
National Highway Traffic Safety Administration Motorcoach Tests

**GRSG - 94th Session
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Background

- NHTSA started to conduct a series of analysis and research to obtain a comprehensive review of motorcoach safety issues and the course of action that NHTSA will pursue to address them.
- www.regulations.gov; NHTSA Docket 2007-28793

Full Frontal Crash Test

- Obtain crash pulse from severe frontal crash event
- Obtain dummy readings for
 - Different dummy sizes
 - Different seat types
 - No belts
 - Lap and shoulder belts (3 – point belts)
 - Lap belts (2 – point belts)
 - Different seat manufacturers
- Study seat and seat attachment strength for different dummy sizes and rear occupant loading
- The test was conducted at the Vehicle Research and Test Center in December 2007.

Motorcoach Details

- 2000 MCI 102EL3 Renaissance
- Series 60 diesel engine
- B500 Allison Automatic transmission
- 54 seats
- 45 ft long, 12 ft 6 inches tall



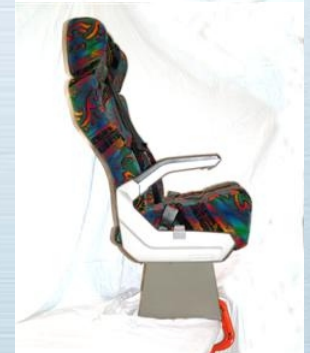
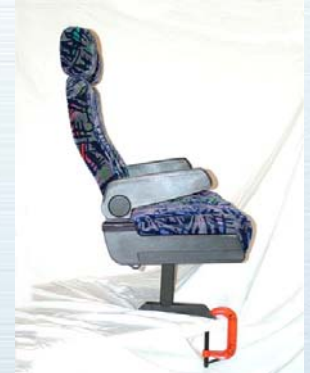
Seats on the Motorcoach

- Baseline seats
 - No belts
 - American Seating
- Seats with Belts
 - MCI/Amaya
 - 3 point belts – 4 rows (dual seats)
 - 2 point belts – 1 row (dual seats)
 - Freedman Seating
 - 3 point belts – 1 row (dual seats)



Seats (Continued)

- Baseline (No belts)
- MCI/Amaya/FAINSA
 - 3 – point
 - 2 – point
- Freedman 3 – point



Seat Attachments

- 9 occupied, 13 unoccupied rows using OEM equipment



- 2 occupied rows reinforced



Test Conditions

- Speed: 30 mph (48.3 kph)
- Frontal impact: 0 degrees; full overlap
- Fixed Rigid Barrier
- Data channels: 355 dummy; 26 vehicle channels @ 12500 samples/sec

