

UPDATE ON NHTSA'S OBLIQUE RESEARCH PROGRAM

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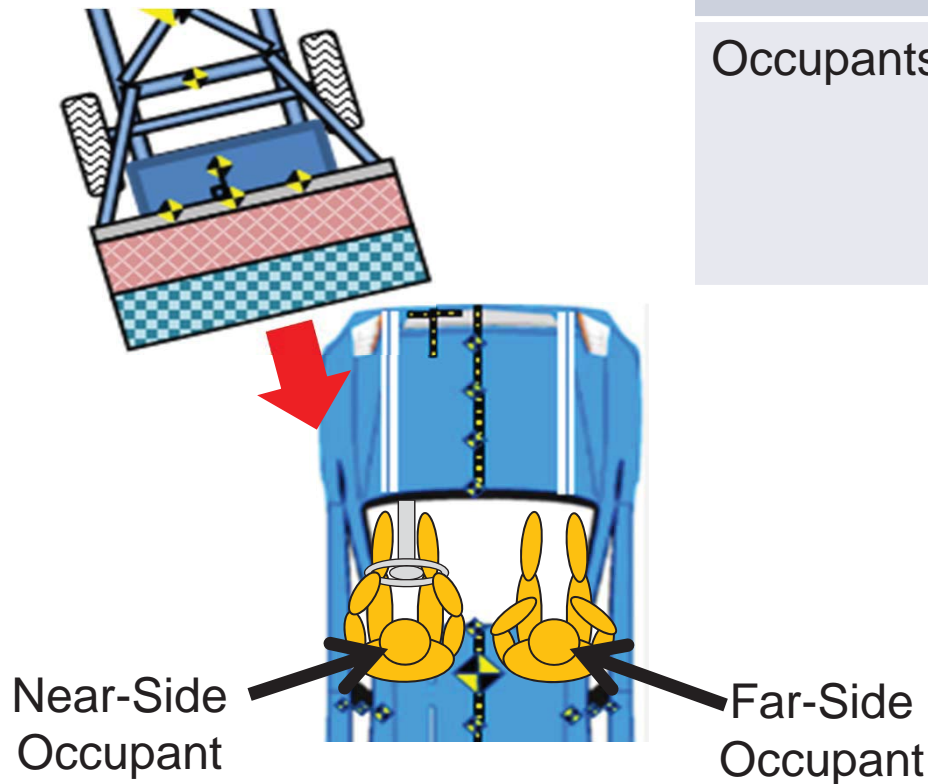
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AGENDA

- **BACKGROUND**
 - NHTSA Oblique RMDB Procedure
 - IIHS Small Overlap Procedure
- **FINDINGS TO DATE**
- **CURRENT RESEARCH**
 - Objective
 - Additional Vehicle Tests
 - New Methodologies
- **RESULTS**
 - Vehicle Response
 - Occupant Response
- **CONCLUSIONS**
- **NEXT STEPS**

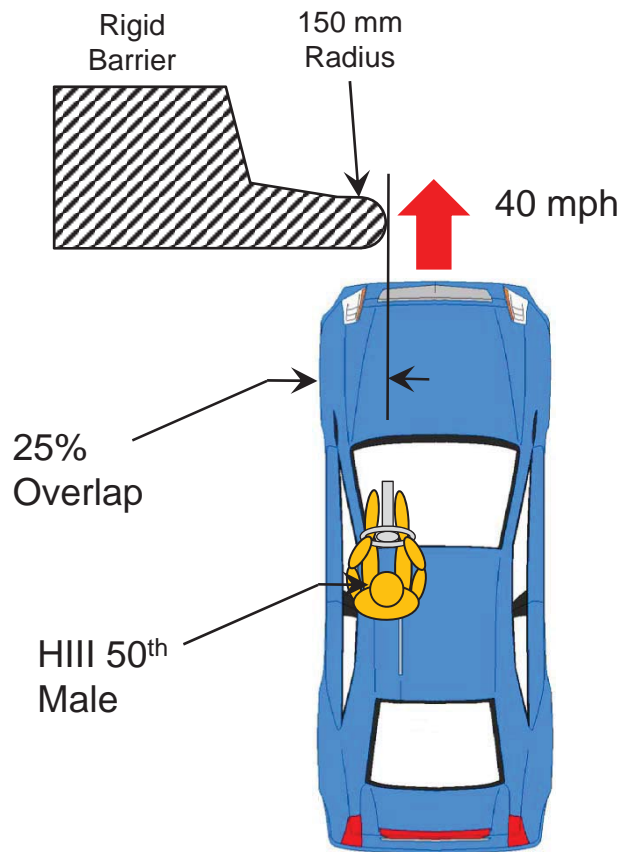
BACKGROUND – NHTSA OBLIQUE RMDB

Research Moving Deformable
Barrier (RMDB)



RMDB Speed	56 mph (90 kph)	
Overlap	35 percent	
Impact Angle	15 degrees (PDOF = 345)	
Occupants	Near-side (Driver)	THOR Mod Kit 50 th Male
	Far-side (Passenger)	THOR Mod Kit 50 th Male

BACKGROUND – IIHS SMALL OVERLAP



- **IIHS *TOP SAFETY PICK+* RATING CRITERIA**
 - *Top Safety Pick* and
 - Overall rating of “Good” or “Acceptable” in IIHS Small Overlap Impact
 - New for 2014 *Top Safety Pick+*: vehicle must have basic, advanced or superior rating for front crash prevention
- **IIHS SMALL OVERLAP IMPACT RATING CRITERIA**
 - Overall
 - Structural
 - Head/Neck
 - Chest
 - Knee/Thigh
 - Leg/Foot
 - Kinematics

NHTSA OBLIQUE FINDINGS TO DATE

- **OBLIQUE RMDB TESTS**
 - 18 vehicle tests to date, two occupants in each vehicle
- **2012 SAE WORLD CONGRESS**
 - Oblique test procedure representative of vehicle-to-vehicle crash test
- **2013 SAE WORLD CONGRESS**
 - Oblique test procedure is repeatable
- **2013 ESV**
 - Newer, high sales volume vehicles show similar injury risk trends to previous test vehicles
 - Far-side occupant response demonstrated high head rotational velocity with high brain injury risk (BrIC)

CURRENT RESEARCH OBJECTIVE

- **QUESTION**

- Would vehicles that perform well in the IIHS Small Overlap test procedure require additional countermeasures to perform well in the NHTSA Oblique RMDB test procedure?

