

FEDERAL HIGHWAY ADMINISTRATION FOCUS AREA DATA DEFINITIONS

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Background and Purpose

Roadway departure (RwD), intersections, and pedestrians have been focus areas of the Federal Highway Administration (FHWA) research and safety programs for well over a decade because of elevated motor vehicle crash incidents. Countermeasures within each focus area have evolved as the data are further evaluated, and data-driven thinking has resulted in new processes for applying countermeasures. This analysis has led to an interest in improving not only the data that are used but also the definitions by which FHWA measures the crashes within each of its focus areas. The latter is the focus of this technical summary.

In 2013, a technical working group (TWG) was convened to consider whether improvements to the methods used to make annual calculations of the status of each focus area were feasible. The TWG was composed of representatives from FHWA headquarters, research, and field staff with interest in RwD, intersection, and pedestrian safety. The TWG also included several National Highway Traffic Safety Administration (NHTSA) experts to provide insights into the Fatality Analysis Reporting System (FARS) attributes and potential analysis.⁽¹⁾ TWG recommendations for changes to the data sets were accepted by FHWA leadership, and this summary outlines the changes to the overall concept of the focus areas as well as specific changes within each focus area.

The primary objectives of this report are as follows:

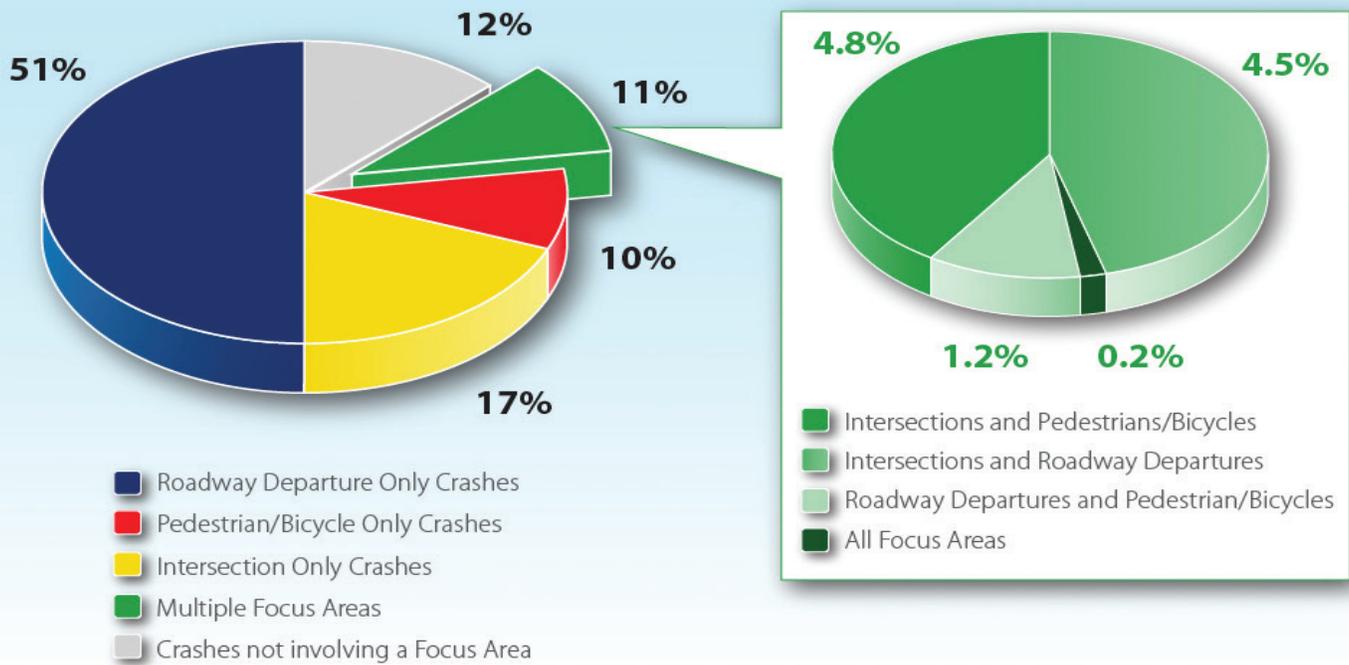
- Inform safety specialists and data analysts of the FHWA revisions to the focus areas.
- Provide detailed information on the current FARS attributes of each FHWA focus area.

