

## HSIP General Crash Pattern and Countermeasures

## General Accident Patterns\*

Crash Pattern	Probable Cause	General Countermeasure
Left-turn head-on collisions	Large volume of left-turns	<ul style="list-style-type: none"> <li>• Create on way street</li> <li>• Widen road</li> <li>• Provide left-turn signal phases</li> <li>• Prohibit left-turns</li> <li>• Reroute left-turn traffic</li> <li>• Channelize intersection</li> <li>• Install stop signs (see MUTCD)</li> <li>• Revise signal sequence</li> <li>• Provide turning arrows or guide markings (if there is a dual left-turn lane)</li> <li>• Provide traffic signal if warranted by MUTCD</li> <li>• Retime signals</li> </ul>
	Restricted sight distance	<ul style="list-style-type: none"> <li>• Remove obstacles</li> <li>• Provide adequate channelization</li> <li>• Provide special phase for left-turning traffic</li> <li>• Provide left-turn slots</li> <li>• Install warning signs</li> </ul>
	Too short yellow phase	<ul style="list-style-type: none"> <li>• Increase yellow phase</li> <li>• Provide all red phase</li> </ul>
	Absence of special left-turning phase	<ul style="list-style-type: none"> <li>• Provide special phase for left-turning traffic</li> </ul>
	Excessive speed on approaches	
Rear-end collisions at unsignalized intersections	Driver not aware of intersection	<ul style="list-style-type: none"> <li>• Install/improve warning signs</li> <li>• Consider flashing signal</li> </ul>
	Slippery surface	<ul style="list-style-type: none"> <li>• Overlay pavement</li> <li>• Provide adequate drainage</li> <li>• Groove pavement</li> <li>• Provide "slippery when wet" signs</li> </ul>
	Large number of turning vehicles	<ul style="list-style-type: none"> <li>• Create left or right-turn lanes</li> <li>• Prohibit turns</li> <li>• Increase curb radii</li> </ul>
	Inadequate roadway lighting	<ul style="list-style-type: none"> <li>• Improve roadway lighting</li> </ul>
	Lack of adequate gaps	<ul style="list-style-type: none"> <li>• Provide traffic signal if warranted (see MUTCD)</li> <li>• Provide stop signs</li> </ul>
	Crossing Pedestrians	<ul style="list-style-type: none"> <li>• Install/improve signing or marking of pedestrian crosswalks</li> </ul>
	Excessive speed on approach	<ul style="list-style-type: none"> <li>• Reduce speed limit on approaches</li> </ul>

\*Highway Safety Engr. Studies Procedural Guide, USDOT, FHWA, Jan. 81 (some areas revised to suit NYSDOT's preference)

**Table 1. (Continued)**

Crash Pattern	Probable Cause	General Countermeasure
Rear-end collisions at signalized intersections	Slippery surface	<ul style="list-style-type: none"> <li>• Overlay pavement</li> <li>• Provide adequate drainage</li> <li>• Groove pavement</li> <li>• Reduce speed limit on approaches</li> <li>• Provide “slippery when wet” signs</li> </ul>
	Large number of turning vehicles	<ul style="list-style-type: none"> <li>• Create left or right-turn lanes</li> <li>• Prohibit turns</li> <li>• Increase curb radii</li> <li>• Provide special phase for left-turning traffic</li> </ul>
	Poor visibility of signals	<ul style="list-style-type: none"> <li>• Install/improve advance warning devices</li> <li>• Install overhead signals</li> <li>• Install 12-in. signal lenses (see MUTCD)</li> <li>• Install visors</li> <li>• Install back plates</li> <li>• Relocate signals</li> <li>• Add additional signal heads</li> <li>• Remove obstacles</li> <li>• Reduce speed limit on approaches</li> </ul>
	Inadequate signal timing	<ul style="list-style-type: none"> <li>• Adjust yellow phase</li> <li>• Provide progression through a set of signalized intersections</li> <li>• Add all-red clearance</li> </ul>
	Unwarranted signals	<ul style="list-style-type: none"> <li>• Remove signals (see MUTCD)</li> </ul>
	Inadequate roadway lighting	<ul style="list-style-type: none"> <li>• Improve roadway lighting</li> </ul>
	Crossing pedestrians	<ul style="list-style-type: none"> <li>• Install/improve signing or marking of pedestrian crosswalks</li> <li>• Provide pedestrian “walk” phase</li> </ul>

