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Recent NHTSA Compatibility Research

Repeatability evaluation for recent compatibility test procedures

2005 SAE Government / Industry Meeting

LC Barrier Repeatability

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- **4 56 kph rigid barrier tests with comparable vehicles**
- **2004 Honda Accord**
  - Belted 50th into 8 x 16 LC barrier
  - Belted 5th into 8 x 16 LC barrier
  - Belted 95th into NCAP 4 by 9 LC barrier
- **2003 Accord**
  - Belted 50th into MGA 2 by 3 LC barrier

Test Comparison

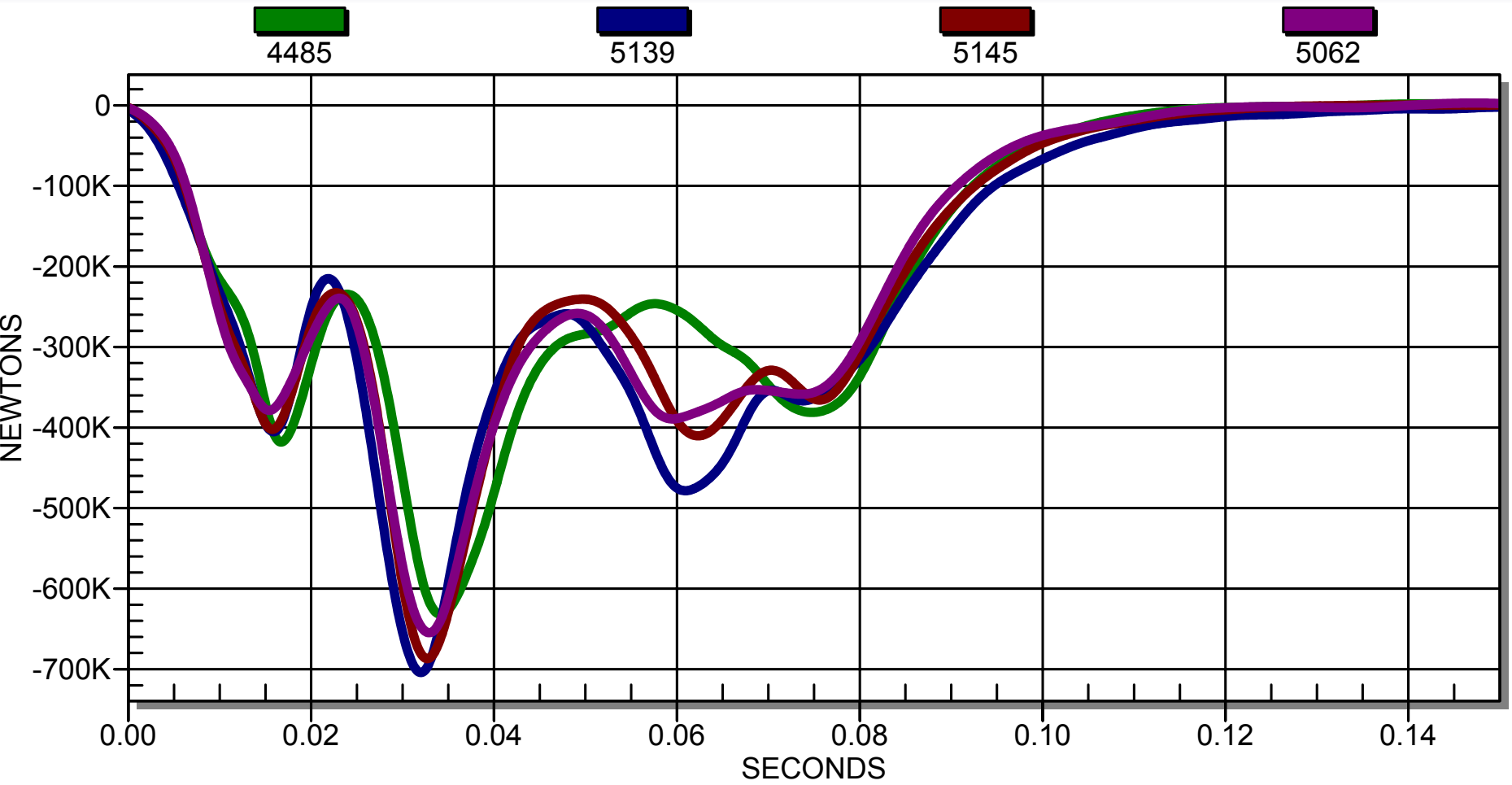
Test	Lab	Driver	Year	Make	Model	Weight	Speed
4485	MGA	50th	2003	HONDA	ACCORD	1571	55.8
5145	TRC	5th	2004	HONDA	ACCORD	1654	56.5
5062	TRC	50th	2004	HONDA	ACCORD	1624	56.6
5139	KAR	95th	2004	HONDA	ACCORD	1834	56.52

The belted 95th test is considerably heavier than the other 3 tests

Test	Load cells	AHOF	Initial Stiffness
4485	6	*443.8*	1467.6
5145	134	436.3	1598.7
5062	134	414.5	1593.1
5139	36	410.7	1527.0

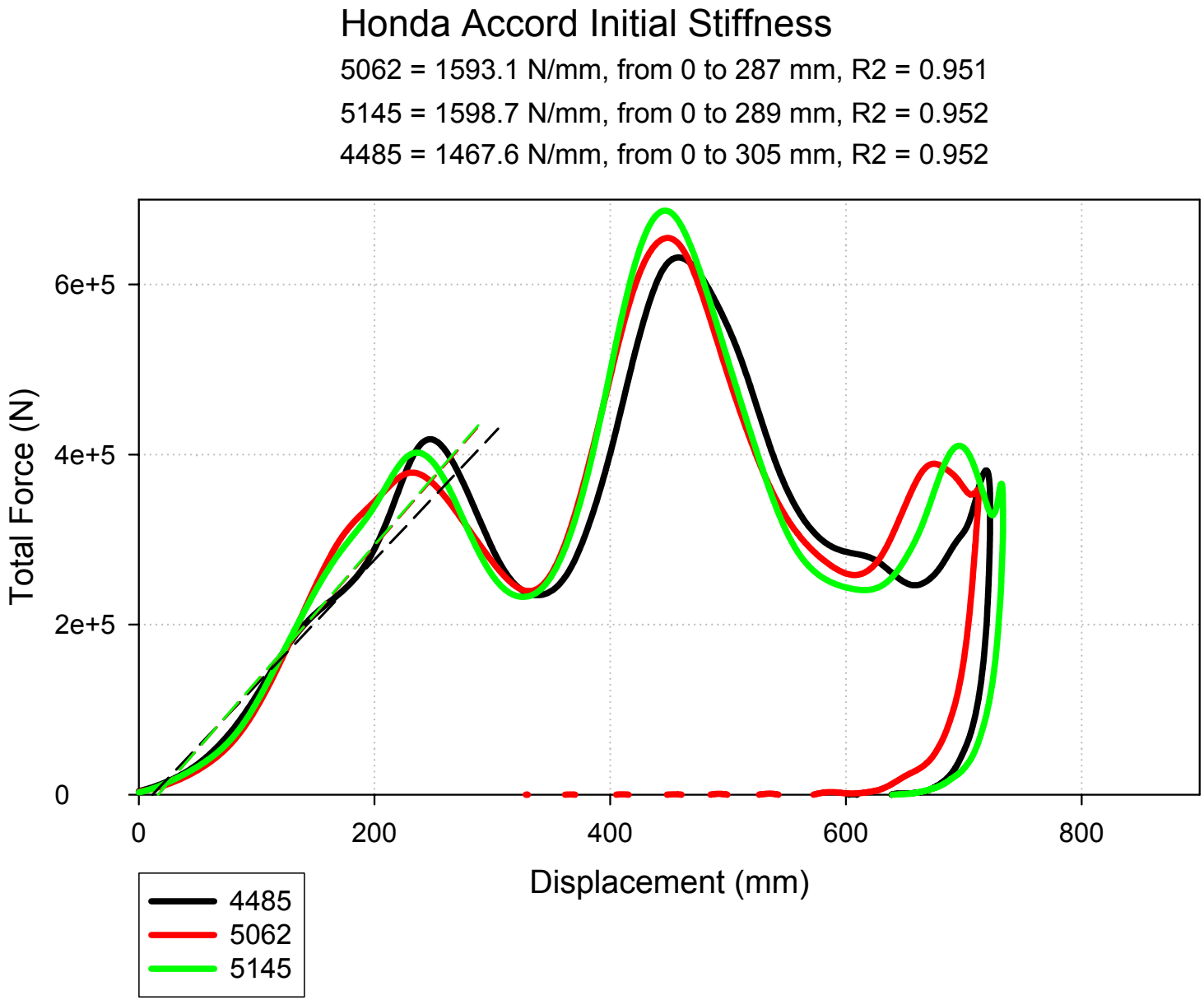
Generally tests with the 2x3 barrier are not used for AHOF estimates

Total Force (t)



