




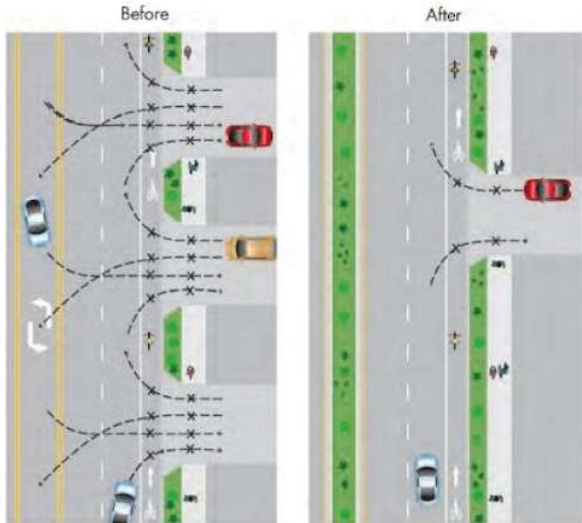
# Sharing the Road: A Safety Action Plan for the City of Columbia, SC

## Countermeasure Toolbox

Countermeasures		Purpose/Benefit	Considerations	Cost (Time to Implement)	Potential Fatal/Injury Crash Reduction	
<b>Access Management Strategies</b>						
AM-01		Unsignalized Reduced Conflict Intersections (RCIs)	Reduces the number of conflict points at unsignalized driveways and intersections by restricting left-turn movements.	<ul style="list-style-type: none"> <li>Unsignalized RCIs should be considered at existing intersections or driveways with minor street AADT less than 3,000 vehicles per day</li> <li>Consider the need to provide 3/4 access (i.e., major street left-turn movements allowed, minor street left-turn movements restricted) or right-in/right-out (RI/RO) access (i.e., all left-turn movements restricted) based on local conditions with respect to traffic volumes and adjacent access points</li> </ul>	\$\$\$-\$\$\$\$ (Medium-Long)	22%-63%
AM-02		Access Management Near Signalized Intersections	Reduces conflicts near signalized intersections by removing or restricting adjacent unsignalized driveways to right-in/right-out (RI/RO) access only.	<ul style="list-style-type: none"> <li>Consider restricting all unsignalized driveways within the functional area of adjacent intersections to right-in/right-out (RI/RO) access only, wherever feasible and/or supported by existing angle crash history</li> <li>The functional area of an intersection consists of the entire space over which drivers make decisions and lane change maneuvers, including turn bay storage area but often extending as far upstream as 1,000 feet or the next signalized intersection on urban roadways</li> </ul>	\$\$-\$\$\$ (Short-Medium)	22%-63%

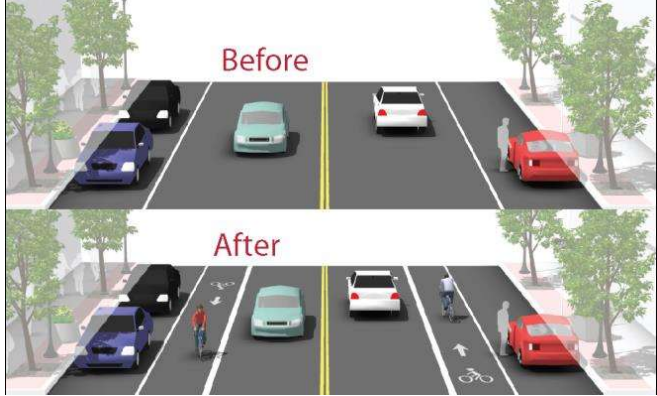
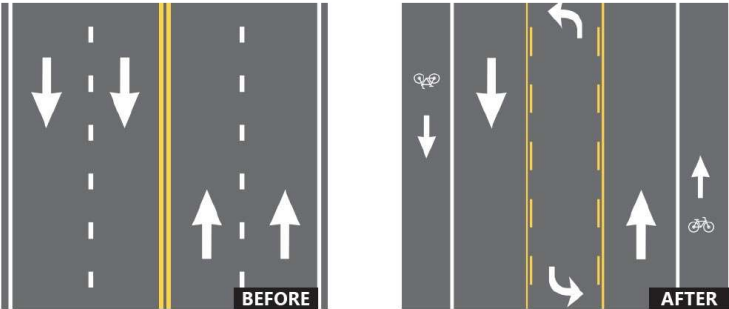

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AM-03		<p>Corridor Access Management: Raised Medians</p> <p>Reduces conflicts along a corridor by physically precluding cross access with a raised or depressed concrete or landscaped median.</p>	<ul style="list-style-type: none"> <li>Consider constructing a raised median wherever absent on undivided facilities (including those with a center TWLTL) with at least 4 lanes, medium/high driveway density, and/or an existing angle crash history</li> <li>Communicate with community stakeholders about closing/consolidating or restricting movements at driveway</li> </ul>	<p>\$\$\$-\$\$\$\$ (Medium-Long)</p>	<p>22%-63%</p>
AM-04		<p>Corridor Access Management: Reduce Driveway Density</p> <p>Reduces conflicts by limiting the number of access points and simplifying turning movement patterns along a corridor.</p>	<ul style="list-style-type: none"> <li>Consider removing or consolidating driveways on urban roadways, both divided and undivided, with medium/high driveway density and/or an existing crash history</li> <li>Driveway density can be described as follows: Less than 10 driveways per mile (low); 10-20 driveways per mile (medium); more than 20 driveways per mile (high)</li> <li>Communicate with community stakeholders about closing/consolidating or restricting movements at driveways</li> </ul>	<p>\$\$-\$\$\$ (Medium-Long)</p>	<p>5%-31%</p>



