REPORT NUMBER: TO1-MGA-2001-006

RIGID POLE SIDE IMPACT TESTS
2002 FORD EXPLORER

ES-2 DRIVER POSITION

PREPARED BY:
MGA RESEARCH CORPORATION
5000 WARREN ROAD
BURLINGTON, WI 53105

December 18, 2001

FINAL REPORT

PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
VOLPE NATIONAL TRANSPORTATION SYSTEM CENTER
55 BROADWAY, KENDALL SQUARE
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This final test report was prepared for the U.S. Department of Transportation, Volpe National Transportation System Center, under Contract No. DTRS57-98-D-00041.

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TABLE OF CONTENTS

SECTION 1
PURPOSE AND TEST PROCEDURE

This Side Impact test is conducted as part of Contract No. DTRS57-98-D-00041, task order 1, sponsored by the U.S. Department of Transportation, Volpe National Transportation System Center. The purpose of this test is to evaluate the responses of the ES-2 dummy in a 2002 Ford Explorer, with side curtain airbag, subjected to a rigid pole side impact.

MGA does not endorse or certify products. The manufacturer's name appears solely for identification purposes.

SECTION 2
SUMMARY OF SIDE IMPACT TEST

A rigid pole side impact test was performed on a model year 2002 Ford Explorer with side curtain airbag. The subject vehicle was towed into a rigid pole at a velocity of 28.0 km/h. The specified impact velocity range is from 27.2 to 28.8 km/h. The test vehicle was positioned 90° to the line of forward motion. The weight of the vehicle as tested was 2218.6 kg. The test was conducted at MGA Research Corporation in Burlington, Wisconsin, on December 18, 2001. Pre- and post-test photographs of the test vehicle and the dummies are included in Appendix A.

One ES-2 side impact dummy was placed in the left front designated seating position according to instructions specified in the FMVSS 201P Laboratory Test Procedure which is dated April 21, 2000 and Evaluation of Eurosid-1 Positioning Procedure Appendix A dated February 5, 1997. The side impact event was documented by ten high speed cameras. Camera locations and other pertinent camera information can be found in this report.

Appendix B contains the vehicle and dummy response data traces. A summary of the side impact dummy (ES-2) configuration and performance verification test data is shown in Appendix C. Dummy and vehicle calibration data can be found in Appendix D of this report.

Appendix E contains a copy of the ES-2 dummy positioning procedure used and Appendix F contains the ES-2 peak responses.

The following table summarizes the results of the Left Side Impact test:

		Left Front
1) Head Performance Criteria - Not calculated due to head impact with airbag		
2) Thorax Performance Criteria		
2.1) Chest Deflection < 42 mm	Upper Rib Deflection	26
	Mid Rib Deflection	46
	Lower Rib Deflection	43
2.2) Viscous Criteria < 1.0 (m/sec)	Upper Rib	0.38
	Mid Rib	0.88
	Lower Rib	0.74
3) Abdominal Protection Criterion		
Sum < 2500 N	Front Abdominal Force	141
	Mid Abdominal Force	637
	Rear Abdominal Force	1372
	Sum of Abdominal Force	2074
4) Pelvis Performance Criterion		
< 6000 N	Pubic Symphysis Force	1262

		Left Front
HIC	T1 (msec)	50.5
	T2 (msec)	73.1
	T2 - T1 (msec)	22.6
	HIC	208

Fir Filtered	Left Front
Upper Rib Y (g's)	134.0
Mid Rib Y (g's)	131.6
Lower Rib Y (g's)	173.6
Lower Spine Y (g's)	63.8
Pelvis Y (g's)	46.7
TTI (g's)	119

Contacts	Left Front
Head (msec)	Not recorded to avoid interference with curtain airbag deployment
Arm (msec)	40.2
Rib (msec)	38.1
Pelvis (msec)	39.8

TEST NOTES

A complete data set, including all ES-2 instrumentation, can be found by accessing the electronic data from the U.S. Department of Transportation.

The following load cell channels were found to be bad during pre test calibration and inspection:

Driver T-12 - MX

SECTION 3

SIDE IMPACT DUMMY (ES-2) AND VEHICLE TEST DATA

DATA SHEET NO. 1

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2002/Ford/Explorer/4WD Test Date: December 18, 2001

TEST VEHICLE INFORMATION

Make	Ford
Model	Explorer
Body Style	4 door
VIN	1FMDU72E82UB14066
Color	Painted Orange
Odometer Reading	328
Transmission	automatic
Final Drive	4WD
Number of Cylinders	6
Engine Displacement	4.0 L
Engine Placement	longitudinal

TEST VEHICLE OPTIONS

Front Airbags	yes
Curtain Airbags	yes
Power Windows	yes
Power Steering	yes
Power Door Locks	yes
Tilt Wheel	yes
Air Conditioning	yes
Power Brakes	yes
Anti-lock Brakes	yes
AM/FM/Cassette	yes
Cruise Control	yes

DATA FROM CERTIFICATION LABEL

Manufactured By	Ford Motor Co.
Date of Manufacture	09/01

GVWR (kg)	2648
GAWR Front (kg)	1195
GAWR Rear (kg)	1508

DATA FROM TIRE PLACARD

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	207	241
Cold Pressure (kPa)	207	241
Recommend Tire Size	P235/70R16	P235/70R16
Tire Size on Vehicle	P235/70R16	P235/70R16
Tire Manufacturer	Michelin	Michelin

Measured Parameter	Front	Rear	Third	Total
Type of Seats	bucket	bench		
Number of Occupants	2	3		5
Capacity Wt. (VCW) (kg)				492.6
Cargo Weight (RCLW) (kg)				136.1

DATA SHEET NO. 1...(continued)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2002/Ford/Explorer/4WD Test Date: December 18, 2001

