Insurance Institute for Highway Safety
Crashworthiness Evaluation

Crash Test Report
1999 Pontiac Grand Am (CF99026)

Vehicle identification number: 1G2NE52T7XC579674
Body style: Midsize four-door sedan
Engine/transmission: Transverse 2.4-liter 4-cylinder, 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)

Other standard safety features:

Four-wheel antilock brakes
Daytime running lamps

Vehicle specifications (provided by manufacturer):

Wheelbase:	272 cm
Overall length:	474 cm
Overall width:	179 cm
Curb weight:	1,413 kg

Vehicle specifications (measured):

Front bumper to firewall:	128 cm
Curb weight:	1,397 kg
Test weight:	1,513 kg (61% front, 39% rear)
Overall width:	179 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 26, 1999

Figure 1
Precrash and Postcrash Side Views — 1999 Pontiac Grand Am

Summary

A 1999 Pontiac Grand Am was crash tested on October 26, 1999 into a fixed deformable barrier at 39.9 mi/h (64.2 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 10-13 cm. Resultant intrusion in the driver footwell measured 23 cm at the footrest and 18-29 cm at other places on the toepan. All doors remained closed during the crash. After the crash, the driver and left rear doors required tools to open, and the right front and right rear doors opened with ease. The floorpan was buckled sharply upward just in front of the driver seat, and the welded seam joining the floorpan to the door sill was torn open.

The driver dummy was restrained by a three-point lap/shoulder belt and an airbag. During the crash, 6 cm of webbing spooled off the retractor. The airbag contacted the dummy's face during deployment. During rebound from the airbag, the dummy's head leaned outward partway past the precrash plane of the open side window and moved downward toward the driver door, which had bowed outward. The left rear part of the head contacted the window sill. The head then moved rearward and upward, and the center rear of the head contacted the leading edge of the B-pillar and shoulder belt upper anchorage D-ring. After the crash, the upper end of the steering column had moved upward 14 cm and rearward 6 cm.

The maximum resultant head acceleration was 88 g from the B-pillar and shoulder belt D-ring contact and 26 g from the window sill contact. The right leg had a maximum tibia axial force of –4.0 kN and a maximum lower tibia L-M moment of –228 Nm, which contributed to a lower tibia index of 1.14.

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 on the footrest.

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 63 cm behind its center of gravity (170 cm behind the front axle). The vehicle speed recorded just prior to impact was 39.9 mi/h (64.2 km/h), and the actual overlap was 41 percent.

Structural Performance

All doors remained closed during the crash. The driver door aperture shortened 6 cm, as measured at the lower edge of the window. After the crash, the driver door required extensive prying with tools to open, the left rear door required light prying with tools to open, and the right front and right rear doors opened with ease.

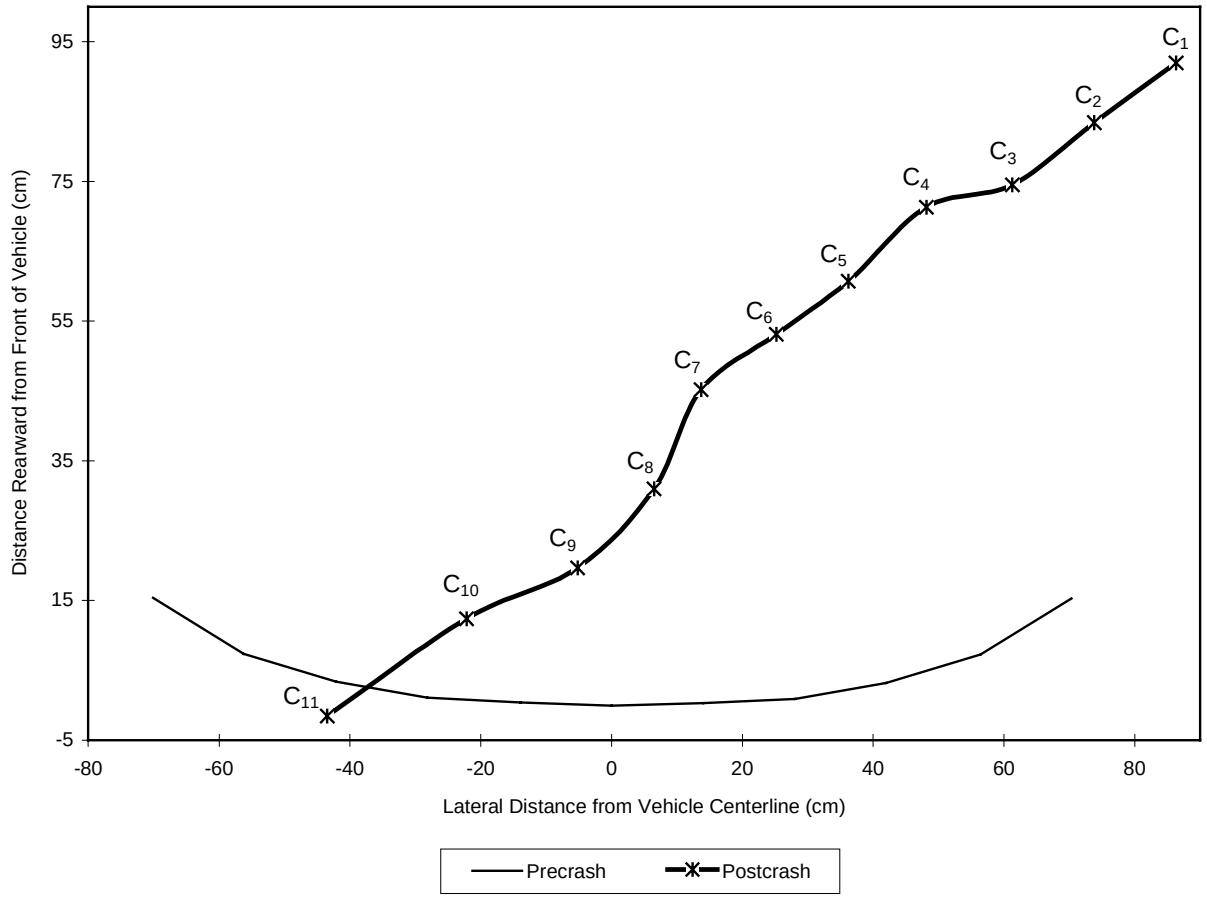
The floorpan was buckled sharply upward just in front of the driver seat, and the welded seam joining the floorpan to the door sill was torn open. The tear was about 32 cm long and had a maximum gap width of 4 cm.

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 — 1999 Pontiac Grand Am

Figure 3
Front Bumper Cover Crush Contour — 1999 Pontiac Grand Am



	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)	92	83	75	71	61	53	45	31	20	12	–2
Precrash Contour (cm)	15	7	3	1	0	0	0	1	3	7	15
Resulting Crush (cm)	77	76	72	70	61	53	45	30	17	5	–17

The bumper cover was torn almost completely off the vehicle during the crash. The postcrash contour represents the best attempt to fit the cover back onto the vehicle. The length of the reference line was 140 cm precrash and 130 cm postcrash.

Figure 4
Precrash and Postcrash Views from Below — 1999 Pontiac Grand Am

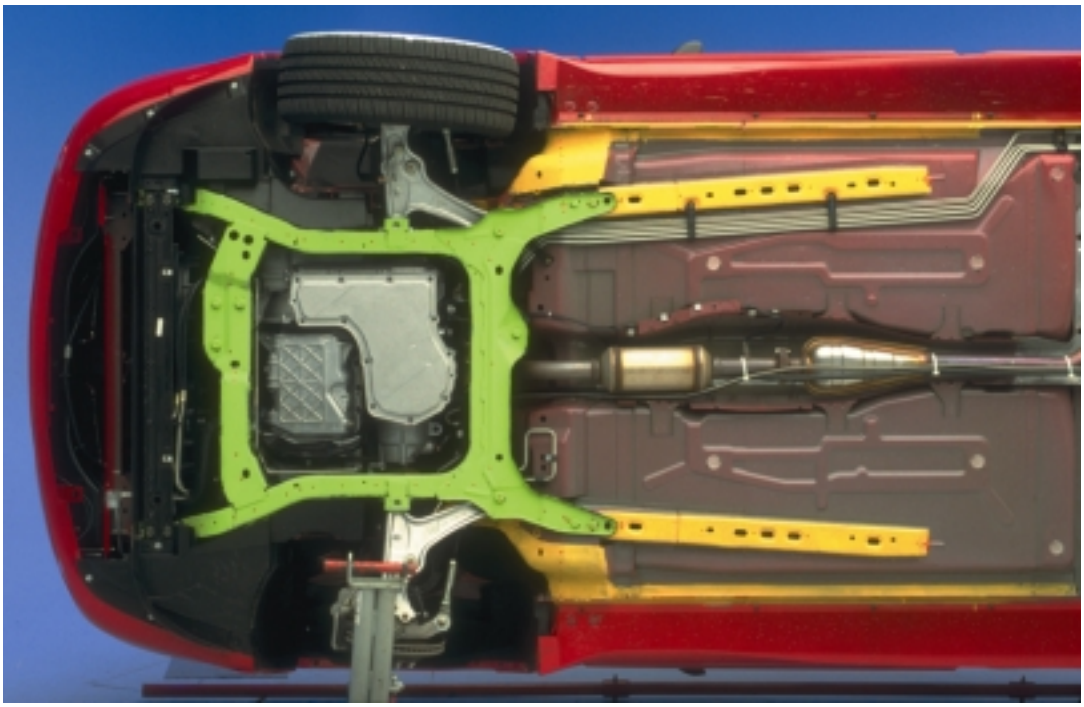
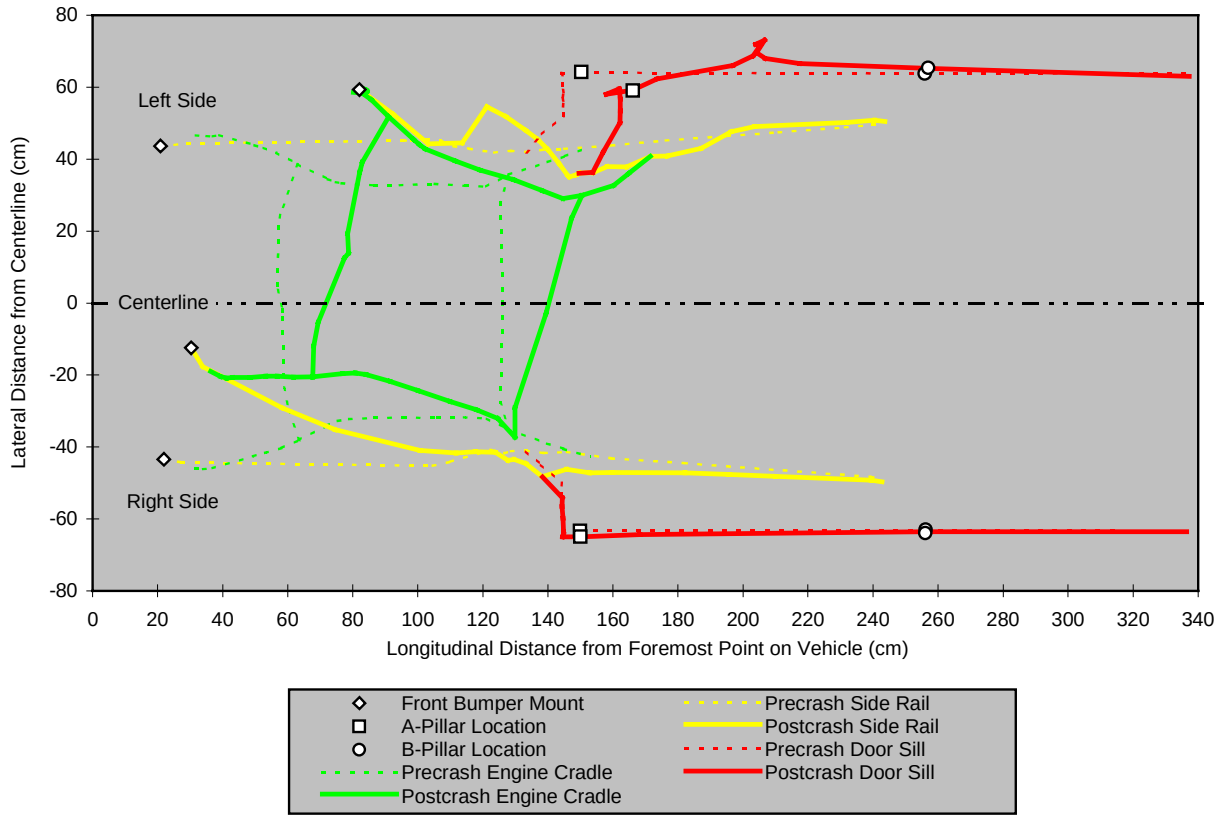
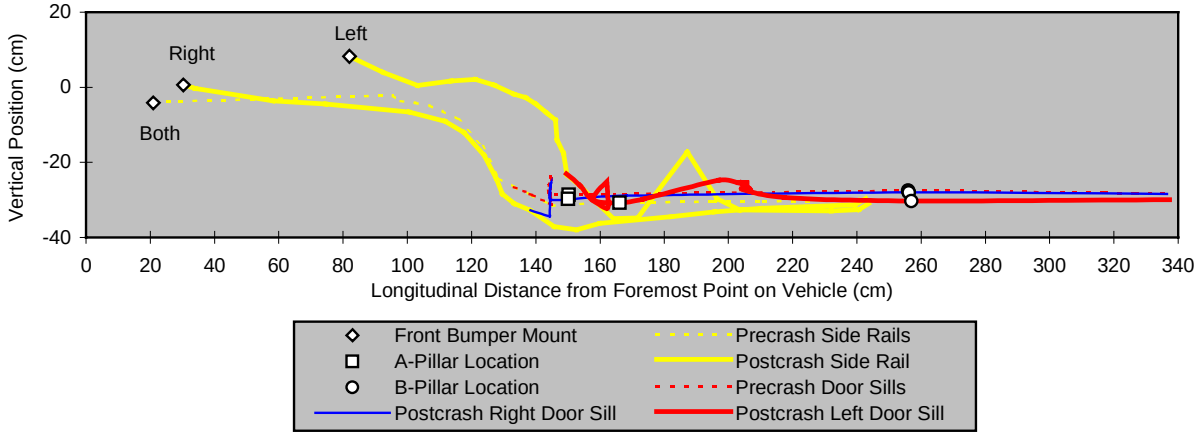


Figure 5
Structural Deformation, Views from Below and Side — 1999 Pontiac Grand Am





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 — 1999 Pontiac Grand Am

Selected Locations*	Longitudinal	Lateral	Vertical	Resultant
Steering column (cm)	–6	–3	14	16
Left lower instrument panel (cm)	–13	–4	10	17
Right lower instrument panel (cm)	–10	–4	10	14
Brake pedal (cm)	–19	–5	3	20
Left toepan (cm)	–27	–8	5	29
Center toepan (cm)	–26	–7	6	28
Right toepan (cm)	–18	–4	2	18
Footrest (cm)	–22	–6	3	23
Average displacement of the four seat-attachment bolts relative to reference system (cm)	0	2	–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 70 cm in diameter and is untethered. The airbag is vented by two holes located at positions corresponding to 10 and 2 o'clock on the forward-facing surface of the airbag. Analysis of the high-speed film taken from camera position E indicated the airbag deployed at 48 ms into the crash and appeared to be fully inflated at 70 ms.

Passenger: The top-mounted passenger airbag deployed vertically, and the excursion of its center when inflated is limited by two tethers. The cylinder-shaped airbag has no vent holes but is made of porous fabric. 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 lower anchorage points are attached to and move with the seats. The front outboard lower anchorage points are bolted to the sills at the base of the B-pillars. During the crash, 6 cm of webbing was pulled from the retractor through the D-ring, as measured by a pull-string mounted between the retractor housing and the webbing beyond the retractor. Postcrash investigation of the force-limiting sliding mount to which the retractor mechanism is attached indicated it was essentially unchanged from its precrash orientation. Therefore, the force limiter did not contribute any 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. Despite the sharp buckle in the floor ahead of the driver seat, there was little obvious pitching or tipping of the seat.

Steering Column

The upper end of the steering column moved upward 14 cm and rearward 6 cm relative to the driver seat.

Dummy Kinematics

Head, Neck, and Torso

Analysis of the high-speed film taken from camera position E indicated the deploying airbag contacted the dummy's face at 54 ms into the crash. The dummy's face began to load the airbag at 86 ms (16 ms after the airbag was fully inflated). Paint transferred from the dummy's face indicated the nose contacted the fully inflated airbag 8 cm above and 11 cm to the left of its center. During rebound from the airbag, the dummy's head leaned outward partway past the precrash plane of the open side window and moved downward toward the driver door, which had bowed outward. The left rear part of the head contacted the window sill 25 cm forward of the B-pillar at 153 ms. The head then moved rearward and upward, and the center rear of the head contacted the leading edge of the B-pillar and shoulder belt upper anchorage D-ring at 235 ms. Table 2 provides the timing of these events.

Table 2 Restraint System Performance and Dummy Kinematics — 1999 Pontiac Grand Am	
Event	**Time (ms)**
Deployment of airbag	48
Airbag contacts face during deployment	54
Airbag fully inflated	70
Face begins to load airbag	86
Left rear of head contacts window sill	153
Center rear of head contacts B-pillar	235

Figure 6
Dummy and Vehicle Interior, Postcrash — 1999 Pontiac Grand Am

Legs and Feet

Left leg and foot: Paint transferred from the dummy's left knee indicated the knee contacted the knee bolster 1 cm directly 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 directly below the knee impact location. The left foot was found fully dorsiflexed and slightly inverted, with the sole of the forefoot and heel against the intruded toepan to the right of the footrest and the back of the heel against a sharp downward buckle in the floorpan.

Right leg and foot: Paint transferred from the dummy's right knee indicated the knee contacted the knee bolster about 4 cm below and 6 cm to the left of the right instrument panel intrusion reference point. Paint transferred from the dummy's right shin indicated the shin contacted the bolster directly below the knee impact location. The right foot was found fully dorsiflexed and considerably everted, with the back of the heel against a sharp downward buckle in the floormat/carpeting on the floorpan. The medial sole was pressed against the intruded toepan, and the lateral sole at the instep was pressed against the accelerator pedal, which in turn was almost fully depressed against the intruded toepan. The lateral edge of the sole near the toe was against a steel brace to the right of the accelerator pedal.