- **APPROACH**

- Test five vehicles that achieved an IIHS Top Safety Pick+ designation in the NHTSA Oblique RMDB test procedure

NHTSA TEST #	YEAR	MAKE	MODEL	TEST WEIGHT (KG)	VEHICLE CLASS
8477	2013	Honda	Civic	1544	Small PC
8089	2013	Hyundai	Elantra	1590	Small PC
8476	2013	Dodge	Dart	1738	Small PC
8488	2012	Volvo	S60	N/A	Midsize PC
8478	2014	Subaru	Forester	1803	Small SUV
8475	2013	Volvo	XC60	2153	Midsize SUV

UPDATES TO OCCUPANT RESPONSE METHODOLOGY



- **TEST DEVICES**

- Both THOR ATDs updated to newest Mod Kit design level including w/SD-3 shoulder

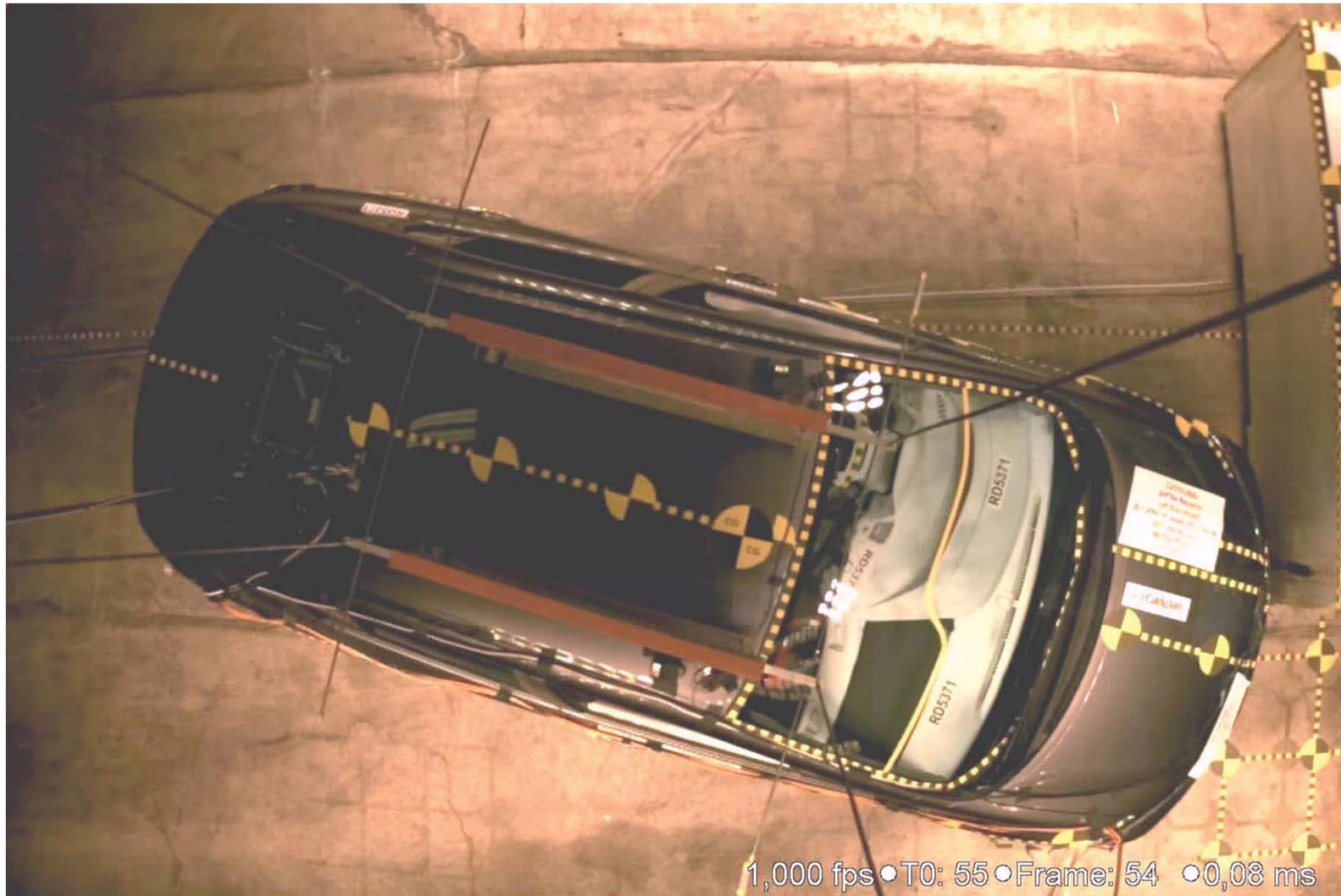
- **INJURY CRITERIA**

- Updated BrIC methodology applied
 - Takhounts, 2013 Stapp
- Updated thoracic injury criterion applied
 - See G105 Biomechanics, “4-Point Thoracic Injury Criteria for THOR”

