Vehicle Research and Test Center

1997 Plymouth Neon into

Rear of a 2004 Jeep Liberty

TRC Inc. Test Number: 131024

Prepared By:

Transportation Research Center Inc.

10820 State Route 347

East Liberty, OH 43319

Final Report

October - November 2013

Prepared For:

Vehicle Research and Test Center

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Test Performed By: John Shultz, Supervisor

Report Approved November 22, 2013 by:

Jeffery W. Sankey
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Section 1.0

Purpose and Test Procedure

Purpose

This vehicle-to-vehicle rear impact test was conducted for the National Highway Traffic Safety Administration (NHTSA) and Vehicle Research and Test Center (VRTC) by Transportation Research Center Inc. (TRC Inc.).

The test mode was defined as the bullet vehicle moving at 64.6 km/h to impact the target vehicle moving at 0 km/h at an impact angle of 180 degrees. The purpose of this test was to evaluate the aggressiveness of the bullet vehicle, a 1997 Plymouth Neon, and the vehicle response of the target vehicle, a 2004 Jeep Liberty, in this vehicle-to-vehicle rear impact mode.

Test Procedure

This test was conducted in accordance with VRTC instructions for a vehicle-to-vehicle rear impact test. Data was obtained relative to FMVSS 301, "Fuel System Integrity," performance.

The target vehicle, a 2004 Jeep Liberty, was instrumented with six (6) accelerometers to measure longitudinal, lateral and vertical axis accelerations.

The bullet vehicle, a 1997 Plymouth Neon, was instrumented with six (6) accelerometers to measure longitudinal, lateral and vertical axis accelerations. The vehicle's specified impact velocity range was 63.6 to 65.2 km/h.

The bullet vehicle impacted the rear of the target vehicle at an impact angle of 180 degrees. The intended impact point was the bullet vehicle's centerline aligned with the target vehicle's centerline.

One (1) Hybrid III 50th Male Ballast dummy was placed in the bullet vehicle's driver's seat. One (1) Hybrid III 5th Female Ballast dummy was placed in the target vehicle's driver's seat; one (1) weighted 6yo Child dummy was placed in the target vehicle's right front passenger seat, one (1) 6yo Child dummy was placed in the target vehicle's left rear passenger seat in a booster seat. All dummies were restrained with seatbelts.

The twelve (12) data channels were digitally sampled and recorded at 12,500 samples per second and processed per SAE J211 March 1995.

The crash event was recorded by three (3) real-time panning motion picture cameras and nine (9) high-speed motion picture cameras.

The test summary data is presented in Section 2.0. The FMVSS 301 data is presented in Section 3.0. The camera and vehicle measurements are presented in Section 4.0. Appendix A contains the still photographic prints. Appendix B contains the vehicle data plots.

Section 2.0

Test Summary

Test Results Summary

This 64.6 km/h 180° vehicle-to-vehicle rear impact test was conducted by TRC Inc. on October 24, 2013.

The target test vehicle, a 2004 Jeep Liberty, was equipped with a 3.7-liter 6 cylinder engine, 3 speed transmission, power steering, power brakes, and dual stage front airbags. The target vehicle's test weight was 1960.4 kg.

The bullet test vehicle, a 1997 Plymouth Neon, was equipped with a 2.0-liter 4 cylinder transverse engine, 3 speed transmission, power steering, power brakes, and dual stage front airbags. The bullet vehicle's test weight was 1275.0 kg. The bullet vehicle's impact speed was 64.6 km/h.

Data Acquisition Explanations

There are no anomalies to report.

Table 1 Crash Test Summary

Test mode:	Vehicle to Vehicle Rear Impact
Test date:	October 24, 2013
Test time:	11:57 AM
Ambient temperature:	5° C
Target vehicle year/make/ model/body style:	2004/Jeep/Liberty/SUV
Target vehicle test weight:	1960.4 kg
Bullet vehicle year/make/ model/body style:	1997/Plymouth/Neon/Passenger Sedan
Bullet vehicle test weight:	1275.0 kg
Impact angle[1]:	180°
Impact velocity[2]:	Bullet vehicle = 64.6 km/h
Total number of data channels:	12
Number of cameras:	
High-speed:	9
Real-time:	3

[1] With respect to tow track centerline.
[2] Speed trap measurement (± .08 km/h accuracy)

Table 2 Target Vehicle General Test and Vehicle Parameter Data

Vehicle year/make/ model/body style:	2004/Jeep/Liberty/SUV
VIN:	1J4GL48K54W222033
Model year:	2004
Body style:	SUV
Color:	Blue
Engine data:	
Cylinders:	6
Displacement	3.7 liters
Type:	V
Placement:	Longitudinal
Transmission data:	_3_ speed, __ manual, _X_ automatic, _X_ overdrive
Final drive:	__ FWD, __ RWD, _X_ 4WD
Date vehicle received:	10/21/2013
Odometer reading:	212,781
Dealer's name	Customer Supplied

Accessories:

Power steering	Yes	Automatic transmission	Yes
Power brakes	Yes	Automatic speed control	No
Power seats	No	Tilting steering wheel	Yes
Power windows	Yes	Telescoping steering wheel	No
Tinted glass	Yes	Air conditioning	Yes
Radio	Yes	Anti-skid brake	No
Clock	Yes	Rear window defroster	Yes
Other	None	Power door locks	Yes

Certification data from vehicle's label:

Vehicle manufactured by:		Daimler Chrysler Corporation
Date of manufacture:		1/04
VIN:		1J4GL48K54W222033
GVWR:		5600 lbs. (2541 kg)
GAWR:	Front:	2750 lbs. (1248 kg)
	Rear:	3150 lbs. (1429 kg)

Table 2 Target Vehicle General Test and Vehicle Parameter Data, Continued

Tires on vehicle (mfr., line, size):	Primewell, Valera HT, P235/70R16
Tire pressure with maximum capacity vehicle load:	
Front:	40 psi (275 kPa)
Rear:	40 psi (275 kPa)
Spare tire (mfr., line, size):	Mesa, Mesa A/P, P235/70R16
Type of seats:	
Front	Bucket
Rear	Split Bench
Maximum width:	1820 mm
Wheelbase:	2640 mm

Location of "Recommended Tire Pressure" label:

Glove Box

Data from vehicle's "Recommended Tire Pressure" label:

Recommended tire size:	P235/70R16
Recommended cold tire pressure:	Front: 33 psi (227 kPa) Rear: 33 psi (227 kPa)
Seating capacity:	Front: 2 Mid: 0 Rear: 3 Total: 5
Vehicle capacity weight:	1150 lbs. (522 kg)
Rated cargo/luggage weight:	N/A lbs. (N/A kg)

Test vehicle attitude:

Pre-test attitude:	LF 790 mm;	RF 800 mm;	LR 802 mm;	RR 806 mm
Post-test attitude:	LF 785 mm;	RF 799 mm;	LR 835 mm;	RR 834 mm

Table 2 Target Vehicle General Test and Vehicle Parameter Data Continued

Weight of test vehicle with required dummies and cargo weight:

Right front	507.6 kg	Right rear	451.4 kg
Left front	537.2 kg	Left rear	464.2 kg
Total front weight	1044.8 kg	(53.3% of total vehicle weight)	
Total rear weight	915.6 kg	(46.7% of total vehicle weight)	
Total test weight	1960.4 kg		

Weight of ballast secured in vehicle: 13.8 kg

Components removed to meet target test weight: None

Location of Vehicle's CG: 1233 mm rearward of front wheel centerline

Fuel System Data:

Usable fuel system capacity N/A liters (from owner's manual)

Actual test volume: 68.5 liters

Table 3 Bullet Vehicle General Test and Vehicle Parameter Data

Vehicle year/make/ model/body style:	1997/Plymouth/Neon/Passenger Sedan
VIN:	3P3ES47CXVT567091
Model year:	1997
Body style:	Passenger Sedan
Color:	Gray
Engine data:	
Cylinders:	4
Displacement	2.0 liters
Type:	Straight
Placement:	Transverse
Transmission data:	_3_ speed, __ manual, _X_ automatic, _X_ overdrive
Final drive:	_X_ FWD, __ RWD, ___ 4WD
Date vehicle received:	10/21/2013
Odometer reading:	172,575
Dealer's name	Customer Supplied

Accessories:

Power steering	Yes	Automatic transmission	Yes
Power brakes	Yes	Automatic speed control	Yes
Power seats	No	Tilting steering wheel	Yes
Power windows	No	Telescoping steering wheel	No
Tinted glass	Yes	Air conditioning	Yes
Radio	Yes	Anti-skid brake	No
Clock	Yes	Rear window defroster	Yes
Other	None	Power door locks	Yes

Certification data from vehicle's label:

Vehicle manufactured by:		Chrysler Corporation
Date of manufacture:		1-97
VIN:		3P3ES47CXVT567091
GVWR:		3514 lbs. (1594 kg)
GAWR:	Front:	1943 lbs. (882 kg)
	Rear:	1621 lbs. (736 kg)

Table 3 Bullet Vehicle General Test and Vehicle Parameter Data, Continued

Tires on vehicle (mfr., line, size):

Left Front:	Master Craft, Stratagen, P185/65R14
Right Front:	Douglas, Xtra-Trac, P185/65R14
Left Rear:	Custom, Custom 428, P195/70R14
Right Rear:	Firestone, FT70c, P195/70R14

Tire pressure with maximum capacity vehicle load:

Front:	44 psi (300 kPa)
Rear:	44 psi (300 kPa)

Spare tire (mfr., line, size): Goodyear, Temporary, T115/70D14

Type of seats:

Front	Bucket
Rear	Split bench

Maximum width: 1701 mm

Wheelbase: 2630 mm

Location of "Recommended Tire Pressure" label:

Driver Door

Data from vehicle's "Recommended Tire Pressure" label:

Recommended tire size:	P185/65R14
Recommended cold tire pressure:	Front: 32 psi (220 kPa) Rear: 32 psi (220 kPa)
Seating capacity:	Front: 2 Mid: 0 Rear: 3 Total: 5
Vehicle capacity weight:	865 lbs. (392 kg)
Rated cargo/luggage weight:	115 lbs. (52 kg)

Test vehicle attitude:

Pre-test attitude:	LF 635 mm;	RF 635 mm;	LR 667 mm;	RR 676 mm
Post-test attitude:	LF 648 mm;	RF 642 mm;	LR 670 mm;	RR 672 mm

Table 3 Bullet Vehicle General Test and Vehicle Parameter Data, Continued

Weight of test vehicle with required dummies and cargo weight:

Right front	374.4 kg	Right rear	240.8 kg
Left front	395.6 kg	Left rear	264.2 kg
Total front weight	770.0 kg	(60.4% of total vehicle weight)	
Total rear weight	505.0 kg	(39.6% of total vehicle weight)	
Total test weight	1275.0 kg		

Weight of ballast secured in vehicle: 0 kg

Components removed to meet target test weight: None

Location of Vehicle's CG: 1041 mm rearward of front wheel centerline

Fuel System Data:

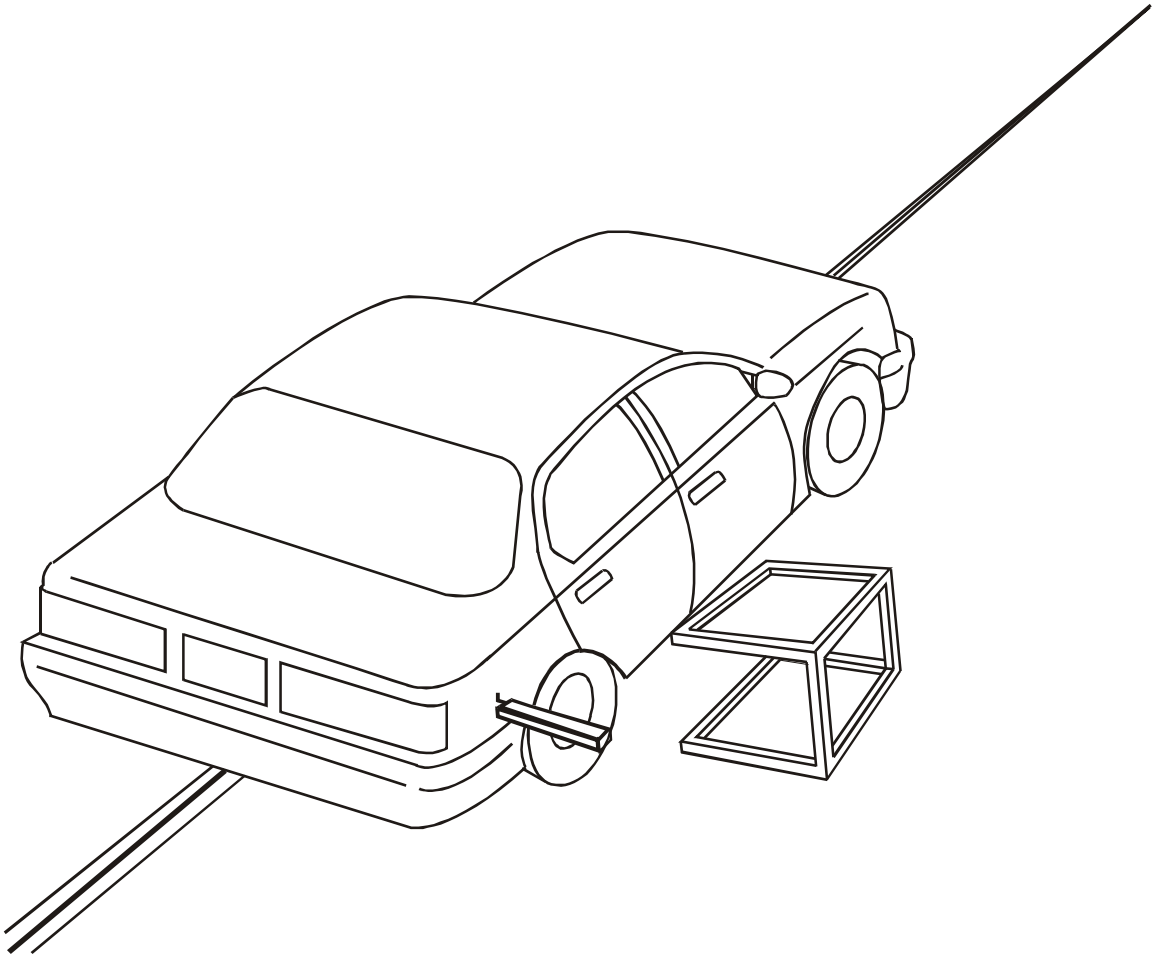
Usable fuel system capacity N/A liters (from owner's manual)

Actual test volume: 43.9 liters

Table 4 Post-Impact Data

Test number:	131024
Test date:	10/24/2013
Test time:	11:57 AM
Test type:	Vehicle to Vehicle Rear Impact
Impact angle:	180°
Ambient temperature at impact area:	5° C
Impact velocity:	
Target vehicle:	0 km/h
Bullet vehicle:	64.6 km/h
Required impact velocity range:	
Bullet vehicle:	63.6 to 65.2 km/h
Distance from each vehicle to intended impact point:	
Entering velocity trap:	660 mm
Exiting velocity trap:	50 mm, approximately

Figure 1 Impact Velocity Measurement System



The vane clears the final emitter/receiver pair approximately 50 millimeters before impact.

The emitter/receiver pairs have 610-millimeter spacing.