Dummy Injury Measures

Head

The HICs were calculated during an interval that corresponds with the dummy's head excursion into the airbag, and the maximum vector resultant head accelerations were recorded when the dummy's head contacted the B-pillar and shoulder belt upper anchorage D-ring. The peak resultant accelerations were 88 g at 238 ms from the B-pillar contact and 26 g at 160 ms from window sill contact. Table 3 provides a summary of the maximum head injury measurements recorded during the crash.

Table 3
Head Injury Measurements — 1999 Pontiac Grand Am

Measure	Published Tolerance Threshold	Result	Time (ms)
Vector resultant acceleration (g)	80	88	238
Vector resultant acceleration — 3 ms clip (g)	80	64	237-240
Head Injury Criterion (HIC)	1000	514	77-113
Head Injury Criterion — 15 ms interval (HIC-15)*	700	331	88-103

* 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 — 1999 Pontiac Grand Am

Measure	Published Tolerance Threshold	Result	Time (ms)
A-P shear force (kN)	±3.1	–0.6	74
Axial compression force (kN)	4.0	0.1	241
Axial tension force (kN)	3.3	1.7	86
Flexion bending moment (Nm)	310	22	263
Extension bending moment (Nm)	122	26	117

Chest

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

Table 5
Chest Injury Measurements — 1999 Pontiac Grand Am

Measure	Published Tolerance Threshold	Result	Time (ms)
Vector resultant spine acceleration — 3 ms clip (g)	60	38	105-108
Rib compression (mm)	–50	–27	100
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 –4.0 kN at 82 ms and a maximum lower tibia L-M moment of –228 Nm at 82 ms, which contributed to a lower tibia index of 1.14 at 82 ms.

The upper tibia A-P bending moment had a time signature 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. 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 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 — 1999 Pontiac Grand Am

Measure	Published Tolerance Threshold	Left		Right	
		Result	Time (ms)	Result	Time (ms)
Femur axial force (kN)	–9.1*	–4.2	101	–2.8	89
Tibia-femur displacement (mm)	–15	–2	116	0	87
Upper Tibia					
L-M moment (Nm)	±225	–34	48	–139	82
A-P moment (Nm)	±225	–92	84	**	n/a
Vector resultant moment (Nm)	225	92	84	**	n/a
Index	1.00	0.48	84	0.73	82
Lower Tibia					
L-M moment (Nm)	±225***	67	73	–228	82
A-P moment (Nm)	±225***	34	98	47	84
Vector resultant moment (Nm)	225***	69	73	232	82
Axial force (kN)	–8.0***	–2.8	74	–4.0	82
Index	1.00	0.38	73	1.14	82
Foot					
A-P acceleration (g)	±150	–80	71	–56	71
I-S acceleration (g)	±150	–72	82	–51	82
Vector resultant acceleration (g)	150	90	70	67	71

* 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.

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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

1999 Pontiac Grand Am Midsize Four-Door Sedan: 5 mi/h Front into Angle Barrier

Test Number: LA99015
VIN: 1G2NE52T7XC579674
Mileage: 96
Features: Driver and passenger airbags, four-wheel antilock brakes, air conditioning, automatic transmission, power mirrors, keyless entry system, power door locks, power windows, power driver seat height adjustment, heated back glass, tilt steering wheel, cruise control, front fog lamps, two-stage paint.

	Part		Labor	
Description	**Mfg. No**	**Price**	**Operation**	**Hours**
Unibody, front			Set up*	1.0
Bumper reinforcement, front	22594042	$167.81	Replace*	2.8
Fog lamp assembly, left			Remove/reinstall	
Fog lamp assembly, right			Remove/reinstall	
Headlamp assembly, right	16526011	221.00	Replace	0.3
Headlamp mounting panel	22639967	151.53	Replace	0.8
Headlamps			Aim	0.5
Fender, right front	22605648	209.50	Replace**	1.9
Fender, right front			Refinish	3.4
Frame sidemember, right front			Repair/align*	1.0
Frame sidemember, right front			Refinish	0.5
End plate, frame sidemember, right front			Repair/align*	0.5
Horn			Remove/reinstall	0.2
Molding, right front fender			Remove/reinstall	0.1
Deflector, rocker panel, right			Remove/reinstall	
Paint and materials		70.20		
Total Parts		$820.04		
Total Labor		442.00		13.0
Grand Total		$1,262.04		

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

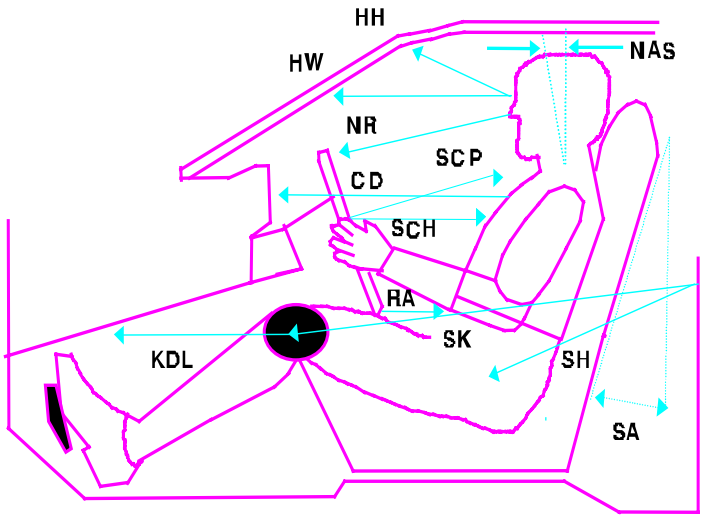
Dummy Clearance Measurements

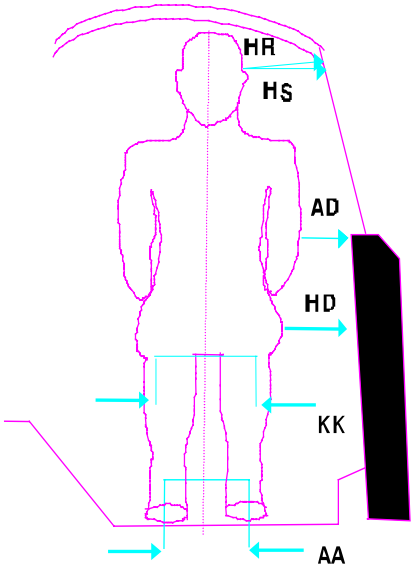
Test Number: CF99026
Vehicle Make/Model: Pontiac Grand Am
Vehicle Model Year: 1999
Seat Type: Bucket seat with manual fore/aft and seat back angle adjustments and electric height adjustment

Manufacturer's Specifications
Seat Back Information: Reclined to 27 degrees from vertical, as measured on outboard rear frame of seat back at adjuster hinge
Upper Belt Anchorage: Set to 2nd position from top
Steering Column Adjustment: Set to midpoint of 5 positions

Location	Code	Measure	Location	Code	Measure
Head to header	HH	255	Neck angle, torso 90	NAT90	21.2°
Head to windshield	HW	546	Neck angle, seated*	NAS	4.4°
Nose to rim	NR	374	Torso angle (NAT90 – NAS)	TA	16.8°
Chest to dash	CD	588	Striker to knee**	SK	586
Rim to abdomen	RA	200	Striker to knee angle**	SKA	–1.7°
Knee to dash, left	KDL	225	Striker to H-point, horizontal	SHH	198
Knee to dash, right	KDR	175	Striker to H-point, vertical	SHV	126
Steering wheel to chest, horizontal	SCH	308	Ankle to ankle	AA	295
Steering wheel to chest, perpendicular	SCP	387	Knee to knee	KK	345
Steering wheel to chest, reference	SCR	370	Arm to door	AD	128
Hub to chest, minimum	HCM	251	H-point to door	HD	170
Pelvic angle	PA	24.6°	Head to A-pillar	HA	504
Seat back angle	SA	27°	Head to roof	HR	180
			Head to side window	HS	237

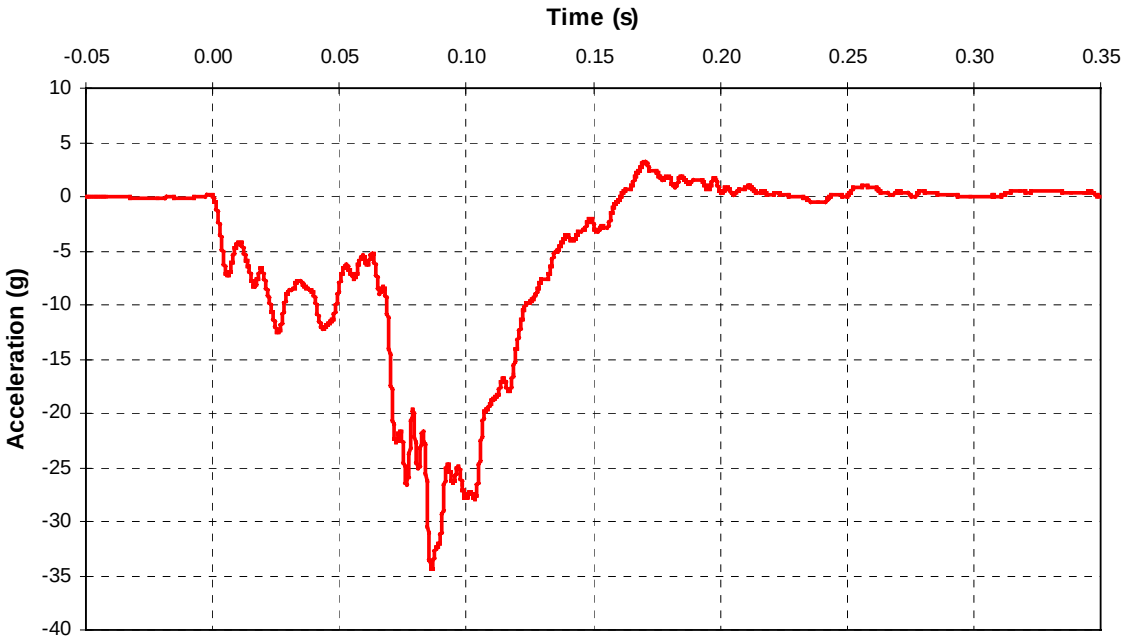
All distance measurements are in millimeters (mm).
* Dummy's neck bracket was adjusted to –3.5 degrees to achieve a level instrumentation plane.
** These measurements were made in a vertical plane containing the striker and parallel to the driver door sill.



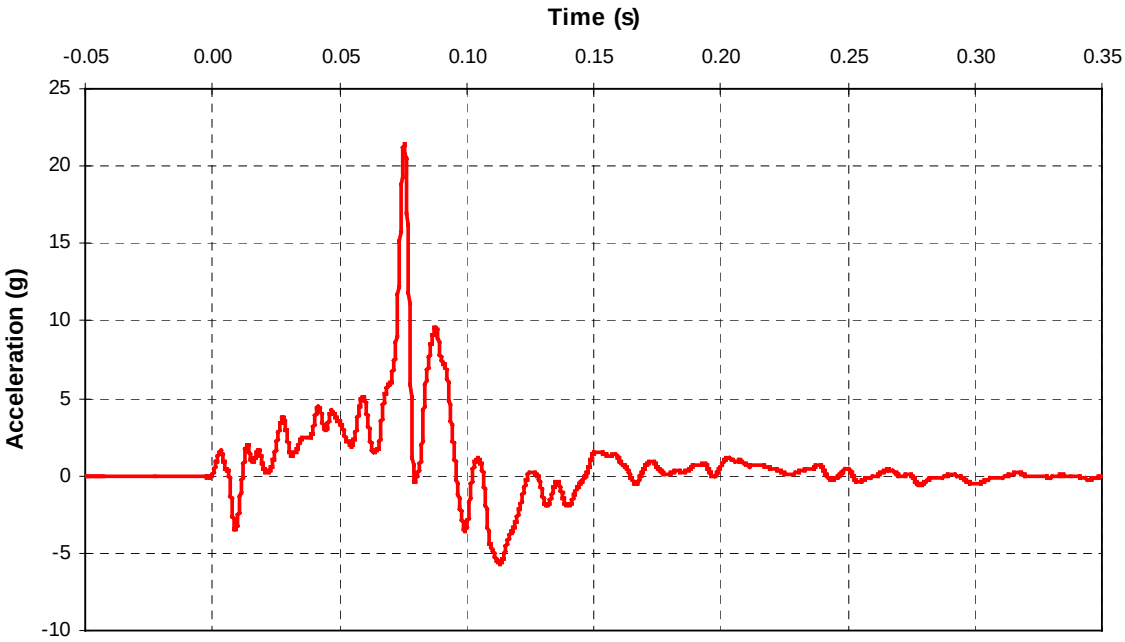


Graph Index

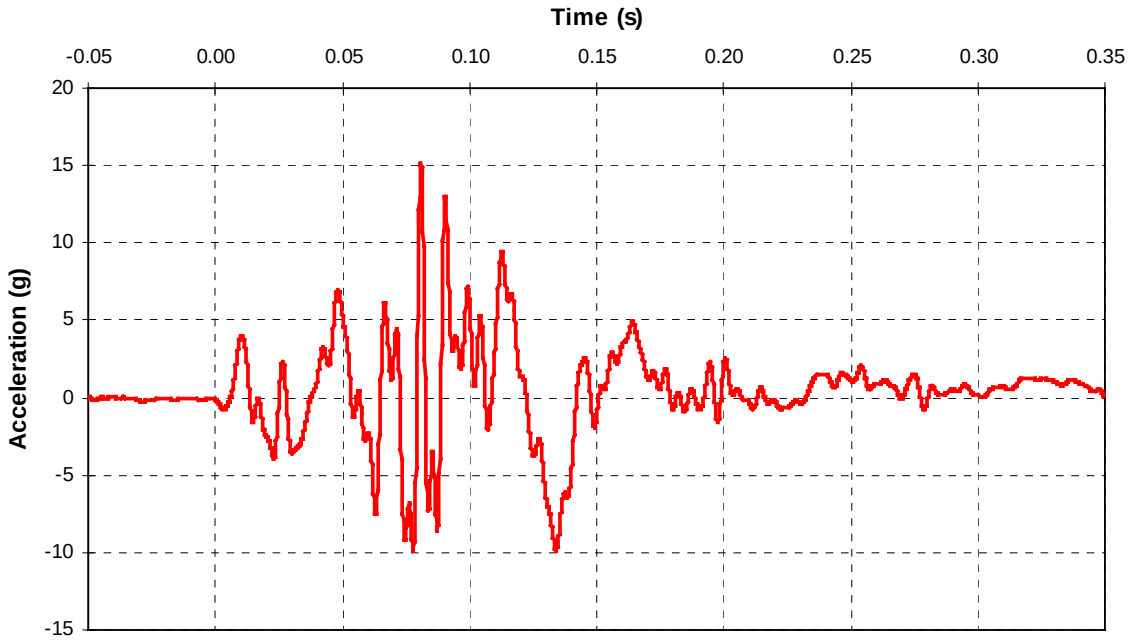
A- 1 CF99026 1999 Pontiac Grand Am Vehicle Longitudinal Acceleration



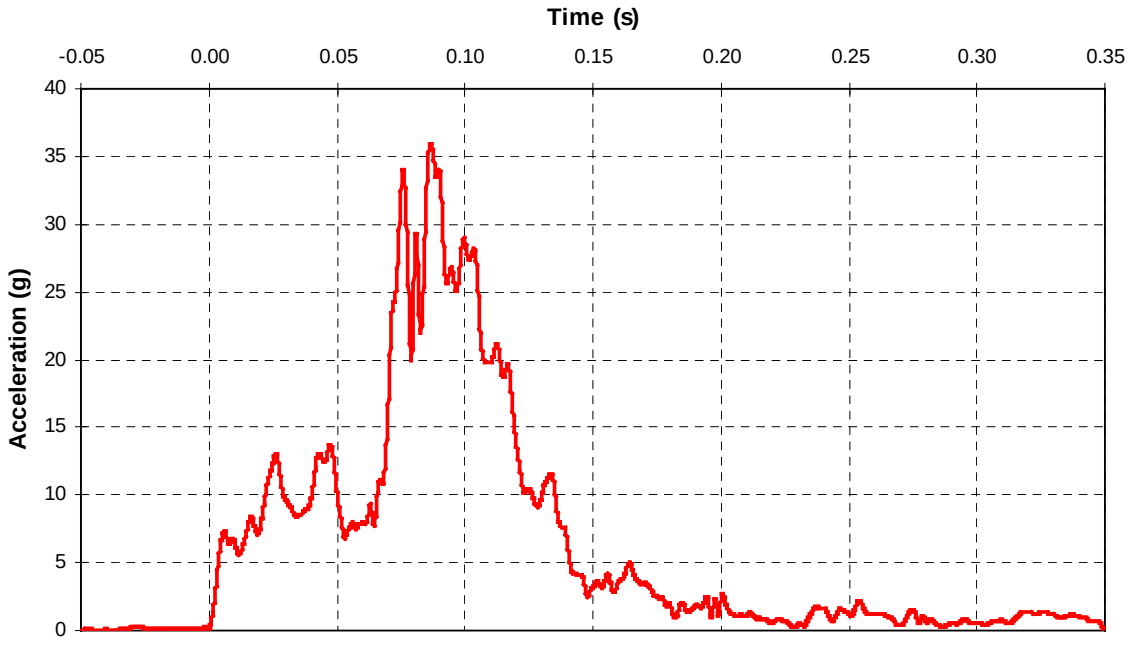
A- 2 CF99026 1999 Pontiac Grand Am Vehicle Lateral Acceleration



