



TEST REPORT FOR:

The Center for Auto Safety

50 mph Vehicle to Vehicle 30% Offset Rear Impact



50 mph Vehicle to Vehicle 30% Offset Rear Impact

1999 Jeep Grand Cherokee Laredo

1987 Ford Taurus

PREPARED FOR:

The Center for Auto Safety

1825 Connecticut Ave, NW

Washington, DC 20009

TEST REPORT NUMBER:

TR-P31015-01-A

TEST DATE:

January 14, 2011

REPORT DATE:

May 31, 2011

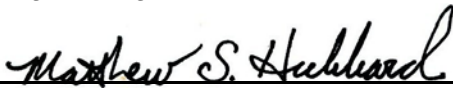


KARCO Engineering, LLC.
Automotive Research Center
9270 Holly Road
Adelanto CA 92301
Tel: (760) 246-1672
Fax: (760) 246-8112

KARCO Engineering compiled this publication for information gathering only. The findings and conclusions expressed in this publication are those of the authors and not necessarily those of any other organization. KARCO Engineering provides test services only and is not involved in consulting, product design or the manufacturing of any automotive products. KARCO does not warrant, supervise or monitor compliance of products or services except as specifically agreed to in writing. By their very nature, testing, analysis and other KARCO services are limited in scope and subject to expected measurement variability. No activity by KARCO Engineering can release a manufacturer from product or any other liability. The results, findings and conclusions expressed in this publication relate only to the items tested for the specific situation simulated in the test.

Prepared By:  _____

Mr. Kelsey A. Chiu, Engineering Department Supervisor
KARCO Engineering, LLC.

Reviewed By:  _____

Mr. Mathew S. Hubbard, Quality Assurance Manager
KARCO Engineering, LLC.

Approved By:  _____

Mr. Michael L. Dunlap, Director of Operations
KARCO Engineering, LLC.

Approval Date: _____ May 31, 2011 _____

TABLE OF CONTENTS

<u>Section</u>		<u>Page No.</u>
1	Purpose and Summary of the Test	1
2	Data Sheets	3

<u>Data Sheet No.</u>		<u>Page No.</u>
1	Crash Test Summary	4
2	Bullet Vehicle Parameter Data	5
3	Bullet Vehicle Accelerometer Data	8
4	Bullet Vehicle Accident Investigation Data	9
5	Target Vehicle Parameter Data	10
6	Target Vehicle Accelerometer Data	13
7	Target Vehicle Accident Investigation Data	14
8	Target Vehicle Profile Measurements	15
9	Target Vehicle Structural Measurements	16
10	Target Vehicle Intrusion Measurements	17

<u>Appendix</u>		<u>Page No.</u>
A	Photographs	A
B	Instrumentation Data Traces	B
C	Instrumentation Data Channel Assignments	C

SECTION 1

PURPOSE AND SUMMARY OF TEST

PURPOSE

This 80.5 km/h 30% offset rear impact test was conducted to examine the fuel system integrity of the subject target vehicle, a 1999 Jeep Grand Cherokee Laredo 5-door MPV, when impacted by a target vehicle, a 1987 Ford Taurus 4-door sedan, under conditions similar to those of FMVSS 301.

The impact test was conducted in accordance with instructions received by KARCO Engineering, LLC from The Center for Auto Safety. This test was funded by the Santos Family Foundation.

SUMMARY

A 1999 Jeep Grand Cherokee Laredo 5-door MPV (target vehicle) was impacted by a 1987 Ford Taurus 4-door sedan (bullet vehicle) at a velocity of 82.7 km/h. The target vehicle was sitting stationary with the transmission in neutral and the parking brake disengaged. It was oriented parallel to the bullet vehicle facing the same direction, with a target offset of 561 mm.

The test was performed at KARCO Engineering, LLC. on January 14, 2011. Pre- and post-test photographs of the vehicle and dummies can be found in Appendix A of this report. Two (2) real-time camera and three (3) high-speed cameras were used to document the vehicle to vehicle impact event.

One Part 572E 50th percentile male anthropomorphic test device (ATD) was placed in both the driver and left front seating positions of the target vehicle. Both ATD's were uninstrumented. One surrogate occupant was placed in both the driver and left front seating positions of the bullet vehicle.

The 6 channels of data were recorded on an on-board data acquisition system. Appendix B contains the dummy response data traces.

The maximum static crush of the target vehicle was 772 mm located at DPD 4 to the right of the vehicle centerline. Both the driver and passenger side doors remained closed during the impact event and were jammed shut after the impact.

The maximum static crush of the bullet vehicle was 120 mm located at DPD 5 to the right of the vehicle centerline. Both the driver and passenger side doors remained closed during the impact event and were operable after the impact.

The target vehicle had no Stoddard solvent leakage immediately after the impact event. After the impact test the vehicle was placed on a rollover spit to perform an FMVSS 301 style rollover. At the 90° position of the rollover the Stoddard solvent began to leak out of the fuel tank and the rollover was stopped. All of the Stoddard solvent that was present in the tank leaked from the fuel tank at the 90° position.

SECTION 2
DATA SHEETS

Bullet Vehicle: 1987 Ford Taurus 4-Door Sedan

Project No.: P31015-01

Target Vehicle: 1999 Jeep Grand Cherokee Laredo 5-Door MPV

Test Date: 01/14/11

CONVERSION FACTORS

Quantity	Typical Application	Std Units	Metric Unit	Multiply By
Mass	Vehicle Weight	lb	kg	0.4536
Linear Velocity	Impact Velocity	miles/hr	km/hr	1.609344
Length or Distance	Measurements	in	mm	25.4
Volume	Fuel Systems	gal	liter	3.785
Volume	Small Fluids	oz	mL	29.573
Pressure	Tire Pressures	lbf/in ²	kPa	7.0
Volume	Liquid	gal	liter	3.785
Temperature	General Use	°F	°C	$=(tf - 32)/1.8$
Force	Dynamic Forces	lbf	N	4.448
Moment	Torque	lbf•ft	N•m	1.355

DATA SHEET NO. 1
CRASH TEST SUMMARY

Bullet Vehicle: 1987 Ford Taurus 4-Door Sedan

Project No.: P31015-01

Target Vehicle: 1999 Jeep Grand Cherokee Laredo 5-Door MPV

Test Date: 01/14/11

PRIMARY IMPACT DATA

Parameter	Units	Value
Bullet Vehicle Velocity at Impact	km/h	82.68
Bullet Vehicle Test Weight	kg	1539.5
Bullet Vehicle Maximum Static Crush	mm	120
Target Vehicle Test Weight	kg	1880.0
Target Vehicle Maximum Static Crush	mm	772
Impact Point (From Centerline)	mm	536

BULLET VEHICLE DOOR OPENING AND SEAT TRACK DATA

Description	Driver	Passenger
Front Door Opening	Remained closed and operational	Remained closed and operational
Rear Door Opening	Remained closed and operational	Remained closed and operational
Seat Track Shift	Unknown	Unknown
Seat Back Failure	No	Yes

TARGET VEHICLE DOOR OPENING AND SEAT TRACK DATA

Description	Driver	Passenger
Front Door Opening	Jammed shut	Jammed shut
Rear Door Opening	Jammed shut	Jammed shut
Seat Track Shift	Unknown	Unknown
Seat Back Failure	Yes	Yes

VIDEO COVERAGE

Description	Number
High Speed Video Cameras	3
Real Time Video Cameras	2
Total	5

INSTRUMENTATION SUMMARY

Description	Number
Driver ATD Sensors	
Passenger ATD Sensors	
Bullet Vehicle Structure Accelerometers	3
Target Vehicle Structure Accelerometers	3
Total	6

DATA SHEET NO. 2

BULLET VEHICLE PARAMETER DATA

Bullet Vehicle: 1987 Ford Taurus 4-Door Sedan Project No.: P31015-01
 Target Vehicle: 1999 Jeep Grand Cherokee Laredo 5-Door MPV Test Date: 01/14/11

BULLET VEHICLE INFORMATION AND OPTIONS

Make	Ford
Year	1987
Model	Taurus
Body Style	4-Door Sedan
VIN	1FABP52U9HG192111
Body Color	White
Delivery Date	1/6/2011
Odometer Reading (mi)	90,218
Odometer Reading (km)	145,192
Dealer	n/a
Transmission	3-Speed Automatic
Final Drive	Front
Type / No. of Cylinders	V6
Engine Displacement (L)	3.0

Engine Placement	Transverse
Power Brakes	Yes
Front Disc Brakes	Yes
Rear Disc Brakes	No
Anti-Lock Brakes	No
Driver Front Airbag	No
Pass. Front Airbag	No
Power Windows	No
Power Steering	Yes
Tilt Wheel	Yes
Power Door Locks	No
Air Conditioning	Yes
Power Seat	No
AM/FM/Cassette	Yes