**Table 1. (Continued)**

Crash Pattern	Probable Cause	General Countermeasure
Right-angle collisions at signalized intersections	Restricted sight distance	<ul style="list-style-type: none"> <li>• Remove sight obstructions</li> <li>• Restrict parking near corners</li> <li>• Install warning signs (see MUTCD)</li> <li>• Reduce speed limit on approaches</li> <li>• Channelize intersections</li> <li>• Install advance markings to supplement signs</li> </ul>
	Excessive speed on approaches	<ul style="list-style-type: none"> <li>• Increase yellow phase</li> <li>• Install rumble strips</li> </ul>
	Poor visibility of signal	<ul style="list-style-type: none"> <li>• Install advance warning devices</li> <li>• Install 12-in. signal lenses (see MUTCD)</li> <li>• Install overhead signal</li> <li>• Install visors</li> <li>• Install back plates</li> <li>• Improve location of signal heads</li> <li>• Add additional signal heads</li> <li>• Add illuminated name signs</li> </ul>
	Inadequate signal timing	<ul style="list-style-type: none"> <li>• Adjust yellow phase</li> <li>• Provide all-red clearance phase</li> <li>• Add multi-dial controller</li> <li>• Install signal actuation</li> <li>• Retime signals</li> <li>• Provide progression through a set of signalized intersections</li> </ul>
	Inadequate roadway lighting	<ul style="list-style-type: none"> <li>• Improve roadway lighting</li> </ul>
	Inadequate advance intersection warning signs	<ul style="list-style-type: none"> <li>• Install advance intersection warning signs</li> </ul>
	Large total intersection volume	<ul style="list-style-type: none"> <li>• Retime signals</li> <li>• Add traffic lane</li> </ul>

**Table 1. (Continued)**

Crash Pattern	Probable Cause	General Countermeasure
<p>Right-angle collisions at unsignalized intersections</p>	<p>Restricted sight distance</p>	<ul style="list-style-type: none"> <li>• Remove sight obstructions</li> <li>• Restrict parking near corners</li> <li>• Install stop signs (see MUTCD)</li> <li>• Install warning signs (see MUTCD)</li> <li>• Install signal (see MUTCD)</li> <li>• Install yield signs (see MUTCD)</li> <li>• Channelize intersection</li> <li>• Install advance markings to supplement signs</li> <li>• Install guide markings</li> </ul>
	<p>Large total intersection volume</p>	<ul style="list-style-type: none"> <li>• Install signal (see MUTCD)</li> <li>• Reroute through traffic</li> </ul>
	<p>Excessive speed on approaches</p>	<ul style="list-style-type: none"> <li>• Install rumble strips</li> </ul>
	<p>Inadequate roadway lighting</p>	<ul style="list-style-type: none"> <li>• Improve roadway lighting</li> </ul>
	<p>Inadequate advance intersection warning signs</p> <p>Inadequate traffic control devices</p>	<ul style="list-style-type: none"> <li>• Install advance intersection warning signs</li> <li>• Upgrade traffic control devices</li> <li>• Increase enforcement</li> </ul>
<p>Pedestrian-vehicle collisions</p>	<p>Restricted sight distance</p>	<ul style="list-style-type: none"> <li>• Remove sight obstructions</li> <li>• Install pedestrian crossings</li> <li>• Install/improve pedestrian crossing signs</li> <li>• Reroute pedestrian paths</li> <li>• Prohibit curb parking near crosswalks</li> </ul>
	<p>Inadequate protection for pedestrians</p>	<ul style="list-style-type: none"> <li>• Add pedestrian refuge islands</li> <li>• Install pedestrian barriers</li> </ul>
	<p>School crossing area</p>	<ul style="list-style-type: none"> <li>• Use crossing guard at school crossing areas</li> </ul>
	<p>Inadequate signals</p> <p>Inadequate phasing signal</p>	<ul style="list-style-type: none"> <li>• Install pedestrian signals (see MUTCD)</li> <li>• Change timing of pedestrian phase</li> </ul>
	<p>Driver had inadequate warning of frequent mid-block crossings</p>	<ul style="list-style-type: none"> <li>• Prohibit parking</li> <li>• Install warning signs</li> <li>• Lower speed limit</li> <li>• Install pedestrian barriers</li> </ul>

