Insurance Institute for Highway Safety
Crashworthiness Evaluation

Crash Test Report
2003 Volvo XC90 (CEF0305)

Vehicle identification number: YV1CM91H131007607
Body style: Midsize utility vehicle
Engine/transmission: Transverse 2.9-liter turbocharged 6-cylinder, 4-speed automatic, 4-wheel drive

Standard crashworthiness features:

Driver and right front passenger dual-stage front airbags with separate deployment thresholds for belted and unbelted occupants
Side curtain airbags for head protection (also designed to inflate in rollovers) (front, second, and third row outboard seating positions)
Driver and right front passenger seat-mounted side thorax airbags
Dual-locking shoulder belts (all seating positions)
Automatic shoulder belt height adjusters (front seating positions only)
Seat belt crash tensioners (pyrotechnic, all seating positions)
Seat belt force-limiting mechanisms (front seating positions only)
Driver and right front passenger seats designed to reduce whiplash injury (WHIPS)
Second row center lap/shoulder belt
Right front and all rear shoulder belt retractors are convertible from emergency to automatic locking for ease of child restraint use
LATCH system (rigid lower anchorages and top tether attachments) for child restraints (second row outboard seating positions)

Other standard safety features:

4-wheel antilock brakes
Daytime running lights

Optional safety features:

Integrated child restraint (second row center seating position)
Electronic stability control system with roll sensors

Vehicle specifications (provided by manufacturer):

Wheelbase:	286 cm
Overall length:	480 cm
Overall width:	190 cm
Curb weight:	2,038 kg

Vehicle specifications (measured):

Front bumper to firewall:	110 cm
Curb weight:	2,094 kg
Test weight:	2,193 kg (53% front, 47% rear)
Overall width:	190 cm

Nominal test parameters:

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

Crash test date:

January 29, 2003

Figure 1
Precrash and Postcrash Side Views — 2003 Volvo XC90

Summary

A 2003 Volvo XC90 was crash tested on January 29, 2003 into a fixed deformable barrier at 39.7 mi/h (63.8 km/h) and a 40 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 0-2 cm. Resultant intrusion in the driver footwell measured 7 cm at the footrest and 10-11 cm at other places on the toepan. After the crash, the driver door required slight additional effort but no tools to open. All other doors opened with ease.

The driver dummy was restrained by a three-point lap/shoulder belt and an airbag. During the crash, the belt crash tensioner activated and retracted about 9 cm of shoulder belt webbing. A net amount of 15 cm of webbing (or a total of 24 cm including the tensioner-retracted length) spooled off the retractor. During the crash, the dummy loaded the fully inflated airbag and, during rebound, the top of the head contacted the A-pillar and roof rail. After the crash, the upper end of the steering column had moved downward 1 cm but not forward or rearward.

The peak resultant head acceleration from the A-pillar/roof rail contact was 27 g.

Test Conditions

This vehicle had been tested previously in the Institute's Low-Speed Crash Test Program and subjected to front and rear impacts at 5 mi/h (8 km/h) into a full-width 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 IX). 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, steering column, and foot pedal adjustments (where applicable) 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, steering column, and foot pedal 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 44 cm behind its center of gravity (178 cm behind the front axle). The vehicle speed recorded just prior to impact was 39.7 mi/h (63.8 km/h), and the actual overlap was 40 percent.

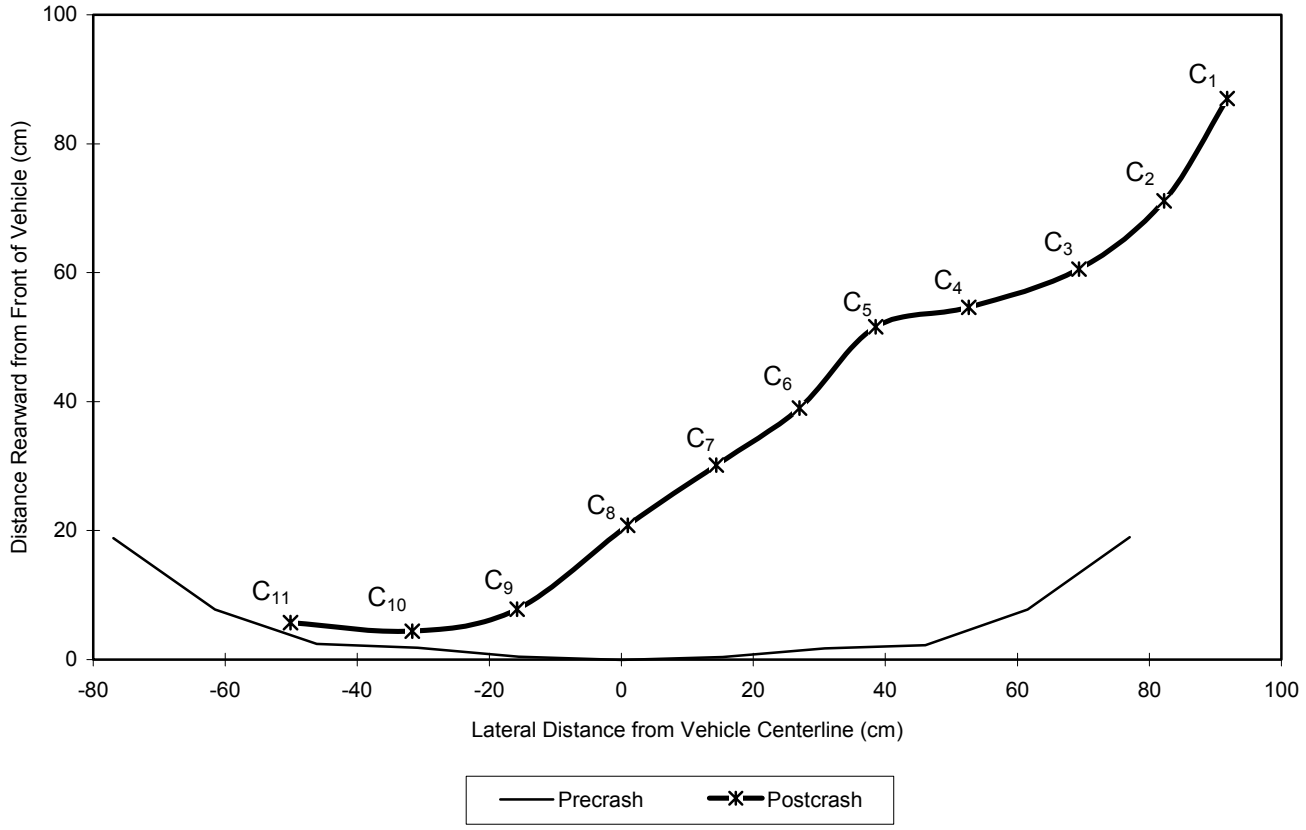
Structural Performance

All doors remained closed during the crash. After the crash, the driver door required additional effort but no tools to open. The right front, left rear, and right rear doors opened with ease. The driver door aperture shortened 1 cm, as measured at the lower edge of the window.

No fuel system leaks were observed after the crash.

Figure 2 illustrates the precrash and postcrash contour measures of the front bumper cover profile and the resulting permanent crush.

Figure 2
Front Bumper Cover Crush Contour — 2003 Volvo XC90



	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)	87	71	61	55	52	39	30	21	8	4	6
Precrash Contour (cm)	19	8	2	2	0	0	0	2	2	8	19
Resulting Crush (cm)	68	63	59	53	52	39	30	19	6	–4	–13

The bumper cover was torn 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 154 cm precrash and 142 cm postcrash.

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 IX). 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. In the XC90, the brake pedal moved forward 2 cm in this test. The resultant movement of 6 cm by the brake pedal was directed away from (rather than toward) the driver seat. (With longitudinal component removed, the resultant movement was 5 cm.)

Table 1
Residual Measurements of Intrusion Relative to Driver Seat — 2003 Volvo XC90

Selected Locations*	Longitudinal	Lateral	Vertical	Resultant
Steering column (cm)	0	–4	–1	4
Left lower instrument panel (cm)	–2	–4	1	5
Right lower instrument panel (cm)	0	–4	0	4
Brake pedal (cm)	2	–4	–4	6
Left toepan (cm)	–8	–5	3	10
Center toepan (cm)	–9	–5	3	11
Right toepan (cm)	–10	–5	2	11
Footrest (cm)	–6	–3	2	7
Average displacement of the four seat-attachment bolts relative to reference system (cm)	0	4	–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 61 cm in diameter, and the excursion of its center when inflated is limited by two tethers. The airbag is vented by two holes located at positions corresponding to 11 and 1 o'clock on the forward-facing surface of the airbag. Analysis of the high-speed film taken from camera positions D and E indicated the airbag deployed at 36 ms into the crash and appeared to be fully inflated at 64 ms. The seat-mounted side airbag and inflatable curtain did not deploy during the crash.

Passenger: The corner-mounted passenger airbag deployed at an angle and is untethered. The cylinder-shaped airbag is vented by two holes located at the lateral ends. Analysis of the high-speed film taken from camera position A indicated the passenger airbag deployed at 28 ms into

the crash. The airbag did not contribute to windshield damage during deployment. The seat-mounted side airbag and inflatable curtain did not deploy during the crash.

Seat Belts

The inboard and outboard lower anchorage points for the driver and right front passenger seat belts are attached to and move with the seats. During the crash, approximately 9 cm of the driver's seat belt webbing was pulled by the belt crash tensioner into the retractor through the D-ring, as determined by film analysis of the movement of a tape strip on the belt webbing near the dummy's shoulder. A net amount of 15 cm of webbing (or a total of 24 cm including the tensioner-retracted length) 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 two-stage (nested) force-limiting torsion bars within the retractor spool indicated they were both twisted. The outer bar broke in two as designed; consequently it was not possible to determine how much spool-out was due to the action of the force limiter.

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 slightly forward.

Steering Column

The upper end of the steering column had moved downward 1 cm but not forward or rearward relative to the driver's seat.

Dummy Kinematics

Head, Neck, and Torso

Analysis of the high-speed film taken from camera position E indicated the dummy began to load the airbag at 64 ms, at the same time the airbag was fully inflated. Paint transferred from the dummy's face indicated the nose loaded the airbag 6 cm above and 3 cm to the left of its center. As the dummy loaded the airbag, the face began to turn inboard and rotate almost 90 degrees. After loading the airbag, the dummy's head rebounded, moving up until the top of the head contacted the A-pillar and then the roof rail beginning at 218 ms, with a peak resultant acceleration of 27 g at 221 ms according to the head acceleration data. The right rear of the dummy's head then contacted the left side of the head restraint at 362 ms. After contacting the head restraint, the head moved slightly forward and the rear of the head contacted the front of the head restraint a second time. Table 2 provides the timing of these events.

Table 2 Restraint System Performance and Dummy Kinematics — 2003 Volvo XC90	
Event	**Time (ms)**
Deployment of driver front airbag	36
Deployment of passenger front airbag	28
Airbag fully inflated and face begins to load airbag	64
Top dummy's head contacts A-pillar/roof rail	218
Right rear of head contacts head restraint	362

Figure 3
Dummy and Vehicle Interior, Postcrash — 2003 Volvo XC90

Figure 4
Dummy Left Knee/Shin Contacts, Postcrash — 2003 Volvo XC90

Figure 5
Dummy Right Knee/Shin Contacts, Postcrash — 2003 Volvo XC90

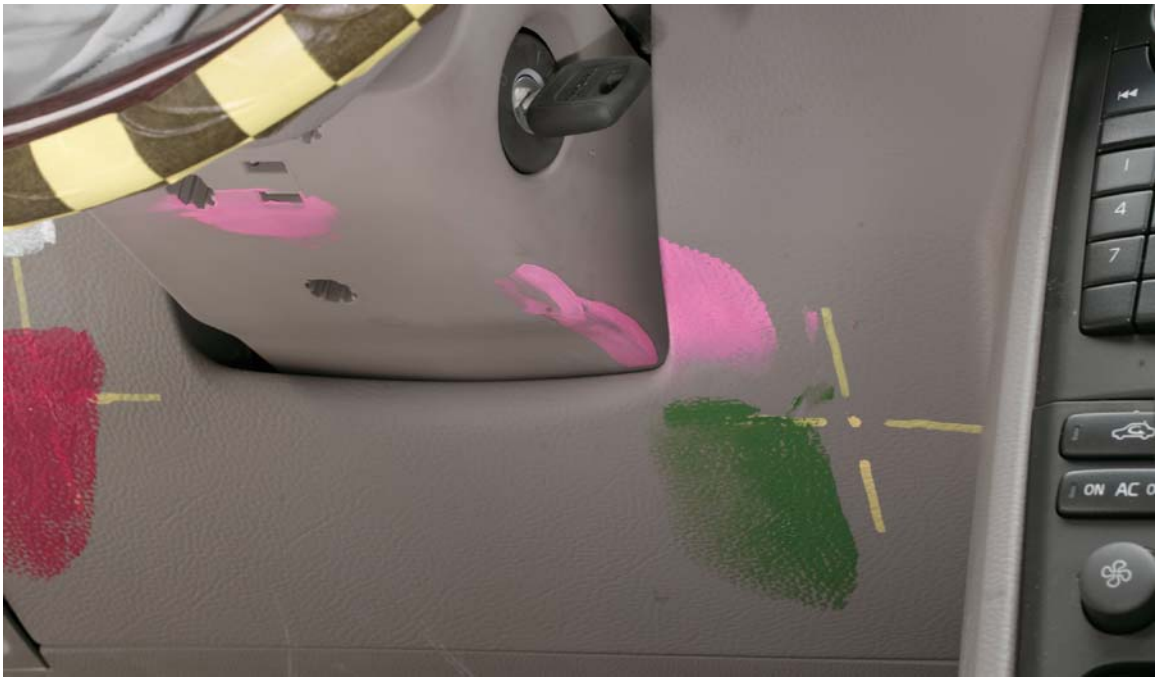


Figure 6
Dummy Feet Positions, Postcrash — 2003 Volvo XC90

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 peak resultant acceleration from the A-pillar/roof rail contact was 27 g at 221 ms. Table 3 provides a summary of the maximum head injury measurements recorded during the crash.

Table 3
Head Injury Measurements — 2003 Volvo XC90

Measure	Published Tolerance Threshold	Result	Time (ms)
Vector resultant acceleration (g)	80	40	104
Vector resultant acceleration — 3 ms clip (g)	80	39	103-106
Head injury criterion (HIC)	1000	302	75-111
Head injury criterion — 15 ms interval (HIC-15)	700	135	78-93

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 — 2003 Volvo XC90

Measure	Published Tolerance Threshold	Result	Time (ms)
A-P shear force (kN)	±3.1	0.7	108
Axial compression force (kN)	4.0	1.5	228
Axial tension force (kN)	3.3	1.4	88
N_{ij} tension-extension	1.00	0.20	88
N_{ij} tension-flexion	1.00	0.29	86
N_{ij} compression-extension	1.00	0.25	228
N_{ij} compression-flexion	1.00	0.27	228
Flexion bending moment (Nm)		33	84
Extension bending moment (Nm)		8	349

Chest

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

Table 5
Chest Injury Measurements — 2003 Volvo XC90

Measure	Published Tolerance Threshold	Result	Time (ms)
Vector resultant spine acceleration — 3 ms clip (g)	60	43	121-124
Rib compression (mm)	–50	–38	83
Viscous criteria (m/s)	1.0	0.3	74
Sternum deflection rate (m/s)	–8.2	–1.4	72

Legs and Feet

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

Table 6
Leg and Foot Injury Measurements — 2003 Volvo XC90

Measure	Published Tolerance Threshold	Left		Right	
		Result	Time (ms)	Result	Time (ms)
Femur axial force (kN)	–9.1*	–6.3	83	–5.0	80
Tibia-femur displacement (mm)	–15	–3	96	0	76
Upper Tibia					
L-M moment (Nm)	±225	–56	87	44	78
A-P moment (Nm)	±225	51	94	52	74
Vector resultant moment (Nm)	225	73	89	59	76
Index	1.00	0.34	89	0.32	76
Lower Tibia					
L-M moment (Nm)	±225**	–12	110	67	91
A-P moment (Nm)	±225**	–31	79	–47	73
Vector resultant moment (Nm)	225**	31	79	69	91
Axial force (kN)	–8.0**	–1.1	57	–2.9	85
Index	1.00	0.15	79	0.37	90
Foot					
A-P acceleration (g)	±150	–48	83	–85	72
I-S acceleration (g)	±150	–37	111	–43	73
Vector resultant acceleration (g)	150	54	82	93	72

* This critical value is for instantaneous loading. Femur loads are compared with magnitude-duration injury criteria in Figures A-24 and A-37.

** 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

2003 Volvo XC90 Midsize Four-Door Utility Vehicle: 5 mi/h Front into Barrier

Test Number: LF03004
VIN: YV1CM91H131007607
Mileage: 18
Features: Driver and passenger front airbags, driver and right front passenger side impact airbags, front and rear seat side curtain airbags, Whiplash Protection System in driver and front passenger seats, four-wheel antilock brakes, air conditioning, automatic transmission, traction control, heated power mirrors, keyless entry system, power door locks, power windows, power driver and front passenger seats, heated back glass, rear wiper, tilt and telescoping steering wheel, cruise control, front fog lamps, moonroof, full-size spare tire, two-stage paint.