Table 5 Target Vehicle Accelerometer Data Summary

Accel. No.	Location		Positive Direction Max. (g)	Positive Direction Time (ms)	Negative Direction Max. (g)	Negative Direction Time (ms)
1	Vehicle Center of Gravity	X	16.3	35.4	-1.5	179.6
		Y	4.2	54.5	-3.8	44.0
		Z	6.6	14.6	-19.4	48.2
		R	19.6	48.2	---	---
2	Vehicle Center of Gravity Redundant	X	15.7	35.6	-1.3	179.5
		Y	3.5	54.5	-4.5	44.0
		Z	5.8	14.2	-18.4	48.1
		R	19.1	48.1	---	---

Reference:
X: + Forward From Rear Bumper
Y: + Rightward From Vehicle Centerline
Z: + Downward From Ground Level

Table 6 Bullet Vehicle Accelerometer Data Summary

Accel. No.	Location		Positive Direction Max. (g)	Positive Direction Time (ms)	Negative Direction Max. (g)	Negative Direction Time (ms)
1	Vehicle Center of Gravity	X	1.2	161.9	-28.7	50.8
		Y	10.4	48.6	-13.1	55.1
		Z	16.7	46.4	-12.2	57.0
		R	29.3	50.9	---	---
2	Vehicle Center of Gravity Redundant	X	1.2	161.8	-29.2	50.7
		Y	9.6	48.7	-13.7	55.1
		Z	17.9	46.3	-11.7	57.0
		R	29.9	50.9	---	---

Reference:
X: + Forward From Rear Bumper
Y: + Rightward From Vehicle Centerline
Z: + Downward From Ground Level

Table 7 Target Vehicle Measurements

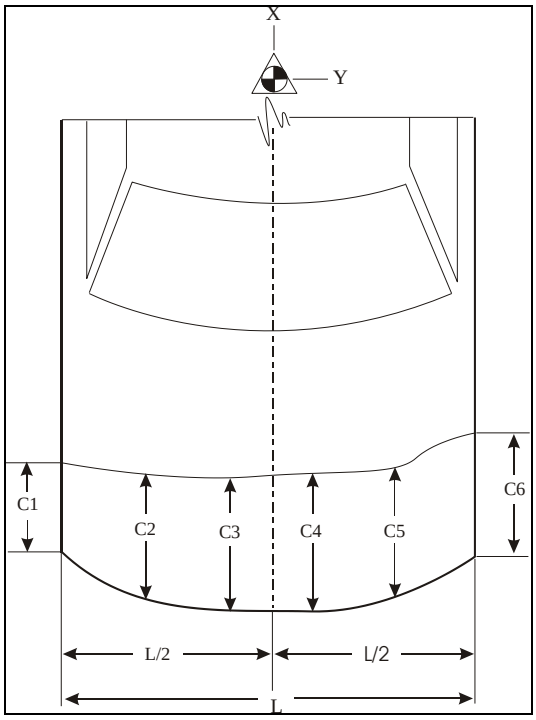
2004 Jeep Liberty

Test Number: 131024

No.	Type of measurement	Pre-Test	Post-Test	Difference
X1	Total Length of Vehicle at Centerline	4211	4100	111
X2	Rear Surface of Vehicle to Front of Engine Block	616	621	-5
X3	Rear Surface of Vehicle to Firewall	1109	1113	-4
X4	Rear Surface of Vehicle to Upper Leading Edge of Right Door	1406	1411	-5
X5	Rear Surface of Vehicle to Upper Leading Edge of Left Door	1401	1405	-4
X6	Rear Surface of Vehicle to Lower Leading Edge of Right Door	1416	1421	-5
X7	Rear Surface of Vehicle to Lower Leading Edge of Left Door	1416	1422	-6
X8	Rear Surface of Vehicle to Upper Trailing Edge of Right Door	2395	2401	-6
X9	Rear Surface of Vehicle to Upper Trailing Edge of Left Door	2386	2391	-5
X10	Rear Surface of Vehicle to Lower Trailing Edge of Right Door	2379	2382	-3
X11	Rear Surface of Vehicle to Lower Trailing Edge of Left Door	2366	2372	-6
X12	Rear Surface of Vehicle to Bottom of " A " Post on Right Side	1447	1450	-3
X13	Rear Surface of Vehicle to Bottom of " A " Post on Left Side	1455	1457	-2
X14	Rear Surface of Vehicle to Firewall-Right Side	1074	1078	-4
X15	Rear Surface of Vehicle to Firewall-Left Side	1074	1079	-5
X16	Rear Surface of Vehicle to Steering Wheel Center	1811	1820	-9
X17	Center of Steering Column to " A " Post	260	260	0
X18	Center of Steering Column to Headliner	495	495	0
X19	Rear Surface of Vehicle to Right Side of Front Bumper	4160	4160	0
X20	Rear Surface of Vehicle to Left Side of Front Bumper	4164	4185	-21
X21	Length of Engine Block	640	640	0

All measurements are in millimeters.

Figure 2 Target Vehicle Crush



Notes: L is pre-test length of contact surface.
C1 through C6 are spaced equally apart.
CL is vehicle centerline.

Vehicle: 2004 Jeep Liberty

	Pre-test	Post-test	Crush
L	1524		
C1	4164	4185	-21
C2	4236	4216	20
C3	4221	4151	70
CL	4211	4100	111
C4	4217	4097	120
C5	4213	4203	10
C6	4160	4160	0

All measurements in millimeters.

Table 8 Bullet Vehicle Measurements

1997 Plymouth Neon

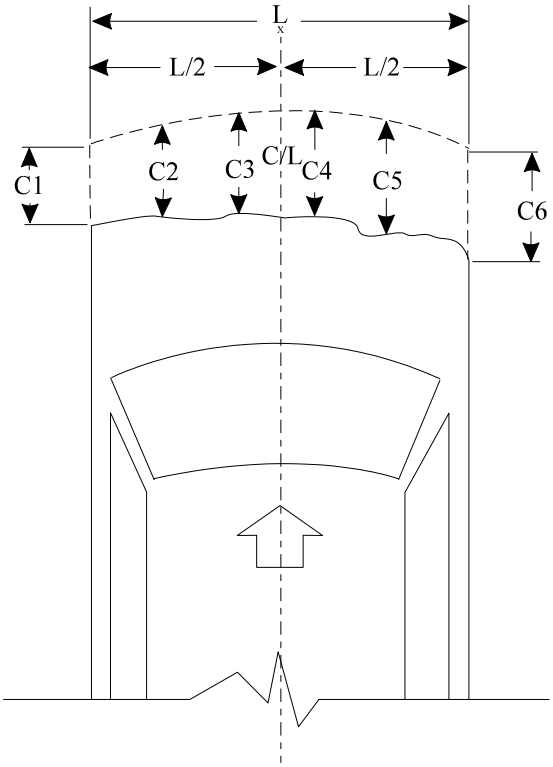
Test Number: 131024

No.	Type of measurement	Pre-Test	Post-Test	Difference
X1	Total Length of Vehicle at Centerline	4373	N/A[1]	N/A[1]
X2	Rear Surface of Vehicle to Front of Engine Block	3953	N/A[1]	N/A[1]
X3	Rear Surface of Vehicle to Firewall	3383	3345	38
X4	Rear Surface of Vehicle to Upper Leading Edge of Right Door	2964	2965	-1
X5	Rear Surface of Vehicle to Upper Leading Edge of Left Door	2964	2962	2
X6	Rear Surface of Vehicle to Lower Leading Edge of Right Door	3005	3005	0
X7	Rear Surface of Vehicle to Lower Leading Edge of Left Door	3010	3010	0
X8	Rear Surface of Vehicle to Upper Trailing Edge of Right Door	1995	1795	200
X9	Rear Surface of Vehicle to Upper Trailing Edge of Left Door	1991	1992	-1
X10	Rear Surface of Vehicle to Lower Trailing Edge of Right Door	1989	1991	-2
X11	Rear Surface of Vehicle to Lower Trailing Edge of Left Door	1991	1991	0
X12	Rear Surface of Vehicle to Bottom of " A " Post on Right Side	2999	2996	3
X13	Rear Surface of Vehicle to Bottom of " A " Post on Left Side	3009	3011	-2
X14	Rear Surface of Vehicle to Firewall-Right Side	3313	3310	3
X15	Rear Surface of Vehicle to Firewall-Left Side	3300	3297	3
X16	Rear Surface of Vehicle to Steering Wheel Center	2579	2557	22
X17	Center of Steering Column to " A " Post	302	303	-1
X18	Center of Steering Column to Headliner	418	418	0
X19	Rear Surface of Vehicle to Right Side of Front Bumper	4164	N/A[1]	N/A[1]
X20	Rear Surface of Vehicle to Left Side of Front Bumper	4145	N/A[1]	N/A[1]
X21	Length of Engine Block	610	610	0
	Left Front Overhang	779	680	99
	Right Front Overhang	779	630	149
X26	Firewall to Engine or Transaxle	120	-20	140
X27	Vertical Distance from Door Sill to Centerline of Steering Column	528	526	2
X28	Left Wheelbase	2630	2631	-1
X28	Right Wheelbase	2630	2642	-12
X29	Maximum Width	1701	1704	-3
X30	Rear Surface of Vehicle to Engine Bottom Target	3745	3719	26
X31	Rear Surface of Vehicle to Occupant Compartment Bottom Targets	2395	2390	5
X32	Rear Surface of Vehicle to Front Bumper Bottom Target	4265	N/A[1]	N/A[1]
X33	Rear Surface of Vehicle to Frame Crossmember Bottom Target	3321	3337	-16
RD	Rear Surface of Vehicle to Right Side of Dash Panel	2737	2735	2
CD	Rear Surface of Vehicle to Center of Dash Panel	2732	2721	11
LD	Rear Surface of Vehicle to Left Side of Dash Panel	2745	2748	-3

All measurements are in millimeters.

[1]Measurement point destroyed during impact.

Figure 3 Bullet Vehicle Crush



Notes: L is pre-test length of contact surface.
C1 through C6 are spaced equally apart.
CL is vehicle centerline.

Vehicle: 1997 Plymouth Neon

	Pre-test	Post-test	Crush
L	1524 mm		
C1	4145	N/A[1]	N/A[1]
C2	4305	N/A[1]	N/A[1]
C3	4373	N/A[1]	N/A[1]
CL	4373	N/A[1]	N/A[1]
C4	4365	N/A[1]	N/A[1]
C5	4305	N/A[1]	N/A[1]
C6	4164	N/A[1]	N/A[1]

All measurements are in millimeters.

[1]Measurement point destroyed during impact.

Section 3.0

FMVSS 301 Data

Table 9 Target Vehicle Fuel System Data

Vehicle year/make/ model/body style:	2004/Jeep/Liberty/SUV
Actual test volume:	68.5 liters
Test fluid type:	Stoddard
Specific gravity:	0.764
Kinematic viscosity:	0.99 centistoke
Test fluid color:	Purple
Type of fuel pump:	Electric
Did electric fuel pump operate with ignition switch "on" and the engine not operating.	Yes
Details of fuel system:	The fuel tank is located behind the rear axle. The fuel filler neck enters the top left side of the tank. The fuel filler cap is located on the left rear quarter panel. The fuel lines run along the inside of the left frame rail.

Table 10 Target Vehicle FMVSS 301 Post-Impact Test Data

Test date: 10/24/2013

Vehicle year/make/
model/body style: 2004/Jeep/Liberty/SUV

Test requirements:

Test vehicle fuel tank filled to 92 to 94% of manufacturer's usable capacity and with electric fuel pump operating (if it will operate without engine operation). Part 572 test dummies located at each front designated seating position.

Test vehicle impact type:

____ Frontal (30 mph)

____ Oblique (30 mph) with __ barrier face first contacting (driver's/passenger's) side

_X_ Rear vehicle to vehicle impact

____ Lateral moving barrier (20 mph)

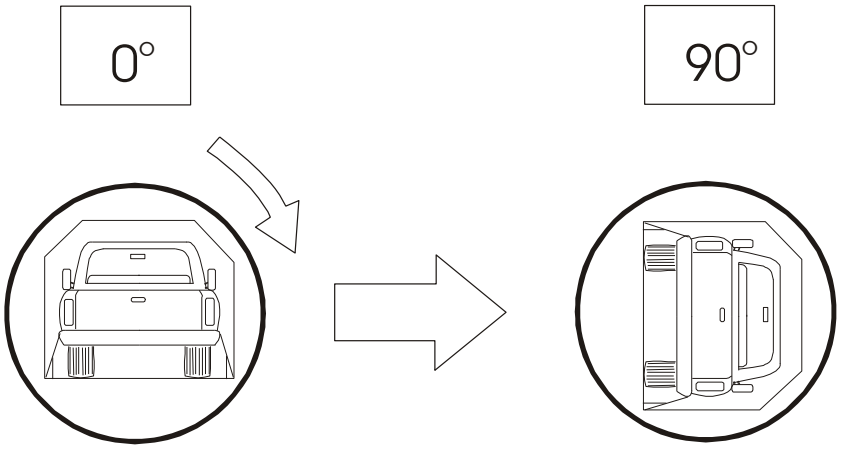
Fuel system fluid spillage measurements:

		Test Results	Maximum Allowable
1.	From impact until vehicle motion ceases	0	28 g
2.	5-minute period after vehicle motion ceases	0	142 g
3.	Next 25 minutes after 5-minute period	0	28 g/minute

Fuel system fluid spillage location(s): None

Figure 4 Target Vehicle FMVSS 301 Static Rollover Test Data

Test phase



Static rollover machine rotation time information: (specified range is 1-3 minutes)

Time required for machine to rotate 90°	=	2	minutes,	0	seconds
FMVSS 301 position hold time	=	5	minutes,	0	seconds
Total	=	7	minutes,	0	seconds
Next whole minute interval	=	7	minutes		

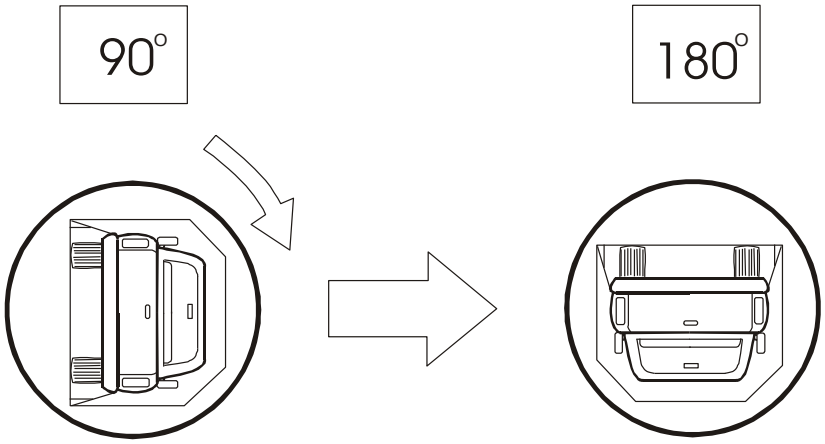
Fuel system fluid spillage measurements:

0° to 90° rotation (fuel filler cap down)	Test Results	Maximum Allowable
1. First five minutes from onset of rotation	0	142 g
2. Sixth minute from onset of rotation	0	28 g
3. Seventh minute from onset of rotation	0	28 g

Fuel system fluid spillage location(s): None

Figure 4 Target Vehicle FMVSS 301 Static Rollover Test Data, Continued

Test phase



Static rollover machine rotation time information: (specified range is 1-3 minutes)

Time required for machine to rotate 90°	=	2	minutes,	0	seconds
FMVSS 301 position hold time	=	5	minutes,	0	seconds
Total	=	7	minutes,	0	seconds
Next whole minute interval	=	14	minutes		

Fuel system fluid spillage measurements:

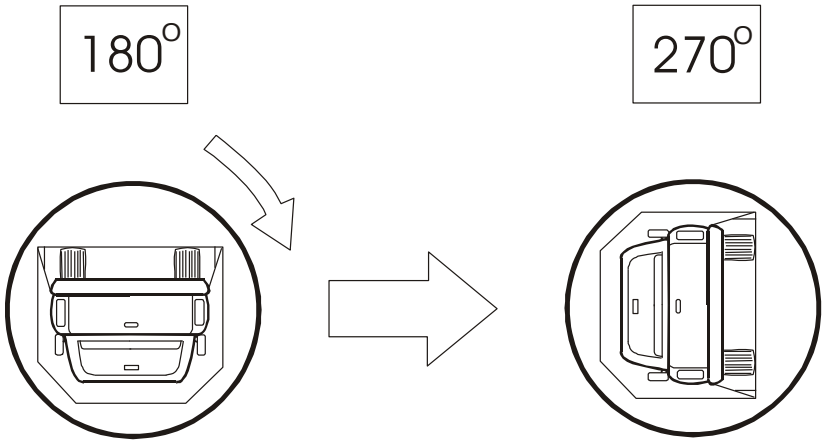
90° to 180° rotation	Test Results	Maximum Allowable
1. First five minutes from onset of rotation	0	142 g
2. Sixth minute from onset of rotation	0	28 g
3. Seventh minute from onset of rotation	0	28 g

Fuel system fluid spillage location(s): None

.

Figure 4 Target Vehicle FMVSS 301 Static Rollover Test Data, Continued

Test phase



Static rollover machine rotation time information: (specified range is 1-3 minutes)

Time required for machine to rotate 90°	=	2	minutes,	0	seconds
FMVSS 301 position hold time	=	5	minutes,	0	seconds
Total	=	7	minutes,	0	seconds
Next whole minute interval	=	21	minutes		

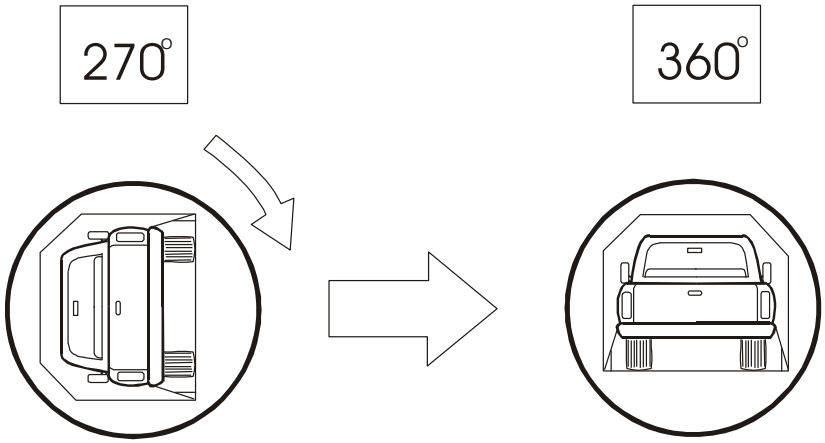
Fuel system fluid spillage measurements:

180 to 270° rotation	Test Results	Maximum Allowable
1. First five minutes from onset of rotation	0	142 g
2. Sixth minute from onset of rotation	0	28 g
3. Seventh minute from onset of rotation	0	28 g

Fuel system fluid spillage location(s): None

Figure 4 Target Vehicle FMVSS 301 Static Rollover Test Data, Continued

Test phase



Static rollover machine rotation time information: (specified range is 1-3 minutes)

Time required for machine to rotate 90°	=	2	minutes,	0	seconds
FMVSS 301 position hold time	=	5	minutes,	0	seconds
Total	=	7	minutes,	0	seconds
Next whole minute interval	=	28	minutes		

Fuel system fluid spillage measurements:

270° to 360° rotation		Test Results	Maximum Allowable
1.	First five minutes from onset of rotation	0	142 g
2.	Sixth minute from onset of rotation	0	28 g
3.	Seventh minute from onset of rotation	0	28 g

Fuel system fluid spillage location(s): None

.