**Table 1. (Continued)**

Crash Pattern	Probable Cause	General Countermeasure
Pedestrian-vehicle collisions (continued)	<p>Inadequate pavement markings</p> <p>Inadequate gaps at unsignalized intersections</p> <p>Inadequate roadway lighting</p> <p>Excessive vehicle speed</p>	<ul style="list-style-type: none"> <li>• Install thermoplastic markings</li> <li>• Supplement markings with appropriate signing (see MUTCD)</li> <li>• Upgrade pavement markings (see MUTCD)</li> <li>• Install traffic signal if warranted by MUTCD</li> <li>• Install pedestrian crosswalk and signs</li> <li>• Install pedestrian "WALK-DON'T WALK" signals</li> <li>• Install roadway lighting</li> <li>• Install proper warning signs</li> <li>• Install pedestrian barriers</li> <li>• Enforcement</li> </ul>
Run-off-roadway collisions	<p>Slippery pavement</p> <p>Roadway design inadequate for traffic conditions</p> <p>Poor delineation</p> <p>Inadequate roadway lighting</p> <p>Inadequate shoulder</p> <p>Improper channelization</p> <p>Inadequate pavement maintenance</p> <p>Poor visibility</p>	<ul style="list-style-type: none"> <li>• Overlay existing pavement</li> <li>• Provide adequate drainage</li> <li>• Groove existing pavement</li> <li>• Reduce speed limit</li> <li>• Provide "slippery when wet" signs</li> <li>• Widen lanes</li> <li>• Relocate islands</li> <li>• Close curb lanes</li> <li>• Install guardrails</li> <li>• Install/improve pavement markings</li> <li>• Install roadside delineators</li> <li>• Install advance warning signs</li> <li>• Improve roadway lighting</li> <li>• Upgrade roadway shoulders</li> <li>• Improve channelization</li> <li>• Perform road surface repair</li> <li>• Increase size of signs</li> </ul>

**Table 1. (Continued)**

Crash Pattern	Probable Cause	General Countermeasure
Fixed object collisions	<p>Obstructions in or too close to roadway</p> <p>Inadequate roadway lighting</p> <p>Inadequate pavement markings</p> <p>Inadequate signs, delineators and guardrails</p> <p>Inadequate roadway design</p> <p>Slippery pavement</p>	<ul style="list-style-type: none"> <li>• Remove obstacles</li> <li>• Install barrier curbing</li> <li>• Install breakaway features to light poles, signposts, etc.</li> <li>• Install guardrail</li> <li>• Install crash cushioning devices</li>   <li>• Install roadway lighting</li>   <li>• Install reflector pavement markings</li>   <li>• Install reflector paint and/or reflectors on the obstruction</li>   <li>• Provide proper superelevation</li> <li>• Improve superelevation at curves</li> <li>• Install appropriate warning signs and delineators</li>   <li>• Improve skid resistance</li> <li>• Provide adequate drainage</li> <li>• Provide “slippery when wet” signs</li> <li>• Provide wider lanes</li> </ul>
Collisions with parked vehicles	<p>Improper pavement markings</p> <p>Improper parking clearance at driveways</p> <p>Angle parking</p> <p>Excessive vehicle speed</p> <p>Illegal parking</p> <p>Improper parking</p> <p>Large parking turnover</p>	<ul style="list-style-type: none"> <li>• Paint parking stall limits 7 feet from curb face</li>   <li>• Post parking restrictions near driveways</li> <li>• Convert angle parking to parallel parking</li>   <li>• Reduce speed limit if justified by spot speed studies</li> <li>• Widen lanes</li>   <li>• Enforcement</li>   <li>• Prohibit parking</li> <li>• Create off street parking</li>   <li>• Create one-way streets</li> <li>• Reroute through traffic</li> </ul>

