Insurance Institute for Highway Safety
Crashworthiness Evaluation

Crash Test Report
2000 Saturn LS (CF99022)

Vehicle identification number: 1G8JW52R5YY600967
Body style: Midsize four-door sedan
Engine/transmission: Transverse 3.0-liter V6, 4-speed automatic, front-wheel drive

Standard crashworthiness features:

Driver and right front passenger airbags
Dual-locking shoulder belts (front and rear outboard seating positions)
Shoulder belt upper anchorage height adjusters (front seating positions only)
Seat belt force-limiting mechanisms (front seating positions only)
Right front and both rear shoulder belt retractors are convertible from emergency to automatic locking for ease of child restraint use

Other standard safety features:

Daytime running lamps

Optional safety features:

Four-wheel antilock brakes

Vehicle specifications (provided by manufacturer):

Wheelbase:	270 cm
Overall length:	484 cm
Overall width:	175 cm
Curb weight:	1,320 kg (base model with manual transmission)

Vehicle specifications (measured):

Front bumper to firewall:	122 cm
Curb weight:	1,448 kg
Test weight:	1,565 kg (51% front, 49% rear)
Overall width:	175 cm

Nominal test parameters:

40.0 mi/h (64.4 km/h), 40 percent overlap, deformable barrier face with slotted bumper

Crash test date:

October 6, 1999

Figure 1
Precrash and Postcrash Side Views — 2000 Saturn LS

Summary

A 2000 Saturn LS was crash tested on October 6, 1999 into a fixed deformable barrier at 40.0 mi/h (64.4 km/h) and a 41 percent overlap on the driver side. A Hybrid III 50th percentile male dummy was positioned in the driver seat with the lap/shoulder belt fastened.

Measures of intrusion taken after the crash indicated the lower instrument panel in front of the dummy moved rearward 4-5 cm. Resultant intrusion in the driver footwell measured 17 cm in the area where a footrest typically would be located and 18-20 cm at other places on the toepan. All doors remained closed during the crash. After the crash, the driver door required tools to open, the left rear door required additional effort but no tools to open, and the right front and right rear doors opened with ease.

The driver dummy was restrained by a three-point lap/shoulder belt and an airbag. During the crash, 18 cm of webbing spooled off the retractor, including at least 8 cm from the force-limiting mechanism. During rebound from the airbag, the dummy's head moved outward and downward toward the window sill. The head then moved upward and inward, and the rear and top portions of the head contacted the leading edge of the B-pillar and the top of the door aperture, respectively. After the crash, the upper end of the steering column had moved upward 7 cm but not rearward.

The resultant head acceleration from the dummy's head contact against the B-pillar was not recorded because the contact occurred late in the crash as data collection was ending. The right leg had a maximum tibia axial force of –5.7 kN, a maximum lower tibia L-M moment of –284 Nm, which contributed to a lower tibia index of 1.42, and a maximum upper tibia L-M bending moment of –159 Nm, which contributed to an upper tibia index of at least 0.86.

Test Conditions

This vehicle had been tested previously in the Institute's Low-Speed Crash Test Program and subjected to an impact on the front corner of the passenger side at 5 mi/h (8 km/h) into a 30 degree angle barrier and a rear impact at 5 mi/h (8 km/h) into a flat barrier. All structural damage on the front was repaired prior to this test (see Appendix, Low-Speed Crash Test Damage Repair Estimate).

This test was conducted according to the procedures specified in the IIHS Offset Barrier Crash Test Protocol (Version VII). The Hybrid III dummy positioned in the driver seat was equipped with instrumented lower legs that included feet modified to include two accelerometers and to have a 45 degree dorsiflexion range with soft stops at all extremes of foot-ankle motion. All dummy seating parameters were set according to the procedures specified for Federal Motor Vehicle Safety Standard 208 compliance testing (49 *CFR* Part 571.208 § 11). The dummy's left foot was placed in the area where a footrest typically would be located.

Seat back, shoulder belt upper anchorage, and steering column adjustments were set according to the manufacturer's specifications for government crash testing. Other adjustments were set according to the procedure specified for Federal Motor Vehicle Safety Standard 208 compliance testing (49 *CFR* Part 571.208 § 7 and 8). After final positioning of the dummy, measurements from various parts of the dummy to a number of vehicle interior points were made. These measurements and the seat back, shoulder belt upper anchorage, and steering column adjustments are described in the Appendix, Dummy Clearance Measurements.

Vehicle acceleration measurements were made by a triaxial arrangement of accelerometers mounted on the vehicle's longitudinal centerline and 43 cm behind its center of gravity (175 cm behind the front axle). The vehicle speed recorded just prior to impact was 40.0 mi/h (64.4 km/h), and the actual overlap was 41 percent.

Structural Performance

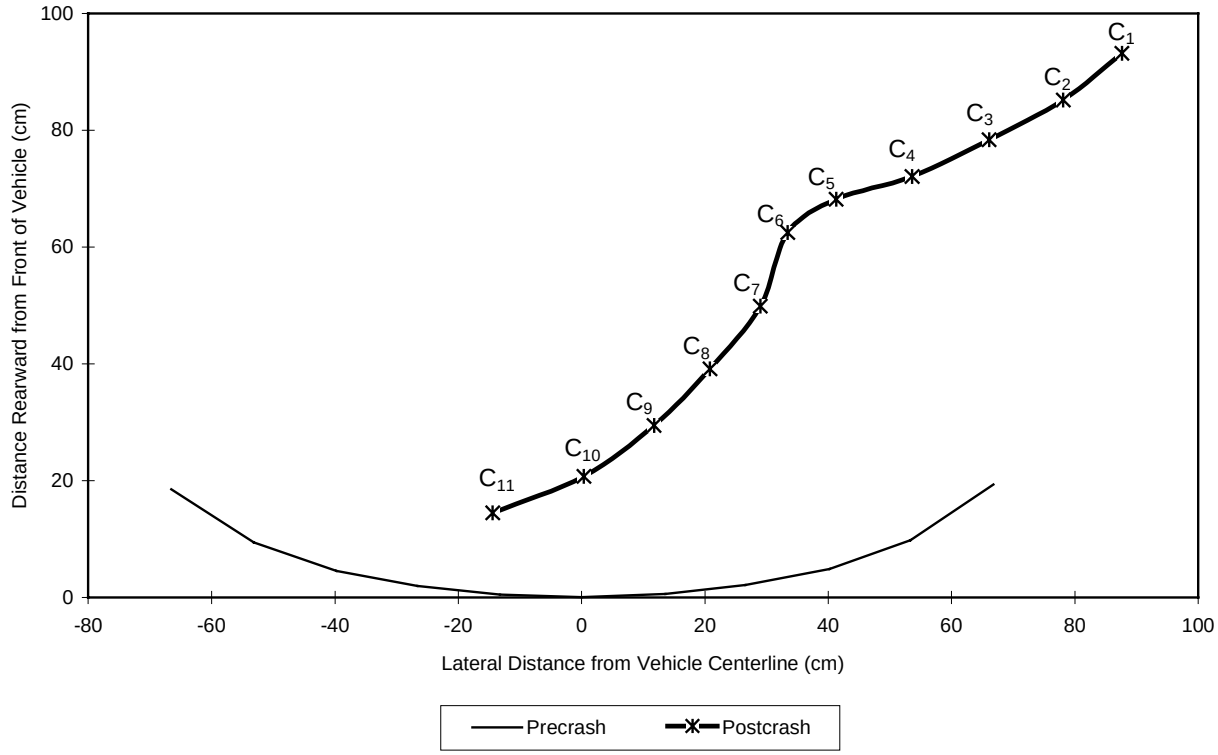
All doors remained closed during the crash. The driver door aperture shortened 3 cm, as measured at the lower edge of the window. After the crash, the driver door required tools to open, the left rear door required additional effort but no tools to open, and the right front and right rear doors opened with ease.

No fuel system leaks were observed after the crash. In addition, no fuel system leaks were observed when the vehicle was rotated onto its right side to allow postcrash photography.

Figure 2 shows the overhead view of the crash deformation. Figure 3 illustrates the precrash and postcrash contour measures of the front bumper cover profile and the resulting permanent crush. Figure 4 shows the precrash and postcrash views from below. Figure 5 illustrates the deformation of the side rails, door sills, and engine cradle, which are visible in Figure 4.

Figure 2
Overhead View of Crash Deformation — 2000 Saturn LS

Figure 3
Front Bumper Cover Crush Contour — 2000 Saturn LS



	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9	C_{10}	C_{11}
Postcrash Contour (cm)	93	85	78	72	68	63	50	39	29	21	14
Precrash Contour (cm)	19	10	5	2	1	0	1	2	5	9	19
Resulting Crush (cm)	74	75	73	70	67	63	49	37	24	12	–5

The length of the reference line was 133 cm precrash and 102 cm postcrash.

Figure 4
Precrash and Postcrash Views from Below — 2000 Saturn LS

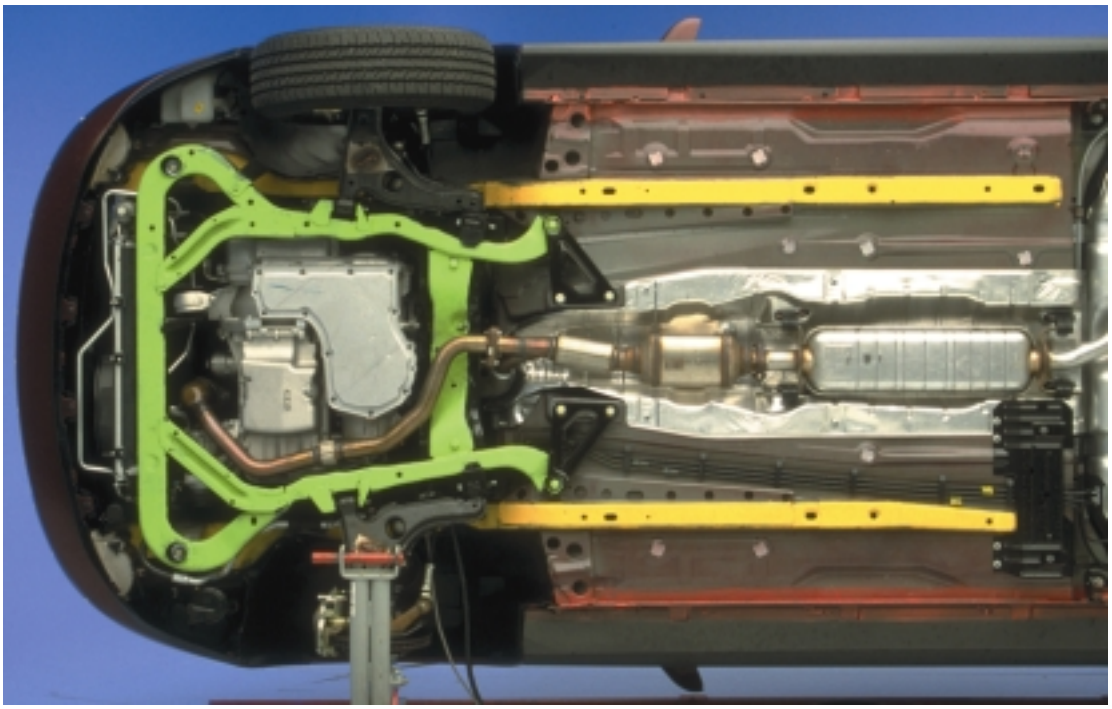
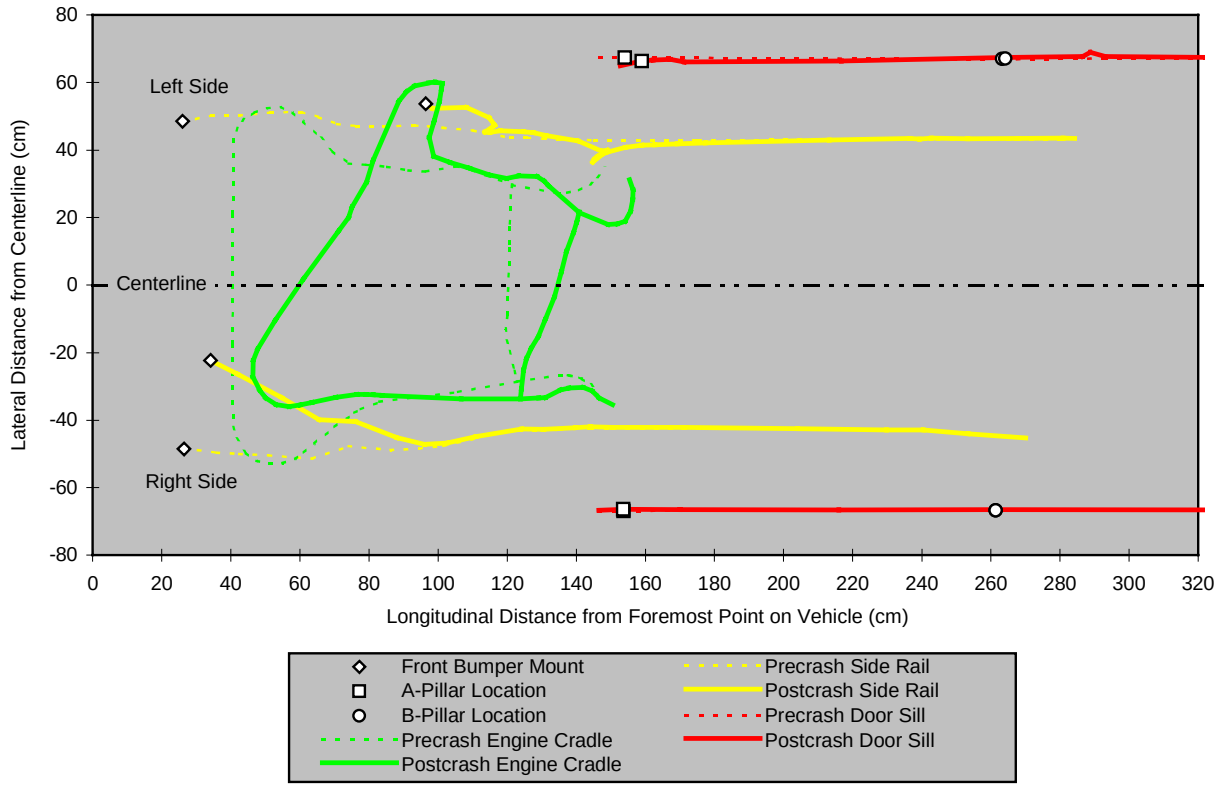
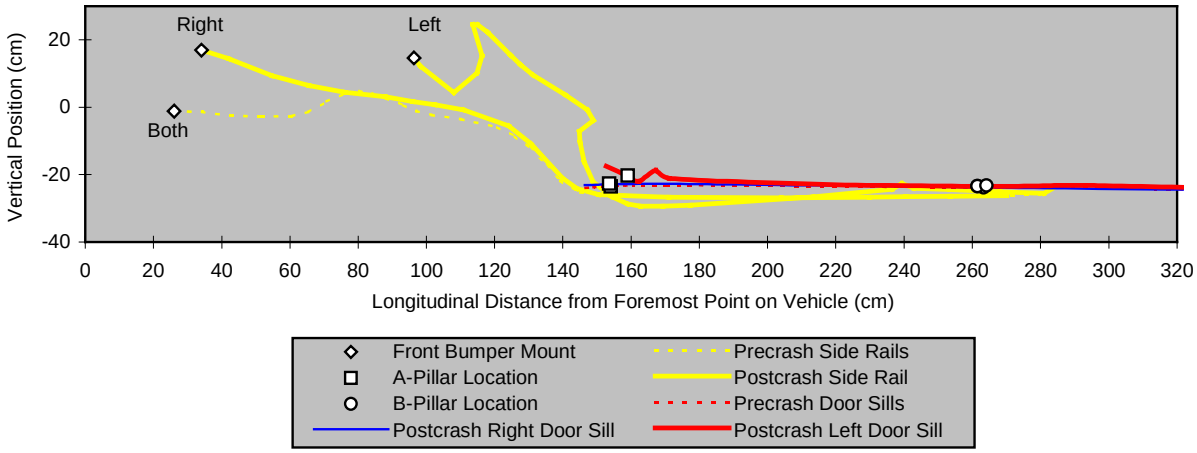


Figure 5
Structural Deformation, Views from Below and Side — 2000 Saturn LS





Various measures of intrusion were made after the crash. These residual measures of intrusion typically are less than the maximum deformation that occurs during the crash. The coordinate reference system for these measures is described in the IIHS Offset Barrier Crash Test Protocol (Version VII). The measures of deformation shown in Table 1 have been adjusted to better reflect the displacement of the various target locations relative to the driver, based on the locations of the four driver seat-attachment bolts. The average displacement of the seat-attachment bolts relative to the reference system also is shown in Table 1.

Table 1
Residual Measurements of Intrusion Relative to Driver Seat — 2000 Saturn LS

Selected Locations*	Longitudinal	Lateral	Vertical	Resultant
Steering column (cm)	0	3	7	7
Left lower instrument panel (cm)	–5	0	3	6
Right lower instrument panel (cm)	–4	0	2	4
Brake pedal (cm)	–13	–1	–3	14
Left toepan (cm)	–19	–5	2	20
Center toepan (cm)	–17	–4	2	18
Right toepan (cm)	–19	–4	0	19
Footrest (cm)	–16	–5	1	17
Average displacement of the four seat-attachment bolts relative to reference system (cm)	–1	1	1	n/a

* All measurements taken on driver side. From the driver's position, positive is forward, left, and up.

Restraint System Performance

Airbags

Driver: The uninflated driver airbag is approximately 57 cm in diameter, and the excursion of its center when inflated is limited by four tethers. The airbag does not have vent holes but is made of porous fabric. Analysis of the high-speed film taken from camera positions D and E indicated the airbag deployed at 32 ms into the crash and appeared to be fully inflated at 66 ms.

Passenger: The mid-mounted passenger airbag deployed rearward, and the excursion of its center when inflated is limited by one broad tether. The cylinder-shaped airbag is vented by two small holes located at the lateral ends. The airbag did not contribute to windshield damage during deployment.

Seat Belts

This vehicle is equipped with dual-locking lap/shoulder belts with sliding latch plates, adjustable upper anchorage points, and mechanical force-limiting mechanisms at both front seating positions. The front inboard and outboard lower anchorage points are attached to and move with the seats. During the crash, 18 cm of webbing was pulled from the retractor through the D-ring, as measured by a pull-string mounted between the B-pillar adjacent to the D-ring and the webbing beyond the D-ring. Postcrash investigation of the force-limiting torsion bar within the retractor spool indicated it was twisted from its precrash orientation. The amount of twisting was not readily discernible but appeared to be at least 180 degrees. This measure, combined with the estimated diameter of the retractor spool and stowed webbing (52 mm), suggested the force limiter contributed at least 8 cm of webbing to the total amount pulled though the D-ring.

Seat

Postcrash examination of the driver seat rails indicated no discernible movement of the seat in its tracks during the crash. Deformation of the floor under the driver seat caused the seat to pitch forward slightly and to tip outboard slightly.

