



www.iihs.org

Static Evaluations of Belt Fit for Boosters – Updated protocol and ratings

**2010 Government/Industry Meeting
Washington, DC • January 28, 2010**

**Chris Sherwood
Senior Research Engineer**



Boosters can improve three-point belt fit

Updated study on booster effectiveness (CHOP)
45% reduction in injury risk Pediatrics, Nov. 2009



Not all boosters achieve this objective



Contents lists available at ScienceDirect

Accident Analysis and Prevention

journal homepage: www.elsevier.com/locate/aap



Evaluation of the static belt fit provided by belt-positioning booster seats

Matthew P. Reed^{a,*}, Sheila M. Ebert^a, Christopher P. Sherwood^b, Kathleen D. Klinich^a, Miriam A. Manary^a

^a University of Michigan Transportation Research Institute, United States

^b Insurance Institute for Highway Safety, Vehicle Research Center, United States

October 2008

Vol. 43, No. 8, October 1, 2008: Special issue

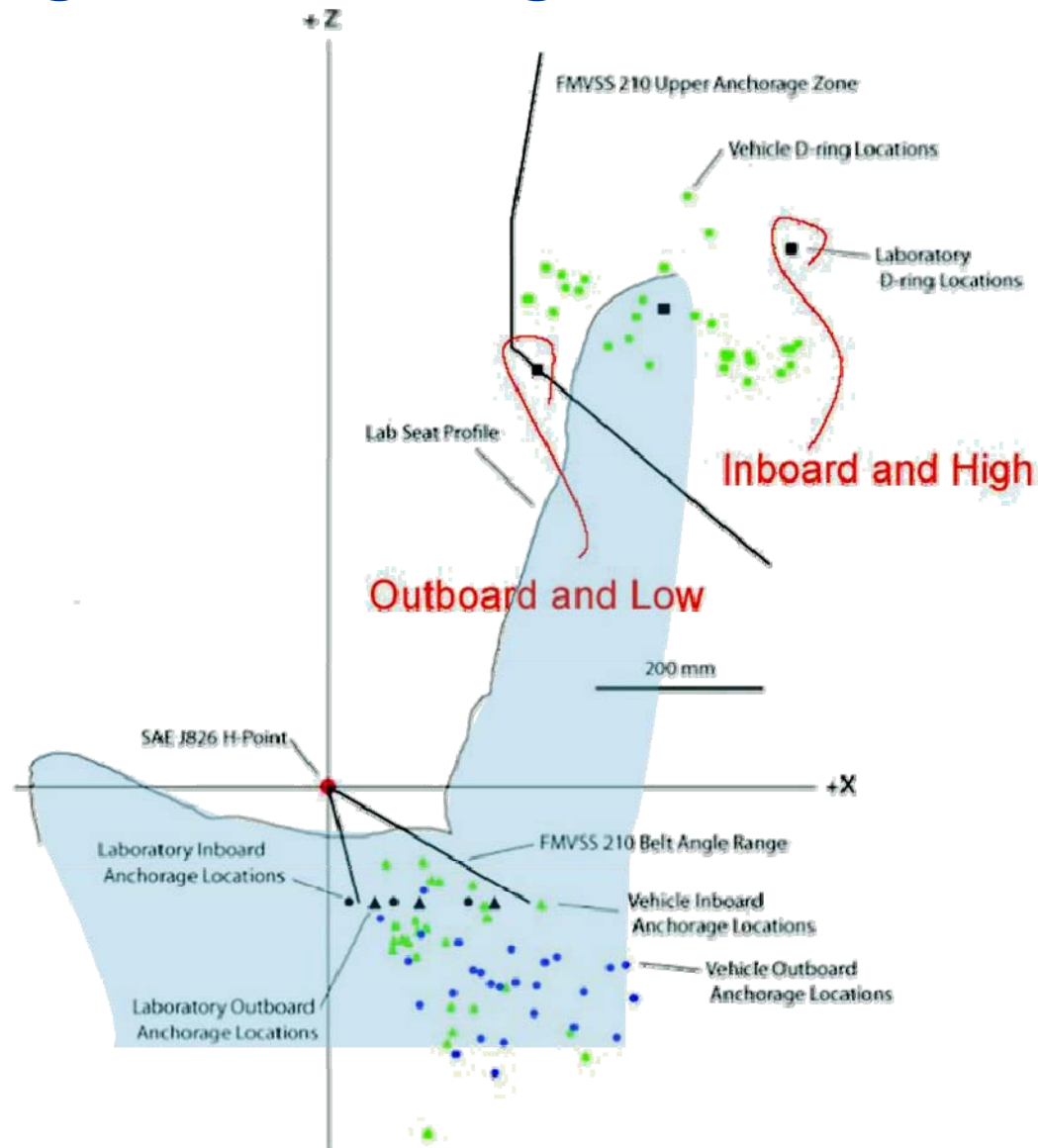
STATUS REPORT

INSURANCE INSTITUTE
FOR HIGHWAY SAFETY

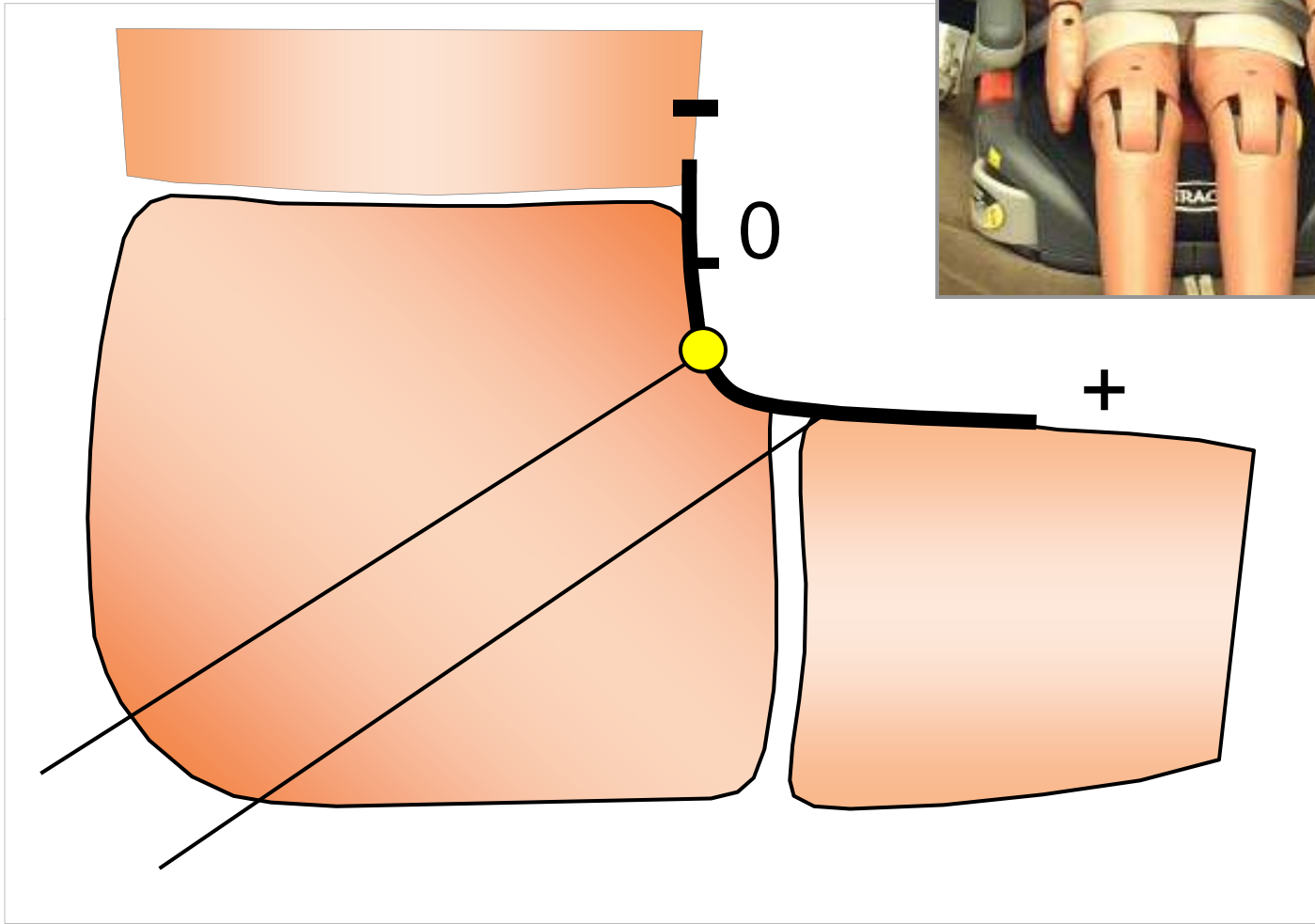
TOO BIG FOR HER CHILD
RESTRAINT, SHE NEEDS A

**BOOSTER
THAT FITS**

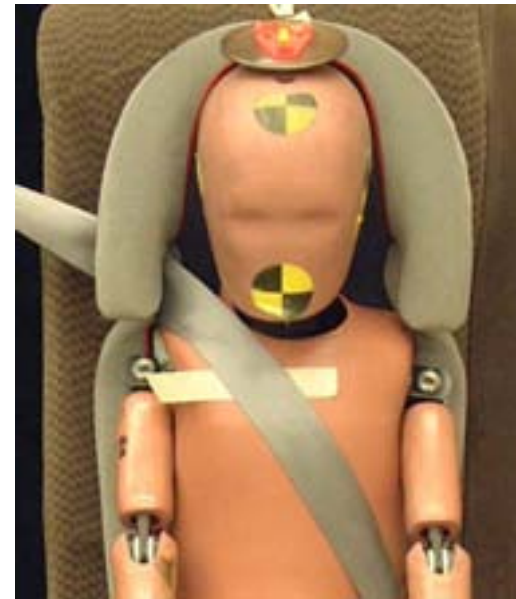
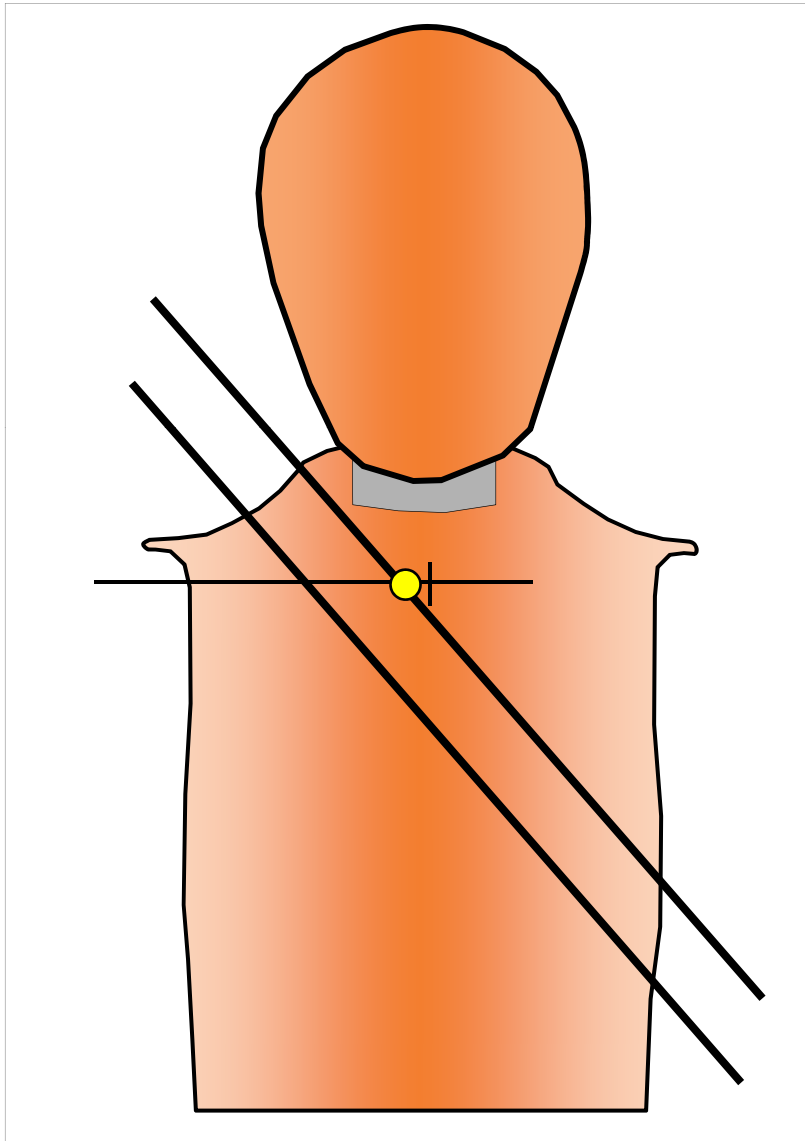
Quantifying belt anchorage locations in vehicles



