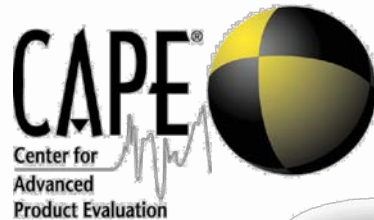
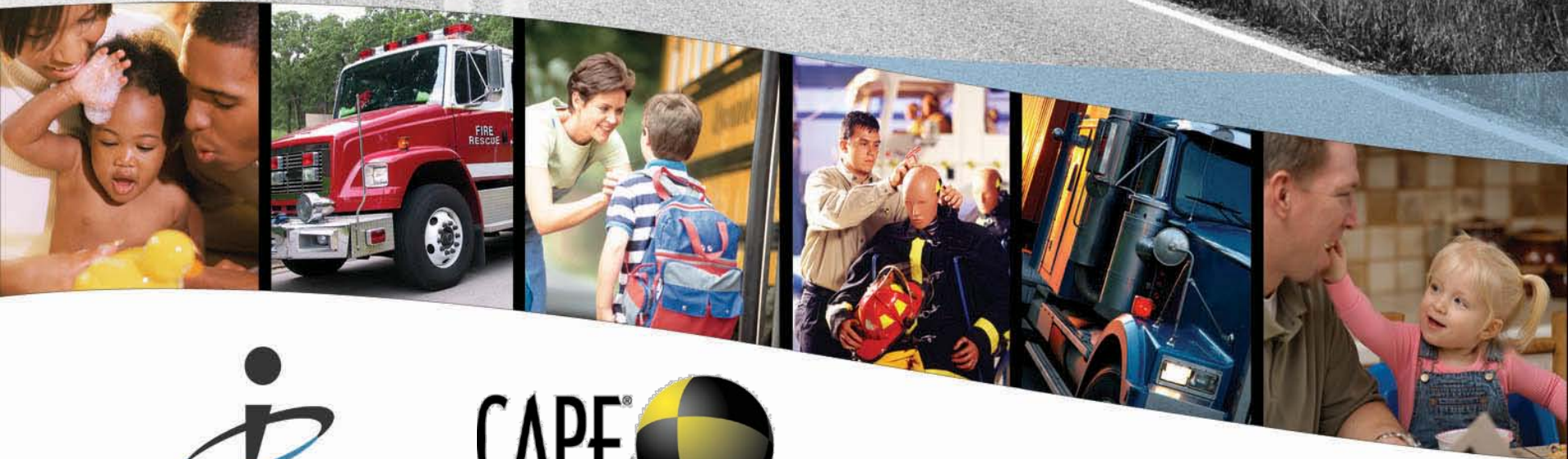


Bringing Safety to People



Test Purpose

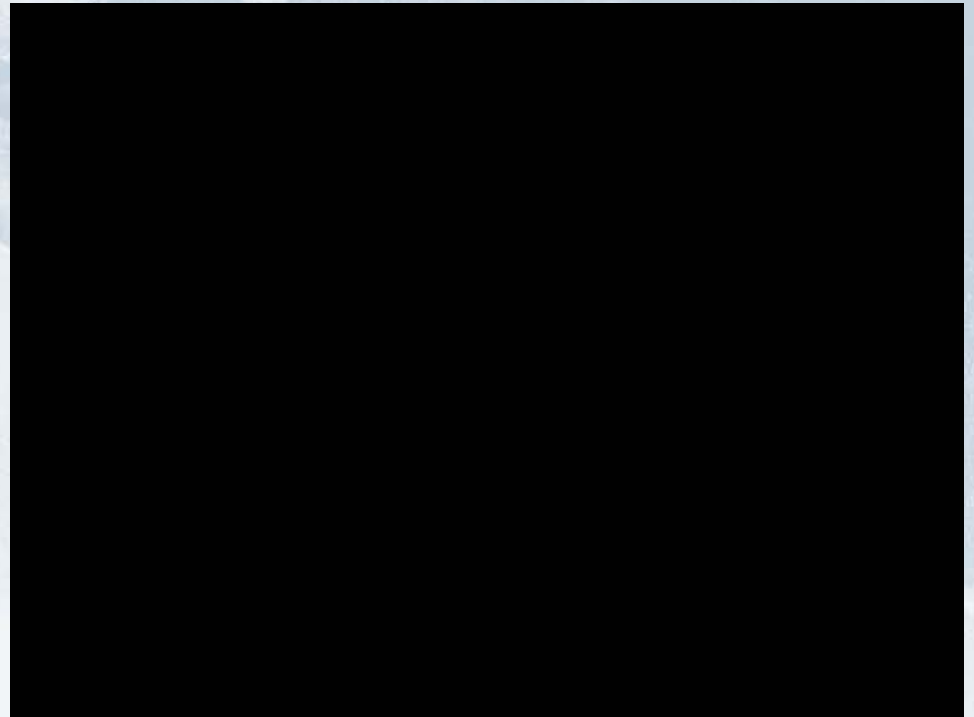
- Research and development in motor coach occupant safety
- Evaluate and compare occupant protection of SafeGuard Premier seat in complete bus environment
- Evaluate seat mounting criteria in a high energy crash
- Build body of knowledge of motor coach crashes





SafeGuard Premier Seat Development

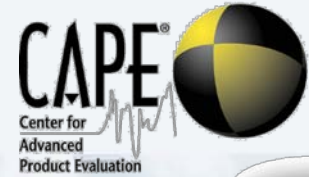
- Applied mechanics simulation
- FMVSS 222 forward & rearward Displacement
- FMVSS 210 anchorage strength
- Dynamic sled testing using NHTSA motor coach pulse



Why 35 mph Impact Speed ?

