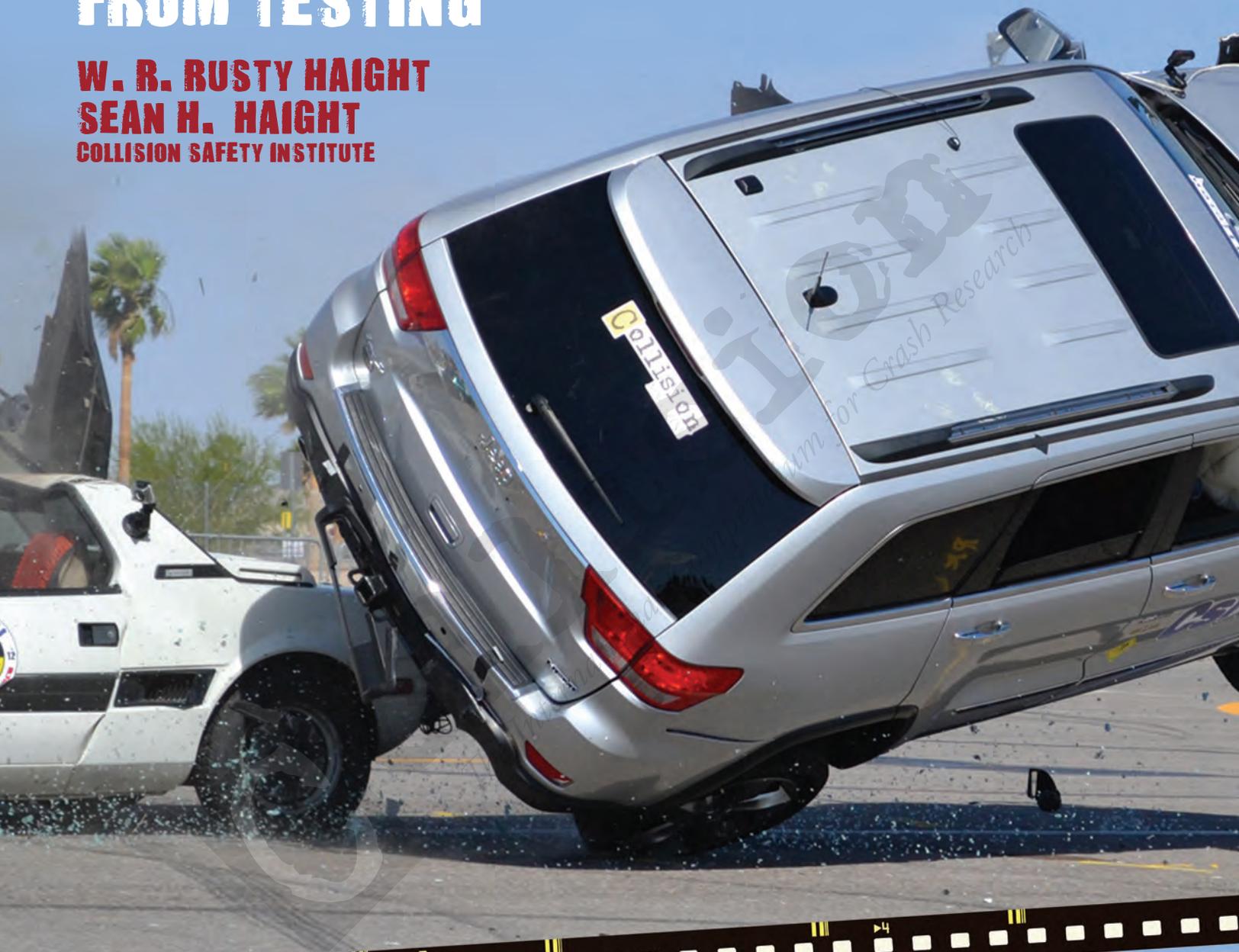


# ANALYSIS AND APPLICATION OF **ROLLOVER DATA** FROM TESTING

**W. R. RUSTY HAIGHT**  
**SEAN H. HAIGHT**  
COLLISION SAFETY INSTITUTE



**R**ollovers represent a small fraction (approximately 3%) of all motor vehicle crashes; however, they account for roughly 22% of crash fatalities for occupants of passenger cars, light trucks, and SUVs.<sup>1</sup> As much as they are disproportionately represented in the overall body of fatal crashes, rollovers remain one of the more difficult events to analyze or reconstruct. With the advent of “event data recorder” (EDR) technology, and the Bosch Crash Data Retrieval (CDR) Tool as one of the major emerging weapons in the crash reconstructionist’s arsenal, the investigation and analysis of rollovers has the potential of becoming somewhat less daunting and results of the analysis more meaningful. This narrative will examine the background for, the conduct of and the resulting data from a full scale

rollover crash test involving a 2011 Jeep Grand Cherokee conducted at the 2012 ARC-CSI Crash Conference.

## **B**ackground

For those vehicle lines accessible using the Bosch CDR Tool, General Motors (GM) was the first to make rollover event data part of the data set available to the reconstructionist.<sup>2</sup> Starting with model year 2007, many GM light trucks and SUVs were equipped with a RollOver Sensor (ROS) which was installed in the vehicle and closely associated with its Sensing and Diagnostic Module (SDM) or air-bag control module (ACM). The ROS (together to one degree or another with the ACM/SDM) controlled the deployment of occupant containment (“roof rail side”) curtains and then, where conditions permitted, together they may record several data elements associated with either a “Rollover” or “Non-rollover” event.<sup>3</sup>



Other CDR Tool supported manufacturer's (OEs) lines also include rollover event related data in their potential data sets for recent vintage vehicles. For example, while introduced to the CDR Tool set of accessible OEs/vehicles later than GM, Toyota line light trucks and SUVs have the potential for recording rollover related data back to calendar year 2003.<sup>2</sup> Where available for certain vehicles, rollover related data is found more frequently in relatively

newer model year vehicles across the many lines supported by the CDR Tool (see Table 1).

