

REPORT NUMBER: TO1-MGA-2001-001

**RIGID POLE SIDE IMPACT TESTS
2000 NISSAN MAXIMA WITH SIDE AIRBAG**

**ES-2 DRIVER POSITION
Q3 LEFT REAR
HYBRID III 3 YR. OLD RIGHT REAR**

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July 3, 2001

FINAL REPORT

**PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
VOLPE NATIONAL TRANSPORTATION SYSTEM CENTER
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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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SECTION 1
PURPOSE AND TEST PROCEDURE

This Side Impact test is conducted as part of Contract No. DTRS57-98-D-00041, task order 5, 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 and SID/HIII dummies in a 2000 Nissan Maxima, with side airbags, when 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 2000 Nissan Maxima 4 door with side airbags. The subject vehicle was towed into a rigid pole at a velocity of 28.6 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 1690.5 kg. The test was conducted at MGA Research Corporation in Burlington, Wisconsin, on July 3, 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. A Q3 dummy was placed in a Cosco Touriva child restraint in the left rear outboard seating position. The Cosco Touriva child restraint was fastened to the vehicle with the combination lap and shoulder belt and the child seat tether strap. A Hybrid III 3 year old dummy was placed in a Cosco Touriva child restraint in the right rear outboard seating position. The Cosco Touriva child restraint was fastened to the vehicle with the combination lap and shoulder belt and the child seat tether strap. The side impact event was documented by eleven 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 instrument 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 and child peak responses.

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

		Left Front
1) Head Performance Criteria		
< 1000	T1 (msec)	Head did not contact any structure
	T2 (msec)	
	HPC	
2) Thorax Performance Criteria		
2.1) Chest Deflection < 42 mm	Upper Rib Deflection	33.3
	Mid Rib Deflection	31.3
	Lower Rib Deflection	31.5
2.2) Viscous Criteria < 1.0 (m/sec)	Upper Rib	0.3
	Mid Rib	0.2
	Lower Rib	0.3
3) Abdominal Protection Criterion		
Sum < 2500 N	Front Abdominal Force	108.5
	Mid Abdominal Force	566.4
	Rear Abdominal Force	801.1
	Sum of Abdominal Force	1449.8
4) Pelvis Performance Criterion		
< 6000 N	Pubic Symphysis Force	2079.9

HIC		Left Front
	T1 (msec)	45.8
	T2 (msec)	76.6
	T2 - T1 (msec)	30.8
	HIC	130

Fir Filtered	Left Front
Upper Rib Y (g's)	38.8
Mid Rib Y (g's)	51.8
Lower Rib Y (g's)	61.9
Lower Spine Y (g's)	44.8
Pelvis Y (g's)	52.6
TTI (g's)	53

Contacts	Left Front
Head (msec)	**
Arm (msec)	21.3
Rib (msec)	19.1
Pelvis (msec)	28.9

** Head contacted airbag, it did not contact any hard points

TEST NOTES

SECTION 3
SIDE IMPACT DUMMY (ES-2) AND VEHICLE TEST DATA

DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2000/Nissan/Maxima/4 door

Test Date: July 3, 2001

TEST VEHICLE INFORMATION

Make	Nissan
Model	Maxima
Body Style	4 door
VIN	JN1CA31DXYT754145
Color	Painted Orange
Odometer Reading	569
Transmission	automatic
Final Drive	front
Number of Cylinders	6
Engine Displacement	3.0 liters
Engine Placement	lateral

TEST VEHICLE OPTIONS

Front Airbags	yes
Side Airbags	yes
Power Windows	yes
Power Steering	yes
Power Door	yes
Tilt Wheel	yes
Air Conditioning	yes
Power Brakes	yes
Anti-lock Brakes	no
AM/FM/Cassette	yes
Cruise Control	yes

DATA FROM CERTIFICATION LABEL

Manufactured By	Nissan Motor Co., Ltd.	GVWR (kg)	1965
Date of Manufacture	01/00	GAWR Front (kg)	1073
		GAWR Rear (kg)	902

DATA FROM TIRE PLACARD

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	230	210
Cold Pressure (kPa)	230	210
Recommend Tire Size	P215/55R16	P215/55R16
Tire Size on Vehicle	P215/55R16	P215/55R16
Tire Manufacturer	Toyo	Toyo

Measured Parameter	Front	Rear	Third	Total
Type of Seats	bucket	bench		
Number of Occupants	2	3		5
Capacity Wt. (VCW) (kg)				400
Cargo Weight (RCLW) (kg)				60

DATA SHEET NO. 1...(continued)**GENERAL TEST AND VEHICLE PARAMETER DATA**Test Vehicle: 2000/Nissan/Maxima/4 doorTest Date: July 3, 2001**TEST VEHICLE WEIGHTS**

	Units	As Delivered (UVW)			As Tested (ATW)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	458.6	291.7		501.2	356.5	
Right	kg	464.9	269.9		499.4	333.4	
Ratio	%	62.2	37.8		59.2	40.8	
Totals	kg	923.5	561.6	1485.1	1000.6	689.9	1690.5

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Vehicle Target Weight (TVTW)*	kg	1690

* Target weight was set to match previous tests with the 2000 Nissan Maxima

TEST VEHICLE ATTITUDES

	Units	As Delivered	Fully Loaded	Ready for Test
Right Door Sill Angle	deg	0.3 BD	0.0	0.2 BD
Left Door Sill Angle	deg	0.1 BD	0.2 BD	0.2 BD
Front Bumper Angle	deg	0.2 LD	0.1 LD	0.2 LD
Rear Bumper Angle	deg	0.2 LD	0.0	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	2751
Total Vehicle Length at Left Side	mm	4176
Total Vehicle Length at Centerline	mm	4813
Total Vehicle Length at Right Side	mm	4176
Weight of Ballast in Cargo Area	kg	0
Amount of Water in Fuel Tank	liters	7.6

TEST VEHICLE VERTICAL IMPACT LINE DATA

Measurement Description	Units	Value
Actual Impact Point	mm	3mm forward

DATA SHEET NO. 1...(continued)

GENERAL TEST AND VEHICLE PARAMETER DATA

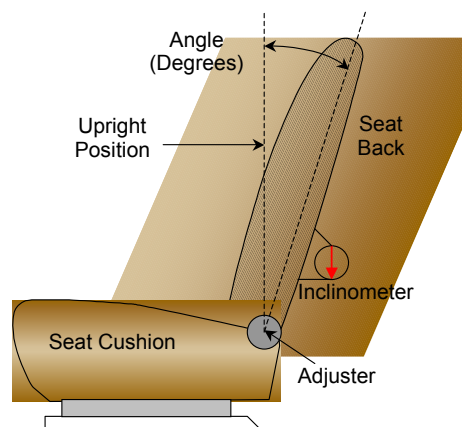
Test Vehicle: 2000/Nissan/Maxima/4 door

Test Date: July 3, 2001

NORMAL DESIGN RIDING POSITION

Driver seat back angle: 11.9 deg. on headrest post
(adjusted forward 1.5 deg. to
achieve 50 mm head
clearance)

Passenger seat back angle: non adjustable



FRONT SEAT ASSEMBLY

SEAT FORE/AFT POSITIONS

The driver's seat is electronically operated and the rear passenger seat has no adjustments. The fore/aft is set to the middle position for the driver's seat.