Lap belt fit measures



Shoulder belt fit measures



LAP BELT: RANGE OF FIT

SHOULDER BELT: RANGE OF FIT

BEST BETS

GOOD BETS

NOT RECOMMENDED

BEST BETS

- Grace TurboBooster backless with clip
- Fisher-Price Safe Voyage backless with clip
- Combi Kabuk backless with clip
- Fisher-Price Safe Voyage
- Britax Parkway
- Lafcoche Bros. Teddy Bear
- Safeguard Go backless with clip
- Volvo booster cushion
- Recaro Young Style
- Britax Monarch

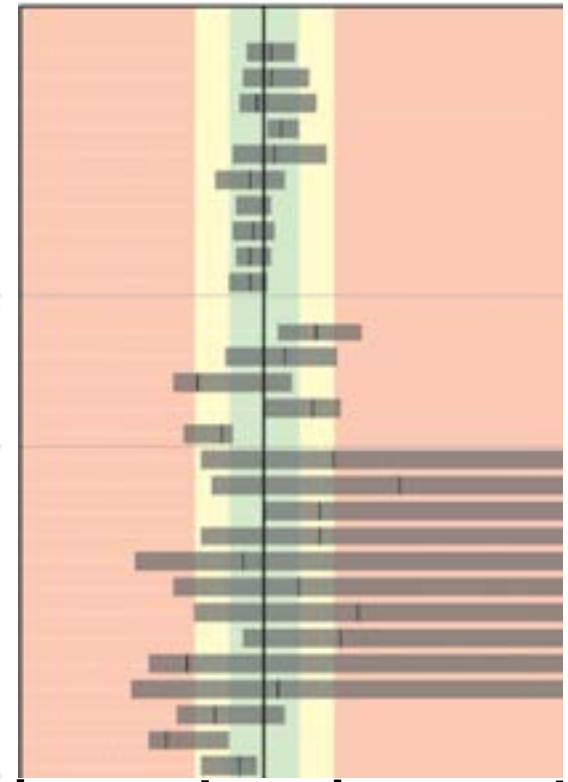
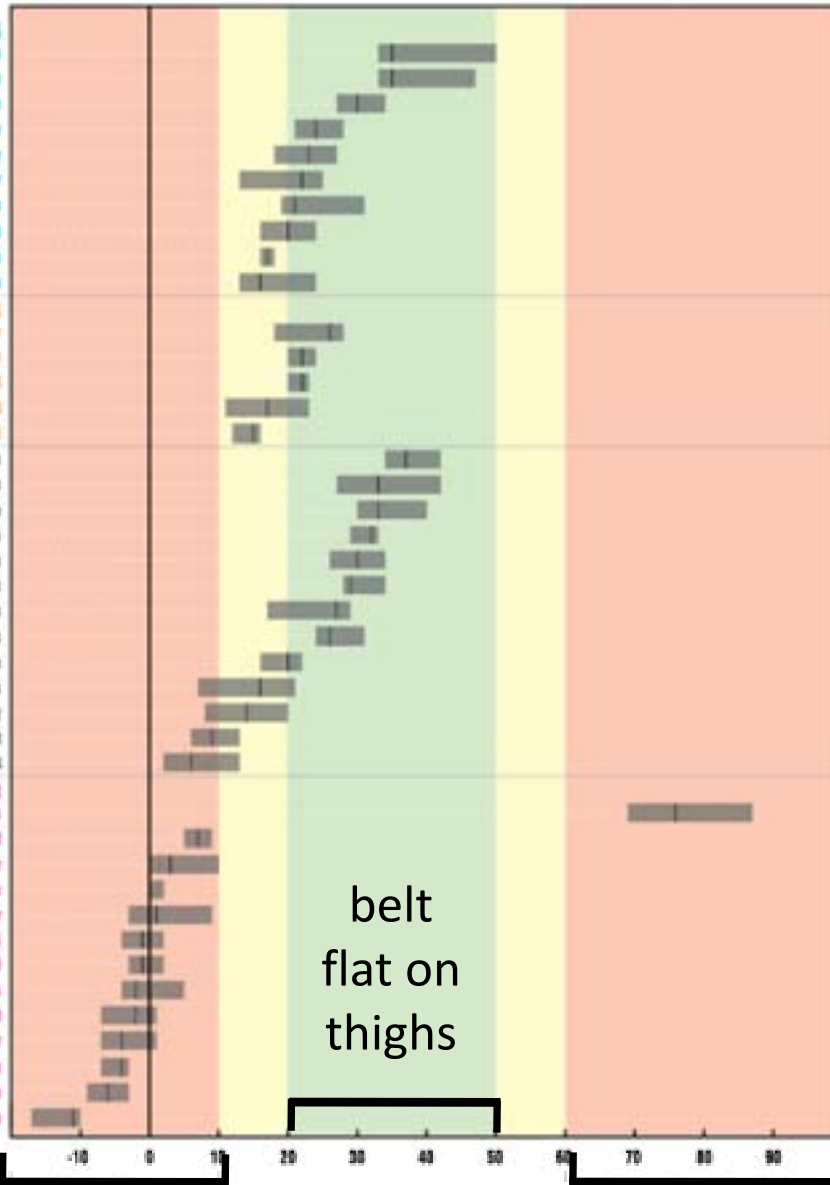
GOOD BETS

- Grace TurboBooster
- Safety Angel Ride Ryle
- Recaro Young Sport
- Combi Kabuk
- Safety 1st/Dorel Apex III

- Safety 1st/Dorel Intera backless
- Britax Monarch backless
- Combi Dakota backless with clip
- Magna Click backless
- Dorel/Safety 1st (Eddie Bauer) Prospect backless
- Profinder CNS booster backless
- Cosco High Rise/Ambassador backless
- Volvo booster cushion backless
- Eventlo Big Kid Confidence backless with clip
- Cosco/Dorel Protek backless
- Jane USA Indy
- Recaro Start
- Cosco/Dorel Protek

NOT RECOMMENDED

- Safety Angel Ride Ryle backless
- Cosco/Dorel (Eddie Bauer) Summit
- Grace CarGo Zephyr
- Eventlo Big Kid Confidence
- Cosco/Dorel Traveler
- Compass 900S
- Compass 8018
- Eventlo Generation
- Dorel/Safety 1st (Eddie Bauer) Prospect
- Cosco Highback Booster
- Cosco/Dorel Alpha Omega
- Eventlo Chase Comfort Touch
- Safety 1st/Dorel Intera