DATA FROM CERTIFICATION LABEL

Manufactured By	Ford Motor Co.
Date of Manufacture	Feb-87

GVWR (kg)	2084.0
GAWR Front (kg)	1137.0
GAWR Rear (kg)	967.0

VEHICLE SEATING AND CAPACITY WEIGHT INFORMATION

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Bench		
Number of Occupants	2	3		5
Capacity Weight (VCW) (kg)				408.0
Cargo Weight (RCLW) (kg)				67.8

DATA SHEET NO. 2 ... (CONTINUED)

BULLET VEHICLE PARAMETER DATA

Bullet Vehicle: 1987 Ford Taurus 4-Door Sedan Project No.: P31015-01
 Target Vehicle: 1999 Jeep Grand Cherokee Laredo 5-Door MPV Test Date: 01/14/11

BULLET VEHICLE WEIGHTS

	Units	As Delivered Weights (UVW)			As Tested Weights (ATW)		
		Front Axle	Rear Axle	Total	Front Axle	Rear Axle	Total
Left	kg	465.0	237.5		492.5	289.5	
Right	kg	448.0	226.5		484.5	273.0	
Ratio	%	66.3%	33.7%	100.0%	63.5%	36.5%	100.0%
Total	kg	913.0	464.0	1377.0	977.0	562.5	1539.5

BULLET VEHICLE TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	1377.0	A
Weight of Surrogate Occupants	kg	170.0	B
Rated Cargo/Luggage Weight (RCLW)	kg	67.8	C
Calculated Vehicle Target Weightt (TVTWT)	kg	1614.8	A+B+C

BULLET VEHICLE ATTITUDES

Condition	Units	LF	RF	LR	RR
As Delivered	mm	676	667	635	633
As Tested	mm	663	655	612	605
Post-Test	mm	674	698	673	609

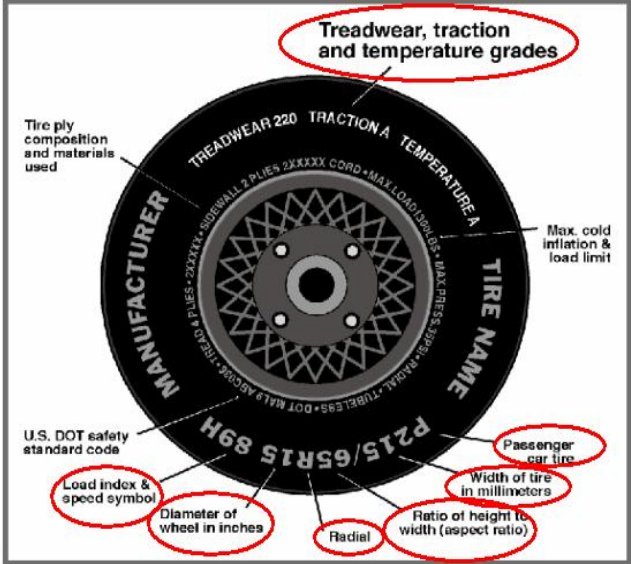
Description	Units	Value
Vehicle Components Removed	kg	0.0
Ballast Added	kg	31.0

BULLET VEHICLE COMPONENTS REMOVED:

None

DATA SHEET NO. 2 ... (CONTINUED)
BULLET VEHICLE PARAMETER DATA

Bullet Vehicle: 1987 Ford Taurus 4-Door Sedan Project No.: P31015-01
 Target Vehicle: 1999 Jeep Grand Cherokee Laredo 5-Door MPV Test Date: 01/14/11



BULLET VEHICLE TIRE INFORMATION

Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	245	245
Cold Pressure (kPa)	240	240
Recommended Tire Size	P195/70R14	P195/70R14
Tire Size on Vehicle	P195/70R14	P195/70R14
Tire Manufacturer	Futura	Futura
Tire Model	775	775
Treadwear	380	380
Traction	A	A
Temperature Grades	B	B
Tire Plies Sidewall	2 Polyester	2 Polyester
Tire Plies Body	2 Steel, 1 Polyester	2 Steel, 1 Polyester
Load Index / Speed Symbol	90S	90S
Tire Material	Polyester, Steel	Polyester, Steel
DOT Safety Code Left	U9RW XC8 0304 B126	U9RW XC8 0304 B126
DOT Safety Code Right	U9RW XC8 0304 B126	U9RW XC8 0304 B126

DATA SHEET NO. 3

BULLET VEHICLE ACCELEROMETER DATA

Bullet Vehicle: 1987 Ford Taurus 4-Door Sedan Project No.: P31015-01

Target Vehicle: 1999 Jeep Grand Cherokee Laredo 5-Door MPV Test Date: 01/14/11

BULLET VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Description	Location		
		X	Y	Z
1	Vehicle Center of Gravity	2231	0	305

Reference Points: X – Rear Surface of Vehicle (+ forward)
Y – Vehicle Centerline (+ to left)
Z – Ground Plane (+ up)

DATA SHEET NO. 4

BULLET VEHICLE ACCIDENT INVESTIGATION DATA

Bullet Vehicle: 1987 Ford Taurus 4-Door Sedan Project No.: P31015-01
 Target Vehicle: 1999 Jeep Grand Cherokee Laredo 5-Door MPV Test Date: 01/14/11

VEHICLE INFORMATION

VIN: 1FABP52U9HG192111 Wheelbase (mm): Unknown
 Vehicle Size Category: 4-Door Sedan Test Weight (kg): 1539.5

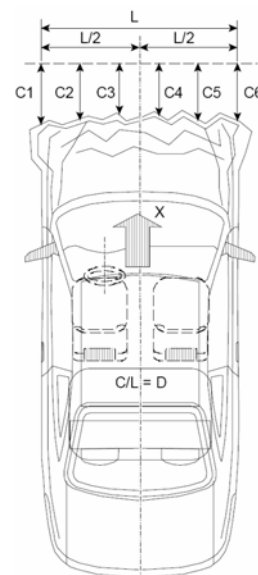
ACCELEROMETER DATA

Accelerometer Locations: Vehicle Center Tunnel
 Cal. Procedure/Interval: Drop Test / 6 months
 Integration Algorithm: NHTSA Standard
 Impact Velocity (km/h): 82.68
 Velocity Change (km/h): 51.0
 Time of Separation (msec): n/a

Linearity: Good

CRUSH PROFILE

Collision Deformation Classification: 01FZEW1
 Midpoint of Damage: Vehicle Centerline
 Damage Region Length (mm): 1545
 Impact Mode: Offset Frontal



No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush Zone 1 at Left Side	mm	170	70	100
C2	Crush Zone 2 at Left Side	mm	70	50	20
C3	Crush Zone 3 at Left Side	mm	30	90	-60
C4	Crush Zone 4 at Right Side	mm	30	135	-105
C5	Crush Zone 5 at Right Side	mm	70	190	-120
C6	Crush Zone 6 at Right Side	mm	173	240	-67
L	C1 to C6	mm	1545		

DATA SHEET NO. 5

TARGET VEHICLE PARAMETER DATA

Bullet Vehicle: 1987 Ford Taurus 4-Door Sedan Project No.: P31015-01
 Target Vehicle: 1999 Jeep Grand Cherokee Laredo 5-Door MPV Test Date: 01/14/11

TARGET VEHICLE INFORMATION AND OPTIONS

Make	Jeep
Year	1999
Model	Grand Cherokee Laredo
Body Style	5-Door MPV
VIN	1J4G25854XC703941
Body Color	Beige
Delivery Date	1/6/2011
Odometer Reading (mi)	205,542
Odometer Reading (km)	330,788
Dealer	n/a
Transmission	4-Speed Automatic
Final Drive	Rear
Type / No. of Cylinders	Inline 6
Engine Displacement (L)	4.0

Engine Placement	Longitudinal
Power Brakes	Yes
Front Disc Brakes	Yes
Rear Disc Brakes	Yes
Anti-Lock Brakes	Yes
Driver Front Airbag	Yes
Pass. Front Airbag	Yes
Power Windows	Yes
Power Steering	Yes
Tilt Wheel	Yes
Power Door Locks	Yes
Air Conditioning	Yes
Power Seat	No
AM/FM/Cassette	Yes

DATA FROM CERTIFICATION LABEL

Manufactured By	DaimlerChrysler Corporation
Date of Manufacture	Apr-99

GVWR (kg)	2336.0
GAWR Front (kg)	1134.0
GAWR Rear (kg)	1339.0

VEHICLE SEATING AND CAPACITY WEIGHT INFORMATION

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Bench		
Number of Occupants	2	3		5
Capacity Weight (VCW) (kg)				522.0
Cargo Weight (RCLW) (kg)				136.0