Steering Column

The upper end of the steering column moved upward 7 cm but not rearward relative to the driver seat.

Dummy Kinematics

Head, Neck, and Torso

Analysis of the high-speed film taken from camera positions D and E indicated the dummy's head began to load the airbag at 74 ms into the crash (8 ms after the airbag was fully inflated). Paint transferred from the dummy's face indicated the nose contacted the airbag 6 cm above and 1 cm to the left of its center. During rebound from the airbag, the dummy's head moved outward and downward toward the window sill. The head then moved upward and inward, and the right rear of the head contacted the outboard portion of the head restraint at about 314 ms. The head pushed the head restraint rearward, and at about 346 ms, the left upper rear part of the head contacted the leading edge of the B-pillar and the top right part of the head contacted the top of the door aperture just ahead of the B-pillar. Table 2 provides the timing of these events.

Table 2 Restraint System Performance and Dummy Kinematics — 2000 Saturn LS	
Event	**Time (ms)**
Deployment of airbag	32
Airbag fully inflated	66
Face begins to load airbag	74
Left upper rear of head contacts B-pillar	346

Figure 6
Dummy and Vehicle Interior, Postcrash — 2000 Saturn LS

Legs and Feet

Left leg and foot: Paint transferred from the dummy's left knee indicated the knee contacted the knee bolster to the left of the steering column, 2 cm below and 3 cm to the right of the left instrument panel intrusion reference point. Paint transferred from the dummy's left shin indicated the shin contacted the bolster below and to the left of the knee impact location. The left foot was found fully dorsiflexed, somewhat everted, and internally rotated about 30 degrees. The medial back of the heel was pressed into a downward buckle in floormat/carpeting on the floorpan, the lateral edge of the forefoot's sole was pressed against the intruded toepan, and the medial edge of the forefoot was pressed against the brake pedal arm. The brake pedal itself was lying on top of the forefoot.

Right leg and foot: Paint transferred from the dummy's right knee indicated the knee contacted and broke the plastic trim on the right underside portion of the steering column. The knee also contacted the upper edge of the knee bolster below the right side of the steering column. Paint transferred from the dummy's right shin indicated the shin contacted the bolster directly below the knee impact location on the bolster. The right foot was found slightly dorsiflexed but neither inverted nor everted. The back of the heel was in a downward buckle in the floormat/carpeting on the floorpan, and the sole of the forefoot was against the intruded toepan to the left of the accelerator pedal. The left side of the console plastic trim was folded against the lateral instep of the foot. The right portion of the brake pedal was just above the medial instep. A black streak on the inside of the right ankle may have been produced by dynamic intrusion of the brake pedal, where the lower right corner of the pedal contacted the ankle.

Dummy Injury Measures

Head

The maximum vector resultant head accelerations were recorded and the HICs were calculated during an interval that corresponds with the dummy's head excursion into the airbag. The resultant head acceleration from the dummy's head contact against the B-pillar was not recorded because the contact occurred late in the crash as data collection was ending. Table 3 provides a summary of the maximum head injury measurements recorded during the crash.

Table 3 Head Injury Measurements — 2000 Saturn LS			
Measure	**Published Tolerance Threshold**	**Result**	**Time (ms)**
Vector resultant acceleration (g)	80	50	104
Vector resultant acceleration — 3 ms clip (g)	80	49	103-107*
Head Injury Criterion (HIC)	1000	451	92-128
Head Injury Criterion — 15 ms interval (HIC-15)**	700	236	98-113

* The acceleration level that was continuously maintained for at least 3 ms is indicated. There was no level associated with an interval of exactly 3 ms in duration.

** Canadian Motor Vehicle Safety Regulations (Standard 208) allow the resultant head acceleration to exceed 80 g in airbag-equipped vehicles if HIC-15 is less than 700 (Transport Canada, 1998).

Neck

Table 4 provides a summary of the maximum neck injury measurements recorded during the crash. None of the recorded neck force measures exceeded the magnitude-duration injury criteria (Figures A-13 to A-16).

Table 4 Neck Injury Measurements — 2000 Saturn LS			
Measure	**Published Tolerance Threshold**	**Result**	**Time (ms)**
A-P shear force (kN)	±3.1	0.5	111
Axial compression force (kN)	4.0	0.4	350*
Axial tension force (kN)	3.3	1.8	109
Flexion bending moment (Nm)	310	16	108
Extension bending moment (Nm)	122	17	123

* This measure was still increasing at the time data collection ended at 350 ms.

Chest

Table 5 provides a summary of the maximum chest injury measurements recorded during the crash.

Table 5
Chest Injury Measurements — 2000 Saturn LS

Measure	Published Tolerance Threshold	Result	Time (ms)
Vector resultant spine acceleration — 3 ms clip (g)	60	43	120-123
Rib compression (mm)	–50	–28	113
Viscous criterion (m/s)	1.0	0.1	80

Legs and Feet

Left leg and foot: None of the injury measures exceeded the published threshold values.

Right leg and foot: The right leg had a maximum tibia axial force of –5.7 kN at 76 ms, a maximum lower tibia L-M moment of –284 Nm at 76 ms, and a lower tibia index of 1.42 at 76 ms. The right leg also had a maximum upper tibia L-M moment of -159 Nm at 76 ms, which contributed to an upper tibia index of 0.86 at 76 ms.

The upper tibia A-P bending moment had a time signature very similar to the axial force (Figures A-40 and A-45). The ratio of the A-P bending moment to the axial force (approximately 0.02 m) is slightly less than the distance (in meters) between a line through the knee and ankle joints and the upper load cell midline due to the bent shape of the dummy's tibia. Also, the tibia-femur displacement measure (Figure A-38) suggests the upper tibia did not contact the knee bolster before the maximum upper bending moment was recorded. Therefore, the upper tibia bending could have resulted from the foot force acting through the moment arm of the tibia bend rather than from transverse forces applied by contact with the knee bolster. Consequently, the upper tibia resultant moment was not calculated, and the reported right upper tibia index was calculated from only the upper tibia L-M moment and tibia axial force.

Table 6 provides a summary of the maximum leg and foot injury measurements recorded during the crash.

Table 6
Leg and Foot Injury Measurements — 2000 Saturn LS

Measure	Published Tolerance Threshold	Left		Right	
		Result	Time (ms)	Result	Time (ms)
Femur axial force (kN)	–9.1*	–4.5	104	–1.5	77
Tibia–femur displacement (mm)	–15	–2	98	–6	96
Upper Tibia					
L–M moment (Nm)	±225	–73	81	–159	76
A–P moment (Nm)	±225	43	96	**	n/a
Vector resultant moment (Nm)	225	77	81	**	n/a
Index	1.00	0.37	81	0.86	76
Lower Tibia					
L–M moment (Nm)	±225***	–144	81	–284	76
A–P moment (Nm)	±225***	112	88	49	72
Vector resultant moment (Nm)	225***	146	81	285	76
Axial force (kN)	–8.0***	–1.1	82	–5.7	76
Index	1.00	0.68	81	1.42	76
Foot					
A–P acceleration (g)	±150	–89	80	–102	78
I–S acceleration (g)	±150	–84	78	–135	75
Vector resultant acceleration (g)	150	101	78	138	75

* This critical value is for instantaneous loading. Femur loads are compared with magnitude-duration injury criteria in Figures A-23 and A-34.

** The upper tibia A-P bending could have resulted from the foot force acting through the moment arm of the tibia bend rather than from transverse forces applied by contact with the knee bolster; therefore the A-P and resultant moments are not indicated. The listed upper tibia index was calculated from only the upper tibia L-M moment and tibia axial force.

*** These published thresholds are for fractures of the tibia. Ankle and foot injuries have been associated with bending moments as low as 50-100 Nm, and heel fractures have been associated with axial forces as low as –6.0 kN.

References

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Appendix

Low-Speed Crash Test Damage Repair Estimate

Dummy Clearance Measurements

Graph Index — index to graphs of time plots of dummy and vehicle data

Manufacturer's window sticker

Low-Speed Crash Test Damage Repair Estimate

2000 Saturn LS Four-Door Sedan: 5 mi/h Front into Angle Barrier

Test Number: LA99017
VIN: 1G8JW52R5YY600967
Mileage: 246
Features: Driver and passenger airbags, four-wheel antilock brakes, air conditioning, automatic transmission, heated power mirrors, keyless entry system, power door locks, power windows, power driver seat, heated back glass, tilt steering wheel, cruise control, front fog lamps, moonroof, two-stage paint.

	Part		Labor	
Description	**Mfg. No**	**Price**	**Operation**	**Hours**
Bumper reinforcement, front	21018510	$142.00	Replace*	2.7
Foglamp assembly, right	90584065	82.50	Replace	0.2
Fender, right front			Repair/align*	0.5
Frame sidemember, right front			Repair/align*	1.0
Frame sidemember, right front			Refinish	0.3
Paint and materials		5.40		
Total Parts		$229.90		
Total Labor		159.80		4.7
Grand Total		$389.70		

* This item was repaired or replaced as indicated before the 40 mi/h frontal offset test.

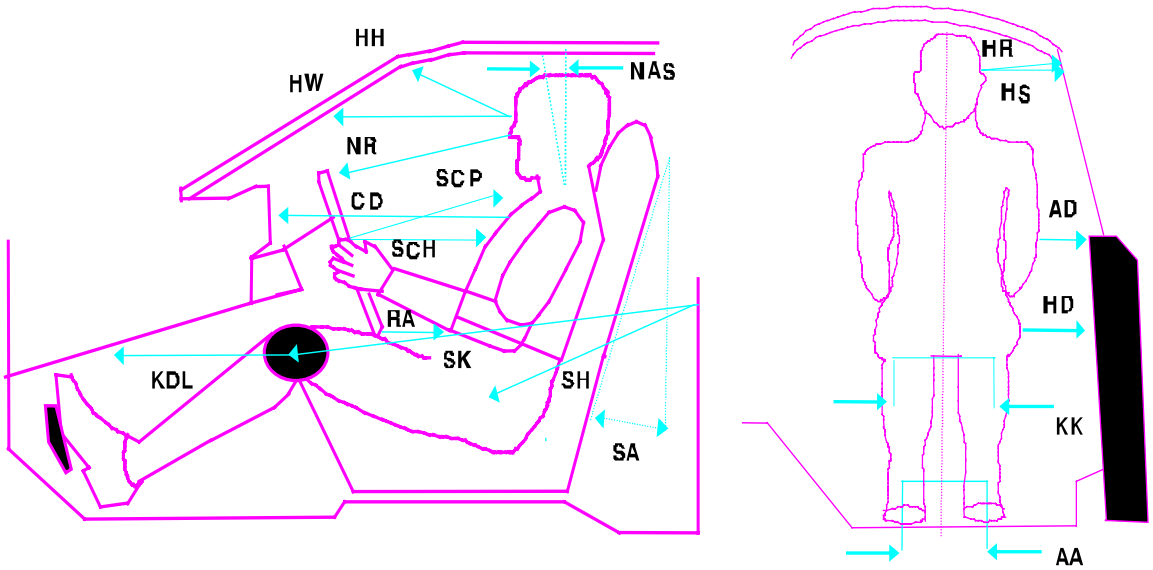
Dummy Clearance Measurements

Test Number: CF99022
Vehicle Make/Model: Saturn LS
Vehicle Model Year: 2000
Seat Type: Electrically adjusted bucket seat (fore/aft, height, and seat back angle)

Manufacturer's Specifications
Seat Back Information: Reclined to 25 degrees, as measured on centerline of forward (occupant) surface of seat back, excluding head restraint
Upper Belt Anchorage: Set to midpoint of 5 positions
Steering Column Adjustment: Set to midpoint of 5 tilt positions

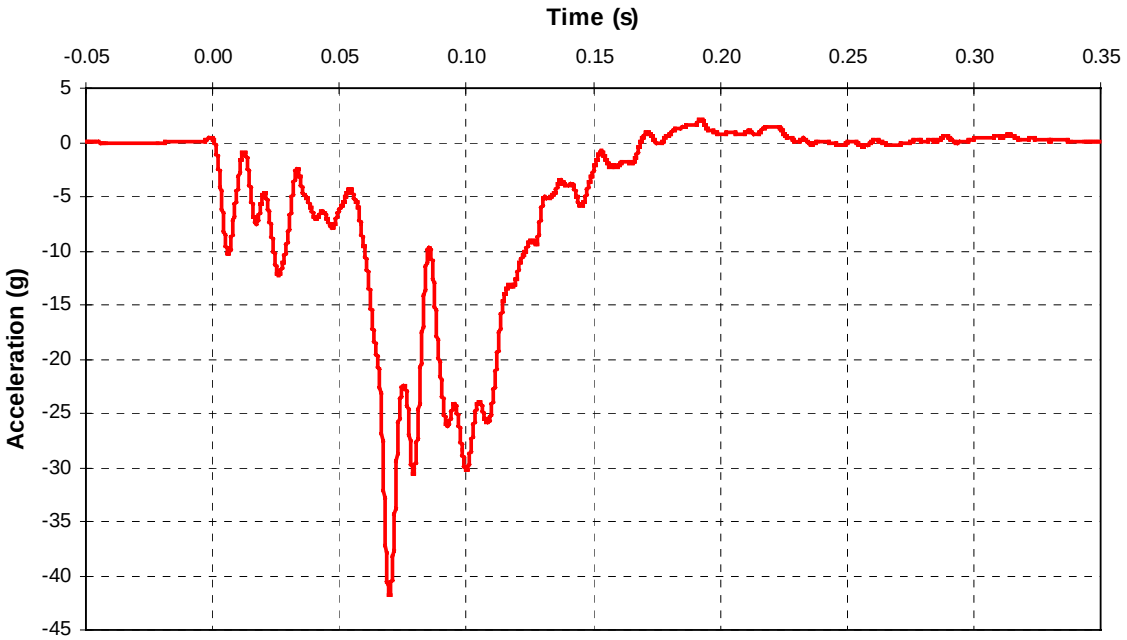
Location	Code	Measure	Location	Code	Measure
Head to header	HH	295	Neck angle, torso 90	NAT90	21.2°
Head to windshield	HW	514	Neck angle, seated*	NAS	3.4°
Nose to rim	NR	385	Torso angle (NAT90 – NAS)	TA	17.8°
Chest to dash	CD	602	Striker to knee**	SK	600
Rim to abdomen	RA	201	Striker to knee angle**	SKA	–7.5°
Knee to dash, left	KDL	211	Striker to H-point, horizontal	SHH	200
Knee to dash, right	KDR	205	Striker to H-point, vertical	SHV	169
Steering wheel to chest, horizontal	SCH	302	Ankle to ankle	AA	287
Steering wheel to chest, perpendicular	SCP	378	Knee to knee	KK	293
Steering wheel to chest, reference	SCR	356	Arm to door	AD	28
Hub to chest, minimum	HCM	258	H-point to door	HD	120
Pelvic angle	PA	25°	Head to A-pillar	HA	536
Seat back angle	SA	25°	Head to roof	HR	229
			Head to side window	HS	250

All distance measurements are in millimeters (mm).
* Dummy's neck bracket was adjusted to –7 degrees to achieve a level instrumentation plane.
** These measurements were made in a vertical plane containing the striker and parallel to the driver door sill.

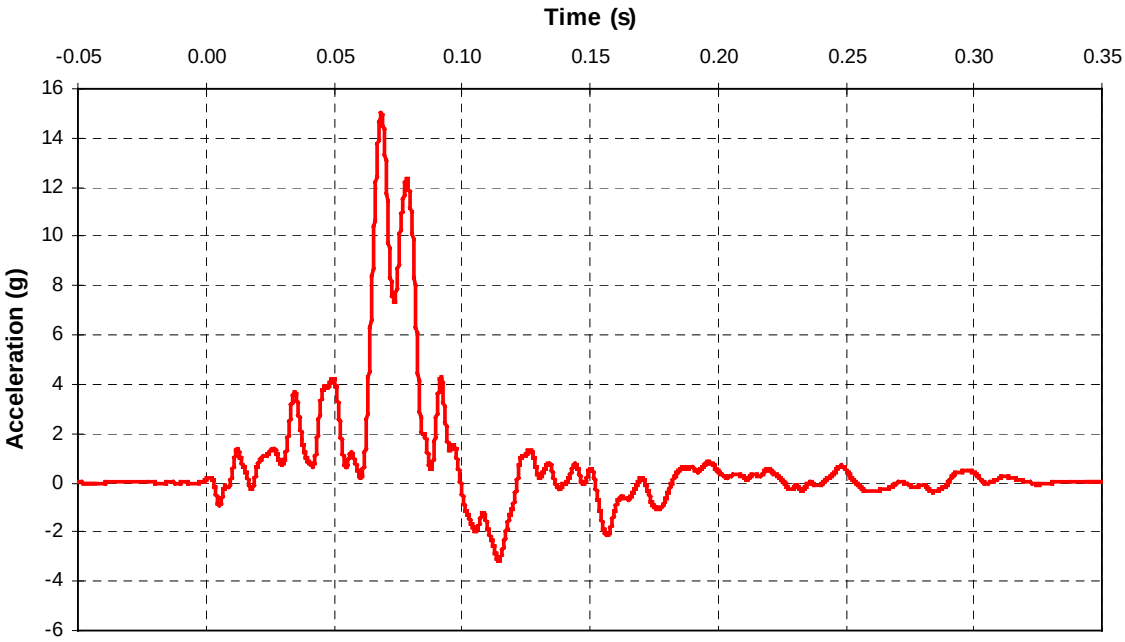


Graph Index

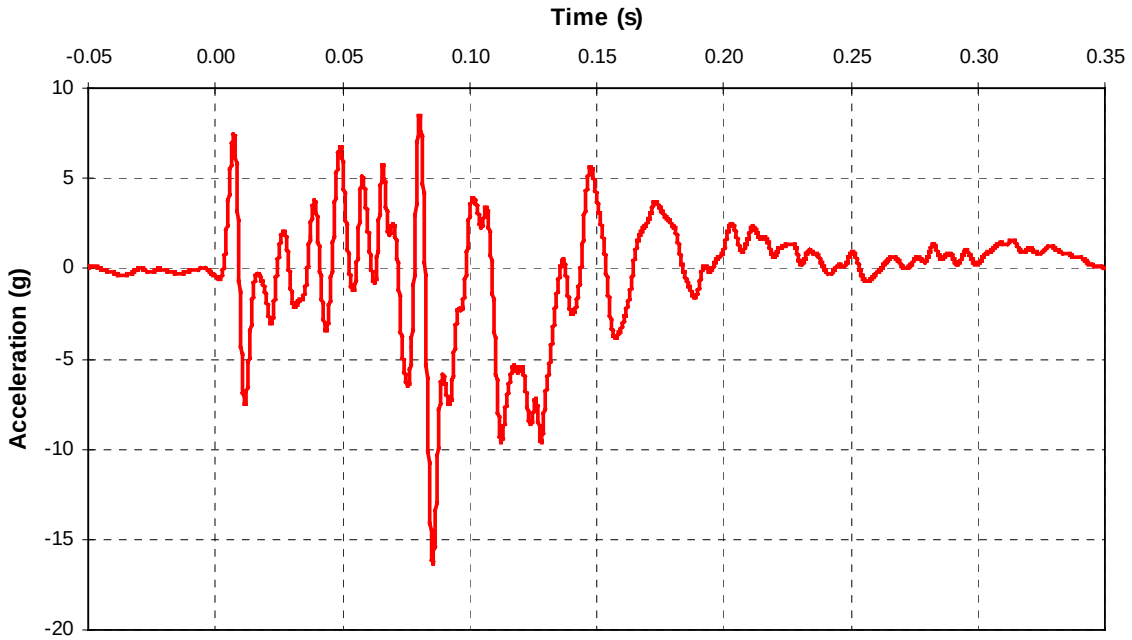
A- 1 CF99022 2000 Saturn LS2 Vehicle Longitudinal Acceleration



