

# USING CDR SYSTEM DATA IN CRASH RECONSTRUCTION ...



**A**fter Vetronix introduced the Crash Data Retrieval (CDR) System for sale to the public<sup>1,2</sup>, they sponsored the first CDR system “Training Seminar” in Santa Barbara, CA<sup>3</sup>. At the time, the most frequently heard refrain in the crash reconstruction community - public or private - was: “this ‘black box’ stuff is going to put reconstructionists out of business!” Later, some would go on to ignorantly suggest that CDR (System) reports would be “the next generation of police report;” to one degree or another, further fueling the misguided notion that the data imaged/downloaded using the CDR system would “replace” crash reconstructionists. The obvious comparison there to the longer standing aviation Flight Data Recorders (“FDR”) and the ongoing work by investigators from, for example, the US NTSB who are still doing the human-based hands on work they do despite the far greater complexity of the data available from the “FDR” should have been sufficient comparison to quell that concern.

**OR WHAT DOES THE TERM  
“COMPLETE RECONSTRUCTION”  
REALLY MEAN?**



**W. R. “RUSTY” HAIGHT  
COLLISION SAFETY INSTITUTE**

While Chidester, et al <sup>4</sup> mainly addressed the broader safety, research and regulatory advantages of collecting objective crash data following the “FDR” example, it became more and more clear that crash reconstructionists would find - while not being “replaced” - that some of their traditional methods of analysis would be supplemented and/or enhanced in one way or another by the otherwise objective data while, in some cases, their analysis would be subjected to further review or scrutiny as a function of conflict - whether real or interpretative - with crash data recovered from light vehicles. Still, the fear that traditional crash analysis would become a thing of the past became the frequently heard refrain.

In the earliest training on the CDR System, Floyd and Haight attempted to address this concern, writing:

“Benefits of data collection - Assists collision reconstructionist to be more accurate, reliable and better understand the collision event” <sup>5</sup>

and then writing to highlight the general application(s) of surface vehicle crash data with, for example:

“Reconstructionist Replacement? - EDR data doesn't stand alone in many “real world” events ... Supplements good investigative and analytical procedures ... The EDR data is a tool to be used by the reconstructionist not a replacement ... Limitations of the system necessitate analysis ... Stresses need for continued reliance on analysis and understanding of collision dynamics ...” <sup>6,7</sup>

The passage took on an interpretative life of its own and some translations became inexplicably limiting and unnecessarily restrictive with assertions such as:

“Nothing about this course suggests that the data obtained from an EDR or ECM should replace the collection of the physical evidence, application of valid mathematical principles, evaluation of human factors, or the development of investigator skills and understanding of collision analysis. The data provided by these instruments should always supplement, and verify, a properly conducted collision reconstruction.” (Emphasis, the original author(s)) <sup>8</sup>

As will be demonstrated more clearly later in this narrative, the latter (underscored by the original authors) portion of that passage is, by any measure, simply wrong in its blanket limitation of CDR data application. While it's true that data from an “event data recorder” subsystem <sup>9</sup> should not be used independent of sufficient information to connect it with an event under study, the notion that it should be relegated to a role where may only “(always) supplement, and verify, a properly conducted collision reconstruction” would presuppose (1) that crash reconstructionists would be incapable of undertaking the independent steps necessary to connect such data with a collision event and (2) that the volumes of research, crash tests and documentation of the relevant and related systems compiled over the last many years is to be blindly discounted. <sup>1</sup>

But even documentation within the system itself can be, at least, misinterpreted, or be seen as so badly constructed as to be, again, overly, even unnecessarily restrictive. For example:

“Ford Motor Company RCM's were not designed for the purpose of assisting accident reconstructionists. ... Accident reconstructionists must be aware of the limi-

tations of the data recorded in Ford's control modules and should compare the recorded data with the physical evidence at the accident scene using professional accident reconstruction techniques (i.e. vehicle crush characteristics, momentum analysis, etc.) before making any assumptions about the import and validity of the data recorded in the module with respect to the crash event being analyzed.” <sup>10</sup>

In *Lesser v Collier County* <sup>11</sup>, during cross examination of the defense expert on a case involving data from a Ford vehicle, there is a line of questioning suggesting that at least the first portion of that passage suggests against if not outright eliminates using CDR imaged data in crash reconstruction (“So, you're using some sort of data that was not intended for use by crash reconstructionists, is that what you're saying?”) In rebuttal, the follow-up line of questioning highlighted the second portion of the passage as that which would enable the reconstructionists - having applied “some (certain) technique(s)” - to use the data. While it was argued that the passages are almost mutually exclusive, this ultimately revisits the flawed notion that “... data provided by these instruments should always supplement, and verify, a properly conducted collision reconstruction...” <sup>8</sup>

That position is also often advanced in the overly broad and over simplified: “you have to do ‘a reconstruction’ to use ‘CDR data;” however, that proposition ignores the independent nature of various types of data imaged using the CDR system and their potential for various applications of that data as an integral part of an analysis just as much as a supplemental tool to corroborate an analysis given the documented reliability of various elements and lacking conditions which might effect the data.

At the same time some were suggesting restrictions on the use of CDR imaged data <sup>8</sup>, a more holistic approach adopted that:

“Analysts apply the data to/with a situationally complete crash analysis/reconstruction” <sup>12</sup>

and advanced in the idea that training on the system should be/ was structured such that:

“CDR general course objectives - Provide CDR Toolkit Data Analysts with ... The ability to read and understand stored crash data then apply that data properly to a situationally complete crash analysis.” <sup>13</sup>

**S**ituationally Complete? The simplistic and restrictive, at least on the surface, notion that “you have to do ‘a reconstruction’ to use ‘CDR data’” assumes there is a commonly or widely accepted definition of what constitutes “a reconstruction.” As far back as 1994, Day <sup>14</sup> posed that question to the co-author/panelists “(Question 1:) Describe the ‘product’ called accident reconstruction. ... Are all reconstructions basically the same?”

The panelists gave various answers but none were so specific or restrictive to presume to lay out any sort of set or list of particular requirements or “checkpoints” which would somehow define a “reconstruction.” Most were sufficiently general including:

“...Reconstructionists take bits and pieces of information from the collision, like pieces of a puzzle, and compare, analyze and evaluate those pieces and finally fit them together to discover the ‘how’ of a traffic collision.” <sup>14</sup>

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## Influence of Dynamic Structural Loading on Vehicle Occupants

Author Name: [Name]  
Author Address: [Address]

**V**ehicle occupants are subjected to dynamic structural loading during a crash event. This loading is the result of the interaction between the vehicle structure and the occupant. The magnitude and duration of this loading are dependent on the severity of the crash and the location of the occupant within the vehicle. This paper discusses the influence of dynamic structural loading on vehicle occupants and presents a method for evaluating the risk of injury to occupants during a crash event.



**S**afety is a primary concern for vehicle manufacturers and consumers alike. One of the most important factors in determining the safety of a vehicle is the ability of the vehicle to protect its occupants in the event of a crash. This paper discusses the influence of dynamic structural loading on vehicle occupants and presents a method for evaluating the risk of injury to occupants during a crash event.



## Current Issue

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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/Kia "ECR Tool" application in crash tests and real-world examples is the focus of the primary feature story in the Fall issue of Collision.

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