The following actions will ensure that the objectives are met:

- Show how each focus area contributes to the entire fatal crash picture.
- Discuss changes to the crash data definitions for each FHWA focus area.
- Provide the current FARS attributes relevant to the three focus areas.
- Specify anticipated next steps in data definition development.

FHWA Focus Areas in Relation to Total Crashes

One of the key issues the TWG tackled was the question of how many fatal crashes were missed by focusing on just three major crash types. Because the team behind each focus area calculates crashes using different levels of FARS (RwD focuses on the vehicle actions, intersections focuses on the crash location and pedestrians focuses on the persons involved), there is overlap among the focus areas. Therefore, it is no simple task to determine the answer to how many crashes are not included in any of the focus areas. However, an analysis method was found, and the result is shown in the mutually exclusive pie charts seen in figure 1. The larger pie shows total fatalities and further indicates that 51 percent of all fatalities are from RwD that do not involve an intersection or a pedestrian. The 17 percent intersection and



NOTE: Totals in the main and secondary pie charts do not add up to 100% and 11%, respectively, due to rounding.

Figure 1. Percent of fatalities, 2010–2012.

10 percent pedestrian fatalities similarly do not involve the other two focus areas.

In addition, 11 percent of the fatalities involve more than one focus area, and 12 percent don't involve any of the three focus areas.¹ The smaller pie illustrates the makeup of the 11 percent of fatalities that involve more than one focus area. As the chart shows, the majority of these involve Rwd at intersections or pedestrian fatalities at intersections.

Roadway Departure Focus

The FHWA concept of Rwd has long been composed of both head-on collisions that are not a result of a turning maneuver and roadside crashes. It is not necessarily intuitive to group these under one major crash type, but there are similarities. The main similarity is that regardless of whether the vehicle leaves its intended travel path to the right or left, the contributing factors are often the same (e.g., driver distraction), and to some extent, the same types of countermeasures may be applicable. Other terms, such as lane departure, roadside crashes, and run-off-road crashes, are sometimes considered synonymous.

However, in 2009, FHWA specifically defined Rwd in an effort to clarify the use of the term.⁽²⁾

Evolution of FARS and FHWA Roadway Departure Definition/Attributes

When FHWA began calculating and reporting the number of fatalities for Rwd in the early 2000s, the attributes selected to define Rwd separated out single- and multiple-vehicle crashes to avoid double counting within the two broad categories. At that time, Rwd counts included crashes in which only one vehicle form was submitted and the first harmful event coded in FARS Accident data file was on the roadside, loosely defined as *SVROR crashes*. These crashes were added with crashes in which more than one vehicle form was submitted and the Accident data file showed a manner of collision including one of the following:

- Front-to-front.
- Front-to-side, opposite direction.
- Sideswipe, opposite direction.

In an effort to better capture the Rwd events, FHWA changed the criteria in 2009. The new method was

¹These crashes do not lend themselves to any particular category or categories. An example of a fatality in this slice of the pie would be a collision with an animal that involved no pedestrians or bicyclists, that did not occur at an intersection, and in which the vehicle involved in the collision did not leave the roadway or cross the center line before hitting the animal. In addition, in this example, there would be no other vehicle involved that left the roadway or crossed the center line to avoid the event.

based on a major change to FARS that occurred in 2004: the advent of vehicle event disaggregation. Vehicle event disaggregation provided a sequence of up to six events specific to each vehicle involved in the crash and included elements such as “Ran Off Road–Right,” “Cross Median/Centerline,” and many fixed roadside objects. Using these FARS attributes, FHWA was able to calculate the number of Rwd fatalities without making two separate queries. FHWA also decided to exclude intersection crashes at that time, primarily because most Rwd countermeasures are not applicable at intersections. While FARS data was available through 2007 at the time the criteria was changed, the use of the vehicle sequence element allowed NHTSA and FHWA to provide a retrospective of fatalities for each State. This was important to provide trend data leading up to the coding change.

