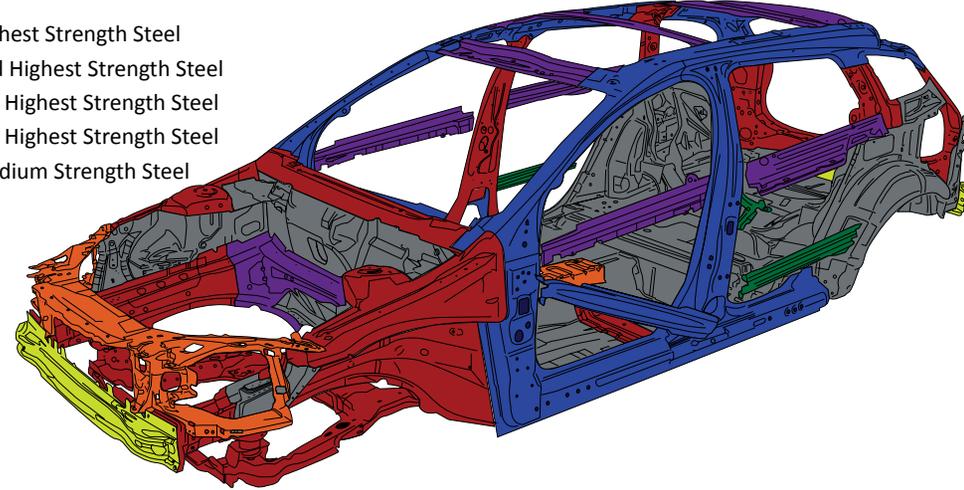
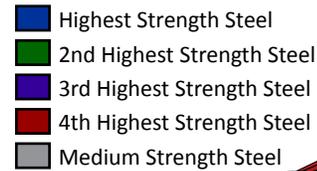


Vehicle Safety Cages

In the event of a collision, the vehicle safety cage protects occupants by maintaining survival space and dissipating collision forces that otherwise the occupants would be exposed to. Safety cages work in conjunction with seatbelts and airbags to slow occupants over the longest possible time and distribute crash forces over the largest area possible. When these systems function correctly, they effectively decrease the loads exerted upon occupants in a crash and reduce the severity of any resulting injury.

Vehicle safety cages are not only designed to provide protection, they are also integral to the handling characteristics and fuel efficiency of a vehicle. In the illustration, the different colors represent different grades of steel. By selectively incorporating higher strength materials throughout the design, manufacturers are able to balance safety and weight concerns and build vehicles that are both safe and efficient.



The Science and Principles of Vehicle Crashworthiness

Advanced Vehicle Safety Systems

Vehicle crashes occur for countless reasons, and thankfully most do not result in substantial injury. When functioning properly, modern vehicle safety systems allow occupants to walk away from crashes that may have been fatal twenty years ago. Advanced vehicle safety cages and restraint systems have become the industry norm.

The Science of Vehicle Crashworthiness

Vehicle crashworthiness is the science of focusing on protecting occupants involved in frontal, side, rear and rollover accident events through the utilization of various safety systems and safety principles.

These include:

1. Minimize crush to maintain survival space
2. Provide proper restraint throughout the entire accident event
3. Prevent ejection from the vehicle and nominal seating positions
4. Distribute energy and dissipate crash forces
5. Prevent post-crash fires

Crashworthiness safety systems must work together to provide adequate occupant protection throughout an entire accident. These safety systems are akin to safety links in a chain. If one link fails, then the safety chain has failed.

Cause of Crash vs. Cause of Injury

Crashworthiness safety systems do not prevent accidents from occurring. Instead, they prevent and minimize the risks of serious injury or death once an accident has occurred. If all accidents could be eliminated, there would be no need for safety systems that help prevent or minimize injuries after an accident has happened. Hence, there is a distinction between the cause of an accident versus the cause of an injury.

Whether a vehicle was designed with features to ensure the safety of its occupants in a foreseeable accident requires an investigation of the vehicles' crashworthiness.

Shaped for Crashworthiness

As seen in the illustration above the occupant area is surrounded by the highest strength steels to prevent intrusion into

the occupant space. Lower strength steels are used in front of and behind to collapse, dissipating collision energy to lower the forces that occupants are subjected to.



The picture above is a front frame rail tip on a newer light truck. The shape may seem arbitrary to the untrained eye, but the "rippled" area is a crush initiation zone. The formations in the metal create a weaker area than the straight rails; when a longitudinal load is applied to the rail, such as in an impact, the rail will collapse in this area first. These crush initiating zones are carefully implemented, checked virtually with FEA, and verified through crash testing of physical properties. With this deliberate design and tuning of these areas, they can be susceptible to interference with aftermarket items such as tow hooks, push bars, and grill guards.

Without proper engineering analysis on the location of the mounting hardware it is foreseeable that aftermarket alterations may cause the rail to crush in an undesirable pattern and even cause the impact sensors to not properly detect the magnitude and direction of collision forces correctly.

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Peter occupied a variety of engineering positions with vehicle manufacturers. His expertise includes vehicle structures and safety equipment, suspension and dynamics, and driver aids such as ABS and Electronic Stability Control systems. He was involved in nearly every phase of design and manufacturing; from early design, to full vehicle development. He has qualified as an expert in vehicle design, repair, and crash reconstruction in various state and federal courts.

As the head of our Vehicle Crash practice, Mr. Leiss can help identify the most appropriate expert to assist on your case.