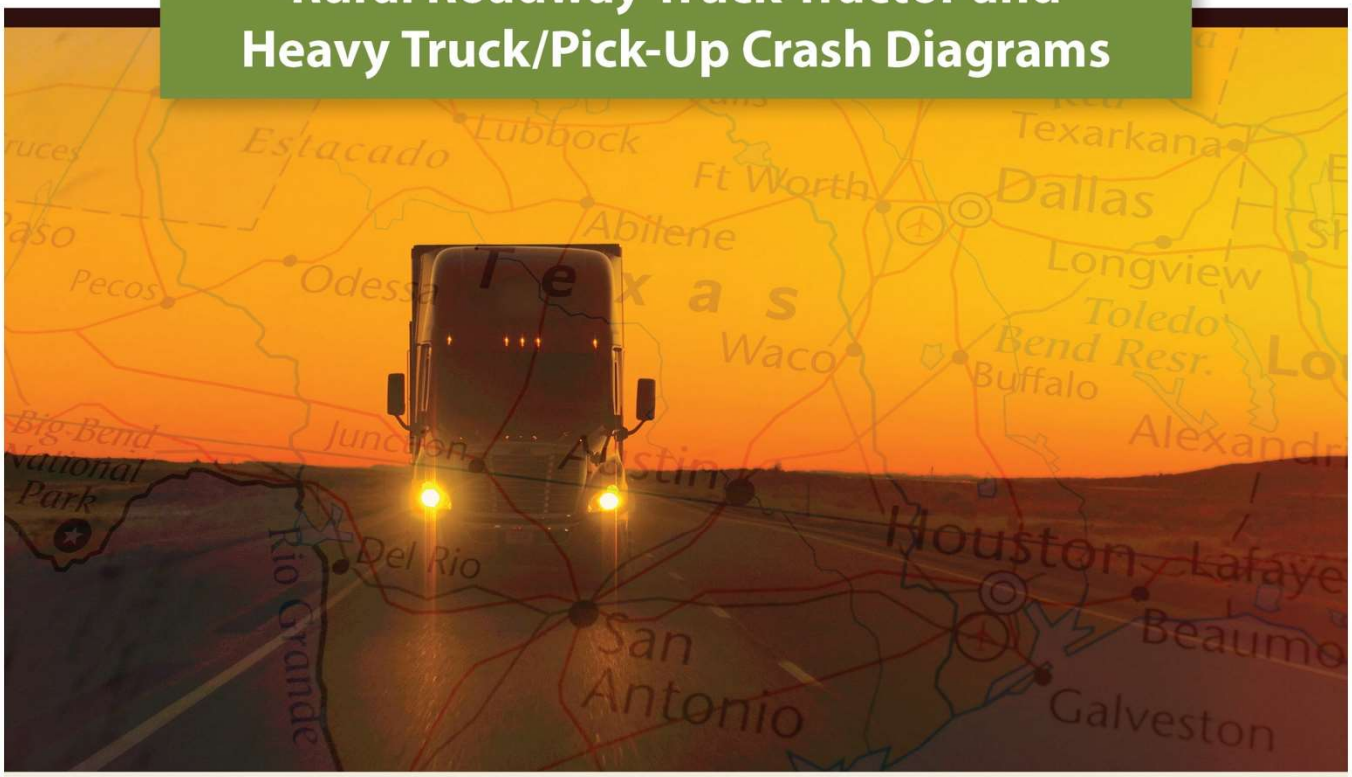
Understanding Crashes Involving Large Trucks on Rural Roads in Texas

Rural Roadway Truck Tractor and Heavy Truck/Pick-Up Crash Diagrams



Texas A&M Transportation Institute

Center for Transportation Safety
Safety Research and Outreach

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RURAL CMV SAFETY CRASH DIAGRAMS

PROJECT OVERVIEW

The goal of this project this FMCSA sponsored project (Understanding Crashes Involving Large Trucks on Rural Roads in Texas) is to prevent crashes and reduce crash severity on rural roads involving large trucks by improving law enforcement and driver knowledge of hazardous roadways and behaviors on rural roads. This will be accomplished through an innovative analysis of crash and roadway data, and the production and dissemination of outreach and educational materials (e.g., fact sheets, data dashboards, and high-risk roadway maps).