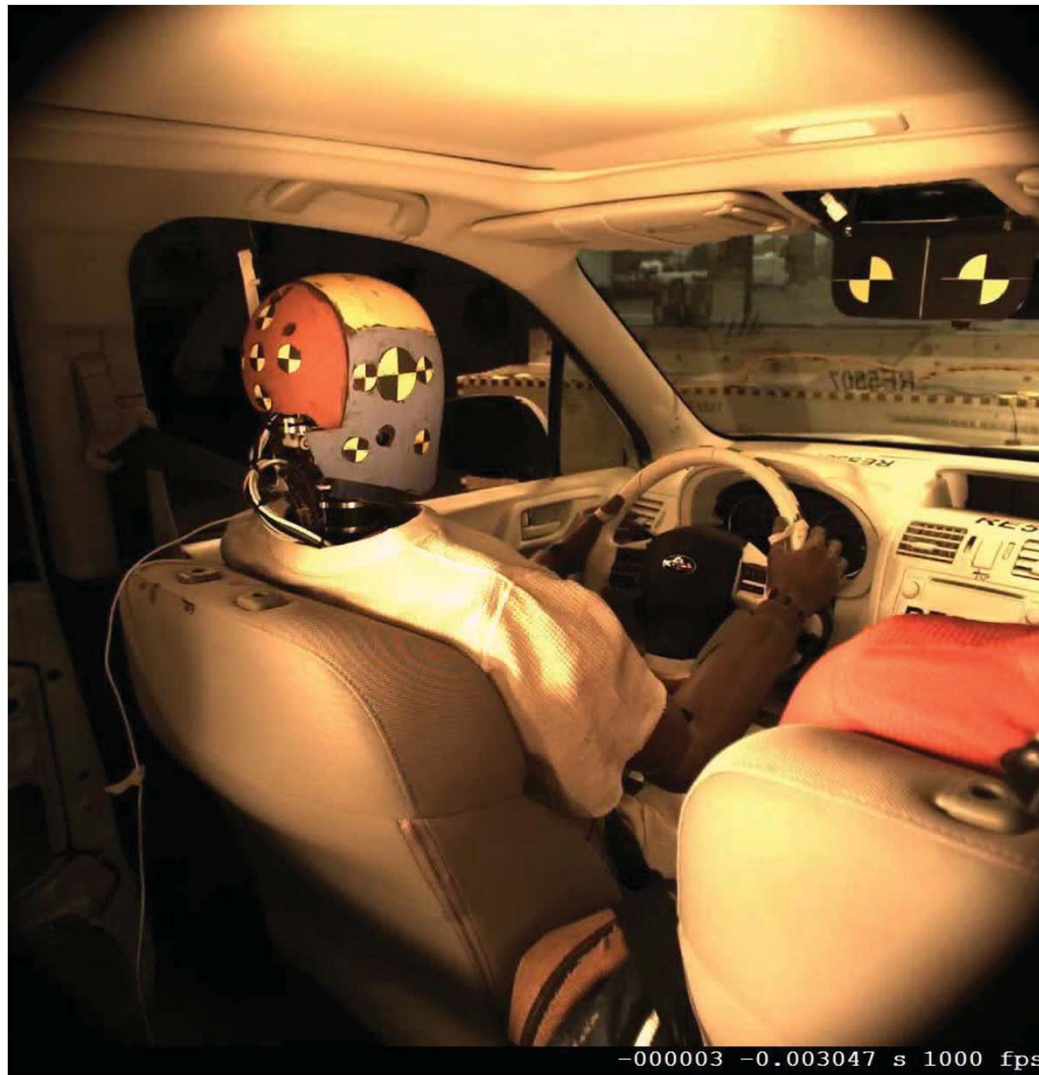
RESULTS: METHODOLOGY

Group Name	TSP+	Non-TSP+
Description	Vehicles that achieved an IIHS <i>Top Safety Pick+</i> designation for their given model year	Vehicles that did not achieve a IIHS <i>Top Safety Pick+</i> designation for their given model year <i>* Note that several vehicle model years were tested before TSP+ designation was developed</i>
Number of Vehicles	5	14
Number of Near-side Occupants	5	14
Number of Far-side Occupants	5	8