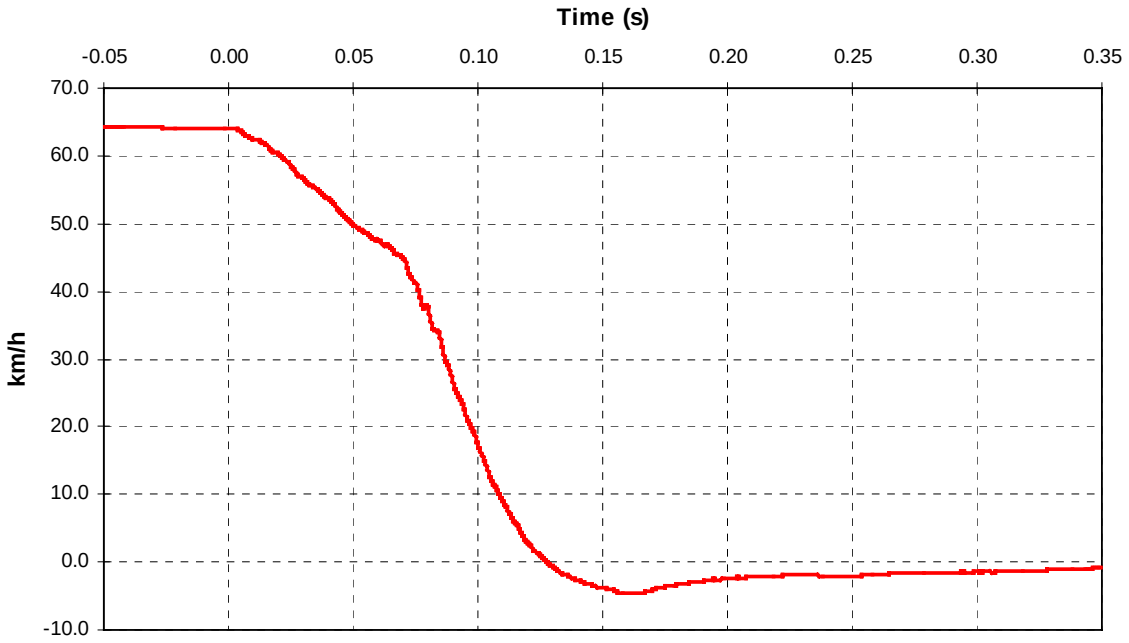
A- 3 CF99026 1999 Pontiac Grand Am Vehicle Vertical Acceleration



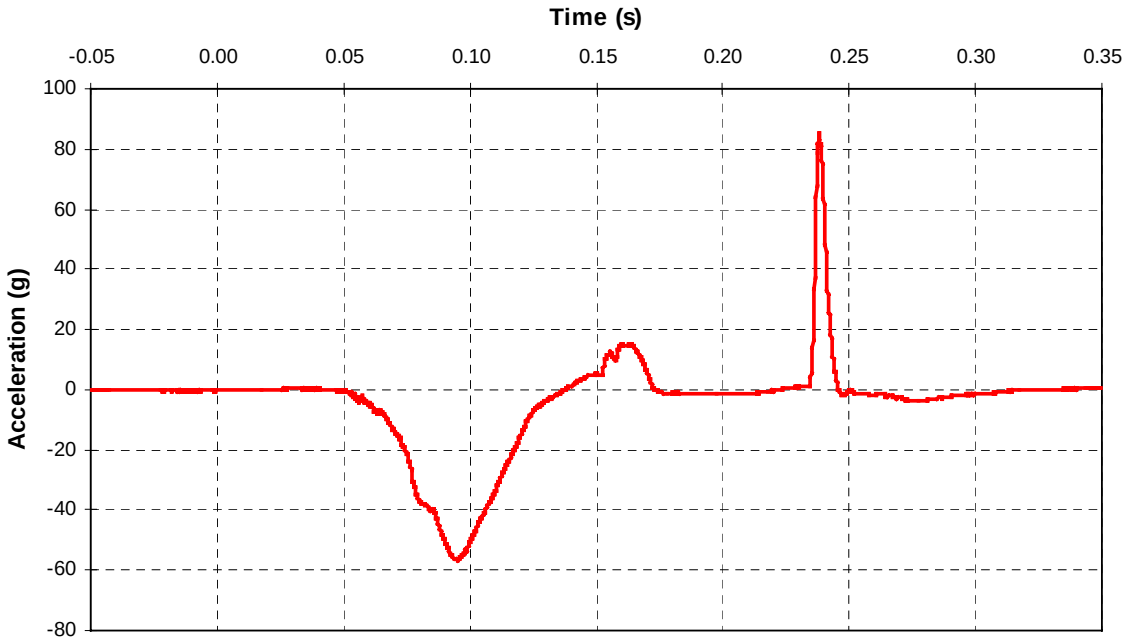
A- 4 CF99026 1999 Pontiac Grand Am Vehicle Vector Resultant Acceleration



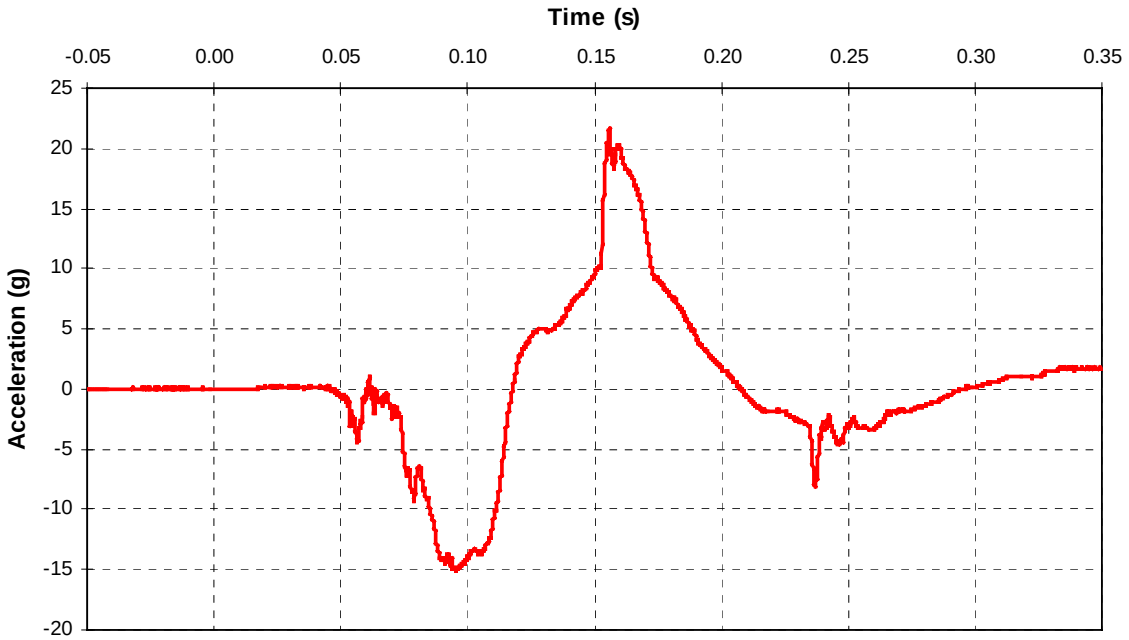
A- 5 CF99026 1999 Pontiac Grand Am Integration of Vehicle Longitudinal Acceleration



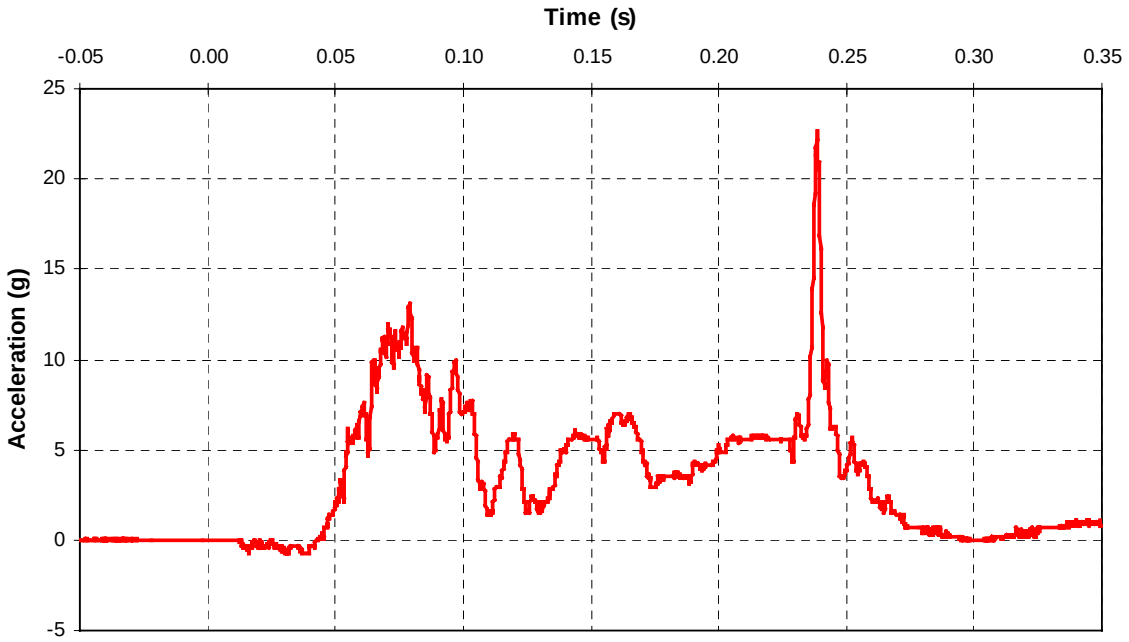
A- 6 CF99026 1999 Pontiac Grand Am Head A-P Acceleration



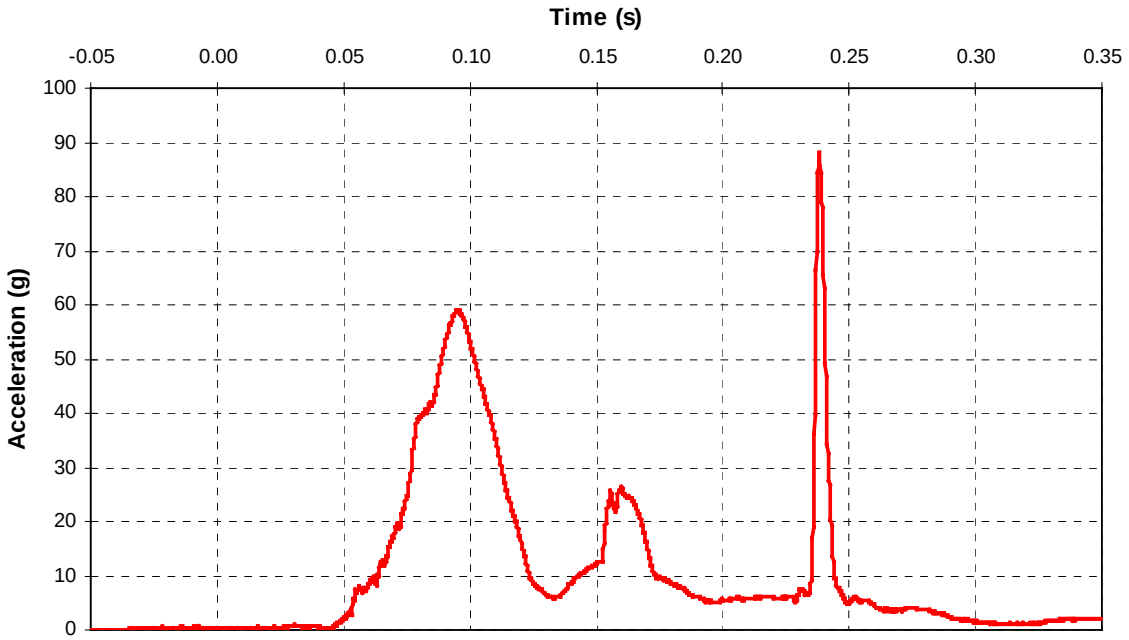
A- 7 CF99026 1999 Pontiac Grand Am Head L-M Acceleration



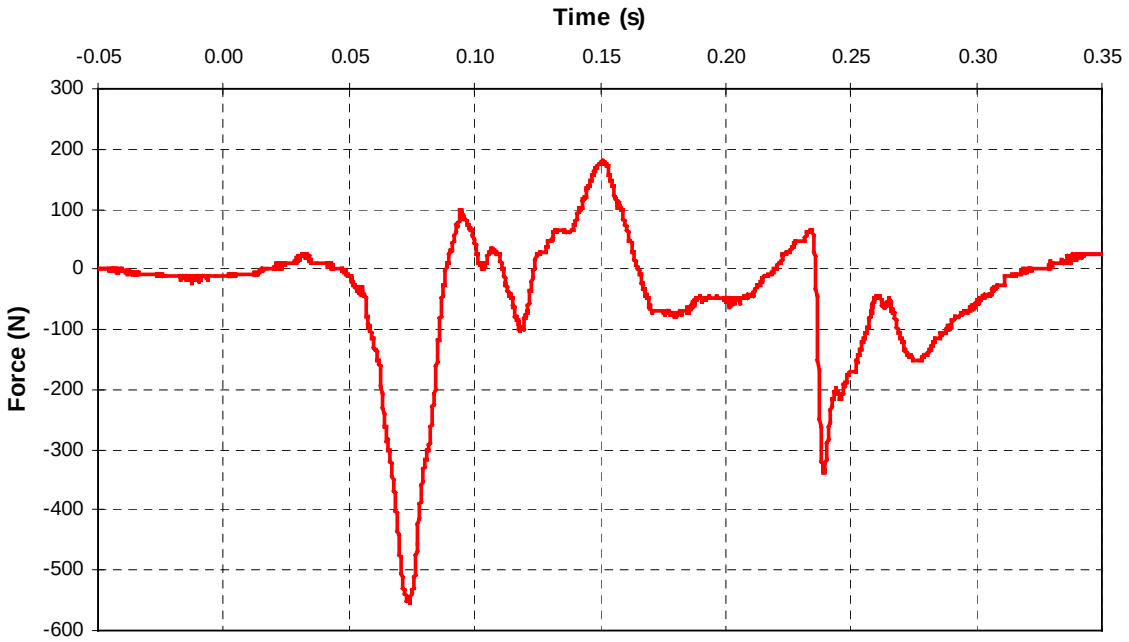
A- 8 CF99026 1999 Pontiac Grand Am Head I-S Acceleration



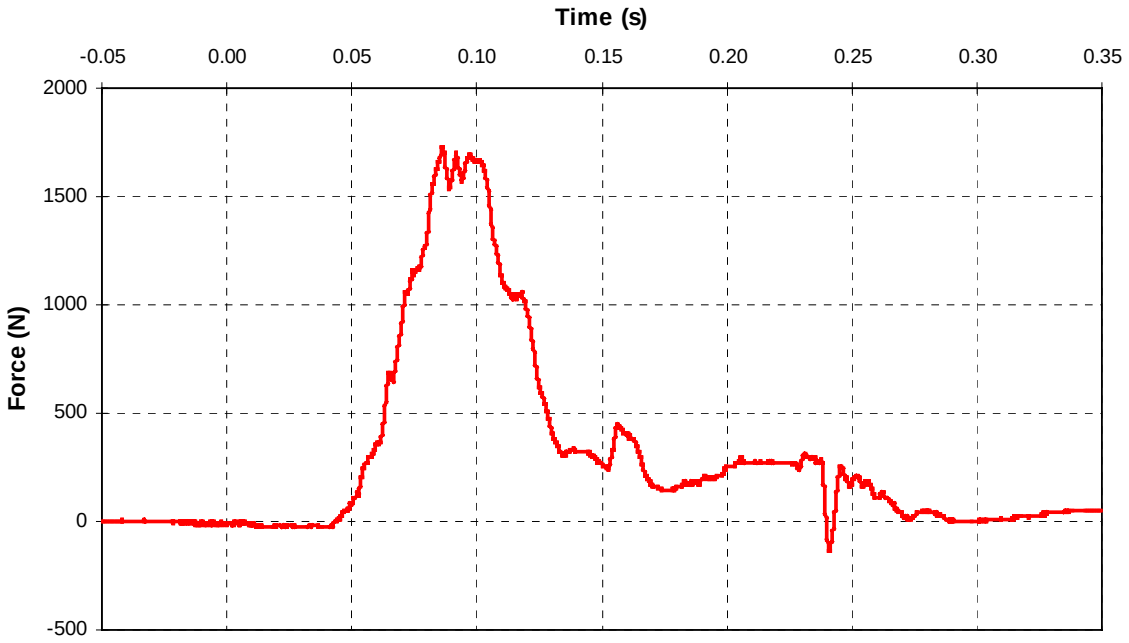
A- 9 CF99026 1999 Pontiac Grand Am Head Vector Resultant Acceleration



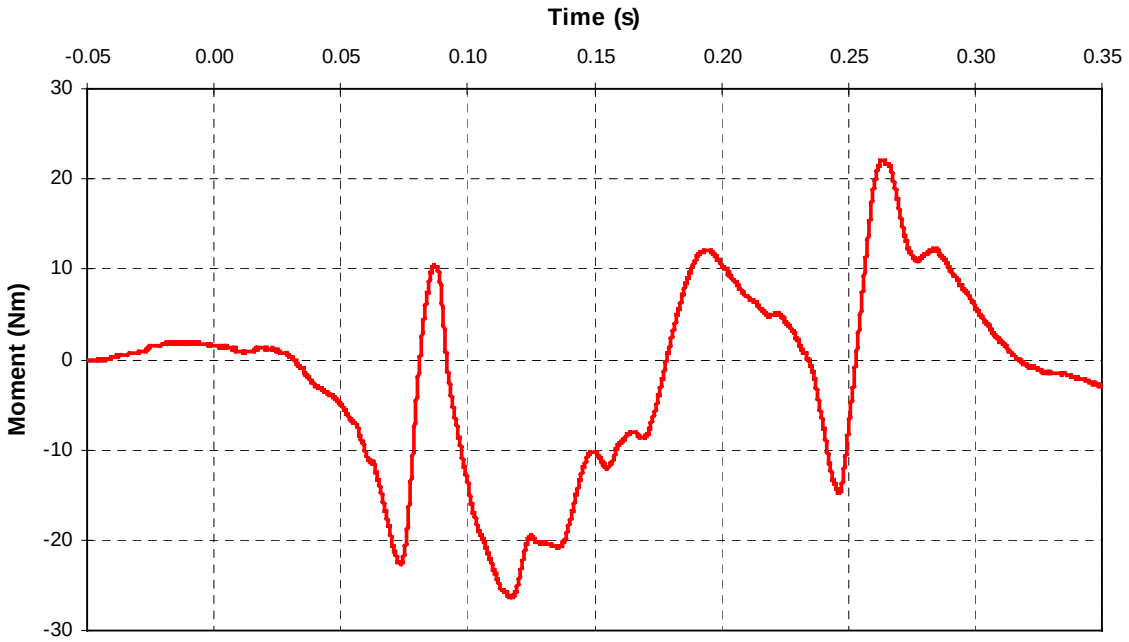
A- 10 CF99026 1999 Pontiac Grand Am Neck A-P Shear Force