**Table 1. (Continued)**

Crash Pattern	Probable Cause	General Countermeasure
Sideswipe or head-on collisions	Inadequate roadway design	<ul style="list-style-type: none"> <li>• Create one-way streets to provide wider lanes</li> </ul>
	Improper road maintenance	<ul style="list-style-type: none"> <li>• Perform necessary road surface repairs</li> </ul>
	Inadequate shoulders	<ul style="list-style-type: none"> <li>• Improve shoulders</li> </ul>
	Excessive vehicle speed	<ul style="list-style-type: none"> <li>• Install median devices</li> <li>• Remove constrictions such as parked vehicles</li> </ul>
	Inadequate pavement markings	<ul style="list-style-type: none"> <li>• Install or refurbish center lines, lane lines and pavement edge lines</li> <li>• Install reflectorized lines, edges</li> </ul>
	Inadequate channelization	<ul style="list-style-type: none"> <li>• Install acceleration and deceleration lanes</li> <li>• Channelize intersection</li> <li>• Provide turning bays</li> </ul>
	Inadequate signing	<ul style="list-style-type: none"> <li>• Place direction and lane change signs to give proper advance warning</li> <li>• Add illuminated name signs</li> </ul>
Driveway-related collisions	Left-turning vehicles	<ul style="list-style-type: none"> <li>• Install median devices</li> <li>• Install two-way left-turn lanes</li> </ul>
	Improperly located driveways	<ul style="list-style-type: none"> <li>• If possible, regulate minimum spacing of driveways</li> <li>• Regulate minimum corner clearance</li> <li>• If possible, move driveway to side street</li> <li>• Install curbing to define driveway locations</li> <li>• If possible, consolidate adjacent driveways</li> </ul>
	Right-turning vehicles	<ul style="list-style-type: none"> <li>• Provide right-turn lanes</li> <li>• Restrict parking near driveways</li> <li>• Increase the width of driveways</li> <li>• Widen through lanes</li> <li>• Increase curb radii</li> </ul>
	Large volume of through traffic	<ul style="list-style-type: none"> <li>• If possible, move driveway to side street</li> <li>• Construct a local service road</li> <li>• Reroute through traffic</li> </ul>

**Table 1. (Continued)**

Crash Pattern	Probable Cause	General Countermeasure
Driveway-related collisions (continued)	<p>Large volume of driveway traffic</p> <p>Restricted sight distance</p> <p>Inadequate roadway lighting</p>	<ul style="list-style-type: none"> <li>• Signalize driveway</li> <li>• Provide acceleration and deceleration lanes</li> <li>• Channelize driveway</li>   <li>• Remove sight obstructions</li> <li>• Restrict parking near driveway</li> <li>• Install/improve street lighting</li> <li>• Reduce speed limit</li>   <li>• Improve street lighting</li> </ul>
Train-vehicle accidents	<p>Restricted sight distance</p> <p>Poor visibility</p> <p>Improper traffic signals pre-emption timing</p> <p>Inadequate pavement markings</p> <p>Slippery surface</p> <p>Improper pre-emption of RR signals or gates</p> <p>Rough crossing surfaces</p> <p>Sharp crossing angle</p>	<ul style="list-style-type: none"> <li>• Remove sight obstructions</li> <li>• Reduce grade</li> <li>• Install train actuated signals (see MUTCD)</li> <li>• Install stop signs (see MUTCD)</li> <li>• Install advance warning signs (see MUTCD)</li> <li>• Install automatic flashers and gates</li>   <li>• Improve roadway lighting</li> <li>• Increase size of signs</li>   <li>• Retime traffic signals</li>   <li>• Install advance markings to supplemental signs</li> <li>• Install limit lines</li> <li>• Install/improve pavement markings</li>   <li>• Skid-proof roadway</li>   <li>• Retime RR signals and gates</li>   <li>• Improve crossing surface</li>   <li>• Rebuild crossing with proper angle</li> </ul>

**Table 1. (Continued)**

Crash Pattern	Probable Cause	General Countermeasure
Wet-pavement accidents	<p>Inadequate pavement markings</p> <p>Slippery pavement</p> <p>Inadequate drainage</p>	<ul style="list-style-type: none"> <li>• Upgrade pavement markings</li> <li>• Overlay existing pavement</li> <li>• Groove existing pavement</li> <li>• Reduce speed limit</li> <li>• Provide “slippery when wet” signs</li> <li>• Skid-proof roadway</li> <li>• Provide adequate drainage</li> </ul>
Night accidents	<p>Poor visibility or lighting</p> <p>Poor sign quality</p> <p>Inadequate channelization or delineation</p>	<ul style="list-style-type: none"> <li>• Install/improve street lighting</li> <li>• Install/improve delineation markings</li> <li>• Install/improve warning signs</li> <li>• Upgrade signing</li> <li>• Provide illuminated signs</li> <li>• Install pavement markings</li> <li>• Improve delineation markings</li> <li>• Provide raised markers</li> <li>• Upgrade advance warning signing</li> </ul>