	Part		Labor	
Description	**Mfg. No**	**Price**	**Operation**	**Hours**
Absorber reinforcement, front	8620596	$58.00	Replace*	1.0
Bumper reinforcement bar, front	8625288	135.00	Replace*	2.0
Bumper reinforcement bar, front			Refinish*	0.8
Frame sidemember end flange, left front inner	8625353	3.83	Replace*	0.5
Frame sidemember end flange, right front inner	8625353	3.83	Replace*	0.5
Frame sidemember end, left front			Repair*	0.5
Frame sidemember end, right front			Repair*	0.5
Frame sidemember ends, left and right front			Refinish*	0.7
Frame sidemember end, left and right front			Anticorrosion	0.2
Headlamps			Remove/reinstall	0.5
Radiator support, left			Repair*	1.5
Radiator support, right			Repair*	1.5
Radiator support, left and right			Refinish*	0.4
Hood latches			Align*	0.5
Hood			Polish	0.2
Air conditioning condenser			Repair	0.2
Fog lamp, right	8693796	65.00	Replace	0.2
Headlamps			Aim	0.5
Fog lamps			Aim	0.3
Paint and materials		46.00		
Total Parts		$311.66		
Total Labor		462.50		12.5
Grand Total		$774.16		

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

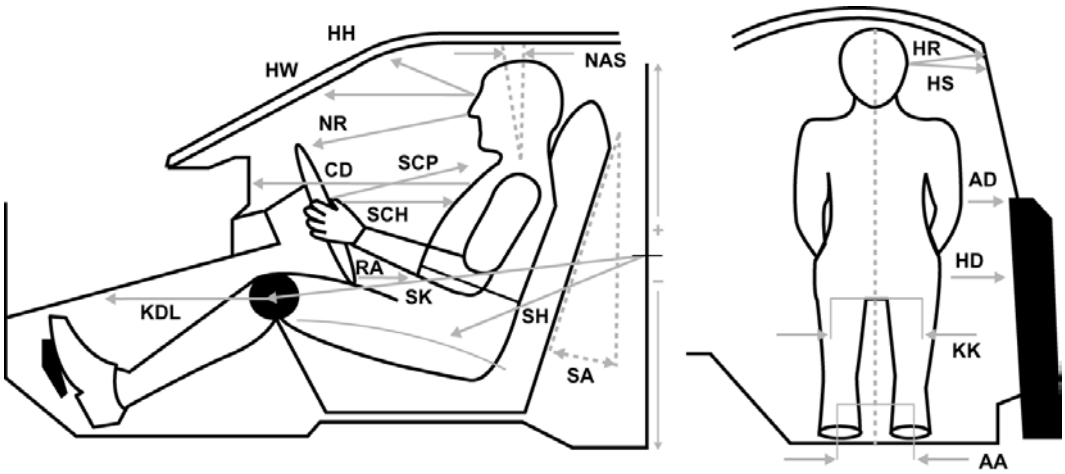
Dummy Clearance Measurements

Test Number: CEF0305
Vehicle Make/Model: Volvo XC90
Vehicle Model Year: 2003
Seat Type: Electrically adjusted bucket seat (fore/aft, height, and seat back angle)

Manufacturer's Specifications
Seat Back Information: Reclined to 19°, as measured on center rear frame of seat back
Upper Belt Anchorage: Automatic (self adjusting)
Steering Column Adjustment: Set to midpoint of tilt and telescopic adjustment ranges
Foot Pedal Adjustment Fixed

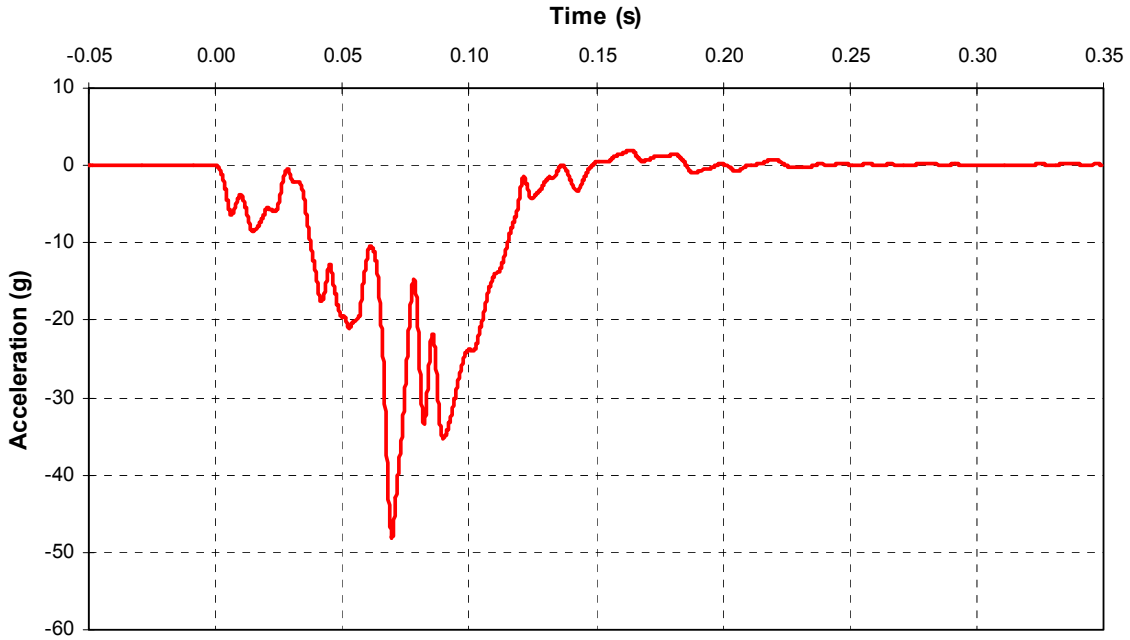
Location	Code	Measure	Location	Code	Measure
Head to header	HH	328	Neck angle, torso 90	NAT90	21.1°
Head to windshield	HW	582	Neck angle, seated	NAS	3.7°
Nose to rim	NR	422	Torso angle (NAT90 – NAS)	TA	17.4°
Chest to dash	CD	629	Striker to knee**	SK	573
Rim to abdomen	RA	206	Striker to knee angle**	SKA	–2.4°
Knee to dash, left	KDL	220	Striker to H-point, horizontal	SHH	188
Knee to dash, right	KDR	210	Striker to H-point, vertical	SHV	–97
Steering wheel to chest, horizontal	SCH	316	Ankle to ankle	AA	333
Steering wheel to chest, perpendicular	SCP	388	Knee to knee	KK	345
Steering wheel to chest, reference	SCR	377	Arm to door	AD	110
Hub to chest, minimum	HCM	234	H-point to door	HD	175
Pelvic angle	PA	22.4°	Head to A-pillar	HA	550
Seat back angle*	SA	19°	Head to roof	HR	225
			Head to side window	HS	250

All distance measurements are in millimeters (mm).
* Indicated value is from vertical, as measured on rear frame of seat back.
** These measurements were made in a vertical plane containing the striker and parallel to the driver door sill.

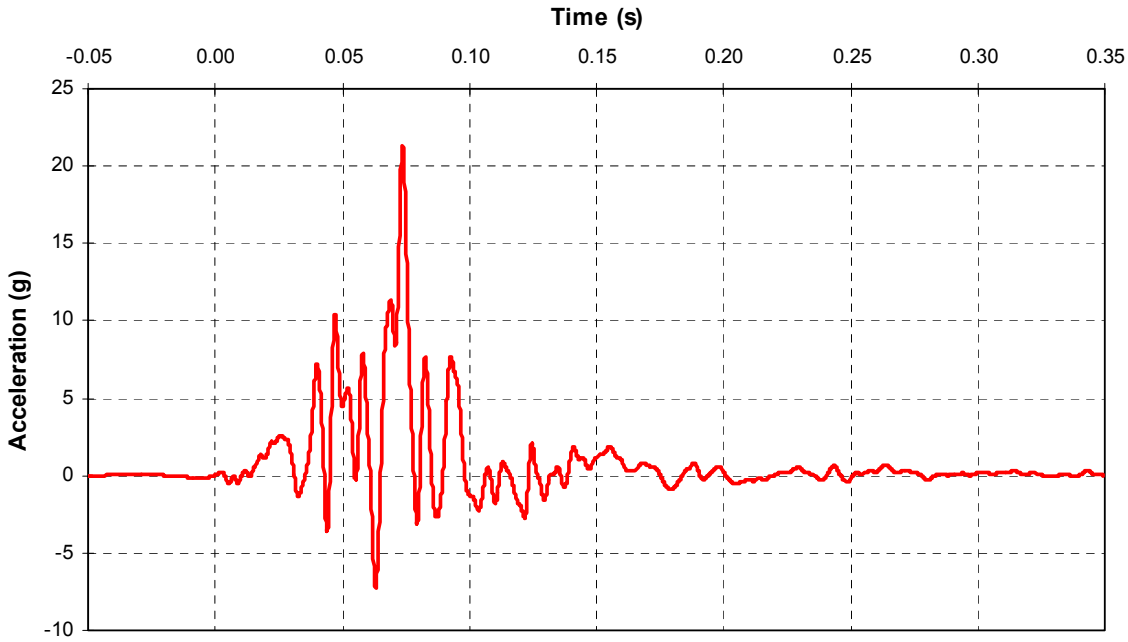


Graph Index

A- 1 CEF0305 2003 Volvo XC90 Vehicle Longitudinal Acceleration



A- 2 CEF0305 2003 Volvo XC90 Vehicle Lateral Acceleration



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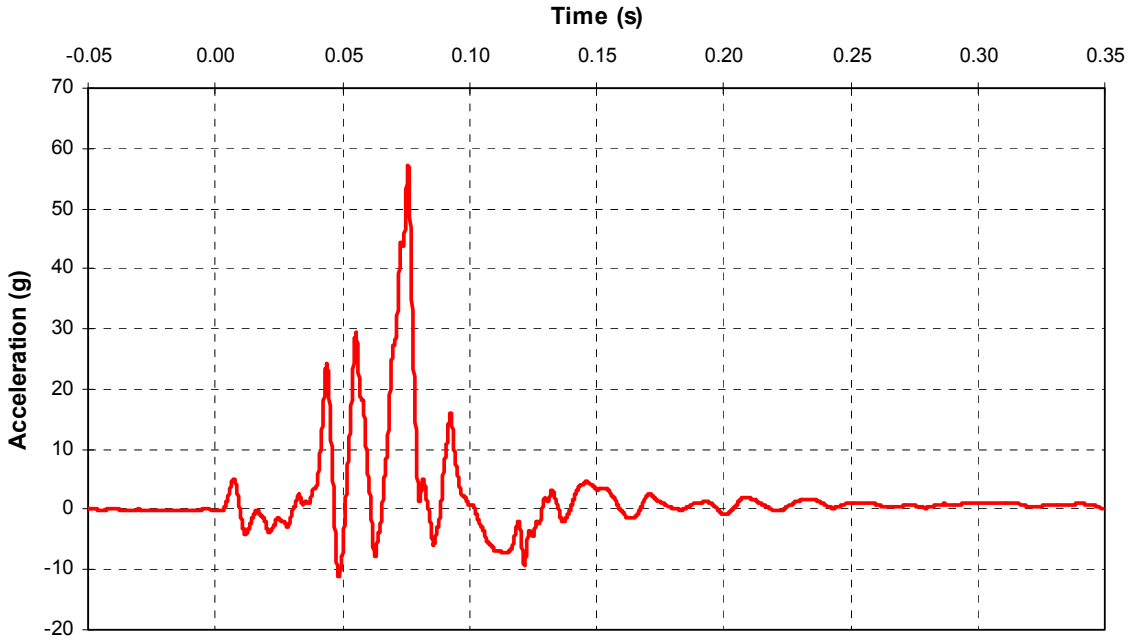
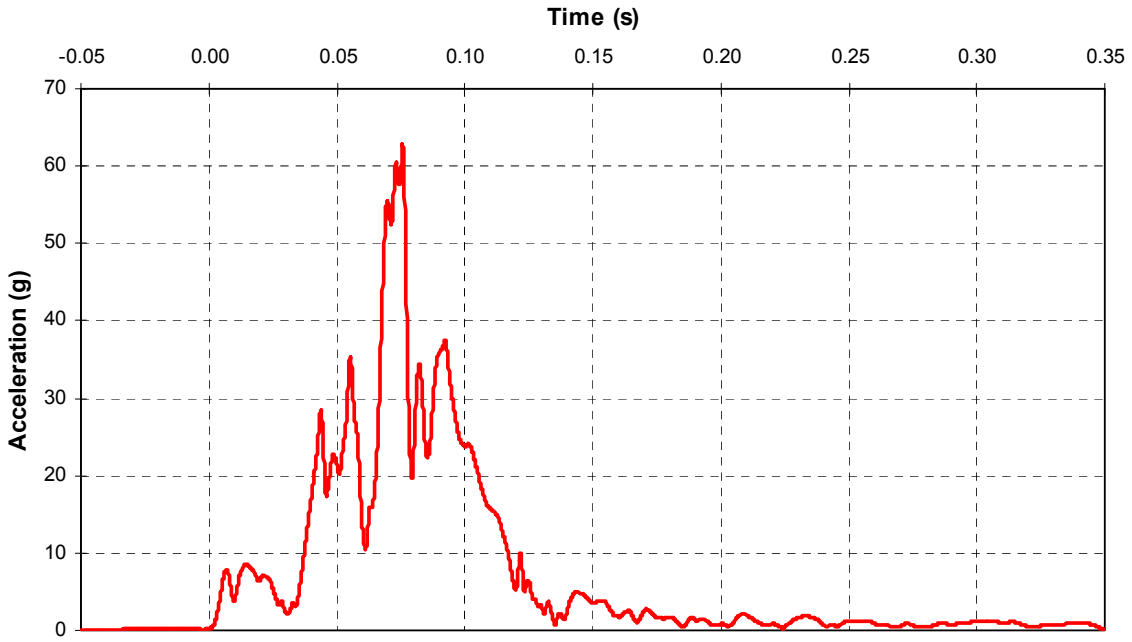
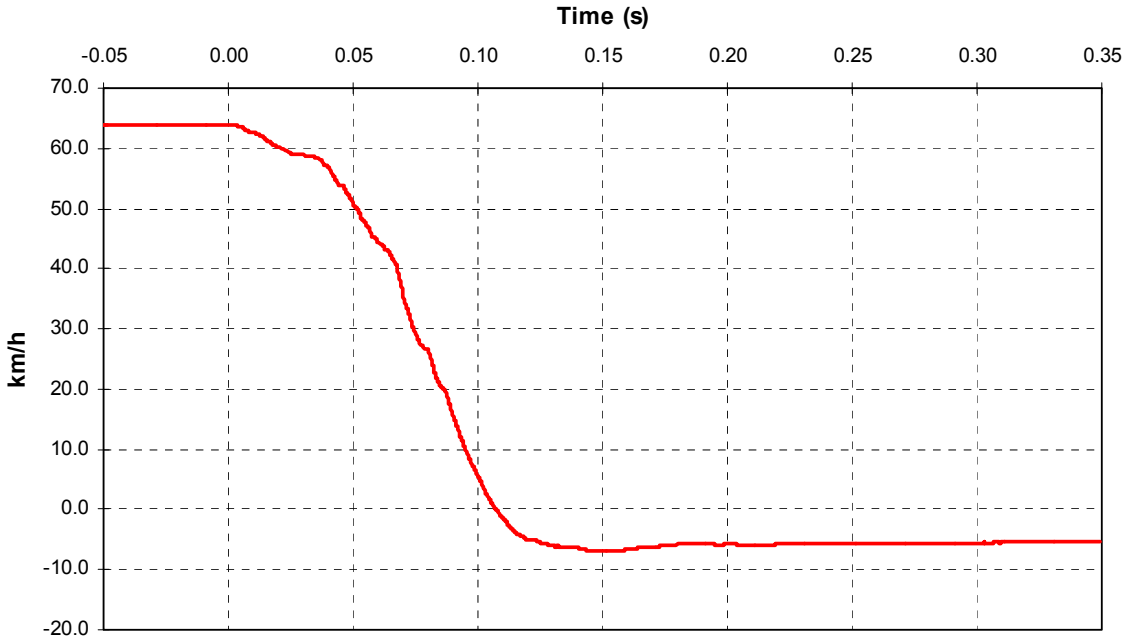


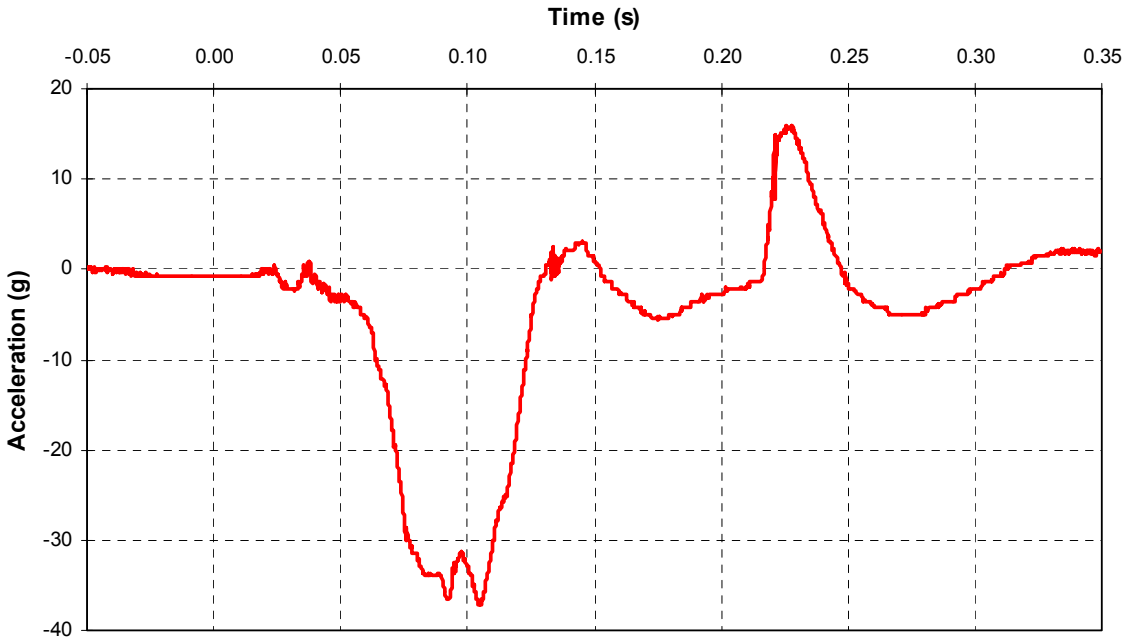
A- 4 CEF0305 2003 Volvo XC90 Vehicle Vector Resultant Acceleration