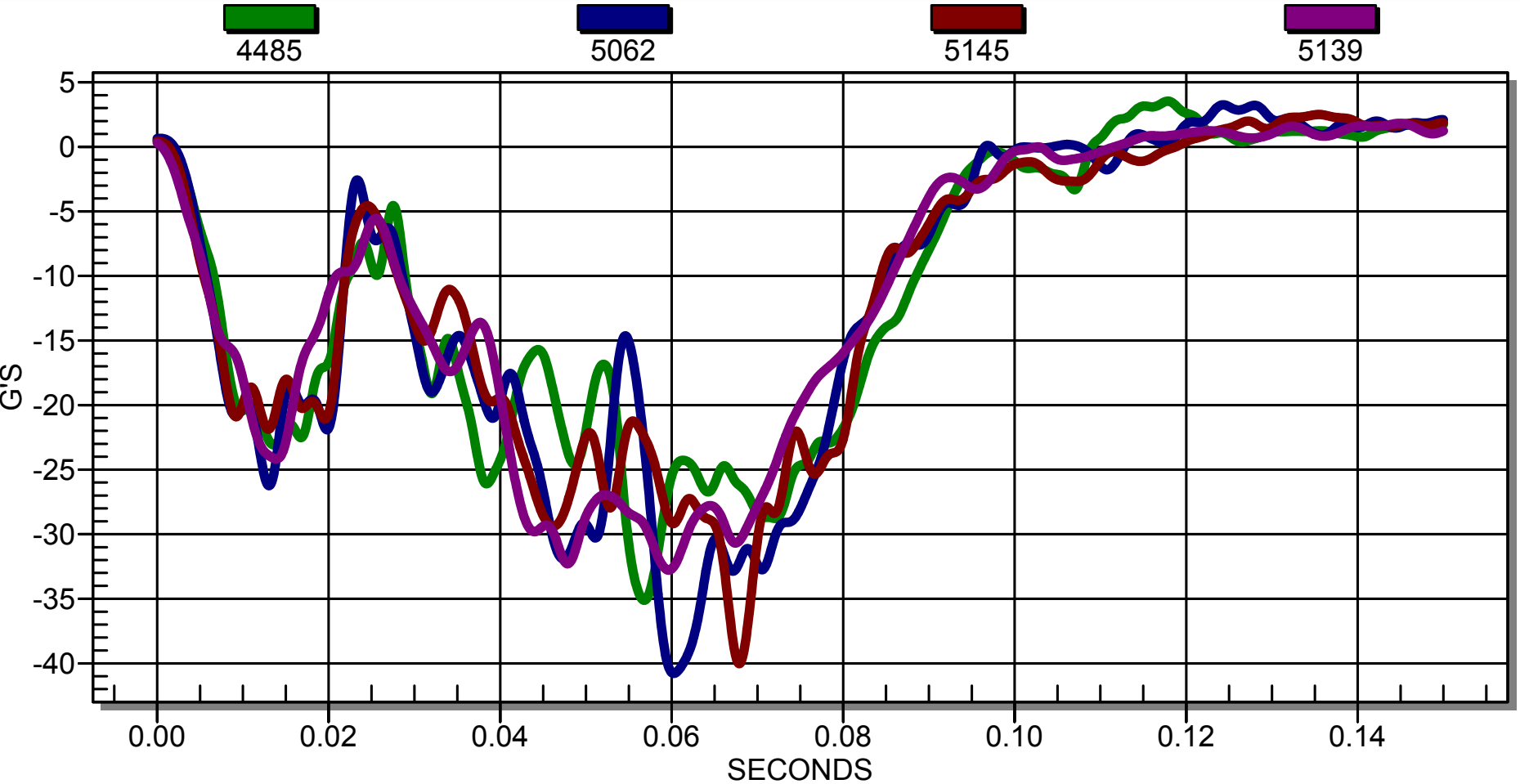
Only around 60 ms do the heavier and lighter vehicles differ

Initial Stiffness



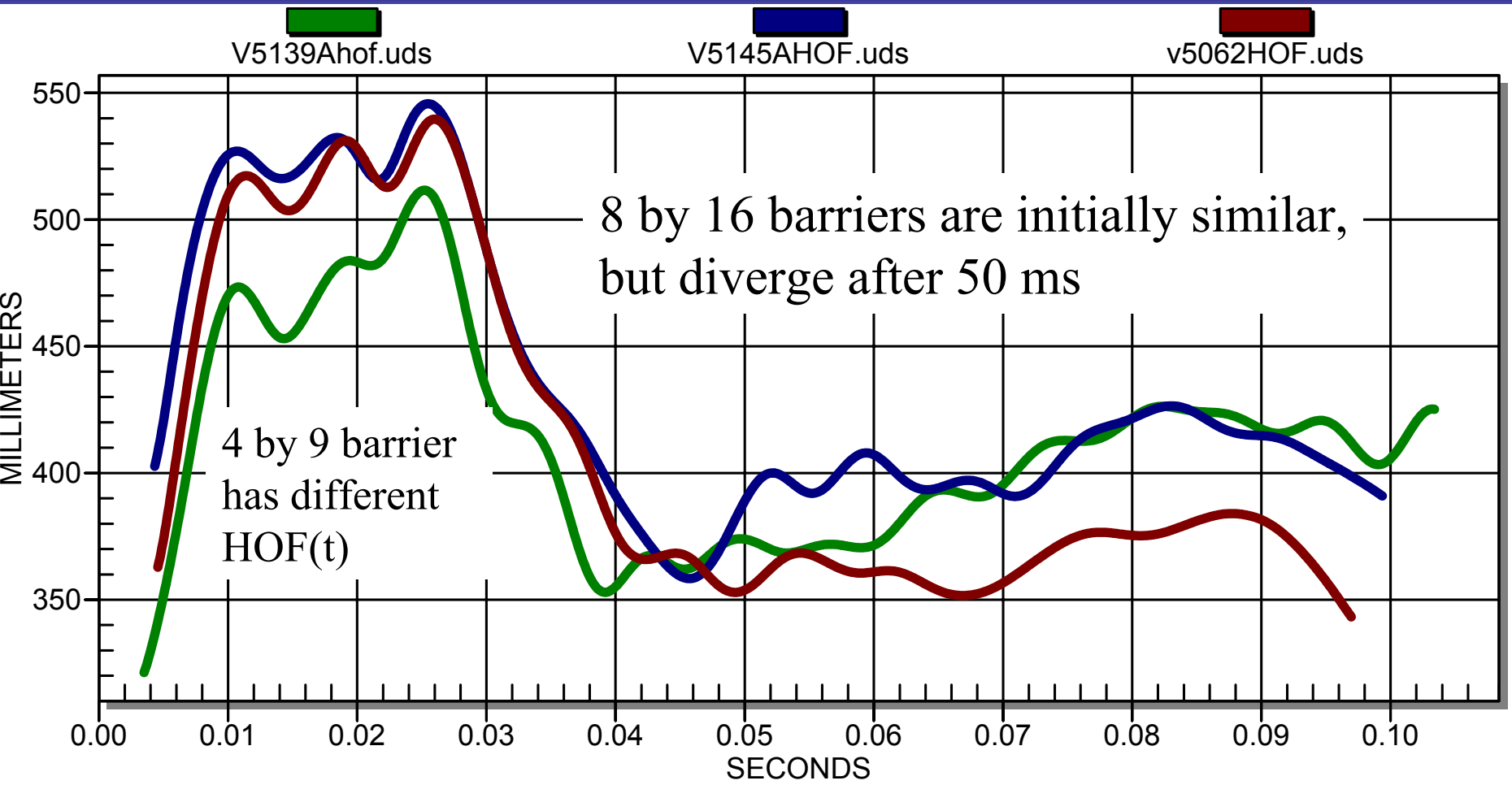
The slope for the Force-deflection profiles repeated well

Acceleration (t)



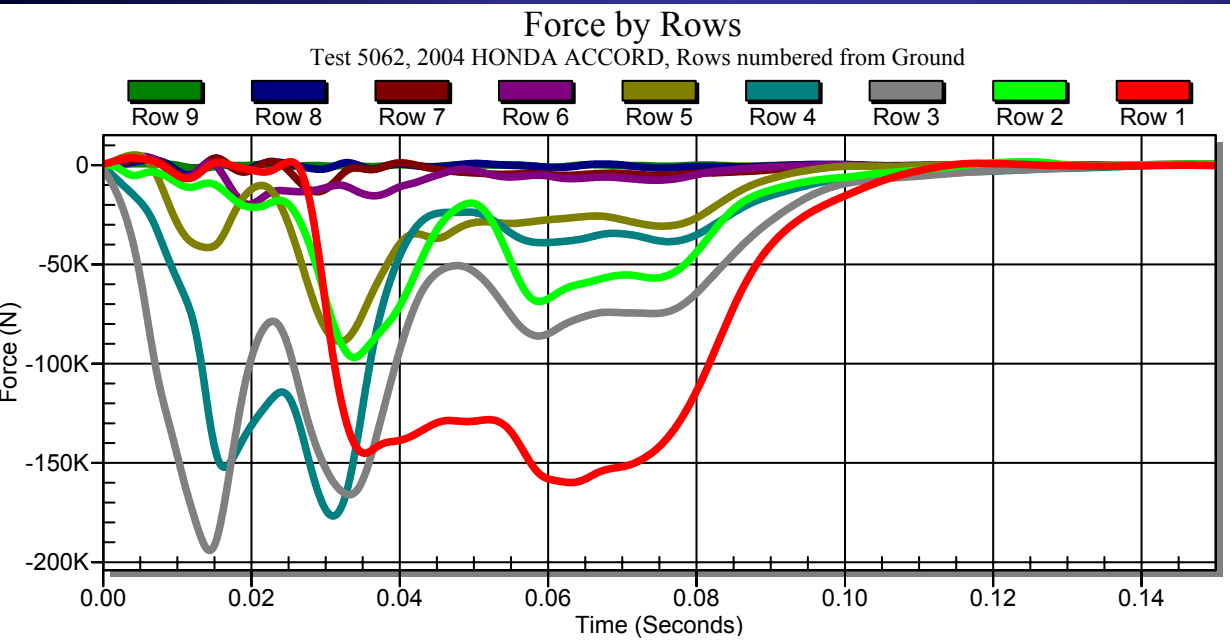
Acceleration profiles are similar, but not as consistent as total force

Height of Force (t)



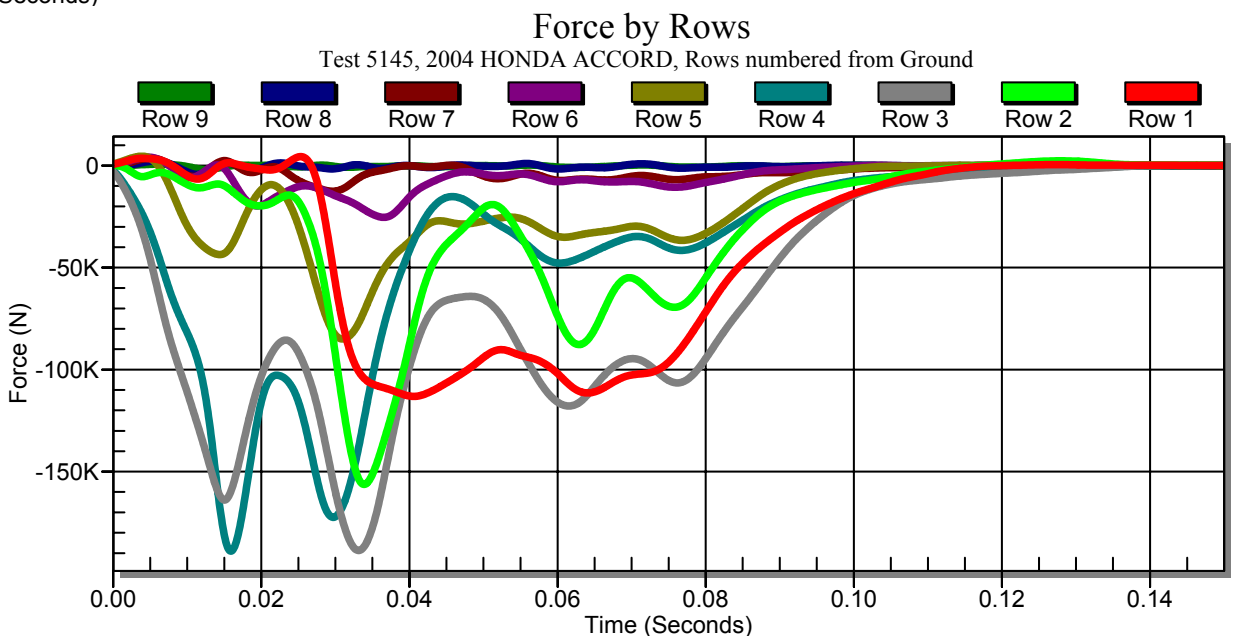
MGA 2 Row barrier was not evaluated for HOF(t)

