack of awareness by the driver on the minor road to the presence of the intersection.
TIME – ● ○ ○ Ⓣ



E8 – Provide supplementary stop signs mounted over the roadway
WHERE TO USE – Unsignalized intersections with patterns of right-angle crashes related to lack of driver awareness of the presence of the intersection. In particular, it might be appropriate to use this strategy at the first stop-controlled approach (possibly of a series) located on a long stretch of highway without any required stops, or at an intersection located after a sharp horizontal curve.
TIME – ● ○ ○ Ⓣ



E9 – Provide pavement markings with supplementary messages, such as STOP AHEAD
WHERE TO USE – Unsignalized intersections with patterns of rear-end, right-angle, or turning crashes related to lack of driver awareness of the presence of the intersection.
TIME – ● ○ ○ Ⓣ

E10 – Provide improved maintenance of stop signs
WHERE TO USE – All stop-controlled intersections.
TIME – ● ○ ○ Ⓣ

E11 – Install flashing beacons at stop-controlled intersections
WHERE TO USE – Unsignalized intersections with patterns of right-angle crashes related to lack of driver awareness of the intersection on an uncontrolled approach and lack of driver awareness of the stop sign on a stop-controlled approach.
TIME – ● ○ ○ Ⓣ

CATEGORY F: CHOOSE APPROPRIATE INTERSECTION TRAFFIC CONTROL

F1 – Avoid signalizing through roads
WHERE TO USE – Medium- to high-volume unsignalized intersections where installation of signals is being considered. Before a decision to install a signal is made, adequate consideration should be given to less restrictive forms of traffic control.
TIME – ● ● ● Ⓣ

F2 – Provide all-way stop-control at appropriate intersections
WHERE TO USE – Unsignalized intersections with patterns of right-angle and turning crashes and moderate and relatively balanced volumes on the intersection approaches.
TIME – ● ○ ○ Ⓟ

F3 – Provide roundabouts at appropriate locations
WHERE TO USE – Unsignalized intersections that are experiencing right-angle, rear-end, and turning crashes. Roundabouts are appropriate at most intersections, and at intersections with large traffic delays roundabouts are oftentimes a superior alternative to signalization. Roundabouts can also be very effective at intersections with complex geometry (e.g., more than four approach roads) and intersections with frequent left-turn movements.
TIME – ● ● ● Ⓟ

CATEGORY G: IMPROVE COMPLIANCE WITH TRAFFIC CONTROL DEVICES AND TRAFFIC LAWS

G1 – Provide targeted enforcement to reduce stop sign violations
WHERE TO USE – Unsignalized intersections where stop sign violations and patterns of crashes related to stop sign violations have been observed. Crash types potentially related to stop sign violations include right-angle and turning collisions.
TIME – ● ○ ○ Ⓣ

G2 – Provide targeted public information and education on safety problems at specific intersections
WHERE TO USE – Jurisdictions that have experienced a large number of safety problems at unsignalized intersections.
TIME – ● ○ ○ Ⓣ

CATEGORY H: REDUCE OPERATING SPEEDS

H1 – Provide targeted speed enforcement
WHERE TO USE – Unsignalized intersections where speed violations and patterns of crashes related to speed violations are observed. Crash types potentially related to speed violations include right-angle, rear-end, and turning crashes.
TIME – ● ○ ○ Ⓟ

H2 – Provide traffic calming on intersection approaches through a combination of geometrics and traffic control devices
WHERE TO USE – Specific approaches to unsignalized intersections that are experiencing crash types potentially related to speed violations, specifically right-angle, rear-end, and turning collisions.
TIME – ● ● ○ Ⓟ

H3 – Post appropriate speed limit on intersection approaches
WHERE TO USE – Unsignalized intersections experiencing a high frequency of speed related crashes.
TIME – ● ○ ○ Ⓣ

