

IV. TEST DATA AND ANALYSIS OF TEST DATA

This chapter presents test data available to the agency on the various static and dynamic test procedures proposed or considered for advanced air bags. The test data, and analysis of the test data, are presented in the following format.

A. Static Tests (Out-of-Position)

1. Driver - 5th Percentile Female Dummy (MY99, MY98 and Pre-MY98 data available)
 - a. Position 1 (chin on module)
 - b. Position 2 (chest on module)

2. Passenger-side OOP
 - a. RFCSS 12-Month-Old Infant (CRABI) dummy
 - b. 6- Year-Old Child Dummy (MY99, MY98 and Pre-MY98)
 - (1) Position 1 (chest on module)
 - (2) Position 2 (head on module)

B. Vehicle Tests (In-Position)

1. Belted Tests
 - a. 56 kmph (35 mph), 0 degree, Belted Barrier Test
 - (1) 50th Male

 - b. 48 kmph (30 mph), 0 degree, Belted Barrier Test
 - (1) 50th Male.
 - (2) 5th Female

 - c. 48 kmph (30 Mph) +/- 30 Degree (L or R) Oblique Belted Barrier Test
 - (1) 50th Male
 - (2) 5th Female (shown for comparison purposes only)

 - d. 40 kmph (25 mph), Offset Deformable Barrier (ODB), 40% Overlap, Belted Test
 - (1) 5th Female

 - e. 60 kmph (37.5 mph), ODB, 40% Overlap, Belted Test (with Tibia Index data)
 - (1) 50th Male
 - (2) 5th Female

2. Unbelted Tests

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- a. 40 kmph (25 mph), 0 degree, Unbelted Barrier Test
 - (1) 50th Male.
 - (2) 5th Female
- b. 48 kmph (30 mph), 0 degree, Unbelted Barrier Test
 - (1) 50th Male.
 - (2) 5th Female
- c. 48 kmph (30 mph) +/- 30 Degree (L or R) Oblique Unbelted Barrier Test
 - (1) 50th Male
- d. 56 kmph (35mph) ODB, 40% Overlap, Unbelted Test (without Tibia Index data)
 - (1) 50th Male
 - (2) 5th Female

C. Summary of Pass Rates by Proposed Test Procedure

D. Test Procedure Stringency

- 1. Out-of-Position Static Test Procedures
 - a. 5th Percentile Female Dummy
 - b. 6-Year-Old Child Dummy
- 2. In-Position Dynamic Test Procedures
 - a. 48 kmph (30 mph), 30 deg oblique unbelted FRB vs 40 kmph (25 mph) unbelted FRB vs 56 kmph (35 mph) unbelted ODB vs 48 kmph (30 mph) unbelted FRB
 - b. Left vs Right oblique
 - c. Left vs Right 35 mph ODB
 - d. 50th Percentile Male vs 5th Percentile Female Dummy Dynamic and Compliance Equivalency

A. Static Tests, Out-of- Position (OOP)

A.1.a. & b. Driver 5th Percentile Female Dummy

Static deployment Positions 1 and 2 tests were conducted using the 5th percentile female dummy representing the driver-side. These positions were the same as those proposed in the NPRM where in Position 1 the dummy's chin is placed on the inflator module and Position 2 the

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dummy's chest is placed on the inflator module. These same positions are proposed in the SNPRM. Table IV-1 shows that HIC_{15} , chest g's and chest deflection are not problem areas for all tests, whereas N_{ij} is a problem area for both Position 1 and Position 2 testing based on MY98 and pre-MY98 vehicles. Compared to pre-MY98 vehicles, the magnitude of N_{ij} has decreased in MY98 and MY99 and the N_{ij} Pass Rates have subsequently improved. In MY99, the N_{ij} Pass Rate improved to the 67 percent level for Position 1 and to the 100 percent level for Position 2.

Tables IV-2 and IV-3 show the individual N_{ij} values by make/model/year used for the averages shown in Table IV-1.

Table IV-4 shows the individual chest deflection, chest g's and N_{ij} values by make/model for 1996 versus 1998. Table IV-5 shows the same responses for individual MY99 make/models.

Passenger-Side OOP

Convertible Child Safety Seat and 12-Month-Old Infant (CRABI) Dummy

The new 12-month-old infant (CRABI) test dummy was sled tested per FMVSS No. 213, Child Restraint Systems, in a convertible child safety seat (can be used either forward facing or rearward facing) with, and without, an air bag present. Test results are organized by common test condition in Table IV-6a. The 213 sled test crash pulse was employed. The SNPRM proposes a Low Risk Deployment Test such as proposed in the NPRM or suppression. The sled tests with air bag deployments used a 1997 Ford Taurus or a 1998

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Table IV-1
 Summary of OOP Results by Model Year
 Driver-5th Percentile Female Dummy
 Numbers in () indicate Pass Rate in Percent

	HIC ₁₅ Avg.	Nij Avg.	Chest g s Avg.	Chest Deflect Avg.	What failed?	n
MY 99 5th Driver						
Pos.1	67 (100)	0.90 (67)	18.2 (100)	24.7 (100)	2/6 Nij failures	6
Pos.2	31 (100)	0.474 (100)	29.38 (100)	35.7 (100)	No Failures	6
MY 98 5th Driver *						
Pos.1	27.6 (100)	1.44 (0)	16.68 (100)	19.91 (100)	All failed Nij	5
Pos.2	26.94 (100)	0.827 (60)	26.7 (100)	34.7 (100)	2/5 failed Nij	5
PRE-98 5th Driver **						
Pos.1	90.14 (100)	1.657 (25)	23.43 (100)	26.7 (100)	3/4 failed Nij	4
Pos.2	55 (100)	1.604 (25)	26.75 (100)	39.03 (100)	3/4 failed Nij	4
5 th % 1CPL	700	1.0	60	52		

* MY 99 and MY 98 are not matched by make/model.

** MY 98 and PRE-98 are matched by make/model.

MY 99 and PRE-98 matched make/models were not tested.

Pos. 1 = Position 1 = chin on the module.

Pos. 2 = Position 2 = chest on the module.

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Table IV-2
 Static Out-of Position Driver Tests, Position 1, 5th Percentile Female Dummy
 Max Nij

Vehicle	MY 1996 Nij	MY 1998 Nij
Ford Explorer	2.791	1.229
Ford Taurus	1.009	1.641
Dodge Neon	2.116	1.767
Toyota Camry	0.712	1.304
Honda Accord	--	1.276

Bold Numbers indicate that the proposed ICPL values were exceeded.

Table IV-3
 Static Out-of Position Driver Tests, Position 1, 5th Percentile Female Dummy
 Max Nij

Make/Model	MY 99 Nij	
Dodge Intrepid*	0.70	
Saturn SL1	0.267	
Ford Econoline (Van)	0.965	
Acura 3.5RL **	1.323	
Ford Expedition (SUV)	0.981	
Toyota Tacoma (PU)*	1.161	

* Indicate that sled bucks were used for these static tests.

** Acura 3.5 RL has a single stage inflator on the driver s side and dual stage inflator on the passenger s side.

MY 99 and pre-MY 98 matched make/models were not available.

MY 99 and MY 98 are not matched make/models.

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Table IV-4
 Static Out-of Position Driver Tests, Position 2
 5th Percentile Female Dummy
 Chest and Neck Measurements

	MY 1996	MY 1998
<u>Chest Deflection (mm)</u>		
Ford Explorer	39.77	22.27
Ford Taurus	43.68	38.69
Dodge Neon	43.32	34.43
Toyota Camry	29.36	32.90
Honda Accord		45.09
<u>Chest g s</u>		
Ford Explorer	36.4	13.95
Ford Taurus	20.85	27.55
Dodge Neon	31.64	34.05
Toyota Camry	17.96	31.74
Honda Accord		26.22
<u>Nij</u>		
Ford Explorer	2.223	1.079
Ford Taurus	1.139	1.003
Dodge Neon	2.297	0.560
Toyota Camry	0.758	0.816
Honda Accord		0.675

Bold Numbers indicate proposed ICPL values were exceeded.

Applicable ICPLs are: $HIC_{15} = 700$, $N_{ij} = 1.0$, chest g s = 60 g s, chest deflection = 52 mm.

Table IV-5
 Static OOP Driver Test Position 2
 5th Percentile Female Dummy

MY 99	
<u>Chest Deflection. (mm)</u>	
Dodge Intrepid*	47.3
Saturn SL1	36.4
Ford Econoline	33.0
Acura 3.5RL	29.0
Ford Expedition	37.0
Toyota Tacoma*	31.3
<u>Chest g s</u>	
Dodge Intrepid*	40.0
Saturn SL1	22.9
Ford Econoline	24.9
Acura 3.5RL	26.4
Ford Expedition	32.2
Toyota Tacoma*	30.2
<u>Nij</u>	
Dodge Intrepid*	0.57
Saturn SL1	0.37
Ford Econoline	0.29
Acura 3.5RL	0.62
Ford Expedition	0.34
Toyota Tacoma*	0.65

* Indicates sled bucks were used for these static tests.

*MY 99 make/models matched to MY 98 or MY 96 make/models were not available for analysis.

Ford Explorer air bag module. The HICs measured were an order of magnitude lower using the 12-month-old CRABI dummy compared to previous VRTC tests (shown in the August 1998 PEA) using a 9-month-old dummy. Overall Pass Rates are zero percent for each test condition which are summarized in Table IV-21. In the SNPRM, the manufacturers have a suppression option for meeting this static OOP test.

Tables IV-10, 11 and 12 in the Preliminary Economic Assessment (PEA) August, 1998 contained baseline 213 sled tests with a 9 month-old dummy as well as tests with air bags (mid-mount and top mount). The maximum HIC_{36} using mid-mounted air bags ranged from 2,000-3,000 and the top mounted air bag HIC_{36} was as high as 3,015. The new VRTC test series involving the 12-month-old CRABI dummy shows that HICs have been reduced by about an order of magnitude despite being computed over 15 ms rather than 36 ms. The test conditions in this test series were identical to those referenced in the PEA.¹

¹ Preliminary Economic Assessment, FMVSS No. 208, Advanced Air Bags, August 1998, Office of Regulatory Analysis and Evaluation, Plans and Policy, NHTSA/DOT.

Tables IV-6a
 FMVSS No.213 Sled Tests
 12-Month-Old Infant (CRABI) Responses

Test Condition <u>1./</u> & <u>2./</u>	Test #	F or R	HIC15 (ICPL 390)	Nij (ICPL 1.0)
Convertible Child Seat w/o Air Bag	1R	F	565	1.51
	5	F	411	1.29
	9	F	214	1.09
	10	F	303	1.12
	11R	F	232	1.14
Convertible Child Seat with Air Bag <u>3./</u>	3M	F	329	1.32
	4M	R	1555	1.27
	7T	F	662	1.04
	8T	R	531	1.41
Convertible Child Seat w/o Air Bags	2R	F	239	1.34
	6	F	241	1.49
	12	F	130	1.12

Bold Numbers exceed proposed ICPL values.

R = child seat rearward facing. F = child seat forward facing.

1./ 1997 Ford Taurus and 1998 Ford Explorer air bag modules.

2./ For Test Conditions, see VRTC Report on the CRABI, Docket No. 99-5156-6.

3./ #3 and #4 are mid-mount air bags (M). #7 and #8 are top mount air bags (T).

NHTSA also conducted a 12-month-old infant (CRABI) low risk deployment test using new inflator technology, namely - the 1st stage of an experimental (confidential make/model) dual stage inflator. The vehicle's passenger-side seat was placed full-forward with the seat back set at a 30 degree angle. The top center of a Century rear facing child safety seat (RFCSS) was aligned with the geometric center of the air bag. The center line of the RFCSS was aligned with the longitudinal center line of the test vehicle. The vehicle safety belts were cinched to secure the RFCSS. The CRABI dummy was belted in the Century RFCSS. The first stage of

an experimental dual power experimental air bag was statically deployed.² Table IV-6b shows that all the responses of the 12-month-old infant dummy were low and passed the proposed ICPLs.

