D23 The Potential Conflict Between Forensic Science and Certain Legal Approaches in Litigation

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Learning Overview: This goal of this presentation is to address the potential conflict between forensic scientific investigation, testing, and analysis versus various "legal approaches" sometimes suggested by attorneys in litigation cases. Those involved in the forensic sciences must be aware that the ethical and scientific demands must be properly met rather than altering investigative and test methods to simply present a case per an attorney's preference.

Impact on the Forensic Science Community: This presentation will impact forensic scientists and engineers who must interact with attorneys and judges in either civil or criminal litigation and who are subject to *Daubert* and *voir dire* challenges by ensuring that the appropriate scientific and ethical standards are met regardless of how those in the legal profession wish to proceed with a case.

"Consumer expectation" is that vehicle safety systems protect motorists in 33mph–39mph Change of Velocity (Delta V) frontal impacts, and seats/belts should not fail in similar rear collisions. Study-conducted National Highway Traffic Safety Administration (NHTSA) rear crash tests of 15mph–20mph Delta V caused belted adult surrogates to catapult headfirst into rear survival space as front seatbacks collapsed, and restraints slackened, crushing rear-seated child surrogates. (For reference,50 percentile of males are 69" tall, 167-pound instrumented crash test dummies per Code of Federal Regulations Title 49, Part 572 and 95 percentile of males are 74" tall, 227-pounds, and 5 percentile of females are 60" tall and 100 pounds. 6-year-old child dummies weigh 50 pounds.) These "unexpected" hazards result from no rear-impact, occupant-protection requirements and NHTSA's admittedly "flawed and inadequate" Federal Motor Vehicle Safety Standard (FMVSS) 207 only requiring 275 pounds seat strength.[1] Quasi-static and dynamic crash tests for this study comparing weak Original Equipment Manufacturer (OEM) and safer, inexpensive alternative design seats consistently demonstrate predictable, preventable dangers. In addition to normal forensic science demands, this case study involved conflicts between study-recommended scientific tests and non-instrumented "demonstrations" requested by legal clients for "consumer expectation" approaches sometimes used in litigation.

In a 33mph–35mph Delta V Sports Utility Vehicle (SUV) rear impact, the 235-pound driver's seatback with 1,960 pounds static load capacity predictably collapsed rearward, slackening vehicle-anchored belts, allowing headfirst loading into the Belt-Integrated center rear Seat (BIS), resulting in quadriplegia. FMVSS 210 requires that torso and lap belts withstand a minimum 3,000 pounds torso and 3,000 pounds pelvic frontal load; static tests of rear BIS demonstrated seatback strength of over 4500 pounds rearward upper torso load capacity.

Two identical 35mph Delta V dynamic crash tests compared a belted 235-pound surrogate in an OEM seat with 1,960 pounds strength versus unbelted in a second row BIS with 4,500 pounds strength (Fig 1.)

Test 1 was a "restrained" surrogate in an OEM seat with 13.9 maximum "G" resistance. (141-pound upper torso inertia force exceeding 13.9 G's will collapse the seat and allow the restrained driver to ramp out of slackened vehicle-mounted restraints, consistent with this real-world case.)

Test 2 was an "unrestrained" surrogate in a second row BIS with 31.9 G resistance to occupant torso loads, which was 230% more resistant to crash forces than the OEM seat, while retaining similar seat track/seatback functionality, also providing much greater occupant protection, and could fit the driver floor pan and operating space.