Since the release of the Rwd definition, the team has worked closely with NHTSA’s National Center for Statistics and Analysis (NCSA) to update elements as changes are made to FARS and to optimize relevant roadway data extraction and codification. In addition, many analyses of Rwd crashes have found the disaggregation of the Rwd event helpful in the identification of specific countermeasures and research guiding development of new countermeasures. The on-going partnership between the two agencies has been helpful in improving efficiency and considering changes needed for the future.

Current Revisions to Roadway Departure Attributes and Definition

Among the issues considered by the 2013 Rwd TWG was the means of data provision. For FARS data from 2004 to 2009, users had at least two options for data extraction when applying the Rwd data definition: the FARS Encyclopedia and the flat files (e.g., Statistical Analysis System (SAS) or other database programs). The first involved running an online query using the FARS Encyclopedia, and the second involved developing a query in SAS or other program software. Both methods would yield frequencies for fatal crashes and fatal injuries. The SAS query provided maximum flexibility with respect to the type of data output and trend analysis over all available years of data. With the modifications of file structure coinciding with the FARS 2010 release, the FARS Encyclopedia no longer allows filtering by

vehicle event, as required by the Rwd definition. For this reason, the Rwd definition must be applied using a SAS query. Although the TWG considered options to once again simplify the query to provide an option for use in the FARS Encyclopedia, the trade-offs in accuracy were not determined to be advisable.

The 2013 TWG also considered applicable crashes that were missed by the Office of Safety Roadway Departure Definition.⁽²⁾ While several changes were considered, the only change that was recommended was to discontinue excluding roadway departures that occur at intersections. This decision was partly to conform more closely to how the other focus areas computed fatalities, partly to simplify the query in software programs such as Microsoft® Access, and partly because of the new concept mentioned previously that considers fatalities that overlap more than one focus area. Based on the scope of those crashes, the Rwd team will work with the other focus areas to place an appropriate level of effort on addressing Rwd crashes that involved intersections and/or pedestrians.

In conclusion, the new FHWA definition of an *Rwd* is “a crash in which a vehicle crosses an edge line, a center line, or leaves the traveled way.”⁽³⁾ The single change to the coding as a result of the TWG deliberations was to remove the intersection filter. Other updates that have been made incrementally (because the sequence of event elements within FARS have changed) are included in the following current list. The vast majority of Rwd events are captured in FARS by finding crashes in which the first event for any vehicle involved in the crash is one of the following: (63) Ran Off Road–Right, (64) Ran Off Road–Left, (65) Cross Median, or (68) Cross Center Line. In addition, a number of fixed object codes are included based on the idea that a vehicle must have left the roadway in order to collide with that object as a first event. Those fixed object codes include 17, 19–43, 46, 52, 53, 57, and 59.² Finally, three other event codes were deemed to most likely be indicative of an Rwd: (67) Vehicle Went Airborne, (69) Reentering Roadway, and (71) End Departure. The above listed event codes will work properly to select roadway departure crashes from the FARS database from 2004 through 2012.³ Prior to 2004, the current concept of the Rwd definition cannot be computed in FARS.

²See the *Fatality Analysis Reporting System (FARS) Analytical User’s Manual 1975–2010* for the specific event codes associated with these numbers in any particular year.⁽⁴⁾

³It should be noted that as new event elements have been added to FARS within this time period, appropriate event codes have been added to this list. For instance, (57) Cable Guardrail was introduced in 2008. In prior years, these events would be included in one of the other guardrail categories. Additionally, many changes have occurred within the events between 19 and 43, but in any year, all of the events in that range are included as Rwd crashes.