Section 4.0

Camera Information

Figure 5 Camera Positions

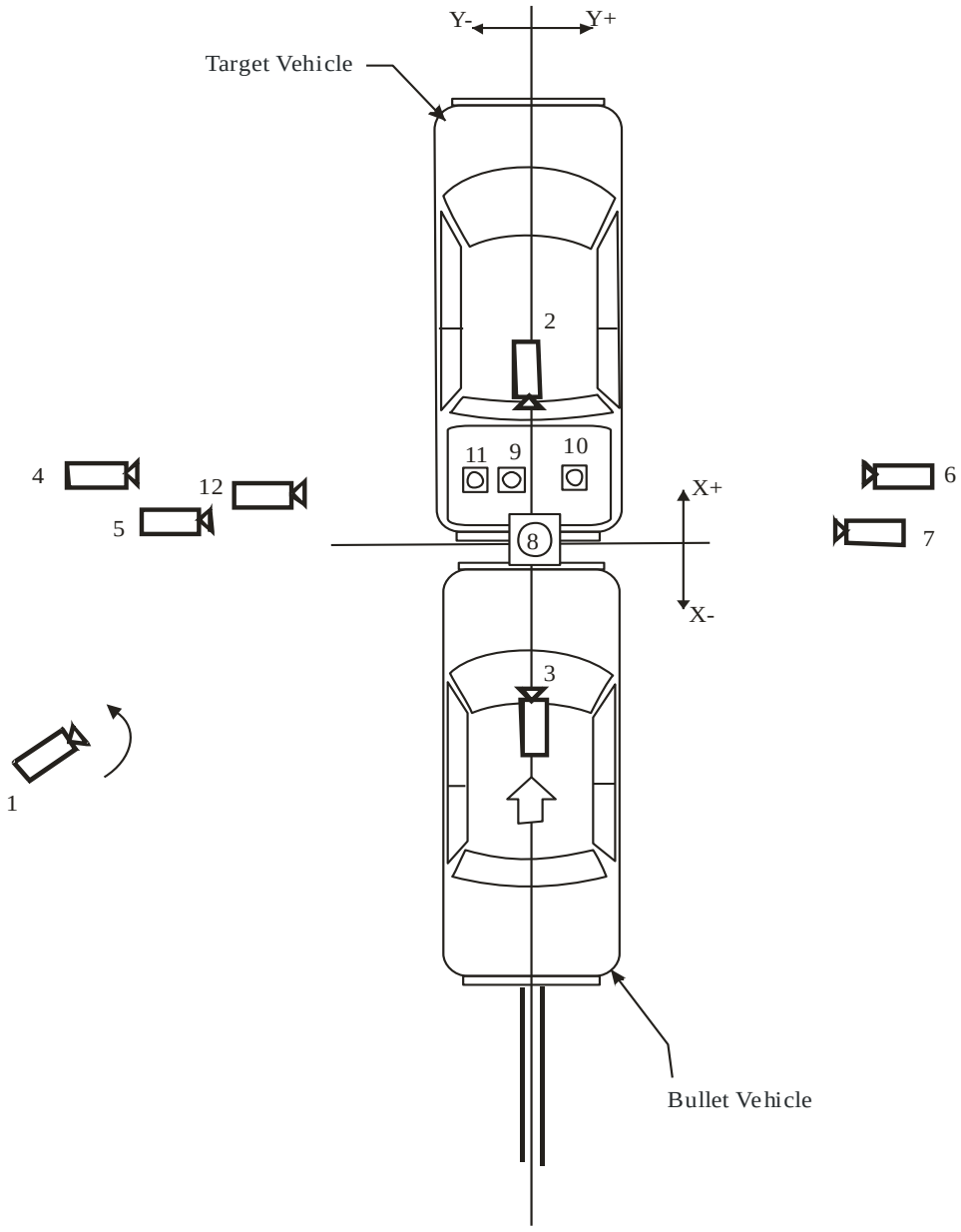


Table 11 Camera Information

Camera Number	Location	Location, mm X	Y	Z	Angle (deg.)	Lens (mm)	Speed (fps)
1	Realtime Panning	N/A	N/A	N/A	N/A	Zoom	30
2	Realtime onboard target vehicle	N/A	N/A	N/A	N/A	Zoom	30
3	Realtime onboard bullet vehicle	N/A	N/A	N/A	N/A	Zoom	30
4	Left target vehicle	-1234	-6401	1295	0.7º	8.5	1000
5	Left side impact	-224	-5486	668	2.5º	16	1000
6	Right target vehicle	-1664	9693	1186	-2.3º	12.5	1000
7	Right side impact	-305	6645	653	1.7º	25	1000
8	Overhead	305	0	5761	N/A	8.5	1000
9	Pit wide	-700	-200	-2860	89.9º	8.5	1000
10	Pit medium	-866	-205	-2871	85.6º	25	1000
11	Pit tight	-515	-455	-2839	85.2º	50	500
12	Left ground level tight impact	-424	-2377	104	4.1	25	1000

+X: Forward (referenced to Target) from impact point
+Y: Rightward (referenced to Target) from impact point
+Z: Downward from ground level