Honda Accord – Row Forces



Test 5062, Note the strong impact on Row 1

Test 5145, Note force on Row 3 has increased and Row 1 has decreased



Accord Pit Camera - 5062

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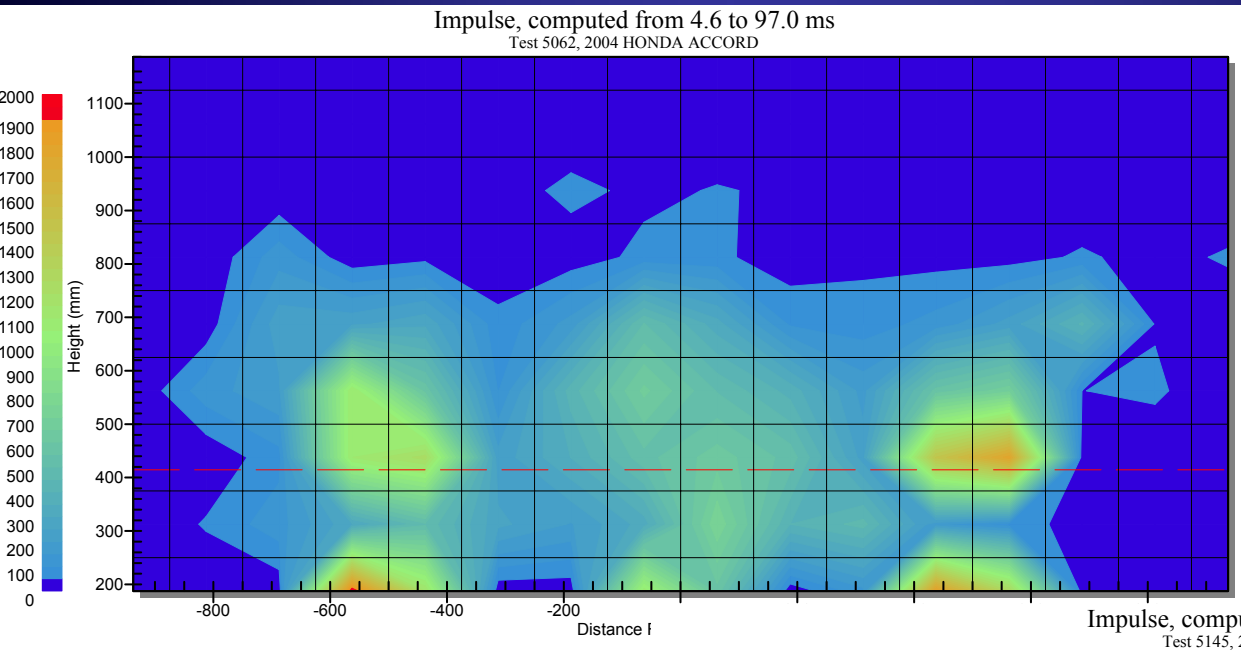
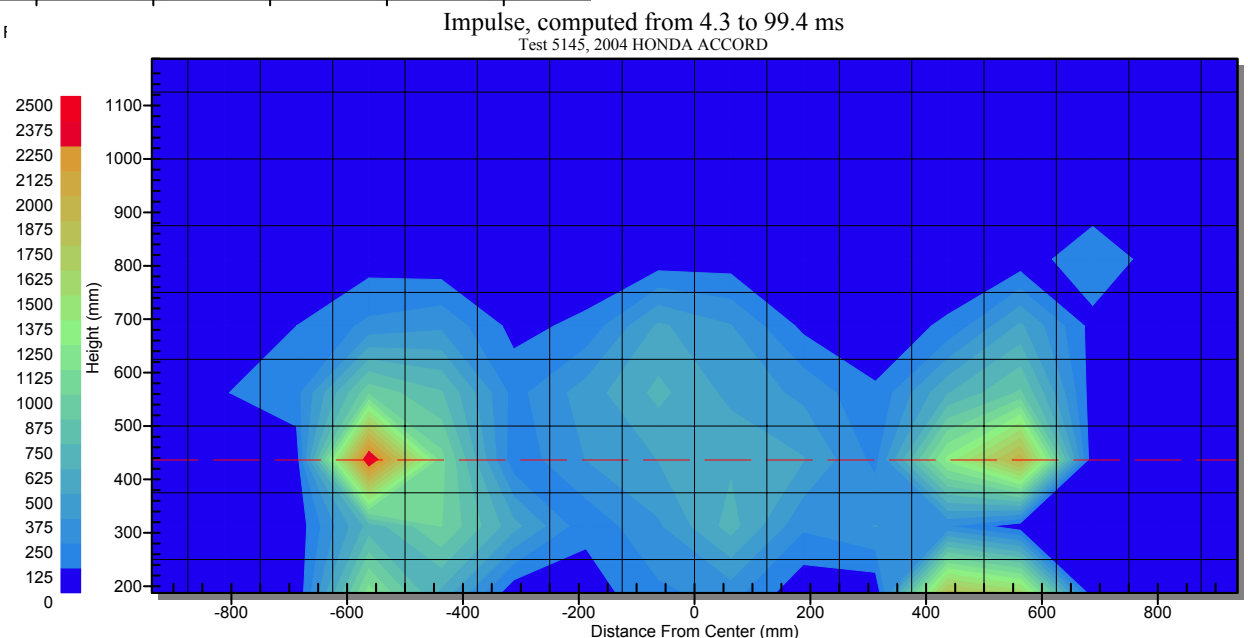
Accord - Impulse

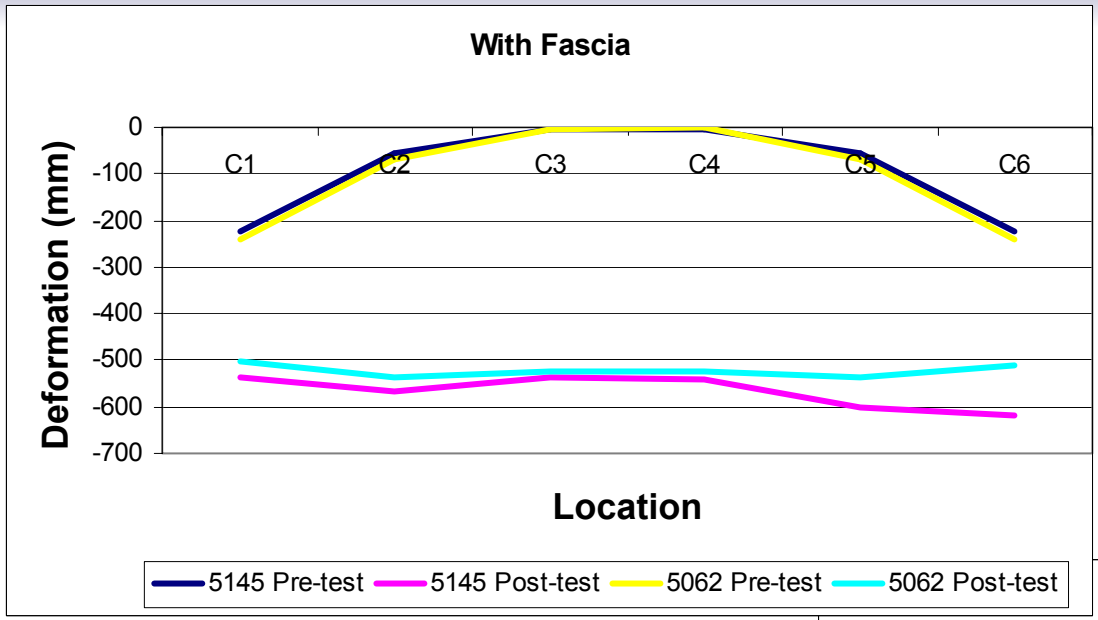


Test 5062

Test 5145



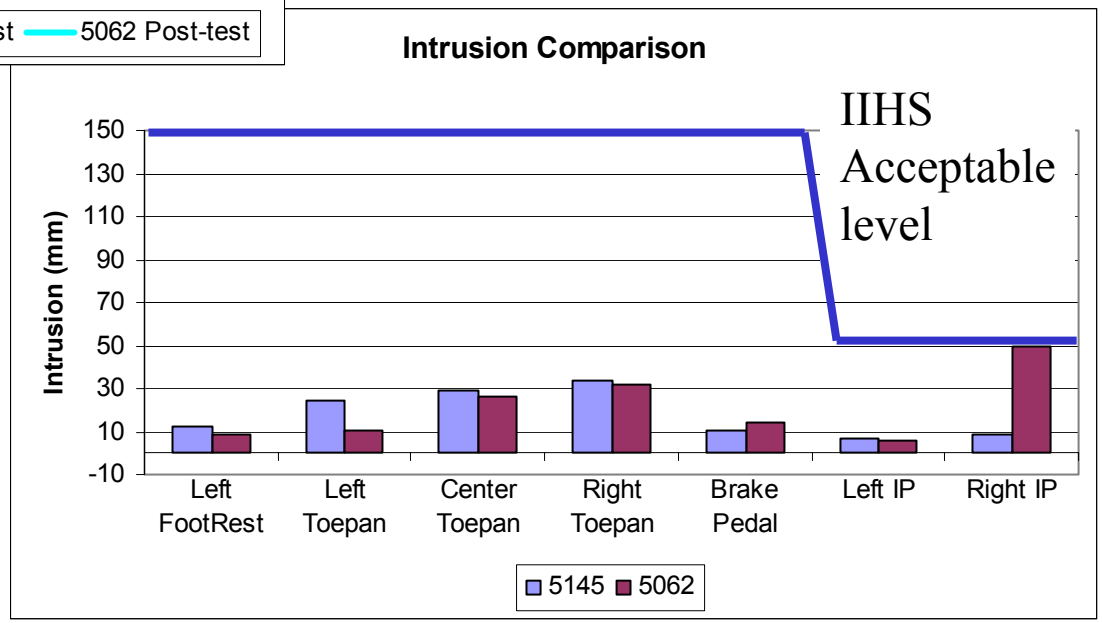
Deformation and Intrusion



Only TRC tests had matching measurements

External Deformation matches well except for C6 (right side)

The right side IP measured additional intrusion in test 5062



Repeatability - Observations

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- **HR tests did not repeat AHOF as well as hoped**
  - Engine impact strongly influenced AHOF
  - FWDB could reduce this effect
- **4x9 row resolution affected HOF(t)**
- **Initial Stiffness repeated well**
  - Total force was not affected by LC differences between 4x9, 2x3, and 8x16 barriers.
- **Need to measure impact accuracy**
  - European tests have shown impact location can vary up to 20 mm
  - Did impact accuracy affect the force distributions?

