



D40 Seat Belt Analysis: Sometimes Plastic Transfer to a Webbing Indicates the Restraint Was NOT in Use During a Crash

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Learning Overview: After attending this presentation, attendees will understand the typical and atypical evidence of restraint system loading during a motor vehicle crash. The role of pretensioner deployment will be demonstrated in a moderate frontal collision.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by providing important information for any reconstructionist desiring to determine the relationship between restraint use and injury production.

In a collision described as very severe by police investigators, the front of a 2006 domestic sedan struck the left side of a 2013 tractor with trailer as they met at an intersection. Both second-generation front airbags in the sedan deployed (first stage only). The 5' 9" tall, 180lbs, 46-year-old female driver of the sedan was noted by police and Emergency Medical Services (EMS) as having been properly three-point restrained, as was her passenger. She was transported to the hospital with several complaints, including a closed head injury. The driver was released the next day and eventually filed suit claiming a traumatic brain injury. The passenger suffered a shoulder injury that required considerably more medical treatment, but she did not participate in the lawsuit. As part of a thorough accident reconstruction, the crash data recorder was downloaded, and it indicated the sedan experienced a change in velocity of 25mph at impact. This is well below the severity of impact in the United States Department Of Transportation (DOT) New Car Assessment Program frontal crash test for this model vehicle (New Car Assessment Program (NCAP) Test 4931). The NCAP test involved a 50 percentile male Anthropomorphic Test Dummy (ATD) of similar stature to the female driver in this case. The sedan earned a maximum five-star rating indicating the chances of serious injury at 10% or less in a 35mph frontal crash into a barrier. Test videos indicate the head and torso of the properly restrained ATD rotated into the deploying airbag and did not contact the headliner, dashboard, or windshield. The data recorder further indicated the sedan driver seatbelt was unbuckled, but the front seat passenger belt was buckled. An investigation of the vehicle was undertaken in order to rule out restraint system failure. Upon inspection, the passenger restraint system showed typical abrasions to the cabin-facing surface of the D-ring and concomitant plastic transfer to the seatbelt webbing—clear evidence of restraint use during the collision. The driver seatbelt webbing was found cut and exhibited similar plastic transfer from the D-ring. Without further examination, one might assume the driver had been properly restrained. However, the webbing was locked at a relatively unspooled length. A driver side retractor-mounted pretensioner clearly fired while the belt was in the stowed position. As the belt was quickly pulled into the spool, it produced abrasions to the inside of the plastic-coated D-ring (the side facing the B pillar). There was very clear evidence of plastic transfer to the belt at a location that would correspond to it being retracted at the time of firing. No evidence or testimony explained why the belt was cut, but it is not uncommon for tow truck operators to cut and use seatbelts to secure a door or the steering wheel.

The driver claimed to suffer a head injury, and, at inspection of the vehicle, it was noted that there were abrasions to the visor and a fracture to the windshield. Both were reasonable locations for head contact by an unrestrained driver—NOT one who was properly restrained, of a size similar to NCAP ATDs, and in an accident that was approximately 30% less severe than NCAP tests.

It is unknown how many vehicles have crash data systems programmed to trigger a pretensioner to fire on an unbuckled seatbelt, but this presentation clearly demonstrates one such case and attendees will now know of this possibility, and the evidence for it, when performing an analysis of a restraint system.

Seat Belt, Pretensioner, D-Ring