Appendix A

Photographs

Figure A-1 Pre-Test Target Vehicle Frontal View

Figure A-2 Post-Test Target Vehicle Frontal View

Figure A-3 Pre-Test Target Vehicle Left Front 3/4 View

Figure A-4 Post-Test Target Vehicle Left Front 3/4 View

Figure A-5 Pre-Test Target Vehicle Left Side View

Figure A-6 Post-Test Target Vehicle Left Side View

Figure A-7 Pre-Test Target Vehicle Rear View

Figure A-8 Post-Test Target Vehicle Rear View

Figure A-9 Pre-Test Target Vehicle Right Rear 3/4 View

Figure A-10 Post-Test Target Vehicle Right Rear 3/4 View

Figure A-11 Pre-Test Target Vehicle Right Side View

Figure A-12 Post-Test Target Vehicle Right Side View

Figure A-13 Pre-Test Target Vehicle Front Underbody View

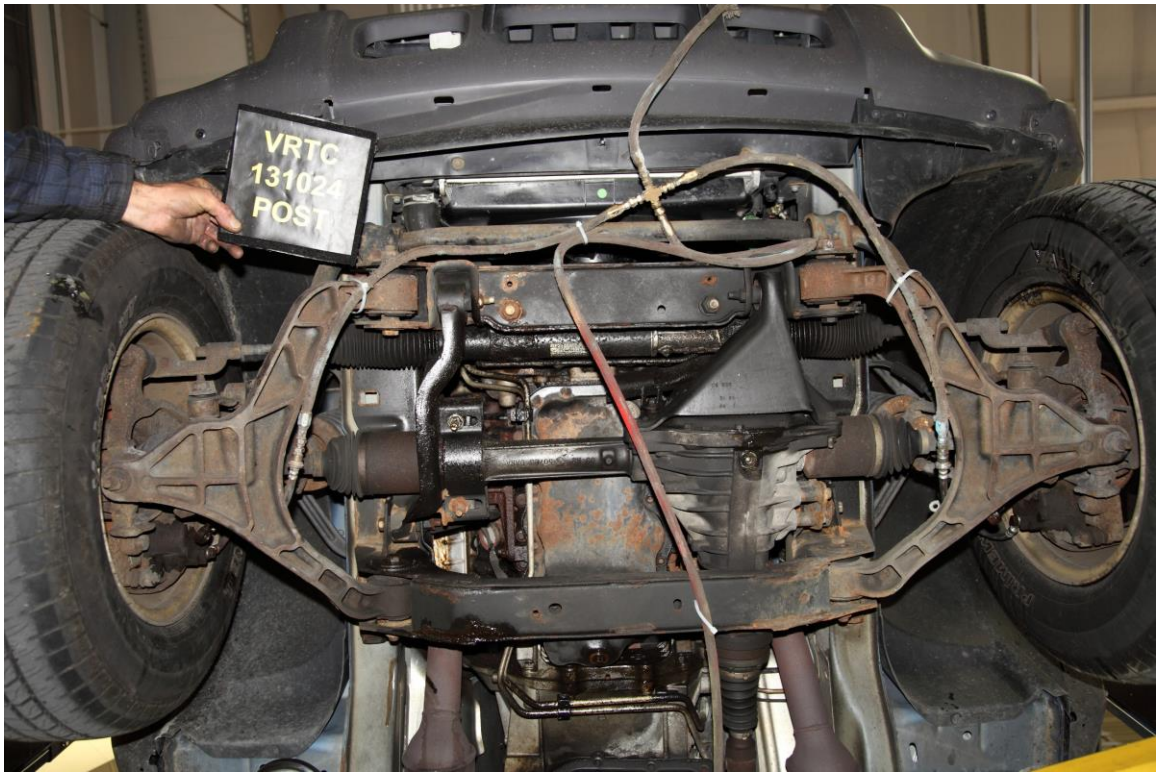


Figure A-14 Post-Test Target Vehicle Front Underbody View

Figure A-15 Pre-Test Target Vehicle Rear Underbody View

Figure A-16 Post-Test Target Vehicle Rear Underbody View

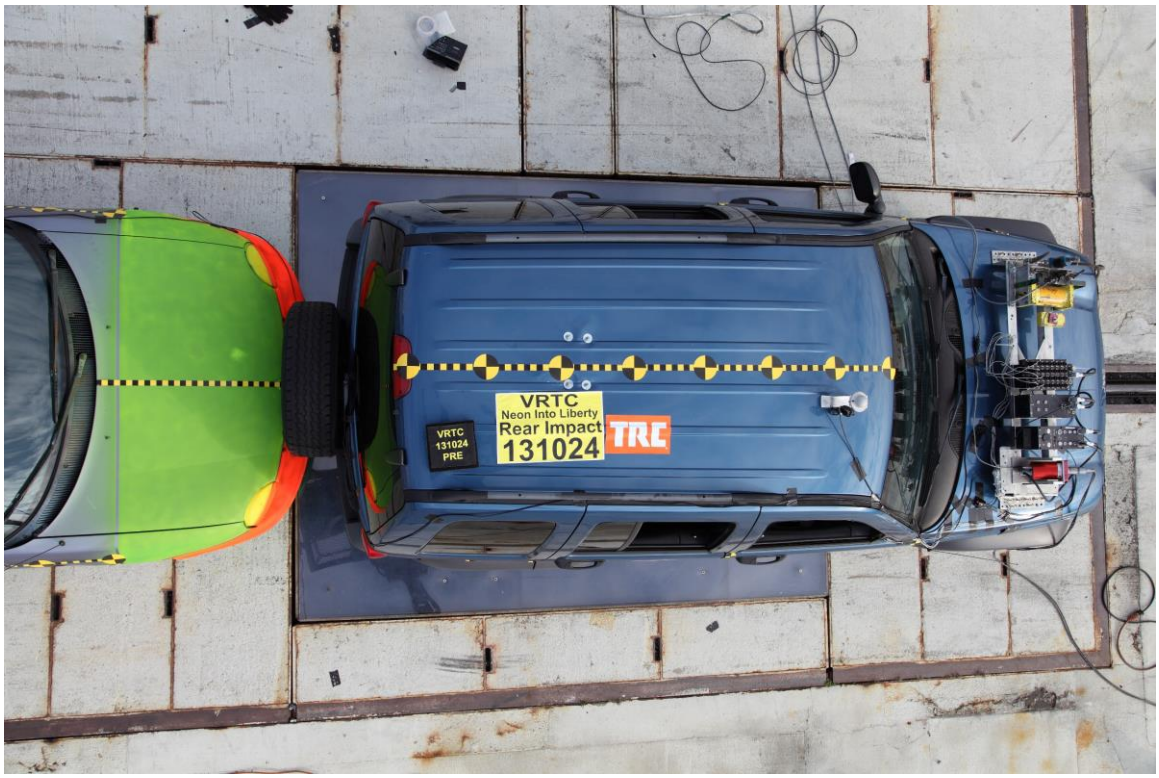


Figure A-17 Pre-Test Target Vehicle Overhead View

Figure A-18 Post-Test Target Vehicle Overhead View

Figure A-19 Pre-Test Target Vehicle Overhead Tight View

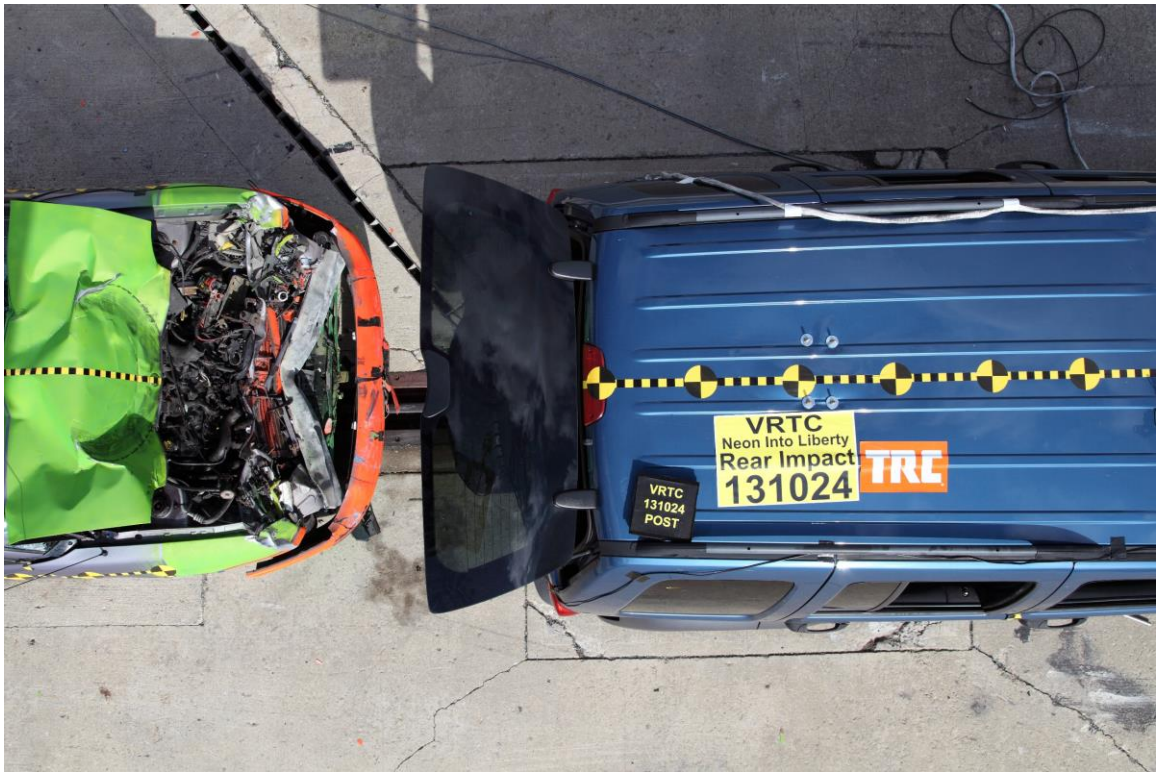


Figure A-20 Post-Test Target Vehicle Overhead Tight View

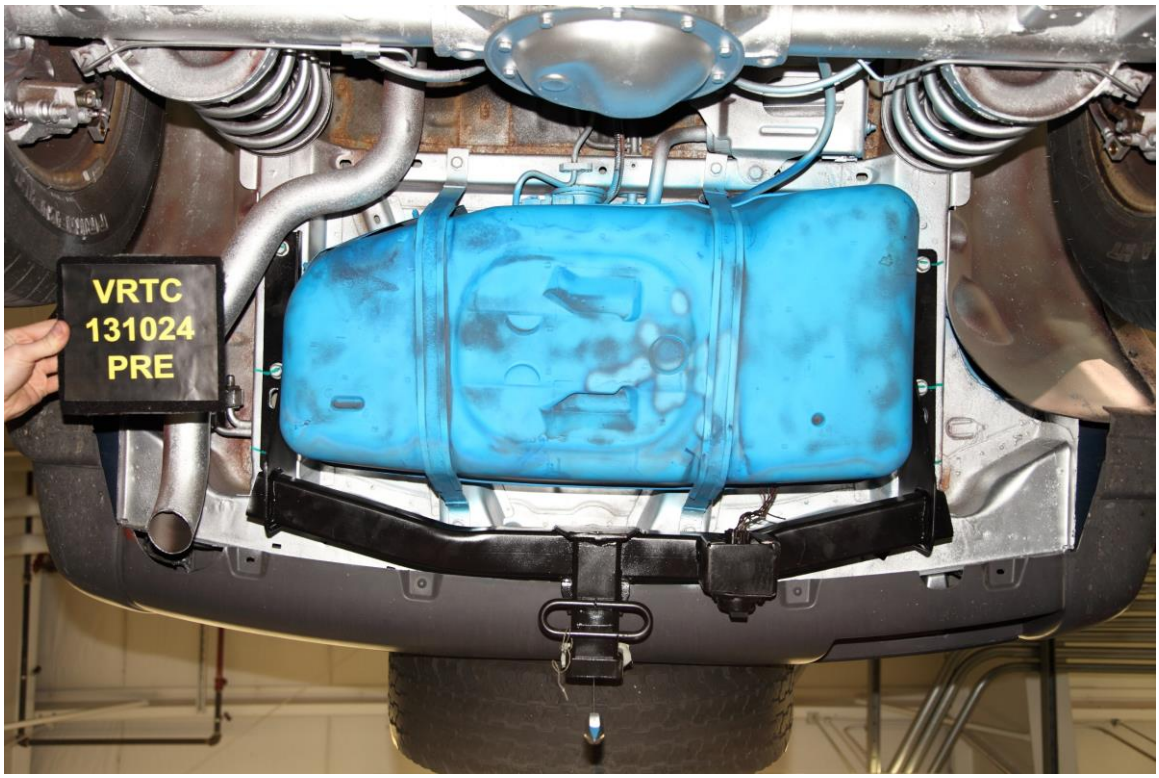


Figure A-21 Pre-Test Target Vehicle Fuel Tank Close-up View

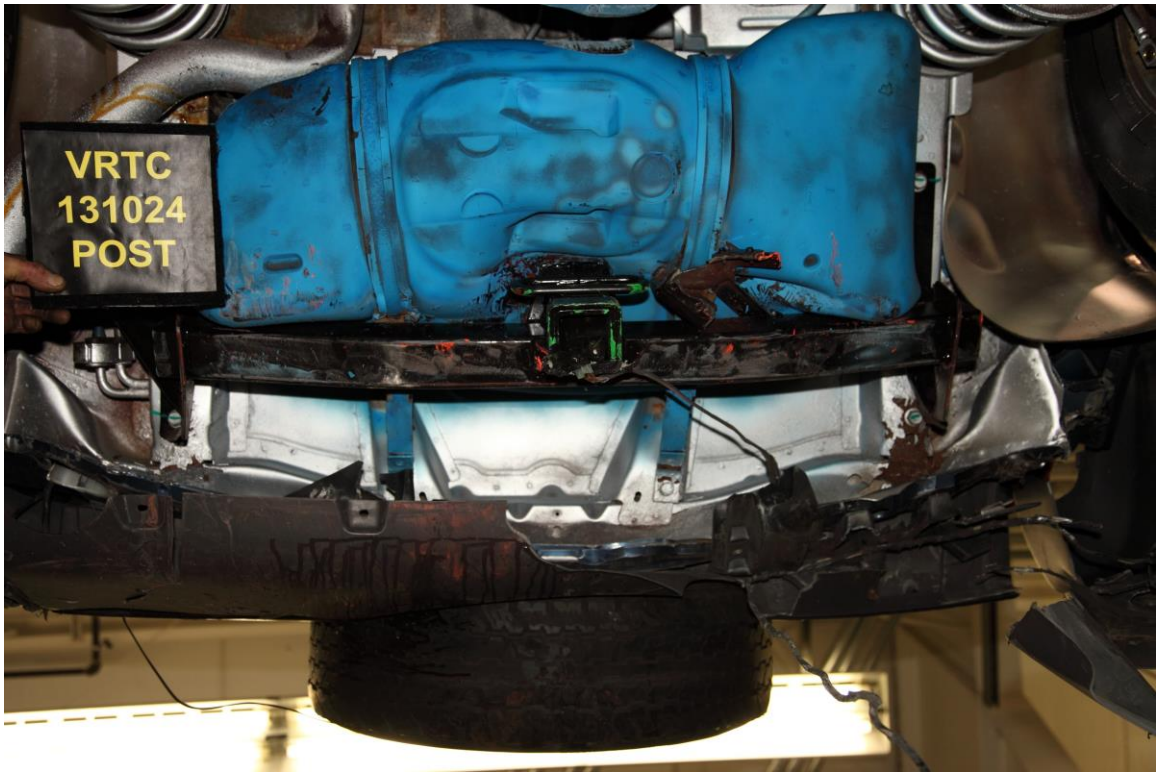


Figure A-22 Post-Test Target Vehicle Fuel Tank Close-up View

Figure A-23 Pre-Test Target Vehicle Fuel Line Close-up View

Figure A-24 Post-Test Target Vehicle Fuel Line Close-up View

Figure A-25 Pre-Test Target Vehicle Fuel Filter Close-up View

Figure A-26 Post-Test Target Vehicle Fuel Filter Close-up View

Figure A-27 Pre-Test Target Vehicle Fuel Filler Close-up View

Figure A-28 Post-Test Target Vehicle Fuel Filler Close-up View

Figure A-29 Pre-Test Target Vehicle Fuel Cap View

Figure A-30 Post-Test Target Vehicle Fuel Cap View

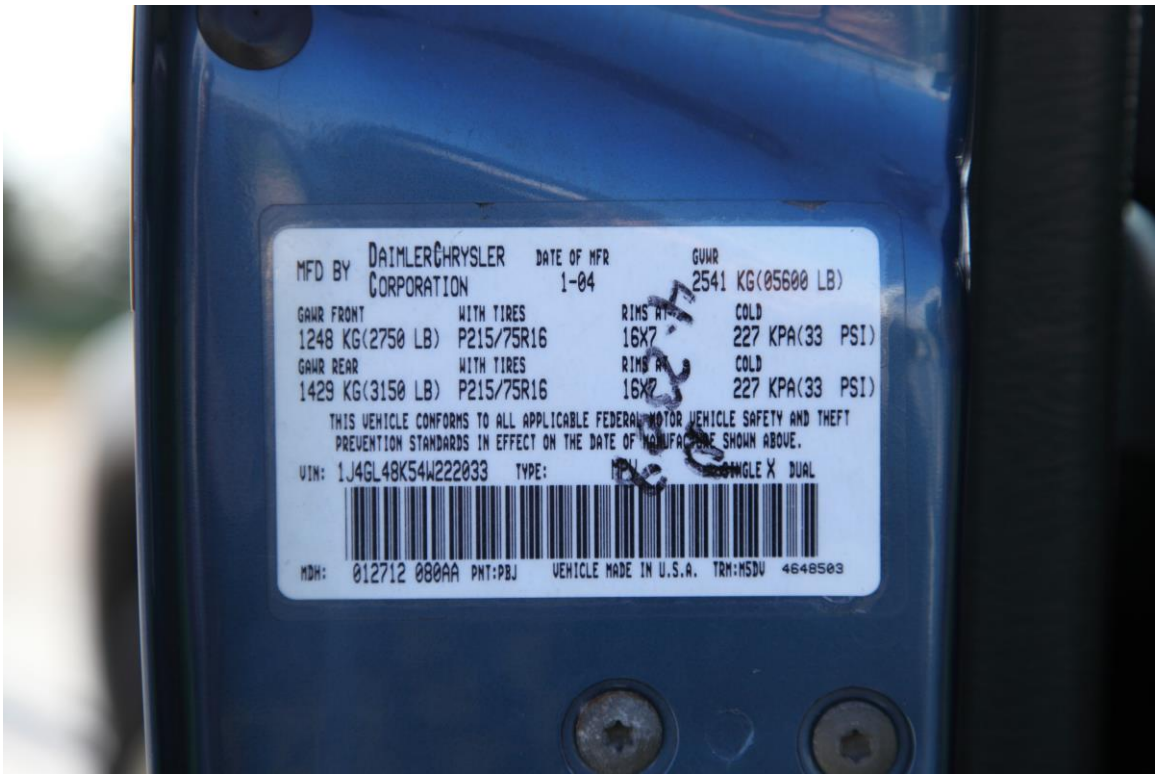


Figure A-31 Close-Up View of Target Vehicle Certification Label

Intentionally Left Blank

Figure A-32 Pre-Test Bullet Vehicle Frontal View

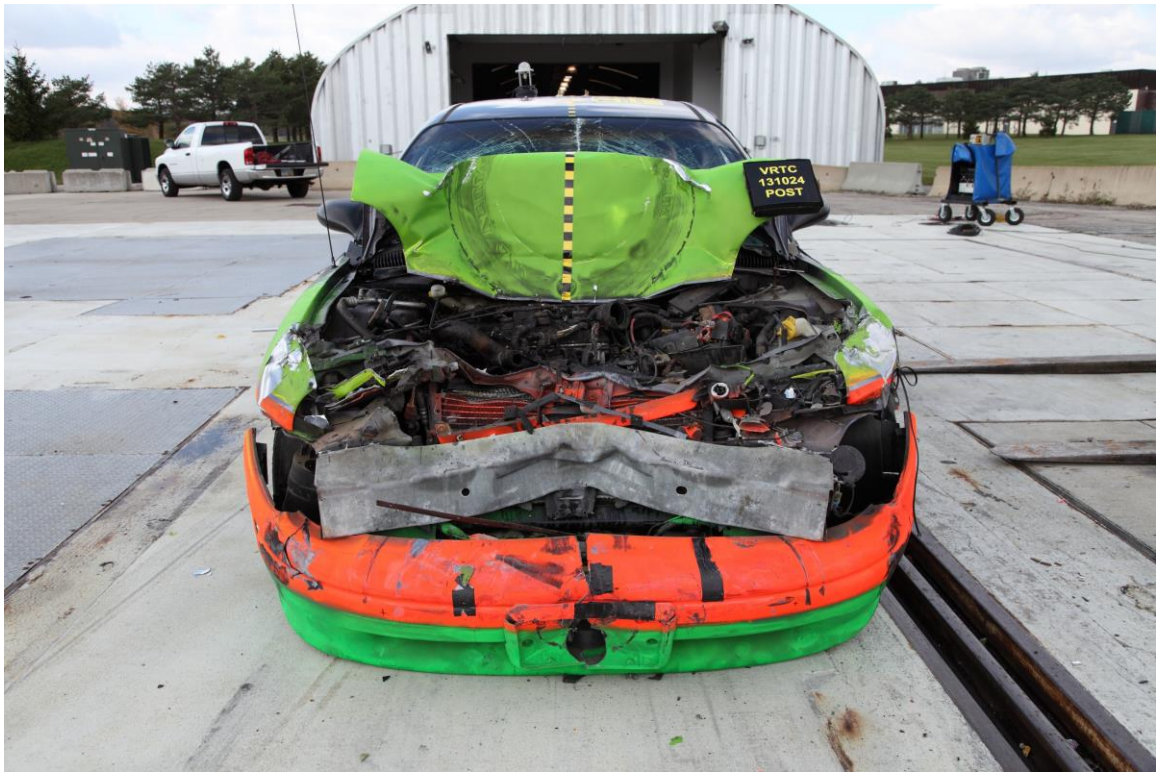