- Severe Test: 36% More Kinetic Energy than December 2007 NHTSA Motor Coach Crash Test
- Investigation of Motor Coach Frontal Crashes Indicates High Energy, Highway Speed Collisions
- FMVSS 208 Standard for Belted Passenger Occupant Protection in Light Vehicles: Phase In Schedule: 9/07 – 9/10
- New Car Assessment Program (NCAP)

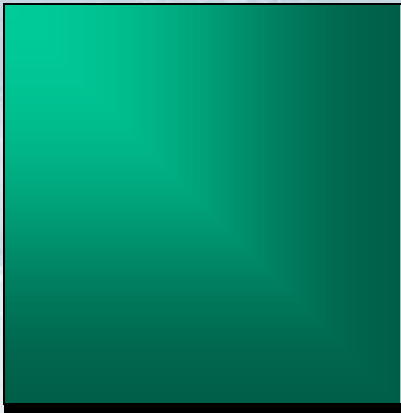
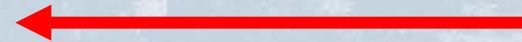




Coach Test

Target: 35 mph

Actual: 34.7 mph



1999 MCI D-Series

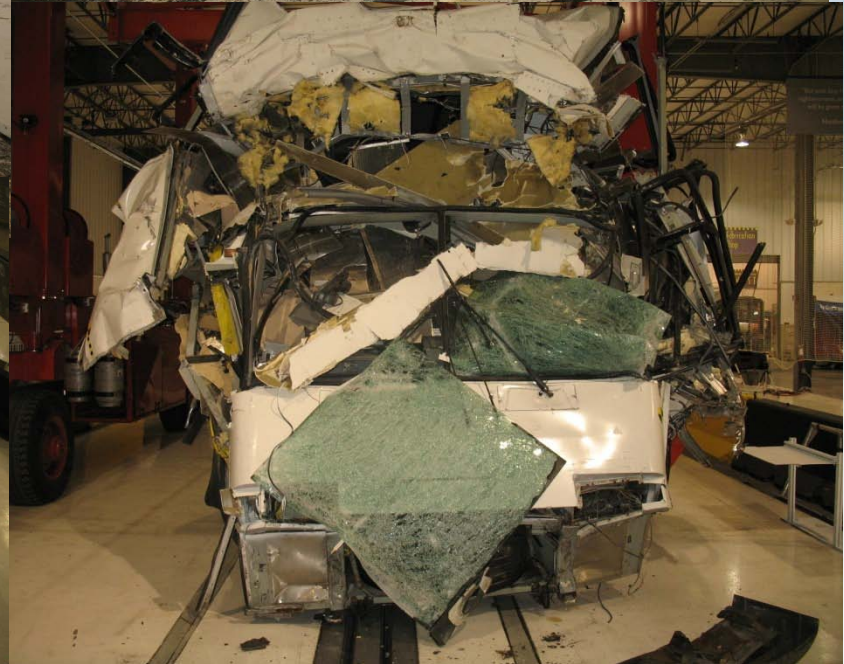
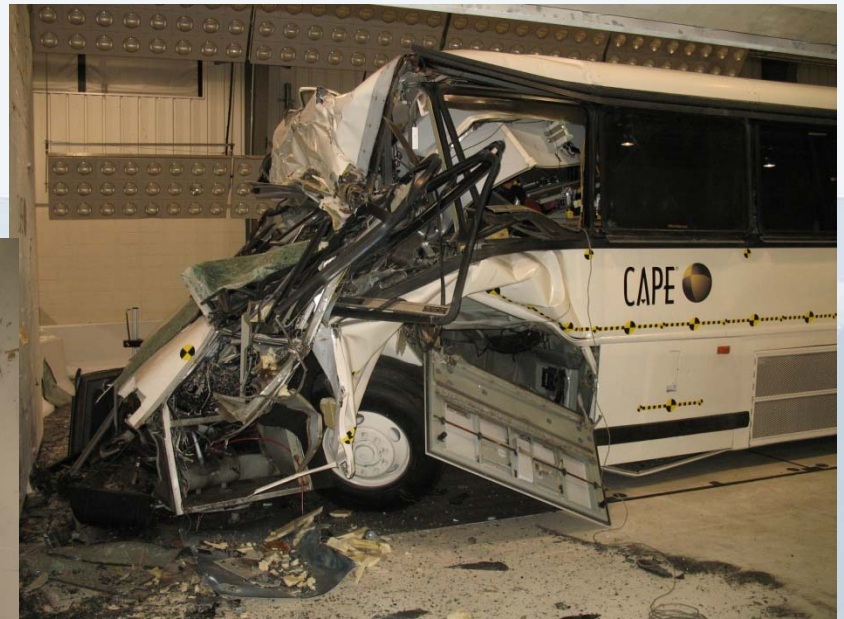
Provided by Greyhound

44,250 lb

Kinetic Energy: 1.8 million lb-ft



Post Test



Instrumentation Plan

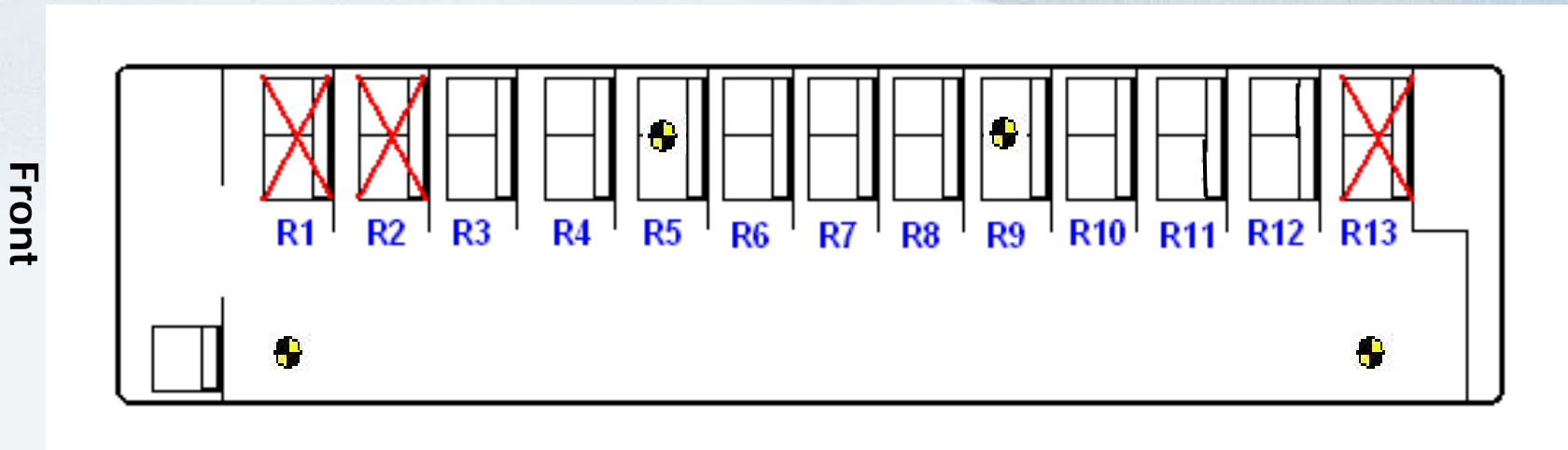
Accelerometers (A_x, A_y, A_z) in Passenger Area, Under Seats

