REPORT NUMBER KAR-20002-02

40% OFFSET
FRONTAL BARRIER IMPACT TEST

FORD MOTOR COMPANY
2000 FORD EXPEDITION 4 WD
4 DOOR SUV

NHTSA NUMBER: FORD01

PREPARED BY:
KARCO ENGINEERING
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AUGUST 17, 2000

FINAL REPORT

PREPARED FOR:
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15. Supplementary Notes

16. Abstract

A 37.5mph (60.3 km/h) 40% offset impact was conducted on a 2000 Ford Expedition 4WD at KARCO Engineering on August 15, 2000. This test was conducted to obtain data indicant of FMVSS 208, 212, 219 (partial), 301 and footwell intrusion performance. The impact velocity is 59.82 km/h. The ambient temperature at the barrier face at the time of impact is 40.6 deg. Celcius. The vehicle's maximum post test static crush is 1040 mm at the left side of the vehicle. The test vehicle is equipped with a 3-point continuous belt system and second generation supplemental airbags in both front outboard seating positions. With respect to FMVSS 208 "Occupant Crash Protection", the occupant injury criteria summary is as follows:

Measurement Description	Units	Threshold	Driver ATD	Passenger ATD
Head Injury Criteria (HIC)	N/A	1000	293.5	396.3
Max. Thorax Accel. (3 msec Clip)	G's	60	28.6	35.9
Left Femur force	Newtons	10009	-3956.3	-1410.8
Right Femur Force	Newtons	10009	-1873.7	-937.8

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60.3km/h 40% Offset Frontal Barrier Impact Test New Car Assessment Program (NCAP) 2000 Ford Expedition 4WD 4 Door SUV NHTSA No. FORD01	Copies of this report are available from: NHTSA Technical Reference Division National Highway Traffic Safety Admin. 400 Seventh St., SW, Room 5108 Washington, DC 20590

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SECTION 1

PURPOSE, TEST PROCEDURE AND SUMMARY OF TEST FORD01

1.1 PURPOSE

This 40% Offset Frontal Impact Test is part of the FY' 2000 crash worthiness evaluation program sponsored by the National Highway Traffic Safety Administration (NHTSA) under Contract Number DTNH22-97-D-02007. The purpose of this test is to obtain vehicle crashworthiness, occupant restraint system performance, and lower leg data for 40% offset barrier impacts.

1.2 TEST PROCEDURE

This 40% offset Frontal impact test was conducted in accordance with the Office of Crashworthiness Standards (OCS) New Car Assessment Program (NCAP) Laboratory Indicant Test Procedure, dated 01 October 1996 and the corresponding KARCO Engineering Test Procedure KTP-001, dated October 18, 1996. Data was obtained indicant of FMVSS 212, "Windshield Retention"; FMVSS 219, "Windshield Zone Intrusion (Partial)"; and FMVSS 301 "Fuel System Integrity" performance. Procedures for receiving, inspection testing and reporting of test results are described in the test procedures and are not repeated in this report.

The test was conducted at KARCO Engineering on August 15, 2000 at a speed of 59.82 km/h. The test vehicle was instrumented with eight (8) accelerometers to measure longitudinal and lateral accelerations. The driver and passenger's restraint systems were instrumented with four (4) seat belt load cells to measure lap and shoulder belt force. The 40% offset impact event was documented by; one (1) real-time panning motion picture camera and eighteen (18) high-speed motion picture cameras. The pre- and post-test conditions were recorded by one (1) real-time motion picture camera. Camera locations and pertinent camera information is documented in the data sheets. Pre- and post-test photographs of the vehicle and dummies can be found in Appendix A.

The test vehicle contained two (2) part 572E 50th percentile adult male anthropomorphic test devices (ATDs). The ATDs were positioned in the front outboard seating positions according to the dummy placement procedures specified in the Laboratory Indicant Test Procedure. Both ATDs were instrumented with head, chest, and pelvic tri-axial accelerometers, left and right femur load cells, upper and lower tibia sensors, and foot accelerometers. In addition, chest displacement and upper neck six-axis force and moment sensors were utilized. Ninety-six (96) channels of data were recorded with a PC based (TDAS) on-board data acquisition system. The data was digitally sampled at 10,000 samples per second and processed per section IP11 of the Laboratory Indicant Test Procedure.

The Driver ATD (Serial No. 34) and the right-front passenger ATD (Serial No. 35) were re-calibrated prior to this test. FMVSS 208 "Occupant Crash Protection" injury criteria were not exceeded by either ATD during this 40% offset frontal impact test.

1.3 SUMMARY OF FRONTAL BARRIER IMPACT TEST

A deformable barrier was mounted to a fixed barrier and was impacted by a 2000 Ford Expedition 4WD 4-door SUV traveling at velocity of 59.82 km/h. The test vehicle weight is 2742 kilograms with two (2) part 572E 50th percentile adult male ATDs, and instrumentation. The test vehicle is equipped with longitudinally mounted 4.6-liter, 8-cylinder engine and a 4-speed automatic transmission.

The driver Head Injury Criteria (HIC) is 293.5. The maximum resultant chest deceleration over three (3) milliseconds is 28.6 g's. The left and right femur loads are –3956.3 and –1873.7 Newtons, respectively. Chest deflection for the driver ATD peaked at –21.3 mm. The driver ATD head chest, and abdomen contacted the airbag, and both knees contacted the knee bolster.

The right front passenger's HIC is 396.3. The maximum resultant chest deceleration over three (3) milliseconds is 35.9 g's. The left and right femur loads are –1410.8 and –937.8 Newtons respectively. Chest deflection for the passenger ATD peaked at –34.4 mm. The passenger ATD head contacted the airbag and headrest, the chest and abdomen contacted the airbag and both knees contacted the glove box.

Maximum shoulder belt spool out as measured by on-board potentiometers is 77.8 mm for the driver ATD and 62.2 mm for the passenger ATD. The shoulder belt stretch was 0.000 mm/cm for the driver ATD and 0.117 mm/cm for the passenger ATD.

There was 100 percent windshield retention (minimum 50 percent required for passive restraint systems). No intrusion occurred into the protected or unprotected zone of the windshield. Approximately 3200 ounces (by weight) of Stoddard leaked during the first thirty minutes after impact. An additional 57 ounces leaked during static rollover.

The test vehicle sustained a maximum static crush of 1040 mm located at the left side of the vehicle. The driver side door was jammed and passenger side doors opened without the aid of tools.

1.4 GENERAL COMMENTS

The 2000 Ford Expedition 4WD 4-door SUV passed the requirements of FMVSS 208, FMVSS 212, FMVSS 219. The tested vehicle failed to meet the test requirements of FMVSS 301. Data pertaining to these standards are presented in the data sheets.

The vehicle, occupant, camera and measurement data are presented in Section 2. Appendix A contains the still photograph prints. Appendix B contains the dummy and vehicle response data traces. Appendix C contains the deformable barrier crush profile. Appendix D contains the instrumentation data channel assignments. Appendix E contains the dummy calibration data and Appendix F contains the owner's manual instructions for the occupant seating and restraint systems.

SECTION 2

OCCUPANT AND VEHICLE INFORMATION/DATA SHEETS

Test Vehicle: 2000 Ford Expedition 4WD 4 door SUV NHTSA No.: FORD01

Test Program: 2000 NHTSA 40% Offset Test Date: 8/15/00

CONVERSION FACTORS USED IN THIS REPORT*

Quantity	Typical Application	Std Units	Metric Unit	Multiply By
Mass	Vehicle Weight	lb	kg	0.4536
Linear Velocity	Impact Velocity	mile/h	km/h	1.609
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	^oF	^oC	=(tf -32)/1.8
Force	Dynamic Forces	lbf	N	4.448
Moment	Torque	lbf/ft	Nm	1.355

* Based on the Recommended Practice in SAE J916, May 85

DATA SHEET NO. 1
CRASH TEST SUMMARY

Test Vehicle: 2000 Ford Expedition 4WD 4 door SUV NHTSA No.: FORD01

Test Program: 2000 NHTSA 40% Offset Test Date: 8/15/00

PRIMARY IMPACT DATA

Measured Parameter	Units	Value
Velocity at Impact	km/h	59.82
Test Weight	kg	2742
Impact Angle	degrees	0
Maximum Static Crush	mm	1040

DOOR OPENING AND SEAT TRACK INFORMATION

Description	Driver	Passenger
Front Door Opening	Jammed	Opened
Rear Door Opening	Opened	Opened
Seat Track Shift (mm)	0	0
Seat Back Failure	None	None

TEST DUMMY INFORMATION

Description	Driver	Passenger
Dummy Type / Serial No.	50% Male Hybrid III / No. 34	50% Male Hybrid III / No. 35
Head Contact	Airbag/Headrest	Airbag/B-pillar/D-ring
Chest Contact	Airbag	Airbag
Abdomen Contact	Airbag	Airbag
Left Knee Contact	Knee Bolster	Glove Box
Right Knee Contact	Knee Bolster	Glove Box

16mm MOVIE COVERAGE

High Speed	18
Real Time	1
Total	19

Driver ATD Sensors	40
Passenger ATD Sensors	40
Belt Assessment Sensors	8
Vehicle Structure Accelerometers	8
Total	96

DATA SHEET NO. 2
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2000 Ford Expedition 4WD 4 door SUV NHTSA No.: FORD01

Test Program: 2000 NHTSA 40% Offset Test Date: 8/15/00

TEST VEHICLE INFORMATION

Manufacturer	Ford Motor Company
Model	Expedition 4WD
Body Style	4 Door SUV
NHTSA NO.	FORD01
VIN	1FMRU1665YLA82245
Color	Silver
Delivery Date	07/31/00
Odometer Reading (mile)	115
Dealer	Colley Ford
Transmission	4-Speed Automatic
Final Drive	Rear
Number of Cylinders	8
Engine Displacement (L)	4.6
Engine Placement	Longitudinal

TEST VEHICLE OPTIONS

Driver Airbag	Yes
Passenger Airbag	Yes
Power Windows	Yes
Power Steering	Yes
Power Door Locks	Yes
Tilt Wheel	Yes
Air Conditioning	Yes
Power Brakes	Yes
Disc Brakes, Front	Yes
Disc Brakes, Rear	Yes
Anti-lock Brakes	Yes
AM/FM/Cassette	Yes
Anti-Theft System	Yes
Cruise Control	Yes

DATA FROM CERTIFICATION LABEL

Manufactured By	Ford Motor Company
Date of Manufacture	December-99

GVWR (kg)	3166
GAWR Front (kg)	1587
GAWR Rear (kg)	1769

DATA FROM TIRE PLACARD

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	207	241
Cold Pressure (kPa)	207	241
Recommend Tire Size	P255/70/R16 SL	P255/70/R16 SL
Tire Size on Vehicle	P255/70/R16	P255/70/R16
Tire Manufacturer	Firestone	Firestone

Measured Parameter	Front	Center	Rear	Total
Type of Seats	Bucket	Bucket	Bench	
Number of Occupants	2	2	3	7
Capacity Wt. *(VCW)* (kg)				N/A
Cargo Weight (RCLW) (kg)				136 *

* RCLW for SUV is 136 kg max.