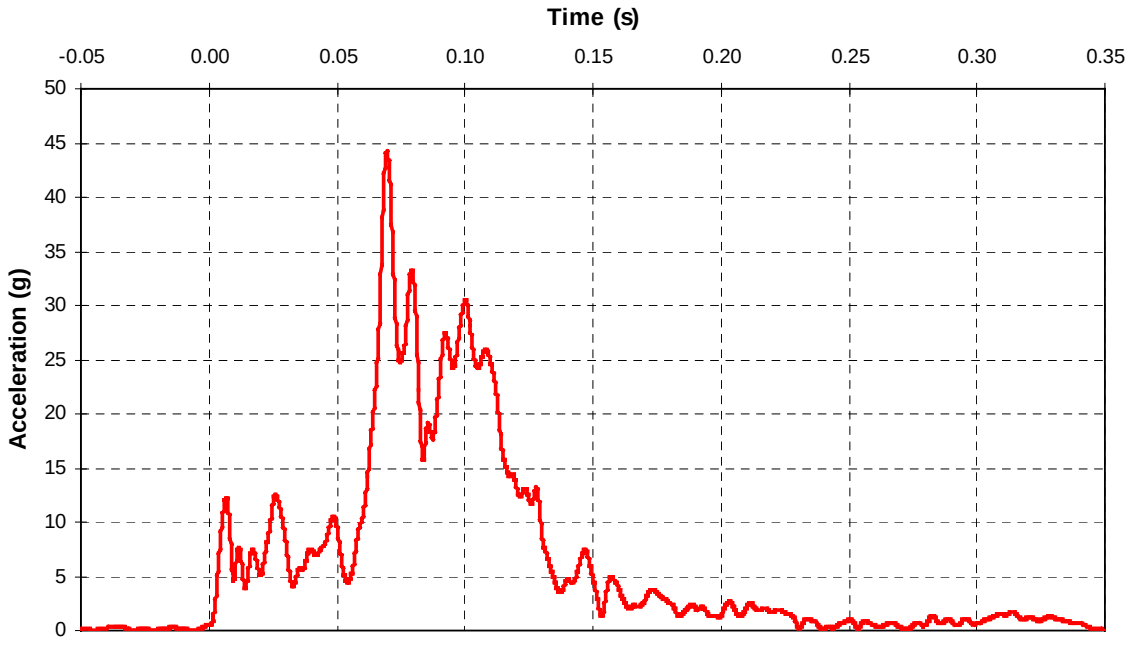
A- 2 CF99022 2000 Saturn LS2 Vehicle Lateral Acceleration



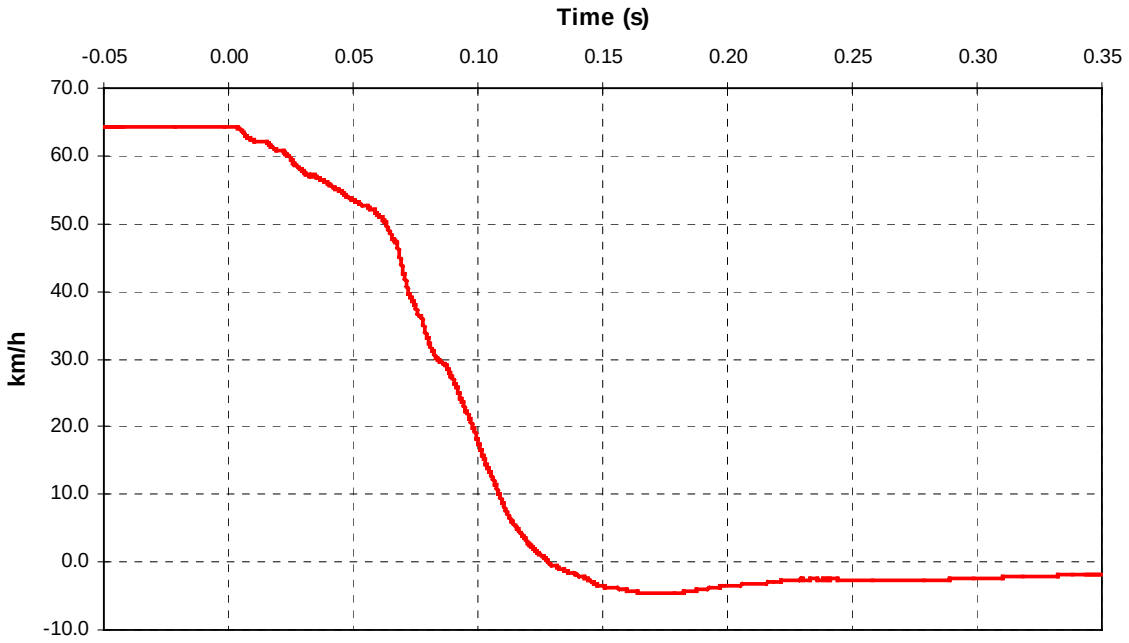
A- 3 CF99022 2000 Saturn LS2 Vehicle Vertical Acceleration



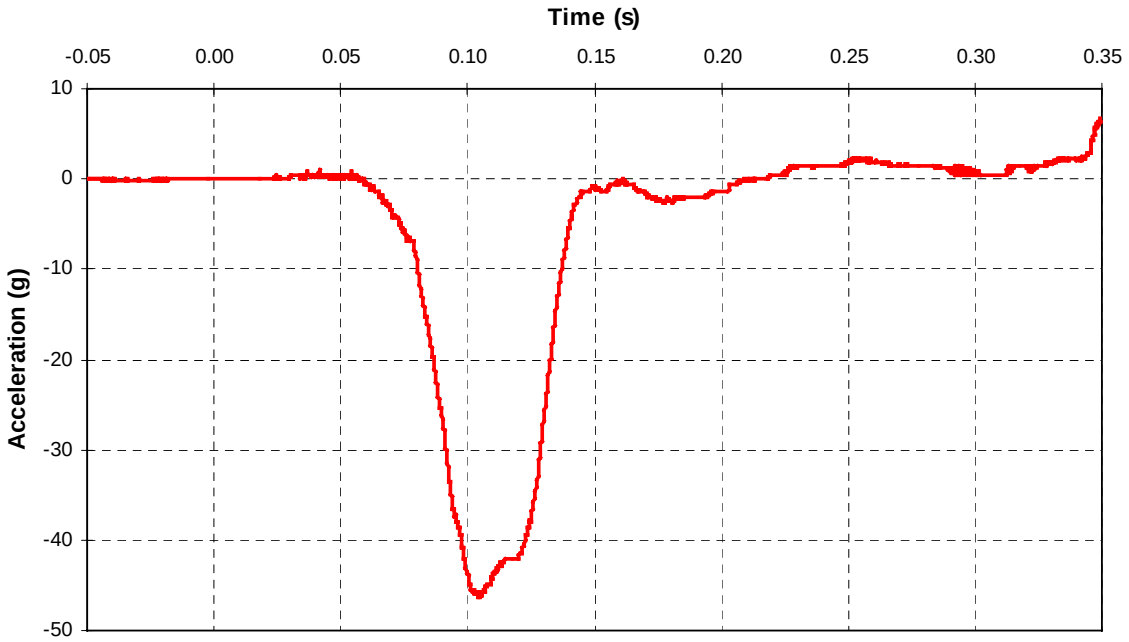
A- 4 CF99022 2000 Saturn LS2 Vehicle Vector Resultant Acceleration



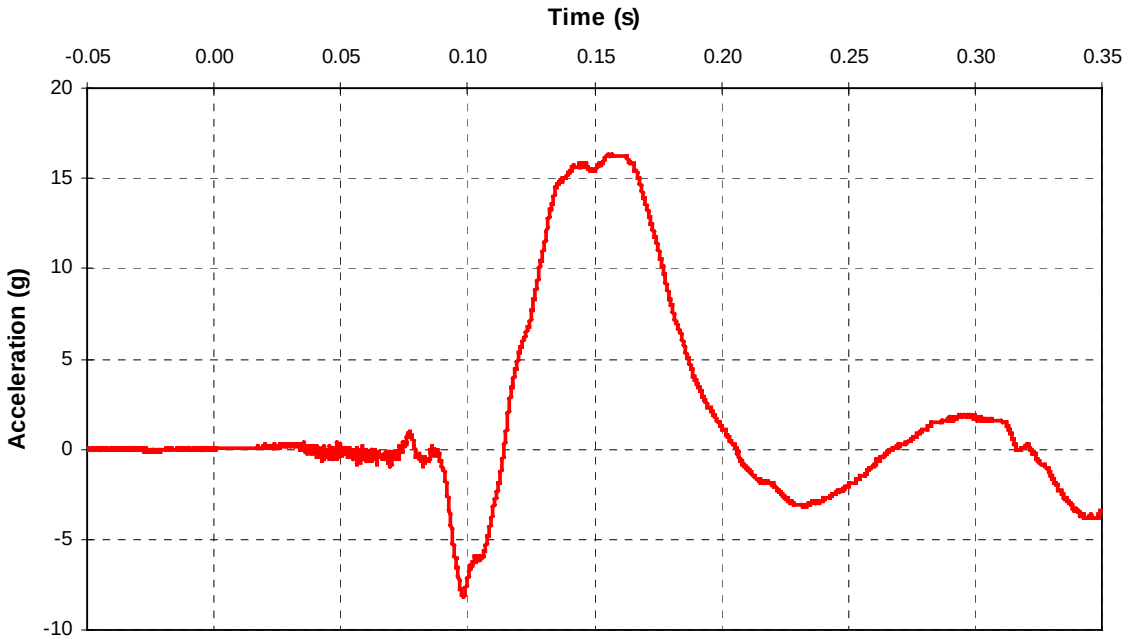
A- 5 CF99022 2000 Saturn LS2 Integration of Vehicle Longitudinal Acceleration



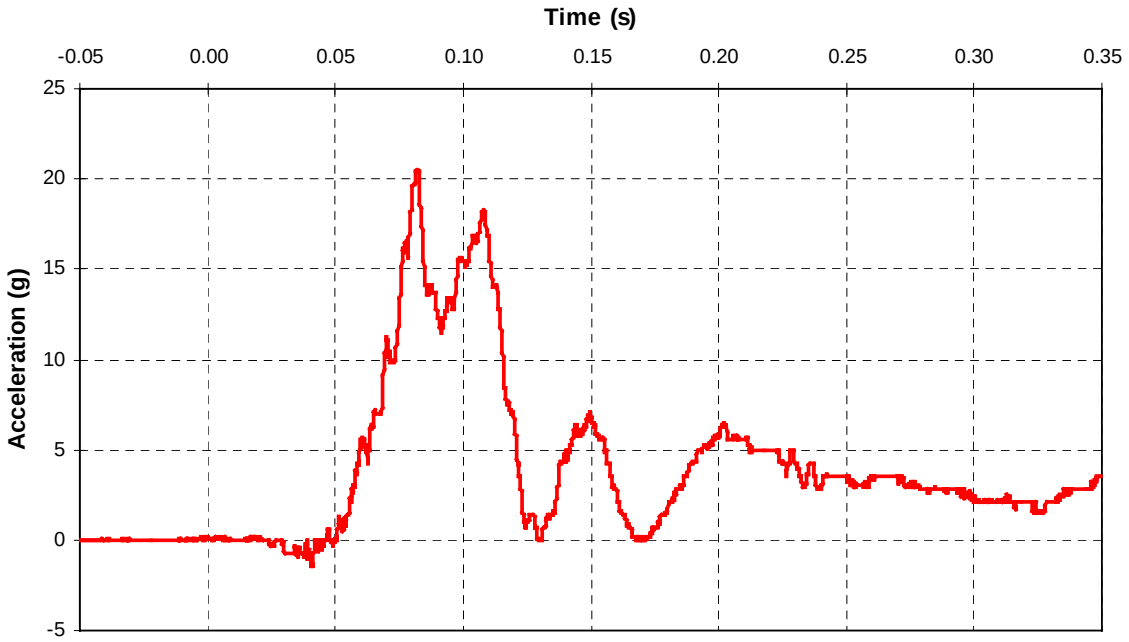
A- 6 CF99022 2000 Saturn LS2 Head A-P Acceleration



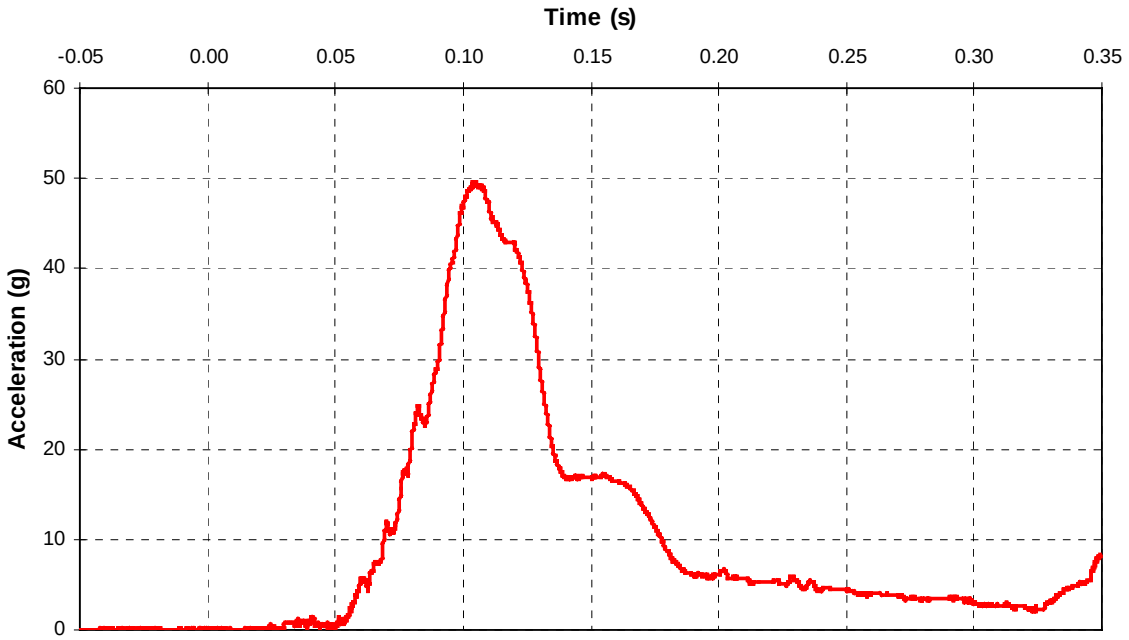
A- 7 CF99022 2000 Saturn LS2 Head L-M Acceleration



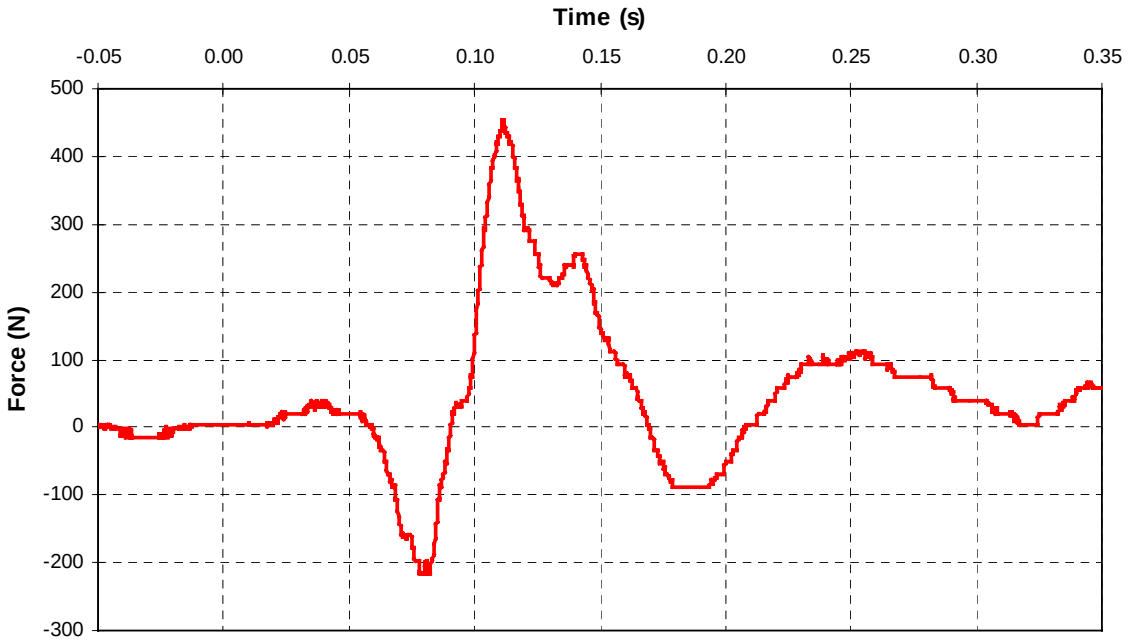
A- 8 CF99022 2000 Saturn LS2 Head I-S Acceleration



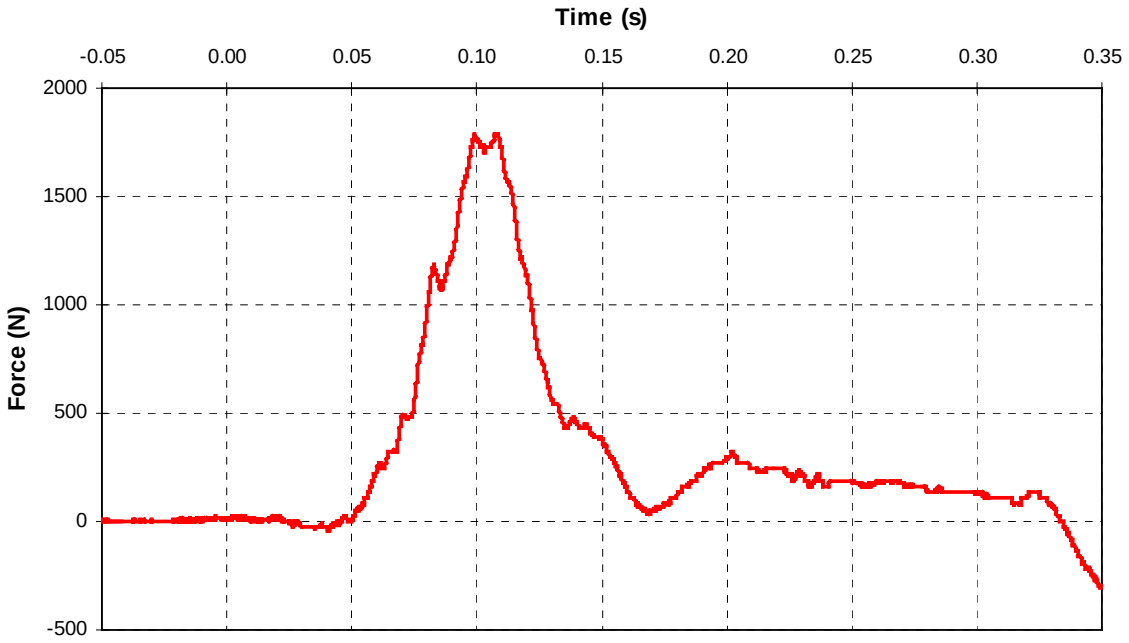
A- 9 CF99022 2000 Saturn LS2 Head Vector Resultant Acceleration



