APPENDIX 1

Regulatory Impact Statement

Regulatory Impact Statement

Proposed ADR Changes to Improve Occupant Protection in Four Wheel Drive and Light Commercial Vehicles

1. DESCRIPTION

This Regulatory Impact Statement assesses the impact of changes to various Australian Design Rules (ADRs) to bring occupant protection levels in forward control passenger vans, four wheel drives (4WDs) and light commercials to the same or similar standards as those applying in cars.

The changes are to include three phases. Phase 1 proposals are assessed herein and are summarised in Table A1.1 for the three vehicle types. Phase 2 is intended to apply ADR 69/00 to passenger vans (vehicle category MB), 4WDs (vehicle category MC) and light commercials (vehicle category NA). This ADR contains injury criteria that passenger cars must meet in full frontal barrier crash testing using Hybrid II or III dummies. New dynamic side impact rules will be developed in Phase 3 of the package of occupant protection improvements.

Table A1.1: Proposed Occupant Protection Improvements by Vehicle Category[1]

ADR		Proposed Improvement	MB	MC	NA
4/01:	Seatbelts	Retractors on second row of seats	Already applies	Adopt 1/7/96	Adopt 1/7/96
5/02:	Anchorages for seatbelts	Retractors on Second row of seats	Already applies	Adopt 1/7/96	Adopt 1/7/96
22/00:	Head restraints	Require head restraints	Applies	Applies	Adopt 1/7/96
29/00:	Side door strength	Side door intrusion beams	Adopt 1/7/96	Adopt 1/7/96	Adopt 1/7/96 for 2 wheel drives with front seats only
60/00:	Centre high-mounted stop lamp	Require lamps	Adopt 1/7/96	Adopt 1/7/96	Not applicable

Note: (1) MB = Forward Control Passenger Vehicles

MC = 4WD Vehicles

NA = Light Commercials

2. OBJECTIVES AND NECESSITY

The objective of the proposals is to upgrade occupant protection standards for passenger vans, 4WDs and light commercials to the same or similar levels applying to passenger cars.

As many of these vehicles are being promoted and sold as passenger vehicles, they should arguably provide occupant protection levels comparable to that of passenger cars.

3. IDENTIFICATION OF ALTERNATIVES

No formal alternatives to the proposed changes to occupant protection ADRs were considered. The ADRs already apply to cars, and the aim was to apply these same ADRs to all vehicles which are often used in place of cars (ie passenger vans, 4WDs and light commercials).

4. CONSULTATION

One of the first issues raised by the National Road Trauma Advisory Council when it was formed was the level of occupant protection provided by 4WD and light commercial vehicles. The matter was referred to the Federal Office of Road Safety (FORS) which formed a working party with the Federal Chamber of Automotive Industries (FCAI) for the purpose of investigating the matter.

In September 1993, a Vehicle Standards Proposal (VSP) was issued to alert interested parties to the review of occupant protection levels. The progress of the working party has been reported at the last two Technical Liaison Group (TLG) meetings. TLG members were asked to provide feedback on the working party's considerations; none has been received to date.

A draft of the proposals and the Regulatory Impact Statement were issued for a public comment period of two months at the beginning of September 1994. The majority of respondents were from industry and government, and they generally supported the proposals. Two respondents asked that the review of occupant protection measures include a wider range of issues, eg child restraints, cargo restraints. These issues will be investigated in the future.

As a result of comment made by FCAI, the proposals to improve occupant protection have been amended from those in the public comment draft in two ways:

i) ADR 29/00 side door strength will now apply to passenger vans, 4WDs and two wheel drive light commercials with front seats only; and

ii) ADR 69/00 Full Frontal Impact Protection will be deferred until Phase 2 because Japan has not finalised introduction dates for this standard. It was originally intended that ADR 69/00 be introduced at a later date (hence its inclusion in Phase 2), but FCAI indicated an earlier date may be possible if the Japanese standard was introduced.

The FCAI also asked for a six month delay in the introduction (ie to January 1997) of ADR 4/01 Seatbelts, ADR 5/02 Anchorages for Seatbelts and ADR 22/00 Head Restraints for light commercial vehicles (Category NA). There was insufficient justification for such a delay.

5. IMPACT ANALYSIS

5.1 Method

The analysis method adopted was largely determined by the available data. There are few data available on the fleet size and age of passenger vans, 4WDs and light commercials. As a result, an analysis of costs and benefits was undertaken for a single vehicle. It was assumed that vehicles have a life of 15 years and that there is no residual value in the safety equipment at the end of 15 years.

Crash data are also sparse for passenger vans, 4WDs and light commercials. In many analyses they are classified as "car derivatives" and included with cars. Crash rates and costs for cars were generally used based on data in Andreassen (1992, 1993) and MUARC (1992).

Andreassen (1992) contains estimates of crash costs by crash type in Victoria for 1987 and 1988. These were summed to provide a total estimate of $3,050.9 million, or $1,525.5 million pa. This represents about 20 percent of all crash costs in Australia (estimated in Andreassen 1993).

The estimated annual cost of $1,525.5 million was divided by car kilometres of travel in Victoria from the 1991 SMVU ($33,576 million to obtain a car crash cost of 4.53 cents per km in 1991 price levels). Using the CPI, the cost in current price levels is 4.77 cents/km.

Data in MUARC (1992) indicate that 65 percent of car crash costs are incurred by occupants, implying a crash rate of 3.10 cents/km for occupant injuries.

The costs are for Victorian crashes in 1987 and 1988 and they may not be representative of current levels. The number of fatalities has reduced significantly (about 20 percent), but there has been much less of a reduction in the number of injuries. Given the relative costs of fatal and injury costs, the crash rate cost might be about 5 percent lower now than in 1987 and 1988. Costs per km of 4.5 cents and 3.0 cents were used for all car crashes and occupant injuries respectively. These were translated to annual benefits per vehicle using an average annual distance travelled of 15,000 kilometres.

Estimates of person costs are based on an ex post value of saving life, while an ex ante value is commonly used in several countries. If person costs were increased by three times to reflect values used in those countries, then the costs per km would be:

- all car crashes 12.0 cents
- occupant injuries 8.0 cents

The potential costs and benefits of the proposed changes to ADRs include:

- the costs of design changes and certification testing;
- the costs of the safety equipment; and
- the benefits of reduced occupant injuries as a result of the safety equipment.

No costs were included for replacement of equipment or its maintenance. Costs, if any, are expected to be minimal. Replacement of some safety equipment will be required in the event of a crash, eg seatbelts, airbags. The proportion of vehicles involved in crashes where replacement is required will be low, so the average cost per vehicle will be similarly low. Given the assumptions made for other parts of the analysis, inclusion of a cost for replacement of equipment in the event of a crash is unlikely to affect the results.

There has been a push to improve occupant protection in passenger vans, 4WDs and light commercial vehicles in Japan. In a number of classes, Japanese manufacturers have voluntarily fitted design improvements to vehicles manufactured for their domestic market. This means that much of the development cost will be amortised for Japanese domestic production.

There will be additional costs for testing and certification affecting thirty-nine models (see Table A1.2). About half of these are Japanese models which account of 70 percent of the vehicles sold.

Table A1.2: Vehicles and Models by Vehicle Category, 1993

Vehicle Category Models	Number of Vehicles	Number of Models
MB (Forward control passenger vehicles)	1 707	2
MC (Off-road passenger vehicles)	44 643	17
NA (Forward control light commercials vehicles)	15 028	7
NA (Non-Forward control light commercial vehicles)	31 223	13
Total	**92 601**	**39**

Source: Black and White Data Book

Certification and testing costs per vehicle were calculated using the data in Table A1.2 and assuming that a model has a life of three years. the number of vehicles was divided by the number of models and multiplied by three to calculate an average number of vehicles per model. This number was then divided into the certification and testing cost per model to obtain a cost per vehicle.

This method is approximate, given that the sales of new vehicles by model vary with the model. For the more popular models, the costs will be overestimated and for the less popular models the costs will be underestimated. It is also conservative as most models are expected to last more than three years, and to be sold into other markets which have similar safety standard requirements.

5.2 Cost-Benefit Analysis

In this section, the cost-benefit analyses for ADRs 4/01, 5/02, 22/00, 29/00 and 60/00 are reported. ADRs 4/01 (seatbelts) and 5/02 (anchorages for seatbelts) are analysed together as it is not feasible to separate the benefits of seatbelt wearing for the two ADR requirements.

5.2.1 Certification and Testing Costs

Estimated certification and testing costs are shown in Table A1.3. These costs are included in the cost of the retractor assembly for ADR 4/01 and the side intrusion beam for ADR 29/00.

Table A1.3: Certification and Testing Costs

ADR	Vehicle Category	Total Cost per Model ($)	Cost per Vehicle ($)
4/01	MC	nil	nil
	NA	nil	nil
5/02	MC	10 000	1.30
	NA	10 000	1.50
22/00	NA	2 000	0.30
29/00	MB	nil	nil
	MC	nil	nil
60/00	MB	300	0.15
	MC	300	0.05

ADR 29/00 lists US FMVSS 214 as an acceptable certification test for cars. The US standard has been extended to vans and 4WDs used to carry passengers and, at the same time, the test procedure was changed. FCAI has requested that the revised FMVSS 214 test be permitted under ADR 29/00. This has been agreed to because the test is equal to (or more likely more stringent) than the current ADR 29/00 test. Costs of certification and testing of applying ADR 29/00 to passenger vans and 4WDs are therefore likely to be lower.

5.2.2 Costs of Safety Equipment

Currently available costs for meeting ADRs 4/01, 5/02, 22/00, 29/00 and 60/00 are as follows:

ADR 4/01: $5 per retractor assembly, including the cost of certification tests which will result in a cost of $10 per vehicle.

ADR 5/02: As anchorages are required for the static belts currently fitted, no extra costs for anchorages are expected.

ADR 22/00: The cost of a head restraint varies depending on the trimming used. The basic version is estimated to cost $15 but those with more elaborate trimming could cost as much as $25. The cost per vehicle is therefore estimated to range from $30 to $50.

ADR 29/00: The estimated cost of the side intrusion beams are $60, including certification tests.

ADR 60/00: The cost of a centre high-mounted stop lamp ranges from $5 to $20, with the higher cost version being a strip LED lamp. It is expected that most vehicles will have lamps at the lower cost range fitted.

5.2.3 Benefits of Reduced Occupant Injuries

ADR 4/01 will require the replacement of static seatbelts with retractor seatbelts in the second row of seats in 4WDs and light commercial vehicles. Consequent strengthening of anchorages will be required (ADR 5/02). Retractor belts are more comfortable than static belts and are therefore believed to increase wearing rates with consequent reductions in occupant injuries.

A survey of seatbelt wearing rates in rural areas reported the following results (Arup Transportation Planning 1991):

- Wearing rates were higher in front seats than in rear seats (94 percent and 90 percent respectively).
- Wearing rates were lower for static seatbelts then inertia reel belts (89 percent and 95 percent respectively).
- Wearing rates were lower in utilities/panel vans and vans than in cars/station wagons (88 percent, 92 percent and 95 percent respectively)

- Comparison with the results of a similar survey undertaken in 1988 indicated an increase in wearing rates particularly in rear seats. The report comments:

  "Factors contributing to these increases could include the higher proportion of vehicles with inertia reel belts and a generally better standard of belt, particularly in rear seats." (p23).

The introduction of seatbelts is estimated to have reduced occupant injuries by 30 percent (Mine 1985), indicating a saving of 0.9 cents/km. The estimated crash cost for occupant injuries was confirmed by relative casualty outcomes of seatbelt wearers and non-wearers (Andreassen 1993). They indicate that person costs are about 26 percent higher than average for non-wearers and about 56 percent lower than average for wearers. When total crash costs are considered, the crash costs for non-wearers are about 20 percent higher than average, or 0.9 cents/km.

This expected reduction in occupant injuries would be lower than 30 percent as wearing rates are already high. Based on the above wearing rates, a 5 percent reduction appears reasonable following replacement of static seatbelts with ones that retract. This implies a benefit of 0.15 cents/km or $22.50 per vehicle pa.

ADR 22/00 will require head restraints in light commercials. They are already required in cars, passenger vans and 4WDs. MUARC (1991) reviewed the literature on the effect of head restraints on occupant injuries and concluded that "in rear impacts, head restraints have proved to be only moderately effective" (p29). The literature indicated that integral restraints are more cost-effective than adjustable head restraints, and current designs are deficient in some respects.

Head restraints are aimed at reducing neck injuries which compromise about 14 percent of occupant injuries and 2 to 3 percent of the cost of injuries (MUARC 1992).

If all neck injuries were eliminated by the installation of head restraints, the crash savings would be a minimum of 0.06 cents/km or $9 per vehicle pa. Given that head restraints have proved to be moderately effective, a 50 percent reduction in neck injuries or $4.50 per vehicle pa was used in the cost-benefit analysis.

MUARC (1991) reviewed the literature on measures to improved occupant protection in side impact collisions (ADR 29/00). It reported that analysis of a limited sample of Australian crashes indicated there was no evidence to show "that compliance with ADR 29 reduced the risk of injury to front seat occupants on the impacted side" (p26).

A US study of a much larger sample of crashes showed that side intrusion beams did reduce occupant injuries. The following injury reductions were reported:

- fatalities decreases by 14 percent in single vehicle crashes;
- serious injuries decreased by 25 percent in multi-vehicle crashes; and

- minor injuries decreased by 9 percent in single vehicle crashes and 13 percent in multi-vehicle crashes.

Based on the above, the potential injury cost reduction was assumed to be 15 percent as a result of applying ADR 29/00 to passenger vans, 4WDs and two wheel drive light commercials with front seats only. Existing side impact crash costs were estimated using the following data:

- 17 to 25 percent of all injury crashes are side impact, and of these two-thirds are multi-vehicle crashes and one-third are single vehicle crashes (MUARC 1991).
- Multi-vehicle crashes cost 15 percent less than the average crash and single vehicle crashes cost 18 percent more than average (Andreassen 1992).

The resulting cost of side impact crashes was estimated to be between 0.39 cents/km and 0.57 cents/km. Applying the 15 percent injury cost reduction gives a benefit ranging from 0.06 cents/km to 0.08 cents/km (or $9 to $12 per vehicle pa).

Centre high-mounted stop lamps (ADR 60/00) are likely to result in fewer rear-end collisions as the driver in the following car has a clearer indication when the vehicle in front is going to slow down or stop.

Table A1.4 shows NSW casualty crash data by vehicle impact type. Seventeen percent of front seat occupants are involved in rear-end collisions (nose-tail), with lower proportions for 4WDs and light trucks (9 percent and 14 percent respectively). These results are supported by Victoria data in which rear-end collisions were 15 percent of all car crashes in 1987 and 1988. These crashes comprised only 8 percent of the total crash costs, indicating lower than average costs per crash (Andreassen 1992).

The Victorian car data was used to estimate crash savings. Savings may be over-estimated given the lower involvement of front seat occupants in 4WD and light truck crashes in NSW.

NHTSA (1987) undertook a study of crash involvement of cars with and without centre high-mounted stop lamps. It found that cars with centre high-mounted stop lamps were involved in 15 percent fewer crashes than those without. Assuming the same reduction for passenger vans and 4WDs implies a crash saving of 0.05 cents/km or $7.50 per vehicle pa.

Table A1.4: Impact Type by Vehicle Type, NSW Casualty Crashes (Percent of front seat occupants)

Impact Type	Cars	4WD	Light Truck	Total
Head-on	11.7	15.3	13.0	11.8
Rollover	6.1	25.8	14.9	6.7
Right-angle	22.4	10.2	16.9	22.0
Nose-tail	17.0	8.9	14.2	16.7
Other angle	18.9	9.2	14.1	18.5
Vehicle-object	23.0	29.2	24.8	23.2
Other	1.0	1.4	2.1	1.0
Total	**100.0**	**100.0**	**100.0**	**100.0**

5.2.4 Cost-Benefit Analysis Results

Table A1.5 summarises the cost-benefit analysis results for seatbelts, head restraints, side intrusion beams and centre high-mounted stop lamps. The costs and benefits estimated above were discounted over a 15 year period at a discount rate of 5 percent to give the present value of costs and benefits, and the net present value of benefits minus costs (NPV).

As noted above, several assumptions were required to make the benefit estimates. They are unlikely to affect the direction of the results to any great extent.

The discounted benefits exceed the discounted costs by a considerable amount in all cases, except in the case of head restraints. Indeed, for the most expensive restraint the costs exceed the benefits. Benefits of head restraints were estimated to be equivalent to a reduction of 50 percent in neck injury costs while the cost of the most expensive head restraint is equivalent to a 54 percent reduction in neck injury costs. As the most expensive head restraints are likely to be purchased for other than safety reasons, the negative NPV is arguably acceptable in view of the result for the most basic restraint.

Table A1.5: Present Value of Costs and Benefits ($)

ADR	Vehicle Category	Costs	Benefits	NPV
4/01 and 5/02	MC	11.30	233.50	222.20
	NA	11.50	233.50	222.00
22/00				
Minimum cost	NA	30.30	46.70	16.40
Maximum cost	NA	50.30	46.70	-3.60
29/00				
Minimum benefit	MB/MC/NA(1)	60.00	93.40	33.40
Maximum benefit	MB/MC/NA(1)	60.00	124.50	64.50
60/00				
Minimum cost	MB	5.15	77.80	72.65
Maximum cost	MB	20.15	77.80	57.65
Minimum cost	MC	5.05	77.80	72.75
Maximum cost	MC	20.05	77.80	57.75

Note: (1) Two wheel drives with front seats only

All benefits were calculated using an ex post value of saving life. If an ex ante value were used, benefits would increase by 270 percent (see Section 5.1), in which case justification for the proposed occupant protection measures would be increased significantly.

6. SUMMARY JUSTIFICATION

The proposals assessed in the Regulatory Impact Statement meet the objective of improving occupant protection for passenger vans, 4WDs and light commercial vehicles. These vehicles are often used as a substitute for cars and it is therefore considered desirable that they afford their occupants a similar level of protection as cars in the event of a crash. The planned improvements in Phases 2 and 3 will meet the objective to a greater extent.

The impact analysis indicates that the proposed changes to ADRs 4/01, 5/02, 22/00, 29/00 and 60/00 are all likely to have safety benefits in excess of the costs of fitting the equipment, over the life of the vehicles. The analyses required several assumptions and estimates; they were based on best available data and were conservative where the data were poor.

The proposals are supported by the Federal Chamber of Automotive Industries. The timing of implementation has been agreed with the Chamber to ensure the proposals can be efficiently integrated in new model designs.

In summary, it is considered that the proposals to improve occupant protection are justified.

7. IMPLEMENTATION

The proposed changes to the ADRs are to be made National Standards under the provisions of the Motor Vehicle Standards Act 1989. They would be implemented under the type approval arrangements for new vehicles administered by the Federal Office of Road Safety.

The manufacturer of each applicable vehicle will be required to ensure that the vehicle complies with the ADRs before first supplying to the market. Penalties for non-compliance with the Motor Vehicle Standards Act are $12,000 for each offence.

The lead times for introduction of the proposed ADRs is one and a half years. This is half the normal lead time provided to industry. This timetable is predicated on having the published ADRs to industry by the end of 1994.

REFERENCES

Andreassen D (1992) *Preliminary Cost for Accident-Types* ARR 217, ARRB.

Andreassen D (1993) *Road Accident Costs and their Use* Special Briefing No 4, ARRB

Arup Transportation Planning (1991) *Survey of Characteristics of Seatbelt Non-Wearers* CR 96, FORS

Milne P W (1985) *Fitting and Wearing of Seatbelts in Australia: The History of a Successful Countermeasure* CR 2, FORS

Monash University Accident Research Centre (MUARC) (1991) *Passenger Cars and Occupant Injury* CR 95, FORS.

Monash University Accident Research Centre (MUARC) (1992) Feasibility of Occupant Protection Measures CR 100, FORS.

National Highway Traffic Safety Administration (NHTSA) (1987) *The Effectiveness of Centre High-Mounted Stop Lamps: A Preliminary Evaluation* NHTSA, US Department of Transportation.

APPENDIX 2

Australian Design Rule 69/00
Full Frontal Impact Occupant Protection

MOTOR VEHICLE STANDARDS ACT
A national standard determined under section 7 of the Act

AUSTRALIAN DESIGN RULE 69/00
FULL FRONTAL IMPACT OCCUPANT PROTECTION

1 FUNCTION AND SCOPE

The function of this Australian Design Rule is to specify vehicle crashworthiness requirements in terms of forces and accelerations measured on anthropomorphic dummies in outboard front seating positions in full frontal test crashes so as to minimise the likelihood of injury to occupants of those seating positions.

2 APPLICABILITY

2.1 This ADR applies to the design and construction of vehicles as required by clauses 2.2 and 2.3, and as set out in clause 3.

2.2 This rule is binding:
- (a) from 1 July 1995 on all new model MA vehicles; and
- (b) from 1 January 1996 on all MA vehicles.

2.3 For the purposes of clause 2.2, a "new model" is a vehicle model first produced with a *'Date of Manufacture'* on or after 1 July 1995.

3 APPLICABILITY TABLE

VEHICLE CATEGORY	VEHICLE CATEGORY CODE	MANUFACTURED ON OR AFTER	ACCEPTABLE PRIOR RULES
Moped 2 wheels	LA	not applicable	
Moped 3 wheels	LB	not applicable	
Motor Cycle	LC	not applicable	
Motor Cycle and Side-car	LD	not applicable	
Motor Tricycle	LE	not applicable	
Passenger Car	MA	1 Jul 1995 (refer clauses 2.2 & 2.3)	nil
Forward-control Passenger Vehicle	MB	not applicable	
Off-road Passenger Vehicle	MC	not applicable	
Light Omnibus	MD	not applicable	
Heavy Omnibus	ME	not applicable	
Light Goods Vehicle	NA	not applicable	
Medium Goods Vehicle	NB	not applicable	
Heavy Goods Vehicle	NC	not applicable	
Very Light Trailer	TA	not applicable	
Light Trailer	TB	not applicable	
Medium Trailer	TC	not applicable	
Heavy Trailer	TD	not applicable	

4 DEFINITIONS

'Hybrid II' - *'Test Dummy'* which conforms to the requirements of US Federal Motor Vehicle Regulations Part 572, Test Dummies Specifications - Anthropomorphic Test Dummy for Applicable Test Procedures, Subpart B - Hybrid II Test Dummy - 50th Percentile Male, published by the National Highway Traffic Safety Administration (400 Seventh St, Southwest, Washington DC 20590). The drawings referred to in clauses 9 and 10 are in Part 572 Subpart B.

'Hybrid III' - *'Test Dummy'* which conforms to the requirements of US Federal Motor Vehicle Regulations Part 572, Test Dummies Specifications - Anthropomorphic Test Dummy for Applicable Test Procedures, Subpart E - Hybrid III Test Dummy - 50th Percentile Male, published by the National Highway Traffic Safety Administration (400 Seventh St, Southwest, Washington DC 20590). The drawings referred to in clauses 7 and 8 are in Part 572 Subpart E.

'Luggage Mass' - a mass equal to a minimum of 13.5kg per seating position or the *'Manufacturer's'* recommended figure.

'Suspension Height' - Vertical measurement from the wheel centre to the top of the wheel arch opening.

'Test Dummy' - anthropomorphic device as defined by either *'Hybrid II'* - *'Test Dummy'* or *'Hybrid III'* - *'Test Dummy'*.

5 REQUIREMENTS

5.1 Impact Velocity

The vehicle shall be impacted at 48 km/h, into a fixed collision barrier that is perpendicular to the line of travel of the vehicle.

5.1.1 If a vehicle is impacted at a higher velocity and conforms with the injury criteria of the ADR, then the test shall be deemed to meet the requirements of this rule.

5.2 Test Dummy

A *'Test Dummy'* in accordance with the following schedule shall be placed at each designated front outboard seating position.

5.2.1 Until 1 January 1998, demonstration of compliance may be done with either *'Hybrid II'* or *'Hybrid III'* *'Test Dummies'*.

5.2.2 From 1 January 1998 all vehicle models shall be required to demonstrate compliance using *'Hybrid III'* *'Test Dummies'*.

5.3 Injury Criteria

The *'Test Dummies'* shall meet the following injury criteria:

5.3.1 The resultant acceleration at the centre of gravity of the head shall be such that the maximum value of the expression:

$$\left[\frac{1}{(t_2-t_1)}\int_{t_1}^{t_2} a\,dt\right]^{2.5}(t_2-t_1)$$

shall not exceed 1,000 where a is the resultant acceleration expressed as a multiple of the acceleration due to gravity, and t_1 and t_2 are any two points in time during the crash of the vehicle which are separated by not more than a 36 millisecond time interval.

5.3.2 The resultant acceleration calculated from the output of the thoracic instrumentation shall not exceed 60 times the acceleration due to gravity, except for intervals whose cumulative duration is not more than 3 milliseconds.

5.3.3 Compression deflection of the sternum relative to the spine shall not exceed 76.2 mm. This requirement only applies when a *'Hybrid III'* *'Test Dummy'* is used.

5.3.4 The force transmitted axially through each upper leg (femur) shall not exceed 10 kN.

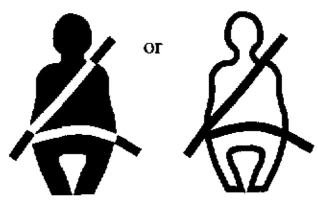
5.4 Crash Barrier

The crash barrier used in the test shall conform to that specified in SAE document J850, "Barrier Collision Test", February 1963.

5.5 Seatbelt Warning System

5.5.1 The vehicle shall be fitted with a seatbelt warning system which activates a continuous or flashing *'Visual Indicator'* for a period of not less than 4 seconds when the vehicle's ignition switch is moved to the "on" position or to the "start" position. An audible signal in addition to the *'Visual Indicator'* is permissible.

5.5.2 The *'Visual Indicator'* shall display the seat belt telltale below or the words "Fasten Seatbelts" or "Fasten Belts".



5.5.3 The *'Visual Indicator'* shall comply with the requirements of a Group 2 *'Visual Indicator'* in ADR 18/... .

5.5.4 A seatbelt warning system which complies with the requirements of clause S7.3 of US Federal Motor Vehicle Safety Standard 208 Occupant Crash Protection, shall be deemed to comply with the clauses 5.5.1 to 5.5.3.

6 TEST VEHICLE CONDITION

6.1 Test Vehicle Mass

The test vehicle, including test devices and instrumentation shall be loaded to its *'Unladen Mass'* and the *'Luggage Mass'*, plus the mass of the necessary *'Test Dummies'*.

6.1.1 The load placed in the cargo area shall be nominally centred on the vehicle.

6.2 Vehicle Test Attitude

The test vehicle attitude shall be such that the front and rear *'Suspension Heights'* shall be at or between the design value in the unladen and fully laden condition as specified by the *'Manufacturer'*.

6.3 Adjustable *'Seats'* shall be in the adjustment position midway between the foremost and rearmost positions, and if separately adjustable in a vertical direction, shall be at the lowest position. If an adjustment position does not exist midway between the foremost and rearmost positions, the closest adjustment position to the rear of the midpoint shall be used.

6.4 *'Seat'* backs shall be positioned at the design *'Seat Back Angle'*.

6.5 Any adjustable *'Seatbelt Anchorages'* shall be placed at the *'Manufacturer's'* nominal design position for the *'Test Dummy'*.

6.6 Each adjustable *'Head Restraint'* shall be placed in its highest adjustment position.

6.7 Adjustable lumbar supports shall be positioned so that the minimum lumbar support is provided.

6.8 Adjustable steering controls shall be adjusted so that the steering wheel hub is at the geometric centre of the locus it describes when it is moved through its full range of driving positions.

6.9 Movable vehicle windows and vents can be in any position at the *'Manufacturer's'* option.

6.10 Convertibles and open-body type vehicles shall have the top, if any, in place in the closed passenger compartment configuration.

6.11 Doors shall be fully closed and latched but not locked.

7 SET UP REQUIREMENTS FOR HYBRID III TEST DUMMY

7.1 Each *'Hybrid III'* 'Test Dummy' shall be set up according to the following:

7.2 The *'Test Dummy'* must be clothed in formfitting cotton stretch garments with short sleeves and midcalf length pants (specified in drawings 78051-292 and -293 or their equivalent).

7.3 A size 11EE shoe specified in drawings 78051-294 (left) and 78051-295 (right) or their equivalents shall be placed on each foot.

7.4 Limb joints shall be set at 1 times the acceleration due to gravity, barely restraining the mass of the limb when extended horizontally.

7.5 Leg joints shall be adjusted with the torso in the supine position.

7.6 Instrumentation shall not affect the motion of dummies during impact.

7.7 The stabilised temperature of the *'Hybrid III'* 'Test Dummy' specified shall be at any level between 20.5 degrees C and 22.2 degrees C.

8 POSITIONING PROCEDURES FOR HYBRID III TEST DUMMY

8.0 A *'Hybrid III'* 'Test Dummy' shall be positioned in each front outboard seating position of a vehicle as specified in the following clauses:

8.1 Head

The transverse instrumentation platform of the head shall be horizontal within 0.5 degrees. To level the head of the *'Test Dummy'*, the following sequences must be followed. First, adjust the position of the *'H point'* within the limits set forth in clause 8.5.1 to level the transverse instrumentation platform of the head. If still not level, then adjust the pelvic angle of the *'Test Dummy'* within the limits specified in clause 8.5.2 of this rule. If the transverse instrumentation platform of the head is still not level, then adjust the neck bracket of the *'Test Dummy'* the minimum amount necessary from the non-adjusted zero setting to ensure that the transverse instrumentation platform of the head is horizontal within 0.5 degrees. The *'Test Dummy'* shall remain within the limits specified in clause 8.5.1 and clause 8.5.2 after any adjustment of the neck bracket.

8.2 Arms

The arms of the *'Hybrid III' 'Test Dummies'* shall be positioned as follows:

8.2.1 The driver's upper arms shall be adjacent to the torso with the centrelines as close to a vertical longitudinal plane as possible.

8.2.2 The passenger's upper arms shall be in contact with the *'Seat'* back and the sides of the torso.

8.3 Hands

The hands of the *'Hybrid III' 'Test Dummies'* shall be placed as follows:

8.3.1 The palms of the driver *''Test Dummy'* shall be in contact with the outer part of the steering wheel rim at the rim's horizontal centreline.

8.3.2 The thumbs of the driver *'Test Dummy'* shall be over the steering wheel rim and shall be lightly taped to the steering wheel rim so that if the hand of the *'Test Dummy'* is pushed upward by a force of not less than 9 N and not more than 22 N, the tape shall release the hand from the steering wheel rim.

8.3.3 Each palm of the passenger *'Test Dummy'* shall be in contact with outside of the thigh.

8.3.4 Each little finger shall be in contact with the *'Seat'* cushion.

8.4 Upper Torso

The upper torso of the *'Hybrid III' 'Test Dummies'* shall be placed as follows:

8.4.1 In vehicles equipped with bench *'Seats'*, the upper torso of the driver and passenger dummies shall rest against the *'Seat'* back. The midsagittal plane of the driver *'Test Dummy'* shall be vertical and parallel to the vehicle's longitudinal centreline, and pass through the centre of the steering wheel rim or the design *'Seating Position'* at the *'Manufacturer's'* option. The midsagittal plane of the passenger *'Test Dummy'* shall be vertical and parallel to the vehicle's longitudinal centreline and the same distance from the vehicle's longitudinal centreline as the midsagittal plane of the driver *'Test Dummy'* or the design *'Seating Position'* at the *'Manufacturer's'* option.

8.4.2 In vehicles equipped with bucket *'Seats'*, the upper torso of the driver and passenger dummies shall rest against the *'Seat'* back. The midsagittal plane of the driver and the passenger *'Test Dummy'* shall be vertical and shall coincide with the longitudinal centreline of the bucket *'Seat'*.

8.5 Lower Torso

The lower torso of the *'Hybrid III' 'Test Dummies'* shall be placed as follows:

8.5.1 *'Test Dummy' 'H-point'* - The *'H-point'* of the driver and passenger dummies shall each coincide within 12.7 mm in the vertical dimension and 12.7 mm in the horizontal dimension of a point 6.3 mm below the position of the *'H point'* determined by using the equipment and procedures specified in SAE J826 (Apr 80) - Devices for Use in Defining and Measuring Vehicle Seating Accommodation except that the length of the lower leg and thigh segments of the *'H point'* machine shall be adjusted to 414 mm and 401 mm, respectively, instead of the 50 th percentile values specified in Table 1 of SAE J826.

8.5.2 Pelvic angle - As determined using the pelvic angle gauge (drawing 78051-532) which is inserted into the *'H point'* gauging hole of the *'Test Dummy'*, the angle measured from the horizontal on the 76.2 mm flat surface of the gauge shall be 22.5 degrees plus or minus 2.5 degrees.

8.5.3 Legs - The upper legs of the driver and passenger *'Hybrid III' 'Test Dummies'* shall rest against the *'Seat'* cushion to the extent permitted by placement of the feet. The initial distance between the outer knee clevis flange surfaces shall nominally be 269 mm. To the extent practicable, the left leg of the driver *'Test Dummy'* and both legs of the passenger *'Test Dummy'* shall be in vertical longitudinal planes. To the extent practicable, the right leg of the driver *'Test Dummy'* shall be in a vertical plane. Final adjustment to accommodate placement of feet in accordance with clause 8.5.4 for various passenger compartment configurations shall be permitted.

8.5.4 Feet - The feet of the *'Hybrid III' 'Test Dummies'* shall be positioned as follows:

> **8.5.4.1** - Driver's right foot. The right foot of the driver shall rest on the undepressed accelerator pedal with the rearmost point of the heel on the floor surface in the plane of the pedal. If the foot cannot be placed on the accelerator pedal, it shall be set initially perpendicular to the lower leg and placed as far forward as possible in the direction of the pedal centreline with the rearmost point of the heel resting on the floor pan. Except as prevented by contact with a vehicle surface, place the right leg so that the upper and lower leg centrelines fall, as close as possible, in a vertical plane without inducing torso movement.
>
> **8.5.4.2** - Driver's left foot. The left foot shall be placed on the toeboard with the rearmost point of the heel resting on the floor pan as close as possible to the point of intersection of the planes described by the toeboard and the floor pan. If the foot cannot be positioned on the toeboard, it shall be set initially perpendicular to the lower leg and placed as far forward as possible with the heel resting on the floor pan. If necessary to avoid contact with the vehicle's brake or clutch pedal, rotate the *'Test Dummy's'* left foot about the lower leg. If there is still pedal interference, rotate the left leg inboard about the hip the minimum distance necessary to

avoid pedal interference. Except as prevented by contact with a vehicle surface, place the left leg so that the upper and lower leg centrelines fall, as close as possible, in a vertical plane. For vehicles with a foot rest that does not elevate the left foot above the level of the right foot, place the left foot on the foot rest so that the upper and lower leg centrelines fall in a vertical plane.

8.5.4.3 - Passenger's feet on vehicles with flat floor pan/toeboard. The right and left feet shall be placed on the vehicle's toeboard with the heels resting on the floor pan as close as possible to the intersection point with the toeboard. If the feet cannot be placed flat on the toeboard, set them perpendicularly to the lower leg centreline and place them as far forward as possible with the heels resting on the floor pan. The right and left legs shall be placed so that the upper and lower leg centrelines fall in vertical longitudinal planes.

8.5.4.4 - Passenger's feet on vehicles with wheelhouse projections in passenger compartment. The right and left feet shall be placed in the well of the floorpan/toeboard and not on the wheelhouse projection. If the feet cannot be placed flat on the toeboard, initially set them perpendicularly to the lower leg centreline and place them as far forward as possible with the heels resting on the floor pan. If it is not possible to maintain vertical longitudinal planes through the upper and lower leg centrelines for each leg, then place the right leg so that its upper and lower centrelines fall, as closely as possible, in a vertical longitudinal plane and place the left leg so that its upper and lower leg centrelines fall, as closely as possible, in a vertical plane.

8.6 Each *'Hybrid III' 'Test Dummy'* shall be *'Correctly Fitted'* with the specified restraint system provided in the vehicle.

8.6.1 After final positioning of the *'Hybrid III'* 'Test Dummy', pull the upper torso webbing out of the retractor and allow it to retract; repeat this operation four times. Apply a 9 to 18 N tension load to the lap belt by pulling the upper torso belt adjacent to the latchplate. Measure the tension load as close as possible to the same location where the force was applied. After the tension load has been applied, ensure that the upper torso belt lies flat on the *'Test Dummy's'* shoulder. Allow the excess webbing in the shoulder belt to be retracted by the retractive force of the retractor.

9 SET UP REQUIREMENTS FOR HYBRID II TEST TEST DUMMY

9.1 Each *'Hybrid II' 'Test Dummy'* shall be set up according to the following:

9.2 The *'Test Dummy'* must be clothed in formfitting cotton stretch garments with short sleeves and midcalf length pants.

9.3 A size 11EE shoe which meets the configuration, size, sole, and heel thickness specifications of MIL-S 131192 and weighs 0.57 ± 0.1 kg shall be placed on each foot.

9.4 Limb joints shall be set at 1 times the acceleration due to gravity, barely restraining the mass of the limb when extended horizontally.

9.5 Leg joints shall be adjusted with the torso in the supine position.

9.6 Instrumentation shall not affect the motion of dummies during impact.

9.7 The stabilised temperature of the *'Hybrid II' 'Test* Dummy' specified shall be at any level between 18.9 degrees C and 25.6 degrees C.

10 POSITIONING PROCEDURES FOR HYBRID II TEST DUMMY

10.0 A *'Hybrid II' 'Test Dummy'* shall be positioned in each front outboard seating position of a vehicle as specified in the following clauses:

10.1 Vehicle Equipped with Front Bucket *'Seats'*

Place the torso of the *'Hybrid II' 'Test Dummy'* against the *'Seat'* back and its upper legs against the *'Seat'* cushion to the extent permitted by placement of the *'Test Dummy*'s' feet in accordance with the appropriate clause of 10. Centre the *'Test Dummy'* on the *'Seat'* cushion of the bucket *'Seat'* and set its midsagittal plane so that it is vertical and parallel to the centreline of the *'Seat'* cushion.

10.1.1 Driver position placement

10.1.1.1 Initially set the knees to be nominally 368 mm apart, measured between the outer surfaces of the knee pivot bolt heads, with the left outer surface 150 mm from the midsagittal plane of the *'Hybrid II' 'Test Dummy'*.

10.1.1.2 Rest the right foot on the undepressed accelerator pedal with the rearmost point of the heel on the floor pan in the plane of the pedal. If the foot cannot be placed on the accelerator pedal, set it initially perpendicular to the lower leg and place it as far forward as possible in the direction of the pedal centreline with the rearmost point of the heel resting on the floor pan. Except as prevented by contact with a vehicle surface, place the right leg so that the upper and lower leg centrelines fall, as close as possible, in a vertical plane without inducing torso movement.

10.1.1.3 Place the left foot on the toeboard with the rearmost point of the heel resting on the floor pan as close as possible to the point of intersection of the planes described by the toeboard and the floor pan and not on the wheelwell projection. If the foot cannot be positioned on the toeboard, set it initially perpendicular to the lower leg and place it as far forward as possible with the heel resting on the floor pan. If necessary to avoid contact with the vehicle's brake or clutch pedal, rotate the *'Test Dummy's'* left foot about the lower leg. If there is still pedal interference, rotate the left leg inboard about the hip the minimum distance necessary to avoid the pedal interference. Except as prevented by contact with a vehicle surface, place the left leg so that the upper and lower leg centrelines fall, as close as possible, in a vertical plane. For vehicles with a foot rest that does not elevate the left foot above the level of the right foot, place the left foot on the foot rest so that the upper and lower leg centrelines fall in a vertical plane.

10.1.2 Passenger position placement.

10.1.2.1 Vehicles with a flat floor pan/toeboard. Initially set the knees to be nominally 299 mm apart, measured between the outer surfaces of the knee pivot bolt heads. Place the right and left feet on the vehicle's toeboard with the heels resting on the floor pan as close as possible to the intersection point with the toeboard. If the feet cannot be placed flat on the toeboard, set them perpendicular to the lower leg centrelines and place them as far forward as possible with the heels resting on the floor pan. Place the right and left legs so that the upper and lower leg centrelines fall in vertical longitudinal planes.

10.1.2.2 Vehicles with wheelhouse projections in passenger compartment.

Initially set the knees to be nominally 299 mm, measured between the outer surfaces of the knee pivot bolt heads. Place the right and left feet in the well of the floor pan/toeboard and not on the wheelhouse projection. If the feet cannot be placed flat on the toeboard, initially set them perpendicular to the lower leg centrelines and then place them as far forward as possible with the heels resting on the floor pan. If it is not possible to maintain vertical and longitudinal planes through the upper and lower leg centrelines for each leg, then place the left leg so that its upper and lower centrelines fall as closely as possible in a vertical longitudinal plane and place the right leg so that its upper and lower leg centrelines fall, as closely as possible, in a vertical plane.

10.2 Vehicle Equipped with Bench *'Seats'*

Place the *'Hybrid II' 'Test Dummy*'s' torso against the *'Seat'* back and its upper legs against the *'Seat'* cushion, to the extent permitted by placement of the *'Test Dummy's'* feet in accordance with the appropriate clause of 10.1.

10.2.1 Driver position placement.

Place the *'Test Dummy'* at the right front outboard designated seating position so that its midsagittal plane is vertical and parallel to the centreline of the vehicle and so that the midsagittal plane of the *'Test Dummy'* passes through the centre of the steering wheel rim or the design *'Seating Position'* at the manufacturer's option. Place the legs, knees and feet of the *'Test Dummy'* as specified in clause 10.1.1.

10.2.2 Passenger position placement.

Place the *'Test Dummy'* at the left front outboard designated seating position so that the midsagittal plane of the *'Test Dummy'* is vertical and longitudinal, and the same distance from the vehicle's longitudinal centreline as the midsagittal plane of the *'Test Dummy'* at the driver's position or the design *'Seating Position'* at the manufacturer's option. Place the legs, knees, and feet of the *'Test Dummy'* as specified in clause10.1.2.

10.3 Initial Hybrid II Test Dummy Hand and Arm Placement

With the *'Test Dummy'* at its designated seating position as specified by the appropriate requirements of clause10.1 or 10.2, place the upper arms against the *'Seat'* back and tangent to the side of the upper torso. Place the lower arms and palms against the outside of the upper legs.

10.4 Hybrid II Test Dummy Settling

10.4.1 *'Test Dummy'* vertical upward displacement. Slowly lift the *'Test Dummy'* parallel to the *'Seat'* back plane until the *'Test Dummy's'* buttocks no longer contact the *'Seat'* cushion or until there is *'Test Dummy'* head contact with the vehicle's headlining.

10.4.2 Lower torso force application.

Apply a rearward force of 223 N against the centre of the *'Test Dummy's'* lower torso in a horizontal direction. The line of force application shall be 165 mm above the bottom surface of the *'Test Dummy's'* buttocks.

10.3.3 *'Test Dummy'* vertical downward displacement. Remove as much of the 223 N force as necessary to allow the *'Test Dummy'* to return downward to the *'Seat'* cushion by its own weight.

10.4.4 *'Test Dummy'* upper torso rocking.

Apply a 44.5 N to 66.8 N horizontal rearward force to the *'Test Dummy's'* lower torso. Then apply a horizontal forward force to the *'Test Dummy's'* shoulders sufficient to flex the upper torso forward until its back no longer contacts the *'Seat'* back. Rock the *'Test Dummy'* from side to side 3 or 4 times so that the *'Test Dummy's'* spine is at any angle from the vertical in the 14 to 16 degree range at the extremes of each rocking movement.

10.4.5 *'Test Dummy'* upper torso force application. While maintaining the 44.5 N to 66.8 N horizontal rearward force applied in clause 10.4.4 and with the *'Test Dummy's'* midsagittal plane vertical, push the upper torso back against the *'Seat'* back with a force of 223 N applied in a horizontal rearward direction along a line that is coincident with the *'Test Dummy's'* midsagittal plane and 457 mm above the bottom surface of the *'Test Dummy's'* buttocks.

10.5 Seatbelt Adjustment for Dynamic Testing

With the *'Hybrid II' 'Test Dummies'* at their designated seating positions as specified by the appropriate requirements of clauses 10.1 through 10.4, place and adjust the seat belts as specified below.

10.5.1 Place the seat belt around the *'Test Dummy'* and fasten the latch. The seatbelt shall be *'Correctly Fitted'* to each *'Hybrid II'* 'Test Dummy'. Pull the upper torso webbing out of the retractor and allow it to retract; repeat this operation four times so that the excess webbing in the shoulder belt is removed by the retractive force of the retractor. Apply a 9 to 18 N tension load to the lap belt by pulling the upper torso belt adjacent to the latchplate. Measure the tension load as close as possible to the same location where the force was applied. After the tension load has been applied, ensure that the upper torso belt lies flat on the *'Test Dummy's'* shoulder. Allow the excess webbing in the shoulder belt to be retracted by the retractive force of the retractor.

10.6 Placement of *'Hybrid II' 'Test Dummy'* Arms and Hands

With the *'Test Dummy'* positioned as specified by clause10.4 and without inducing torso movement, place the arms, elbows, and hands of the *'Test Dummy'*, as appropriate for each designated seating position in accordance with clauses 10.1 or 10.2. Following placement of the arms, elbows and hands, remove the force applied against the lower half of the torso.

10.6.1 Driver's position.

Move the upper and the lower arms of the *'Test Dummy'* at the driver's position to their fully outstretched position in the lowest possible orientation. Push each arm rearward permitting bending at the elbow, until the palm of each hand contacts the outer part of the rim of the steering wheel at its horizontal centreline. Place the *'Test Dummy's'* thumbs over the steering wheel rim and position the upper and lower arm centrelines as close as possible in a vertical plane without inducing torso movement. The thumbs shall be over the steering wheel rim and are lightly taped to the steering wheel rim so that if the hand of the *'Test Dummy'* is pushed upward by a force of not less than 9 N and not more than 22 N, the tape shall release the hand from the steering wheel rim.