Table IV-6b
Low Risk Deployment Test (n=1) with the 12-Month-Old Infant (CRABI) Dummy
1st Stage of Experimental Dual Power Inflator

Injury Criteria	CRABI Responses	SNPRM ICPLs	IARVs **	Pass/Fail
HIC ₁₅ *	224	390		P
Neck Tension (N)	443		780	P
Neck Comp. (N)	199		960	P
Neck Flexion (N-m)	11.5		27	P
Neck Extens. (N-m)	4.8		11	P
Head Acceler.(g s)	113	---		
Chest g s (3ms clip)	23.1	50		P

* HIC₁₅ estimated from HIC₃₆.

** Independent critical neck values proposed by AAMA in their docket comments (Docket No. 98-4405-79, December 17, 1998, Attachment C, Page 22, Table 10.)

² Evaluation of the CRABI 12-Month-Old Infant Dummy and Its Comparison with TNO P3/4, February 1999, Hagedorn, A.V. and Pritz, H.B., Vehicle Research and Test Center, East Liberty, OH, Docket No. NHTSA-99-5156-6.

6-Year-Old Child Dummy (Passenger-side)

The static deployment OOP Positions 1 and 2 (0 mm clearance) were tested using the 6-year-old child dummy. Positions 1 and 2 were the same as those proposed in the NPRM such that in Position 1 the chest is placed on the module, whereas for Position 2, the head is placed on the module. These same positions are proposed in the SNPRM. As shown in Table IV-7, HIC_{15} is not a problem in either Position 1 or Position 2 tests using MY99 vehicles or test bucks. Model year 1998 and pre-model year 1998 vehicles are matched. MY98 and MY99 vehicles are not matched by make/model. N_{ij} , chest g 's, and chest deflection, however, were problems using Position 1 and Position 2 position procedures based on MY98 and 99 vehicles or sled test bucks. Position 2 tests were not conducted in MY98 or pre-MY98. HIC_{15} , chest g 's and chest deflection have improved with the new redesigned air bags. Similarly, N_{ij} values have improved, but there is still a low N_{ij} Pass Rate in MY98 and 99 vehicles.

Tables IV-8a and IV-8b contain the specific 6-year-old dummy responses by make/model for MY96, MY98 and MY99 for static OOP Position 1 with zero clearance. Tables IV-8b and IV-8c show a 100 percent Pass Rate for OOP Positions 1 and 2 for the Acura 3.5RL using the first stage of a two stage inflator.

Table IV-7
 Summary of OOP Results by Model Year
 Passenger 6-Year-Old Child Dummy
 Number in () indicates Pass Rate in Percent

	HIC ₁₅ Avg.	Nij Avg.	Chest g's Avg.	Chest Deflect Avg.	What failed?	n
MY 99 6 Year Old Passenger (0 mm)						
Position 1	141 (100)	1.83 (28.6)	32.63 (100)	31.53 (42.9)	5/7 - Nij 4/7 - Deflect	7
Position 2	246 (100)	2.01 (28.6)	48.37 (57.1)	27.53 (71.4)	5/7 - Nij 3/7 - Chest g 2/7 - Deflect	7
MY 98 6 Year Old Passenger (0 mm)						
Position 1	512 (83)	3.39 (0)	39.5 (83)	40.75 (16.7)	1/6 - HIC ₁₅ 6/6 - Nij 1/6 - Chest g 5/6 - Deflect	6
Position 2	***					
Pre-MY98 6-Year-Old Passenger (0 mm)						
Position 1	938 (50)	4.39 (0)	52.85 (67)	48.4 (16.7)	3/6 - HIC ₁₅ 5/5 - Nij 2/6 - Chest g 5/6 - Deflect	6
Position 2	***	***	***	***		
6-Year-Old Child ICPLs	700	1.0	60	40		

* MY 99 vehicles are not matched to MY 98 by make/model.

** MY 98 and Pre-MY 98 are matched by make/model.

*** These tests not conducted.

Position 1 = chest on the module.

Position 2 = head on the module.

Table IV-8a
 Static Out-of-Position Tests with a 6-Year- Old Child Test Dummy
 Position 1 @ 0 mm Clearance from the Air Bag Module

Vehicle	MY 96 HIC 15	MY 98 HIC15	MY 96 Chest g s	MY98 Chest g s	MY 96 Chest Deflect	MY98 Chest Deflect	MY 96 Nij	MY 98 Nij
Ford Taurus	2471	1854	53.8	64	28	50.5	3.69	2.81
Dodge Neon	377	172	35.7	22.3	43.8	41.8	3.13	2.65
Toyota Camry	1020	213	64.6	32.8	45.4	11.3	8.67	3.64
Dodge Caravan	1207	493	82.9	30.7	50	50.6	N.A.	3.30
Honda Accord	N.A.	132	N.A.	37	N.A.	40.1	N.A.	2.05
Ford Explorer	276	210	42.5	50.2	63	50.2	2.91	5.91
Ford Explorer	278	-	37.5	-	60.2	-	3.58	-
ICPL	700	700	60		40		1.0	1.0

Bold Numbers exceed proposed ICPL values.

N.A. indicates data Not Available

Table IV-8b
 Static Out-of-Position Tests With a 6-Year-Old Child Dummy
 Position 1 @ 0 mm Clearance from the Air Bag
 Module for MY 99

MY 99	HIC ₁₅	Nij	Chest g s	Chest Deflection (mm)
Dodge Intrepid	149	2.78	58.93	42.1
Saturn SL1	35	0.89	23.1	44.2
Ford Econoline	428	2.66	50.3	45.1
Acura 3.5RL*	101	1.26	19.5	10.7
Acura 3.5RL**	87	0.91	19.4	6.9
Ford Expedition	42	1.02	39.2	49.8
Toyota Tacoma	145	3.31	17.9	21.9
ICPLs	700	1.0	60	40

Bold Numbers exceed proposed ICPL values.

* Stage 1 fired and then Stage 2 fired with a 40 ms delay.

** Stage 1 fired only

Table IV-8c
 Static Out-of-Position Tests With a 6-Year-Old Child Dummy
 Position 2 @ 0 mm Clearance from the Air Bag
 Module for MY 99

MY 99	HIC ₁₅	Nij	Chest g s	Chest Deflection (mm)
Dodge Intrepid	627	3.27	68.8	39.7
Saturn SL1	76	1.97	44.6	43.4
Ford Econoline	429	2.22	65.0	34.3
Acura 3.5RL*	113	0.94	16.0	9.0
Acura 3.5RL**	101	0.83	17.7	3.0
Ford Expedition	131	2.27	85.5	45.0
Toyota Tacoma	246	2.54	41.0	18.3
ICPLs	700	1.0	60	40

Bold Numbers exceed proposed ICPL values.

* Stages 1 fired and then Stage 2 fired with a 40 ms delay.

** Stage 1 fired only.

3-Year-Old Child Dummy Static OOP Tests

The SNPRM proposes the same OOP Position 1 and 2 static deployment tests as proposed in the NPRM. The agency did not conduct new, post-August 1998 PEA, Position 1 and 2 tests using the 3-year-old child dummy because of time and resource constraints. The agency believes that if a 6-year-old dummy fails the OOP tests, it is likely that the 3-year-old dummy will also fail. However, if the 6-year-old dummy passes the OOP tests, there is no guarantee the 3-year-old will pass.

B. Full-Scale Vehicle Tests (In-Position)

Belted Test Procedures

56 kmph (35 mph), 0 Deg., Barrier Test, Belted, 50th Percentile Male Dummy

For a limited set of matched pairs (n=14) as shown in Table IV-9a, MY99 and MY98 responses are not significantly different, except for Nij which was lower by 12-14 percent for the driver and passenger, respectively, for MY99. Given the similarity of the two model years, NHTSA has combined MY98 and MY99 vehicles into a redesigned air bag group for further analysis. For Pass Rates in Table IV-21, for example, MY98 and MY99 have been combined.

Table IV-9a
 NCAP Test Results
**Average NCAP Test Results for Matched Make/Models
 Belted @ 56 kmph (35 mph), 50th Percentile Male Dummy
 MY 99 vs MY 98**

	HIC ₁₅	Nij	Chest g s	Chest Deflection (mm)	Sample Size (n)
Drivers					
MY 99	446	0.597	50	37	14
MY 98	445	0.695	49	37	15*
Passengers					
MY 99	379	0.569	47	30	14
MY 98	368	0.648	51	33	15
ICPLs 50th	700	1.0	60	63	

All average responses rounded to the nearest whole number.

*MY 98 had two Ford Windstar Tests, whereas MY 99 had one Windstar.

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Comparing MY99 make/models to matched pre-MY98 make/models, as shown in Table IV-9b, indicates that HIC₁₅ decreased 14 and 47 percent and chest g s increased slightly by about 3 g s for both the driver and passenger, respectively. Nij and chest deflection responses were mixed with no clear trend. Table IV-9b is based on matching MY98 and pre-MY98 make/models to MY99 make/models.

Table IV-9b
 NCAP Test Results
Average NCAP Test Results for Matched Make/Models
Belted @ 56 kmph (35 mph), 50th Percentile Male Dummy
 MY 99 vs Pre-MY 98

Occupant Position	HIC₁₅	Nij	Chest g s	Chest Deflection (mm)	N
Driver					
MY 99	532.8	0.634	56.04	39.89	5
Pre-MY 98	618.2	0.824	53.62	31.42	5
Passenger					
MY 99	352.8	0.662	50.8	26.2	5
Pre-MY 98	670	0.594	47.72	41.4	5
ICPLs 50 th	700	1.0	60	63 mm	

Table IV-9c is based on matching MY98 make/models and pre-MY98 make/models. Table IV-9c shows very little difference between responses for MY98 and pre-MY98 vehicles, on the average, for the belted 56 kmph (35 mph) fixed rigid barrier test condition.

Table IV-9c
 NCAP Test Results
Average NCAP Test Results for MY98 vs Pre-MY98 (Matched Make/Models*)
Belted @ 56 kmph (35 mph), 50th Percentile Male Dummy

	HIC ₁₅	Nij	Chest g s	Chest Deflection (mm)	Sample Size (n)
Driver					
MY1998	376.8	0.608	47.89	34.55	34
Pre-MY98	404	0.607	49.1	32.5	30-32
Passenger					
My1998	357.2	0.532	47.75	31.38	33
Pre-MY98	364.7	0.802	49.82	33.66	30-32
ICPLs	1000	1.0	60	63 mm	

* The matched make/models for this table were identified in Appendix A, Table A1., ESV Paper 98-S11-O-01, entitled The Effect of Redesigned Air Bags on Frontal USA NCAP, Park, B.T., Morgan, R.M., and Hackney, J.R., NHTSA/DOT and Lowrie, J.C., Conrad Technologies, Inc.