R1 Left

R5 Right

R13 Left

R9 Left



Accelerometers (A_x, A_z) on Ballast Plates Front, Mid, Rear



CTR03813 Crash Pulse (Row5&9)



18881 US 31 N
Westfield IN 46074
(317) 867-8225
www.capetesting.com

Test ID: CTR03813-001

Test Date: 16-Nov-2009

Title: ROW 5 AND 9 X ACCELERATION OVERLAY

Comment: 35mph Flat Frontal Barrier - 2000 MCI 102D

— Row5right X

Max: 7.4 g (72.9 m/s^2) at 0.022 s

Min: -13.1 g (-128.3 m/s^2) at 0.103 s

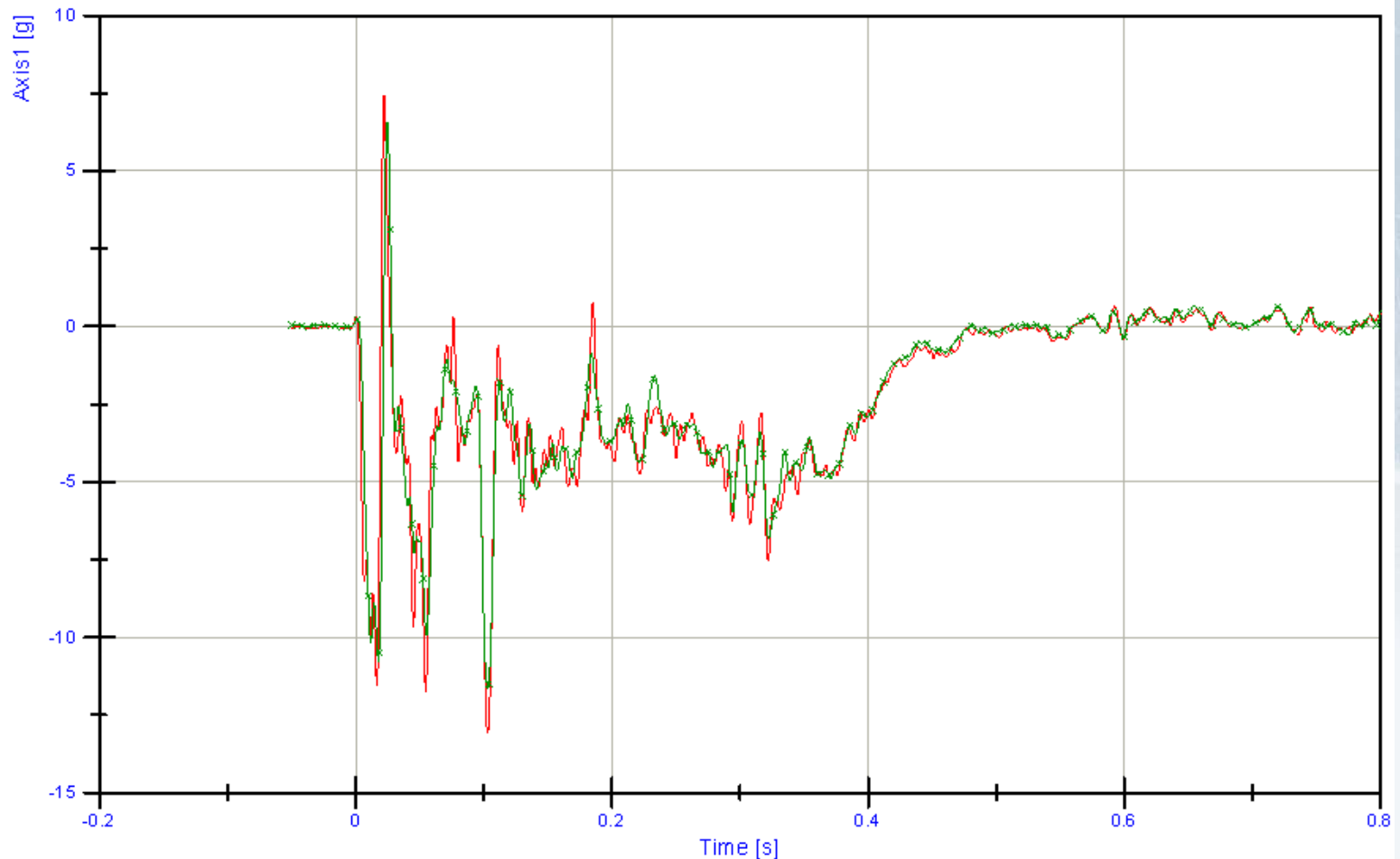
Filter: CFC_60

— Row9right X

Max: 6.6 g (64.6 m/s^2) at 0.025 s

Min: -11.6 g (-114.1 m/s^2) at 0.103 s

Filter: CFC_60





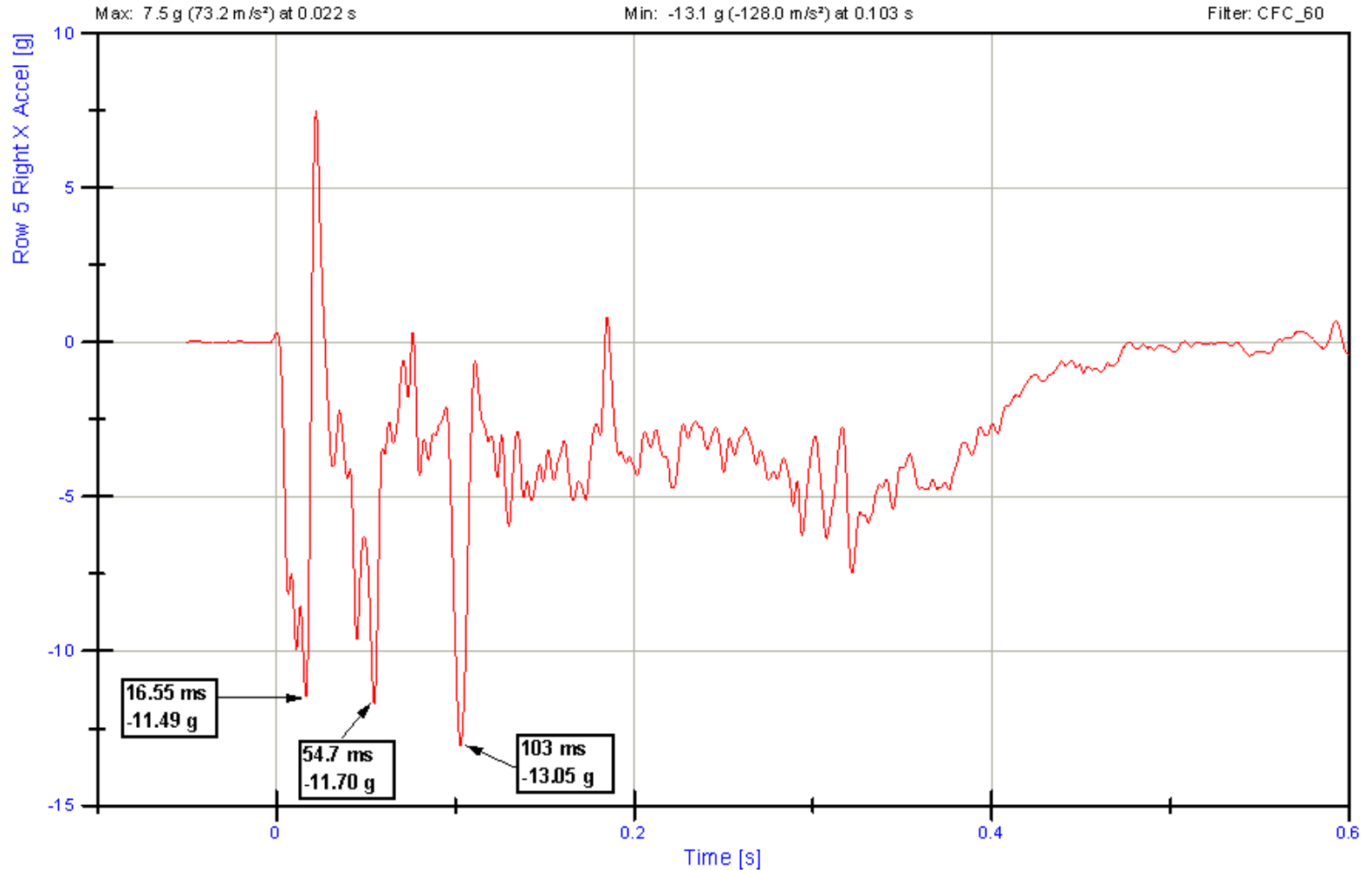
CTR03813 Crash Pulse



18881 US 31 N
Westfield IN 46074
(317) 867-8225
www.capetesting.com

Test ID: CTR03813-001
Test Date: 16-Nov-2009

Title: ROW 5 RIGHT X ACCELERATION
Comment: 35mph Flat Frontal Barrier - 2000 MCI 102D