10.6.2 Passenger position.

Move the upper and the lower arms of the *'Test Dummy'* at the passenger position to the fully outstretched position in the lowest possible orientation. Push each arm rearward, permitting bending at the elbow, until the upper arm contracts the *'Seat'* back and is tangent to the upper part of the side of the torso, the palm contacts the outside of the thigh, and the little finger is barely in contact with the *'Seat'* cushion.

10.7 Repositioning of Feet and Legs

After the *'Test Dummy'* has been settled in accordance with clause 10.4, the safety belt system has been positioned, if necessary, in accordance with clause 10.5, and the arms and hands of the *'Test Dummy'* have been positioned in accordance with clause 10.6, reposition the feet and legs of the *'Test Dummy'*, if necessary, so that the feet and legs meet the applicable requirements of clauses 10.1 or 10.2.

APPENDIX 3

Federal Motor Vehicle Safety Standard 208
Extracts

Federal Motor Vehicle Safety Standards 208
Extracts

This appendix consists of extracts from US Federal Motor Vehicle Safety Standard (FMVSS) 208 - Occupant Crash Protection which describe the test procedures used in this crash series.

The US regulations allow the use of either Hybrid II (Part 572, Subpart B test dummy) or the more advanced Hybrid III (Part 572, Subpart E test dummy) for certifying vehicles to FMVSS 208.

In the case of the FORS test series, Hybrid III test dummies were used, therefore reference should be made to the Subpart E dummies in the extract below.

Extract from FMVSS 208

S8. ***Test conditions***

S8.1 *General conditions.* The following conditions apply to the frontal, lateral, and rollover tests.

S8.1.1 Except as provided in paragraph (c) of this section, the vehicle, including test devices and instrumentation is loaded as follows:

(a) *Passenger cars.* A passenger car is loaded to its unloaded vehicle weight plus its rated cargo and luggage capacity weight, secured in the luggage area, plus the weight of the necessary anthropomorphic test devices.

(b) *Multipurpose passenger vehicles, trucks, and buses.* A multipurpose passenger vehicle, truck, or bus is loaded to its unloaded vehicle weight plus 300 pounds or its rated cargo and luggage capacity weight, whichever is less, secured in the load carrying area and distributed as nearly as possible in proportion to its gross axle weight ratings, plus the weight of the necessary anthropomorphic test devices. For the purposes of S8.1.1, unloaded vehicle weight does not include the weight of work-performing accessories. Vehicles are tested to a maximum unloaded vehicle weight of 5,500 pounds.

(c) *Fuel system capacity.* With the test vehicle on a level surface, pump the fuel from the vehicle's fuel tank and then operate the engine until it stops. Then, add stoddard solvent to the test vehicle's fuel tank in an amount which is equal to not less than 92 and not more than 94 percent of the fuel tank's usable capacity stated by the vehicle's manufacturer. In addition, add the amount of stoddard solvent needed to fill the entire fuel system from the fuel tank through the engine's induction system.

(d) *Vehicle test attitude.* Determine the distance between a level surface and a standard reference point on the test vehicle's body, directly above each wheel opening, when the vehicle is in its "as delivered" condition. The "as delivered" condition is the vehicle as received at the test site, with 100 percent of all fluid capacities and all tires inflated to the manufacturer's specifications as listed on the vehicle's tire placard. Determine the distance between the same level surface and the same standard reference points in the vehicle's "fully loaded condition". The "fully loaded condition" is the test vehicle loaded in accordance with S8.1.1 (a) or (b), as applicable. The load placed in the cargo area shall be centred over the longitudinal centreline of the vehicle. The pretest vehicle attitude shall be equal to either the as delivered or fully loaded attitude or between the as delivered attitude and the fully loaded attitude.

S8.1.2 Adjustable seats are in the adjustment position midway between the forwardmost and rearmost positions, and if separately adjustable in a vertical direction, are at the lowest position. If an adjustment position does not exist midway between the forwardmost and rearmost positions, the closest adjustment position to the rear of the midpoint is used.

S8.1.3 Place adjustable seat backs in the manufacturer's nominal design riding position in the manner specified by the manufacturer. Place any adjustable anchorages at the manufacturer's nominal design position for a 50th percentile adult male occupant. Place each adjustable head restraint in its highest adjustment position. Adjustable lumbar supports are positioned so that the lumbar support is in its lowest adjustment position.

S8.1.4 Adjustable steering controls are adjusted so that the steering wheel hub is at the geometric centre of the locus it describes when it is moved through its full range of driving positions.

S8.1.5 Movable vehicle windows and vents are, at the manufacturer's option, placed in the fully closed position.

S8.1.6 Convertibles and open-body type vehicles have the top, if any, in place in the closed passenger compartment configuration.

S8.1.7 Doors are fully closed and latched but not locked.

S8.1.8 *Anthropomorphic test dummies.*

S8.1.8.1 The anthropomorphic test dummies used for evaluation of occupant protection systems manufactured pursuant to applicable portions of paragraphs S4.1.2, 4.1.3, and S4.1.4 shall conform to the requirements of Subpart B of Part 572 of this Chapter.

S8.1.8.2 Anthropomorphic text devices used for the evaluation of occupant protection systems manufactured pursuant to applicable portions of paragraphs S4.1.2, S4.1.3 and S4.1.4 shall conform to the requirements of Subpart E of Part 572 of this Chapter.

S8.1.9.1 Each Part 572, Subpart B test dummy specified in S8.1.8.1 is clothed in formfitting cotton stretch garments with short sleeves and mid-calf length pants. Each foot of the test dummy is equipped with a size 11EE shoe which meets the configuration size, sole, and heel thickness specifications of MIL-S 131192 and weights 1.25 ± 0.2 pounds.

S8.1.9.2 Each Part 572, Subpart E test dummy specified in S8.1.8.2 is clothed in formfitting cotton stretch garments with short sleeves and mid-calf length pants specified in drawings 78051-292 and -293 incorporated by reference in Part 572, Subpart E of this Chapter, respectively or their equivalents. A size 11EE shoe specified in drawings 78051-294 (left) and 78051-295 (right) or their equivalents is placed on each foot of the test dummy.

S8.1.10 Limb joints are set at 1g, barely restraining the weight of the limb when extended horizontally. Leg joints are adjusted with the torso in the supine position.

S8.1.11 Instrumentation does not affect the motion of dummies during impact or rollover.

S8.1.12 *Temperature of the test dummy.*

S8.1.12.1 The stabilised temperature of the test dummy specified by S8.1.8.1 is at any level between 66 degrees F and 78 degrees F.

S8.1.12.2 The stabilised temperature of the test dummy specified by S8.1.8.2 is at any level between 69 degrees F and 72 degrees F.

S11 *Positioning procedure for the Part 572 Subpart E Test Dummy.* Position a test dummy, conforming to Subpart E of Part 572 of this Chapter, in each front outboard seating position of a vehicle as specified in S11.1 through S11.6. Each test dummy is restrained in accordance with the applicable requirements of S4.1.2.1, 4.1.2.2 or S4.6.

S11.1 *Head.* The transverse instrumentation platform of the head shall be horizontal within 1/2 degree. To level the head of the test dummy in vehicles with upright seats with non-adjustable backs, the following sequences must be followed. First adjust the position of the H point within the limits set forth in S11.4.3.1 to level the transverse instrumentation platform on the head of the test dummy. If the transverse instrumentation platform of the head is still not level, then adjust the pelvic angle of the test dummy within the limits provided in S11.4.3.2 of the standard. If the transverse instrumentation platform of the head is still not level, then adjust the neck bracket of the test dummy the minimum amount necessary to ensure that the transverse instrumentation platform of the head is horizontal within 1/2 degree.

S11.2 *Arms*

S11.2.1 The driver's upper arms shall be adjacent to the torso with the centrelines as close to a vertical plane as possible.

S11.2.2 The passenger's upper arms shall be in contact with the seat back and the sides of torso

S11.3 *Hands*

S11.3.1 The palms of the driver test dummy shall be in contact with the outer part of the steering wheel rim at the rim's horizontal centreline. The thumbs shall be over the steering wheel rim and shall be lightly taped to the steering wheel rim so that if the hand of the test dummy is pushed upward by a force of not less than 2 pounds and not more than 5 pounds, the tape shall release the hand from the steering wheel rim.

S11.3.2 The palms of the passenger test dummy shall be in contact with outside of thigh. The little finger shall be in contact with the seat cushion.

S11.4 Torso

S11.4.1 In vehicles equipped with bench seats, the upper torso of the driver and passenger test dummies shall rest against the seat back. The midsagittal plane of the driver dummy shall be vertical and parallel to the vehicle's longitudinal centreline, and pass through the centre of the steering wheel rim. The midsagittal plane of the passenger dummy shall be vertical and parallel to the vehicle's longitudinal centreline and the same distance from the vehicle's longitudinal centreline as the midsagittal plane of the driver dummy.

S11.4.2 In vehicles equipped with bucket seats, the upper torso of the driver and passenger test dummies shall rest against the seat back. The midsagittal plane of the driver and the passenger dummy shall be vertical and shall coincide with the longitudinal centreline of the bucket seat.

S11.4.3 *Lower Torso*

S11.4.3.1 *H-Point.* The H-point of the driver and passenger test dummies shall coincide within 1/2 inch in the vertical dimension and 1/2 inch in the horizontal dimension of a point 1/4 inch below the position of the H-point determined by using the equipment and procedures specified in SAE J826 (Apr 80) except that the length of the lower leg and thigh segments of the H-Point machine shall be adjusted to 16.3 and 15.8 inches, respectively, instead of the 50th percentile values specified in Table 1 of SAE J826.

S11.4.3.2 *Pelvic angle.* As determined using the pelvic angle gauge (GM drawing 78051-532 incorporated by reference in Part 572, Subpart E of this chapter) which is inserted into the H-Point gauging hole of the dummy, the angle measured from the horizontal on the 3 inch flat surface of the gauge shall be 22½ degrees plus or minus 2½ degrees.

S11.5 *Legs*

S11.5.1 The legs of the driver and passenger test dummy shall be placed as provided in S11.5.2 or, at the option of the vehicle manufacturer until September 1, 1991, as provided in S10.1.1 for the driver and S10.1.2 for the passenger, except that the initial distance between the outboard knee clevis flange surfaces shall be 10.6 inches for both the driver and the passenger rather than 14½ inches as specified in S10.1.1(a) for the driver and 11¾ inches as specified in S10.1.2.1(a) and S10.1.2.2(a) for the passenger.

S11.5.2 The upper legs of the driver and passenger test dummies shall rest against the seat cushion to the extent permitted by placement of the feet. The initial distance between the outboard knee clevis flange surfaces shall be 10.6 inches. To the extent practicable, the left leg of the driver dummy and both legs of the passenger dummy shall be in vertical longitudinal planes. To the extent practicable, the right leg of the driver dummy shall be in a vertical plane. Final adjustment to accommodate placement of feet in accordance with S11.6 for various passenger compartment configurations is permitted.

S11.6 *Feet.* The feet of the driver test dummy shall be positioned in accordance with S10.1.1(b) and (c) of this standard. The feet of the passenger test dummy shall be positioned in accordance with S10.1.2.1(b) and (c) or S10.1.2.2(b) and (c) of this standard, as appropriate:-

S10.1.1 *Driver position placement.*

....

(b) Rest the right foot of the test dummy on the undepressed accelerator pedal with the rearmost point of the heel on the floor pan in the plane of the pedal. If the foot cannot be placed on the accelerator pedal, set it initially perpendicular to the lower leg and place it as far forward as possible in the direction of the pedal centreline with the rearmost point of the heel resting on the floor pan. Except as prevented by contact with a vehicle surface, place the right leg so that the upper and lower leg centrelines fall, as close as possible, in a vertical plane without inducing torso movement.

(c) Place the left foot on the toeboard with the rearmost point of the heel resting on the floor pan as close as possible to the point of intersection of the planes described by the toeboard and the floor pan and not on the wheelwell projection. If the foot cannot be positioned on the toeboard, set it initially perpendicular to the lower leg and place it as far forward as possible with the heel resting on the floor pan. If necessary to avoid contact with the vehicle's brake or clutch pedal, rotate the test dummy's left foot about the lower leg. If there is still pedal interference, rotate the left leg outboard about the hip the minimum distance necessary to avoid the pedal interference. Except as prevented by contact with a vehicle surface, place the left leg so that the upper and lower leg centrelines fall, as close as possible, in a vertical plane. For vehicles with a foot rest that does not elevate the left foot above the level of the right foot, place the left foot on the foot rest so that the upper and lower leg centrelines fall in a vertical plane.

S10.1.2 *Passenger position placement.*

S10.1.2.1 *Vehicles with a flat floor pan/toeboard.*

....

(b) Place the right and left feet on the vehicle's toeboard with the heels resting on the floor pan as close as possible to the intersection point with the toeboard. If the feet cannot be placed flat on the toeboard, set them perpendicular to the lower leg centrelines and place them as far forward as possible with the heels resting on the floor pan.

(c) Place the right and left legs so that the upper and lower leg centrelines fall in vertical longitudinal planes.

S10.1.2.2 *Vehicles with wheelhouse projections in passenger compartment.*

....

(b) Place the right and left feet in the well of the floor pan/toeboard and not on the wheelhouse projection. If the feet cannot be placed flat on the toeboard, initially set them perpendicular to the lower leg centrelines and then place them as far forward as possible with the heels resting on the floor pan.

(c) If it is not possible to maintain vertical and longitudinal planes through the upper and lower leg centrelines for each leg, then place the left leg so that its upper and lower centrelines fall as closely as possible in a vertical longitudinal plane and place the right leg so that its upper and lower leg centrelines fall, as closely as possible, in a vertical plane.

APPENDIX 4

Vehicle Data Sheets

Test Vehicle Parameter Data - B4025

Vehicle Year/Make/Model Suzuki Vitara

Body Style 5 door 4 WD

Crashlab Test No B4025 **VIN** JSAETD01V00150219

Body Colour White **Build Date** 02/1994

Odometer reading (km:) 21

Engine:

X	Reciprocal		Other	4	No. of Cylinders/Rotors		
X	Longitudinal		Transverse	1.6	Capacity (litres)		
	Carburettor	X	EFI		Turbo		Supercharged
X	Petrol		Gas		Diesel		

Fuel Tank Capacity (litres) 55

Transmission	X	Manual		Automatic	5	Speed
Final Drive		Front wheel		Rear	X	Four wheel
Other Items	X	Air cond.	X	P/steer		
		P/windows		P/seats		
		Adj.Steer		Cruise Ctl.		4 Whl/Steer

Restraint types and positions:

Front 2 x ELR Lap sash

Rear 2 x ELR Lap sash

1 x Centre rear lap

Tyres:

Manufacturer: Bridgestone

Type:

Size: P205/75

Recommended cold tyre Pressure:

Front:(kPa) 160

Rear: (kPa) 160

Seating capacity	5	Front	2	Rear	3	Third seat	
Front seat		Bucket	X	Bench		Split bench	
Front seat back		Fixed		Adjustable	X	with lever	X
						with Rot. knob	

Test Vehicle Parameter Data - B4025 (cont.)

The weight of vehicle as received from dealer (with maximum fluids) is the vehicle's ***Unloaded Delivery Weight*** (UDW)

Vehicle mass (kg)

Left front	302.5	Right front	326.5
Left rear	282.5	Right rear	289.5
Total UDW (kg)	**1201.0**		
Total Front weight (kg)	629.0	% of total	52.3
Total rear weight (kg)	572.0	% of total	47.7

Calculation for Target Test Weight:-

UDW	= Unloaded Delivery Weight	1201.0	kg
VCW	= Vehicle Capacity Weight	449.0	kg
DSC	= Designated Seating Capacity	5	
RCW	= Rated Cargo Weight	108.85	kg
	= VCW - (68.03x DSC)		

Target Test Weight = UDW + RCW + (2 dummies x 74.4/dummy)

Target Test Weight (TTW) = **1458.0** **kg**

Weight of Test Vehicle with required ATD's and Cargo

Weight of ballast secured in vehicle (kg) 30

Vehicle mass:

Left front (kg)	348.0	Right front (kg)	362.0
Left rear (kg)	364.5	Right rear (kg)	375.5
Total front weight (kg)	710.0	% of total	48.9
Total rear weight (kg)	740.0	% of total	51.1
Total Test Weight (kg)	**1450.0**		

Vehicle Attitude (all dimensions in mm)

Delivered Attitude:	810	LF	810	RF	810	LR	810	RR
Ballasted Attitude: (without dummies)	814	LF	817	RF	802	LR	804	RR

Wheel Base = 2480 mm, C of G 1265 mm rearward of front wheel c\l

Test Vehicle Parameter Data - B4026

Vehicle Year/Make/Model Mitsubishi Pajero GLX

Body Style 4 door 4 WD

Crashlab Test No B4026 **VIN** JMFNJ5V45RJ003481

Body Colour White **Build Date** 01/1994

Odometer reading (km:) 14

Engine:

X	Reciprocal		Other	6	No. of Cylinders/Rotors		
X	Longitudinal		Transverse	3.0	Capacity (litres)		
	Carburettor	X	EFI		Turbo		Supercharged
X	Petrol		Gas		Diesel		

Fuel Tank Capacity (litres) 92

Transmission	X	Manual		Automatic	5	Speed
Final Drive		Front wheel		Rear	X	Four wheel
Other Items	X	Air cond.	X	P/steer		
		P/windows		P/seats		
	X	Adj.Steer		Cruise Ctl.		4 Whl/Steer

Restraint types and positions:

Front 2 x ELR Lap sash

Rear 2 x ELR Lap sash
1 x Centre rear lap

Tyres:

Manufacturer: Yokohama

Type: Super Digger

Size: P235/75R15

Recommended cold tyre Pressure:

Front:(kPa) 180

Rear: (kPa) 200

Seating capacity	5	Front	2	Rear	3	Third seat	
Front seat		Bucket	X	Bench		Split bench	
Front seat back		Fixed		Adjustable	X	with lever	X
						with Rot. knob	

Test Vehicle Parameter Data - B4026 (cont.)

The weight of vehicle as received from dealer (with maximum fluids) is the vehicle's ***Unloaded Delivery Weight*** (UDW)

Vehicle mass (kg)

Left front	434.0	Right front	451.5
Left rear	504.0	Right rear	488.5

Total UDW (kg)	**1878.0**		
Total Front weight (kg)	885.5	% of total	47.0
Total rear weight (kg)	992.5	% of total	53.0

Calculation for Target Test Weight:-

UDW	=	Unloaded Delivery Weight	1878.0	kg
VCW	=	Vehicle Capacity Weight	471.5	kg
DSC	=	Designated Seating Capacity	5	
RCW	=	Rated Cargo Weight	130.85	kg
	=	VCW - (68.03x DSC)		

Target Test Weight = UDW + RCW + (2 dummies x 74.4/dummy)

Target Test Weight (TTW) = **2158.0** **kg**

Weight of Test Vehicle with required ATD's and Cargo

Weight of ballast secured in vehicle (kg) 86

Vehicle mass:

Left front (kg)	489.5	Right front (kg)	502.0
Left rear (kg)	592.5	Right rear (kg)	566.5
Total front weight (kg)	991.5	% of total	46.0
Total rear weight (kg)	1159.0	% of total	54.0
Total Test Weight (kg)	**2150.5**		

Vehicle Attitude (all dimensions in mm)

Delivered Attitude:	860	LF	870	RF	900	LR	900	RR
Ballasted Attitude: (without dummies)	842	LF	849	RF	878	LR	884	RR

Wheel Base = 2725 mm, C of G 1440 mm rearward of front wheel c\l

Test Vehicle Parameter Data - B4027

Vehicle Year/Make/Model Mitsubishi Triton

Body Style Utility

Crashlab Test No B4027 **VIN** JMFMJ3M27RJ010627

Body Colour White **Build Date** 02/1994

Odometer reading (km:) 18

Engine:

X	Reciprocal		Other	4	No. of Cylinders/Rotors		
X	Longitudinal		Transverse	2.6	Capacity (litres)		
X	Carburettor		EFI		Turbo		Supercharged
X	Petrol		Gas		Diesel		

Fuel Tank Capacity (litres) 55

Transmission	X	Manual		Automatic	5	Speed
Final Drive		Front wheel	X	Rear		Four wheel
Other Items	X	Air cond.	X	P/steer		
		P/windows		P/seats		
	X	Adj.Steer		Cruise Ctl.		4 Whl/Steer

Restraint types and positions:

Front: 2 x ELR Lap sash
1 x static lapbelt

Rear: N/A

Tyres:

Manufacturer: Dunlop

Type: SP LT5

Size: 185R14C 8P.R.

Recommended cold tyre Pressure:

Front:(kPa) 180

Rear: (kPa) 220

Seating capacity	3	Front	3	Rear		Third seat	
Front seat		Bucket		Bench	X	Split bench	
Front seat back		Fixed	X	Adjustable		with lever	
						with Rot. knob	

Test Vehicle Parameter Data - B4027 (cont.)

The weight of vehicle as received from dealer (with maximum fluids) is the vehicle's ***Unloaded Delivery Weight*** (UDW)

Vehicle mass (kg)

Left front	365.5	Right front	358.0
Left rear	292.0	Right rear	283.5
Total UDW (kg)	**1299.0**		
Total Front weight (kg)	723.5	% of total	55.7
Total rear weight (kg)	575.5	% of total	44.3

Calculation for Target Test Weight:-

UDW	=	Unloaded Delivery Weight	1299.0	kg
VCW	=	Vehicle Capacity Weight	1196.0	kg
DSC	=	Designated Seating Capacity	3	
RCW	=	Rated Cargo Weight	991.9	kg
	=	VCW - (68.03x DSC)		

Target Test Weight = UDW + RCW + (2 dummies x 74.4/dummy)

Target Test Weight (TTW) = 1584.2 **kg**

Weight of Test Vehicle with required ATD's and Cargo

Weight of ballast secured in vehicle (kg) 0

Vehicle mass:

Left front (kg)	399.0	Right front (kg)	398.0
Left rear (kg)	393.0	Right rear (kg)	390.0
Total front weight (kg)	797.0	% of total	50.5
Total rear weight (kg)	783.0	% of total	49.5
Total Test Weight (kg)	**1581.0**		

Vehicle Attitude (all dimensions in mm)

Delivered Attitude:	730	LF	731	RF	803	LR	807	RR
Ballasted Attitude:	729	LF	727	RF	780	LR	778	RR

(without dummies)

Wheel Base = 2950 mm, C of G 1307 mm rearward of front wheel c\l

Test Vehicle Parameter Data - B4028

Vehicle Year/Make/Model Holden Rodeo

Body Style Utility

Crashlab Test No B4028 **VIN** JAATFR17HR7102560

Body Colour White **Build Date** 04/1994

Odometer reading (km:) 31

Engine:

X	Reciprocal		Other	4	No. of Cylinders/Rotors		
X	Longitudinal		Transverse	2.6	Capacity (litres)		
	Carburettor	X	EFI		Turbo		Supercharged
X	Petrol		Gas		Diesel		

Fuel Tank Capacity (litres) 75

Transmission	X	Manual		Automatic	5	Speed
Final Drive		Front wheel	X	Rear		Four wheel
Other Items	X	Air cond.		P/steer		
		P/windows		P/seats		
		Adj.Steer		Cruise Ctl.		4 Whl/Steer

Restraint types and positions:

Front	2 x ELR Lap sash
	1 x static lap belt
Rear	N/A

Tyres:

Manufacturer: Yokohama

Type: Super Van 356

Size: 185R14 8PR, LT

Recommended cold tyre Pressure:

Front:(kPa) 220.0

Rear: (kPa) 450.0

Seating capacity 3	Front	3	Rear		Third seat	
Front seat	Bucket		Bench	X	Split bench	
Front seat back	Fixed	X	Adjustable		with lever	
					with Rot. knob	

Test Vehicle Parameter Data - B4028 (cont.)

The weight of vehicle as received from dealer (with maximum fluids) is the vehicle's ***Unloaded Delivery Weight*** (UDW)

Vehicle mass (kg)

Left front	375.0	Right front	392.0
Left rear	276.5	Right rear	313.0
Total UDW (kg)	**1356.0**		
Total Front weight (kg)	767.0	% of total	56.6
Total rear weight (kg)	589.0	% of total	43.4

Calculation for Target Test Weight:-

UDW	=	Unloaded Delivery Weight	1356.0	kg
VCW	=	Vehicle Capacity Weight	1374.0	kg
DSC	=	Designated Seating Capacity	3	
RCW	=	Rated Cargo Weight	1169.9	kg
	=	VCW - (68.03x DSC)		

Target Test Weight = UDW + RCW + (2 dummies x 74.4/dummy)

Target Test Weight (TTW) = **1641.0** **kg**

Weight of Test Vehicle with required ATD's and Cargo

Weight of ballast secured in vehicle (kg) 47

Vehicle mass:

Left front (kg)	409.0	Right front (kg)	432.5
Left rear (kg)	375.5	Right rear (kg)	416.0
Total front weight (kg)	841.5	% of total	51.5
Total rear weight (kg)	791.5	% of total	48.5
Total Test Weight (kg)	**1633.0**		

Vehicle Attitude (all dimensions in mm)

Delivered Attitude:	220	LF	220	RF	400	LR	400	RR
Ballasted Attitude: (without dummies)	-	LF	-	RF	-	LR	-	RR

Wheel Base = 3025 mm, C of G 1314 mm rearward of front wheel c\l

Test Vehicle Parameter Data - B4029

Vehicle Year/Make/Model Toyota Landcruiser

Body Style 5 door 4 WD

Crashlab Test No B4029 **VIN** JT711UJ8008010431

Body Colour White **Build Date** 03/1994

Odometer reading (km:) 37

Engine:

X	Reciprocal		Other	6	No. of Cylinders/Rotors		
X	Longitudinal		Transverse	4.5	Capacity (litres)		
	Carburettor	X	EFI		Turbo		Supercharged
X	Petrol		Gas		Diesel		

Fuel Tank Capacity (litres) 145

Transmission	X	Manual		Automatic	5	Speed
Final Drive		Front wheel		Rear	X	Four wheel
Other Items	X	Air cond.	X	P/steer		
		P/windows		P/seats		
	X	Adj.Steer		Cruise Ctl.		4 Whl/Steer

Restraint types and positions:

Front	2 x ELR Lap sash
Rear	2 x ELR Lap sash + 1 x Centre lap Static
Far Rear	2 x ELR Lap sash + 1 x Centre lap Static

Tyres:

Manufacturer: Dunlop

Type: SP Road Gripper

Size: 7.5 R16 6PR

Recommended cold tyre Pressure:

Front:(kPa) 260.0

Rear: (kPa) 350.0

Seating capacity	8	Front	2	Rear	3	Third seat	3
Front seat		Bucket	X	Bench		Split bench	
Front seat back		Fixed		Adjustable	X	with lever	X
						with Rot. knob	

Test Vehicle Parameter Data - B4029 (cont.)

The weight of vehicle as received from dealer (with maximum flu;ds) is the vehicle's ***Unloaded Delivery Weight*** (UDW)

Vehicle mass (kg)

Left front	574.0	Right front	566.5
Left rear	555.0	Right rear	541.0

Total UDW (kg)	**2236.5**		
Total Front weight (kg)	1140.5	% of total	50.9
Total rear weight (kg)	1096.0	% of total	49.1

Calculation for Target Test Weight:-

UDW	=	Unloaded Delivery Weight	2236.5	kg
VCW	=	Vehicle Capacity Weight	723.5	kg
DSC	=	Designated Seating Capacity	8	
RCW	=	Rated Cargo Weight	136.4	kg
	=	VCW - (68.03x DSC)		

Target Test Weight = UDW + RCW + (2 dummies x 74.4/dummy)

Target Test Weight (TTW) = **2521.7** **kg**

Weight of Test Vehicle with required ATD's and Cargo

Weight of ballast secured in vehicle (kg) 130

Vehicle mass:

Left front (kg)	593.0	Right front (kg)	626.0
Left rear (kg)	641.0	Right rear (kg)	625.5
Total front weight (kg)	1219.0	% of total	48.6
Total rear weight (kg)	1293.5	% of total	51.4
Total Test Weight (kg)	**2512.5**		

Vehicle Attitude (all dimensions in mm)

Delivered Attitude:	902	LF	916	RF	925	LR	935	RR
Ballasted Attitude: (without dummies)	906	LF	905	RF	894	LR	889	RR

Wheel Base = 2850 mm, C of G 1397 mm rearward of front wheel c\l

Test Vehicle Parameter Data - B4030

Vehicle Year/Make/Model Toyota Hi-Lux

Body Style Utility

Crashlab Test No B4030 **VIN** JT731RN8509022335

Body Colour White **Build Date** 05/1994

Odometer reading (km:) 16

Engine:

X	Reciprocal		Other	4	No. of Cylinders/Rotors		
X	Longitudinal		Transverse	2.4	Capacity (litres)		
X	Carburettor		EFI		Turbo		Supercharged
X	Petrol		Gas		Diesel		

Fuel Tank Capacity (litres) 56

Transmission	X	Manual		Automatic	5	Speed
Final Drive		Front wheel	X	Rear		Four wheel
Other Items	X	Air cond.	X	P/steer		
		P/windows		P/seats		
		Adj.Steer		Cruise Ctl.		4 Whl/Steer

Restraint types and positions:

	Front	2 x ELR Lap sash
		1 x Centre static lapbelt
	Rear	N/A

Tyres:

Manufacturer: Dunlop

Type: SP LT5

Size: 195R14C 8PR

Recommended cold tyre Pressure:

Front:(kPa) 220

Rear: (kPa) 450

Seating capacity 3	Front	3	Rear		Third seat	
Front seat	Bucket		Bench		Split bench	X
Front seat back	Fixed		Adjustable	X	with lever	X
					with Rot. knob	

Test Vehicle Parameter Data - B4030 (cont.)

The weight of vehicle as received from dealer (with maximum fluids) is the vehicle's ***Unloaded Delivery Weight*** (UDW)

Vehicle mass (kg)

Left front	353.5	Right front	378.0
Left rear	273.5	Right rear	290.5
Total UDW (kg)	**1295.5**		
Total Front weight (kg)	731.5	% of total	56.5
Total rear weight (kg)	564.0	% of total	43.5

Calculation for Target Test Weight:-

UDW	=	Unloaded Delivery Weight	1295.5	kg
VCW	=	Vehicle Capacity Weight	1434.0	kg
DSC	=	Designated Seating Capacity	3	
RCW	=	Rated Cargo Weight	1229.9	kg
	=	VCW - (68.03x DSC)		

Target Test Weight = UDW + RCW + (2 dummies x 74.4/dummy)

Target Test Weight (TTW) = 1580.9 kg

Weight of Test Vehicle with required ATD's and Cargo

Weight of ballast secured in vehicle (kg) 0

Vehicle mass:

Left front (kg)	389.0	Right front (kg)	422.0
Left rear (kg)	373.0	Right rear (kg)	391.0
Total front weight (kg)	811.0	% of total	51.5
Total rear weight (kg)	764.0	% of total	48.5
Total Test Weight (kg)	**1575.0**		

Vehicle Attitude (all dimensions in mm)

Delivered Attitude:	750	LF	750	RF	810	LR	810	RR
Ballasted Attitude: (without dummies)	752	LF	748	RF	790	LR	792	RR

Wheel Base = 2850 mm, C of G 1241 mm rearward of front wheel c\l

APPENDIX 5

Pre and Post Test Measurements

B4025 - Passenger Compartment Deformation

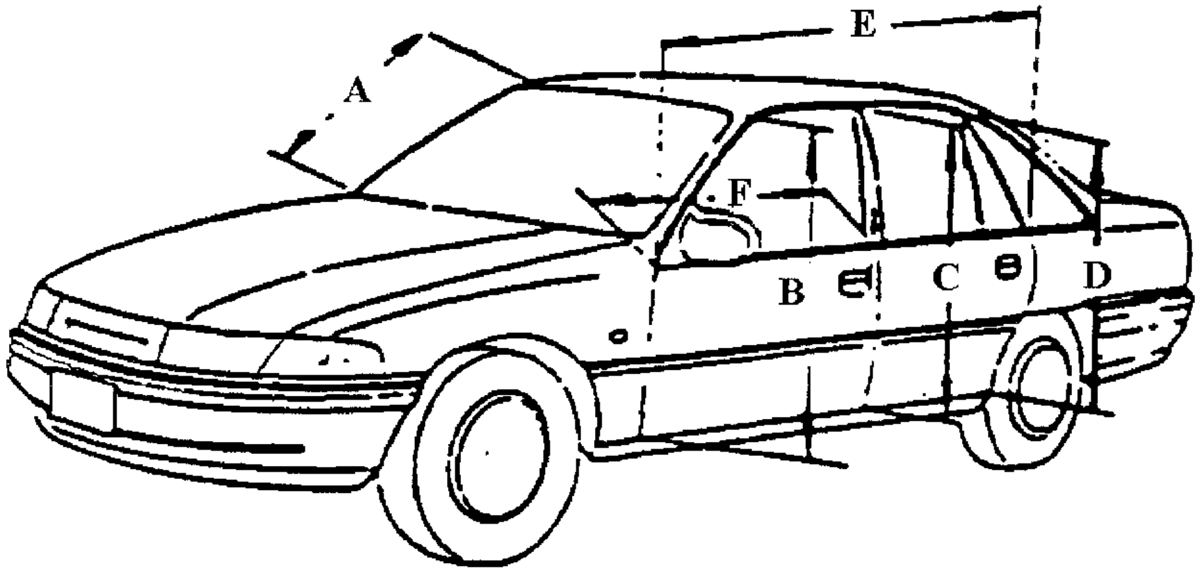


Figure A5.1

	LEFT HAND SIDE			RIGHT HAND SIDE		
DIMENSION (mm)	**Before**	**After**	**Residual**	**Before**	**After**	**Residual**
A - midpoint to top of A pillar	708	690	-18	708	642	-66
B -height of A Pillar	1143	1151	+8	1146	1152	+6
C -height of B Pillar	1177	1182	+5	1183	1186	+3
D -height of C Pillar	1174	1191	+17	1179	1203	+24
E - distance from A to C pillars along window sill	1896	1840	-56	1888	1822	-66
F - distance from A to B pillars along window sill	1006	988	-18	1004	971	-33
Overall Length Front to Rear Datum.	3786	3392	-394	3779	3365	-414
"A" Pillar to Strut Tower	567	317	-250	567	362	-205
Instrument Panel to Rear Datum	2296	2241	-55	2320	2288	-32

	Before	**After**	**Residual**
Instrument Panel to Parcel Shelf C/L	-	-	-
Steering Wheel Target to Reference Target	2107	2074	-33
Between Strut Towers	937	920	-17

B4025 - Vehicle Underbody Crush Dimensional Record

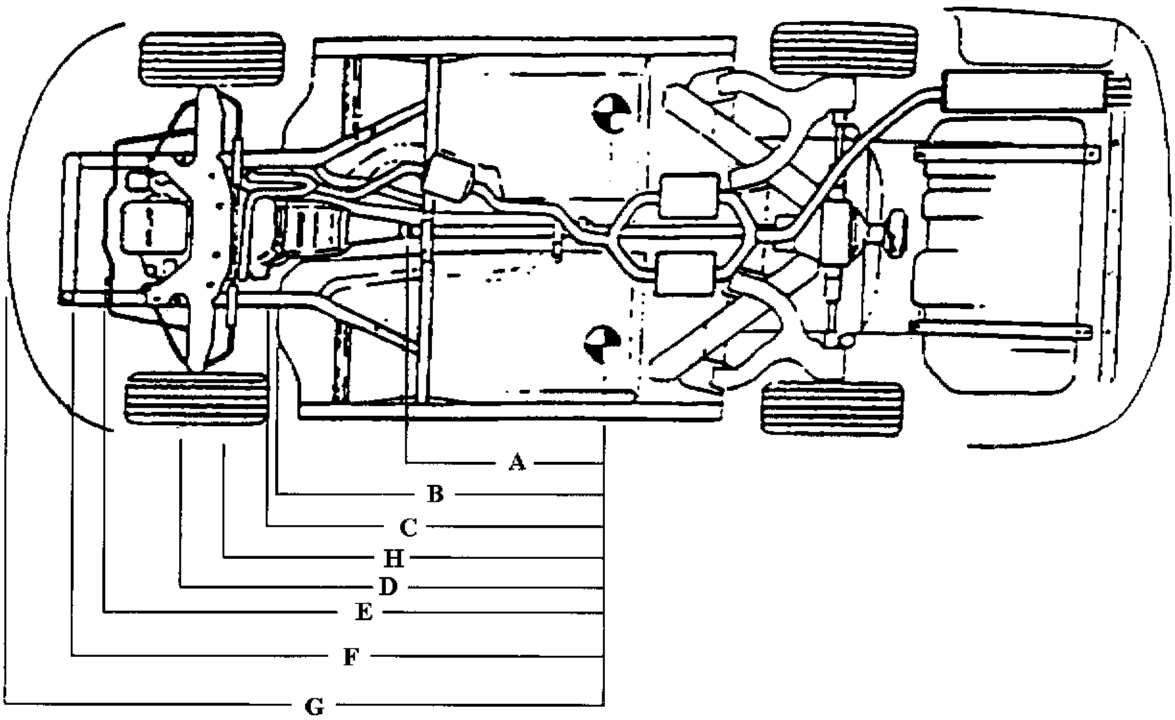


Figure A5.2

	LEFT HAND SIDE			RIGHT HAND SIDE		
DIMENSION (mm)	**Before**	**After**	**Diff.**	**Before**	**After**	**Diff.**
A -Centre First Universal Joint	1945	1856	-89	1889	1833	-56
B - Front Edge of Floorpan	1683	1704	+21	1683	1705	+22
C - Front Face Transmission	1985	1908	-77	1973	1905	-68
D - Front Face Cross Member	2070	2017	-53	2070	2029	-41
E - Engine Front Face	2360	2219	-141	2360	2223	-137
F - Radiator Lower Rear Edge	2548	2259	-289	2557	2281	-276
G - Front Bumper	2857	2484	-373	2859	2486	-373
H - Steering R+P Centreline	2204	2089	-115	2204	2104	-100

B4025 - Vehicle Crush Data Measurements

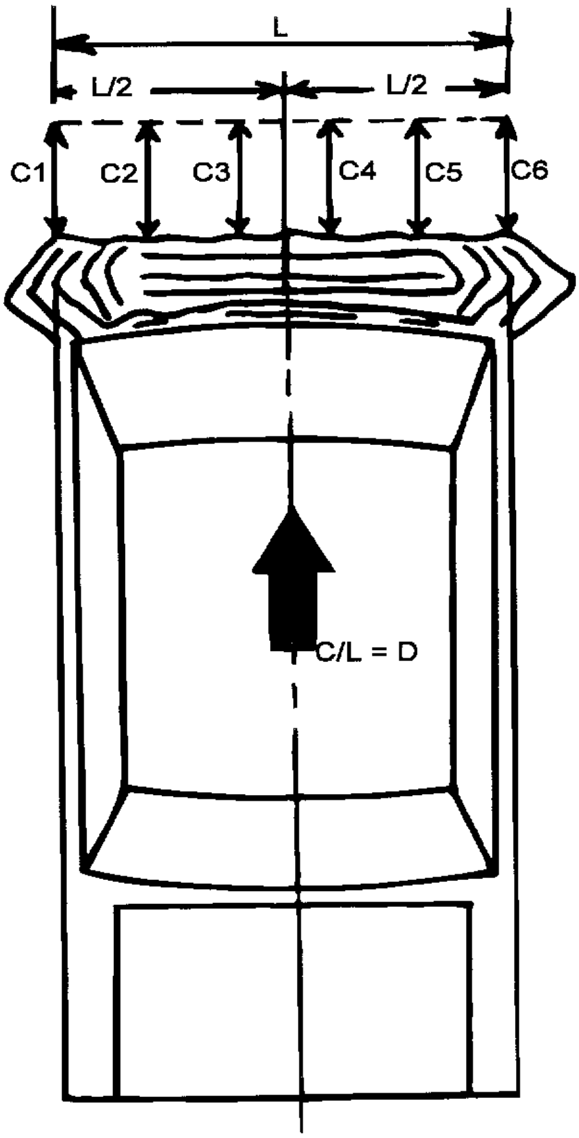


Figure A5.3

Measurement	Dimension		
	Pre-Test	Post-Test	Crush
L	1320	1320	0
L/2	660	660	0
C1	3720	3310	410
C2	3768	3363	405
C3	3784	3385	399
C4	3781	3378	403
C5	3764	3370	394
C6	3718	3329	389

B4025 - Seatbelt Anchorage Point Deformation

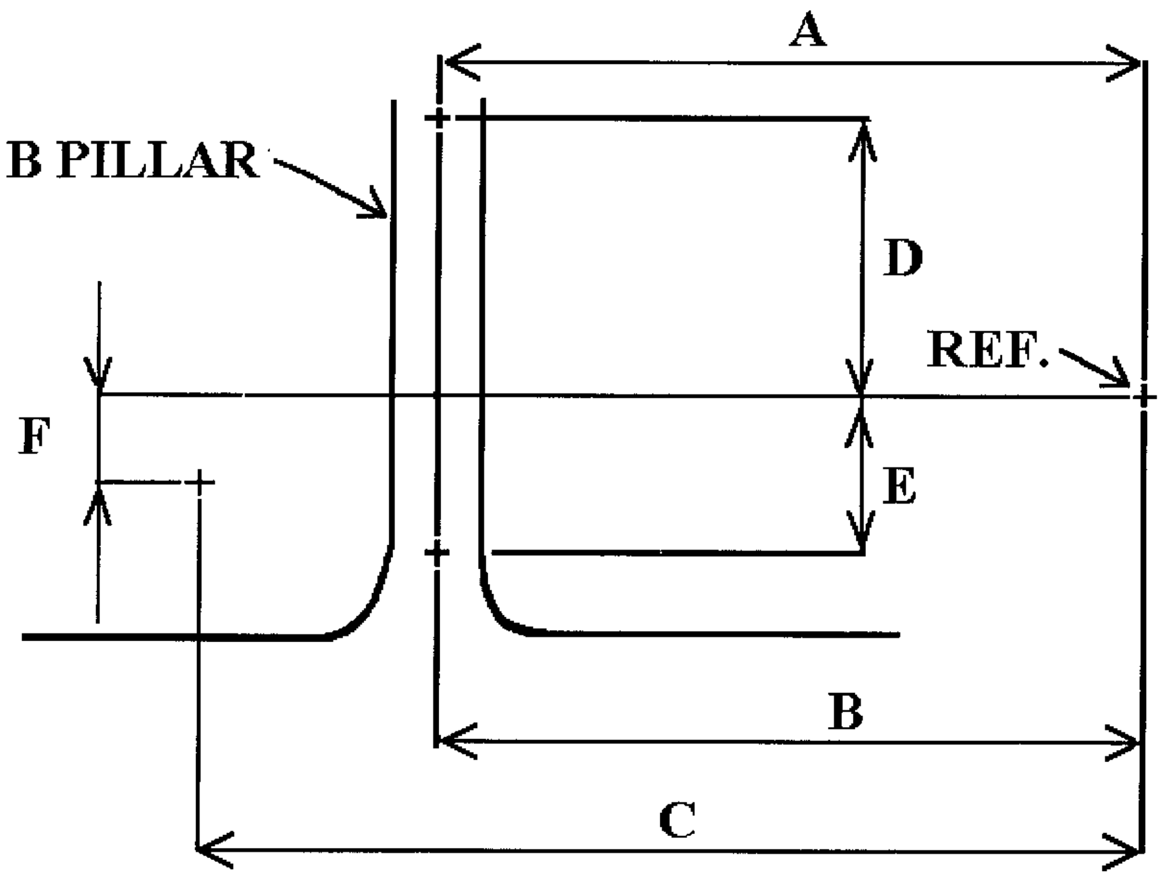


Figure A5.4

			LEFT HAND SIDE			RIGHT HAND SIDE		
		DIM	Before	After	Residual	Before	After	Residual
X axis-	D ring bolt	A	1496	1520	+24	1499	1522	+23
	retractor mount	B	1574	1489	-85	1577	1466	-111
	seatbelt stork mount	C	1670	1652	-18	1669	1661	-8
Z axis -	D ring bolt	D	413	329	-84	409	319	-90
	retractor mount	E	565	651	+86	564	659	+95
	seatbelt stork mount	F	371	462	+91	367	460	+93

Seatbelt Loop Length

		LEFT HAND SIDE			RIGHT HAND SIDE		
DIM		Before	After	Residual	Before	After	Residual
LAP BELT	L1	670	690	-20	670	690	+20
SASH BELT	L2	740	712	+28	740	711	+29