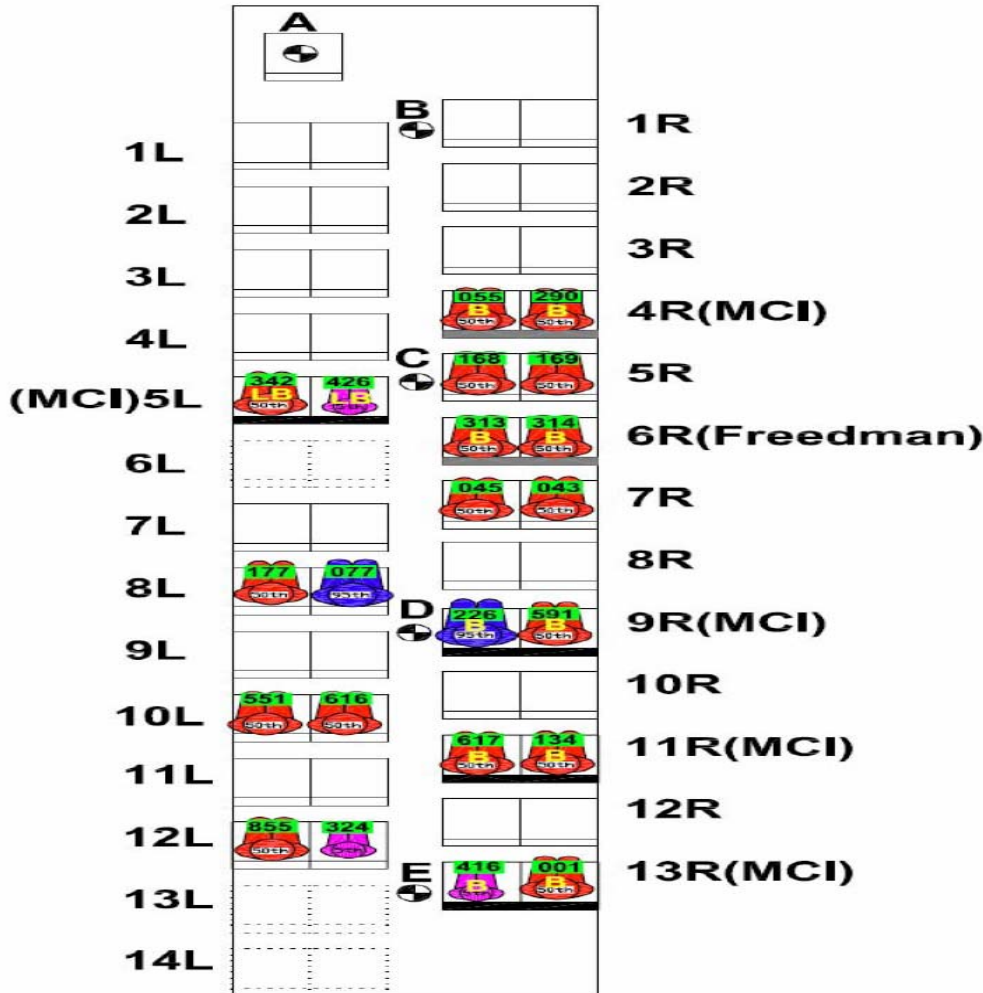


Occupants

- Hybrid III 50th percentile male – 17 dummies
 - 175 cm (5 ft 9 in) tall and 77 kg (170 lb)
- Hybrid III 5th percentile female – 3 dummies
 - 150 cm (5 ft) tall and 50 kg (110 lb)
- Hybrid III 95th percentile male** – 2 dummies
 - 188 cm (6 ft 2 in) and 100 kg (220 lb)
- Each dummy has
 - Accelerometers in head and chest
 - Load cells in upper neck and femur
 - Chest displacement potentiometer

** The 95th percentile male dummy is not in FMVSS

Dummy Seating Locations



	Accel Locations
	95th Unbelted
	50th Unbelted
	5th Unbelted
	50th Lap Belt Only
	5th Lap Belt Only
	95th 3-Point Belted
	50th 3-Point Belted
	5th 3-Point Belted
	Reinforced Attachment
	OEM Attachment