Figure A-33 Post-Test Bullet Vehicle Frontal View

Figure A-34 Pre-Test Bullet Vehicle Left Front 3/4 View

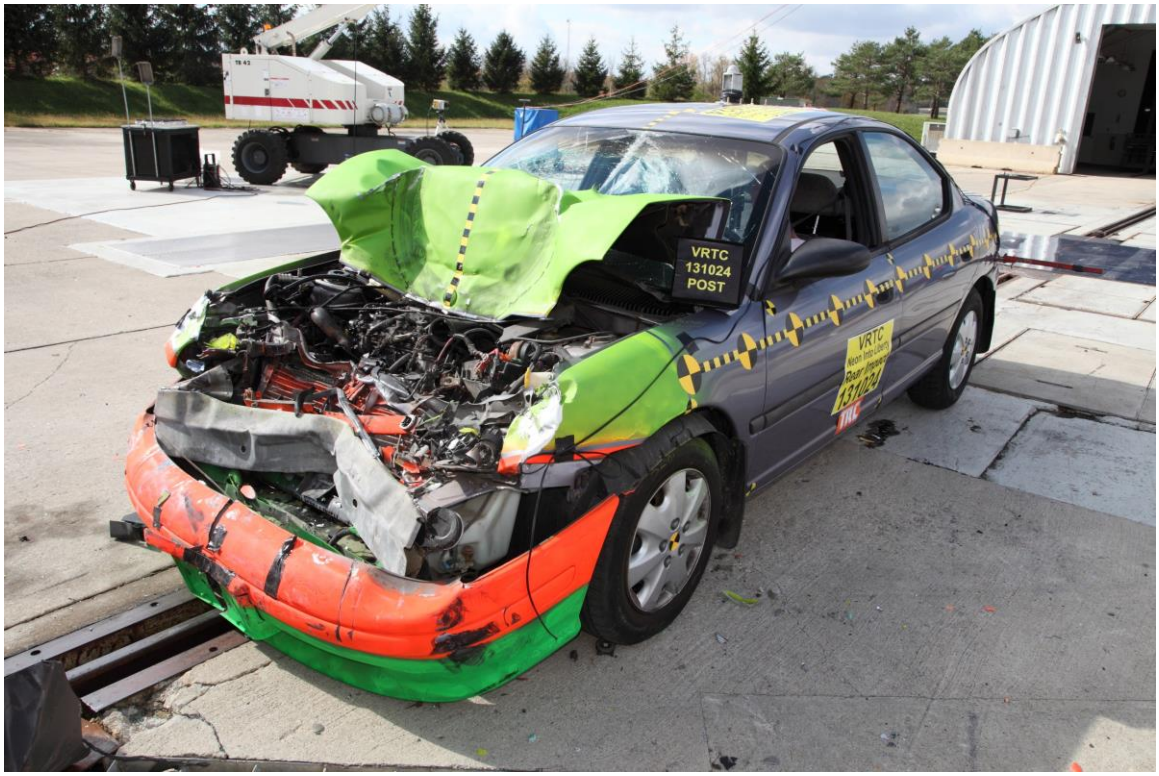


Figure A-35 Post-Test Bullet Vehicle Left Front 3/4 View

Figure A-36 Pre-Test Bullet Vehicle Left Side View

Figure A-37 Post-Test Bullet Vehicle Left Side View

Figure A-38 Pre-Test Bullet Vehicle Rear View

Figure A-39 Post-Test Bullet Vehicle Rear View

Figure A-40 Pre-Test Bullet Vehicle Right Rear 3/4 View

Figure A-41 Post-Test Bullet Vehicle Right Rear 3/4 View

Figure A-42 Pre-Test Bullet Vehicle Right Side View

Figure A-43 Post-Test Bullet Vehicle Right Side View

Figure A-44 Pre-Test Bullet Vehicle Front Underbody View

Figure A-45 Post-Test Bullet Vehicle Front Underbody View

Figure A-46 Pre-Test Bullet Vehicle Rear Underbody View

Figure A-47 Post-Test Bullet Vehicle Rear Underbody View

Figure A-48 Pre-Test Bullet Vehicle Fuel Line Close-up View

Figure A-49 Post-Test Bullet Vehicle Fuel Line Close-up View

Figure A-50 Pre-Test Bullet Vehicle Fuel Filter Close-up View

Figure A-51 Post-Test Bullet Vehicle Fuel Filter Close-up View

Figure A-52 Pre-Test Bullet Vehicle Fuel Filler Close-up View

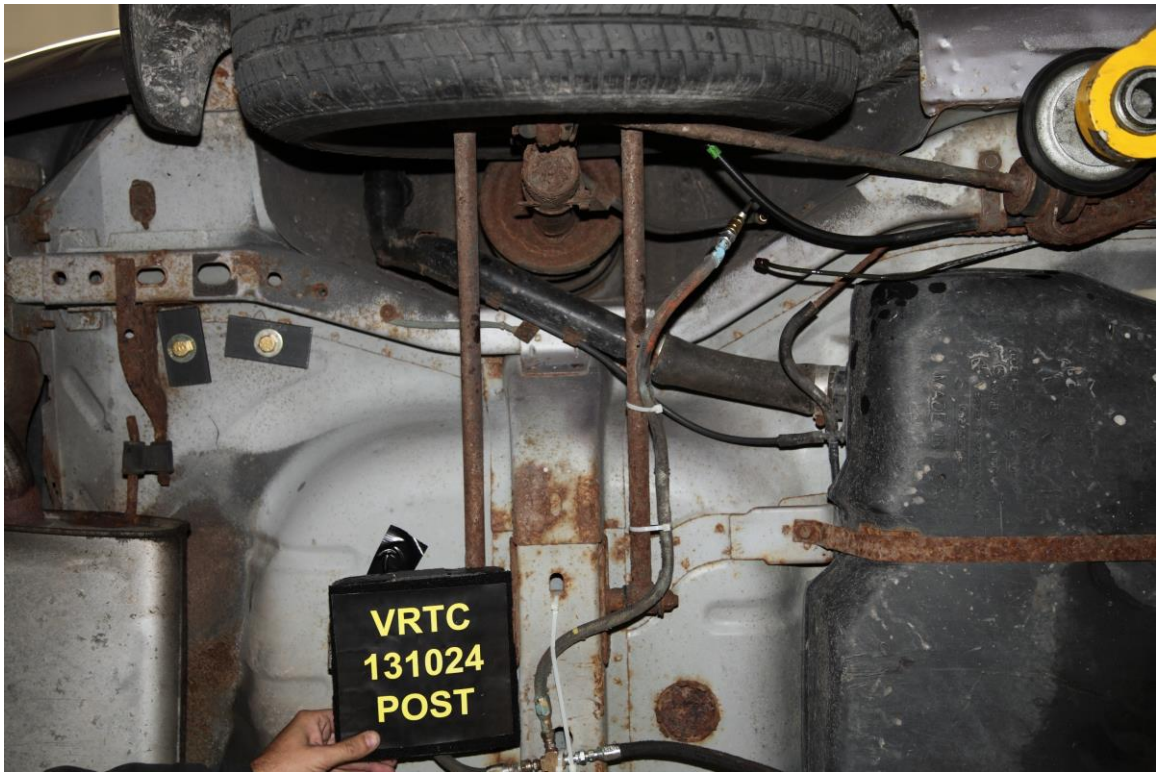


Figure A-53 Post-Test Bullet Vehicle Fuel Filler Close-up View

Figure A-54 Close-Up View of Bullet Vehicle Certification Label

Figure A-55 Close-Up View of Bullet Vehicle Tire Information Placard or Label

Figure A-56 Pre-Test Bullet and Target Vehicles Overall Left Side View

Figure A-57 Post-Test Bullet and Target Vehicles Overall Left Side View

Figure A-58 Pre-Test Bullet and Target Vehicles Overall Right Side View

Figure A-59 Post-Test Bullet and Target Vehicles Overall Right Side View

Figure A-60 Pre-Test Bullet and Target Vehicles Overhead View

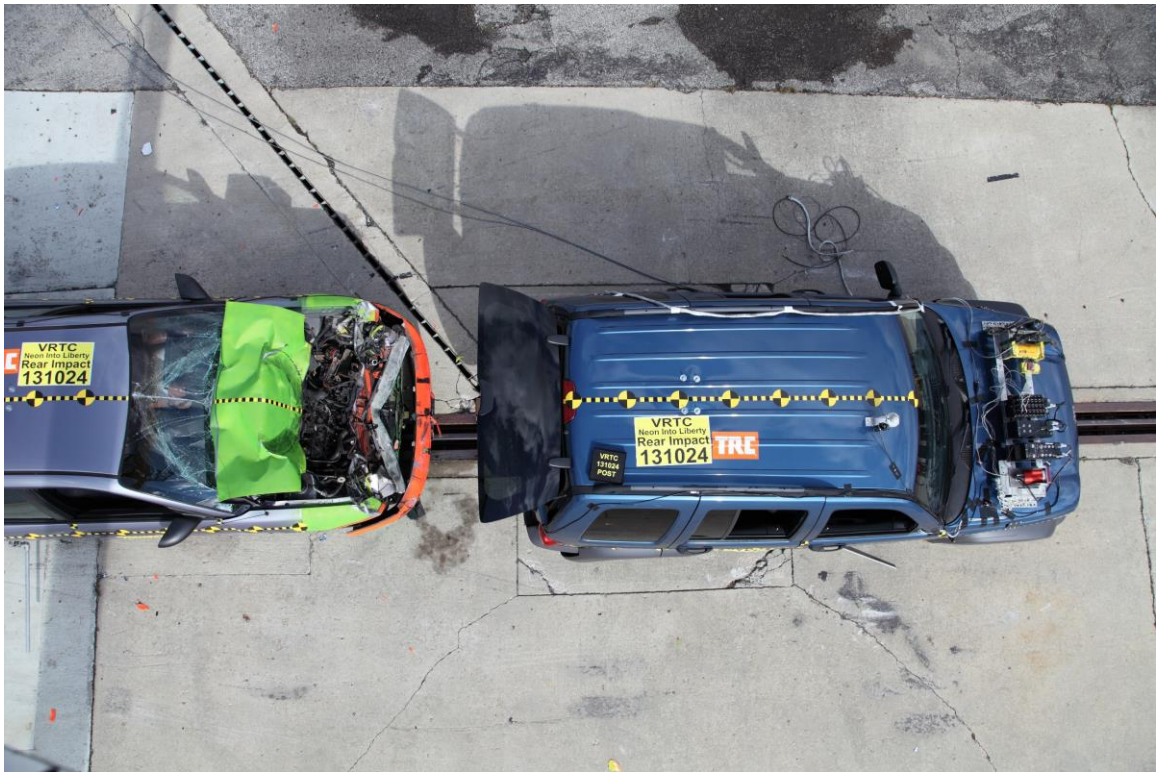


Figure A-61 Post-Test Bullet and Target Vehicles Overhead View

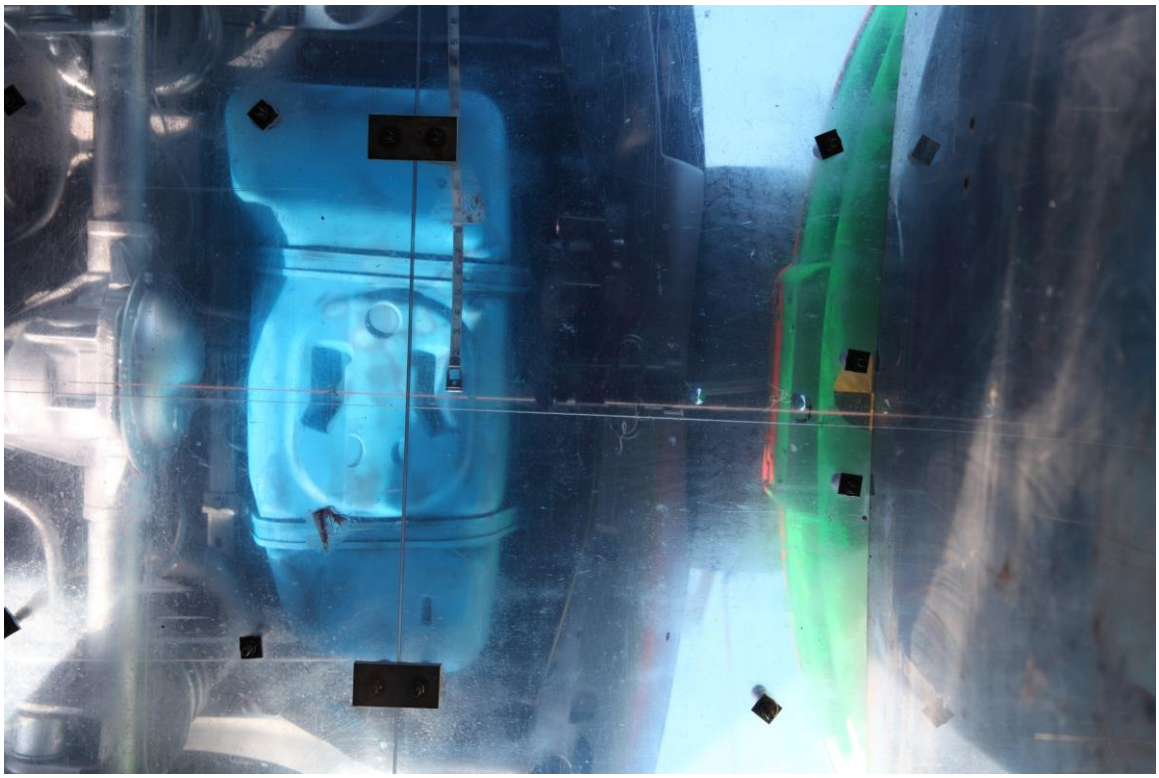


Figure A-62 Pre-Test Impact Alignment – Bullet and Target Vehicles Pit View

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Figure A-63 Pre-Test Impact Area Close-Up View

