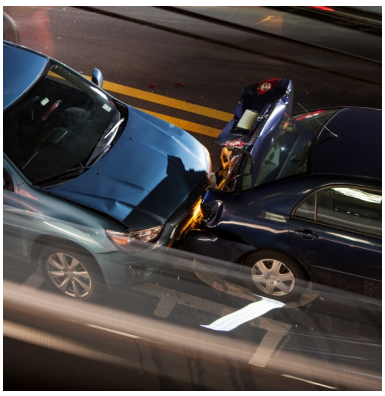
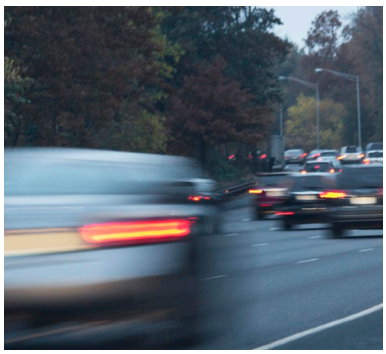
U.S. Department of Transportation
Federal Highway Administration

Improving Speed Management Using a Systemic Safety Approach



Traditional crash analysis treats the problem after a crash has occurred.



A Systemic Safety Approach fixes the problem before a tragedy occurs.

REESTABLISHING TRUST IN SPEEDING-RELATED CRASH DATA

When contemplating an approach to understand the myriad of complex and interwoven factors and circumstances involved in speeding-related questions, practitioners sometimes ask "Where do I even start?" and "Which data are the most trustworthy?"

State crash reports use a variety of categories to describe speeding-related crashes: "exceeded speed limit," "too fast for conditions," "following too closely," "driving aggressively," etc. The assignment of these categories may be based largely on the perceptions or judgment of the responding law enforcement officers, introducing the potential for human error. Compounding this concern is that crash report categories may be imprecise; for example, driving "too fast for conditions" may not accurately or fully describe the circumstances surrounding the crash. As a result of these factors, many transportation agencies do not believe their speeding-related crash data is truly reflective of actual events and suitable for addressing speeding-related crashes.

A Systemic Safety Approach uses information from well-documented severe crashes (fatal and serious injury crashes) to help agencies define where future crashes may occur. Severe crash records have a greater accuracy than lesser crash severity records increasing an agency's certainty that these crashes are speeding-related and that the data are reliable. A Systemic Safety Approach uses severe crashes to identify the most prevalent crash types, facility types, and risk factors. This trilogy of characteristics enables an agency to identify locations with roadway characteristics similar to those of the known severe crash locations and preemptively prevent crashes from continuing to occur at those sites.

A Systemic Safety Approach uses speeding-related severe crash data to identify locations with similar risk characteristic that may experience a severe crash in the future.

A BETTER WAY: SIX STEPS TO IDENTIFYING SPEEDING IMPROVEMENT OPPORTUNITIES

The following steps are based on the process outlined in the FHWA's *Systemic Safety Project Selection Tool*.[1]

Step 1 Identify Focus Crash Types

Examine the agency's speeding-related severe crash data to determine a focus crash type and select the crash type with the greatest number or greatest severity of crashes. Often, these crash types will be emphasis areas in a States' Strategic Highway Safety Plan (SHSP). Examples include:

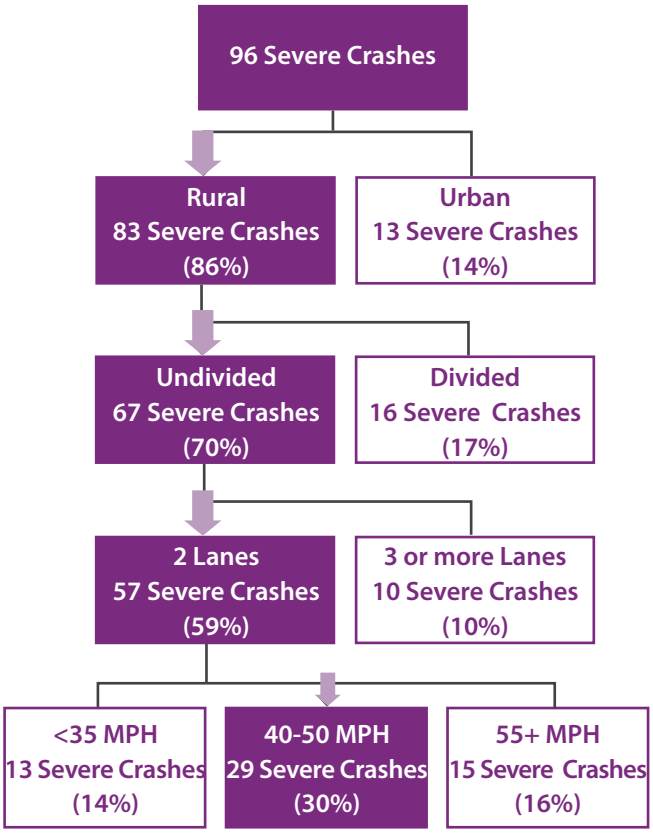
- Intersection crashes
- Fixed object crashes
- Horizontal curve crashes

Step 2 Identify Focus Facilities

The purpose for identifying a focus facility type is to take a very broad crash type (e.g., horizontal curves) and break it down into smaller groups based on location types that exhibit similar risk characteristics.