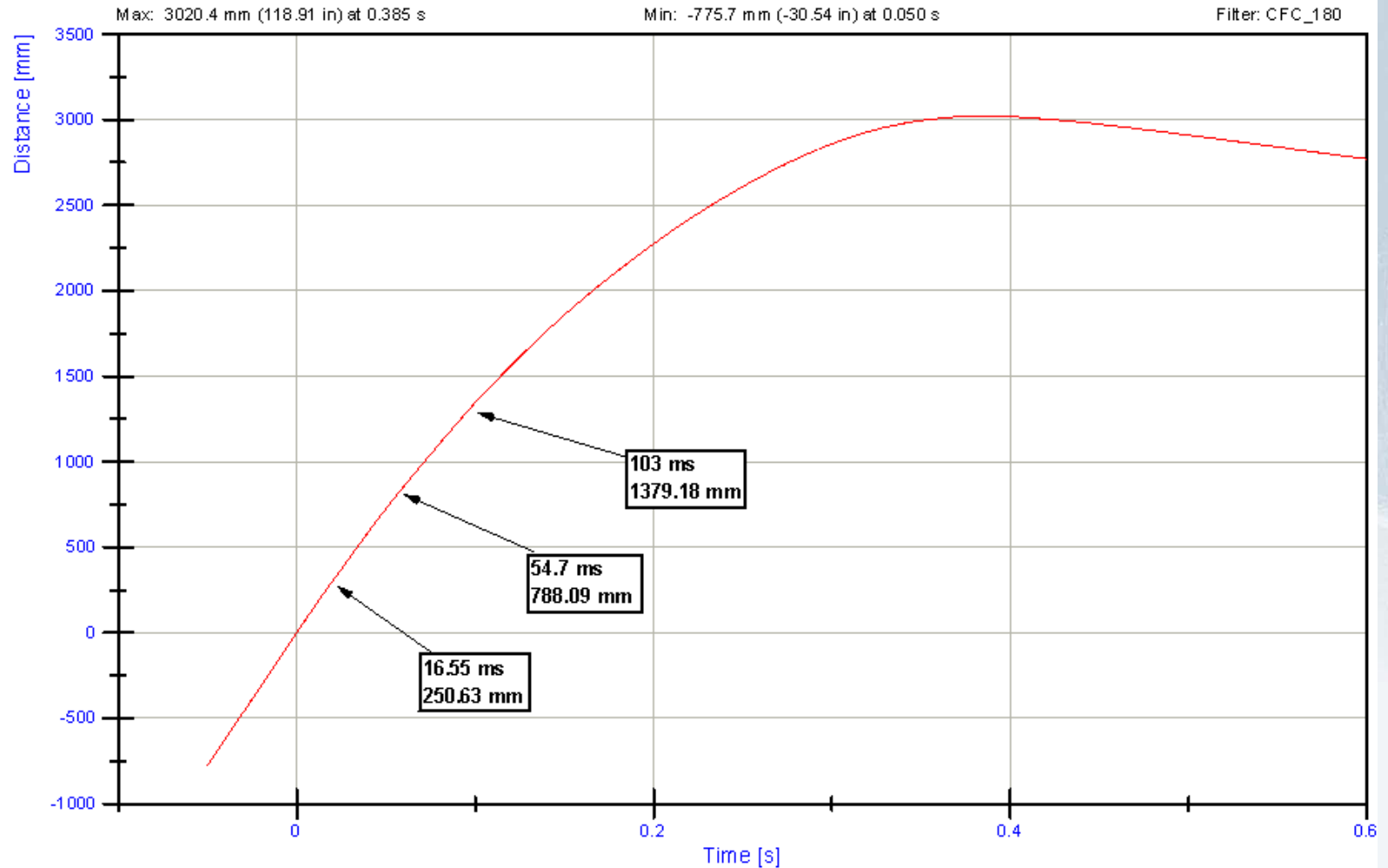
CTR03813 Displacement



18881 US 31 N
Westfield IN 46074
(317) 867-8225
www.capeesting.com

Test ID: CTR03813-001
Test Date: 16-Nov-2009

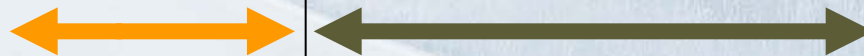
Title: ROW 5 RIGHT DISTANCE
Comment: 35mph Flat Frontal Barrier - 2000 MCI 102D