CATEGORY I: GUIDE MOTORISTS MORE EFFECTIVELY

I1 – Provide turn path markings
WHERE TO USE – Complex unsignalized intersections with a high frequency of crashes related to turning vehicle positioning (e.g., sideswipe crashes).
TIME – ● ○ ○ Ⓣ

I2 – Provide a double yellow centerline on the median opening of a divided highway at intersections
WHERE TO USE – Unsignalized intersections on divided highways that are experiencing a high degree of crashes caused by side-by-side queuing and angle stopping within the median area.
TIME – ● ○ ○ Ⓣ

I3 – Provide lane assignment signing or marking at complex intersections
WHERE TO USE – Unsignalized intersections with a high frequency of crashes caused by driver indecision in lane assignment.
TIME – ● ○ ○ Ⓣ

SIGNALIZED INTERSECTION SAFETY STRATEGIES

CATEGORY A: REDUCE FREQUENCY AND SEVERITY OF INTERSECTION CONFLICTS THROUGH TRAFFIC CONTROL AND OPERATIONAL IMPROVEMENTS

A1 – Employ Multiphase Signal Operation

WHERE TO USE – Signalized intersections with a high frequency of angle crashes involving left turning and opposing through vehicles. A properly timed protected left-turn phase can also help reduce rear-end and sideswipe crashes between left-turning vehicles and the through vehicles behind them.

TIME – ● ○ ○ Ⓣ Ⓟ

A2 – Optimize Change Intervals

WHERE TO USE – Signalized intersections with a high frequency of crashes related to change interval lengths that are possibly too short. These crashes include angle crashes between vehicles continuing through the intersection after one phase has ended and the vehicles entering the intersection on the following phase. Rear-end crashes may also be a symptom of short change intervals.

TIME – ● ○ ○ Ⓟ

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

WHERE TO USE – Signalized intersections with a high frequency of crashes related to turning maneuvers. For right turn on red (RTOR), the target of this strategy is right-turning vehicles that are involved in rear-end or angle crashes with cross-street vehicles approaching from the left or vehicles turning left from the opposing approach, and crashes involving pedestrians.

TIME – ● ○ ○ Ⓣ

A4 – Employ signal coordination

WHERE TO USE – Signalized intersections with a high frequency of crashes involving major street left-turning and minor street right-turning vehicles where adequate safe gaps in opposing traffic are not available. Major road rear-end crashes associated with speed changes can also be reduced by retiming signals to promote platooning.

TIME – ● ● ○ Ⓟ

A5 – Employ emergency vehicle preemption

WHERE TO USE – Signalized intersections where normal traffic operations impede emergency vehicles and where traffic conditions create a potential for conflicts between emergency and non-emergency vehicles.

TIME – ● ● ○ Ⓟ

A6 – Improve operation of pedestrian and bicycle facilities at signalized intersections

WHERE TO USE – Signalized intersections with high frequencies of pedestrian and/or bicycle crashes. Also on routes serving schools or other generators of pedestrian and bicycle traffic.

TIME – ● ○ ○ Ⓣ Ⓟ

A7 – Remove unwarranted signal

WHERE TO USE – Signalized intersections where the traffic volumes and safety record do not warrant a traffic signal.

TIME – ● ○ ○ Ⓟ

CATEGORY B: REDUCE INTERSECTION CONFLICTS THROUGH GEOMETRIC IMPROVEMENTS

B1 – Provide/improve left-turn channelization

WHERE TO USE – Signalized intersections where crashes related to left-turn movements are an issue.

TIME – ● ● ○ Ⓣ Ⓟ

B2 – Provide/improve right-turn channelization

WHERE TO USE – Signalized intersections with a high frequency of rear-end collisions resulting from conflicts between: (1) vehicles turning right and following vehicles; and (2) vehicles turning right and through vehicles coming from the left on the cross street.

TIME – ● ● ○ Ⓟ

B3 – Improve geometry of pedestrian and bicycle facilities

WHERE TO USE – Signalized intersections with high frequencies of pedestrian and/or bicycle crashes and on routes serving schools or other generators of pedestrian and bicycle traffic.