Impact Accuracy

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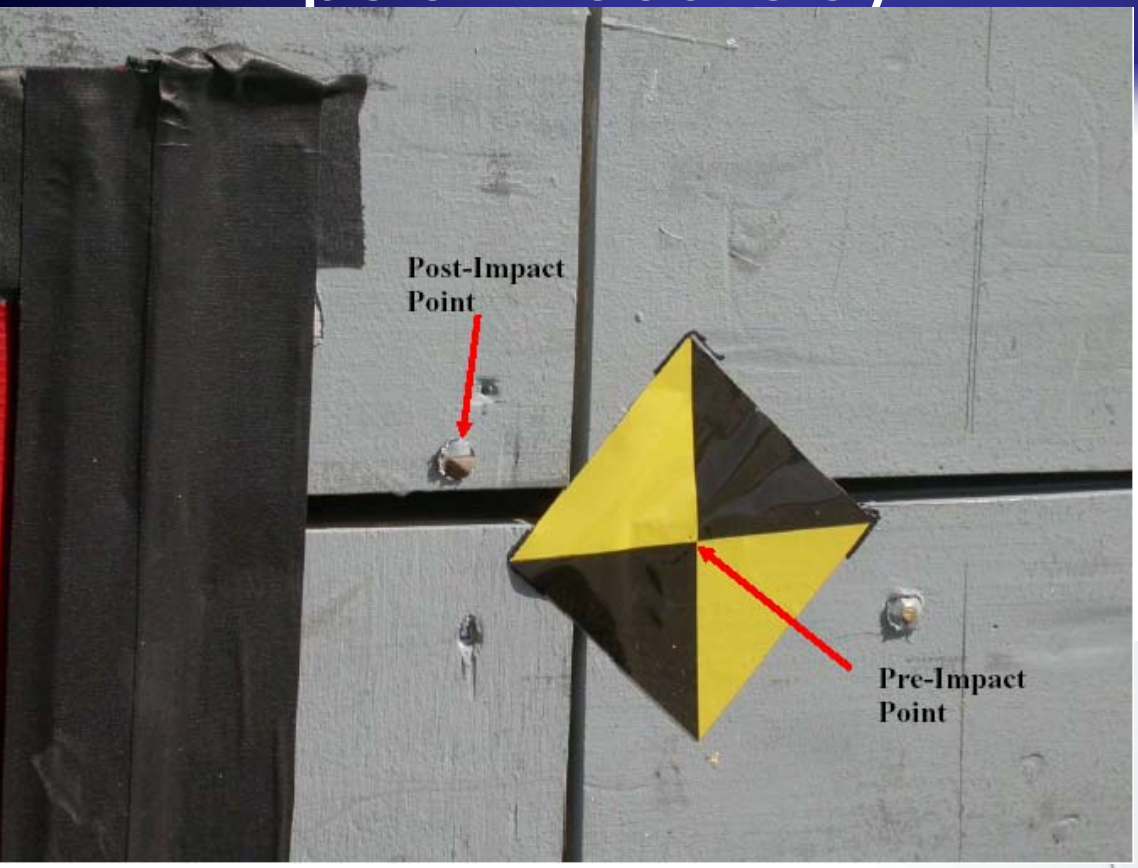
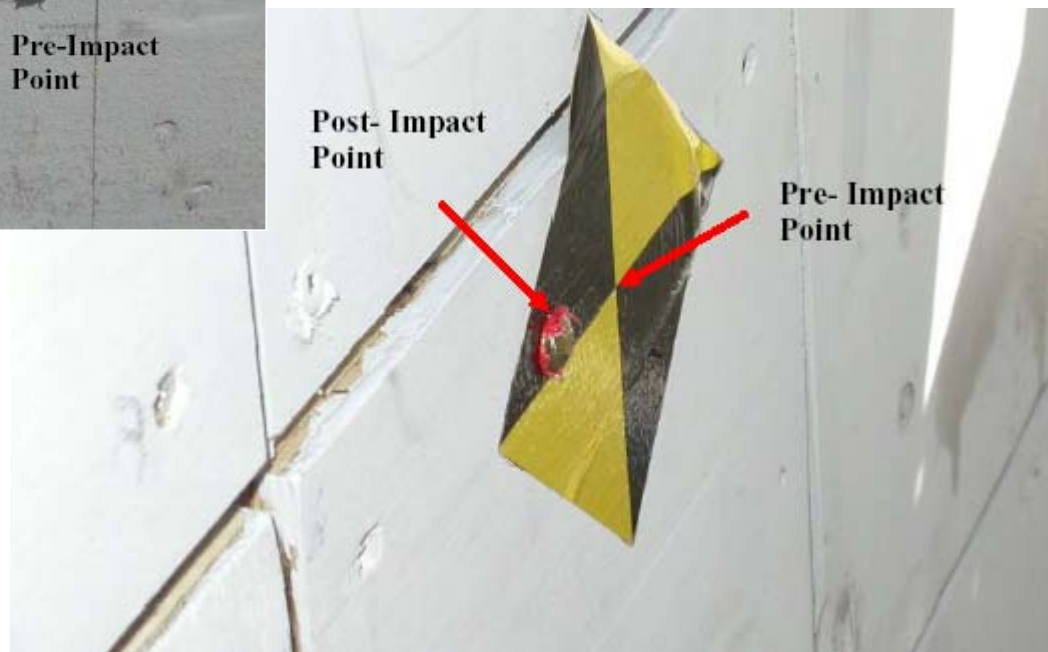
- **IHRA researchers has been monitoring the repeatability / accuracy of vehicle impact point**
  - Pre test vehicle to barrier alignment is recorded using a sticker on barrier
  - Pin on vehicle puts a hole in sticker and the X and Y offset is recorded
  - Up to 35 mm deviation has been recorded
- **NHTSA has just begun to record impact accuracy**
  - Working to incorporate into standardized testing

Impact Accuracy



Camry Test,
Center of 75 mm target was aligned with the pin pre-test



Accord Test

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Full Width Deformable Barrier Tests

Comparison of Plascore and Cellbond Barrier Faces

Concorde Test Series

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1996 Chrysler Concorde

test	weight	speed	Barrier	AHOF	Vertical Accuracy	Corrected AHOF	Interval (ms)
4963	1788	56.4	Rigid	435.1			5-114
5251	1788	56.4	Cellbond	449.6	20	429.6	7-119
5252	1788	56.2	Plascore	434.2	1	433.2	26-138

- Plascore was low bidder
- Cellbond was manufacturer for FWDB development tests
- FWDB's were 1000 mm high
- FWDB was mounted 125 mm above the ground
- AHOF was corrected by subtracting the vertical offset.
- Impact accuracy was not measured for the rigid barrier test