RESULTS: VEHICLE RESPONSE



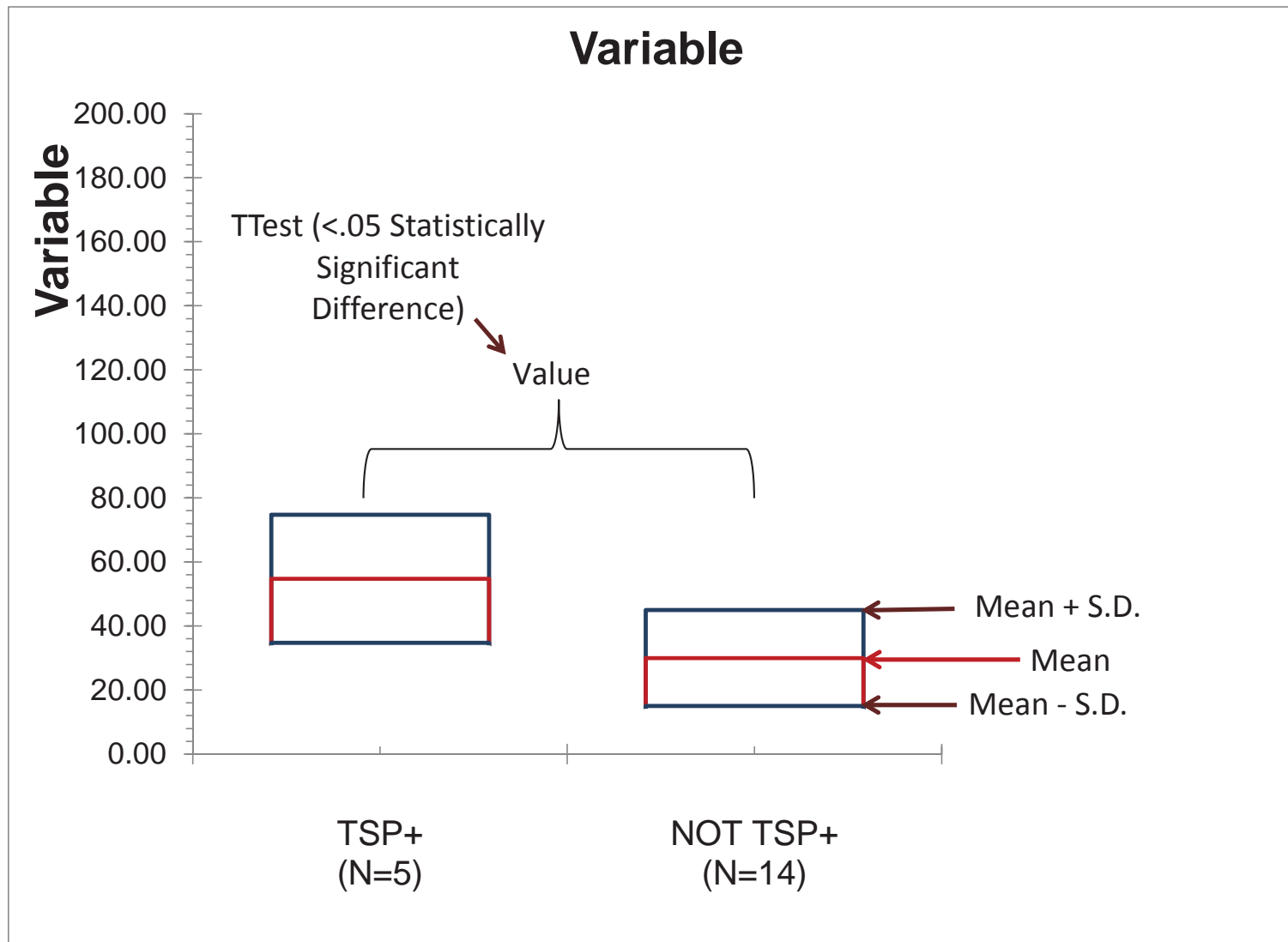
RESULTS: NEAR-SIDE OCCUPANT RESPONSE



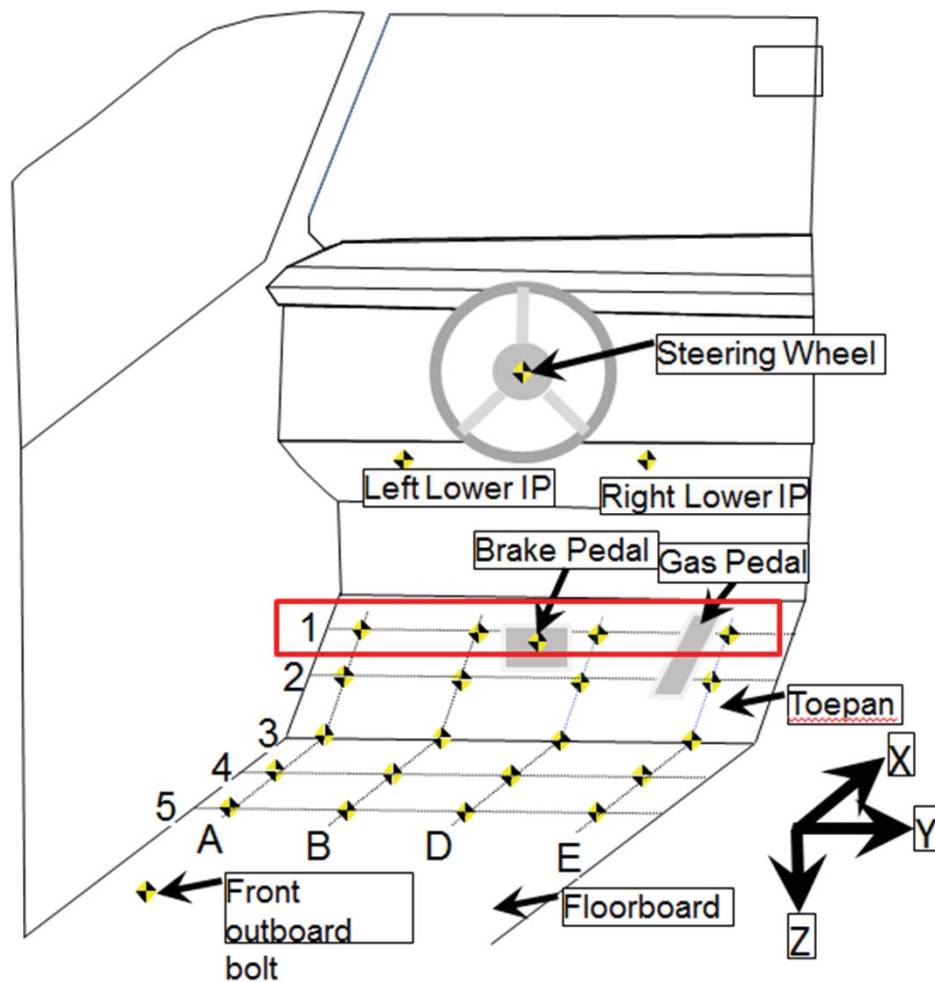
RESULTS: FAR-SIDE OCCUPANT RESPONSE



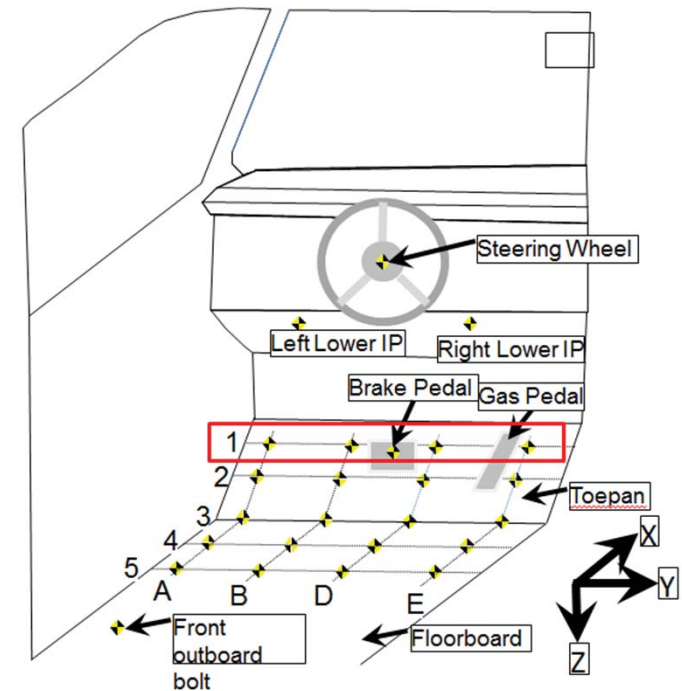
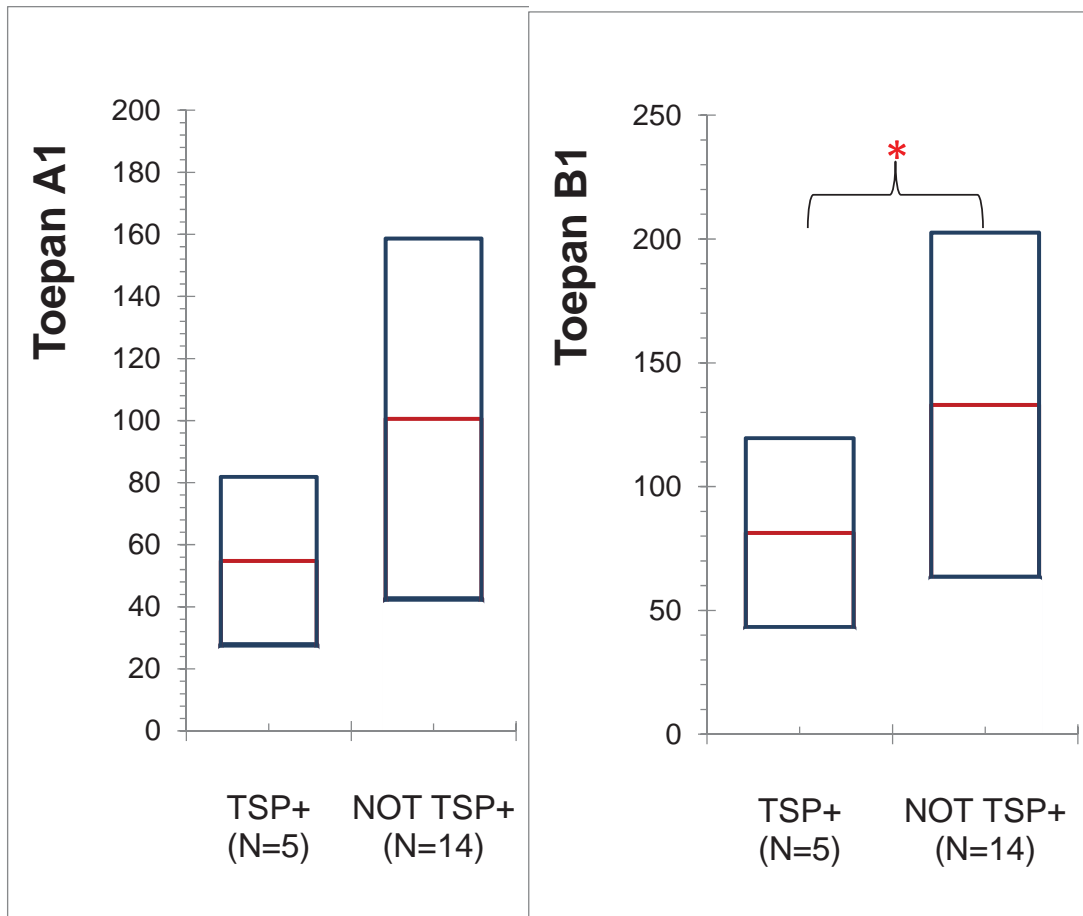
EXAMPLE CHART