TIME – ● ○ ○ Ⓣ Ⓟ

B4 – Revise geometry of complex intersections

WHERE TO USE – Signalized intersections with high levels of crashes on a leg where other low-cost strategies have not been successful or are not considered appropriate.

TIME – ● ● ● Ⓣ Ⓟ

B5 – Construct special solutions

WHERE TO USE – Signalized intersections with high frequencies of crashes that are not reduced through other lower-cost solutions.

TIME – ● ● ● Ⓣ

CATEGORY C: IMPROVE SIGHT DISTANCE AT SIGNALIZED INTERSECTIONS

C1 – Clear sight triangles

WHERE TO USE – Signalized intersections where there is a high frequency of crashes between vehicles turning right on red from one street and through vehicles on the other street or crashes involving left turning traffic where landscaped medians are present.

TIME – ● ○ ○ Ⓣ

C2 – Redesign intersection approaches

WHERE TO USE – Signalized intersections with safety problems related to sight distance that cannot be addressed with less expensive methods.

TIME – ● ● ● Ⓟ

CATEGORY D: IMPROVE DRIVER AWARENESS OF INTERSECTIONS AND SIGNAL CONTROL

D1 – Improve visibility of intersections on approach(es)

WHERE TO USE – Signalized intersections with a high frequency of crashes attributed to drivers being unaware of the presence of the intersection.

TIME – ● ○ ○ Ⓣ

D2 – Improve visibility of signals and signs at intersections

WHERE TO USE – Signalized intersections with a high frequency of right-angle and rear-end crashes occurring because drivers are unable to see traffic signals and signs sufficiently in advance to safely negotiate the intersection being approached.

TIME – ● ○ ○ Ⓣ

CATEGORY E: IMPROVE DRIVER COMPLIANCE WITH TRAFFIC CONTROL DEVICES

E1 – Provide public information and education

WHERE TO USE – Signalized intersections with a high frequency of crashes related to drivers either being unaware of (or refusing to obey) traffic laws and regulations that impact traffic safety (especially red-light running, speeding, and not yielding to pedestrians).

TIME – ● ○ ○ Ⓣ

E2 – Provide targeted conventional enforcement of traffic laws

WHERE TO USE – Signalized intersections with a high frequency of crashes related to drivers either being unaware of (or refusing to obey) traffic laws and regulations that impact traffic safety.

TIME – ● ○ ○ Ⓣ

E3 – Implement automated enforcement of red-light running (cameras)

WHERE TO USE – Signalized intersections with a high frequency of right-angle and rear-end crashes attributed to drivers who intentionally disobey red signal indications.

TIME – ● ● ○ Ⓟ

E4 – Implement automated enforcement of approach speeds (cameras)

WHERE TO USE – Signalized intersections with a high frequency of crashes attributed to drivers who intentionally disobey posted approach speed limits.

TIME – ● ● ○ Ⓣ

E5 – Control speed on approaches

WHERE TO USE – Signalized intersections with a high frequency of crashes attributed to drivers who intentionally disobey posted approach speed limits.

TIME – ● ● ○ Ⓔ

CATEGORY F: IMPROVE ACCESS MANAGEMENT NEAR SIGNALIZED INTERSECTIONS

F1 – Restrict access to properties using driveway closures or turn restrictions

WHERE TO USE – Signalized intersections with high crash frequencies related to driveways adjacent to the intersection. Generally, driveways within 250 feet of the intersection are the greatest concern.

TIME – ● ○ ○ Ⓣ

F2 – Restrict cross-median access near intersections

WHERE TO USE – Approaches to signalized intersections with a high frequency of crashes involving drivers making turns across medians.