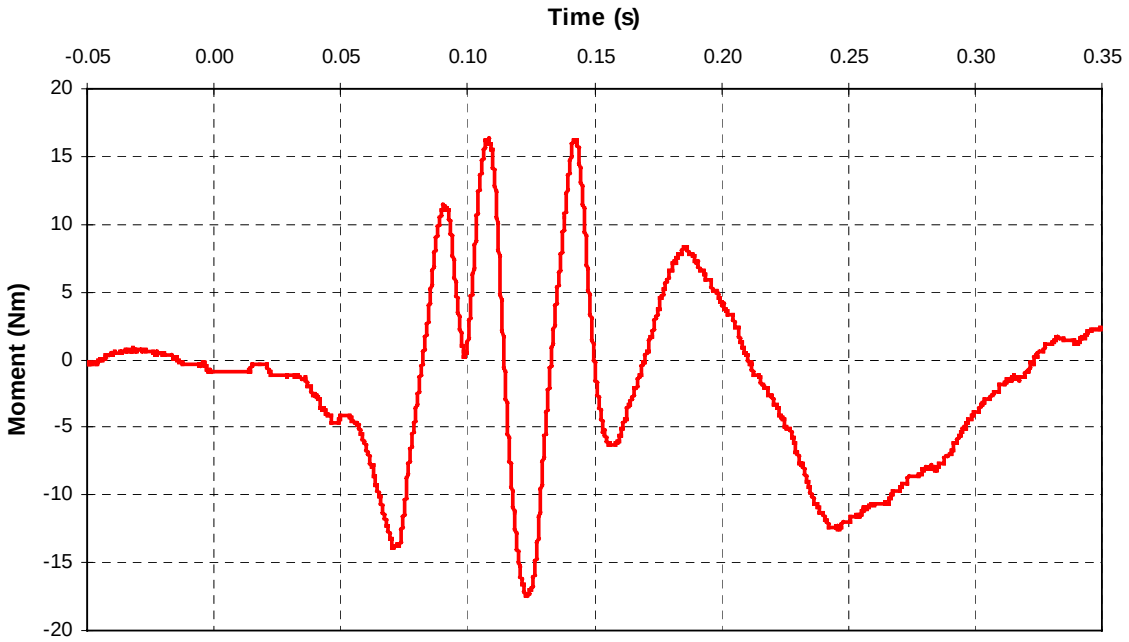
A- 10 CF99022 2000 Saturn LS2 Neck A-P Shear Force



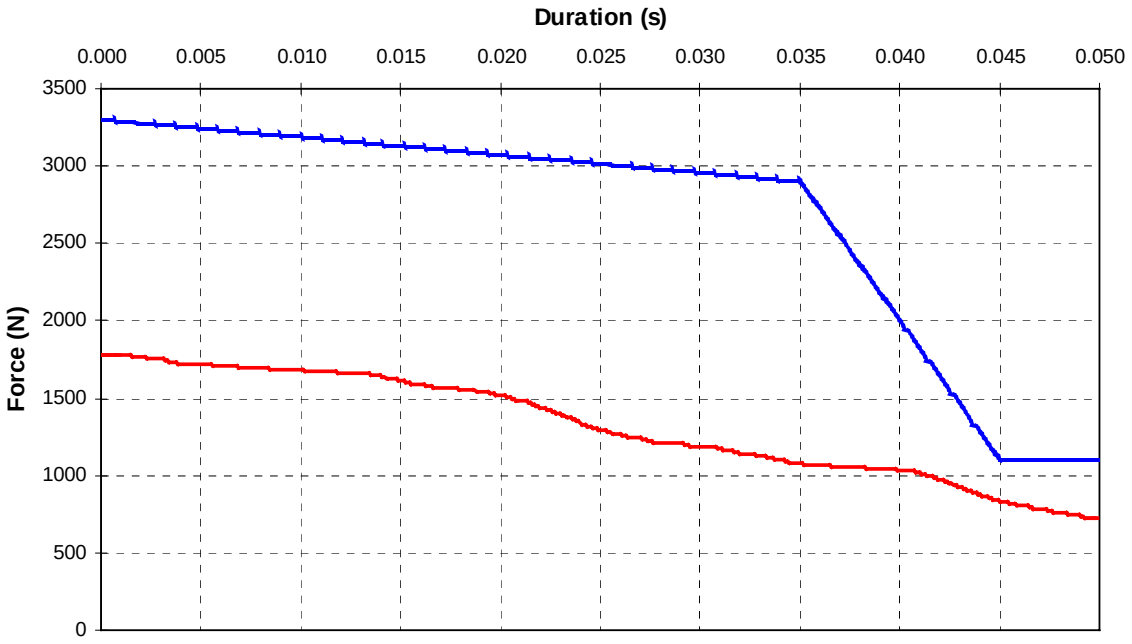
A- 11 CF99022 2000 Saturn LS2 Neck Axial Force



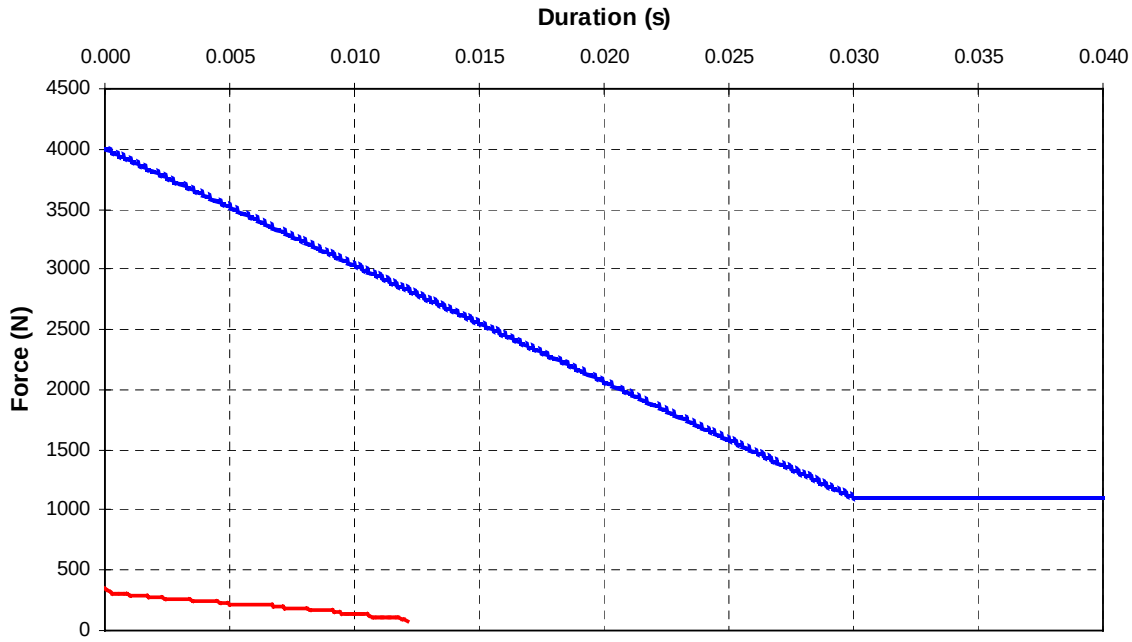
A- 12 CF99022 2000 Saturn LS2 Neck Occipital A-P Moment



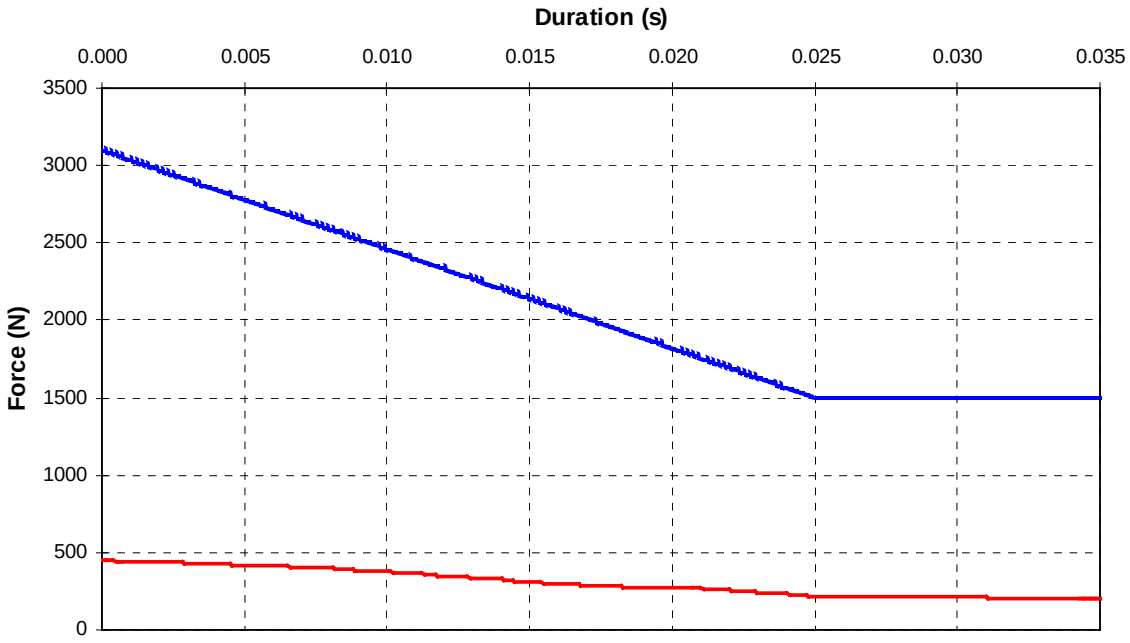
A- 13 CF99022 2000 Saturn LS2 Neck Tension Analysis



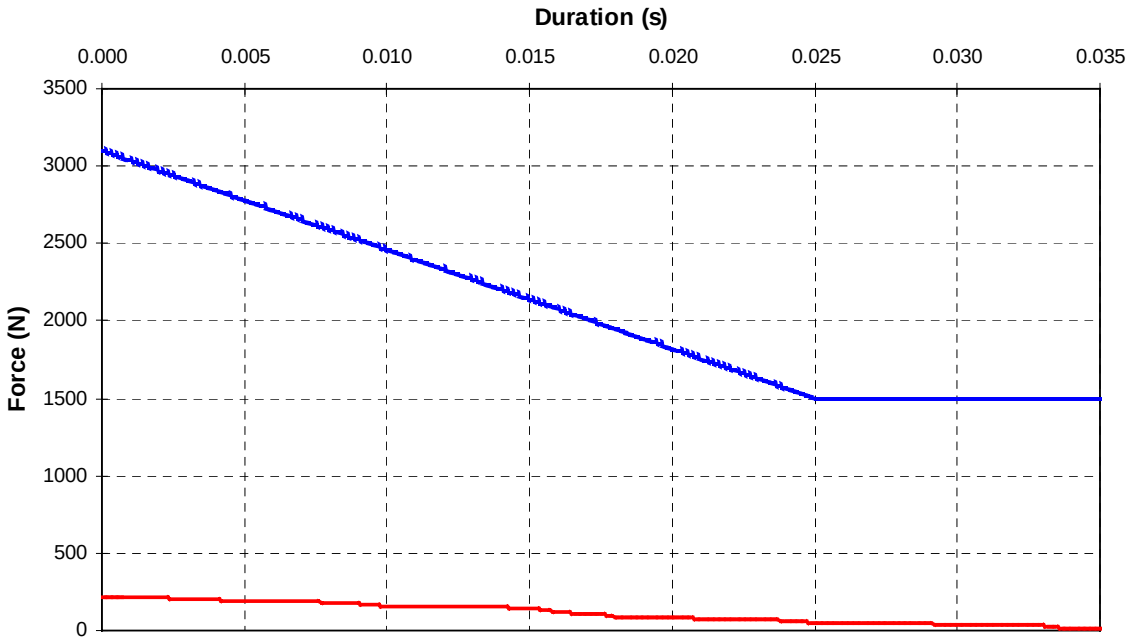
A- 14 CF99022 2000 Saturn LS2 Neck Compression Analysis



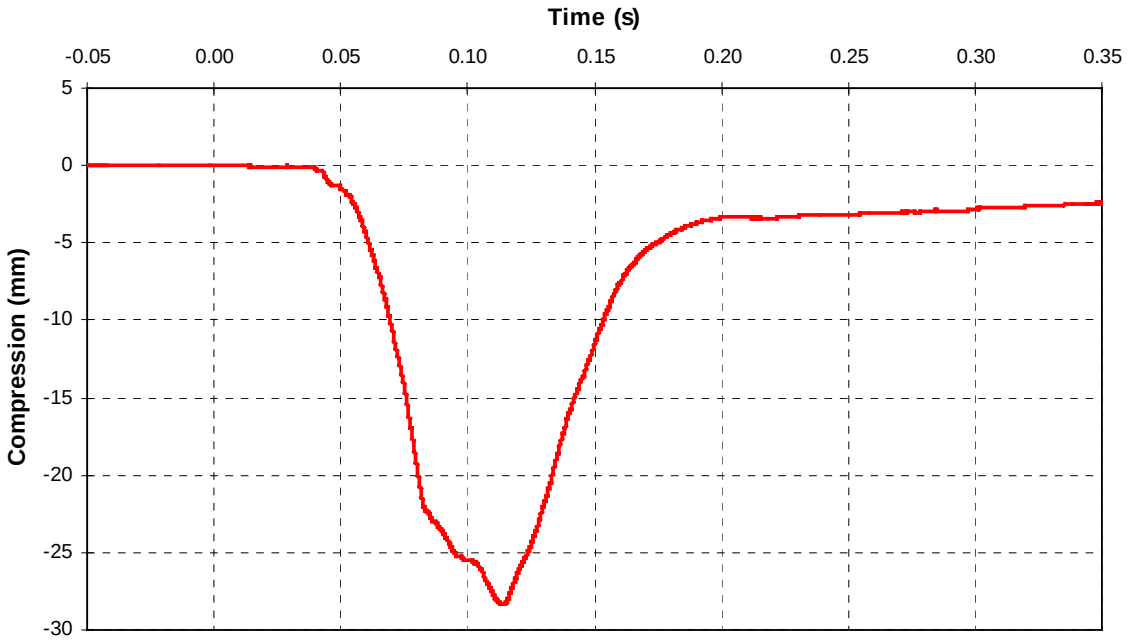
A- 15 CF99022 2000 Saturn LS2 Neck A-P Shear (Positive) Analysis



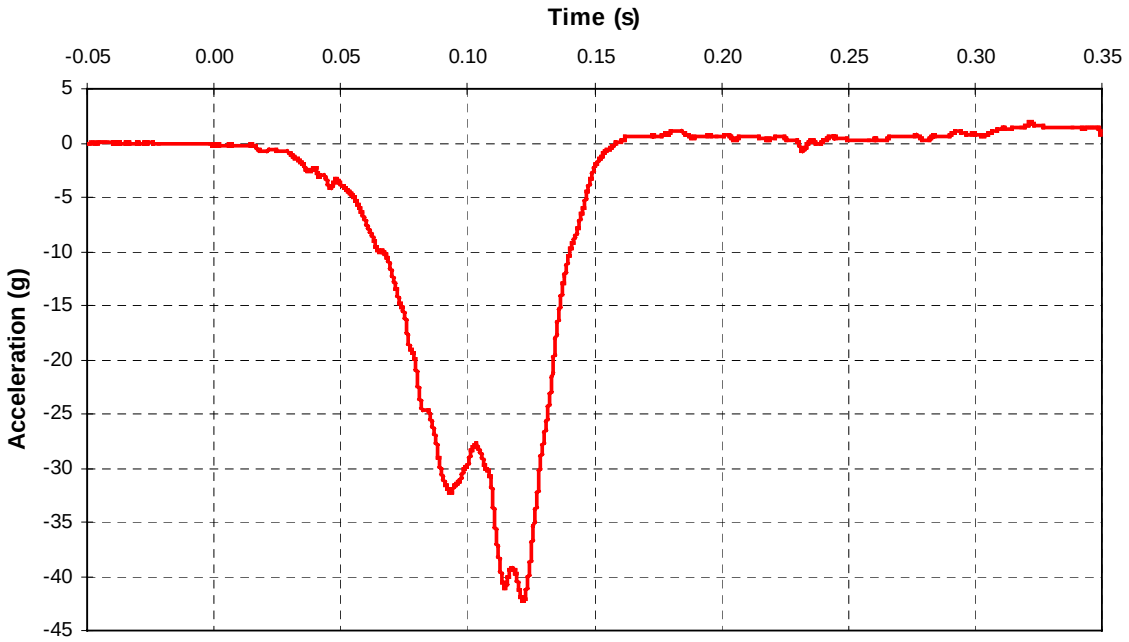
A- 16 CF99022 2000 Saturn LS2 Neck A-P Shear (Negative) Analysis



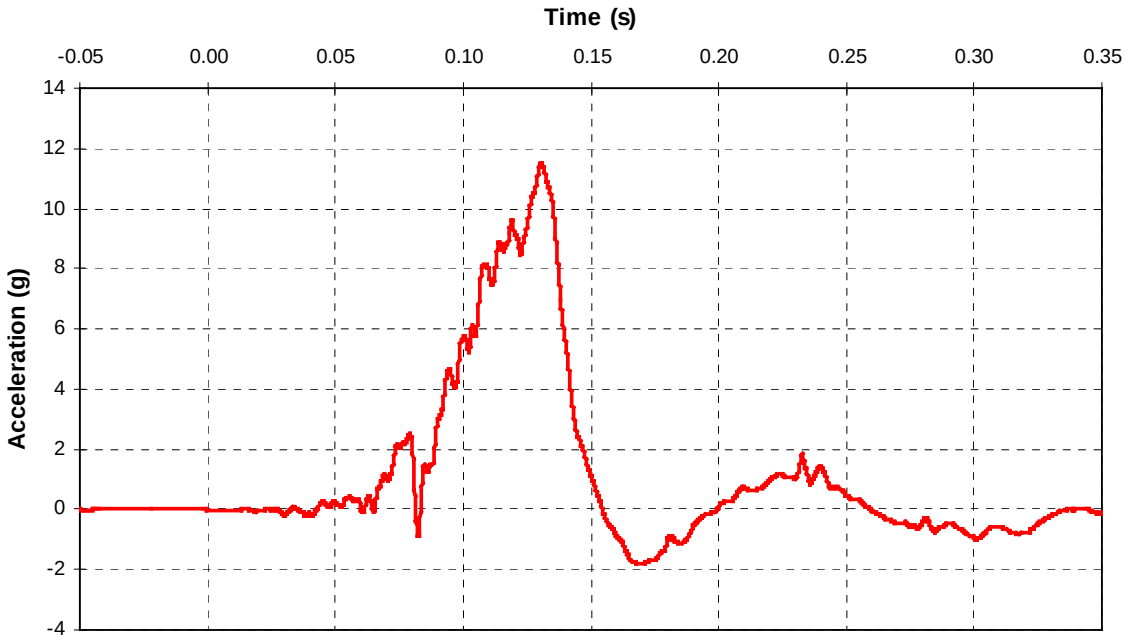
A- 17 CF99022 2000 Saturn LS2 Chest Compression