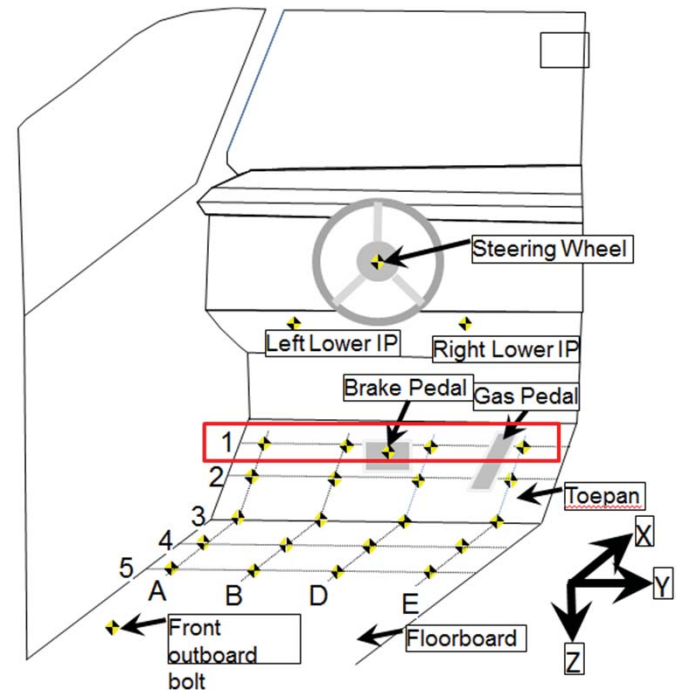
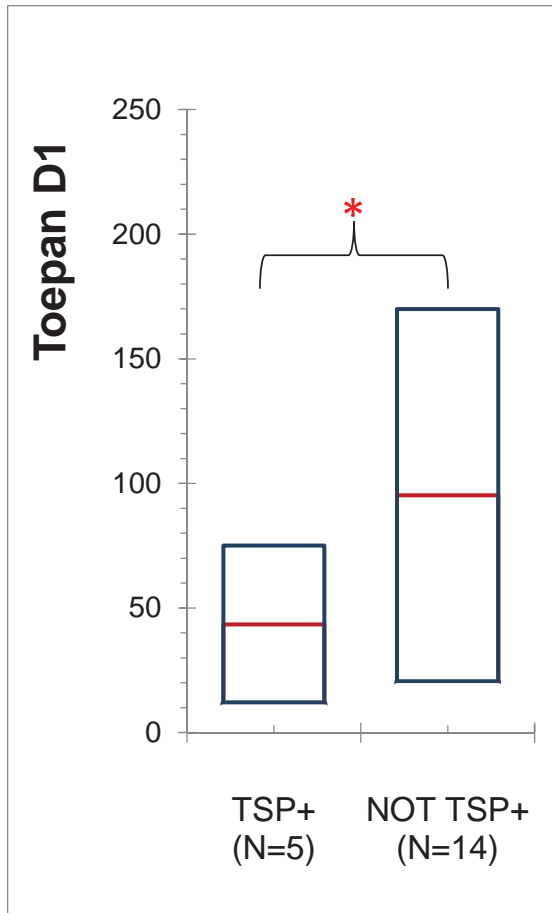
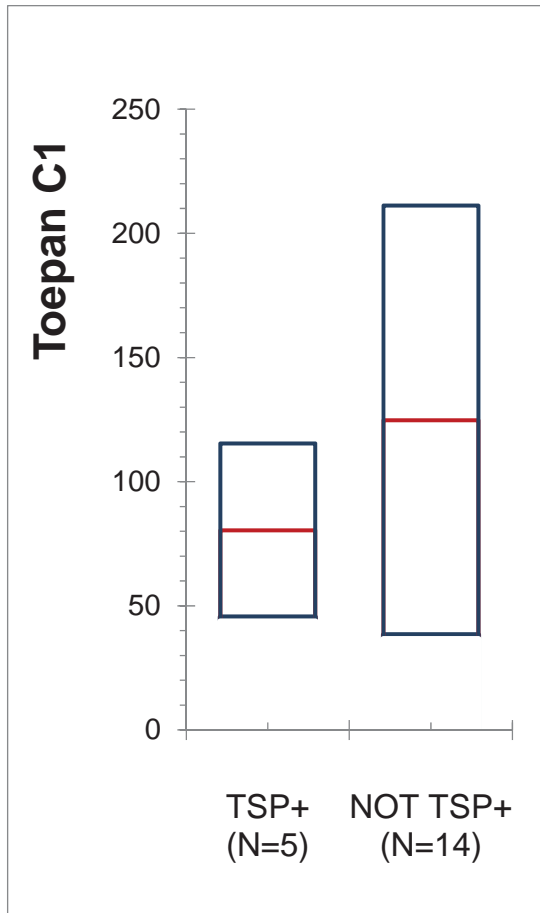
INTRUSION MEASUREMENTS