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	527.1	480.8		568.4	546.6	
Right	kg	544.3	456.3		592.4	511.2	
Ratio	%	53.3	46.7		52.3	47.7	
Totals	kg	1071.4	937.1	2008.5	1160.8	1057.8	2218.6

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	2008.5
Weight of 1 P572F Side Impact Dummy	kg	80.7
Rated Cargo/Luggage Weight (RCLW)	kg	136.1
Vehicle Target Weight (TVTW)	kg	2225.3

TEST VEHICLE ATTITUDES

	Units	As Delivered	Fully Loaded	Ready for Test
Right Door Sill Angle	deg	0.9 ND	0.5 ND	0.9 ND
Left Door Sill Angle	deg	0.8 ND	0.4 ND	0.5 ND
Front Bumper Angle	deg	0.4 RD	0.4 LD	0.4 LD
Rear Bumper Angle	deg	0.1 LD	0.3 LD	0.3 LD

ND = Nose Down, BD = Back Down, LD = Left Down, RD = Right Down

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Test Vehicle Wheel Base	mm	2886
Total Vehicle Length at Left Side	mm	4015
Total Vehicle Length at Centerline	mm	4805
Total Vehicle Length at Right Side	mm	4015
Weight of Ballast in Cargo Area	kg	24.9
Amount of Water in Fuel Tank	liters	85.2

TEST VEHICLE VERTICAL IMPACT LINE DATA

Measurement Description	Units	Value
Actual Impact Point	mm	3 rear

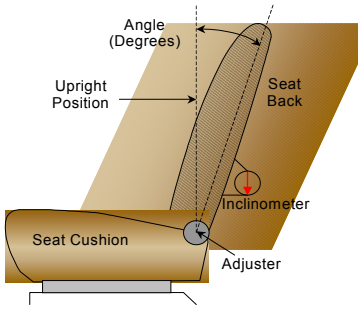
DATA SHEET NO. 1...(continued)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2002/Ford/Explorer/4WD Test Date: December 18, 2001

NORMAL DESIGN RIDING POSITION

Driver seat back angle: 16.0 deg. (Moved forward 3.5 deg from original location to achieve 50 mm head clearance)



FRONT SEAT ASSEMBLY

SEAT FORE/AFT POSITIONS

The driver's seat is manually operated.

Driver seat fore/aft total travel: 26 positions

Driver seat fore/aft position: 14th position, 1st as "1"

SEAT BELT UPPER ANCHORAGE

The test vehicle "D" ring anchorage for the driver's seat position was placed in the third position of 5, top position as "1".

STEERING COLUMN ADJUSTMENT

The steering column was placed in the mid position of travel.

DATA SHEET NO. 2

POST TEST OBSERVATIONS

Test Vehicle: 2002/Ford/Explorer/4WD Test Date: December 18, 2001

TEST DUMMY INFORMATION AND CONTACT POINTS

Description	Left Front
Dummy Type	ES-2/009
Head Contact	Side curtain airbag, side header
Upper Torso Contact	Mid door trim panel
Lower Torso Contact	Door trim panel below armrest
Left Knee Contact	Door trim panel below armrest
Right Knee Contact	Left knee

POST TEST DOOR OPENING

Description	Front	Rear
Left Side Door Opening	Remained closed	Remained closed
Right Side Door Opening	Remained closed	Remained closed

POST TEST STRUCTURAL OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions
Pillar Performance	No failures
Sill Separation	None
Windshield Damage	Windshield cracked
Window Damage	Left side window down for test
Other Notable Effects	None