Driver seat fore/aft total travel: 230 mm

Rear passenger seat fore/aft total travel: non adjustable

Driver seat fore/aft position: 115 mm rearward

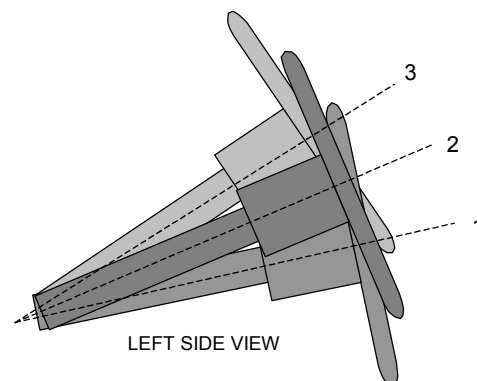
Rear passenger seat fore/aft position: non adjustable

SEAT BELT UPPER ANCHORAGE

The test vehicle "D" ring anchorage for the driver's seat position was placed in the full up position.

STEERING COLUMN ADJUSTMENT

Lowermost, position 1:	21.9°
Geometric center, position 2:	23.6°
Uppermost, position 3:	25.2°



STEERING COLUMN ASSEMBLY

POST TEST OBSERVATIONS

Test Vehicle: 2000/Nissan/Maxima/4 door

Test Date: July 3, 2001

TEST DUMMY INFORMATION AND CONTACT POINTS

Description	Left Front	Left Rear	Right Rear
Dummy Type	ES-2	Q3	HIII 3 yr. old
Head Contact	head airbag, headrest	child seat	Head to child seat
Upper Torso Contact	side airbag	Left foot to door trim panel	
Lower Torso Contact	armrest, door trim panel		
Left Knee Contact	door trim panel		
Right Knee Contact	left knee		

POST TEST DOOR OPENING

Description	Left Front	Left 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	struck side windows removed pre test
Other Notable Effects	None

AIRBAG DEPLOYMENT

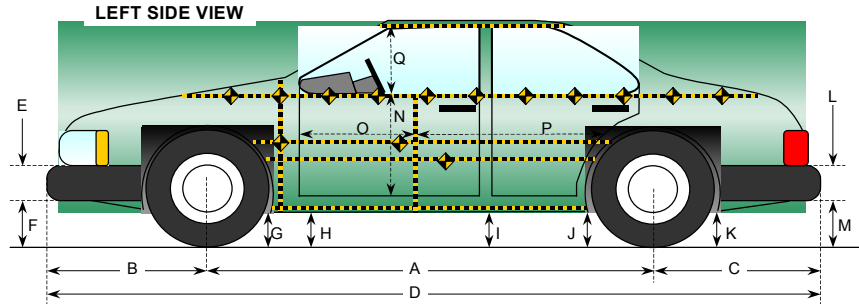
	Driver	Left Front	Left Rear
Front	no	no	
Side	yes	no	
Curtain			

SECTION 4
OCCUPANT AND VEHICLE INFORMATION

DATA SHEET NO. 3

VEHICLE PRE-TEST AND POST-TEST MEASUREMENTS

Test Vehicle: 2000/Nissan/Maxima/4 door Test Date: July 3, 2001



All Measurements in mm

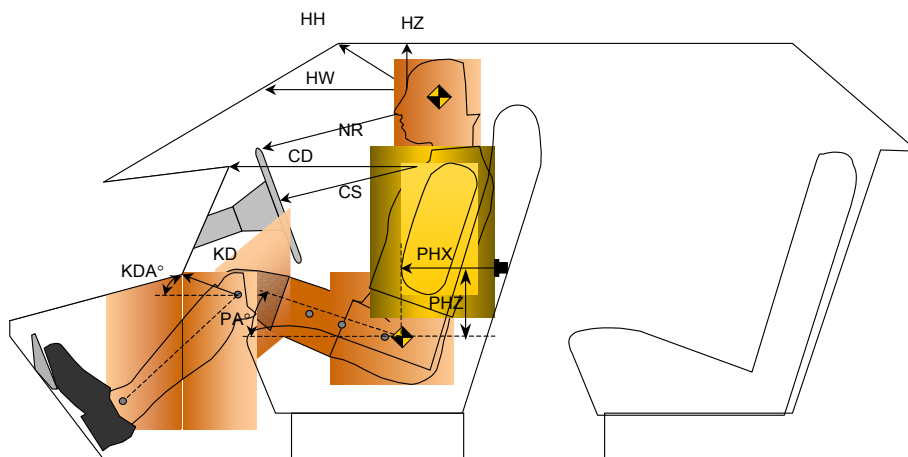
Code	Measurement Description	Pre-Test	Post-Test	Difference
A	Wheelbase	2751	2602	-149
B	Front Axle to FSOV	900	971	71
C	Rear Axle to RSOV	1162	1164	2
D	Total Length at Centerline	4813	4734	-79
E	Front Bumper Thickness	263	263	0
F	Front Bumper Bottom to Ground	273	280	7
G	Sill Height at Front Wheel Well	205	200	-5
H	Sill Height at Front Door Leading Edge	207	206	-1
I	Sill Height at "B" Pillar	209	254	45
J1	Sill Height at Rear Wheel Well	200	220	20
J2	Pinch Weld Height at Rear Wheel Well	200	247	47
K	Sill Height Aft of Rear Wheel Well	262	320	58
L	Rear Bumper Thickness	270	270	0
M	Rear Bumper Bottom to Ground	354	400	46
N	Sill Height to Window Bottom Sill	650	633	-17
O	Front Door Leading Edge to Impact CL	972	972	0
P	Rear Door Trailing Edge to Impact CL	1052	1005	-47
Q	Front Window Opening	453	410	-43
R	Right Side Length	4176	4208	32
S	Left Side Length	4176	3967	-209
T	Vehicle Width at "B" Post	1698	1431	-267