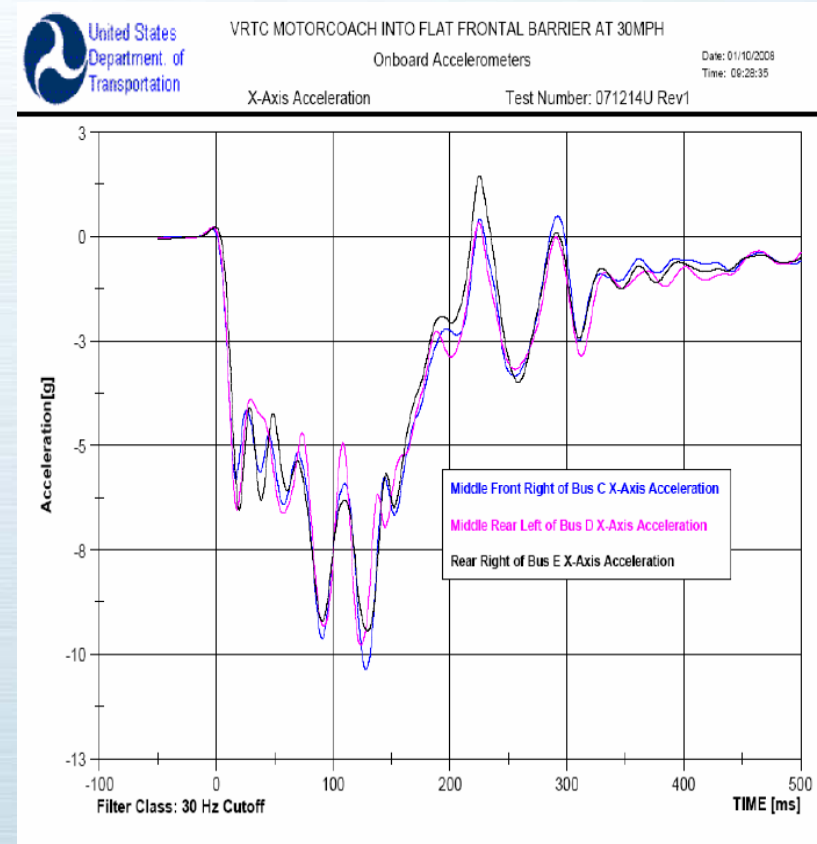
Frontal Crash Videos

Post Test Pictures



Crash Data