DATA SHEET NO. 5 ... (CONTINUED)

TARGET VEHICLE PARAMETER DATA

Bullet Vehicle: 1987 Ford Taurus 4-Door Sedan Project No.: P31015-01
 Target Vehicle: 1999 Jeep Grand Cherokee Laredo 5-Door MPV Test Date: 01/14/11

TARGET VEHICLE WEIGHTS

	Units	As Delivered Weights (UVW)			As Tested Weights (ATW)		
		Front Axle	Rear Axle	Total	Front Axle	Rear Axle	Total
Left	kg	472.0	372.5		510.0	431.5	
Right	kg	473.5	370.5		508.5	430.0	
Ratio	%	56.0%	44.0%	100.0%	54.2%	45.8%	100.0%
Total	kg	945.5	743.0	1688.5	1018.5	861.5	1880.0

TARGET VEHICLE TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	1688.5	A
Weight of Surrogate Occupants	kg	152.0	B
Rated Cargo/Luggage Weight (RCLW)	kg	136.0	C
Calculated Vehicle Target Weightt (TVTWT)	kg	1976.5	A+B+C

TARGET VEHICLE ATTITUDES

Condition	Units	LF	RF	LR	RR
As Delivered	mm	809	805	839	837
As Tested	mm	802	792	819	815
Post-Test	mm	769	821	996	842

Description	Units	Value
Vehicle Components Removed	kg	31.0
Ballast Added	kg	44.0

TARGET VEHICLE COMPONENTS REMOVED:

Rear Door Panels (8.0 kg), Front Door Panels (8.0 kg), Front Door Side Windows (12.0 kg)

Outboard Mirrors (3.0 kg)

DATA SHEET NO. 5 ... (CONTINUED)

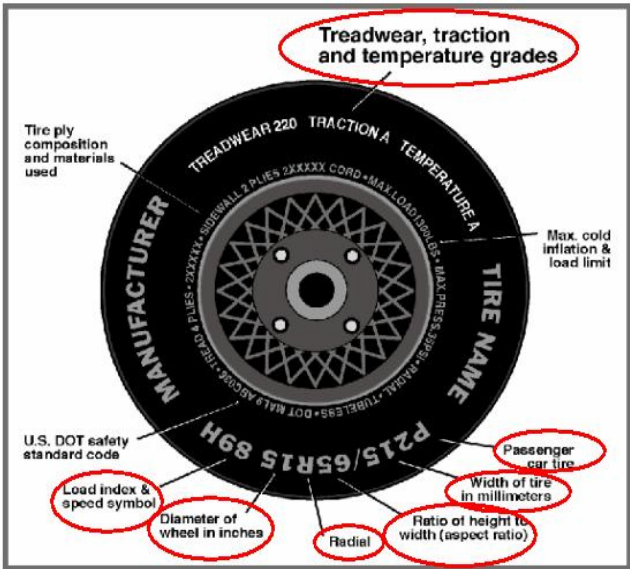
TARGET VEHICLE PARAMETER DATA

Bullet Vehicle: 1987 Ford Taurus 4-Door Sedan

Project No.: P31015-01

Target Vehicle: 1999 Jeep Grand Cherokee Laredo 5-Door MPV

Test Date: 01/14/11



TARGET VEHICLE TIRE INFORMATION

Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	300	300
Cold Pressure (kPa)	227	227
Recommended Tire Size	P225/75R16	P225/75R16
Tire Size on Vehicle	P245/70R16	P245/70R16
Tire Manufacturer	Hankook	Hankook
Tire Model	Dyna Pro AS	Dyna Pro AS
Treadwear	440	440
Traction	A	A
Temperature Grades	B	B
Tire Plies Sidewall	2 Polyester	2 Polyester
Tire Plies Body	2 Polyester, 2 Steel, 1Nylon	2 Polyester, 2 Steel, 1Nylon
Load Index / Speed Symbol	107S	107S
Tire Material	Polyester, Steel, Nylon	Polyester, Steel, Nylon
DOT Safety Code Left	1 GKJ NA H	1 GKJ NA H
DOT Safety Code Right	1 GKJ NA H	1 GKJ NA H

DATA SHEET NO. 6

TARGET VEHICLE ACCELEROMETER DATA

Bullet Vehicle: 1987 Ford Taurus 4-Door Sedan Project No.: P31015-01

Target Vehicle: 1999 Jeep Grand Cherokee Laredo 5-Door MPV Test Date: 01/14/11

TARGET VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Description	Location		
		X	Y	Z
1	Vehicle Center of Gravity	2231	0	305

Reference Points: X – Rear Surface of Vehicle (+ forward)
Y – Vehicle Centerline (+ to left)
Z – Ground Plane (+ up)

DATA SHEET NO. 7

TARGET VEHICLE ACCIDENT INVESTIGATION DATA

Bullet Vehicle: 1987 Ford Taurus 4-Door Sedan Project No.: P31015-01
 Target Vehicle: 1999 Jeep Grand Cherokee Laredo 5-Door MPV Test Date: 01/14/11

VEHICLE INFORMATION

VIN: 1J4G25854XC703941 Wheelbase (mm): 2696
 Vehicle Size Category: 5-Door MPV Test Weight (kg): 1880.0

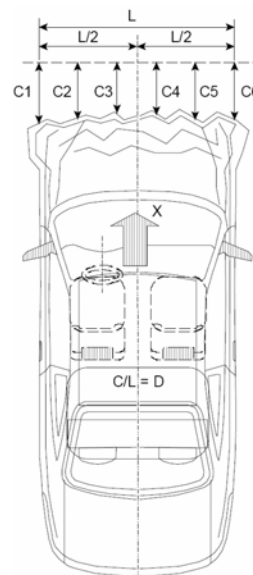
ACCELEROMETER DATA

Accelerometer Locations: Vehicle Center Tunnel
 Cal. Procedure/Interval: Drop Test / 6 months
 Integration Algorithm: NHTSA Standard
 Impact Velocity (km/h): 82.68
 Velocity Change (km/h): 41.8
 Time of Separation (msec): n/a

Linearity: Good

CRUSH PROFILE

Collision Deformation Classification: 07BLEW4
 Midpoint of Damage: Vehicle Centerline
 Damage Region Length (mm): 1516
 Impact Mode: Offset Rear



No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush Zone 1 at Left Side	mm	111	295	-184
C2	Crush Zone 2 at Left Side	mm	0	480	-480
C3	Crush Zone 3 at Left Side	mm	3	770	-767
C4	Crush Zone 4 at Right Side	mm	3	775	-772
C5	Crush Zone 5 at Right Side	mm	0	735	-735
C6	Crush Zone 6 at Right Side	mm	111	715	-604
L	C1 to C6	mm	1516		

DATA SHEET NO. 8

TARGET VEHICLE PROFILE MEASUREMENTS

Bullet Vehicle: 1987 Ford Taurus 4-Door Sedan Project No.: P31015-01
 Target Vehicle: 1999 Jeep Grand Cherokee Laredo 5-Door MPV Test Date: 01/14/11

TARGET VEHICLE PROFILE MEASUREMENTS

No.	Measurement Description	Pre-Test	Post-Test	Difference
1	Total Length of Vehicle at Centerline	4610	4330	280
2	Rear Surface of Vehicle to Front of Engine			
3	RSOV to Firewall			
4	FSOV to Upper Leading Edge of Right Door	2475	1400	1075
5	FSOV to Upper Leading Edge of Left Door	1377	1360	17
6	FSOV to Lower Leading Edge of Right Door	1421	1420	1
7	FSOV to Lower Leading Edge of Left Door	1422	1410	12
8	FSOV to Upper Trailing Edge of Right Door	3400	2484	916
9	FSOV to Upper Trailing Edge of Left Door	2467	2440	27
	FSOV to Trailing Edge of Right Door	2462	2484	-22
	FSOV to Trailing Edge of Left Door	2460	2440	20
10	FSOV to Lower Trailing Edge of Right Door	2481	2485	-4
11	FSOV to Lower Trailing Edge of Left Door	2489	2473	16
	FSOV to Upper Trailing Edge of Right Rear Door	3400	3409	-9
	FSOV to Upper Trailing Edge of Left Rear Door	3397	3271	126
	FSOV to Trailing Edge of Right Rear Door	3400	3409	-9
	FSOV to Trailing Edge of Left Rear Door	3397		¹
	FSOV to Lower Trailing Edge of Right Rear Door	3036	3045	-9
	FSOV to Lower Trailing Edge of Left Rear Door	3039	3039	0
	FSOV to Upper Trailing Edge of Right Rear Door	3400	3409	-9
	FSOV to Upper Trailing Edge of Left Rear Door	3397	3271	126
12	FSOV to Bottom of A-Pillar of Right Side	1422	1410	12
13	FSOV to Bottom of A-Pillar of Left Side	1420	1391	29
	FSOV to Bottom of B-Pillar on Right Side	2480	2491	-11
	FSOV to Bottom of B-Pillar on Left Side	2500	2480	20
	FSOV to Bottom of C-Pillar on Right Side	3363	3070	293
	FSOV to Bottom of C-Pillar on Left Side	3360	3022	338
14	RSOV to Firewall, Right Side			
15	RSOV to Firewall, Left Side			
16	FSOV to Steering Column	1895	1880	15
17	Center of Steering Column to A-Pillar	427	420	7
18	Center of Steering Column to Headliner	430	450	-20
19	FSOV to Right Side of Rear Bumper	3771	4271	-500
20	FSOV to Left Side of Rear Bumper	3778	3425	353

All measurements in millimeters.