DATA SHEET NO. 4

ES-2 LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2000/Nissan/Maxima/4 door

Test Date: July 3, 2001



Driver Code	Measurement Description	Left Front	
		Length(mm)	Angle(°)
HH	Head to Header	302	
HW	Head to Windshield	522	
HZ	Head to Roof	135	
NR	Nose to Rim	438	
CD	Chest to Dash	568	
CS	Chest to Steering Wheel	360	
KDL	Left Knee to Dash	210	0.0
KDR	Right Knee to Dash	220	0.0
PA	Pelvic Angle (Longitudinal)		21.6
PA	Pelvic Angle (Lateral)		0.3
SA	Spine Angle (Longitudinal)		24.6
SA	Spine Angle (Lateral)		1.2
PHX	H-Point to Striker (X-Axis)	217	
PHZ	H-Point to Striker (Z-Axis)	123	

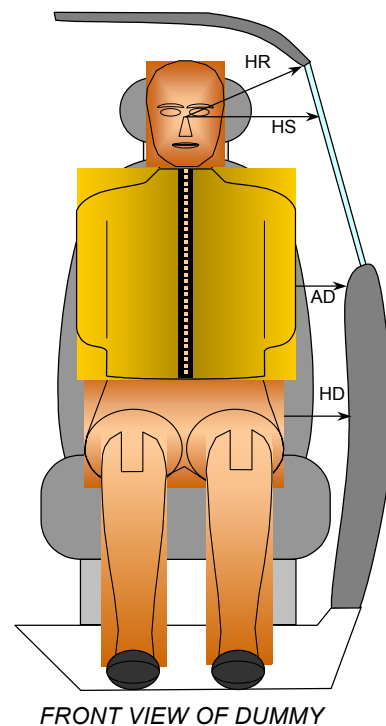
DATA SHEET NO. 5

ES-2 LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2000/Nissan/Maxima/4 door

Test Date: July 3, 2001

Code	Measurement Description	Units	Left Front
HR	Head to Side Header	mm	234
HS	Head to Side Window	mm	310
AD	Arm to Door	mm	84
HD	H-Point to Door	mm	140



CHILD DUMMY MEASUREMENTS

Measurement Description	Units	Left Rear	Right Rear
Head CG to Striker X	mm	106	80
Head CG to Striker Y	mm	365	378
Head CG to Striker Z	mm	205	188
Chest Center to Door	mm	371	379

DATA SHEET NO. 6

DUMMY POSITIONING

Test Vehicle: 2000/Nissan/Maxima/4 door

Test Date: July 3, 2001

	Left Front		
	H-Point Machine	Dummy H Point	Dummy H Point after seat back adjustment
HP to Floor Z (mm)	176	175	175
HP to Hinge X (mm)	818	813	813
HP to Sill Y (mm)	223	228	228
HP to Striker X (mm)	362	360	359
HP to Dash X (mm)	573	570	570
HP to Header Z (mm)	789	786	786
H-POINT MACHINE (deg)			
Left Knee	128		
Right Knee	126		
Left Foot	104		
Right Foot	136		
Left Leg (mm)	192		
Right Leg (mm)	122		
Hip Angle	96		
Back Angle	23		

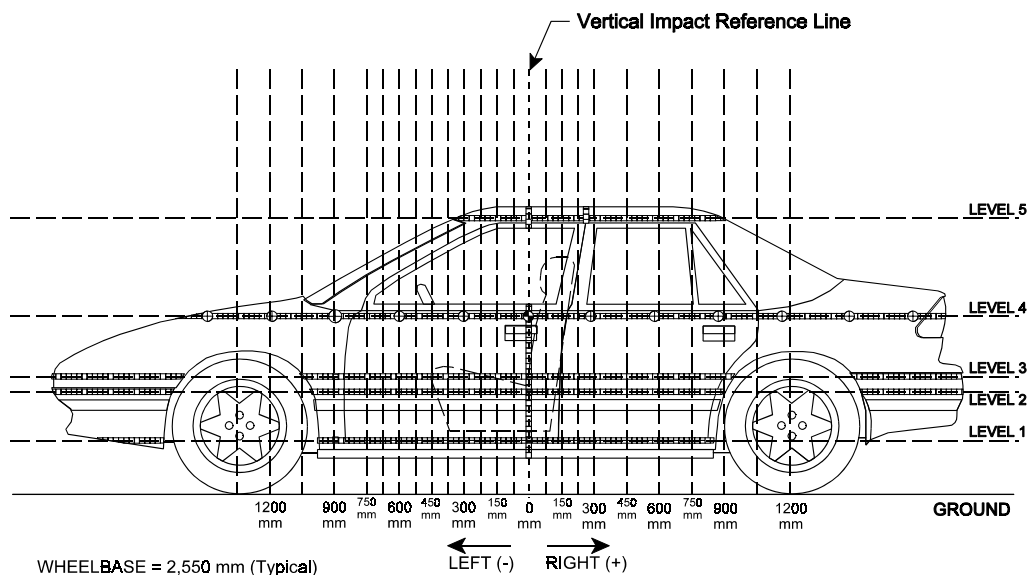
DATA SHEET NO. 7

VEHICLE SIDE MEASUREMENTS

Test Vehicle: 2000/Nissan/Maxima/4 door

Test Date: July 3, 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 800 mm.