Figure A-64 Post-Test Impact Area Close-Up View

Figure A-65 Target Vehicle at 0º on Static Rollover Device

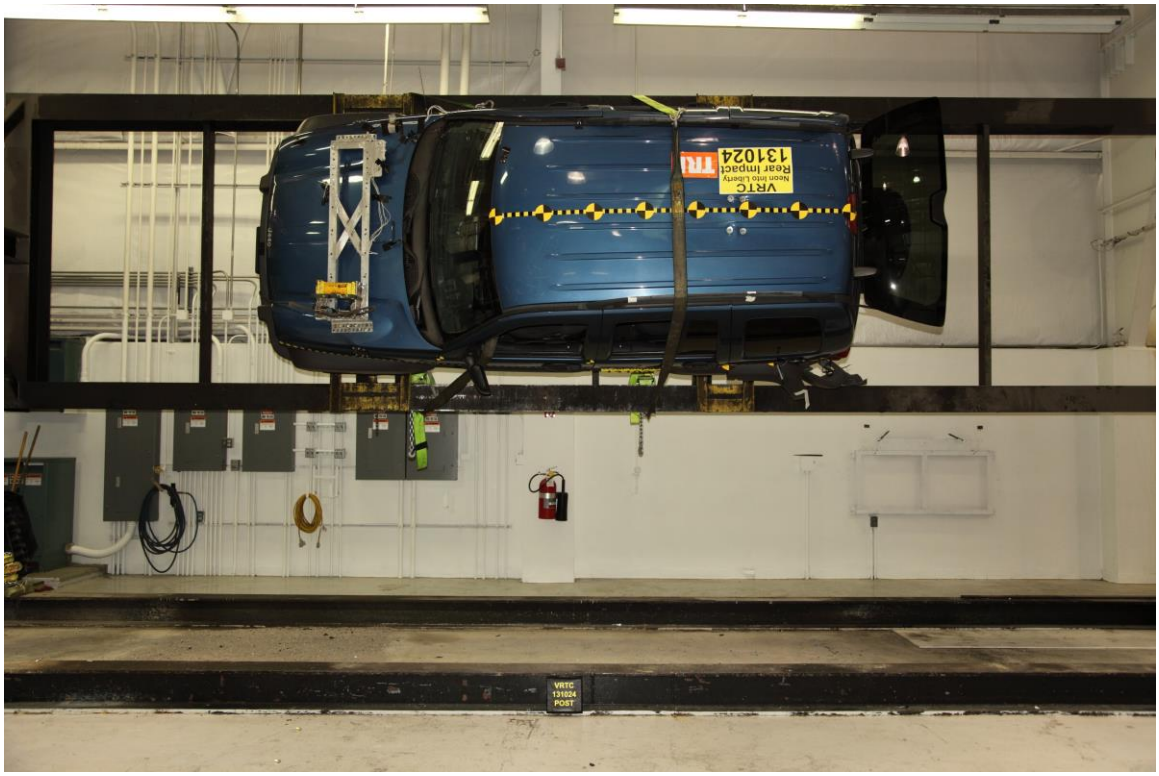


Figure A-66 Target Vehicle at 90º on Static Rollover Device

Figure A-67 Target Vehicle at 180º on Static Rollover Device

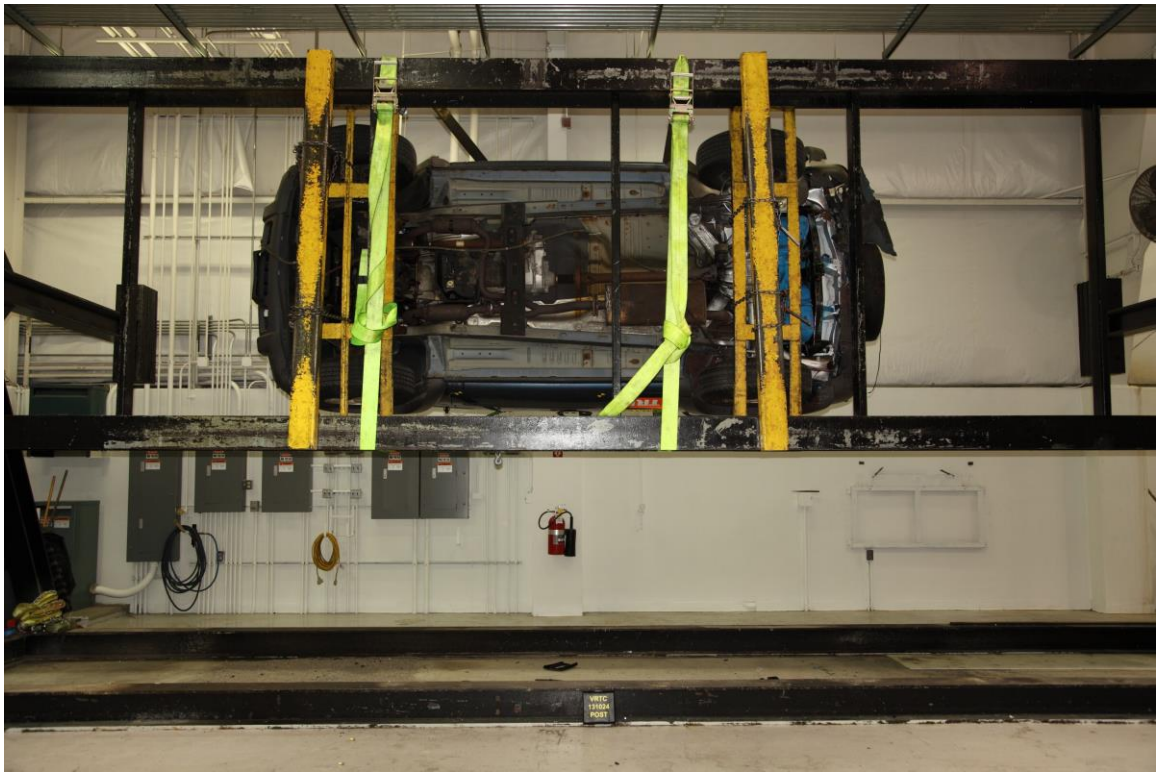


Figure A-68 Target Vehicle at 270º on Static Rollover Device

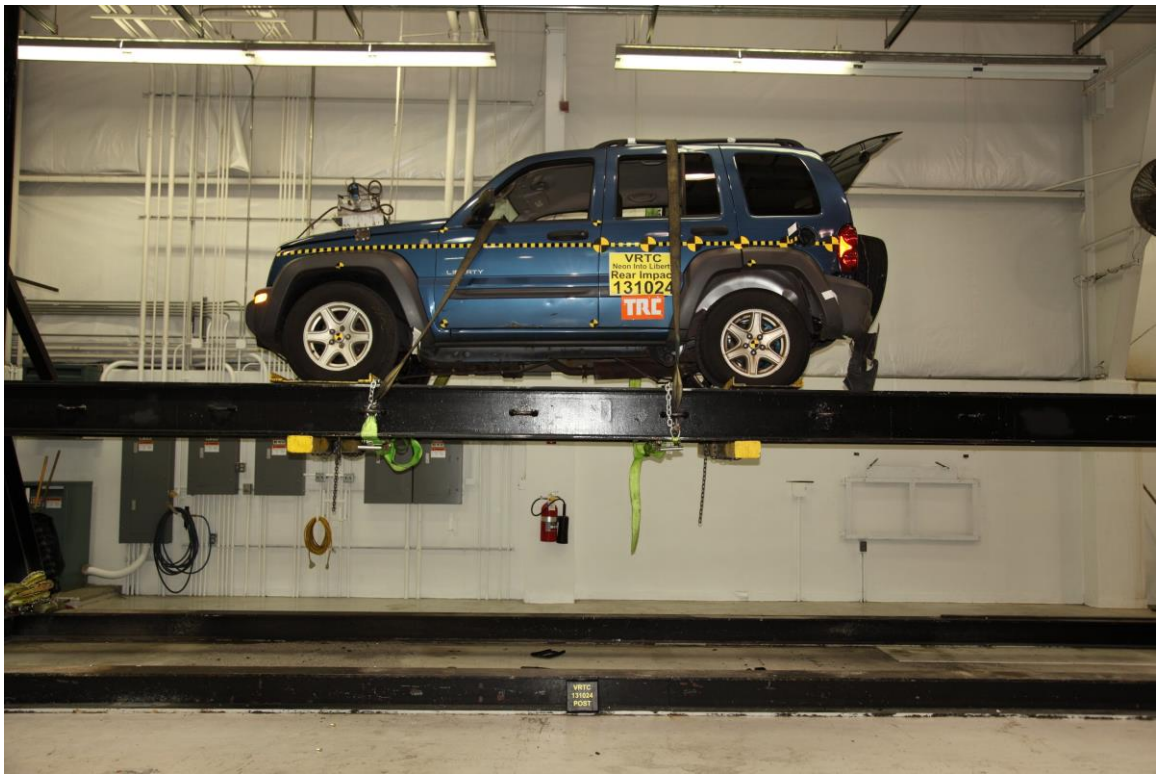


Figure A-69 Target Vehicle at 360º on Static Rollover Device

Intentionally Left Blank

Appendix B

Data Plots

1997 Neon Into Rear of 2004 Jeep Liberty

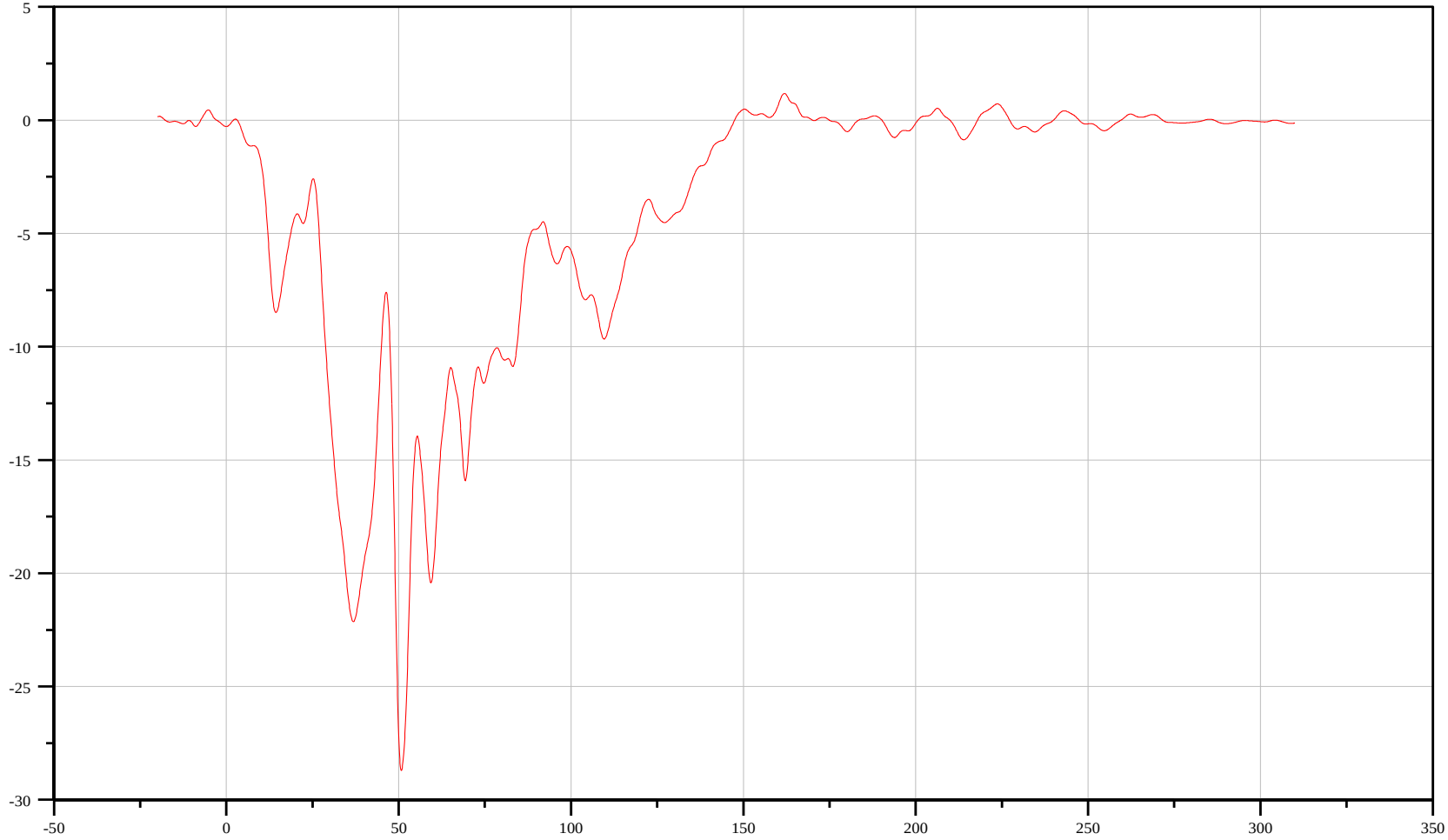
Bullet Vehicle CG X-axis Acceleration

Date: 10/24/2013
Time: 12:01

Customer: VRTC

10VEHCCG0000ACXD

TRC Inc. Test Lab: CTF
Test Number: 131024



Filter: CFC_60

Min. Value
-28.71 g at 50.80 ms

Max. Value
1.18 g at 161.92 ms

1997 Neon Into Rear of 2004 Jeep Liberty

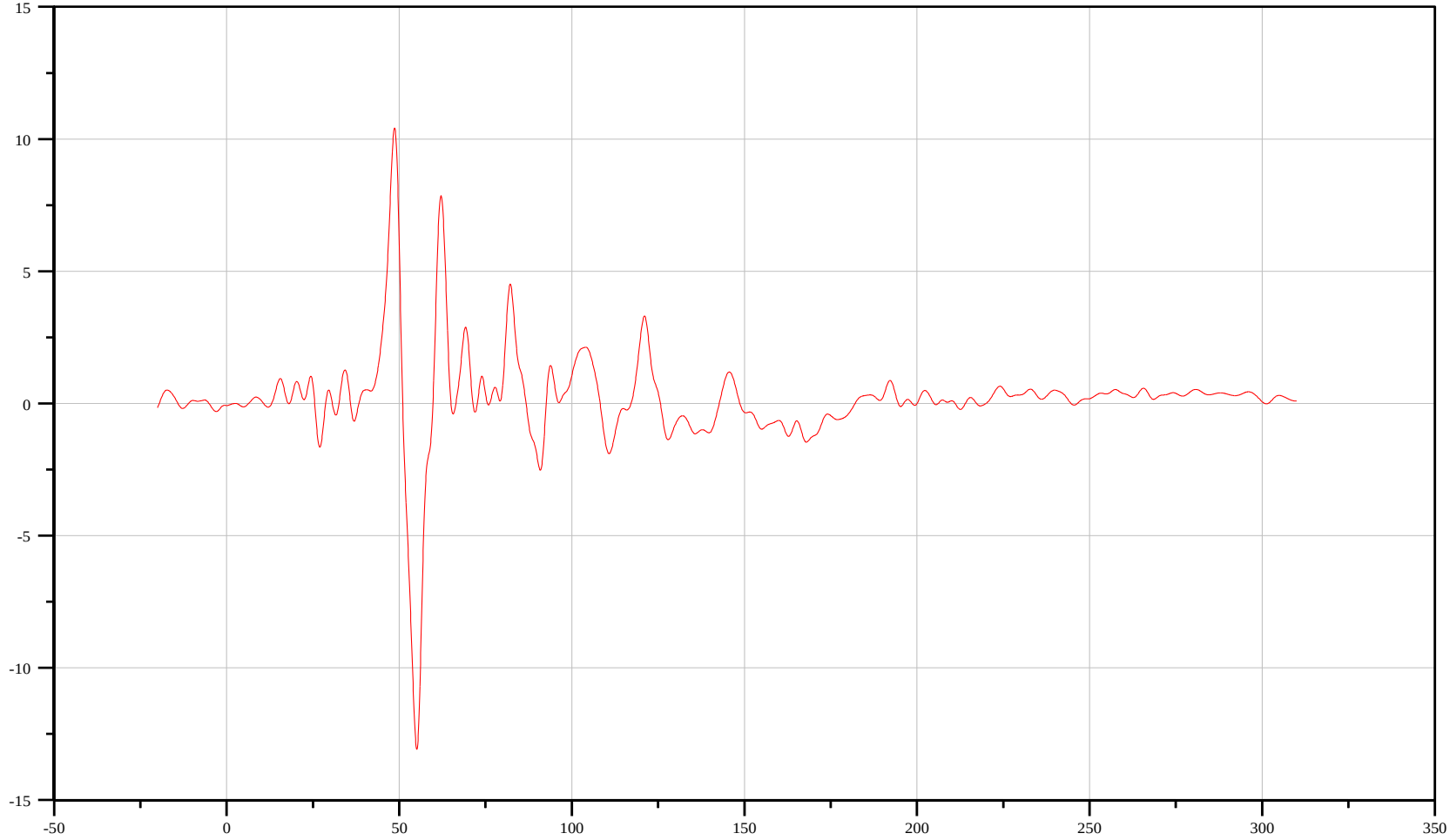
Bullet Vehicle CG Y-axis Acceleration

Date: 10/24/2013
Time: 12:01

Customer: VRTC

10VEHCCG0000ACYD

TRC Inc. Test Lab: CTF
Test Number: 131024



Filter: CFC_60

Min. Value
-13.08 g at 55.12 ms

Max. Value
10.42 g at 48.64 ms

1997 Neon Into Rear of 2004 Jeep Liberty

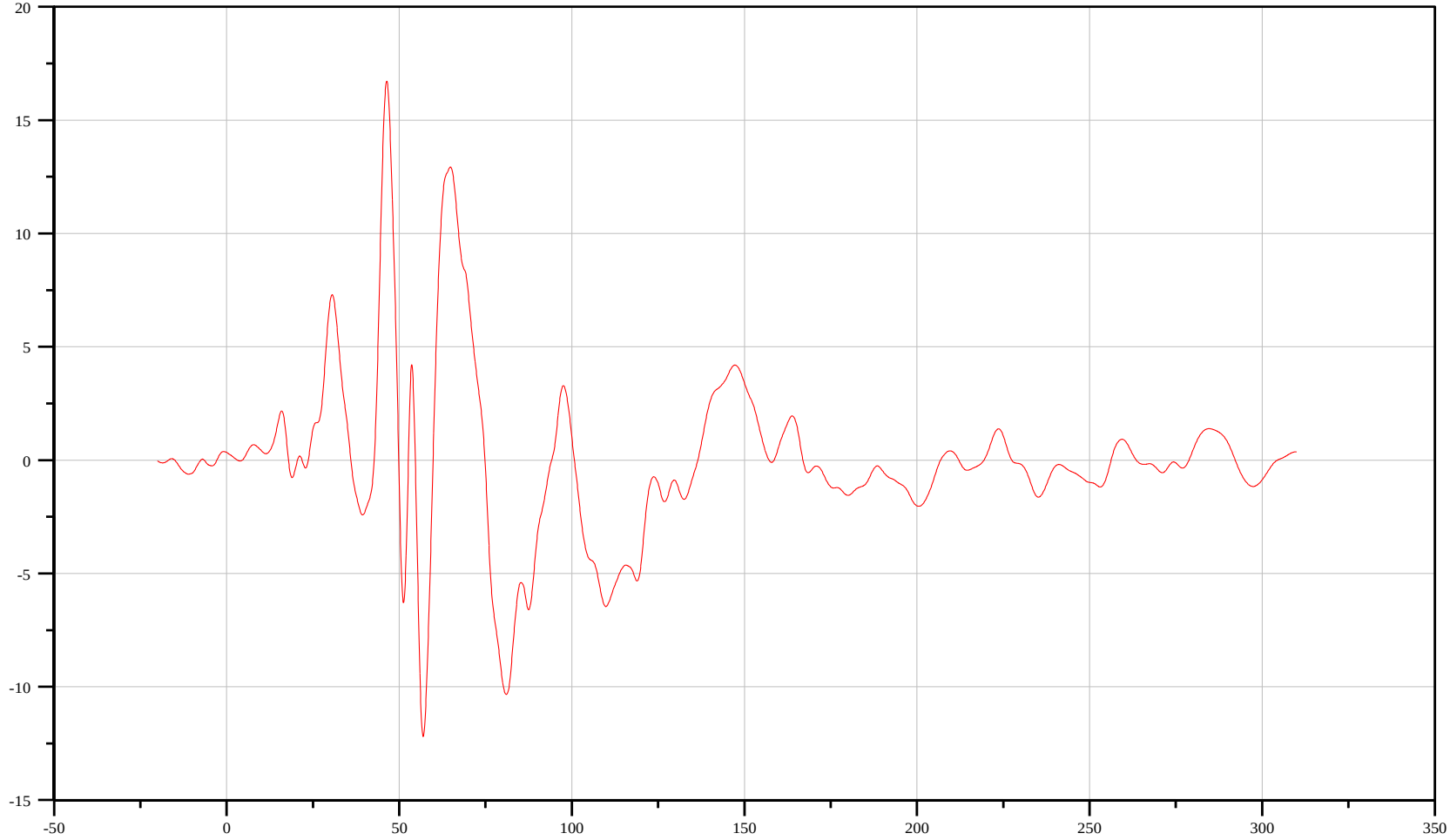
Bullet Vehicle CG Z-axis Acceleration

Date: 10/24/2013
Time: 12:01

Customer: VRTC

10VEHCCG0000ACZD

TRC Inc. Test Lab: CTF
Test Number: 131024



Filter: CFC_60

Min. Value
-12.19 g at 56.96 ms

Max. Value
16.73 g at 46.40 ms

1997 Neon Into Rear of 2004 Jeep Liberty

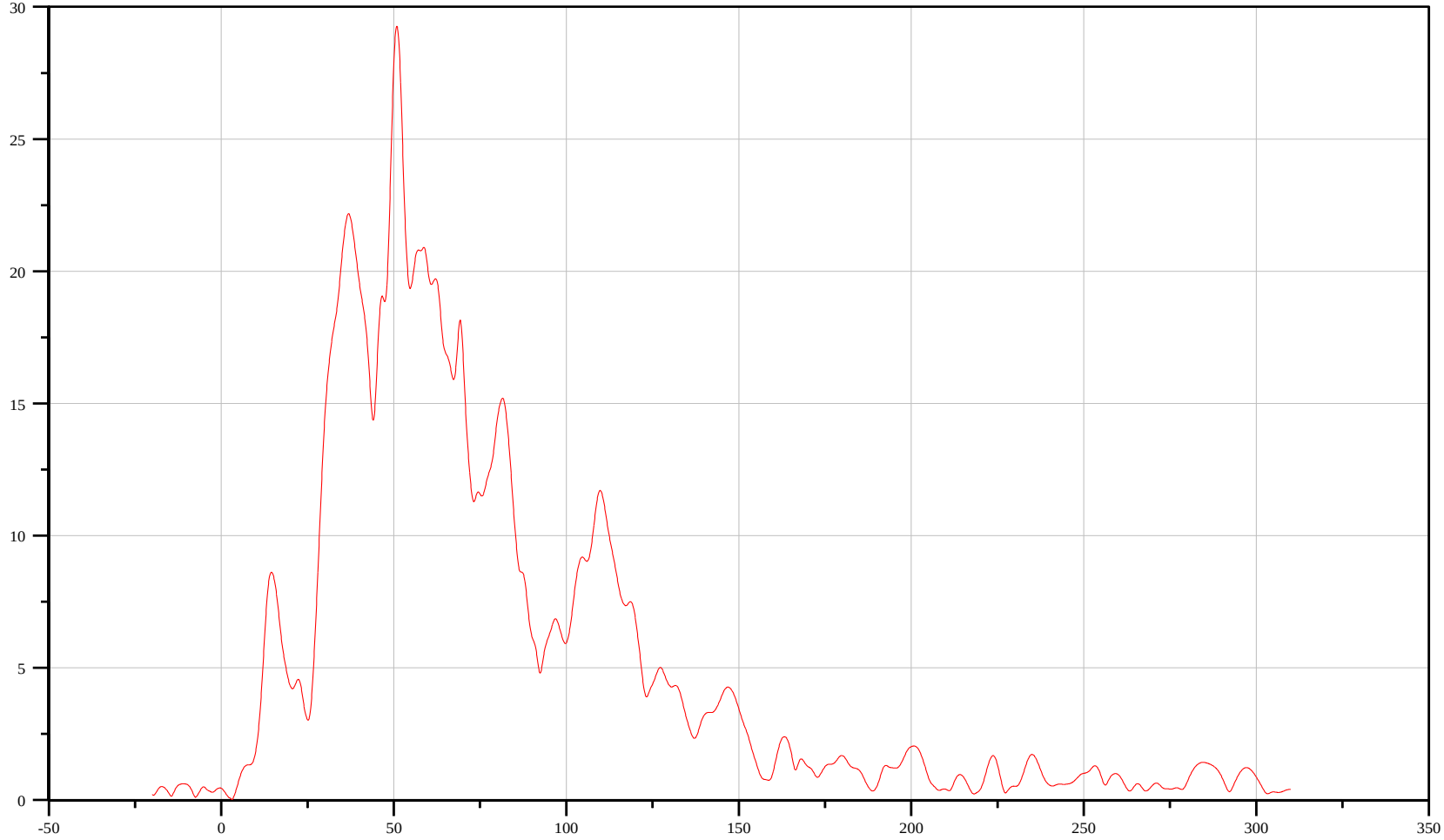
Bullet Vehicle CG Acceleration Resultant