B4025 - Dummy Positioning Data

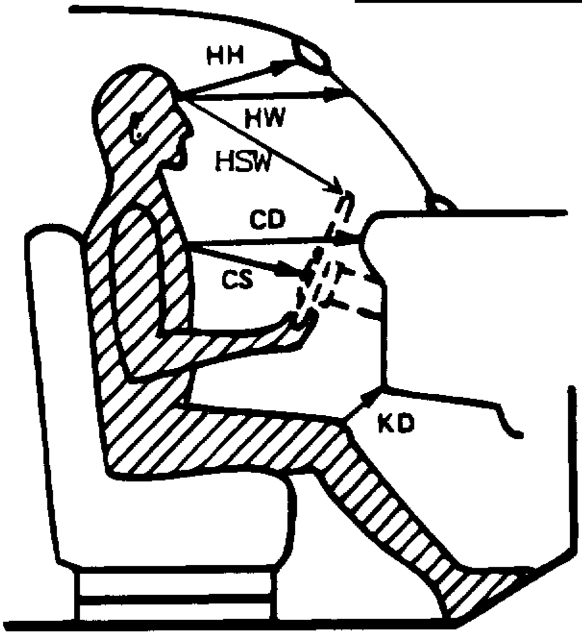


Figure A5.5

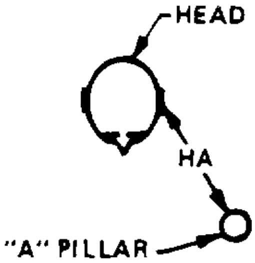


Figure A5.6

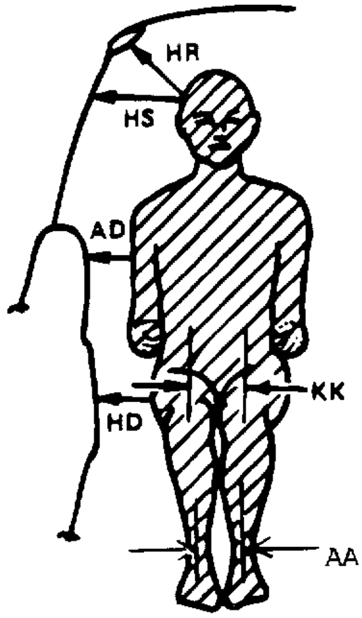


Figure A5.7

All Dimensions in Millimetres

		Driver	Passenger
Fiducial Mark Location	**X**	2855	2936
	Y	-	-
	Z	7756	7770
H-Point Location	**X**	2496	3078
	Y	-	-
	Z	7705	7721
head to windshield header	HH	481	499
head to windshield, horiz.	HW	665	676
chest to dash	CD	581	555
chest to steering wheel	CS	358	-
knee to dash, left	KDL	171	177
knee to dash, right	KDR	183	179
seat back angle	SA	20°	20°
torso angle	TA	21.5°	21.5°
head to steering wheel	HSW	499	-
head target to side roof	HR	198	182
head target to side window	HS	189	171
upper arm to door	AD	72	66
hip to door	HD	152	155
Out board knee to camera		336	376
knee to knee, centres	KK	270	200
head target to 'A' pillar	HA	642	676
ankle to ankle, centre	AA	307	193
nose tip to rim top rear	NR	465	-
nose tip to hub centre	NH	442	-
Belt/chest contact to D-ring		320	275
top of plate to sash, top edge	PBU	301	309
top of plate to sash,lower edge	PBL	212	223
top plate to lap belt top		50	50

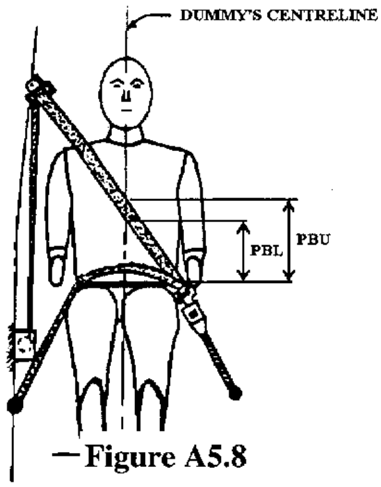


Figure A5.8

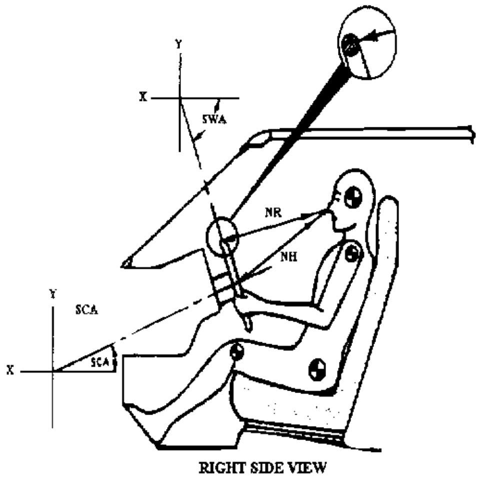


Figure A5.9

B4025 - Post Impact Data

Type of Test: ADR 69/00 Full Frontal **Impact Angle:** 90°

Date of Test: 07/06/1994 **Time of Test:** 4 pm

Ambient Temperature: 17.0 °C at impact area

Temp.in occupant compartment 21.5 °C (Spec. range 18.9°C to 25.5°C)

Required impact velocity range 47.5 to 49.1 km/h

Impact Velocity: 48.1 km/h primary 47.9 km/h secondary

Visible Dummy Contact Points

	Driver	**Passenger**
Head	upper rim & hub	right knee, dash front, chest
Chest	lower rim	
Abdomen		
Left Knee	lower dash	glove box
Right Knee	lower dash	glove box

Door and Seat Functionality

	Front		**Rear**	
	Left	**Right**	**Left**	**Right**
Door Opening	OK	lock struck ok	OK	OK
Seat Back				
Seat Shift (mm)				

Glazing damage: Lower edge folded shattered but intact

B4026 - Passenger Compartment Deformation

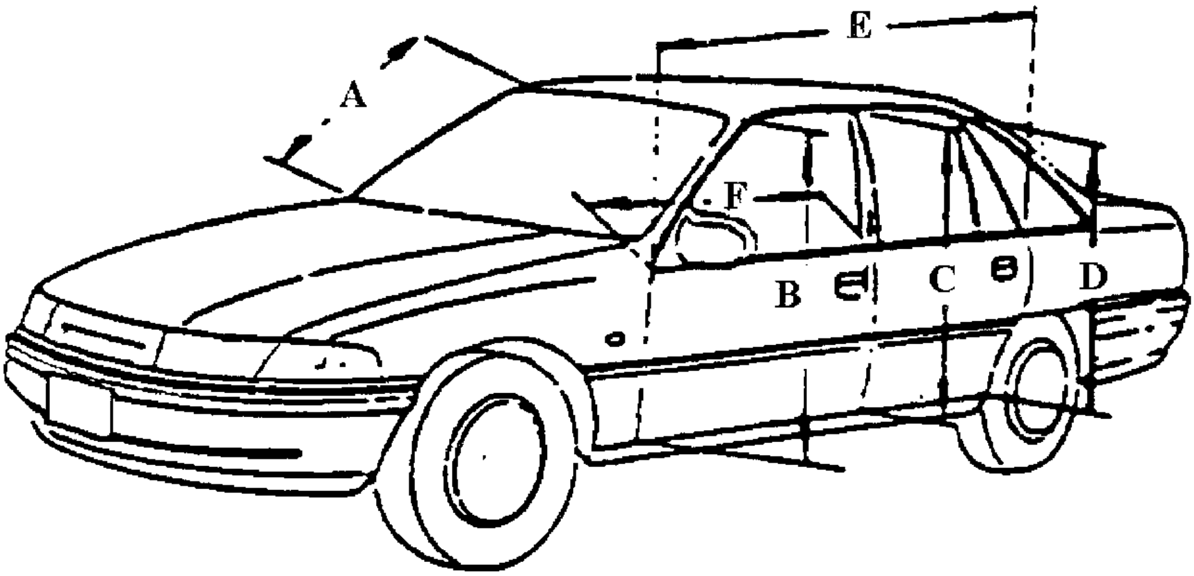


Figure A5.1

	LEFT HAND SIDE			RIGHT HAND SIDE		
DIMENSION (mm)	**Before**	**After**	**Residual**	**Before**	**After**	**Residual**
A - midpoint to top of A pillar	583	778	+195	585	777	+192
B -height of A Pillar	1205	1221	+16	1210	1225	+15
C -height of B Pillar	1234	1229	-5	1240	1237	-3
D -height of C Pillar	846	844	-2	858	855	-3
E - distance from A to C pillars along window sill	2114	2121	+7	2115	2122	+7
F - distance from A to B pillars along window sill	1263	1252	-11	1307	1262	-45
Overall Length Front to Rear Datum.	4354	3901	-453	4345	3889	-456
"A" Pillar to Strut Tower	498	590	+92	490	495	+5
Instrument Panel to Rear Datum	-	-	-	-	-	-

	Before	After	Residual
Instrument Panel to Parcel Shelf C/L	-	-	-
Steering Wheel Target to Reference Target	2593	2591	-2
Between Strut Towers	891	991	+100

B4026 - Vehicle Underbody Crush Dimensional Record

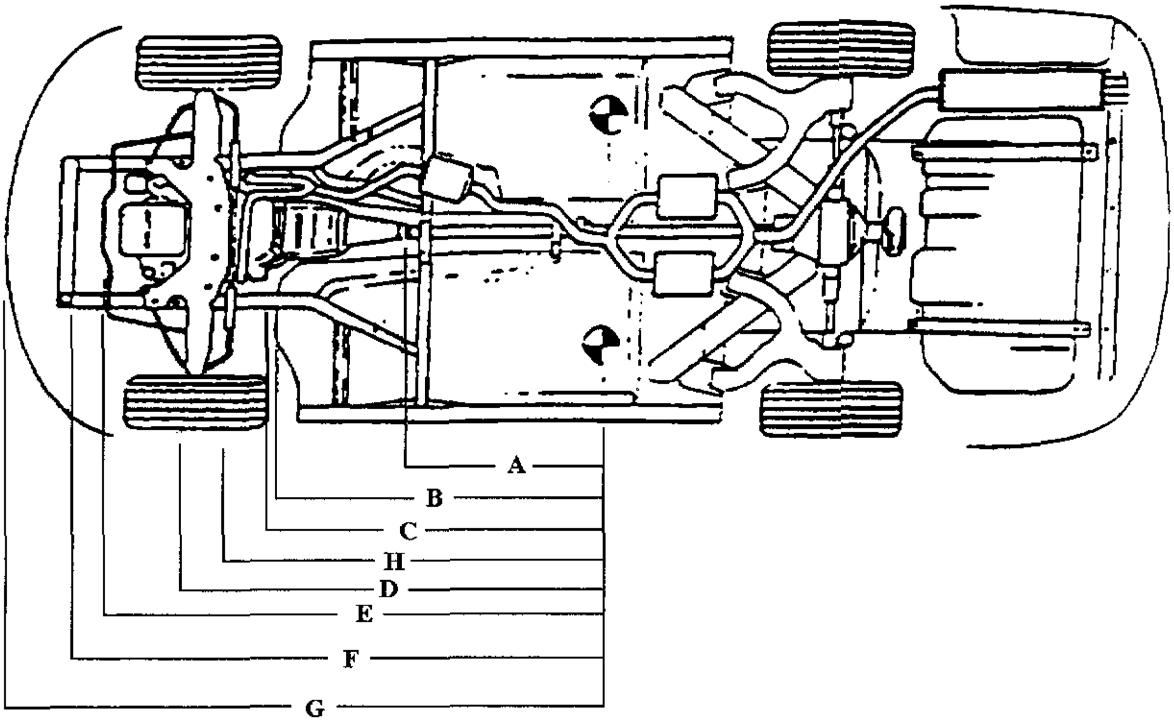


Figure A5.2

	LEFT HAND SIDE			RIGHT HAND SIDE		
DIMENSION (mm)	**Before**	**After**	**Diff.**	**Before**	**After**	**Diff.**
A - Centre First Universal Joint	1202	1180	-22	1358	1308	-50
B - Front Edge of Floorpan	895	925	+30	898	925	+27
C - Front Face Transmission	1152	1182	+30	1155	1122	-33
D - Front Face Cross Member	1463	1435	-28	1454	1397	-57
E - Engine Front Face	1579	1568	-11	1576	1569	-7
F - Radiator Lower Rear Edge	1809	1750	-59	1813	1698	-115
G - Front Bumper	2193	1940	-253	2182	1953	-229
H - Steering R+P Centreline	1561	1500	-61	1549	1475	-74

B4026 - Vehicle Crush Data Measurements

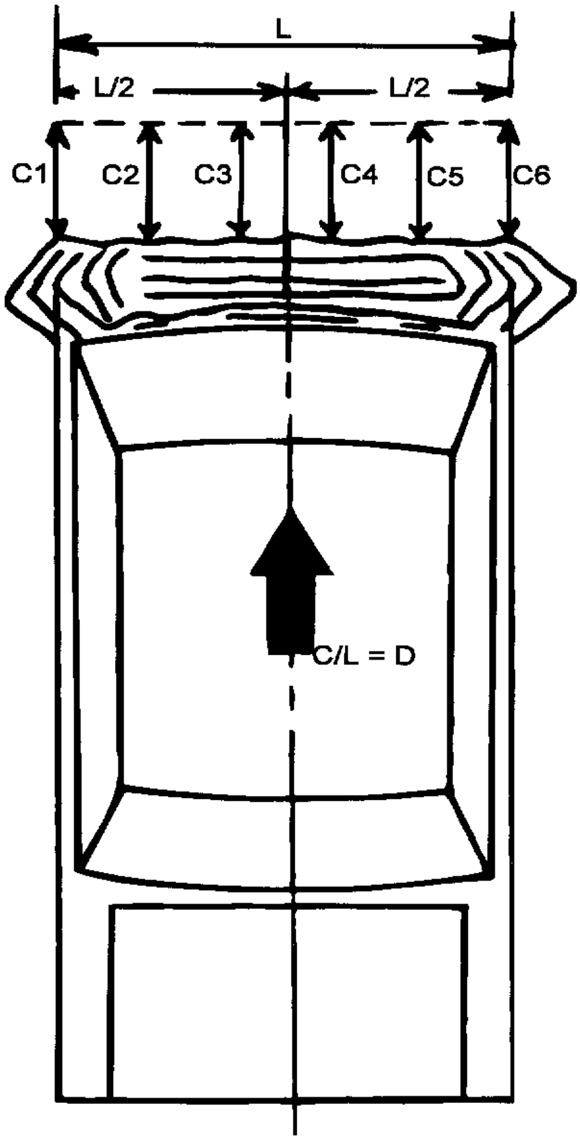


Figure A5.3

Measurement	Dimension		
	Pre-Test	Post-Test	Crush
L	1437	1381	-56
L/2	718.5	690.5	-28
C1	4252	3885	-367
C2	4321	3891	-430
C3	4343	3881	-462
C4	4343	3879	-464
C5	4331	3871	-460
C6	4261	3846	-415

B4026 - Seatbelt Anchorage Point Deformation

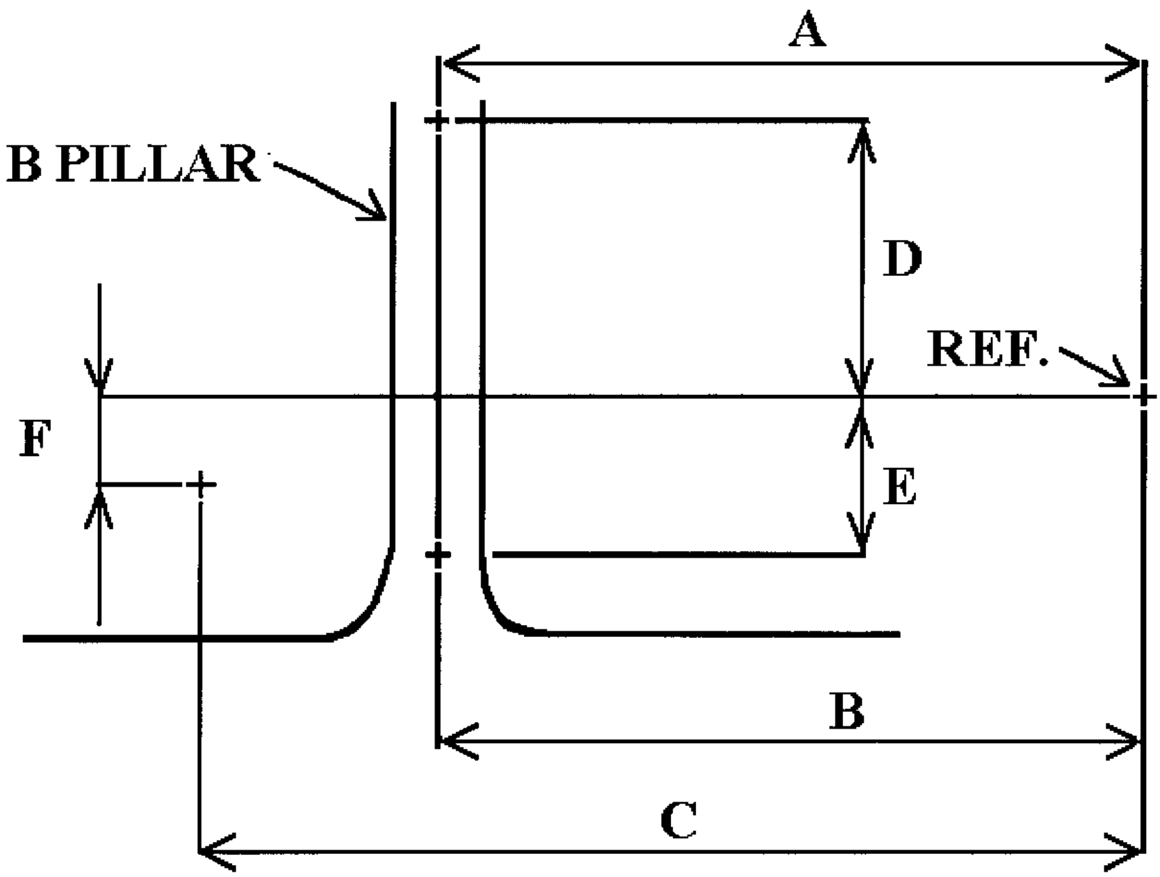


Figure A5.4

			LEFT HAND SIDE			RIGHT HAND SIDE		
		DIM	**Before**	**After**	**Residual**	**Before**	**After**	**Residual**
X axis-	D ring bolt	**A**	1917	1947	+30	1912	1949	+37
	retractor mount	**B**	1982	1979	-3	1978	1986	+8
	seatbelt stork mount	**C**	2165	2149	-16	2151	2129	-22
Z axis -	D ring bolt	**D**	345	213	-132	339	212	-127
	retractor mount	**E**	-559	-684	-125	-564	-679	-115
	seatbelt stork mount	**F**	-448	-535	-87	-445	-535	-90

Seatbelt Loop Length

	LEFT HAND SIDE			RIGHT HAND SIDE		
DIM	**Before**	**After**	**Residual**	**Before**	**After**	**Residual**
LAP BELT L1	863	780	-83	867	805	-62
SASH BELT L2	840	770	-70	825	1043	+218

B4026 - Dummy Positioning Data

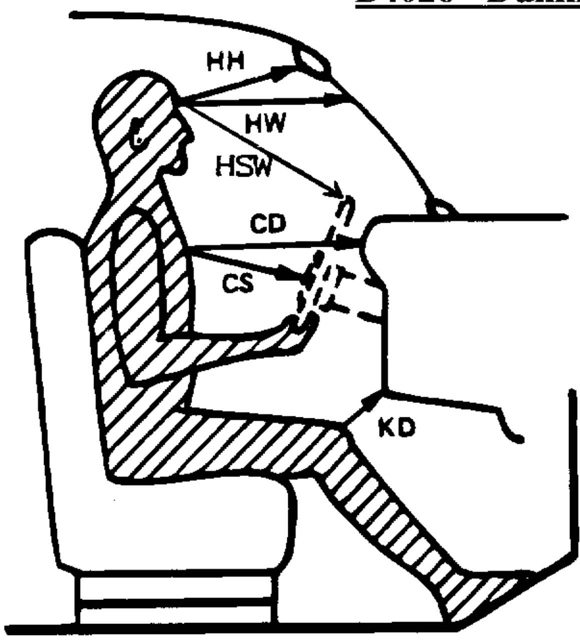


Figure A5.5

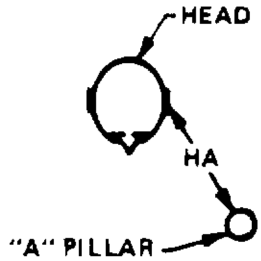


Figure A5.6

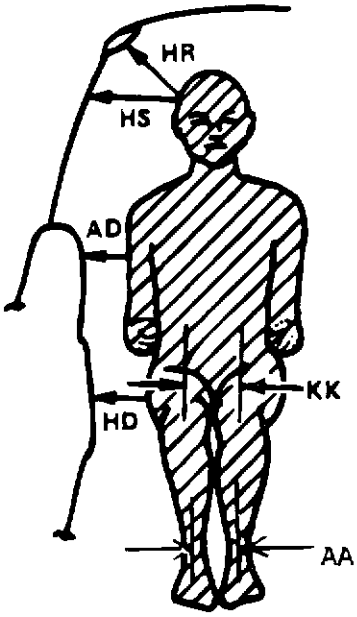


Figure A5.7

All Dimensions in Millimetres

		Driver	Passenger
Fiducial Mark Location	**X**	2757	2835
	Y	-	-
	Z	7647	7652
H-Point Location	**X**	3034	3127
	Y	-	-
	Z	7820	7825
head to windshield header	HH	465	470
head to windshield, horiz.	HW	617	611
chest to dash	CD	542	519
chest to steering wheel	CS	337	-
knee to dash, left	KDL	122	103
knee to dash, right	KDR	131	102
seat back angle	SA	20.5°	21°
torso angle	TA	20.5°	23°
head to steering wheel	HSW	501	-
head target to side roof	HR	205	210
head target to side window	HS	230	230
upper arm to door	AD	92	78
hip to door	HD	191	186
Out board knee to camera		427	511
knee to knee, centres	KK	290	200
head target to 'A' pillar	HA	574	611
ankle to ankle, centre	AA	343	200
nose tip to rim top rear	NR	465	-
nose tip to hub centre	NH	432	-
Belt/chest contact to D-ring		414	435
top of plate to sash, top edge	PBU	304	325
top of plate to sash,lower edge	PBL	221	245
top plate to lap belt top		48	48

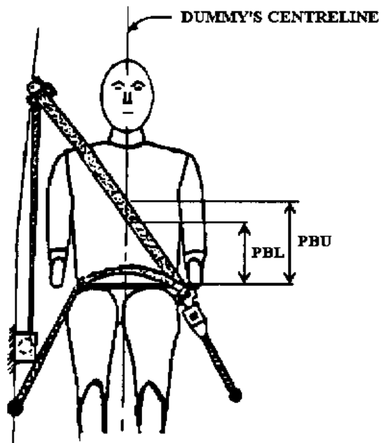


Figure A5.8

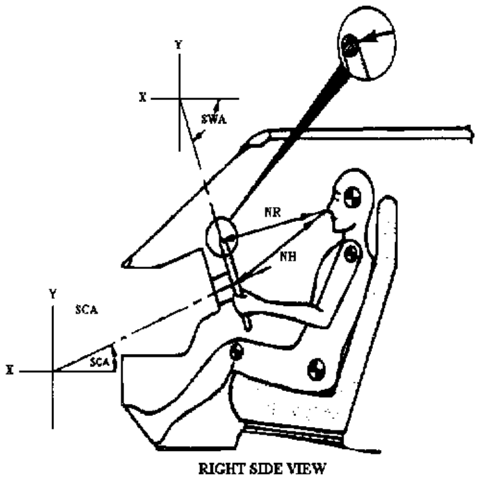


Figure A5.9

B4026 - Post Impact Data

Type of Test: ADR 69/00 Full Frontal **Impact Angle:** 90°

Date of Test: 10/Jun/94 **Time of Test:** 12.30pm

Ambient Temperature: 16 °C at impact area

Temp.in occupant compartment 21 °C (Spec. range 18.9°C to 25.5°C)

Required impact velocity range 47.5 to 49.1 km/h

Impact Velocity: 48.4 km/h primary 48.3 km/h secondary

Visible Dummy Contact Points

	Driver	**Passenger**
Head	Mid-steering hub. Mount hits centre of steering wheel	No strike
Chest		
Abdomen		
Left Knee	Steering column	Glove box door
Right Knee	Lower part of dashboard	Glove box door

Door and Seat Functionality

	Front		**Rear**	
	Left	**Right**	**Left**	**Right**
Door Opening	OK	OK	OK	OK
Seat Back				
Seat Shift (mm)				

Glazing damage: Windscreen - small crack on bottom LHS - all windscreen OK

B4027 - Passenger Compartment Deformation

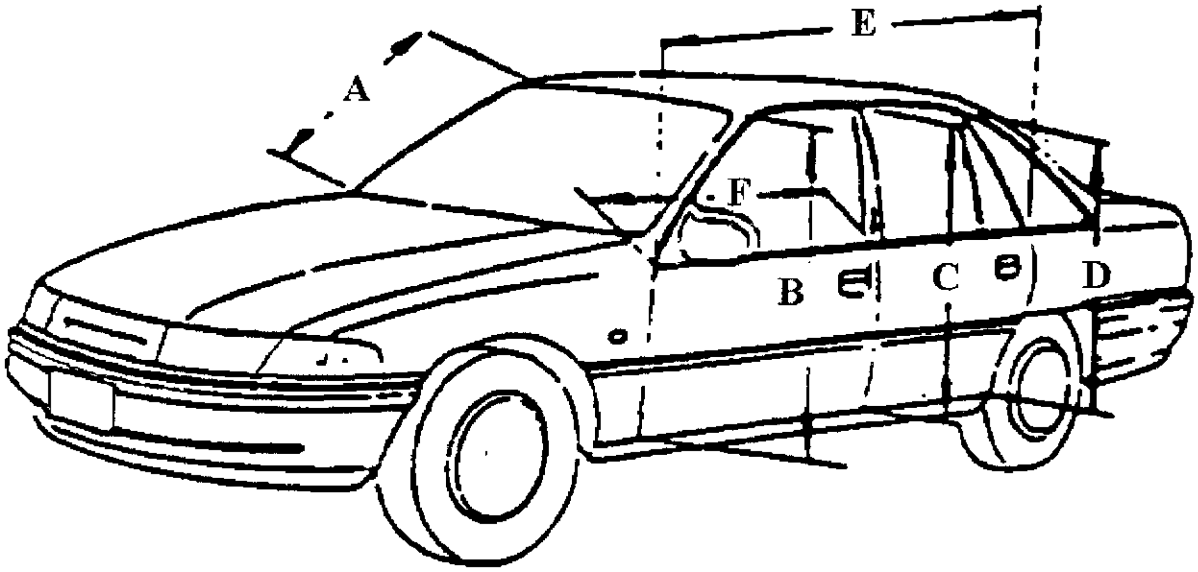


Figure A5.1

	LEFT HAND SIDE			RIGHT HAND SIDE		
DIMENSION (mm)	**Before**	**After**	**Residual**	**Before**	**After**	**Residual**
A - midpoint to top of A pillar	792	794	+2	792	792	0
B -height of A Pillar	1099	1109	+10	1105	1107	+2
C -height of B Pillar	1099	1108	+9	1104	1107	+3
D -height of C Pillar	-	-	-	-	-	-
E - distance from A to C pillars along window sill	-	-	-	-	-	-
F - distance from A to B pillars along window sill	1000	990	-10	1002	994	-8
Overall Length Front to Rear Datum.	4827	4431	-396	4820	4426	-394
"A" Pillar to Strut Tower	587	542	-45	587	550	-37
Instrument Panel to Rear Datum	3314	3279	-35	3353	3338	-15

	Before	After	Residual
Instrument Panel to Parcel Shelf C/L	-	-	-
Steering Wheel Target to Reference Target	3077	3035	-42
Between Strut Towers	850	853	+3

B4027 - Vehicle Underbody Crush Dimensional Record

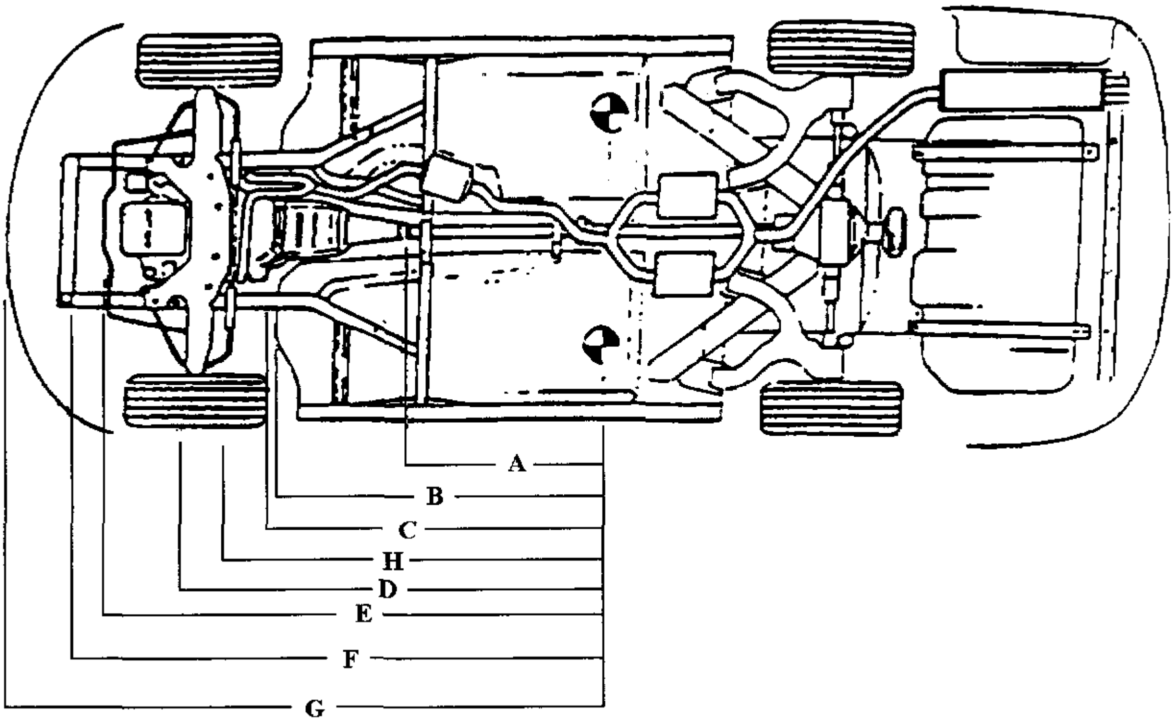


Figure A5.2

	LEFT HAND SIDE			RIGHT HAND SIDE		
DIMENSION (mm)	**Before**	**After**	**Diff.**	**Before**	**After**	**Diff.**
A - Centre First Universal Joint	877	861	-16	903	883	-20
B - Front Edge of Floorpan	1288	1249	-39	1279	1245	-34
C - Front Face Transmission	1580	1574	-6	1577	1568	-9
D - Front Face Cross Member	1880	1726	-154	1871	1715	-156
E - Engine Front Face	2055	2009	-46	2050	2010	-40
F - Radiator Lower Rear Edge	2283	2107	-176	2295	2107	-188
G - Front Bumper	2500	2175	-325	2491	2155	-336
H - Steering R+P Centreline	1628	1596	-32	1628	1585	-43

B4027 - Vehicle Crush Data Measurements

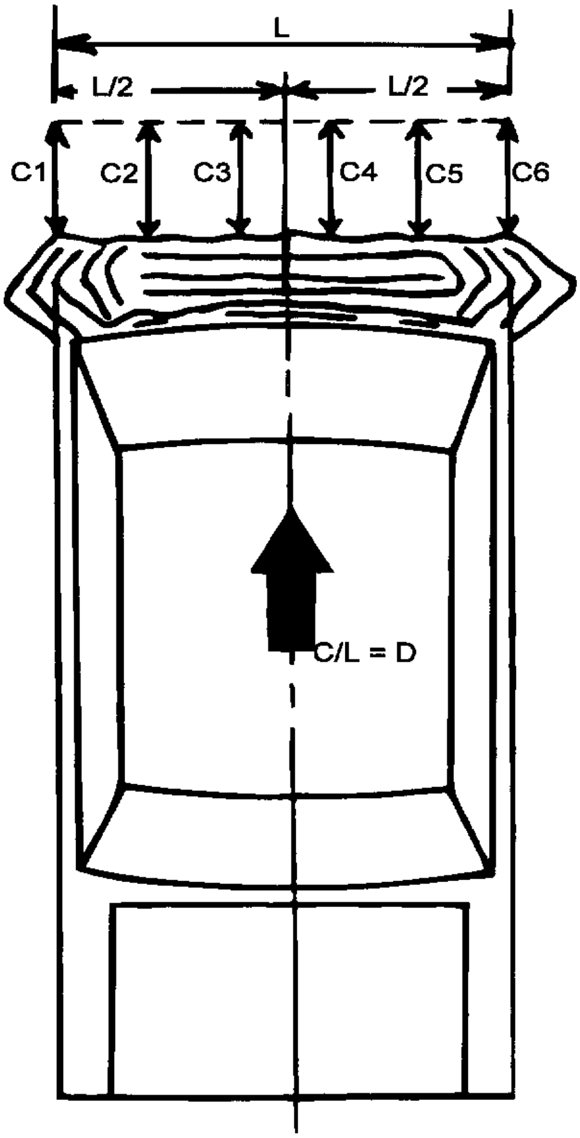


Figure A5.3

Measurement	Dimension		
	Pre-Test	**Post-Test**	**Crush**
L	1335	1341	+6
L/2	667.5	670.5	+3
C1	4774	4440	-334
C2	4803	4416	-387
C3	4815	4416	-399
C4	4815	4429	-386
C5	4802	4411	-391
C6	4776	4447	-329

B4027 - Seatbelt Anchorage Point Deformation

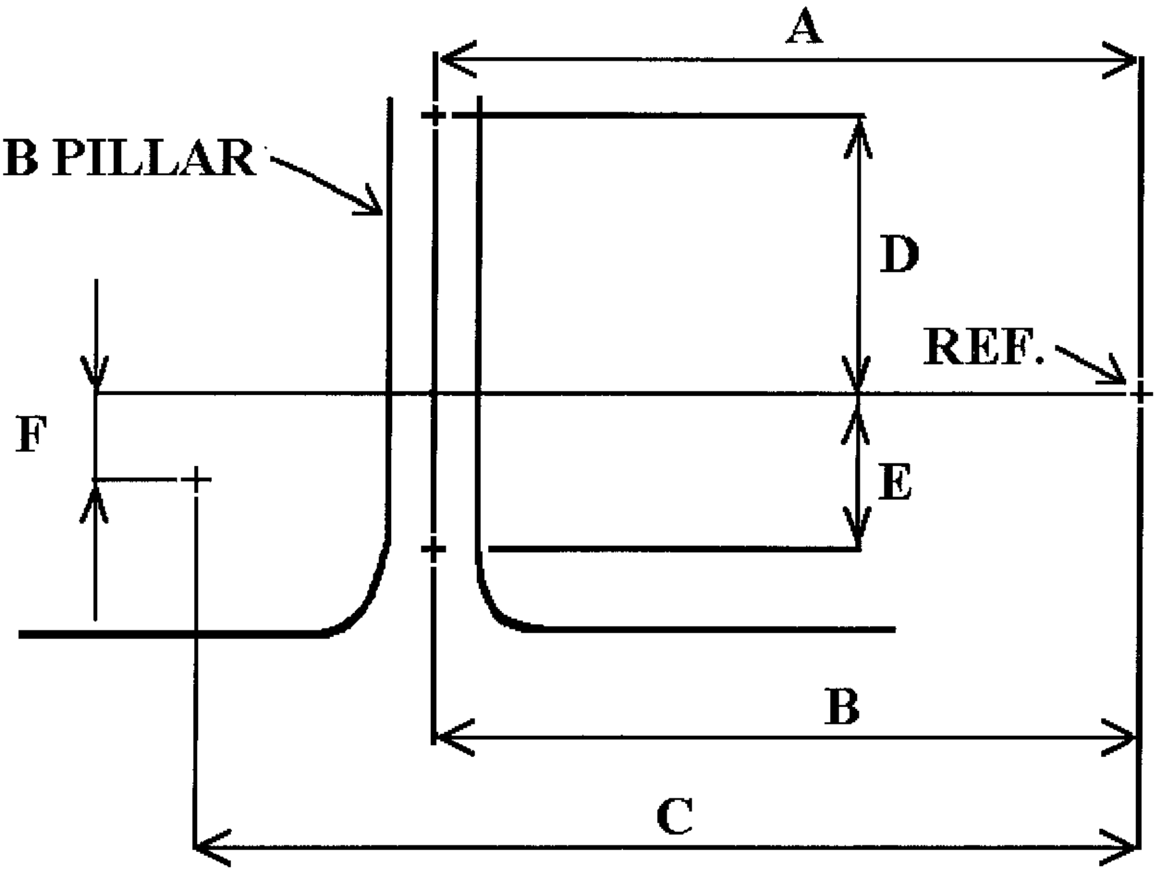


Figure A5.4

			LEFT HAND SIDE			RIGHT HAND SIDE		
		DIM	**Before**	**After**	**Residual**	**Before**	**After**	**Residual**
X axis-	D ring bolt	**A**	2426	2412	-14	2428	2417	-11
	retractor mount	**B**	2403	2384	-19	2405	2377	-28
	seatbelt stork mount	**C**	2506	2501	-5	2492	2484	-8
Z axis -	D ring bolt	**D**	695	557	-138	709	546	-163
	retractor mount	**E**	179	322	+143	192	326	+134
	seatbelt stork mount	**F**	201	303	+102	223	306	+83

Seatbelt Loop Length

		LEFT HAND SIDE			RIGHT HAND SIDE		
DIM		**Before**	**After**	**Residual**	**Before**	**After**	**Residual**
LAP BELT	**L1**	615	611	-4	670	663	-7
SASH BELT	**L2**	810	810	0	875	812	-63

B4027 - Dummy Positioning Data

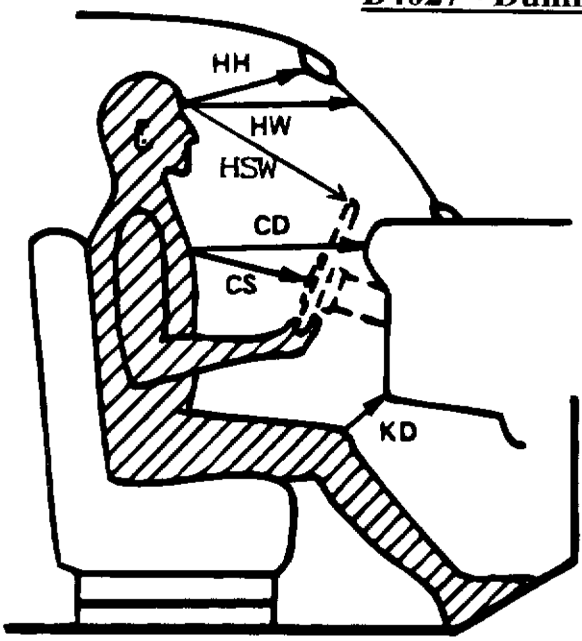


Figure A5.5

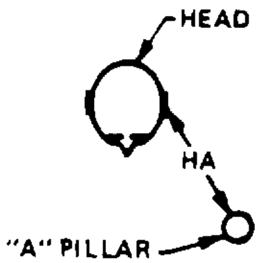


Figure A5.6

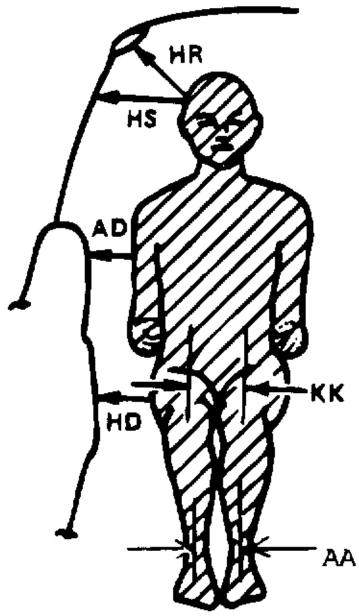


Figure A5.7

All Dimensions in Millimetres

		Driver	Passenger
Fiducial Mark Location	**X**	2949	3026
	Y	-	-
	Z	7714	7730
H-Point Location	**X**	3147	3244
	Y	-	-
	Z	7643	7663
head to windshield header	HH	391	420
head to windshield, horiz.	HW	444	573
chest to dash	CD	557	501
chest to steering wheel	CS	256	-
knee to dash, left	KDL	159	124
knee to dash, right	KDR	165	124
seat back angle	SA	17^0	18^0
torso angle	TA	19.8^0	23.5^0
head to steering wheel	HSW	406	-
head target to side roof	HR	204	179
head target to side window	HS	237	213
upper arm to door	AD	126	106
hip to door	HD	218	190
Out board knee to camera		474	504
knee to knee, centres	KK	257	205
head target to 'A' pillar	HA	501	519
ankle to ankle, centre	AA	312	210
nose tip to rim top rear	NR	363	-
nose tip to hub centre	NH	383	-
Belt/chest contact to D-ring		320	338
top of plate to sash, top edge	PBU	310	340
top of plate to sash,lower edge	PBL	225	250
top plate to lap belt top		50	50

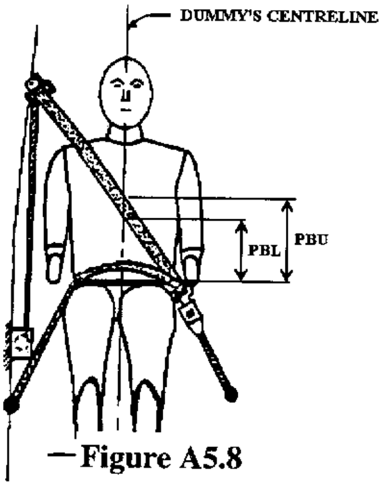


Figure A5.8

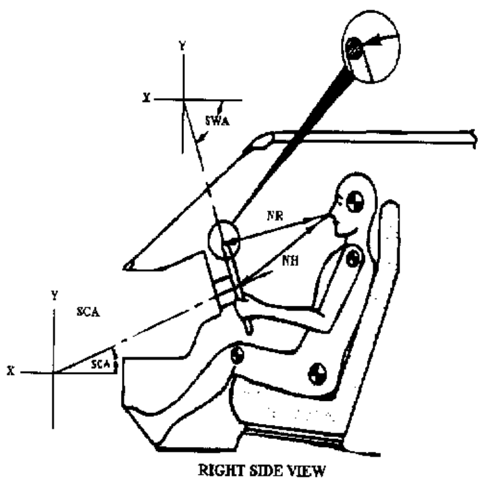


Figure A5.9

B4027 - Post Impact Data

Type of Test: ADR 69/00 Full Frontal **Impact Angle:** 90°

Date of Test: 16/June/1994 **Time of Test:** 4 pm

Ambient Temperature: 16.0 °C at impact area

Temp.in occupant compartment 22.0 °C (Spec. range 18.9°C to 25.5°C)

Required impact velocity range 47.5 to 49.1 km/h

Impact Velocity: 48.4 km/h primary 48.1 km/h secondary

Visible Dummy Contact Points

	Driver	**Passenger**
Head	forehead to rim, chin to hub/lower rim	crown to roof on rebound
Chest	lower rim	
Abdomen		
Left Knee	lower dash/hand brake steering column adj	glove box, dash
Right Knee	lower dash	glove box, dash

Door and Seat Functionality

	Front		**Rear**	
	Left	**Right**	**Left**	**Right**
Door Opening	slight force	OK		
Seat Back				
Seat Shift (mm)				

Glazing damage:

B4028 - Passenger Compartment Deformation

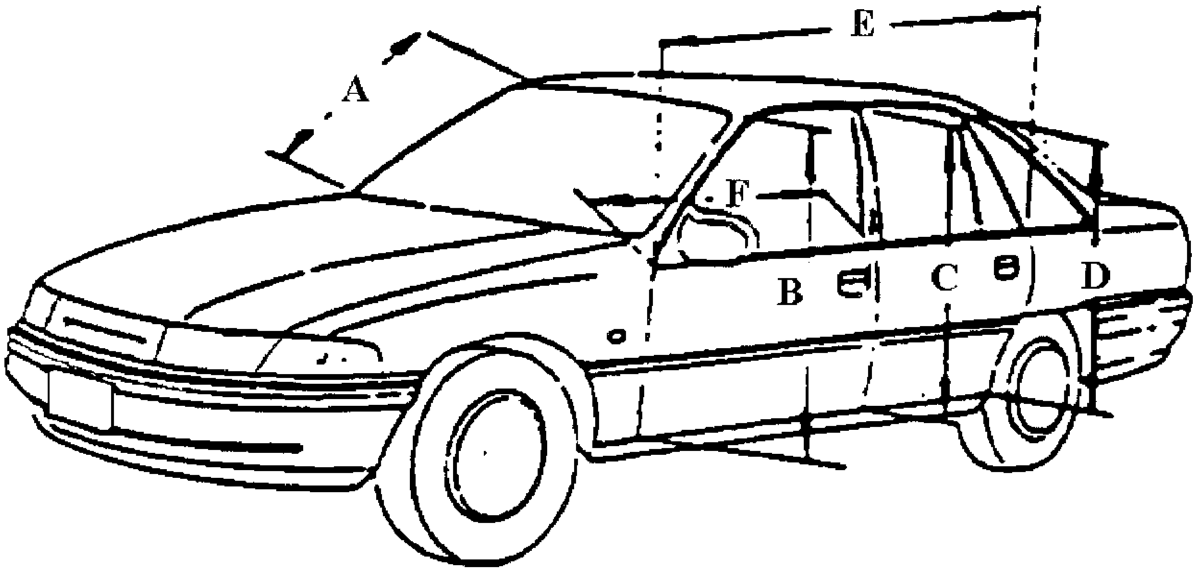


Figure A5.1

	LEFT HAND SIDE			RIGHT HAND SIDE		
DIMENSION (mm)	**Before**	**After**	**Residual**	**Before**	**After**	**Residual**
A - midpoint to top of A pillar	580	525	-55	578	528	-50
B -height of A Pillar	1116	1140	+24	1119	1160	+41
C -height of B Pillar	1143	1138	-5	1148	1149	-1
D -height of C Pillar	-	-	-	-	-	-
E - distance from A to C pillars along window sill	-	-	-	-	-	-
F - distance from A to B pillars along window sill	1249	1189	-60	1243	1189	-54
Overall Length Front to Rear Datum.	4799	4291	-508	4791	4279	-512
"A" Pillar to Strut Tower	517	375	-142	508	370	-138
Instrument Panel to Rear Datum	3304	3228	-76	3281	3201	-80