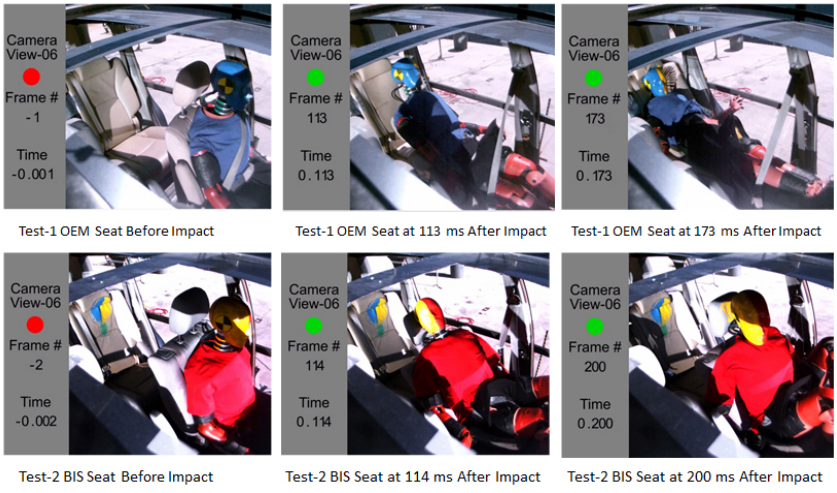

Figure-1: Video Clip Images Comparing Surrogate Maximum Rearward kinematics for Tests 1 and 2.

These tests demonstrated how "consumer expectation" tests should be run to scientifically prove, to a reasonable degree of engineering certainty, that: the belted surrogate in the weaker OEM seat experienced head injury ten times higher and neck injury 36 times higher than the unbelted surrogate in the BIS. These injury risks are consistent with paralyzing quadriplegia injuries to the actual driver; and (2) the unbelted surrogate in the stronger rear BIS had head and neck injury risk measures well below the injury thresholds acceptable by NHTSA, proving the BIS, even without belt use, gave far safer protection than the OEM seat and belts.[2]

The foregoing demonstrates a reliable method for clearly presenting scientifically verifiable evidence to consumers validating "consumer expectations" of what should or should not occur when a primary "safety system," like the seat and belt restraints, fail to "function as expected" during foreseeable rear crashes.

Legal clients often misunderstand scientific aspects of a case and are concerned about testing costs of scientifically proving likely injury risk levels for the defective product and available alternative safer designs. Many challenges, such as *Daubert*, face forensic experts when legal clients restrict data gathering, scientific test-analysis comparisons, and alternate design approaches. Opposition experts may suggest that injury risks of alternate designs are no better than visual kinematics shown by the clients' restrictive choice. Judges may allow such incomplete and unchallenged misinformation to be presented to a jury without allowing the forensic expert time to conduct scientific testing to provide a clearer picture of design comparisons. Non-scientific "consumer expectation" legal tactics using "visual demonstrations only" risks expert reputations and often costs far more than properly planned scientific testing.

INJURY MEASURES **(Red Measures Exceed IRV)**	**OEM DRIVER SEAT** **Test 1**	**2nd ROW BIS** **Test 2**
HIC	**1,362.4** **(NHTSA Limit is 700)**	**133.6**
Ntf (tension-flex) **Nte (tension-ext)** **Ncf (compression-flex)** **Nce (compression-ext)**	**0.15** **0.13** **0.94** **0.95**	**0.21** **0.15** **0.04** **0.01**
Neck Axial Compression (Newtons)	**- 6,036.2** **(NHTSA Limit is -4000N)**	**- 165.0**
Neck Axial Tension (Newtons)	**713.1**	**1,143.7**
Neck Flexion Torque (N-m)	**- 45.9**	**-27.6**
Neck Extension Torque (N-m)	**25.2**	**16.2**
Chest 3 msec (G's)	**29.8**	**24.4**

Reference(s):

1. Federal Motor Vehicle Safety Standard per 49 CFR, Part 571.
2. Author-tested 35mph rear-impact Delta velocity injury risk measures of 235 pound "belted" surrogate in weak OEM seat vs "unbelted" surrogate in second-row BIS from same vehicle. IRV=Injury Reference Values. HIC= Head Injury Criteria. Ntf, Nte, Nef, and Nce are acronyms for individual measures of the NHTSA neck injury criteria (All Injury Criteria per 49 CFR Part 571).

Forensic Science, Testing, Litigation