DATA SHEET NO. 2…(continued)
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2000 Ford Expedition 4WD 4 door SUV NHTSA No.: FORD01

Test Program: 2000 NHTSA 40% Offset Test Date: 8/15/00

TEST VEHICLE WEIGHTS

	Units	As Delivered *(UVW)*			As Tested *(ATW)*		
		Front Axle	Rear Axle	Total	Front Axle	Rear Axle	Total
Left	kg	643	615		680	709	
Right	kg	610	593		652	699	
Ratio	%	50.9	49.1		48.6	51.4	
Totals	kg	1253	1208	2461	1332	1408	2740

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight *(UVW)*	kg	2461
Weight of 2 P572 ATD's	kg	152
Rated Cargo/Luggage Weight *(RCLW)*	kg	136
Calculated Vehicle Target Weight *(TVTW)*	kg	2749

TEST VEHICLE ATTITUDE AND CG

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	943	957	909	921	1490
As Tested	mm	927	944	887	898	1560

Vehicle Wheel base (mm): 3035

Weight of Ballast secured in cargo area (kg): 0 *

Vehicle Components Removed: Left middle seat, jack, tools.

* Ballast weight does not include cameras, instrumentation, and brake abort system.

FUEL SYSTEM DATA

Fuel System Capacity From Owner's Manual (L): 113.6

Usable Capacity Figure Furnished by COTR (L): 113.6

Actual Test Volume with entire fuel System Filled (L): 105.6

Test Fluid Type: Stoddard Solvent ; Specific Gravity: 0.764

Is Vehicle Fuel Pump Electric or Mechanical?: Electric

If electric, does pump operate with ignition switch "ON" & engine "OFF"? Yes

Fuel System Particulars: Fuel pump operates for 2 seconds when ignition is turned on, then automatically shuts off if engine is not started.

DATA SHEET NO. 3
POST IMPACT DATA

Test Vehicle: 2000 Ford Expedition 4WD 4 door SUV NHTSA No.: FORD01

Test Program: 2000 NHTSA 40% Offset Test Date: 8/15/00

SPEED TRAP DATA

Measured Parameter	Units	Requirement	Value
Trap No. 1 Velocity (Primary)	km/h	59.5 to 61.1	59.82
Trap No. 1 Entry Distance	mm	< 1524	1524
Trap No. 1 Exit Distance	mm	< 1524	305
Trap No. 2 Velocity (Redundant)	km/h	59.5 to 61.1	59.97
Trap No. 2 Entry Distance	mm	< 1524	1524
Trap No. 2 Exit Distance	mm	< 1524	305

VEHICLE STATIC CRUSH

Measured Parameter	Units	Pre-Test	Post-Test	Difference
Left Side	mm	4910	3870	-1040
Center	mm	5190	4605	-585
Right Side	mm	4910	5205	295

VEHICLE REBOUND FROM BARRIER (mm)

Axis	Front Tire		Rear Tire	
	Left	Right	Left	Right
X-Axis	2560	1275	4885	3930
Y-axis	595	1675	1810	3205

Reference points

X-axis = Concrete barrier face

Y-axis = Monorail centerline

DATA SHEET NO. 4

TEST VEHICLE INFORMATION

Test Vehicle: 2000 Ford Expedition 4WD 4 door SUV NHTSA No.: FORD01

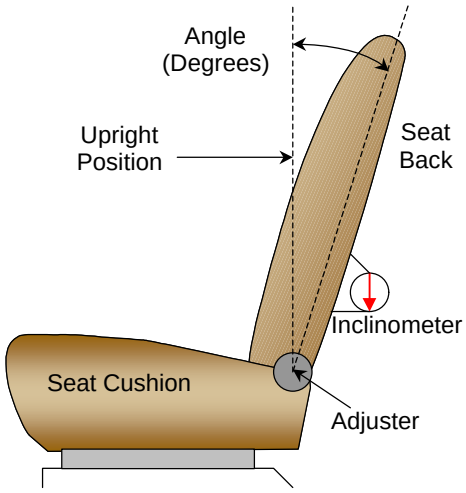
Test Program: 2000 NHTSA 40% Offset Test Date: 8/15/00

NOMINAL DESIGN RIDING POSITION

The driver and passenger seat backs are positioned to the manufacturers designated angle. The procedure is as follows: An inclinometer is inserted through a slit in the seat back the fabric, making contact with the rigid portion of the seat frame assembly, approximately 13 inches above the pivot point of the seat back. The inclinometer is placed against the flat surface of the seat back and the angle is measured directly from the dial face.

Driver seat back angle: 21° with a seated dummy

Passenger seat back angle: 21° with a seated dummy



FRONT SEAT ASSEMBLY

SEAT FORE/AFT POSITIONS

The driver seat is electrically adjusted and is set to middle position. The passenger seat is mechnically adjusted and has 19 positions or detents, and set to middle position. The first or forward most position is counted as number one (1).

Driver seat fore/aft total travel: 192 mm total travel

Driver seat fore/aft position: 96 mm aft of forward most

Passenger seat fore/aft total travel: 19 seating positions or detents

Passenger seat fore/aft position: 10th detent from forward most

SEAT BELT UPPER ANCHORAGE

The test vehicle was equipped with adjustable anchorages for both driver and passenger seat positions. There are 5 positions or detents. Anchors are set to middle position.

DATA SHEET NO. 4…(continued)

TEST VEHICLE INFORMATION

Test Vehicle: 2000 Ford Expedition 4WD 4 door SUV NHTSA No.: FORD01

Test Program: 2000 NHTSA 40% Offset Test Date: 8/15/00

FUEL TANK CAPACITY DATA

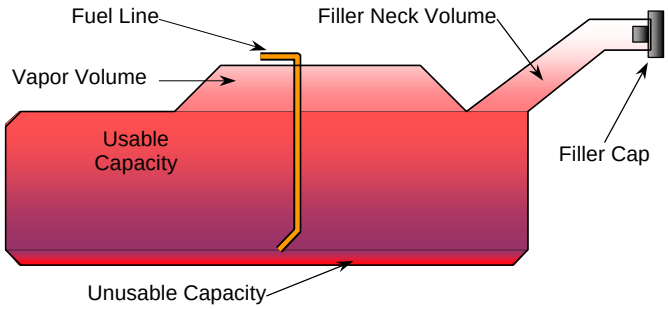
The “Usable Capacity" of the standard equipment fuel tank is: 113.6 liters

The “Usable Capacity" of any optional equipment fuel tank is: N/A liters

“Usable Capacity” used for certification tests FMVSS 301 requirements: 104.5 to 106.8 liters

Actual amount of Stoddard solvent added to vehicle for certification test: 105.6 liters

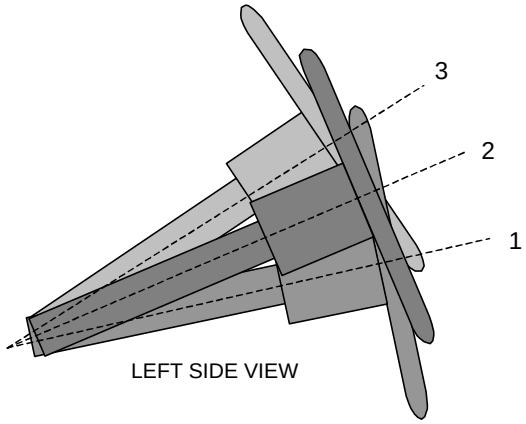
The test vehicle is equipped with an electric fuel pump. The fuel pump operates for approximately two seconds after the ignition is placed to the “ON” position, after which the fuel pump automatically shuts off. The fuel filler door is located on the left rear fender. The standard fuel tank occupies the area under the left center and rear seat. Fuel lines run along the left frame rail to the engine compartment.



VEHICLE FUEL TANK ASSEMBLY

STEERING COLUMN ADJUSTMENT

Steering wheel and column adjustments are made so that the steering wheel hub is at the geometric center of the locus it describes, when it is moved through its full range of motion. An aluminum plate is placed across the rim of the steering wheel, an inclinometer is placed onto the plate and the angle is measured. The tested vehicle has an adjustable steering column with 5 detents. The column is set to the middle position as indicated in the drawing at right and the angle below.