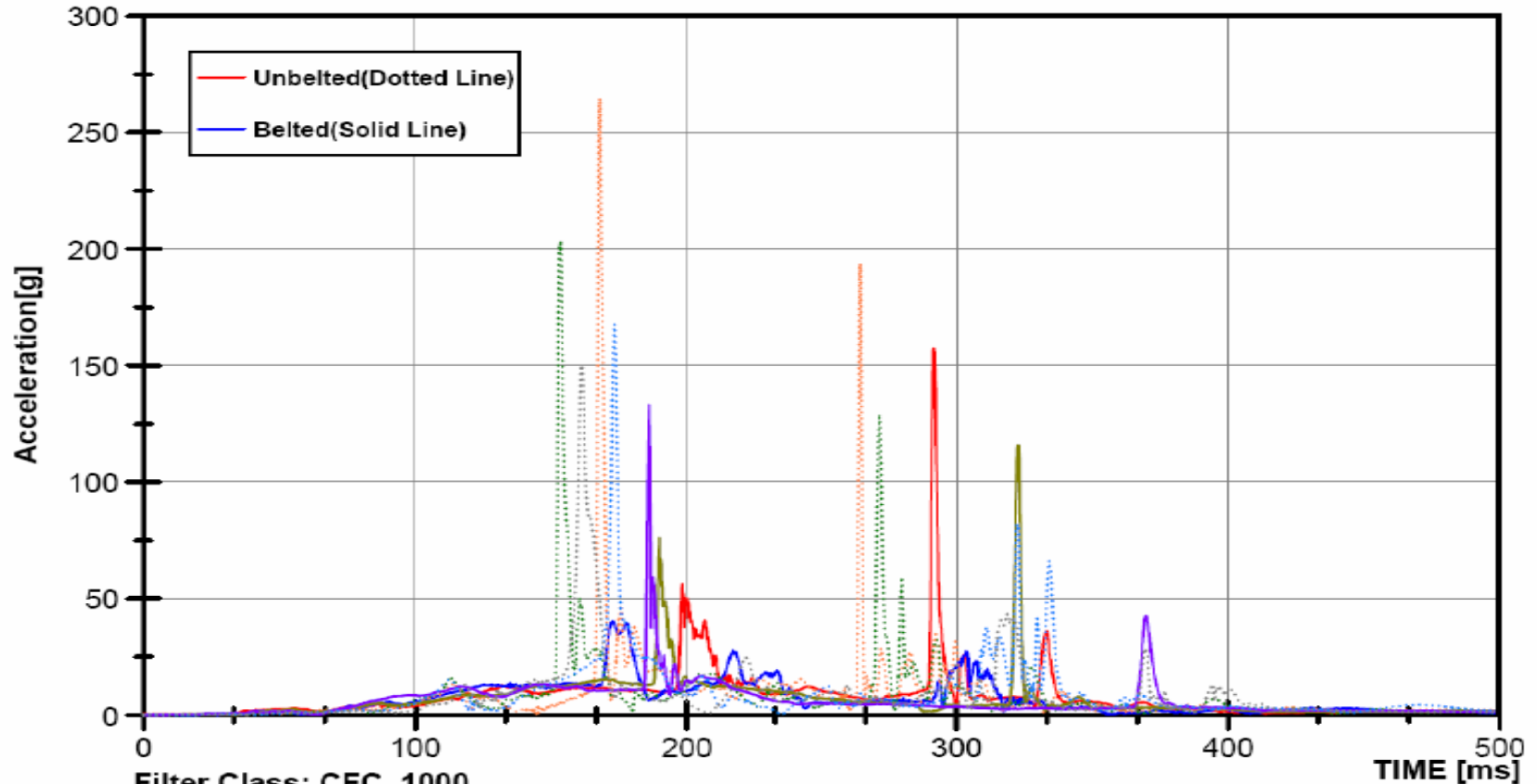
- Speed: 30.36 mph
- Dynamic Crush: 6.5 ft
- Peak deceleration: 10g at 125msec