Date: 10/24/2013
Time: 12:01

Customer: VRTC

10VEHCCG0000ACRD

TRC Inc. Test Lab: CTF
Test Number: 131024



Filter: CFC_60

Min. Value
0.02 g at 3.12 ms

Max. Value
29.27 g at 50.88 ms

1997 Neon Into Rear of 2004 Jeep Liberty

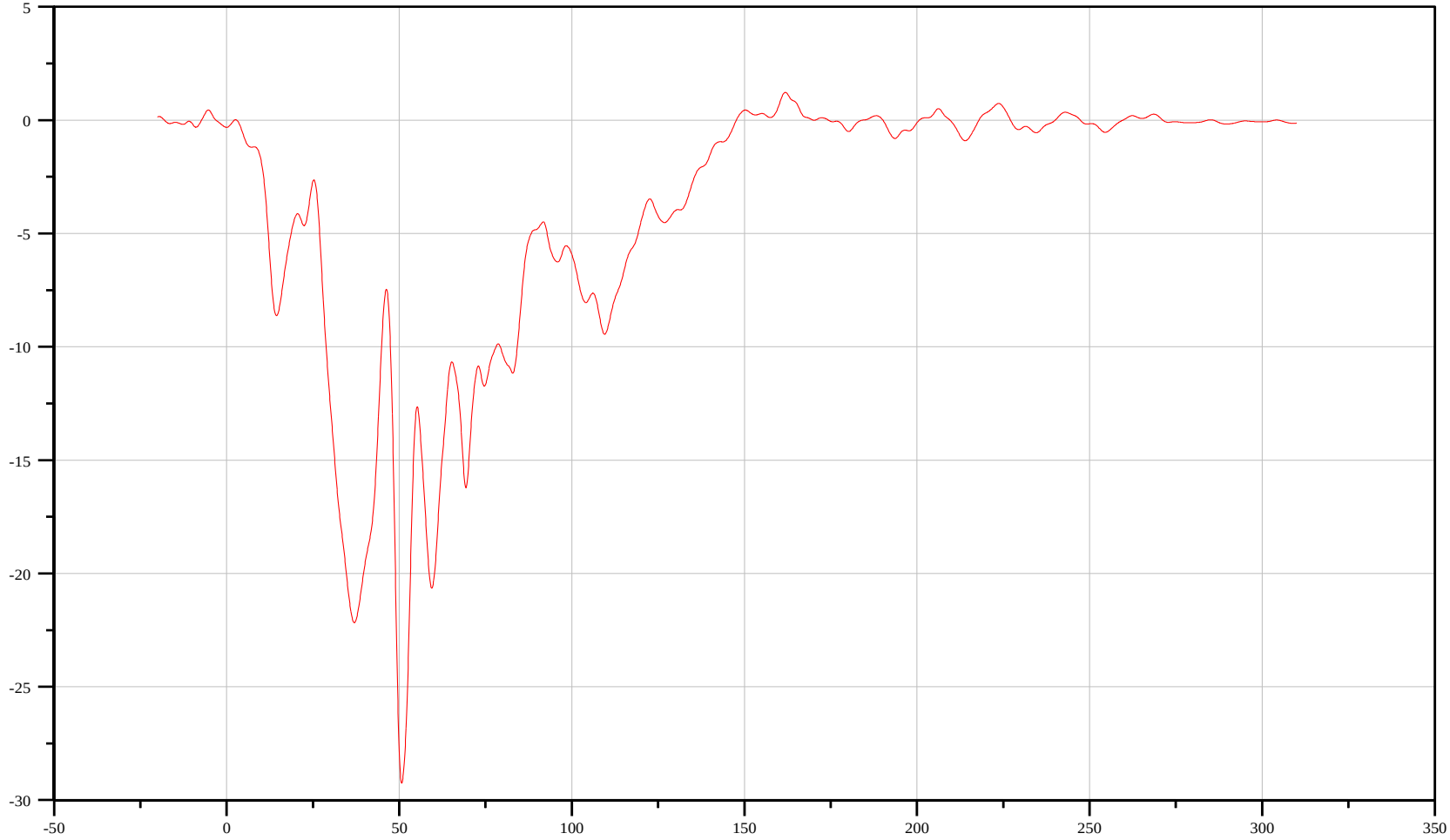
Bullet Vehicle CG Redundant X-axis Acceleration

Date: 10/24/2013
Time: 12:01

Customer: VRTC

10VEHCCGRD00ACXD

TRC Inc. Test Lab: CTF
Test Number: 131024



Filter: CFC_60

Min. Value
-29.25 g at 50.72 ms

Max. Value
1.22 g at 161.84 ms

1997 Neon Into Rear of 2004 Jeep Liberty

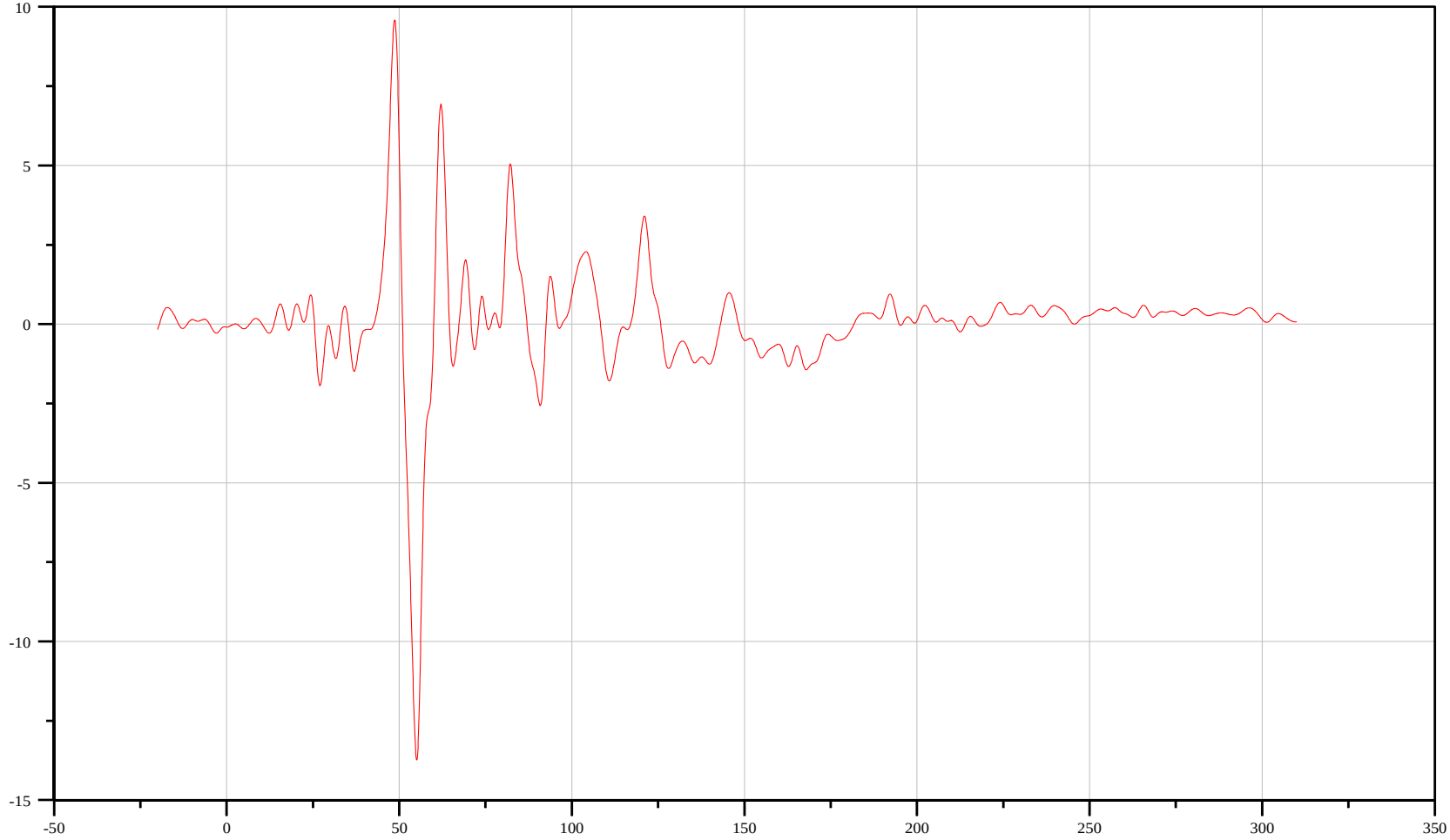
Bullet Vehicle CG Redundant Y-axis Acceleration

Date: 10/24/2013
Time: 12:01

Customer: VRTC

10VEHCCGRD00ACYD

TRC Inc. Test Lab: CTF
Test Number: 131024



Filter: CFC_60

Min. Value
-13.74 g at 55.12 ms

Max. Value
9.59 g at 48.72 ms

1997 Neon Into Rear of 2004 Jeep Liberty

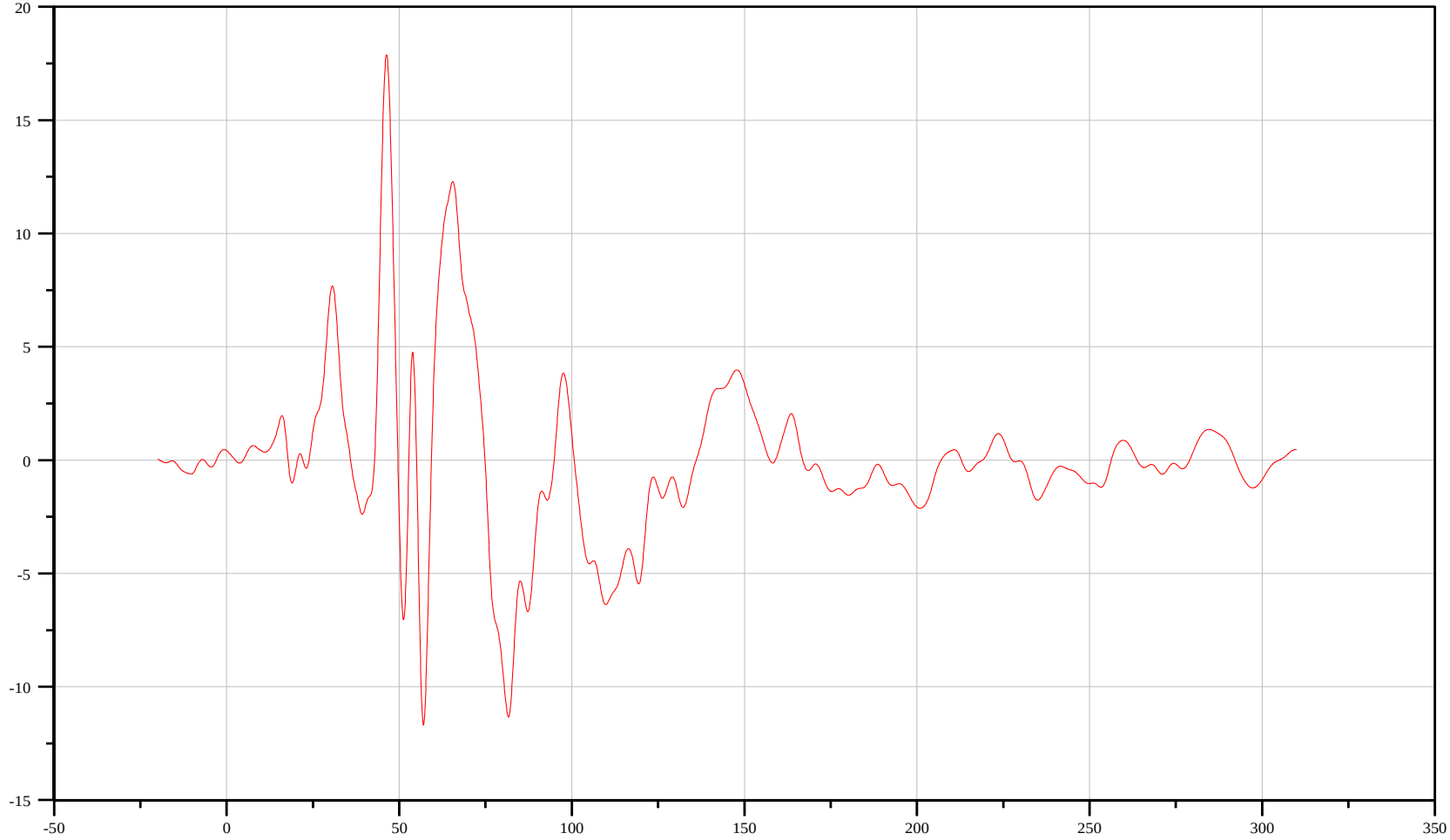
Bullet Vehicle CG Redundant Z-axis Acceleration

Date: 10/24/2013
Time: 12:01

Customer: VRTC

10VEHCCGRD00ACZD

TRC Inc. Test Lab: CTF
Test Number: 131024



Filter: CFC_60

Min. Value
-11.69 g at 57.04 ms

Max. Value
17.89 g at 46.32 ms

1997 Neon Into Rear of 2004 Jeep Liberty

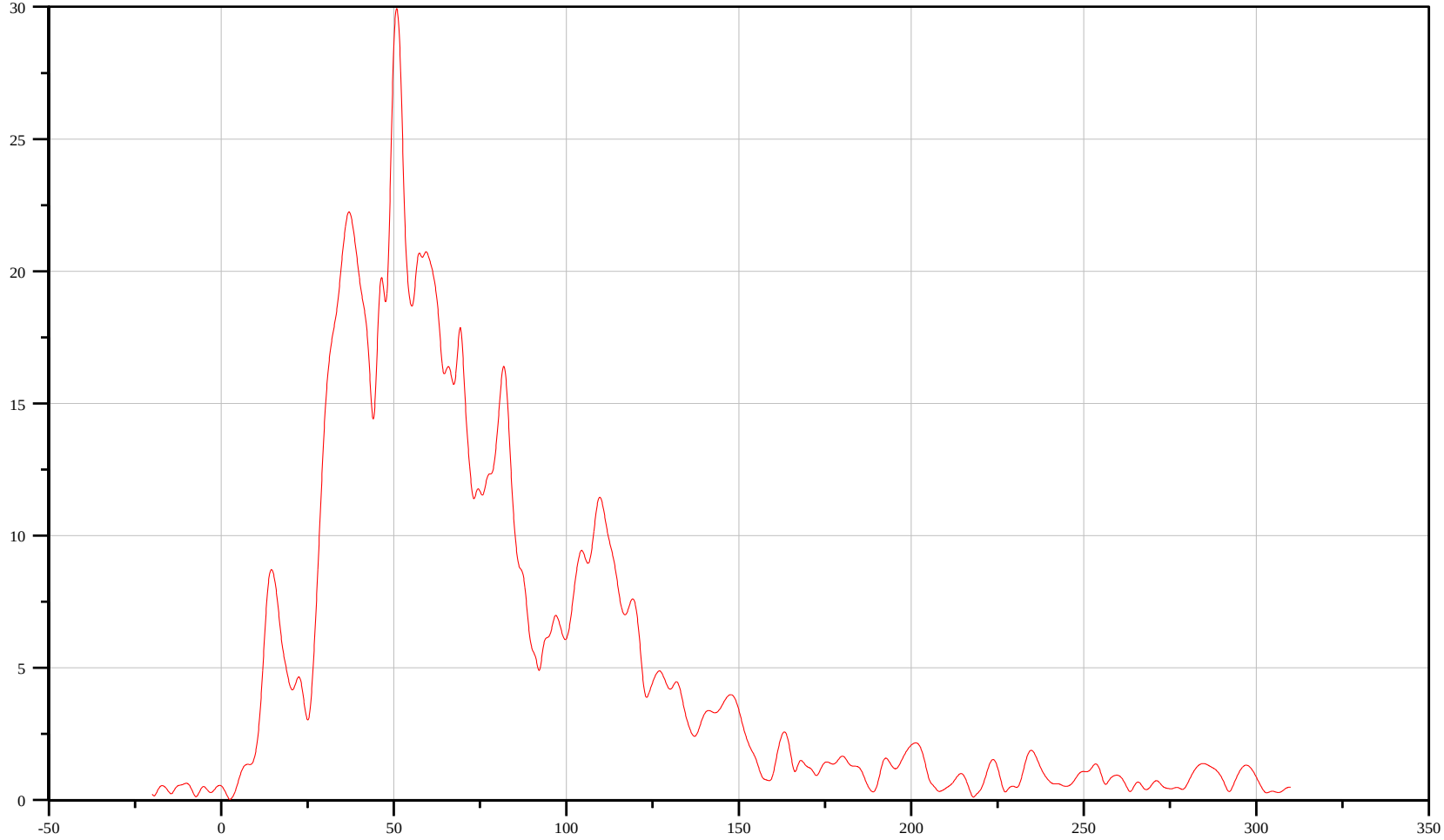
Bullet Vehicle CG Redundant Acceleration Resultant