¹ – Post-test measurement unavailable.

DATA SHEET NO. 9

TARGET VEHICLE STRUCTURAL MEASUREMENTS

Bullet Vehicle: 1987 Ford Taurus 4-Door Sedan Project No.: P31015-01
Target Vehicle: 1999 Jeep Grand Cherokee Laredo 5-Door MPV Test Date: 01/14/11

TARGET VEHICLE STRUCTURAL MEASUREMENTS

No.	Description	Pre-Test	Post-Test	Difference
1	Total Length	4610	4330	280
2	Total Width	1800	2085	-285
3	Bumper Top Height	696	505	191
4	Bumper Bottom Height	719	400	319
5	Longitudinal Member Top Height			
6	Distance Between Longitudinal Members			
7	Longitudinal Member Width			
8	Engine Top Height			
9	Engine Bottom Height			
10	Engine and Gearbox Width			
11	Front Bumper to Engine Distance			
12	Front Shock Absorber Fixing Height			
13	Bonnet Leading Edge Height			
14	Front Shock Absorber Fixing Width			
15	Front Bumper to Front Axle Distance			
16	Front Axle to A-Pillar Distance	590	580	10
17	A-Pillar to B-Pillar Distance	710	935	-225
	C-Pillar to Rear Axle Distance	442	350	92
18	B-Pillar to Rear Axle Distance	1013	690	323
19	B-Pillar to C-Pillar Distance	861	920	-59
20	Roof Sill Bottom Height	1521	1520	1
21	Roof Sill Top Height	1648	1643	5
22	Floor Sill Bottom Height	320	334	-14
23	Floor Sill Top Height	487	509	-22

All measurements in millimeters.

DATA SHEET NO. 10

TARGET VEHICLE INTRUSION MEASUREMENTS

Bullet Vehicle: 1987 Ford Taurus 4-Door Sedan Project No.: P31015-01

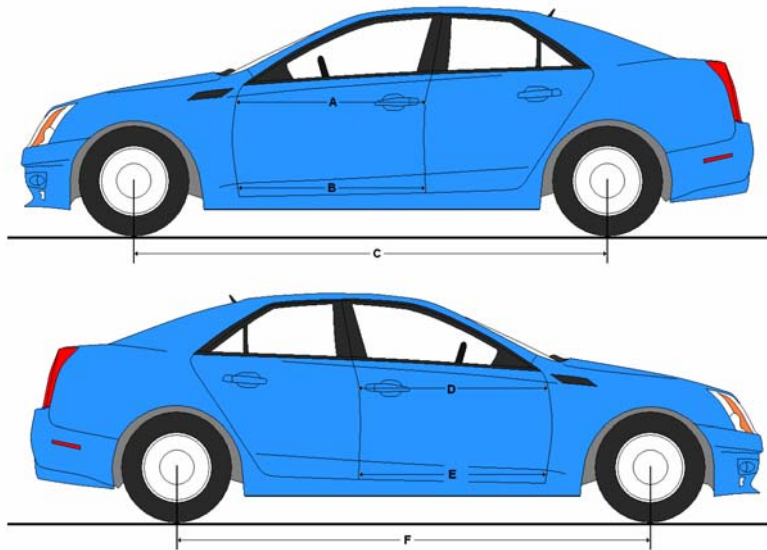
Target Vehicle: 1999 Jeep Grand Cherokee Laredo 5-Door MPV Test Date: 01/14/11

DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Front Upper	mm	1010	986	24
B	Left Side Front Lower	mm	927	916	11
	Left Side Rear Upper	mm	859		
	Left Side Rear Lower	mm	536		
D	Right Side Front Upper	mm	988	986	2
E	Right Side Front Lower	mm	928	927	1
	Right Side Rear Upper	mm	870		
	Right Side Rear Lower	mm	571		

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	2696	2364	332
F	Right Side Wheelbase	mm	2695	2636	59



² – Measurement unavailable, door will not open.

DATA SHEET NO. 10 ... (CONTINUED)

TARGET VEHICLE INTRUSION MEASUREMENTS

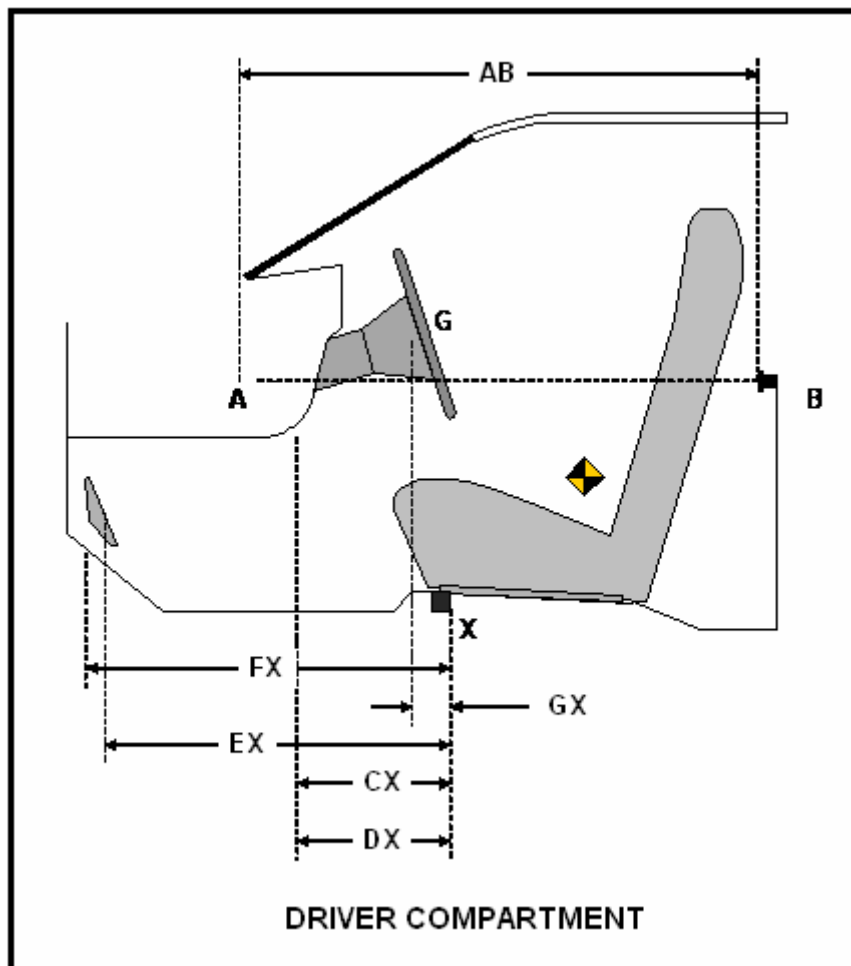
Bullet Vehicle: 1987 Ford Taurus 4-Door Sedan Project No.: P31015-01

Target Vehicle: 1999 Jeep Grand Cherokee Laredo 5-Door MPV Test Date: 01/14/11

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside Window Jam)	mm	866	836	30
CX	Left Knee Bolster to X	mm	342	360	-18
DX	Right Knee Bolster to X	mm	344	350	-6
EX	Brake Pedal to X	mm	575	570	5
FX	Foot Rest to X	mm	634	630	4
GX	Center of Steering Wheel Hub to X	mm	66	40	26

X = Front of Seat Track (Stationary)