	Before	**After**	**Residual**
Instrument Panel to Parcel Shelf C/L	748	748	0
Steering Wheel Target to Reference Target	3111	3014	-97
Between Strut Towers	858	1119	+261

B4028 - Vehicle Underbody Crush Dimensional Record

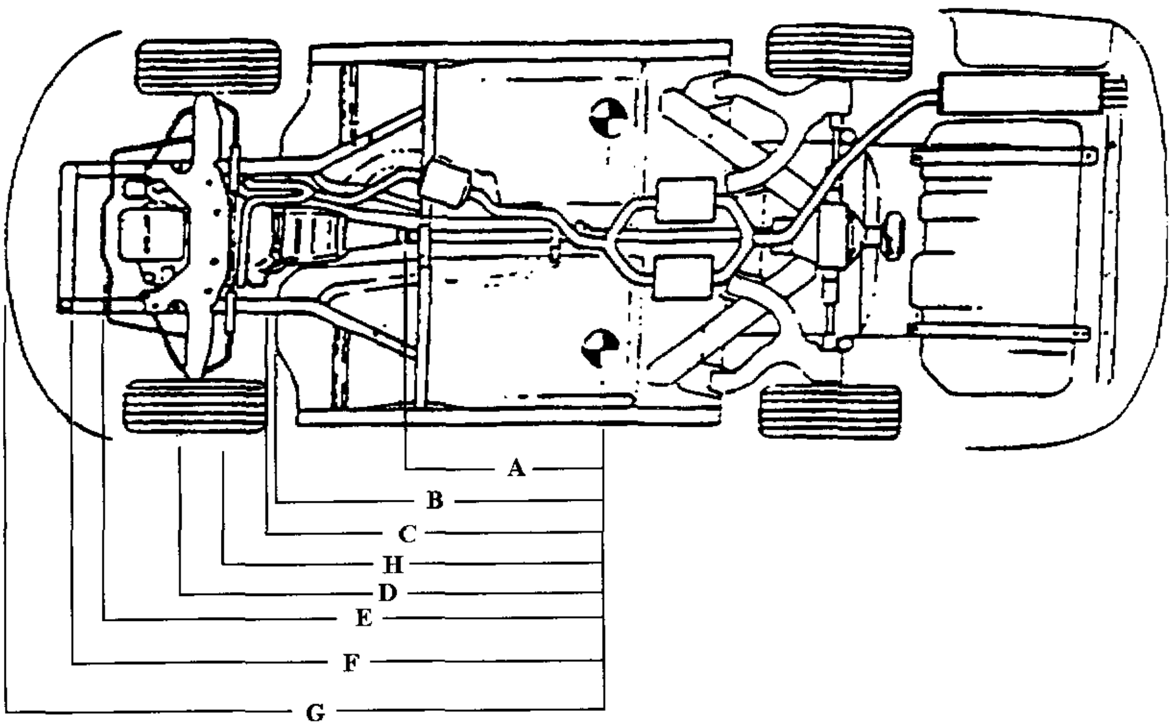


Figure A5.2

	LEFT HAND SIDE			RIGHT HAND SIDE		
DIMENSION (mm)	**Before**	**After**	**Diff.**	**Before**	**After**	**Diff.**
A - Centre First Universal Joint	315	247	-68	315	265	-50
B - Front Edge of Floorpan	835	832	-3	840	825	-15
C - Front Face Transmission	1100	1010	-90	1115	1017	-98
D - Front Face Cross Member	1390	1252	-138	1400	1235	-165
E - Engine Front Face	1570	1505	-65	1580	1483	-97
F - Radiator Lower Rear Edge	1840	1535	-305	1845	1425	-420
G - Front Bumper	2025	1661	-364	2020	1673	-347
H - Steering R+P Centreline	1525	1293	-232	1530	1293	-237

B4028 - Vehicle Crush Data Measurements

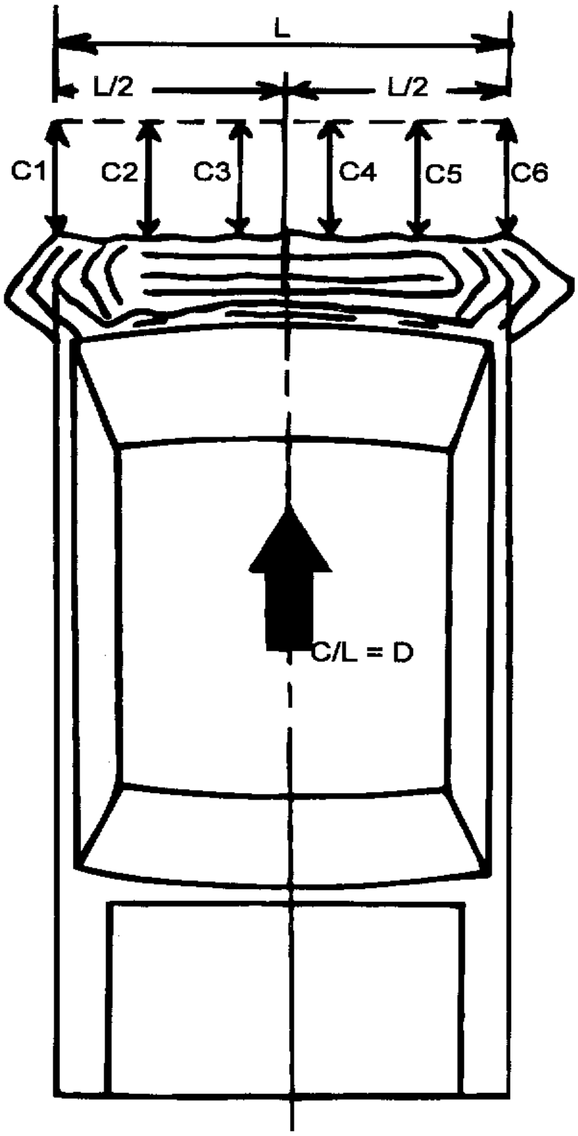


Figure A5.3

Measurement	Dimension		
	Pre-Test	Post-Test	Crush
L	1371	1376	5
L/2	685.5	688	2.5
C1	4735	4280	455
C2	4775	4283	492
C3	4790	4281	509
C4	4790	4281	509
C5	4780	4279	501
C6	4738	4276	462

B4028 - Seatbelt Anchorage Point Deformation

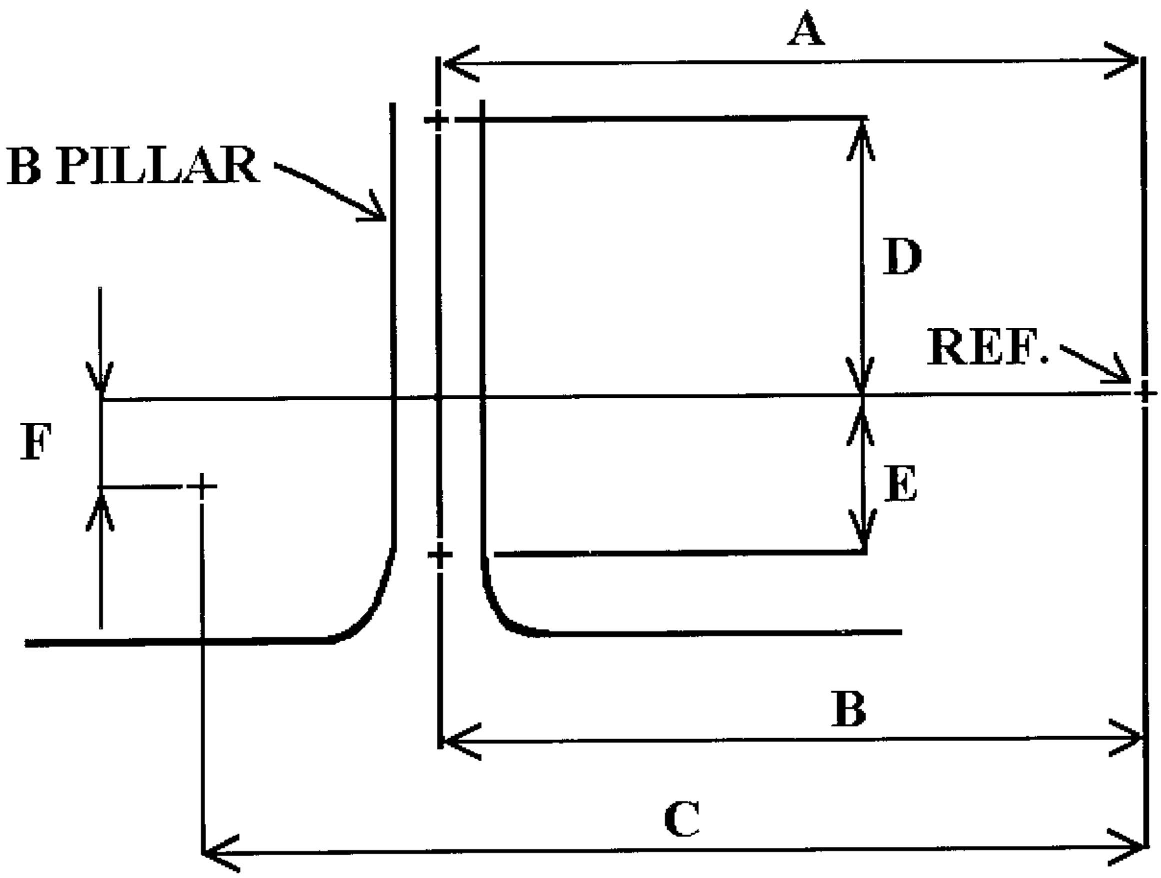


Figure A5.4

			LEFT HAND SIDE			RIGHT HAND SIDE		
		DIM	**Before**	**After**	**Residual**	**Before**	**After**	**Residual**
X axis-	D ring bolt	**A**	2403	2367	36	2402	2366	36
	retractor mount	**B**	2487	2432	55	2485	2422	63
	seatbelt stork mount	**C**	2562	2494	68	2554	2487	67
Z axis -	D ring bolt	**D**	343	125	218	336	108	228
	retractor mount	**E**	558	770	212	567	783	216
	seatbelt stork mount	**F**	569	756	187	569	742	173

Seatbelt Loop Length

	LEFT HAND SIDE			RIGHT HAND SIDE		
DIM	**Before**	**After**	**Residual**	**Before**	**After**	**Residual**
LAP BELT L1	730	730	0	710	720	10
SASH BELT L2	810	830	20	792	810	18

B4028 - Dummy Positioning Data

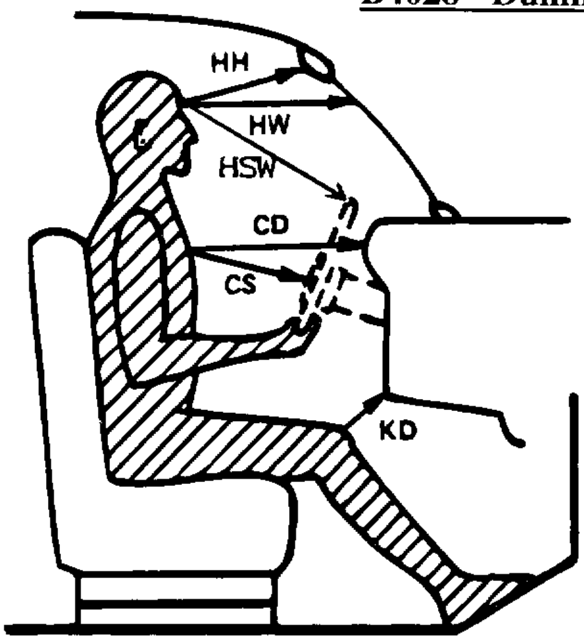


Figure A5.5

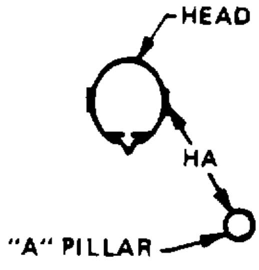


Figure A5.6

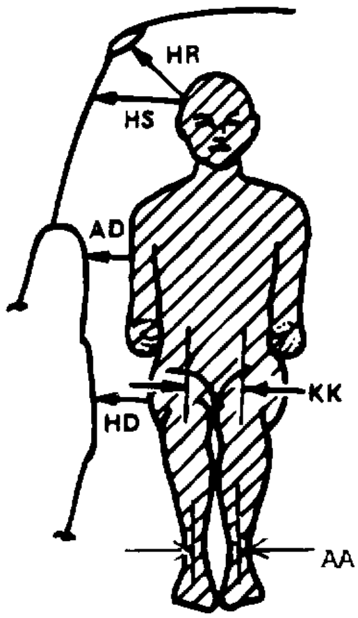


Figure A5.7

All Dimensions in Millimetres

			Driver	Passenger
Fiducial Mark Location		X	2848	2923
		Y	-	-
		Z	7751	7778
H-Point Location		X	3152	3244
		Y	-	-
		Z	7673	7688
head to windshield header	HH		396	388
head to windshield, horiz.	HW		572	561
chest to dash	CD		511	505
chest to steering wheel	CS		322	-
knee to dash, left	KDL		122	199
knee to dash, right	KDR		121	196
seat back angle	SA		23°	23°
torso angle	TA		23.5°	23.5°
head to steering wheel	HSW		434	-
head target to side roof	HR		239	227
head target to side window	HS		249	235
upper arm to door	AD		137	127
hip to door	HD		172	200
Out board knee to camera			460	550
knee to knee, centres	KK		260	190
head target to 'A' pillar	HA		578	506
ankle to ankle, centre	AA		286	195
nose tip to rim top rear	NR		399	-
nose tip to hub centre	NH		417	-
Belt/chest contact to D-ring			387	400
top of plate to sash, top edge	PBU		290	264
top of plate to sash,lower edge	PBL		210	184
top plate to lap belt top			50	50

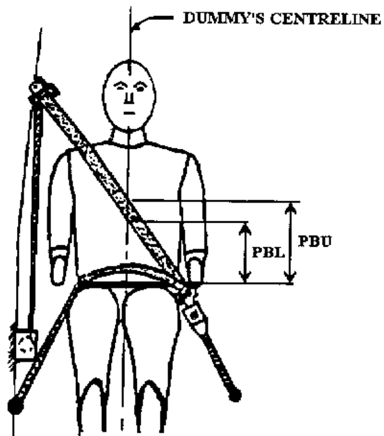


Figure A5.8

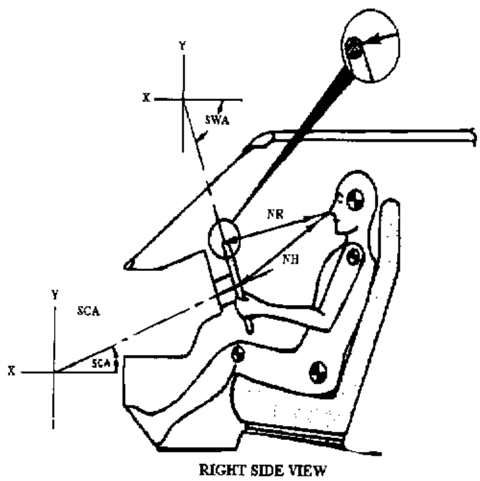


Figure A5.9

B4028 - Post Impact Data

Type of Test: ADR 69/00 Full Frontal **Impact Angle:** 90°

Date of Test: 21/June 1994 **Time of Test:** 2 pm

Ambient Temperature: 15.0 °C at impact area

Temp.in occupant compartment 21.0 °C (Spec. range 18.9°C to 25.5°C)

Required impact velocity range 47.5 to 49.1 km/h

Impact Velocity: 48.4 km/h primary 48.3 km/h secondary

Visible Dummy Contact Points

	Driver	Passenger
Head	rim & hub	right knee
Chest		
Abdomen		
Left Knee	hand brake	lower dash glove box
Right Knee	fuse box lower dash	lower dash glove box

Door and Seat Functionality

	Front		Rear	
	Left	**Right**	**Left**	**Right**
Door Opening	OK	OK		
Seat Back	OK			
Seat Shift (mm)				

Glazing damage: cracked at both bottom corners

B4029 - Passenger Compartment Deformation

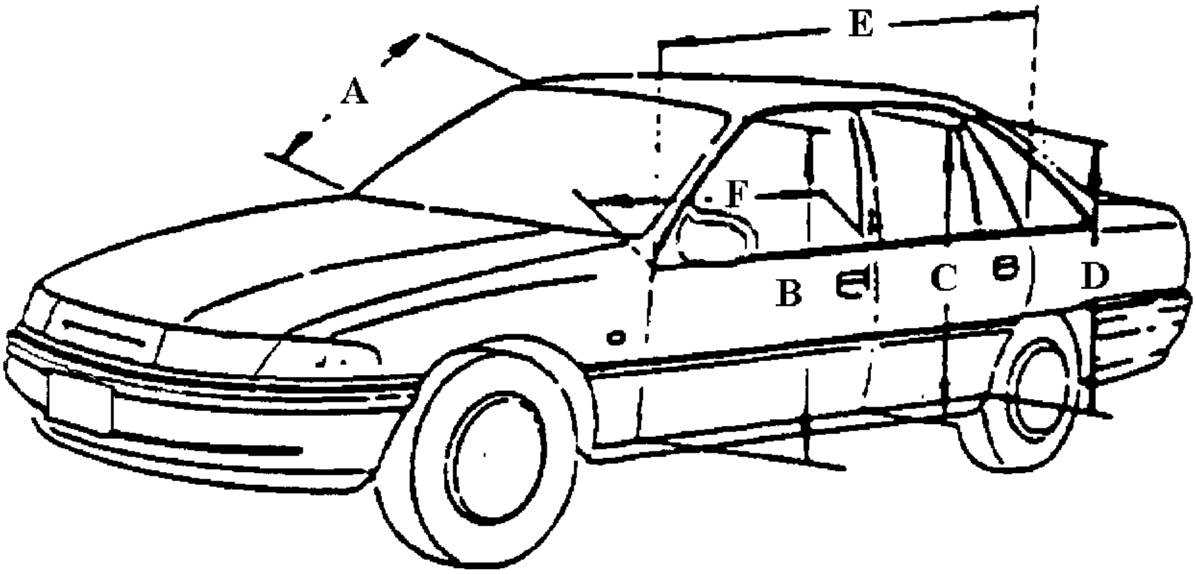


Figure A5.1

	LEFT HAND SIDE			RIGHT HAND SIDE		
DIMENSION (mm)	**Before**	**After**	**Residual**	**Before**	**After**	**Residual**
A - midpoint to top of A pillar	598	600	+2	609	610	+1
B -height of A Pillar	1167	1182	+15	1172	1204	+32
C -height of B Pillar	1234	1229	-5	1230	1235	+5
D -height of C Pillar	908	910	+2	906	905	-1
E - distance from A to C pillars along window sill	1800	1790	-10	1792	1775	-17
F - distance from A to B pillars along window sill	938	925	-13	934	915	-19
Overall Length Front to Rear Datum.	4576	4124	-452	4572	4118	-454
"A" Pillar to Strut Tower	651	494	-157	638	475	-163
Instrument Panel to Rear Datum	2866	2811	-55	2849	2813	-36

	Before	**After**	**Residual**
Instrument Panel to Parcel Shelf C/L	2814	2776	-38
Steering Wheel Target to Reference Target	2670	2628	-42
Between Strut Towers	900	910	+10

B4029 - Vehicle Underbody Crush Dimensional Record

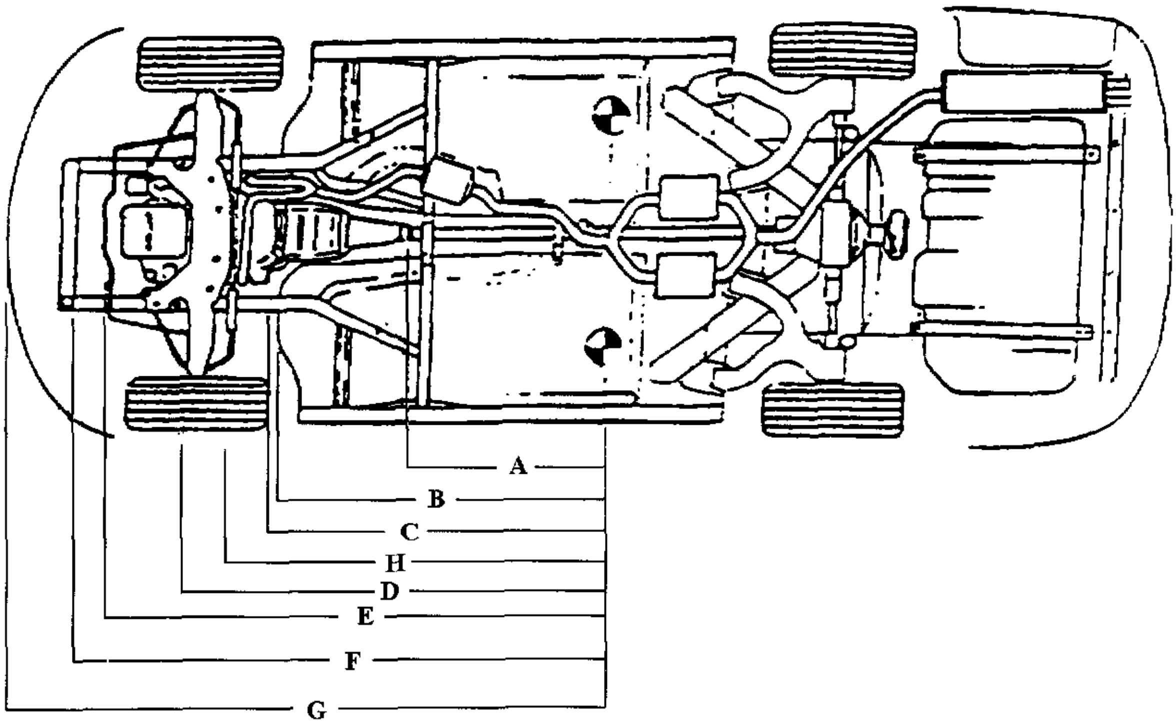


Figure A5.2

	LEFT HAND SIDE			RIGHT HAND SIDE		
DIMENSION (mm)	**Before**	**After**	**Diff.**	**Before**	**After**	**Diff.**
A - Centre First Universal Joint	480	470	-10	480	470	-10
B - Front Edge of Floorpan	1295	1291	-4	1290	1316	+26
C - Front Face Transmission	1445	1396	-49	1455	1410	-45
D - Front Face Cross Member	950	935	-15	955	945	-10
E - Engine Front Face	2170	2092	-78	2170	2092	-78
F - Radiator Lower Rear Edge	2400	2211	-189	2410	2185	-225
G - Front Bumper	2615	2200	-415	2615	2200	-415
H - Steering R+P Centreline	1665	1670	+5	1675	1670	-5

B4029 - Vehicle Crush Data Measurements

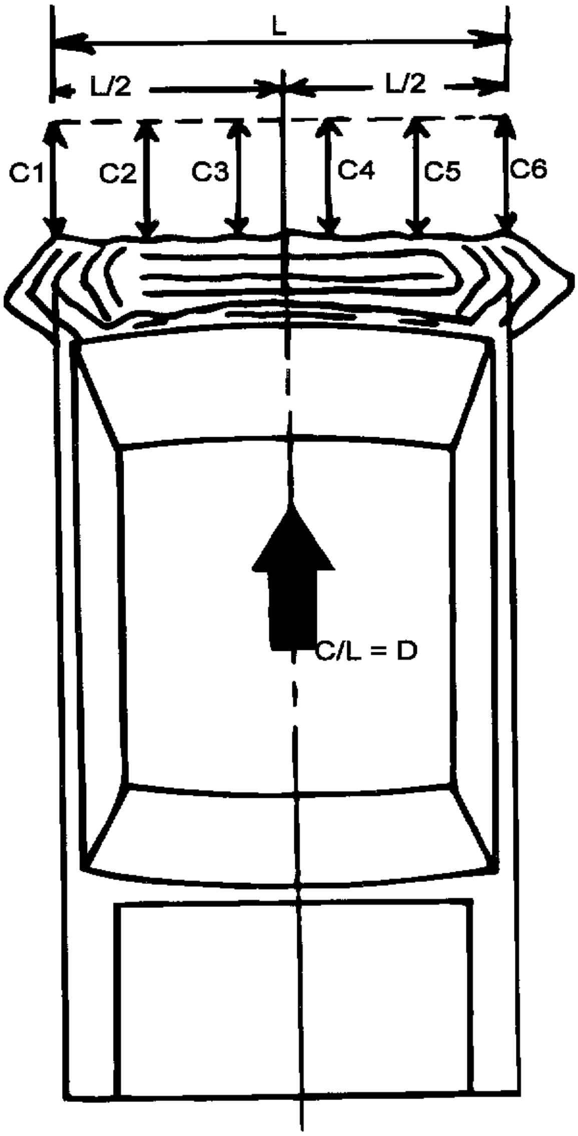


Figure A5.3

Measurement	Dimension		
	Pre-Test	**Post-Test**	**Crush**
L	1470	1459	-11
L/2	735	729.5	-5.5
C1	4576	4124	-452
C2	4622	4152	-470
C3	4635	4153	-482
C4	4629	4147	-482
C5	4617	4140	-477
C6	4572	4118	-454

B4029 - Seatbelt Anchorage Point Deformation

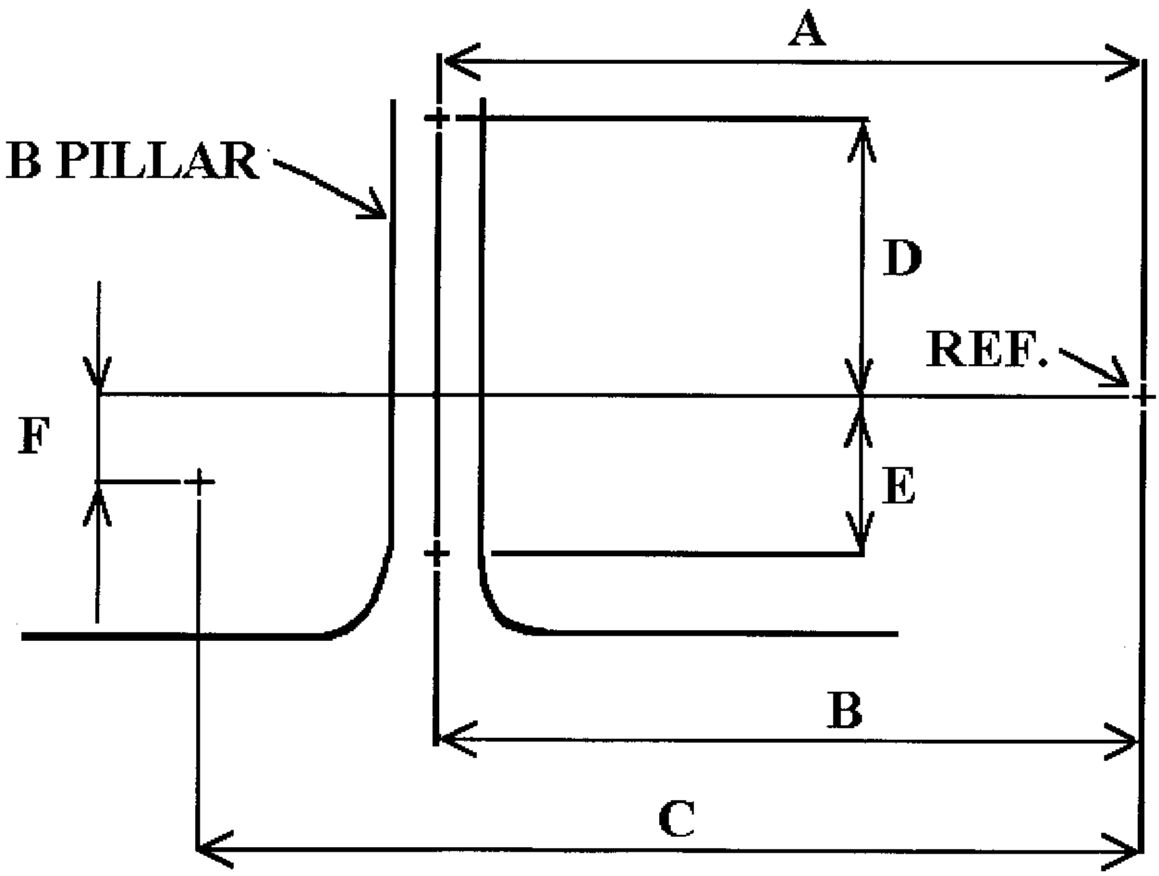


Figure A5.4

			LEFT HAND SIDE			RIGHT HAND SIDE		
		DIM	**Before**	**After**	**Residual**	**Before**	**After**	**Residual**
X axis-	D ring bolt	**A**	2041	2068	+27	2037	2058	+21
	retractor mount	**B**	2152	2105	-47	2132	2077	-55
	seatbelt stork mount	**C**	2290	2260	-30	2295	2263	-32
Z axis -	D ring bolt	**D**	386	194	-192	387	187	-200
	retractor mount	**E**	515	687	+172	504	691	+187
	seatbelt stork mount	**F**	338	527	+189	337	537	+200

Seatbelt Loop Length

		LEFT HAND SIDE			RIGHT HAND SIDE		
DIM		**Before**	**After**	**Residual**	**Before**	**After**	**Residual**
LAP BELT	**L1**	750	715	-35	765	730	-35
SASH BELT	**L2**	765	735	-30	770	750	-20

B4029 - Dummy Positioning Data

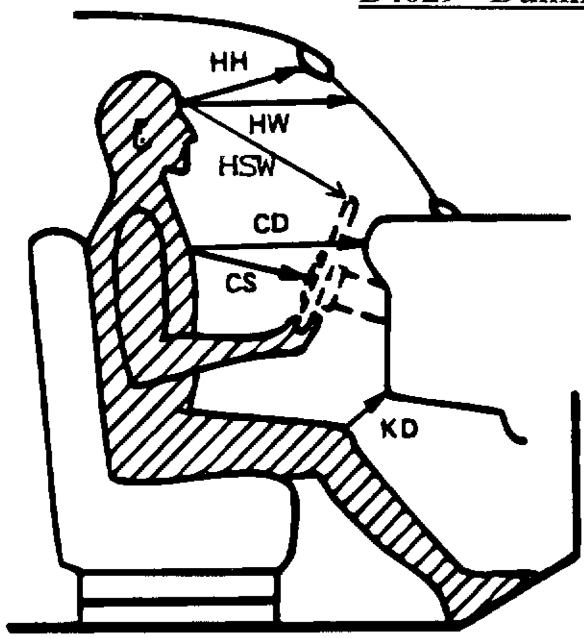


Figure A5.5

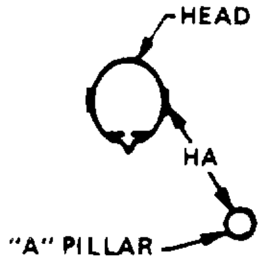


Figure A5.6

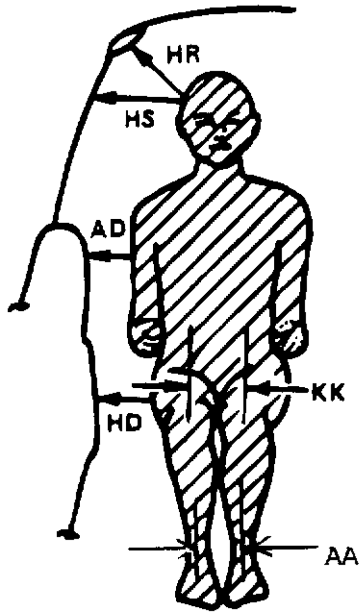


Figure A5.7

All Dimensions in Millimetres

			Driver	Passenger
Fiducial Mark Location		**X**	2911	2987
		Y	-	-
		Z	7979	2997
H-Point Location		**X**	3126	3214
		Y	-	-
		Z	7887	7910
head to windshield header	HH		387	361
head to windshield, horiz.	HW		551	556
chest to dash	CD		514	525
chest to steering wheel	CS		318	-
knee to dash, left	KDL		92	110
knee to dash, right	KDR		129	93
seat back angle	SA		23^0	23^0
torso angle	TA		22.5^0	22.5^0
head to steering wheel	HSW		465	-
head target to side roof	HR		228	201
head target to side window	HS		236	212
upper arm to door	AD		123	104
hip to door	HD		205	205
Out board knee to camera			490	535
knee to knee, centres	KK		305	200
head target to 'A' pillar	HA		535	514
ankle to ankle, centre	AA		357	185
nose tip to rim top rear	NR		426	-
nose tip to hub centre	NH		426	-
Belt/chest contact to D-ring			344	313
top of plate to sash, top edge	PBU		333	354
top of plate to sash,lower edge	PBL		251	266
top plate to lap belt top			50	50

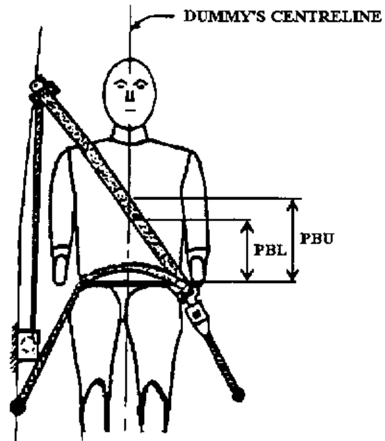


Figure A5.8

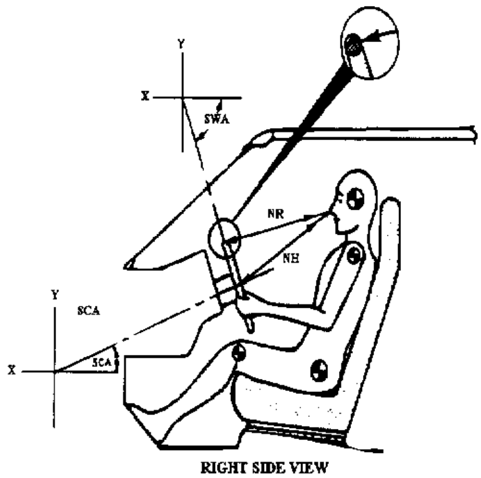


Figure A5.9

B4029 - Post Impact Data

Type of Test: ADR 69/00 Full Frontal **Impact Angle:** 90°
Date of Test: 29/June 1994 **Time of Test:** 2 pm

Ambient Temperature: 13 °C at impact area

Temp.in occupant compartment 23 °C (Spec. range 18.9°C to 25.5°C)

Required impact velocity range 47.5 to 49.1 km/h
Impact Velocity: 48.1 km/h primary 48.1 km/h secondary

Visible Dummy Contact Points

	Driver	Passenger
Head	rim & hub	forehead to dash, nose to handrail
Chest	lower rim	
Abdomen		
Left Knee	lower dash, column	glove box
Right Knee	fuse box, lower dash	glove box

Door and Seat Functionality

	Front		Rear	
	Left	**Right**	**Left**	**Right**
Door Opening	OK	stiff	OK	OK
Seat Back	jammed	OK		
Seat Shift (mm)	OK	OK		

Glazing damage: Shattered at lower edge by engine cracked overall but intact, seperated at lower edge approx 500mm long

B4030 - Passenger Compartment Deformation

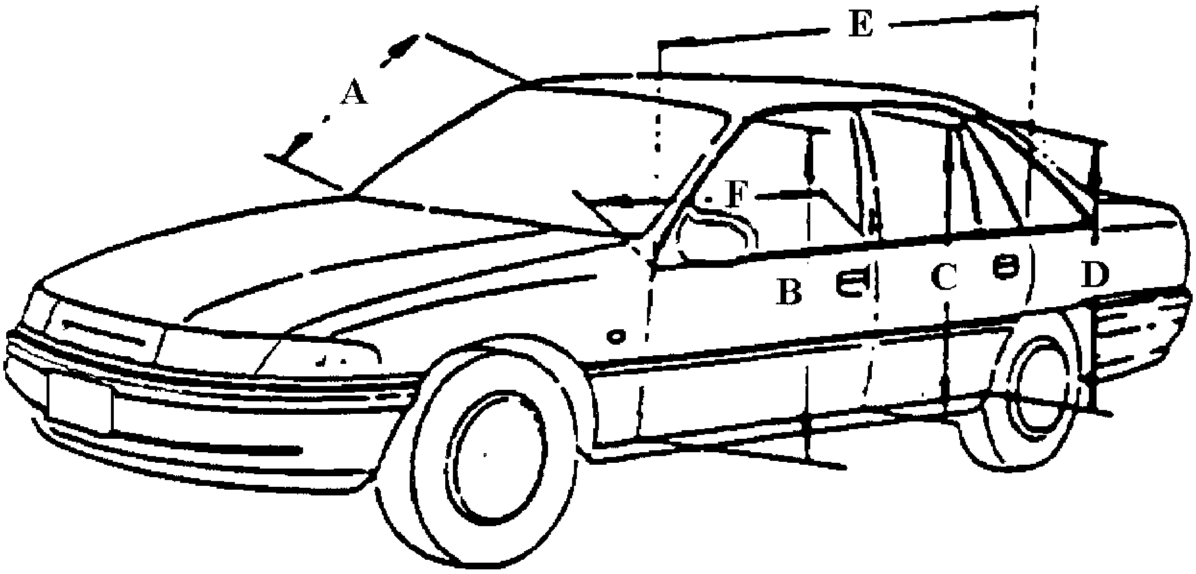


Figure A5.1

	LEFT HAND SIDE			RIGHT HAND SIDE		
DIMENSION (mm)	**Before**	**After**	**Residual**	**Before**	**After**	**Residual**
A - midpoint to top of A pillar	809	808	-1	809	803	-6
B -height of A Pillar	1075	1081	+6	1075	1087	+12
C -height of B Pillar	1140	1125	-15	1130	1141	+11
D -height of C Pillar	-	-	-	-	-	-
E - distance from A to C pillars along window sill	-	-	-	-	-	-
F - distance from A to B pillars along window sill	1094	1087	-7	1091	1091	0
Overall Length Front to Rear Datum.	5504	4231	-1273	5507	4236	-1271
"A" Pillar to Strut Tower	550	418	-132	553	398	-155
Instrument Panel to Rear Datum	3256	3265	+9	3294	3246	-48

	Before	After	Residual
Instrument Panel to Parcel Shelf C/L	699	699	0
Steering Wheel Target to Reference Target	3040	2960	-80
Between Strut Towers	812	764	-48

B4030 - Vehicle Underbody Crush Dimensional Record

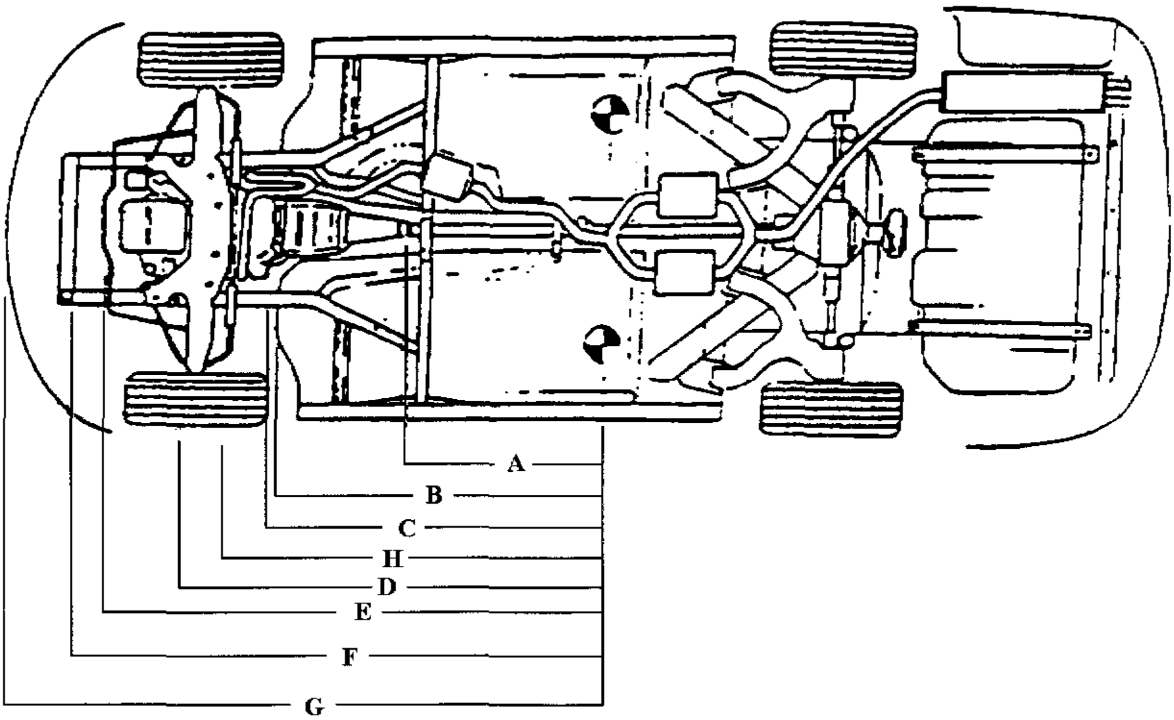


Figure A5.2

	LEFT HAND SIDE			RIGHT HAND SIDE		
DIMENSION (mm)	**Before**	**After**	**Diff.**	**Before**	**After**	**Diff.**
A - Centre First Universal Joint	1240	1224	-16	1230	1216	-14
B - Front Edge of Floorpan	1730	1742	+12	1730	1753	+23
C - Front Face Transmission	1977	1939	-38	1977	1930	-47
D - Front Face Cross Member	2213	2225	+12	2215	2213	-2
E - Engine Front Face	2460	2415	-45	2457	2405	-52
F - Radiator Lower Rear Edge	2695	2517	-178	2680	2491	-189
G - Front Bumper	2923	2511	-412	2925	2506	-419
H - Steering R+P Centreline	2315	2350	+35	2305	2364	+59

B4030 - Vehicle Crush Data Measurements

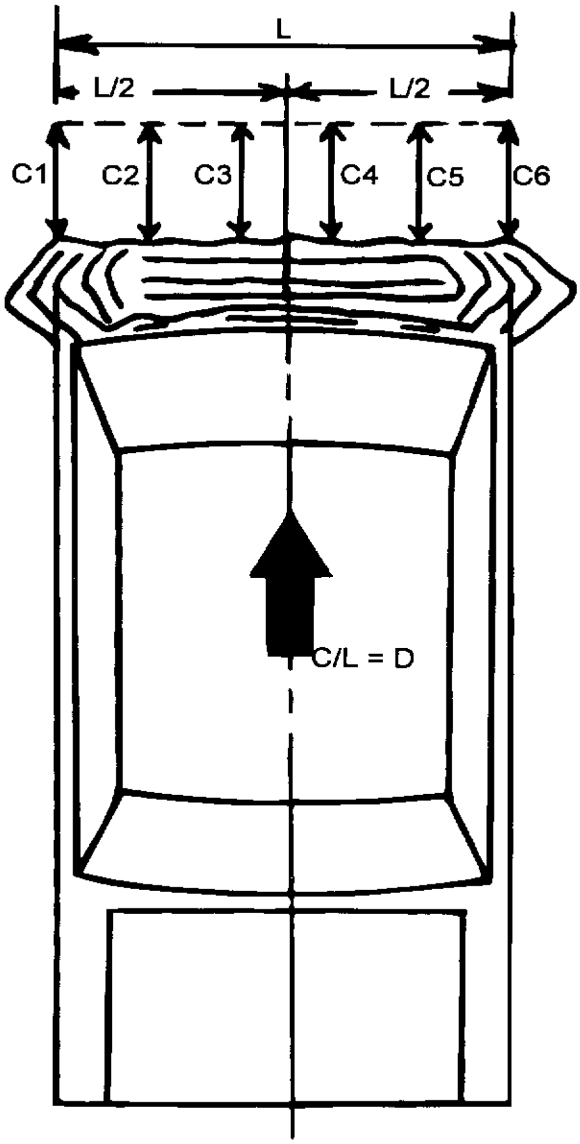


Figure A5.3

Measurement	Dimension		
	Pre-Test	Post-Test	Crush
L	1397	1402	+5
L/2	698.5	701	+2.5
C1	5504	4231	-1273
C2	5546	4250	-1296
C3	5560	4266	-1294
C4	5561	4263	-1298
C5	5549	4261	-1288
C6	5507	4236	-1271