CRASH SEVERITY BY VEHICLE TYPE

In general, crash severity varies across area types in a pattern wherein crashes were more likely to be severe in rural areas followed by urban-fringe areas, and then urban areas in a continuum.

The severity of crashes also differs by type of urban-fringe area. In most cases, crashes are more severe in medium urban-fringe and small urban-fringe areas compared to large urban- fringe areas.

With respect to vehicle type, the crash severity is highest among heavy trucks/pickups. The prevalence of severe crashes for truck tractors is similar to heavy trucks/pickups but lower with the prevalence markedly lower for passenger vehicles. Given that truck tractors typically weigh more than heavy trucks/pickups, this finding was not expected.

These differences notwithstanding, crash profiles and diagrams were created for six common crash scenarios across all rural areas. These six common crash scenarios involved tractor trailers and resulted in fatalities or suspected serious injuries. Key features of each scenario are provided below each diagram. The six crash scenarios are:

- Run-off-road – hit fixed object (Figure 3)
- Run-off-road – curve (Figure 4)
- Rear-end (Figure 5)
- Sideswipe (Figure 6)
- Overturned (Figure 7)
- Intersection-related (Figure 8)

RUN-OFF-ROAD, HIT FIXED OBJECT

Hitting fixed objects is closely related to running off the road. (By definition, running off the road is a precursor tohitting a fixed object that is off the roadway.) **Run-off-road and hit a fixed object** incidents are all or nearly all single vehicle crashes. Figure 3 illustrates a typical fixed object strike scenario (run-off-road – hit fixed object).

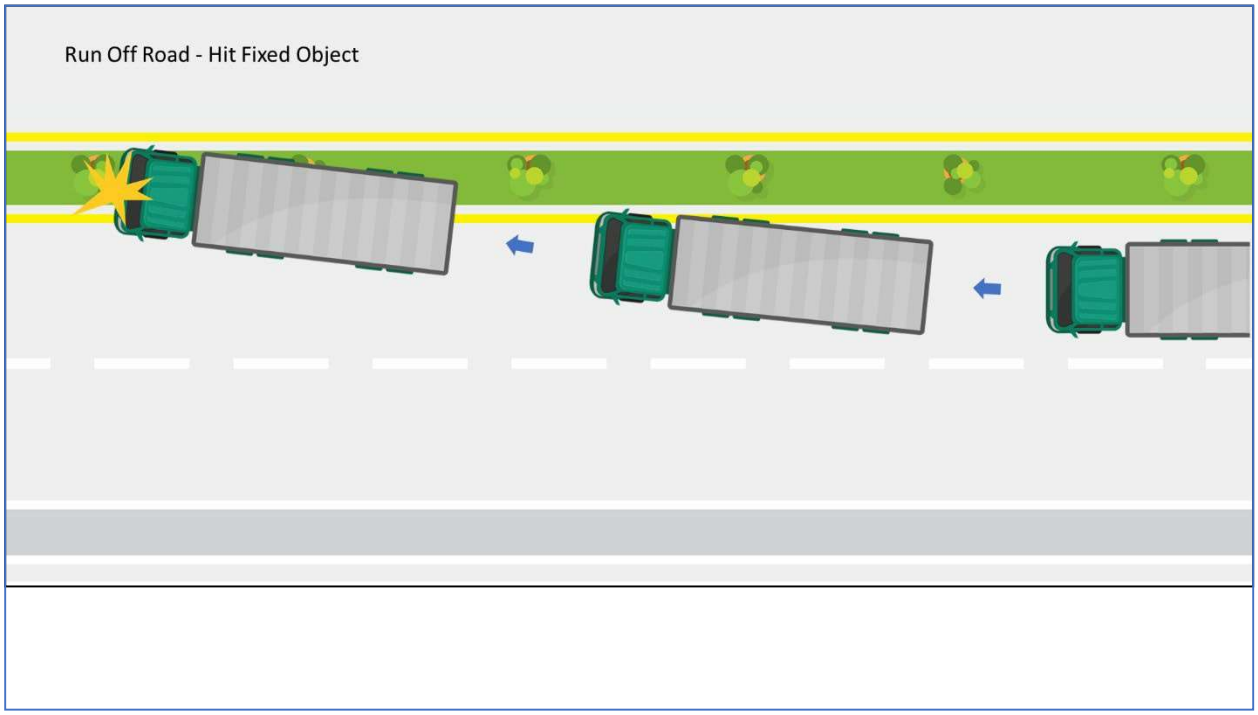

Figure 1. Run-off-Road and Hit Fixed Object Crash.