AIRBAG DEPLOYMENT

	Driver
Front	no
Side	
Curtain	yes

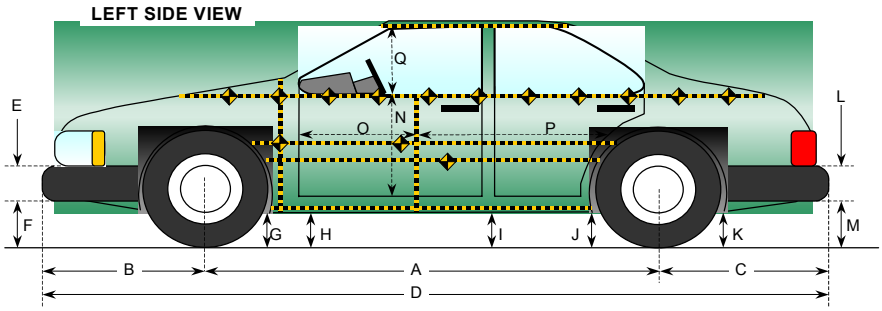
SECTION 4

OCCUPANT AND VEHICLE INFORMATION

DATA SHEET NO. 3

VEHICLE PRE-TEST AND POST-TEST MEASUREMENTS

Test Vehicle: 2002/Ford/Explorer/4WD Test Date: December 18, 2001



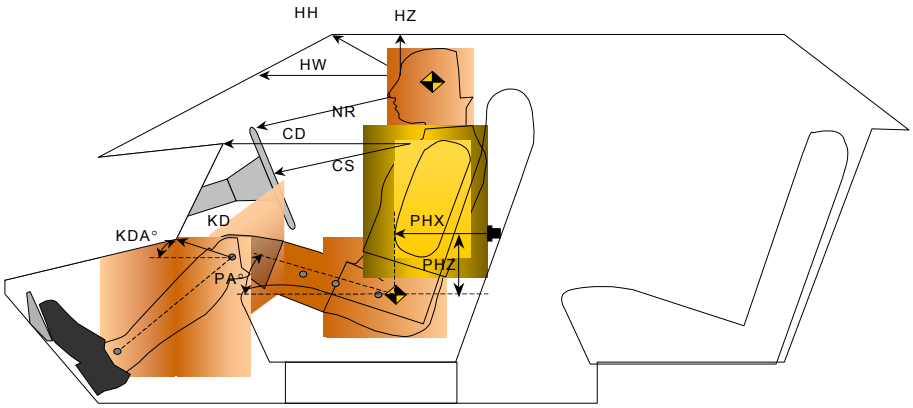
All Measurements in mm

Code	Measurement Description	Pre-Test	Post-Test	Difference
A	Wheelbase	2886	2816	-70
B	Front Axle to FSOV	830	825	-5
C	Rear Axle to RSOV	1089	1079	-10
D	Total Length at Centerline	4805	4720	-85
E	Front Bumper Thickness	349	349	0
F	Front Bumper Bottom to Ground	381	379	-2
G	Sill Height at Front Wheel Well	340	341	1
H	Sill Height at Front Door Leading Edge	348	349	1
I	Sill Height at "B" Pillar	386	398	12
J1	Sill Height at Rear Wheel Well	382	402	20
J2	Pinch Weld Height at Rear Wheel Well	381	405	23
K	Sill Height Aft of Rear Wheel Well	451	462	11
L	Rear Bumper Thickness	98	98	0
M	Rear Bumper Bottom to Ground	576	613	37
N	Sill Height to Window Bottom Sill	834	818	-16
O	Front Door Leading Edge to Impact CL	900	899	-1
P	Rear Door Trailing Edge to Impact CL	1128	1154	26
Q	Front Window Opening	520	488	-32
R	Right Side Length	4015	4030	15
S	Left Side Length	4015	3891	-124
T	Vehicle Width at "B" Post	1818	1477	-341

DATA SHEET NO. 4

ES-2 LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2002/Ford/Explorer/4WD Test Date: December 18, 2001

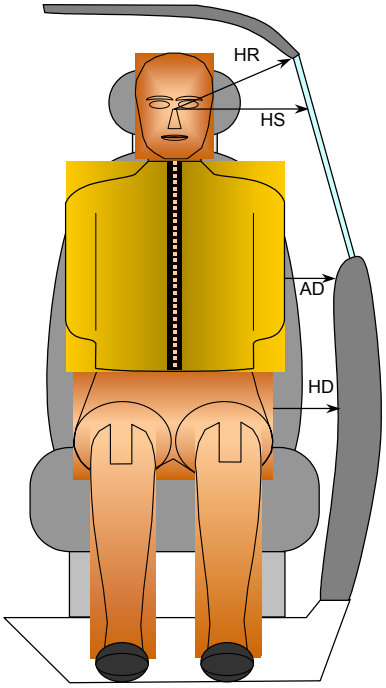


Driver Code	Measurement Description	Left Front	
		Length(mm)	Angle(°)
HH	Head to Header	374	
HW	Head to Windshield	513	
HZ	Head to Roof	163	
NR	Nose to Rim	390	
CD	Chest to Dash	516	
CS	Chest to Steering Wheel	313	
KDL	Left Knee to Dash	232	0.0
KDR	Right Knee to Dash	214	0.0
PA	Pelvic Angle (Longitudinal)		19.4
PA	Pelvic Angle (Lateral)		0.6
SA	Spine Angle (Longitudinal)		20.8
SA	Spine Angle (Lateral)		0.7
PHX	H-Point to Striker (X-Axis)	209	
PHZ	H-Point to Striker (Z-Axis)	24	

DATA SHEET NO. 5

ES-2 LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2002/Ford/Explorer/4 door Test Date: December 18, 2001



FRONT VIEW OF DUMMY

Code	Measurement Description	Units	Left Front
HR	Head to Side Header	mm	191
HS	Head to Side Window	mm	319
AD	Arm to Door	mm	82
HD	H-Point to Door	mm	139

DATA SHEET NO. 6

DUMMY POSITIONING

Test Vehicle: 2002/Ford/Explorer/4WD Test Date: December 18, 2001

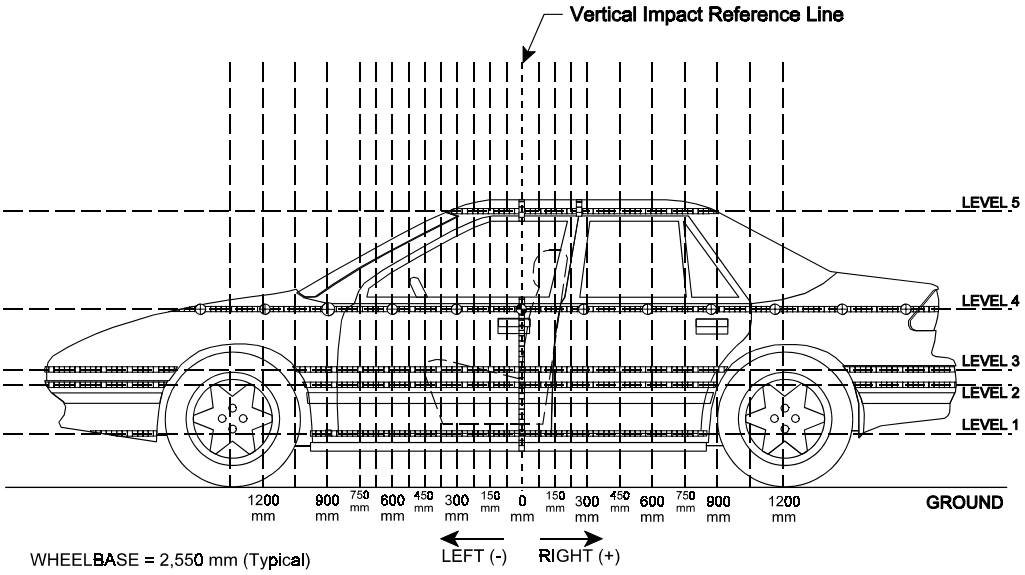
	Left Front		
	H-Point Machine	Dummy H Point	Dummy H Point after seat back adjustment
HP to Floor Z (mm)	295	306	310
HP to Hinge X (mm)	815	820	820
HP to Sill Y (mm)	141	151	151
HP to Striker X (mm)	314	315	315
HP to Dash X (mm)	595	599	598
HP to Header Z (mm)	784	774	774
H-POINT MACHINE (deg)			
Left Knee	134		
Right Knee	132		
Left Foot	110		
Right Foot	73		
Left Leg (mm)	149		
Right Leg (mm)	145		
Hip Angle	103		
Back Angle	23		

DATA SHEET NO. 7

VEHICLE SIDE MEASUREMENTS

Test Vehicle: 2002/Ford/Explolrer/4WD Test Date: December 18, 2001

PRETEST AND POST TEST EXTERIOR PROFILE MEASUREMENTS



LEFT SIDE VIEW

Measurements are taken with vehicle in the as tested condition.