Barrier Deformation

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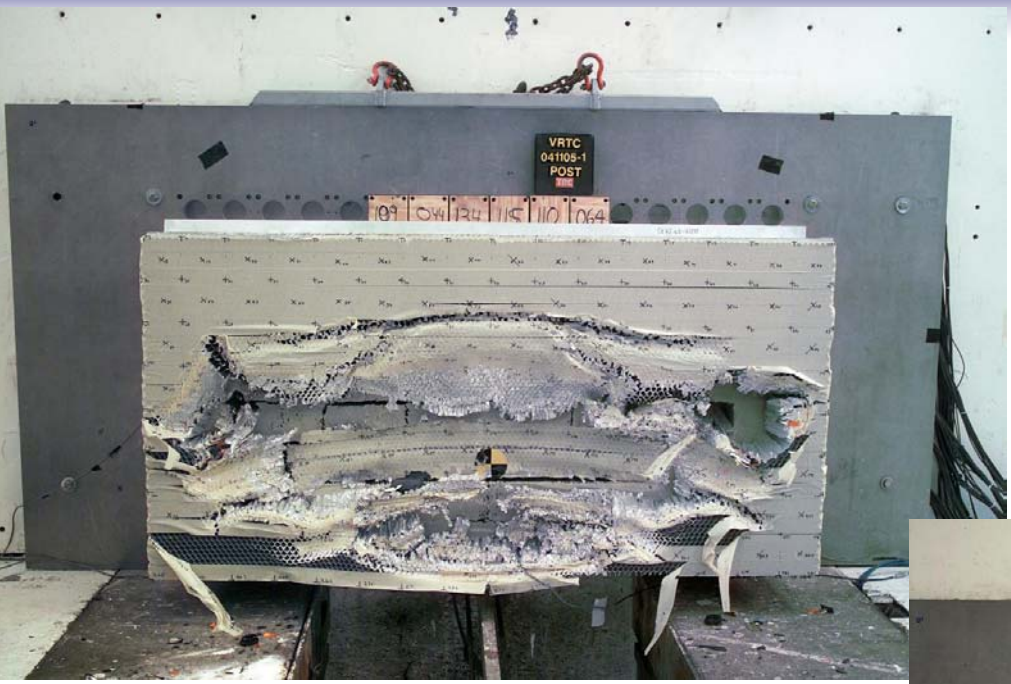
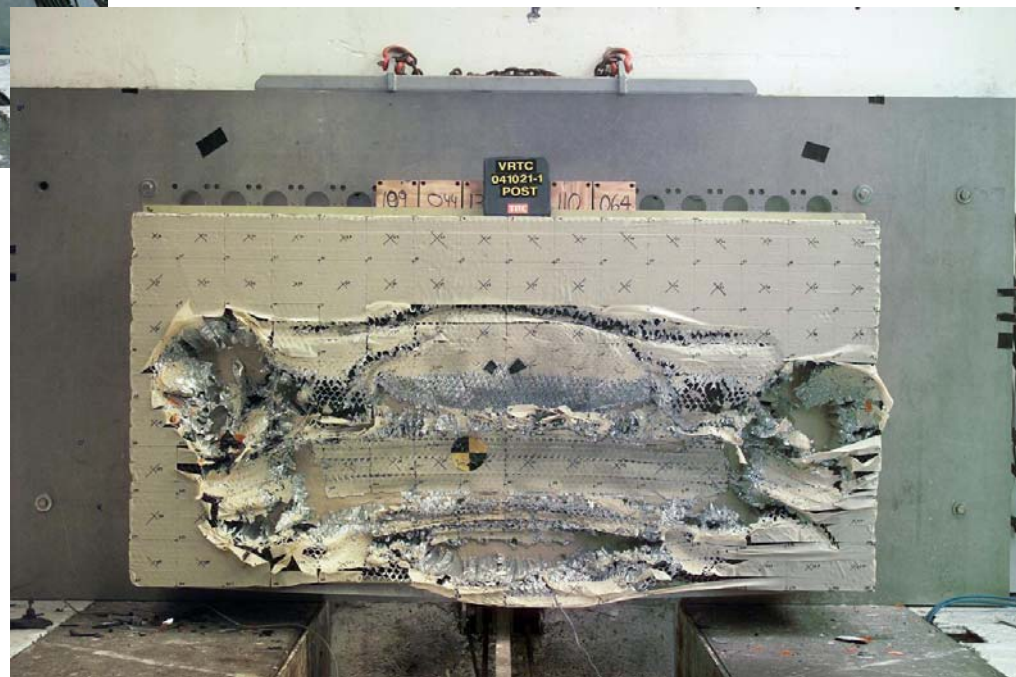
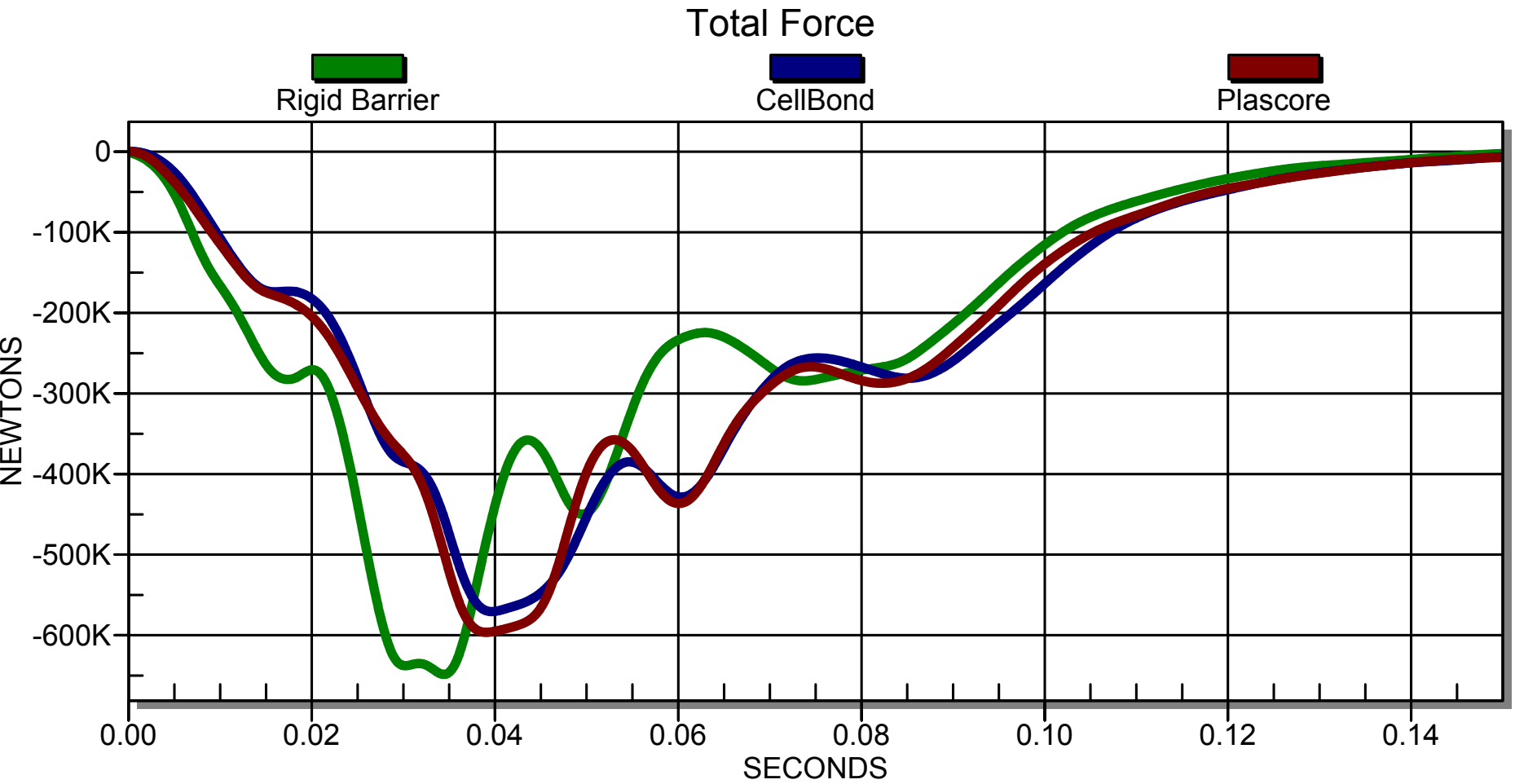


Cellbond

Plascore

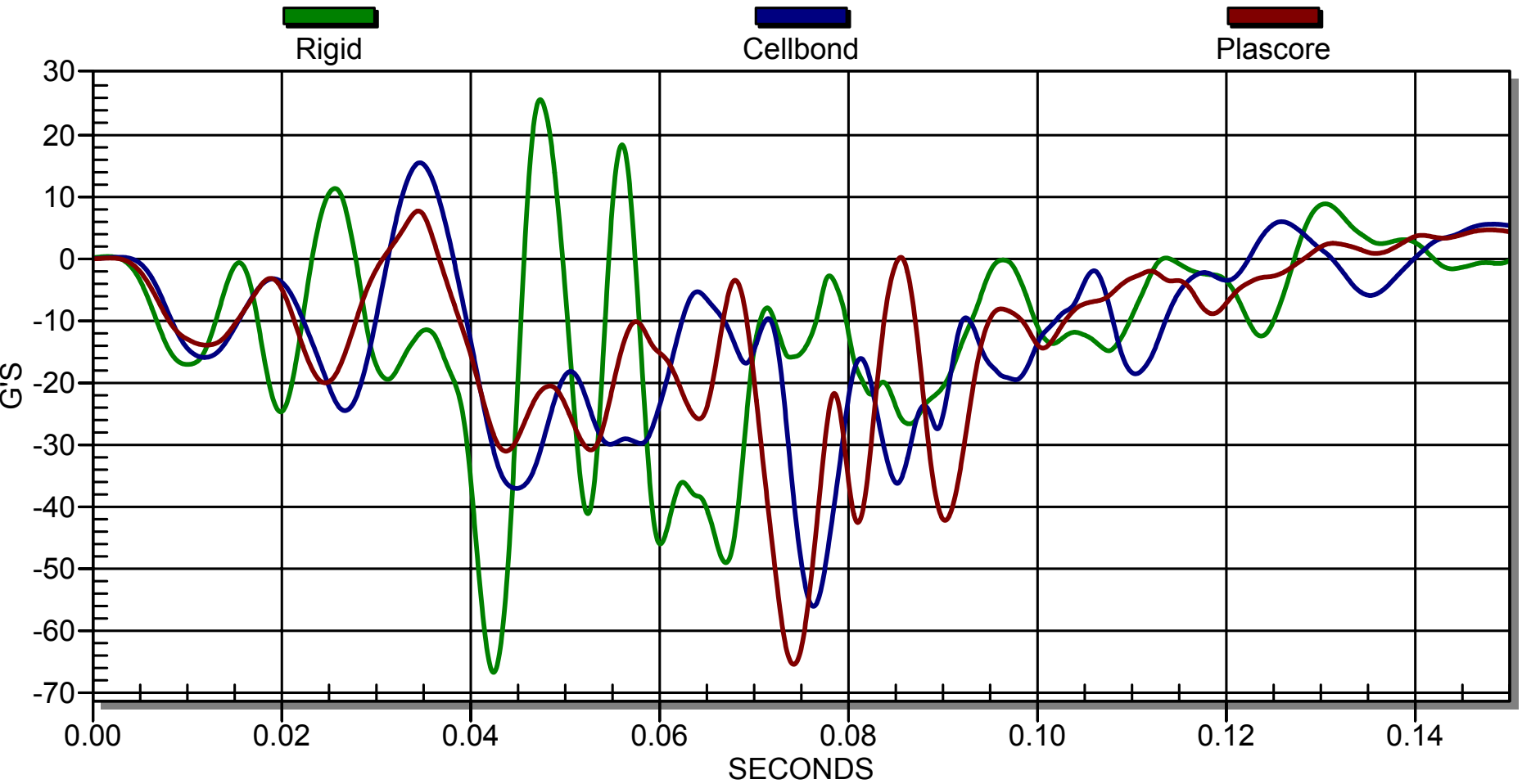


Total Force (t)