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<b>Cross Section Modifications</b>						
CS-01		Lane Narrowing	Narrowing lane widths can help reduce vehicle speeds and provide additional space for bicycle lanes, parking lanes, wider sidewalks, or landscape buffers.	<ul style="list-style-type: none"> <li>AASHTO Greenbook minimum lane widths:               <ul style="list-style-type: none"> <li>9 feet on rural highways</li> <li>10 feet for most vehicle travel lanes or turn lanes</li> <li>11 feet to accommodate larger vehicles</li> </ul> </li> <li>Consider surrounding land uses or if lane narrowing would divert traffic to local neighborhood streets</li> <li>On roadways with exceeded capacity, a road diet/lane reduction may be a better option</li> </ul>	\$-\$\$\$ (Medium-Long)	38%-46%
CS-02		Complete Street Retrofit	A complete street retrofit typically involves reallocating or "right-sizing" existing pavement width on undivided highways without left-turn lanes. When applied appropriately, retrofits can reduce travel speeds and improve safety for all road users by providing exclusive left-turn lanes and enhancing non-motorist facilities.	<ul style="list-style-type: none"> <li>4-to-3 lane conversion should be considered for roadways with documented safety concerns and moderate volumes (i.e., typically less than 20,000 vehicles per day, with the best candidate roadways carrying less than 15,000 vehicles per day)</li> <li>Retrofits can be uncommon for a community, so community outreach is helpful to educate and gather input</li> <li>Consider impacts on alternative routes</li> </ul>	\$-\$\$\$ (Medium-Long)	19%-47%
CS-03		One-Way/Two-Way Street Conversions	Convert one-way street to two-way or vice versa to change the character of a roadway.	<ul style="list-style-type: none"> <li>Consider how conversion may affect overall circulation of the system</li> <li>Converting to one-way may affect accessibility for businesses and may increase the potential for speeding issues</li> <li>One-way conversion should occur as a couplet where a nearby street is converted to one-way in the opposite direction</li> </ul>	\$\$\$\$-\$\$\$\$ (Long)	Unknown


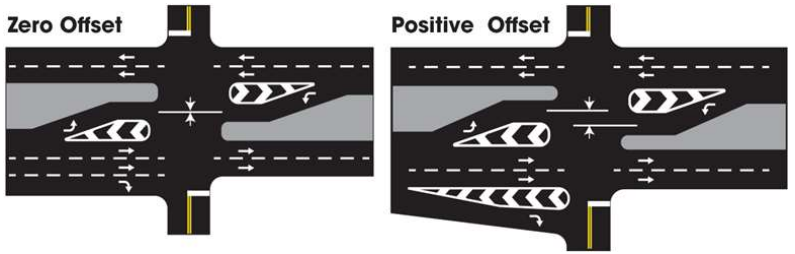

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CS-04		Roadway Widening	Roadway widening and other capacity-expanding projects can improve safety by reducing congestion, thereby reducing the risk for crashes related to queues, speed differentials, and aggressive driving behavior while also improving emergency response time when crashes do occur.	<ul style="list-style-type: none"> <li>Widening should be considered on segments exhibiting a high potential for future growth and long-term volume-to-capacity ratios in excess of 110%. Roadway widening should be considered after reviewing intersection and lower-cost corridor improvement alternatives</li> </ul>	<p>\$\$\$\$ (Long)</p> <p>10%</p>
<b>Intersection Upgrades</b>					
I-01		Dedicated Left-Turn Lanes	Reduces rear-end and angle crash risk by removing left-turning traffic from the through lanes (all cases) and providing opportunities for phasing upgrades (at signalized intersections).	<ul style="list-style-type: none"> <li>Left-turn lanes should be provided: <ul style="list-style-type: none"> <li>On the major street at any signalized intersection</li> <li>On the major street at any unsignalized intersection with an arterial or collector</li> <li>At all entrances to major developments and all median crossovers</li> <li>At any intersection where crash history may be influenced by the absence of a turn lane</li> <li>In general, where the peak hour left-turning volume &gt; 100 vehicles per hour</li> <li>As dual left-turn lanes where the peak hour left-turning volume &gt; 300 vehicles per hour</li> </ul> </li> </ul>	<p>\$\$-\$\$\$ (Short-Medium)</p> <p>28%-48%</p>



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I-02		Dedicated Right-Turn Lanes	Reduces rear-end crash risk by removing right-turning traffic from the through lanes (all cases) and providing opportunities for phasing upgrades (at signalized intersections).	<ul style="list-style-type: none"> <li>• Right-turn lanes should be provided:               <ul style="list-style-type: none"> <li>○ On a six-lane major street at any unsignalized, free-flowing intersection approach</li> <li>○ At any major street signalized intersection approach with right-turn volumes &gt; 300 vehicles per hour</li> <li>○ At any intersection where crash history may be influenced by the absence of a turn lane</li> <li>○ For uniformity along a corridor where right-turn lanes are typically provided</li> </ul> </li> </ul>	\$\$\$-\$\$\$ (Short-Medium)  14%-26%
I-03		Provide Positive Offset for Left-Turn Lanes	Improves sight distance for left-turning vehicles by shifting the left-turn bay closer to the opposing traffic stream.	<ul style="list-style-type: none"> <li>• Consider providing a positive offset for major street left-turn lanes at signalized intersections when operating under permissive or protected-permissive control where sight distance constraints and existing angle crash history are prevalent</li> </ul>	\$\$\$-\$\$\$ (Short-Medium)  36%
I-04		Extend Existing Left- or Right-Turn Lanes	Reduces rear-end crash risk by providing additional deceleration and/or storage length for turning traffic.	<ul style="list-style-type: none"> <li>• Where additional turn lanes may not be appropriate or feasible but projected traffic volumes, existing traffic operations data, or anecdotal knowledge of traffic conditions indicate that existing storage is insufficient, consider extending left- or right-turn lanes</li> </ul>	\$\$\$-\$\$\$ (Short-Medium)  15%