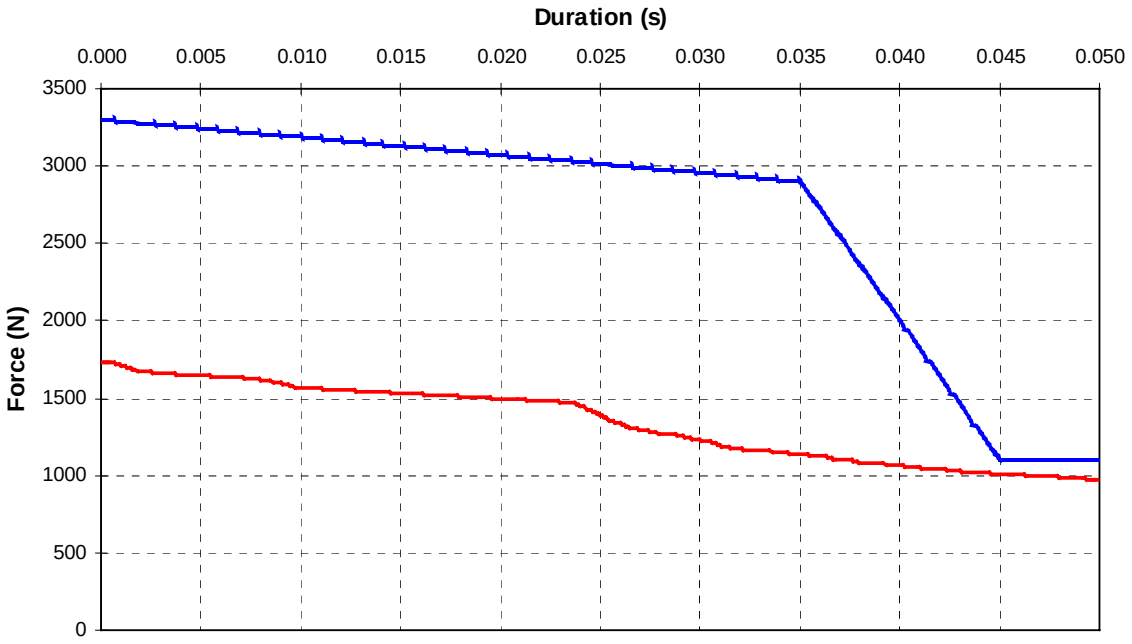
A- 11 CF99026 1999 Pontiac Grand Am Neck Axial Force



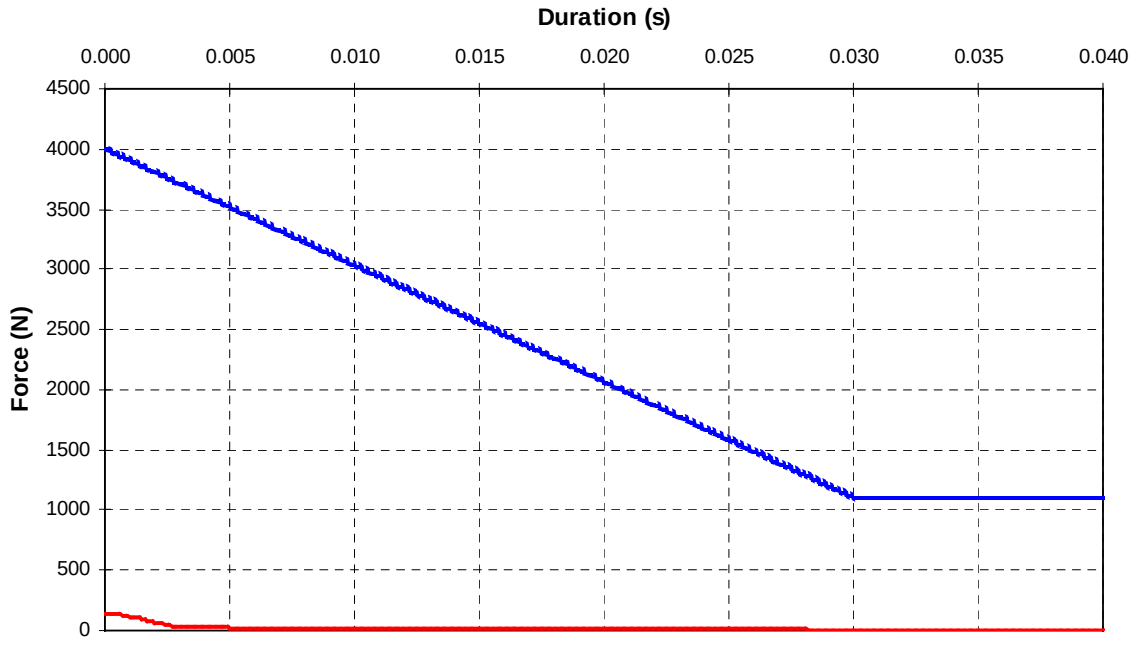
A- 12 CF99026 1999 Pontiac Grand Am Neck Occipital A-P Moment



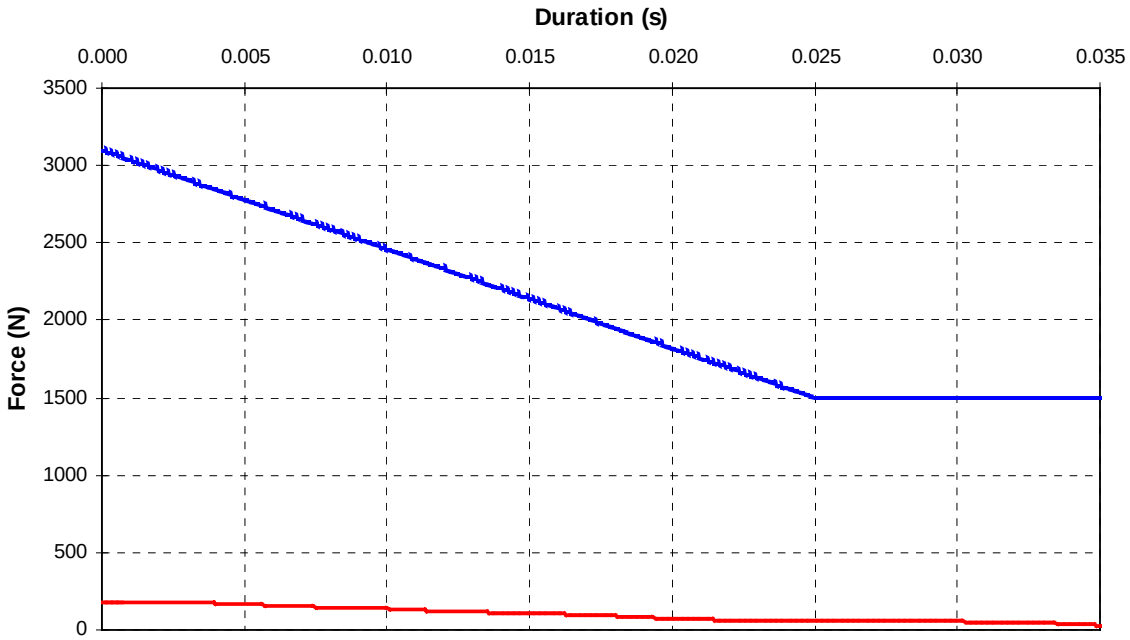
A- 13 CF99026 1999 Pontiac Grand Am Neck Tension Analysis



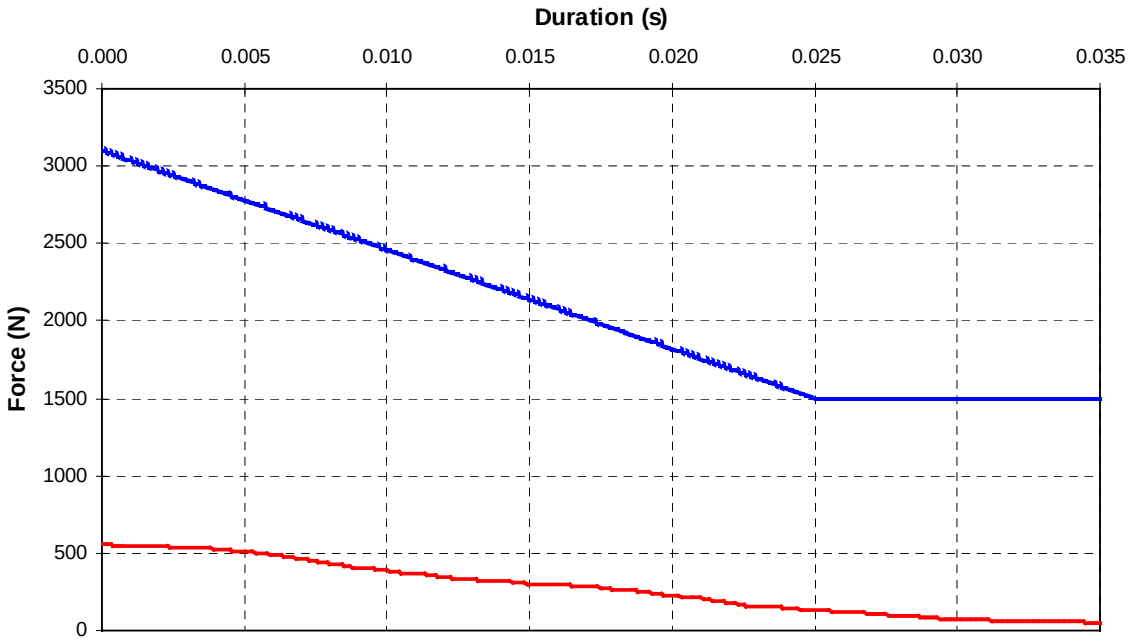
A- 14 CF99026 1999 Pontiac Grand Am Neck Compression Analysis



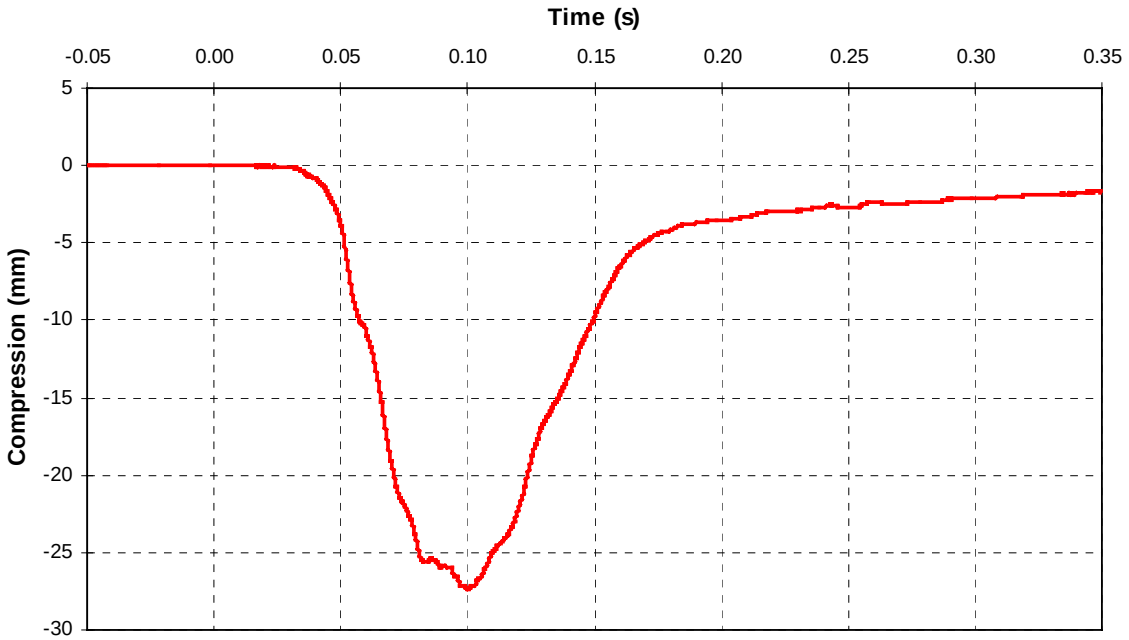
A- 15 CF99026 1999 Pontiac Grand Am Neck A-P Shear (Positive) Analysis



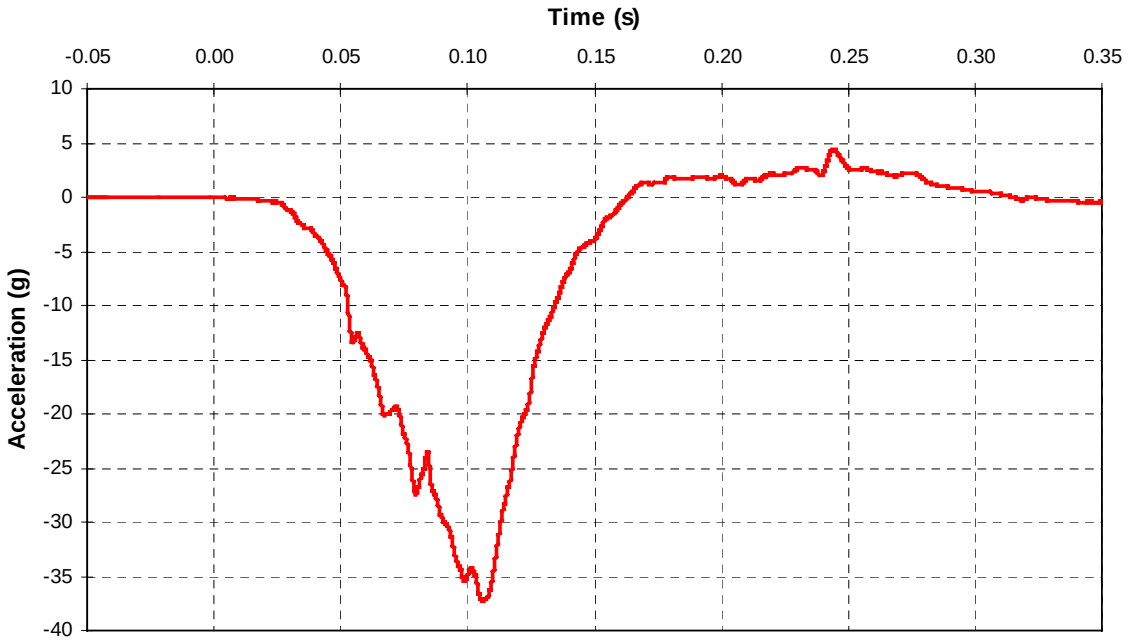
A- 16 CF99026 1999 Pontiac Grand Am Neck A-P Shear (Negative) Analysis



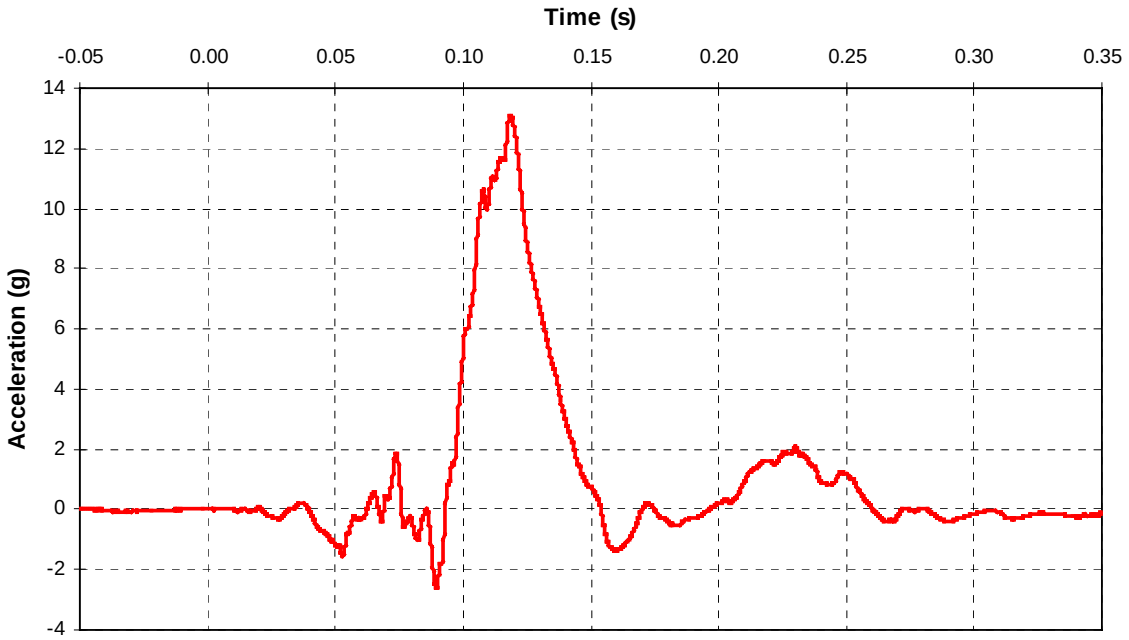
A- 17 CF99026 1999 Pontiac Grand Am Chest Compression