The table below summarizes key characteristics for contributing factors and type of object struck. ***Two-thirds (68%) of the contributing factors are related to driver inattention(staying in lane, fatigue itself, and general inattention)***.

Contributing Factors	Type of Object Struck
• Failure to stay in lane (35%) • Fatigue/asleep (25%) • Unsafe speed (22%) • Faulty evasive action (16%) • General driver inattention (8%)	• Hitting the median barrier (21%) • Hitting the guard rail (17%) • Hitting a fence (11%) • Hitting a tree or other landscaping (8%) • Hitting highway signs (8%)

RUN-OFF-ROAD, CURVE

Road departure crashes (run-off-road) on a curve are also single vehicle crashes. The location of the resulting crash from roadwaydepartures on curves is primarily off the roadway (82%), with 15% in the median, and 3% on the shoulder.

Curves are especially prone to running off the road because they require greater attention to changes in speed and maintaining lane position. They are also high impact crashes. Running off the road on a curve is often a precursor to other harmful events, such as overturns and hitting a fixed object as illustrated in Figure 4.

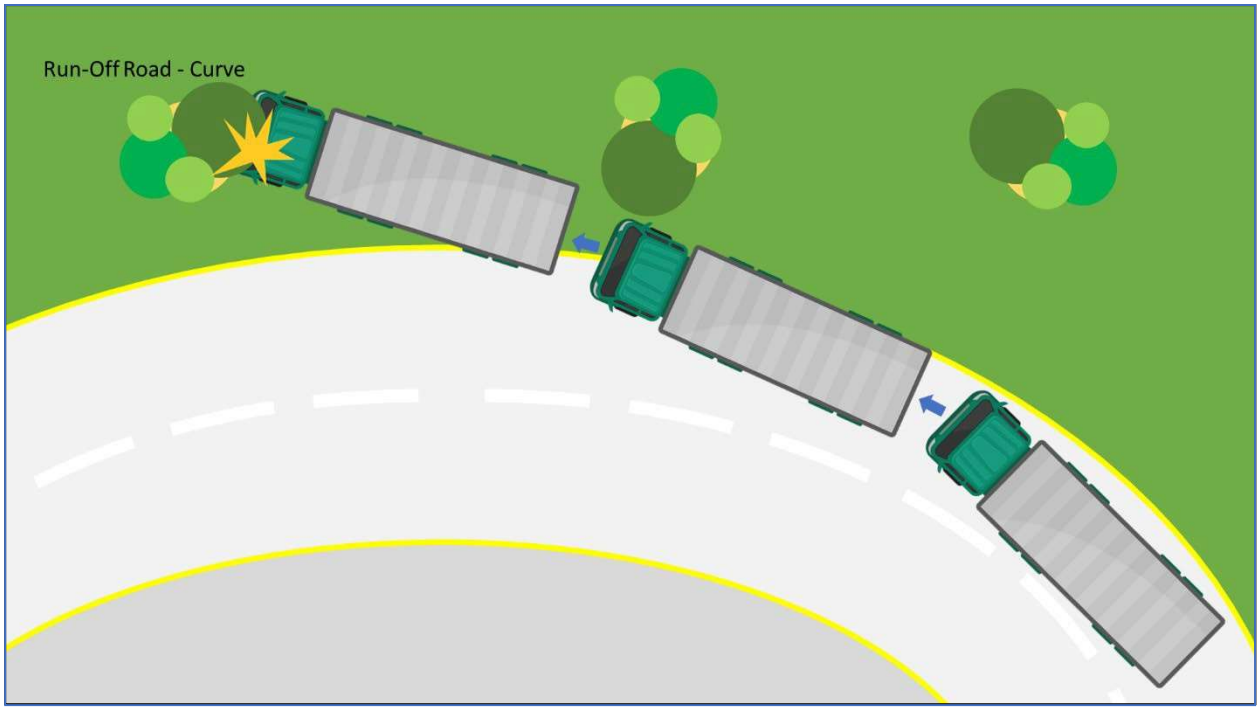

Figure 2. Run-off-Road on Curve Crash.