B4030 - Seatbelt Anchorage Point Deformation

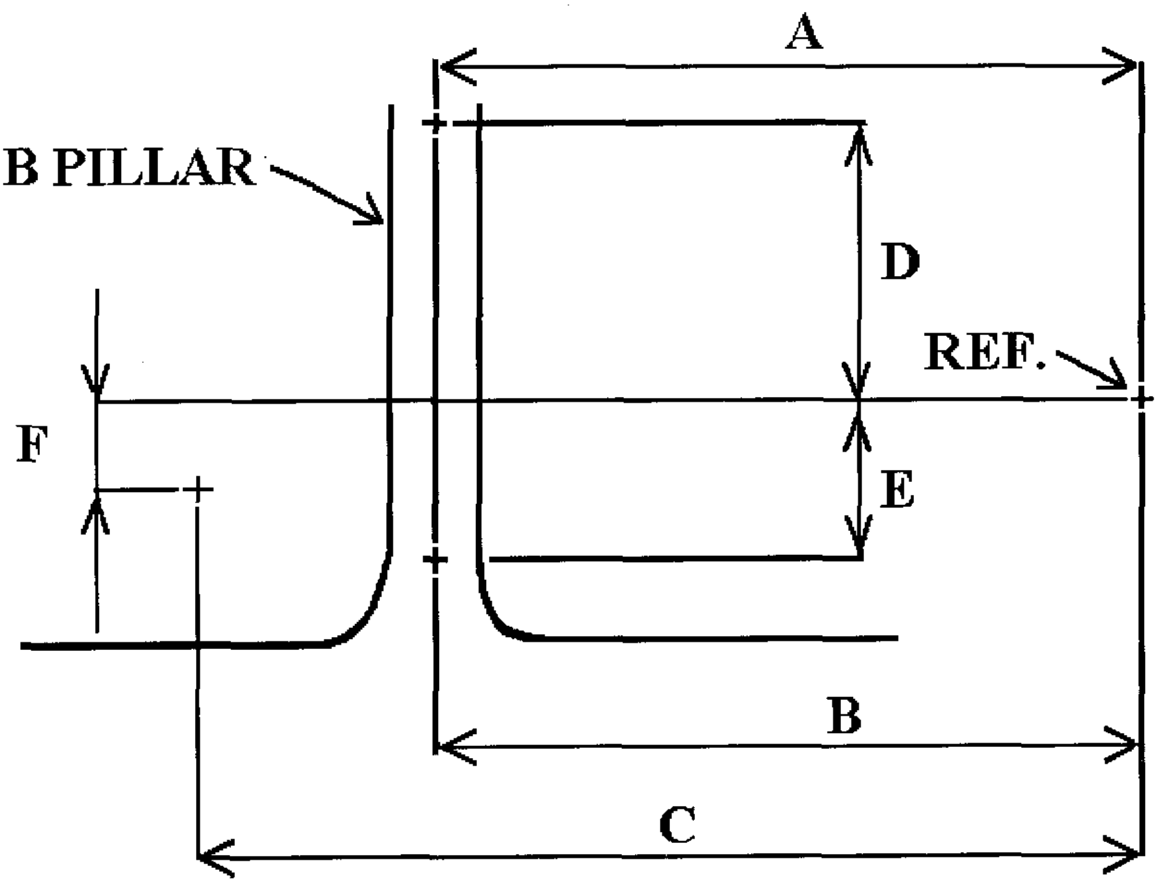


Figure A5.4

		DIM	LEFT HAND SIDE Before	After	Residual	RIGHT HAND SIDE Before	After	Residual
X axis-	D ring bolt	A	2361	2366	+5	2362	2361	-1
	retractor mount	B	2434	2409	-25	2427	2406	-21
	seatbelt stork mount	C	2565	2530	-35	2536	2525	-11
Z axis -	D ring bolt	D	333	197	-136	329	184	-145
	retractor mount	E	516	641	+125	520	661	+141
	seatbelt stork mount	F	518	620	+102	466	584	+118

Seatbelt Loop Length

DIM		LEFT HAND SIDE Before	After	Residual	RIGHT HAND SIDE Before	After	Residual
LAP BELT	L1	720	705	-15	762	710	-52
SASH BELT	L2	720	657	-63	735	680	-55

B4030 - Dummy Positioning Data

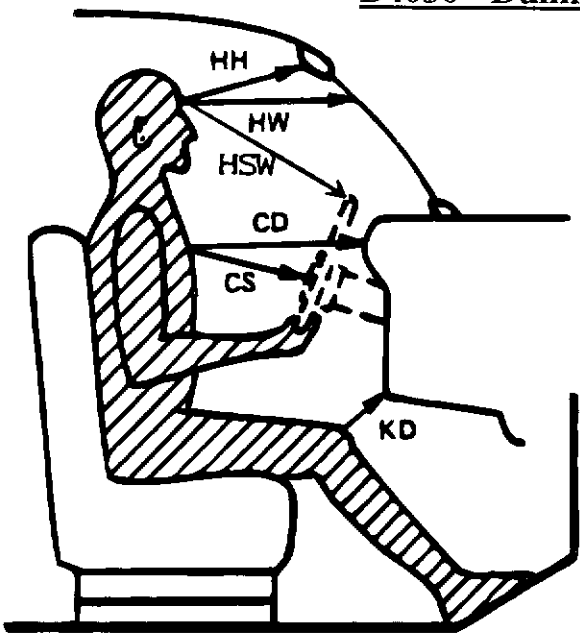


Figure A5.5

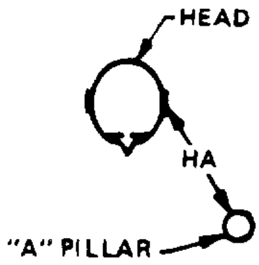


Figure A5.6

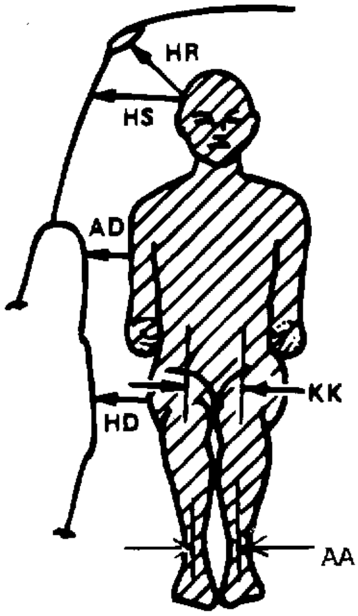


Figure A5.7

All Dimensions in Millimetres

		Driver	Passenger
Fiducial Mark Location	**X**	2811	2887
	Y	-	-
	Z	7786	7801
H-Point Location	**X**	3158	3229
	Y	-	-
	Z	7657	7664
head to windshield header	HH	384	409
head to windshield, horiz.	HW	533	572
chest to dash	CD	548	568
chest to steering wheel	CS	310	-
knee to dash, left	KDL	146	173
knee to dash, right	KDR	135	182
seat back angle	SA	24°	23°
torso angle	TA	22.5°	23.0°
head to steering wheel	HSW	430	-
head target to side roof	HR	198	201
head target to side window	HS	215	225
upper arm to door	AD	130	121
hip to door	HD	178	200
Out board knee to camera		465	545
knee to knee, centres	KK	280	200
head target to 'A' pillar	HA	516	508
ankle to ankle, centre	AA	320	200
nose tip to rim top rear	NR	394	-
nose tip to hub centre	NH	406	-
Belt/chest contact to D-ring		350	350
top of plate to sash, top edge	PBU	295	320
top of plate to sash,lower edge	PBL	210	235
top plate to lap belt top		50	50

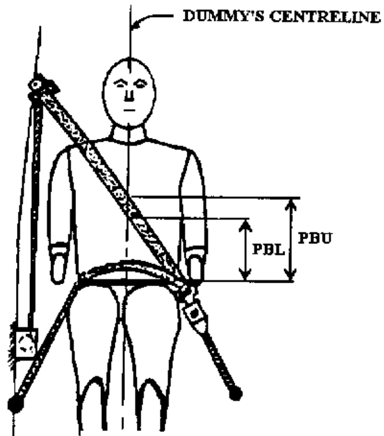


Figure A5.8

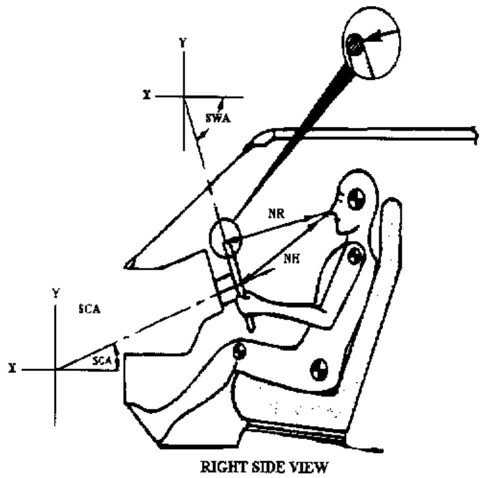


Figure A5.9

B4030 - Post Impact Data

Type of Test: ADR 69/00 Full Frontal **Impact Angle:** 90°

Date of Test: 5/July 1994 **Time of Test:** 12 pm

Ambient Temperature: 17.0 °C at impact area

Temp.in occupant compartment 21.5 °C (Spec. range 18.9°C to 25.5°C)

Required impact velocity range 47.5 to 49.1 km/h

Impact Velocity: 48.4 km/h primary 48.5 km/h secondary

Visible Dummy Contact Points

	Driver	Passenger
Head	top of rim & hub	no contact
Chest	bottom of rim	no contact
Abdomen		
Left Knee	lower dash, hand brake	dash face, glove box
Right Knee	column, key, and under dash	dash face, glove box

Door and Seat Functionality

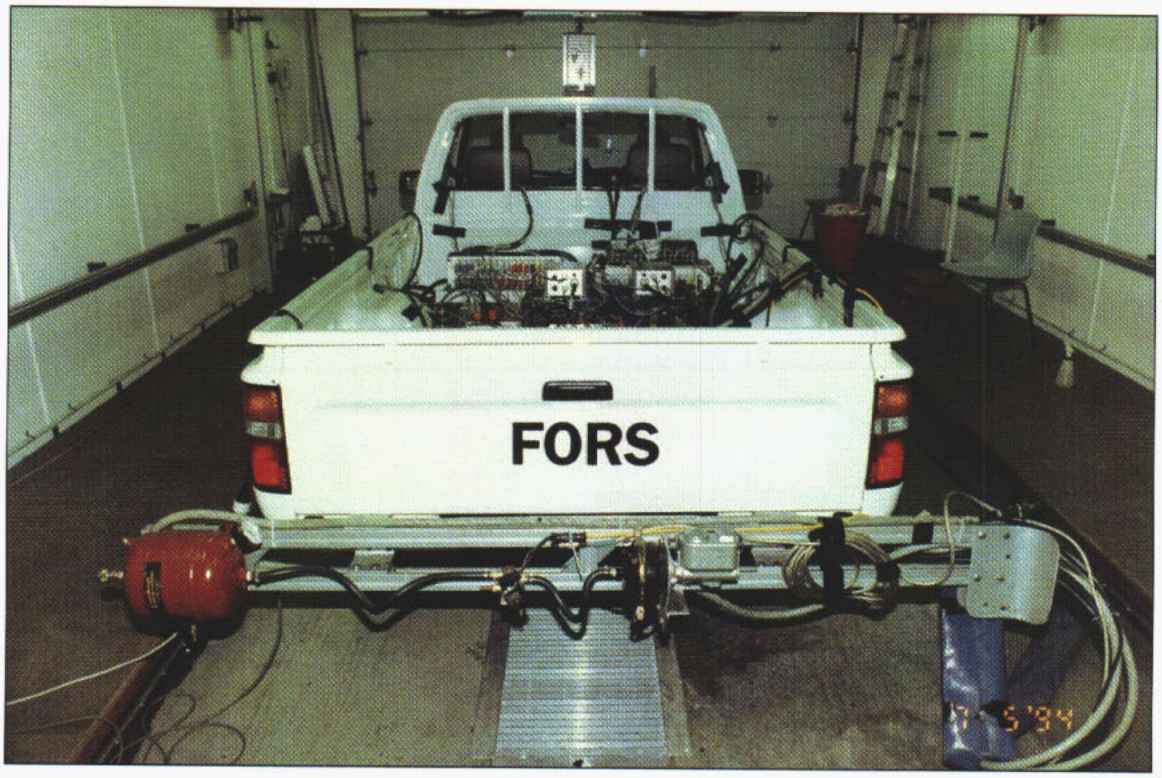
	Front		Rear	
	Left	**Right**	**Left**	**Right**
Door Opening	OK	OK		
Seat Back	OK	OK		
Seat Shift (mm)		OK		

Glazing damage: NONE

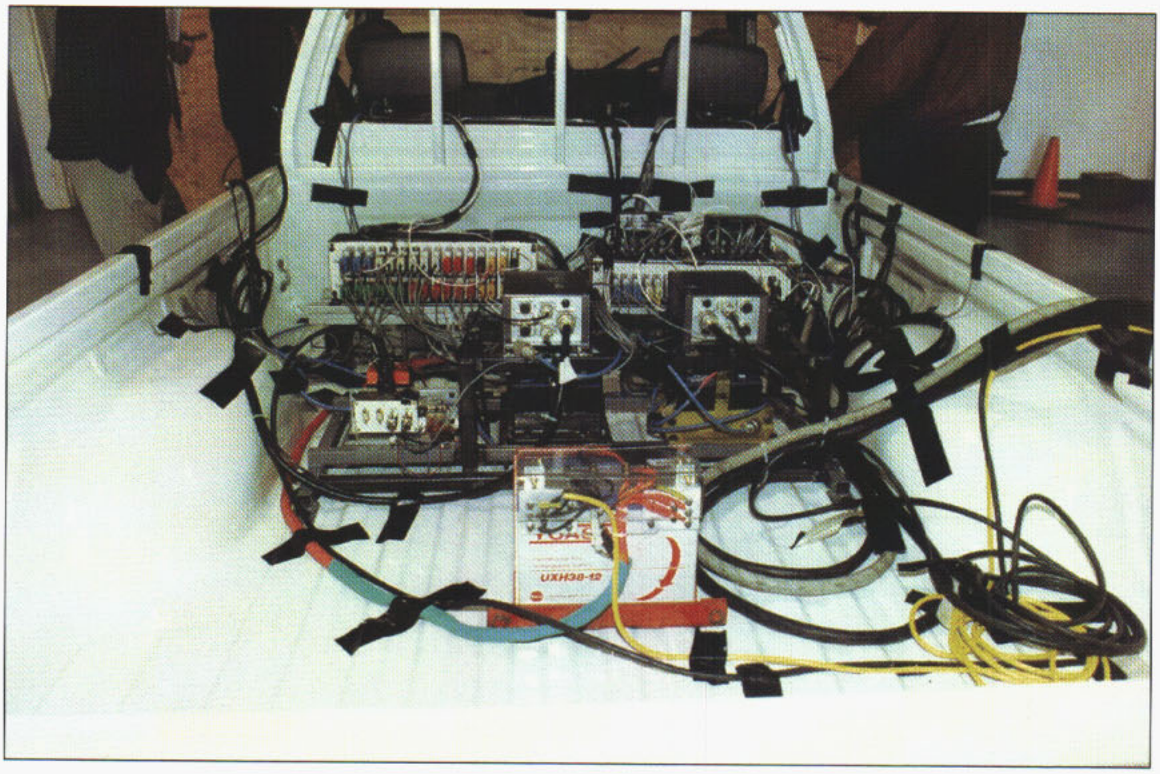
APPENDIX 6

Test Vehicle Photographs

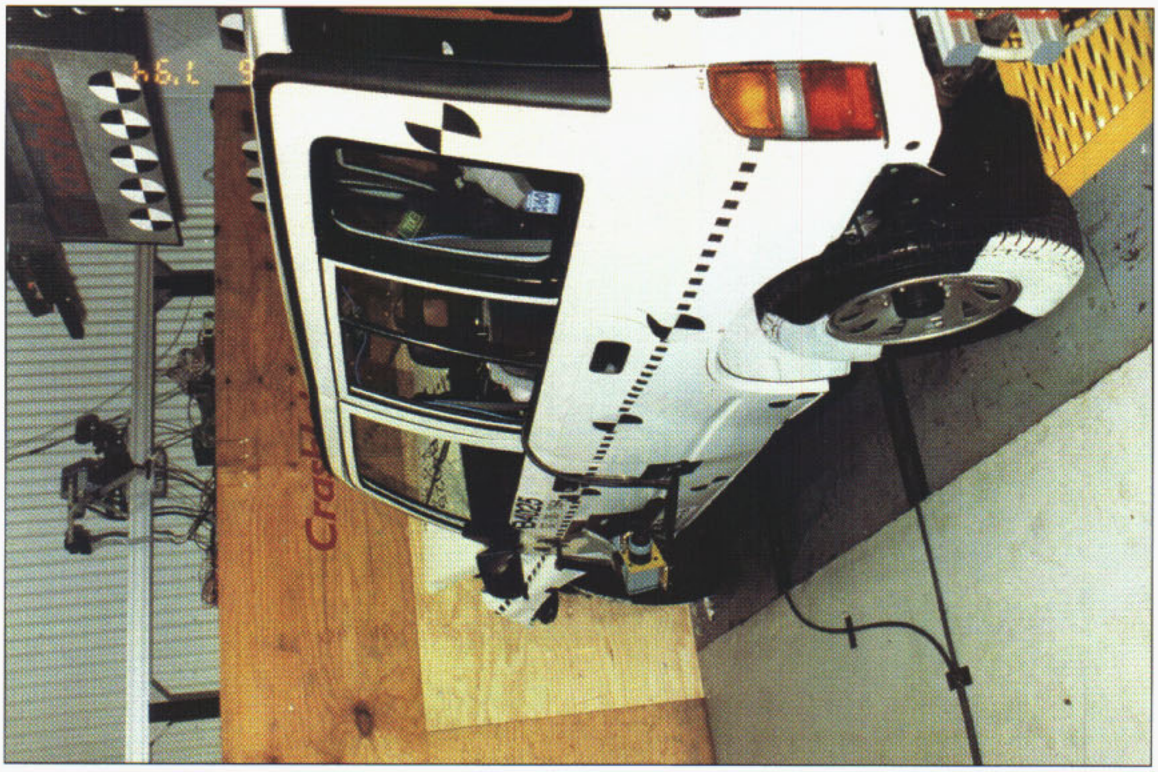
Typical test vehicle setup - rear view showing brake abort system and "umbilical cord" data cable (blue sheath).



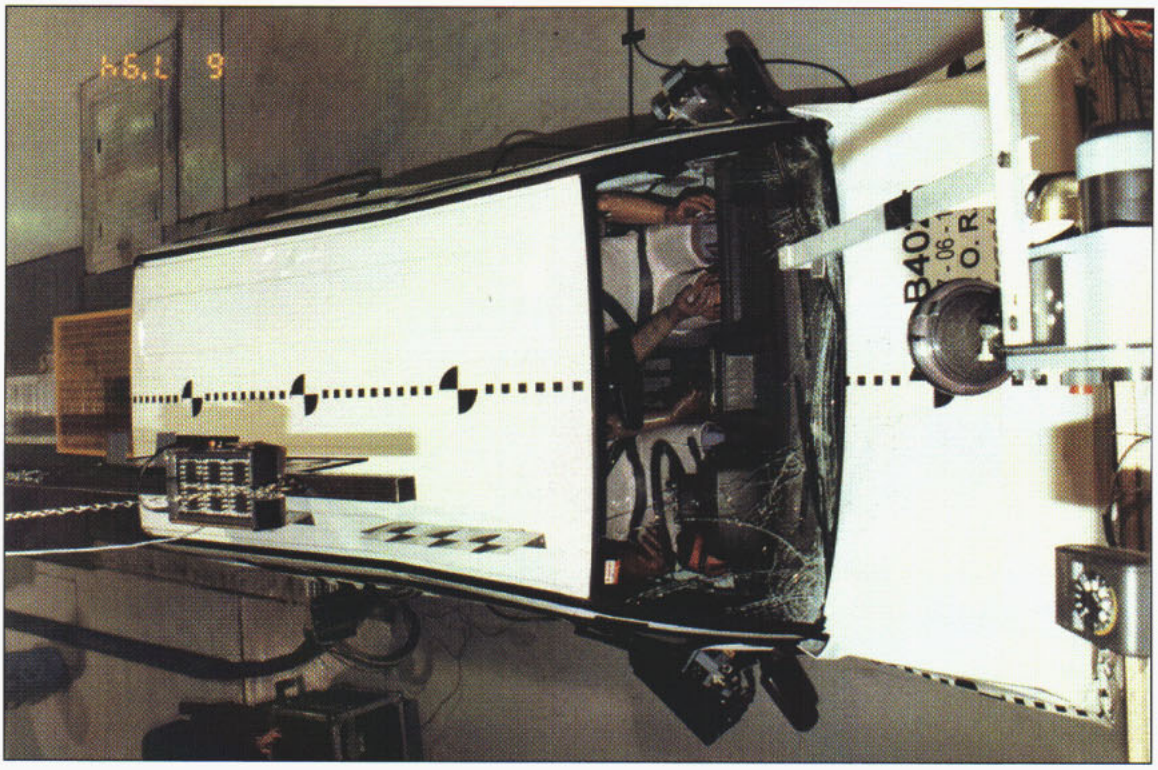
Typical setup of instrumentation electrical connections and amplification equipment



B4025 - Post-test overall view

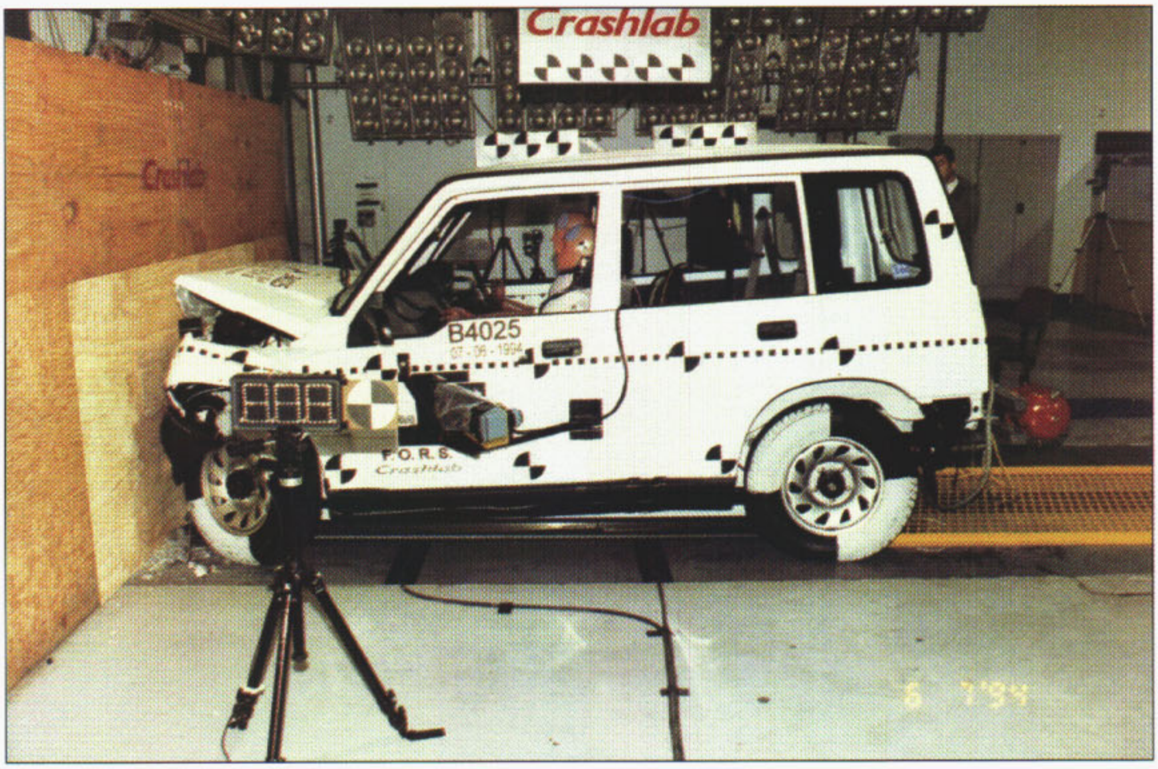


B4025 - Post-test overhead view

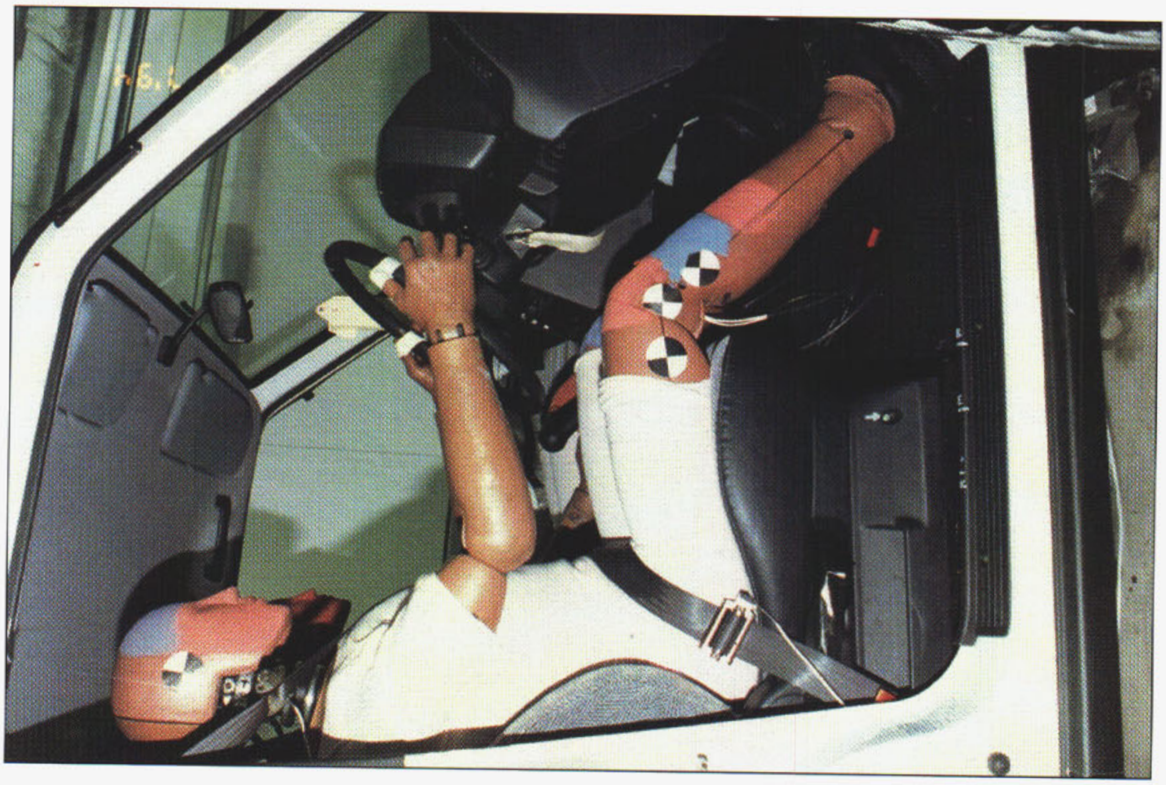


B4025 - Post-test driver's side view

B4025 - Post-test passenger's side view

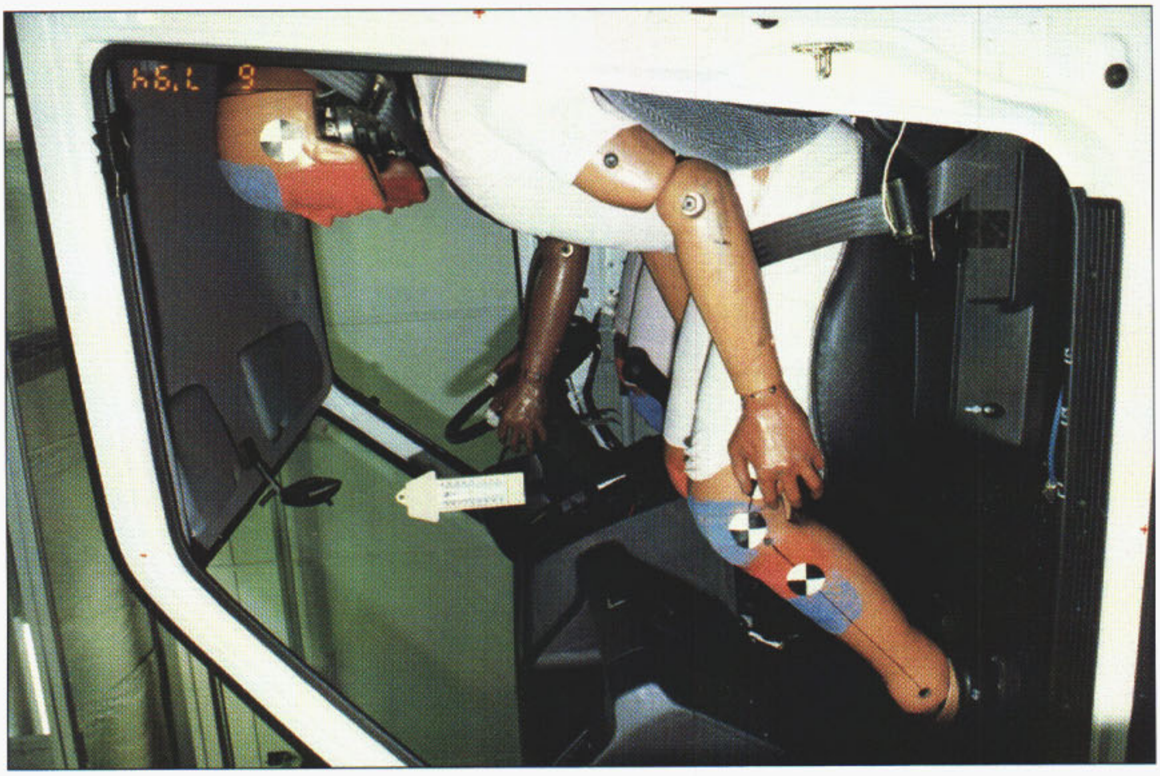


B4025 - Pre-test driver's side closeup view



B4025 - Post-test driver's side closeup view

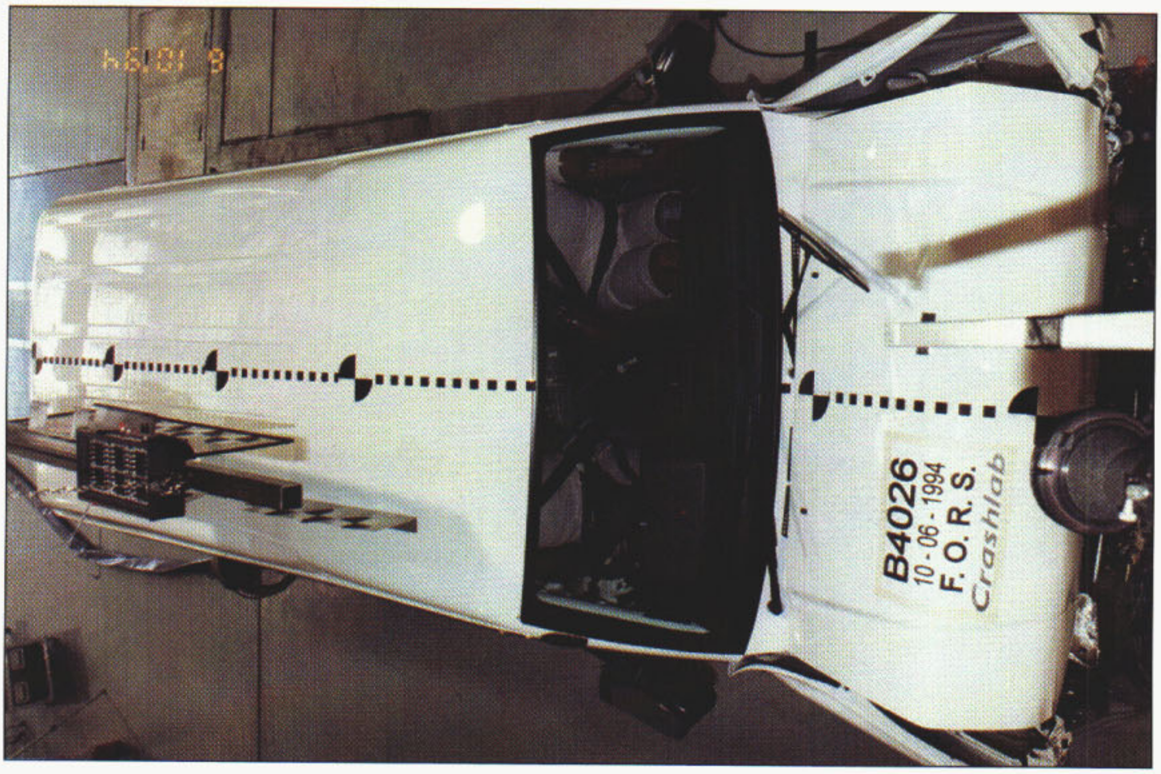
B4025 - Pre-test passenger's side closeup view



B4025 - Post-test passenger's side closeup view

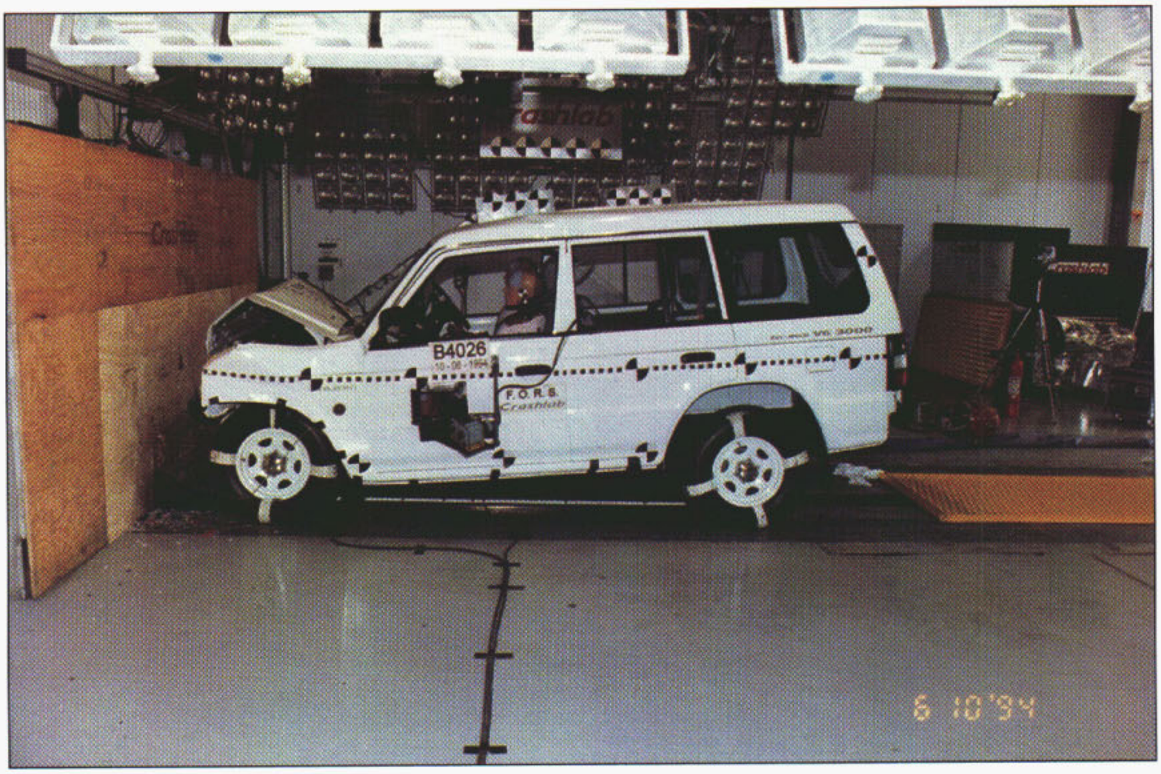
B4026 - Post-test overall view

B4026 - Post-test overhead view



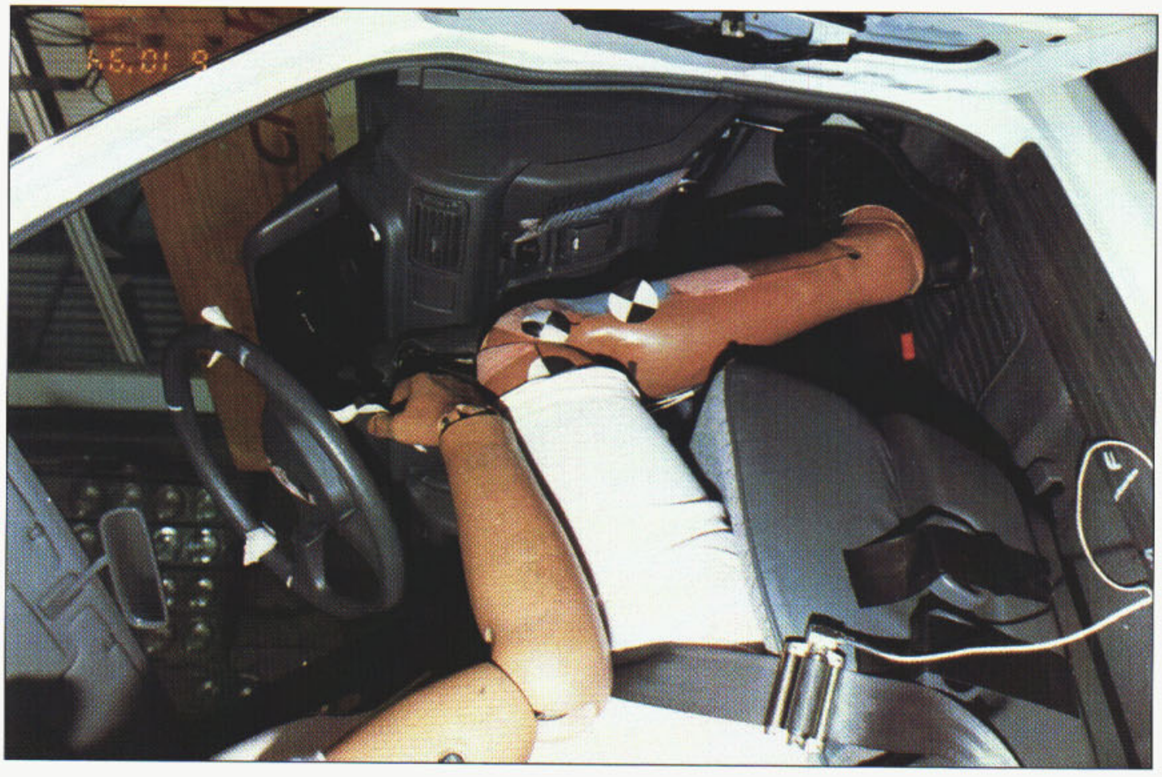
B4026 - Post-test driver's side view

B4026 - Post-test passenger's side view

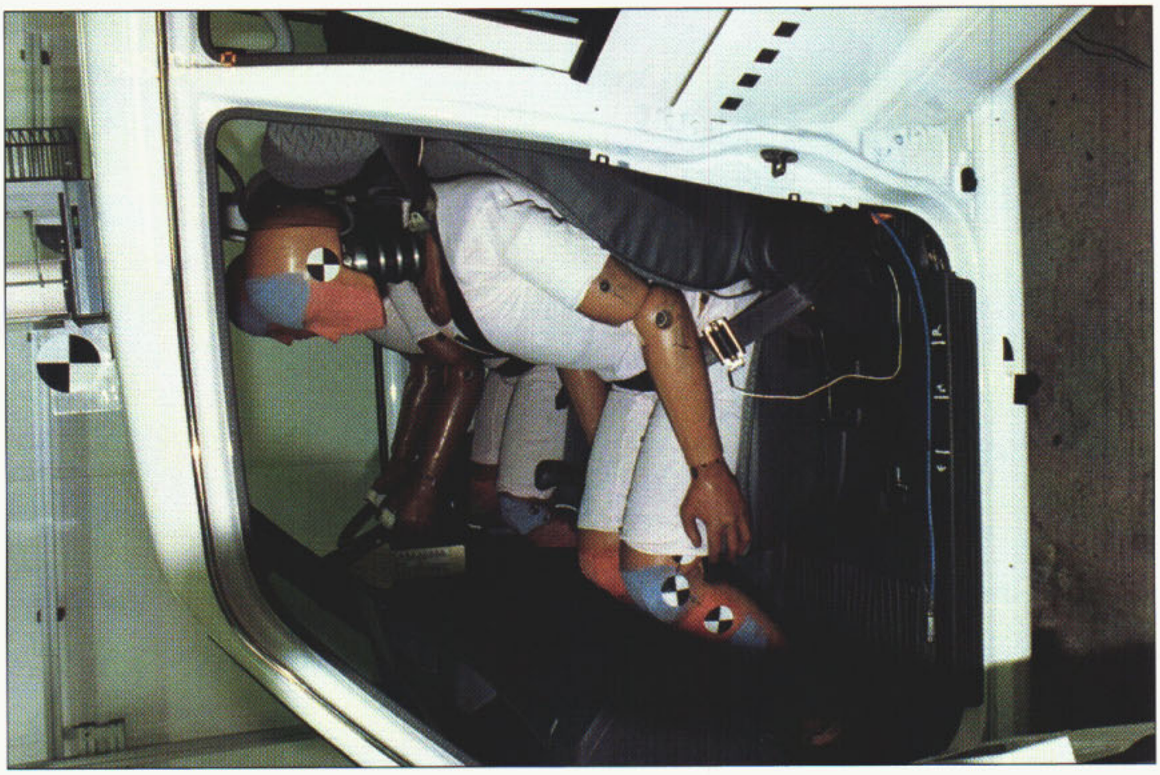


B4026 - Pre-test driver's side closeup view

B4026 - Post-test driver's side closeup view



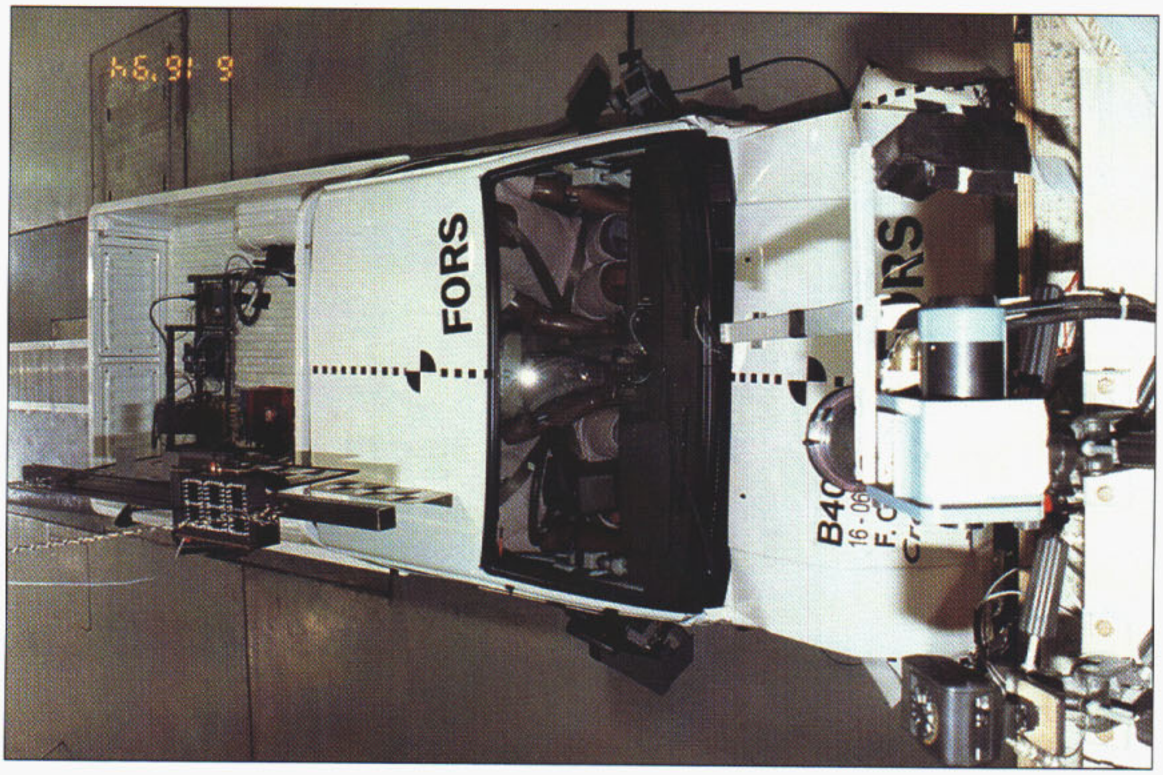
B4026 - Pre-test passenger's side closeup view



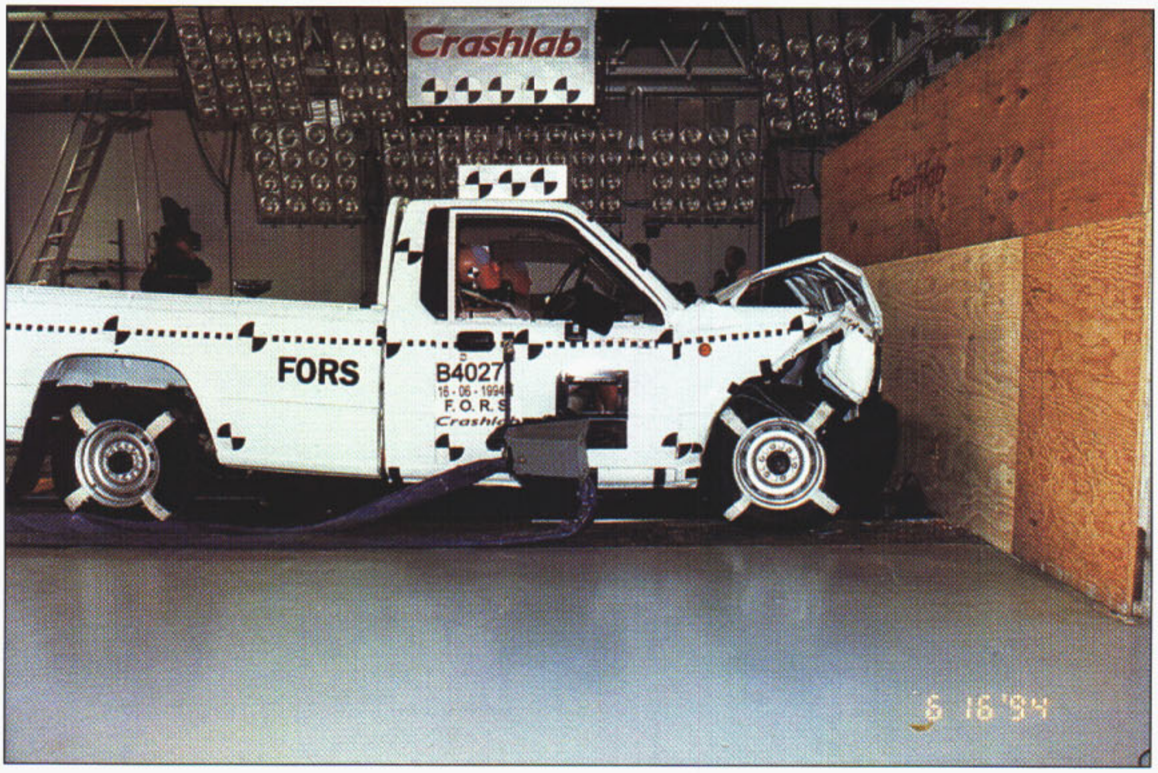
B4026 - Post-test passenger's side closeup view