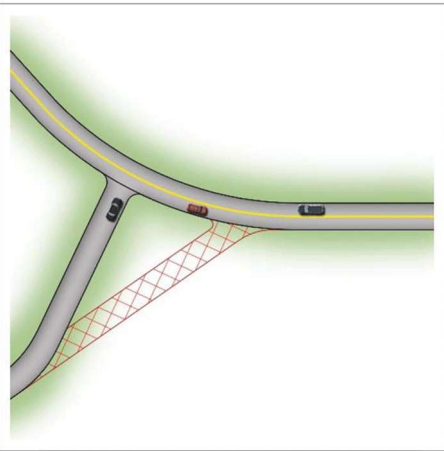
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I-05		<p>Signalized Reduced Conflict Intersections (RCIs)</p> <p>Reduces the number of conflict points at signalized intersections by restricting left-turn movements. Utilizing an RCI design at a signalized intersection can also improve the efficiency of the traffic signal, thereby reducing the potential for rear-end crashes.</p>	<ul style="list-style-type: none"> <li>Signalized reduced conflict intersections (i.e., RCUT or Thru-Cut intersections) should be considered at existing signalized or unsignalized intersections on 4-, 6-, or 8-lane arterials with minor street AADT &gt; 3,000 vehicles per day.</li> </ul>	<p>\$\$\$-\$\$\$\$ (Medium-Long)</p>	<p>22%</p>
I-06		<p>Roundabouts</p> <p>Reduces travel speeds and the number of conflict points relative to conventional intersection designs and creates an environment that minimizes the risk of injury crashes.</p>	<ul style="list-style-type: none"> <li>A roundabout should be considered at existing signalized or unsignalized intersections where the minor street AADT is at least 10% of the major street AADT, feasible volume thresholds are not exceeded, and sufficient right-of-way is available</li> <li>For a single-lane roundabout, the entering average daily traffic volume should not exceed 25,000 vehicles per day.</li> <li>For a multi-lane roundabout, the entering average daily traffic volume should not exceed 45,000 vehicles per day</li> </ul>	<p>\$\$\$\$ (Medium-Long)</p>	<p>78%-82%</p>

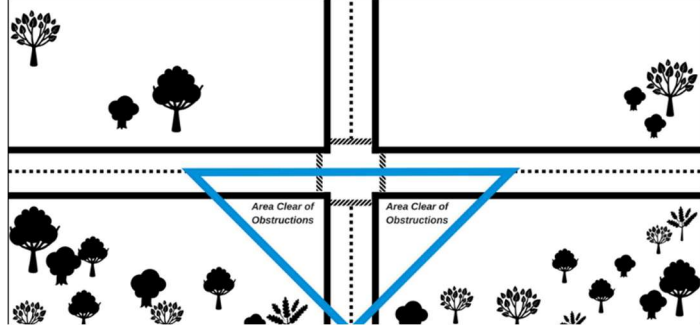


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I-07		All-Way Stop Control	Reduces travel speeds approaching an unsignalized intersection and provides protected access for all movements.	<ul style="list-style-type: none"> <li>All-way stop control should only be considered at existing unsignalized intersections that meet the volume thresholds provided in the Chapter 2B of the MUTCD, where signal warrants are not met, and a roundabout is not feasible</li> <li>The average daily traffic volume on all approaches should not exceed 7,500 vehicles per day, and the total entering volume should not exceed 15,000 vehicles per day</li> </ul>	<p style="text-align: center;">\$ (Short)</p> <p style="text-align: center;">72%-86%</p>
I-08		New Traffic Signal	Provides protected access and reduces delay for minor movements at an intersection (i.e., major street left-turn movements and all minor street movements).	<ul style="list-style-type: none"> <li>A traffic signal should only be considered when one or more of the warrants presented in Part 4 of the MUTCD are met</li> <li>A new traffic signal may typically be considered at unsignalized intersections with AADT in excess of 3,000 vehicles per day and/or a history of angle crashes</li> </ul>	<p style="text-align: center;">\$\$-\$\$\$ (Short-Medium)</p> <p style="text-align: center;">34%-61%</p>
I-09		Reduce Intersection Skew Angle	Improves sight distance for turning traffic from the minor/stop-controlled approaches and allows major street left-turn movements to be completed at appropriate speeds.	<ul style="list-style-type: none"> <li>While developing intersection traffic safety projects or other projects, study the need to realign intersection approaches to reduce or eliminate intersection skew at unsignalized intersections with a high frequency of collisions resulting from insufficient intersection sight distance and awkward sight lines at a skewed intersection</li> </ul>	<p style="text-align: center;">\$\$-\$\$\$ (Medium)</p> <p style="text-align: center;">20%-60%</p>




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I-10		Intersection Sight Distance Improvements	Improves sight distance for minor/stop-controlled approaches by removing vegetation, parking, or other obstructions.	<ul style="list-style-type: none"> <li>Consider the need for regular maintenance/trimming at intersections with non-removable vegetation and implement design standards that consider sight distance at intersections in urban areas</li> </ul>	\$\$\$ (Short-Medium)	15%-25%
<b>Non-Motorized Enhancements</b>						
N-01		Pedestrian Hybrid Beacon (PHB)	Helps pedestrians cross at mid-block or uncontrolled intersection locations by stopping motor vehicles.	<ul style="list-style-type: none"> <li>Recommended for 3+ lane roadways with speeds higher than 40 mph and AADT greater than 9,000</li> <li>Should be installed with other improvements such as high visibility crosswalks, advance yield/stop signage and pavement markings, and/or pedestrian refuge islands</li> <li>PHB and RRFB should not be installed at the same crossing</li> <li>See Chapter 4J.02 of the MUTCD for further guidance</li> </ul>	\$\$\$-\$\$\$ (Short-Medium)	15%-55%
N-02		Rectangular Rapid Flashing Beacon (RRFB)	Improves pedestrian visibility at mid-block or uncontrolled intersection locations by providing dynamic signing and marking enhancements.	<ul style="list-style-type: none"> <li>Recommended for:                             <ul style="list-style-type: none"> <li>2-lane roadways with speeds greater than 30 mph and AADT less than 15,000 or speeds less than 40 mph for AADT greater than 15,000</li> <li>3-lane roadways with speeds less than 40 mph</li> <li>4+ lanes roadways with speeds less than 40 mph and AADT less than 15,000 or speeds less than 30 mph for AADT greater than 15,000</li> </ul> </li> <li>PHB and RRFB should not be installed at the same crossing</li> <li>See Chapter 4L of the MUTCD for further guidance</li> </ul>	\$\$\$-\$\$\$ (Short-Medium)	47%