belt on abdomen

belt too far forward on thighs

belt on neck

belt off shoulder

belt flat on thighs

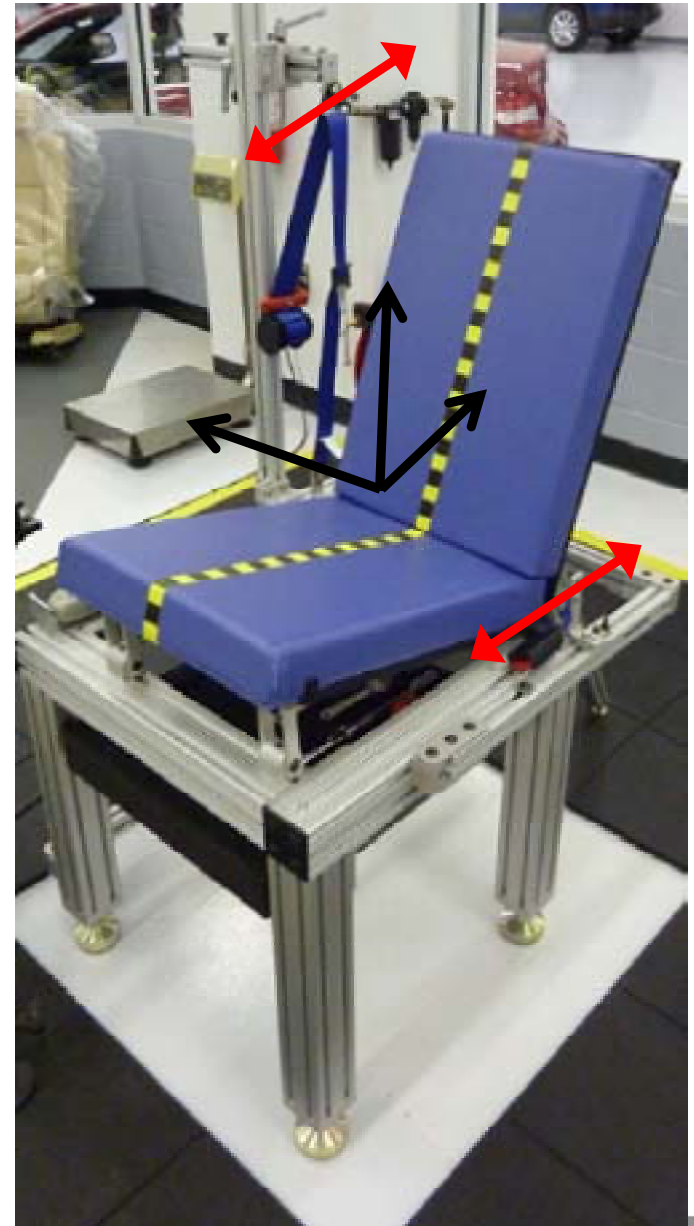
Development of IIHS protocol

- Develop a test fixture that could be reliably reproduced by child restraint manufacturers and other research groups
 - Replace vehicle seat
 - Standardize design/materials
- Modify protocol to improve repeatability
 - Improve definition of important dummy landmarks
 - Teflon chest bib to improve shoulder belt positioning