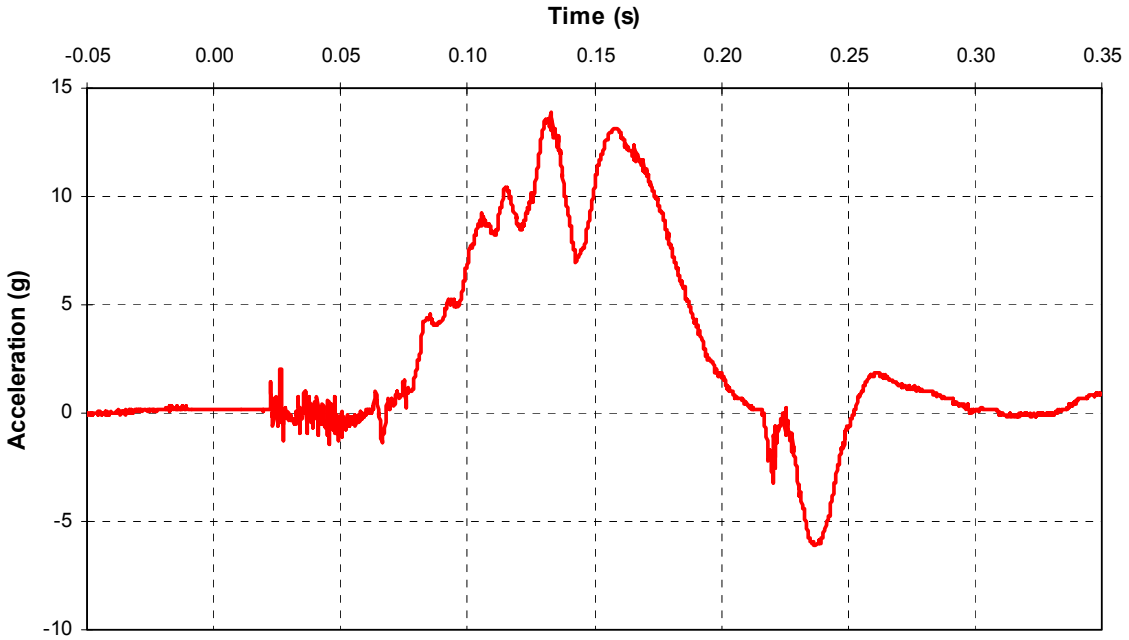
A- 5 CEF0305 2003 Volvo XC90 Integration of Vehicle Longitudinal Acceleration



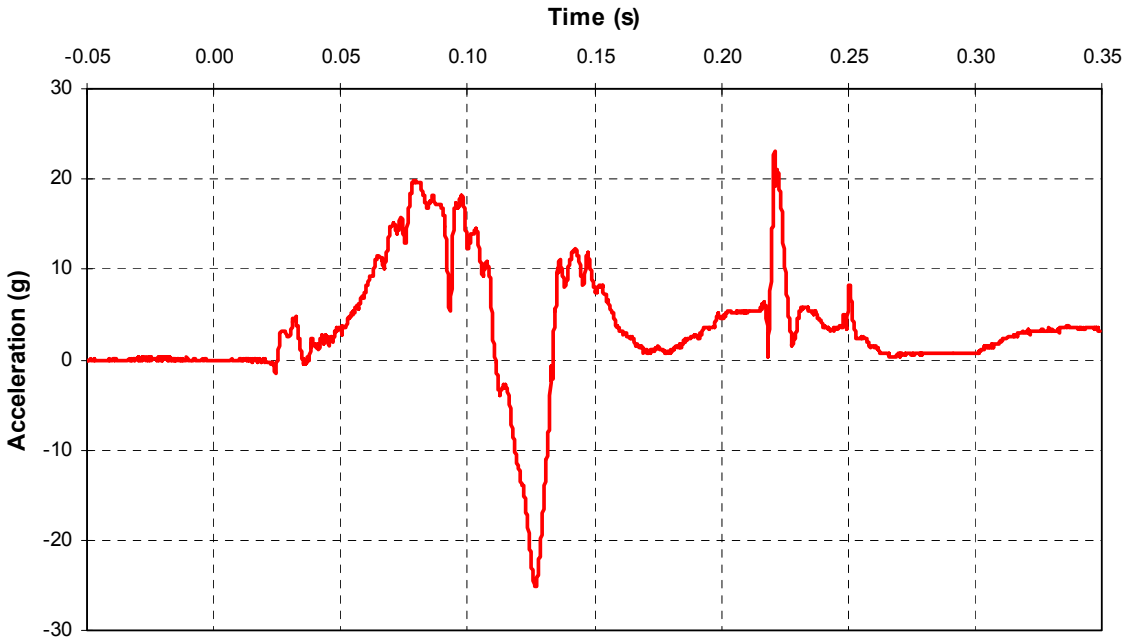
A- 6 CEF0305 2003 Volvo XC90 Head A-P Acceleration



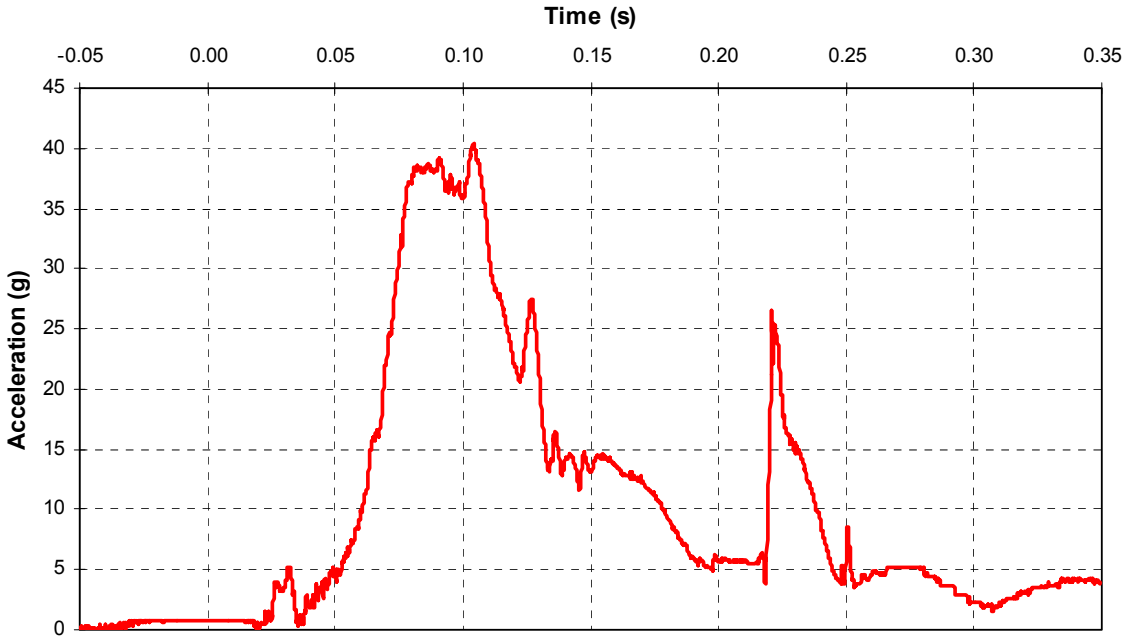
A- 7 CEF0305 2003 Volvo XC90 Head L-M Acceleration



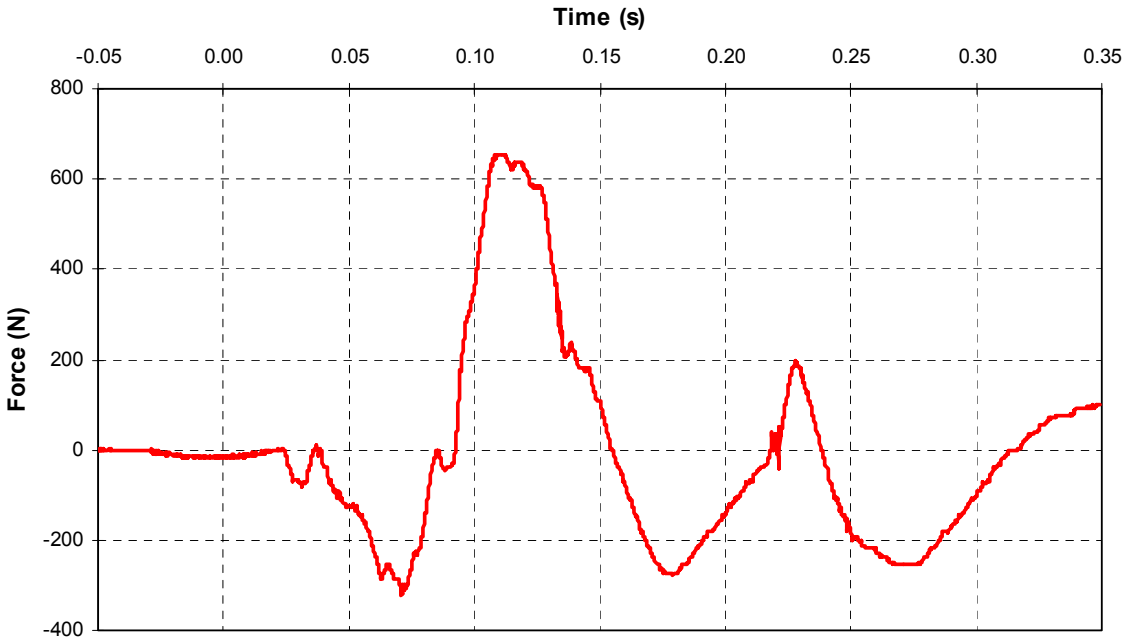
A- 8 CEF0305 2003 Volvo XC90 Head I-S Acceleration



A- 9 CEF0305 2003 Volvo XC90 Head Vector Resultant Acceleration



A- 10 CEF0305 2003 Volvo XC90 Neck A-P Shear Force



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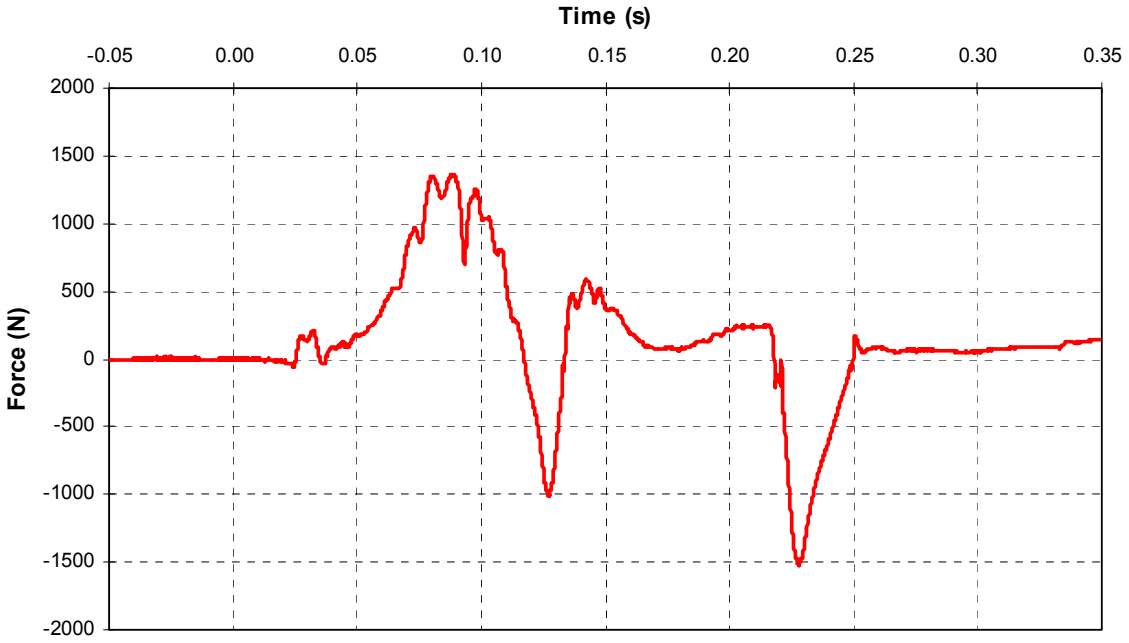

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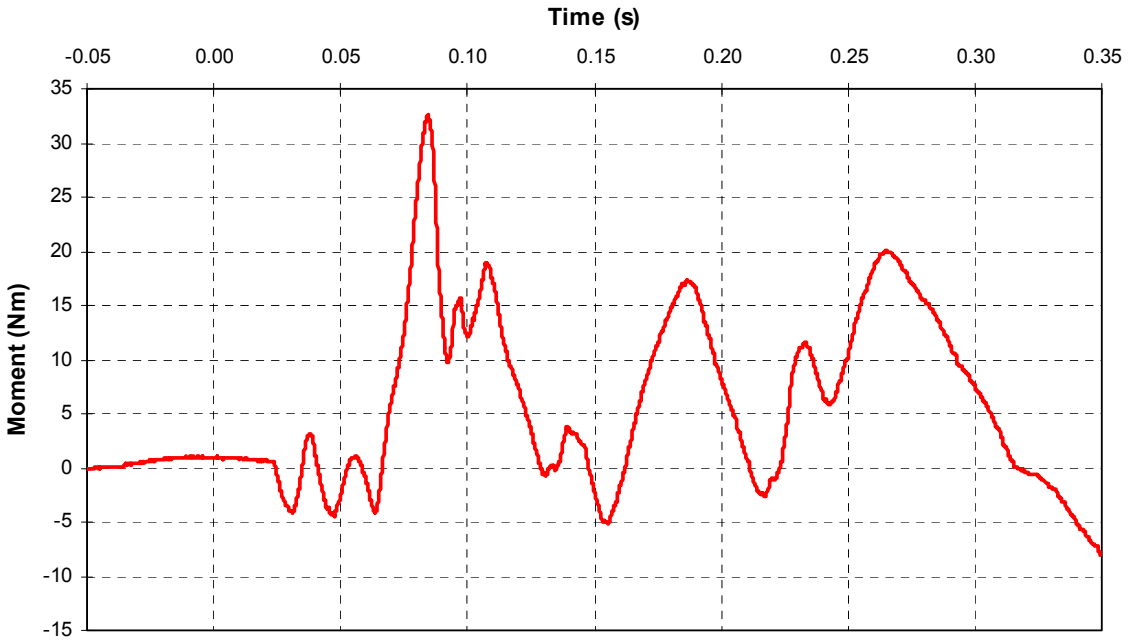
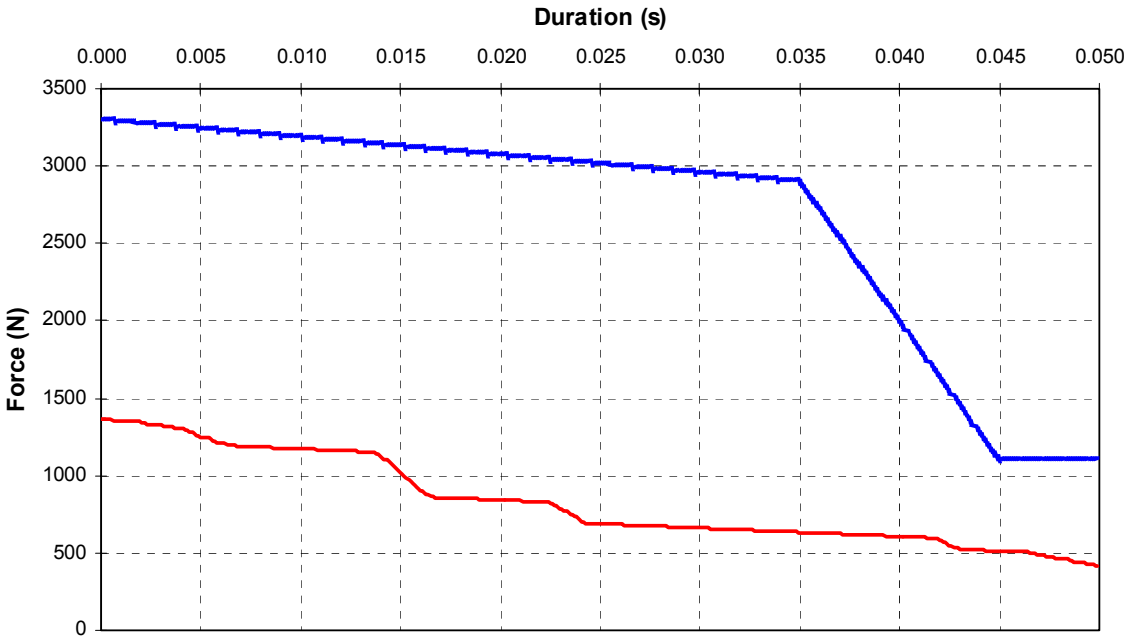
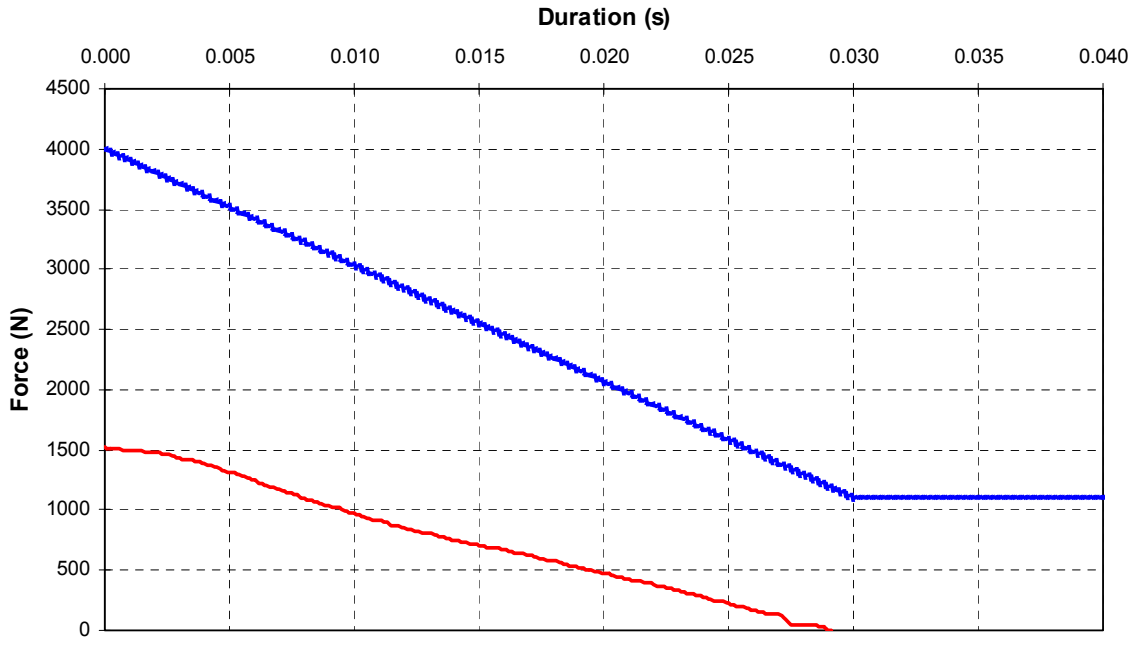