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N-03		<p>In-Street Pedestrian Crossing Sign (MUTCD R1-6)</p> <p>Reminds roadway users of laws regarding right-of-way.</p>	<ul style="list-style-type: none"> <li>Recommended for multilane roadways where AADT is greater than 10,000 or on 2- to 3-lane roads where speed limits are 30 mph or less</li> <li>Cannot be implemented at signalized locations</li> <li>See Section 2B.20 of the MUTCD for further guidance</li> </ul>	\$ (Short)	Unknown
N-04		<p>Pedestrian Refuge Island</p> <p>Breaks up walking distance and allows pedestrians to focus on one direction at a time.</p>	<ul style="list-style-type: none"> <li>Recommended for roadways with raised median, especially for roadways with more than 2 lanes in each direction</li> <li>At controlled crossing, it is recommended that pedestrian signal button is installed in the pedestrian refuge island</li> <li>Need to be of sufficient size for ADA compliance</li> </ul>	\$\$-\$\$\$ (Medium-Long)	46%
N-05		<p>Raised Pedestrian Crossings</p> <p>Improves safety for pedestrians by increasing visibility for drivers and reducing vehicle speed.</p>	<ul style="list-style-type: none"> <li>Recommended as an uncontrolled crossing for 2- to 3-lane roadways with speeds less than 30 mph and AADT less than 9,000</li> <li>Attention should be paid to impacts on drainage</li> <li>May be inappropriate on curves or steep roadway grades</li> <li>Need to consider impacts on emergency response vehicles</li> </ul>	\$\$-\$\$\$ (Medium)	30%-45%




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N-06		Curb Extensions/Radius Reductions	Increases visibility, reduces speed of turning vehicles, and reduces pedestrian crossing exposure.	<ul style="list-style-type: none"> <li>• Curb extensions appropriate where there is an on-street parking and transit users and bicyclists would travel outside curb edge</li> <li>• Curb extensions should not extend more than 6 feet from curb</li> <li>• Curb extensions and radius reductions need to consider turning needs for larger vehicles such as school buses or emergency vehicles</li> <li>• Attention should be paid to impacts on drainage</li> </ul>	\$\$\$ (Medium)	0%-57%
N-07		Improve Right-Turn Slip Lane Design	Improved right-turn slip lane design may slow turning vehicles, allow pedestrian and drivers to see each other, reduce pedestrian exposure in the roadway, and reduce the complexity of an intersection.	<ul style="list-style-type: none"> <li>• Right-turn slip lanes are most appropriate at signalized intersections with higher right-turn volumes or signalized intersections where geometry makes the right-turn movement infeasible without impeding pedestrian crossings</li> </ul>	\$\$\$ (Medium-Long)	44%-60%
N-08		Pedestrian Overpass/Underpass	Provides completely separated crossing from vehicular traffic or provides safe crossing over/under barriers such as freeway, railways and natural barriers.	<ul style="list-style-type: none"> <li>• Use sparingly and as a measure of last resort</li> <li>• Pedestrians will not use if there is a more direct route</li> <li>• Lighting, drainage, graffiti removal, and security are a major concern with underpasses</li> <li>• Long ramps may be necessary to accommodate ADA</li> </ul>	\$\$\$ Long	Unknown


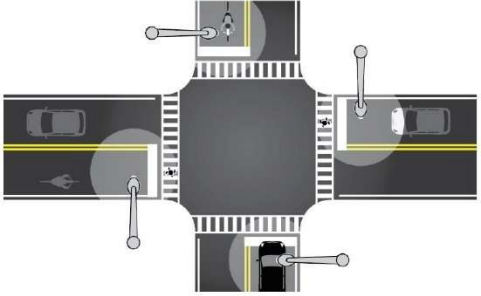

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N-09		Enhanced Signage and Markings	Improves pedestrian visibility by providing advance warning to drivers of marked crosswalks and/or better delineating crossings themselves.	<ul style="list-style-type: none"> <li>High-Visibility Crosswalk Markings (See SCDOT Traffic Engineering Guidelines), Advance Yield/Stop Pavement Markings (See Section 3B.19 of the MUTCD), Yield/Stop Here to Pedestrians Signage (See Section 2B.19 of the MUTCD), Bicycle Signage and Pavement Markings (Chapter 9 of the MUTCD), and Improved Retroreflectivity/Conspicuity of Signs all fall within this category</li> </ul>	<p>-\$-\$\$\$ (Short)</p>	25%-42%
N-10		Bicycle Lanes	Provides dedicated portion of the roadway for preferential use by bicyclists.	<ul style="list-style-type: none"> <li>Provide adequate bicycle lane width</li> <li>4-5 feet when on-street parking is not present.                             <ul style="list-style-type: none"> <li>6-7 feet for locations with higher bicycle traffic, higher vehicle speeds or volume, or higher percentage of larger vehicles</li> <li>When adjacent to on-street parking make sure to provide additional space between bicycle lane and vehicles</li> </ul> </li> <li>Make sure bicycle lanes are clear of debris and avoid placing paving joints within a bicycle lane</li> <li>Marked crosswalk should be extended across bicycle lanes to inform bicyclists that they should yield to pedestrians</li> <li>See Chapter 9E of the MUTCD for further guidance</li> </ul>	<p>\$\$-\$\$\$ (Medium-Long)</p>	30%-53%
N-11		Separated Bicycle Lanes	Physically separates bicyclists from vehicular traffic.	<ul style="list-style-type: none"> <li>Minimum width of separated bicycle lane is 5 feet, with a minimum 3-foot buffer</li> <li>At intersections, make sure to have signage and pavement markings to improve awareness</li> </ul>	<p>\$\$\$-\$\$\$\$ Long</p>	30%-53%



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N-12		Sidewalk/Shared Use Path Provides dedicated space separate from public right-of-way for non-motorists.	<ul style="list-style-type: none"> <li>While constructing continuous facilities is ideal, constructing sections can help set groundwork for a later continuous system</li> <li>In retrofitting streets that do not have space for continuous walkways, prioritize locations near transit stops, schools, parks, public buildings, and other areas with high concentrations of pedestrians</li> <li>Street furniture should not restrict pedestrian flow</li> </ul>	\$\$\$\$\$ (Medium-Long)	65%-89%
N-13		Roadway/Intersection Lighting Provides better visibility of users or objects on the roadway or crossing at an intersection.	<ul style="list-style-type: none"> <li>Install lighting on both sides of street for wider streets and streets in commercial districts</li> <li>Roadways should have uniform lighting levels</li> <li>Place lights in advance of mid-block and intersection crosswalks on both approaches to illuminate in front of pedestrians and avoid creating a silhouette</li> </ul>	\$\$\$\$ Medium	28%-42%
N-14		Pedestrian Countdown Signal Informs pedestrians of the number of seconds remaining in the pedestrian change interval.	<ul style="list-style-type: none"> <li>Pedestrians should also have audible means to indicate crossing interval for pedestrians with restricted vision</li> <li>See Chapter 4I of the MUTCD for further guidance</li> </ul>	\$\$\$ Short	55%-70%