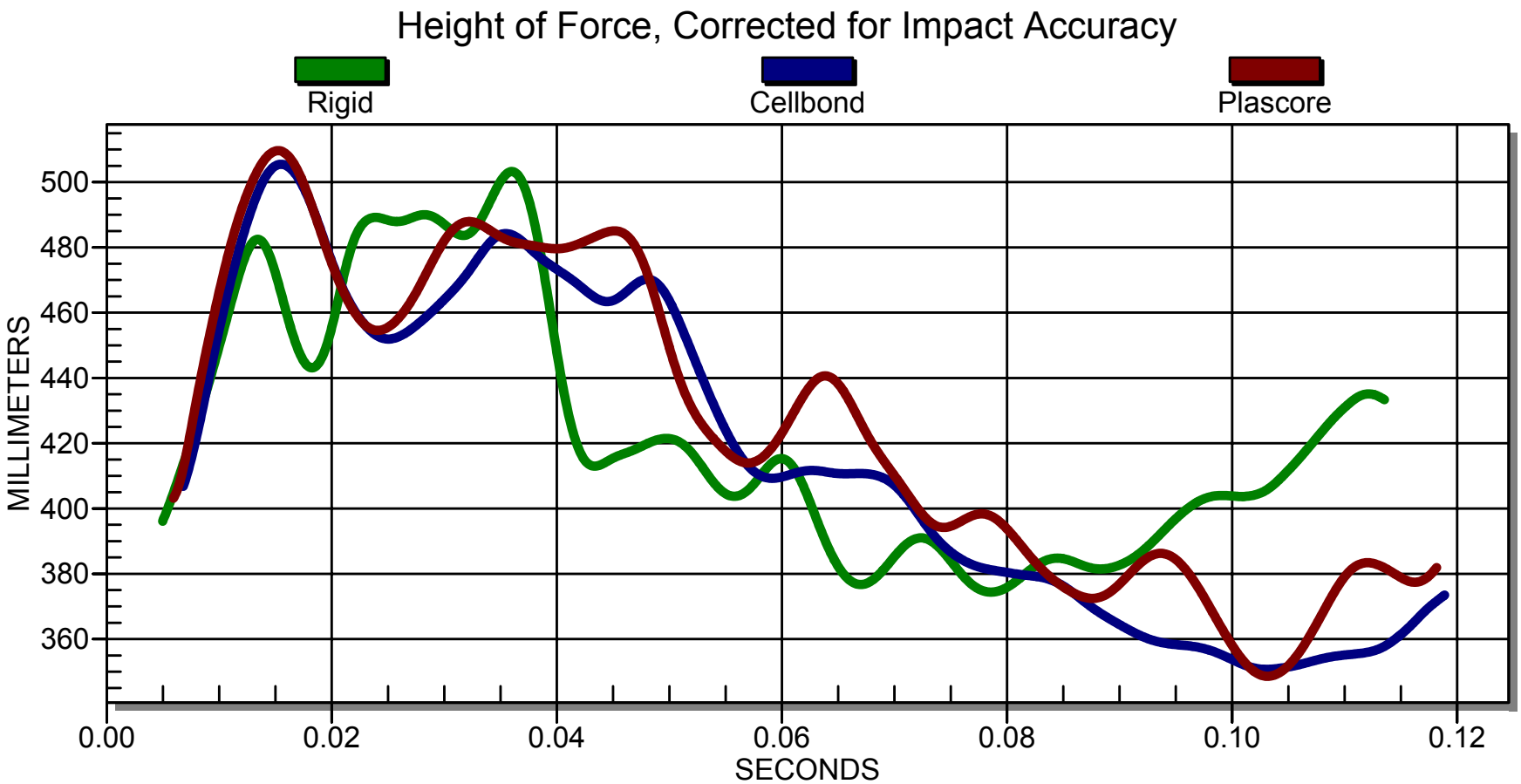
The FWDB tests had similar total force measurements

Concorde CG Acceleration (t)



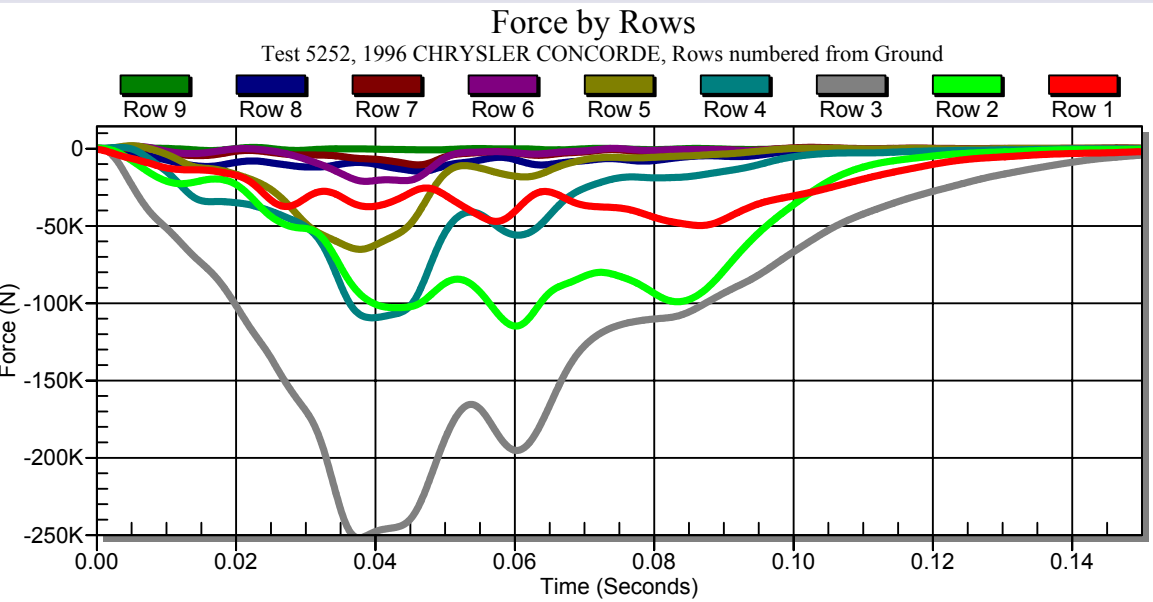
Acceleration profiles are noisy, which is common for older vehicles

Height of Force (t)



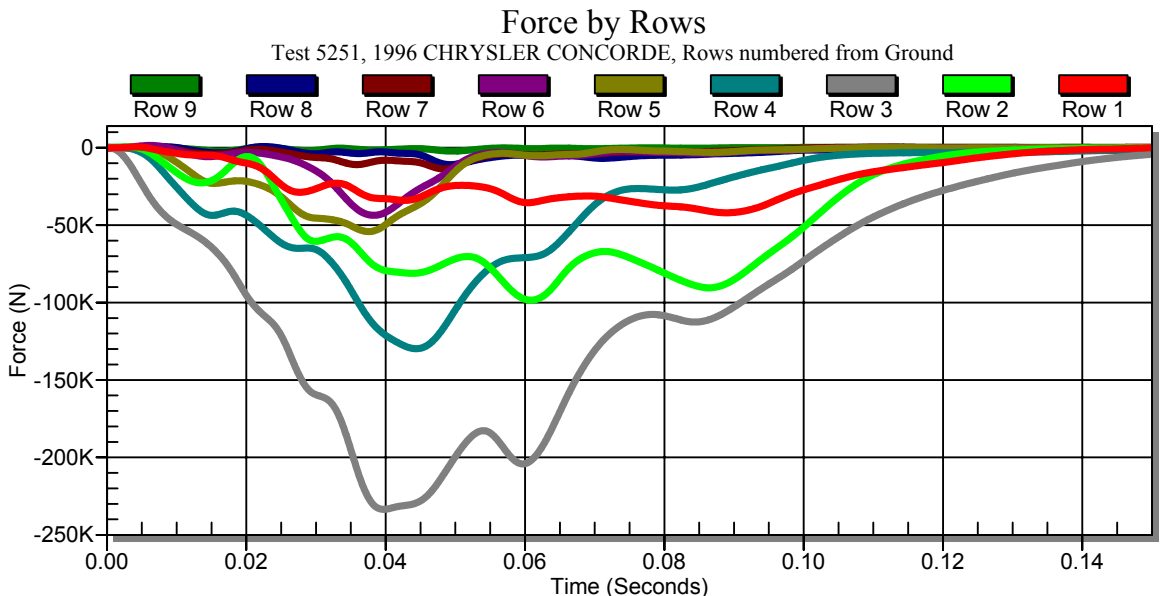
The HOF(t) are similar after correcting for impact accuracy

Row Forces (Uncorrected)

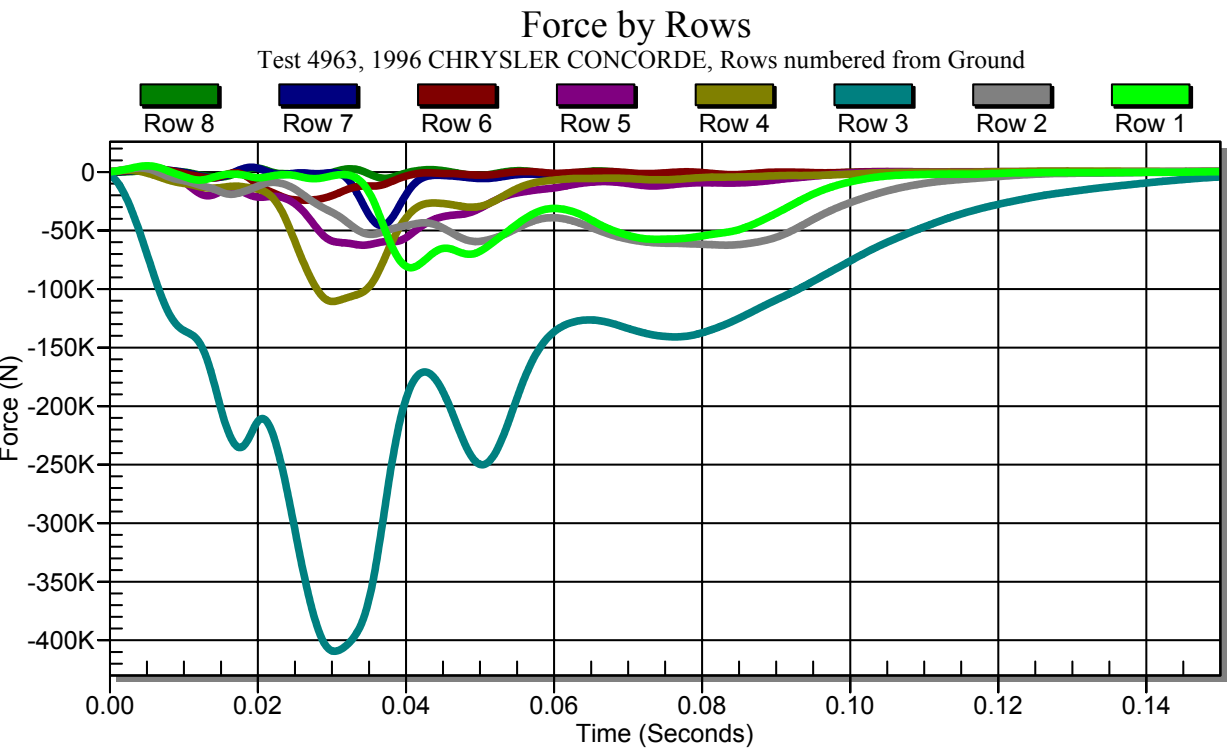


Plascore Barrier

Cellbond Barrier
(19 mm higher impact),
Increase force in row 4
Less in rows 1 and 2



Rigid Barrier Row Forces



The force distribution for the rigid barrier test is much different than either of the FWDB tests

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Vehicle-to-Vehicle Repeatability

Full Frontal Collinear
Dodge Ram 1500 into
Honda Accord

Test Matrix

NHTSA conducted a collinear frontal vehicle-to-vehicle test in which a driver air bag failure occurred in the Accord.