**APPENDIX A
PHOTOGRAPHS**

TABLE OF PHOTOGRAPHS

Figure		Page
1	Bullet Vehicle, As-Received	A-1
2	Bullet Vehicle, As-Received	A-1
3	Bullet Vehicle Manufacturer's Label	A-2
4	Bullet Vehicle Tire Placard	A-2
5	Target Vehicle, As-Received	A-3
6	Target Vehicle, As-Received	A-3
7	Target Vehicle Manufacturer's Label	A-4
8	Target Vehicle Tire Placard	A-4
9	Test Setup, Left Side	A-5
10	Test Setup, Left Front $\frac{3}{4}$	A-5
11	Test Setup, Front	A-6
12	Test Setup, Right Front $\frac{3}{4}$	A-6
13	Test Setup, Right Side	A-7
14	Test Setup, Right Rear $\frac{3}{4}$	A-7
15	Test Setup, Rear	A-8
16	Test Setup, Left Rear $\frac{3}{4}$	A-8
17	Test Setup	A-9
18	Post-Test	A-9
19	Pre-Test Bullet Vehicle, Left Side	A-10
20	Post-Test Bullet Vehicle, Left Side	A-10
21	Pre-Test Bullet Vehicle, Left Front $\frac{3}{4}$	A-11
22	Post-Test Bullet Vehicle, Left Front $\frac{3}{4}$	A-11
23	Pre-Test Bullet Vehicle, Front	A-12
24	Post-Test Bullet Vehicle, Front	A-12
25	Pre-Test Bullet Vehicle, Right Front $\frac{3}{4}$	A-13
26	Post-Test Bullet Vehicle, Right Front $\frac{3}{4}$	A-13
27	Pre-Test Bullet Vehicle, Right Side	A-14
28	Post-Test Bullet Vehicle, Right Side	A-14
29	Pre-Test Target Vehicle, Left Side	A-15
30	Post-Test Target Vehicle, Left Side	A-15
31	Pre-Test Target Vehicle, Left Rear $\frac{3}{4}$	A-16
32	Pre-Test Target Vehicle, Left Rear $\frac{3}{4}$	A-16
33	Pre-Test Target Vehicle, Rear	A-17
34	Pre-Test Target Vehicle, Rear	A-17
35	Pre-Test Target Vehicle, Right Rear $\frac{3}{4}$	A-18

TABLE OF PHOTOGRAPHS ... (CONTINUED)

<u>Figure</u>		<u>Page</u>
36	Pre-Test Target Vehicle, Right Rear $\frac{3}{4}$	A-18
37	Pre-Test Target Vehicle, Right Side	A-19
38	Pre-Test Target Vehicle, Right Side	A-19