STEERING COLUMN ASSEMBLY

Lowermost, position 1: 77°

Geometric center, position 2: 69°

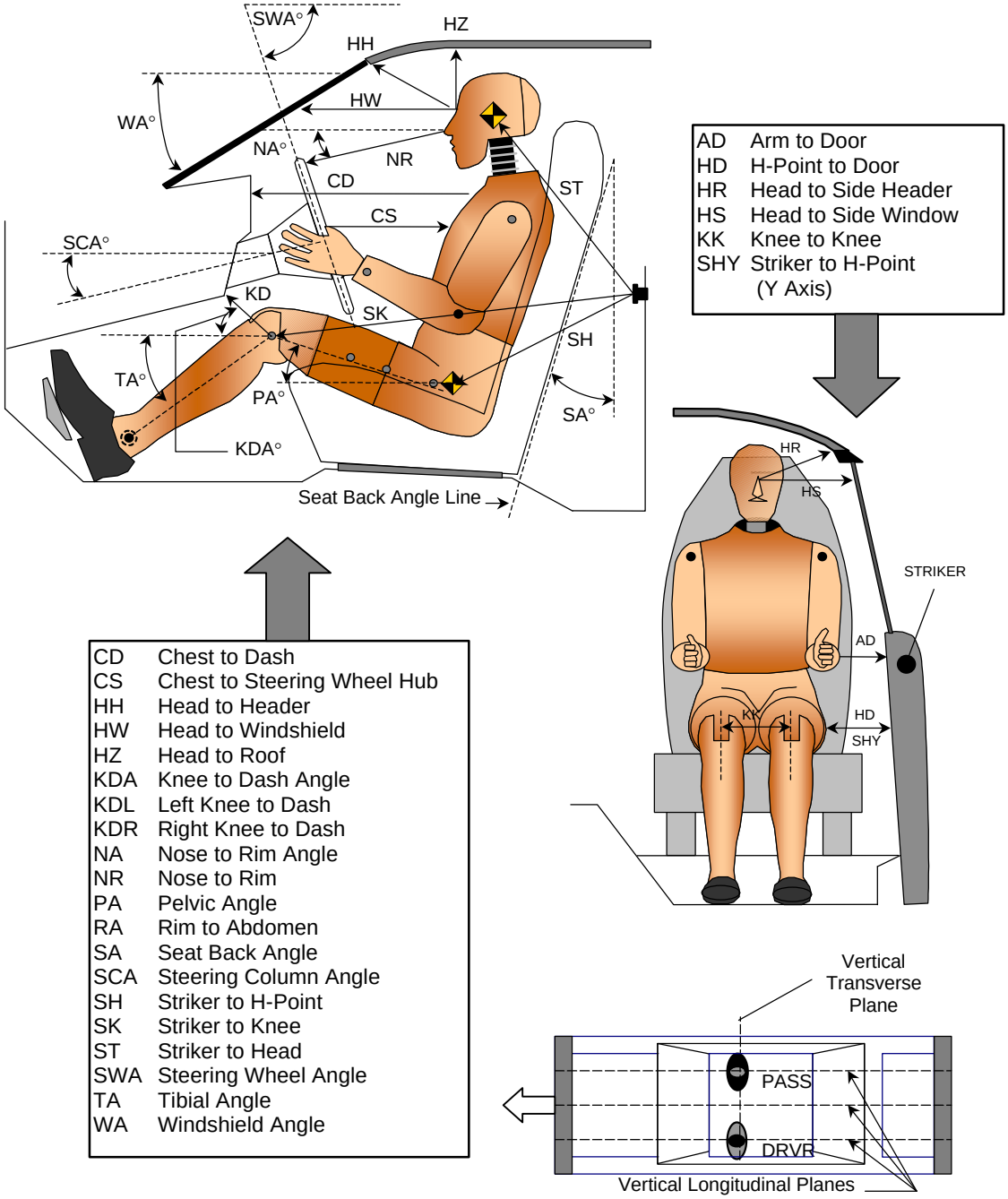
Uppermost, position 3: 61°

DATA SHEET NO. 5

DUMMY POSITIONING IN VEHICLE

Test Vehicle: 2000 Ford Expedition 4WD 4 door SUV NHTSA No.: FORD01

Test Program: 2000 NHTSA 40% Offset Test Date: 8/15/00



DUMMY MEASUREMENTS FOR FRONT SEAT OCCUPANTS

DATA SHEET NO. 5…(continued)
DUMMY POSITIONING IN VEHICLE

Test Vehicle: 2000 Ford Expedition 4WD 4 door SUV NHTSA No.: FORD01

Test Program: 2000 NHTSA 40% Offset Test Date: 8/15/00

TEST DUMMY POSITION MEASUREMENTS

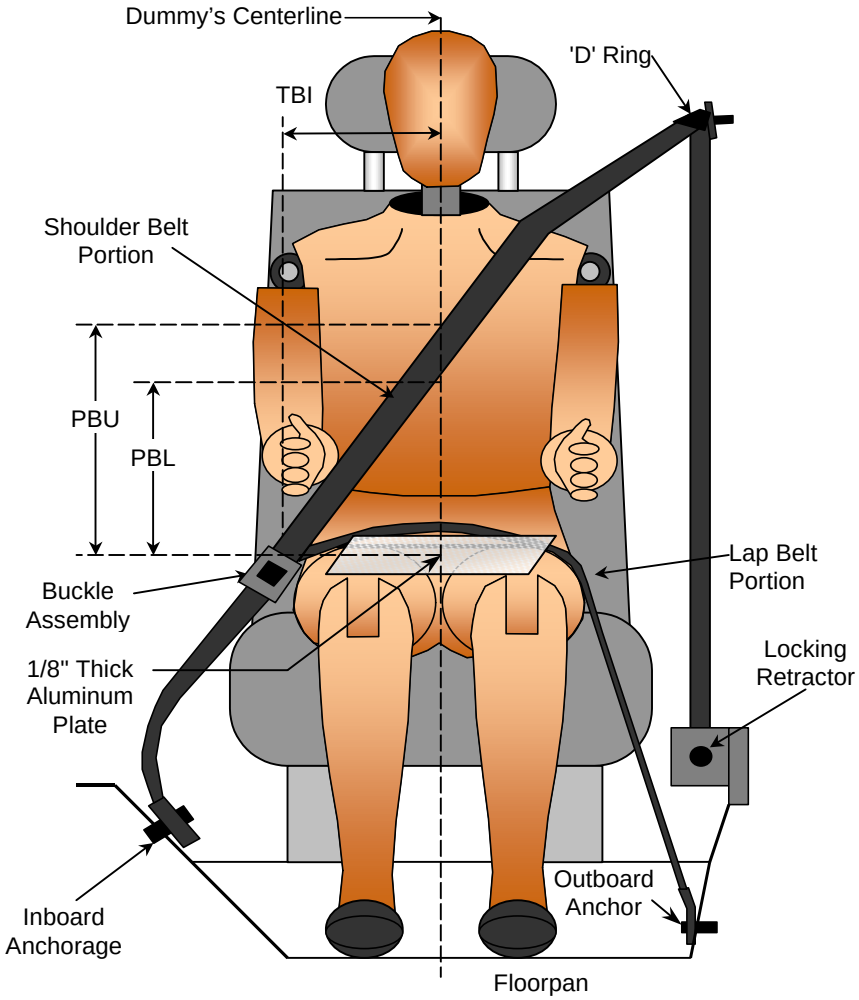
Code	Measurement Description	Driver		Passenger	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA	Windshield Angle		32		
SWA	Steering Wheel Angle		69		
SCA	Steering Column Angle		19		
SA	Seat Back Angle		21		21
HZ	Head to Roof (Z)	235	90	220	90
HH	Head to Header	390	0	392	0
HW	Head to Windshield	620	0	612	0
HR	Head to Side Header (Y)	270		245	
NR	Nose to Rim	385	8		
CD	Chest to Dash	555		570	
CS	Chest to Steering Hub	300	0		
RA	Rim to Abdomen	200	0		
KDL	Left Knee to Dash	155	26	180	
KDR	Right Knee to Dash	165		180	35
TA	Tibia Angle		55		22
PA	Pelvic Angle		23		46
KK	Knee to Knee (Y)	290		210	
SK	Striker to Knee	615	5	630	3
ST	Striker to Head	680	81	684	10
SH	Striker to H-Point	220	5	220	4
SHY	Striker to H-Point (Y)	252	0	250	0
HS	Head to Side Window	352	0	295	0
HD	H-Point to Door (Y)	172	0	184	0
AD	Arm to Door (Y)	115	0	65	0

DATA SHEET NO. 6

SEAT BELT POSITIONING DATA

Test Vehicle: 2000 Ford Expedition 4WD 4 door SUV NHTSA No.: FORD01

Test Program: 2000 NHTSA 40% Offset Test Date: 8/15/00



SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
TBI - Dummy centerline to lap/shoulder belt intersect	mm	180	190
PBU -Top surface of reference to belt upper edge	mm	330	310
PBL - Top surface of reference to belt lower edge	mm	225	220
Lap Belt tension	Newtons	10	10
Shoulder Belt tension	N/A	Retractor	Retractor

DATA SHEET NO. 7 - VEHICLE ACCELEROMETER LOCATION AND DATA SUMMARY

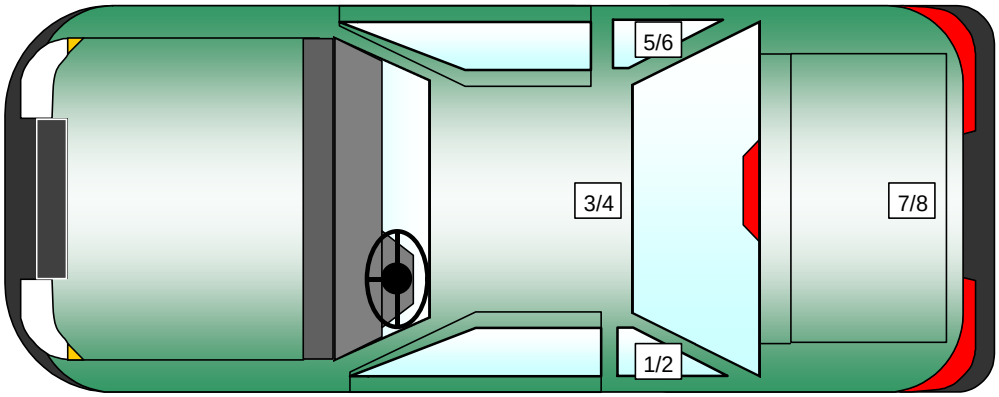
Test Vehicle: 2000 Ford Expedition 4WD 4 Door SUV NHTSA No.: FORD01

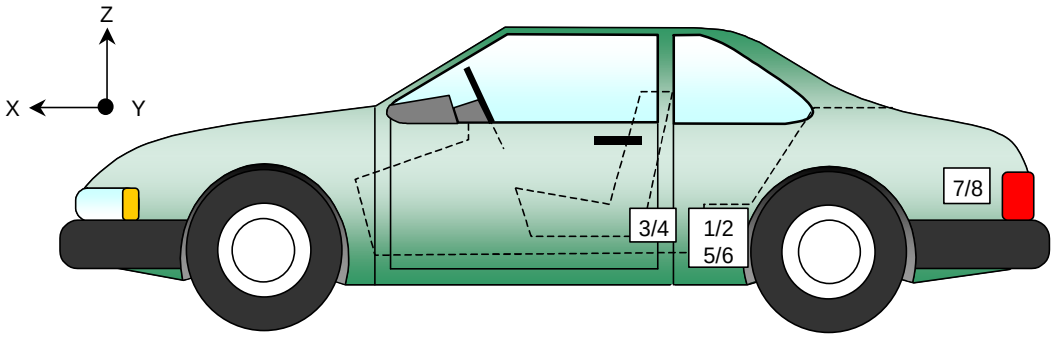
Test Program: 2000 NHTSA 40% Offset Test Date: 8/15/00

VEHICLE X-AXIS ACCELEROMETER PEAK DATA AND PRE-TEST LOCATIONS

No.	Accelerometer Location	Measurements (mm)			Peak Values				
		X	Y	Z	Units	Max	Time	Min	Time
1	Left Sill X	1878	-695	685	G's	1.9	248.6	-25.9	110.6
2	Left Sill Y	1923	-695	685	G's	13.9	99.1	-5.2	148.1
3	Center Tunnel X	2351	25	690	G's	2.2	278.3	-24.8	111.4
4	Center Tunnel Y	2371	-40	690	G's	14.6	107.2	-7.5	146.5
5	Right Sill X	1981	695	680	G's	2.0	299.9	-21.9	108.1
6	Right Sill Y	1901	695	680	G's	12.8	107.8	-5.2	136.1
7	Trunk X	364	-35	895	G's	1.9	212.4	-25.0	110.6
8	Trunk Y	364	25	895	G's	10.2	144.2	-3.6	98.0

Reference Points X - From Vehicle Rear Surface Y - Vehicle Centerline Z - Ground Plane





DATA SHEET NO. 8 - HYBRID III ATD INJURY CRITERIA AND SENSOR DATA

Test Vehicle: 2000 Ford Expedition 4WD 4 Door SUV NHTSA No.: FORD01

Test Program: 2000 NHTSA 40% Offset Test Date: 8/15/00

HEAD PRIMARY PEAK ACCELERATIONS

			Driver				Passenger			
Location	Axis	Units	Max	Time	Min	Time	Max	Time	Min	Time
Head CG	X	G's	3.4	299.3	-44.6	106.9	14.8	292.8	-38.4	118.3
Head CG	Y	G's	11.9	191.4	-14.4	115.1	32.5	128.1	-20.4	273.7
Head CG	Z	G's	17.4	92.6	-8.3	153.4	21.2	99.4	-4.1	85.1
Head CG Resultant	N/A	G's	47.2	106.9			48.9	127.6		