Honda repeated the Ram/Accord frontal test, providing an opportunity to examine the repeatability for this vehicle-to-vehicle test series

Test	Year	Make	Model	Speed	Weight	Width	Length
5041	2002	DODGE	RAM1500	92.5	2527	2018	5805
5041	2004	HONDA	ACCORD	0	1624	1894	4800
5247	2002	DODGE	RAM1500	92.4	2502	2024	5805
5247	2004	HONDA	ACCORD	0	1623	1821	4777

MGA ran both tests under identical conditions.
Stationary Accord impacted full frontal collinear.
Both vehicle centerlines were aligned.

Ram 1500 Post Test

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V5247

V5041

Accord Post Test

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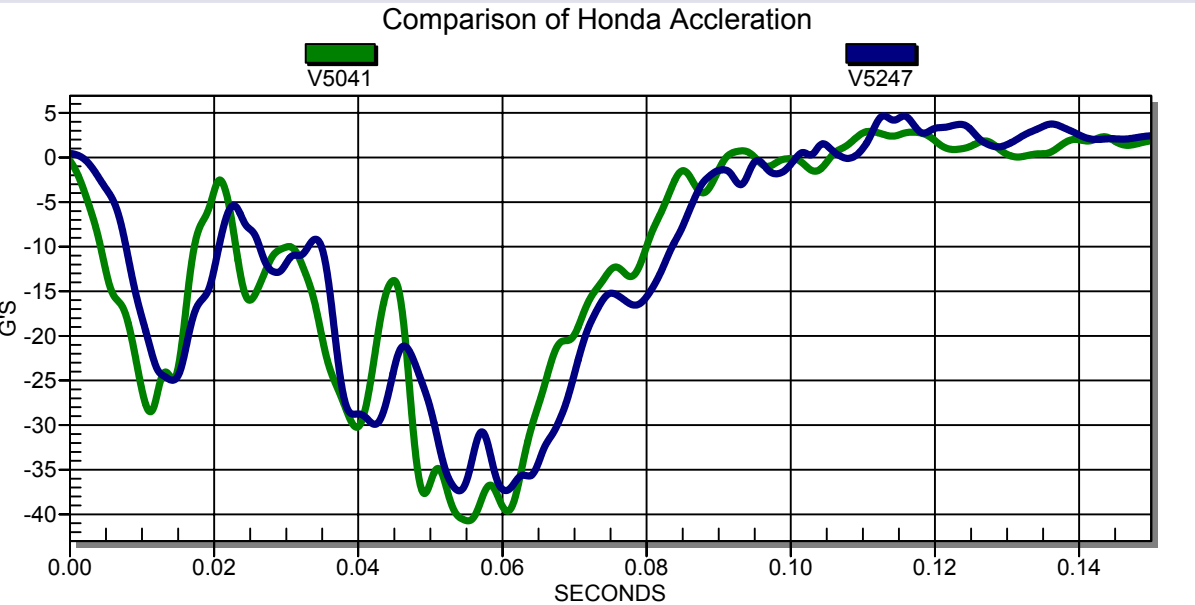
V5247

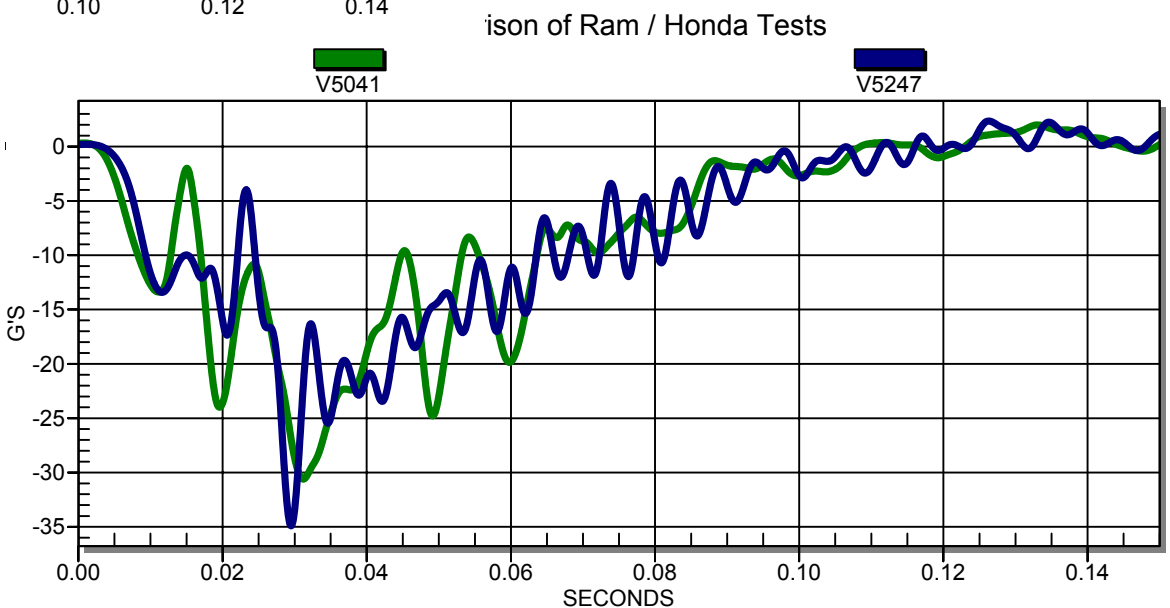
V5041

Acceleration



Honda Accord
(CF = 0.96)

Dodge Ram 1500
(CF = 0.95)



Injury Measures

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Honda Driver injury measures not compared

Honda Pass

tstno	Striking Vehcle	15 ms HIC	Max Nij	Chest Acceleration	Chest Deflection	Left Femur	Right Femur
5041↑↑	Ram 1500	255.2	0.321	43.9	14.9	3391	3232
5247↑↑	Ram 1500	286.7	0.297	48.1	17	3891	2259

Ram Driver

tstno	Striking Vehcle	15 ms HIC	Max Nij	Chest Acceleration	Chest Deflection	Left Femur	Right Femur
5041↑↑	Ram 1500	130.8	0.245	36.4	26.6	2916	3745
5247↑↑	Ram 1500	180.2	0.219	34	26.7	3909	4011

Ram Pass

tstno		15 ms HIC	Max Nij	Chest Acceleration	Chest Deflection	Left Femur	Right Femur
5041	Ram 1500	103.3	0.696	37.8	15.9	2888	7486
5247	Ram 1500	129.95	0.88	37.3	19.3	4309	2879

Bullet Vehicle Deformation

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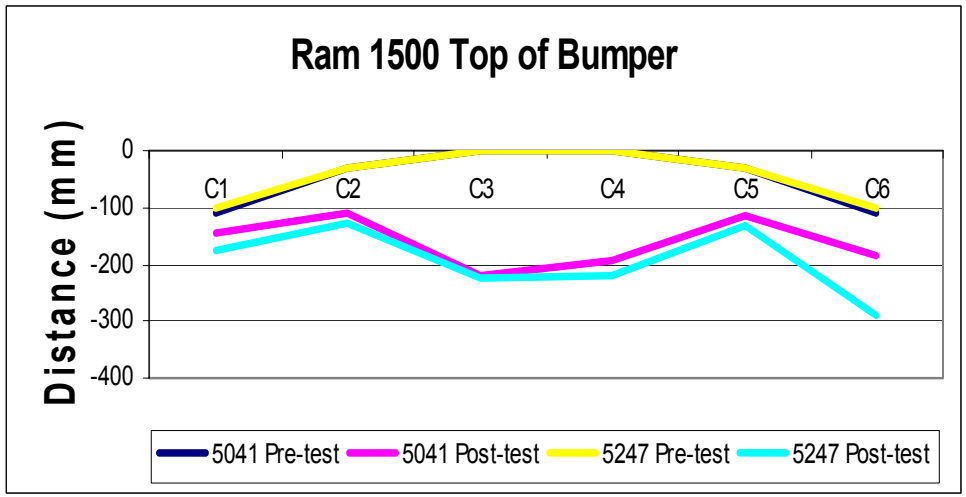