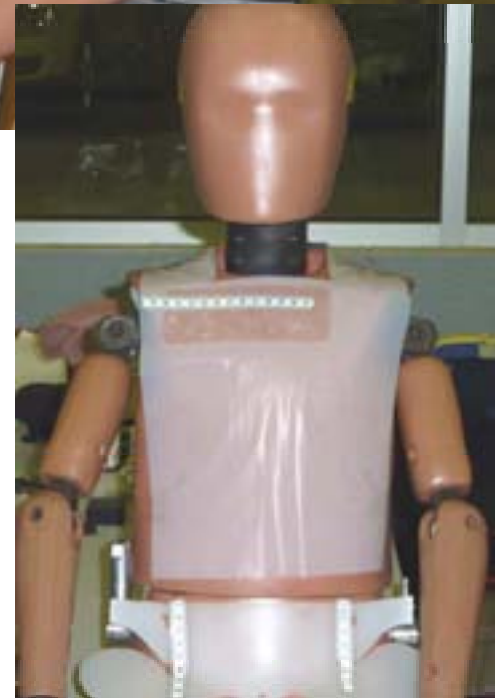
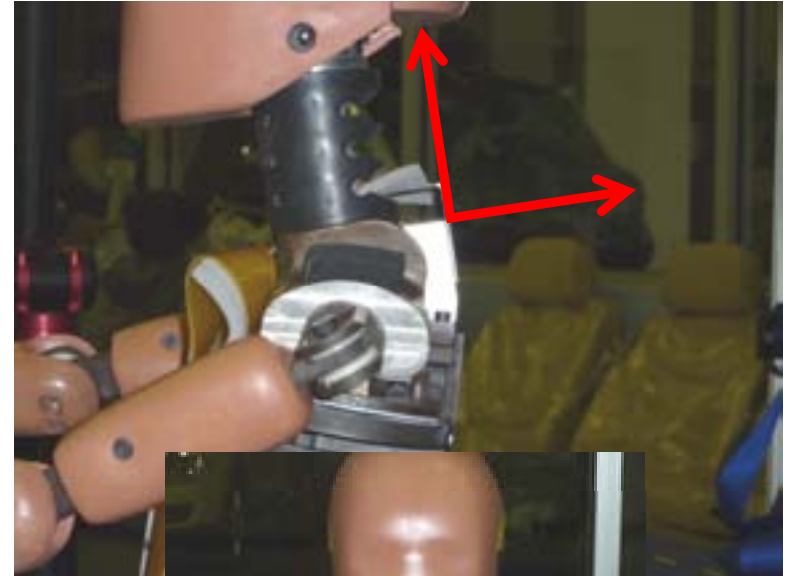
Test Fixture

- FMVSS 213 foam
- Adjustable Lap/D-Ring anchorage locations
- Coordinate system origin
 - SAE H-Point
- Three-point belt system
 - Commercially available



Measurement Protocol

- Modified chest reference point
 - Location specified with respect to dummy spine
 - Pads added under jacket
 - Allow adjustment
 - Reduce jacket variability
- Teflon sheet added to jacket surface



IIHS Booster Protocol Meeting

September 22-23, 2009

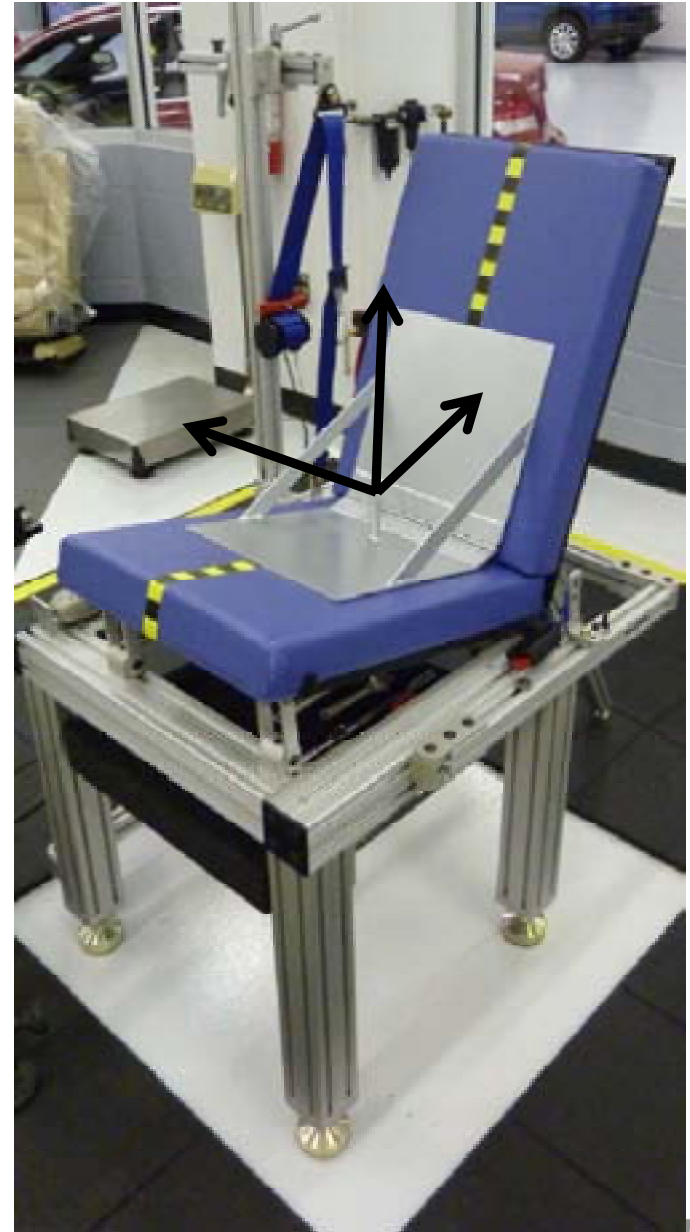
- Purpose of meeting was to explain protocol and demonstrate how test is conducted
 - Child Restraint Manufacturers
 - Juvenile Products Manufacturers Association (JPMA)
 - Consumer Reports
 - NHTSA
- Child restraint manufacturers also given access to the fixture to perform measures on their own boosters