Intersection Focus

Intersections are another area that has long been considered a major focus of FHWA. NHTSA crash data (including FARS) adheres to the American National Standards Institute (ANSI) *D16.1-2007 Manual on Classification of Motor Vehicle Traffic Accidents*.⁽⁵⁾ Based on this manual, an intersection “contains a crossing or connections of two or more roadways not classified as driveway access, and is embraced within the prolongation of the lateral curb lines or, if none, the lateral boundary lines of the roadways. Where the distance along a roadway between two areas meeting these criteria is less than 33 ft (10 m), the two areas and the roadway connecting them are considered to be parts of a single intersection.”⁽⁵⁾ The manual also defines the following two crash types:⁽⁵⁾

2.7.3 at-intersection accident: An at-intersection accident is a traffic accident in which the first harmful event occurs within the limits of an intersection.

2.7.5 intersection-related accident: An intersection-related accident is a traffic accident in which the first harmful event (1) occurs on an approach to or exit from an intersection, and (2) results from an activity, behavior, or control related to the movement of traffic units through the intersection.

The FARS coding also differentiates between interchange and non-interchange areas. Historically, FHWA and NHTSA limited the count of intersection fatalities to only non-interchange intersection and non-interchange intersection-related crashes.

Current Revisions to Intersection Attributes and Definition

One of the primary concerns of the TWG intersection experts was the omission of many intersection crashes that occurred at or were related to intersections within interchange areas and at driveways and alleys. Crashes at these locations involve the same crossing/angle, turning, and rear-end conflicts present at all other intersections, and similar countermeasures are often appropriate. Therefore, to present a more complete picture on intersection safety, the TWG decided to include intersection crashes regardless of interchange area status and also add those coded as driveways or alleys.

In summary, the new *intersection* definition incorporates not only intersection and intersection-related crashes but also driveway and alley access or related crashes. All of the aforementioned crashes are included in the new definition regardless of whether they are in an interchange area. With the inception of the 2010 FARS changes, the intersection query is relatively simple because one uses the combination of the following “Relation to Junction” elements: (2) Intersection, (3) Intersection-Related, (4) Driveway Access, and (8) Driveway Access Related. When using the FARS database from 2009 and earlier, the new intersection definition requires the following combination of “Relation to Junction” elements: (2) Intersection (Non-Interchange), (3) Intersection Related (Non-Interchange), (4) Driveway, Alley Access, etc. (Non-Interchange), (8) Driveway-Access Related, (10) Intersection (Interchange Area), (11) Intersection Related (Interchange Area), and (12) Driveway Access (Interchange Area).

Pedestrian/Bicycle Focus

Pedestrian crashes are a focus area for both NHTSA and FHWA. NHTSA focuses primarily on the behavioral and vehicle issues involved in these crashes, and FHWA focus is primarily on the infrastructure aspect of pedestrian safety. The pedestrian focus area was largely self-explanatory and, similar to the intersection definition, followed the ANSI manual:⁽⁵⁾

2.6.5 collision involving pedestrian: A collision involving a pedestrian is a collision accident in which the first harmful event is the collision of a pedestrian and a road vehicle in-transport.⁽⁵⁾

While the FHWA focus definition has been limited to pedestrians, stakeholders involved with solving this crash problem are frequently interested in other non-motorized or vulnerable users, primarily bicyclists, in motor vehicle crashes. The limited access to reliable and complete data in these areas has been a challenge to understanding the issues and formulating solutions. Owing to the nature of the data sets capturing vulnerable user information, the data definition misses important elements, including exposure, crashes not involving a motor vehicle, and crashes occurring outside of the right-of-way (e.g., in a parking lot).

Current Revisions to Pedestrian and Bicycle Focus Attributes and Definition

Like the other focus areas, the pedestrian focus was expanded in the 2013 revisions. The FARS Person data file includes a wide range of persons on light conveyances that have pedestrian-like characteristics that are accommodated by the pedestrian infrastructure. For this reason, the pedestrian has been joined by persons using motorized or human-powered devices such as wheelchairs, scooters, or skates, and also persons in or on rideable toys such as strollers or wagons. In addition, interest in promoting wellness and decreasing emissions has increased the number of bicyclists and the frequency of these trip types. Therefore, FHWA has chosen to include bicyclists and other cyclists within this focus area.