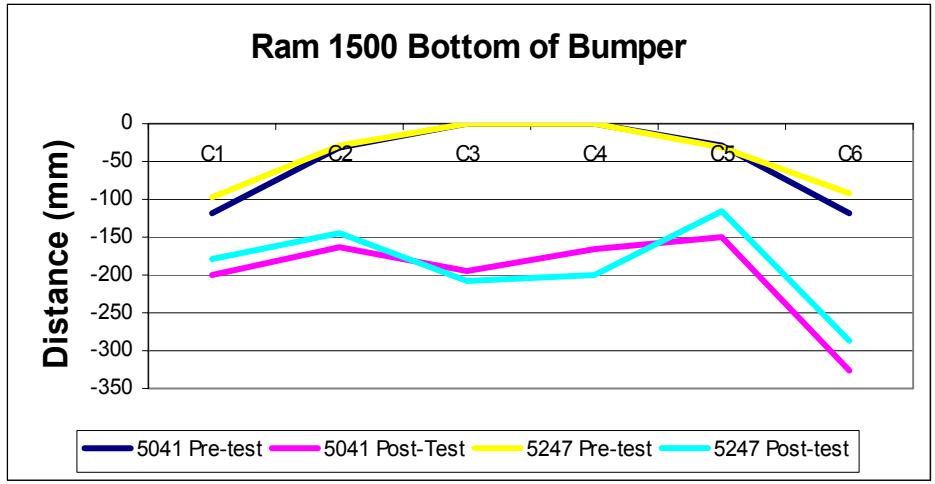

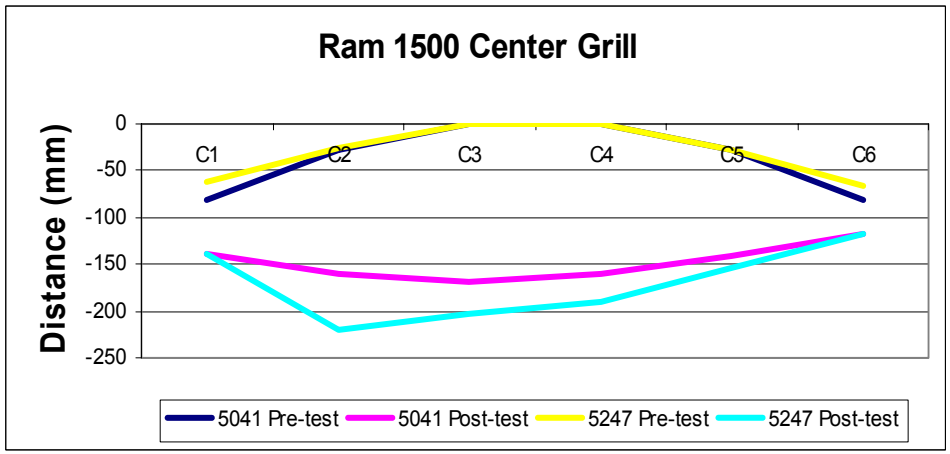

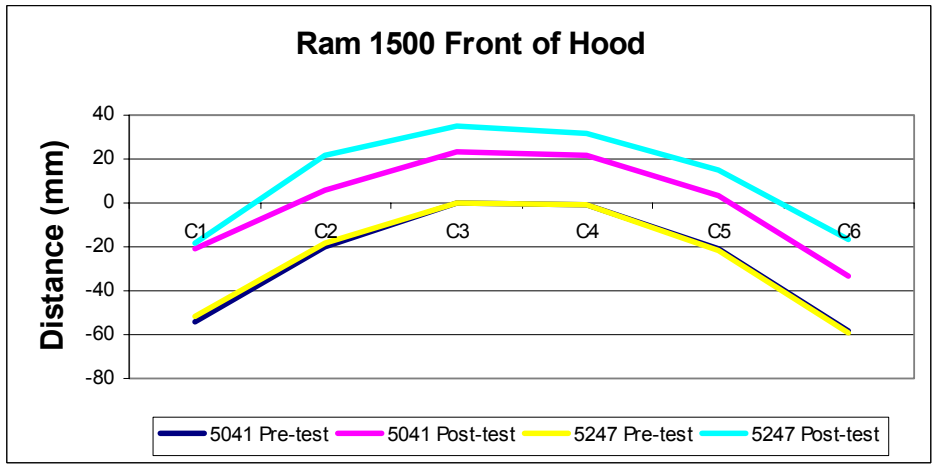

Target Vehicle Deformation

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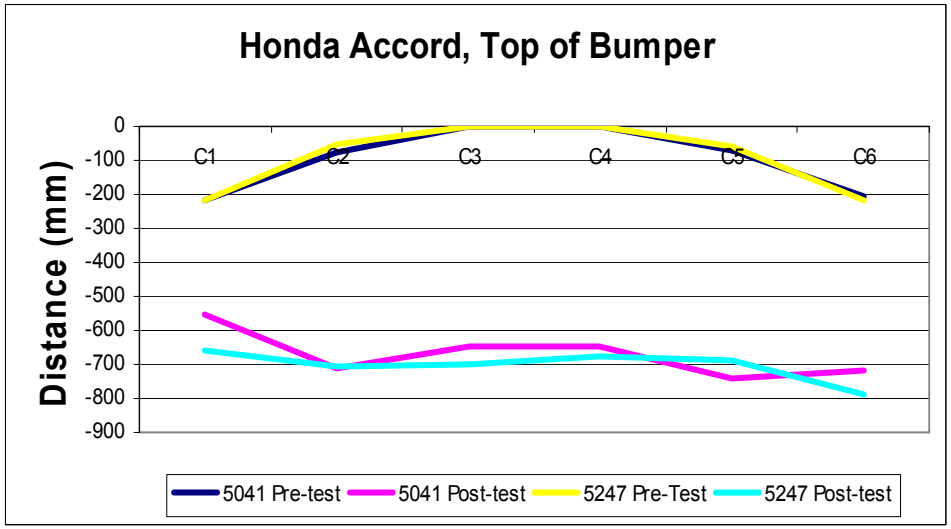

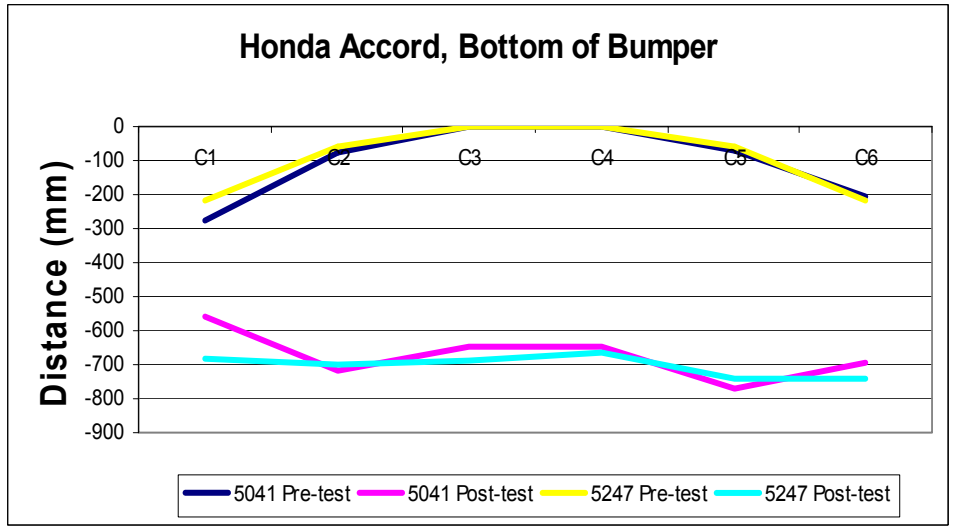

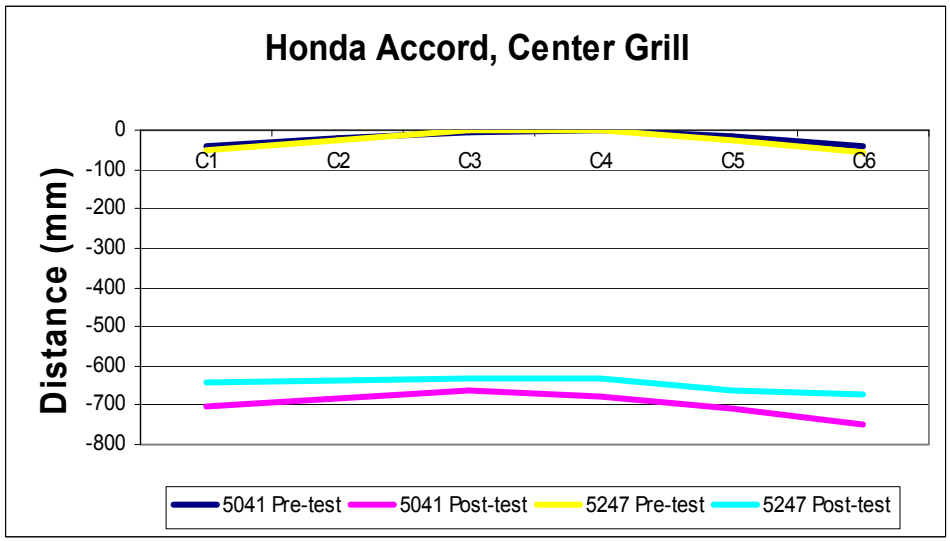

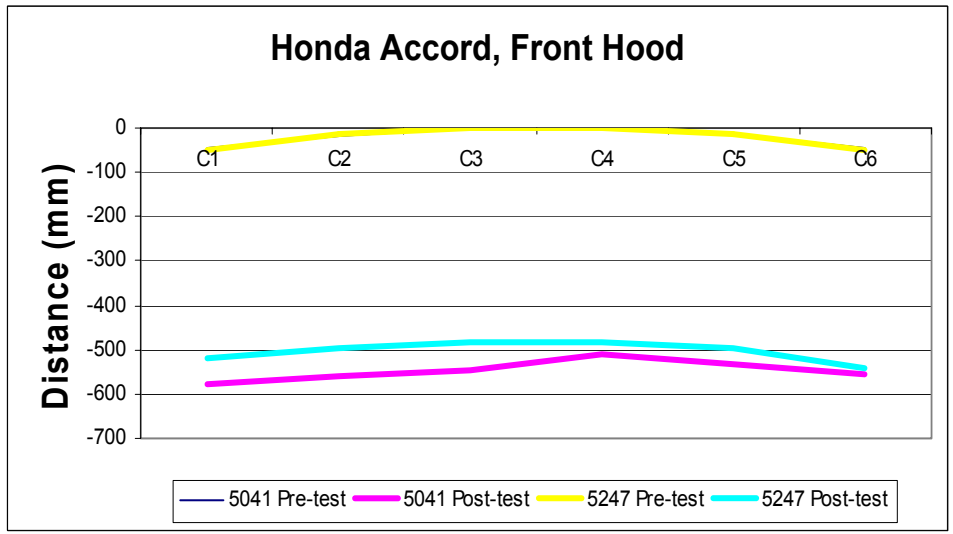

Observations

- **Vehicle measurements repeated very well**
- **Injury measures for Honda passenger and Ram driver repeated well**
- **Ram Passenger injury measures did not repeat**
  - No clear explanation for the difference in Ram passenger femur or neck loads
- **External deformation measurements repeated well**
  - The repeat test did not measure toe pan intrusions