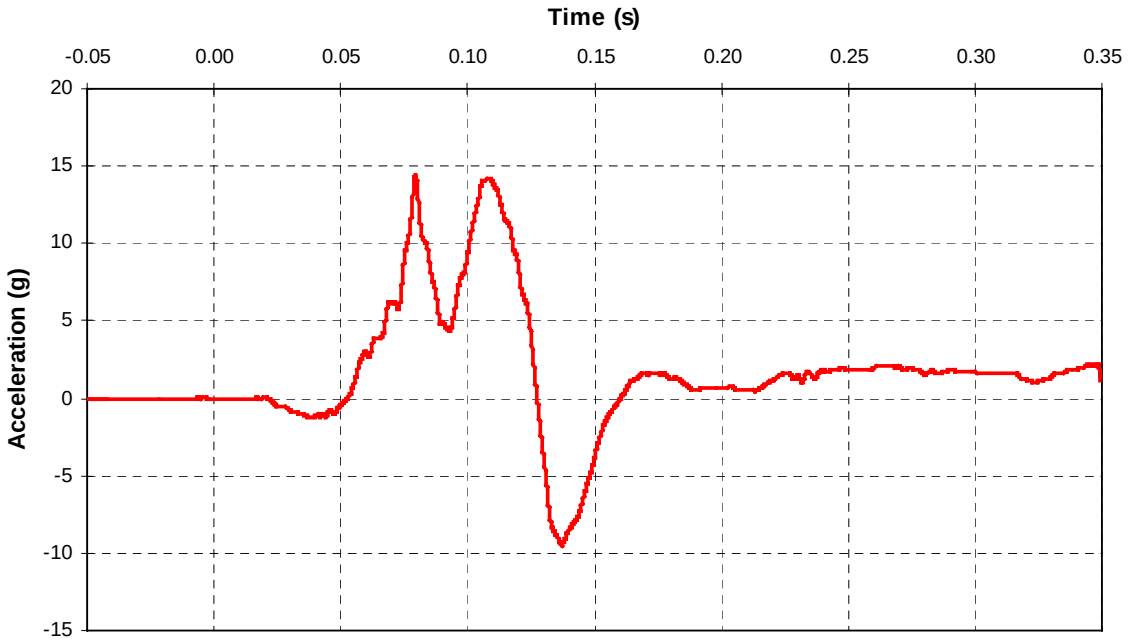
A- 18 CF99022 2000 Saturn LS2 Chest A-P Acceleration



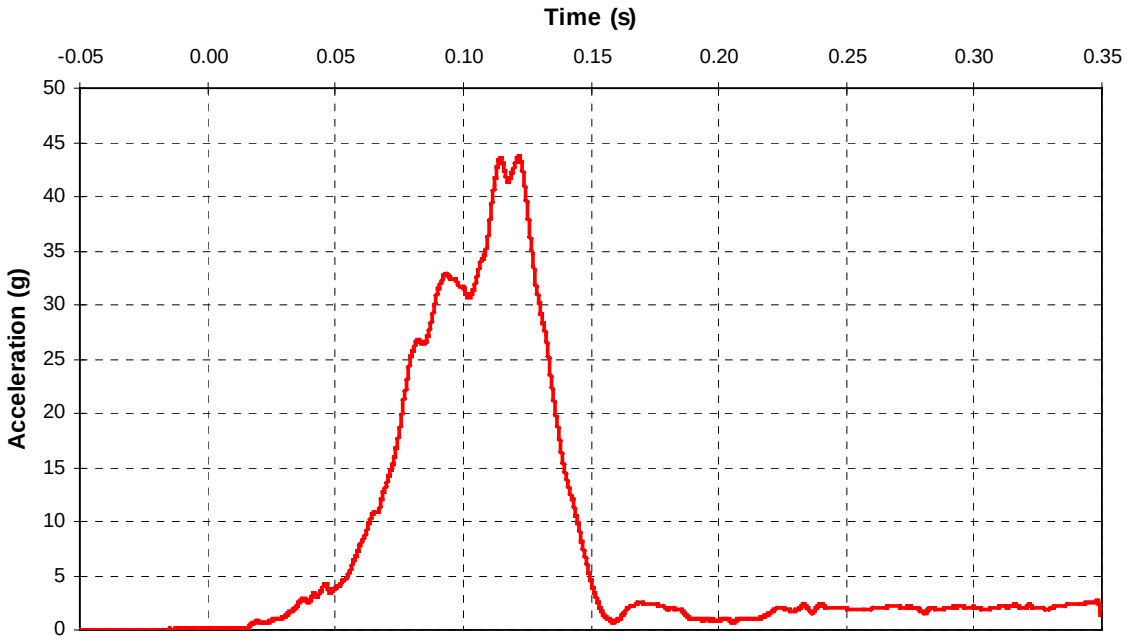
A- 19 CF99022 2000 Saturn LS2 Chest L-M Acceleration



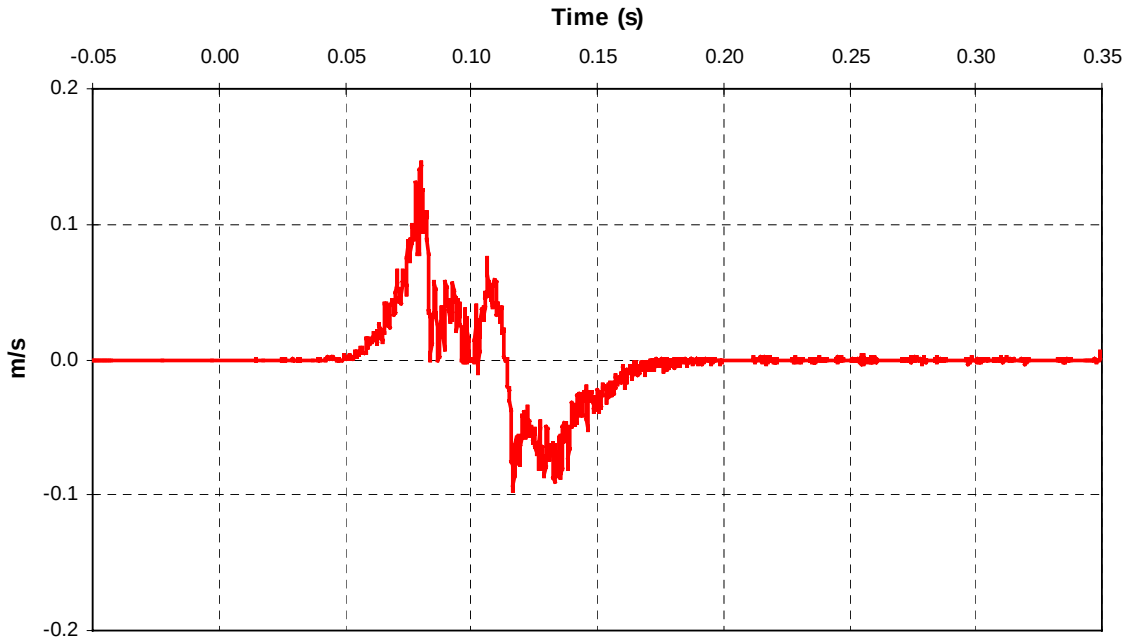
A- 20 CF99022 2000 Saturn LS2 Chest I-S Acceleration



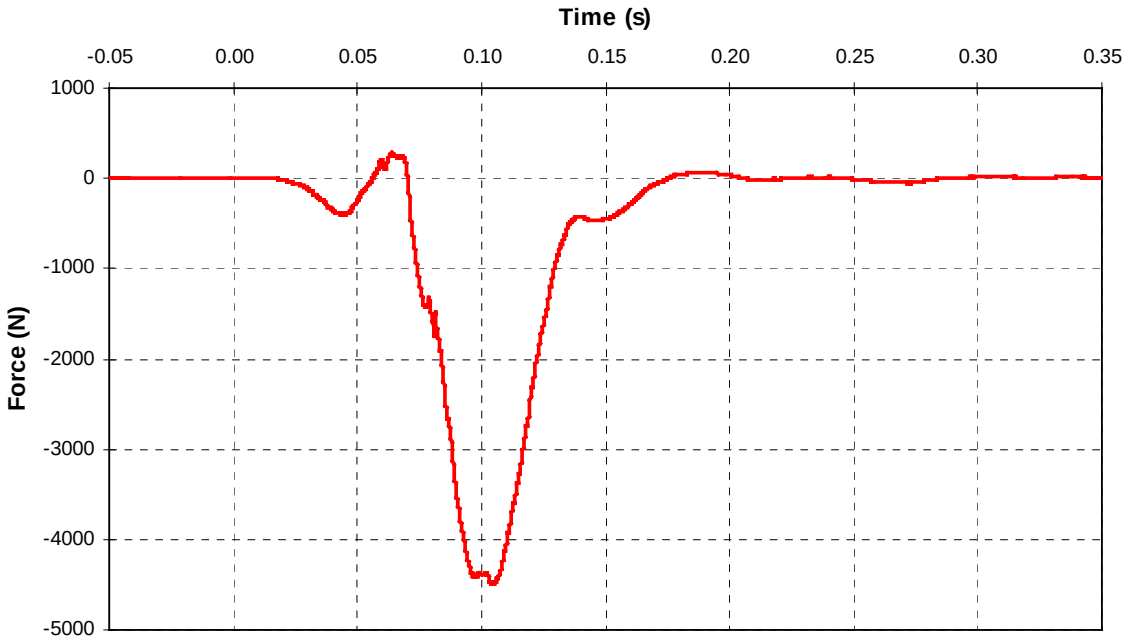
A- 21 CF99022 2000 Saturn LS2 Chest Vector Resultant Acceleration



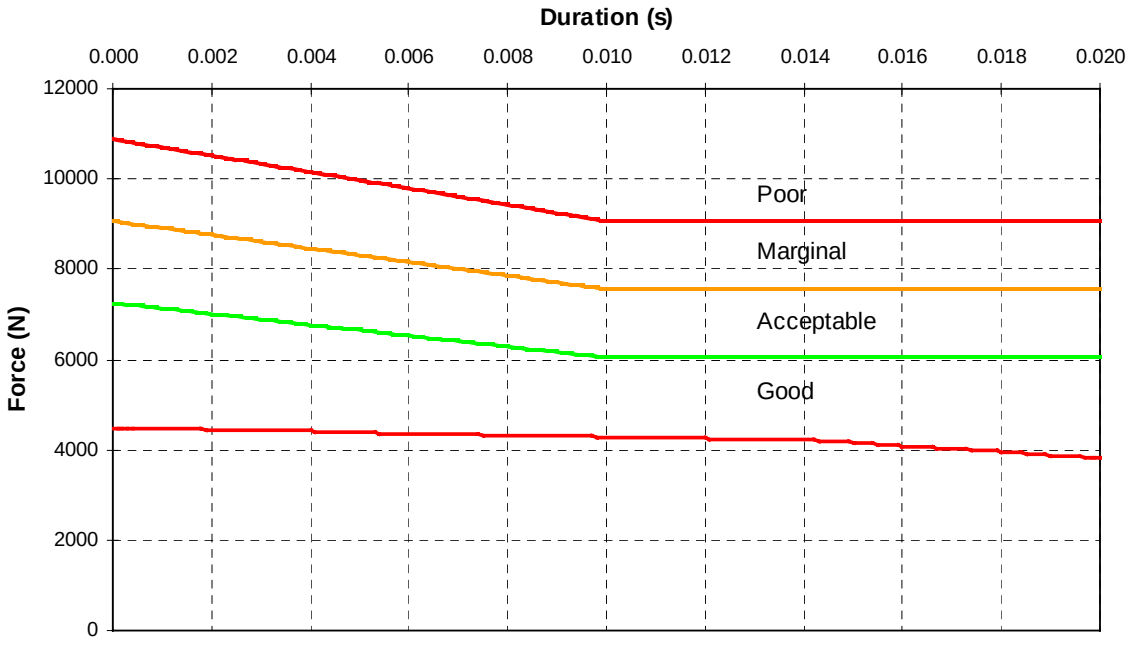
A- 22 CF99022 2000 Saturn LS2 Viscous Criterion



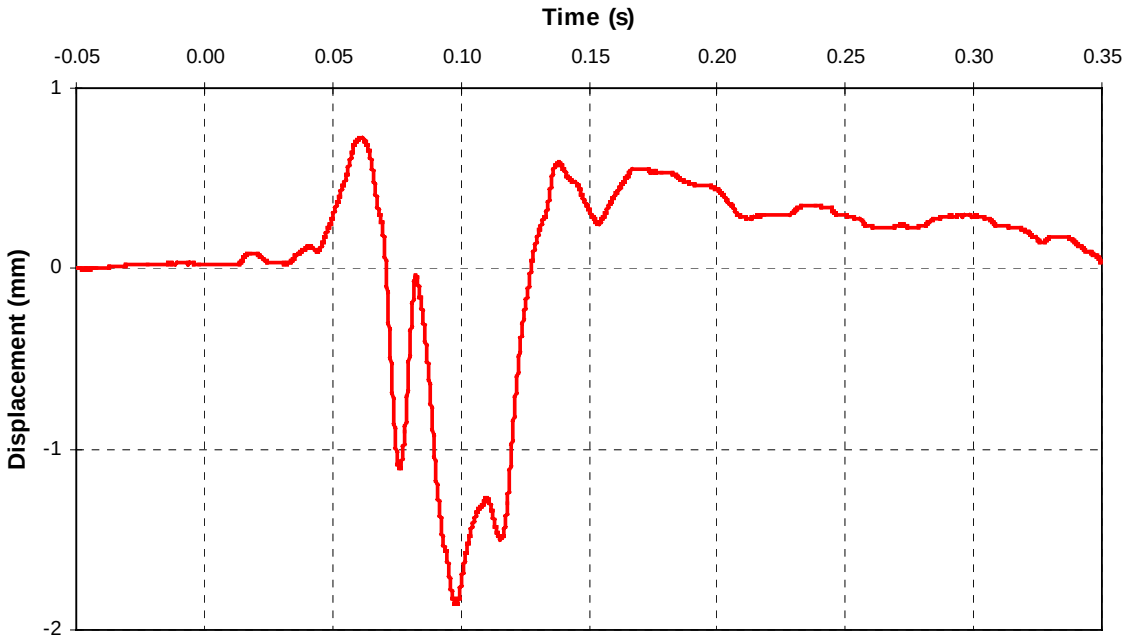
A- 23 CF99022 2000 Saturn LS2 Left Femur Axial Force



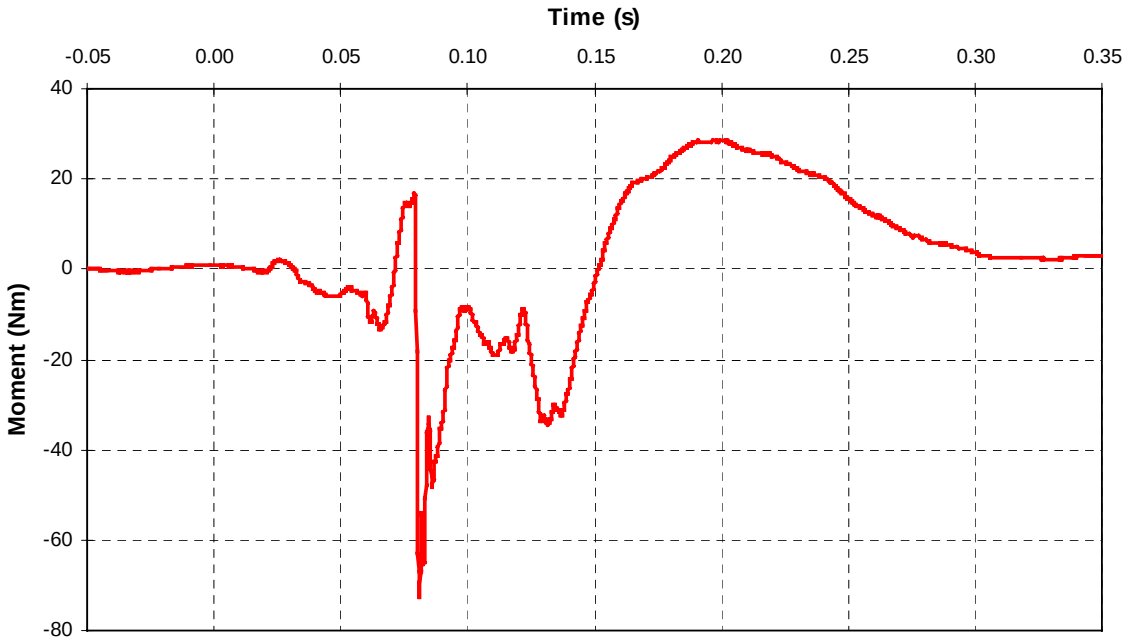
A- 24 CF99022 2000 Saturn LS2 Left Femur Axial Force Analysis



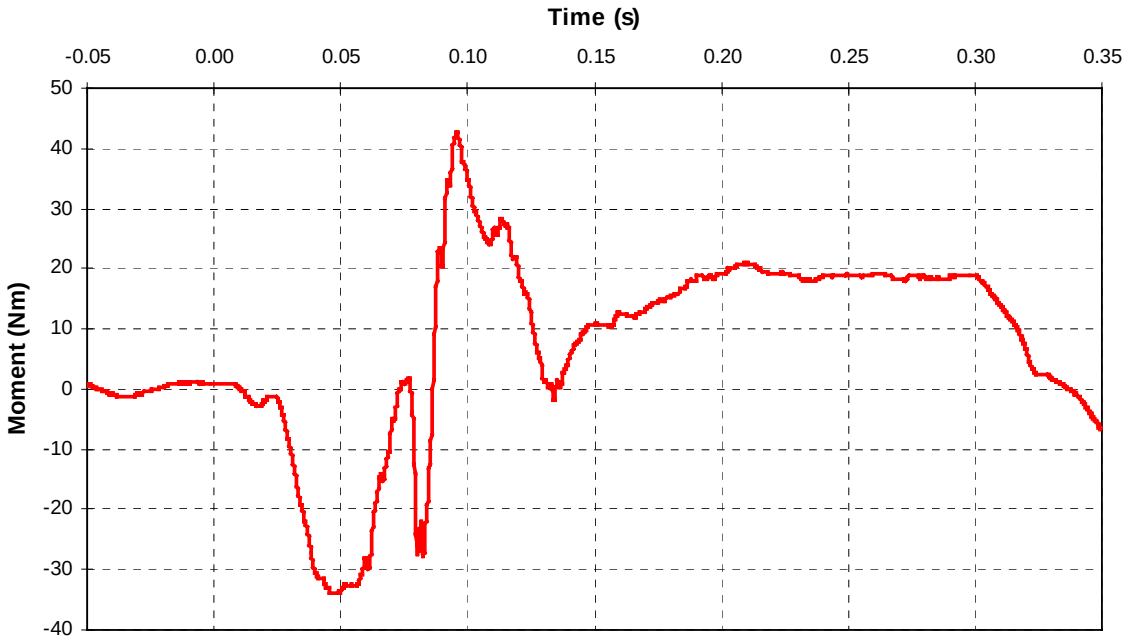
A- 25 CF99022 2000 Saturn LS2 Left Tibia-Femur Displacement