FIGURE 1. Bullet Vehicle, As-Received



FIGURE 2. Bullet Vehicle, As-Received

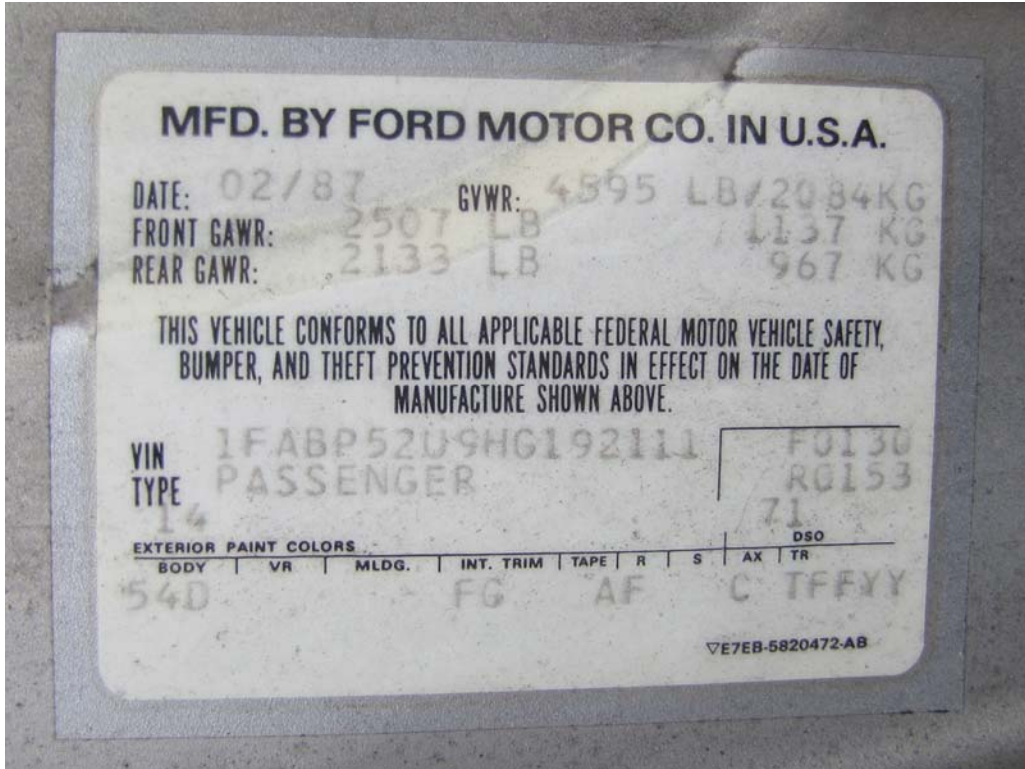


FIGURE 3. Bullet Vehicle Manufacturer's Label

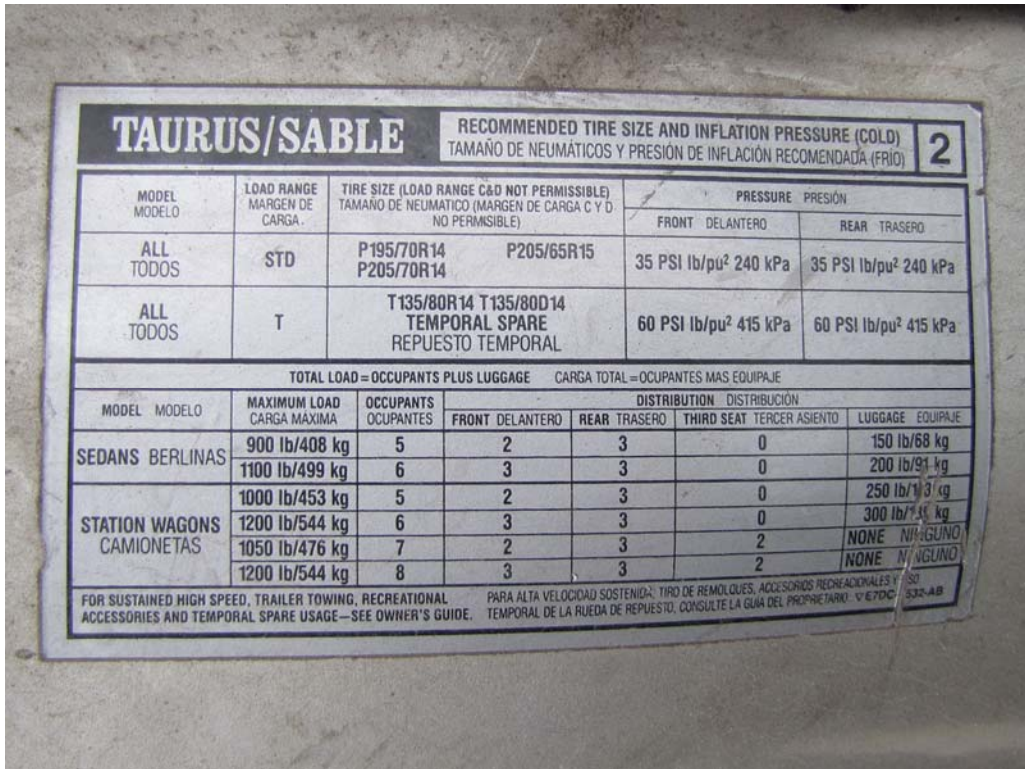


FIGURE 4. Bullet Vehicle Tire Placard



FIGURE 5. Target Vehicle, As-Received



FIGURE 6. Target Vehicle, As-Received

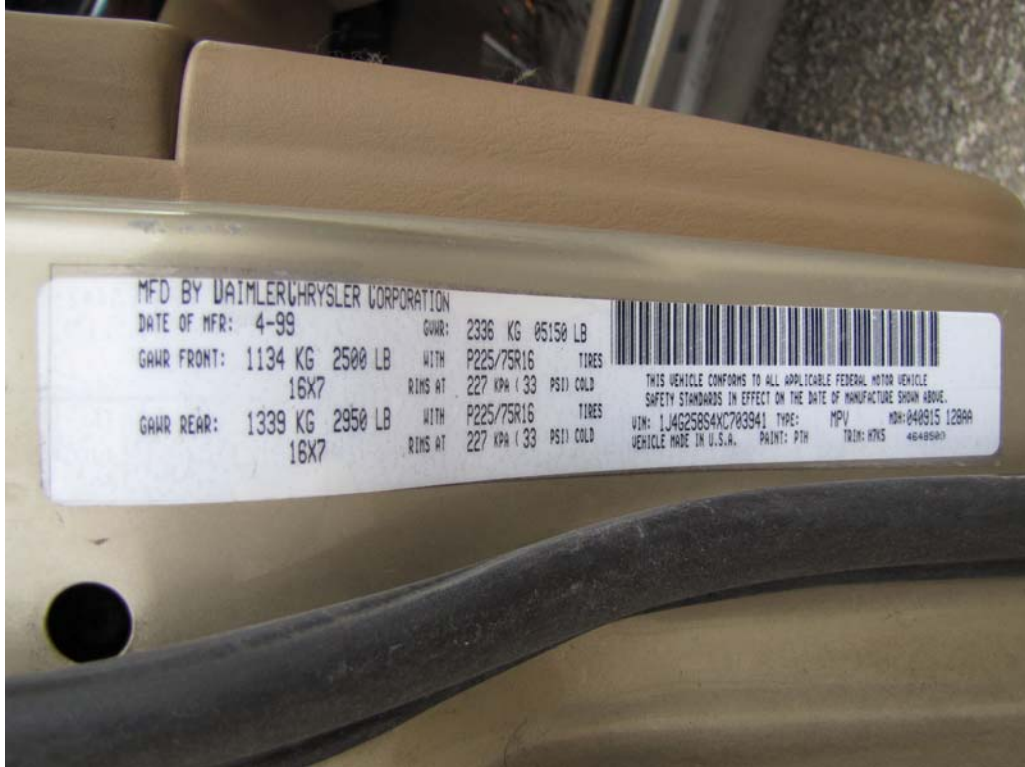


FIGURE 7. Target Vehicle Manufacturer's Label

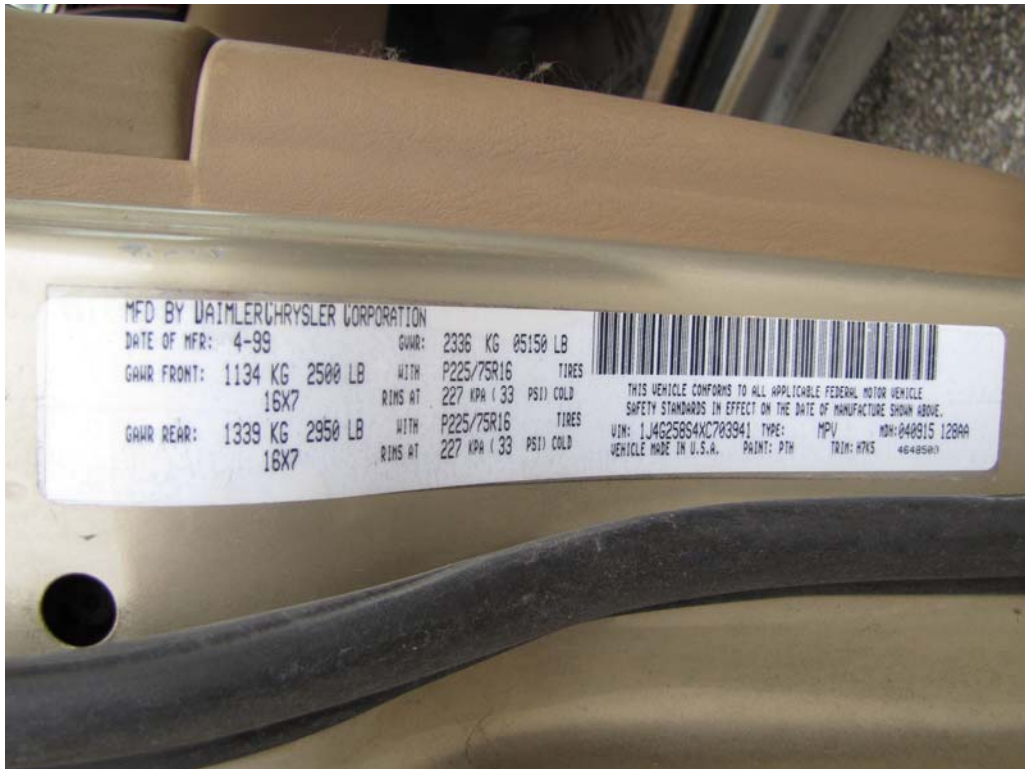


FIGURE 8. Target Vehicle Tire Placard



FIGURE 9. Test Setup, Left Side



FIGURE 10. Test Setup, Left Front $\frac{3}{4}$



FIGURE 11. Test Setup, Front



FIGURE 12. Test Setup, Right Front $\frac{3}{4}$



FIGURE 13. Test Setup, Right Side



FIGURE 14. Test Setup, Right Rear ¾



FIGURE 15. Test Setup, Rear



FIGURE 16. Test Setup, Left Rear $\frac{3}{4}$



FIGURE 17. Test Setup



FIGURE 18. Post Test



FIGURE 19. Pre-Test Bullet Vehicle, Left Side



FIGURE 20. Post-Test Bullet Vehicle, Left Side



FIGURE 21. Pre-Test Bullet Vehicle, Left Front $\frac{3}{4}$



FIGURE 22. Post-Test Bullet Vehicle, Left Front $\frac{3}{4}$



FIGURE 23. Pre-Test Bullet Vehicle, Front

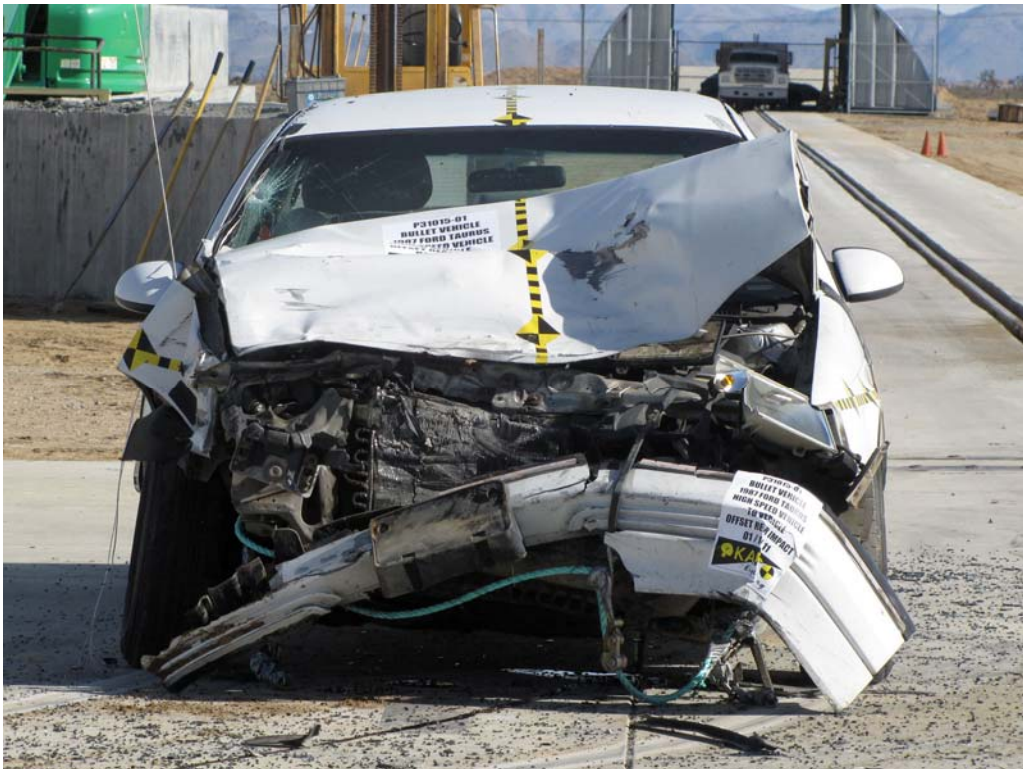


FIGURE 24. Post-Test Bullet Vehicle, Front



FIGURE 25. Pre-Test Bullet Vehicle, Right Front $\frac{3}{4}$



FIGURE 26. Post-Test Bullet Vehicle, Right Front $\frac{3}{4}$



FIGURE 27. Pre-Test Bullet Vehicle, Right Side



FIGURE 28. Post-Test Bullet Vehicle, Right Side



FIGURE 29. Pre-Test Target Vehicle, Left Side



FIGURE 30. Post-Test Target Vehicle, Left Side



FIGURE 31. Pre-Test Target Vehicle, Left Rear $\frac{3}{4}$