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N-15		<p>Leading Pedestrian Interval (LPI)</p> <p>Increases pedestrian visibility by giving pedestrians the opportunity to enter an intersection before vehicles are given green indication.</p>	<ul style="list-style-type: none"> <li>• Right turn on red rules might limit the effectiveness of LPIs</li> <li>• If there is particularly high pedestrian traffic, consider adding an exclusive pedestrian phase instead of LPI</li> </ul>	\$-\$\$ Short	13%
N-16		<p>Exclusive Pedestrian Phase</p> <p>Creates an exclusive phase for pedestrian traffic to separate non-motorists from conflicting vehicular movements.</p>	<ul style="list-style-type: none"> <li>• Implement at intersections with high pedestrian volume</li> <li>• If there is low pedestrian traffic, consider an LPI</li> </ul>	\$-\$\$ Short	0%-50%





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N-17		Right-Turn on Red Restriction	Potentially reduces conflicts with pedestrian and right-turn motorists.	<ul style="list-style-type: none"> <li>• RTOR restriction should be used at school crossings or intersections with a crossing guard or with inadequate sight distances and where there are known areas of high pedestrian activity</li> <li>• Sign should be clearly visible to right-turning motorists</li> <li>• Also consider implementing LPI or exclusive pedestrian phase</li> </ul>	\$-\$\$ Short	Unknown
N-18		Median Crossing Treatments for Bicycles	Crossing enhancements and median refuge treatments to assist bicyclists and are designed to improve safety by increasing bicyclist visibility, improving yielding rates, and alerting drivers to the potential presence of bicyclists.	<ul style="list-style-type: none"> <li>• Treatments are most effective on multilane roadways with higher volumes and speeds where gaps are limited</li> <li>• Confirm the crossing aligns with a designated bikeway, trail crossing, or key desire line</li> <li>• Consider proximity to schools, transit stops, employment centers, or shared-use paths</li> <li>• Ensure adequate refuge (typically ≥6–10 ft preferred for bicyclists)</li> </ul>	\$-\$\$\$ (Short-Medium)	86%



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<b>Roadway Departure Countermeasures</b>					
RD-01		Install Longitudinal Rumble Strips and Stripes	Rumble strips and stripes alert distracted, drowsy, or otherwise inattentive drivers who drift from their lane.	<ul style="list-style-type: none"> <li>Agencies should consider milled center line rumble strips (including in passing zone areas) and milled edge line or shoulder rumble strips with bicycle gaps for systemic safety projects, location-specific corridor safety improvements, as well as reconstruction or resurfacing projects</li> </ul>	<p>-\$\$\$ (Short-Medium)</p> <p>13%-64%</p>
RD-02	  <p><i>Roadway with 4-in edge line</i>      <i>Roadway with 8-in edge line</i></p>	Install Wider Edge Lines	Wider edge lines increase drivers' perception of the edge of the travel lane and can provide a safety benefit to all facility types. This countermeasure typically involves widening of existing markings to the maximum normal line width of 6 inches. Use of thermoplastic markings with retroreflective beads, raised pavement markers, or other measures that improve visibility may increase the effectiveness of this countermeasure.	<ul style="list-style-type: none"> <li>Agencies should consider implementing a systemic approach to wider edge line installation based roadway departure crash risk factors</li> <li>Potential risk factors for two-lane rural roads include: <ul style="list-style-type: none"> <li>Pavement and shoulder widths</li> <li>Presence of curves</li> <li>Traffic volumes</li> <li>History of nighttime crashes</li> </ul> </li> </ul>	<p>-\$\$\$ (Short-Medium)</p> <p>22%-37%</p>
RD-03		Install Median Barriers	Median barriers significantly reduce the number of cross-median crashes, which are attributed to the relatively high speeds that are typical on divided highways.	<ul style="list-style-type: none"> <li>To reduce cross-median crashes, transportation agencies should review their head-on crash history on divided highways to identify hot spots</li> <li>Agencies should also consider implementing a systemic approach to median barrier placement based on cross-median crash risk factors</li> <li>Potential risk factors include: <ul style="list-style-type: none"> <li>Traffic volumes</li> <li>Vehicle classifications</li> <li>Median crossover history</li> <li>Vertical and horizontal alignment</li> <li>Median terrain configurations</li> </ul> </li> <li>Median barriers can be cable, metal-beam, or concrete</li> </ul>	<p>\$\$-\$\$\$ (Short)</p> <p>97%</p>



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## Countermeasure Toolbox

Countermeasures		Purpose/Benefit	Considerations	Cost (Time to Implement)	Potential Fatal/Injury Crash Reduction
RD-04		<p>Install Roadside Barriers</p>	<p>Roadside barriers reduce the number of run-off-road crashes by redirecting vehicles departing the outside edge of the travel lane.</p>	<ul style="list-style-type: none"> <li>Roadside barriers should be considered wherever roadside hazards cannot be removed, relocated, or redesigned in curves and/or steep embankments do not allow for a recoverable clear zone</li> <li>Roadside barriers can be cable, metal-beam, or concrete</li> </ul>	<p>\$\$\$-\$\$\$ (Short)</p> <p>8%-44%</p>
RD-05		<p>Remove, Relocate, or Delineate Roadside Obstacles</p>	<p>Removal, relocation, or delineation of roadside obstacles reduce the risk of severe injury run-off-road crashes.</p>	<ul style="list-style-type: none"> <li>Consider removing, relocating, or delineating roadside obstacles, including vegetation, where single-vehicle/roadway departure crashes are frequent</li> <li>These steps should always be sought prior to implementing roadside barriers as a countermeasure</li> </ul>	<p>\$\$\$-\$\$\$ (Short)</p> <p>8%-44%</p>



