By RON MOORE

Extrication Challenges Of Advanced Steel in Vehicles: Part 2 - Advanced Steel

SUBJECT: Advanced Steel
TOPIC: Extrication Challenges of Advanced Steel in Vehicles: Part 2
OBJECTIVE: The rescuer will understand and explain the rescue challenges presented by the introduction of advanced steels into the structure of late-model passenger vehicles.
TASK: Given the information contained in Part 2 of this series and reference to a late-model passenger vehicle, the rescuer will be able to identify potential areas of the vehicle where its structural steel is or could consist of "advanced steel."

THE SERIES...

- ❑ Part 1: More Steel
- ☑ Part 2: Advanced Steel
- ❑ Part 3: Cutting Tools
- ❑ Part 4: Power Cutters
- ❑ Part 5: New Rescue Techniques

Photo courtesy of Roger Cada, Bloomington, IL

The cut-away view of the B-pillar in this demonstration vehicle reveals that the B-pillar is not entirely Boron steel. Only the silver-colored inner layer of steel shown here is Boron. In most cases, only one layer of two or three layers will be advanced steel. In the real-world, there is no visible difference between the appearance of normal mild steel and any of the advanced steels on a vehicle.

RON MOORE, a *Firehouse*® contributing editor, is a battalion chief and the training officer for the McKinney, TX, Fire Department. He also authors a monthly online article in the Firehouse.com "MembersZone" and serves as the Forum Moderator for the extrication section of the Firehouse.com website. Moore can be contacted directly at Rmoore@firehouse.com.

We continue our discussion about the rescue challenges presented by the structural steel materials being used in the newest model-year vehicles. Automakers are working towards improving the side impact and rollover "crashworthiness" of their vehicles to comply with new government motor vehicle standards. In Part One of this series, we learned that there are two engineering solutions being employed; more and thicker steel or use of special alloys to create what is referred to as advanced steel. This second engineered solution – constructing areas such as B-pillars, roof rails, and rocker channels of ultra high-strength advanced steels – is the focus of this article.

To better understand what is different about these new advanced steels, we first need to understand what types of steels can be found in a passenger vehicle. Rescuers might find portions of a crash-damaged vehicle constructed of aluminum. This can include small components, a door panel or a hood for example, or possibly major structural portions of the vehicle such as the aluminum space-frame of the Audi A8.

Most often though, rescue person-

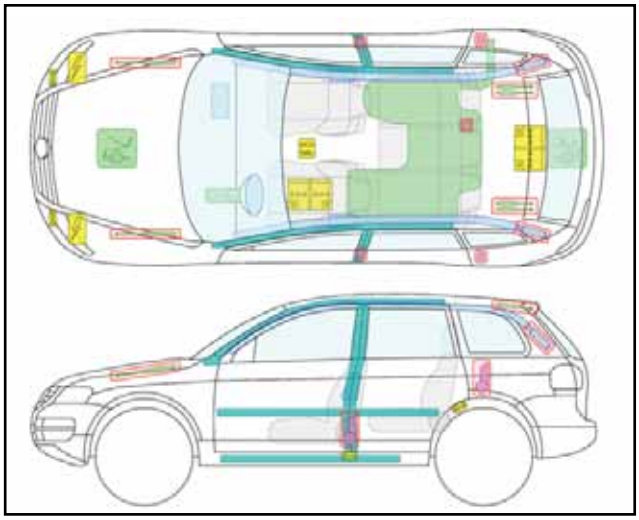

Photo courtesy of Moditech Rescue Solutions BV

This screen shot from Moditech Rescue Solutions' Crash Recovery System reveals locations where advanced steel is used on a late-model Volkswagen Touareg vehicle. The greenish areas show Boron steel in the roof rail, A- and B-pillars, rocker and door collision beams.