Level	Measurement Description	Units	Height Above Ground
5	Window	mm	1382
4	Window Sill	mm	915
3	Mid Door	mm	605
2	Occupant H-Point	mm	485
1	Sill Top	mm	290

DATA SHEET NO. 8

VEHICLE EXTERIOR CRUSH PROFILES

Test Vehicle: 2000/Nissan/Maxima/4 door

Test Date: July 3, 2001

	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-1950				507					515					8	
-1800				495					518					23	
-1650				480					510					30	
-1500				449					483					34	
-1350				440					485					45	
-1200				434					492					58	
-1050	424	380	382	433		511	460	460	498		87	80	78	65	
-900	430	385	380	433		536	476	474	504		106	91	94	71	
-825	432	384	378	432		560	502	501	511		128	118	123	79	
-750	432	384	378	432		581	523	523	535		149	139	145	103	
-675	432	383	377	432		607	548	550	556		175	165	173	124	
-600	432	383	377	431		630	573	572	596		198	190	195	165	
-525	432	382	377	430		651	613	609	636		219	231	232	206	
-450	432	382	376	430		681	664	658	681		249	282	282	251	
-375	432	381	376	430		716	708	706	722		284	327	330	292	
-300	432	381	376	429		750	752	759	763		318	371	383	334	
-225	433	381	376	429		810	802	807	804		377	421	431	375	
-150	433	380	375	429	652	862	855	855	850	870	429	475	480	421	218
-75	433	380	375	427	648	900	896	895	905	924	467	516	520	478	276
0	432	380	375	427	646	900	911	910	911	934	468	531	535	484	288
75	432	380	375	427	647	878	873	872	877	932	446	493	497	450	285
150	431	380	375	427	647	815	796	790	827	932	384	416	415	400	285
300	432	381	375	428	647	729	728	727	770	906	297	347	352	342	259
450	431	382	375	428	648	650	673	669	712	852	219	291	294	284	204
600	430	382	376	428	653	587	609	606	766	803	157	227	230	338	150
750	430	384	378	430	651	538	546	546	619	757	108	162	168	189	106
900	424	381	379	430	656	496	484	480	568	732	72	103	101	138	76
1050			364	432	672			440	520	732			76	88	60
1200				435					476					41	
1350				441					486					45	
1500				448					480					32	
1650				456					482					26	
1800				468					482					14	
1950				483					486					3	
2100				501					493					-8	

Reference plane is parallel to test vehicle longitudinal centerline

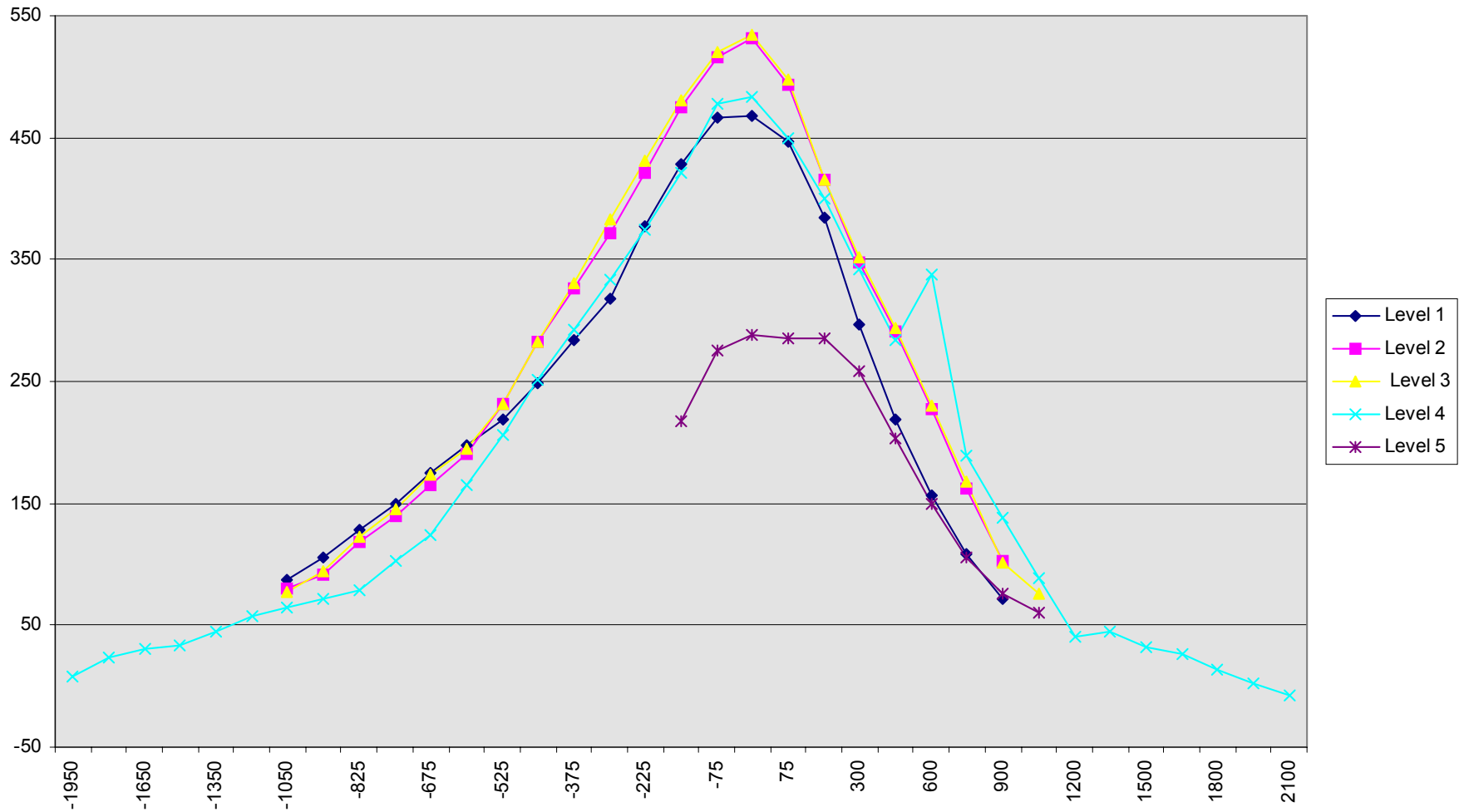
Given dimensions = Reference plane to car body

DATA SHEET NO. 8...(continued)