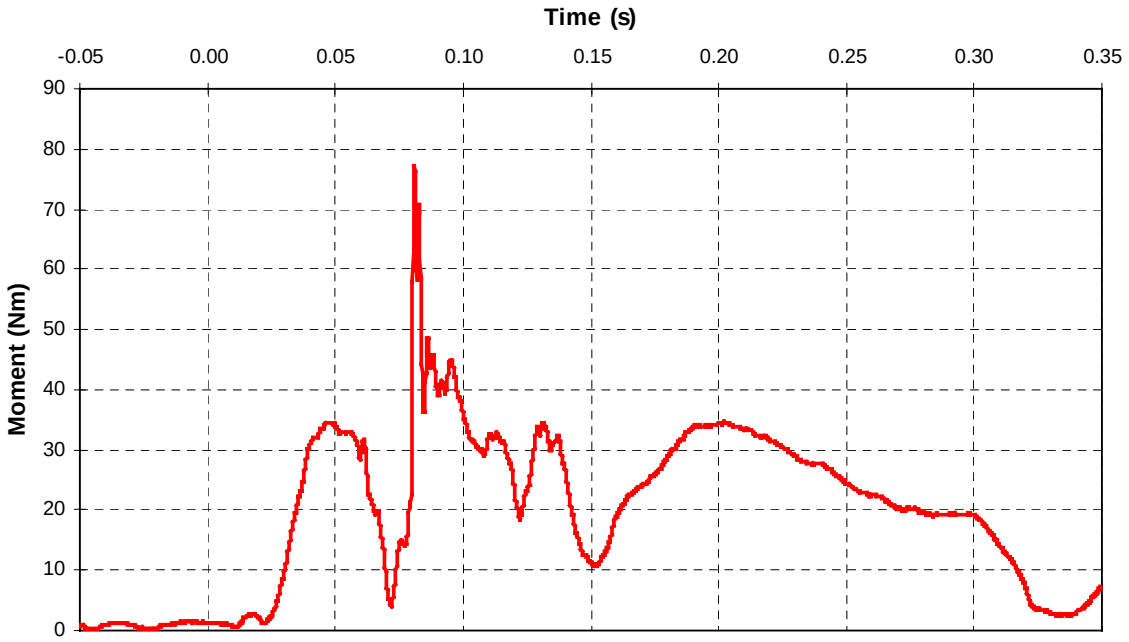
A- 26 CF99022 2000 Saturn LS2 Left Upper Tibia L-M Moment



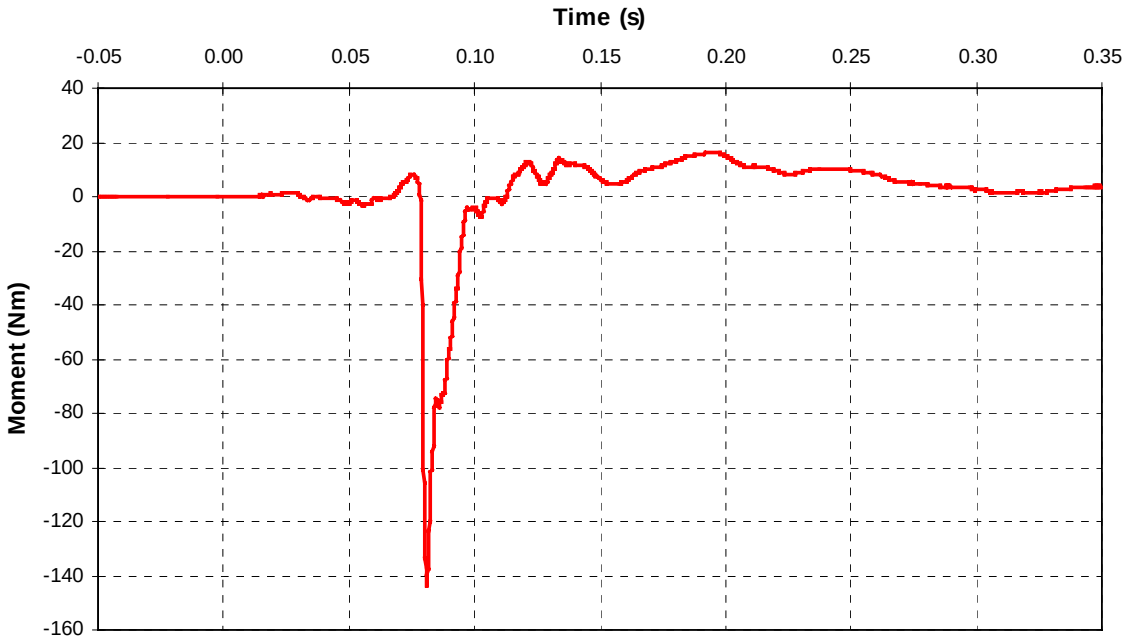
A- 27 CF99022 2000 Saturn LS2 Left Upper Tibia A-P Moment



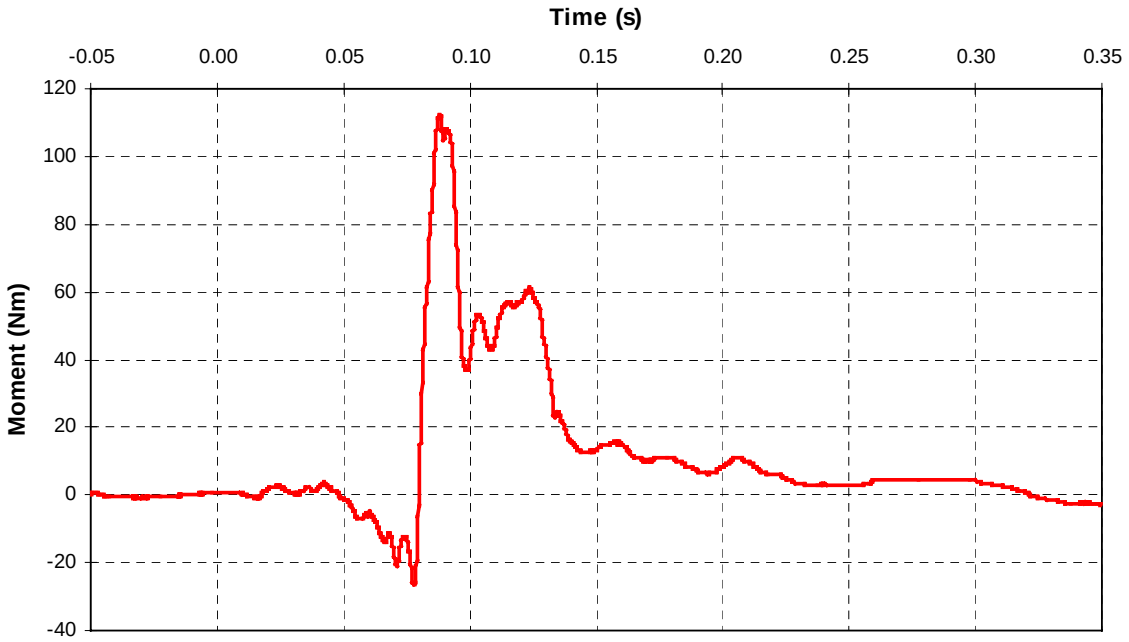
A- 28 CF99022 2000 Saturn LS2 Left Upper Tibia Vector Resultant Moment



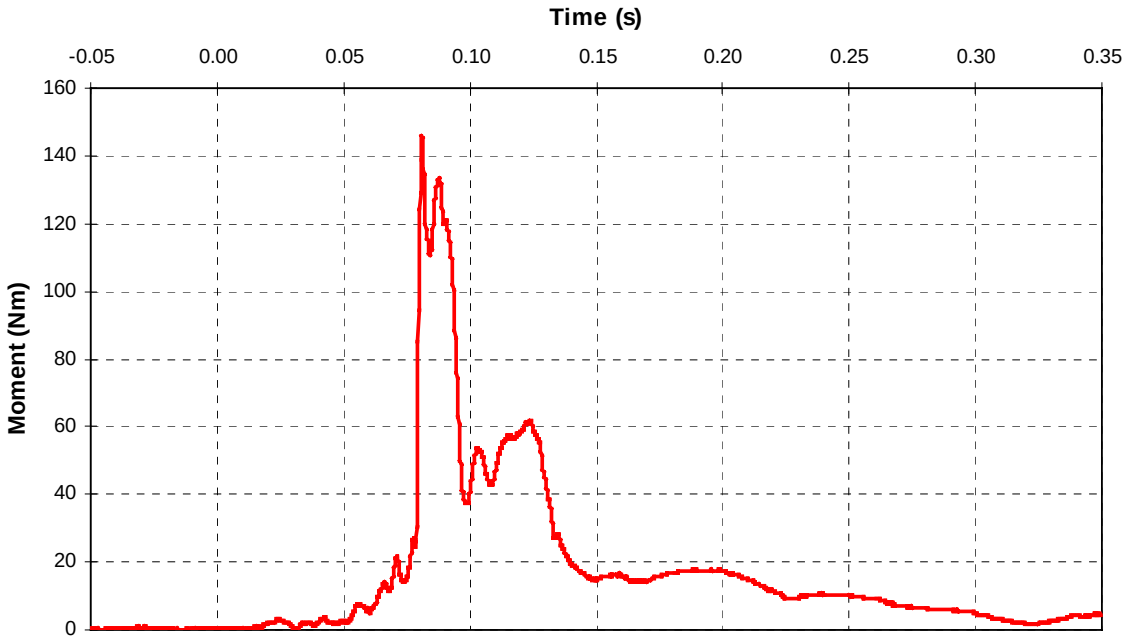
A- 29 CF99022 2000 Saturn LS2 Left Lower Tibia L-M Moment



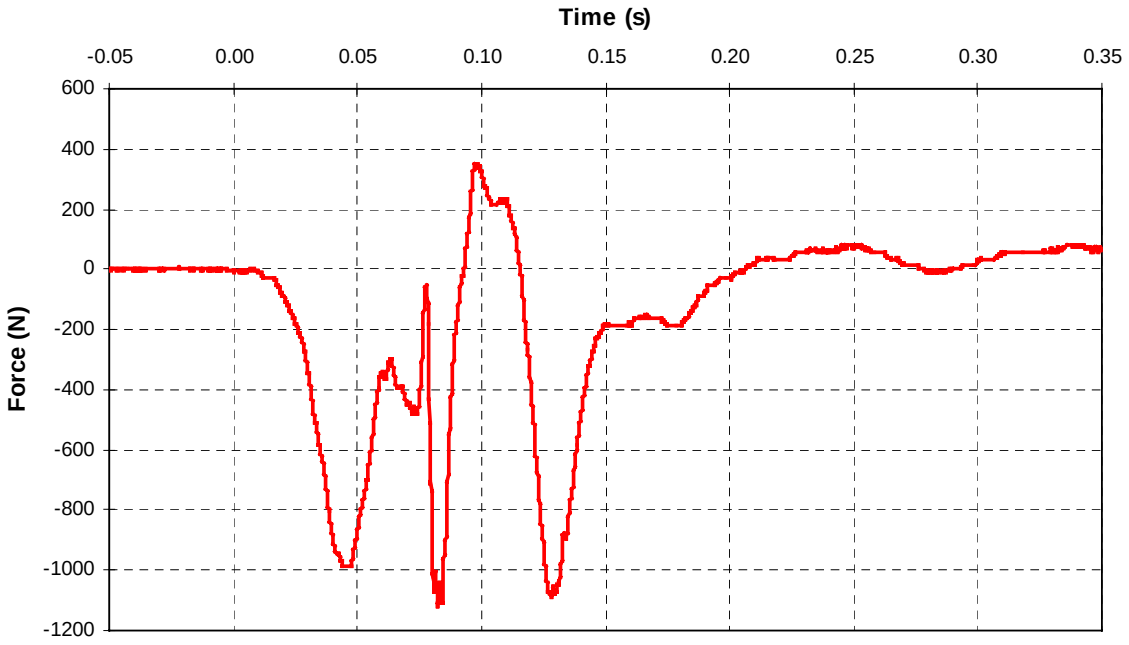
A- 30 CF99022 2000 Saturn LS2 Left Lower Tibia A-P Moment



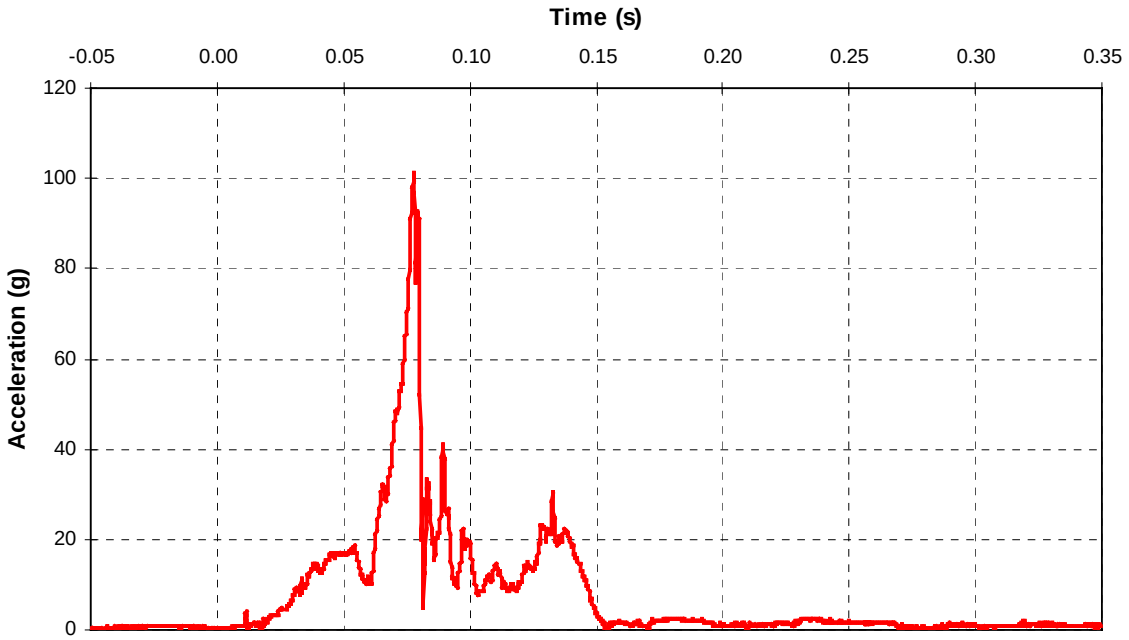
A- 31 CF99022 2000 Saturn LS2 Left Lower Tibia Vector Resultant Moment



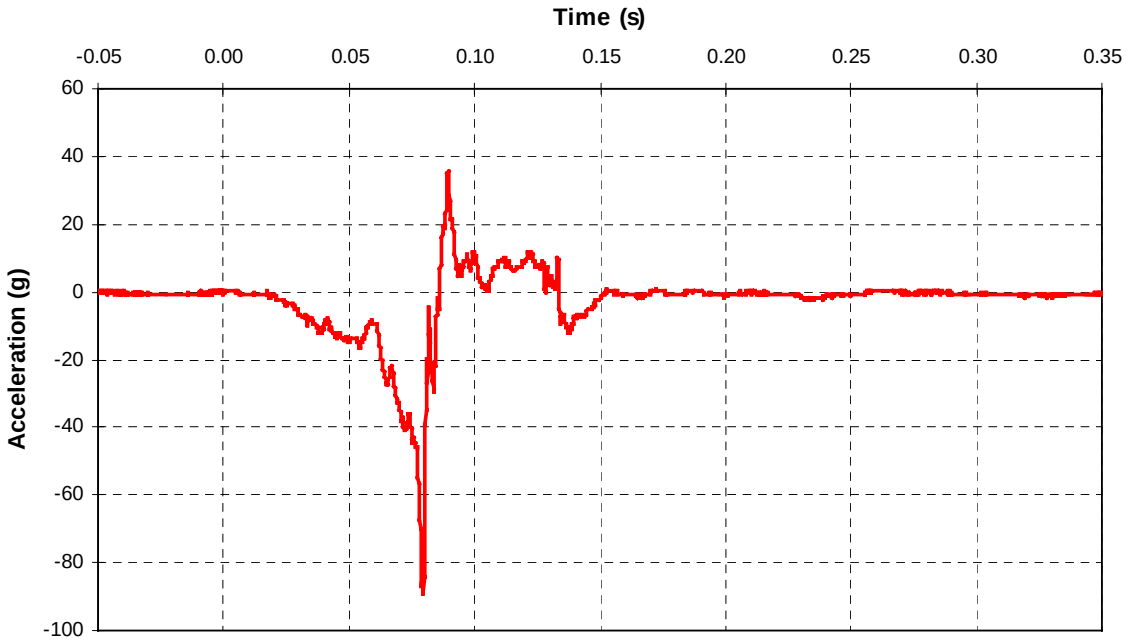
A- 32 CF99022 2000 Saturn LS2 Left Lower Tibia Axial Force



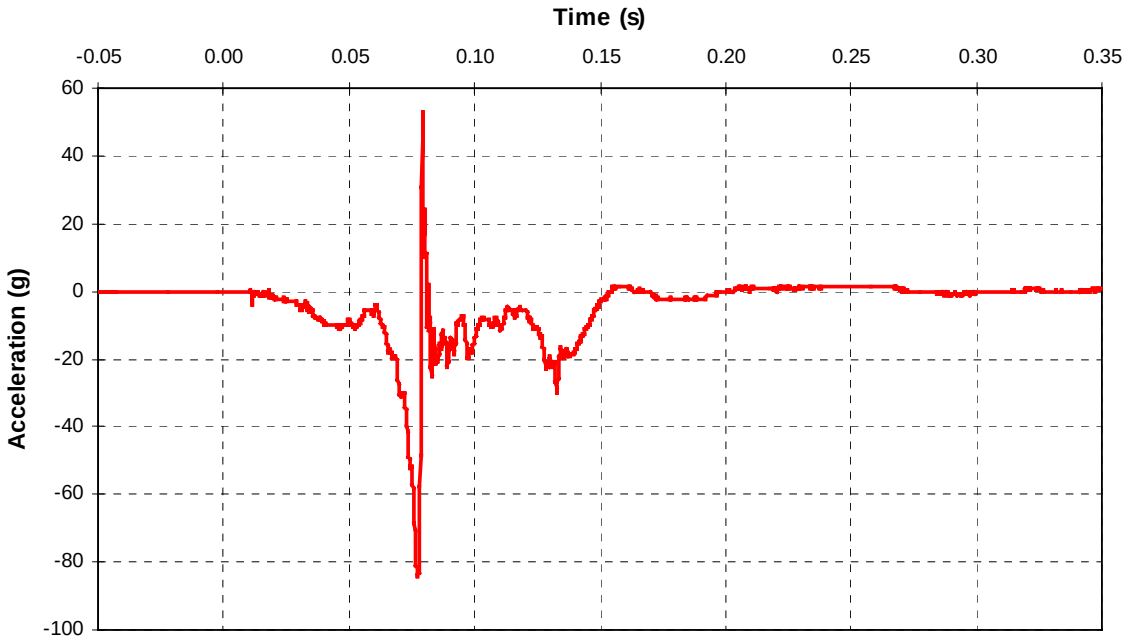
A- 33 CF99022 2000 Saturn LS2 Left Foot Vector Resultant Acceleration