Measurements along the vertical 0 mm.

Level	Measurement Description	Units	Height Above Ground
5	Window	mm	1645
4	Window Sill	mm	1106
3	Occupant H-Point	mm	796
2	Mid Door	mm	727
1	Sill Top	mm	430

DATA SHEET NO. 8

VEHICLE EXTERIOR CRUSH PROFILES

Test Vehicle: 2002/Ford/Explorer/4WD Test Date: December 18, 2001

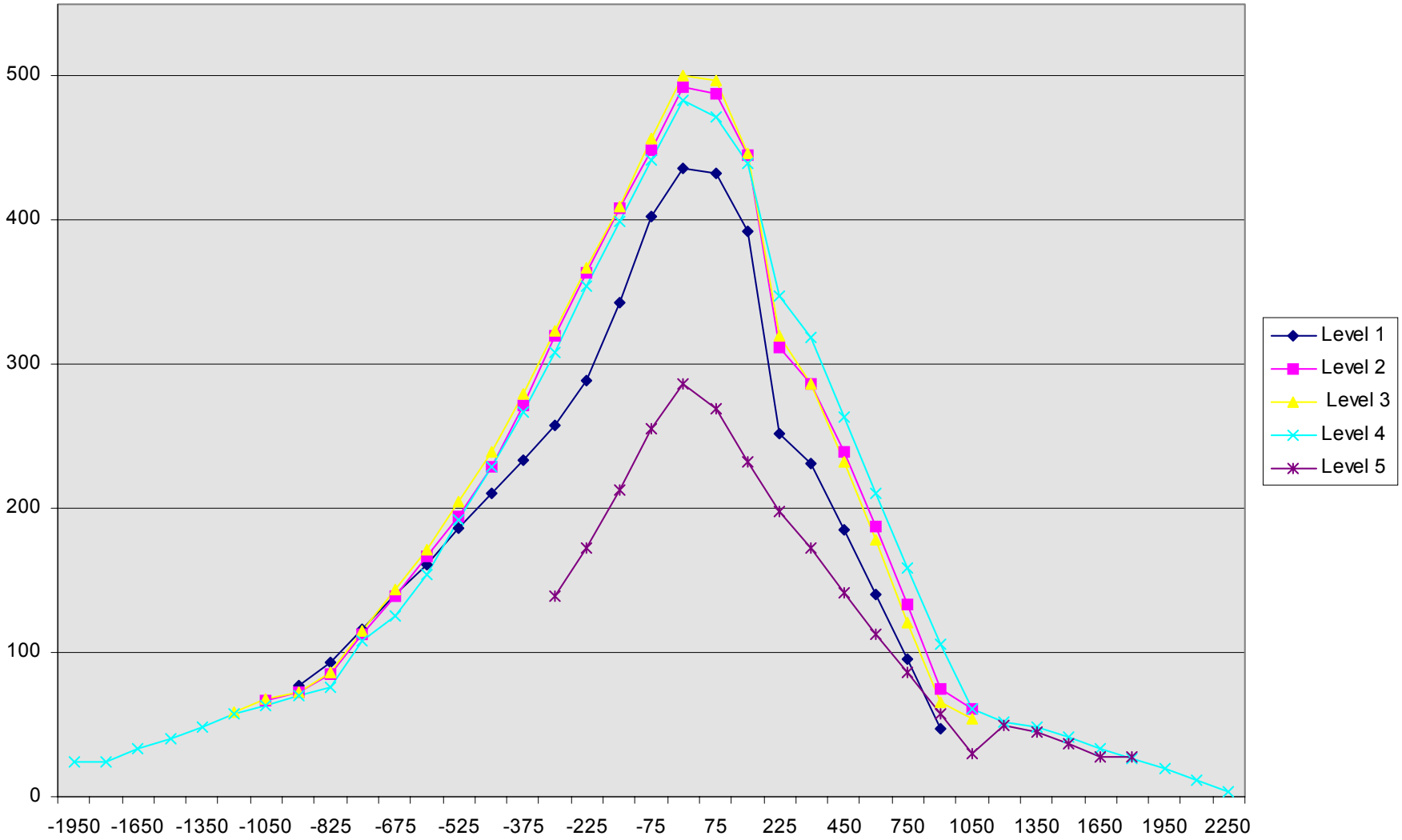
	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-2100															
-1950				188					212					24	
-1800				173					197					24	
-1650				160					193					33	
-1500				149					189					40	
-1350				142					190					48	
-1200			90	136				149	193				59	57	
-1050		93	94	133			160	162	196			67	68	63	
-900	140	104	98	129		217	177	171	199		77	73	73	70	
-825	141	103	98	129		234	188	184	205		93	85	86	76	
-750	140	99	96	129		256	212	211	237		116	113	115	108	
-675	140	99	95	128		280	238	239	253		140	139	144	125	
-600	140	98	95	126		301	265	267	280		161	167	172	154	
-525	139	97	94	125		325	292	299	317		186	195	205	192	
-450	138	99	94	125		349	328	333	354		211	229	239	229	
-375	138	98	93	125		372	370	373	392		234	272	280	267	
-300	139	98	92	124	336	397	418	415	432	475	258	320	323	308	139
-225	139	98	92	124	331	428	462	459	478	504	289	364	367	354	173
-150	139	97	92	124	330	482	506	502	523	543	343	409	410	399	213
-75	139	97	92	123	329	542	546	549	565	585	403	449	457	442	256
0	138	97	92	122	330	574	590	592	605	617	436	493	500	483	287
75	137	97	92	122	330	570	585	589	594	599	433	488	497	472	269
150	136	97	92	122	331	528	542	539	561	563	392	445	447	439	232
225	139	97	92	122	331	391	409	412	470	529	252	312	320	348	198
300	140	97	92	122	331	371	384	379	441	504	231	287	287	319	173
450	141	98	94	123	332	326	337	326	387	473	185	239	232	264	141
600	144	100	95	124	333	284	287	273	335	446	140	187	178	211	113
750	145	101	97	125	336	240	235	218	284	422	95	134	121	159	86
900	149	102	98	126	340	196	177	164	232	398	47	75	66	106	58
1050		98	85	128	342		159	139	189	372		61	54	61	30
1200				132	346				184	396				52	50
1350				136	349				184	394				48	45
1500				139	353				180	390				41	37
1650				143	364				176	392				33	28
1800				147	365				173	393				26	28
1950				151					170					19	
2100				158					169					11	
2250				185					189					4	