The table below summarizes key characteristics for contributing factors and type of object struck. While the contributing factors are similar to those for running off the road and hitting a fixed object, speed plays a greater role. ***Unsafe speed is a contributing factor for over half of Texas CMV run-off-road on curve crashes.***

Contributing Factors	Harmful Event or Object Struck
• Unsafe speed (52%) • Failure to stay in lane (20%) • Fatigue/asleep (19%) • Faulty evasive action (19%) • General driver inattention (8%)	• Vehicle overturned (59%) • Hitting a fixed object (35%) • Hitting a parked vehicle (3%)

OVERTURNED

Virtually all **overturns** on or along a straight roadway segment (94%) are single vehicle crashes. Of these, 62% are off the roadway where the overturn is often a "subsequent harmful event" to roadway departure, and 26% are on the roadway. Figure 5 illustrates an overturn on a straight roadway segment.

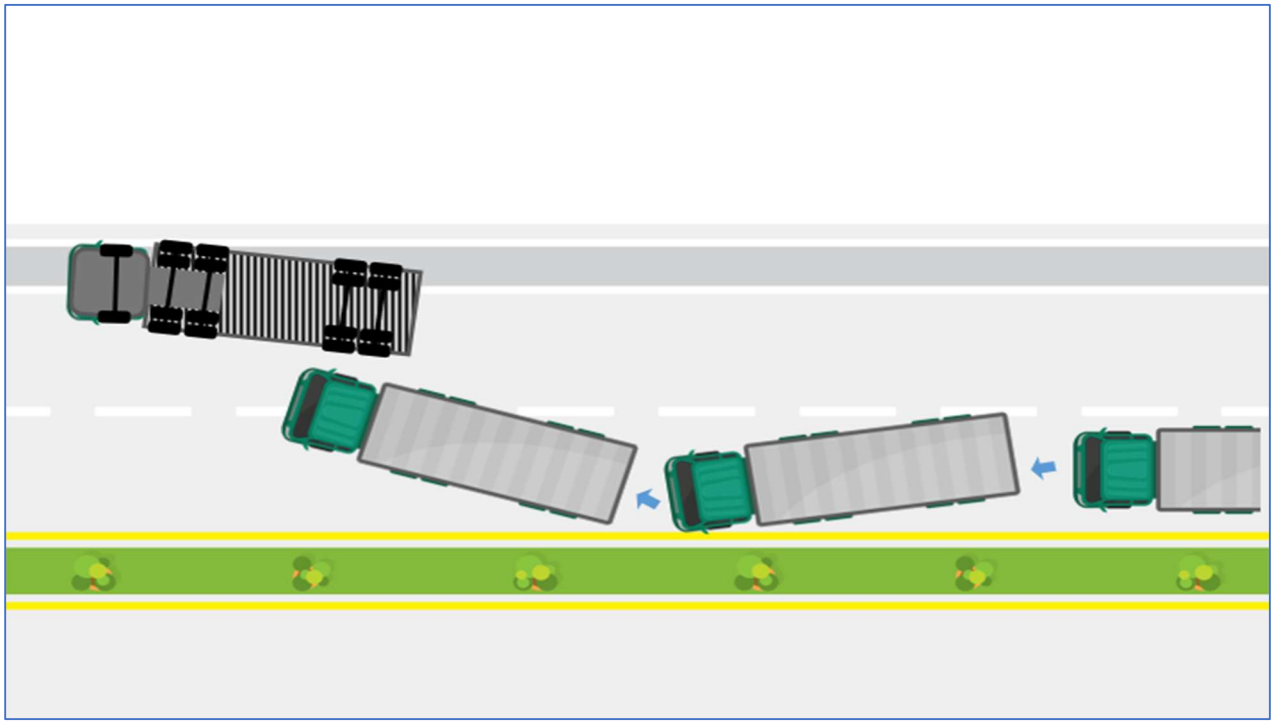

Figure 3. Overturn Crash on a Straight Roadway Segment.