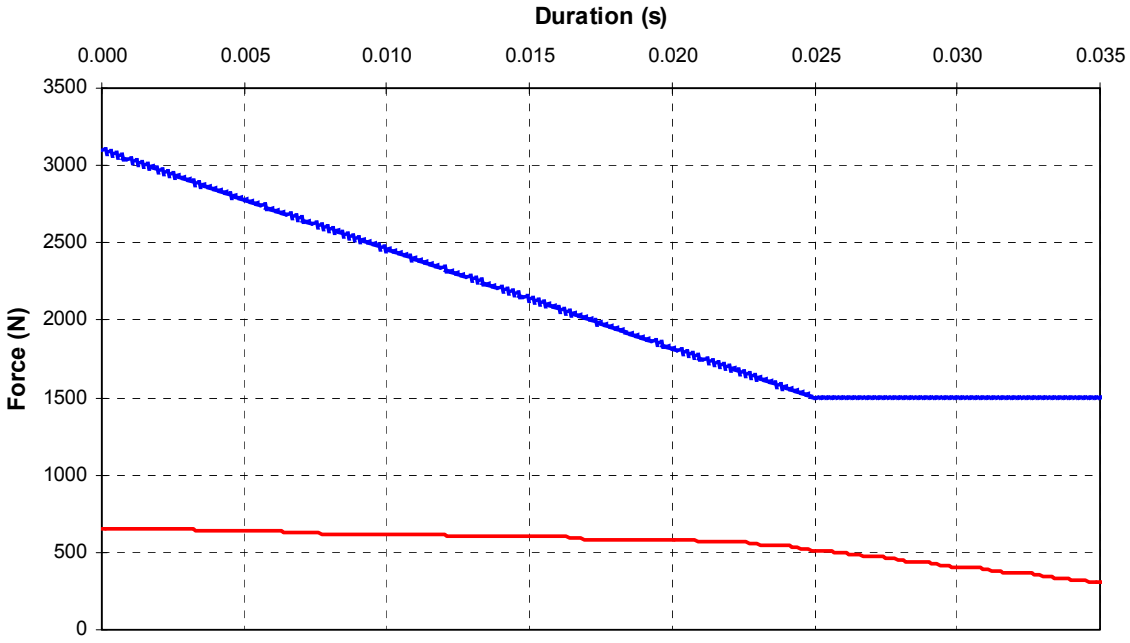
A- 13 CEF0305 2003 Volvo XC90 Neck Tension Analysis



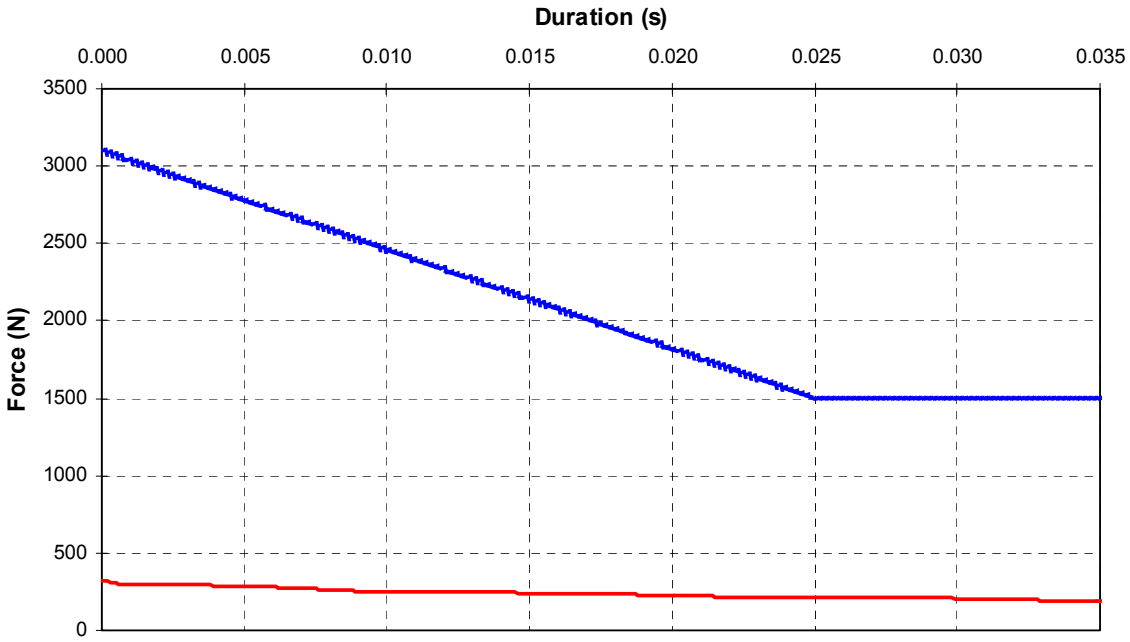
A- 14 CEF0305 2003 Volvo XC90 Neck Compression Analysis



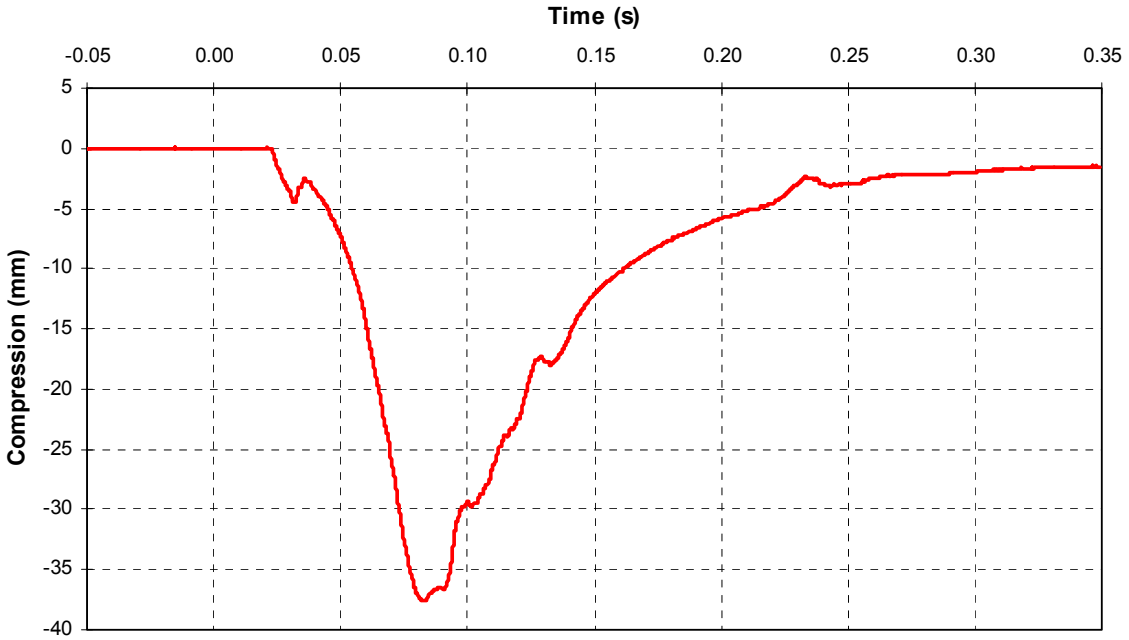
A- 15 CEF0305 2003 Volvo XC90 Neck A-P Shear (Positive) Analysis



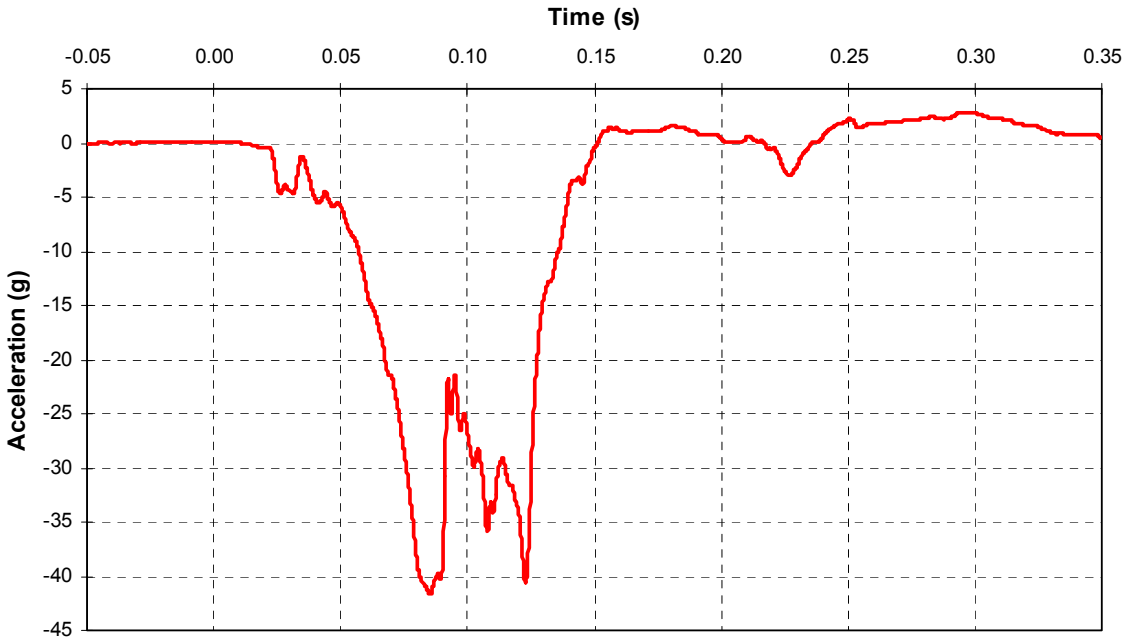
A- 16 CEF0305 2003 Volvo XC90 Neck A-P Shear (Negative) Analysis



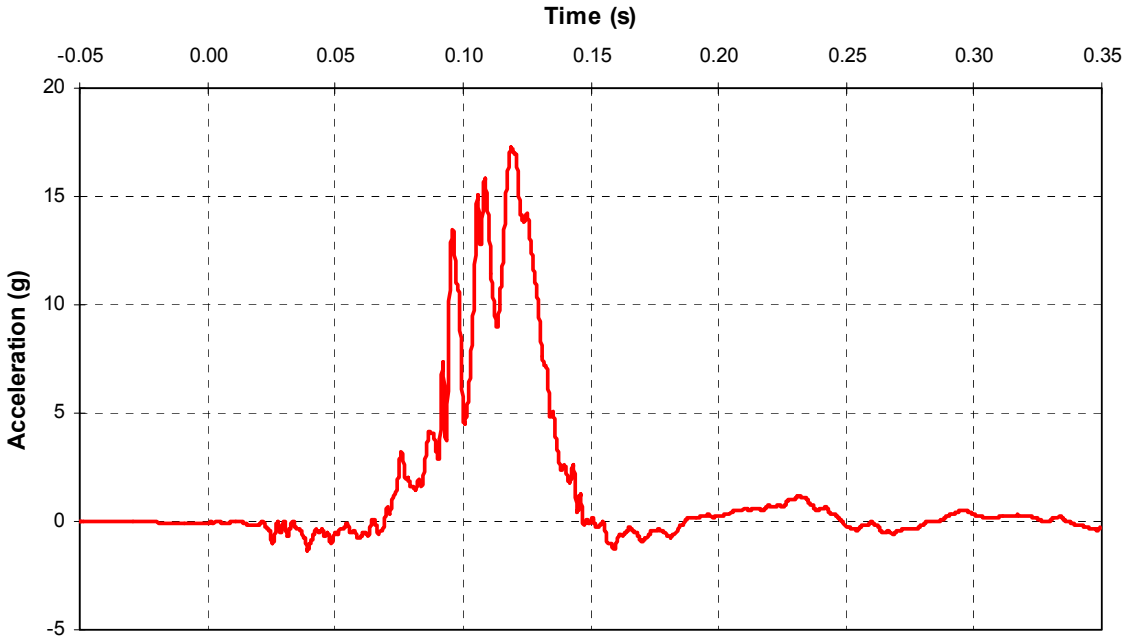
A- 17 CEF0305 2003 Volvo XC90 Chest Compression



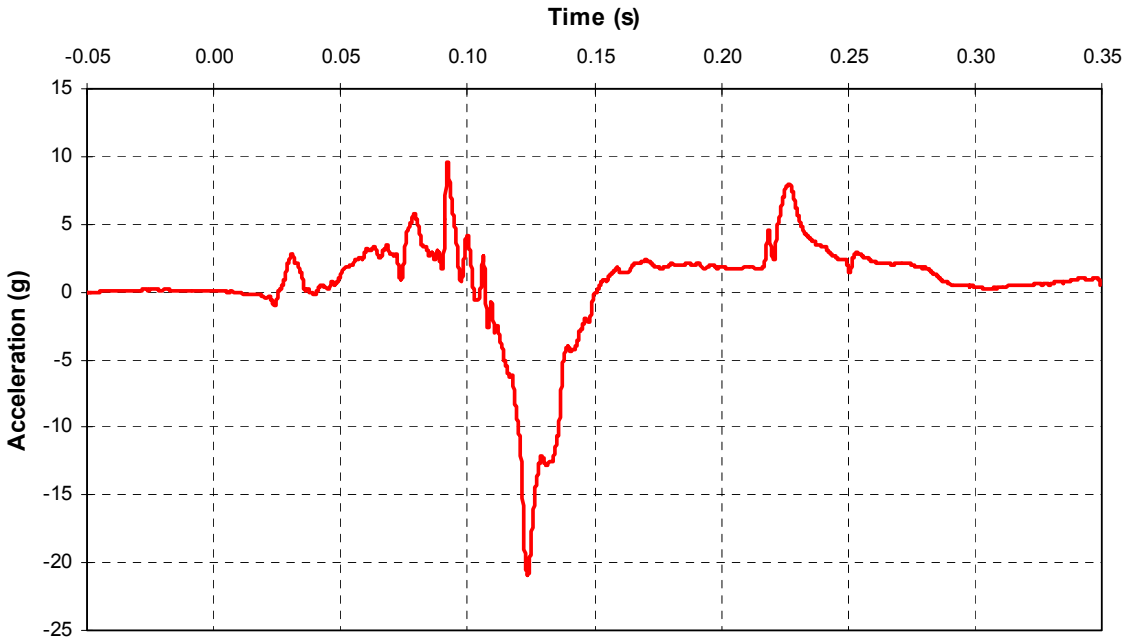
A- 18 CEF0305 2003 Volvo XC90 Chest A-P Acceleration



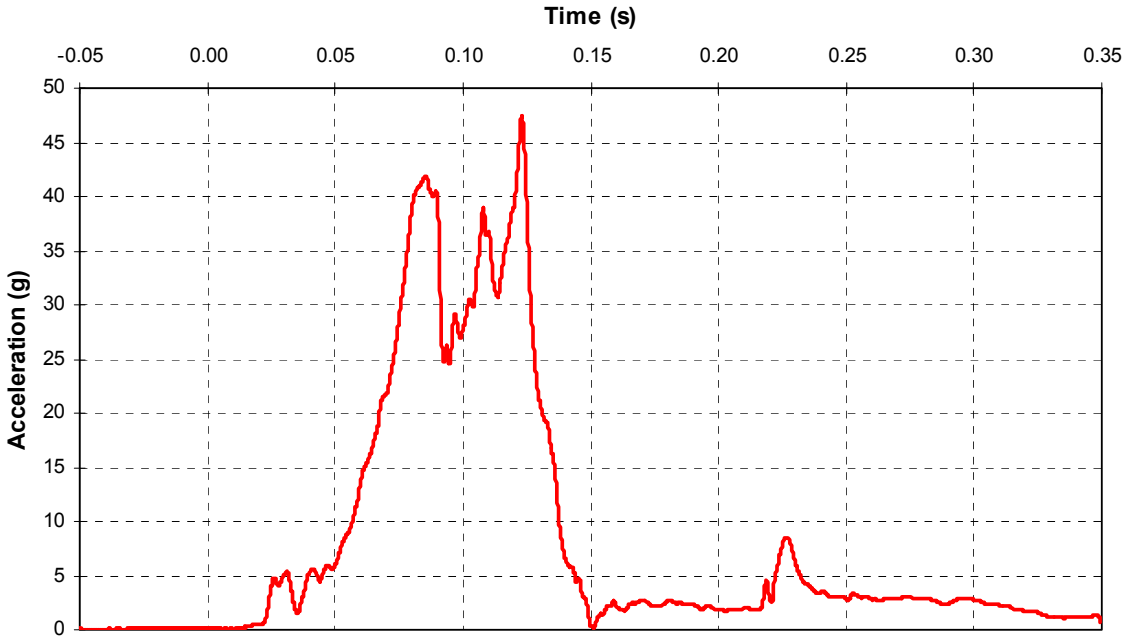
A- 19 CEF0305 2003 Volvo XC90 Chest L-M Acceleration