Tables IV-9d and IV-9e compare NCAP results by model year for the driver and passenger, respectively, and show the same comparisons as above based on All Vehicles in the file, rather than matched make/models. Except for passenger Nij, there has been no substantive change year-to-year, on the average. Femur axial loads do not appear to be a problem. For the passenger-side, there has been a downward trend in Nij from 1996 to 1999. The values in parentheses are Pass Rates (%) to assess the effect of applying the 50th percentile ICPL values proposed in the SNPRM to NCAP. For example, if the decision was made to extend the proposed ICPLs to the NCAP program, driver and passenger side failures would occur, but at the same rate as earlier years. The agency conducted several 56 kmph (35 mph) belted crash tests (n=2) using the 5th percentile female dummy using a 1988

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Table IV-9d
 NCAP Test Results
 56 kmph (35 mph) NCAP Average Responses & Pass Rates x Model Year
 Belted, 50th Percentile Male Dummy
DRIVER (All Vehicles)

MY	HIC ₁₅	Nij	Chest g s	Chest Deflect	Left Femur	Right Femur	N Sample
1996	438.6 (91)	0.667 (91)	51.2 (91)	36.6 (100)	5031 (97)*	4871 (100)	32
1997	464.1 (94)	0.645 (97)	50.2 (89)	29.9 (100)	4576 (100)	4803 (100)	36
1998	423.1 (94)	0.648 (94)	49.0 (96)	35.8 (100)	4415 (100)	4202 (100)	52
1999	408 (92)	0.569 (94)	50.2 (83)	34.5 (100)	4832 (100)	4787 (100)	35
1CPL	700	1.0	60	63	10,000	10,000	

Table IV-9e
 NCAP Test Results
 56 kmph (35 mph) NCAP Average Responses & Pass Rates X Model Years
 Belted, 50th Percentile Male Dummy
PASSENGER (All Vehicles)

MY	HIC ₁₅	Nij	Chest g s	Chest Deflect	Left Femur	Right Femur	N Sample
1996	382.1 (94)	0.902 (88)	51.9 (82)	36.2 (100)	4687 (100)	4236 (100)	33
1997	439.7 (92)	0.635 (94)	50.5 (94)	31.9 (100)	4059 (100)	3627 (100)	36
1998	374.4 (92)	0.560 (92)	49.2 (96)	32.9 (100)	4068 (100)	3578 (100)	51
1999	397 (92)	0.525 (97)	48.0 (97)	29.2 (100)	4761 (100)	4129 (100)	36
1CPL	700	1.0	60	63	10,000	10,000	

and 1993 Ford Taurus. As shown in Tables IV-9f, there was a HIC₁₅ failure for the 1988 Ford Taurus and an Nij failure for the 1993 Ford Taurus.

Table IV-9f
 NCAP Test Results
 Belted @ 56 kmph (35 mph), 5th Percentile Female Dummy
 1988 & 1993 Ford Taurus (NHTSA data)

Occupant Position	HIC ₁₅	Nij	Chest g s	Chest Deflection (mm)	Maximum Femur (N)
Driver					
1988 Taurus*	1305	---	52.4	---	---
1993 Taurus*	119	0.84	53.6	35.6	3370R
Passenger					
1988 Taurus	484	---	47.3	---	---
1993 Taurus	508	2.10	47.1	33.1	3212R
5 th ICPLs	700	1.0	60	52 mm	6,800

Bold Numbers indicate test values exceeded the proposed ICPL.

R indicates right femur had maximum axial load.

* 1988 Ford Taurus did not have air bags, whereas the 1993 Ford Taurus had driver and passenger air bags.

48 kmph (30 mph), 0 Deg., Barrier Test, Belted, 50th Percentile Male Dummy

Based on the 1997-98 NHTSA/Transport Canada test program, the 48 kmph (30 mph) belted 50th percentile male responses in the August, 1998 PEA consisted of 3 driver (MY98 + pre-MY98 vehicles) and 7 passenger (MY98 + pre-MY98 vehicles) test points with 100 percent Pass Rates. If adjusted to the HIC₁₅ and Nij, it is believed the Pass Rates for all responses would remain at 100 percent. Based on the 1998-99 NHTSA/Transport Canada test program using 18 - MY 1999 test vehicles, after applying the new injury criteria and ICPL values, there were no Nij or other response failures. Although confidential compliance data received from [name confidential] was incomplete

relative to the proposed ICPLs in the SNPRM (e.g., contained driver and passenger HIC₃₆ and chest g s data only) there was a 100 percent Pass Rate for driver and passenger side for a large sample of pre-MY98 and a few MY98 [name confidential] make/models. These Pass Rates are reflected in Table IV-21, Summary of Pass Rates by Proposed Test Procedure.

48 kmph (30 mph), 0 Deg., Barrier Test, Belted 5th Percentile Female Dummy

Table IV-10 shows that for the same test condition as above, the 5th percentile female dummy would experience Nij failures on the driver-side and Nij and chest g s failures on the passenger side.

Table IV-10
48 kmph (30 mph) Belted Barrier, 5th Percentile Female Dummy
MY 98 and 99 Combined, Average Responses

	HIC ₁₅	Nij	Chest g s	Chest Deflection (mm)	Sample (n)
Drivers	232.4 (100%)	1.019 (67.9%)	45.50 (100%)	29.72 (100%)	28
Passengers	244 (100%)	0.670 (92.9%)	42.65 (96.4%)	24.94 (100%)	28
ICPL	700	1.0	60	52	

() Number in parentheses are Pass Rates.

Note: Table IV-10 contains NHTSA/Transport Canada test data. For the passenger side, the air bag did not deploy for either the 1998 Honda Civic or the 1999 Hyundai Accent as these test vehicles were purchased without passenger-side air bags.

48 kmph (30 mph), +/-30 Degree Oblique (L or R), Belted Test

In the SNPRM, NHTSA is proposing an up-to- 48 kmph (30 mph), +/- 30 degree (L or R) oblique belted test for the 50th percentile dummy. The tests shown in Table IV-11 are identical to the current FMVSS 208 procedure. Two 1999 Dodge Intrepids were tested in a left-side (driver s side) oblique test, one with 50th percentile dummies and the other with 5th percentile dummies. Although only the 50th percentile dummy is being proposed for use in the belted oblique tests, the 5th percentile female dummy data is shown for comparison purposes. This is the same test as currently required by FMVSS 208 for the 50th percentile male dummy, except the SNPRM proposes to add HIC₁₅ and Nij. The responses were very low resulting in a 100 percent Pass Rate for both dummies. This is a very benign test because (1) an oblique impact angle crushes soft sheet metal resulting in a soft crash pulse, (2) the dummies were belted and do not normally move out-of-position, and (3) the air bag fire time was very timely, similar to a full frontal fixed rigid barrier test. The maximum femur load recorded was 6,376 N for the right femur of the 50th percentile driver dummy, well below the ICPL maximum of 10,000 N. [Name confidential] provided 30 mph, +/-30 degree oblique (left and right) belted test data based on HIC₃₆ and chest g s responses for the driver and passenger 50th percentile male dummy. The [name confidential] make/models in this confidential data set were predominantly pre-MY98 with a few MY98 make/models. Although the Pass Rate was 100 percent, a full set of responses equivalent to the SNPRM were not available for review.

Table IV-11
 30 mph (48 kmph) , +/-30 Degree Oblique (Left shown), Belted
 50th %-ile Male and 5th %-ile Female
 1999 Dodge Intrepid (n=1 test per dummy size)

	HIC ₁₅	Nij	Chest g s	Chest Deflection	Max. Femur Load (N)
Driver					
50 th %-ile M	171	0.31	34.46	24.19	6376R
5 th %-ile F	113	0.52	38.45	20.62	4256R
Passenger					
50 th %-ile M	117	0.30	35.57	21.53	3268R
5 th %-ile F	132	0.33	36.29	23.20	2729L

NHTSA/Transport Canada cooperative research data.

40 kmph (25 mph), ODB, 40 Percent Overlap, Belted, 5th Percentile Female Test Dummy

NHTSA is proposing a new test procedure in the SNPRM which is the same as was proposed in the NPRM, namely a 40 kmph (25 mph), offset deformable barrier (ODB) test, with 40 percent overlap, using a belted 5th percentile female test dummy. As shown in Table IV-12, HIC₁₅, chest g s and chest deflection did not exceed the proposed ICPL values on the driver s side. However, Nij did exceed the proposed ICPL value of 1.0 on the driver s side (3/5 or 60% for MY99 passed and 8/14 or 57% passed for MY98). On the passenger-side, there were no HIC₁₅ , chest g s or chest deflection failures. There was a 100 % pass rate for MY99 vehicles based on Nij and an 86% (12/14) pass rate for MY98 vehicles based on Nij. [There was one **Right** side 40 kmph (25 mph) ODB, 40% overlap, belted, test conducted by NHTSA/Transport Canada using a 1999 Ford Crown Victoria, but this test was excluded from this analysis.]

Table IV-12
 40 kmph (25 mph) ODB, 40% Overlap, Belted, Left, 5th Percentile Female Dummy
 Average Responses for MY98 and MY99 Combined
 () indicates Pass Rate in Percent.

	HIC ₁₅	Nij	Chest g s	Chest Deflection (mm)	Sample size (n)
Driver	203 (100)	1.021 (57.89)	23.41 (100)	19.72 (100)	19
Passenger	133 (100)	0.545 (89.5)	21.61 (100)	14.95 (100)	19
ICPLs	700	1.0	60	52	

NHTSA/Transport Canada cooperative research data.

Note: n=19 vehicles. 14- MY1998 vehicles and 5 MY1999 vehicles. Table IV-21, Pass Rates, shows n=20 for the same crash test procedure as Left side (n=19) and right side (n=1 MY99 vehicle) impacts were combined. Also, note on the passenger-side, air bags did not deploy for the 1999 VW Beetle or the 1999 Toyota Camry.

60 kmph (37.5 mph), Offset Deformable Barrier, 40% Overlap, Belted Tests

NHTSA is proposing in the SNPRM an 35-56 kmph (22-35 mph), unbelted, offset deformable barrier (ODB) test procedure that may be conducted on the left or right front of the vehicle. Tests with both 50th and 5th percentile dummies would be required. The ODB test at 56 kmph (35 mph) produces lower toe pan intrusion and lower potential for debilitating lower leg injury than a test at 60 kmph (37.5 mph). The European lower leg injury threshold has a Tibia Index with an IARV of 1.3 for both dummies. The Tibia Index was discussed briefly in Chapter III, Injury Criteria. It is being used for analysis purposes and is not part of the SNPRM proposal. Table IV-13 shows belted results for the 50th percentile male dummy (both driver and passenger sides), however, at a speed slightly higher than the SNPRM maximum (37.5 mph) and belted. The agency's rationale being -- if they fail the ODB test belted, they would most probably fail the same test unbelted. Table IV-13 shows that

despite a

Table IV-13
60 kmph (37.5 mph), 40% Overlap, Left, Offset Deformable Barrier Test Comparison
Belted, 50th Percentile Male Dummy including Tibia Index

MY	Make/ Model	50 th %-ile	HIC ₁₅	Nij	Chest g s	Chest Defl. (mm)	Max Femur (N)	U.T. Left	U.T. Right	L.T. Left	L.T. Right
94	Ford Aspire	Dr Pass.	181 87	---	37.6 33.3	31.5 32.1	6505L ND	0.91 ND	0.82 ND	0.76 ND	0.45 ND
94	Saturn	Dr. Pass.	201 142	---	35.9 33.5	37.3 38.1	7618L ND	0.44 ND	0.58 ND	1.75 ND	0.81 ND
94	Pontiac Gr Am	Dr. Pass.	374 268	---	46.13 37.3	32.4 55.4	6614L ND	0.64 ND	0.38 ND	0.38 ND	0.21 ND
94	Hyundai Excel	Dr. Pass.	249 255	---	37.8 ND	26.5 23.3	3146R ND	0.50 ND	0.85 ND	0.18 ND	0.29 ND
95	Dodge Neon	Dr Pass	399 111	----	39.8 ND	29.9 21.8	6896L ND	1.02 ND	1.22 ND	1.87 ND	1.22 ND
96	Ford Taurus	Dr. Pass.	200 137	0.45 0.43	30 32	30 30	3493R 3728L	0.42 ND	0.70 ND	0.21 ND	0.12 ND
96	Toyota Camry	Dr. Pass.	256 117	0.64 0.30	34 29	22 32	2958R 2806L	0.31 ND	0.58 ND	0.67 ND	0.70 ND
98	Dodge Neon	Dr. Pass.	182 21	0.54 0.50	38 36	31 31	7266L 4074L	0.24 0.44	0.64 0.53	1.97 0.33	0.99 0.28
98	Ford Contour	Dr. Pass.	133 117	0.43 0.41	27 29	27 33	3087L 3223L	0.17 0.55	0.35 0.36	1.53 0.24	1.19 0.30
98	Chevy Venture	Dr. Pass.	210 93	1.48 0.26	42 28	21 26	6067L 3754L	2.29 0.32	0.69 0.20	1.89 0.20	0.92 0.12

Bold Numbers exceed proposed ICPL values.

