
PERSPECTIVES

COLLISION SEVERITY AND ACCIDENT RECONSTRUCTION: Why Crash Severity Matters in Personal Injury Claims



Our perspectives feature the viewpoints of our subject matter experts on current topics and emerging trends.

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Introduction: Understanding Collision Severity

According to *ConsumerShield*, a car crash occurs in the United States every five seconds. In 2023, this amounted to a total of 6.14 million crashes. These crashes lead to an estimated 5.1 million injuries per year requiring medical consultation, but not all injuries are created equally. With an observed rise in reported minor injuries, such as whiplash associated disorder (WAD) and sprains/strains, quantifying the likelihood of an injury is pertinent to appropriately assessing claims or seeking compensation.

So, what determines who gets hurt and how badly? Since no two crashes are the same, there are many factors at play. The occupants of a large pickup truck rear-ended by a small sedan in a parking lot will experience a different outcome than the occupants of a convertible that is T-boned by a crossover at a high-speed rural intersection. This comparison highlights factors in collisions that need to be considered, such as the size of the vehicle, direction of travel, direction of impact, and vehicle speeds. Ultimately, these factors determine the collision severity for each vehicle, i.e., a measure of how “bad” the crash was.

In this article, we discuss how collision severity is determined and how severity affects vehicle occupants in order to illustrate that not all collisions are equal. The following information may be of particular interest to plaintiff and defence counsels, as well as insurance professionals in the casualty space.

Accident Reconstruction Methods for Determining Collision Severity and Crash Severity

There are several different methods that an [accident reconstructionist](#) may rely on when determining the severity of a collision. One method to determine the severity of the crash is to simply measure it. By taking a series of measurements across the damage, the profile of the crush on a vehicle can be captured. Crash testing and research on the subject vehicles allow for detailed calculations to understand the stiffness of the vehicles for the area of damage observed. Based on a conservation of energy analysis, the extent of the deformation can be used to calculate the speed change.

A conservation of momentum analysis can also be used to determine the severity of the collision. This utilizes the approach speeds and directions of the vehicles, along with their post-impact travel, and accounts for where they came to rest. Computer simulations can also be used to reconstruct the dynamics experienced by the vehicles in the collision, which can also aid in determining the severity of the collision.

In other cases, data from crash tests with known and published severities and crashes that have been documented and made available can be used to determine the severity of a collision. These crash tests and known crashes will often have the available electronic data from the vehicle (i.e., the data from the onboard electronic data recorders, or “black boxes”), which can be used to verify the severity.

Ideally, multiple methods can be used to determine the severity. If the same severity is calculated/found through various methods,

it can increase the confidence of the severity range.

Luckily, with modern technology, we have more accurate and broadly applicable methods to determine collision severity.

Event Data Recorders in Collision Severity Analysis

The first event data recorders (EDRs) were installed in General Motors vehicles in the mid-90s, but as of late 2013, almost all new vehicles sold in the United States and Canada have had an event data recorder installed. Typically integrated into the airbag control module (ACM), these devices record approximately five seconds of pre-crash driver inputs, as well as the speed change of the collision, and the crash pulse of the collision (the acceleration versus time profile), both along and across the direction of the vehicle. This feat is accomplished using highly sensitive accelerometers integrated into the ACM. The data recorded by these devices can be downloaded by trained personnel with OEM-approved tools. The resulting reports state the speed change experienced by the vehicle along each axis and eliminate the possibility of practitioner error or bias.

When available, the data from the event data recorder should be accessed; however, it is not a one-size-fits-all solution. In low-severity collisions (below approximately an 8 km/h or 5 mph speed change), the data recorder often does not record a collision. This can tell us how low the severity of the collision may have been.

Similarly, due to mass disparities between vehicles, a smaller third-party vehicle may experience a speed change sufficient to record an event, while the larger vehicle of

interest may not. When possible, it is a good practice to obtain the EDR data from both vehicles involved.