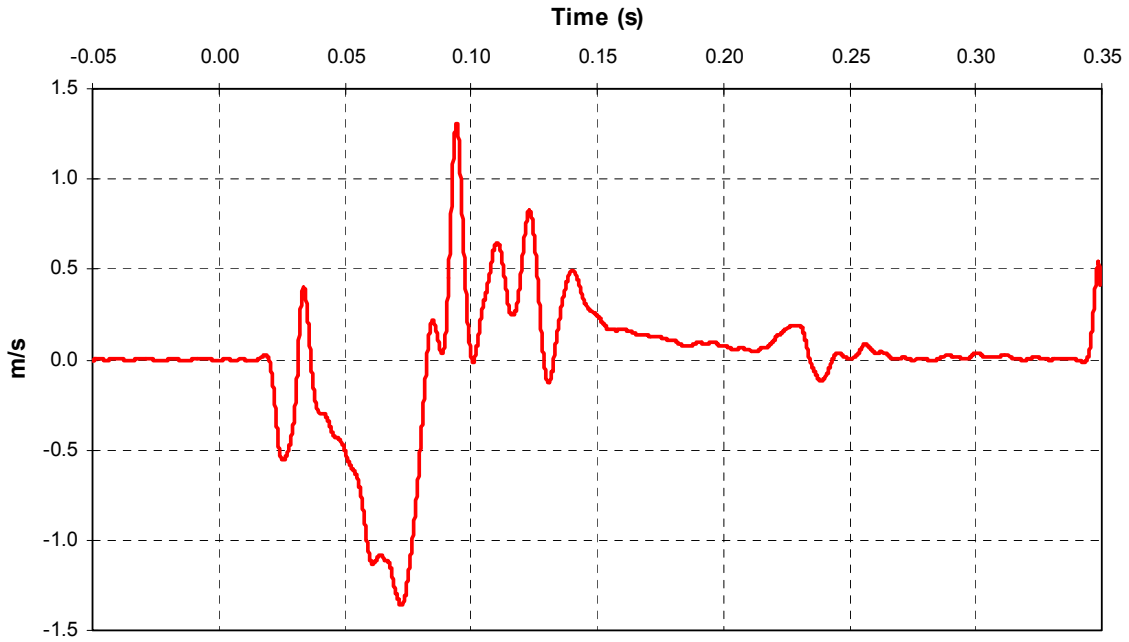
A- 20 CEF0305 2003 Volvo XC90 Chest I-S Acceleration



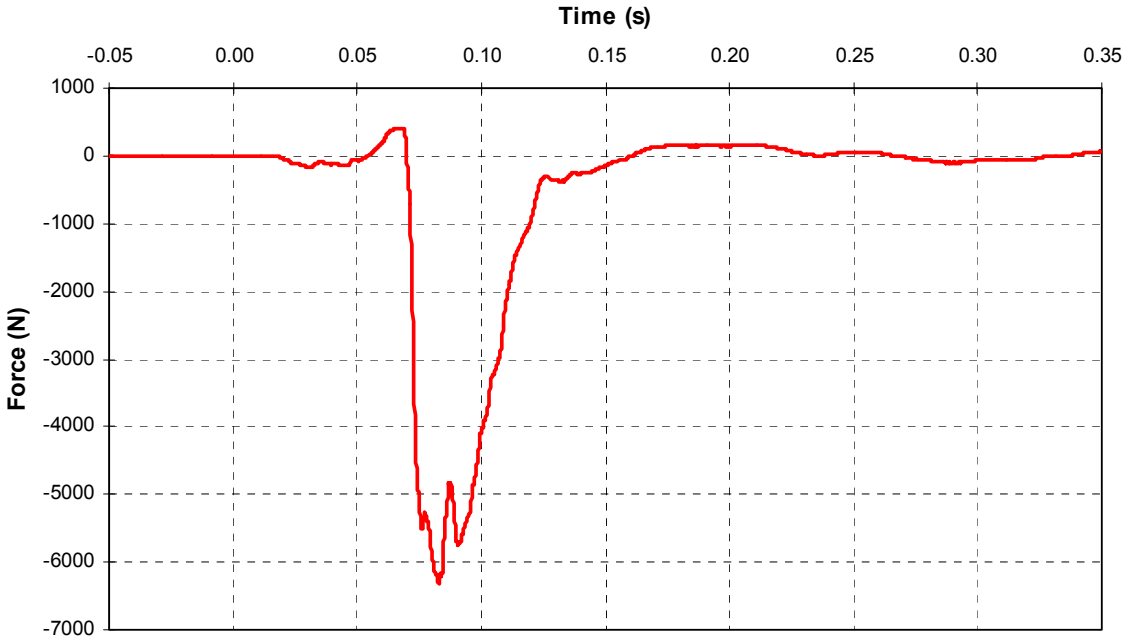
A- 21 CEF0305 2003 Volvo XC90 Chest Vector Resultant Acceleration



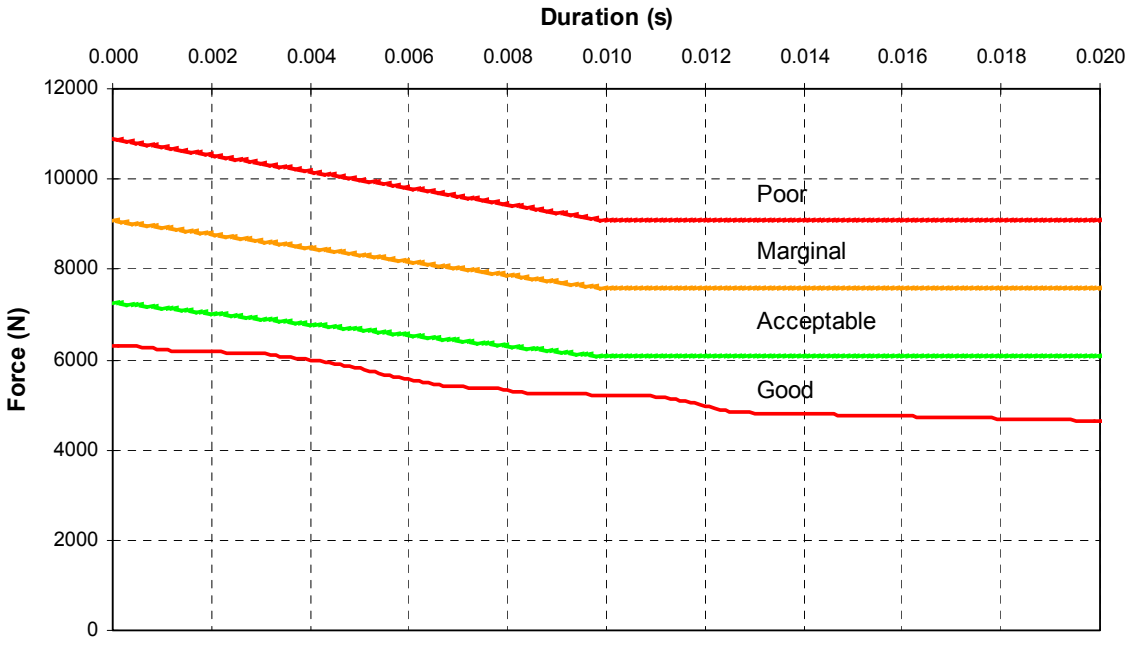
A- 22 CEF0305 2003 Volvo XC90 Sternum Deflection Rate



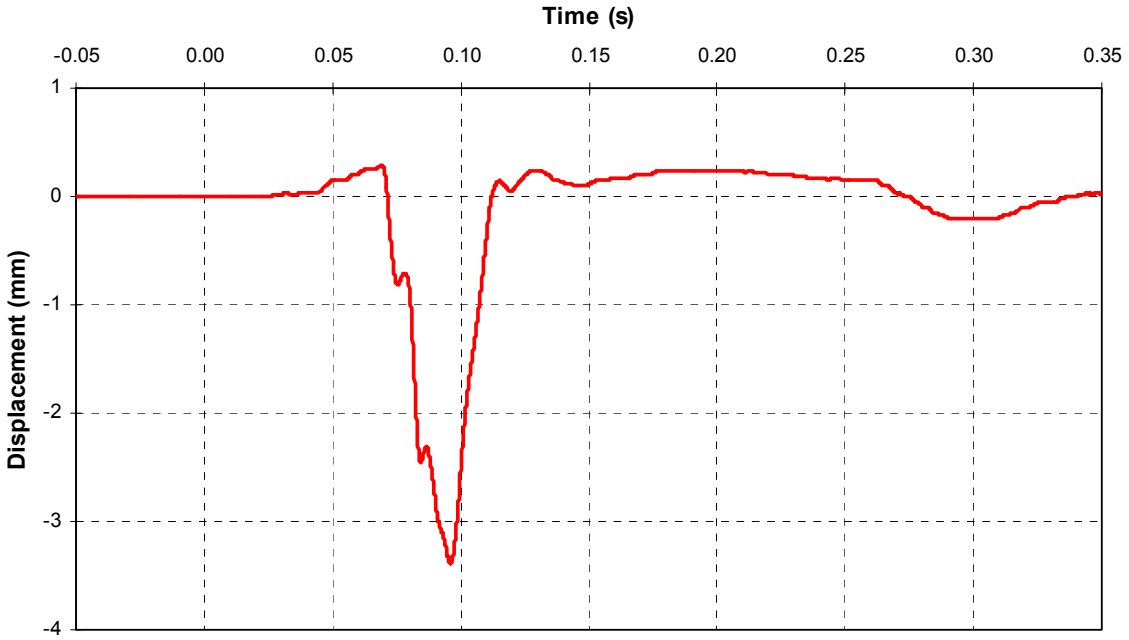
A- 23 CEF0305 2003 Volvo XC90 Left Femur Axial Force



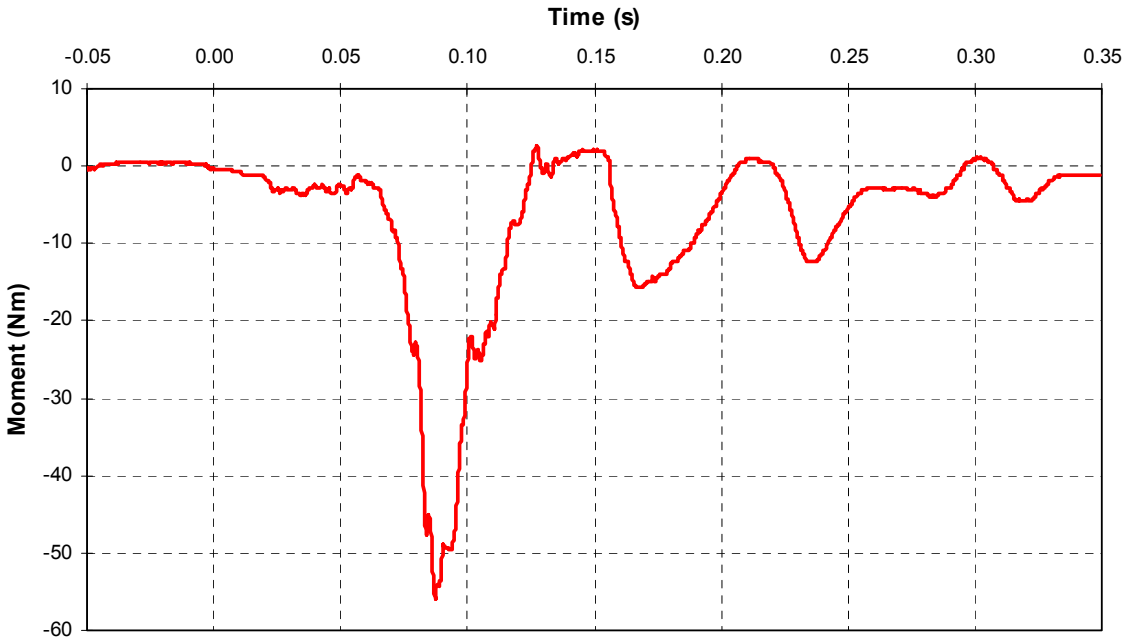
A- 24 CEF0305 2003 Volvo XC90 Left Femur Axial Force Analysis



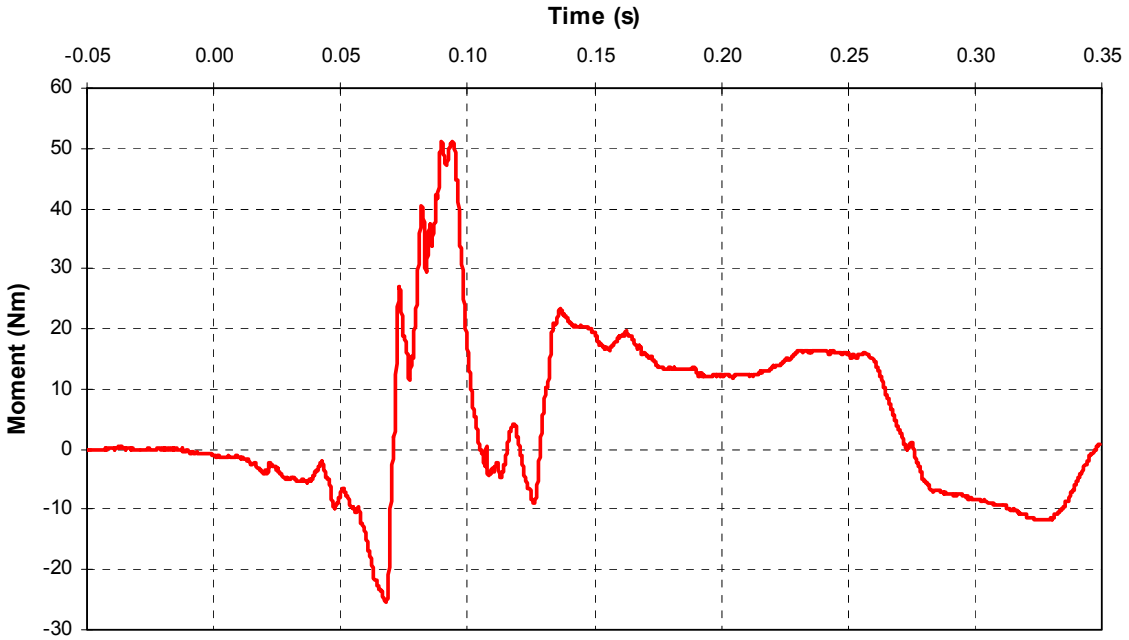
A- 25 CEF0305 2003 Volvo XC90 Left Tibia-Femur Displacement



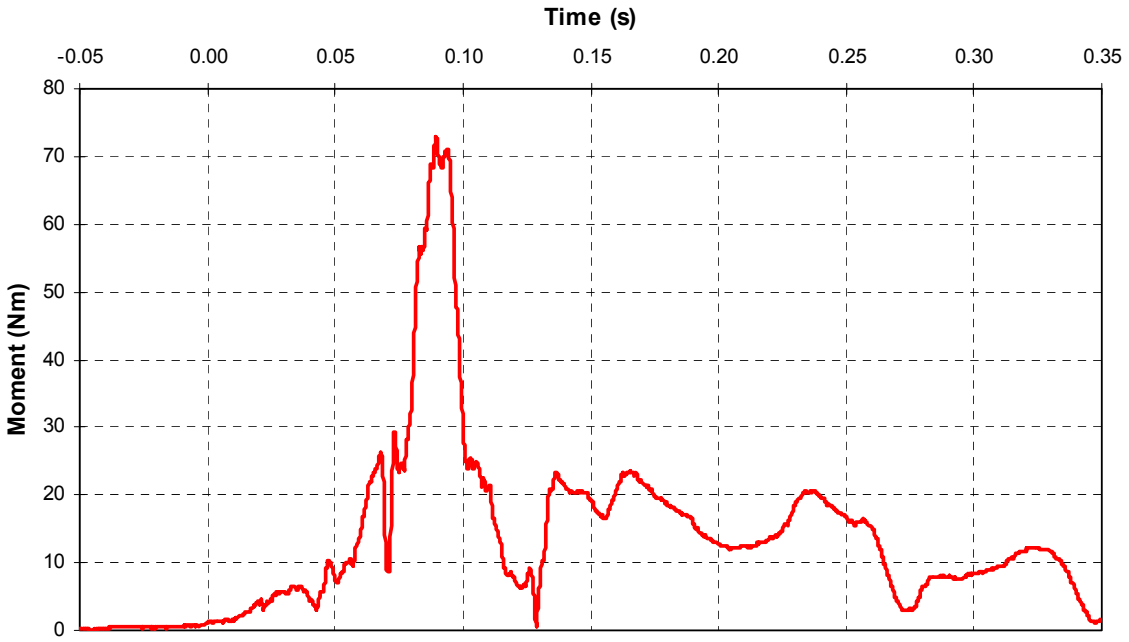
A- 26 CEF0305 2003 Volvo XC90 Left Upper Tibia L-M Moment



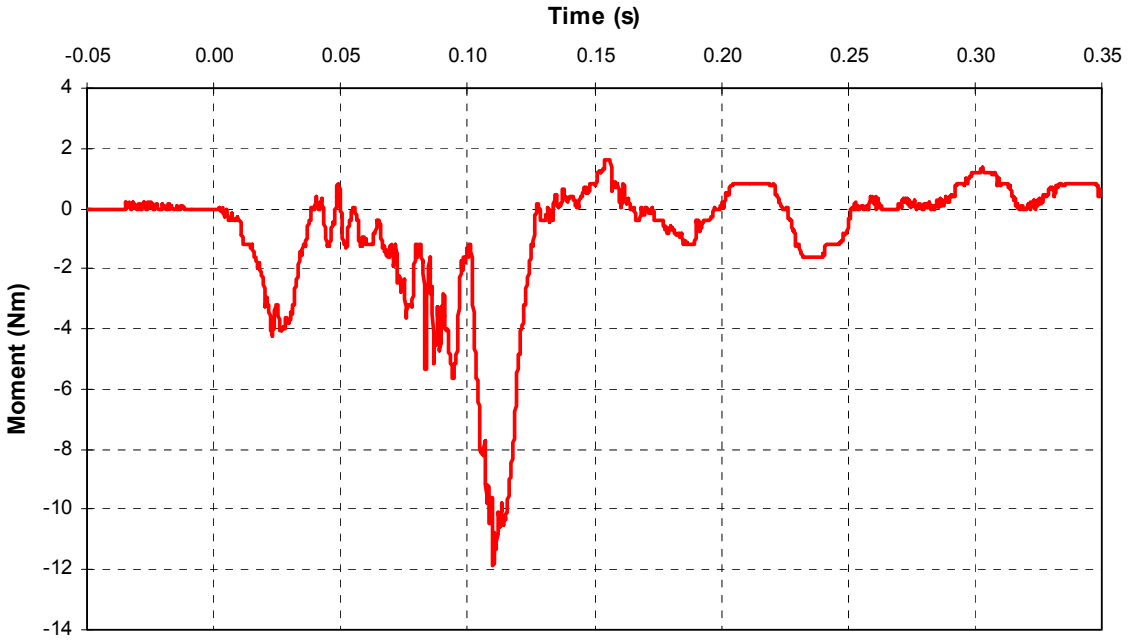
A- 27 CEF0305 2003 Volvo XC90 Left Upper Tibia A-P Moment