Head Accelerations

50th Male – Front Seats

HIC's for HIII Mid-Sized Adult Male Dummies in Rows 4R,5R,6R and 7R

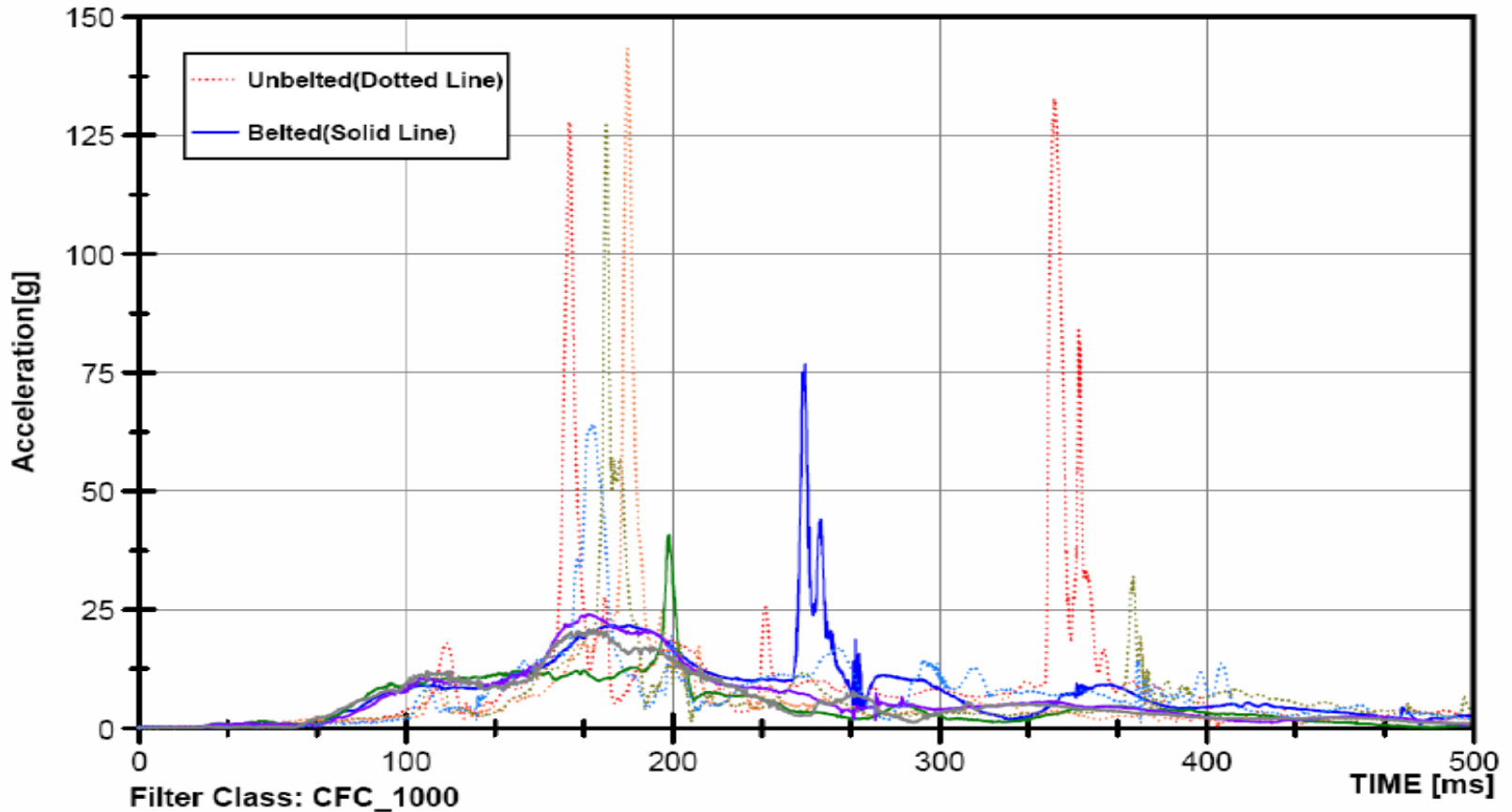


Dummy #	Seat	Belt Status	T1(Begin)	T2(End)	Avg. g T1 to T2	HIC[15]
Dummy #055	Seat 4R Aisle	3-Point Belt	439.05	290.56	293.04	127.68
Dummy #168	Seat 5R Aisle	Unbelted	1308.49	167.20	169.60	200.60
Dummy #290	Seat 4R Window	3-Point Belt	77.26	169.84	181.44	33.97
Dummy #169	Seat 5R Window	Unbelted	843.77	152.48	155.20	159.67
Dummy #313	Seat 6R Aisle	3-Point Belt	203.77	321.44	323.92	94.09
Dummy #045	Seat 7R Aisle	Unbelted	612.81	171.76	174.88	132.94
Dummy #314	Seat 6R Window	3-Point Belt	157.21	185.04	188.48	73.86
Dummy #043	Seat 7R Window	Unbelted	728.31	159.04	167.36	95.33