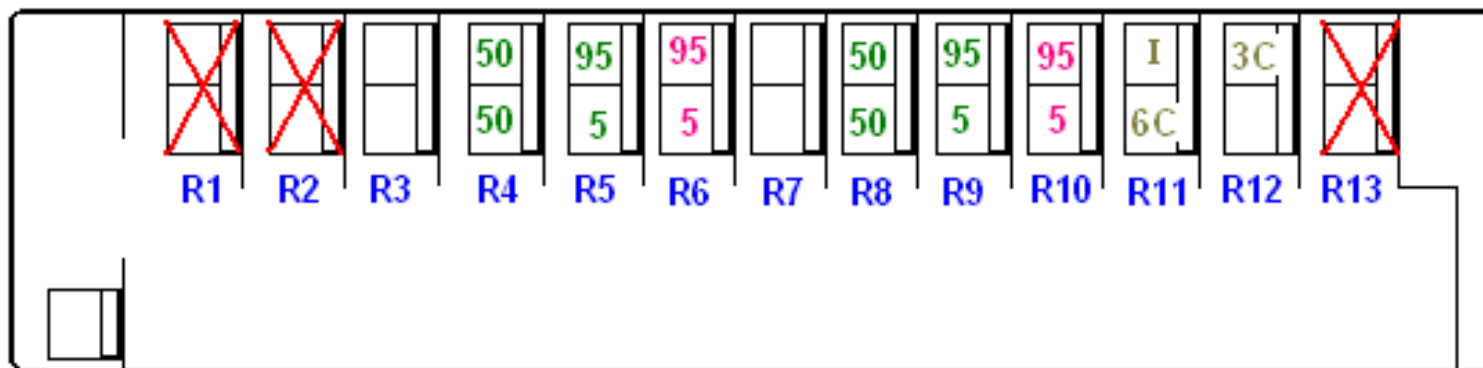
Seating Test Plan

European
Seats

PREMIER™



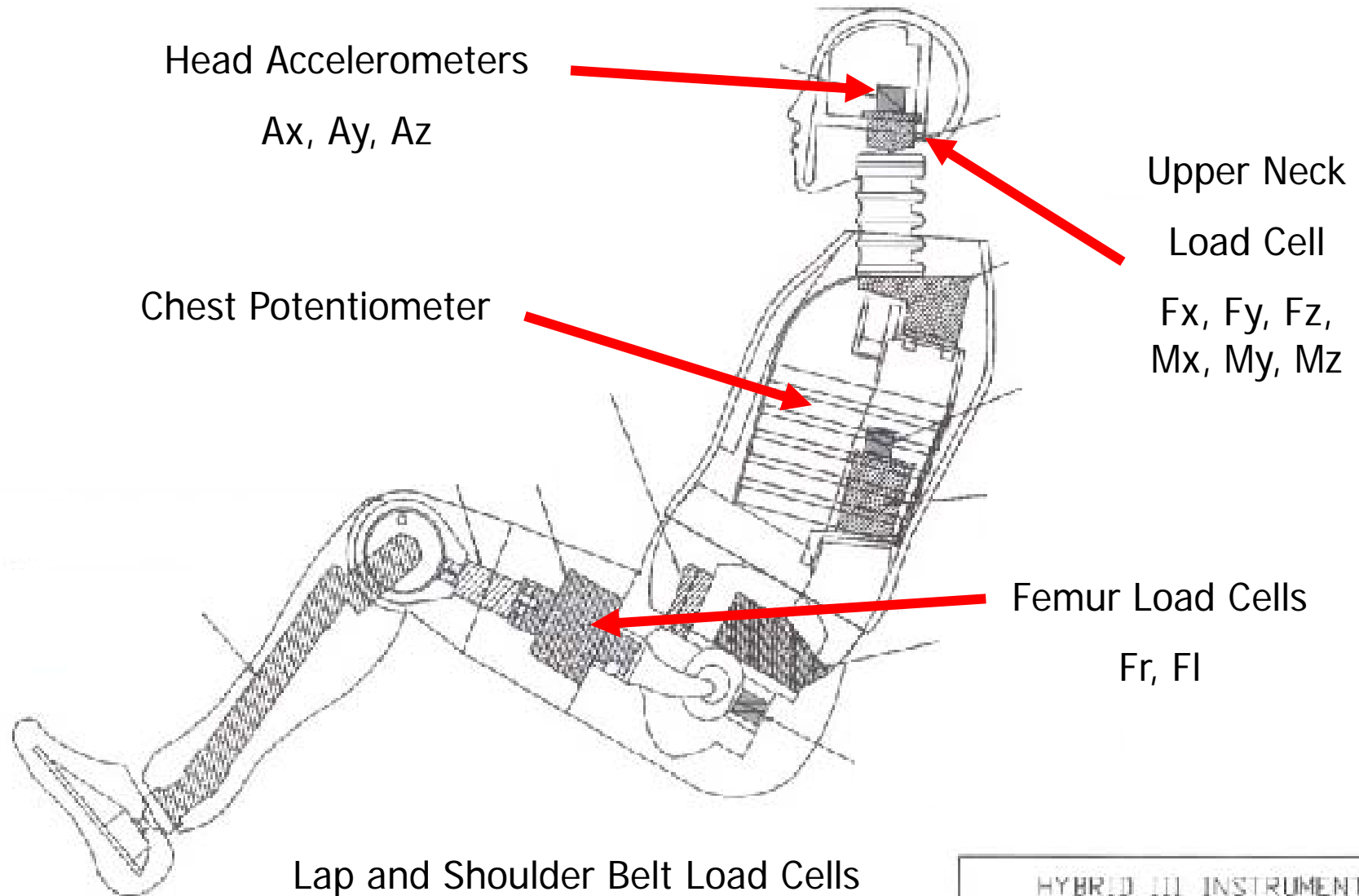
Front



Seat Spacing: 31.25 in.



ATD Instrumentation





Weight = 102# ea

Test Setup: European Seats



Row 4



Row 5



Row 6

Double Loading



European Seats: HIC_{36}

	Row 4	Row 5	Row 6
Wall	H3-50M A10 172	H3-95M A8 345	H3-95M A14 346
Aisle	H3-50M A12 1065 (727)	H3-5F A16 86	H3-5F A1 1485

A12 head struck by falling overhead bin at peak HIC_{36} of 1065.
Highest earlier HIC_{36} was 727.



European Seats: Nij

	Row 4	Row 5	Row 6
Wall	H3-50M A10 Data Suspect	H3-95M A8 0.42	H3-95M A14 0.30