VEHICLE EXTERIOR CRUSH PROFILES

Test Vehicle: 2000/Nissan/Maxima/4 door

Test Date: July 3, 2001



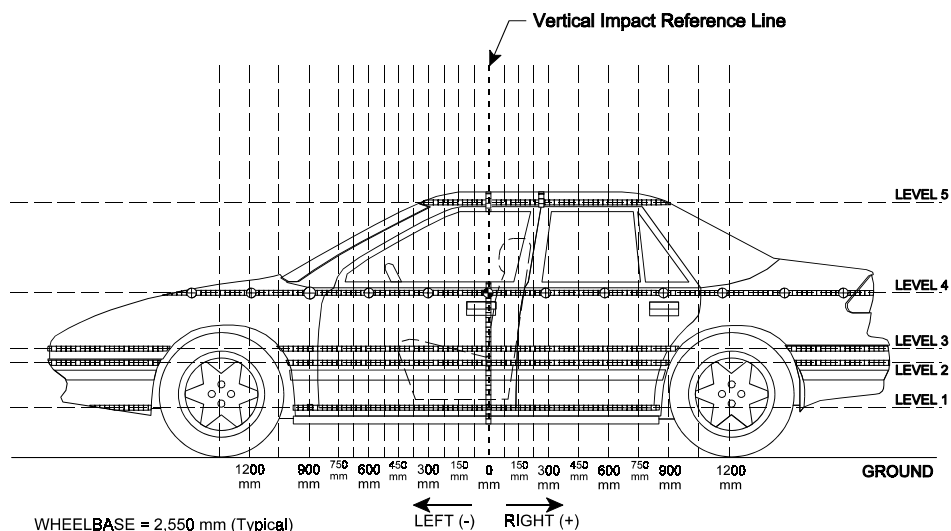
DATA SHEET NO. 9

VEHICLE DAMAGE PROFILE DISTANCES

Test Vehicle: 2000/Nissan/Maxima/4 door

Test Date: July 3, 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	1950 mm	4	483	486	3
2	1154 mm	4	434	489	55
3	372 mm	3	375	699	324
4	-397 mm	3	376	694	318
5	-1192 mm	4	434	493	59
6	-1950 mm	4	507	515	8

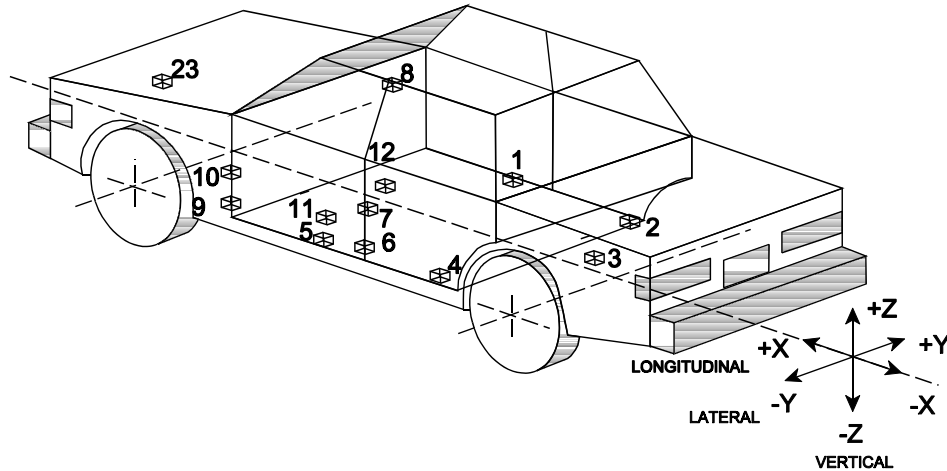
Reference plane is parallel to test vehicle longitudinal centerline
 Given dimensions = Reference plane to car body

DATA SHEET NO. 10

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

Test Vehicle: 2000/Nissan/Maxima/4 door

Test Date: July 3, 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
10	Left Mid A Post
11	Driver Seat Track

No.	Location
12	Vehicle CG
13	Left A Pillar @ Roof
14	Left Front Door @ Pelvis
15	Left Front Door @ Arm
16	Left Rear Door @ Front of CRS
17	Left Rear Door @ Rear of CRS
18	Child Seat @ Pelvis
19	Left Driver Seat Frame
20	Right Driver Seat Frame
21	Lower Center Radiator Support

DATA SHEET NO. 10...(continued)

VEHICLE ACCELEROMETER LOCATION AND DATA SUMMARY

Test Vehicle: 2000/Nissan/Maxima/4 door

Test Date: July 3, 2001

VEHICLE ACCELEROMETER PEAK DATA AND PRE-TEST LOCATIONS

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	3.5	1.5	9.0	0.1	2.0	2.3	9.4
2	Right Side Sill at Rear Seat	3.4	1.0	10.4	0.2	2.1	3.4	11.0
3	Rear Floorpan Above Axle	3.1	1.7	9.4	0.1	3.7	3.8	9.8
4	Left Side Sill at Rear Door			11.6	0.3			
5	Left Side Sill at Front Door *			34.0	31.5			
6	Left Lower B Post			65.4	8.6			
7	Left Mid B Post			50.5	5.4			
8	Left Upper B Post			86.9	79.6			
9	Left Lower A Post			17.6	4.2			
10	Left Mid A Post			8.1	1.1			
11	Driver Left Seat Track			53.3	22.6			
12	Vehicle CG	6.8	4.9	42.0	9.5	19.0	17.7	44.2
13	Left A Pillar @ Roof			35.8	1.8			
14	Left Front Door @ Pelvis			118.5	81.0			
15	Left Front Door @ Arm			107.3	37.8			
16	Left Rear Door @ Front of CRS			58.2	48.7			
17	Left Rear Door @ Rear of CRS			67.9	40.3			
18	Child Seat @ Pelvis			36.7	5.4			
19	Left Driver Seat Frame			67.8	20.1			
20	Right Driver Seat Frame			65.9	20.7			
21	Lower Center Radiator Support	5.1	8.1	10.5	4.2	3.3	3.5	11.0

* No valid data after approximately 39 msec.

DATA SHEET NO. 10...(continued)

VEHICLE ACCELEROMETER LOCATION AND DATA SUMMARY

Test Vehicle: 2000/Nissan/Maxima/4 door

Test Date: July 3, 2001

VEHICLE ACCELEROMETER COORDINATES

Loc. No.	Description	Coordinates (mm)*		
		X	Y	Z
1	Right Side Sill at Front Seat	2904	688	212
2	Right Side Sill at Rear Seat	1728	688	216
3	Rear Floorpan Above Axle	1024	0	523
4	Left Side Sill at Rear Door	1761	-688	210
5	Left Side Sill at Front Door	2888	-688	214
6	Left Lower B Post	2204	-691	301
7	Left Mid B Post	2229	-715	894
8	Left Upper B Post	2165	-487	1360
9	Left Lower A Post	3284	-720	300
10	Left Mid A Post	3355	-808	848
11	Driver Left Seat Track	2435	-485	331
12	Vehicle CG	2692	0	308
13	Left A Pillar @ Roof	2670	-539	1261
14	Left Front Door @ Pelvis	2431	-758	608
15	Left Front Door @ Arm	2754	-789	730
16	Left Rear Door @ Front of CRS	1858	-758	620
17	Left Rear Door @ Rear of CRS	1539	-748	588
18	Child Seat @ Pelvis	1481	-195	666
19	Left Driver Seat Frame	2169	-484	682
20	Right Driver Seat Frame	2169	-208	682
21	Lower Center Radiator Support	4563	0	218