The underlying behavior for heavy trucks overturning is that the driver lost control of his or her vehicle. Contributing factors associated with overturns include:

Contributing Factors
• Unsafe speed (38%) • Faulty evasive action (21%) • Failure to stay in lane (21%) • Driver fatigue/Asleep (16%)

CMV operators can ***reduce the chance of an overturn by clearly avoiding or eliminating key contributing factors, especially speed, lane drift, and fatigue***. Further research may indicate that additional driver training on vehicle handling, especially in emergencies, might reduce "faulty evasive actions", which probably include overcorrection.

REAR-END

Rear-end crashes are, by definition, same direction crashes (Figure 6). The large majority (86%) of rear-end crashes are non-intersection related, and 14% are intersection related.

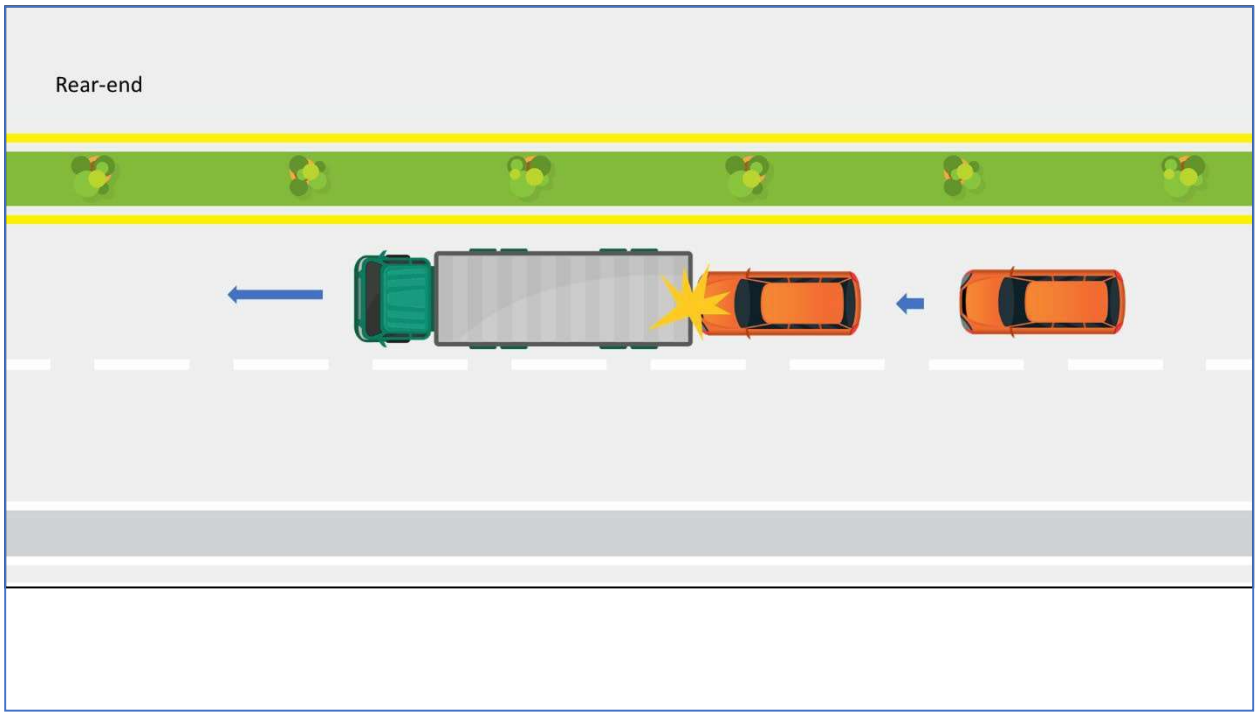

Figure 4. Rear-end Crash.