U.T. = Upper Tibia Index (L and R shown) or ICPL = 1.3

L.T. = Lower Tibia Index (L and R shown) or ICPL = 1.3

ND - No data (either data was lost or lacked instrumentation).

100 percent femur axial load Passing Rate (both driver and passenger) for the 50th percentile male dummy, there was lower leg injury potential as evidenced by the Tibia Index values exceeding 1.3 in 50 percent of the test vehicles. The predominant left maximum femur load reflects a near-side impact. The above data shows, for the driver-side, an 80 percent Pass Rate for Nij alone and a 50 percent Pass Rate. As these are left side or driver side offset tests, the passenger-side had a 100 percent Pass Rate. The overall Pass Rates are summarized in Table IV-21, Summary of Pass Rates by Proposed Test Procedure. However, the 35 mph unbelted ODB test procedure proposed in the SNPRM would result in a somewhat lower Pass Rate. Table IV-14 below shows similar results for the 5th percentile female dummy.

Table IV-14
60 kmph (37.5 mph), 40% Overlap, Left, Offset Deformable Barrier Test Comparison
Belted, 5th Percentile Female Dummy incl. Tibia Index

NHTSA data

MY	Make/ Model	50 th %-ile	HIC ₁₅	Nij	Chest g s	Chest defl. (mm)	Max. Femur (N)	U.T. Left	U.T. Right	L.T. Left	L.T. Right
96	Dodge Neon	Dr. Pass.	110 95	1.13 0.54	52 30	51 49	4273L 1830L	0.73 0.57	1.43 0.53	2.04 0.22	2.67 ND
96	Ford Taurus	Dr. Pass.	82 148	1.11 1.01	23 29	16 11	2928L 2238L	0.30 0.99	0.65 0.31	0.83 0.10	0.59 ND
96	Toyota Camry	Dr. Pass.	52 90	1.28 2.17	28 22	25 18	3147L 2715L	0.04 0.45	0.75 0.21	0.15 0.20	1.86 ND
98	Dodge Neon	Dr. Pass.	290 192	0.68 0.45	44 49	29 22	4170L 2876L	0.84 0.86	2.13 0.67	3.35 0.67	2.46 0.53
98	Ford Contour	Dr. Pass.	147 ND	2.37 0.49	29 34	25 18	2161L 1885L	0.72 0.51	1.14 0.37	3.76 0.24	2.00 0.19
98	Chevy Venture	Dr. Pass.	798 605	1.33 1.24	47 32	16 17	5586L 3647L	2.18 0.54	1.79 0.45	2.87 0.43	2.92 0.45

Bold Numbers exceed proposed ICPL values. U.T. = Upper Tibia Index. L.T.= Lower Tibia Index

As shown in Table IV-14, using the 5th percentile dummy in the belted 60 kmph (37.5 mph) ODB (left) test procedure, both the driver and passenger had problems passing Nij. Driver and passenger Pass Rates based on Nij alone were 16.7 percent and 50 percent, respectively. The Tibia Index was also a problem on for the driver-side, or the seating position on the impacted side of the test vehicle. The Pass Rate based on the Tibia Index alone was 16.7 percent for the driver and 100 percent for the passenger-side, despite the fact that the driver and passenger femur axial loads had a Pass Rate of 100 percent. The maximum femur axial loads occurred on the impacted, left side of the test vehicle.

Table IV-14a compares the responses of the 50th and 5th percentile dummies for the same MMY test vehicles. Table IV-14b compares the Tibia Index values by dummy size for the same MMY test vehicles. Combining Table IV-14a and IV-14b responses, the passenger-side dummy (50th or 5th) passed almost all ICPL and IARV values, except for Nij in one case (1998 Chevy Venture, 5th %ile dummy). As expected, the left-side ODB impact affects the driver dummies as they had higher responses. Counting the driver and passenger responses for all three test vehicles and both dummies (n=48), the 5th percentile female dummy exceeded ICPL values 2.6 times more often as the 50th percentile dummy (27.1 % vs 10.42 %). Overall, the decision regarding compliance (P or F) using either of the two dummies was identical, with the 5th percentile dummy exceeding the lower leg IARV values more frequently. This is reasonable considering the fact that the 5th percentile female dummy s seated position is with the seat full-forward, whereas with the 50th percentile male dummy the seat is positioned mid-track. Based on Tables IV-14a and IV-14b, both

dummies appear to behave with dynamic equivalency (similar responses for the same test condition)

with a few exceptions.

Table IV-14a
60Kmh (37.5 mph), ODB, 40% Overlap, Left, Belted by Dummy Type

MMY	Dummy Type	HIC ₁₅	Nij	Chest g s	Chest Deflection (mm)	Max. Femur (N) (L or R Leg)
1998 Dodge Neon	Dr. 50 th 5th	182	0.54	38	31	7266L
		290	0.68	44	29	4170L
1998 Dodge Neon	Pass. 50 th 5th	21	0.50	36	31	4074L
		192	0.45	49	22	2876L
1998 Ford Contour	Dr. 50 th 5th	133	0.43	27	27	3087L
		147	2.37	29	25	2161L
1998 Ford Contour	Pass. 50 th 5th	117	0.41	29	33	3223L
		ND	0.49	34	18	1885L
1998 Chevy Venture	Dr. 50 th 5th	210	1.48	42	21	6067L
		798	1.33	47	16	5586L
1998 Chevy Venture	Pass. 50 th 5th	93	0.26	28	26	3754L
		605	1.24	32	17	3647L
ICPLs	50th	700	1.0	60	63	10,000
ICPLs	5th	700	1.0	60	52	6,800

MMY = Make/Model/Year

Table IV-14b
60 kmph (37.5 mph), ODB, 40% Overlap, Left, Belted
Tibia Index Value Comparisons by Dummy Type

MMY	Dummy Type	Upper Tibia Left	Upper Tibia Right	Lower Tibia Left	Lower Tibia Right	Max. Femur (N) L or R leg
1998 Dodge Neon	Dr. 50 th	0.24	0.64	1.97	0.99	7266L
	5 th	0.84	2.13	3.35	2.46	4170L
	Pass. 50 th	0.44	0.53	0.33	0.28	4074L
	5 th	0.86	0.67	0.67	0.53	2876L
1998 Ford Contour	Dr. 50 th	0.17	0.35	1.53	1.19	3087L
	5 th	0.72	1.14	3.76	2.00	2161L
	Pass. 50 th	0.55	0.36	0.24	0.30	3223L
	5 th	0.51	0.37	0.24	0.19	1885L
1998 Chevy Venture	Dr. 50 th	2.29	0.69	1.89	0.92	6067L
	5 th	2.18	1.79	2.87	2.92	5586L
	Pass. 50 th	0.32	0.20	0.20	0.12	3754L
	5 th	0.54	0.43	0.43	0.45	3647L
IARVs	50 th	1.3	1.3	1.3	1.3	10,000
IARVs	5 th	1.3	1.3	1.3	1.3	6,800

European Tibia Index IARV is 1.3

MMY = Make/Model/Year

Unbelted Test Procedures

40 kmph (25 Mph) Unbelted Barrier Test, 50th Percentile Male and 5th Percentile Female Dummies

Tables IV-15a shows that for the 5 vehicles tested, the 50th percentile male and 5th percentile female dummies did not exceed any of the proposed ICPL values on the driver-side, whereas Table IV-15b

shows the only passenger-side ICPL exceeded for both dummies was the Nij. This occurred for the same test vehicles - namely the 1999 Toyota Tacoma.

Table IV-15a
40kmh (25 mph), 0 degree, Unbelted by Dummy Type
DRIVER

MMY	Dummy Type	HIC ₁₅	Nij	Chest g s	Chest Deflection (mm)	Femur (N) (L or R Leg) Max.
1999 Dodge Intrepid	50 th 5th	193 99	0.407 0.349	40.1 40.5	33.0 32.1	7823R 4674R
1999 Toyota Tacoma	50 th 5th	96 238	0.339 0.615	42.8 50.5	46.1 40.5	7281L 4712L
1999 Acura 3.5RL	50 th	62	0.236	34.7	35.7	5912L
Confidential Make/Model	5th*	[]	[]	[]	[]	[]
Confidential Make/Model	50th** 5th**	[] []	[] []	[] []	[] []	[] []
ICPLs	50th	700	1.0	60	63	10,000
ICPLs	5th	700	1.0	60	52	6,800

* Single stage inflator

** 1st stage of dual stage inflator.

Table IV-15b
 40kmh (25 mph), 0 degree, Unbelted X Dummy Type
PASSENGER

MMY	Dummy Type	HIC ₁₅	Nij	Chest g s	Chest Deflection (mm)	Femur (N) (L or R Leg) Max.
1999 Dodge Intrepid	50 th 5 th	83 121	0.393 0.517	48.1 35.1	18.3 4.6	9017L 4324R
1999 Toyota Tacoma	50 th 5 th	82 143	1.120 2.064	23.4 34.1	15.7 3.7	5236R 5419L
1999 Acura 3.5RL	50 th	119	0.435	32.5	17.4	6215R
Confidential Make/ Model	5 th *	[]	[]	[]	[]	[]
Confidential Make/ Model	50 th ** 5 th **	[] []	[] []	[] []	[] []	[] []
ICPLs	50 th	700	1.0	60	63	10,000
ICPLs	5 th	700	1.0	60	52	6,800

* Single stage inflator.

** 1st stage of inflator used.

48 kmph (30 Mph) Unbelted Barrier Test (Matched Pairs MY99 vs Pre-MY98 and Matched Pairs MY98 vs Pre-MY98)

The SNPRM is proposing an up-to-48 kmph (30 mph), unbelted, fixed rigid barrier test for the 50th and 5th percentile dummies. Pre-MY1998 vehicles were required to meet this test using the 50th percentile male dummy. In addition to the 5th percentile female dummy being added to the test, HIC₁₅, Nij and revised chest deflection ICPLs are also be proposed in the SNPRM. Tables IV-16a and IV-16b show the average responses from the 30 mph test condition as required for the 50th

percentile male dummy using the SNPRM proposed injury criteria. For the redesigned air bags, there was little difference between the MY98 and MY99 responses. For purposes of analysis, MY98 and MY99 vehicles were not necessarily matched make/models.

Table IV-16a
 Summary of 48 kmph (30 mph) Unbelted Barrier Tests, 50th Percentile Dummy
 Average Responses

	HIC ₁₅	Nij	Chest Chest g	Chest Deflect	Sample Size
Drivers					
MY 1999	188	0.38	48.43	39.5	6
MY 1998	205	0.41	47.33	39.96	9*
Passengers					
MY 1999	220	0.453	46.1	16.2	6
MY 1998	187	0.41	50.3	15.0	9*
ICPL	700	1.0	60	63	

* Sample sizes: MY99 - There were 6 - MY99 (VRTC). MY98 - There were 7 - MY98 (VRTC), one 1998 Ford Escort and one confidential make/model.

48 kmph (30 mph), Unbelted Barrier Test, 5th Percentile Female Dummy

The SNPRM proposes an up-to- 48 kmph (30 mph) unbelted barrier test for the 5th percentile female dummy. The test data in Table IV-16b represents the 48 kmph (30 mph) test condition for 1- MY1998, 3 - MY1999, 1 - confidential MM1999 and 3 confidential make/model/year. Nij and chest deflection were problems for the driver and Nij and chest g s were a problem for the passenger-side.