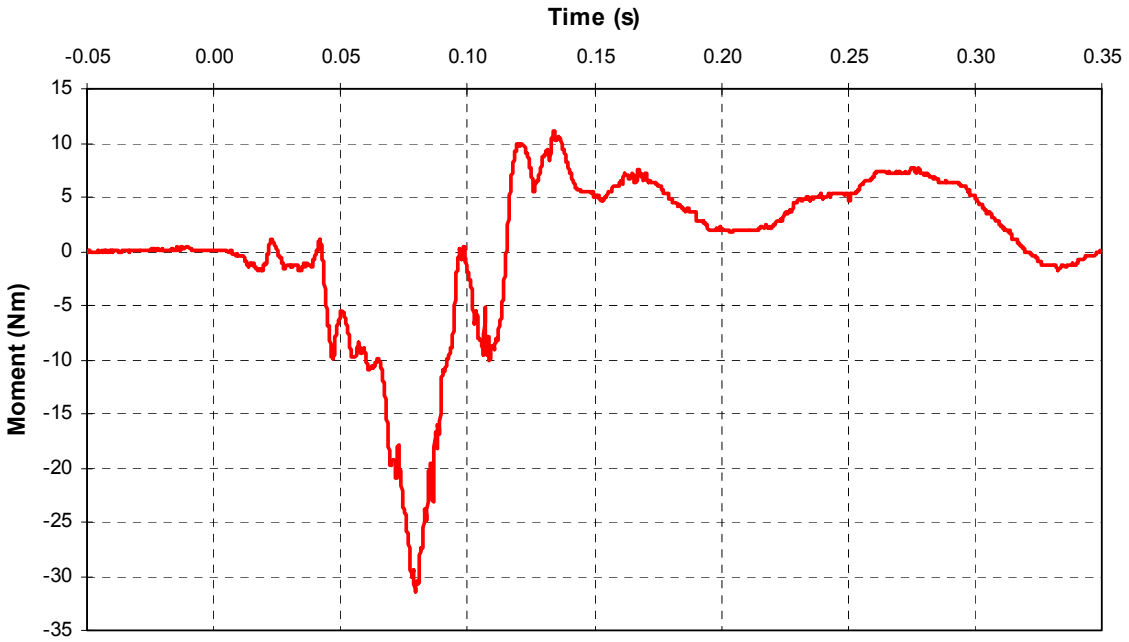
A- 28 CEF0305 2003 Volvo XC90 Left Upper Tibia Vector Resultant Moment



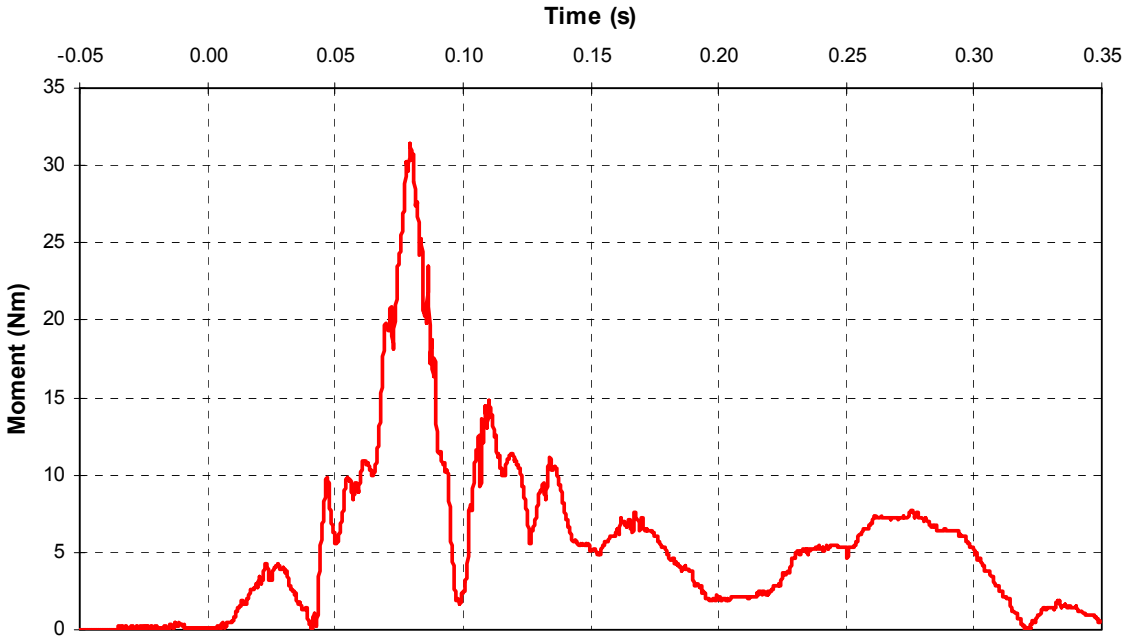
A- 29 CEF0305 2003 Volvo XC90 Left Lower Tibia L-M Moment



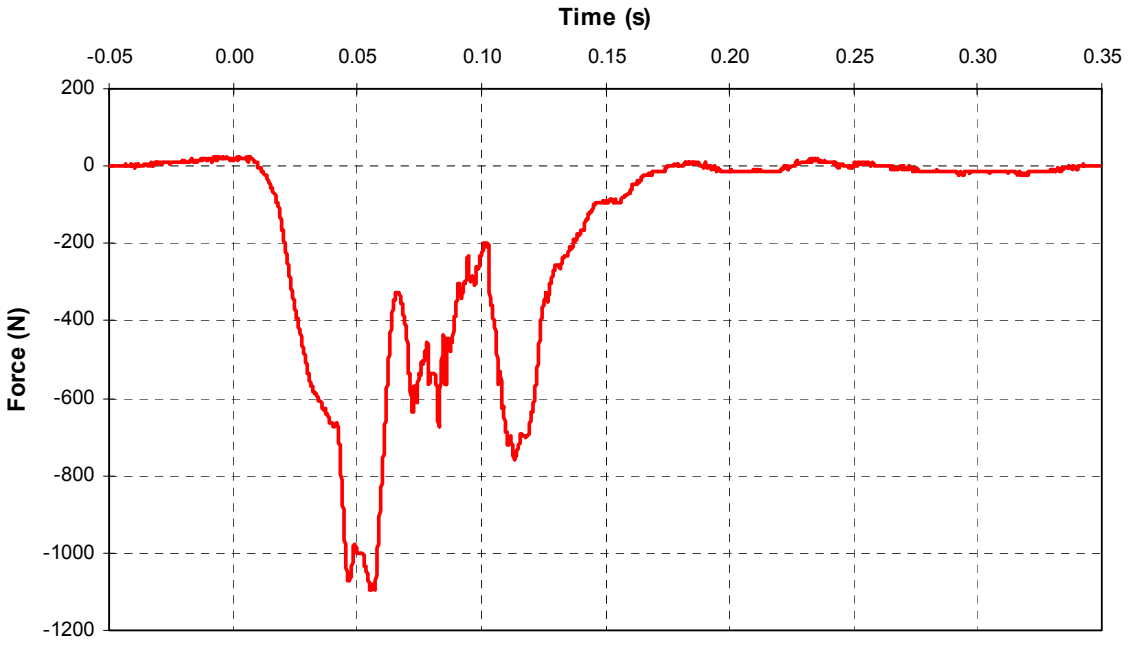
A- 30 CEF0305 2003 Volvo XC90 Left Lower Tibia A-P Moment



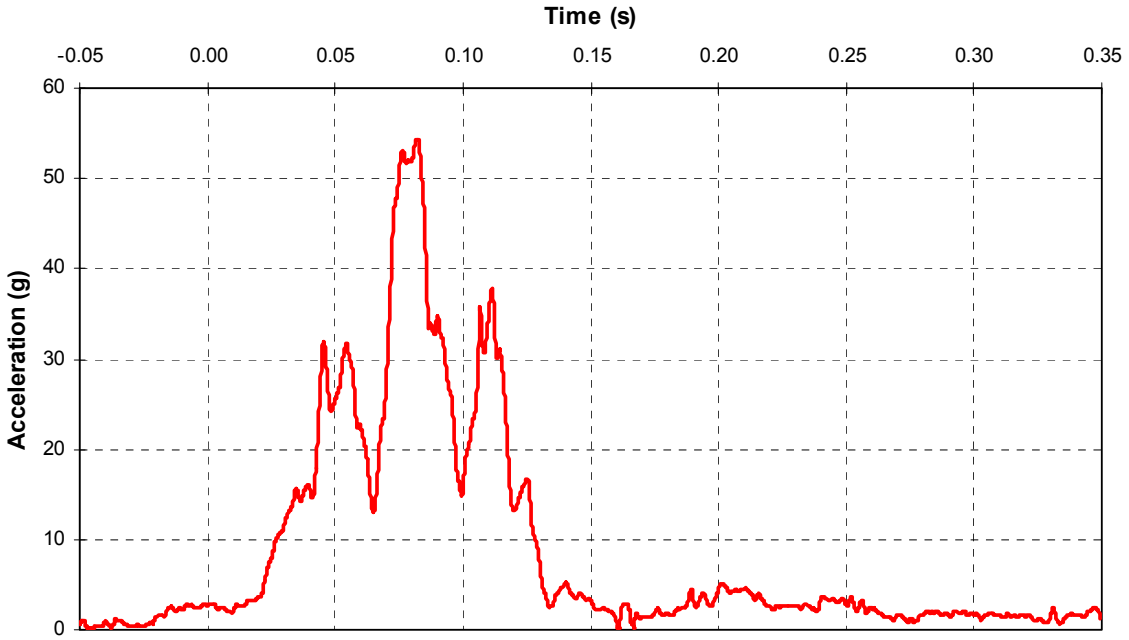
A- 31 CEF0305 2003 Volvo XC90 Left Lower Tibia Vector Resultant Moment



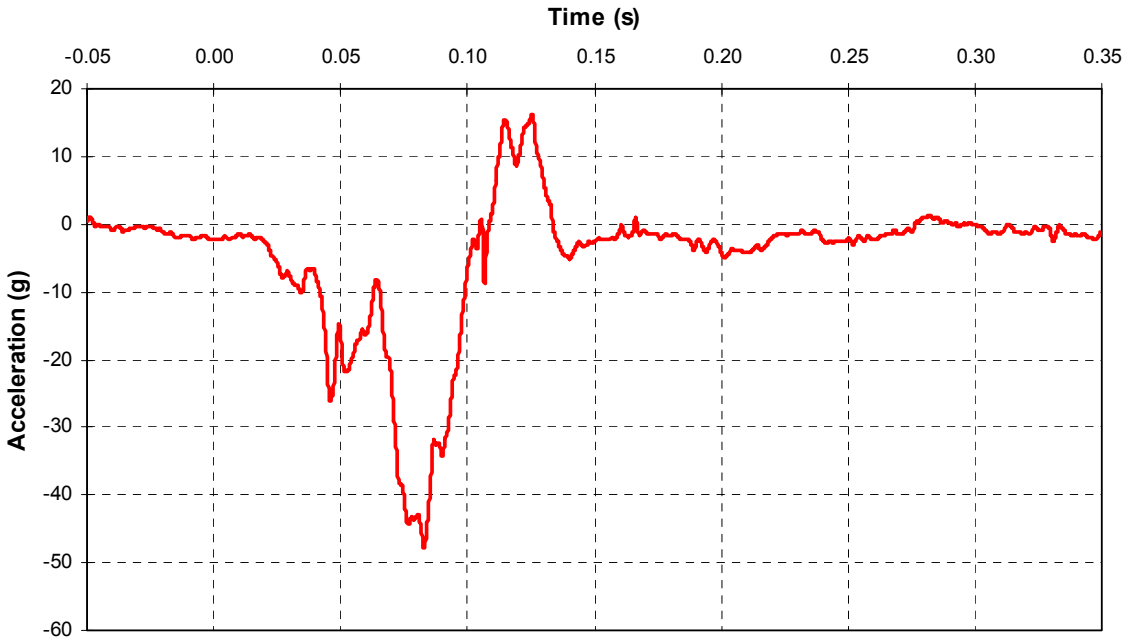
A- 32 CEF0305 2003 Volvo XC90 Left Lower Tibia Axial Force



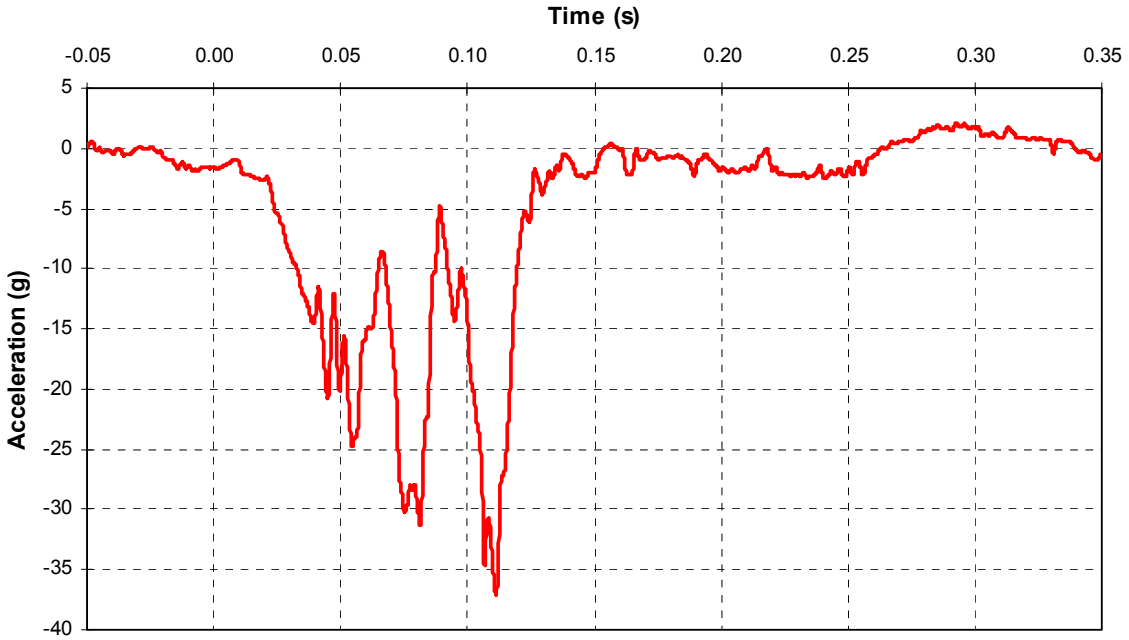
A- 33 CEF0305 2003 Volvo XC90 Left Foot Vector Resultant Acceleration



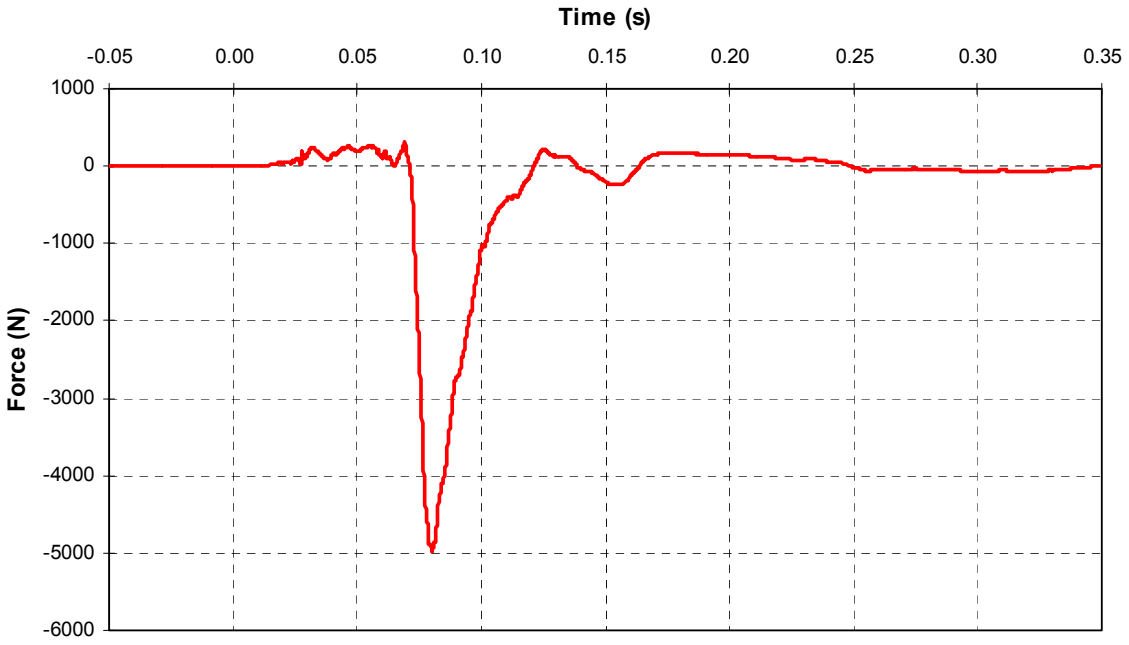
A- 34 CEF0305 2003 Volvo XC90 Left Foot A-P Acceleration