B4027 - Post-test overall view

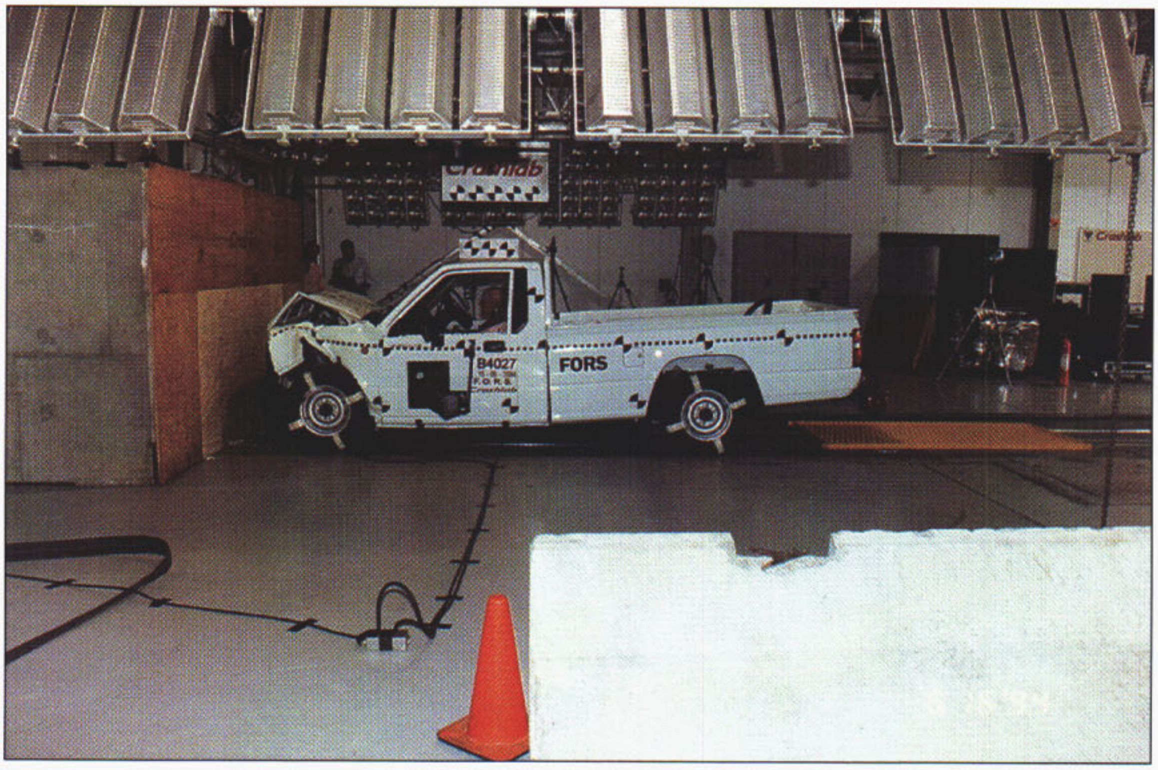
B4027 - Post-test overhead view



B4027 - Post-test driver's side view

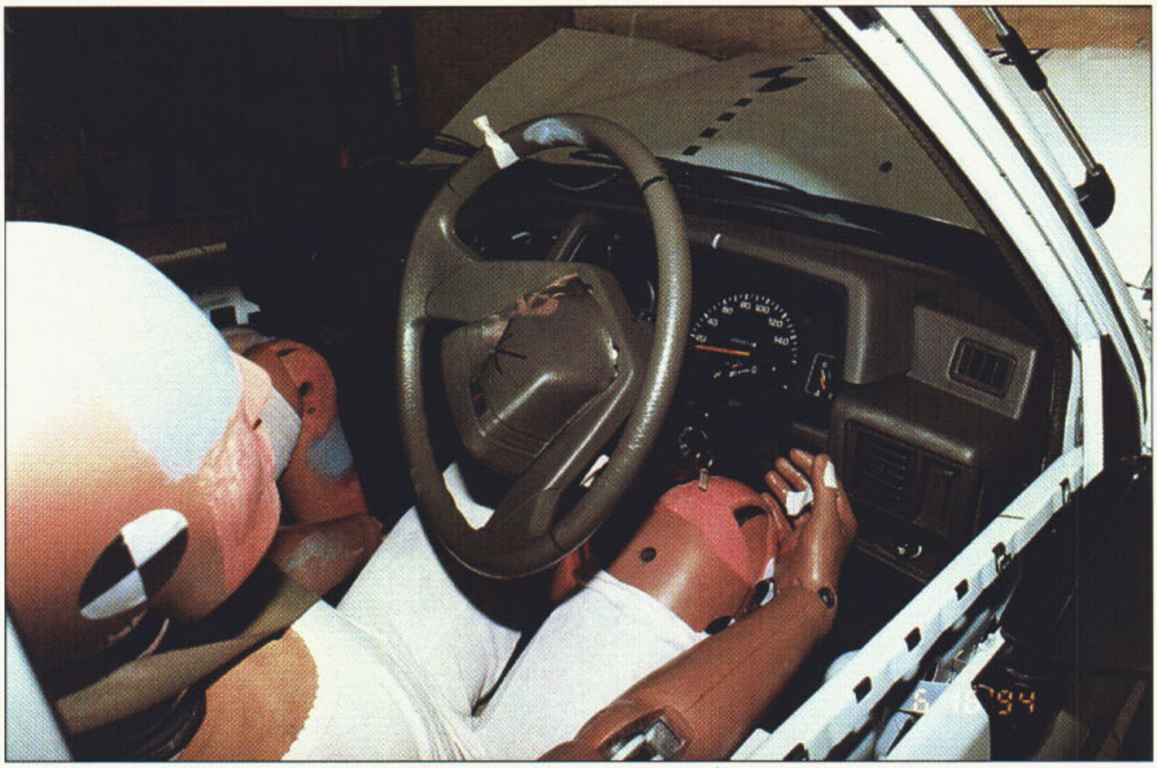


B4027 - Post-test passenger's side view

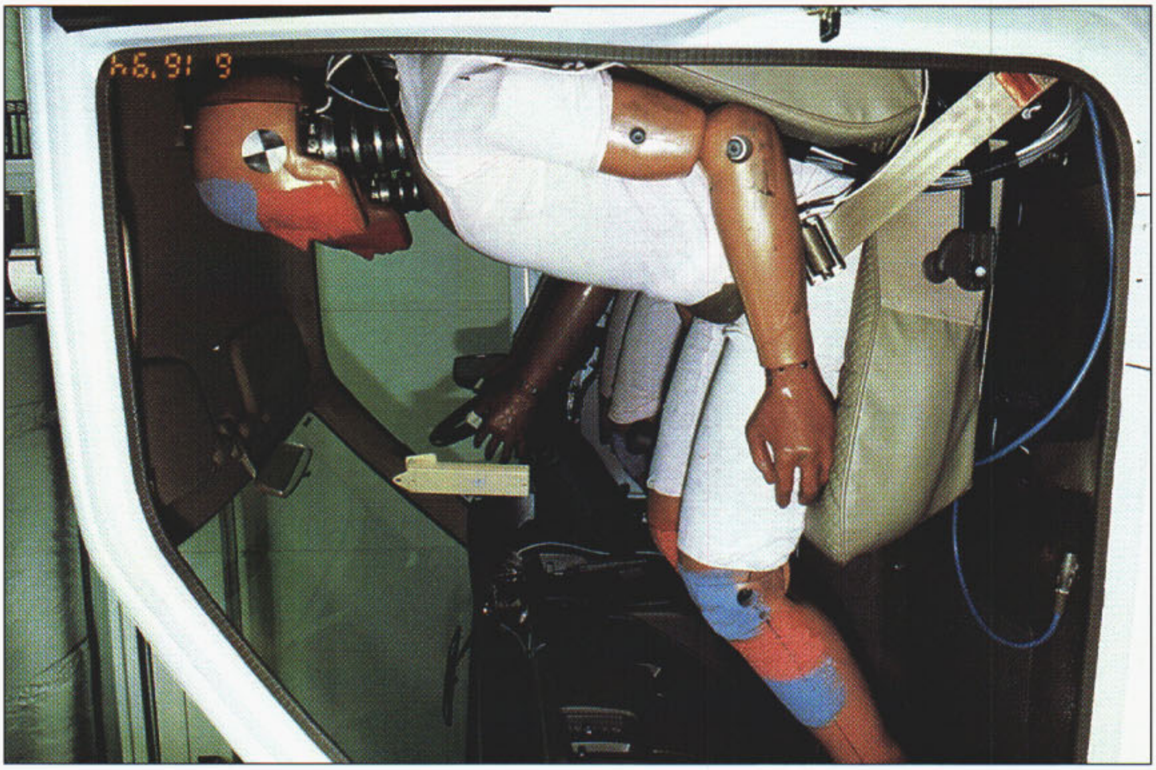


B4027 - Pre-test driver's side closeup view

B4027 - Post-test driver's side closeup view

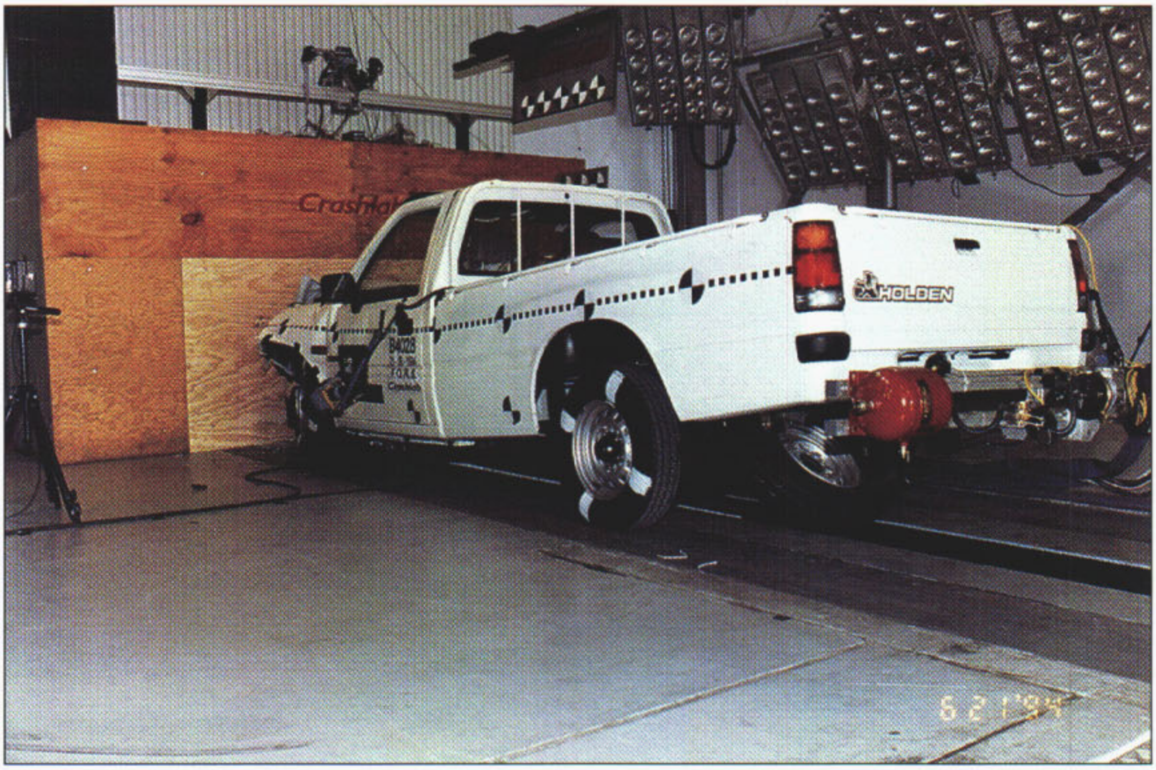


B4027 - Pre-test passenger's side closeup view

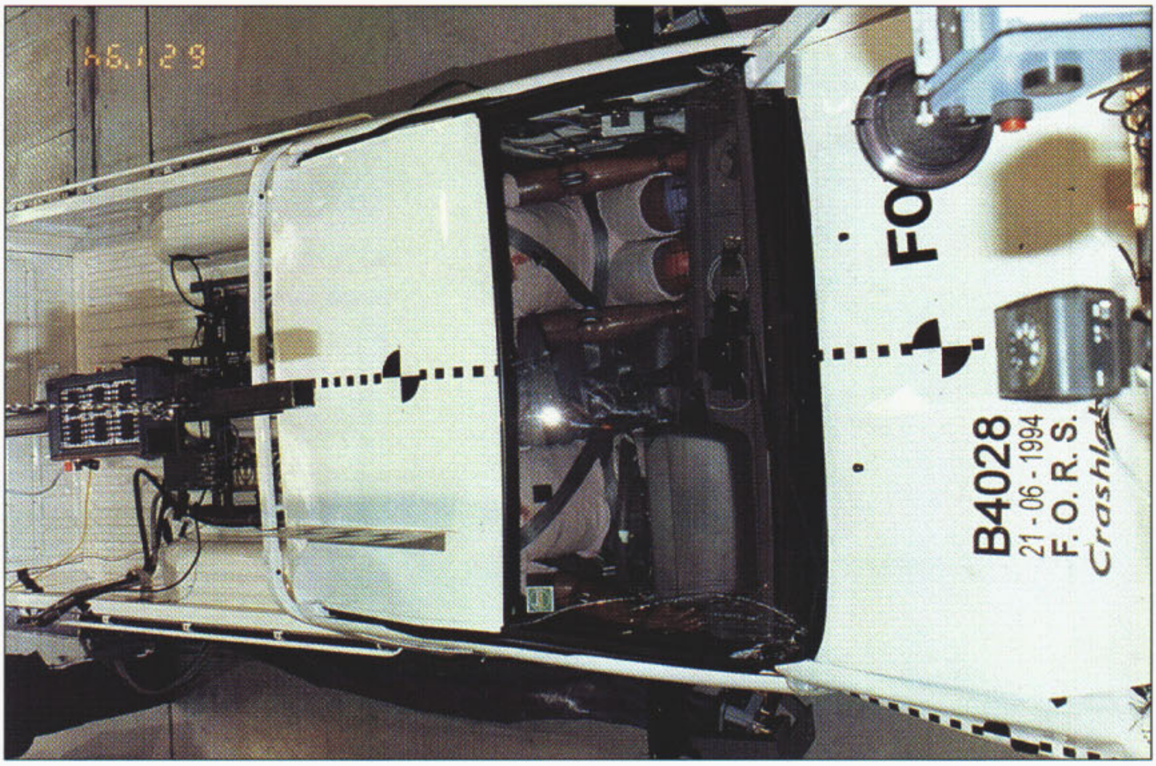


B4027 - Post-test passenger's side closeup view

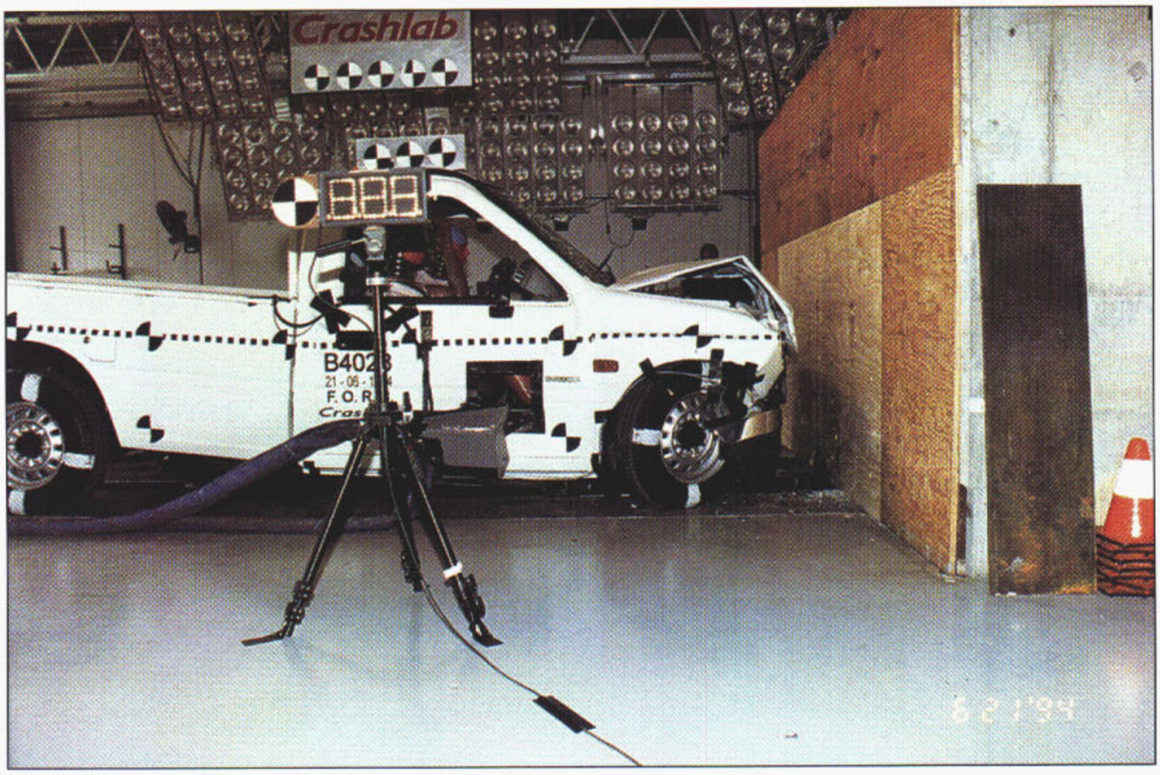
B4028 - Post-test overall view



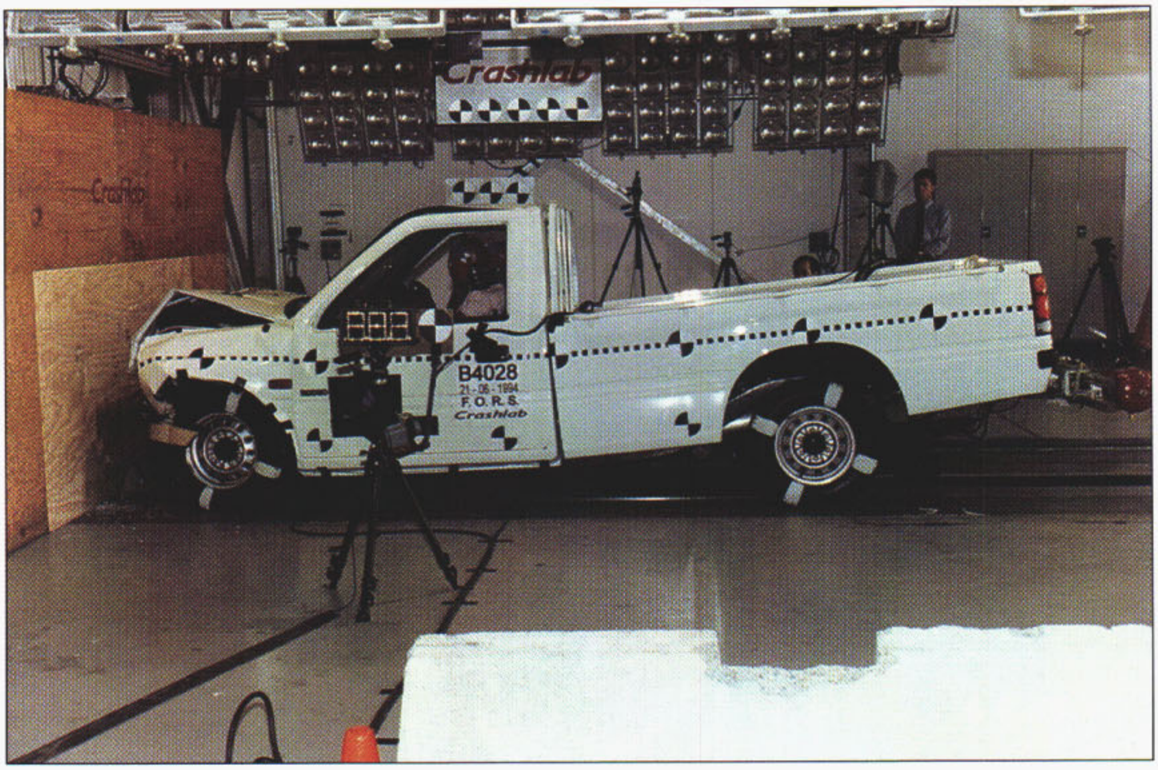
B4028 - Post-test overhead view



B4028 - Post-test driver's side view



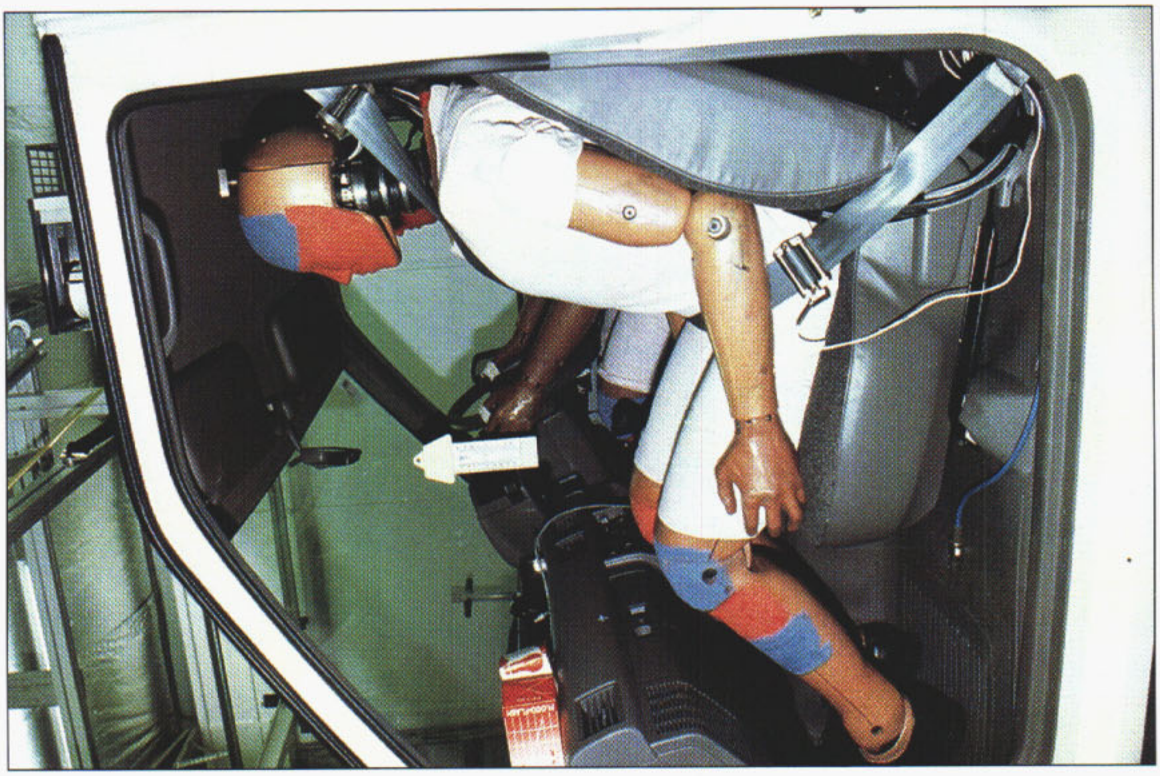
B4028 - Post-test passenger's side view



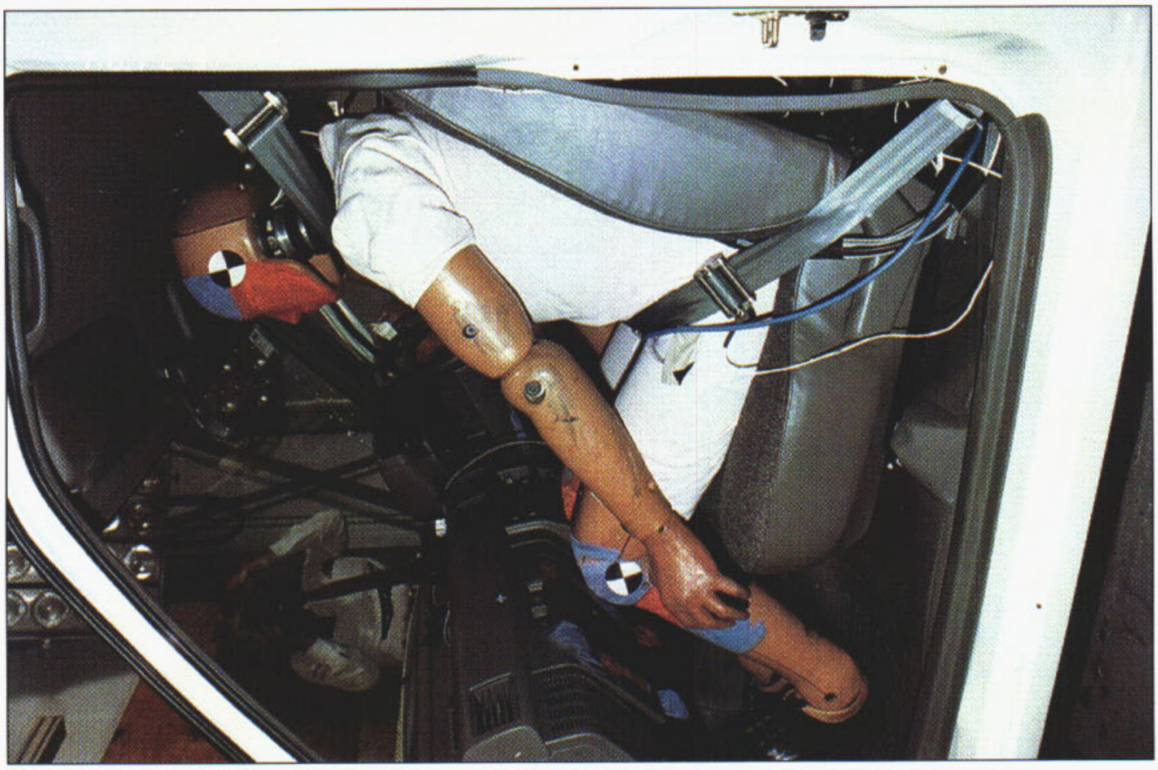
B4028 - Pre-test driver's side closeup view

B4028 - Post-test driver's side closeup view

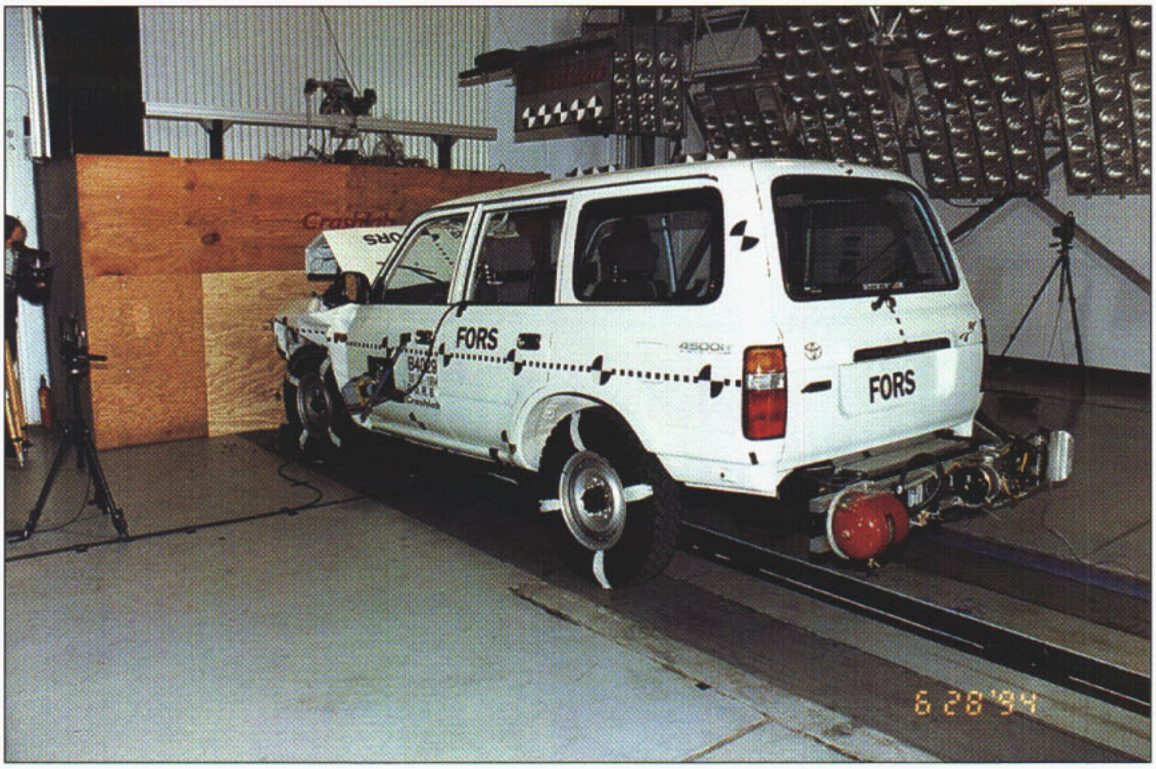
B4028 - Pre-test passenger's side closeup view



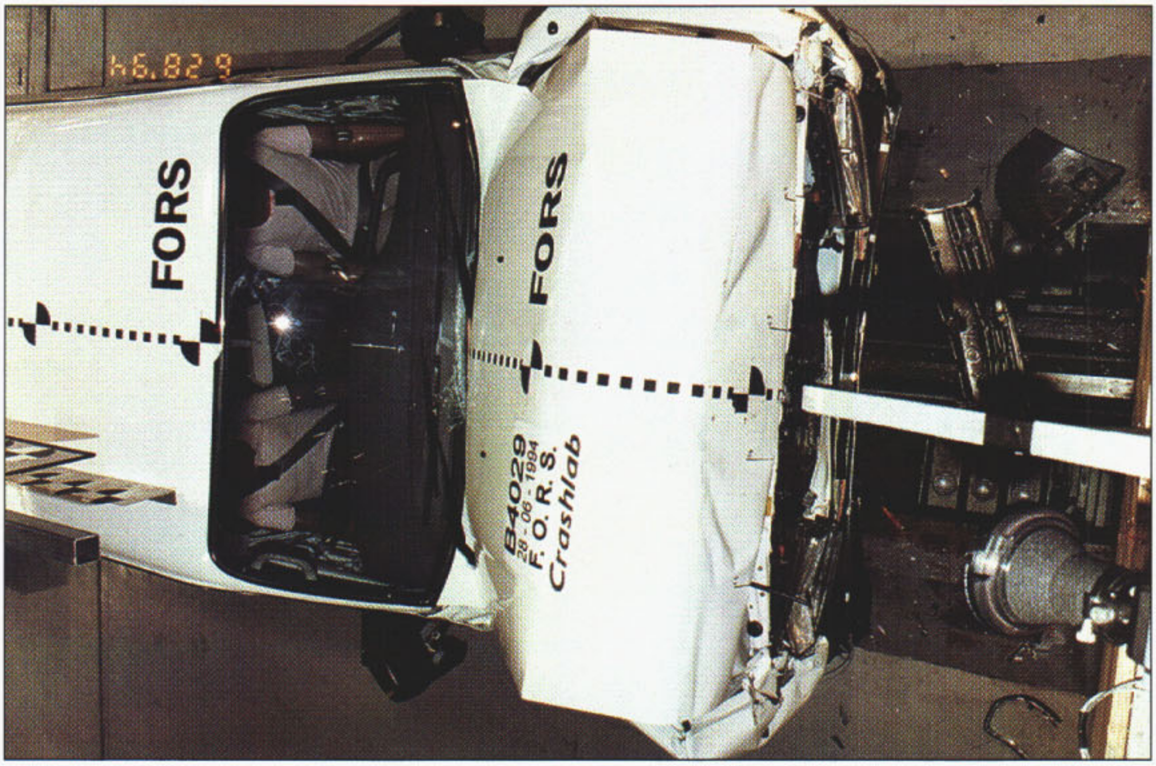
B4028 - Post-test passenger's side closeup view



B4029 - Post-test overall view

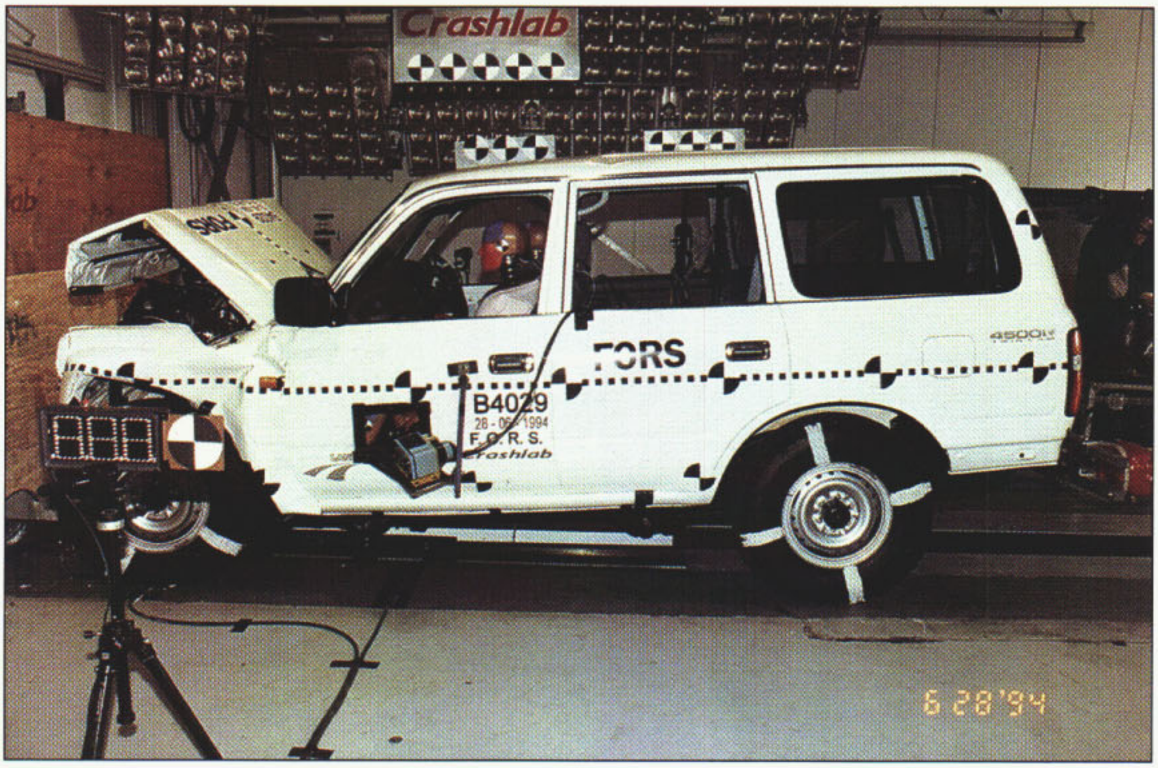


B4029 - Post-test overhead view

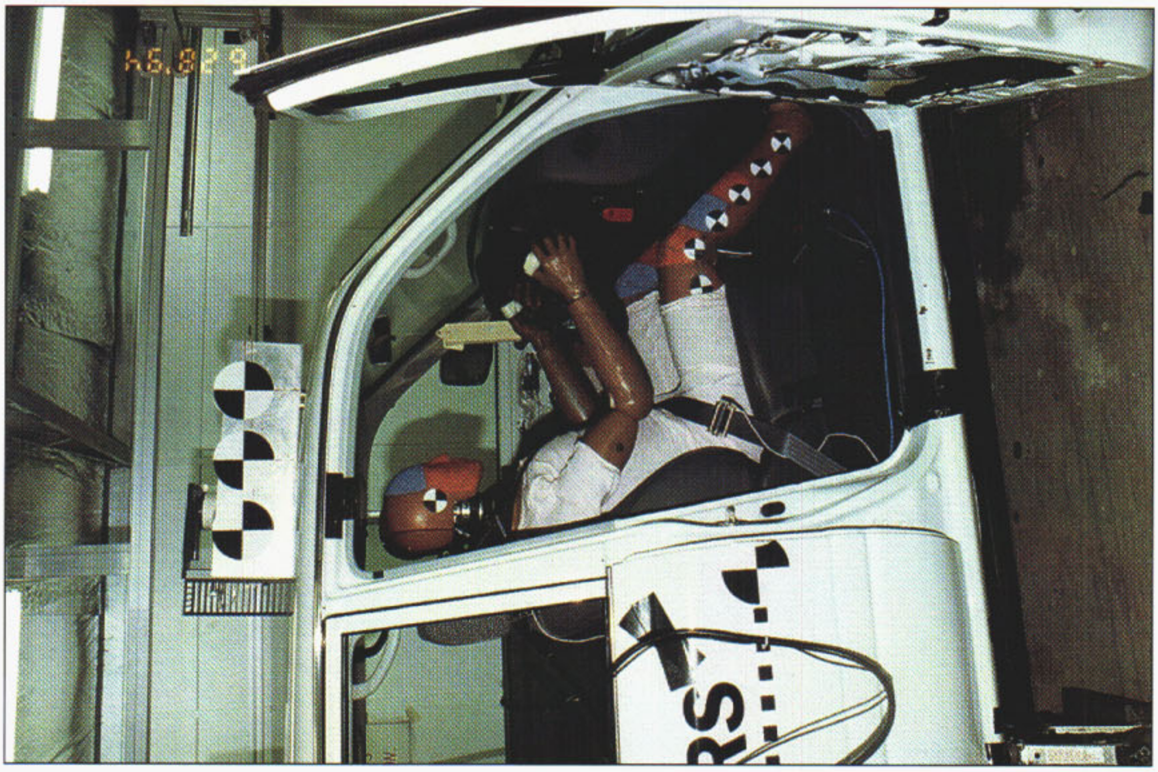


B4029 - Post-test driver's side view

B4029 - Post-test passenger's side view



B4029 - Pre-test driver's side closeup view

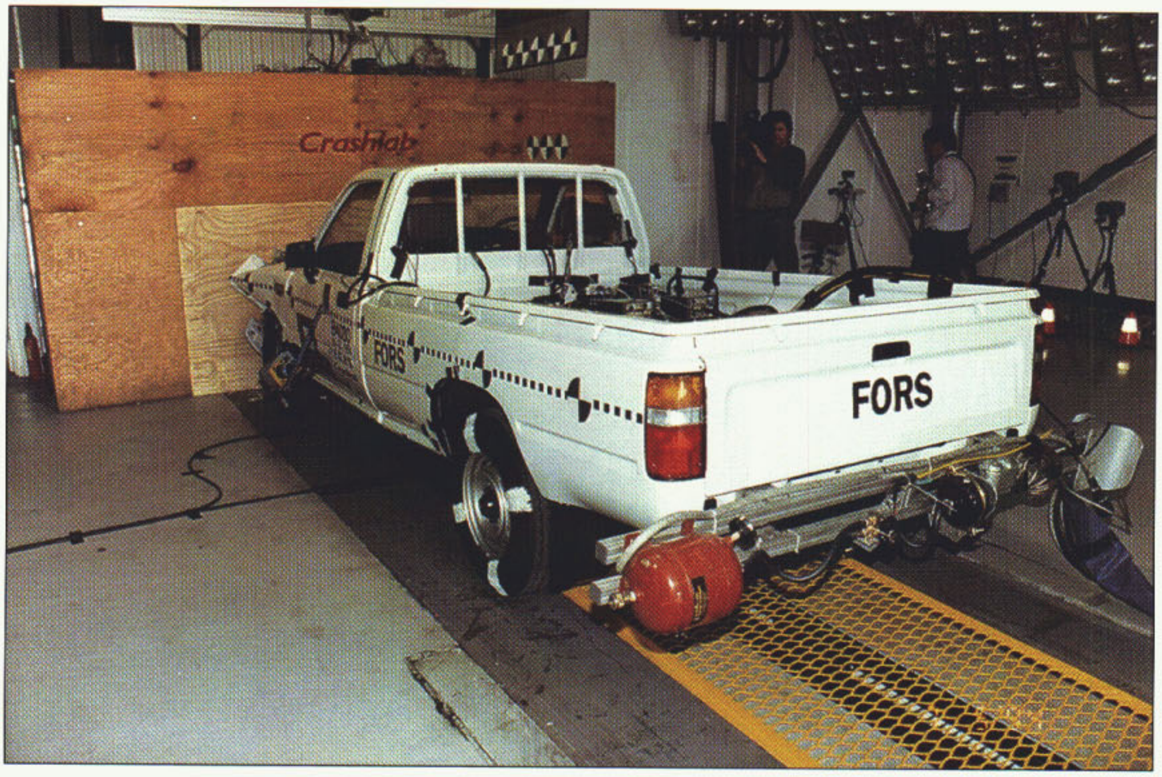


B4029 - Post-test driver's side closeup view

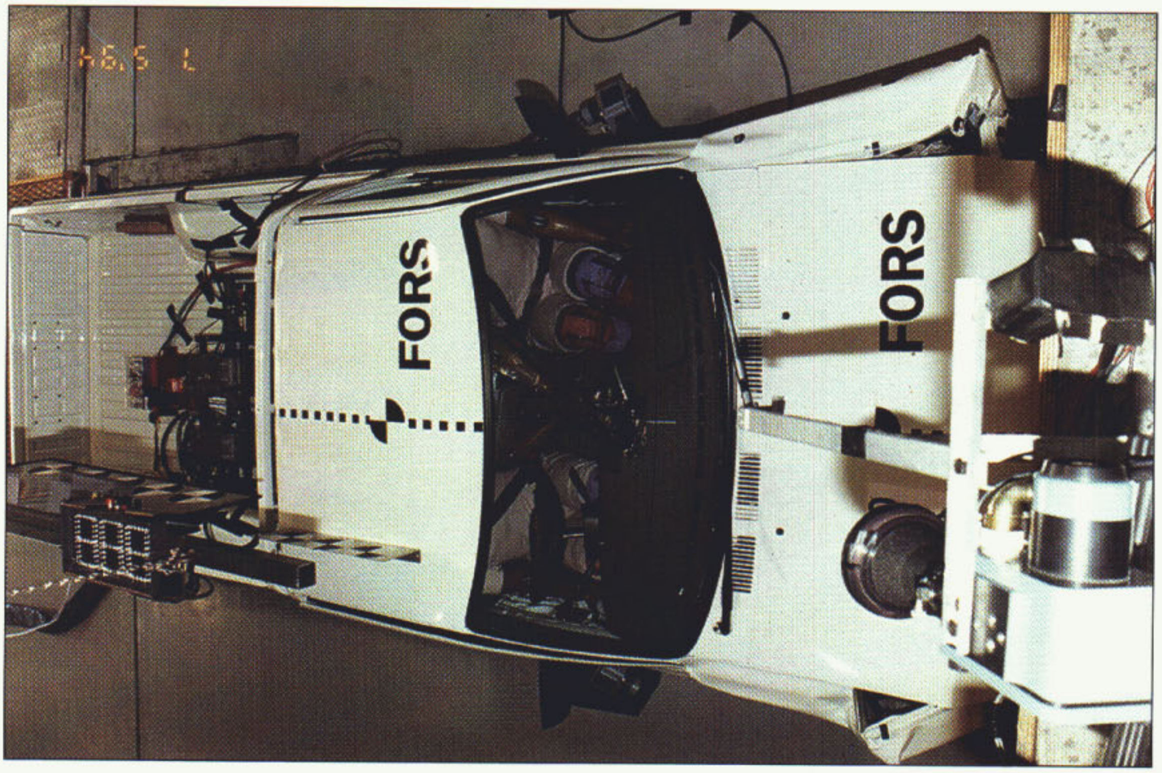
B4029 - Pre-test passenger's side closeup view