Aisle	H3-50M A12 0.48	H3-5F A16 0.51	H3-5F A1 0.86



European Seats: Chest Deflection

	Row 4	Row 5	Row 6
Wall	H3-50M A10 11	H3-95M A8 No Data	H3-95M A14 10
Aisle	H3-50M A12 21	H3-5F A16 13	H3-5F A1 6

[mm]



European Seats: Femur Loads

	Row 4	Row 5	Row 6
Wall	H3-50M A10	H3-95M A8	H3-95M A14
	-1817	-1850	-2662
	-1619	-1450	-2842
Aisle	H3-50M A12	H3-5F A16	H3-5F A1
	-3696	-427	-964
	-5043	-230	-1567

Right [N]

Left [N]



European Seats: Belt Loads

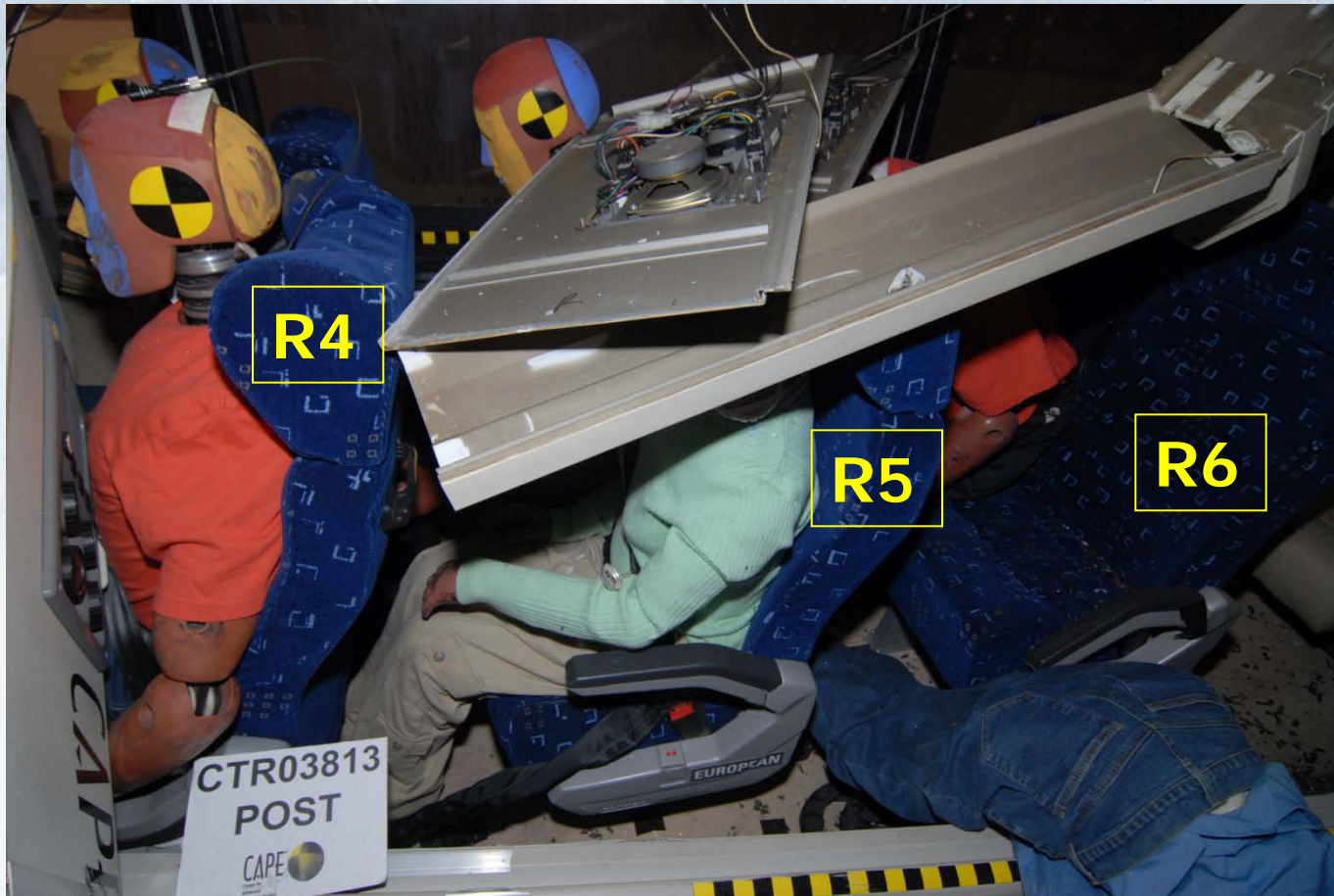
	Row 4	Row 5	Row 6
Wall	H3-50M A10 1285 1663	H3-95M A8 1631 1770	H3-95M A14 N/A
Aisle	H3-50M A12 1400 2316	H3-5F A16 945 1795	H3-5F A1 N/A