# Sharing the Road: A Safety Action Plan for the City of Columbia, SC

## Countermeasure Toolbox

Countermeasures		Purpose/Benefit	Considerations	Cost (Time to Implement)	Potential Fatal/Injury Crash Reduction
RD-06		Resurfacing and Shoulder Widening	Adding or widening shoulders gives drivers more recovery area to regain control in the event of a roadway departure. Maintaining a general state of good repair, particularly on rural two-lane highways, also reduces the risk of roadway departure crashes related to poor pavement condition.	<ul style="list-style-type: none"> <li>Consider shoulder widening where single-vehicle/roadway departure crashes are frequent. Shoulder widening should occur in conjunction with programmed mill-and-fill or overlay resurfacing efforts</li> <li>Where shoulder widening is cost prohibitive or infeasible, consider paving with Safety Edge technology to improve pavement durability and reduce the risk of edge-drop-offs</li> </ul>	<p>\$\$\$-\$\$\$ (Short-Medium)</p> <p>8%-44%</p>
RD-07		Apply High-Friction Surface Treatment	High-friction surface treatments (HFST) reduce the risk of vehicles leaving the roadway due to a lack of friction caused by wet conditions or high travel speeds in horizontal curves.	<ul style="list-style-type: none"> <li>HFST should be applied in locations with increased friction demand, including: <ul style="list-style-type: none"> <li>Horizontal curves</li> <li>Interchange ramps</li> <li>Intersection approaches</li> <li>Higher-speed signalized and stop-controlled intersections</li> <li>Steep downward grades</li> <li>Locations with a history of rear-end, failure to yield, wet-weather, or red-light-running crashes</li> <li>Crosswalk approaches</li> </ul> </li> </ul>	<p>\$\$\$-\$\$\$ (Short)</p> <p>20%-63%</p>




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## Countermeasure Toolbox

Countermeasures		Purpose/Benefit	Considerations	Cost (Time to Implement)	Potential Fatal/Injury Crash Reduction
<b>Signal Upgrades</b>					
S-03		<p>Modify Yellow Change Intervals</p>	<p>Appropriately timed yellow change intervals reduce the risk of red-light running, a significant contributor to severe injury crashes at signalized intersections.</p>	<ul style="list-style-type: none"> <li>Agencies should institute regular evaluation and adjustment protocols for existing traffic signal timing</li> <li>Transportation agencies should refer to the Manual on Uniform Traffic Control Devices (MUTCD) for basic requirements and further recommendations about yellow change interval timing</li> </ul>	<p>\$-\$\$ (Short)</p> <p>12%</p>
S-01		<p>Install Backplates With Retroreflective Borders</p>	<p>Backplates added to a traffic signal head improve the visibility of the illuminated face of the signal by introducing a controlled-contrast background.</p>	<ul style="list-style-type: none"> <li>Agencies should consider backplates with retroreflective borders as part of their efforts to systematically improve safety performance at signalized intersections</li> </ul>	<p>\$-\$\$ (Short)</p> <p>15%</p>



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## Countermeasure Toolbox

Countermeasures		Purpose/Benefit	Considerations	Cost (Time to Implement)	Potential Fatal/Injury Crash Reduction
S-02		Install Flashing Yellow Arrow Signal Heads	Provides clearer direction for drivers making permissive or protected-permissive left-turn movements at signalized intersections, eliminates the potential for the "left-turn trap" associated with five-section "doghouse" signal heads, and provides opportunities for lead-lag phasing.	<ul style="list-style-type: none"> <li>Agencies should consider flashing yellow arrow signal heads as part of their efforts to systematically improve safety performance at signalized intersections</li> <li>Flashing yellow arrow signal heads may require a signal rebuild if the existing poles/mast arms are not equipped to support the proposed load and configuration</li> </ul>	<p>\$-\$\$\$ (Short-Medium)</p> <p>15%-65%</p>
S-04		Modify Left-Turn Phasing	Protected or protected-permissive left-turn phasing reduces the risk of severe injury, angle crashes occurring during permissive left-turn movements.	<ul style="list-style-type: none"> <li>Agencies should institute regular evaluation and adjustment protocols for existing traffic signal timing</li> <li>Transportation agencies should refer to the Manual on Uniform Traffic Control Devices (MUTCD) and SCDOT Roadway Design Manual for basic requirements and further recommendations about left-turn signal phasing</li> </ul>	<p>\$-\$\$ (Short)</p> <p>15%-99%</p>
S-05		Corridor Signal Retiming	Regular retiming of coordinated signal systems can improve safety by optimizing progression between signals and reducing congestion, thereby reducing the risk for crashes related to queues, speed differentials, and aggressive driving behavior.	<ul style="list-style-type: none"> <li>Agencies should institute regular evaluation and adjustment protocols for existing traffic signal timing</li> <li>Transportation agencies should refer to the Manual on Uniform Traffic Control Devices (MUTCD), SCDOT Roadway Design Manual, and other guiding documents for basic requirements and further recommendations about signal timing and phasing</li> </ul>	<p>\$-\$\$\$ (Short-Medium)</p> <p>15%</p>