Reference plane is parallel to test vehicle longitudinal centerline
Given dimensions = Reference plane to car body

DATA SHEET NO. 8...(continued)

VEHICLE EXTERIOR CRUSH PROFILES

Test Vehicle: 2002/Ford/Explorer/4WD Test Date: December 18, 2001

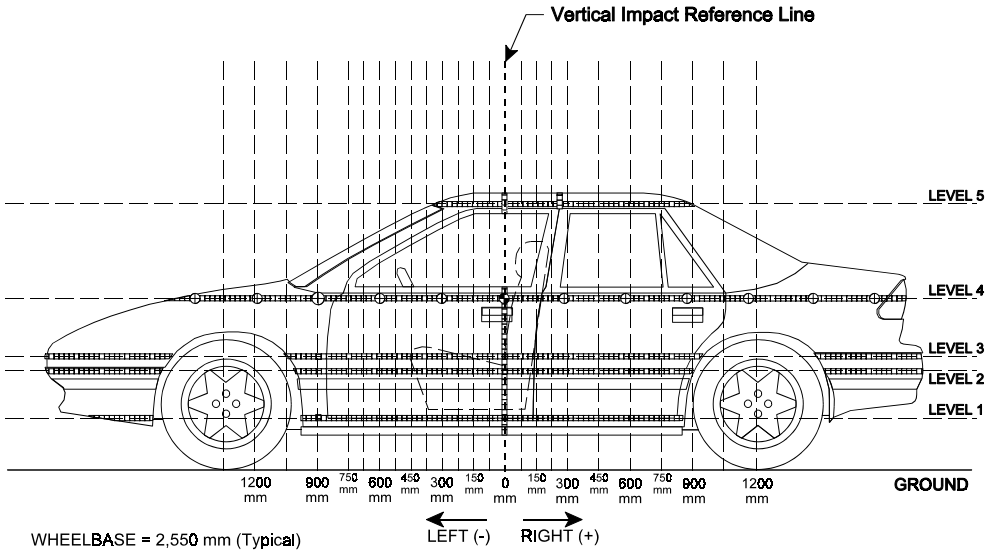


DATA SHEET NO. 9

VEHICLE DAMAGE PROFILE DISTANCES

Test Vehicle: 2002/Ford/Explorer/4WD Test Date: December 18, 2001

PRETEST AND POST TEST EXTERIOR PROFILE MEASUREMENTS



LEFT SIDE VIEW

Damage Profile Distances

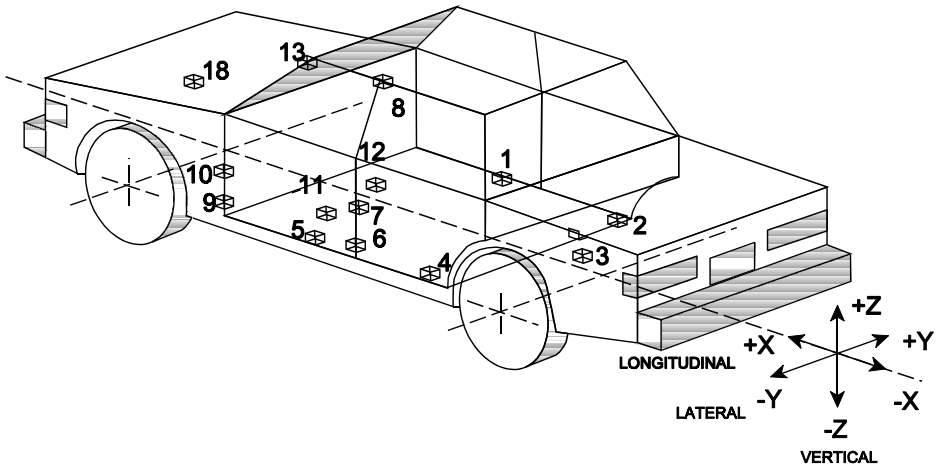
DPD	Distance from Impact Point in mm	Level	Pre-Test (mm)	Post-Test (mm)	Max Static Crush (mm)
1	2250 mm	4	185	189	4
2	1468 mm	4	138	181	43
3	722 mm	4	125	292	167
4	-150 mm	3	92	502	410
5	-1013 mm	2	97	166	69
6	-1800 mm	4	173	197	24