Table IV-16b
 Summary of 48 kmph (30 mph) Unbelted Barrier Tests, 5th Percentile Female Dummy
 Average Response of Test Vehicles
 () indicate Pass Rate %

	HIC ₁₅	Nij	Chest g s	Chest (mm) Deflection	Sample size (n)
Driver	132 (100)	0.814 (75)	47.79 (100)	47.39 (50)	8
Passenger	282 (100)	0.994 (71)	52.47 (57)	9.76 (100)	7
5 th ICPLs	700	1.0	60	52	

The driver sample (n=8) includes 1998 Ford Taurus from the August, 1998 PEA, 1999 Saturn SL1, 1999 Dodge Intrepid, 1999 Toyota Tacoma, and 1- confidential MY99 and 3 confidential MMY are included in this table. The passenger sample (n=7) employed only 2 of the above confidential MMY tests.

48 kmph (30 Mph), +/-30 Degree (L or R) Oblique, Unbelted Test, 50th %-ile Male & 5th Percentile Female Dummies

The SNPRM proposes a test speed of up-to-48 kmph (30 mph), for a +/- 30 degree (L or R) oblique unbelted test procedure for the 50th percentile dummy. This test at 48 kmph (30 mph) is already required by FMVSS 208 using the 50th percentile male dummy, except that HIC₁₅ and Nij are being proposed in the subject SNPRM. Oblique tests with the 5th percentile female dummy are not proposed in the SNPRM, but response data is shown in Tables IV-17 and IV-18 for comparison purposes. As shown in Tables IV-17 and IV-18, driver and passenger responses were benign for the 50th percentile male dummy with a 100 Pass Rate for the 30 mph, 30 degree oblique unbelted test. [Similarly, driver and passenger responses were benign for the 5th percentile female dummy, except for the driver-side Nij for the 1999 Dodge Intrepid resulting in a 75 percent Pass Rate (considering all 4 test vehicles) for the 30 mph, 30 degree oblique, unbelted test. The maximum femur axial load

occurred predominantly on the impacted or near-side and were not a problem in these tests. It is difficult to detect any significant differences in stringency between left or right side impacts for either dummy size. For the same MMY test vehicle, the impact-side dummy appears to have the higher responses, but responses were mixed.

Table IV-17
 48 kmph (30 Mph), +/-30 Degree Oblique (L or R), Unbelted Barrier Test
 50th Percentile Male & 5th Percentile Female Dummies

DRIVER

Make/ Model/ Year	Impact Direction	ATD Size	HIC ₁₅	Nij	Chest g s	Chest Deflection (mm)	Maximum Femur (N) (L or R leg)
Confidential Make/ Model	Right	50 th *	[]	[]	[]	[]	[]
1999 Dodge Intrepid	Right	50 th	53	0.35	34.3	24	5624R
1999 Dodge Intrepid	Left	50 th 5 th	210 86	0.37 1.693	43.0 44.52	32.1 27.6	5666L 4249R
Confidential Make/ Model	Right	50 th ** 5 th **	[] []	[] []	[] []	[] []	[] []
ICPLs		50 th	700	1.0	60	63	10,000
ICPLs		5 th	700	1.0	60	52	6,800

* Single stage inflator.

** Only the 1st stage of a dual stage inflator fired.

Table IV-18
48 kmph (30 mph), +/-30 Degree Oblique, Unbelted 50th Percentile Male & 5th Percentile
Female Dummies
PASSENGER

Make/ Model/ Year	Impact Direction	ATD Size	HIC₁₅	Nij	Chest g s	Chest Deflection (mm)	Maximum Femur (N) (L or R leg)
Confident- ial Make/ Model	Right	50 th *	[]	[]	[]	[]	[]
1999 Dodge Intrepid	Right	50 th	233	0.43	34.7	6.10	5180L
1999 Dodge Intrepid	Left	50 th 5 th	288 123	0.44 0.475	45.5 51.0	18.9 5.82	6267L 5397L
Confident- ial Make/ Model	Right	50 th ** 5 th **	[] []	[] []	[] []	[] []	[] []
ICPLs		50 th	700	1.0	60	63	10,000
ICPLs		5 th	700	1.0	60	52	6,800

* Single stage inflator.

** Only the 1st stage of a dual stage inflator was fired.

Given the range of dummy response variability observed in other crash tests, these test vehicles would still be expected to pass if typical variations occurred as in other tests. This appears to be a very benign test because (1) an oblique impact angle involves a lot of crushed soft sheet metal and a soft crash pulse and (2) the fire time was very timely, similar to a full frontal fixed rigid barrier. [Name

confidential] provided 48 kmph (30 mph), +/-30 degree oblique (L+R) unbelted 50th percentile male dummy compliance data (confidential), but this was an incomplete data set (e.g., included driver and passenger HIC 36 and chest g s only). The [name confidential] data was predominantly pre-MY98 and a few MY98 make/models.

56 kmph (35 mph), ODB Test Procedure, Unbelted 50th %-ile Male and 5th Percentile Female

Option 2, Full-Scale Test Procedures, proposes an unbelted, 35-56 kmph (22-35 mph), offset deformable barrier (ODB) test procedure (L or R) using the unbelted 50th percentile male and 5th percentile female dummies. The following data is representative of the expected responses, but Tibia response data was not available for these tests.

Table IV-19
56 kmph (35 mph), ODB, Unbelted, 50th Percentile Male & 5th Percentile Female
Dummy Comparisons
DRIVER

Make/ Model/ Year	Impact Direction	Dummy Type	HIC ₁₅	Nij	Chest g s	Chest Deflection (mm)	Maximum Femur (N)
1999 Dodge Intrepid	Left	50 th	348	1.39	57.8	42.4	5558R
	Left	5 th	470	1.94	51.45	41.0	2928R
	Right	5 th	57	1.213	35.45	34.77	3426R
1999 Toyota Tacoma	Left	50 th	149	0.419	38	46.2	4845L
	Left	5 th	354	0.572	44.42	36.94	3466L
	Right	5 th	335	0.536	40.46	30.27	4926R
1999 Saturn SL1	Left	5 th	99	0.36	33.61	55.14	3612L
Confident- ial Make/ Model	Left	50 th *	[]	[]	[]	[]	[]
Confident- ial Make/ Model	Left	50 th **	[]	[]	[]	[]	[]
Confident- ial Make/ Model	Left	50 th **	[]	[]	[]	[]	[]

Bold Numbers exceed proposed ICPL values.

No Tibia response data available for these tests.

* Single stage inflator.

** Stages 1 + 2 of dual stage inflator were fired.

Table IV-20
56 kmph (35 mph), ODB, Unbelted 50th Percentile Male & 5th Percentile Female
Dummy Comparisons
PASSENGER

Make/ Model/ Year	Impact Direction	ATD Size	HIC ₁₅	Nij	Chest g s	Chest Deflection (mm)	Maximum Femur (N)
1999 Dodge Intrepid	Left	50 th	196	0.574	53.2	19.5	7592L
	Left	5 th	366	1.702	77.7	12.3	4450L
	Right	5 th	220	0.479	55.9	9.0	4616R
1999 Toyota Tacoma	Left	50 th	208	0.567	39.4	23.4	4591L
	Left	5 th	163	0.609	41.73	1.14	3373L
	Right	5 th	331	0.933	47.2	16.1	3609L
1999 Saturn SL1	Left	5 th	45	0.309	24	5.73	3701L
Confident- ial	Left	50 th *	[]	[]	[]	[]	[]
Confident- ial	Left	50 th **	[]	[]	[]	[]	[]
Confident- ial	Left	50 th **	[]	[]	[]	[]	[]

Bold Numbers exceed proposed ICPLs.

No Tibia response data available for these tests.

* Single stage inflator. ** Stages 1 + 2 of dual stage inflator were fired.

Based on Tables IV-19 and 20, for the 1999 Dodge Intrepid driver-side using either the 50th percentile male or 5th percentile female dummy, both failed Nij. For the 1999 Toyota Tacoma driver-side using either dummy, both passed. For the 1999 Dodge Intrepid passenger-side, with left side impact, the 50th percentile male passed and the 5th percentile female dummy failed Nij. For the 1999 Toyota

Tacoma passenger-side using either dummy, both passed. For the 1999 Saturn SL1, the 5th percentile driver failed chest deflection.

Left vs Right ODB Test - A comparison of left-side versus right-side impact responses for the 5th percentile female dummy was conducted. The left-side impact was more stringent based on the driver-side for the 1999 Dodge Intrepid, where as L or R were almost identical based on the passenger-side of the 1999 Toyota Tacoma. Based on passenger-side responses for the 1999 Dodge Intrepid, the left-side impact was more stringent, whereas the right-side impact was more stringent for the 1999 Toyota Tacoma based on the passenger-side responses.

50th vs 5th driver and passenger - For the same MMY (a 1999 Toyota Tacoma) tested with both size dummies, there did not appear to be much difference in responses in the 50th vs 5th percentile dummies for either the driver or passenger sides of the test vehicle.

Near-side vs Far-side Impacts - For the driver-side, 8/10 or 80 percent of the near-side femurs had the highest maximum axial loads, whereas for the passenger-side, 9/10 or 90 percent of the near-side femurs had the highest axial loads.

C. Summary of Pass Rates by Proposed Test Procedure

Table IV-21 summarizes the Pass Rates for each of the full-scale vehicle test procedures and the static OOP test procedures proposed for Options 1 & 2. Static OOP test Pass Rates are also shown for the 5th percentile female dummy, 6-year-old child dummy and the 12-month-old infant (CRABI) dummy.

The agency combined MY98 and MY99 vehicles together, combined left and right oblique tests, or combined left and right ODB test data together, in order to calculate Pass Rates. Because of the very limited number of test vehicles available for the unbelted ODB test condition at 56 kmph (35 mph), two confidential MMY s were combined with three MY1999 vehicles NHTSA had tested to create a sample of 5. For the 25 mph unbelted test Pass Rates, MY1999 (n=3) test results and 1 confidential MMY were combined. Similarly, for the 30 mph unbelted barrier test Pass Rate, using the 5th percentile female dummy, 1 - MY98 was combined with 4 - MY99 (one of which was confidential) and 3 confidential MMY for a total sample of 8. Also, for the 30 mph, 30 degree, unbelted oblique crash test Pass Rate, several confidential MMYs were combined with NHTSA s tests. Some of the pre-MY98 and MY98+99 Pass Rates shown in Table IV-21 were determined using confidential 208 compliance data. The Pass Rates are used in Chapters VI, Benefits, and VII, Cost and Leadtime, to calculate costs and benefits.