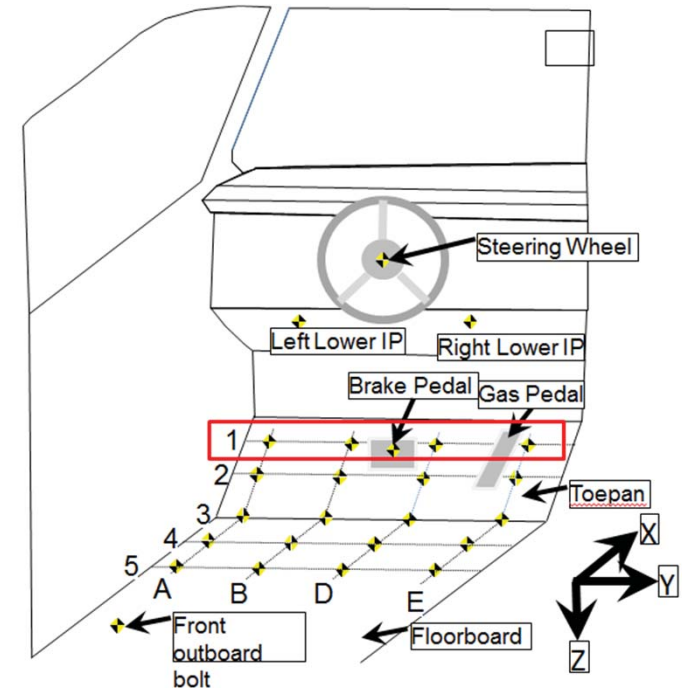
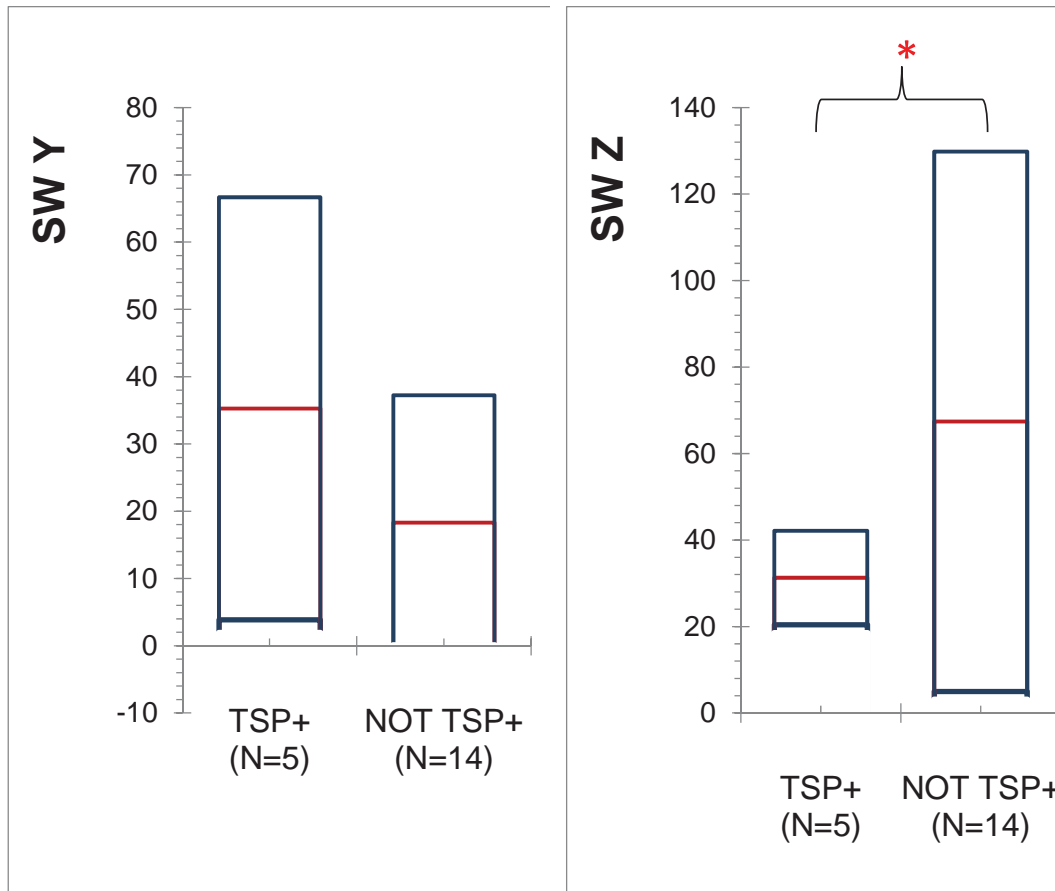
TOEPAN INTRUSIONS