About model year 2010, GM line vehicles which offered occupant containment protection for rollover events controlled those components using an ACM which incorporated rollover sensing and logic in the ACM rather than as a function of a separate ROS as had been the previously

"563" Data parameter 1	Table	GM - ROS <sup>2</sup>	GM - ACM <sup>5</sup>	Ford <sup>5</sup>	Chrysler <sup>5</sup>	Toyota <sup>5</sup>	Honda <sup>5</sup>	Nissan <sup>5</sup>	Mazda <sup>5</sup>	Suzuki <sup>5</sup>
Speed, vehicle indicated	Table 1	Yes	Yes	Yes	Yes	Yes <sup>6</sup>	Yes	Yes	Yes	Yes
Steering input	Table 2	No	Yes	Yes	Yes	Yes <sup>6</sup>	Yes	Yes	Yes	Yes
Stability control (on, off, engaged)	Table 2	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ignition cycle, crash	Table 1	Yes <sup>3</sup>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lateral acceleration	Table 2	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Normal acceleration	Table 2	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vehicle roll angle	Table 2	Yes <sup>4</sup>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pretensioner deployment, time to fire, driver	Table 2	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pretensioner deployment, time to fire, right front passenger	Table 2	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Side curtain/tube air bag deployment, time to deploy, driver side	Table 2	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Side curtain/tube air bag deployment, time to deploy, right side	Table 2	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Complete file recorded (yes, no)	Table 1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 1

1 - Select data parameters from 49CFR563 representative of those which might otherwise be commonly sought after in the analysis of a roll over event. While other parameters (i.e.: RF occupant classification) may be available in certain circumstances, this list is more narrow for the purposes of this analysis.

2 - ROS for 07-09 GM vehicles would "share" some data elements with those which might be found in SDM data

3 - "Ignition cycles" would be a value found in the SDM, a "synchronization counter" (comparable to an ignition cycle counter) would be common to the SDM and ROS

4 - Records "roll rate" data rather than "roll angle" but angle could, of course, be calculated from the roll rate

5 - Starting with modules/vehicles which would have to be "563" compliant (built for sale after Sept 2012) and which may have "occupant rollover protection" of some sort. Some may be subject to the "if equipped" limitation.

6 - Toyota "Gen 3" modules which record pre-crash data have a different resolution than other OE modules/systems

Back Issue Catalog

Industry Partners

About Collisions

Advertising Options

Submit an Article



## Collision Magazine

The International Compendium for Crash Research

is the number one publication for accident reconstruction, safety investigation and crash research.

Over the course of the last 7 years, Collision Magazine has become the preeminent crash reconstruction journal providing subscribers with access to timely, relevant and peer-reviewed, thought-provoking reconstruction-related studies and meaningful crash test data from multiple sources. A semi-annual publication, Collision Magazine serves crash reconstructionists from the government and private sectors internationally.

Every issue of Collision Magazine is packed with real, invaluable information on a variety of topics. Included with every issue is a state-of-the-art compendium of the proceedings of either the [APRIL 2011 CDR Summit](#) or the [OCTOBER 2011 Summit](#), including presentations, relevant material, crash data, videos, photos, and much more.



SUBSCRIBE NOW

## Collision Magazine Special Edition #1

Hyundai & Kia Crash Data: The Indispensable Compendium

Limited Press Release

[Click here to read the press release](#)

Collision Publishing is pleased to announce the first Special Edition of Collision Magazine. This special edition is the first of a series of special editions that will be published in the future. The special edition is a limited press release. The special edition is a limited press release. The special edition is a limited press release.

The Special Edition #1 contains the following:

- Hyundai & Kia Crash Data: The Indispensable Compendium
- Hyundai & Kia Crash Data: The Indispensable Compendium

The Special Edition #1 is available for purchase at a special price. It is an excellent special edition. It is an excellent special edition. It is an excellent special edition.



The full version of this and other articles from back issues of Collision magazine are available at: <http://www.collisionmagazine.com/>

## Influence System: Structured Using Mobile Applications

Author: [Name]  
Title: [Title]

**V**...



**S**...



## Current Issue

Volume 8, Issue 2, Fall 2012  
Shipping December 2012

[Click here to read the press release](#)

This issue of Collision features the most detailed and in-depth analysis of Hyundai and Kia crash data published to date. The extensive review of the functionality of the Hyundai's "ECR Tool" application of crash tests and real-world examples is the focus of the primary feature story in the Fall issue of Collision.

In addition, "Differentiating Forensic Cause-Effect Component Damage from 'Crash Damage'" will get a look at methods for evaluating damaged components and an alternate method of investigating the potential of a pre-crash mechanical failure which may lead to or contribute to a crash. The analysis is carried out by the increasing use of vehicle examinations in "Evidence Collection Overhead" during vehicle inspections. A job of detailed study, three crash-relevant factors: safety and an examination of crash data in order to help with conclusions to the end and the effect of crash course on the contents of the indispensable issue of Collision Magazine.