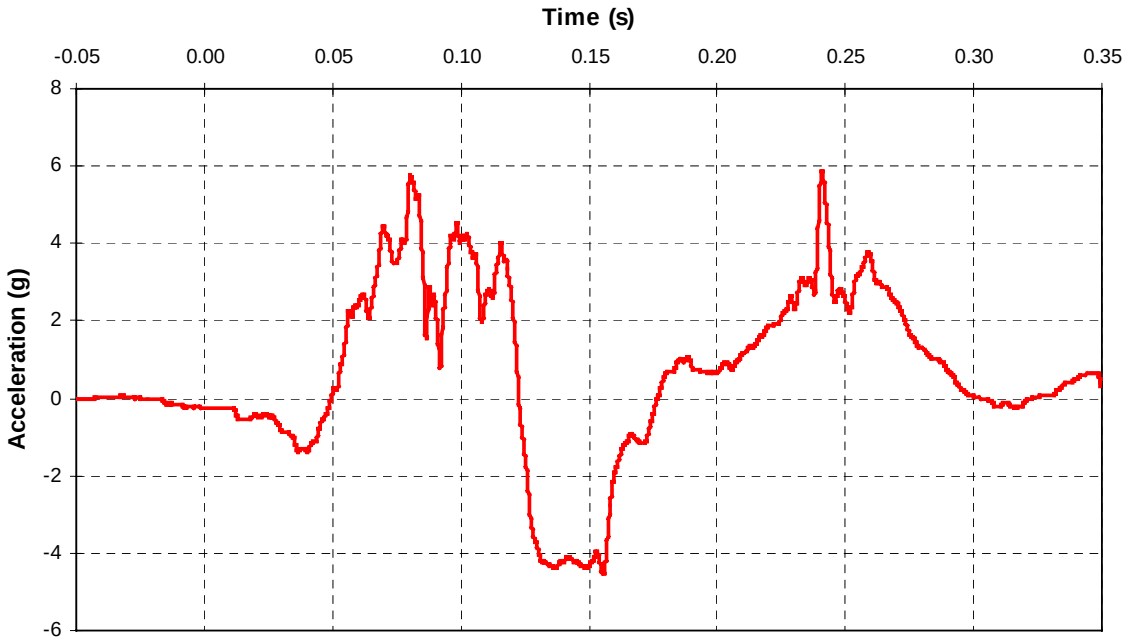
A- 18 CF99026 1999 Pontiac Grand Am Chest A-P Acceleration



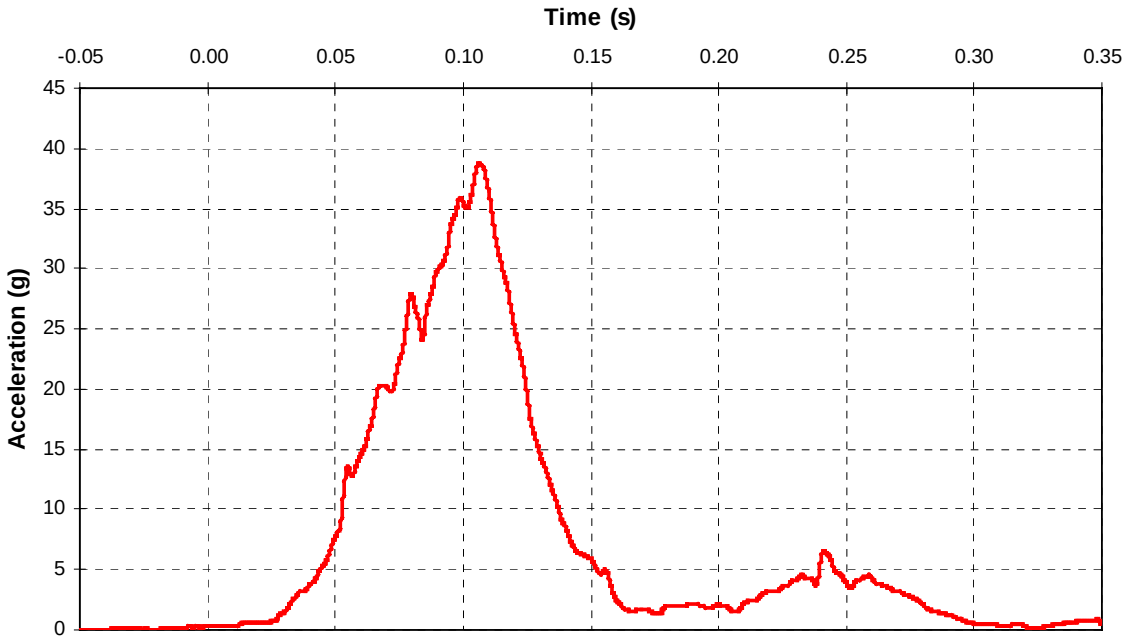
A- 19 CF99026 1999 Pontiac Grand Am Chest L-M Acceleration



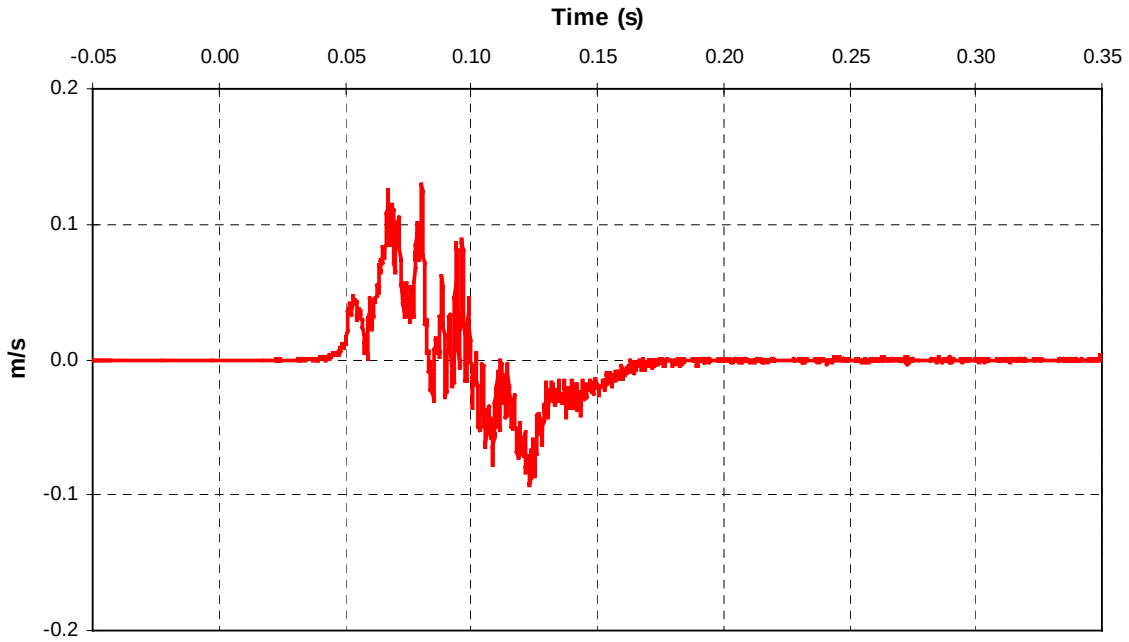
A- 20 CF99026 1999 Pontiac Grand Am Chest I-S Acceleration



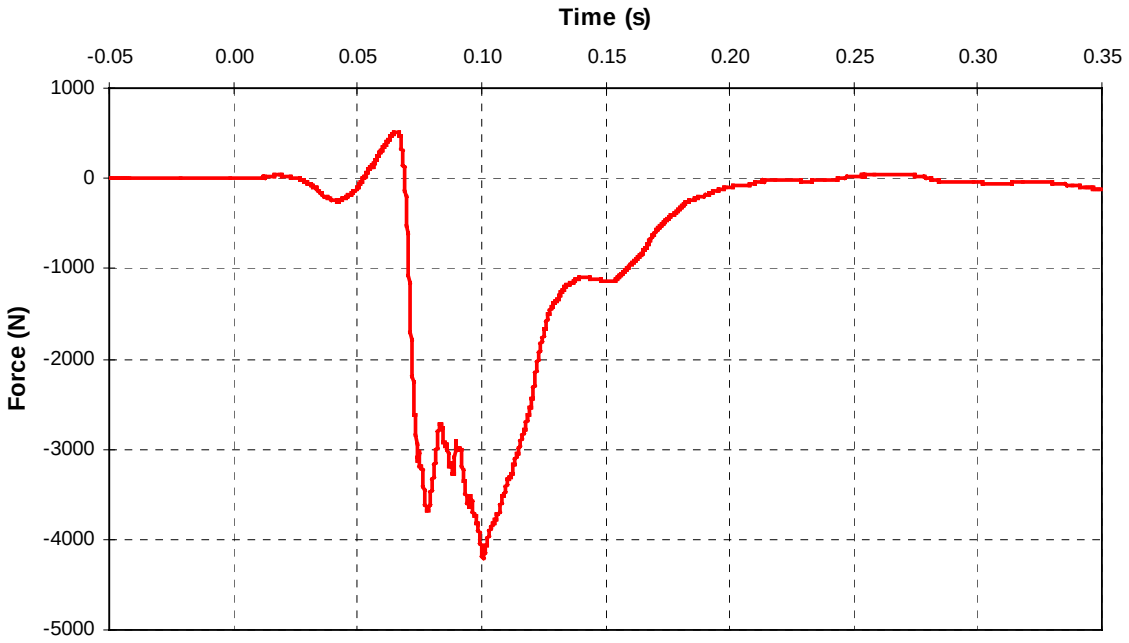
A- 21 CF99026 1999 Pontiac Grand Am Chest Vector Resultant Acceleration



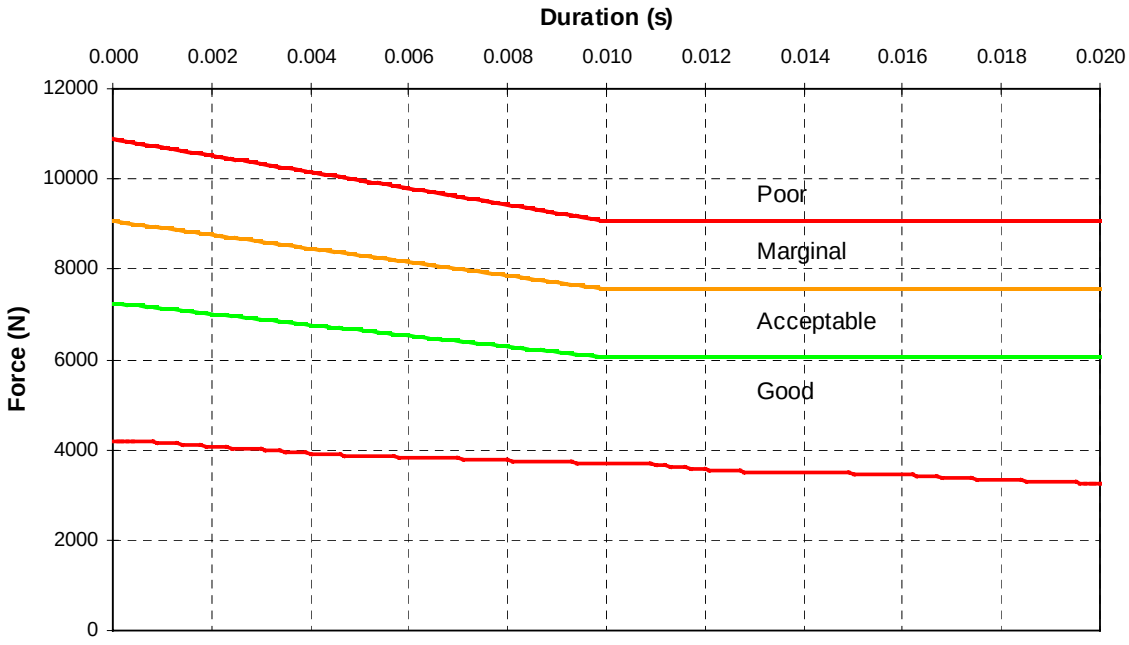
A- 22 CF99026 1999 Pontiac Grand Am Viscous Criterion



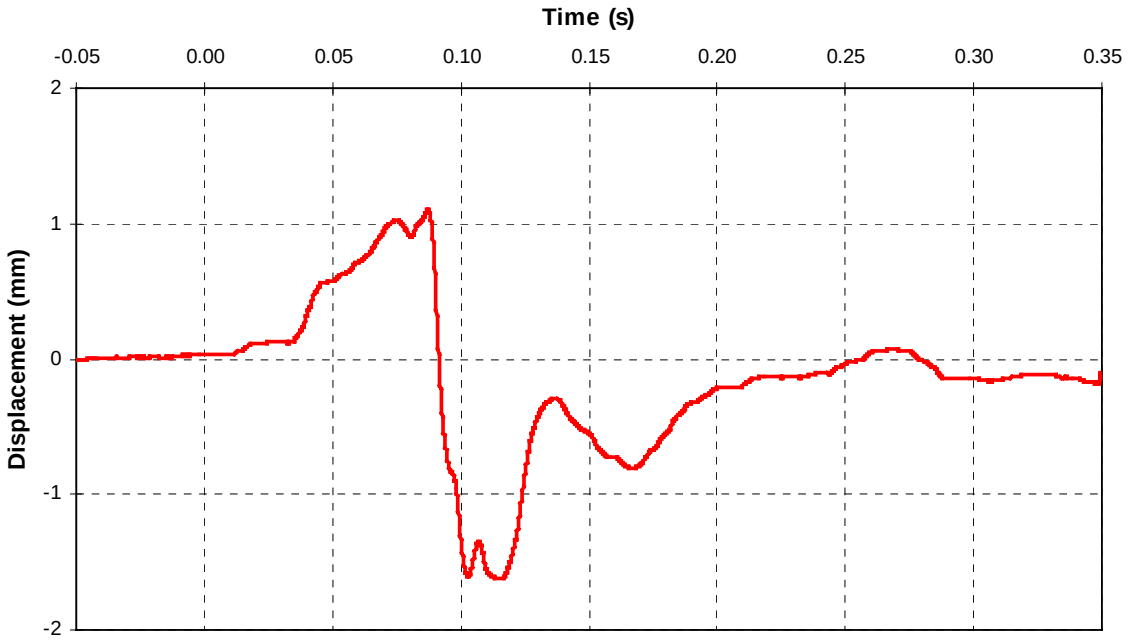
A- 23 CF99026 1999 Pontiac Grand Am Left Femur Axial Force



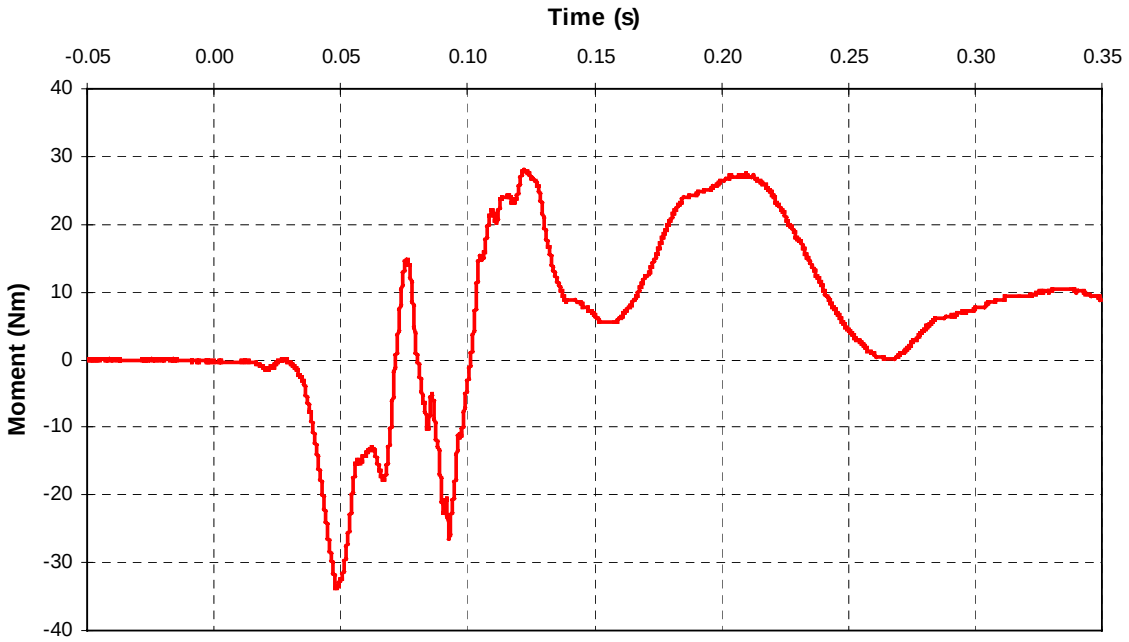
A- 24 CF99026 1999 Pontiac Grand Am Left Femur Axial Force Analysis



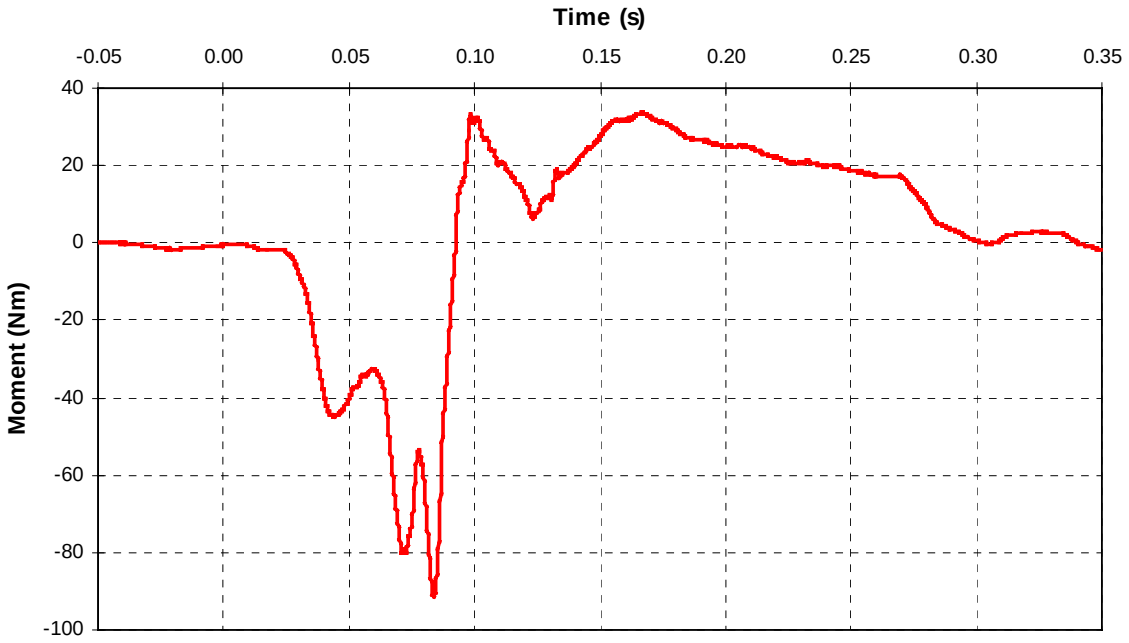
A- 25 CF99026 1999 Pontiac Grand Am Left Tibia-Femur Displacement