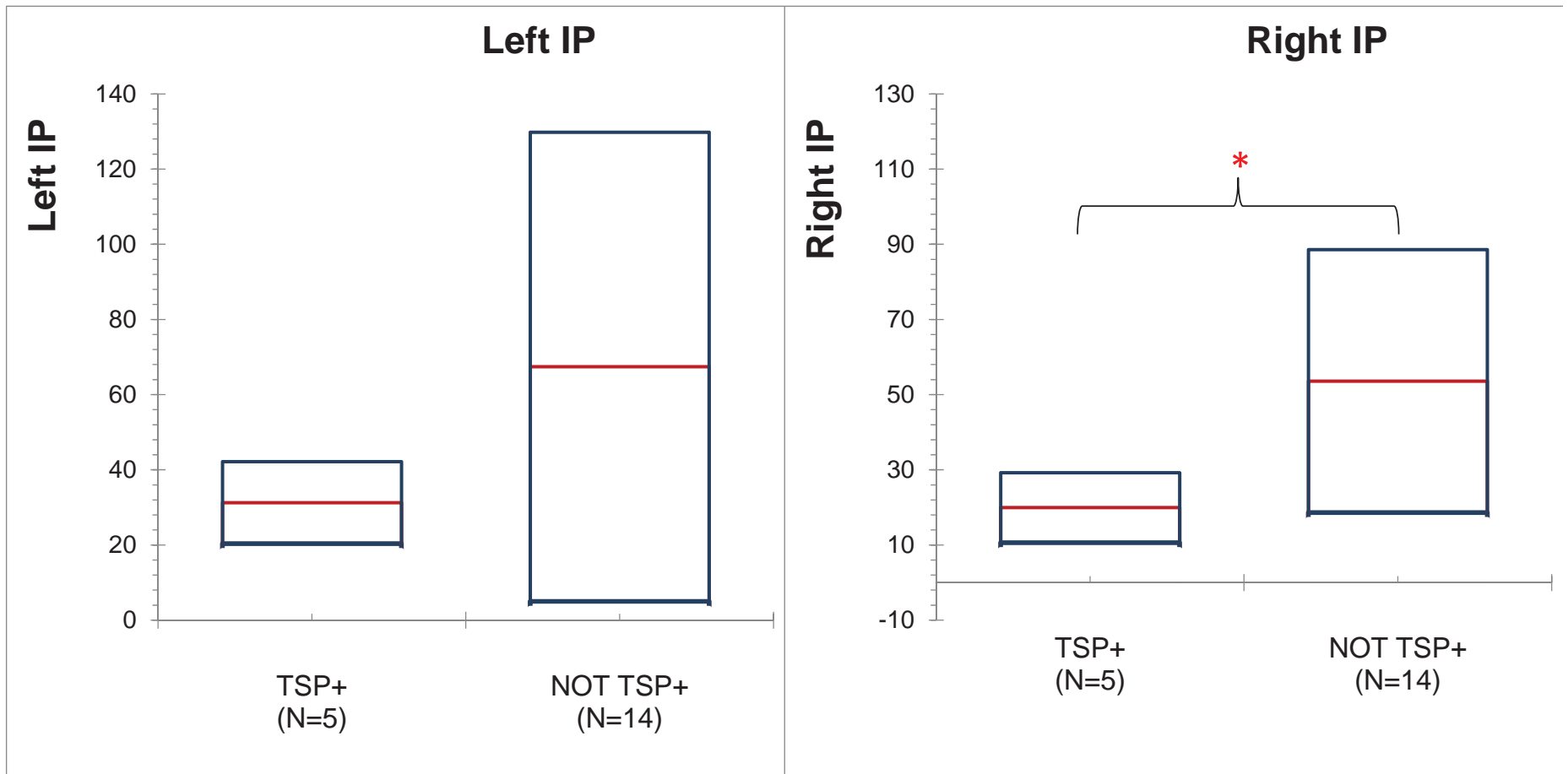
TOEPAN INTRUSIONS



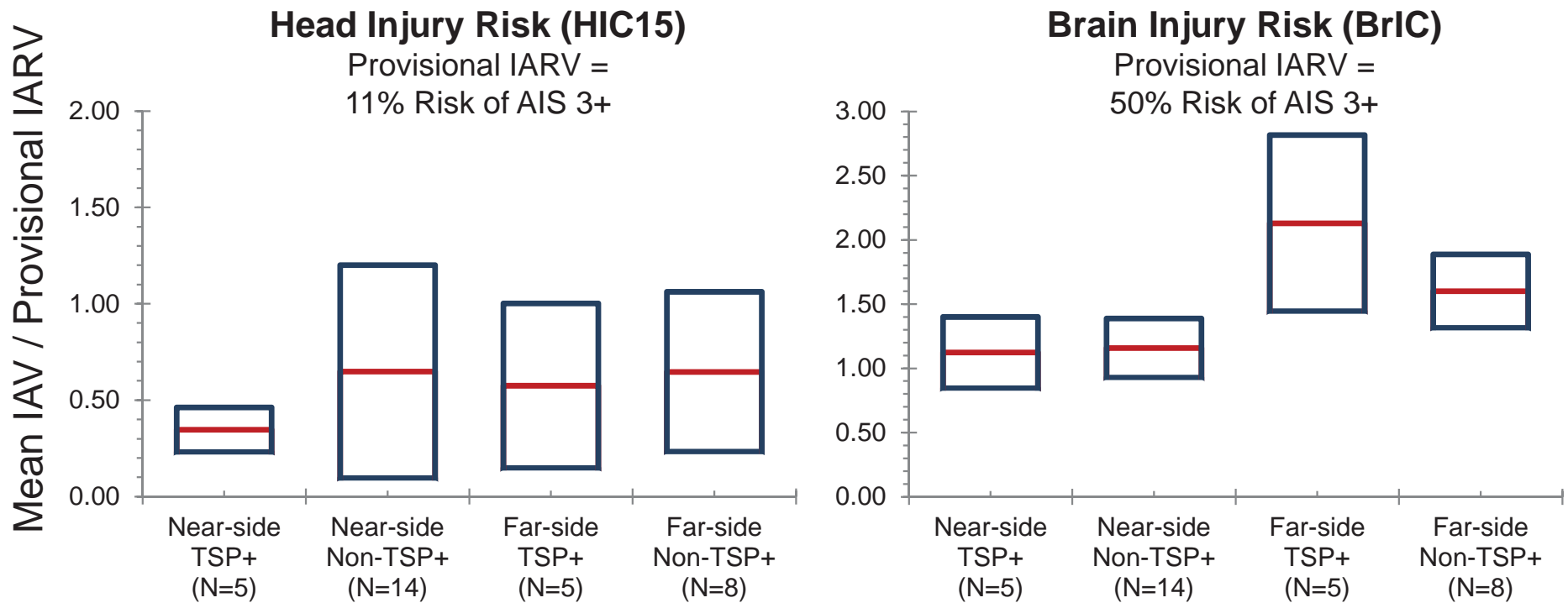
STEERING WHEEL (SW) Y AND Z



LEFT AND RIGHT INSTRUMENT PANEL (IP)