Table IV-21
Summary of PASS RATES by Proposed Test Procedure

Test Procedure	Pre-MY98 Pass Rate	MY98+99 Pass Rate	Source of Data	Remarks
OOP 5th Percentile Female Driver	HIC ₁₅ 700, Nij =1, 60g s, 52mm	HIC ₁₅ 700, Nij =1, 60g s, 52mm		
	25% (1/4)	36.4% (4/11)	VRTC tests, Pre-MY98, MY98 & MY99: Position 1 and Position 2	Pre-MY98 & MY98 all fail Nij MY99- 2/6 fail Nij
Static OOP CRABI*, **	HIC ₁₅ 390, Nij 1, 50 g s, 30 mm*	HIC ₁₅ 390, Nij 1, 50 g s, 30 mm*		
	N.D. (a.)	100% (b.)	VRTC 213 sled tests. This replaces Table IV-10, 11 & 12 in 8/98 PEA. Docket 5156-6. Static OOP deployment test. n=1	(a.) HIC ₁₅ & Nij failures in sled test. *** (b.) No ICPL failures. ****
OOP 6-Year-Old Child Passenger	HIC ₁₅ 700, Nij 1, 60 g s, 40 mm	HIC ₁₅ 700, Nij 1, 60 g s, 40 mm	VRTC Pre-MY98 MY 98 + MY 99 Tests Position 1 + Position 2	MY99 Nij, chest g & deflect. failures. MY98 HIC ₁₅ , chest g, deflect & Nij failures.
	0%	7.69% (1/13)		
35 mph, belted, 50th Percentile Male	HIC ₁₅ 700, Nij 1, 60 g s, 63 mm	HIC ₁₅ 700, Nij 1, 60 g s, 63 mm		
Driver	81.2% (56/69)	84.1% (74/88)	1996-1999 NCAP data	HIC, Nij, & chest g s failures
Passenger	72.46% (50/69)	87.5% (77/88)	1996-1999 NCAP data	HIC, Nij, & chest g s failures
35 mph, belted, 5th Percentile Female	HIC ₁₅ 700, Nij 1, 60 g s, 52 mm	HIC ₁₅ 700, Nij 1, 60 g s, 52 mm		
Driver	50% (1/2)	N.D.	1988 Ford Taurus, no air bags & 1993 Ford Taurus with air bags. (VRTC)	1988 Ford Taurus failed HIC ₁₅
Passenger	50% (1/2)	N.D.	1988 Ford Taurus, no air bags & 1993 Ford Taurus with air bags. (VRTC)	1993 Ford Taurus failed Nij
30 mph, belted, 50th Percentile Male	HIC ₁₅ 700, Nij 1, 60 g s, 63 mm	HIC ₁₅ 700, Nij 1, 60 g s, 63 mm		
Driver	100 %	100%	n=1, Pre-MY98, 1996 Dodge Caravan n=18 MY1999 T.C. data Confid. compliance data 1990-98	No failures
Passenger	100%	100%	Pre-MY98 Table B-15 PEA June, 1998. n=18, MY1999 T.C. data Confid. Compliance data 1990-98	No failures
30 mph, belted 5th Percentile Female	HIC ₁₅ 700, Nij 1, 60 g s, 52 mm	HIC ₁₅ 700, Nij 1, 60 g s, 52 mm		
Driver	47.6% (10/21)	67.9% (19/28)	NHTSA/ Transport Canada	Pre-MY98 Nij failures MY 98+99 Nij failures

Passenger	64.3% (9/14)	93% (26/28)	NHTSA/ Transport Canada	No MY99 failures MY98 - 2 Nij& 1 chest g.
30 mph belted 30 deg oblique 50th Percentile Male	HIC ₁₅ 700, Nij 1, 60 g s, 63 mm	HIC ₁₅ 700, Nij 1, 60 g s, 63 mm		
Driver	100%	100%	Confid. Compliance data - 1990-98, MY99 Dodge Intrepid (n=1)	
Passenger	100%	100%	Confid. Compliance data - 1990-98, MY99 Dodge Intrepid (n=1)	
25 mph, ODB belted 5th Percentile Female	HIC ₁₅ 700, Nij 1, 60 g s, 52 mm	HIC ₁₅ 700, Nij 1, 60 g s, 52 mm		
Driver	36.4% (4/11)	60% (12/20)	NHTSA/ Transport Canada (97+98) (98+99)	Nij only problem. Combined L (n=19) + R (n=1)*
Passenger	71.43% (5/7)	90% (18/20)	NHTSA/ Transport Canada (97+98) (98+99)	Nij only problem. Combined L (n=19) +R (n=1)*
37.5 mph, belted, ODB, L or R, with Tibia Index Data	50 th - HIC ₁₅ 700, Nij 1, 60 g s, 63 mm 5 th - HIC ₁₅ 700, Nij 1, 60 g s, 52 mm	50 th - HIC ₁₅ 700, Nij 1 60 g s, 63mm 5 th - HIC ₁₅ 700, Nij 1, 60 g s, 52 mm		
Driver 50 th Percentile Male	71.43%	0%	VRTC	1/3 Nij failed & 3/3 Tibia Index failures MY99
Driver 5 th Percentile Female	0% (3/3 Nij fail.) (2/3 Tibia Index fail.)	0% (3/3 Nij fail.) (3/3 Tibia Index fail.)	VRTC	
Passenger 50 th Percentile Male	100% (No Tibia Data)	100% (with Tibia data)	VRTC	
Passenger 5 th Percentile Female	33% (No Tibia data)	67% (1/3 Nij fail. No Tibia problems)	VRTC	
25 mph, Unbelted Barrier Tests	50 th - HIC ₁₅ 700, Nij 1, 60 g s, 63 mm 5 th - HIC ₁₅ 700, Nij 1, 60 g s, 52 mm	50 th - HIC ₁₅ 700, Nij 1 60 g s, 63mm 5 th - HIC ₁₅ 700, Nij 1, 60 g s, 52 mm		
Driver 50 th Male	N.D.	100% (4/4)	n=4 3 VRTC, 1 Confid MMY	No Failures
Driver 5 th Female	N.D.	100% (4/4)	n=4 2 VRTC, 2 Confid. MMY	No Failures
Passenger 50 th Male	N.D.	75% (3/4)	n=4 3 VRTC, 1 Confid. MMY	1 Nij failure Tacoma
Passenger 5 th Female	N.D.	75% (3/4)	n=4 2 VRTC, 2 Confid. MMY	1 Nij failure Tacoma
30 mph , unbelted 50th Percentile Male	HIC ₁₅ 700, Nij 1, 60 g s, 63mm	HIC ₁₅ 700, Nij 1, 60 g s, 63mm		
Driver	100% HIC only (Nij not available, not instrumented)	100% (15/15)	VRTC 6-MY 1999 VRTC 7-MY 1998 1- MY98 Ford Escort 1- Confid. MMY	1999 Acura Driver Femur failure excluded from driver Pass Rate computation.

Passenger	100% HIC only (Nij not available, not instrumented)	93.33% (14/15)	VRTC 6-MY 1999 VRTC 7-MY 1998 1- MY98 Ford Escort 1- Confid. MMY	1998 Dodge Neon Chest g s
30 Mph, Unbelted 5th Percentile Female	HIC ₁₅ 700, Nij 1, 60 g s, 52 mm	HIC ₁₅ 700, Nij 1, 60 g s, 52 mm		
Driver	Not available	38% (3/8)	n=1 MY98, n=3 MY99, n=1 Confid. MY99, n=3 Confid. MMY	2 Nij & 4 chest deflection failures
Passenger	Not available	29% (2/7)	n=1 MY98, n=3 MY99, n=1 Confid. MY99, n=2 Confid. MMY	1 Nij & 3 chest g s failures
30 mph, unbelted, 30 deg oblique 50th Percentile Male	HIC ₁₅ =700, Nij 1, 60 g s, 63 mm	HIC ₁₅ =700, Nij 1, 60 g s, 63 mm		
Driver	100%	100%	Confid Compliance data 1990-98. See Table IV-17 (NHTSA + Confid. MMY)	No failures
Passenger	100%	100%	Confid. Compliance data 1990-98, See Table IV-17 (NHTSA + Confid. MMY)	No failures
35 mph unbelted ODB, L or R, No Tibia data available *****	50 th - HIC ₁₅ 700, Nij 1, 60 g s, 63 mm 5 th - HIC ₁₅ 700, Nij 1, 60 g s, 52 mm	50 th - HIC ₁₅ 700, Nij 1 60 g s, 63mm 5 th - HIC ₁₅ 700, Nij 1, 60 g s, 52 mm		
Driver 50 th Percentile Male	N.D.	80% (4/5)	n=5 2 VRTC, 3 Confid. MMY	1 Nij failure for 99 Intrepid
Driver 5 th Percentile Female	N.D.	40% (2/5)	n=5 5 VRTC	2 Nij failures 1 chest g s failure L+R combined.
Passenger 50 th Percentile Male	N.D.	100% (5/5)	n=5 2 VRTC, 3 Confid. MMY	No Failures
Passenger 5 th Percentile Female	N.D.	80% (4/5)	n=5 5 VRTC	Nij & chest g failure 99 Intrepid. L+R combined

Table IV-21 Footnotes are as follows: N.D. - No data available at this time. *CRABI dummy cannot measure deflection. **Suppression or low risk test proposed in the SNPRM. *** 1997 Ford Taurus and 1998 Ford Explorer inflator technology, **** 1st stage of experimental inflator for static OOP test and ***** Upgraded structural changes may be required.

D. Test Procedure Stringency**Static Test Procedures, Out-of-Position****a. Static OOP Test (Driver-Side) - Position 1 vs Position 2 Stringency based the 5th Percentile Female Dummy**

Considering that the dummy injury responses are equally weighted, and the limited number of data points available, OOP Position 1 would appear to be more stringent than OOP Position 2 based on N_{ij} and HIC_{15} , whereas Position 2 would appear to be more stringent than Position 1 based on chest g s and chest deflection. The data supports the idea that these tests are complementary, namely - OOP Position 1 is more of a worst case head/neck impact condition, while OOP Position 2 is more of a worst case chest impact condition. The agency has a limited number of data points because of resource and manpower constraints.

Static OOP Test (Passenger-Side) - Position 1 vs Position 2 Stringency based the 6-Year-Old Child Dummy

Recognizing the limited number of data points, OOP Position 2 would appear to be more stringent than Position 1 based on the magnitude of HIC_{15} , N_{ij} and chest g s responses.

Static OOP Test (Passenger-Side) - Position 1 vs Position 2 Stringency based the 3-Year-Old Child Dummy

This was discussed earlier. Due to limited time and resources, the agency did not conduct any 3-year-old child dummy static OOP tests.

Dynamic Test Procedures, In-Position

a. Test Procedure Stringency Comparison 40 kmph (25 mph) Unbelted Barrier vs 48 kmph (30 mph) Unbelted barrier vs 56 kmph (35 mph) Unbelted, ODB (Left) (50th & 5th Percentile Dummies) based on a 1999 Toyota Tacoma and a 1999 Dodge Intrepid

Methodology

Part I. Two test vehicles were used to assess test procedure stringency, particularly the stringency of the 35 mph ODB unbelted test procedure compared to a 25 mph unbelted FRB and a 30 mph unbelted FRB test. The two vehicles employed by the agency were a 1999 Dodge Intrepid and a 1999 Toyota Tacoma. Both 50th and 5th percentile dummies were used in the assessment. Tables IV-22a & 22b show the 50th percentile dummy driver and passenger responses for the 1999 Dodge Intrepid by test procedure type. Tables IV-22c & 22d show the 5th percentile dummy driver and passenger responses for the 1999 Dodge Intrepid by test procedure type. Tables IV-23a- 23b show the 50th percentile dummy driver and passenger responses, respectively, for the 1999 Toyota Tacoma by test procedure type. Tables IV-23c & 23d show the 5th percentile dummy driver and passenger responses, respectively, for the 1999 Toyota Tacoma by test procedure type. The percentage values shown in parentheses () represents the percent difference between the subject test procedure and the 48 kmph (30 mph) unbelted test procedure. Tables IV-24a & IV-24b are further comparisons for the [confidential MMY] and Tables IV-25a & IV-25b are for the [confidential MMY], using the 50th percentile male dummy, but were not used to rank the test procedures.

Table IV-22a
50th Driver - 1999 Dodge Intrepid

Barrier Speed	HIC₁₅	Chest g s	Chest Deflection (mm)	Nij
25 mph unbelted	193 (-52%)	40.1 (-26%)	33 (-26%)	0.407 (-22%)
30 mph unbelted	403	54.4	44.8	0.522
35 mph ODB (Left) Unbelted	348 (-13.4%)	57.8 (+6.25%)	42.4 (-5.37%)	1.39 (+166%)

All percentages calculated with respect to the 48 kmph (30 mph) unbelted barrier test condition.

Bold Numbers exceed proposed ICPLs.