Lap [N]

Torso [N]



European Seats: Post Test





European Seats: Post Test





European Seats: Post Test





European Seats: Post Test





European Seats: Post Test





Simulated FMVSS 210 Anchorages

Test Setup: **PREMIER™**



Row 8



Row 9

Double Loading



Row 10

Weight = 116# ea



Premier Seats: HIC₃₆

	Row 8	Row 9	Row 10
Wall	H3-50M A7 29	H3-95M A22 27	H3-95M A13 117
Aisle	H3-50M A17 28	H3-5F A20 20	H3-5F A21 159



Premier Seats: Nij

	Row 8	Row 9	Row 10
Wall	H3-50M A7 0.16	H3-95M A22 0.11	H3-95M A13 Data Suspect
Aisle	H3-50M A17 Data Suspect	H3-5F A20 0.31	H3-5F A21 0.69



Premier Seats: Chest Deflection

	Row 8	Row 9	Row 10
Wall	H3-50M A7 8	H3-95M A22 7	H3-95M A13 5
Aisle	H3-50M A17 7	H3-5F A20 9	H3-5F A21 3

[mm]



Premier Seats: Femur Loads

	Row 8	Row 9	Row 10
Wall	H3-50M A7	H3-95M A22	H3-95M A13
	-436 -636	-1170 -1687	-1437 -2500
Aisle	H3-50M A17	H3-5F A20	H3-5F A21
	-415 -278	-324 -305	-1372 -1430

Right [N]

Left [N]



Premier Seats: Belt Loads

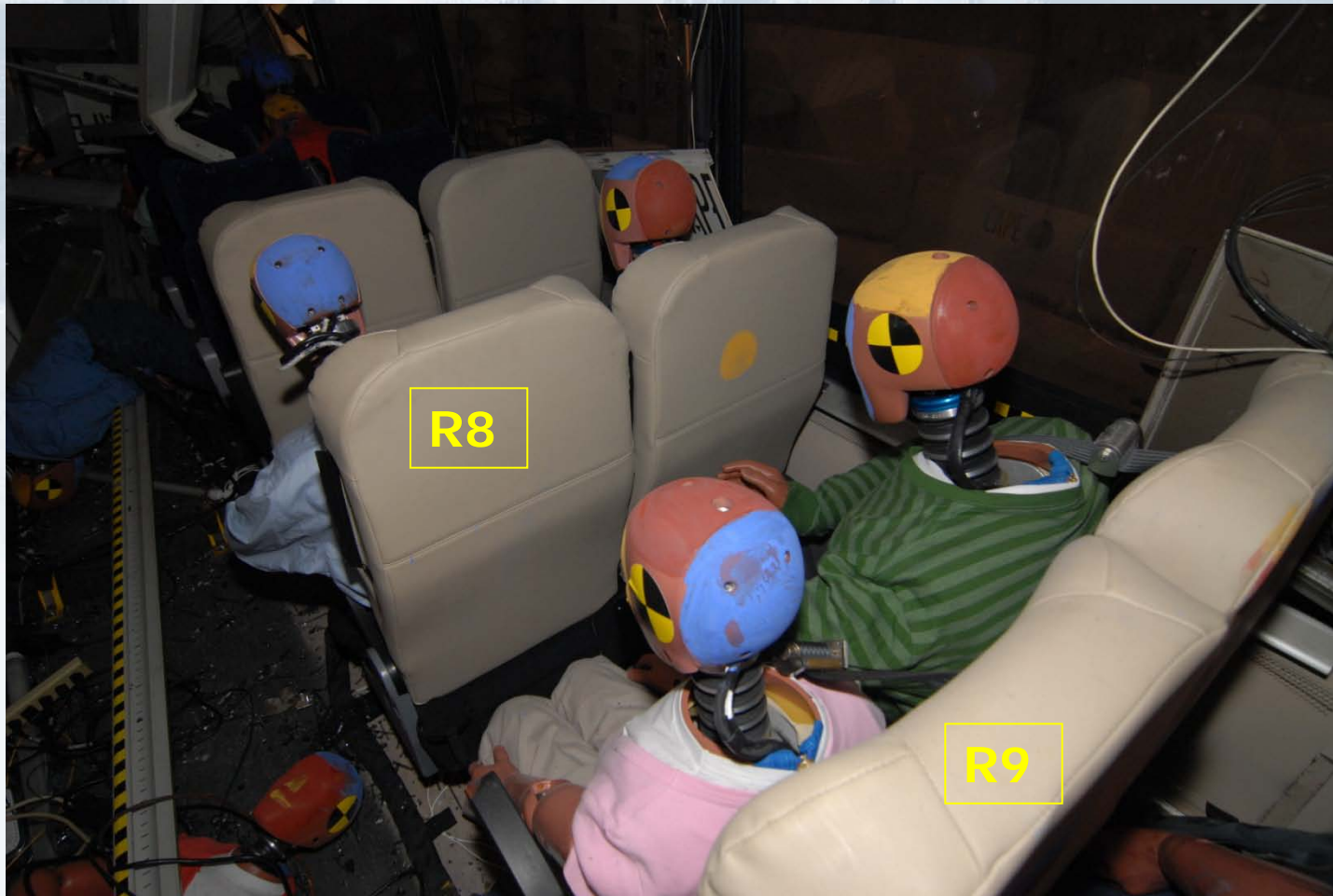
	Row 8	Row 9	Row 10
Wall	H3-50M A7 1316 1592	H3-95M A22 1232 1342	H3-95M A13 N/A
Aisle	H3-50M A17 1603 1541	H3-5F A20 1236 1501	H3-5F A21 N/A