Consider representing this "narrowing down" as a crash tree diagram that graphically breaks down crashes into progressively more detailed categories. The highest level of the crash tree begins with the total number of severe crashes in the focus crash type. In the example at right, the focus crash type is Speeding-related Roadway Departure Horizontal Curve crashes. Each subsequent level separates the severe crashes by intrinsic roadway characteristics. The roadway characteristics with the greatest number of severe crashes are carried forward into the next level of the crash tree diagram.

Roadway Departure Horizontal Curve Speed-Related Severe Crashes



Note: Percentages in parenthesis represent the proportion of total roadway departure horizontal curve speeding-related severe crashes. (Total: 96 Severe Crashes).

[1] Federal Highway Administration, "Systemic Safety Project Selection Tool," FHWA-SA-13-019 (Washington DC: July 2013). Available at: https://safety.fhwa.dot.gov/systemic/resources.cfm.

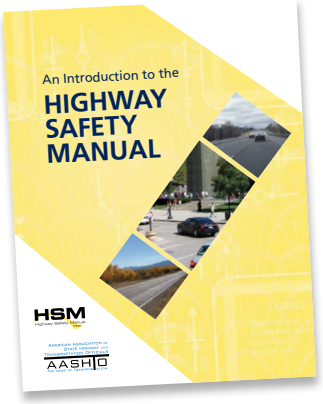
Step 3 Gather Risk Factor Information

The next step is to *define, document,* and *assess* the most common roadway characteristics, or risk factors, associated with the focus crash type and focus facility type. Again, an agency does not necessarily need a robust dataset to identify locations that can benefit from safety improvements. Examples of methods an agency can use to quantify roadway and intersection characteristics for risk factor evaluation include:

- Roadway and intersection inventories
- Online aerial imagery
- Photo and video logs
- Field visits

It's important to remember that a roadway feature itself is not the risk factor; rather, it is the degree to which the characteristic contributes to crash severity or frequency. For example, a 90 degree horizontal curve is more likely to contribute to a crash than a 5 degree curve. Translated: the 90 degree curve poses a greater risk for future crashes.

Step 4 Identify and Evaluate Risk Factors



Identifying risk factors can largely come from engineering judgment and experience, but it can also come from documented resources, including the *Highway Safety Manual* (HSM), field visits, conversations with field staff about their first-hand observations, and the Federal Highway Administration's guide to *Potential Risk Factors*.[2]

A few of the many examples of potential risk factors include:

- Number of lanes.
- Lane/Shoulder/Clear zone width.
- Curve radius or density.
- Roadside edge features and quality.
- Traffic volume.
- Intersection elements.
- Speed limit or differential.
- Pavement condition.

Note that practitioners can use the *Highway Safety Manual* and the *Crash Modification Factor (CMF) Clearinghouse*[3] to estimate the degree to which each risk factor contributes to the overall reduced level of safety within the facility type.

Step 5 Apply Risk Factors to the Entire Focus Group Population to Identify a Ranked List of Sites

Expand the vetting process from the severe crash locations (used to determine the focus group and risk factors) to all roads within the focus facility type. For each crash location, determine the number of risk factors (determined in Step 4) the site exhibits. This can be accomplished by using a roadway or intersection inventory, online aerial imagery, photo or video logs, or field visits. Rank locations based on the number of risk factors present. Some agencies choose to use a weighted ranking system, emphasizing roadway characteristics with greater risk. The result will be a ranked list with severe crash locations near the top along with non-severe crash locations that have a high-risk of experiencing a severe crash in the future.

[2] Federal Highway Administration, *Potential Risk Factors,* Washington, D.C. (n.d.). Available at: https://safety.fhwa.dot.gov/systemic/pdf/FHWA_SystemicApproach_PotentialRiskFactors.pdf.

[3] Federal Highway Administration, *CMF Clearinghouse User Guide*, Washington, D.C. Available at: http://www.cmfclearinghouse.org/userguide.cfm.

Step 6 Select the Appropriate Countermeasure(s)

Countermeasure selection should be largely based on the risk factors identified. For example, if a narrow shoulder is a risk factor, then a countermeasure may be expanding shoulder widths. Not all risk factors need to be directly addressable. For example, if a horizontal curve has narrow lanes, a tight radius, and no shoulders, then an appropriate countermeasure may be enhanced roadside delineation because it draws the motorist's eyes to these features. Directly addressing a risk factor by widening the road or straightening a curve may not be cost effective.

Once an agency has identified risk factors, it can consider the benefit-cost ratio of various countermeasures. The CMF Clearinghouse and other published resources can provide expected countermeasure safety benefits and the crash types they address.

AN EFFECTIVE, DATA-CENTRIC APPROACH

A Systemic Safety Approach does not require robust data or complex analysis methods to be effective. Nearly all transportation professionals have access to the basic data needed to pursue systemic safety analysis and make appropriate systemic-based decisions. By identifying recurring risk factors using speeding-related severe crashes, agencies can treat the most at-risk facilities throughout their system (e.g., intersections with similar characteristics, horizontal curves with a particular radius, etc.) occur using low-cost, effective speed-mitigation countermeasures.

Additional Information

For more information on a Systemic Safety Approach to Speed Management, visit:

- FHWA's A Systemic Approach to Safety Website. This website contains Systemic Safety resources including the Systemic Safety Analysis Tool. (https://safety.fhwa.dot.gov/systemic/resources.cfm)
- FHWA's Speed Management Website. This website contains Speed Management resources including examples of speed management plans and ongoing speed management research. (https://safety.fhwa.dot.gov/speedmgt/)

For assistance, or to request technical support, contact:

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