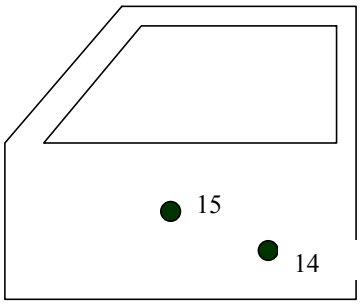
Reference plane is parallel to test vehicle longitudinal centerline
Given dimensions = Reference plane to car body

DATA SHEET NO. 10

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

Test Vehicle: 2002/Ford/Explorer/4WD Test Date: December 18, 2001





No.	Location
1	Right Side Sill at Front Seat
2	Right Side Sill at Rear Seat
3	Rear Floorpan Above Axle
4	Left Side Sill at Rear Door
5	Left Side Sill at Front Door
6	Left Lower B Post
7	Left Mid B Post
8	Left Upper B Post
9	Left Lower A Post

No.	Location
10	Left Mid A Post
11	Driver Seat Track
12	Vehicle CG
13	Left A Pillar @ Roof
14	Left Front Door @ Pelvis
15	Left Front Door @ Arm
16	Left Driver Seat Frame
17	Right Driver Seat Frame
18	Lower Center Radiator Support

DATA SHEET NO. 10...(continued)

VEHICLE ACCELEROMETER LOCATION AND DATA SUMMARY

Test Vehicle: 2002/Ford/Explorer/4WD Test Date: December 18, 2001

VEHICLE ACCELEROMETER PEAK DATA

Loc. No.	Accelerometer Location	Long. (X) Maximums (g's) (CFC 60)		Lat.. (Y) Maximums (g's) (CFC 60)		Vert. (Z) Maximums (g's) (CFC 60)		Resultant (g's) (CFC 60)
		Pos.	Neg.	Pos.	Neg.	Pos.	Neg.	Max.
1	Right Side Sill at Front Seat	4.8	2.2	13.3	0.4	2.6	5.8	14.1
2	Right Side Sill at Rear Seat	4.2	2.6	14.4	0.7	2.2	8.0	14.6
3	Rear Floorpan Above Axle	6.3	1.7	12.2	1.2	4.5	6.3	13.3
4	Left Side Sill at Rear Door			19.8	1.0			
5	Left Side Sill at Front Door *			58.6	0			
6	Left Lower B Post			48.0	42.7			
7	Left Mid B Post			44.2	5.1			
8	Left Upper B Post			***	***			
9	Left Lower A Post			20.7	11.6			
10	Left Mid A Post			14.2	1.1			
11	Driver Left Seat Track			40.5	3.1			
12	Vehicle CG	17.5	17.5	37.2	14.0	25.9	26.9	45.8
13	Left A Pillar @ Roof			***	***			
14	Left Front Door @ Pelvis			103.8	34.8			
15	Left Front Door @ Arm			67.8	30.4			
16	Left Driver Seat Frame			76.0	38.6			
17	Right Driver Seat Frame			102.4	49.3			
18	Lower Center Radiator Support	4.9	5.2	11.6	1.6	2.9	6.6	12.4

* No valid data after 27 msec
*** Not used to avoid interference with the side airbag

DATA SHEET NO. 10...(continued)

VEHICLE ACCELEROMETER LOCATION AND DATA SUMMARY

Test Vehicle: 2002/Ford/Explorer/4WD Test Date: December 18, 2001

VEHICLE ACCELEROMETER COORDINATES

Loc. No.	Description	Coordinates (mm)*		
		X	Y	Z
1	Right Side Sill at Front Seat	2568	616	420
2	Right Side Sill at Rear Seat	1594	616	473
3	Rear Floorpan Above Axle	1134	0	734
4	Left Side Sill at Rear Door	1612	-652	383
5	Left Side Sill at Front Door	2538	-652	365
6	Left Lower B Post	2240	-720	608
7	Left Mid B Post	2262	-738	1158
8	Left Upper B Post	**	**	**
9	Left Lower A Post	3208	-732	574
10	Left Mid A Post	3324	-828	1213
11	Driver Left Seat Track	2495	-559	603
12	Vehicle CG	2512	0	833
13	Left A Pillar @ Roof	**	**	**
14	Left Front Door @ Pelvis	2455	-779	854
15	Left Front Door @ Arm	2792	-769	1094
16	Left Driver Seat Frame	2222	-574	1104
17	Right Driver Seat Frame	2222	-193	1109
18	Lower Center Radiator Support	4268	0	246

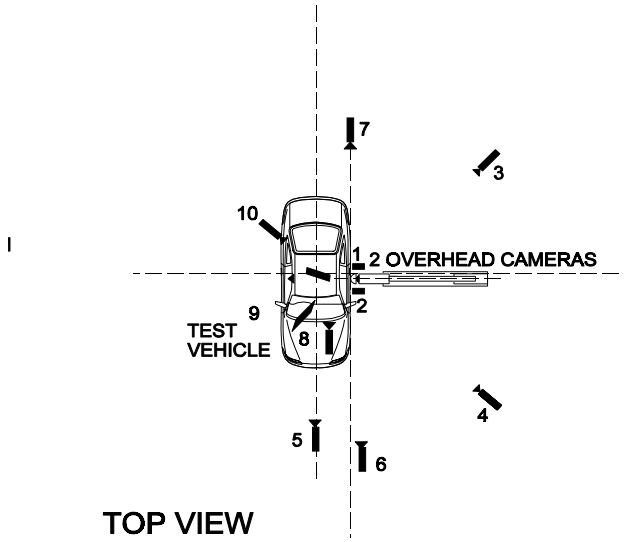
Reference Points X - Rear Bumper (+ Forward)
Y - Vehicle Centerline (+ to right)
Z - Ground Level (+ up)