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## Countermeasure Toolbox

Countermeasures		Purpose/Benefit	Considerations	Cost (Time to Implement)	Potential Fatal/Injury Crash Reduction	
<b>Traffic Control Device Upgrades</b>						
TCD-01		Stop-Controlled Intersection Upgrades	These countermeasures increase driver awareness and recognition of the intersections and potential conflicts.	<ul style="list-style-type: none"> <li>The low-cost countermeasures for stop-controlled intersections generally consist of the following treatments on the through approach:                             <ul style="list-style-type: none"> <li>Doubled-up (left and right), oversized advance intersection warning signs, with supplemental street name plaques (can also include flashing beacon)</li> <li>Retroreflective sheeting on sign posts</li> <li>Enhanced pavement markings that delineate through lane edge lines</li> </ul> </li> <li>The low-cost countermeasures for stop-controlled intersections generally consist of the following treatments on the stop approaches:                             <ul style="list-style-type: none"> <li>Doubled-up (left and right), oversized advance "Stop Ahead" intersection warning signs (can also include flashing beacon)</li> <li>Doubled-up (left and right), oversized Stop signs</li> <li>Retroreflective sheeting on sign posts</li> <li>Properly placed stop bar</li> <li>Removal of vegetation, parking, or obstructions that limit sight distance</li> <li>Double arrow warning sign at stem of T-intersections</li> </ul> </li> </ul>	\$-\$\$ (Short)	10%-27%
TCD-02		Enhanced Delineation for Horizontal Curves	Enhanced delineation treatments improve safety by alerting drivers to upcoming curves, the direction and sharpness of the curve, and appropriate operating speed.	<ul style="list-style-type: none"> <li>Agencies can take the following steps to implement enhanced delineation strategies:</li> <li>Review signing practices and policies to ensure they comply with the Manual on Uniform Traffic Control Devices (MUTCD) principles of traffic control devices</li> <li>Consistent practice for similar curves sets the appropriate driver expectancy</li> <li>Use the systemic approach to identify and treat problem curves                             <ul style="list-style-type: none"> <li>For example, Minnesota uses risk factors that include curve radii between 500 and 1,200 ft, traffic volumes between 500 and 1,000 vehicles per day, intersection in the curve, and presence of a visual trap</li> </ul> </li> <li>Match the appropriate strategy to the identified problem(s), considering the full range of enhanced delineation treatments</li> <li>Once the MUTCD requirements and recommendations have been met, an incremental approach is often beneficial to avoid excessive cost</li> </ul>	\$-\$\$ (Short)	15%-60%




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## Countermeasure Toolbox

Countermeasures		Purpose/Benefit	Considerations	Cost (Time to Implement)	Potential Fatal/Injury Crash Reduction
TCD-03		Speed Feedback Signs Increases driver awareness of their current travel speed.	<ul style="list-style-type: none"> <li>Speed feedback signs have proven to be an effective tool for reducing travel speeds, particularly on rural highways with long tangent sections and infrequent posted speed limit signs</li> </ul>	\$-\$\$ (Short)	46%
TCD-04		Transverse Rumble Strips Grooves or strips of material alert drivers of an area to reduce speed.	<ul style="list-style-type: none"> <li>Vehicles passing over the strips produce noise and vibration</li> <li>Alerts drivers of a need to reduce speed</li> <li>See Chapter 3K of the MUTCD for further guidance</li> </ul>	\$-\$\$ (Short)	24%
TCD-05		Variable Speed Limits Improves safety by dynamically adjusting the posted speed limit to reflect a safe travel speed based on then-current conditions.	<ul style="list-style-type: none"> <li>Agencies can typically implement variable speed limits for the following applications: congestion, incidents, work zones, and inclement weather.</li> <li>VSLs are particularly effective on urban and rural freeway and high-speed arterials with posted speed limits great than 40 mph</li> </ul>	\$\$\$-\$\$\$ (Medium)	51%

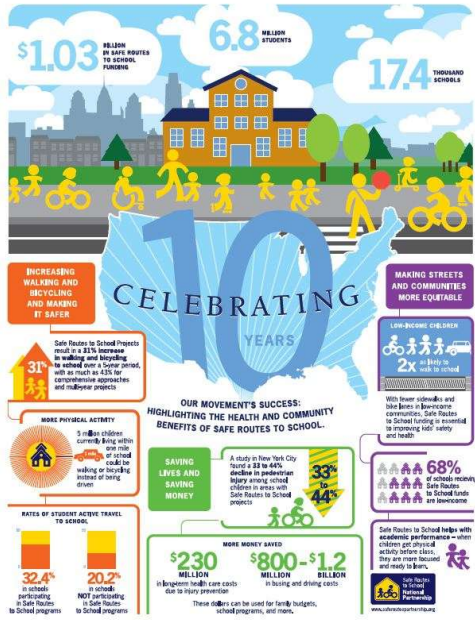

# Sharing the Road: A Safety Action Plan for the City of Columbia, SC

## Countermeasure Toolbox

Countermeasures		Purpose/Benefit	Considerations	Cost (Time to Implement)	Potential Fatal/Injury Crash Reduction
<b>Education, Enforcement, Policy, and Partnership</b>					
EEPP-01		Appropriate Speed Limit Setting	Setting a speed limit no more than 5 mph below the 85th percentile travel speed on a corridor may result in fewer injury crashes and lead to increased driver compliance.	<ul style="list-style-type: none"> <li>When setting a speed limit, agencies should consider a range of factors such as pedestrian and bicyclist activity, crash history, land use context, intersection spacing, driveway density, roadway geometry, roadside conditions, roadway functional classification, traffic volume, and observed speeds</li> </ul>	<p>\$\$ (Short)</p> <p>15%-44%</p>
EEPP-02		Speed Enforcement	Increase awareness of and enforce laws for motorists, pedestrians, and bicyclists.	<ul style="list-style-type: none"> <li>Campaign must be sensitive to needs of different neighborhoods, age/ethnic groups, etc.</li> <li>Enforcement operation should be conducted with help of staff support and awareness of the courts</li> <li>Enforcement can be conducted physically or through the use of speed safety cameras, where permitted</li> </ul>	<p>\$\$\$\$ (Ongoing)</p> <p>Unknown</p>
EEPP-03		Pedestrian and Bicycle Safety Action Plan Advocacy	Raises awareness of increasing pedestrian-involved fatalities and injuries and the importance of pedestrian safety on the transportation network.	<ul style="list-style-type: none"> <li>Use the Pedestrian and Bicycle Safety Action Plan to create awareness of increasing pedestrian-involved fatalities and injuries and the importance of pedestrian safety on the transportation network</li> <li>Educate planners, engineers, and law enforcement on the plan and the strategies and countermeasures contained therein</li> <li>Consider the recommended strategies and high-crash/high-risk networks identified in the Plan when prioritizing future investment</li> </ul>	<p>\$\$ (Ongoing)</p> <p>Unknown</p>