TIME – ● ○ ○ Ⓣ

CATEGORY G: IMPROVE SAFETY THROUGH OTHER INFRASTRUCTURE TREATMENTS

G1 – Improve drainage in intersection and on approaches

WHERE TO USE – Signalized intersections with a high frequency of crashes that are related to poor drainage. Such crashes involve vehicles that hydroplane and, hence, are not able to stop when required.

TIME – ● ● ○ Ⓣ

G2 – Provide skid resistance in intersection and on approaches

WHERE TO USE – Signalized intersection approaches where skidding is determined to be a problem, especially in wet conditions.

TIME – ● ● ○ Ⓣ

G3 – Coordinate closely spaced signals near at-grade railroad crossings

WHERE TO USE – Signalized intersections in close proximity to at-grade railroad crossings with a high frequency of crashes. This situation presents a significant potential for vehicle-train crashes, but vehicle-vehicle crashes could also occur if drivers try to speed through an intersection to avoid waiting in a queue near the railroad crossing.

TIME – ● ● ○ Ⓣ

G4 – Relocate signal hardware out of clear zone

WHERE TO USE – Signalized intersections where signal hardware is located within the clear zone or is a sight obstruction (particularly on high-speed approaches).

TIME – ● ○ ○ Ⓣ

G5 – Restrict or eliminate parking on intersection approaches

WHERE TO USE – Signalized intersections with permitted parking on the approaches that may present a safety hazard either by blocking sight distance or due to parking maneuvers.

TIME – ● ○ ○ Ⓟ

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. Example short term strategies include signage improvements, signal timing changes, and sight distance improvements. Two circles indicates a medium time frame of 1-2 years. Example medium term strategies include channelization improvements, system-wide signal improvements, and minor geometric improvements. Three circles indicates a longer time frame of over 2 years. These strategies will typically 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 strategy. 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 be employed with a good degree of confidence, but with the understanding that any application can lead to results that vary

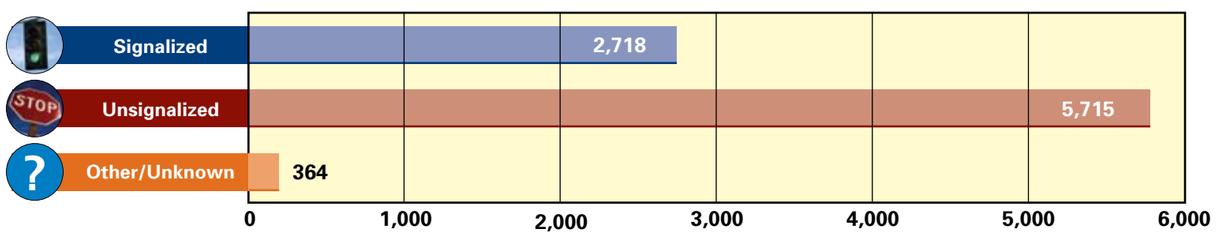
CONTINUED ON BACK PANEL

COST

SAFETY CONCERN	Low	Moderate	Moderate-High	High
High frequency of right-angle crashes attributed to:				
nearby driveways	F1, F2			
traffic from cross street	A2, A3	E2, E3		
skewed intersection				B4, B5, C2
poor sight distance	A1, C1, G5	G4		B4, B5, C2
drivers misjudging gaps	A1			
not enough gaps for drivers	A1	A4		
driver unaware of intersection	D1, D2			B4, C2
nighttime conditions	D1, D2			
right turning vehicles hit from side	A3, C1, G5	B2, G4		
High frequency of rear-end crashes attributed to:				
left turning vehicles hit from behind	A1	B1		B4, B5
left opposing vehicles hit from behind		B1		B5
right turning vehicles hit from behind	A3	B2		
standing water on roadway		G1		
vehicles unable to stop safely (skidding)		G2		
driver unaware of intersection	D1, D2			
nighttime conditions	D1, D2			
speed differentials of vehicles		A4, E4, E5		
sudden stops	A2, A3	A4		
High frequency of left-turn crashes attributed to:				
left turn vehicles hit by opposing traffic	A1, A3, C1	B1		B4, B5
nighttime conditions	D1, D2			
High frequency of sideswipe crashes attributed to:				
vehicles within intersection	A1	B1		
High frequency of pedestrian/bicycle crashes:				
on school routes or near generators of ped/bike traffic	A6, B3	E2		
vehicle/bicycle sideswipes on approaches		G1		
with left turning vehicles	A1, A3			
Address overall safety issues:				
violation of traffic laws	E1	E2		
intersection near railroad crossing		G3		
intersection near fire station		A5		
excessive delay	A7			
disobedience of traffic signal	A7			