Rarely is the EDR data the only information available to determine the severity of the collision. To validate the recorded information, it is good practice to compare it to the physical damage and other analysis methods.

Overall, the appropriate methodology to determine severity will vary as much as collisions themselves. It will depend on the available information, involved vehicles, and the severity itself.

Injury Biomechanics Expert Analysis

Collision severity can be used to answer questions about liability, including the speeds of vehicles at impact. However, it is also critical in determining the injury risk of the occupants involved. In its overarching form, biomechanics is the study of physics as it applies to the human body. Of interest to this article is the narrow branch of biomechanics focused on injury causation. When an injury mechanism is present and the magnitude of the forces is great enough, then there exists a risk of specific injury. For example, a high-five has the mechanism to break your hand, but only if your hand is hit hard enough.

In the early moments of a vehicle collision, the occupants of the vehicle continue to move in the direction they were driving while the vehicle slows down around them. This means that inside the vehicle, the occupants, generally speaking, appear to move toward the point of impact. The occupants will only stop moving in this direction when they interact with another structure, such as a seatbelt or the side of the car.

A biomechanist will look at the severity and directionality of a collision (among other factors) to determine how the occupant will move within the vehicle and what structures they may have contacted. The severity of the collision will help to determine the magnitude of the forces the occupants will experience. Research data can then be used to determine what forces and accelerations occupants or crash test dummies experienced in similar collisions and what they may have contacted within a vehicle. Other research can also be used to determine the human tolerances for various forces on the body. This will help to determine the injury risk for occupants in the vehicle. Without knowing the severity of the collision, the injury risk may be difficult to determine.

Expert Guidance in Accident Reconstruction and Personal Injury Analysis

As we have seen, there are many different methodologies for determining the severity of a given collision, depending on numerous factors, including the vehicles involved, the severity, and available information. A knowledgeable expert should consider all the methodologies discussed above and know which is the most appropriate in any given scenario.

It is important, when possible, to work with experts who have access to multi-disciplinary teams that can ensure that information about your unique situation is shared accurately, that reporting occurs consistently, and that the end product in a collision severity and injury-biomechanics case is of the quality that you need and expect.

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[Liam Rodgers](#) is a Professional Engineer in J.S. Held's [Accident Reconstruction Practice](#). Liam specializes in accident reconstruction for the insurance and legal sectors. With over five years of experience in the accident reconstruction field and a background in biomechanics, Mr. Rodgers has been retained as an expert on over 100 files across Canada and has been accepted as an expert witness in the Alberta Court of Justice. He has been involved in a broad range of investigations, from fraudulent damage claims to reconstructions of multi-vehicle collisions. His experience includes analysis of incidents involving personal, commercial, construction, recreational, and off-road vehicles, as well as pedestrians, cyclists, motorcycles, and golf carts. His duties include fieldwork across western Canada, such as vehicle and site inspections. Liam is also heavily involved with providing opinions regarding fraudulent damage claims and contributes to the analysis of motor vehicle crashes, including speed calculations, collision dynamics, avoidance analysis, and analysis of digital data and crash data recorder records.

Liam can be reached at liam.rodgers@jsheld.com or +1 825 360 0779.

[Karla Cassidy](#) is a Senior Engineer in J.S. Held's [Accident Reconstruction Practice](#). Ms. Cassidy has been an active member in the biomechanics community since 2006 and in the accident reconstruction industry since 2010. Her expertise spans both biomechanical and mechanical engineering. She has been involved in hundreds of cases involving vehicles, pedestrians, motorcycles,

farm equipment, and cyclists. Her specialty areas are biomechanics, personal injury, injury probability, seatbelt usage, slip, trip and falls, and determination of occupant position. Ms. Cassidy also conducts collision reconstruction and damage consistency analyses. She is a published author and has provided litigation support.

Karla can be reached at
karla.cassidy@jsheld.com or
+1 416 977 0009.



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