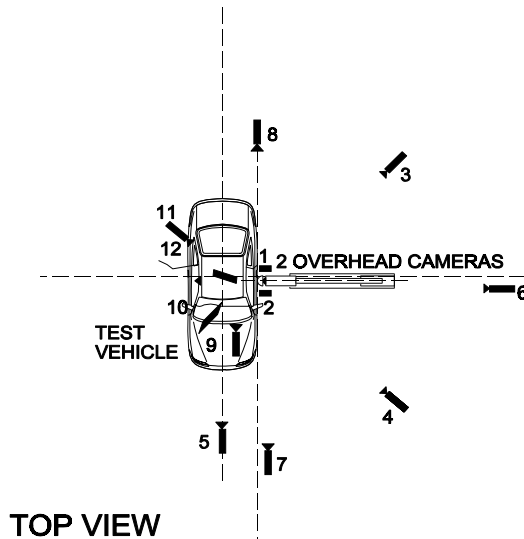
Reference Points X - Rear Bumper (+ Forward)
 Y - Vehicle Centerline (+ to right)
 Z - Ground Level (+ up)

DATA SHEET NO. 11

HIGH SPEED CAMERA LOCATIONS AND DATA

Test Vehicle: 2000/Nissan/Maxima/4 door

Test Date: July 3, 2001



No.	Camera View	Location (mm)			Lens (mm)	Film Speed (fps)
		X	Y	Z		
1	Overhead Overall	-840	0	5000	8	1010
2	Overhead Close-up	0	0	5000	13	1000
3	Left Side 45° Rearward Pole View	-1950	6800	1234	50	1015
4	Left Side 45° Forward Pole View	-1800	-6220	1365	50	1000
5	Real Time				13	32
6	Left Side Rear Pole View	-3000	0	2570	8	1000
7	Front Ground Level Vehicle/Pole Impact	2800	-9000	1520	25	1005
8	Rear Ground Level Vehicle/Pole Impact	3900	8700	1320	25	1010
9	Test Vehicle Onboard Driver Hip				7.5	513
10	Test Vehicle Onboard Hood				13	505
11	Test Vehicle Onboard Driver Head Contact				13	509
12	Test Vehicle Onboard Child Dummies				13	506

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

APPENDIX A

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ES-2 AND VEHICLE 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	J11014	Endevco	3/28/01
Head Y Accelerometer	J11625	Endevco	3/28/01
Head Z Accelerometer	J10730	Endevco	3/28/01
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	J13941	Endevco	3/20/01
Upper Spine Y Accelerometer	J13984	Endevco	3/20/01
Upper Spine Z Accelerometer	J13927	Endevco	3/28/01
Upper Rib Y Accelerometer	AJ9Y3	Endevco	3/28/01
Mid Rib Y Accelerometer	ANAM1	Endevco	3/28/01
Lower Rib Y Accelerometer	ANAN7	Endevco	3/28/01
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	ALFP1	Endevco	5/30/01
Lower Spine Y Accelerometer	AP179	Endevco	5/30/01
Lower Spine Z Accelerometer	AHTY4	Endevco	5/30/01
Torso Load Cell	122	FTSS	4/12/01
T-12 Load Cell	102	FTSS	3/27/01
Front Abdomen Load Cell	122	FTSS	4/26/01
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	J13772	Endevco	2/21/01
Pelvis Y Accelerometer	J14008	Endevco	2/21/01
Pelvis Z Accelerometer	J14028	Endevco	2/21/01
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

DUMMY AND VEHICLE CALIBRATION DATA

	INSTRUMENTS FOR RIGHT REAR DUMMY NO. 025		
	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Head X	ALB87	Endevco	6/1/01
Head Y	AHRP5	Endevco	6/1/01
Head Z	AJ9T6	Endevco	6/1/01
Upper Neck Load Cell	233	Denton	4/17/01
Lower Neck Load Cell	214	Denton	4/17/01
Chest X	J13650	Endevco	3/22/01
Chest Y	J14007	Endevco	3/22/01
Chest Z	J13424	Endevco	3/22/01
Pelvis X	AH0A2	Endevco	5/31/01
Pelvis Y	AGMT2	Endevco	5/31/01
Pelvis Z	AJ837	Endevco	5/31/01

	INSTRUMENTS FOR LEFT REAR DUMMY Q3		
	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Head X	AJ9D6	Endevco	3/22/01
Head Y	AJ9D8	Endevco	3/22/01
Head Z	AHTF1	Endevco	3/22/01
Upper Neck Load Cell	86	FTSS	7/23/99
Lower Neck Load Cell	84	FTSS	7/23/99
Chest X	AH0D1	Endevco	3/22/01
Chest Y	AH0M0	Endevco	3/22/01
Chest Z	AHWK8	Endevco	3/22/01
Pelvis X	ACC81	Endevco	5/30/01
Pelvis Y	AMTB8	Endevco	5/30/01
Pelvis Z	AP1Y1	Endevco	5/30/01
Left Mid A-Post Y	D11-F06	Entran	5/30/01
Left Lower A-Post Y	E03-H07	Entran	6/6/01
Left Upper B-Post Y	D11-F09	Entran	5/31/01

VEHICLE INSTRUMENT CALIBRATION

	VEHICLE ACCELEROMETERS		
	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Left Mid B-Post Y	J10-E03	Entran	6/19/01
Left Lower B-Post Y	I18-G02	Entran	2/15/01
Rear Floorpan Above Axle X	G13-F16	Entran	4/4/01
Rear Floorpan Above Axle Y	G13-F18	Entran	4/4/01
Rear Floorpan Above Axle Z	G13-F03	Entran	4/4/01
Driver Seat Track Y	I25-F04	Entran	6/11/01
Driver Left Seat Frame	F04-N07	Entran	6/22/01
Driver Right Seat Frame	G13-B03	Entran	6/11/01
Right Side Sill at Front Seat X	I25-F08	Entran	6/11/01
Right Side Sill at Front Seat Y	I25-F07	Entran	6/11/01
Right Side Sill at Front Seat Z	I25-F09	Entran	6/11/01
Right Side Sill at Rear Seat X	K11-J11	Entran	5/25/01
Right Side Sill at Rear Seat Y	C18-G09	Entran	5/25/01
Right Side Sill at Rear Seat Z	A09-G09	Entran	5/25/01
Left Side Sill at Front Seat Y	A08-A12	Entran	2/8/01
Left Side Sill at Rear Seat Y	E03-H24	Entran	6/7/01
Vehicle CG X	D11-F14	Entran	5/30/01
Vehicle CG Y	E03-H09	Entran	6/6/01
Vehicle CG Z	G13-F02	Entran	2/7/01
Left A Pillar @ Roof	F04-N12	Entran	6/22/01
Left Front Door @ Pelvis Y	F04-N10	Entran	6/22/01
Left Front Door @ End of Arm Y	E03-H16	Entran	6/7/01
Left Rear Door @ Front of CRS	F11-G02	Entran	6/11/01
Left Rear Door @ Rear of CRS	D11-F13	Entran	5/30/01
Child Seat @ Pelvis	F04-N17	Entran	6/25/01
Lower Center Radiator Support X	A08-A10	Entran	2/7/01
Lower Center Radiator Support Y	G13-F07	Entran	2/15/01
Lower Center Radiator Support Z	A08-A11	Entran	2/8/01