Table IV-22b
50th Passenger - 1999 Dodge Intrepid

Barrier Speed	HIC₁₅	Chest g s	Chest Deflection (mm)	Nij
25 mph Unbelted	83 (-63%)	48.1 (-11%)	18.3 (-28.8%)	0.393 (-0.76%)
30 mph Unbelted	223	54.1	25.7	0.396
35 mph ODB (Left) Unbelted	196 (-12.1%)	53.2 (-1.67%)	19.5 (-24%)	0.574 (+44.5%)

All percentages calculated with respect to the 48 kmph (30 mph) unbelted barrier test condition.

50 th Percentile Male Dummy ICPLs	700	60	63	1.0
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Table IV-22c
5th Driver - 1999 Dodge Intrepid

Barrier Speed	HIC₁₅	Chest g s	Chest Deflection (mm)	Nij
25 mph unbelted	99 (-28.8%)	40.5 (-28.4%)	32.1 (-39.2%)	0.349 (-77.1%)
30 mph unbelted	139	56.6	52.8	1.523
35 mph ODB (Left) unbelted	470 (+239%)	51.4 (-9.0%)	41.0 (-22.5%)	1.94 (+27.4%)

All percentages calculated with respect to the 48 kmph (30 mph) unbelted barrier test condition. **Bold numbers** exceed proposed ICPLs.

Table IV-22d
5th Passenger - 1999 Dodge Intrepid

Barrier Speed	HIC₁₅	Chest g s	Chest Deflection (mm)	Nij
25 mph unbelted	121 (-60%)	35.1 (-43.3%)	4.6 (-65%)	0.517 (-16.7%)
30 mph unbelted	302	62.2	13.1	0.621
35 mph ODB (Left) unbelted	366 (+21.5%)	77.7 (+25%)	12.3 (-6.11%)	1.702 (+174%)

All percentages calculated with respect to the 48 kmph (30 mph) unbelted barrier test condition. **Bold numbers** exceed proposed ICPLs.

Table IV-23a
50th Driver - 1999 Toyota Tacoma

Barrier Speed	HIC ₁₅	Chest g s	Chest Deflection (mm)	Nij
25 mph Unbelted	96 (-45.2%)	42.8 (-1.8%)	46.1 (-4.8%)	0.339 (+1.8%)
30 mph Unbelted	176	43.7	48.4	0.333
35 mph ODB (Left) Unbelted	149 (-15.3%)	38 (-13%)	46.2 (-4.6%)	0.419 (+25.8%)

All percentages calculated with respect to the 48 kmph (30 mph) unbelted barrier test condition. **Bold numbers** exceed proposed ICPLs.

Table IV-23b
50th Passenger -1999 Toyota Tacoma

Barrier Speed	HIC ₁₅	Chest g s	Chest Deflection (mm)	Nij
25 mph Unbelted	82 (-52.9%)	23.45 (-34.9%)	15.7 (-35%)	1.120 (+61.4%)
30 mph Unbelted	173	36	24	0.694
35 mph ODB (Left) Unbelted	208 (+19.5%)	39.4 (+8.3%)	23.4 (-2.5%)	0.567 (-18.3%)

All percentages calculated with respect to the 48 kmph (30 mph) unbelted barrier test condition. **Bold numbers** exceed proposed ICPLs.

Table IV-23c
5th Driver - 1999 Toyota Tacoma

Barrier Speed	HIC ₁₅	Chest g s	Chest Deflection (mm)	Nij
25 mph unbelted	238 (+18.9%)	51 (-2.5%)	41 (-20.3%)	0.615 (+27.9%)
30 mph unbelted	199	52.3	51.4	0.481
35 mph ODB (Left) unbelted	354 (+76.1%)	44.42 (-15.1%)	37 (-28.1%)	0.572 (+18.9%)

All percentages calculated with respect to 48 kmph (30 mph) unbelted barrier test.

Table IV-23d
5th Passenger -1999 Toyota Tacoma

Barrier Speed	HIC ₁₅	Chest g s	Chest Deflection (mm)	Nij
25 mph unbelted	143 (-62.4%)	34.1 (-17.3%)	3.7 (-11.9%)	2.064 (-22%)
30 mph unbelted	380	42.2	4.2	2.647
35 mph ODB (Left) unbelted	163 (-56.8%)	41.7 (-1.42%)	1.1 (-72.8%)	0.609 (-77%)

All percentages calculated with respect to 48 kmph (30 mph) unbelted barrier test.

Bold numbers exceed proposed ICPLs.

5 th ICPLs	700	60	52	1.0
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Table IV-24a
CONFIDENTIAL

IV-50

Table IV-24b
CONFIDENTIAL

Table IV-25a
CONFIDENTIAL

Table IV-25b
CONFIDENTIAL

50 th ICPLs	700	60	63	1.0
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Tables IV-25c shows 30 mph unbelted barrier test data for the [confidential MMY] using the 5th percentile female dummy, while Table IV-25d shows 30 mph, 30 degree oblique unbelted test data for the [confidential MMY] using the 5th percentile female dummy. Table IV-25e shows 25 mph unbelted barrier test data for the [confidential MMY] and [confidential MMY] using the 5th percentile female dummy.

Table IV-25c
CONFIDENTIAL

Table IV-25d
CONFIDENTIAL

Table IV-25e
CONFIDENTIAL

Data Analysis: Test Procedure Stringency Comparison for 40 kmph (25 mph) Unbelted Barrier, 48 kmph (30 mph) Unbelted barrier and 56 kmph (35 mph) Unbelted ODB (Left) (50th and 5th %-ile Dummy)

Based on the above tables (excluding the confidential data), Tables 26a & 26b compare the stringency of each test condition by dummy size. The following questions were asked: (1) Combining driver and passenger responses, what percentage of the responses at 30 mph unbelted are more stringent (greater than) than the 25 mph unbelted responses? (2) Combining driver and passenger responses, what percentage of the responses at 35 mph ODB unbelted are more stringent (greater than) than 30 mph unbelted responses? (3) Combining driver and passenger responses, what percentage of responses at 35 mph ODB unbelted are more stringent (greater than) than 25 mph unbelted responses? Table 26a shows the answers to these questions based on any measurable difference, whereas Table 26b answers the same questions based on at least a 20 percent difference.

Table IV-26a
40, 48, & 56 kmph (25, 30 and 35 mph) ODB Test Procedure Stringency Comparison
by Dummy Size (Any Difference at All)

	50th Tacoma Dr. + Pass.	50th Intrepid Dr + Pass.	50th Comb	50th Comb %	5th Tacoma Dr. + Pass.	5th Intrepid Dr. + Pass.	5th Comb	5th Comb %
30 > = 25 mph test unbelted	6/8	8/8	14/16	88%	6/8	8/8	14/16	88%
35 > = 30 mph test unbelted	3/8	3/8	6/16	38%	2/8	5/8	7/16	44%
35 > = 25 mph test unbelted	6/8	8/8	14/16	88%	3/8	8/8	11/16	69%

Source: Tables IV-22a to IV-22d and Tables IV-23a to IV-23d.

Given a sample of two test vehicles, with responses from all three test procedures (50th and 5th percentile dummies), the 35 mph unbelted ODB is less stringent than the 30 mph unbelted barrier test using either dummy as fewer than half (38% and 44% for the 50th percentile male and 5th percentile female dummies, respectively) of the responses at 35 mph ODB exceeded those at 30 mph.

On the other hand, 88% and 88% (50th percentile male and 5th percentile female dummies, respectively) of the 30 mph responses exceeded the 25 mph responses and 88% and 69% (50th percentile male and 5th percentile female dummies, respectively) of the 35 mph ODB responses exceeded the 25 mph responses.

Table IV-26b

40, 48, & 56 kmph (25, 30 and 35 mph) ODB Test Procedure Stringency Comparison
by Dummy Size (At least +20% Difference)

	50th Tacoma Dr. + Pass.	50th Intrepid Dr + Pass.	50th Comb	50th Comb %	5th Tacoma Dr. + Pass.	5th Intrepid Dr. + Pass.	5th Comb	5th Comb %
30 > = 25 mph test unbelted	4/8	6/8	10/16	63%	3/8	7/8	10/16	63%
35 > = 30 mph test unbelted	1/8	2/8	3/16	19%	1/8	5/8	6/16	38%
35 > = 25 mph test unbelted	5/8	6/8	11/16	69%	1/8	8/8	9/16	56%

Source: Tables IV-22a to IV-22d and Tables IV-23a to IV-23d.

Given a sample of two test vehicles, with responses from all three test procedures (50th percentile and 5th percentile dummies), the 35 mph unbelted ODB appears to be less stringent than the 30 mph unbelted barrier test using either dummy as fewer than half (19% and 38% for the 50th and 5th %-ile dummies, respectively) of the responses at 35 mph ODB exceeded those at 30 mph by at least 20%.

On the other hand, 63 % and 63 % (50th percentile male and 5th percentile female dummies, respectively) of the 30 mph responses exceeded the 25 mph responses by at least 20 % and 69 % and 56 % (50th percentile male and 5th percentile female dummies, respectively) of the 35 mph ODB responses exceeded the 25 mph responses by at least 20 %.

Conclusion - Based on the above data sets (Tables IV-26a & 26b), and all dummy responses,

the agency concluded that the 35 mph ODB 40 % overlap, unbelted test is less stringent than the 30 mph unbelted barrier test but more stringent than a 25 mph unbelted barrier test.

NHTSA also compared crash pulses of a 56 kmph (35 mph) offset deformable barrier (ODB) test with 40 kmph (25 mph) and 48 kmph(30 mph) rigid barrier tests using a 1999 Dodge Intrepid and a 1999 Toyota Tacoma. There is a long duration, low magnitude acceleration that is associated with the crushing of the honeycomb barrier facing during the ODB test. After the crushing of the deformable face takes place, the remaining segment of the crash pulse is similar to that of a 40 or 56 kmph (25 or 35 mph) fixed rigid barrier test and this portion of the acceleration profile generally would fall between the two rigid barrier pulses, if adjusted with a time shift. Therefore, the agency has concluded that the 56 kmph (35 mph) ODB equivalent velocity is approximately 20 percent lower than a 56 kmph (35 mph) full frontal barrier speed. That is, a 56 kmph (35 mph) offset test is approximately equal to a 45 kmph (28 mph) rigid barrier test. The crash pulse analysis is consistent with, and supports, the above dummy response analysis.

Part 2. 48 kmph (30 mph), +/- 30 degree (L or R) Oblique, Unbelted Test Procedure Stringency Comparison

A further comparison of the above test procedures was made for the 48 kmph (30 mph), 30 degree oblique unbelted test procedure using the 1999 Dodge Intrepid and response data from the 50th and 5th percentile dummies. Tables IV-27a and 27b employ the same 1999 Dodge Intrepid data as above, except 48 kmph (30 mph), 30 degree oblique (L+R) test data has been

added for comparison. From this data set, the agency concluded that the 48 kmph (30 mph), 30 degree oblique test was only marginally less stringent than a 25 mph unbelted barrier test.

Table IV-27a
Stringency Comparison by Test Procedure by Dummy Size
1999 Dodge Intrepid
Driver 50th vs 5th Percentile Dummies

	ATD Size	HIC ₁₅	Chest g s	Chest Deflection	Nij	n
25 mph unbelted	50th 5th	193 99	40.1 40.52	33 32.05	0.407 0.349	1
30 mph, 30 deg Oblique unbelted	50th 5th	132 97	38.7 59	27.85 29.8	0.358 1.06	2 (L+R) 2(L+R)
30 mph unbelted	50th 5th	403 139	54.4 56.6	44.8 52.78	0.581 1.523	1
35 ODB unbelted	50th 5th	348 472	57.8 51.45	42.4 40.94	1.39 1.94	1

Bold Numbers exceed proposed ICPL values.