Top contributing factors for rear-end crashes include:

Contributing Factors
• Failure to control speed (84%) • Driver inattention (22%) • Driver fatigue/asleep (9%)

[Contributing factors may sum to over 100% due to multiple factors per crash.]

Top contributing factors for rear-end crashes are similar whether a large truck was rear-ended, or vice versa. The similarity implies that rear-end crashes are consistent in their character across vehicles, except for a failed rear-end evasive maneuver that evolves into a sideswipe. (See the next crash description.)

SIDESWIPE

Sideswipe crashes are, by definition, same direction – straight roadway crashes (Figure 7). Virtually all (96%) sideswipe crashes are non-intersection crashes.

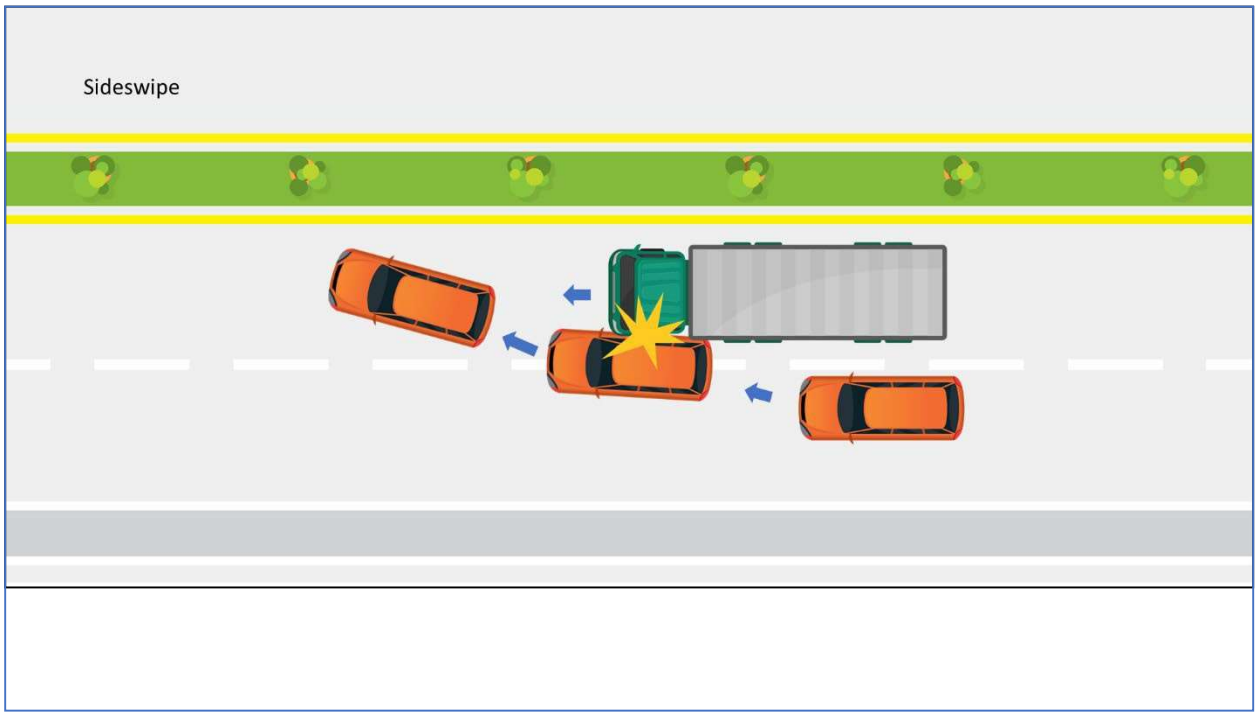

Figure 5. Sideswipe Crash.

Top contributing factors for sideswipe crashes include:

Contributing Factors
• Unsafe lane change (30%) • Failure to control speed (25%) • Failure to stay in lane (22%) • Faulty evasive action (13%)

The first, second, and fourth contributing factors suggest that ***some drivers of smaller/passenger vehicles lack appropriate understanding of the operating behavior and space requirements of large trucks*** (i.e., stopping distance, judging relative speed due to size). Sideswipe crashes may also be related to failed rear-end crash avoidance maneuvers.