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 a 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 ± 10 mm 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

ES-2 PEAK RESPONSE COMPARISON TABLE

Location	Peak Values (G's)								
	Class	Axis	Units	Maxima 6/27/01 ES-2		Maxima 6/29/01 SID/HILL		Maxima 7/03/01 ES-2	
				Peak	Time (msec)	Peak	Time (msec)	Peak	Time (msec)
Head	1000	X	G	111.6	59	-107.8	60	8.5	150
	1000	Y	G	* 501.6	59	729.8	60	32.8	58
	1000	Z	G	145.2	59	200.4	60	14.8	59
	1000	RES	G	532.1	59	759.5	60	36.3	58
Head Injury Criteria (HIC)				4728		9233	6128	130	
time 1 msec				58.6		59.9	59.8	45.8	
time 2 msec				59.6		60.9	61.0	76.6	
							Corrected Y Acc.		
Upper Neck Force	1000	X	N	-244.9	61	285.7	59	-191.5	79
	1000	Y	N	-1455.1	59	981.9	61	257.1	102
	1000	Z	N	-1616.0	62	-2565.7	61	581.7	58
	1000	RES	N	1742.9	59	2583.2	61	586.1	58
Upper Neck Moment	600	X	Nm	-49.4	62	89.2	62	-16.2	40
	600	Y	Nm	29.0	96	23.4	109	18.0	97
	600	Z	Nm	11.1	72	15.9	103	-21.1	174
	600	RES	Nm	51.1	62	89.6	62	26.6	169
Lower Neck Force	1000	X	N	-321.0	70			-238.1	70
	1000	Y	N	763.6	58			271.2	35
	1000	Z	N	-1646.3	63			618.3	59
	1000	RES	N	1707.7	63			624.3	59

ES-2 PEAK RESPONSE COMPARISON TABLE

Location	Peak Values (G's)								
	Class	Axis	Units	Maxima 6/27/01		Maxima 6/29/01		Maxima 7/03/01	
				Peak	Time (msec)	Peak	Time (msec)	Peak	Time (msec)
Lower Neck Moment	600	X	Nm	74.4	59			-51.8	172
	600	Y	Nm	48.5	76			31	77
	600	Z	Nm	9.0	59			-20.2	170
	600	RES	Nm	76.9	59			57.2	169
Shoulder Force	1000	X	N	-643.7	37			634.1	35
	1000	Y	N	1343.9	38			479.6	27
	1000	Z	N	-909.0	43			-574.6	30
Upper Spine	180	X	G	-12.0	62	-15.4	47	7.4	34
	180	Y	G	51.8	56	79.1	53	36.7	53
	180	Z	G	11.3	60	14.3	61	5.7	66
	180	RES	G	52.4	56	79.8	53	36.8	53
Lower Spine	180	X	G	11.7	68	-20.7	84	9.2	20
	180	Y	G	55.5	51	77.2	44	45.4	43
	180	Z	G	11.3	61	12.9	61	4.7	67
	180	RES	G	55.5	51	72.8	44	45.7	42
Upper Rib	180	Y	G	64.8	39	66.0	42	49.3	21
Mid Rib	180	Y	G	115.3	40			62.1	20
Lower Rib	180	Y	G	180.2	40	60.4	58	88.0	20

ES-2 PEAK RESPONSE COMPARISON TABLE

Location	Peak Values (G's)								
	Class	Axis	Units	Maxima 6/27/01		Maxima 6/29/01		Maxima 7/03/01	
				Peak	Time (msec)	Peak	Time (msec)	Peak	Time (msec)
Upper Rib Deflection	180	Y	mm	-45.1	57			-33.3	59
Mid Rib Deflection	180	Y	mm	-42.7	57	42.3	106	-31.3	58
Lower Rib Deflection	180	Y	mm	-40.1	56			-31.5	56
Upper Rib VC	180	Y	msec	0.7	46			0.3	35
Mid Rib VC	180	Y	msec	0.6	45			0.2	53
Lower Rib VC	180	Y	msec	0.5	46			0.3	27
Torso Force	600	X	N	243.3	60			110.1	69
	600	Y	N	-294.2	42			278.9	49
Torso Moment	600	Y	Nm	-14.4	62			16.5	81
	600	Z	Nm	17.3	55			19.3	70
T12 Force	600	X	N	632.1	53			1820.2	50
	600	Y	N	1665.3	41			-968.3	62
T12 Moment	600	X	Nm	-155.4	41			-82.5	54
	600	Y	Nm	79.9	71			61.6	50
Abdomen Front Force	600	Y	N	204.9	41			108.5	60
Abdomen Mid Force	600	Y	N	708.9	41			566.4	43
Abdomen Rear Force	600	Y	N	880.5	51			801.1	43
Abdomen Summed Force	600	Y	N	1757.7	41			1449.8	43
Pubic Symphysis Force	600	Y	N	-1930.1	46			-2079.9	45