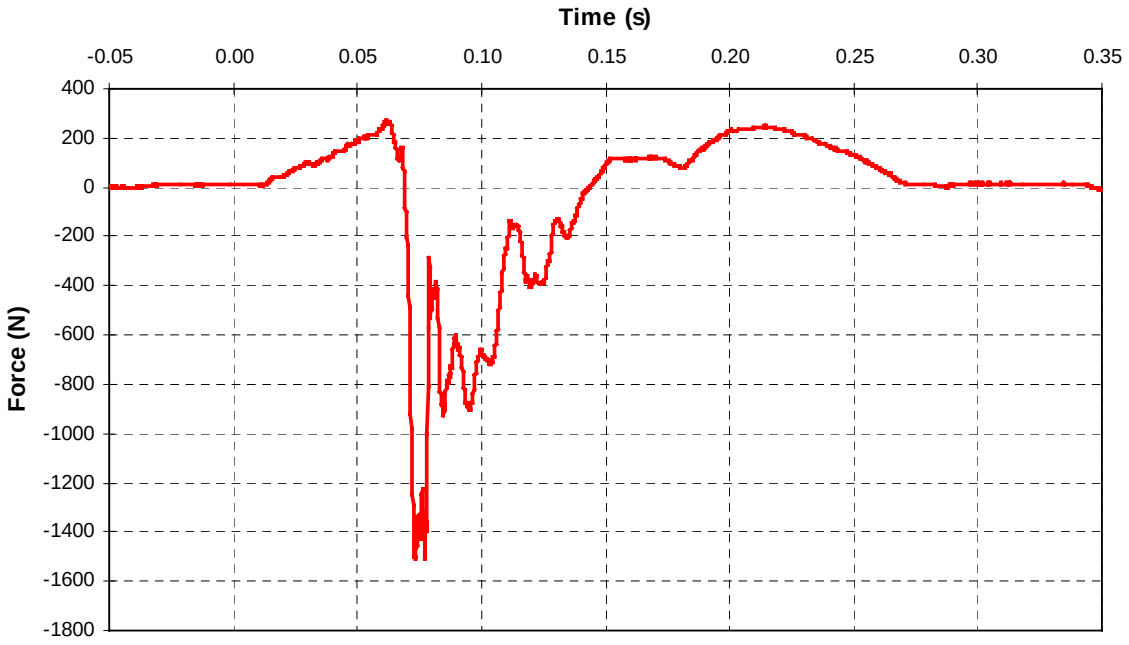
A- 34 CF99022 2000 Saturn LS2 Left Foot A-P Acceleration



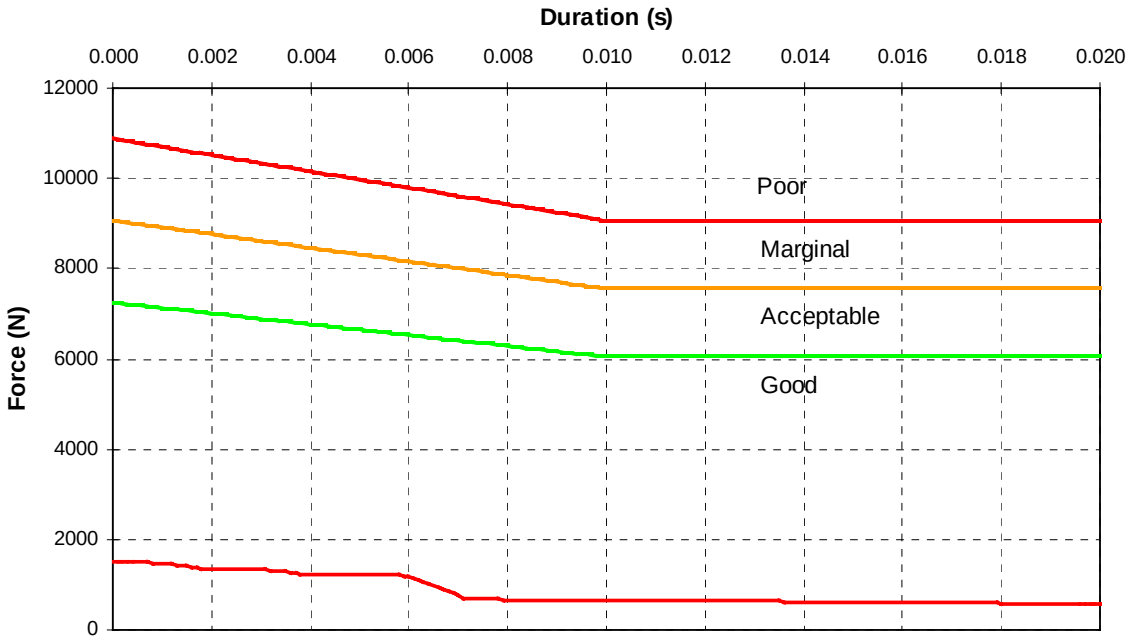
A- 35 CF99022 2000 Saturn LS2 Left Foot I-S Acceleration



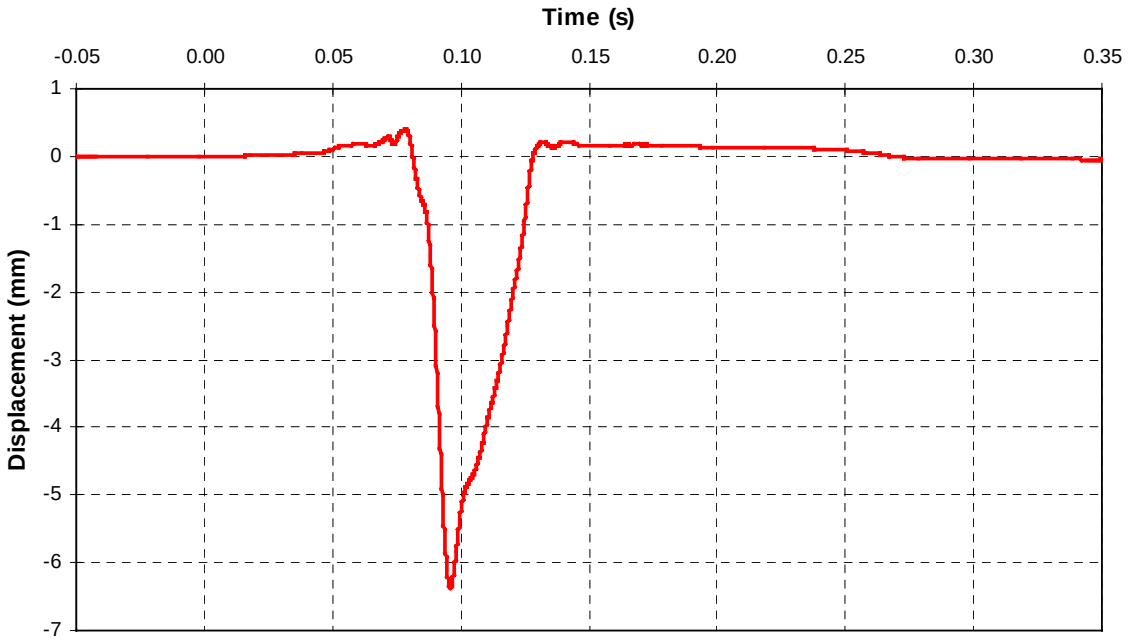
A- 36 CF99022 2000 Saturn LS2 Right Femur Axial Force



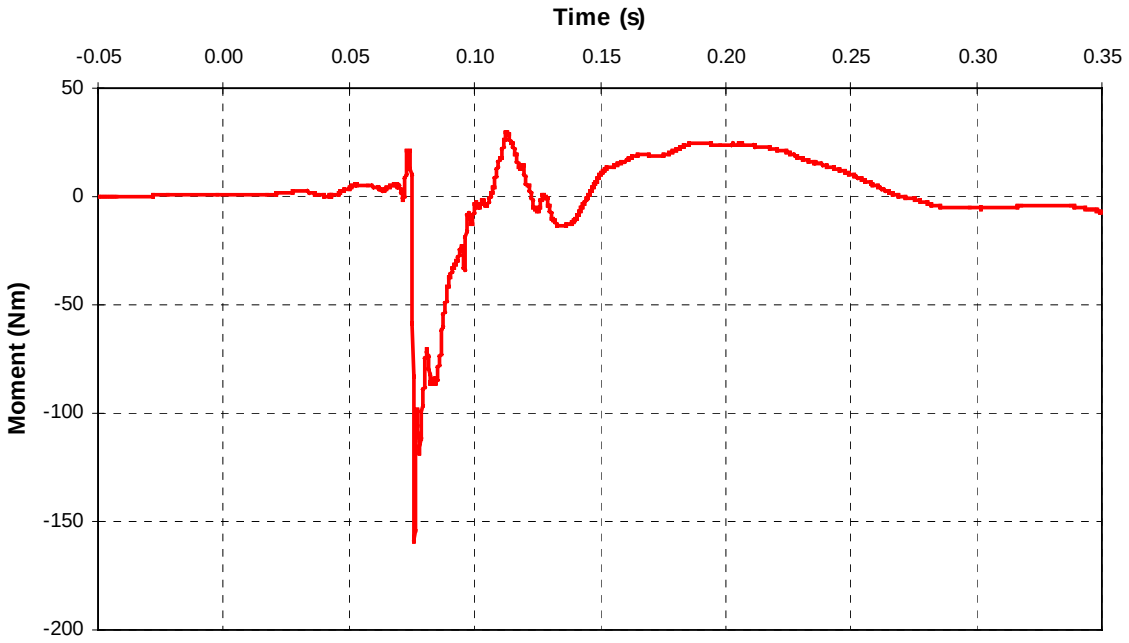
A- 37 CF99022 2000 Saturn LS2 Right Femur Axial Force Analysis



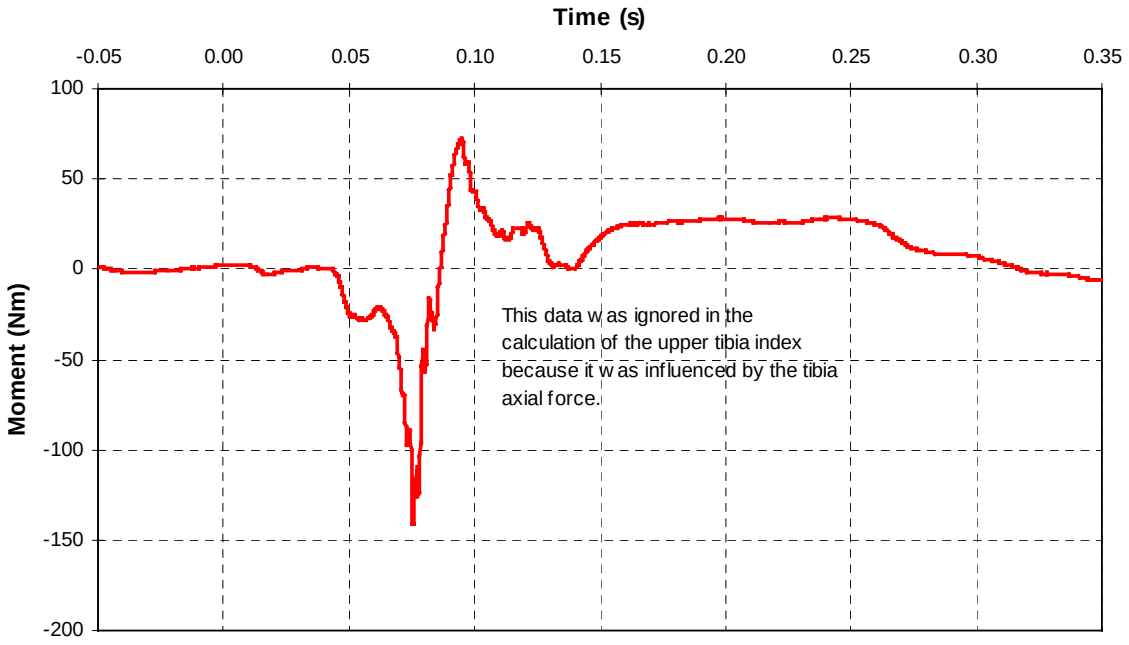
A- 38 CF99022 2000 Saturn LS2 Right Tibia-Femur Displacement



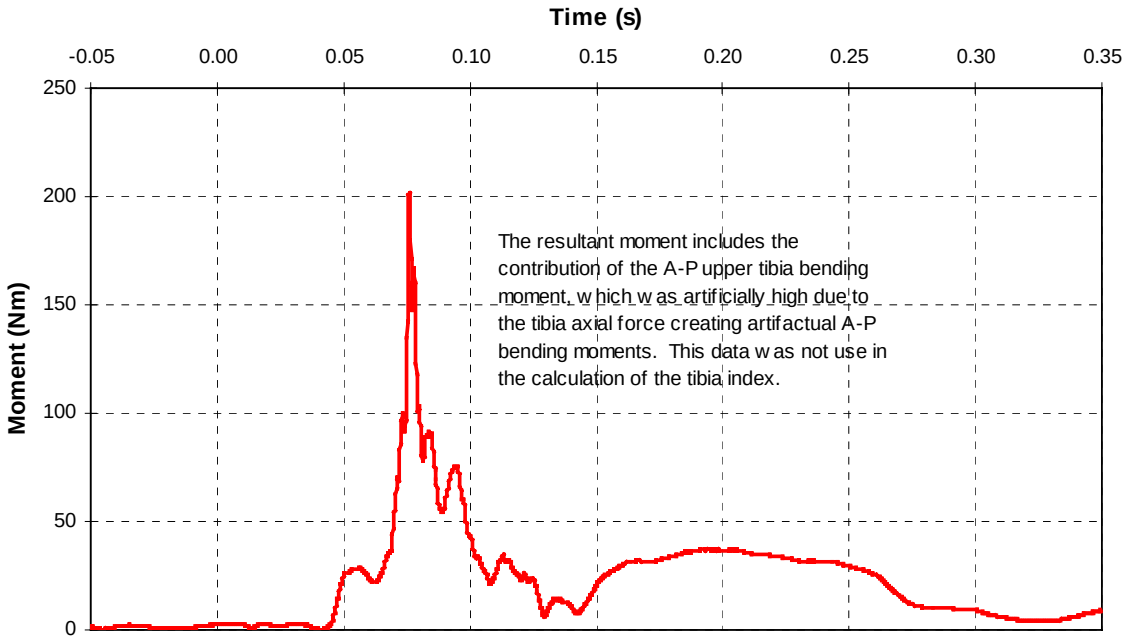
A- 39 CF99022 2000 Saturn LS2 Right Upper Tibia L-M Moment



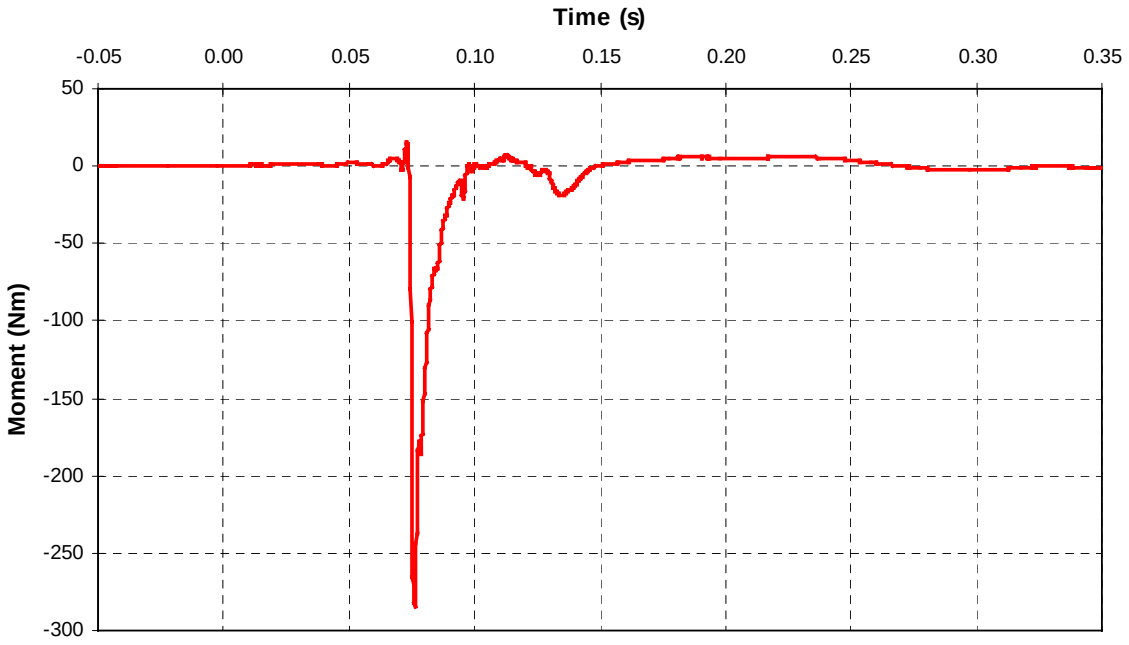
A- 40 CF99022 2000 Saturn LS2 Right Upper Tibia A-P Moment