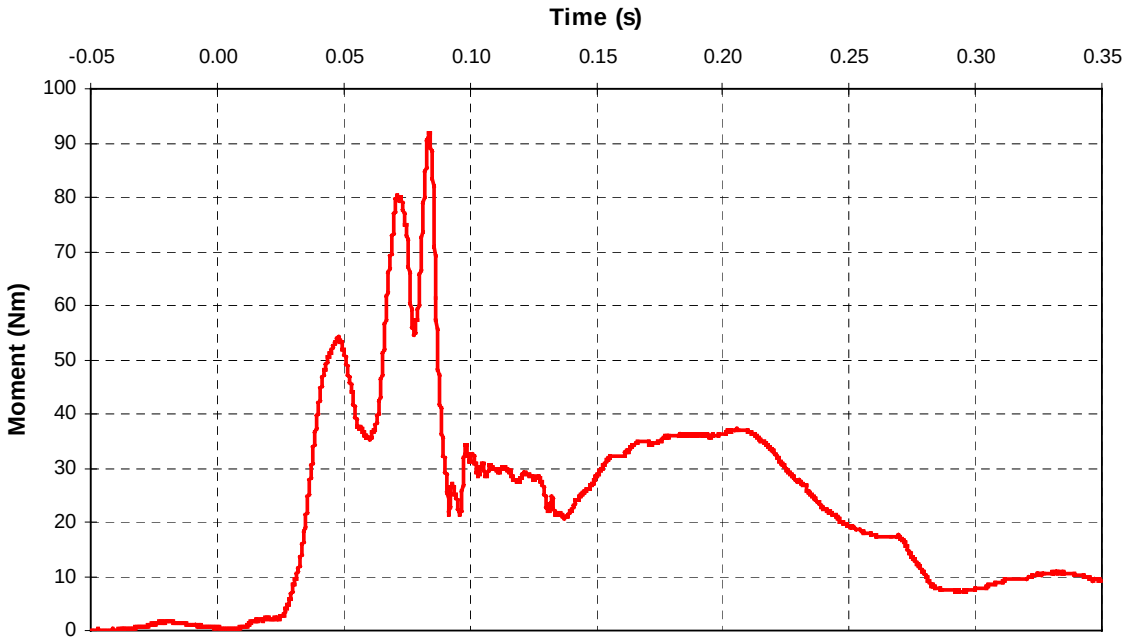
A- 26 CF99026 1999 Pontiac Grand Am Left Upper Tibia L-M Moment



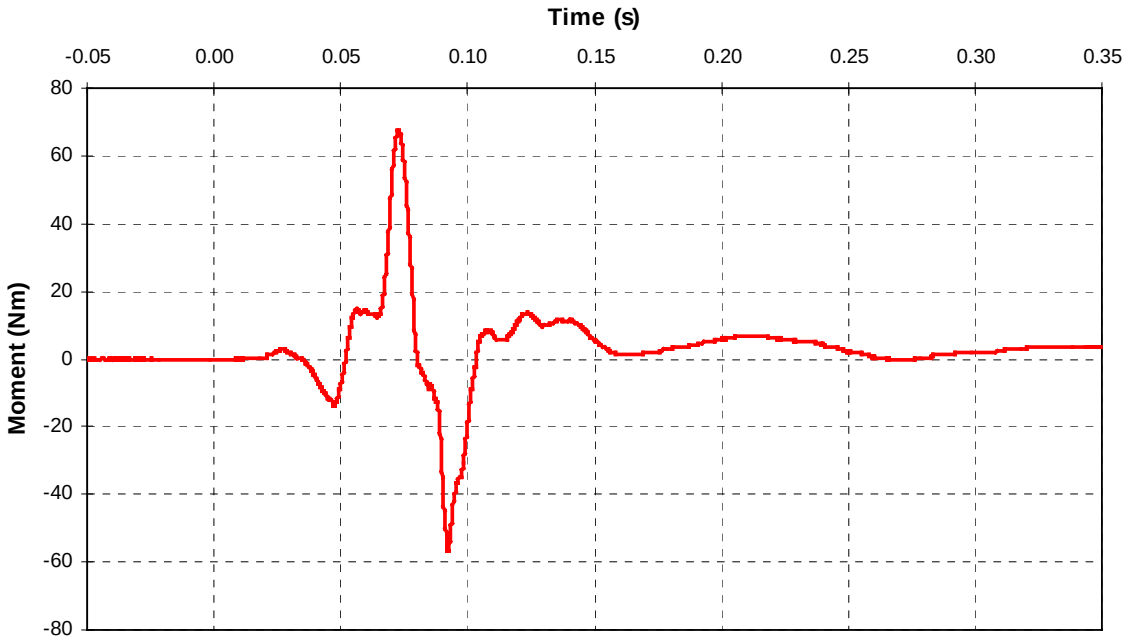
A- 27 CF99026 1999 Pontiac Grand Am Left Upper Tibia A-P Moment



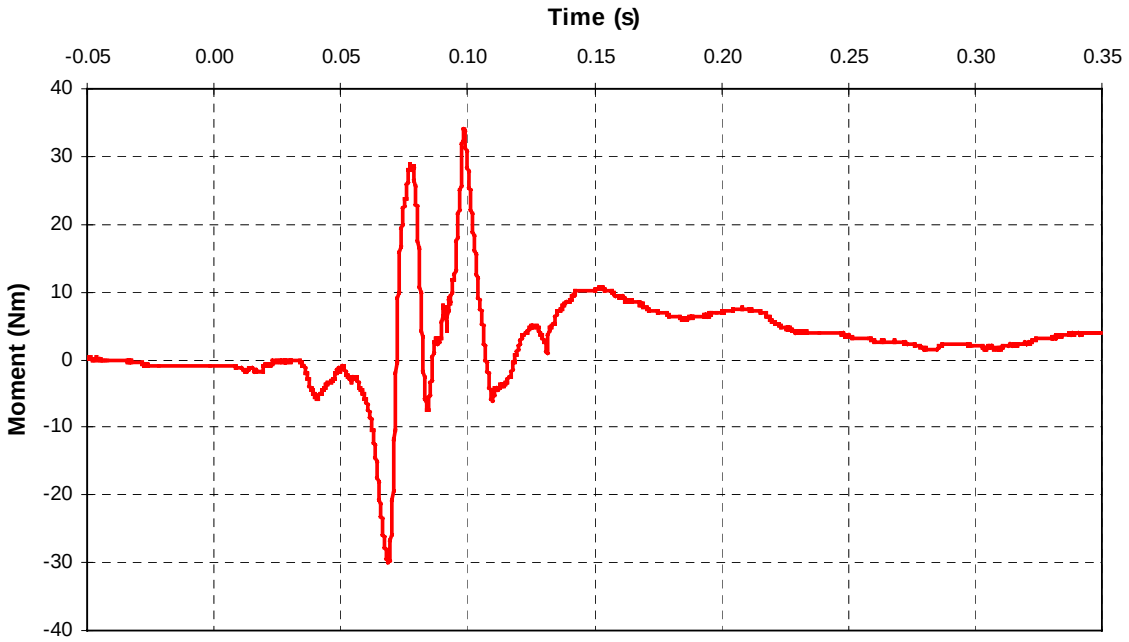
A- 28 CF99026 1999 Pontiac Grand Am Left Upper Tibia Vector Resultant Moment



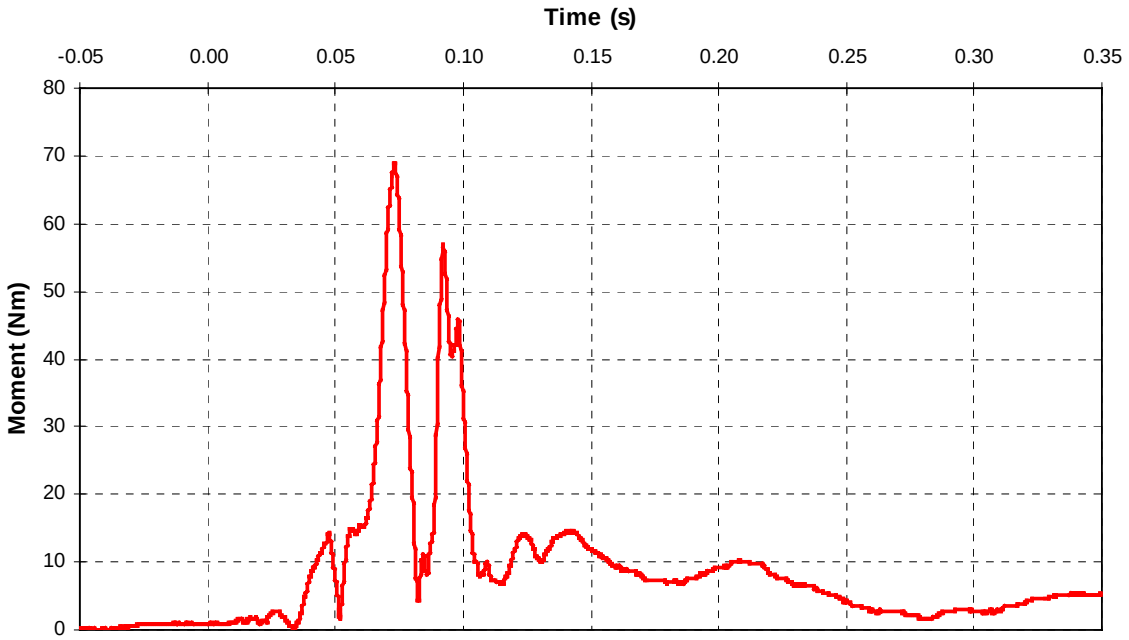
A- 29 CF99026 1999 Pontiac Grand Am Left Lower Tibia L-M Moment



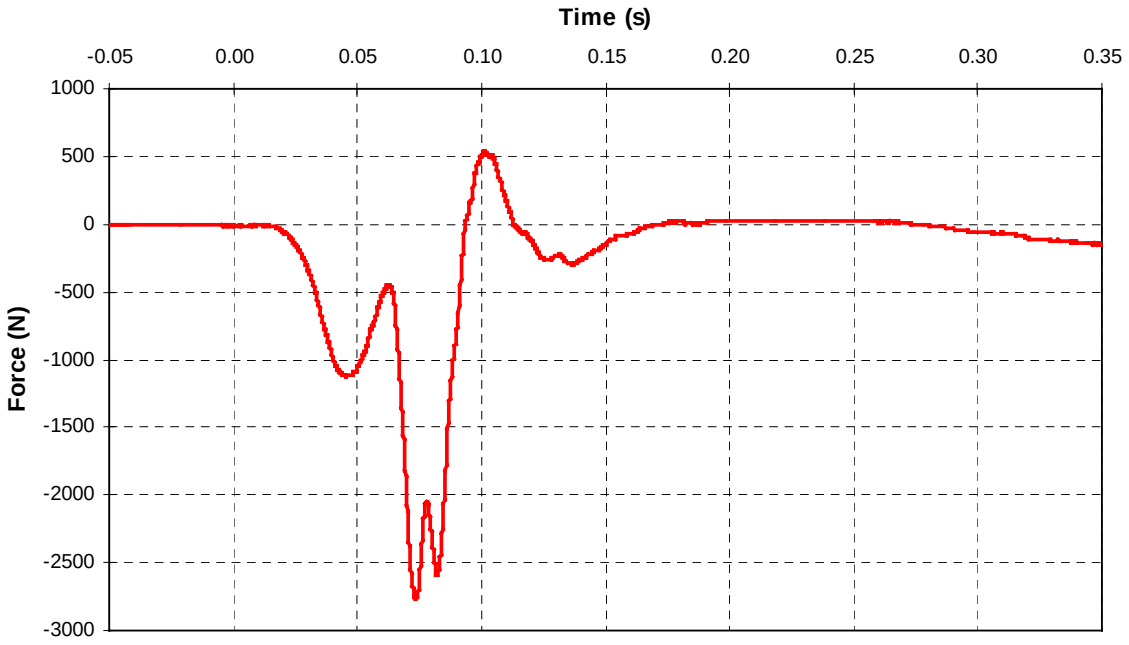
A- 30 CF99026 1999 Pontiac Grand Am Left Lower Tibia A-P Moment



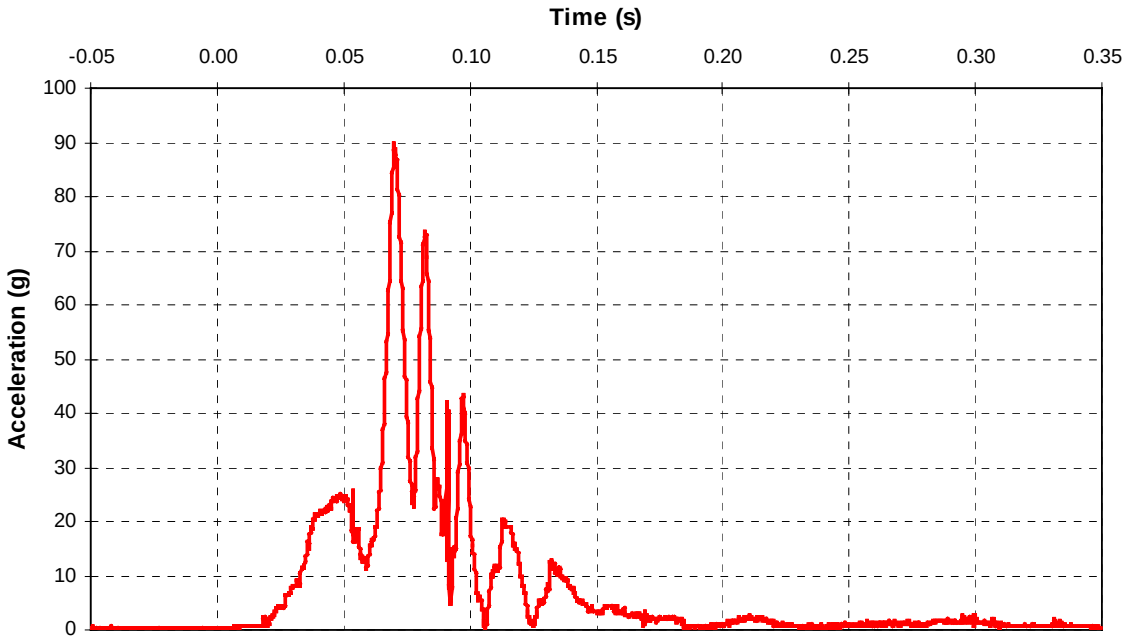
A- 31 CF99026 1999 Pontiac Grand Am Left Lower Tibia Vector Resultant Moment



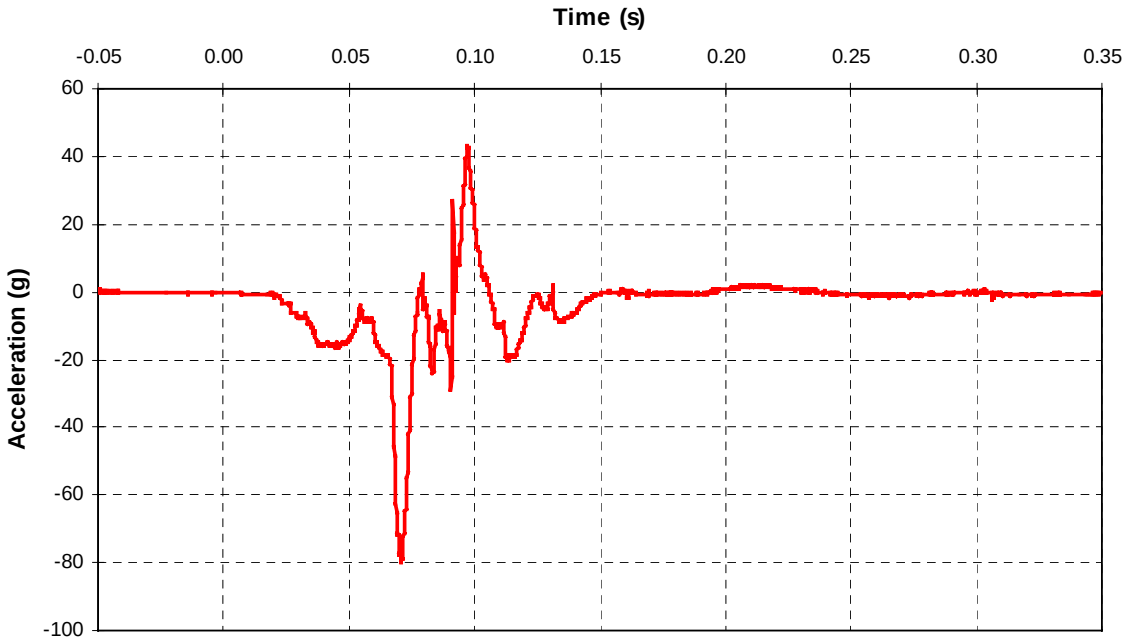
A- 32 CF99026 1999 Pontiac Grand Am Left Lower Tibia Axial Force