Table IV-27b
Stringency Comparison by Test Procedure by Dummy Size

1999 Dodge Intrepid
 Passenger 50th and 5th Percentile Dummies

	ATD Size	HIC ₁₅	Chest g s	Chest Deflection	Nij	n
25 mph unbelted	50th	83	48.1	18.3	0.393	1
	5th	121	35.18	4.56	0.517	1
30 mph, 30 deg Oblique unbelted	50th	261	40.13	12.47	0.432	2 (L+R)
	5th	122	40.1	5.49	0.398	2(L+R)
30 mph unbelted	50th	223	54.1	25.7	0.396	1
	5th	302	62.2	13.06	0.621	1
35 ODB unbelted	50th	196	53.2	19.5	0.574	1
	5th	366	77.7	12.3	1.702	1

Bold Numbers exceed proposed ICPL values.

Conclusions: Based on both 50th and 5th percentile dummy responses, the 35 mph ODB unbelted test is more stringent than the 25 mph unbelted barrier test, but less stringent than the 30 mph unbelted barrier test. The 30 mph 30 degree oblique was only marginally less stringent than the 25 mph unbelted barrier test. Table IV-28 ranks the proposed test procedures from least stringent to the most stringent.

Table IV-28
 Proposed Test Procedure Stringency Rank

Stringency Rank	Unbelted Barrier Tests
1. Least	30 Mph 30 Degree Oblique FRB
2.	25 Mph Fixed Rigid Barrier (FRB)
3.	35 Mph Offset Deformable Barrier (equivalent to a 28 mph FRB)
4. Most	30 Mph Fixed Rigid Barrier (FRB)

Left vs Right 48 kmph (30 mph), 30 degree Oblique Belted Test Stringency

The SNPRM proposes both left and right side 48 kmph (30 mph), 30 degree oblique belted impact tests using the 50th percentile male dummy. This is the same as the current 208 standard except for HIC₁₅, Nij and chest deflection ICPLs. The following [name confidential] 208 compliance data compares the two test directions. Table IV-29a shows a few selected [name confidential] vehicles tested both in the left and right directions, whereas Table 29b compares All Vehicles in the [name confidential] file.

Table IV-29a

L vs R, 48 kmph (30 mph), 30 degree Oblique Impacts, Belted, 50th Percentile Male Dummy
Confidential

Although the number of tests are limited, and recognizing that the data available reflects pre-MY98 make/models, there does not appear to be any significant difference between a left or right 48 kmph (30 mph), 30 degree oblique belted impacts, on the average, when using the 50th percentile male dummy.

Table IV-29b

L vs R, 48 kmph (30 mph), 30 degree Oblique Impacts, Belted, 50th Percentile Male Dummy,
Confidential

Although the data available reflect pre-MY98 [name confidential] make/models and a few MY98 models, there does not appear to be any significant difference between a left or right 48 kmph (30 mph), 30 degree oblique belted impact when using the 50th percentile male dummy based on All Vehicles. On the average, the left-side impact responses were higher numerically in all cases, except passenger-side chest g s. This suggest that the left-side oblique belted test condition might be slightly more stringent, on the average, compared to the right-side belted

oblique test condition. Because the left impact and right impact samples of make/models were not necessarily matched, the higher numerical values could have been due to the differences in the make/models selected, rather than the side of the impact.

Left vs Right 48 kmph (30 mph), 30 degree Oblique, Unbelted Test Stringency

The SNPRM proposes both left and right side 48 kmph (30 mph), 30 degree oblique unbelted impact tests using the 50th percentile male dummy. This is the same as the current 208 standard, except for the new proposed HIC₁₅, Nij and chest deflection ICPLs. The following [name confidential] 208 compliance data compares the two test directions. Table IV-30a shows a few selected [name confidential] vehicles tested both in the left and right directions, whereas Table 30b compares All Vehicles in the [name confidential] file.

Table IV-30a

L vs R, 48 kmph (30 mph), 30 degree Oblique Impacts, Unbelted, 50th Percentile Male Dummy
Confidential

Although the number of tests are limited, and recognizing that the data available reflects pre-MY98 make/models, there does not appear to be any significant difference between a left (L) or right (R) 48 kmph (30 mph), 30 degree oblique unbelted impacts when using the 50th percentile male dummy.

Table IV-30b

L vs R, 48 kmph (30 mph), 30 degree Oblique Impacts, Unbelted, 50th Percentile Male

Dummy
Confidential

Although the number of tests are limited, and the data available reflects pre-MY98 make/models, there does not appear to be any significant difference between a left (L) or right (R) 30 mph, 30 degree oblique unbelted impact, when using the 50th percentile male dummy based on All Vehicles. On the average, all responses for the left-side impacts were numerically higher than the right-side oblique impacts. This suggests that the left-side unbelted oblique impact condition might be slightly more stringent, on the average, compared to the right-side oblique impact condition. However, because left-side and right-side impact make/models were not necessarily matched, the higher numerical values could be due to make/model differences.

Left vs Right 56 kmph (35 mph), ODB, 40% Overlap, Unbelted Test Stringency

Table IV-31 shows a matched pair of 1999 Dodge Intrepid left (L) and right (R) side impacts, for the 5th percentile dummy, based on the proposed 56 kmph (35 mph), ODB, 40% overlap, unbelted test procedure. There was no significant difference between L and R side impacts based on the driver-side responses. Either crash direction would have resulted in a compliance test failure. However, on the passenger-side, responses were mixed with the passenger-side dummy failing Nij and chest g s in a left-side ODB test and passing Nij and chest g s on the right-side ODB test. Despite these differences, both left and right ODB tests would have resulted in compliance test failures based on the 5th percentile dummy. However, left side impact responses for HIC₁₅, Nij, chest g s and chest deflection were higher for both the driver

and passenger. Recognizing the limited number of test points, the left impact condition would appear to be somewhat more stringent having higher response values across the board.

Table IV-31
 56 kmph (35 mph), ODB, L vs R, 40% Overlap, Unbelted Test,
 5th Percentile Female Dummy
 1999 Dodge Intrepid (Left n=1/Right n=1)

	ATD Size	L or R Impact	HIC ₁₅	Nij	Chest g s	Chest deflection	Max. Femur
Driver	5th	L	470	1.94	51.45	41.0	2928R
	5th	R	57	1.213	35.45	34.8	3426R
Passenger	5th	L	366	1.702	77.7	12.3	4450L
	5th	R	220	0.479	55.9	9.0	4616R

50th vs 5th Percentile Dummy Dynamic and Compliance Equivalence

Sled Tests

BMW provided a comparison of 50th and 5th percentile dummy responses based on the FMVSS 208 (S13) sled test. (See Docket No. 98-4405-59) Figure IV-1 shows a good comparison of the dynamic responses of both dummies under identical, low variability test conditions. This bar chart compares the dynamic equivalence of the two dummies. For example, the 5th percentile dummy is more vulnerable in the areas of fore/aft neck shear and neck moments (extension and flexion) compared to the 50th percentile dummy, whereas the 50th percentile male dummy is more vulnerable in the chest g s area for the same test condition.

Figure IV-1 **BMW 208 sled test (S13) bar chart comparing 50th and 5th percentile dummy responses.** [See Docket No. NHTSA-1998-4405-59]

Full-Scale Vehicle Tests: Dummy Response Comparison**48 kmph (30 mph), 30 degree oblique (L) belted test condition**

Table IV-11 shows that the 50th and 5th percentile dummies responded almost identically in this test. Both dummies would have resulted in the 1999 Dodge Intrepid passing the compliance test procedure.

60 kmph (37.5 mph), ODB, 40% overlap, belted test condition

For the 1998 Dodge Neon, driver and passenger responses were very similar. The 1998 Dodge Neon would have passed the compliance test using both the 50th and 5th percentile dummies. For the 1998 Ford Contour, driver and passenger responses were very similar, except the 5th percentile dummy failed Nij on the driver's side. Therefore, based on the 50th percentile dummy the Ford Contour would have passed the compliance test, whereas based on the 5th percentile dummy the same vehicle would have failed. For the 1998 Chevy Venture, compliance test failure would have occurred using either dummy. The 50th percentile dummy driver failed Nij and the 5th percentile driver failed both Nij and HIC₁₅. The 5th percentile passenger failed Nij. Therefore, for 2 out of the 3 MY1998 make/models studied, the use of both dummies would have resulted in the same compliance test decision, whereas in 1 out of 3 there would have been a conflict. (See Tables IV-14a and IV-14b)

For the 60 kmph (37.5 mph), ODB, 40% overlap, belted test condition with the Tibia Index, and full-forward seating position for the 5th percentile female dummy, shows that overall test stringency can be enhanced by the incorporation of a lower leg injury criteria. Given the 48

test responses measured over 3 test vehicles, including the Tibia Index, the 5th percentile dummy exceeded the ICPL or IARV values 27 percent of the times, whereas the 50th exceeded the ICPL or IARV values only 10 percent of the time. (See Tables IV-14a and 14b.)

30 mph, 0 Degree Fixed Rigid Barrier, Unbelted Test Condition

Table IV-32 compares the responses of the 50th percentile male and 5th percentile female dummies for the 30 mph, 0 degree impact, unbelted, fixed rigid barrier test condition using a 1999 Saturn SL test vehicle. The driver and passenger responses for both dummies were very similar. Using either dummy and the new proposed injury criteria and associated ICPLs, the subject vehicle would have passed the compliance test.

48 kmph (30 mph), 30 degree oblique (L) unbelted test condition

As shown in Tables IV-17 and IV-18, for the 1999 Dodge Intrepid (L), the responses of the 50th and 5th percentile dummies were very similar, except for driver-side Nij failure for the 5th percentile female dummy. The 50th percentile male dummy Nij was 0.37, whereas the 5th percentile female dummy Nij was 1.693. Passenger-side responses were very similar and did not exceed any of the applicable ICPLs. Therefore, for this test vehicle, introduction of the 5th percentile female dummy and concomitant ICPLs results in compliance test failure, whereas passage would have occurred with the 50th percentile male dummy alone. [NOTE: The 5th percentile female dummy is included here for comparison purpose only and is not proposed for this test in the SNPRM.]

Table IV-32
50th Percentile Male vs 5th Percentile Female Dummies
48 kmph (30 mph), 0 Degree Fixed Rigid Barrier, Unbelted Test

Model Year	Make/ Model	Occupant Position/ ATD	HIC₁₅	Nij	Chest g s	Chest Deflection	Max. Femur (N)*
1999	Saturn SL1	Driver 50th	128	0.412	36.8	46.8	5288(L)
1999	Saturn SL1	Driver 5th	106	0.372	37.0	31.1	3566(L)
1999	Saturn SL1	Passenger 50th	200	0.501	40.2	9.2	6374(L)
1999	Saturn SL1	Passenger 5th	276	0.734	44.7	15.2	3259(R)

* Maximum Femur (left or Right leg indicated by parentheses).

56 kmph (35 mph), ODB, 40 % Overlap, Left, Unbelted Test Condition

For the 1999 Dodge Intrepid (L), driver responses were very similar and both failed Nij. The passenger-side responses were not as similar as the 5th percentile dummy failed Nij and chest g s. Use of either dummy would have resulted in a compliance test failure. For the 1999 Toyota Tacoma (L), driver responses were very similar and none of the responses exceeded the applicable ICPLs. Similarly, the passenger-side responses were very similar and none of the responses exceeded the applicable ICPLs. Use of either dummy would have resulted in passing the compliance test. Therefore, these two specific test vehicles, the usage of either dummy led to the same compliance test decision. (See Tables IV-19 and IV-20.)

Conclusion: Overall, the two dummies appear to be dynamically equivalent as they have very similar responses for the same dynamic test conditions and appear to be equivalent from a compliance point of view. However, there were several cases where the dummies were not equivalent from a compliance point of view. In each of those cases, the 5th percentile female dummy was more vulnerable to failure than the 50th percentile male dummy.