IIHS Booster Protocol Meeting

- Positive feedback from attendees
 - May serve as a tool in the initial design process
- Immediate requests for detailed information on fixture
- Three manufacturers have already measured prototype boosters using this fixture/protocol

IIHS Protocol

- Developed a **B**ooster Seat H-**P**oint **O**rigin **D**evice (BPOD)
 - Maintains industry standard reference frame
 - Eliminates use of SAE H-Point Machine



2009 booster seat ratings

60 booster configurations



23 highback



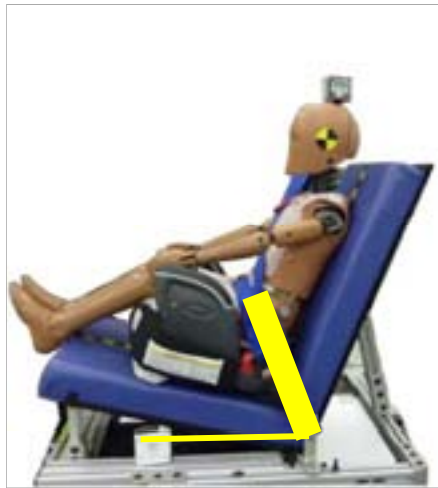
11 backless



13 dual use
(removable back)

2009 booster ratings

Booster tested in 4 Lap/Shoulder belt scenarios



lap belt angle

minimum

maximum



shoulder belt (d-ring) location

fore/outboard/low

aft/inboard/high

STATUS REPORT

INSURANCE INSTITUTE
FOR HIGHWAY SAFETY

Vol. 44, No. 11, Dec. 22, 2009



WHICH BOOSTER IS BEST FOR ME?

New ratings from the Institute take the guesswork out of selecting boosters most likely to provide good lap and shoulder belt fit in a range of vehicles. The Institute rates 9 belt-positioning boosters as *BEST BETS* and 6 as *GOOD BETS* out of 60 models examined in a new round of evaluations. Eleven boosters aren't recommended at all because they do such a poor job of fitting the belt. Fit is important because safety belts are designed with adults in mind, not kids. Boosters elevate children so belts will fit their small frames better to protect them

Summary of 2009 booster ratings

- Similar range of results
 - Time for new designs to reach market
 - Some of worst performers have been taken off market
- Encouraged by discussions with booster manufacturers
 - Test fixture as tool in design process
 - Used for prototype testing

2009 booster ratings

Ratings and protocol information available
on the IIHS website

<http://www.iihs.org/research/topics/boosters/default.html>



www.iihs.org

**Dedicated to reducing deaths, injuries,
and property damage on the highway**