CHEST PRIMARY PEAK ACCELERATIONS

			Driver				Passenger			
Location	Axis	Units	Max	Time	Min	Time	Max	Time	Min	Time
Chest CG	X	G's	0.5	274.7	-28.4	95.5	1.8	212.6	-33.6	128.0
Chest CG	Y	G's	12.0	146.0	-3.0	77.9	15.3	125.1	-3.2	206.0
Chest CG	Z	G's	8.5	77.1	-8.9	160.6	6.1	115.5	-3.5	152.4
Chest CG Resultant	N/A	G's	29.2	95.5			36.7	127.6		

FEMUR PEAK FORCES

			Driver				Passenger			
Location	Axis	Units	Max	Time	Min	Time	Max	Time	Min	Time
Left Femur	Z	Newtons	999.3	155.0	-3956.3	88.9	633.6	124.1	-1410.8	102.8
Right Femur	Z	Newtons	1261.8	134.7	-1873.7	102.7	352.1	79.6	-937.8	95.3

SEAT BELT SENSOR PEAK VALUES

			Driver				Passenger			
Location	Axis	Units	Max	Time	Min	Time	Max	Time	Min	Time
Lap Belt Force	N/A	Newtons	2849.0	138.2	-9.8	0.0	3777.9	115.7	-7.3	3.5
Shoulder Belt Force	N/A	Newtons	4002.3	96.5	-0.7	288.3	5987.4	127.1	10.8	0.0
Shoulder Belt Pullout	N/A	MM	77.8	138.8	0.0	13.8	62.2	153.2	0.0	9.1
Shoulder Belt Stretch	N/A	MM/CM	0.000	0.0	0.000	0.0	0.117	138.2	-0.061	276.1 *

* Driver Channel Failed, No Data

HEAD INJURY CRITERA (HIC)

	Driver				Passenger			
Location	HIC	Avg G	T^1	T^2	HIC	Avg G	T^1	T^2
Head CG Primary	293.5	36.7	88.8	124.7	396.3	41.4	103.5	139.4

CHEST CLIP (3MSEC)

	Driver			Passenger		
Location	CLIP	T^1	T^2	CLIP	T^1	T^2
Chest CG Primary	28.6	94.5	97.5	35.9	126.3	129.3

Test Vehicle: 2000 Ford Expedition 4WD 4 Door SUV NHTSA No.: FORD01

Test Program: 2000 NHTSA 40% Offset Test Date: 8/15/00

PELVIC PEAK ACCELERATIONS

			Driver				Passenger			
Location	Axis	Units	Max	Time	Min	Time	Max	Time	Min	Time
Pelvis	X	G's	3.3	178.8	-36.2	89.6	4.0	190.4	-27.0	99.3
Pelvis	Y	G's	15.2	133.0	-6.1	89.9	14.9	110.5	-6.3	174.0
Pelvis	Z	G's	3.9	74.7	-17.4	144.4	4.5	299.0	-11.4	125.4

UPPER NECK PEAK FORCES AND MOMENTS

			Driver				Passenger			
Location	Axis	Units	Max	Time	Min	Time	Max	Time	Min	Time
Neck Force	X	Newtons	299.7	109.0	-268.7	204.4	92.9	291.1	-383.6	106.3
Neck Force	Y	Newtons	450.8	190.6	-115.3	296.5	264.9	212.4	-434.4	273.2
Neck Force	Z	Newtons	1220.8	97.4	-271.3	156.2	1635.8	105.7	-131.3	294.9
Neck Moment	X	N•m	31.4	196.1	-31.0	113.9	23.1	111.4	-15.9	130.6
Neck Moment	Y	N•m	29.4	103.1	-20.8	143.0	7.3	219.1	-22.0	134.1
Neck Moment	Z	N•m	25.3	136.2	-10.2	190.7	16.7	218.6	-32.5	140.7

FOOT PEAK ACCELERATIONS

			Driver				Passenger			
Location	Axis	Units	Max	Time	Min	Time	Max	Time	Min	Time
Left Foot Aft	X	G's	62.4	90.5	-245.6	75.7	4.6	196.0	-38.1	89.9
Left Foot Aft	Z	G's	86.7	87.3	-89.1	82.6	6.6	119.1	-27.6	89.8
Left Foot Fore	Z	G's	118.2	97.1	-185.4	89.1	24.5	111.6	-47.7	89.9
Right Foot Aft	X	G's	19.4	93.0	-91.1	87.3	14.9	205.9	-57.5	95.3
Right Foot Aft	Z	G's	20.4	92.3	-134.3	85.4	1.0	272.0	-32.9	99.9
Right Foot Fore	Z	G's	115.5	91.8	-175.9	85.5	5.4	109.8	-45.1	91.7

UPPER AND LOWER TIBIA PEAK FORCES AND MOMENTS

			Driver				Passenger			
Location	Axis	Units	Max	Time	Min	Time	Max	Time	Min	Time
Left Lower Moment	X	N•m	18.9	83.5	-37.1	100.1	11.5	214.3	-39.0	111.0
Left Lower Moment	Y	N•m	413.0	90.4	-151.9	76.2	19.3	93.5	-16.3	123.6
Left Lower Force	Z	Newtons	111.0	272.7	-3235.7	75.4	105.1	150.9	-1172.7	72.5
Left Upper Moment	X	N•m	69.0	156.6	-34.1	93.6	7.7	188.0	-41.9	111.6
Left Upper Moment	Y	N•m	76.1	91.1	-218.0	145.7	45.7	89.5	-41.0	122.9
Right Lower Moment	X	N•m	16.4	85.4	-149.1	88.3	14.2	95.1	-17.6	151.3
Right Lower Moment	Y	N•m	280.9	102.5	-34.5	84.0	46.3	95.3	-5.2	258.6
Right Lower Force	Z	Newtons	79.3	291.7	-5158.7	88.9	223.1	148.3	-872.9	95.7
Right Upper Moment	X	N•m	37.7	85.1	-78.8	88.7	12.4	130.2	-42.3	152.7
Right Upper Moment	Y	N•m	5.8	56.4	-168.1	137.8	64.3	139.2	-17.1	81.2

Test Vehicle: 2000 Ford Expedition 4WD 4 Door SUV NHTSA No.: FORD01

Test Program: 2000 NHTSA 40% Offset Test Date: 8/15/00

CHEST PEAK DISPLACEMENTS

			Driver				Passenger			
Location	Axis	Units	Max	Time	Min	Time	Max	Time	Min	Time
Chest CG	X	MM	0.1	43.7	-21.3	102.6	0.5	0.4	-34.4	129.3

HEAD REDUNDANT PEAK ACCELERATIONS

			Driver				Passenger			
Location	Axis	Units	Max	Time	Min	Time	Max	Time	Min	Time
Head CG	X	G's	2.5	296.3	-44.1	106.5	14.6	292.7	-36.6	117.9
Head CG	Y	G's	12.5	192.0	-13.5	114.7	33.8	129.1	-21.3	273.6
Head CG	Z	G's	15.2	89.5	-11.0	148.5	19.1	117.3	-1.6	19.3
Head CG Resultant	N/A	G's	47.2	106.5			49.4	126.8		

CHEST REDUNDANT PEAK ACCELERATIONS

			Driver				Passenger			
Location	Axis	Units	Max	Time	Min	Time	Max	Time	Min	Time
Chest CG	X	G's	0.6	219.4	-28.1	95.4	1.5	213.1	-33.8	127.8
Chest CG	Y	G's	12.7	145.9	-3.7	78.1	15.5	126.8	-2.8	207.1
Chest CG	Z	G's	8.1	77.1	-9.4	160.7	7.1	115.5	-3.0	152.0
Chest CG Resultant	N/A	G's	28.7	95.5			37.0	127.4		

REDUNDANT HEAD INJURY CRITERA (HIC)

	Driver				Passenger			
Location	HIC	Avg G	T^1	T^2	HIC	Avg G	T^1	T^2
Head CG Redundant	294.1	36.7	88.4	124.3	396.7	41.4	103.3	139.2

REDUNDANT CHEST CLIP (3MSEC)

	Driver			Passenger		
Location	CLIP	T^1	T^2	CLIP	T^1	T^2
Chest CG Redundant	28.3	94.9	97.9	36.0	126.3	129.3

DATA SHEET NO. 9

SEAT BELT PERFORMANCE ASSESSMENT TEST DATA

Test Vehicle: 2000 Ford Expedition 4WD 4 door SUV NHTSA No.: FORD01

Test Program: 2000 NHTSA 40% Offset Test Date: 8/15/00

SEAT BELT PLACEMENT MEASUREMENTS

Measurement Description	Units	Driver	Passenger
TBI - Dummy centerline to lap/shoulder belt intersect	mm	180	190
PBU -Top surface of reference to belt upper edge	mm	330	310
PBL - Top surface of reference to belt lower edge	mm	225	220
Lap Belt tension	Newtons	10	10
Shoulder Belt tension	N/A	Retractor	Retractor

BELT LENGTH DATA

Measurement Description	Units	Driver	Passenger
Retractor reel to 'D' ring	mm	800	800
Shoulder belt length as measured on ATD	mm	810	840
Lap belt length as measured on ATD	mm	780	790
Remainder of belt on reel	mm	875	810
Total belt length for continuous webbing systems	mm	3265	3240

SHOULDER BELT SPOOL-OFF DATA

Measurement Description	Units	Driver	Passenger
As determined mechanically	mm	60.0	73.0
As determined electronically	mm	77.8	62.2

BELT STRETCH DATA

Measurement Description	Units	Driver	Passenger
Electronically from shoulder belt load cell and "D" ring	mm/cm	No Data	0.12
Mechanically	mm/cm	No Data	No Data

DATA SHEET NO. 10

SUMMARY OF FMVSS 212 DATA

Test Vehicle: 2000 Ford Expedition 4WD 4 door SUV NHTSA No.: FORD01

Test Program: 2000 NHTSA 40% Offset Test Date: 8/15/00

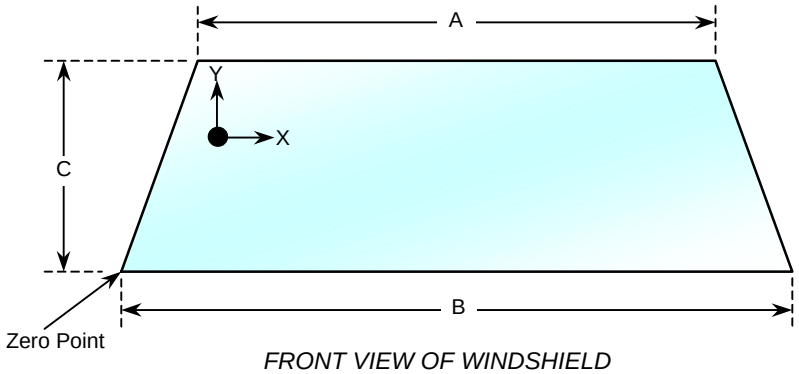
Windshield Mounting Details:
Windshield glass is secured to the vehicle frame with a rubber type adhesive. There is molding that covers the windshield periphery at the top and sides. A molding covers the bottom of the window but is not attached to the windshield.