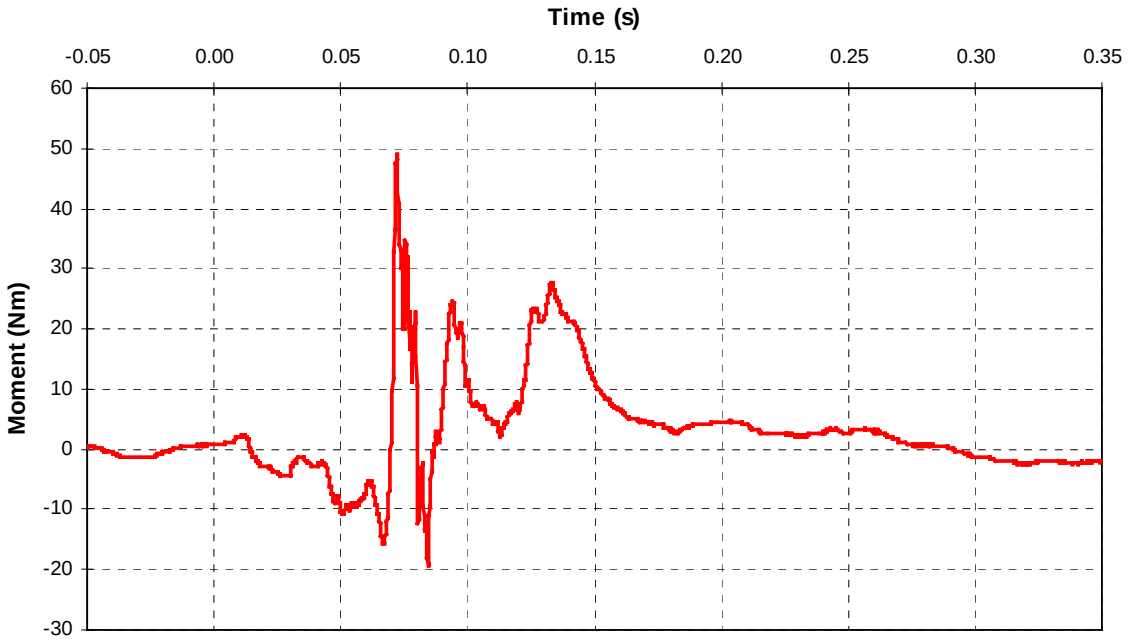
A- 41 CF99022 2000 Saturn LS2 Right Upper Tibia Vector Resultant Moment



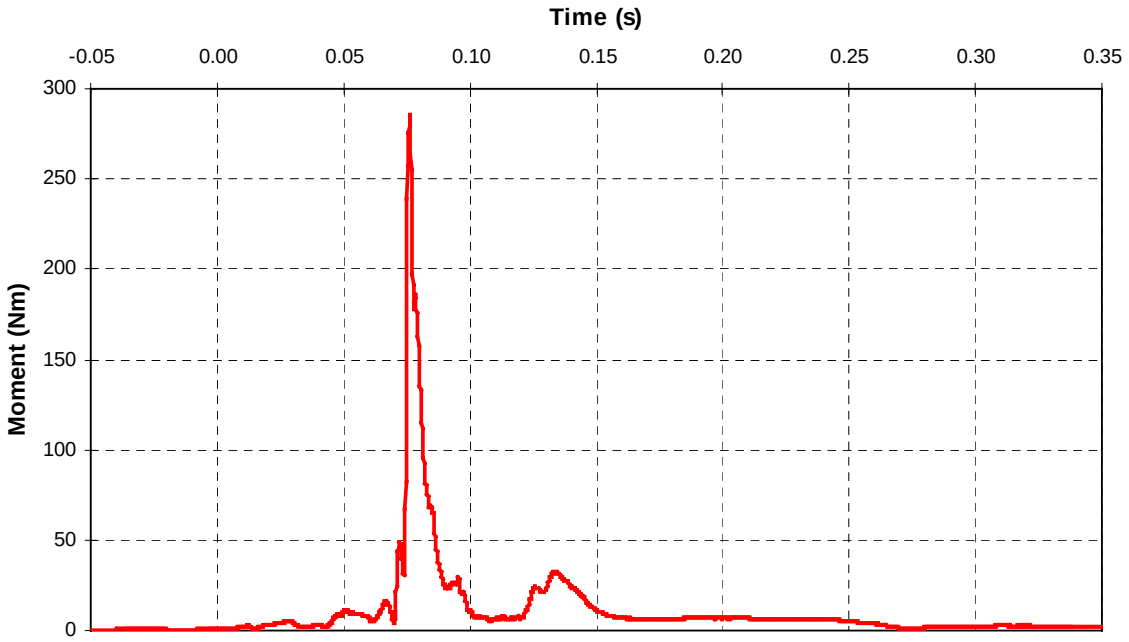
A- 42 CF99022 2000 Saturn LS2 Right Lower Tibia L-M Moment



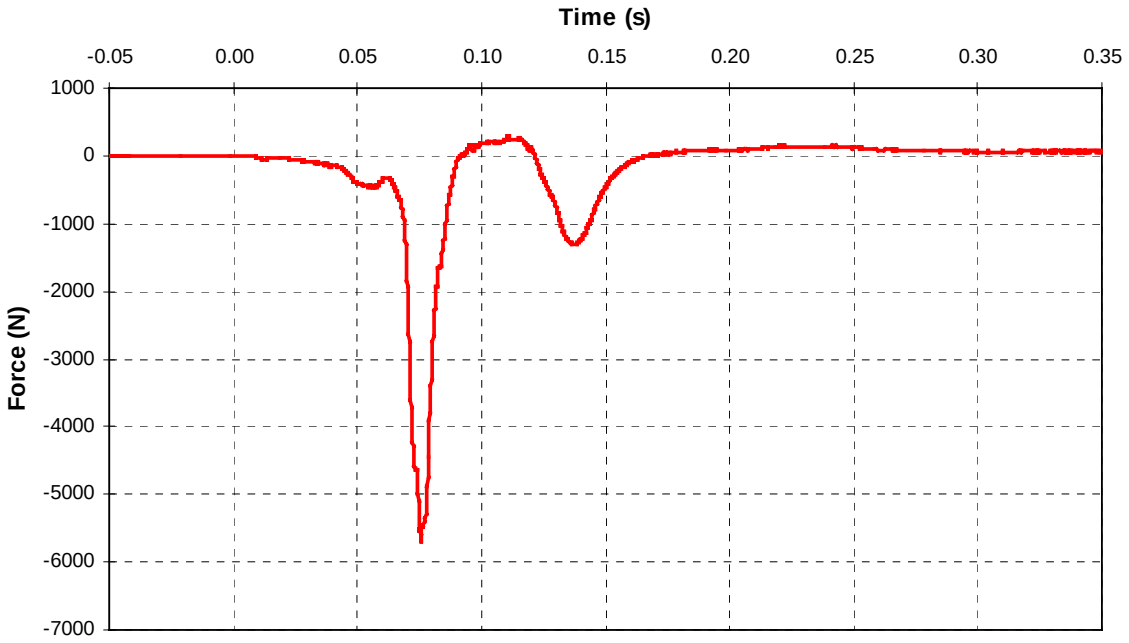
A- 43 CF99022 2000 Saturn LS2 Right Lower Tibia A-P Moment



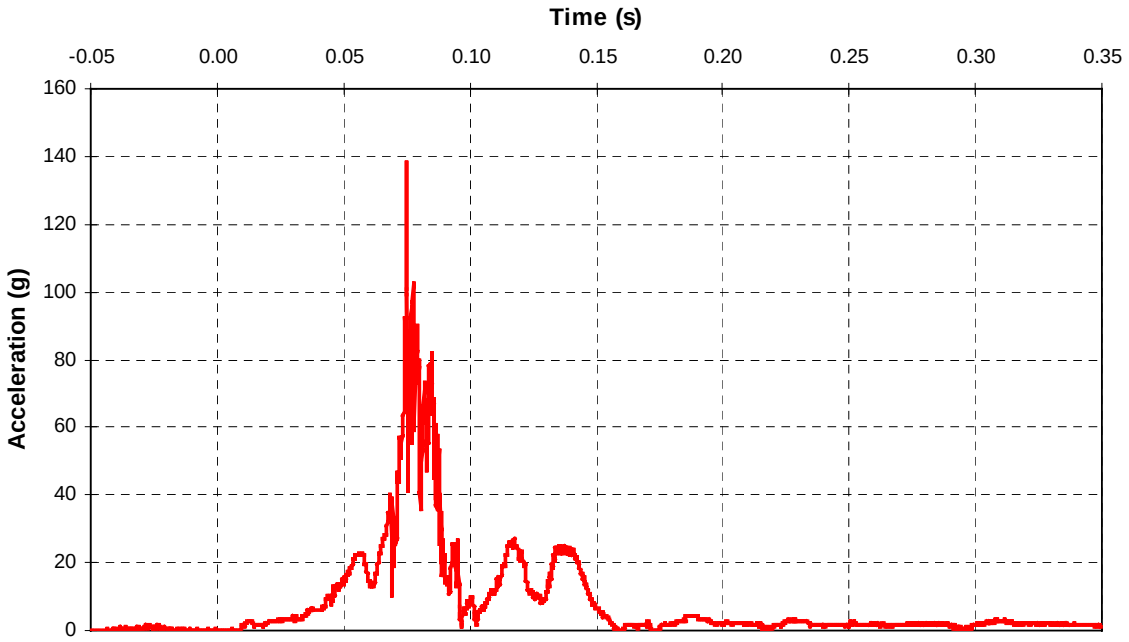
A- 44 CF99022 2000 Saturn LS2 Right Lower Tibia Vector Resultant Moment



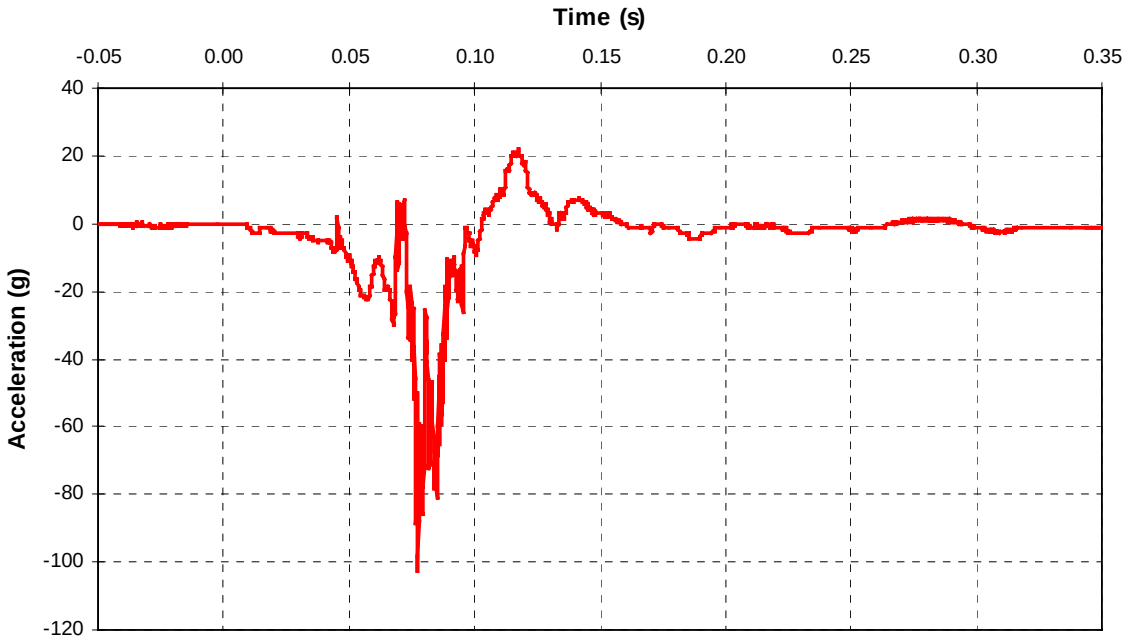
A- 45 CF99022 2000 Saturn LS2 Right Lower Tibia Axial Force



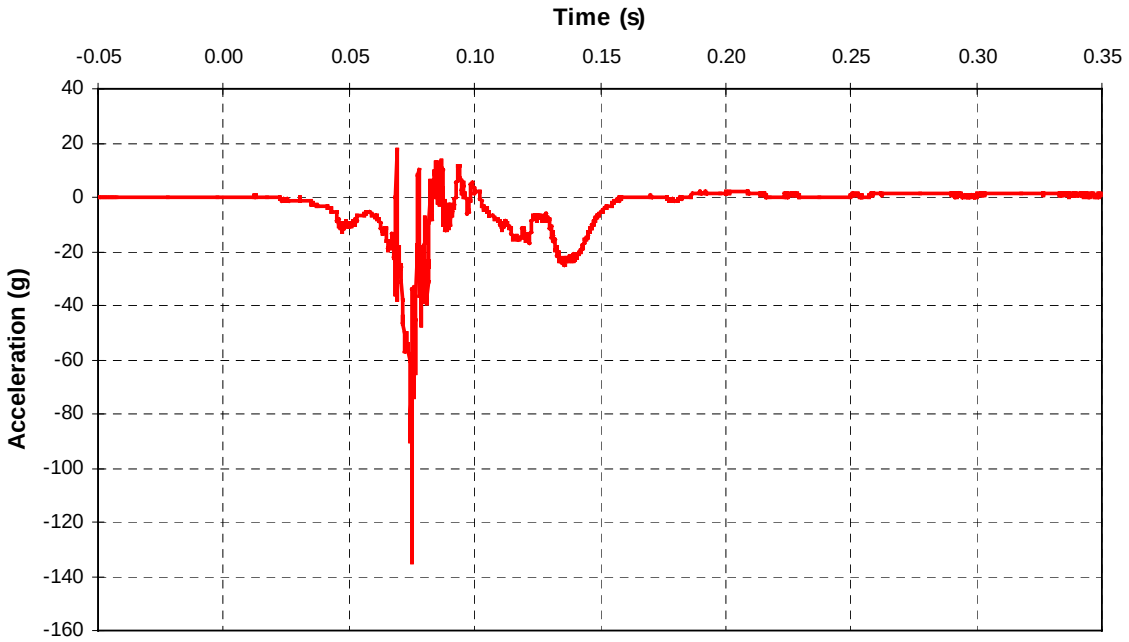
A- 46 CF99022 2000 Saturn LS2 Right Foot Vector Resultant Acceleration



A- 47 CF99022 2000 Saturn LS2 Right Foot A-P Acceleration



A- 48 CF99022 2000 Saturn LS2 Right Foot I-S Acceleration



2000 LS2 - AUTOMATIC

3.0L DOHC V6 ENGINE

4-SPD AUTOMATIC TRANSMISSION

EXTERIOR DARK RED

INTERIOR GREY LEATHER

SATURN

STANDARD EQUIPMENT

Items Featured Below are included at NO EXTRA CHARGE in the Standard Vehicle Price Shown at Right

- 3.0L DOHC 24 VALVE V6 ENGINE
- 4-SPD AUTOMATIC TRANSMISSION
- IMMOBILIZER THEFT DETERNT SYS
- SECURITY SYS W/ REMOTE ENTRY
- 4-WAY ADJ FRT HEAD RESTRAINTS
- 2-SPEED INTERMITTENT WIPERS
- FOG LAMPS
- AUTO DOOR LOCK W/ KEY ON/OFF
- 2 KEY VALET SYS W/ SECURE TRK
- 5MPH COLOR-KEYED IMPACT BUMPR
- FRONT & REAR STABILIZER BARS
- 4 WHEEL DISC BRAKES
- ENHANCED SPORT TUNED SUSPSN
- DENT RESISTANT DOORS/FENDERS
- P205/65R15 PERFORMANCE TIRES
- 15" ALLOY WHEELS
- DUAL HEATED POWER MIRRORS
- DRIVER SEAT HEIGHT ADJUSTER
- AM/FM CD & CASS W/ 8 SPEAKERS
- AIR CONDITIONING W/FILTRATION
- CRUISE CONTROL
- POWER LOCKS AND WINDOWS
- ADJ. DRIVER LUMBAR SUPPORT
- FOLD-DOWN RR SEATS (60/40)
- DUAL LIT VISOR VANITY MIRRORS
- 4-WAY ADJ FRT HEAD RESTRAINTS
- FRONT CONSOLE W/ CUPHOLDERS
- REAR ARMREST W/ CUPHOLDERS
- INTERIOR WOODGRAIN ACCENTS
- TACHOMETER & TRIP ODOMETER
- FRONT AND REAR FLOOR MATS
- LEATHER WRPD TILT STRG WHEEL
- 3YR/36K BMPR TO BMPR WARRANTY
- 24 HOUR ROADSIDE ASSISTANCE
- 100,000 MILE TUNE-UP INTERVAL

*** SAFETY FEATURES ***

- REDUCED FORCE DUAL AIR BAGS
- DAYTIME RUNNING LAMPS
- SIDE IMPACT DOOR BEAMS & PADS
- 3-PT OUTBRD FRT/RR SFTY BELTS
- CHILD PROOF REAR DOOR LOCKS

Compare this vehicle to others in the **FREE FUEL ECONOMY GUIDE** available at the dealer.

CITY MPG

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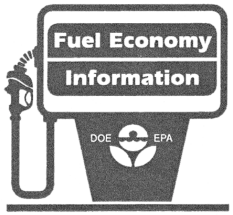

HIGHWAY MPG

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ACTUAL MILEAGE

WILL VARY WITH OPTIONS, DRIVING CONDITIONS, DRIVING HABITS AND VEHICLE'S CONDITION. RESULTS REPORTED TO EPA INDICATE THAT THE MAJORITY OF VEHICLES WITH THESE ESTIMATES WILL ACHIEVE BETWEEN

17 AND 23 MPG IN THE CITY AND BETWEEN

22 AND 30 MPG ON THE HIGHWAY.

2000 SATURN LS SEDAN
3.0 LITER V6 ENGINE
FUEL INJECTION, ELECTRONIC W/LOC
4 SPEED TRANSMISSION
CATALYST, FEEDBACK FUEL SYSTEM

ESTIMATED ANNUAL FUEL COST: $785

FOR COMPARISON SHOPPING, ALL VEHICLES CLASSIFIED AS MID-SIZE

HAVE BEEN ISSUED MILEAGE RATINGS RANGING FROM

TO MPG CITY AND

TO MPG HIGHWAY.

NOT AVAILABLE

ZRA

MANUFACTURER'S SUGGESTED RETAIL PRICE

STANDARD VEHICLE PRICE	**$20,135.00**
Options Installed by Manufacturer	
LEATHER APPOINTMENT PACKAGE • LEATHER SEATING SURFACES • HEATED FRONT SEATS • LEATHER DOOR TRIM • LEATHER WRAPPED PARK BRK HNDL • LEATHER WRAPPED SHIFT KNOB	1,095.00
6-WAY POWER DRIVER'S SEAT W/ ADJUSTABLE LUMBAR SUPPORT	325.00
POWER SUNROOF	725.00
REAR SPOILER	225.00
N/E STATES EMISSIONS PACKAGE	0.00
SATURN ADVANCED AUDIO SYSTEM (AMP, SUBWFR & PREM SPKRS)	220.00
TOTAL OPTIONS	2,590.00
TOTAL VEHICLE & OPTIONS	$22,725.00
DESTINATION CHARGE	440.00
TOTAL VEHICLE PRICE*	**$23,165.00**

SEQ. 211241
VIN 1G8JW52R5YY600967
FINAL ASSEMBLY: WILMINGTON, DE, USA

Delivered to SATURN OF RICHMOND
11840 MIDLOTHIAN TURNPIKE
MIDLOTHIAN, VA 23113

Order No. DKA334
Mod. No. ZJW19
Order Type: T
Ship To Fac 10034

This label has been applied pursuant to Federal law—Do not remove prior to delivery to the ultimate purchaser. *Includes Manufacturer's Recommended Pre-Delivery Service. Does not include dealer installed options and accessories, local taxes or license fees.

PART NO. 09227727

HL