In addition, 80% of crash narratives and diagrams reviewed showed other vehicles striking the large truck in the front portion of the truck, a factor that is especially relevant to sideswipes on two-lane undivided highways as is the case for many rural roads. Public education, outreach, and training in driving training and defensive driving courses may help improve driver understanding of large truck operations and space needs.

INTERSECTION RELATED

Intersection-related crashes are a distinct category of crashes, especially for large trucks. Location at or near an intersection defines this category of crash, which includes other harmful events with their own separate category (e.g., rear-end collision).

Most intersection-related crashes (67%) occur at the intersection itself, while the rest (33%) are related to intersections, meaning the intersection was involved in some way. Figure 8 illustrates a typical intersection-related crash scenario.

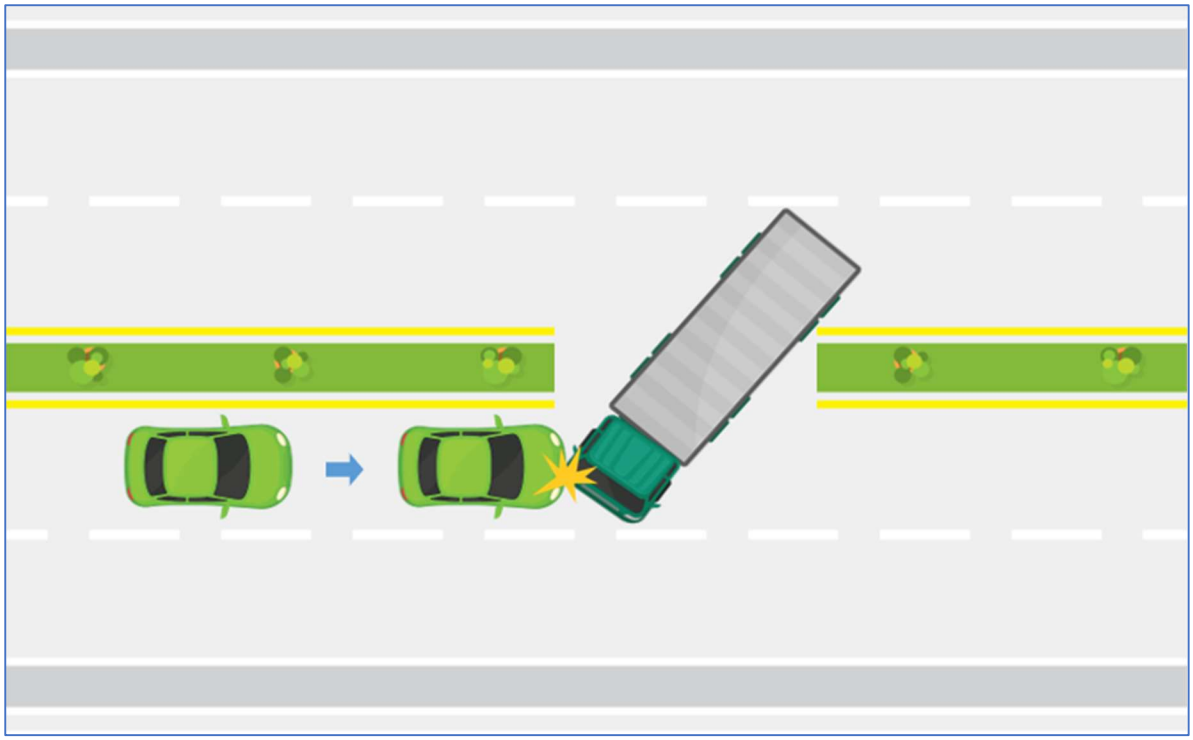

Figure 6. Intersection-Related Crash.

The table below summarizes key characteristics for contributing factors and crash configuration. As indicated by the contributing factors, ***most intersection-related crashes involve thefailure to follow intersection control protocols***.

Contributing Factors	Crash Configuration
Failure to yield at stop sign (24%)	Angular (57%)
Failure to control speed (19%)	Same direction (25%)
Disregarding signal of stop sign (16%)	Opposite direction (11%)
General driver inattention (13%)	Single vehicle crash (10%)