This focus area is the only one that had a name change as a result of the 2013 revisions. The FARS attributes included in calculating the fatalities involving the new FHWA focus area of pedestrians and bicycles, including those in which the person who was fatally injured in a motor vehicle crash, were a (5) Pedestrian, (6) Bicyclist, (7) Other Cyclist, or (8) Person on Personal Conveyance.

Addressing Crashes Involving More than One Focus Area

Although it seems like addressing crashes in the overlap areas could be challenging, it might be reasoned that this challenge has been overcome. Previously, confounding factors and political motivation forced crashes into a single focus area without regard for the multiple aspects of an overlap crash. Today, however, an opportunity exists for a crash to be assessed based on all characteristics of its locations, vehicle events, and involved users. From this, a single countermeasure might be found to best address a portion of the crashes, or countermeasures applicable to each constituent focus area might be considered to determine the best set of countermeasures and the degree to which these might be applied. The issue of double counting has been avoided because the crashes are identified as composite crashes rather than associated with each focus area individually.

Figure 1 shows a significant number of fatalities that involve more than one of the focus areas. As a direct result of the 2013 TWG, the FHWA focus-area

experts have agreed that there is a need to work more closely together to ensure that these crashes are addressed with appropriate countermeasures. Hopefully, by providing similar information to each State, this will also be addressed in States where significant overlap occurs.

Next Steps

This technical summary informs key stakeholders of the changes and is therefore the first step in using the new focus area definitions and attributes. FHWA plans to undertake the following important steps:

- Provide crash data based on the new definitions showing the national and State-by-State frequencies as well as trends.
- Use each of the focus area leads to filter crashes in ways that allow for improved understanding, thereby suggesting possible countermeasures. The following two issues have been identified by the TWG:
 - Develop a method to logically characterize intersection types broken down by traffic control device based on the new FARS codes in the Vehicle data file.
 - Analyze and report horizontal curve crashes with the roadway alignment codes that are now within the new precrash level of FARS.
- Identify the scope of each focus area regarding injury crashes. This will require transitioning our analysis from the FARS census data (crash data available on all fatal crashes) into a sample environment. This could be either the National Automotive Sampling System General Estimates System (GES) or Crashworthiness Data System (CDS).^(6,7) GES was harmonized with FARS in 2010, and CDS will provide data for targeted studies, so both have potential for exploring the spectrum of injuries. This potential may be limited to somewhat generalized information because the GES and CDS do not contain many of the data elements contained in FARS (e.g., functional class).
- Continue with minor improvements to the FARS attributes used to define each focus area as FARS evolves and sustain the dialog that has begun with NHTSA regarding additional data needs by FHWA.

The most important element will be the continued relationship with NHTSA NCSA. Their support of the FHWA data acquisition needs and understanding of the focus area burden will strengthen subsequent revisions to the data definitions.

References

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6. NHTSA, *2012 Fatality Analysis Reporting System (FARS) and National Automotive Sampling System (NASS) General Estimates System (GES) Coding and Validation Manual*, DOT HS 811 854, Washington, DC, 2013.
7. NHTSA, *2013 National Automotive Sampling System Crashworthiness Data System Coding and Editing Manual*, DOT HS 812067, Washington, DC, 2014.

For More Information

The data definition for each of FHWA’s three safety focus areas was modified by the Technical Working Group, represented by subject matter experts from FHWA and NHTSA. Cathy Satterfield and Ana Maria Eigen led the analysis of FARS data using SAS software to improve the FHWA focus area definitions and update the Roadway Departure Strategic Plan. For more information about the FHWA Focus Area Definitions, please contact Cathy Satterfield, (708) 283-3552, cathy.satterfield@dot.gov or Ana Maria Eigen, (202) 493-3168, ana.eigen@dot.gov at FHWA.