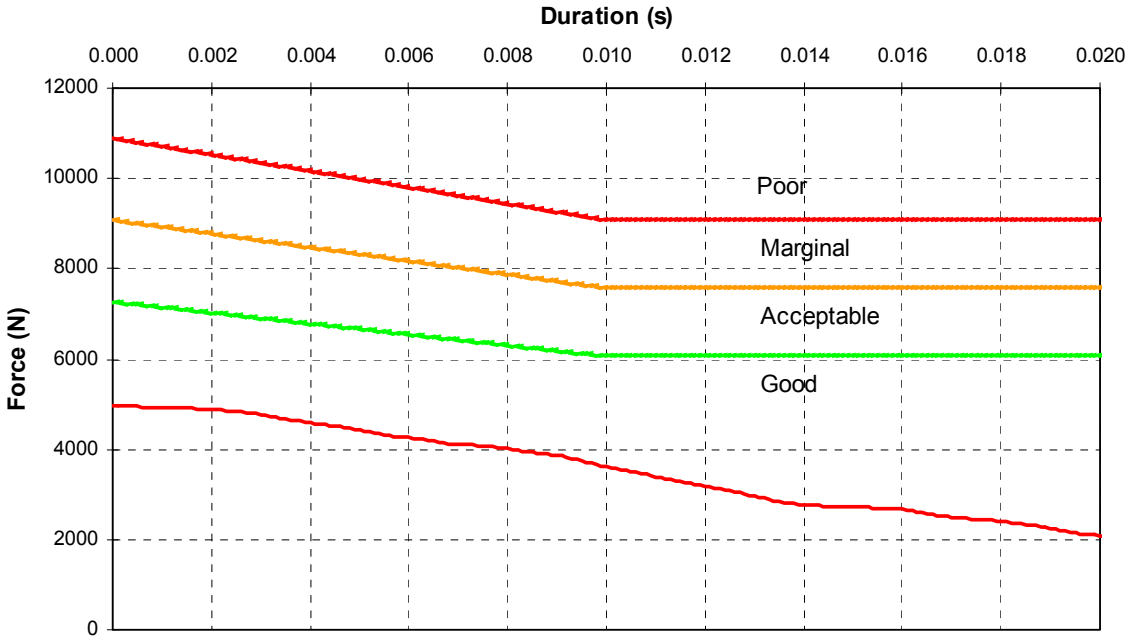
A- 35 CEF0305 2003 Volvo XC90 Left Foot I-S Acceleration



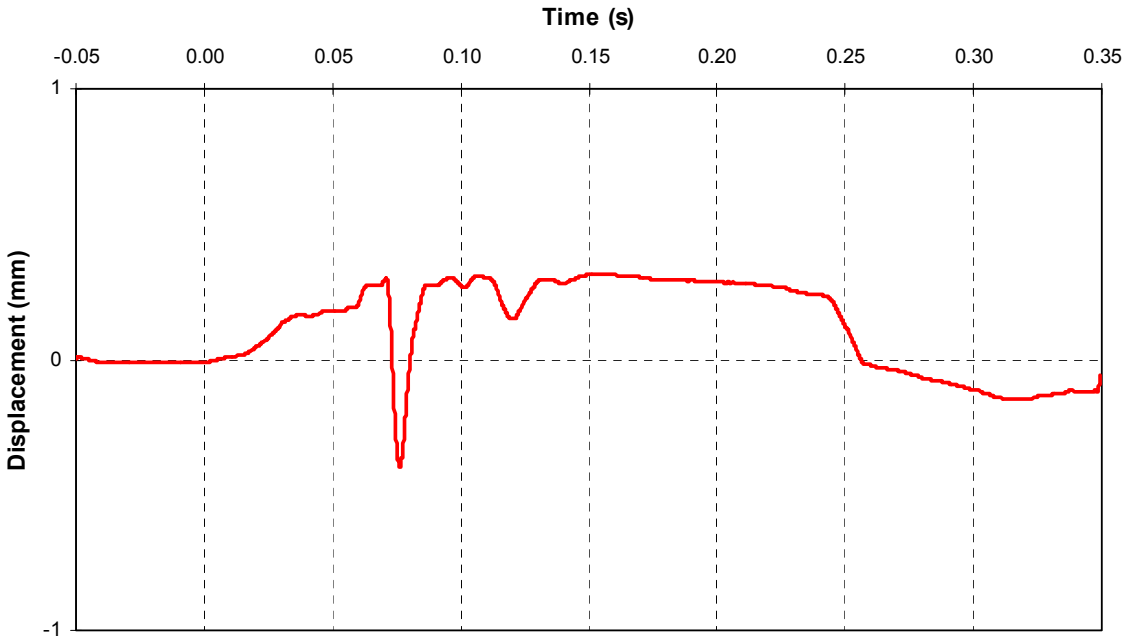
A- 36 CEF0305 2003 Volvo XC90 Right Femur Axial Force



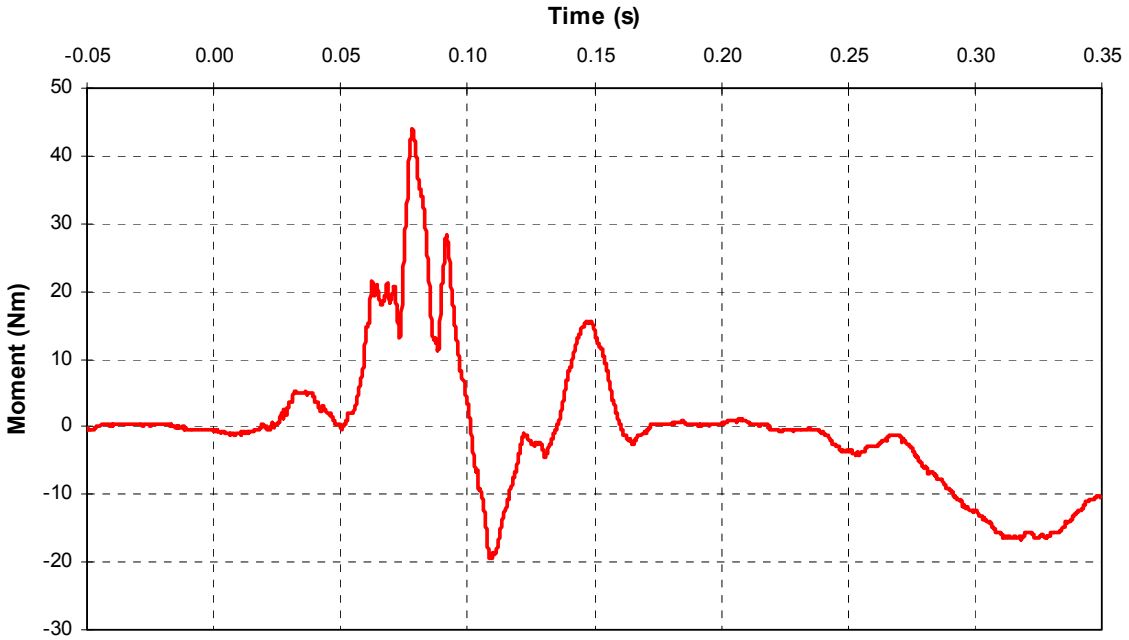
A- 37 CEF0305 2003 Volvo XC90 Right Femur Axial Force Analysis



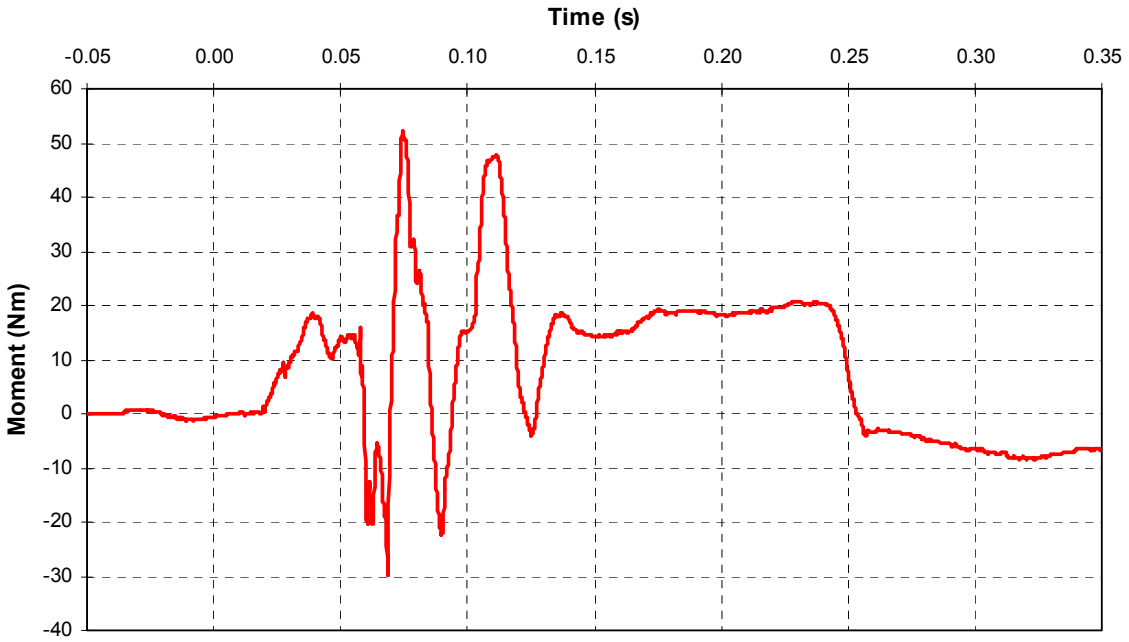
A- 38 CEF0305 2003 Volvo XC90 Right Tibia-Femur Displacement



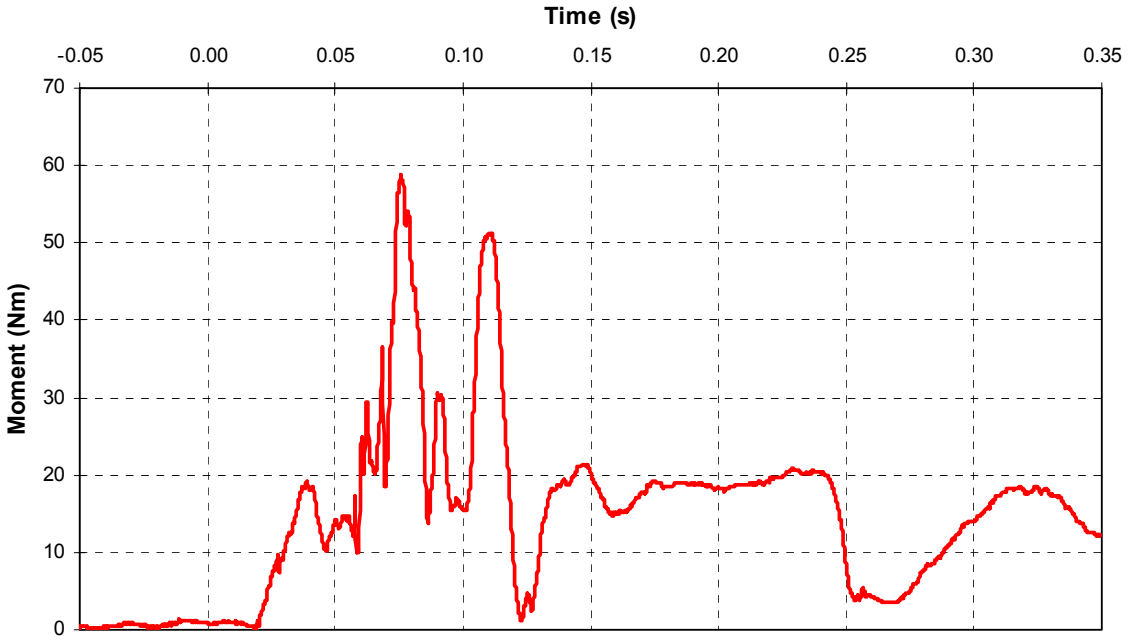
A- 39 CEF0305 2003 Volvo XC90 Right Upper Tibia L-M Moment



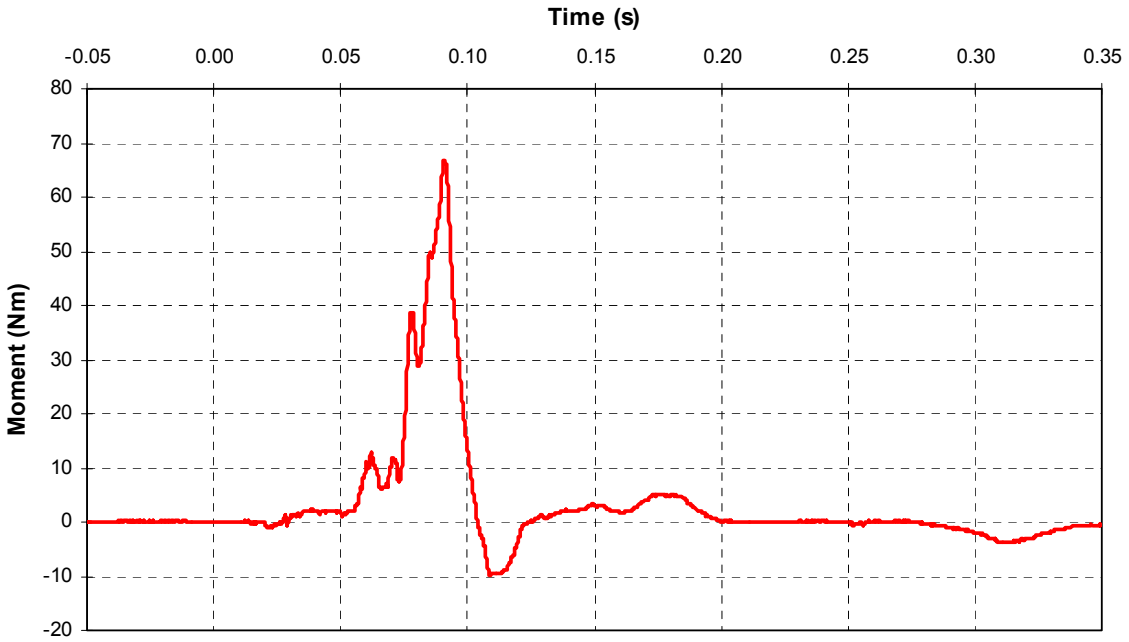
A- 40 CEF0305 2003 Volvo XC90 Right Upper Tibia A-P Moment



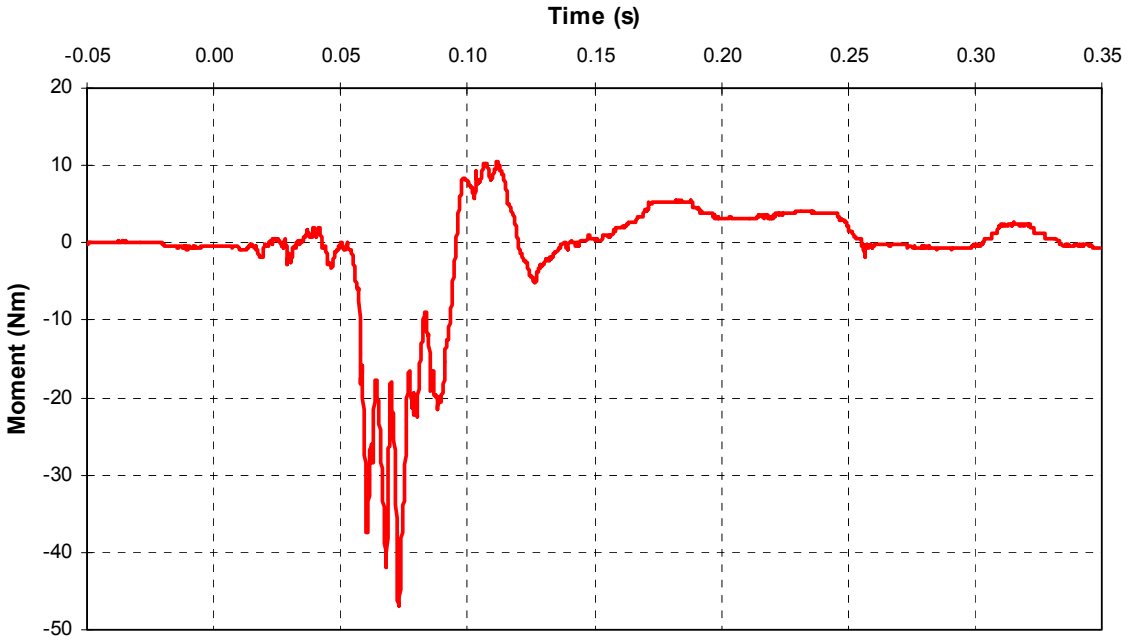
A- 41 CEF0305 2003 Volvo XC90 Right Upper Tibia Vector Resultant Moment



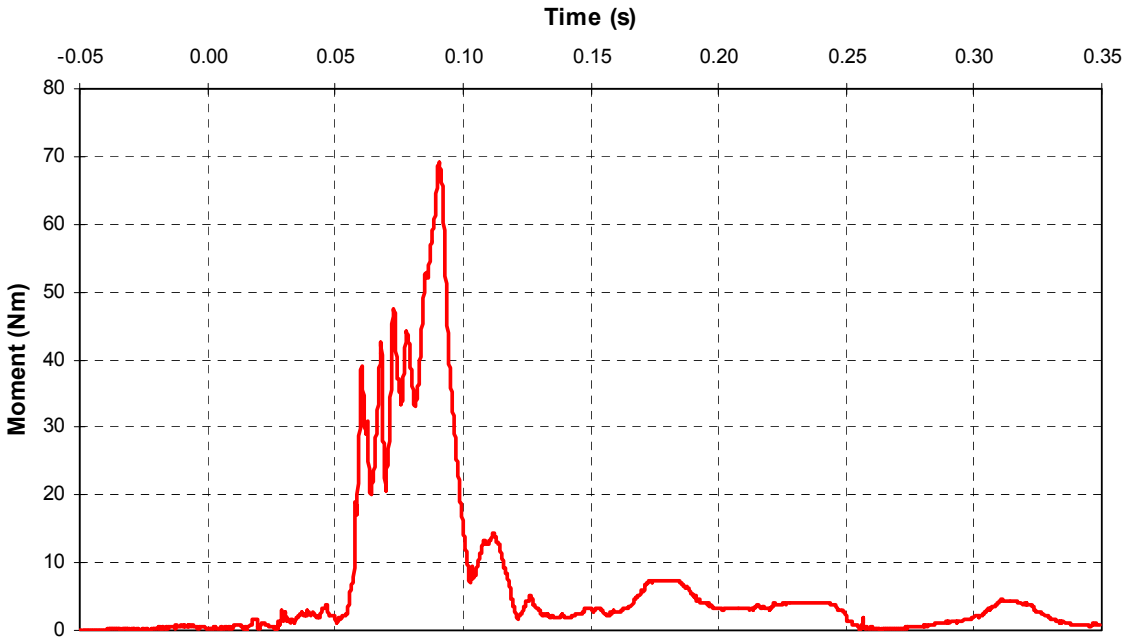
A- 42 CEF0305 2003 Volvo XC90 Right Lower Tibia L-M Moment