B4029 - Post-test passenger's side closeup view

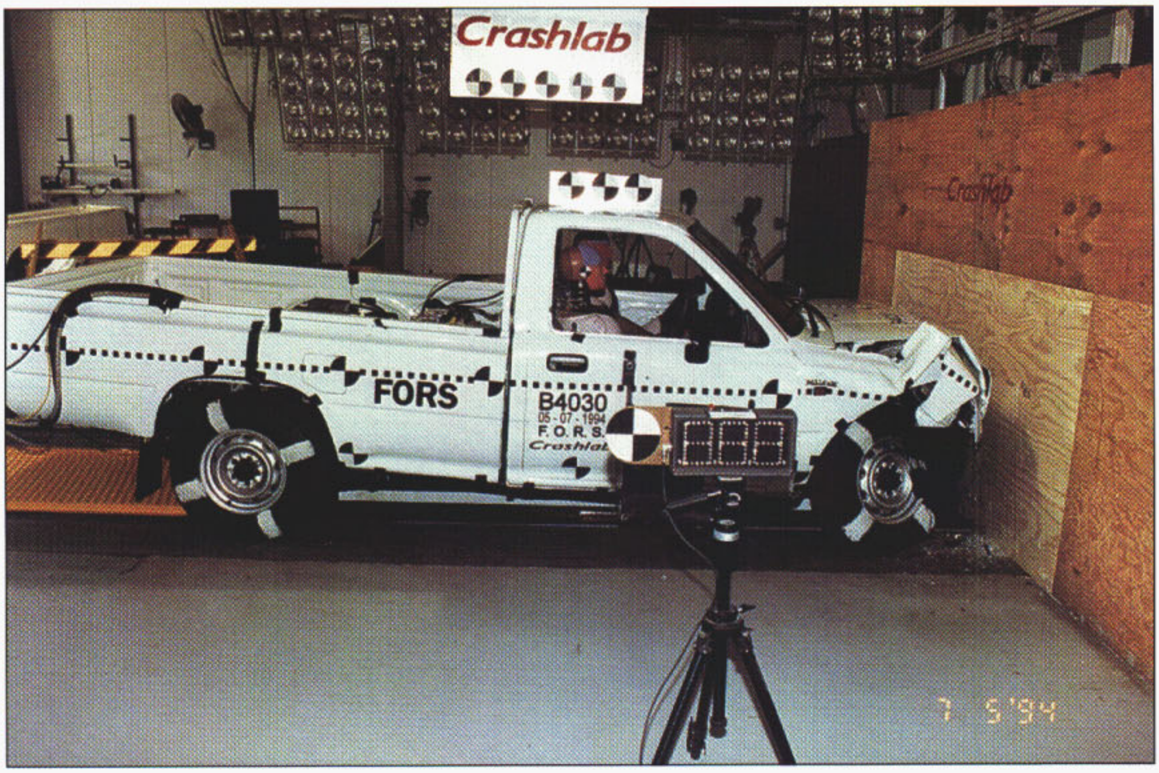
B4030 - Post-test overall view



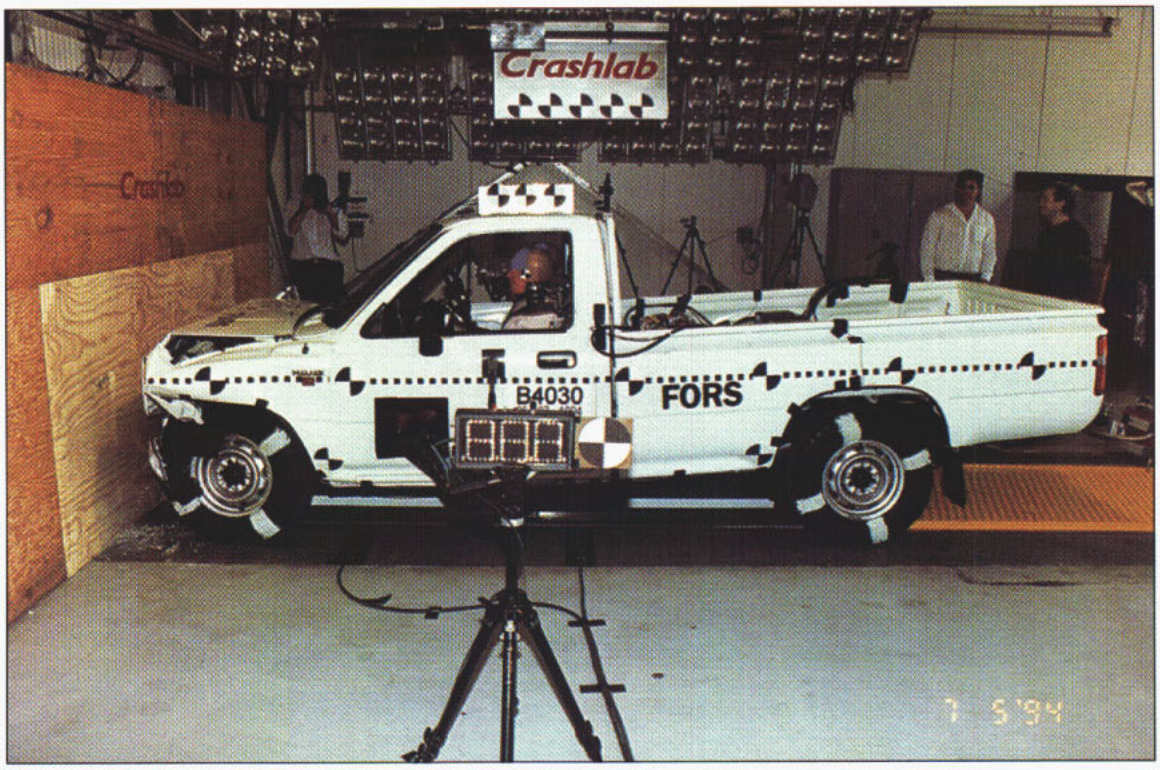
B4030 - Post-test overhead view



B4030 - Post-test driver's side view



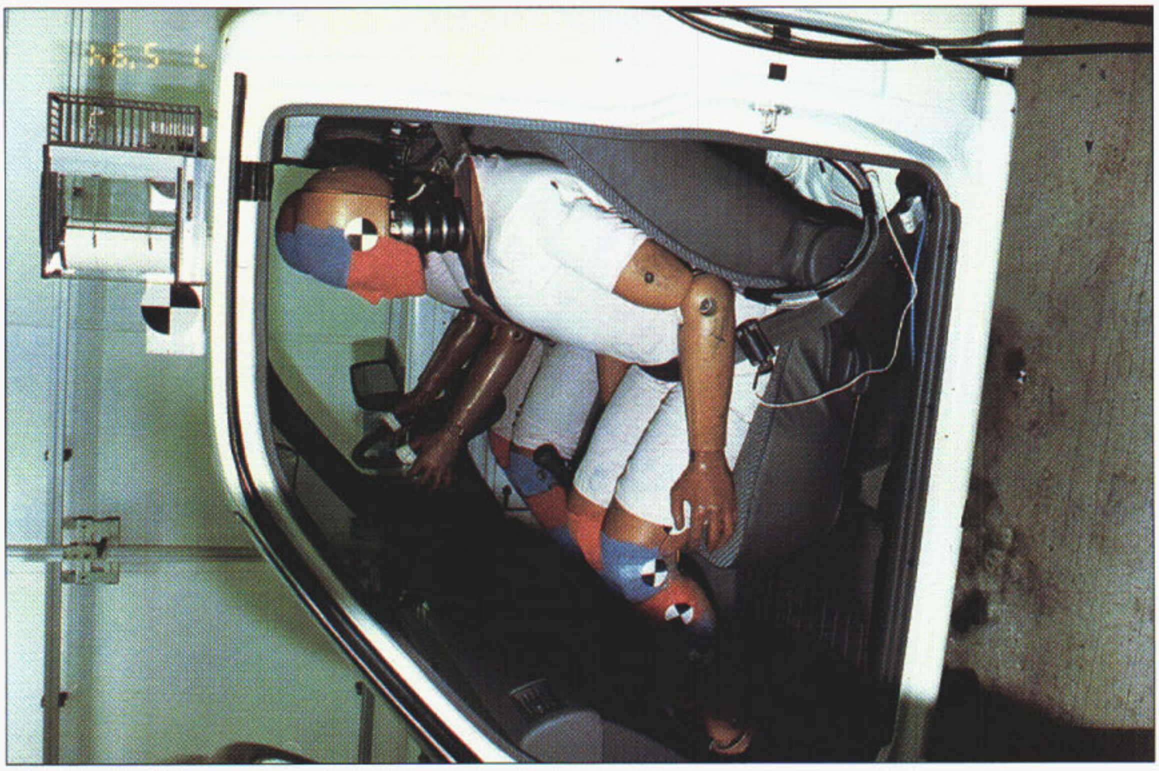
B4030 - Post-test passenger's side view



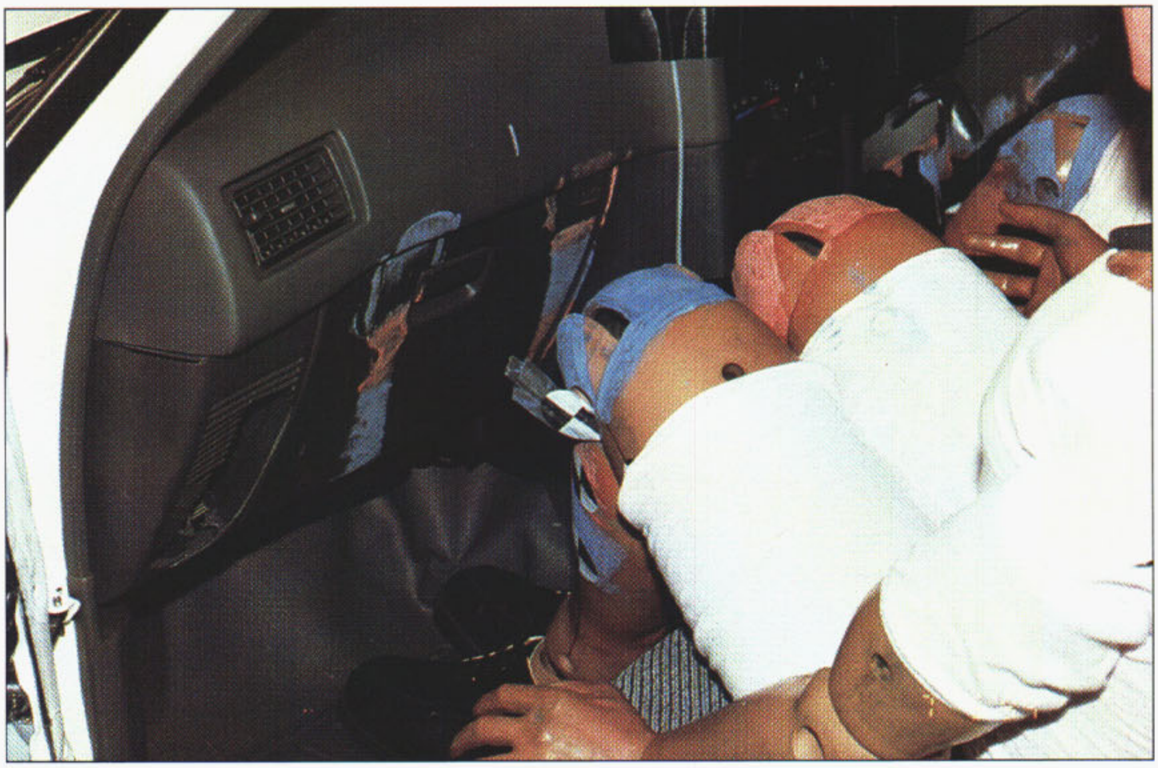
B4030 - Pre-test driver's side closeup view

B4030 - Post-test driver's side closeup view

B4030 - Pre-test passenger's side closeup view

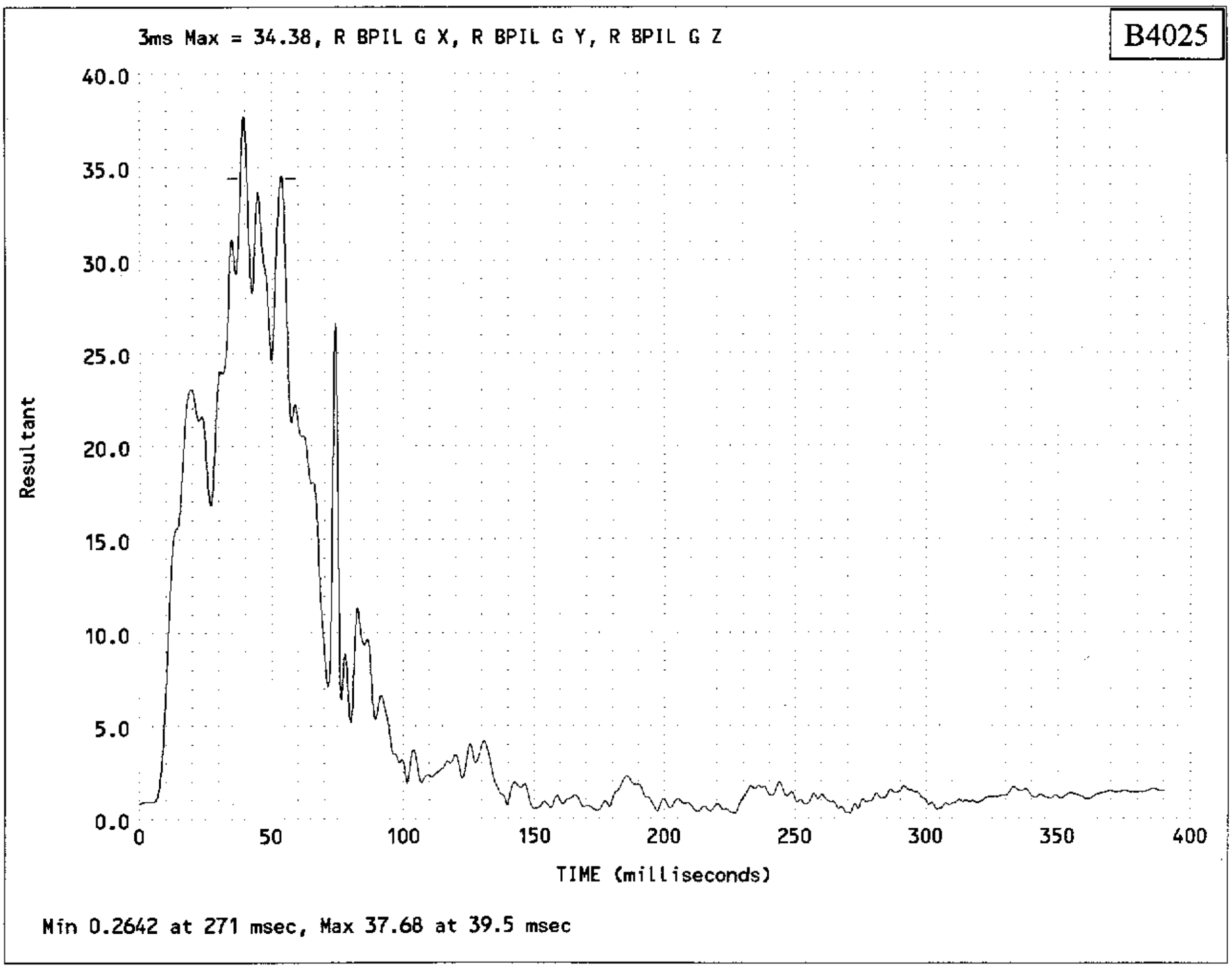


B4030 - Post-test passenger's side closeup view



APPENDIX 7

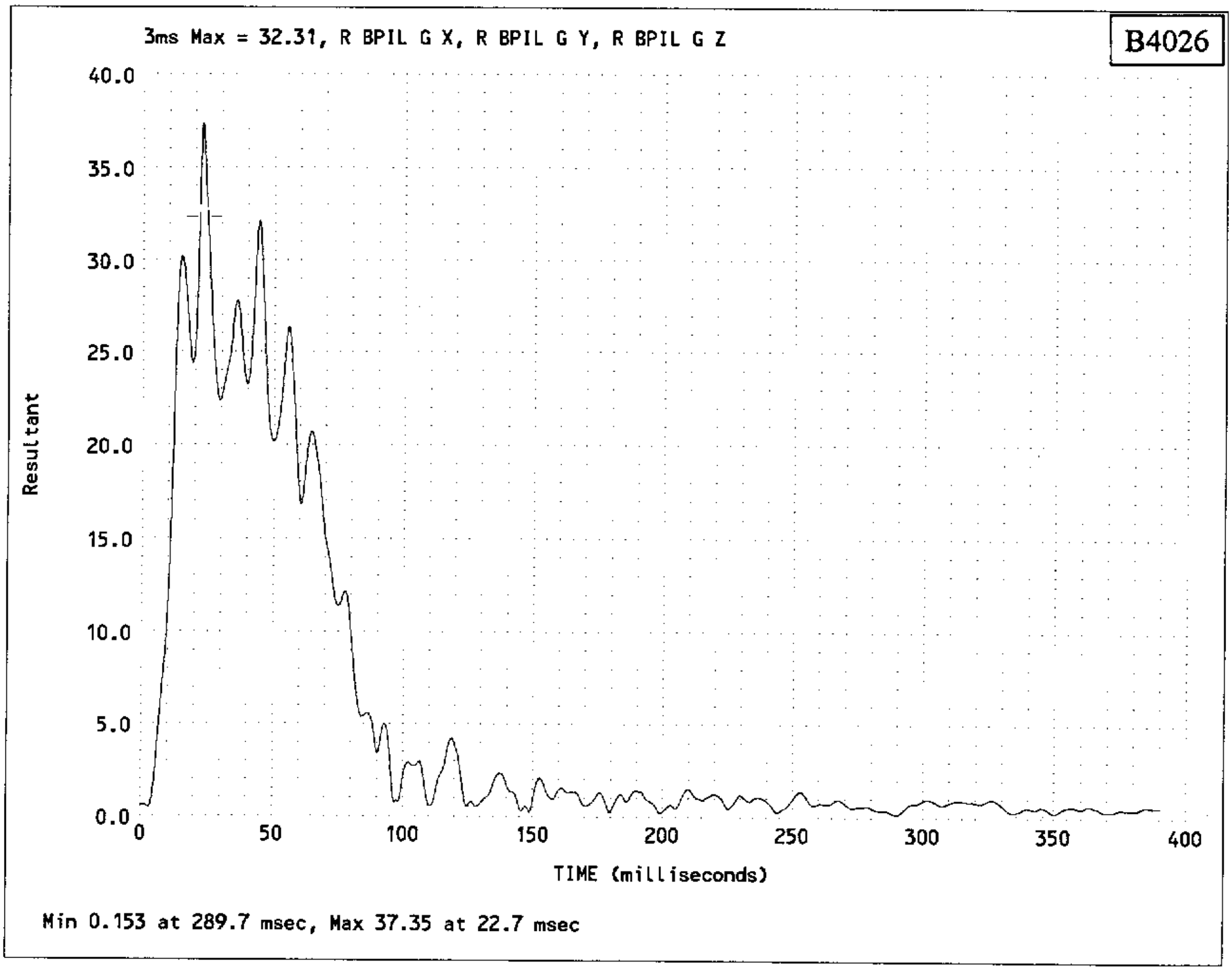
Test Vehicle Crash Pulses



Channel: 4
Sensitivity: -25.04
Offset: 2.3394 V
Sampling Rate: 10000/s
PGF Gain: 1
Analog Filter: 1650 Hz
Transducer Code: 199/ET53 940712
Transducer Type: 7231-750C
Remarks: FOR4B TIM44 G=200 ACCEL MOUNTED 180 DEG

Channel: 5
Sensitivity: -24.9
Offset: 0.95215 V
Sampling Rate: 10000/s
PGF Gain: 1
Analog Filter: 1650 Hz
Transducer Code: 076/ADMF2 940712
Transducer Type: 7231-750C
Remarks: FOR4B TIM45 G=200 ACCEL MOUNTED 180 DEG

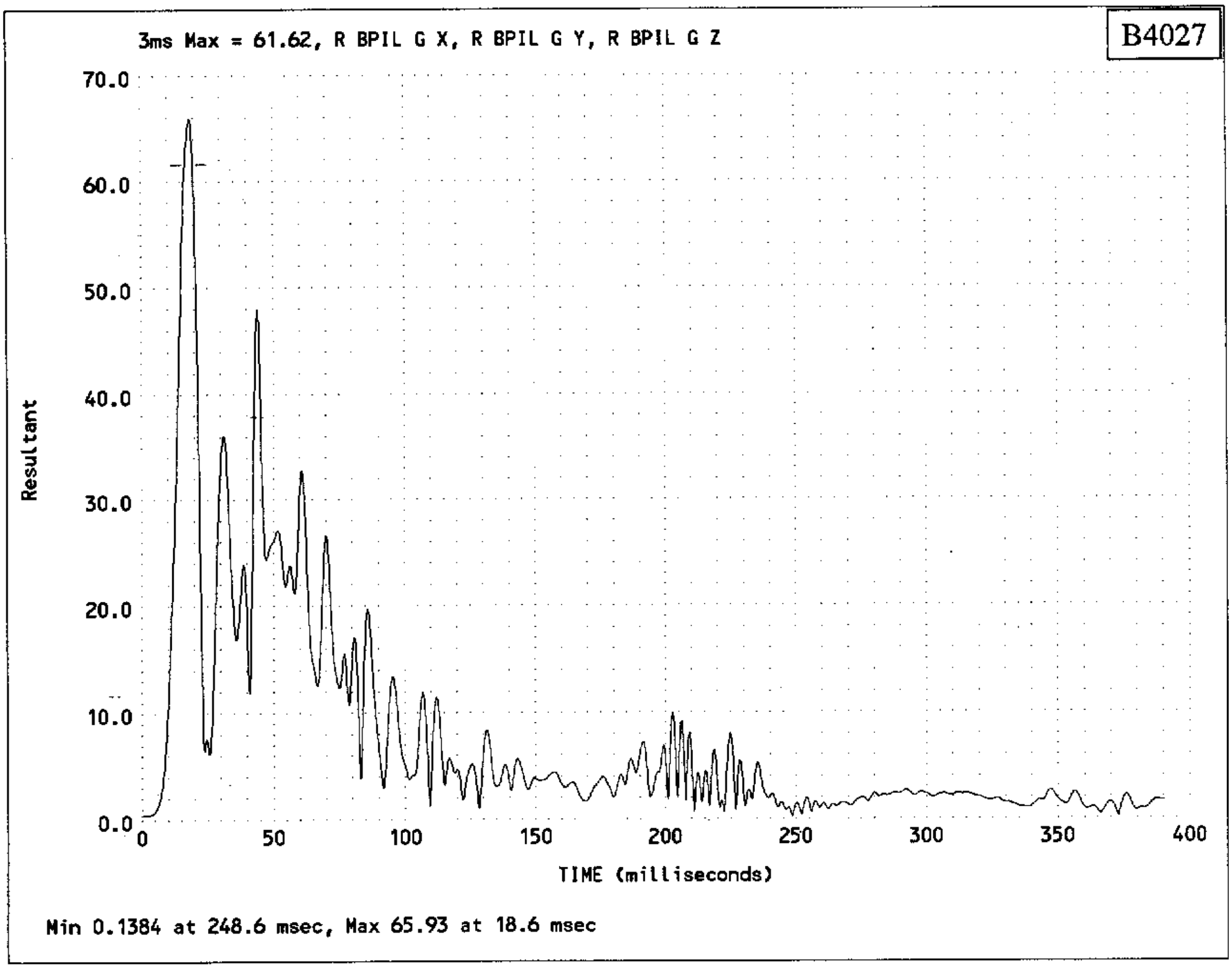
Channel: 6
Sensitivity: -25.15
Offset: 4.4897 V
Sampling Rate: 10000/s
PGF Gain: 1
Analog Filter: 1650 Hz
Transducer Code: 065/AD4R4 940712
Transducer Type: 7231-750C
Remarks: FOR4B TIM46 G=200 ACCEL MOUNTED 180 DEG



Channel: 4
Sensitivity: -25.04
Offset: 2.3921 V
Sampling Rate: 10000/s
PGF Gain: 1
Analog Filter: 1650 Hz
Transducer Code: 199/ET53 940712
Transducer Type: 7231-750C
Remarks: FOR4B TIM44 G=200 ACCEL MOUNTED 180 DEG

Channel: 5
Sensitivity: -24.9
Offset: 0.83838 V
Sampling Rate: 10000/s
PGF Gain: 1
Analog Filter: 1650 Hz
Transducer Code: 076/ADMF2 940712
Transducer Type: 7231-750C
Remarks: FOR4B TIM45 G=200 ACCEL MOUNTED 180 DEG

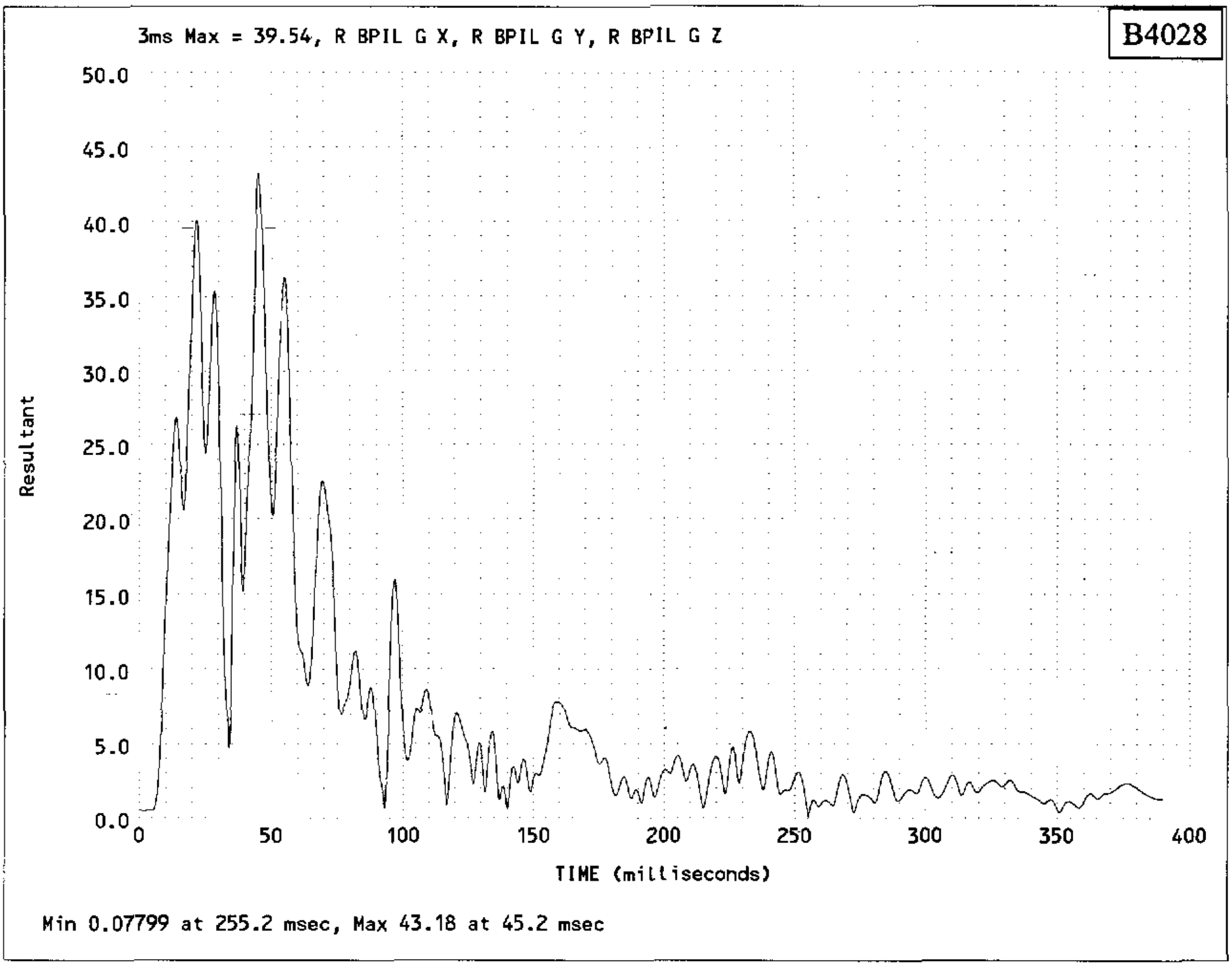
Channel: 6
Sensitivity: -25.15
Offset: 4.5098 V
Sampling Rate: 10000/s
PGF Gain: 1
Analog Filter: 1650 Hz
Transducer Code: 065/AD4R4 940712
Transducer Type: 7231-750C
Remarks: FOR4B TIM46 G=200 ACCEL MOUNTED 180 DEG



Channel: 4
Sensitivity: -25.04
Offset: 2.3599 V
Sampling Rate: 10000/s
PGF Gain: 1
Analog Filter: 1650 Hz
Transducer Code: 199/ET53 940712
Transducer Type: 7231-750C
Remarks: FOR4B TIM44 G=200 ACCEL MOUNTED 180 DEG

Channel: 5
Sensitivity: -24.9
Offset: 0.89307 V
Sampling Rate: 10000/s
PGF Gain: 1
Analog Filter: 1650 Hz
Transducer Code: 076/ADMF2 940712
Transducer Type: 7231-750C
Remarks: FOR4B TIM45 G=200 ACCEL MOUNTED 180 DEG

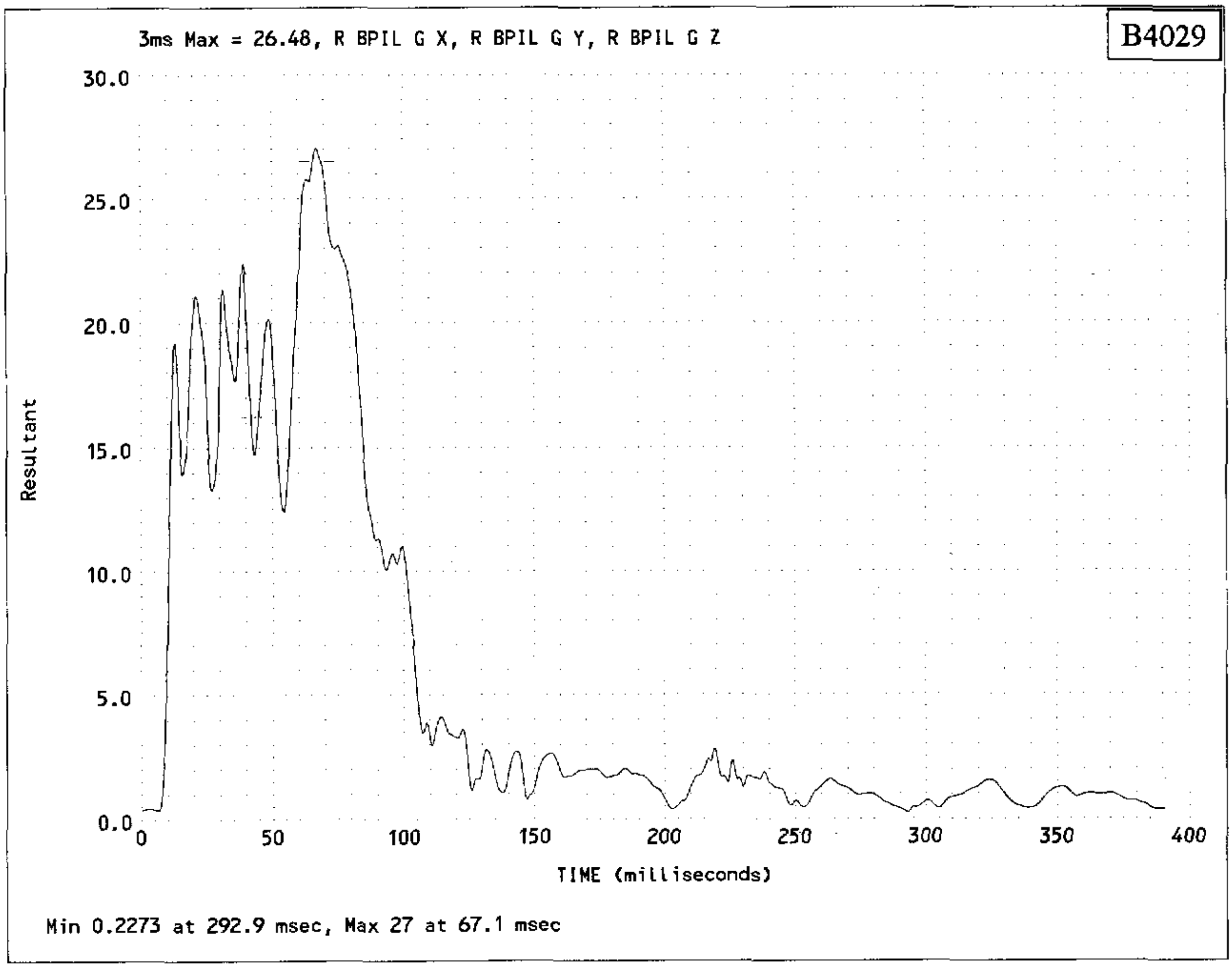
Channel: 6
Sensitivity: -25.15
Offset: 4.5312 V
Sampling Rate: 10000/s
PGF Gain: 1
Analog Filter: 1650 Hz
Transducer Code: 065/AD4R4 940712
Transducer Type: 7231-750C
Remarks: FOR4B TIM46 G=200 ACCEL MOUNTED 180 DEG



Channel: 4
Sensitivity: -25.04
Offset: 2.312 V
Sampling Rate: 10000/s
PGF Gain: 1
Analog Filter: 1650 Hz
Transducer Code: 199/ET53 940712
Transducer Type: 7231-750C
Remarks: FOR4B TIM44 G=200 ACCEL MOUNTED 180 DEG

Channel: 5
Sensitivity: -24.9
Offset: 0.90479 V
Sampling Rate: 10000/s
PGF Gain: 1
Analog Filter: 1650 Hz
Transducer Code: 076/ADMF2 940712
Transducer Type: 7231-750C
Remarks: FOR4B TIM45 G=200 ACCEL MOUNTED 180 DEG

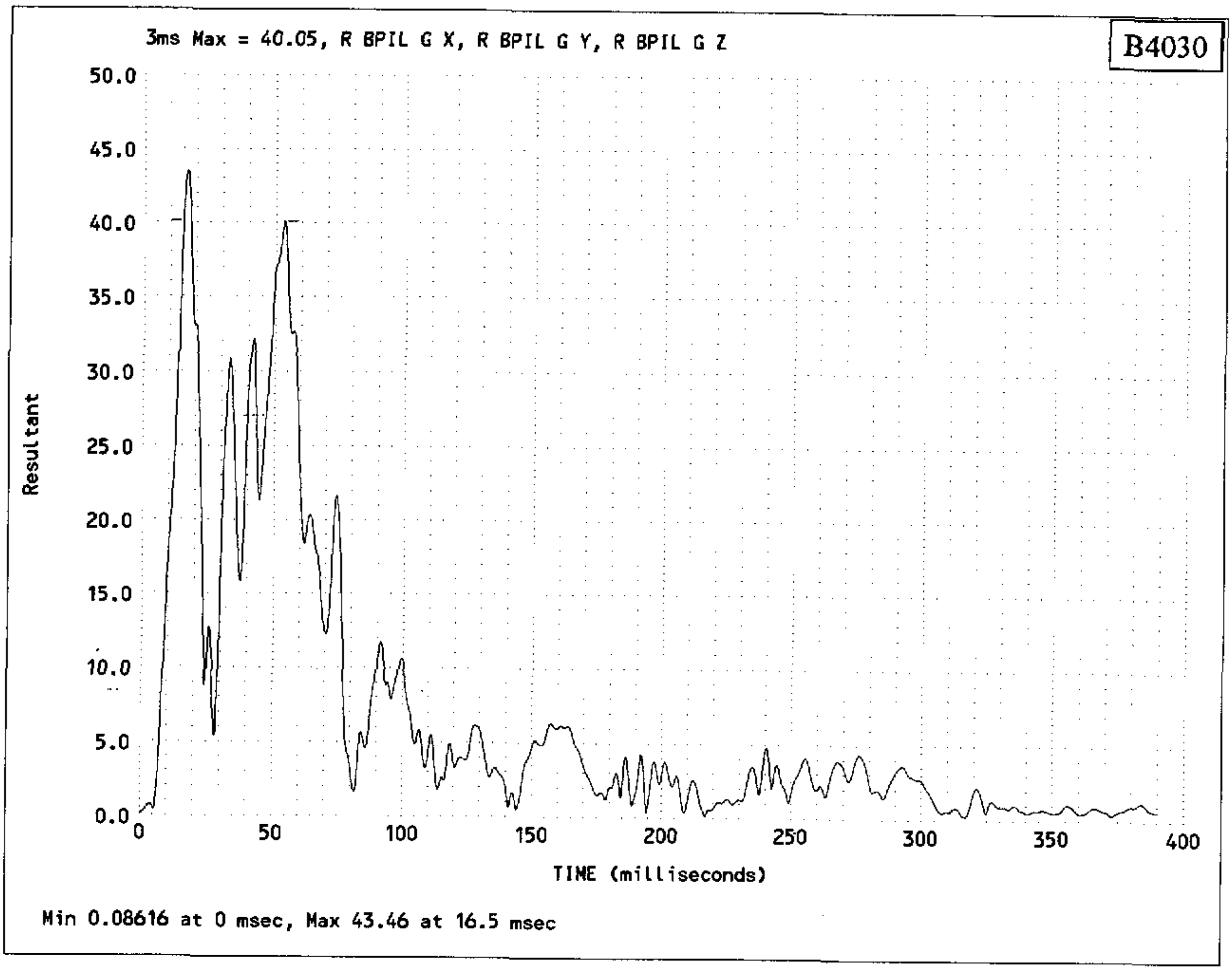
Channel: 6
Sensitivity: -25.15
Offset: 4.5112 V
Sampling Rate: 10000/s
PGF Gain: 1
Analog Filter: 1650 Hz
Transducer Code: 065/AD4R4 940712
Transducer Type: 7231-750C
Remarks: FOR4B TIM46 G=200 ACCEL MOUNTED 180 DEG



Channel: 4
Sensitivity: -25.04
Offset: 2.2612 V
Sampling Rate: 10000/s
PGF Gain: 1
Analog Filter: 1650 Hz
Transducer Code: 199/ET53 940712
Transducer Type: 7231-750C
Remarks: FOR4B TIM44 G=200 ACCEL MOUNTED 180 DEG

Channel: 5
Sensitivity: -24.9
Offset: 0.91309 V
Sampling Rate: 10000/s
PGF Gain: 1
Analog Filter: 1650 Hz
Transducer Code: 076/ADMF2 940712
Transducer Type: 7231-750C
Remarks: FOR4B TIM45 G=200 ACCEL MOUNTED 180 DEG

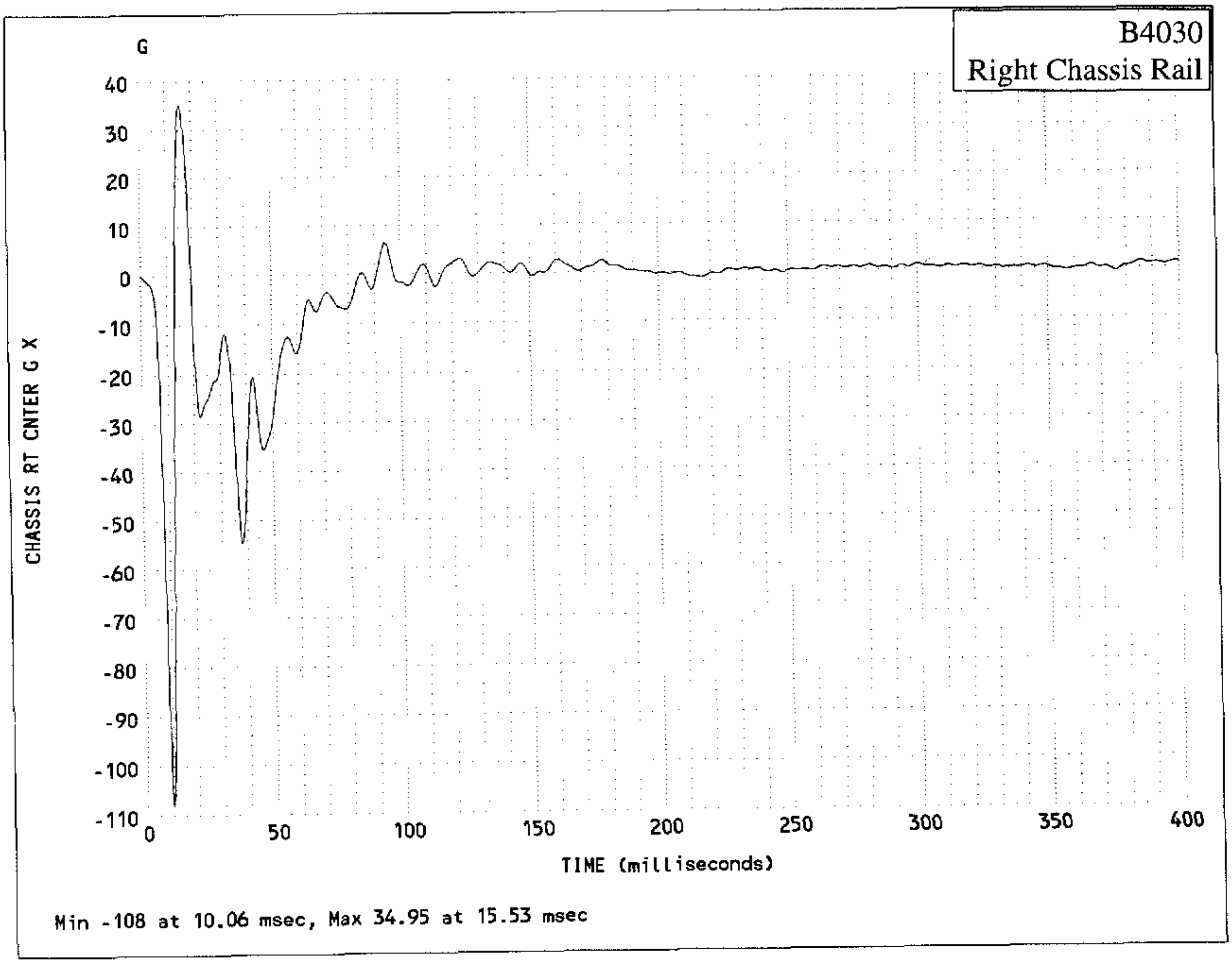
Channel: 6
Sensitivity: -25.15
Offset: 4.5312 V
Sampling Rate: 10000/s
PGF Gain: 1
Analog Filter: 1650 Hz
Transducer Code: 065/AD4R4 940712
Transducer Type: 7231-750C
Remarks: FOR4B TIM46 G=200 ACCEL MOUNTED 180 DEG



Channel: 4
Sensitivity: -25.04
Offset: 2.2773 V
Sampling Rate: 10000/s
PGF Gain: 1
Analog Filter: 1650 Hz
Transducer Code: 199/ET53 940712
Transducer Type: 7231-750C
Remarks: FOR4B TIM44 G=200 ACCEL MOUNTED 180 DEG

Channel: 5
Sensitivity: -24.9
Offset: 0.98682 V
Sampling Rate: 10000/s
PGF Gain: 1
Analog Filter: 1650 Hz
Transducer Code: 076/ADMF2 940712
Transducer Type: 7231-750C
Remarks: FOR4B TIM45 G=200 ACCEL MOUNTED 180 DEG

Channel: 6
Sensitivity: -25.15
Offset: 4.5513 V
Sampling Rate: 10000/s
PGF Gain: 1
Analog Filter: 1650 Hz
Transducer Code: 065/AD4R4 940712
Transducer Type: 7231-750C
Remarks: FOR4B TIM46 G=200 ACCEL MOUNTED 180 DEG