ES-2 PEAK RESPONSE COMPARISON TABLE

Location	Peak Values (G's)								
	Class	Axis	Units	Maxima 6/27/01		Maxima 6/29/01		Maxima 7/03/01	
				Peak	Time (msec)	Peak	Time (msec)	Peak	Time (msec)
Right Femur Force	600	X	N	274.7	125			427.7	59
	600	Y	N	-832.6	59			-969.3	61
	600	Z	N	696.9	77			622.8	71
	600	RES	N	891.3	59			1078.0	61
Right Femur Moment	600	X	Nm	-97.0	43			-102.1	44
	600	Y	Nm	-27.4	72			36.7	108
	600	Z	Nm	-46.2	66			-32.0	67
	600	RES	Nm	97.6	43			104.5	44
Left Femur Force	600	X	N	307.8	133			221.5	66
	600	Y	N	-1362.9	60			-2136.8	59
	600	Z	N	1247.2	52			1054.1	53
	600	RES	N	1769.4	54			2363.6	58
Left Femur Moment	600	X	Nm	-112.8	69			-100.2	71
	600	Y	Nm	42.8	113			29.3	68
	600	Z	Nm	-51.7	58			-34.9	55
	600	RES	Nm	114.2	69			104.6	71
Pelvis	1000	X	G	23.1	54	-11.0	79	20.9	53
	1000	Y	G	52.7	43	51.3	44	54.8	44
	1000	Z	G	9.5	63	11.9	63	6.8	41
Upper Spine			G (fir)	45.3	57	80.2	55	36.1	54
Lower Spine			G (fir)	54.5	52	69.5	46	44.8	44
Upper Rib			G (fir)	62.3	42	65.1	42	38.8	31
Mid Rib			G (fir)	113.3	41			51.8	21
Lower Rib			G (fir)	128.9	41	60.8	59	61.9	21
Pelvis			G (fir)	50.6	44	49.6	46	52.6	46
TTI			G (fir)	92		67		53	
Impact Speed			kph	28.3		28.6		28.6	

ES-2 CHILD PEAK RESPONSE COMPARISON TABLE

Location	Peak Values (G's)														
	Class	Axis	Units	Maxima 6/27 Left Rear/HIII 3 yr 201P		Maxima 6/27 Right Rear/HIII 6 yr 201P		Maxima 6/29 Left Rear/HII 6yr/bst. 201P		Maxima 6/29 Right Rear/HIII 6 yr 201P		Maxima 7/3 Left Rear/Q3 201P		Maxima 7/3 Right Rear HIII 3 yr 201P	
				Peak	Time (msec)	Peak	Time (msec)	Peak	Time (msec)	Peak	Time (msec)	Peak	Time (msec)	Peak	Time (msec)
Head	1000	X	G	-10.2	108	7.1	107	-9.4	121	-4.9	116	-8.1	139	-9.3	122
	1000	Y	G	15.9	109	11.8	125	23.5	90	10.3	105	22.1	92	16.2	109
	1000	Z	G	28.5	101	14.3	109	12.6	92	12.7	113	11.4	111	12.1	109
	1000	RES	G	31.6	101	18.6	109	26.9	92	16	113	24.8	92	20.9	109
Head Injury Criteria (HIC)				42		43		44		29		38		48	
time 1 msec				91.0		104.4		86.5		100.6		84.9		99.3	
time 2 msec				127.0		140.4		122.5		136.6		120.9		135.3	
Upper Neck Force	1000	X	N	-306.8	99	-115.3	153	-176.7	110	-111.3	142	-175.8	140	-93.0	122
	1000	Y	N	463.5	100	-309.9	144	140.2	135	-202.9	115	125.9	90	342.6	131
	1000	Z	N	599.5	102	695.7	108	543.5	92	395.5	113	360.2	152	348.6	122
	1000	RES	N	682.4	102	711.6	108	543.5	92	446.2	113	387.5	133	486.6	122
Upper Neck Moment	600	X	m	46.9**	103	18.2	145	14.1	102	13.4	124	7.1	101	50.1	109
	600	Y	m	11.5	99	-7.0	122	-15.6	107	-8.5	110	4.4	119	12.9	158
	600	Z	m	-7.2	129	13.5	146	18.7	116	13.7	131	3.1	100	9.2	135
	600	RES	m	**NVD after 150 msec.		22.4	146	26.0	107	20.7	125	8.0	101	50.6	109

ES-2 CHILD PEAK RESPONSE COMPARISON TABLE

Location	Peak Values (G's)														
	Class	Axis	Units	Maxima 6/27 Left Rear/HIII 3 yr 201P		Maxima 6/27 Right Rear/HIII 6 yr 201P		Maxima 6/29 Left Rear/HII 6yr/bst.201P		Maxima 6/29 Right Rear/HIII 6 yr 201P		Maxima 7/3 Left Rear/Q3 201P		Maxima 7/3 Right Rear HIII 3 yr 201P	
				Peak	Time (msec)	Peak	Time (msec)	Peak	Time (msec)	Peak	Time (msec)	Peak	Time (msec)	Peak	Time (msec)
Lower Neck Force	1000	X	N	175.9	101	-88.1	188	No Load Cell Available		-57.2	183	-182.5	138	196.3	125
	1000	Y	N	275.6	103	-294.5	138			-152.5	109	299.2	87	282.2	106
	1000	Z	N	-536.9	101	736.0	110			436.6	114	314.5	133	243.2	106
	1000	RES	N	612.1	101	767.4	110			461.0	114	403.8	132	385.5	125
Lower Neck Moment	600	X	m	-13.3	109	66.1	140	No Load Cell Available		-14.7	113	24.9	91	-14.7	112
	600	Y	m	-4.8	146	34.3	109			49.8	115	16.8	139	-6.2	147
	600	Z	m	-8.8	125	-19.0	136			23.0	113	2.7	101	-9.8	128
	600	RES	m	15.0	113	71.4	138			56.7	113	25	91	16.2	115
Rib Deflection	180		mm									15.1	106		
Chest	180	X	G	-7.8	104	-3.9	143	5.1	73	-4.7	141	-8.4	95	-6.6	121
	180	Y	G	21.9	99	14.4	98	17.8	84	13.3	97	18.8	96	12.9	83
	180	Z	G	-6.8	99	6.7	140	6.6	153	4.9	118	3.5	137	4.8	126
	180	RES	G	22.5	99	14.9	98	17.9	84	13.4	97	19.2	76	13.0	83
Pelvis	1000	X	G	-6.0	102	-4.9	127	4.5	58	-4.4	83	-6.2	84	-5.7	141
	1000	Y	G	27.7	75	16.8	86	19.5	77	16.3	107	29.1	89	11.4	104
	1000	Z	G	-15.7	102	6.8	139	6.3	155	2.9	150	-4.3	75	3.9	116
Head to Striker		X		76		141		228		372		106		80	
		Y		391		409		145		124		365		378	
		Z		184		207		358		122		205		188	
Chest to Door				366		461		372		382		371		379	