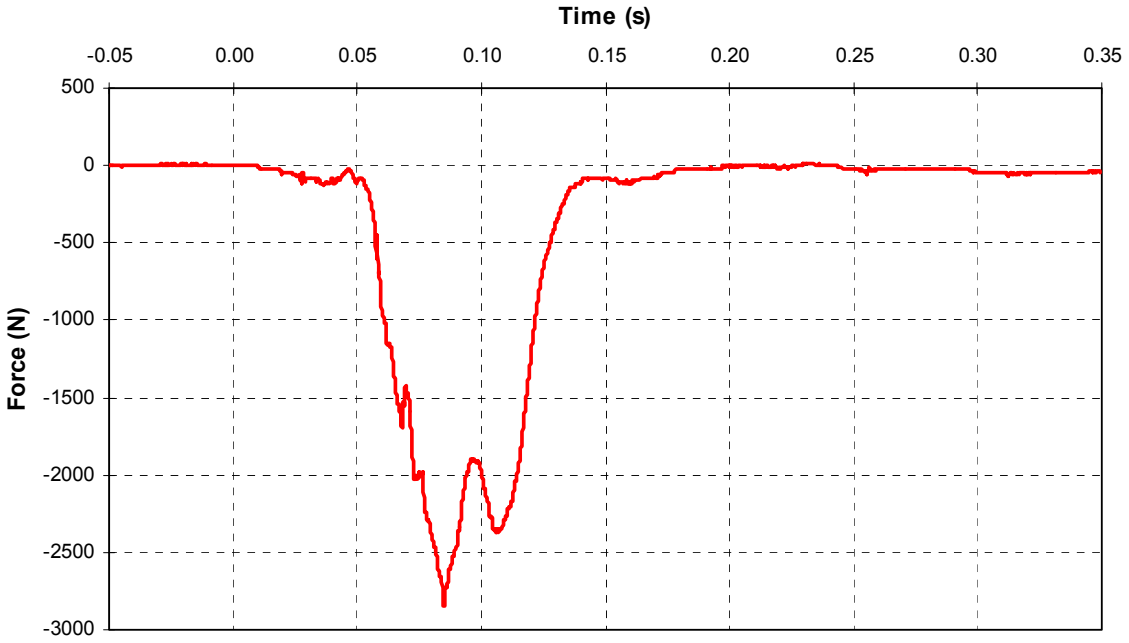
A- 43 CEF0305 2003 Volvo XC90 Right Lower Tibia A-P Moment



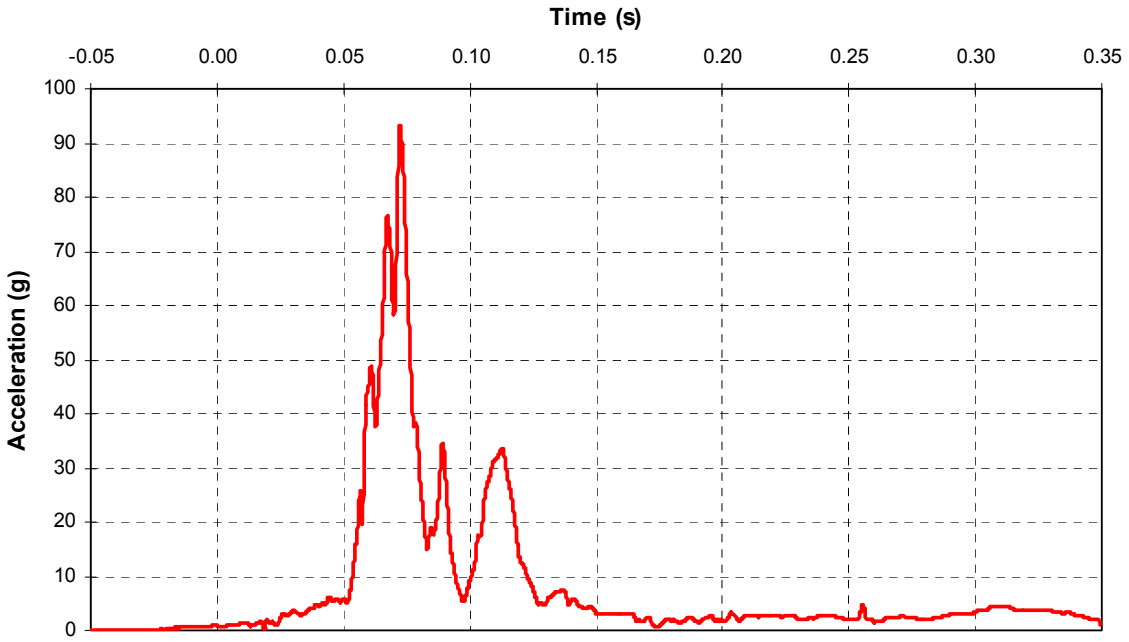
A- 44 CEF0305 2003 Volvo XC90 Right Lower Tibia Vector Resultant Moment



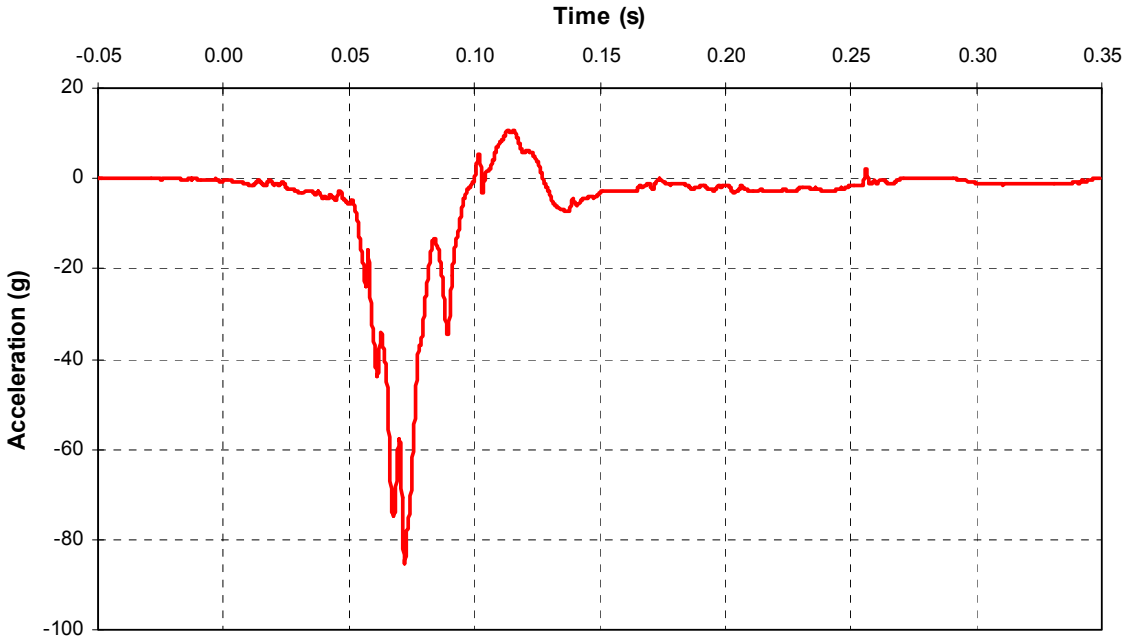
A- 45 CEF0305 2003 Volvo XC90 Right Lower Tibia Axial Force



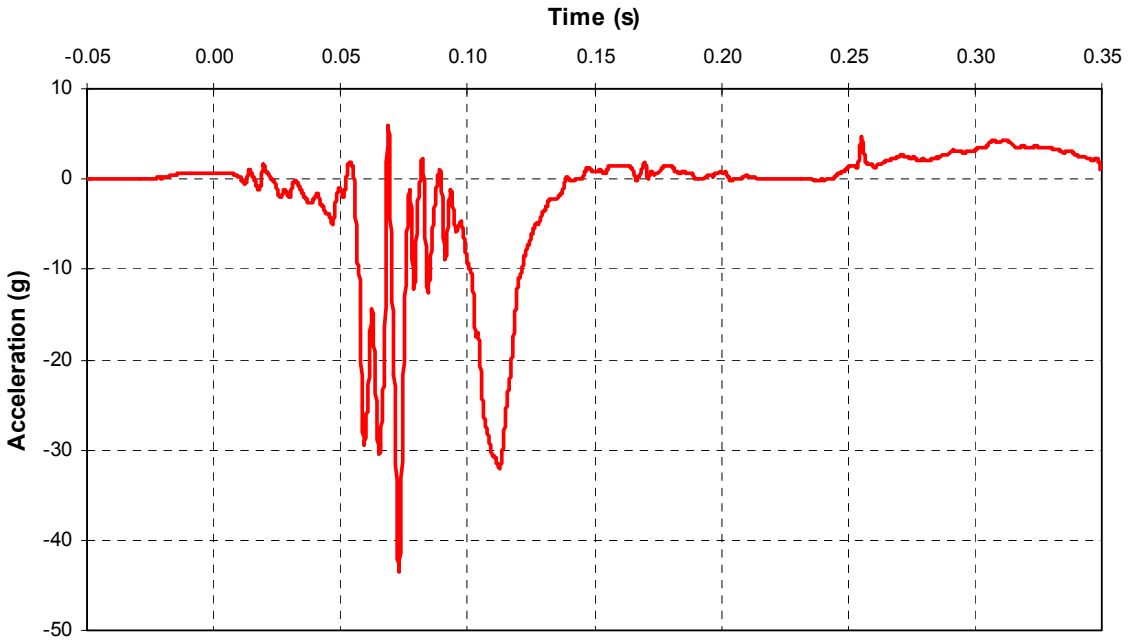
A- 46 CEF0305 2003 Volvo XC90 Right Foot Vector Resultant Acceleration



A- 47 CEF0305 2003 Volvo XC90 Right Foot A-P Acceleration



A- 48 CEF0305 2003 Volvo XC90 Right Foot l-S Acceleration



VOLVO

for life

Volvo Cars of North America, LLC
Irvine, CA 92618

Make & Model: 2003 VOLVO Special Purpose Veh.
Model Description: XC90 T6AWD ASR5
Vehicle ID No: YV1CM91H131007607
Color: 456 Crystal Green Met
Port of Importation: Brunswick, GA
Delivered by: Truck

Authorized Retailer:
Annapolis Volvo
333 Busch's Frontage Road
Annapolis, MD 21401

Importer's Suggested List Price P.O.E.:	**$ 39,975.00**
Metallic Paint	450.00
Intergrated Center Booster Cushion - 2nd Row	150.00
Premium Package:	
18" Alloy Wheels, ATLANTIS	
Premium Sound System w/Dolby Pro Logic 2	
Power Retractable Rearview Mirrors	
Wood Steering Wheel	
Value $1,900 Savings ($600) Special Price	1,300.00
Destination Charge	660.00
VOLVO "On-Call" Road Assist	
Total Suggested Retail Price:	**$ 42,535.00**

Power Performance · Occupant Safety · Comfort Convenience

ENGINE & TRANSMISSION
- 2.9 Liter, Intercooled Twin Turbo, 6 Cylinder Alloy Engine w/DOHC, Continuous Variable Valve Timing
- 268 HP @ 5100 RPM & 280 lb-ft Trq.@ 1800-5000 RPM
- ULEV (Ultra-Low Emissions Vehicle)
- Geartronic 4-Speed Automatic Transmission w/Adaptive Shift Logic and Winter Mode

SUSPENSION/CHASSIS/STEERING
- Front Independent Strut Suspension w/Anti-Roll Bar & Anti-Dive Geometry
- Fully Independent Rear Multi-Link Suspension
- 4-Wheel Pwr.Assisted,Ventilated Disc Brakes w/Anti-Lock Braking System (ABS), Electronic Brake Distribution (EBD), Electronic Brake Assistance (EBA)
- 17" Alloy Wheels with All-Season Tires
- Steel Front Skidplate
- Power Assisted Rack & Pinion Steering
- Dynamic Stability Traction Control (DSTC)

SAFETY & SECURITY
- Unibody Construction with Integral High Strength Steel (HSS) Passenger Safety Cage
- Rollover Protection System (ROPS) w/Boron Steel Reinforced Roof Structure
- Inflatable Curtain (IC) Head Protection System for all Rows of Seating
- Roll Stability Control (RSC)
- Side Impact Protection System (SIPS) w/Driver & Front Passenger Side-Impact Airbags
- Driver & Front Passenger Dual Stage Supplemental Restraint System (Airbag)
- 5 3-Point Safety Belts w/Auto.Height Adjustment & Force Limiters on Front Seats & Pretensioners on all 5 Belts
- 5 Padded Head Restraints
- Whiplash Protection System (WHIPS) in Driver & Front Passenger Seats
- Safe Approach & Home Safe Perimeter Lighting System
- Immobilizer Anti-Theft Ignition w/Coded Keys
- Security System w/Separate Back-Up Battery for Siren
- Dual ISO-FIX (LATCH) Attachment System, Second Row
- Tailgate Auto Wiper System
- Child Safety Locks in Rear Doors
- Side-Mounted Directional Indicators
- Integrated Front Foglights
- Cargo Security Cover

COMFORT & CONVENIENCE FEATURES
- Power Glass Moonroof
- Leather Upholstery (Seating Surface)
- Driver & Front Passenger 8-Way Power Seats (Driver w/3 Position & Remote Memory) w/Lumbar Support & Front & Rear Storage
- Dual Zone Electronic Climate Ctrl.w/Rear Seat Air Vents
- Tilt & Telescopic Steering Wheel
- 3-pc. Flat Folding 2nd Row Seats (40/20/40) with Retractable Head Restraints
- Remote Keyless 2-Step Entry w/Tailgate Release, Panic Alarm, and Safe Approach
- Trip Computer
- Simulated Wood Inlays
- Fr. & Rr. Power Windows, Fronts w/Auto-Down & Auto-Up
- Heated Power Outside Rearview Mirrors w/Remote Memory
- Removable Front Center Armrest w/CD and Storage Comp.
- 12 Beverage Holders
- Plush Floor Mats and Grocery Bag Holder
- Deep Tinted Windows (NOT WITH SECURITY PACKAGE)
- Roof Rails
- Flat Folding Front Passenger Seat

AUDIO EQUIPMENT
- In Dash, 6-CD Changer with AM/FM Stereo Radio with Active Sound Control, Scan, Autostore (Note Does Not Include Cassette Player)
- 4 X 40 Watt Amplifier/8 Speakers
- Illuminated Cruise & Radio Steering Wheel Controls

ENVIRONMENT
This vehicle is equipped with PremAir - A coating on the radiator that helps transform ground level ozone into oxygen as you drive.
(PremAir is a Registered Trademark of Engelhard Corp.)

The price shown does not include Gasoline, License and Title Fees, State and Local Taxes and Dealer Installed Options and Accessories. The factory reserves the right to modify price, designs and equipment without previous notice.

DELIVERY ADDRESS
Annapolis Volvo
333 Busch's Frontage Road
Annapolis, MD 21401

VEHICLE IDENTIFICATION
Type & Chassis: 275 007607
Year: 2003
Color: 456 Crystal Green Met
VIN: YV1CM91H131007607

YV1CM91H131007607

ENVIRONMENTAL PARTNERSHIP

Environmental Partnership

This vehicle was manufactured in an environmentally compatible manner. Volvo reminds you to properly handle and dispose of all automotive chemicals in accordance with regulations established in your area. Caring for our environment is best achieved when we do it together.

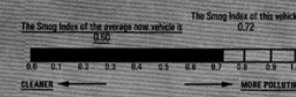
PARTS CONTENT INFORMATION

FOR VEHICLES IN THIS CARLINE: VOLVO SERIES
U.S./CANADIAN PARTS CONTENT: 9.6%
MAJOR SOURCES OF FOREIGN PARTS CONTENT:
SWEDEN: 24%
GERMANY: 15%
FOR THIS VEHICLE:
FINAL ASSEMBLY POINT: GOTHENBURG, SWEDEN
COUNTRY OF ORIGIN:
ENGINE PARTS: SWEDEN
TRANSMISSION PARTS: UNITED STATES
Note: Parts content does not include final assembly, distribution, or other non-parts costs.

WARRANTY

48 Month/50,000 Mile Limited Warranty Coverage
96 Month Corrosion Protection
** Unlimited Mileage **
Refer to Warranty Info Book for Specific Limitations

SMOG EMISSIONS INFORMATION



Note: The Smog Index (SI) indicates the relative level of smog-forming pollutants emitted by the vehicle. The lower the SI, the lower the vehicle's emissions.

Compare this vehicle to others in the **FREE GAS MILEAGE GUIDE** available at the dealer.

CITY MPG

15

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 12 and 18 mpg in the city and between 17 and 23 mpg on the highway.

HIGHWAY MPG

20

MODEL: 2003 Volvo XC90 AWD, 2.9 Liter, 6 Cylinder, Turbocharger, Charge Air Cooler, Geartronic 4 Speed Electronically Controlled Automatic/ Manual Transmission w/Lockup Torque Converter, Electronic Fuel Injection.

For Comparison Shopping, all vehicles classified as Spec.Purp.Veh.-4WD have been issued mileage ratings ranging from 10 to 25 mpg city and 13 to 31 mpg highway.

ESTIMATED ANNUAL FUEL COST
$ 1455.00

See Gas Mileage Guide for Details at www.fueleconomy.gov