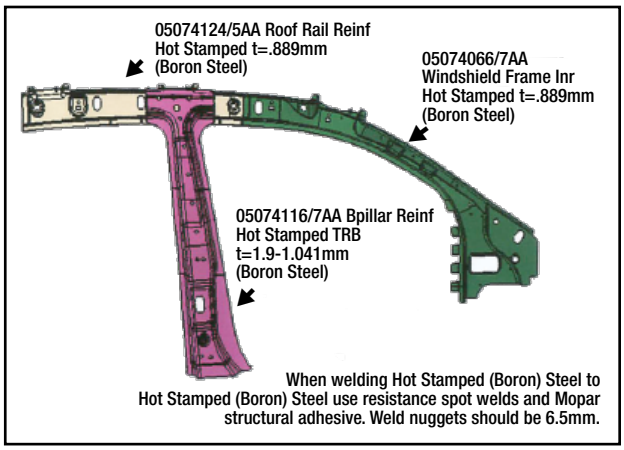

Photo courtesy of Chrysler Corporation Jeep Compass Body Repair Manual

This schematic diagram of the Boron structure of a new Jeep Compass SUV reveals not only where the Boron is located on this vehicle but even the engineered thicknesses at various points. Note that the Boron varies from less than a millimeter in thickness to almost two millimeters thick. For reference, a U.S. quarter is not quite two millimeters in thickness.

nel find that steel is what the vehicle is primarily made of. During rescue efforts, our extrication tools are able to bend, fold, or otherwise mutilate the common mild steel. Now however, with requirements for newer and more crashworthy vehicles, mild steel isn't the only type of steel we will encounter. Automakers over the past few years have introduced the use of stronger steels referred to as high-strength, low-alloy (HSLA) steels. HSLA steel is a tougher, more rescue tool cut-resistant metal. Our older hydraulic power cutters and our light-duty air chisel rescue tools will probably have difficulty working their way through HSLA metal pillars, roof rails, rockers, etc.

Just as we were getting used to high-strength steels, we are now facing the rescue reality of having vehicles built with an even stronger type of steel alloy; what the American Iron and Steel Institute refers to as Advanced Steels. Advanced steels are all Ultra High Strength (UHS) materials. There are several types of advanced steel; the most popular of which is Boron. Automotive engineers consider Boron the "most ultra" of the ultra-high-strength steels. Along with this hot stamped, Boron-alloyed steel, the family of advanced steels also includes Dual Phase steel (DP), Transformation Induced Plasticity steel (TRIP), and Martensite steel.

Why these advanced steels are becoming increasingly more common elements of a modern-day vehicle is due to the fact that advanced steels are lighter in weight than mild steels and are as much as much as eight times stronger than conventional metals. Almost every vehicle manufacturer has increased their use of advanced high-strength steels over the last two model years to improve the crash resistance of their vehicle. A typical 2009 model-year vehicle can have as much as 22 percent of its steel comprised of advanced steel.

To meet the new tougher requirements for intrusion-resistant passenger and engine compartments, vehicles built since the 2007 model year have a higher possibility of having advanced steels integrated into key structural areas. It's almost as if a race car roll cage is being built into the structure of a typical passenger vehicle without the vehicle owner ever being aware of its presence. Rescuers should anticipate that with any new vehicle they encounter at a crash scene, there is a great possibility that the door collision beams, A-pillar, B-pillar, and probably most of the roof rail will contain advanced steel. In addition, the lower rocker area from A- to C-pillar and even cross-members running beneath the floorpan or across the roof may be advanced steel.

The Challenges

For rescuers, the new application of advanced steel is both good news and a challenge. Real-world responses are showing that vehicles built with advanced steel integrated into their structural design are withstanding collision impacts with less and less injury and/or entrapment of the occupants. This is a good thing. A recent frontal collision involving a four-door Jeep Patriot vehicle, for example, resulted in the vehicle going off the road and rolling over more than a full time. Afterward, three of the four doors still could be opened by hand, the roof line had minor damage, and the rear liftgate opened normally. Without the advanced steel skeleton, the invisible roll cage, integrated into this vehicle, crush damage would be expected to have been much more significant and the chance of injury and entrapment for the occupants much greater. In this case, there was no injury to the belted driver and no entrapment.

The rescue challenges of advanced steels are many. In appearance, it is impossible to tell the difference between mild steel, high-strength steel, and the new advanced steels such as Boron. They all look the same. It will actually be our rescue tools that will tell us that we're into something tough. It will be our reciprocating saw that won't cut the roof pillar. It will be our air chisel that won't cut the rocker. And most importantly, it will be our hydraulic rescue cutter, the tool that we've had in on our rescue truck for the past ten years and that has always done what we wanted it to do, that will absolutely stall out when trying to cut through these new advanced steels. When your cutter goes to bite the B-pillar of a late-model vehicle with an advanced steel Boron B-pillar, you and the tool will quickly realize that we've been out-gunned by these new steel alloys.

TASK: Given the information contained in Part 2 of this series and reference to a late-model passenger vehicle, the rescuer will be able to identify potential areas of the vehicle where its structural steel is or could consist of "advanced steel."