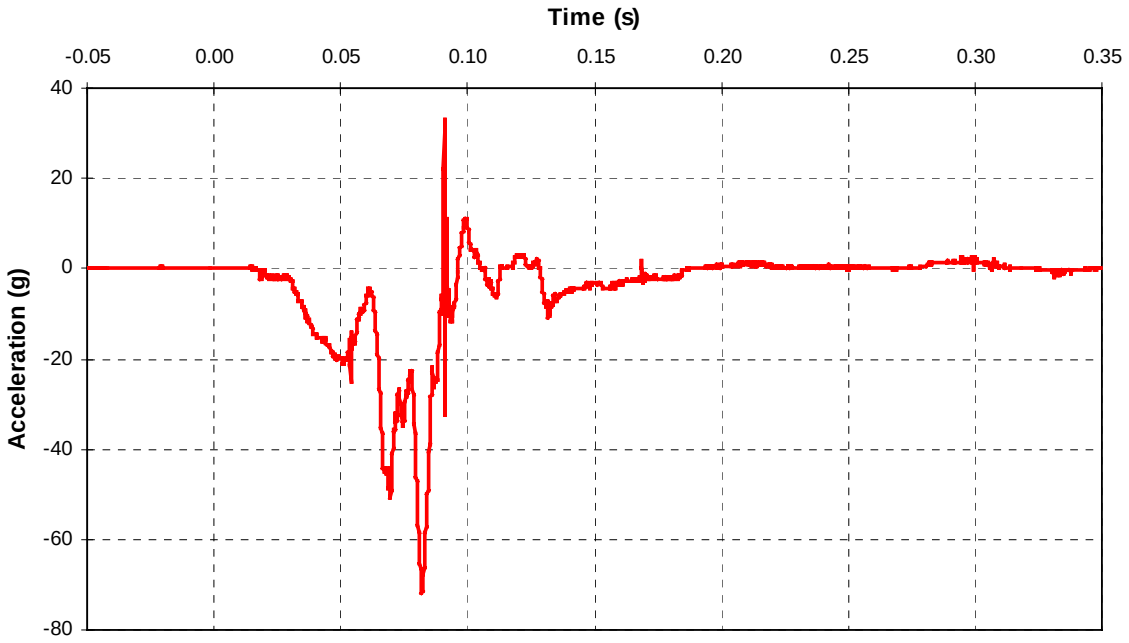
A- 33 CF99026 1999 Pontiac Grand Am Left Foot Vector Resultant Acceleration



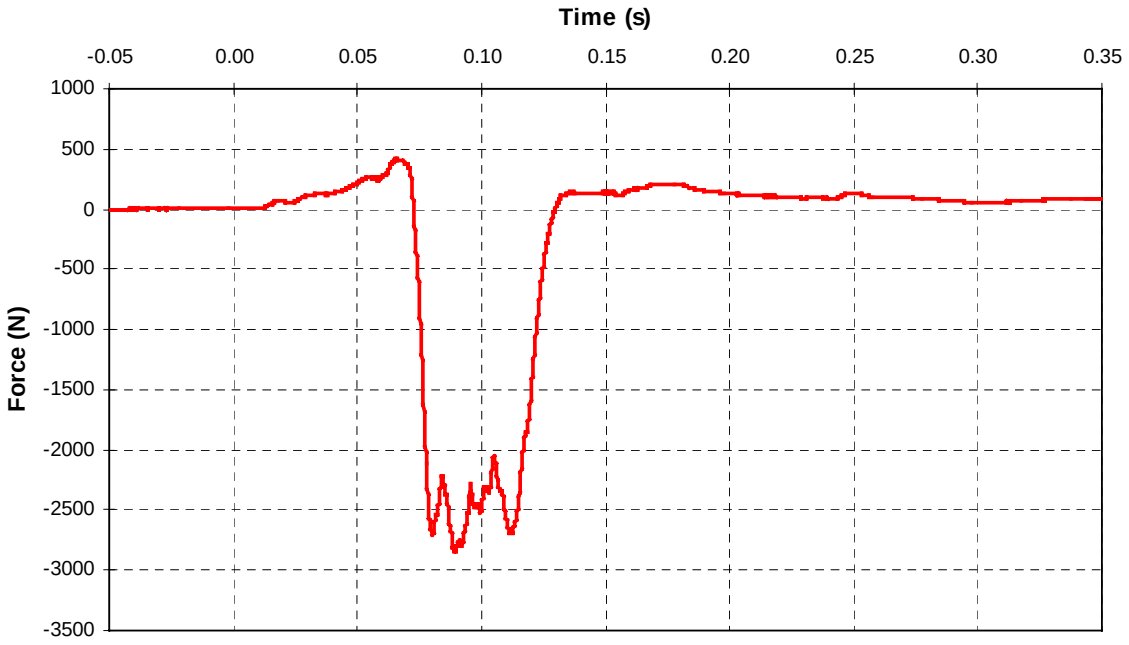
A- 34 CF99026 1999 Pontiac Grand Am Left Foot A-P Acceleration



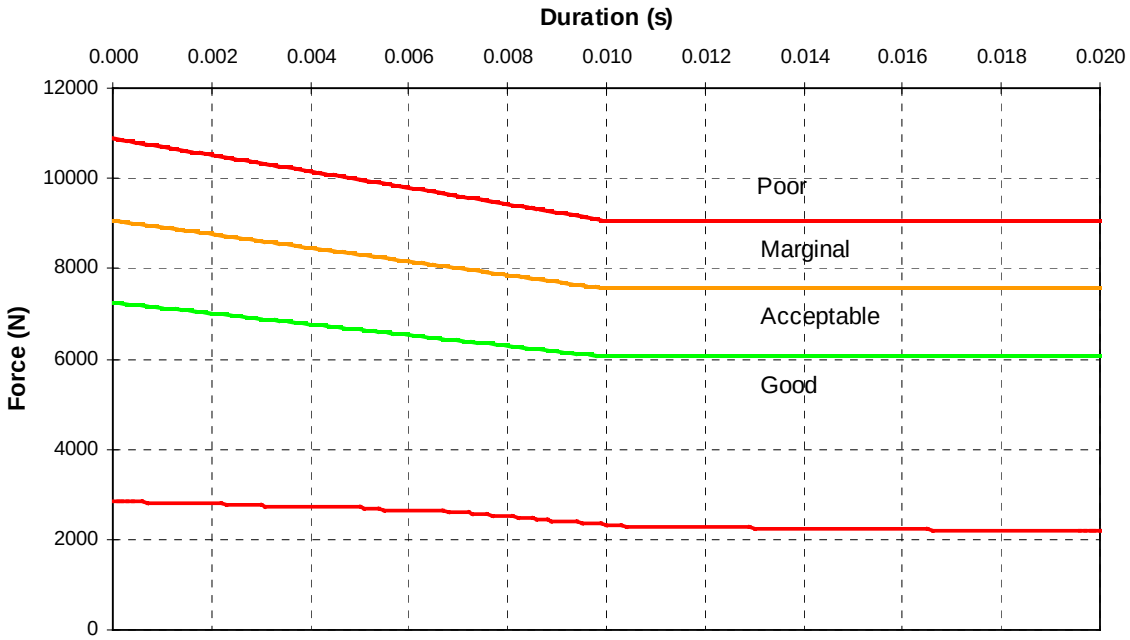
A- 35 CF99026 1999 Pontiac Grand Am Left Foot I-S Acceleration



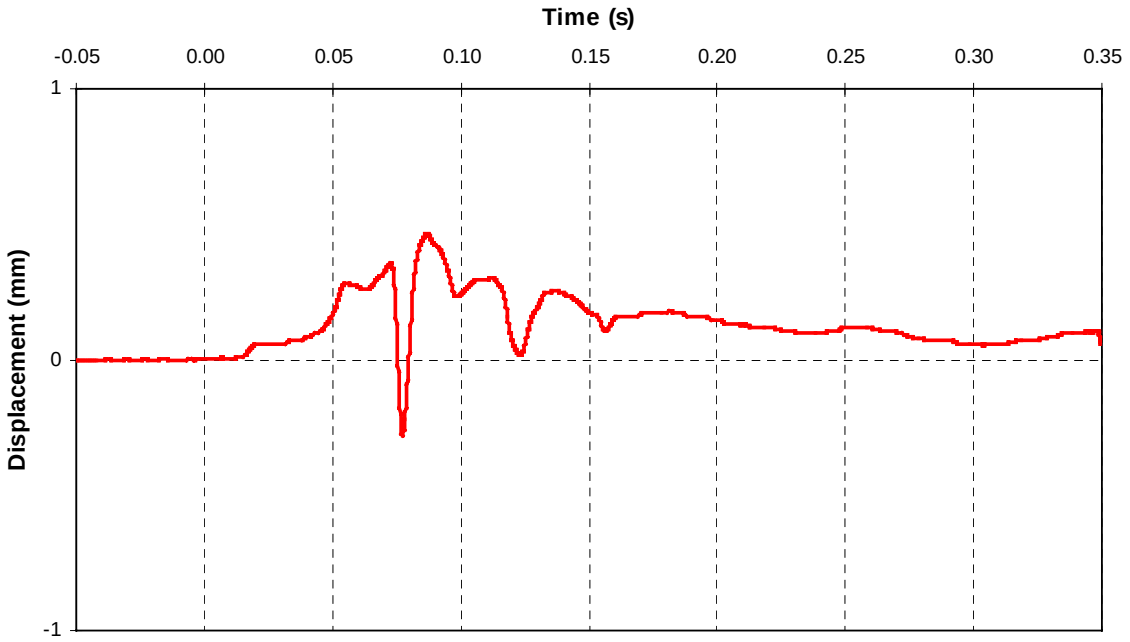
A- 36 CF99026 1999 Pontiac Grand Am Right Femur Axial Force



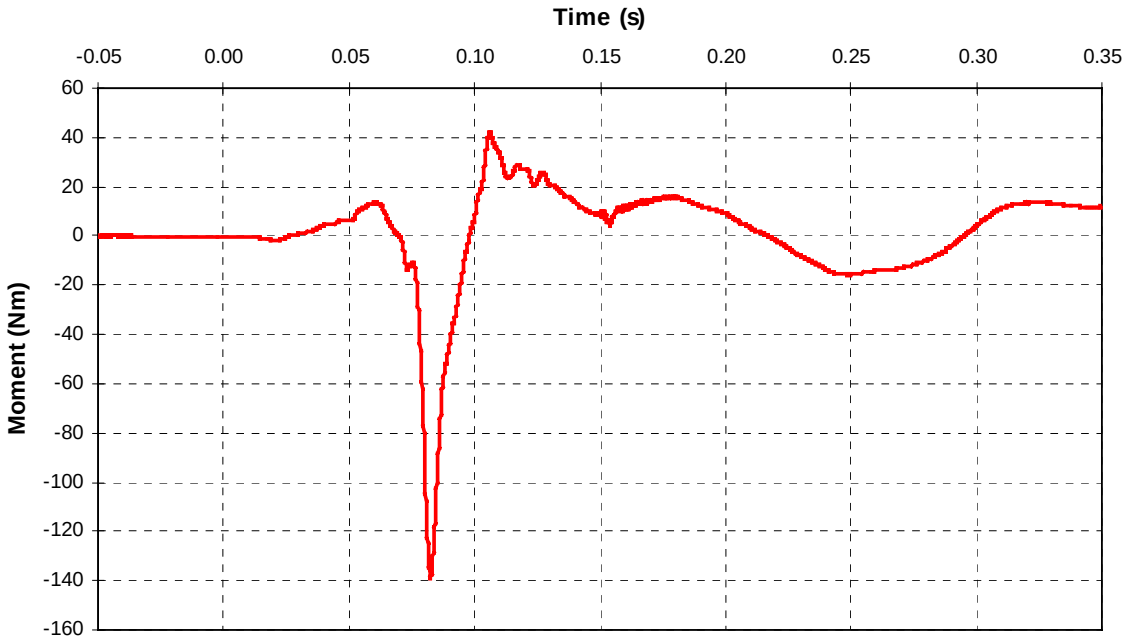
A- 37 CF99026 1999 Pontiac Grand Am Right Femur Axial Force Analysis



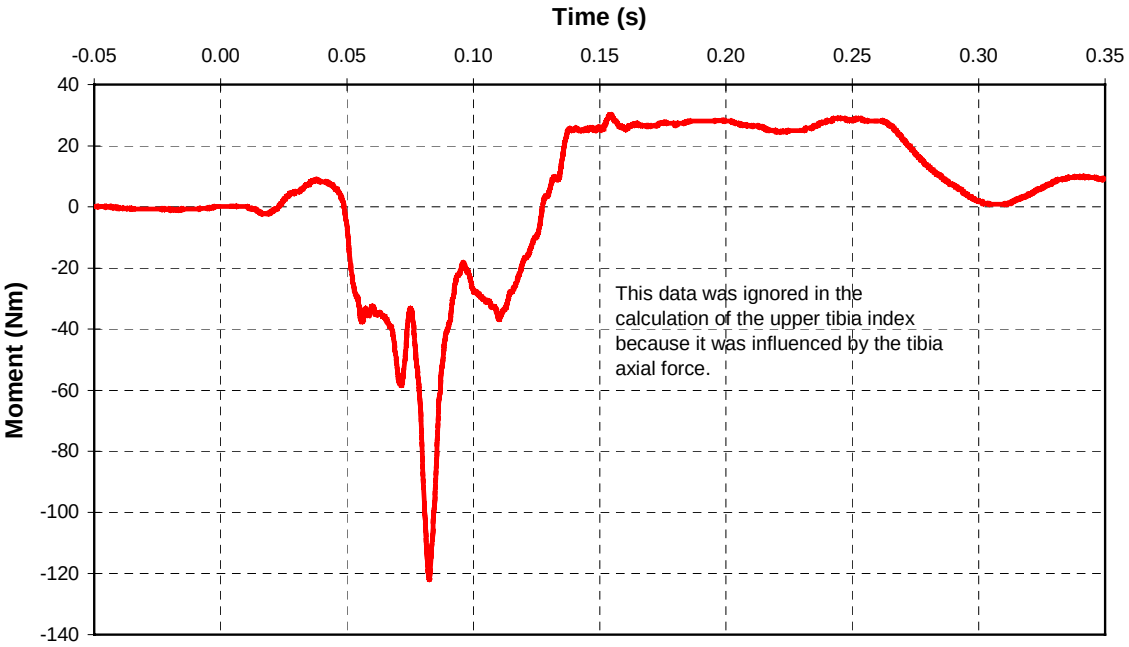
A- 38 CF99026 1999 Pontiac Grand Am Right Tibia-Femur Displacement



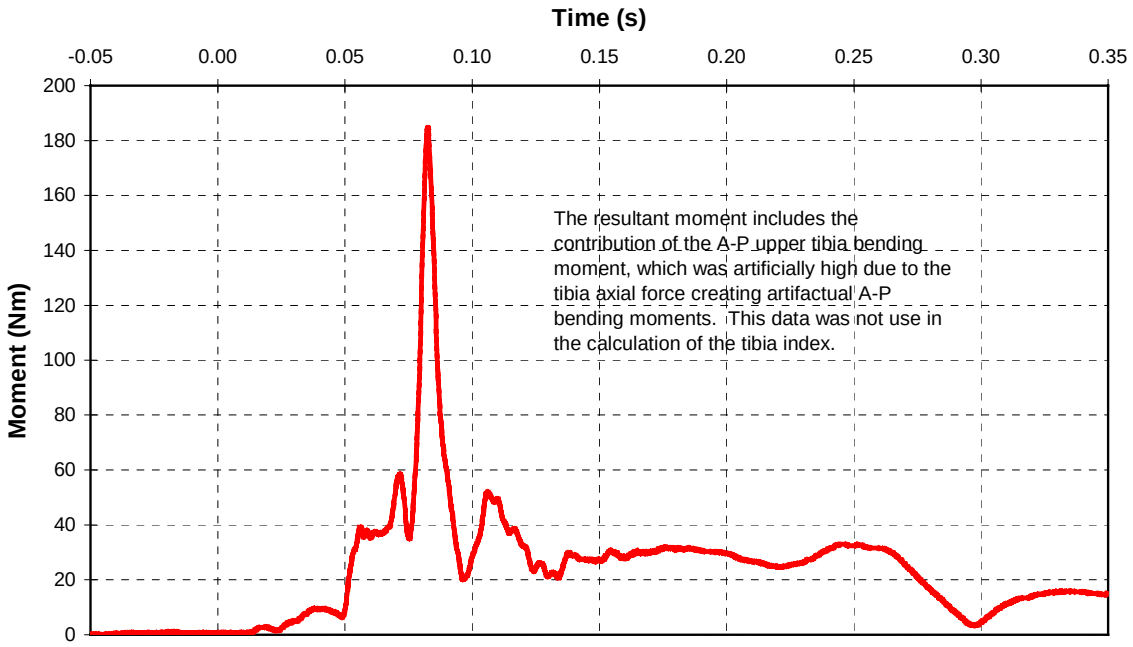
A- 39 CF99026 1999 Pontiac Grand Am Right Upper Tibia L-M Moment



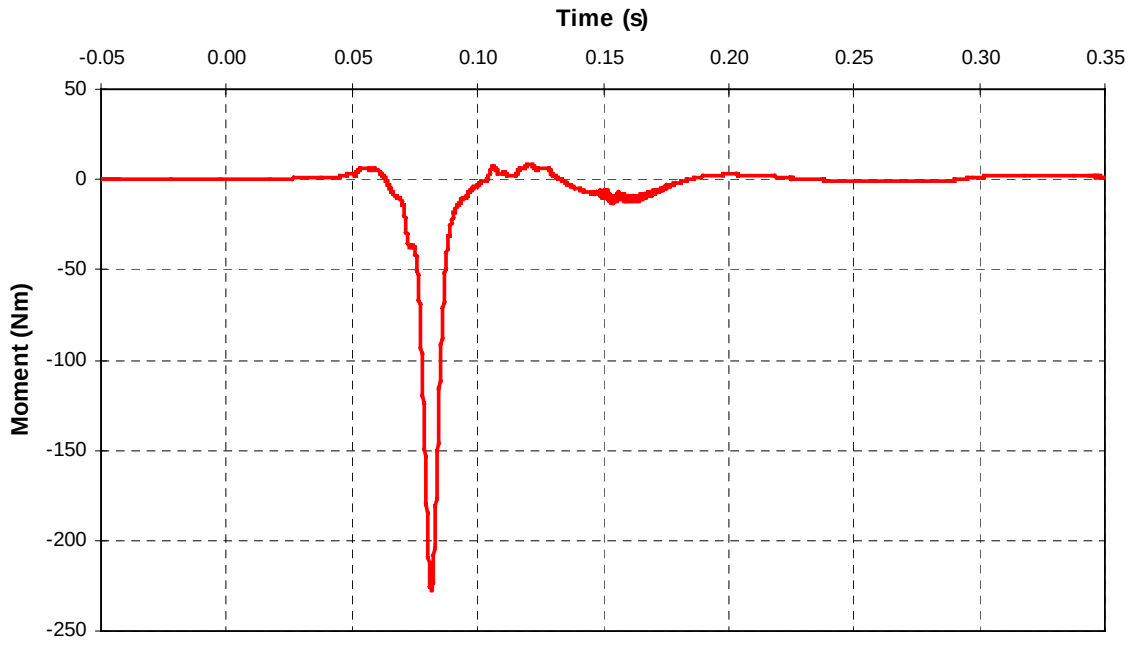
A- 40 CF99026 1999 Pontiac Grand Am Right Upper Tibia A-P Moment