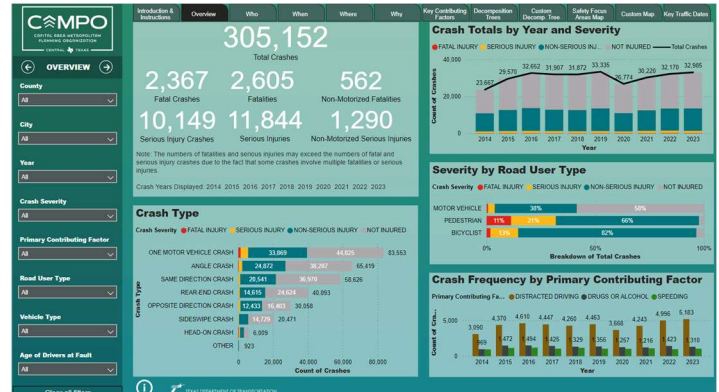
# Sharing the Road: A Safety Action Plan for the City of Columbia, SC

## Countermeasure Toolbox

	Countermeasures	Purpose/Benefit	Considerations	Cost (Time to Implement)	Potential Fatal/Injury Crash Reduction	
EEPP-04		Safe Routes to School Advocacy and Awareness	Raises awareness of the importance of safe routes to school in safety-related planning, engineering, and policy measures.	<ul style="list-style-type: none"> <li>Distribute educational brochures and maps with identified safe routes to schools</li> <li>Prioritize the maintenance and development of safe routes to school in safety-related planning, engineering, and policy measures</li> <li>The Safe Routes to School program offers a great opportunity to build strong partnerships with local jurisdictions, agencies, and schools</li> </ul>	\$-\$\$ (Ongoing)	Unknown
EEPP-05		Awareness and Safety Campaigns	Raises awareness of the risks to pedestrians and cyclists on all roadway types to promote safe behavior by motorists and non-motorists.	<ul style="list-style-type: none"> <li>Implement awareness campaigns emphasizing the risks to motorists, pedestrians, and cyclists on all roadway types to promote safe behavior by motorists and non-motorists</li> <li>These campaigns should leverage multiple mediums, including pop-up booths, radio ads, and social media posts</li> <li>Partner with local and state agencies to develop these campaigns</li> <li>Educational messages should encourage people to think about their own travel attitude and behaviors and make more informed choices</li> <li>Materials should be sensitive to the different groups of people receiving them</li> </ul>	\$-\$\$ (Ongoing)	Unknown



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## Countermeasure Toolbox

	Countermeasures		Purpose/Benefit	Considerations	Cost (Time to Implement)	Potential Fatal/Injury Crash Reduction
EEPP-06		Educational Classes/Training	Improves understanding of basic non-motorist safety principles and misinformation regarding traffic laws and safe behaviors by both motorists and non-motorists.	<ul style="list-style-type: none"> <li>Provide education, both in schools and for the general public, regarding basic non-motorist safety principles and misinformation regarding traffic laws and safe behaviors by both motorists and non-motorists</li> <li>Educational messages should encourage people to think about their own travel attitude and behaviors and make more informed choices</li> <li>Materials should be sensitive to the different groups of people receiving them</li> </ul>	\$-\$\$ (Ongoing)	Unknown
EEPP-07		Intelligent Transportation Systems (ITS) Strategies	Implementation of traffic responsive or adaptive signal systems can improve corridor traffic operations and reduce crash risks. Detection and video can be utilized to monitor conflicts/near misses.	<ul style="list-style-type: none"> <li>If the corridor is located in an area with significant travel pattern variability, consider implementing a traffic responsive or adaptive system</li> <li>Corridors near recreational areas, tourist destinations, and event centers or those experiencing incidents and inclement weather regularly are most likely to benefit from this type of signal system</li> <li>Detection status and inter-signal communication are keys to success for traffic responsive systems</li> <li>Continuous detection and/or video at signalized intersections can also be utilized to evaluate intersection operations and safety performance</li> </ul>	\$\$\$-\$\$\$\$ (Varies)	Unknown
EEPP-08		System Performance Monitoring	Enhances availability of data that can be used to monitor system performance as the Safety Action Plan is implemented and as high-crash locations and countermeasure needs change.	<ul style="list-style-type: none"> <li>Specific actions to be taken include:                             <ul style="list-style-type: none"> <li>Conduct pedestrian and bicycle counts with an emphasis on locations impacted by new or improved infrastructure</li> <li>Maintain a dashboard and/or webpage that can be used to review the Safety Action Plan, associated publications/news, and crash data trends</li> <li>Collaborate with partners to share data/results and identify potential projects to ensure resources are being leveraged and targets can be reached together</li> </ul> </li> </ul>	\$\$-\$\$\$ (Ongoing)	Unknown

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## Countermeasure Toolbox

Countermeasures		Purpose/Benefit	Considerations	Cost (Time to Implement)	Potential Fatal/Injury Crash Reduction	
EEPP-09		Road Safety Audits	<ul style="list-style-type: none"> <li>• RSAs provide the following benefits:                             <ul style="list-style-type: none"> <li>○ Reduced number and severity of crashes due to safer designs</li> <li>○ Reduced costs resulting from early identification and mitigation of safety issues before projects are built</li> <li>○ Increased opportunities to integrate multimodal safety strategies and proven safety countermeasures</li> <li>○ Expanded ability to consider human factors in all facets of design</li> <li>○ Increased communication and collaboration among safety stakeholders</li> <li>○ Objective review by independent multidisciplinary team</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Agencies are encouraged to conduct an RSA at the earliest stage possible, as all roadway design options and alternatives are being explored</li> <li>• Candidate RSA locations can be identified through system performance monitoring and partnership between road owning agencies and jurisdictions</li> </ul>	\$\$\$-\$\$\$ (Ongoing)	10%-60%
EEPP-10		Publicized Sobriety Checkpoints	<ul style="list-style-type: none"> <li>• Publicized sobriety checkpoints use high-visibility and enforced checkpoints to deter and catch impaired drivers, enhancing road safety for all users.</li> </ul>	<ul style="list-style-type: none"> <li>• Checkpoints can be implemented in configuration with holidays or regional events that are prone to high driver impairment</li> </ul>	\$\$-\$\$ (Short)	17%