The standard requires that the post-test retention measurement be a minimum of 75 percent of the pretest total periphery measurement for vehicles not equipped with occupant passive restraints and 50 percent for each side of the windshield for vehicles which are equipped with occupant passive restraints.

Temperature of windshield molding during test: 22.1 °C

WINDSHIELD PERIPHERY MEASUREMENTS

Measurement	Pre-Test (mm)	Post-Test (mm)	% of Retention
Left Side	2299	2299	100
Right Side	2299	2299	100
Total	4598	4598	100



FRONT VIEW OF WINDSHIELD

WINDSHIELD DIMENSIONS

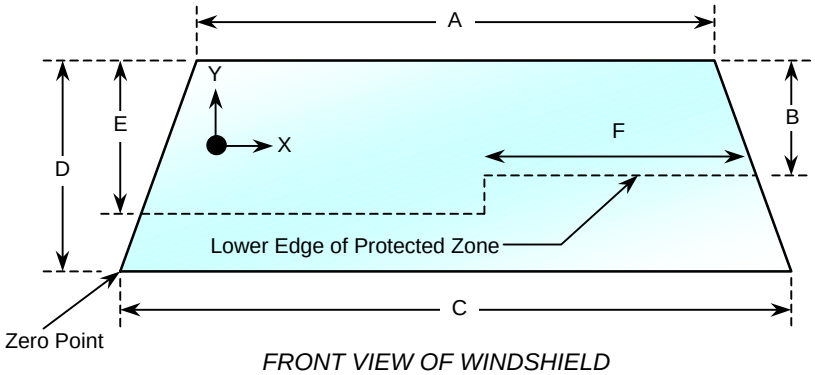
Item	Units	Segment Length	Molding Width
A	mm	1368	30
B	mm	1759	14
C	mm	735	26

DATA SHEET NO. 11

WINDSHIELD ZONE INTRUSION FMVSS 219 (PARTIAL) DATA

Test Vehicle: 2000 Ford Expedition 4WD 4 door SUV NHTSA No.: FORD01

Test Program: 2000 NHTSA 40% Offset Test Date: 8/15/00



FRONT VIEW OF WINDSHIELD

WINDSHIELD AND PROTECTED ZONE

Item	Units	Value
A	mm	1368
B	mm	406
C	mm	1759
D	mm	735
E	mm	524
F	mm	653

AREA OF PROTECTED ZONE FAILURES

A. Provide coordinates of the area that the protected zone was penetrated more than 0.25 in. by a vehicle component other than one that is normally in contact with the windshield.

X	Y
N/A	N/A
N/A	N/A
N/A	N/A
N/A	N/A

B. Provide coordinates of the area beneath the protected zone that the inner surface of the windshield was penetrated by a vehicle component.

X	Y
N/A	N/A
N/A	N/A
N/A	N/A
N/A	N/A

DATA SHEET NO. 12

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Test Vehicle: 2000 Ford Expedition 4WD 4 door SUV NHTSA No.: FORD01

Test Program: 2000 NHTSA 40% Offset Test Date: 8/15/00

Temperature at Time of Impact: 40.6 °C Test Time: 1:10 PM

STODDARD SOLVENT SPILLAGE MEASUREMENT

A. From impact until vehicle motion ceases: 0.0 oz.
(Maximum Allowable = 1 ounce)

B. For the 5-minute period after motion ceases: 640 oz.
(Maximum Allowable = 5 ounces)

C. For the following 25 minutes: 2560 oz.
(Maximum Allowable = 1 oz./minute)

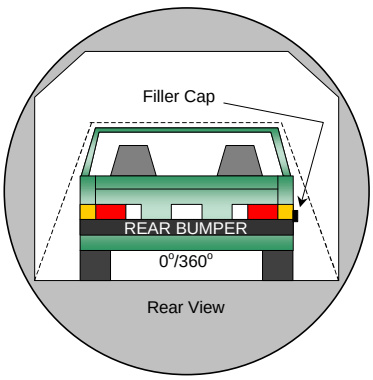
C. Stoddard Solvent Spillage Details:
Driver side torsion bar moved rearward and ruptured the fuel tank on the forward most edge (see figure A-71 for close-up photograph).

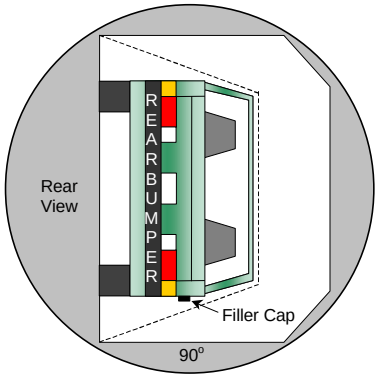
DATA SHEET NO. 13

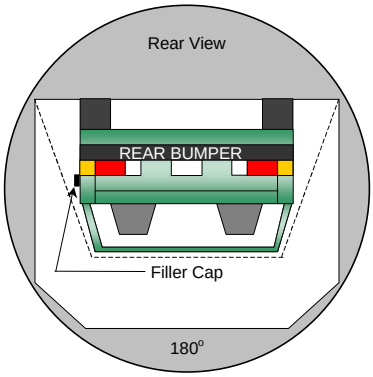
FMVSS 301 STATIC ROLLOVER DATA SHEET

Test Vehicle: 2000 Ford Expedition 4WD 4 door SUV NHTSA No.: FORD01

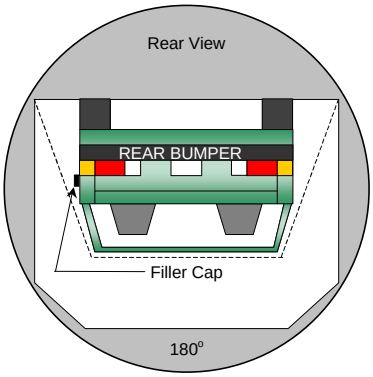
Test Program: 2000 NHTSA 40% Offset Test Date: 8/15/00

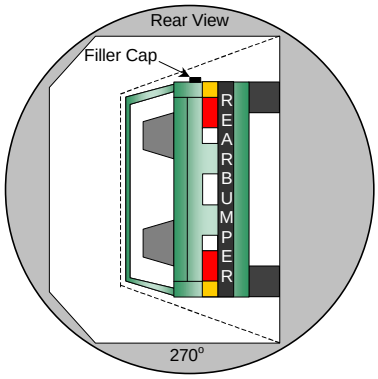


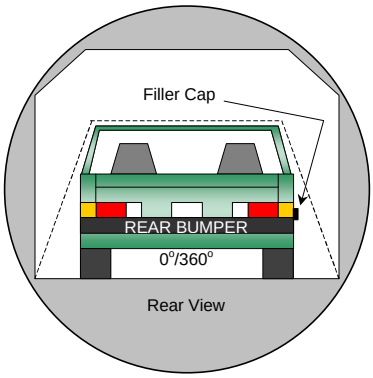




0° TO 90° **90°TO 180°**







180° TO 270° **270°TO 360°**

1. The specified fixture rollover rate for each 90° of rotation is 60 to 120 seconds.
2. The position hold time at each position is 300 seconds (minimum).
3. Details of Stoddard Solvent spillage location:

   Spillage occurred from rupture at the front surface of fuel tank. Rupture caused by intrusion of driver side torsion bar and aft mounting bracket into fuel tank.

Rollover Test Phase	Rotation Time (sec.)	Hold Time (sec.)	Spillage (oz.)
0° TO 90°	82	300	0.0
90° TO 180°	80	300	56.0
180° TO 270°	80	300	0.1
270° TO 360°	80	300	0.6