Channel: 6

Sensor Name: Generic Linear/Ratiometric

Sensor Serial: T0060/A41C 940710

Brick Version: 9

Sampling Rate: 8048.9/s

Sampling Period: 0.00012424/s

Number of Points: 32759

Offset Points: 8048

Digital Filter: 100 Hz

APPENDIX 8

Data Bar Charts

Chart A8.1 Driver HIC 36

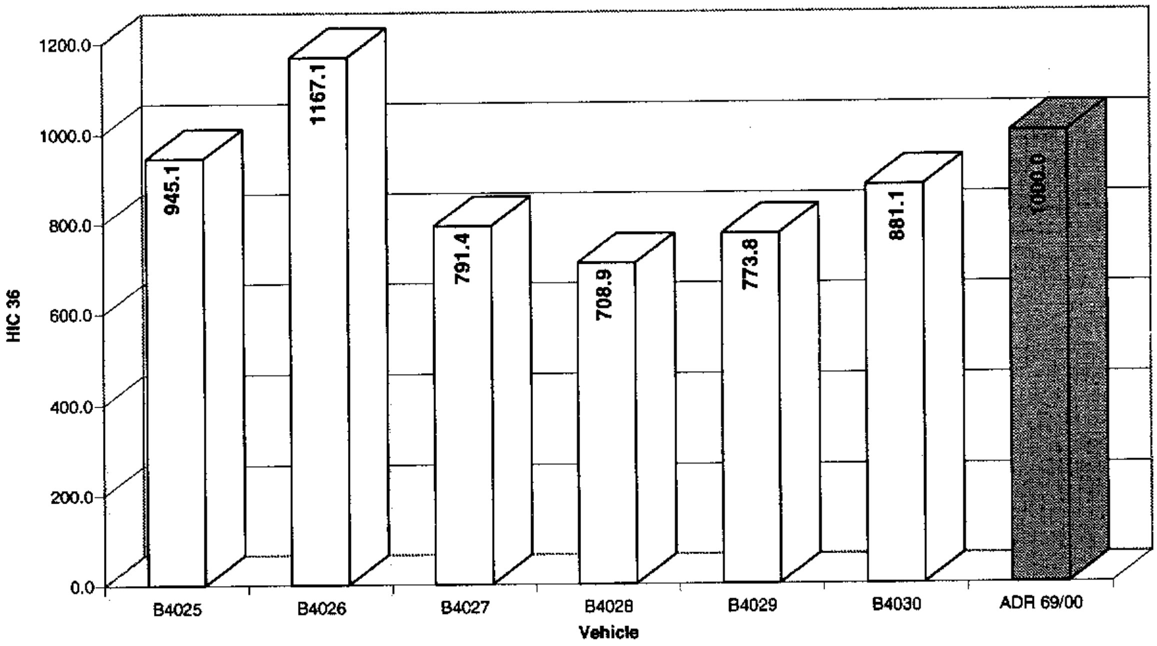


Chart A8.2 Front Passenger HIC 36

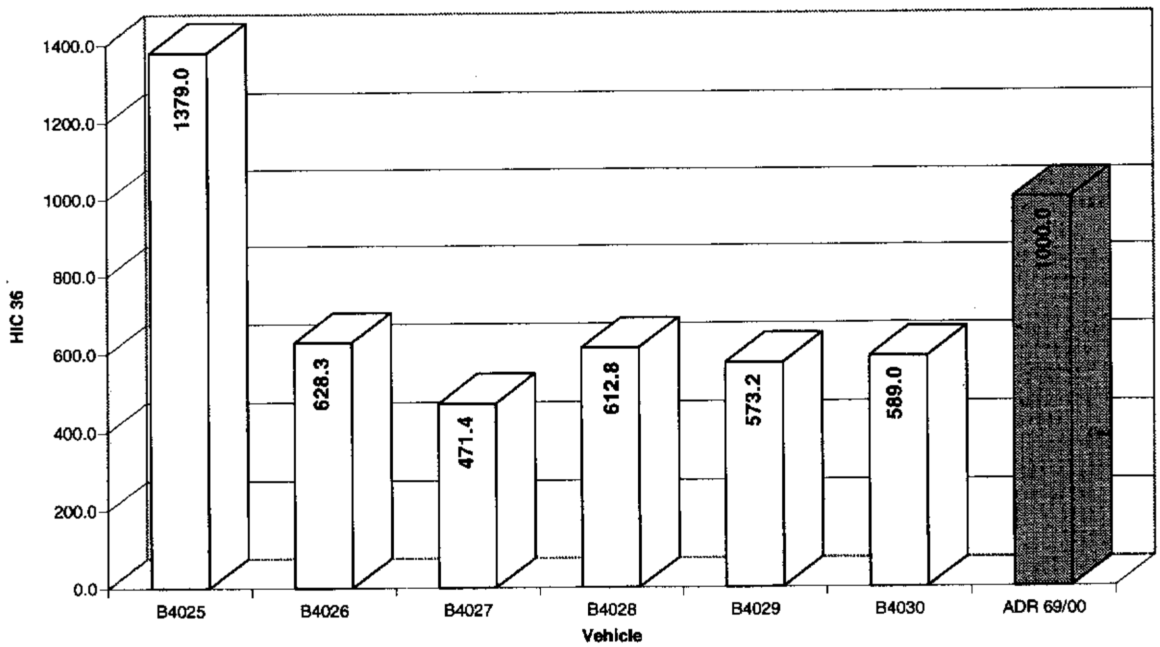


Chart A8.3 Driver HIC 15

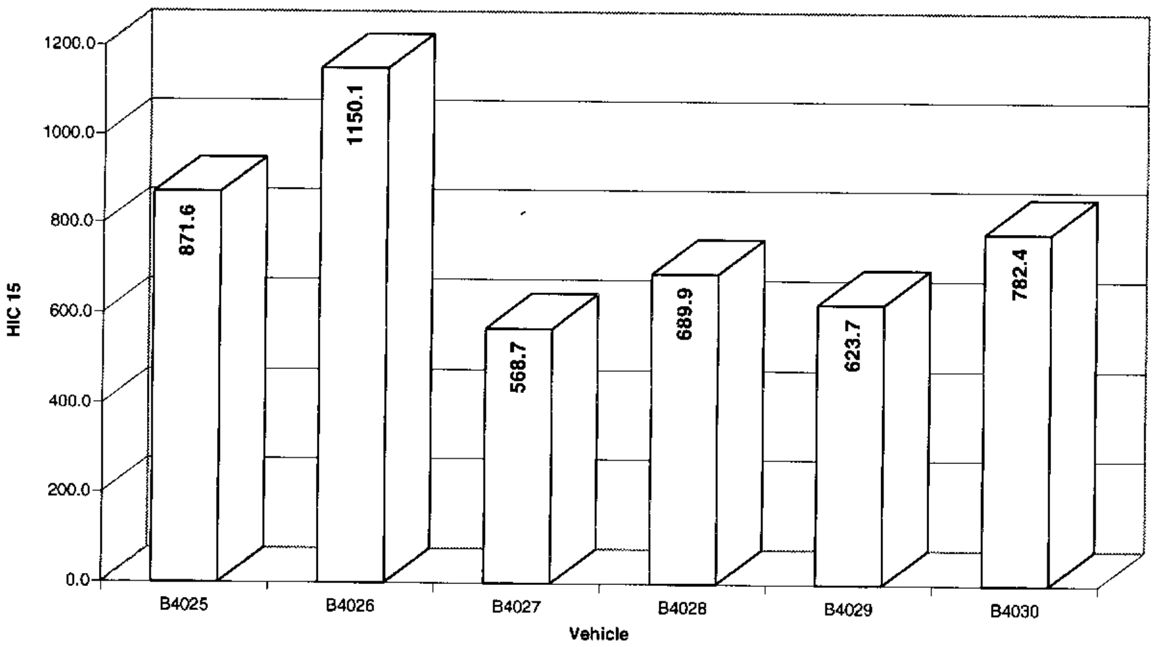
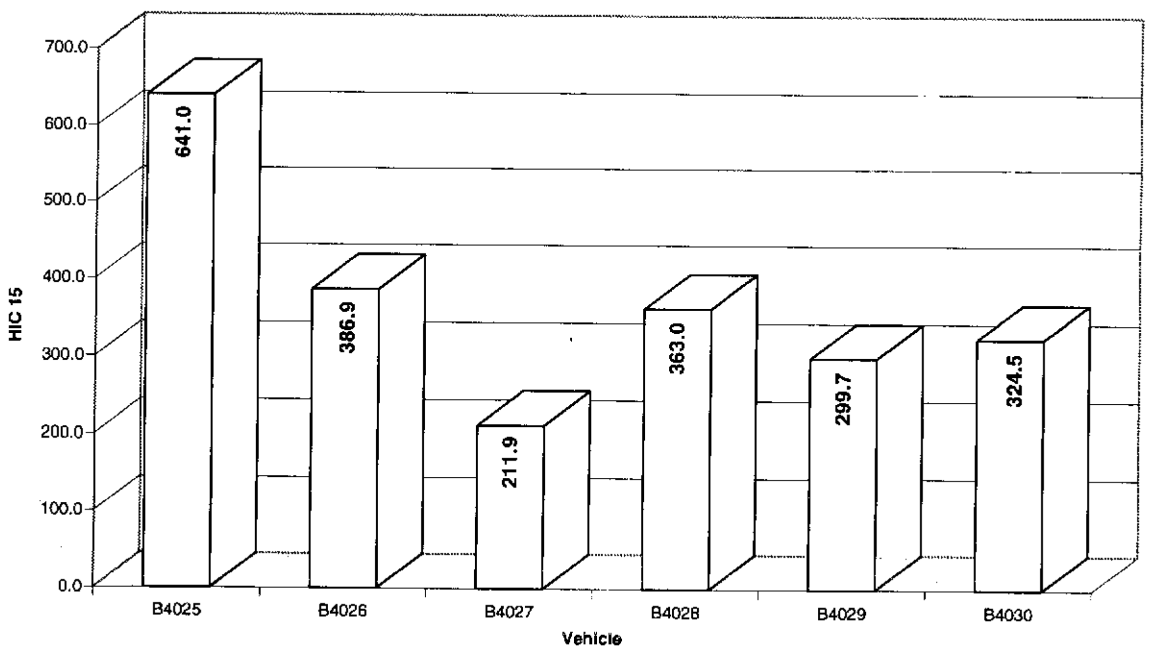


Chart A8.4 Front Passenger HIC 15



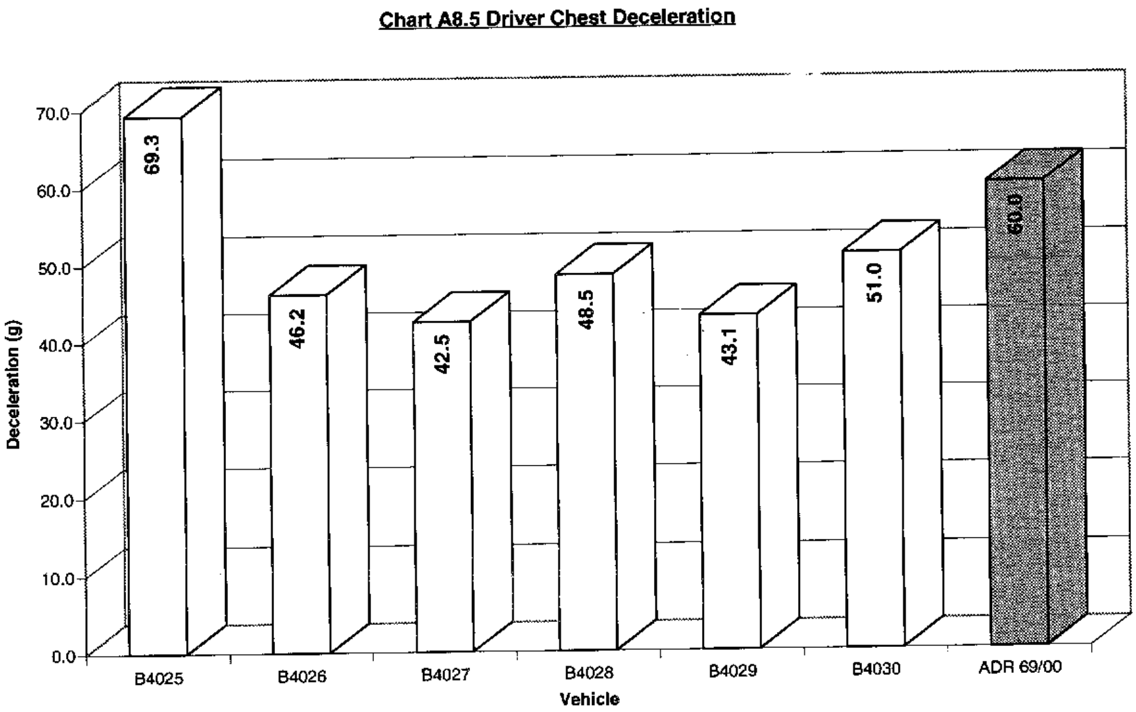


Chart A8.5 Driver Chest Deceleration
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Deceleration (g)
69.3
46.2
42.5
48.5
43.1
51.0
60.0
B4025
B4026
B4027
B4028
B4029
B4030
ADR 69/00
Vehicle

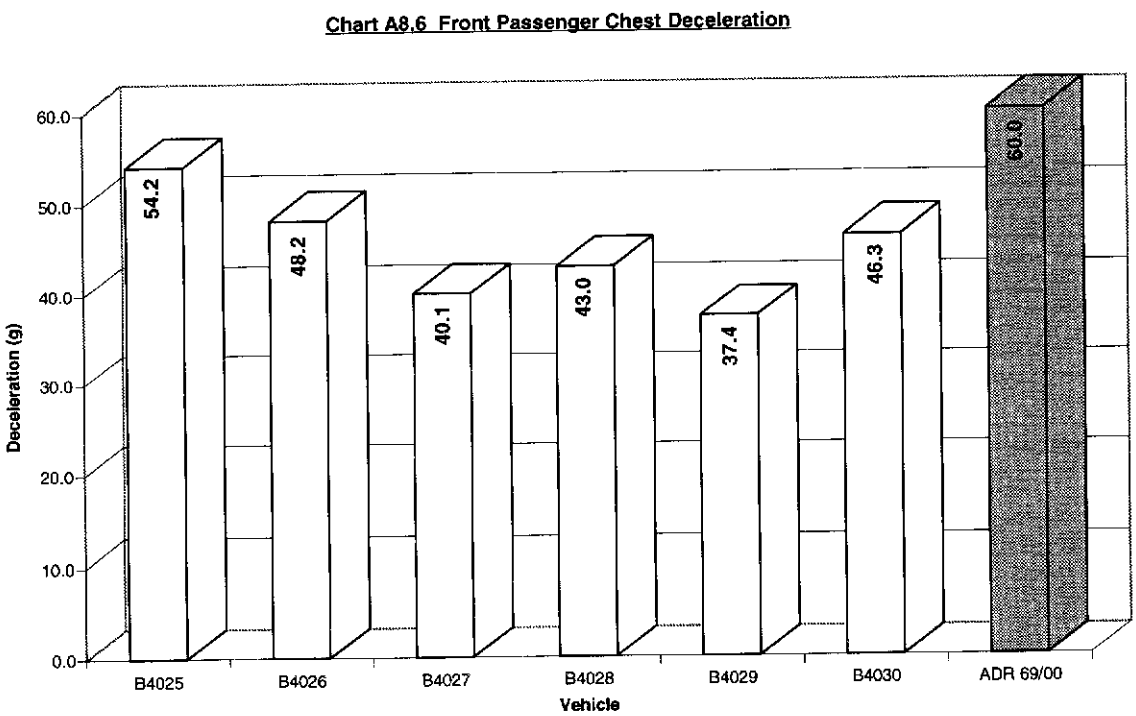


Chart A8.6 Front Passenger Chest Deceleration
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Deceleration (g)
54.2
48.2
40.1
43.0
37.4
46.3
60.0
B4025
B4026
B4027
B4028
B4029
B4030
ADR 69/00
Vehicle

Chart A8.7 Driver Chest Deflection at Sternum

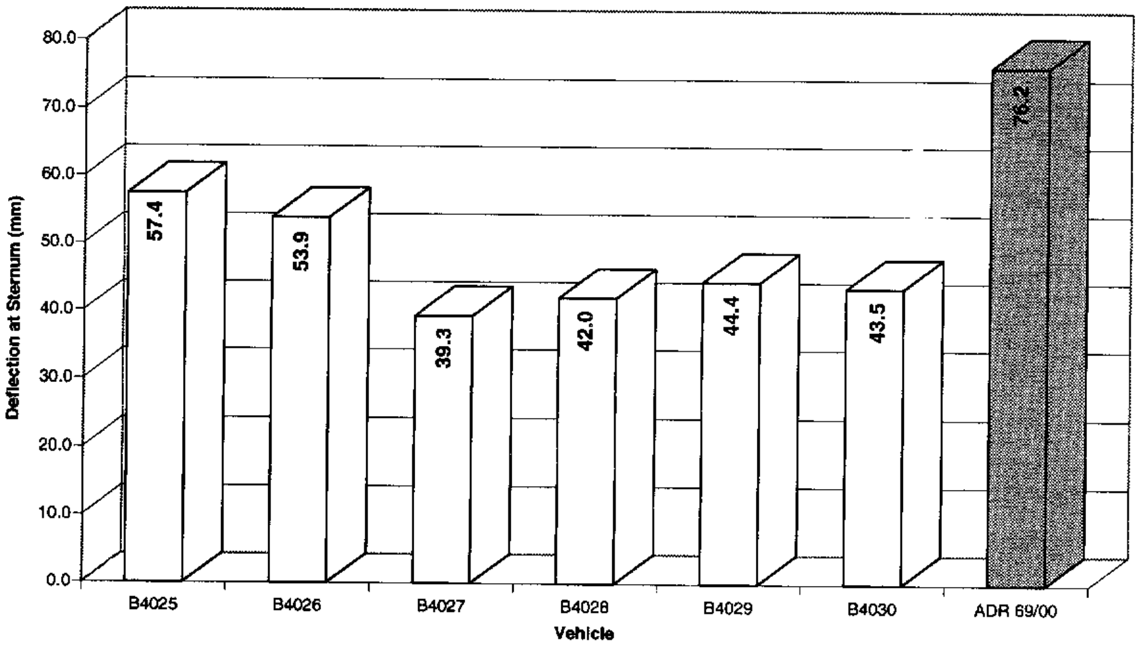


Chart A8.8 Front Passenger Chest Deflection at Sternum

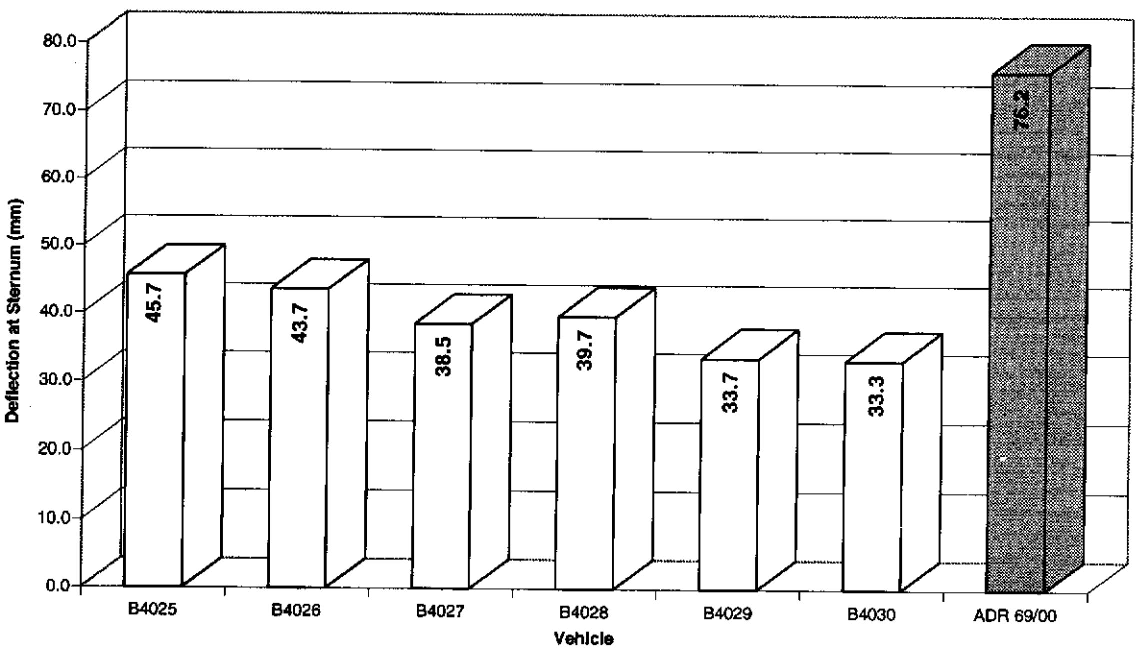


Chart A8.9 Driver Femur Loads

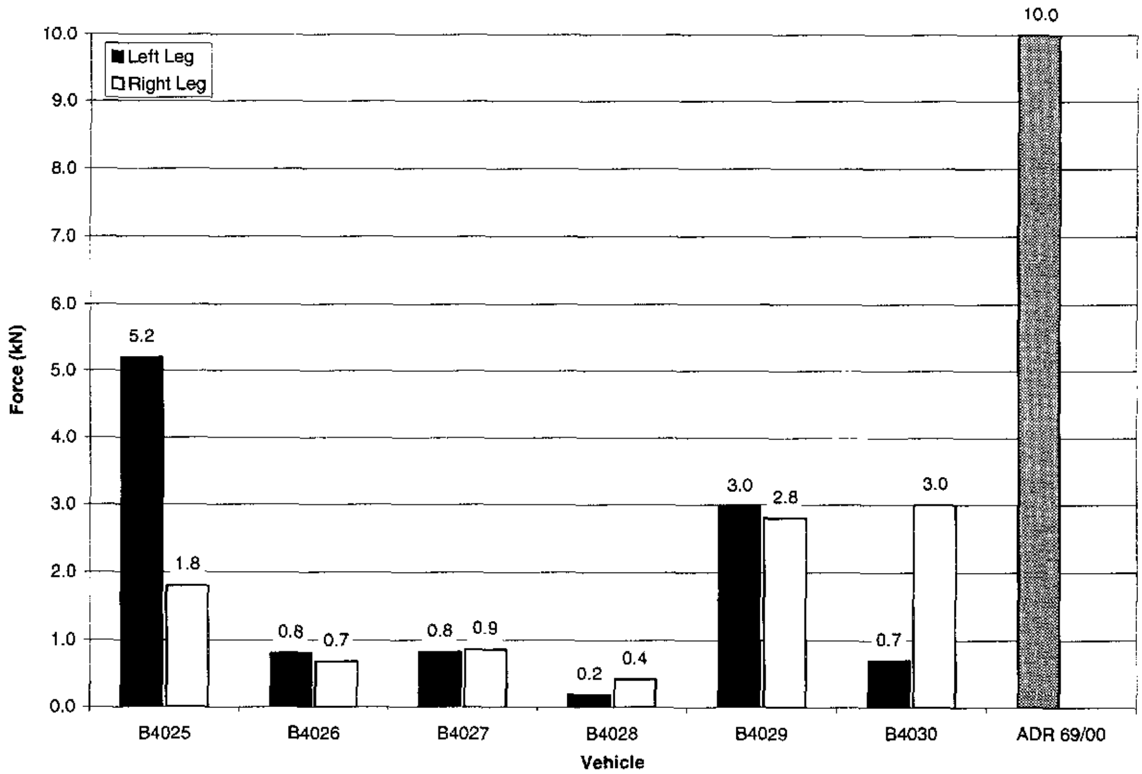


Chart A8.10 Front Passenger Femur Loads

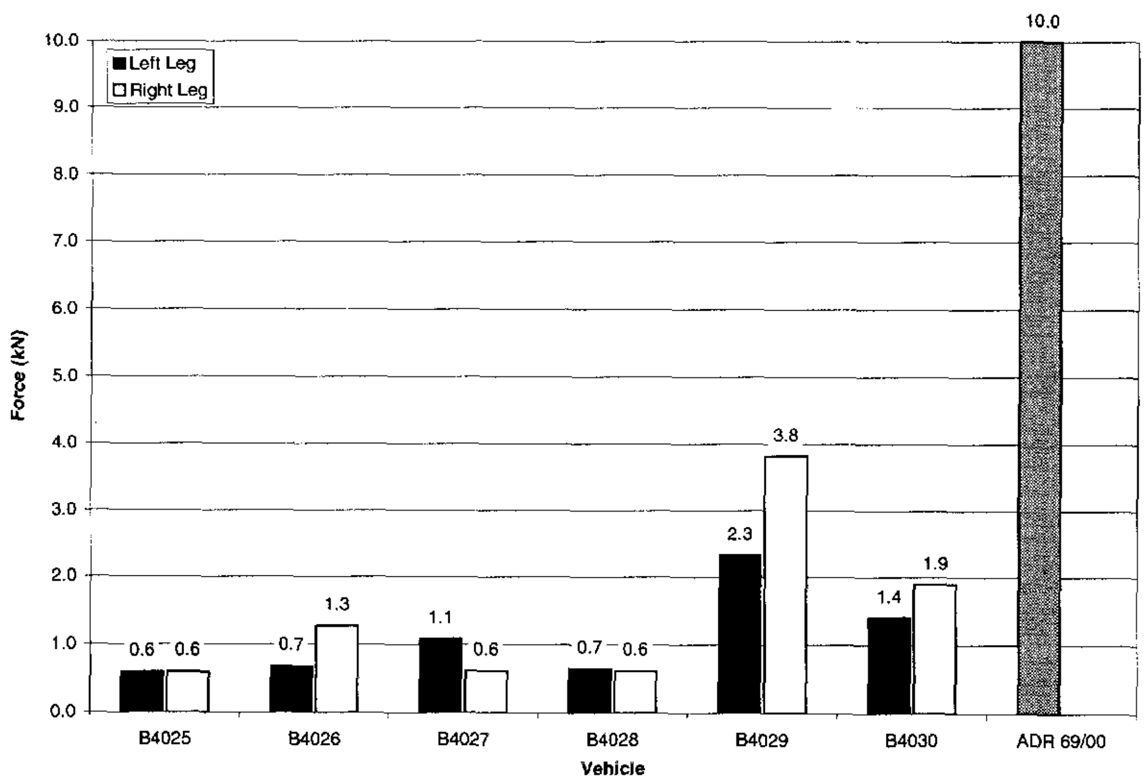


Chart A8.11 Driver Pelvic Deceleration

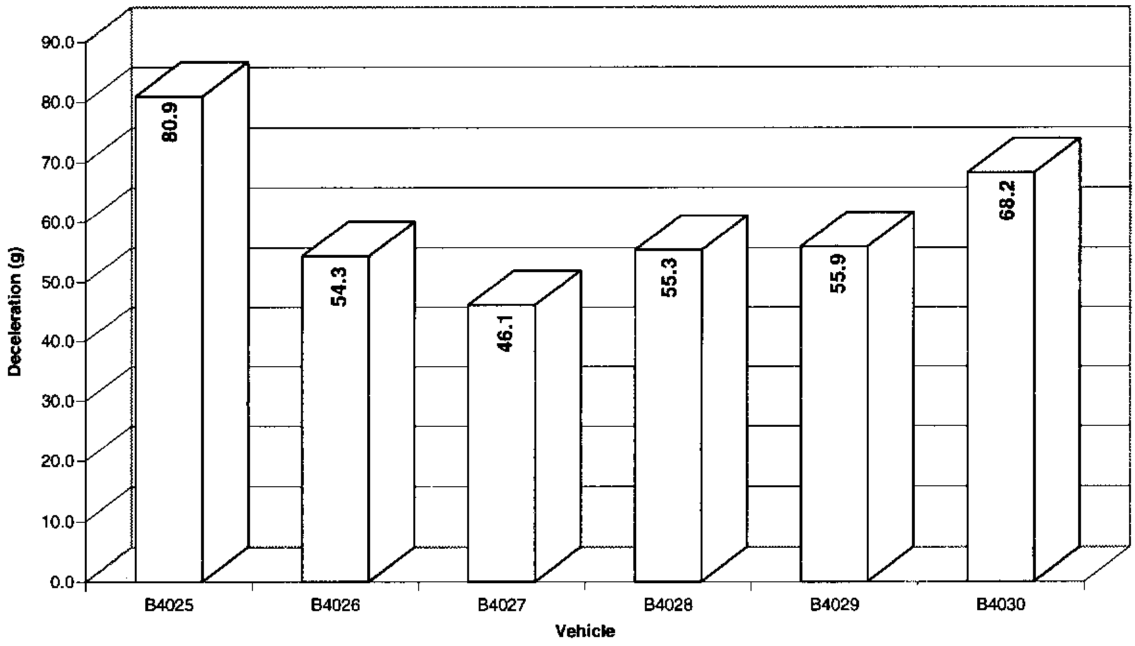


Chart A8.12 Front Passenger Pelvic Deceleration

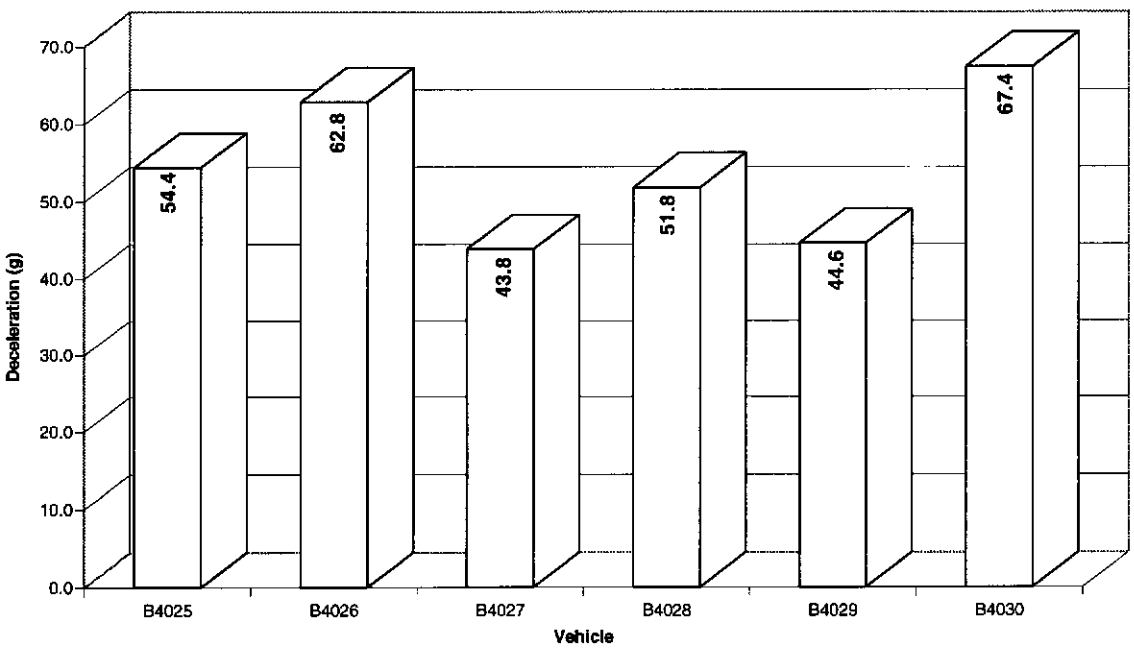


Chart A8.13 Driver Neck Moments

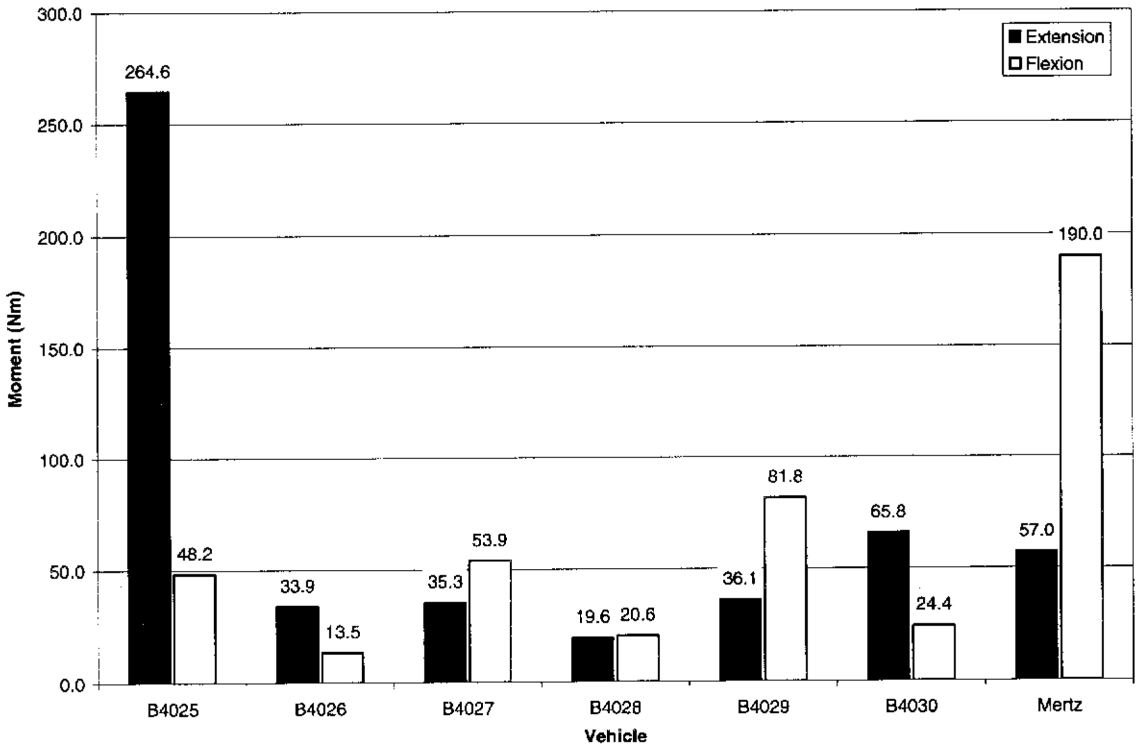


Chart A8.14 Front Passenger Neck Moments

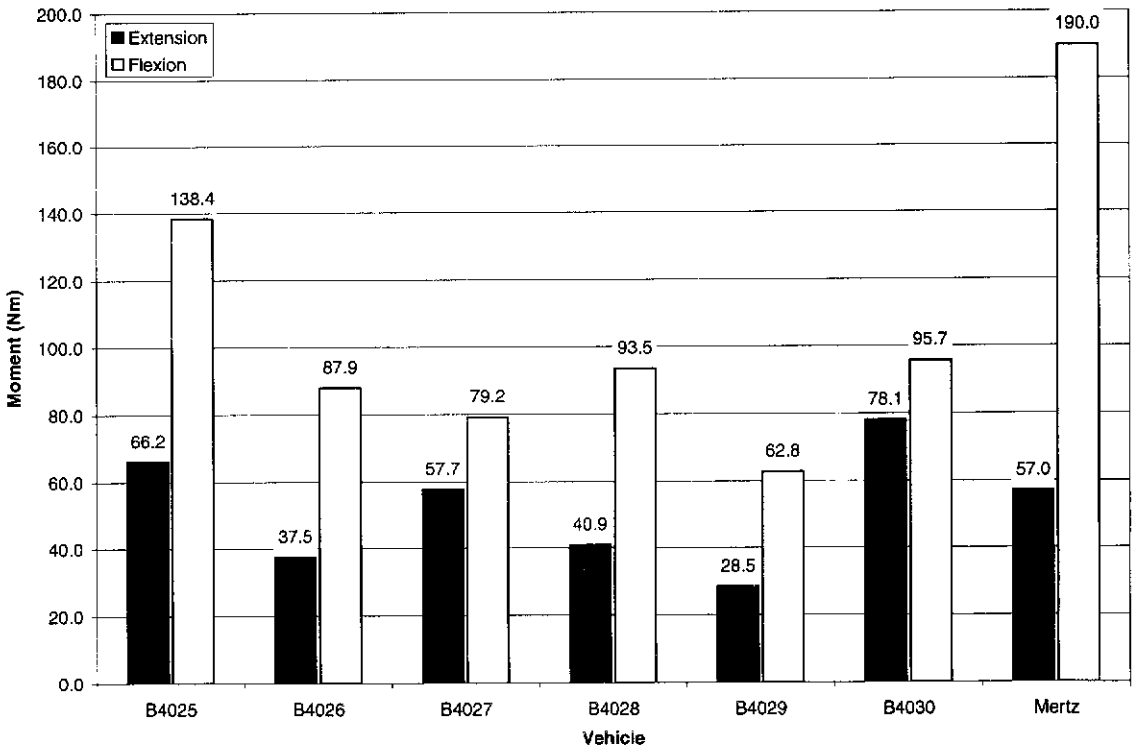


Chart A8.15 Driver Neck Forces

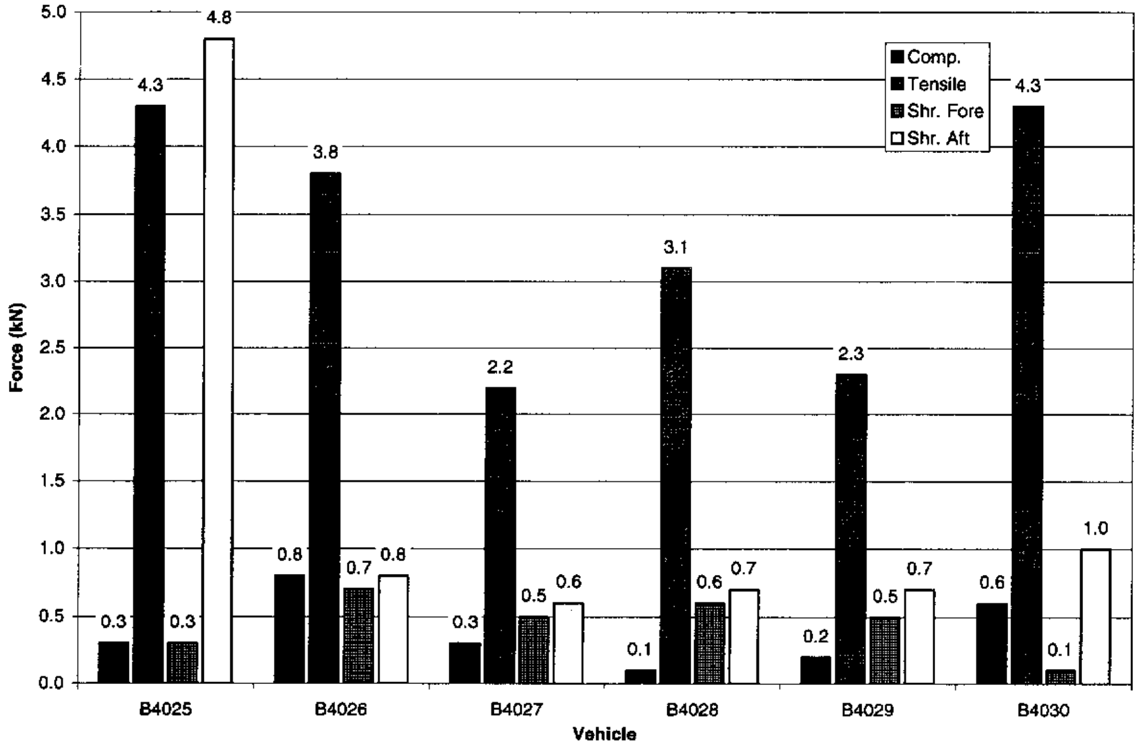


Chart A8.16 Front Passenger Neck Forces

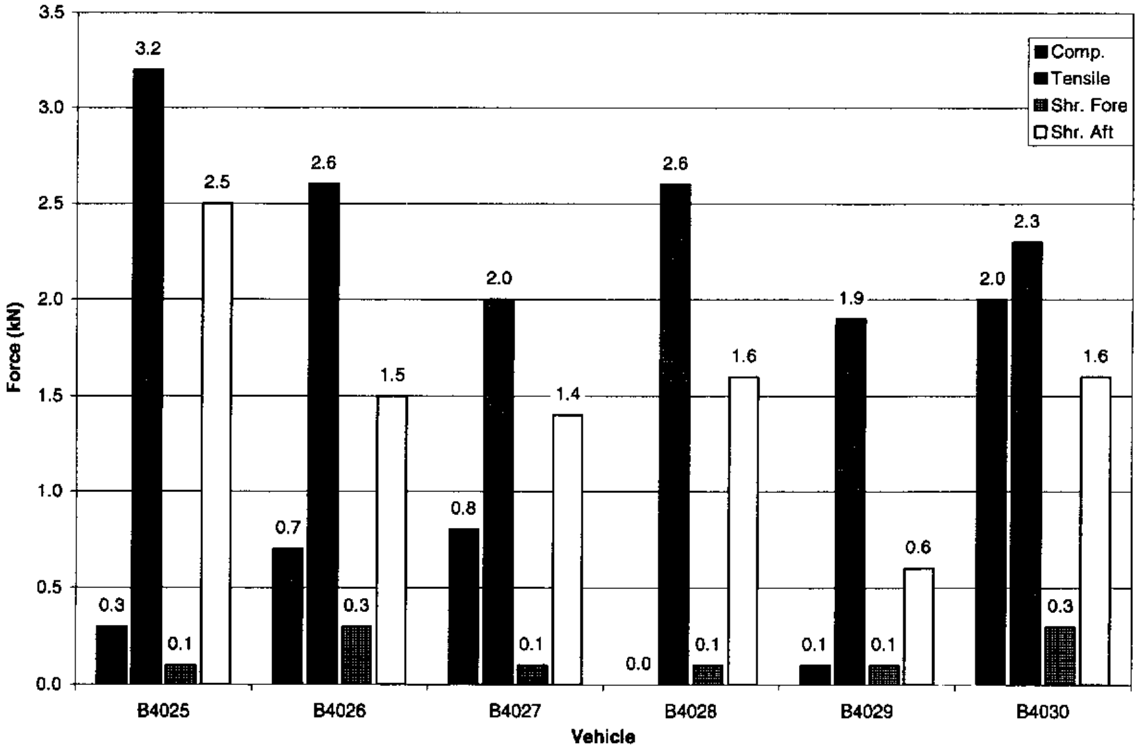


Chart A8.17 Driver Lower Leg Clevis Forces

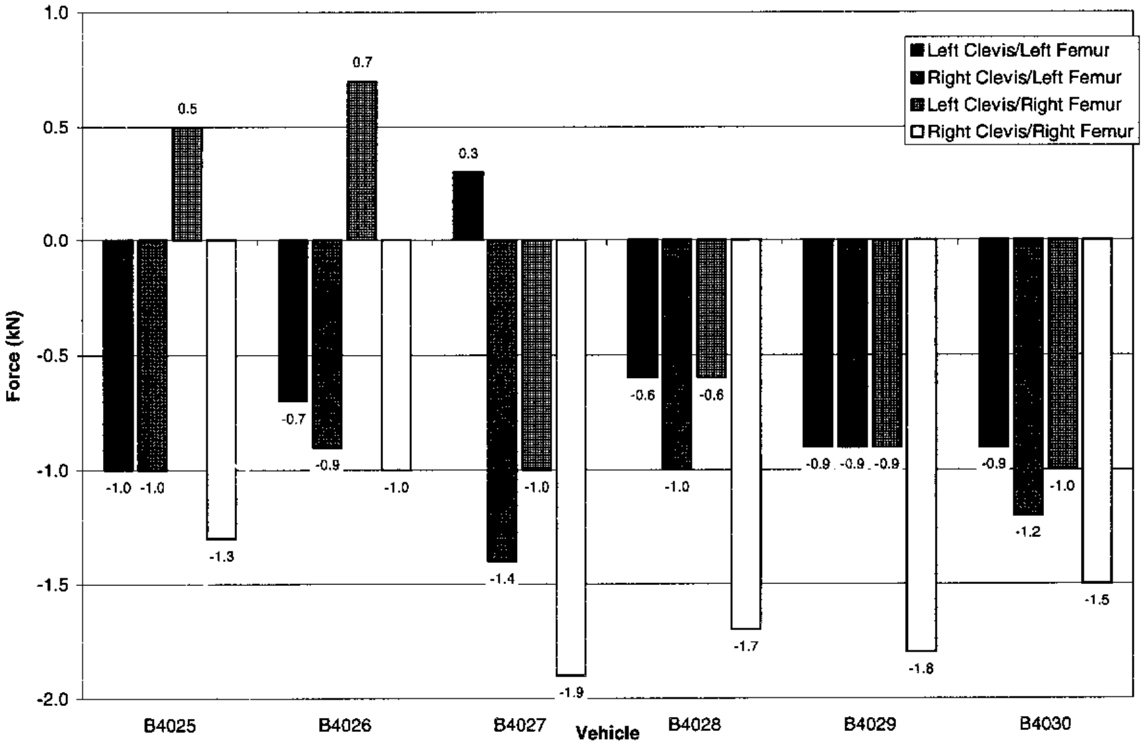


Chart A8.18 Driver Lower Leg Combined Bending and Axial Compressive Loads

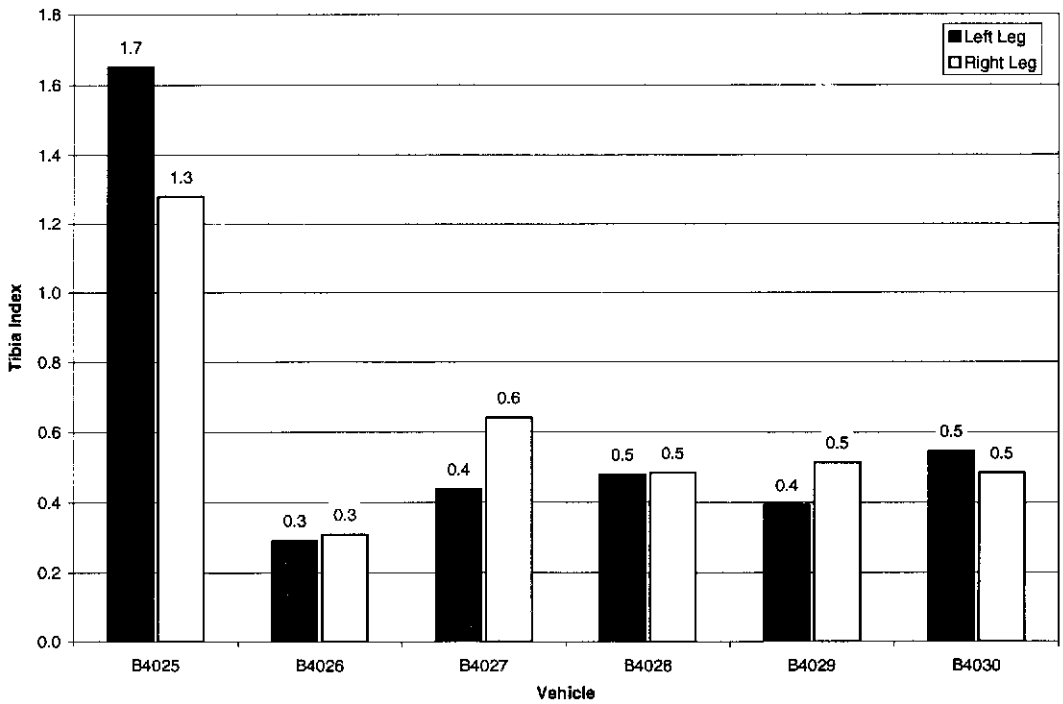


Chart A8.19 Driver Seatbelt Loads

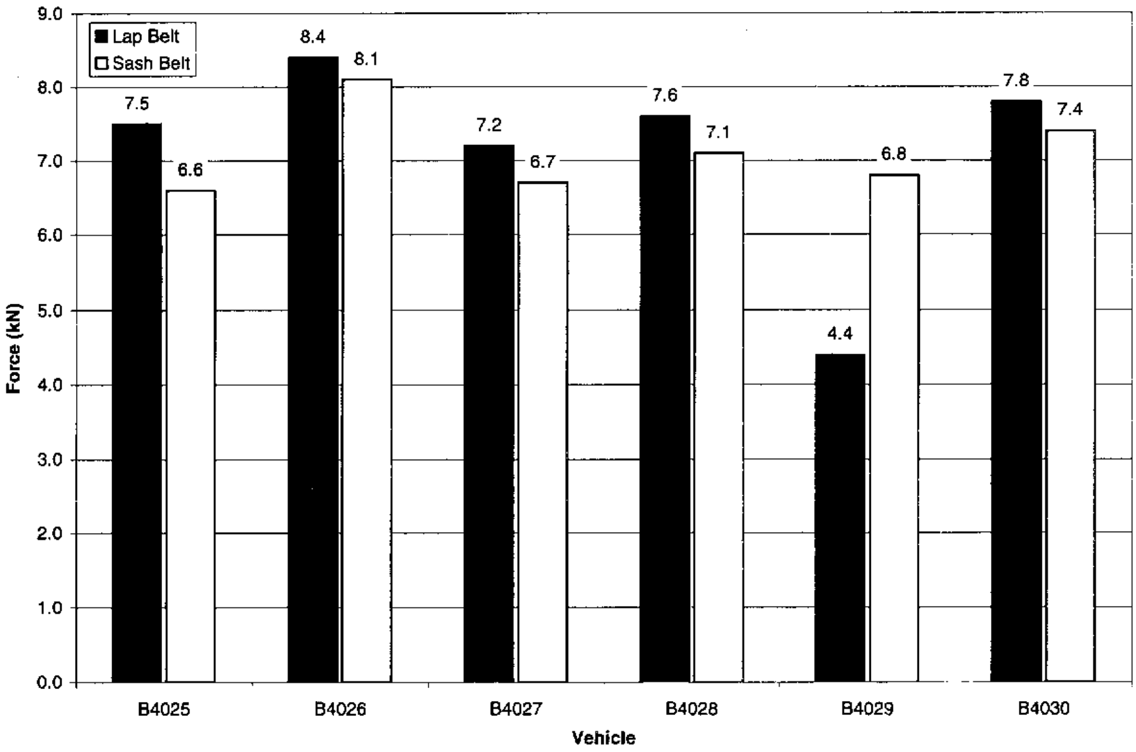


Chart A8.20 Front Passenger Seatbelt Loads