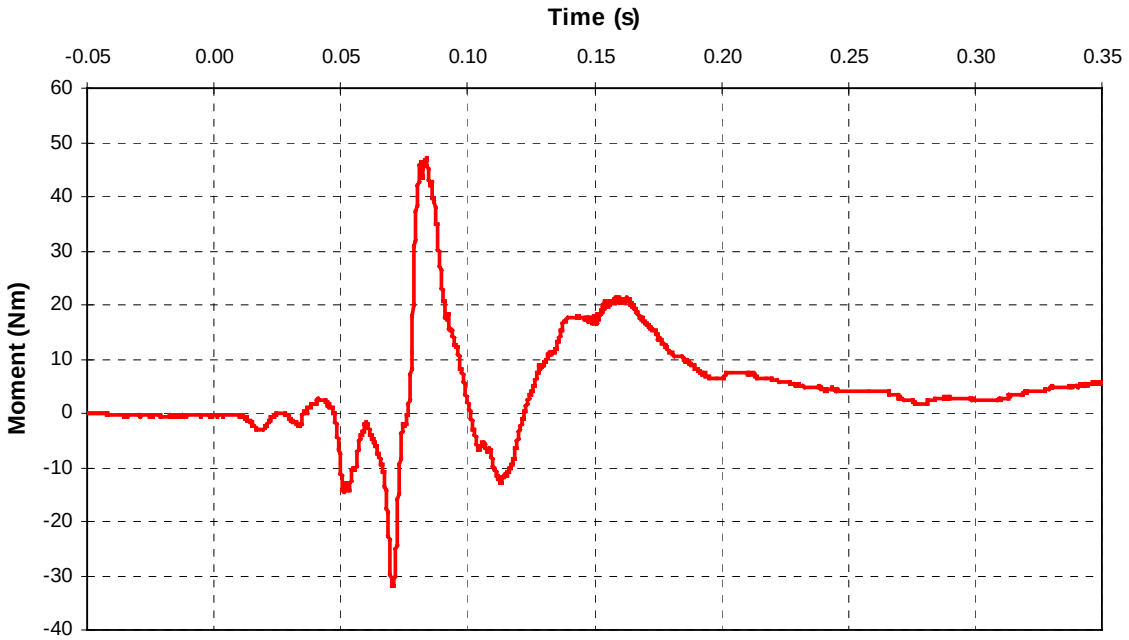
A- 41 CF99026 1999 Pontiac Grand Am Right Upper Tibia Vector Resultant Moment



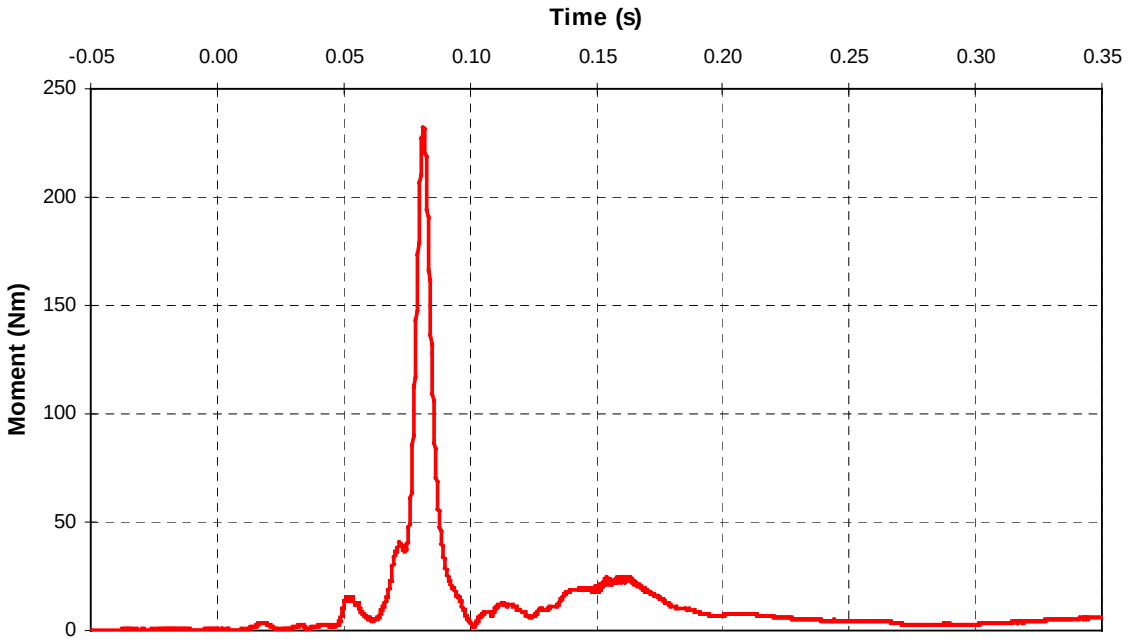
A- 42 CF99026 1999 Pontiac Grand Am Right Lower Tibia L-M Moment



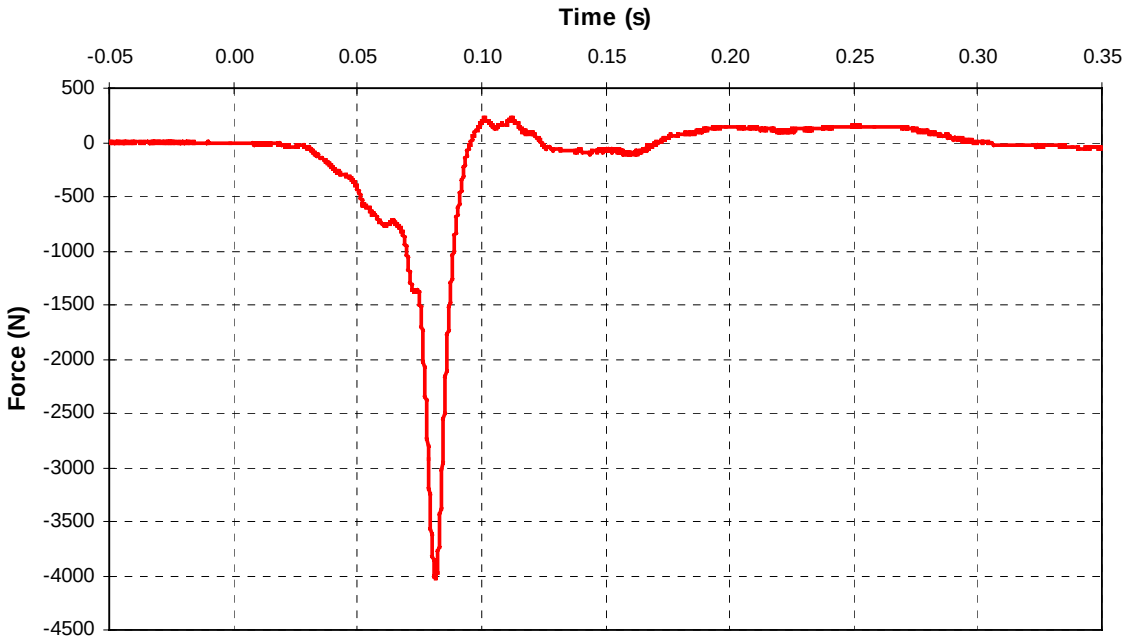
A- 43 CF99026 1999 Pontiac Grand Am Right Lower Tibia A-P Moment



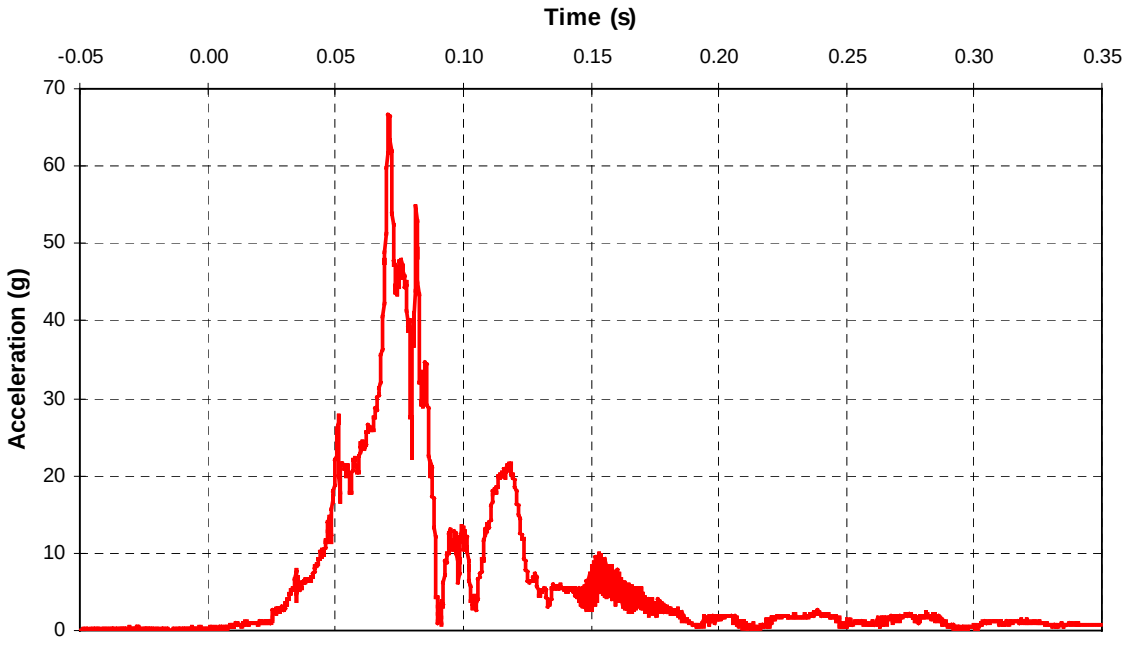
A- 44 CF99026 1999 Pontiac Grand Am Right Lower Tibia Vector Resultant Moment



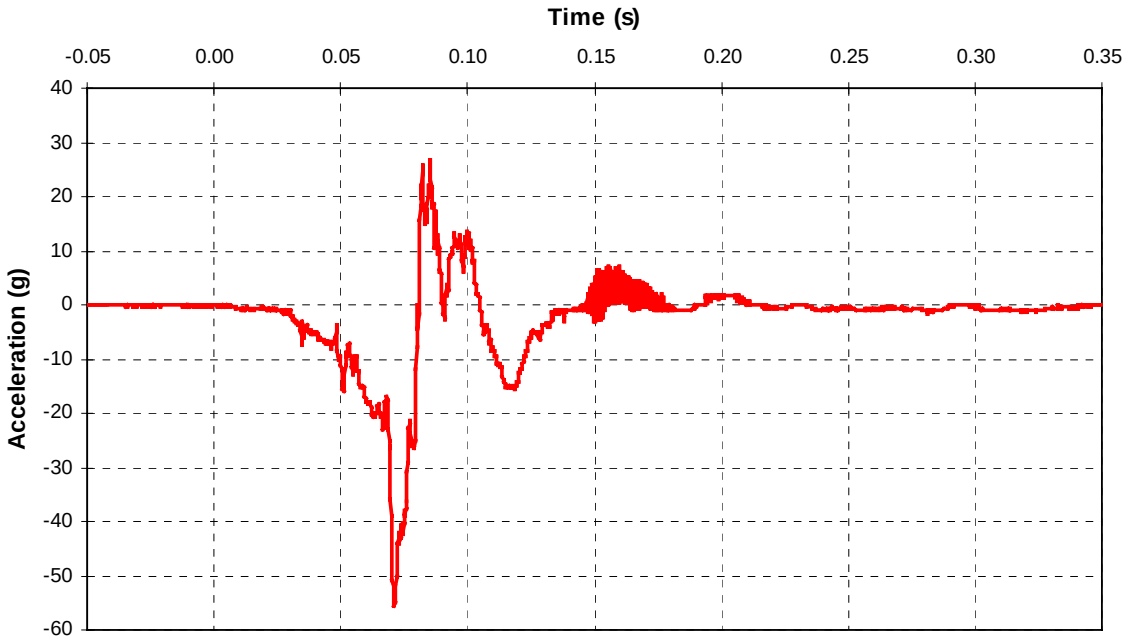
A- 45 CF99026 1999 Pontiac Grand Am Right Lower Tibia Axial Force



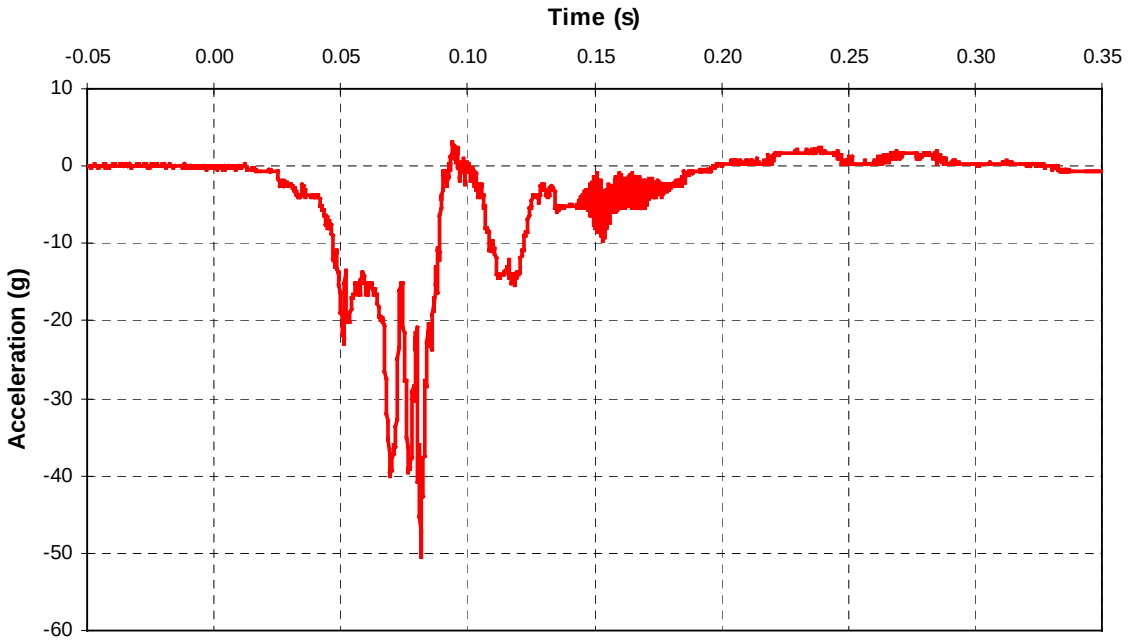
A- 46 CF99026 1999 Pontiac Grand Am Right Foot Vector Resultant Acceleration



A- 47 CF99026 1999 Pontiac Grand Am Right Foot A-P Acceleration



A- 48 CF99026 1999 Pontiac Grand Am Right Foot I-S Acceleration



1999 GRAND AM SE1 SEDAN

2.4L TWIN CAM 16V 4-CYL ENGINE — EXTERIOR PAINT, BRIGHT RED

TRANSMISSION, 4-SPEED AUTOMATIC — INTERIOR TRIM, DARK PEWTER CLOTH

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- 4-SPEED AUTO TRANSMISSION WITH ENHANCED TRACTION SYSTEM
- STAINLESS STEEL EXHAUST
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S A F E T Y /S E C U R I T Y:
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- INSTRUMENTATION W/TACHOMETER
- CONSOLE W/FR & RR CUPHOLDERS
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- CARPETED FLOOR MATS - FR & RR
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CITY MPG

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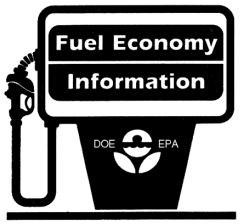

HIGHWAY MPG

30

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

18 AND 26 MPG IN THE CITY AND BETWEEN

25 AND 35 MPG ON THE HIGHWAY.

1999 GRAND AM
2.4 LITER L4 ENGINE
FUEL INJECTION, AUTOMATIC
4 SPD ELECTRONIC TRANS
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ESTIMATED ANNUAL FUEL COST: $719

FOR COMPARISON SHOPPING, ALL VEHICLES CLASSIFIED AS

COMPACT

HAVE BEEN ISSUED MILEAGE RATINGS RANGING FROM

11 TO 42 MPG CITY AND

16 TO 49 MPG HIGHWAY.

NTA

MANUFACTURER'S SUGGESTED RETAIL PRICE

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CT/MA/NJ/NY/RI EMISSIONS	.00
SE1 CONTENT:	NO CHARGE
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• POWER WINDOWS	
• POWER MIRRORS	
• DRIVER'S SEAT, 4 WAY MANUAL W/POWER HEIGHT ADJUSTMENT	
• SPLIT FOLDING REAR SEAT	
• AM/FM STEREO RADIO W/CLOCK & CASSETTE W/AUTO REV	
• WHEELS, 15" ALUMINUM	
'SOLID STYLE' OPTION PACKAGE	895.00
• AM/FM STEREO RADIO W/CD (REPLACES RADIO INCLUDED IN OPTION PKG)	
• 16" ALUMINUM WHEELS/TIRES	
• REAR SPOILER	
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LIGHTER ELEMENT/ASHTRAY	15.00
TOTAL VEHICLE & OPTIONS	18,990.00
DESTINATION CHARGE	525.00
SUBTOTAL	19,515.00
"VALUE PACKAGE" SAVINGS	-300.00

TOTAL FACTORY SAVINGS OF -300.00
BASED ON PRICE OF OPTIONS AND MODULES PURCHASED SEPARATELY

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PART NO. 10283711

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