** Not used to avoid interference with restraint systems

DATA SHEET NO. 11

HIGH SPEED CAMERA LOCATIONS AND DATA

Test Vehicle: 2002/Ford/Explorer/4WD Test Date: December 18, 2001



TOP VIEW

No.	Camera View	Location (mm)			Lens (mm)	Film Speed (fps)
		X	Y	Z		
1	Overhead Overall	-650	0	5000	8	1005
2	Overhead Close-up	0	0	5000	13	1010
3	Left Side 45° Rearward Pole View	-3735	-6435	1585	50	862
4	Left Side 45° Forward Pole View	-3430	5630	1465	50	806
5	Real Time				13	
6	Front Ground Level Vehicle/Pole Impact	-680	9330	1613	25	1053
7	Rear Ground Level Vehicle/Pole Impact	-470	-9653	1625	25	1005
8	Test Vehicle Onboard Driver Hip				13	508
9	Test Vehicle Onboard Hood				13	500
10	Test Vehicle Onboard Driver Head Contact				13	505

Reference Points X - + Forward of Impact
Y - + Right of Impact
Z - + Up from Ground

APPENDIX A

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APPENDIX B

VEHICLE AND ES-2 RESPONSE DATA

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APPENDIX C

ES-2 CONFIGURATION AND PERFORMANCE VERIFICATION DATA

APPENDIX D

TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

DUMMY AND VEHICLE CALIBRATION DATA

	INSTRUMENTS FOR LEFT FRONT DUMMY NO. 009		
	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Head X Accelerometer	J14006	Endevco	10/2/01
Head Y Accelerometer	J13628	Endevco	10/2/01
Head Z Accelerometer	J13652	Endevco	10/2/01
Upper Neck Load Cell	105	FTSS	4/30/01
Lower Neck Load Cell	110	FTSS	5/4/01
Shoulder Force Load Cell	119	FTSS	4/24/01
Upper Spine X Accelerometer	J10730	Endevco	10/2/01
Upper Spine Y Accelerometer	J11014	Endevco	10/2/01
Upper Spine Z Accelerometer	J11625	Endevco	10/2/01
Upper Rib Y Accelerometer	AGRW3	Endevco	6/20/01
Mid Rib Y Accelerometer	AHY71	Endevco	6/20/01
Lower Rib Y Accelerometer	AMPY0	Endevco	6/20/01
Upper Rib Displacement	009	Honeywell	5/22/01
Mid Rib Displacement	009	Honeywell	5/22/01
Lower Rib Displacement	009	Honeywell	5/22/01
Lower Spine X Accelerometer	J13927	Endevco	10/2/01
Lower Spine Y Accelerometer	J13941	Endevco	10/2/01
Lower Spine Z Accelerometer	J13984	Endevco	10/2/01
Torso Load Cell	122	FTSS	4/12/01
T-12 Load Cell	102	FTSS	11/3/00
Front Abdomen Load Cell	122	FTSS	7/23/01
Mid Abdomen Load Cell	123	FTSS	4/26/01
Rear Abdomen Load Cell	124	FTSS	4/26/01
Pubic Symphysis Load Cell	115	Denton	3/29/01
Pelvis X Accelerometer	AHTF1	Endevco	10/2/01
Pelvis Y Accelerometer	AJ9D6	Endevco	10/2/01
Pelvis Z Accelerometer	AJ9D8	Endevco	10/2/01
Right Femur Load Cell	135	FTSS	4/18/01
Left Femur Load Cell	136	FTSS	4/19/01
Lumbar Load Cell	104	FTSS	4/24/01

VEHICLE INSTRUMENT CALIBRATION

	VEHICLE ACCELEROMETERS		
	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Left Mid A-Post Y	I12-F04	Entran	10/10/01
Left Lower A-Post Y	J07-X16	Entran	10/29/01
Left Mid B-Post Y	F07-A14	Entran	8/8/01
Left Lower B-Post Y	I12-F15	Entran	10/29/01
Rear Floorpan Above Axle X	H02-J14	Entran	8/29/01
Rear Floorpan Above Axle Y	F07-A20	Entran	8/29/01
Rear Floorpan Above Axle Z	F20-G10	Entran	8/29/01
Driver Seat Track Y	G03-N15	Entran	7/30/01
Right Side Sill at Front Seat X	H14-N10	Entran	9/12/01
Right Side Sill at Front Seat Y	H14-N07	Entran	9/12/01
Right Side Sill at Front Seat Z	H14-N11	Entran	9/12/01
Right Side Sill at Rear Seat X	I12-F05	Entran	10/10/01
Right Side Sill at Rear Seat Y	F04-N04	Entran	6/22/01
Right Side Sill at Rear Seat Z	E13-D06	Entran	8/8/01
Left Side Sill at Front Seat Y	I12-F14	Entran	10/29/01
Left Side Sill at Rear Seat Y	E23-R11	Entran	9/27/01
Vehicle CG X	G13-F03	Entran	10/29/01
Vehicle CG Y	G13-F16	Entran	7/16/01
Vehicle CG Z	G13-F18	Entran	10/29/01
Left Front Door @ Pelvis Y	G03-N02	Entran	9/27/01
Left Front Door @ End of Arm Y	G01-J04	Entran	11/2/01
Lower Center Radiator Support X	I25-F25	Entran	9/27/01
Lower Center Radiator Support Y	A08-A11	Entran	8/29/01
Lower Center Radiator Support Z	H07-F07	Entran	9/27/01
Left Driver Seat Frame Y	G03-N01	Entran	8/7/01
Right Driver Seat Frame Y	I12-F10	Entran	10/10/01

Note: All Endevco accelerometers are Model No. 7264-2000

All Entran accelerometers are Model No. EGE-72

APPENDIX E

PROCEDURE USED FOR ES-2 POSITIONING

Installation of the Side Impact Dummy (recommended practice)

1. GENERAL

1.1 The dummy to be used for the following installation procedure is described in Annex 6 to this regulation.

1.2 Adjust the knee joints so that they just support the leg when it is extended horizontally (1 to 2 g).

1.3 Clothe the dummy in form fitting cotton stretch mid-calf length pants. Each foot is equipped with a shoe.

2. INSTALLATION

2.1 Place the dummy in the outboard front seat of the impact side as described in the test specifications.

2.2 The mid-sagittal plane of the dummy shall coincide with the centerplane of the occupant (as determined according to Annex 3, paragraph 2.8) with a tolerance of 2°.