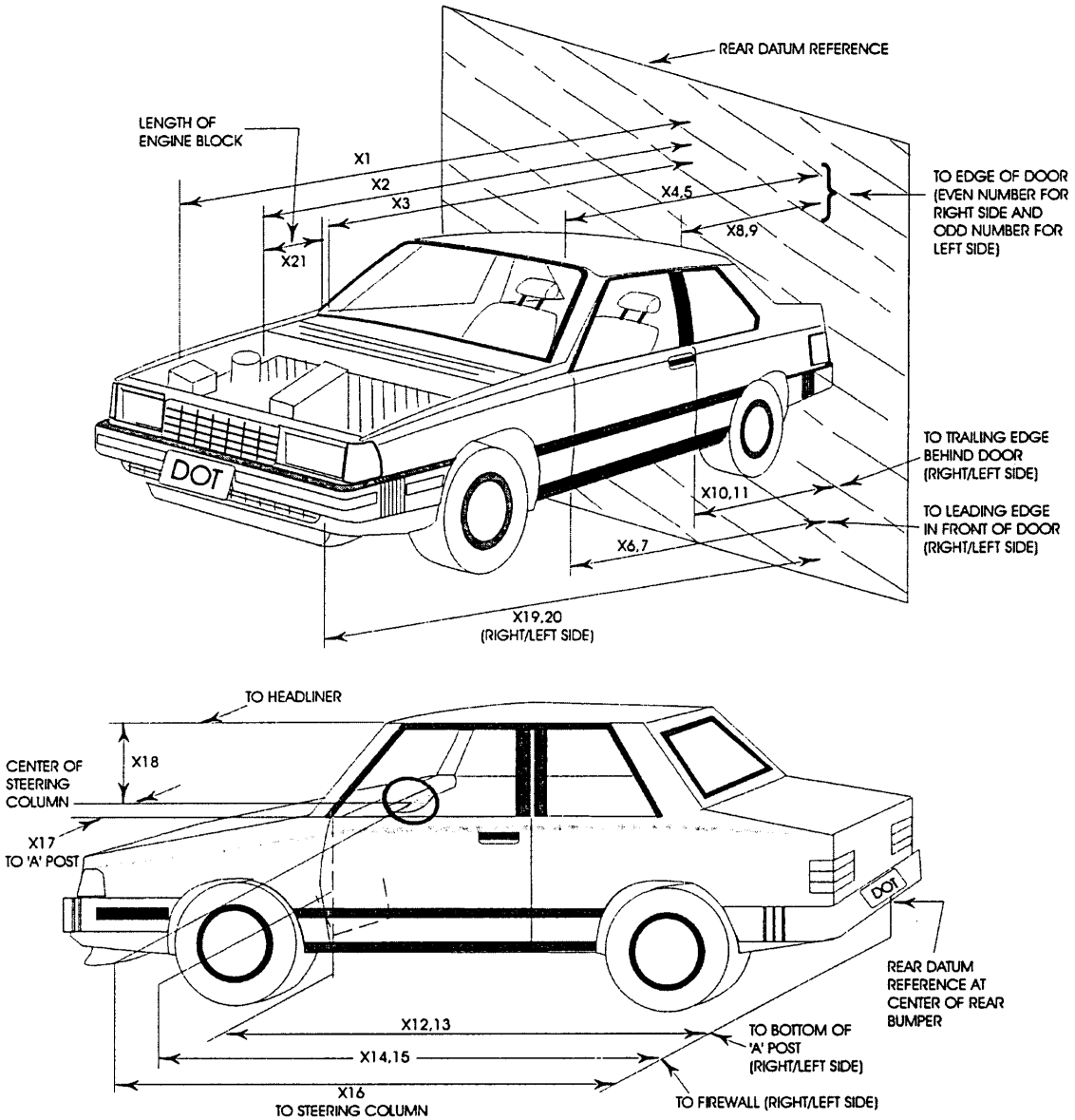
DATA SHEET NO. 14

VEHICLE MEASUREMENTS

Test Vehicle: 2000 Ford Expedition 4WD 4 door SUV NHTSA No.: FORD01

Test Program: 2000 NHTSA 40% Offset Test Date: 8/15/00

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
1	Total length of vehicle at centerline	mm	5190	4505	-685
2	RSOV to front of engine	mm	4345	4270	-75
3	RSOV to firewall centerline	mm	3988	3985	-3
4	RSOV to upper leading edge of right door	mm	3603	3620	17
5	RSOV to upper leading edge of left door	mm	3605	3606	1
6	RSOV to lower leading edge of right door	mm	3522	3530	8
7	RSOV to lower leading edge of left door	mm	3523	3521	-2
8	RSOV to upper trailing edge of right door	mm	2471	2491	20
9	RSOV to upper trailing edge of left door	mm	2472	2467	-5
10	RSOV to lower trailing edge of right door	mm	2460	2480	20
11	RSOV to lower trailing edge of left door	mm	2460	2458	-2
12	RSOV to bottom of right ‘A’ pillar	mm	3600	3625	25
13	RSOV to bottom of left ‘A’ pillar	mm	3602	3515	-87
14	RSOV to firewall on right side	mm	3927	3965	38
15	RSOV to firewall of left side	mm	3969	3922	-47
16	RSOV to steering column	mm	3075	3130	55
17	Center of steering column to left ‘A’ pillar	mm	448	370	-78
18	Center of steering column to headlining	mm	480	400	-80
19	RSOV to right side of front bumper	mm	4910	5175	265
20	RSOV to left side of front bumper	mm	4910	3870	-1040
21	Length of engine block	mm	500	500	0
RD	RSOV to right side of dash panel	mm	3361	3380	19
CD	RSOV to center of dash panel	mm	3290	3300	10
LD	RSOV to left side of dash panel	mm	3211	3205	-6


REAR DATUM REFERENCE
LENGTH OF ENGINE BLOCK
X1
X2
X3
X21
X4,5
X8,9
TO EDGE OF DOOR (EVEN NUMBER FOR RIGHT SIDE AND ODD NUMBER FOR LEFT SIDE)
DOT
TO TRAILING EDGE BEHIND DOOR (RIGHT/LEFT SIDE)
X10,11
TO LEADING EDGE IN FRONT OF DOOR (RIGHT/LEFT SIDE)
X6,7
X19,20 (RIGHT/LEFT SIDE)
TO HEADLINER
X18
CENTER OF STEERING COLUMN
X17 TO 'A' POST
DOT
REAR DATUM REFERENCE AT CENTER OF REAR BUMPER
X12,13
TO BOTTOM OF 'A' POST (RIGHT/LEFT SIDE)
X14,15
X16 TO STEERING COLUMN
TO FIREWALL (RIGHT/LEFT SIDE)

DATA SHEET NO. 15

CAMERA LOCATIONS

Test Vehicle: 2000 Ford Expedition 4WD 4 door SUV NHTSA No.: FORD01

Test Program: 2000 NHTSA 40% Offset Test Date: 8/15/00

No.	Camera View	Location (mm)			Angle (deg.)	Film Plane to Head	Lens (mm)	Speed (fr/sec)
		X	Y	Z				
1	Left Side, Real Time	7620	10290	956	1	12750	Zoom	24
2	Left Side, Overall	940	8250	1100	1	7750	12	*
3	Left Side, Close-Up	1140	8400	1570	3	8450	24	1020
4	Left Side, Above Vehicle	1025	8465	3190	16	8000	19	990
5	Left Side, Above Vehicle	1020	8450	2770	13	8020	19	1000
6	Right Side, Overall	1060	8300	975	3	7900	13	1000
7	Right Side, Close-up	600	0	5486	90	7950	24	970
8	Right Side, Over shoulder	7000	9200	2970	8	9980	40	960
9	Right Side, Close-up	5	11500	1800	1	N/A	25	1030
10	Overhead, Overall	1830	8500	1600	3	N/A	19	1000
11	Overhead, Close-Up	90	15	6300	90	N/A	85	1000
12	Front, Driver	1490	210	2700	29	N/A	19	1250
13	Front, Passenger	1490	460	2700	27	N/A	19	1250
14	Pit engine	60	200	-1500	90	N/A	13	960
15	Pit barrier	40	0	1410	15	N/A	25	970
16	Right side, tank view	4150	9900	10	1	N/A	63	640
17	Onboard, Driver	3800	260	1685	12	1300	13	440
18	Onboard, Passenger	3805	390	1685	12	1280	13	380
19	Right Side Close-up	10	8600	1060	2	N/A	13	*

X - Barrier Face Y - Monorail Centerline Z - Ground

* No timing marks

DATA SHEET NO. 16

PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

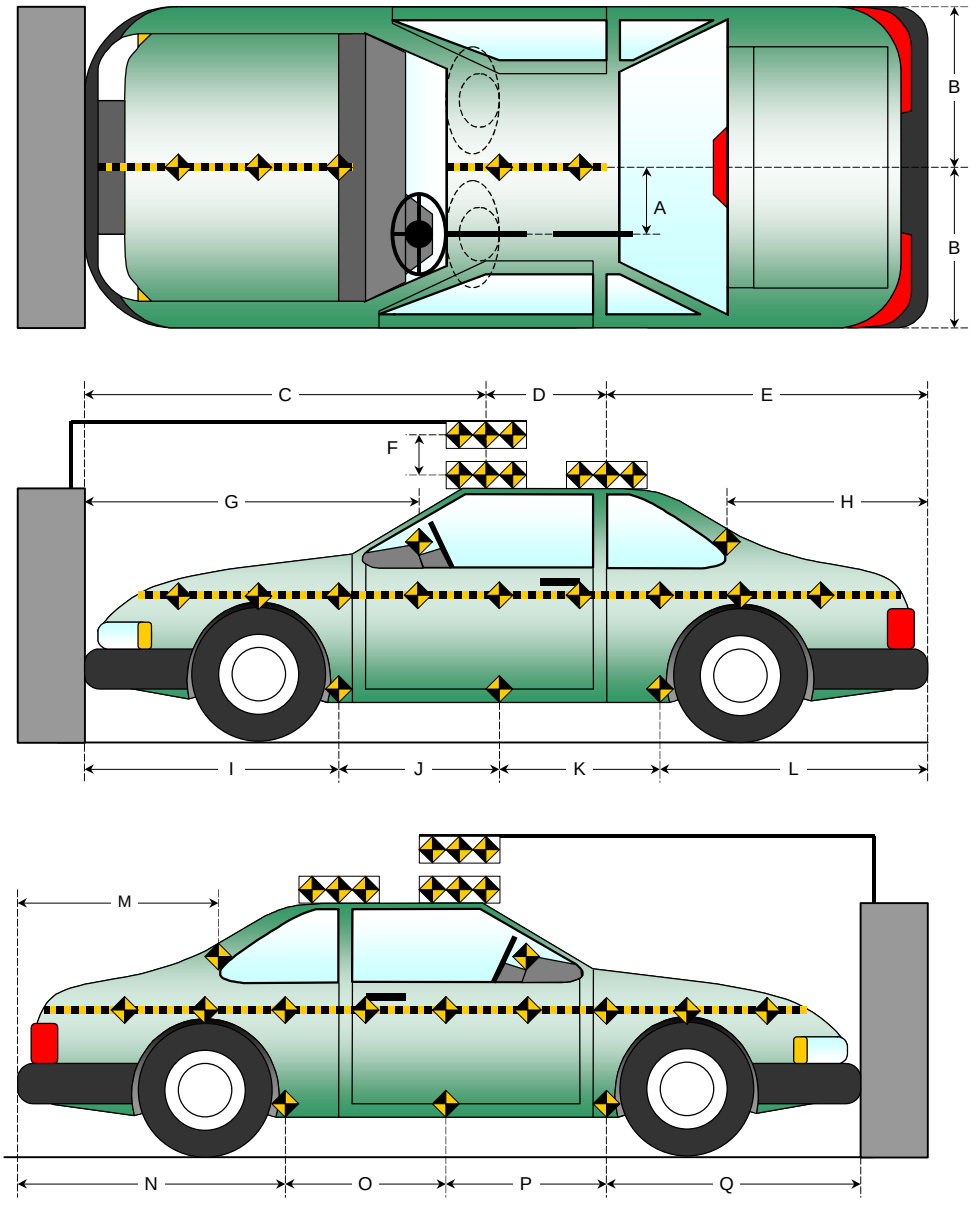
Test Vehicle: 2000 Ford Expedition 4WD 4 door SUV NHTSA No.: FORD01

Test Program: 2000 NHTSA 40% Offset Test Date: 8/15/00

All Dimensions

in mm

Item	Value
A	432
B	1001
C	2303
D	610
E	2302
F	155
G	1875
H	1465
I	1556
J	960
K	965
L	1711
M	1465
N	1712
O	959
P	969
Q	1548



DATA SHEET NO. 17

VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2000 Ford Expedition 4WD 4 door SUV NHTSA No.: FORD01

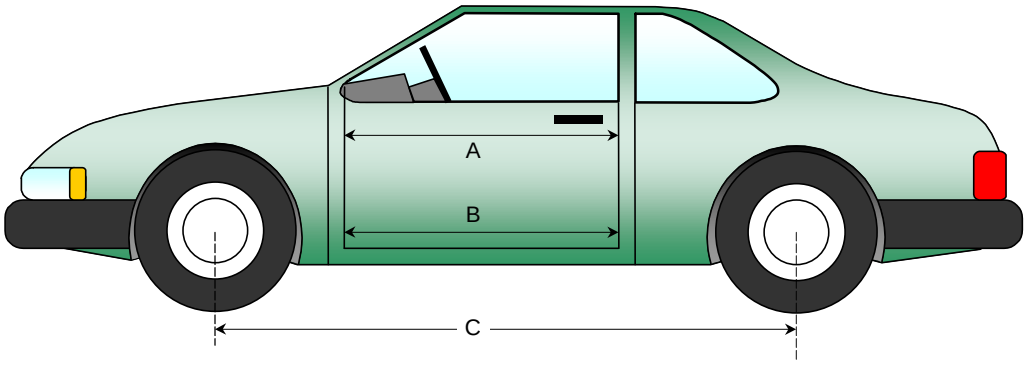
Test Program: 2000 NHTSA 40% Offset Test Date: 8/15/00