FIGURE 32. Post-Test Target Vehicle, Left Rear $\frac{3}{4}$



FIGURE 33. Pre-Test Target Vehicle, Rear

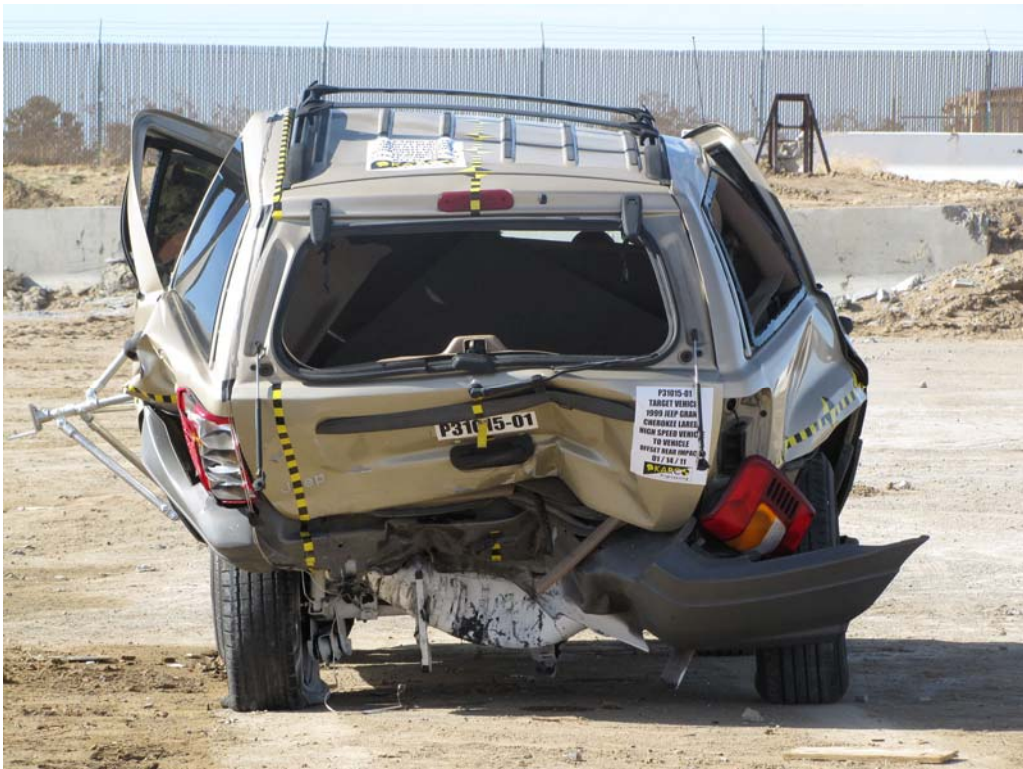


FIGURE 34. Post-Test Target Vehicle, Rear



FIGURE 35. Pre-Test Target Vehicle, Right Rear $\frac{3}{4}$



FIGURE 36. Post-Test Target Vehicle, Right Rear $\frac{3}{4}$



FIGURE 37. Pre-Test Target Vehicle, Right Side



FIGURE 38. Post-Test Target Vehicle, Right Side

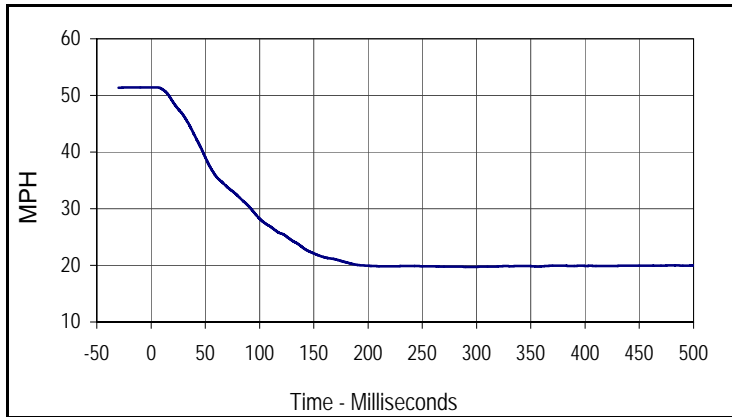
APPENDIX B
INSTRUMENTATION DATA TRACES

TABLE OF DATA PLOTS

<u>Plot</u>		<u>Page</u>
1	Bullet Vehicle Center Tunnel X	B-1
2	Bullet Vehicle Center Tunnel Y	B-1
3	Bullet Vehicle Center Tunnel Z	B-1
4	Bullet Vehicle Center Tunnel Resultant	B-1
5	Bullet Vehicle Center Tunnel X Velocity	B-2
6	Target Vehicle Center Tunnel X	B-3
7	Target Vehicle Center Tunnel Y	B-3
8	Target Vehicle Center Tunnel Z	B-3
9	Target Vehicle Center Tunnel Resultant	B-3
10	Target Vehicle Center Tunnel X Velocity	B-4

Test Vehicle: 1987 Ford Taurus 4-Dr Sedan
 Test Program: 50 MPH 70% 301 Rear Impact

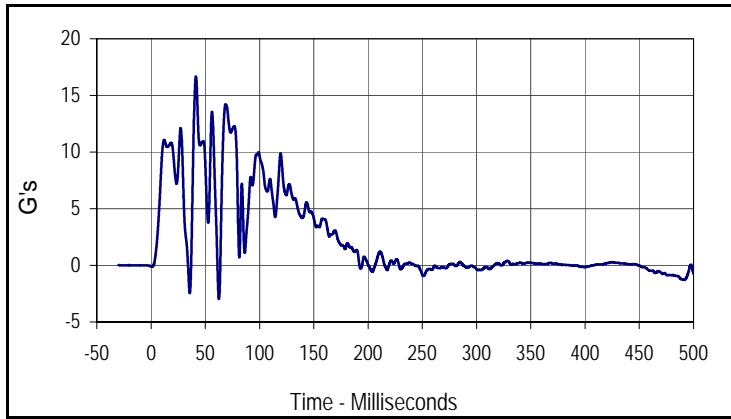
Project No.: P31015-01
 Test Date: 1/14/11



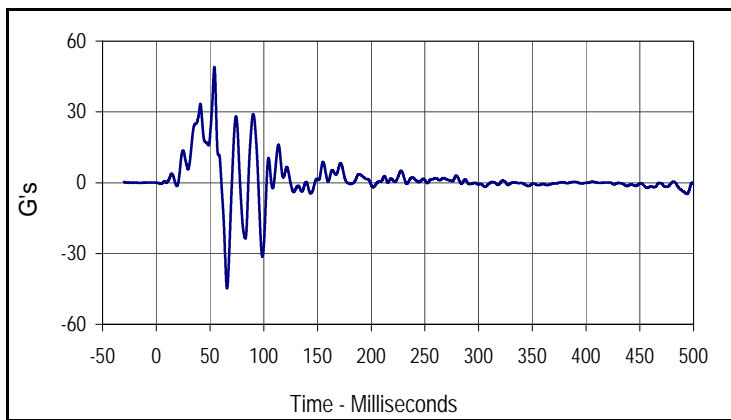
Curve Description			
Bullet Vehicle Center Tunnel X Velocity			
CURNO	Type	SAE Class	Units
005	IN1	180	MPH
Max	Time	Min	Time
51.4	4.3	19.7	297.2

Test Vehicle: 1999 Jeep Grand Cherokee Laredo 5-Dr MPV
 Test Program: 50 MPH 70% 301 Rear Impact

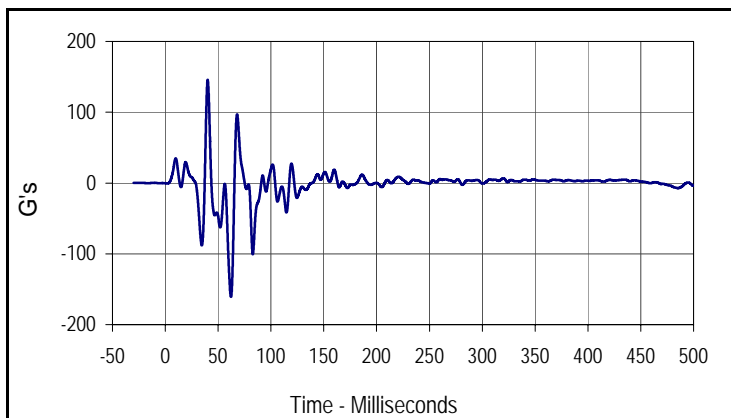
Project No.: P31015-01
 Test Date: 1/14/11



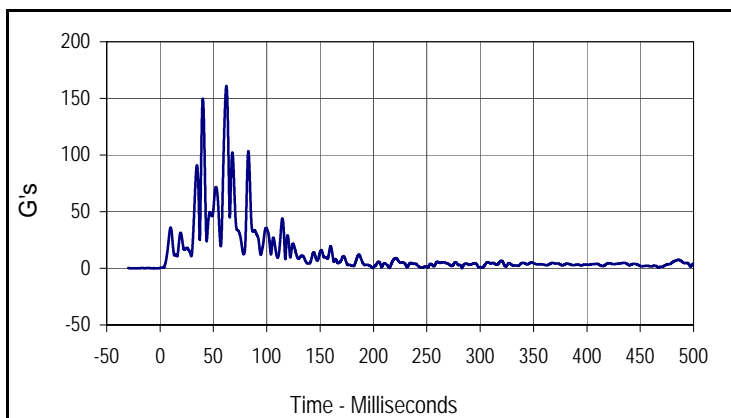
Curve Description			
Target Vehicle Center Tunnel X			
CURNO	Type	SAE Class	Units
006	FIL	60	G's
Max	Time	Min	Time
16.7	41.4	-3.0	62.6