Lap [N]

Torso [N]

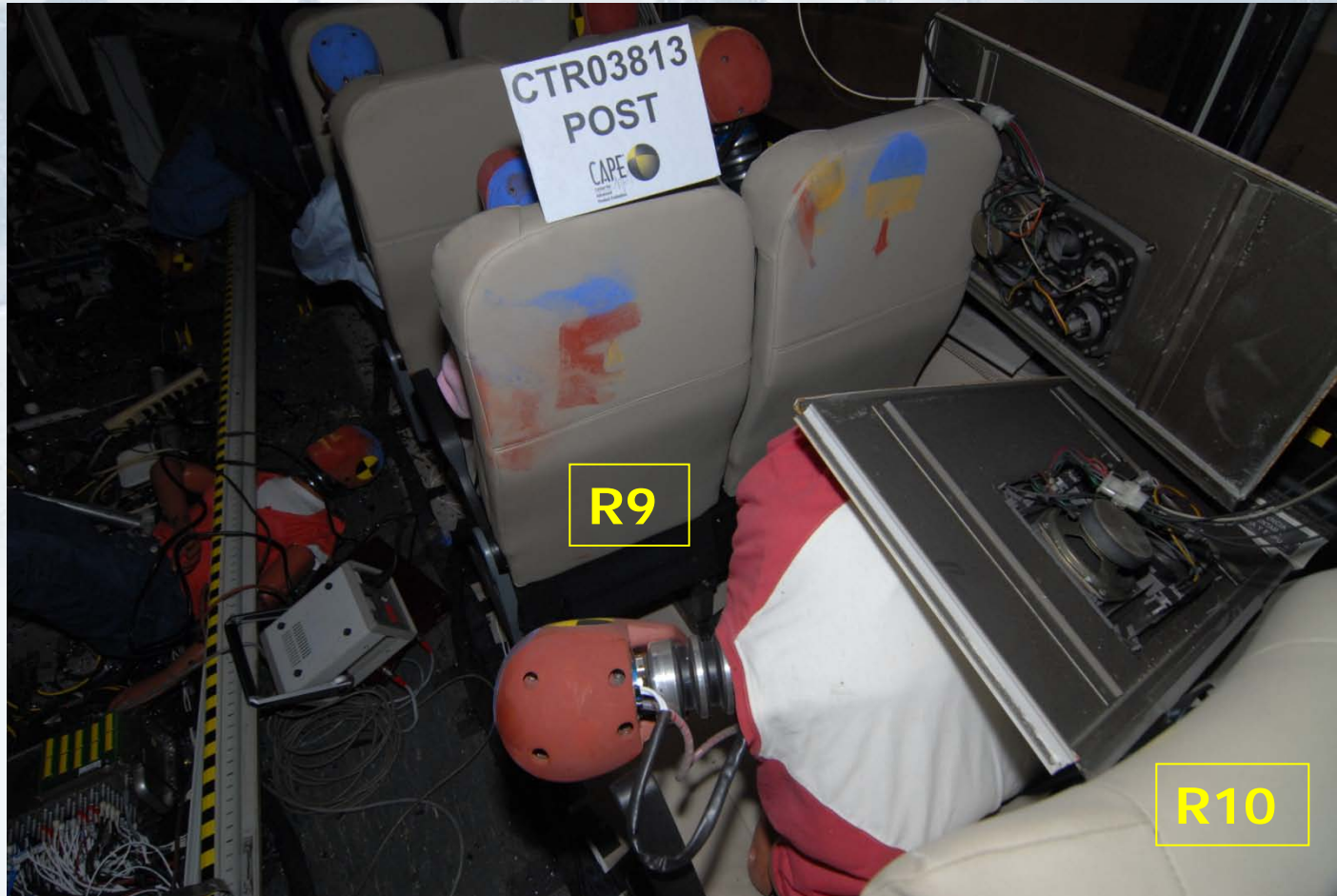


Premier Seats: Post Test





Premier Seats: Post Test





Premier Seats: Post Test





Premier Seats: Post Test





Simulated FMVSS
210 Anchorages

Test Setup: **PREMIER™**



Row 11

Row 12

Go! Booster, 3pt. , H3-6C

Go! Seat, LATCH+Tether,
H3-3C

Graco SnugRide, Belt System, CRABI-12



Premier Seats: Child HIC₃₆

	Row 11	Row 12	
Wall	CRABI-12 C23 17	H3-3C C22 30	
Aisle	H3-6C C11 No data		



Premier Seats: Post Test





Premier Seats: Post Test