Head Accelerations

50th Male – Rear Seats

Dummy: HIII Mid-Sized Adult Male

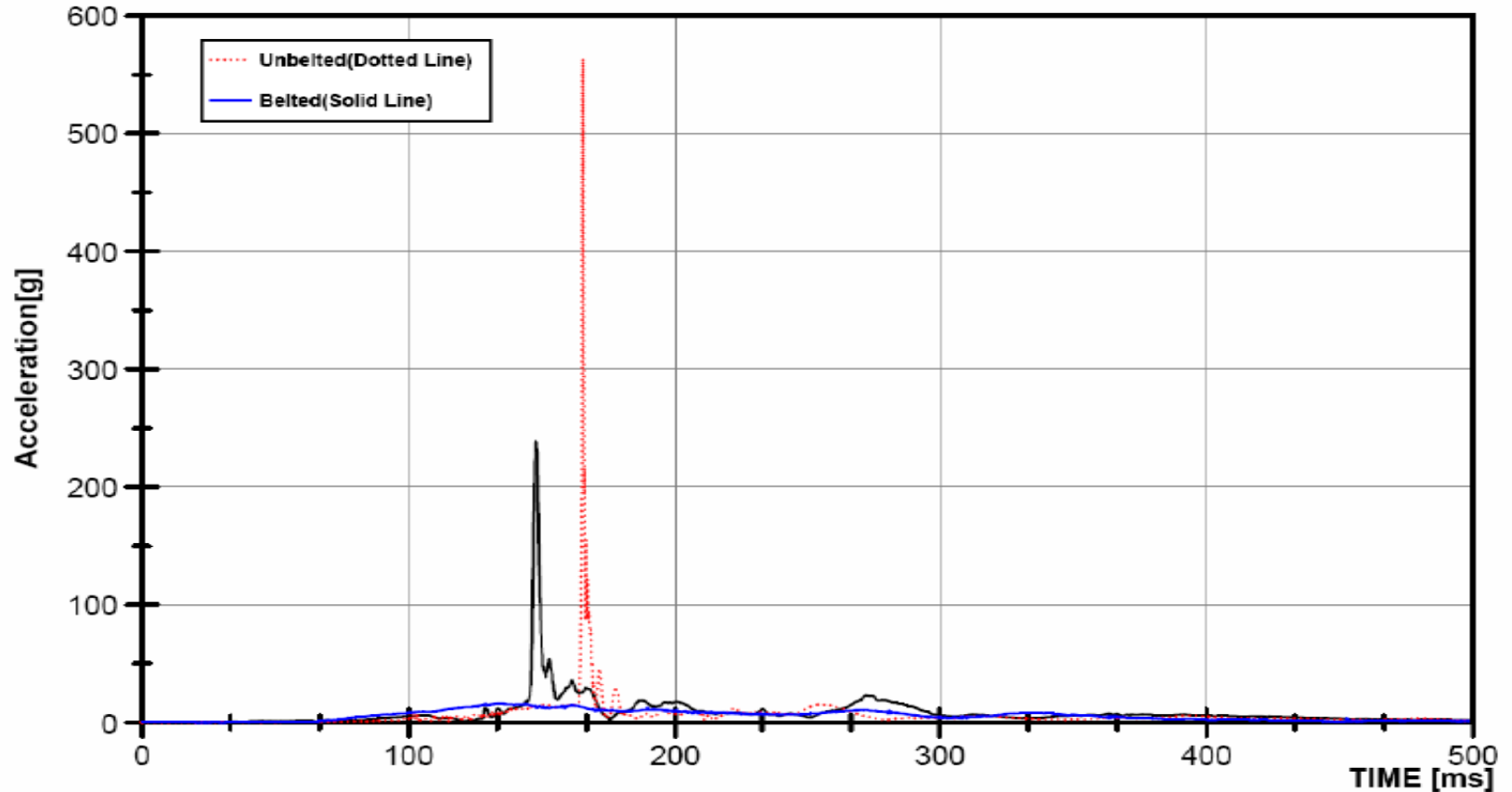


Filter Class: CFC_1000

Seat / <th>Condition</th> <th>HIC[15]</th> <th>T1(Begin)</th> <th>T2(End)</th> <th>Avg. g T1 to T2</th>	Condition	HIC[15]	T1(Begin)	T2(End)	Avg. g T1 to T2
Dummy #177 Seat 8L Window	Unbelted	700.05	340.72	346.56	108.37
Dummy #161 Seat 10L Aisle	Unbelted	570.01	181.12	185.52	112.04
Dummy #591 Seat 9R Window	3-Point Belt	117.91	246.80	256.88	42.58
Dummy #617 Seat 11R Aisle	3-Point Belt	29.57	195.04	202.16	28.20
Dummy #551 Seat 10L Window	Unbelted	336.33	172.88	181.92	67.68
Dummy #855 Seat 12L Window	Unbelted	209.65	163.20	175.76	49.05
Dummy #134 Seat 11R Window	3-Point Belt	38.08	161.36	176.40	23.10
Dummy #001 Seat 13R Window	3-Point Belt	26.62	160.72	175.76	20.02