2.3 The pelvis of the dummy shall be positioned according to the following:

2.3.1 The pelvis pitch angle shall be 20.0° +/- 2.5°.

2.3.2 A line passing through the dummy H-points shall pass through an imaginary circle in the mid-sagittal plane of the dummy. This circle has a radius of 10 mm and is located 20 mm horizontally forward and 5 mm vertically above the reference H-point, determined by the 3D H-point machine.

2.4 The upper torso of the dummy shall be positioned according to the following:

2.4.1 The upper torso shall be bent forward and then laid back against the seat back. The shoulder of the dummy shall be set fully rearward.

2.4.2 The torso reference line pitch angle shall be 25.0° +/- 2.5°. The torso reference line is defined as the thoracic spine center line.

2.5 The arms shall be positioned in such as way that the angle between the projection of the arm centerline on the mid-sagittal plane of the dummy and the torso reference line is 40° +/- 5°.

2.6 For the driver's seating position, without inducing pelvis or torso movement, place the right foot of the dummy on the undepressed accelerator pedal with the heel resting as far forward as possible on the floorpan. Set the left foot perpendicular to the lower leg with the heel resting on the floorpan in the same lateral line as the right heel. Set the knees of the dummy such that their outside surfaces are 150 +/- 10mm from the plane of symmetry of the dummy. If possible, within these constraints, place the thighs of the dummy in contact with the seat cushion.

2.7 For other seating positions, without inducing pelvis or torso movement, place the heels of the dummy as far forward as possible on the floorpan without compressing the seat cushion more than the compression due to the weight of the leg. Set the knees of the dummy such that their outside surfaces are 150 +/- 10 mm from the plane of symmetry of the dummy.

APPENDIX F

ES-2 PEAK RESPONSES

DRIVER (ES-2) PEAK RESPONSE TABLE

Location	Peak Values				
				2002 Ford Explorer 12/19/01	
	Class	Axis	Units	Peak	Time
Head	1000	X	G	-17.5	72
	1000	Y	G	45.0	58
	1000	Z	G	-17.7	58
	1000	RES	G	49.1	58
Head Injury Criteria (HIC)				208	
t1				50.5	
t2				73.1	
Upper Neck Force	1000	X	N	-336	74
	1000	Y	N	231	54
	1000	Z	N	719	65
	1000	RES	N	754	65
Upper Neck Moment	600	X	Nm	-78.9	56
	600	Y	Nm	-25.6	55
	600	Z	Nm	23.7	67
	600	RES	Nm	83.9	56
Lower Neck Force	1000	X	N	-578	74
	1000	Y	N	852	55
	1000	Z	N	812	52
	1000	RES	N	1117	54
Lower Neck Moment	600	X	Nm	50.1	55
	600	Y	Nm	74.7	75
	600	Z	Nm	23.3	65
	600	RES	Nm	76.7	74
Shoulder Force	600	X	N	2219	46
	600	Y	N	3871	48
	600	Z	N	-239	63

DRIVER (ES-2) PEAK RESPONSE TABLE (CONTINUED)

Location	Peak Values				
				2002 Ford Explorer 12/19/01	
	Class	Axis	Units	Peak	Time
Upper Spine	180	X	G	-19.6	45
	180	Y	G	52.9	49
	180	Z	G	5.4	61
	180	Res	G	53.4	49
Lower Spine	180	X	G	-7.5	53
	180	Y	G	65.0	53
	180	Z	G	4.5	77
	180	Res	G	65.5	53
Upper Rib	180	Y	G	145.2	48
Mid Rib	180	Y	G	143.2	45
Lower Rib	180	Y	G	238.7	44
Upper Rib Deflection	180	Y	mm	-25.6	64
Mid Rib Deflection	180	Y	mm	-45.9	58
Lower Rib Deflection	180	Y	mm	-43.1	60
Upper Rib VC	180	Y	m/sec	0.38	52
Mid Rib VC	180	Y	m/sec	0.88	47
Lower Rib VC	180	Y	m/sec	0.74	49
Torso Force	600	X	N	308	46
	600	Y	N	-542	55
Torso Moment	600	Y	Nm	-5.3	46
	600	Z	Nm	10.6	52
T12 Force	600	X	N	858	72
	600	Y	N	1529	46
T12 Moment	600	X	Nm		
	600	Y	Nm	119.6	75

DRIVER (ES-2) PEAK RESPONSE TABLE (CONTINUED)

Location	Peak Values				
				2002 Ford Explorer 12/19/01	
	Class	Axis	Units	Peak	Time
Abdomen Front Force	600	Y	N	141	46
Abdomen Mid Force	600	Y	N	637	52
Abdomen Rear Force	600	Y	N	1372	52
Abdomen Summed Force	600	Y	N	2073	52
Pubic Symphysis Force	600	Y	N	-1262	60
Right Femur Force	600	X	N	277	71
	600	Y	N	-913	74
	600	Z	N	947	68
	600	RES	N	1131	71
Right Femur Moment	600	X	Nm	105.7	72
	600	Y	Nm	-41.9	85
	600	Z	Nm	-55.3	71
	600	RES	Nm	118.0	72
Left Femur Force	600	X	N	358	61
	600	Y	N	896	135
	600	Z	N	967	78
	600	RES	N	990	78
Left Femur Moment	600	X	Nm	-120.5	76
	600	Y	Nm	46.8	65
	600	Z	Nm	-33.2	62
	600	RES	Nm	126.7	76
Pelvis	1000	X	G	-14.7	75
	1000	Y	G	48.4	52
	1000	Z	G	6.2	77