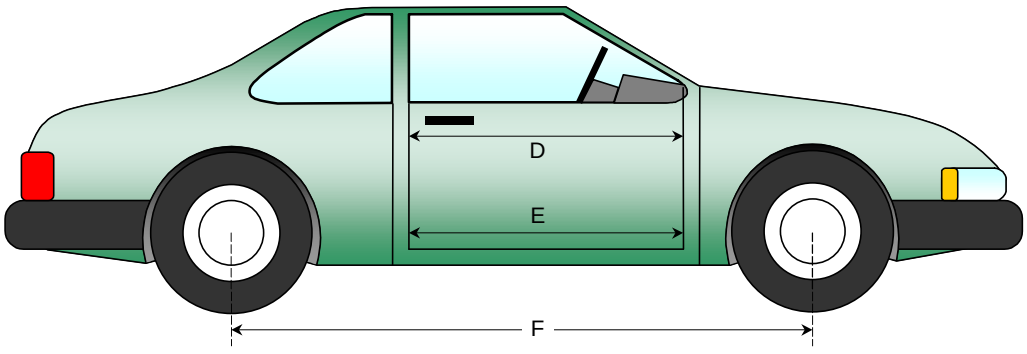
DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	1012	966	-46
B	Left Side Lower	mm	954	904	-50
D	Right Side Upper	mm	1009	1016	7
E	Right Side Lower	mm	954	961	7

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheel base	mm	3035	2545	-490
F	Right Side Wheel base	mm	3025	3110	85





DATA SHEET NO. 17…(CONTINUED)

VEHICLE INTRUSION MEASUREMENTS

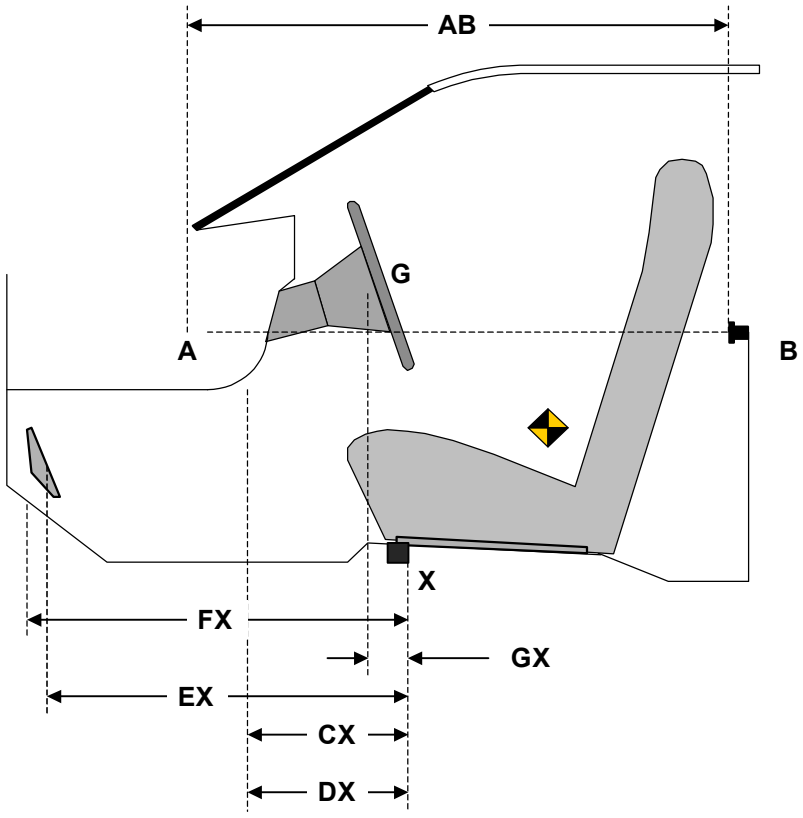
Test Vehicle: 2000 Ford Expedition 4WD 4 door SUV NHTSA No.: FORD01

Test Program: 2000 NHTSA 40% Offset Test Date: 8/15/00

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside window jam)	mm	1012	966	-46
CX	Left Knee Bolster to X	mm	300	310	10
DX	Right Knee Bolster to X	mm	306	290	-16
EX	Brake Pedal to X	mm	565	375	-190
FX	Foot Rest to X	mm	550	390	-160
GX	Center of Steering Wheel Hub to X	mm	86	135	49

X = Left Front Seat Outboard Anchor Bolt Head



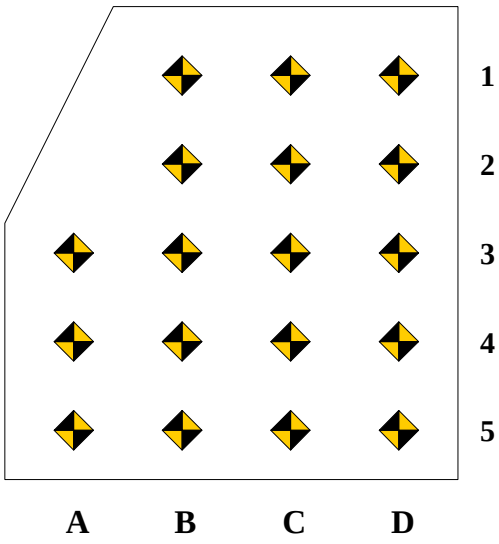
DRIVER COMPARTMENT

DATA SHEET NO. 17…(CONTINUED)

VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2000 Ford Expedition 4WD 4 door SUV NHTSA No.: FORD01

Test Program: 2000 NHTSA 40% Offset Test Date: 8/15/00



Measurement reference point for X and Z-axis is the forward outboard seat mounting bolt.

Columns A through D are evenly spaced.

Rows 1 and 2 are on the toe kick portion of the floor pan. Rows 3, 4, and 5 are located on the most level portion of the floor pan.

Row 3 will be at the intersection of the toe kick and the level sections of the floor pan.

DRIVER FLOOR PAN X-AXIS

	Pre-Test				Post-Test				Difference			
	A	B	C	D	A	B	C	D	A	B	C	D
1		701	693	696		391	391	394		-310	-302	-302
2		606	598	601		317	324	343		-289	-274	-258
3	503	503	498	501	289	304	332	346	-214	-199	-166	-155
4	401	405	398	401	224	264	268	276	-177	-141	-130	-125
5	301	303	299	301	169	178	181	191	-132	-125	-118	-110

DRIVER FLOOR PAN Z-AXIS

	Pre-Test				Post-Test				Difference			
	A	B	C	D	A	B	C	D	A	B	C	D
1		17	13	13		219	215	206		202	202	193
2		-23	-20	-27		153	138	121		176	158	148
3	-58	-58	-62	-62	81	67	55	54	139	125	117	116
4	-65	-65	-63	-63	10	6	-4	2	75	71	59	65
5	-64	-65	-65	-65	-75	-70	-50	-44	-11	-5	15	21

DATA SHEET NO. 17…(CONTINUED)

VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2000 Ford Expedition 4WD 4 door SUV NHTSA No.: FORD01

Test Program: 2000 NHTSA 40% Offset Test Date: 8/15/00

Measurement reference point for X and Z-axis is the forward outboard seat mounting bolt.

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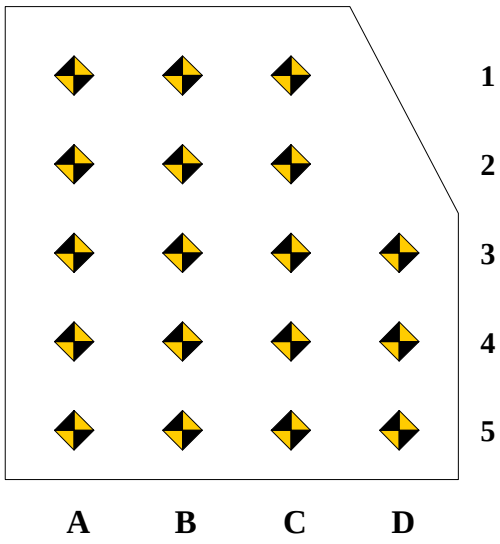


PASSENGER FLOOR PAN X-AXIS

	Pre-Test				Post-Test				Difference			
	A	B	C	D	A	B	C	D	A	B	C	D
1	677	663	681		498	517	644		-179	-146	-37	
2	581	566	583		403	438	547		-178	-128	-36	
3	477	466	483	479	323	335	447	458	-154	-131	-36	-21
4	379	367	383	381	325	337	347	360	-54	-30	-36	-21
5	281	265	281	281	230	235	245	260	-51	-30	-36	-21

PASSENGER FLOOR PAN Z-AXIS

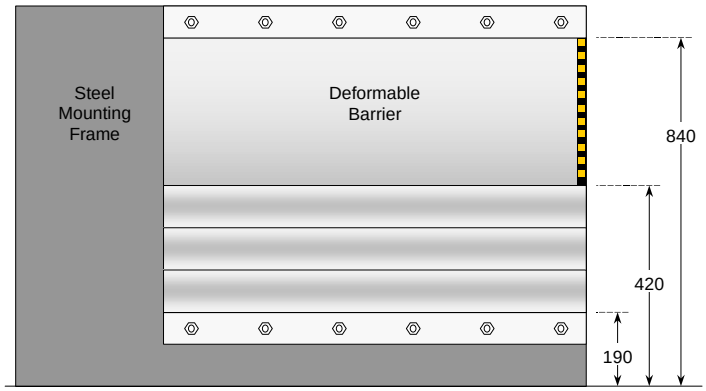
	Pre-Test				Post-Test				Difference			
	A	B	C	D	A	B	C	D	A	B	C	D
1	15	8	2		-22	-65	-80		-37	-73	-82	
2	-32	-40	-38		-87	-130	-120		-55	-90	-82	
3	-62	-62	-62	-69	-128	-162	-148	-133	-66	-100	-86	-64
4	-65	-65	-65	-64	-155	-160	-140	-120	-90	-95	-75	-56
5	-63	-62	-60	-60	-152	-150	-130	-103	-89	-88	-70	-43