Counter measures indicated on the table are *possible* treatments for individual crash problems. Implementation should be based on individual circumstances and studies.

2006 INTERSECTION FATALITIES



Source: FARS, National Highway Traffic Safety Administration

KEY TO THE BROCHURE CONTINUED

significantly from those found in previous evaluations. Crash reduction factors reported are typically based on valid research methods.

Ⓣ **Tried:** Those strategies that have been implemented in a number of locations and may 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 attributes cited in the guide and relate them 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. Crash reduction factors reported are not necessarily based on valid research methods and should be used with caution.

Ⓔ **Experimental:** Those strategies that have been suggested and that at least one agency has considered sufficiently promising to try on a small scale in at least one location. These strategies should be considered only after the others have been determined to be inappropriate or unfeasible. Even where they are considered, their implementation should initially occur using a very controlled and limited pilot study that includes a properly designed evaluation component.

This brochure is a quick reference to the countermeasures described in the NCHRP Report 500 volumes 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.

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U.S.Department of Transportation
Federal Highway Administration

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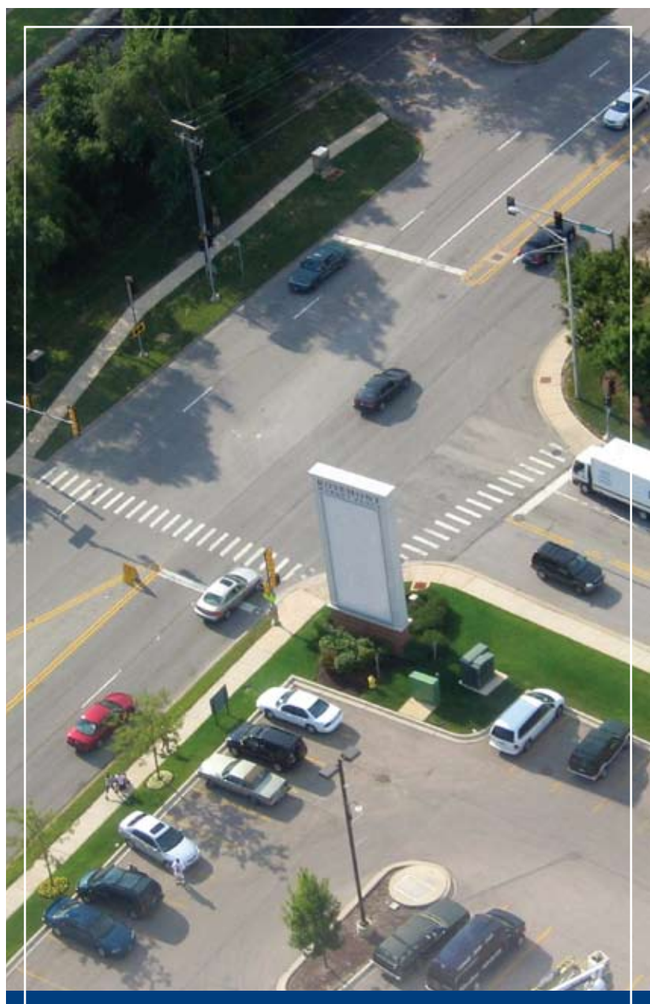

Intersection Safety Strategies

U.S.Department of Transportation
Federal Highway Administration