Head Accelerations – 5th Female

Dummy: HIII Small Adult Female



Filter Class: CFC_1000

	Dummy #426 Seat 5L Aisle Lap Belt Only				Dummy #324 Seat 12L Aisle Unbelted				Dummy #416 Seat 13R Aisle 3-Point Belt			
	T1(Beg)	T2(End)	Avg. a T1 to T2		T1(Beg)	T2(End)	Avg. a T1 to T2		T1(Beg)	T2(End)	Avg. a T1 to T2	
HIC[15]=	1356.42	146.64	149.04	203.45	1958.93	165.20	165.92	393.20	14.37	130.08	145.12	15.64

Observation - Restraints

- Unbelted dummies:
 - High head and neck accelerations
- Dummies with 2-pt belts:
 - High head and neck accelerations
- Dummies with 3-pt belts:
 - Low head and neck accelerations
- All dummies have low chest accelerations and chest displacements and femur loads

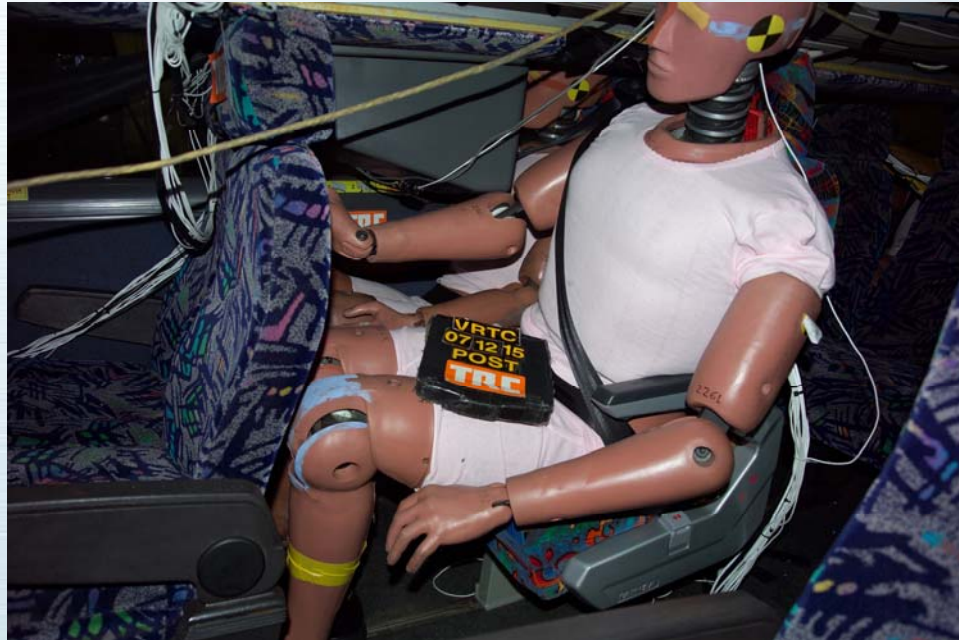
Observation - Unbelted Dummies

- Unbelted dummies typically made head contact with the backseat in front within 150-180 ms
- Dummies on the aisle seats ended up on the floor and dummies on the window seats ended up on the front seats or on the floor



Observation - Belted Dummies

- Dummies stayed in seats
- Head/Knee contact with front backseat for 95th male dummies



Observation - Seat Hardware

- All seat attachments including baseline stayed intact
- Baseline seats and Freeman seatback broke/bent when impacted by unbelted dummies from behind



Rollover Tests

- Tests were done on 2 motorcoach models: MCI and Prevost
- ECE-R66 test procedures
- Data is being analyzed



MCI R66 Exterior

Roof Crush Tests

- Tests were done on 2 motorcoach models: MCI and Prevost
- FMVSS 220 test procedures
- Data is being analyzed



Future Plans

- Conduct evacuation and flammability tests
- Evaluate research data for rulemaking recommendations
- Complete information can be found at www.regulations.gov; docket # NHTSA-2007-28793