DATA SHEET NO. 18

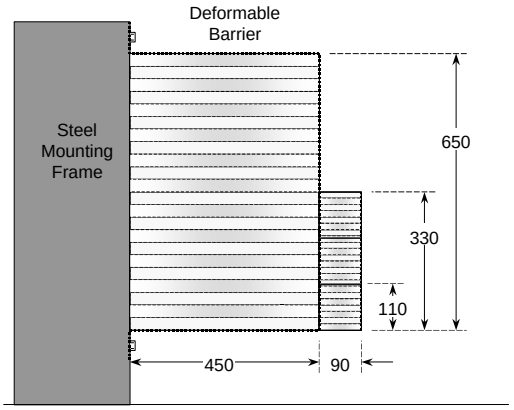
DEFORMABLE BARRIER DIMENSIONS AND ORIENTATION

Test Vehicle: 2000 Ford Expedition 4WD 4 door SUV NHTSA No.: FORD01

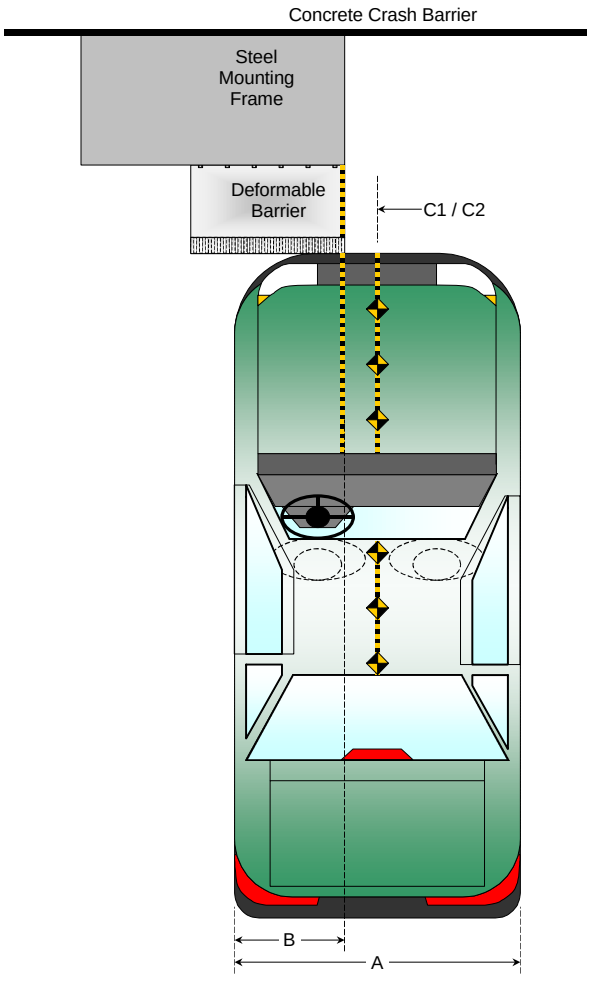
Test Program: 2000 NHTSA 40% Offset Test Date: 8/15/00



FRONT VIEW



LEFT SIDE VIEW



Item	Measured Parameter	Value
A	Vehicle Width at Widest Point	2002 *
B	40% Offset From Left Edge	801
C1	Impact Point Left of C_L	200
C2	Actual Impact Point Left of C_L	195

All Dimensions in mm

* Width does not include the vehicles bolt-on running boards.

DATA SHEET NO. 19
ACCIDENT INVESTIGATION DATA

Test Vehicle:	2000 Ford Expedition 4WD 4 door SUV	NHTSA No.:	FORD01
Test Program:	2000 NHTSA 40% Offset	Test Date:	8/15/00

VEHICLE INFORMATION

VIN:	1FMRU1665YLA82245	Wheel base (mm):	3035
Vehicle Size Category:	SUV	Test Weight (kg):	2874

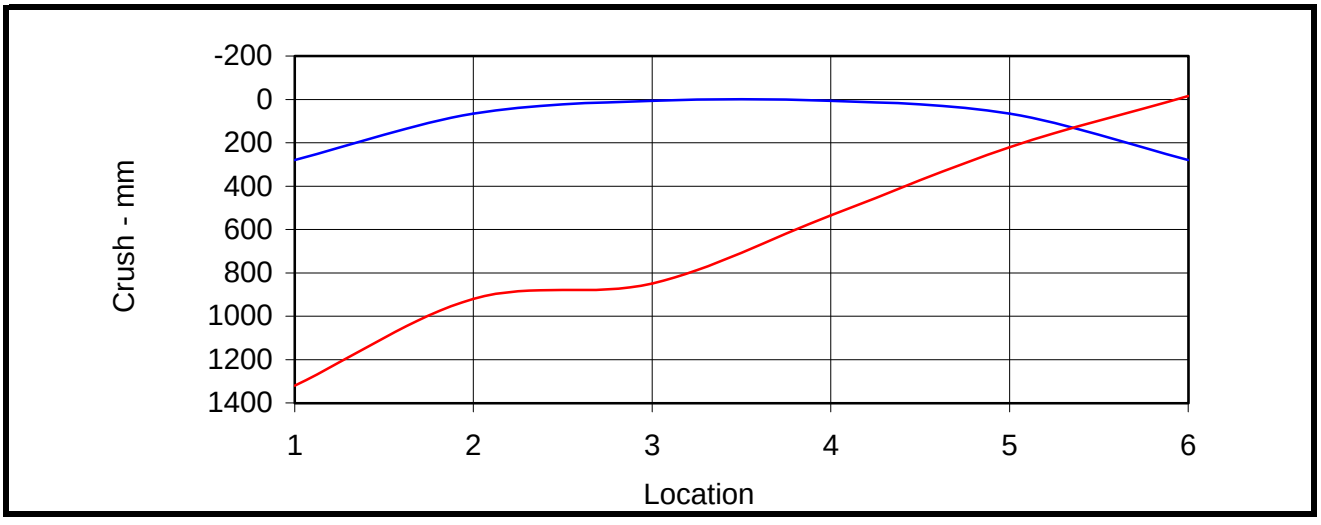
ACCELEROMETER DATA

Accelerometer Location:	Left Sill		
Cal. Procedure/Interval:	6 months / drop test		
Integration Algorithm:	NHTSA Standard	Linearity:	Good
Impact Velocity (km/h):	59.82		
Velocity Change (km/h):	72.47	Time of Separation (msec):	142.6

CRUSH PROFILE

Collision Deformation Classification:	12FYEW8	Midpoint of Damage:	Vehicle Driver Side
Damage Region Length (mm):	1715	Impact Mode:	40% Offset

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush zone 1 at left side	mm	280	1320	-1040
C2	Crush zone 2 on left side	mm	66	920	-854
C3	Crush zone 3 on left side	mm	7	850	-843
C4	Crush zone 4 on right side	mm	7	535	-528
C5	Crush zone 5 on right side	mm	66	220	-154
C6	Crush zone 6 at right side	mm	280	-15	295

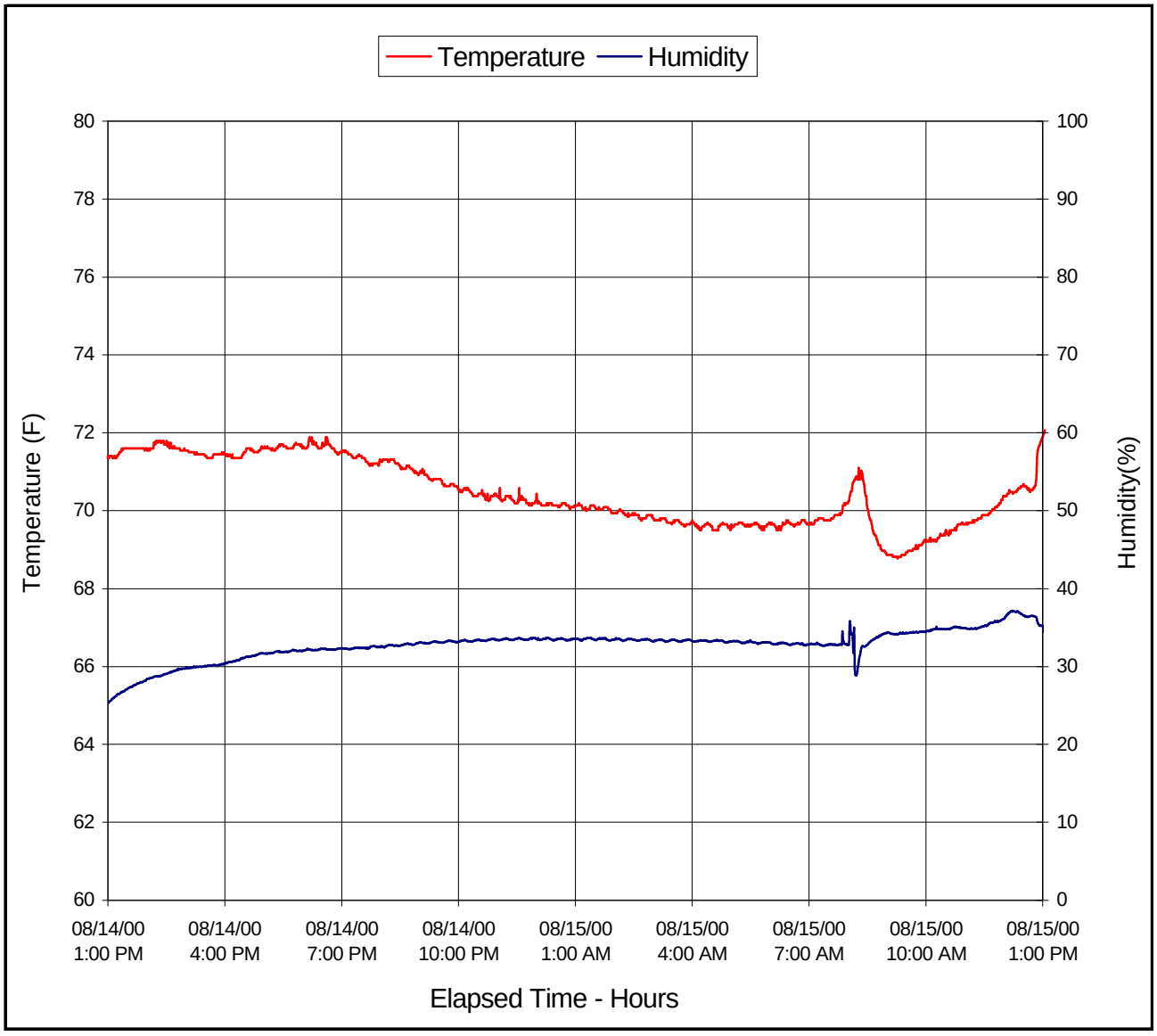


DATA SHEET NO. 20

DUMMY/ VEHICLE TEMPERATURE STABILIZATION

Test Vehicle: 2000 Ford Expedition 4WD 4 door SUV NHTSA No.: FORD01

Test Program: 2000 NHTSA 40% Offset Test Date: 8/15/00



APPENDIX A

PHOTOGRAPHS

APPENDIX B

DUMMY AND VEHICLE RESPONSE DATA TRACES

APPENDIX C

DEFORMABLE BARRIER CRUSH PROFILE

APPENDIX D

INSTRUMENTATION DATA CHANNEL ASSIGNMENTS

APPENDIX E

DUMMY CALIBRATION DATA

APPENDIX F

VEHICLE OWNER'S MANUAL

RESTRAINT AND SEATING INSTRUCTIONS