Curve Description			
Target Vehicle Center Tunnel Y			
CURNO	Type	SAE Class	Units
007	FIL	60	G's
Max	Time	Min	Time
49.0	54.1	-44.8	65.8



Curve Description			
Target Vehicle Center Tunnel Z			
CURNO	Type	SAE Class	Units
008	FIL	60	G's
Max	Time	Min	Time
145.7	40.1	-160.7	62.2



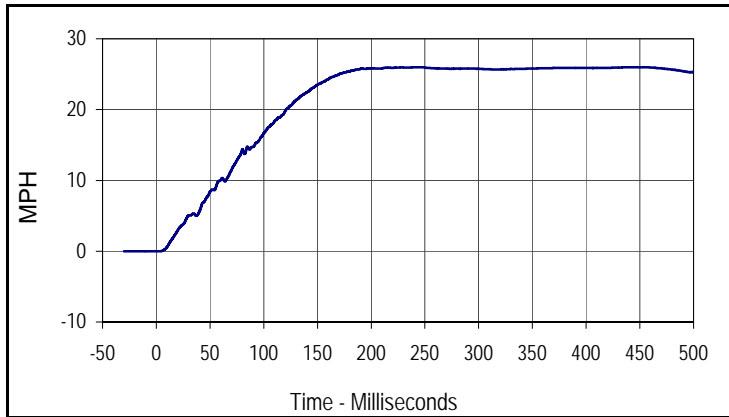
Curve Description			
Target Vehicle Center Tunnel Resultant			
CURNO	Type	SAE Class	Units
009	RES	60	G's
Max	Time	Min	Time
161.1	62.2	0.1	283.0

Test Vehicle: 1999 Jeep Grand Cherokee Laredo 5-Dr MPV

Project No.: P31015-01

Test Program: 50 MPH 70% 301 Rear Impact

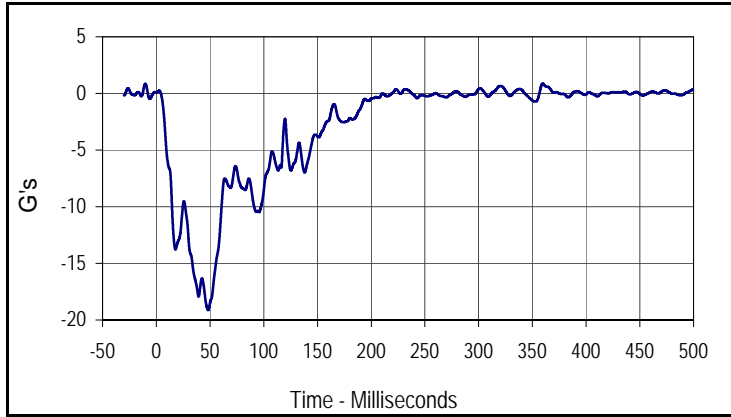
Test Date: 1/14/11



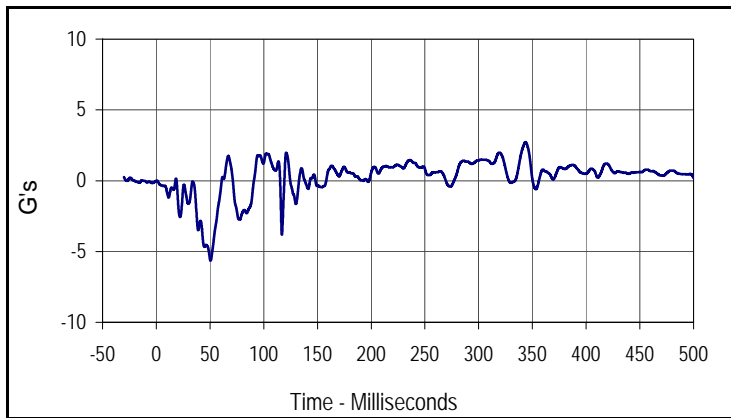
Curve Description			
Target Vehicle Center Tunnel X Velocity			
CURNO	Type	SAE Class	Units
010	IN1	180	MPH
Max	Time	Min	Time
26.0	448.5	0.0	1.3

Test Vehicle: 1987 Ford Taurus 4-Dr Sedan
 Test Program: 50 MPH 70% 301 Rear Impact

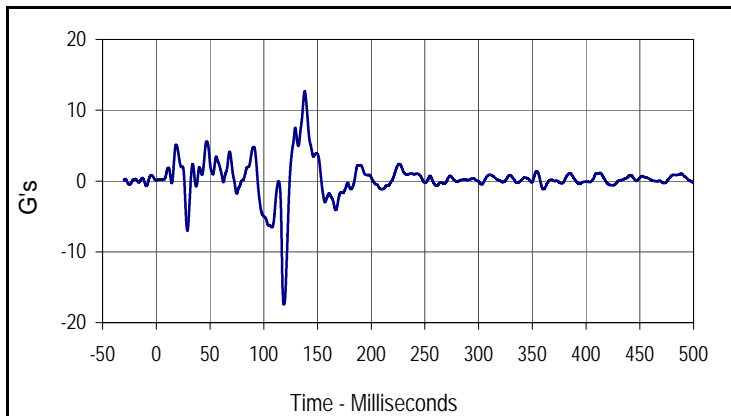
Project No.: P31015-01
 Test Date: 1/14/11



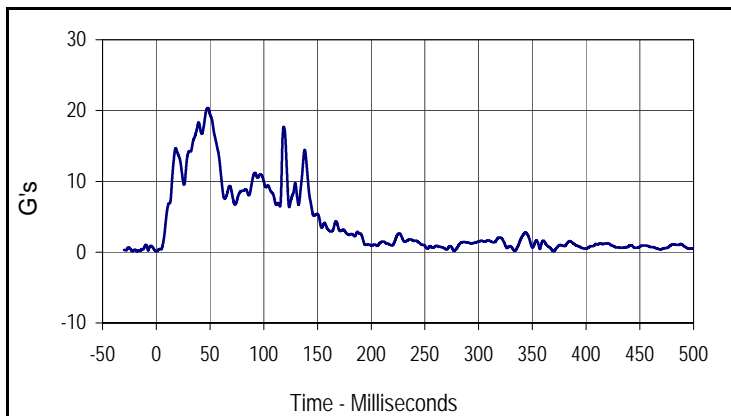
Curve Description			
Bullet Vehicle Center Tunnel X			
CURNO	Type	SAE Class	Units
001	FIL	60	G's
Max	Time	Min	Time
0.9	359.6	-19.1	48.3



Curve Description			
Bullet Vehicle Center Tunnel Y			
CURNO	Type	SAE Class	Units
002	FIL	60	G's
Max	Time	Min	Time
2.7	343.6	-5.6	50.6



Curve Description			
Bullet Vehicle Center Tunnel Z			
CURNO	Type	SAE Class	Units
003	FIL	60	G's
Max	Time	Min	Time
12.7	138.2	-17.4	118.7



Curve Description			
Bullet Vehicle Center Tunnel Resultant			
CURNO	Type	SAE Class	Units
004	RES	60	G's
Max	Time	Min	Time
20.4	48.0	0.1	0.0

APPENDIX C
INSTRUMENTATION DATA CHANNEL ASSIGNMENTS

**50 MPH 70% 301 Rear Impact
Instrumentation Data Channel Assignments
Vehicle Accelerometers
1/14/11
1987 Ford Taurus 4-Dr Sedan**

CH.	LOCATION	AXIS	IDENT. NO.	DESCRIPTION	MFR	MODEL	UNITS
1	VEHICLE CENTER TUNNEL	X	KETX12A	Accel., Vehicle block	I.C. Sensor	3031-200	G
2	VEHICLE CENTER TUNNEL	Y	KETX12B	Accel., Vehicle block	I.C. Sensor	3031-200	G
3	VEHICLE CENTER TUNNEL	Z	KETX12C	Accel., Vehicle block	I.C. Sensor	3031-500	G

1999 Jeep Grand Cherokee Laredo 5-Dr MPV

6	VEHICLE CENTER TUNNEL	X	KETX13X	Accel., Vehicle block	I.C. Sensor	3031-200	G
7	VEHICLE CENTER TUNNEL	Y	KETX13Y	Accel., Vehicle block	I.C. Sensor	3031-200	G
8	VEHICLE CENTER TUNNEL	Z	KETX13Z	Accel., Vehicle block	I.C. Sensor	3031-200	G