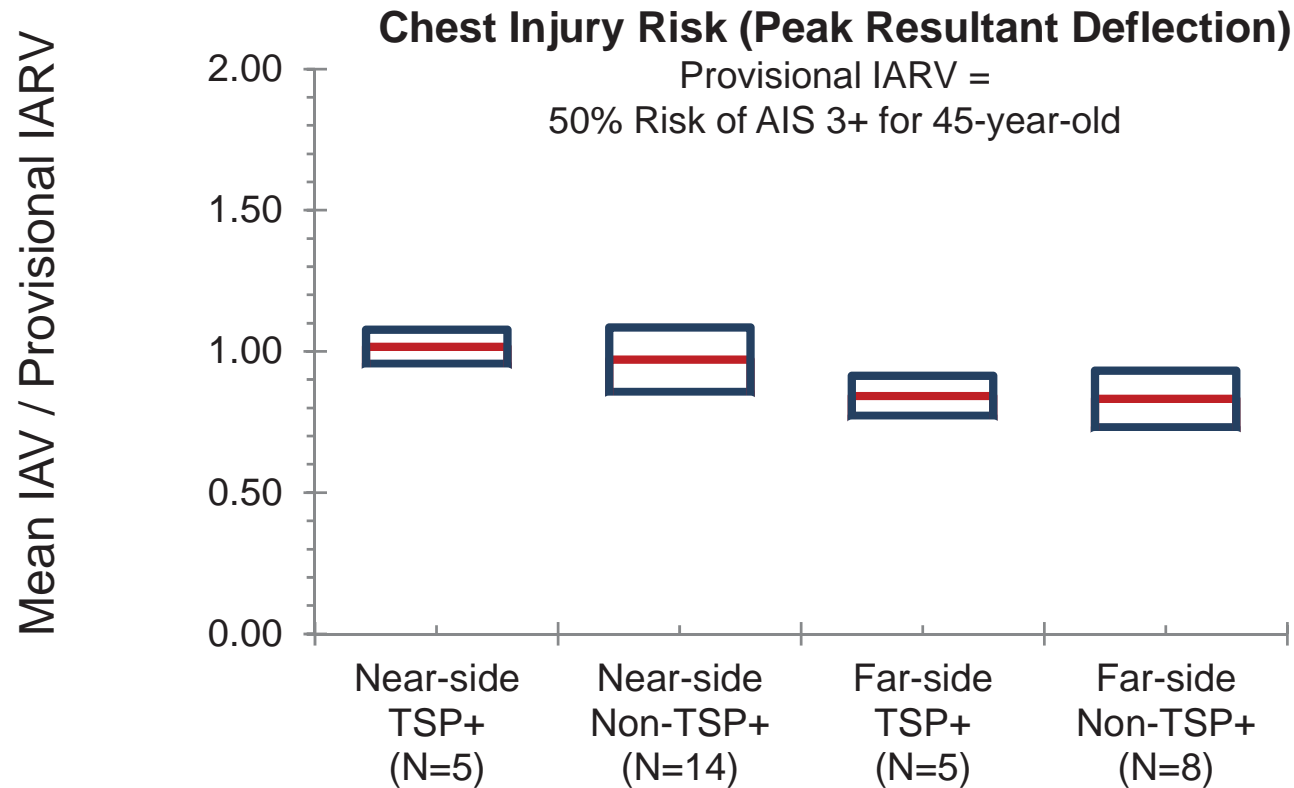


PRELIMINARY OCCUPANT INJURY RISK



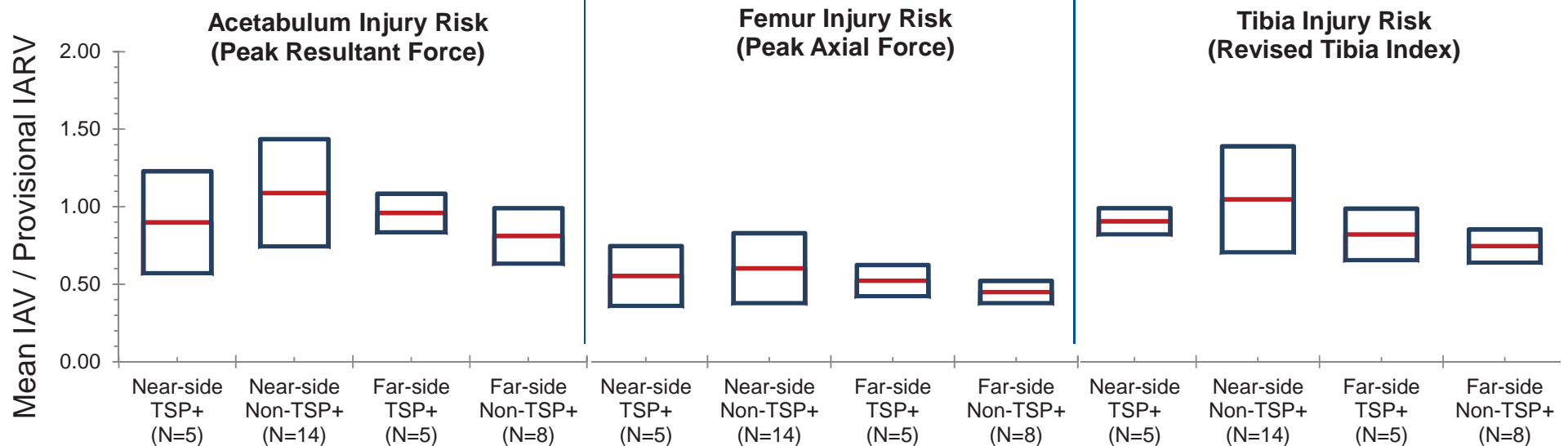
- For the far side occupant, brain injury risk predicted using BrIC is on average higher for TSP+ vehicles than for Non-TSP+ vehicles but not statistically-significant

PRELIMINARY OCCUPANT INJURY RISK



- No statistically-significant differences in chest injury risk between TSP+ and Non-TSP+

PRELIMINARY OCCUPANT INJURY RISK



- No statistically-significant differences in acetabulum, femur, or tibia injury risk between TSP+ vehicles and Non-TSP+ vehicles

OBSERVATIONS

- **TOP SAFETY PICK+ VEHICLES IN NHTSA OBLIQUE**
 - Less intrusion (some statistically significant)
 - Average interior intrusion points were smaller for the TSP+ when compared Non-TSP+, except for SW Y
 - Similar injury risk (none statistically significant)
 - Even with interior intrusion being less for TSP+ there were no statistically-significant differences in injury risk between TSP+ and non-TSP+ groups
 - → Some vehicles that perform well in the IIHS Small Overlap frontal impact test *may* require additional countermeasures in the NHTSA Oblique test mode
- **LIMITATIONS**
 - Preliminary data
 - Relatively small sample size (N=5 vs N=14)

NEXT STEPS

- **PUBLISH TEST DATA AND REPORTS – 2014**
- **NHTSA AGENCY DECISION – 2014**
- **LOAN AGREEMENT**
 - An agreement is place to allow manufacturers to perform Oblique and Small Overlap testing
 - RMDB only
 - RMDB and THOR ATD(s)
 - Allows manufacturers to gain experience and provide feedback on NHTSA's Small Overlap/Oblique test procedures
 - Contact James Saunders (james.saunders@dot.gov)