Date: 10/24/2013
Time: 12:01

Customer: VRTC

10VEHCCGRD00ACRD

TRC Inc. Test Lab: CTF
Test Number: 131024



Filter: CFC_60

Min. Value
0.02 g at 2.48 ms

Max. Value
29.93 g at 50.88 ms

1997 Neon Into Rear of 2004 Jeep Liberty

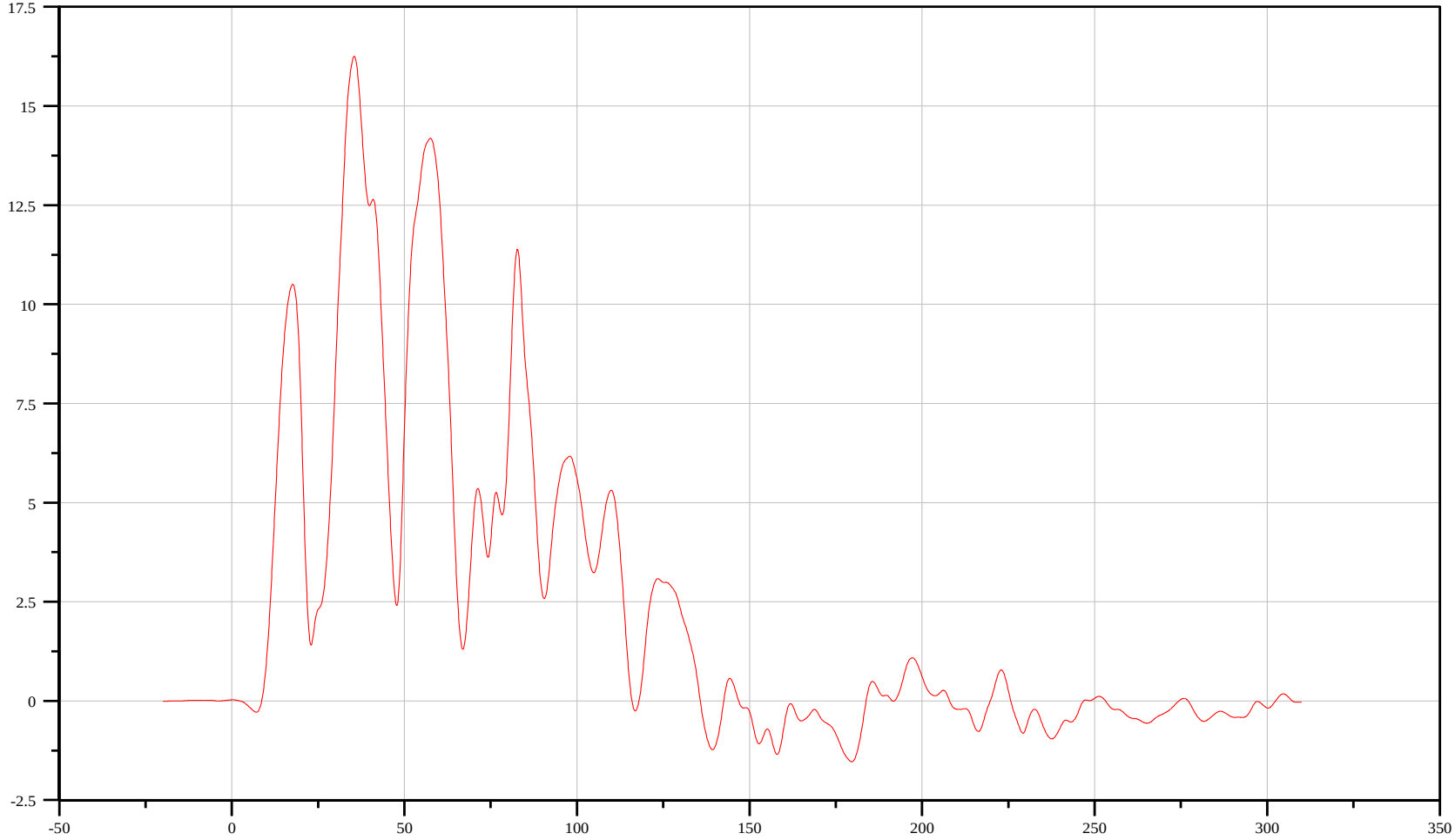
Target Vehicle CG X-axis Acceleration

Date: 10/24/2013
Time: 12:01

Customer: VRTC

20VEHCCG0000ACXD

TRC Inc. Test Lab: CTF
Test Number: 131024



Filter: CFC_60

Min. Value
-1.53 g at 179.60 ms

Max. Value
16.25 g at 35.44 ms

1997 Neon Into Rear of 2004 Jeep Liberty

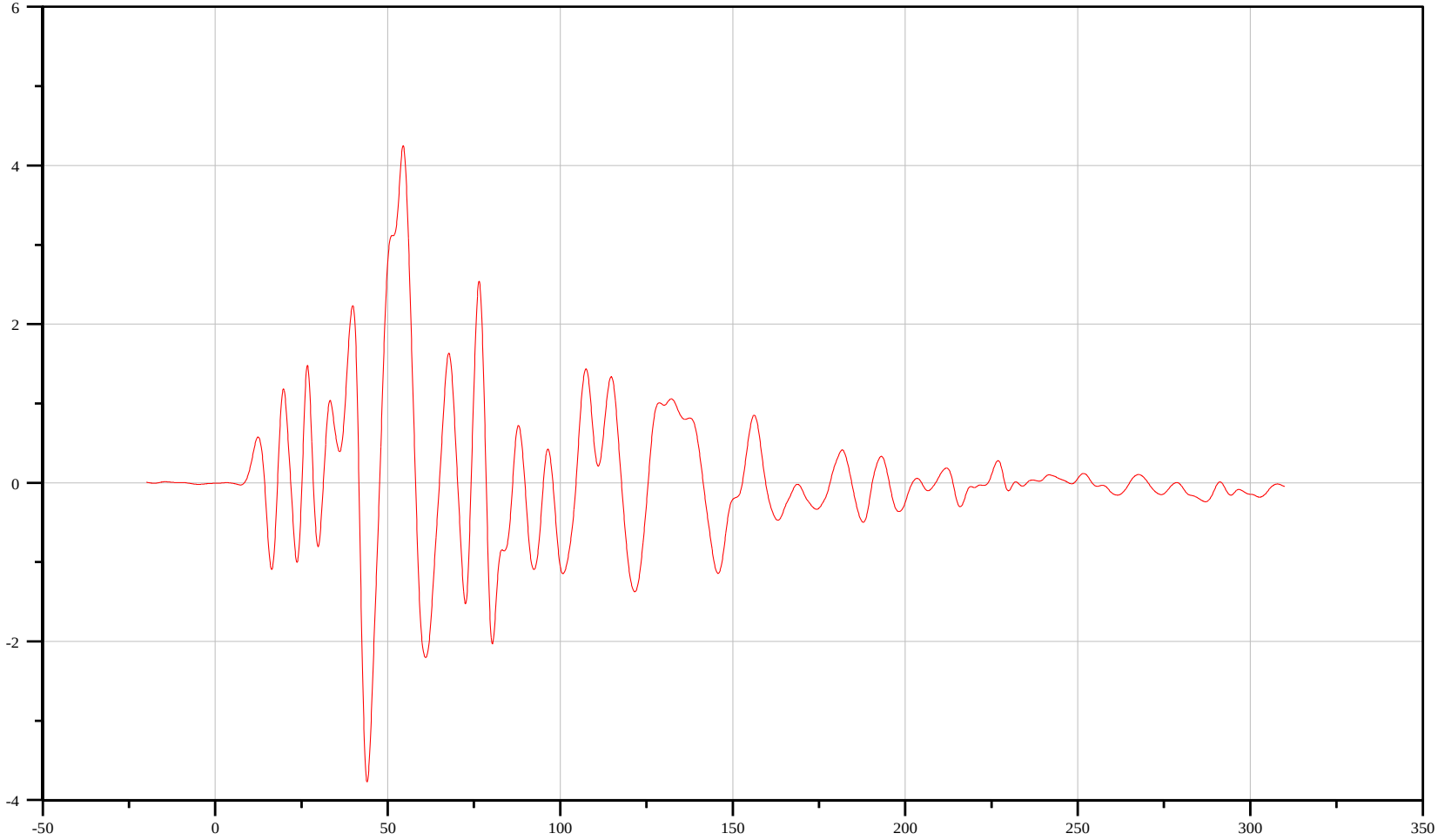
Target Vehicle CG Y-axis Acceleration

Date: 10/24/2013
Time: 12:01

Customer: VRTC

20VEHCCG0000ACYD

TRC Inc. Test Lab: CTF
Test Number: 131024



Filter: CFC_60

Min. Value
-3.77 g at 44.00 ms

Max. Value
4.25 g at 54.48 ms

1997 Neon Into Rear of 2004 Jeep Liberty

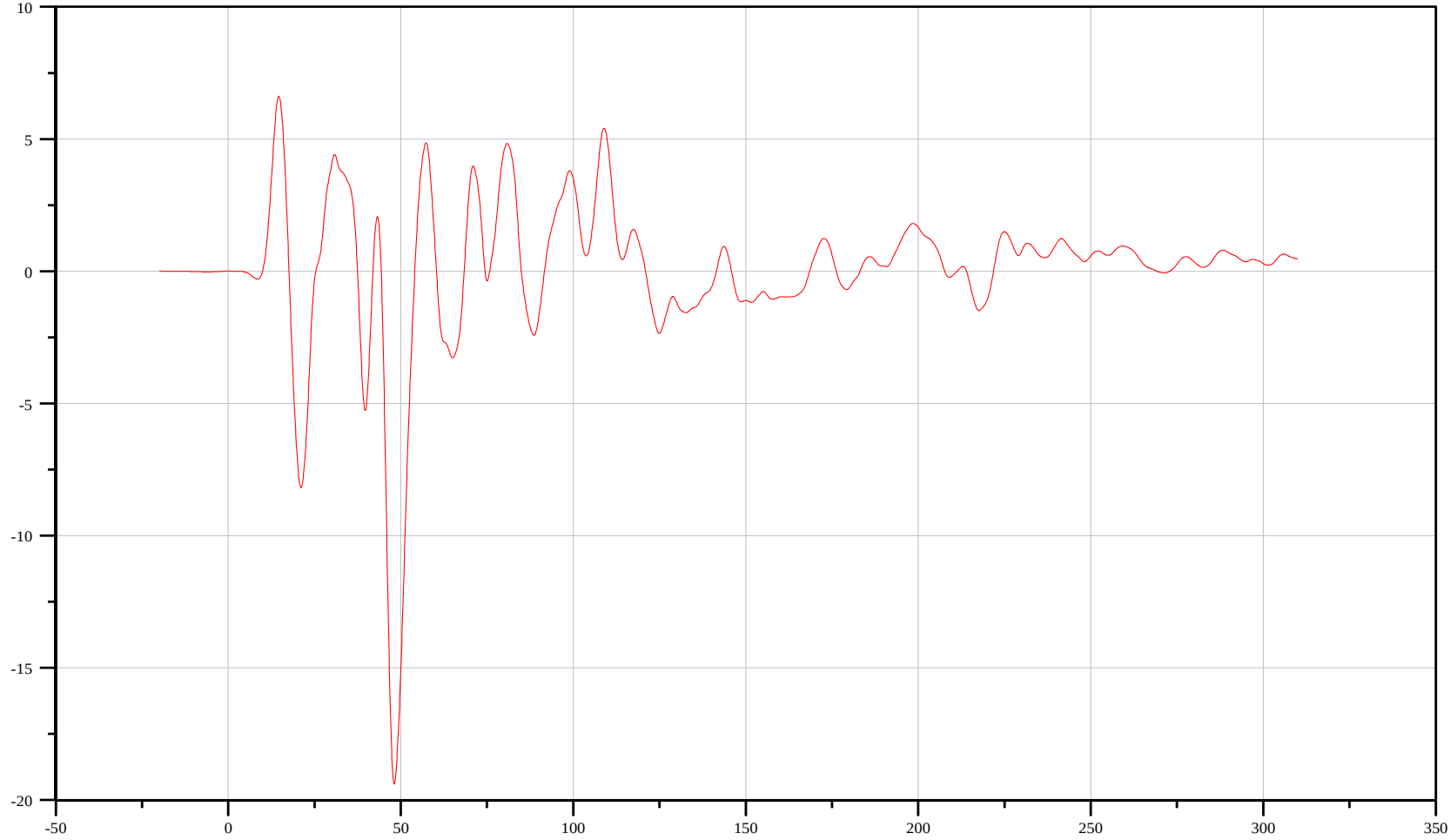
Target Vehicle CG Z-axis Acceleration

Date: 10/24/2013
Time: 12:01

Customer: VRTC

20VEHCCG0000ACZD

TRC Inc. Test Lab: CTF
Test Number: 131024



Filter: CFC_60

Min. Value
-19.40 g at 48.16 ms

Max. Value
6.62 g at 14.64 ms

1997 Neon Into Rear of 2004 Jeep Liberty

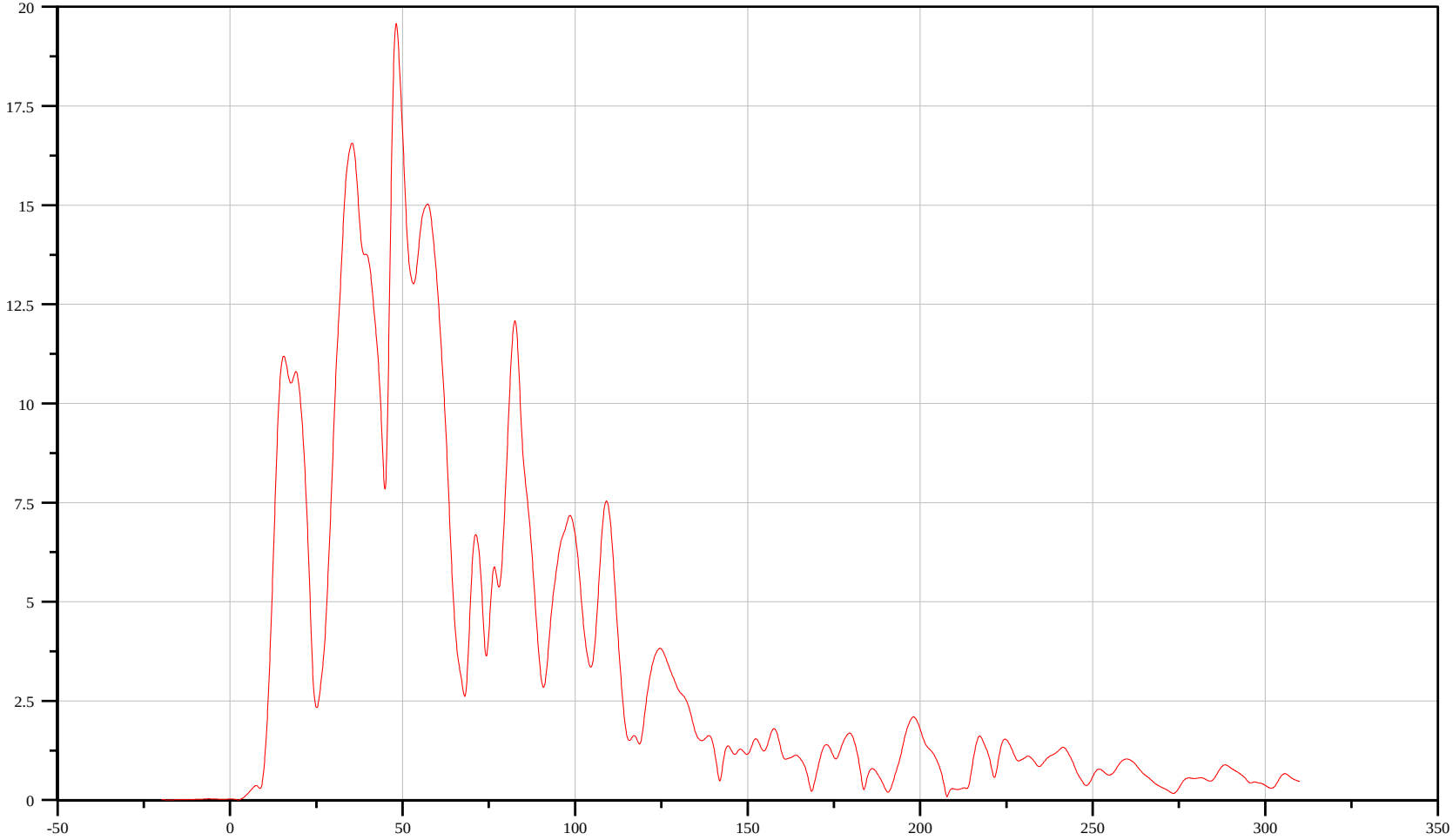
Target Vehicle CG Acceleration Resultant

Date: 10/24/2013
Time: 12:01

Customer: VRTC

20VEHCCG0000ACRD

TRC Inc. Test Lab: CTF
Test Number: 131024



Filter: CFC_60

Min. Value
0.00 g at 2.40 ms

Max. Value
19.58 g at 48.16 ms

1997 Neon Into Rear of 2004 Jeep Liberty

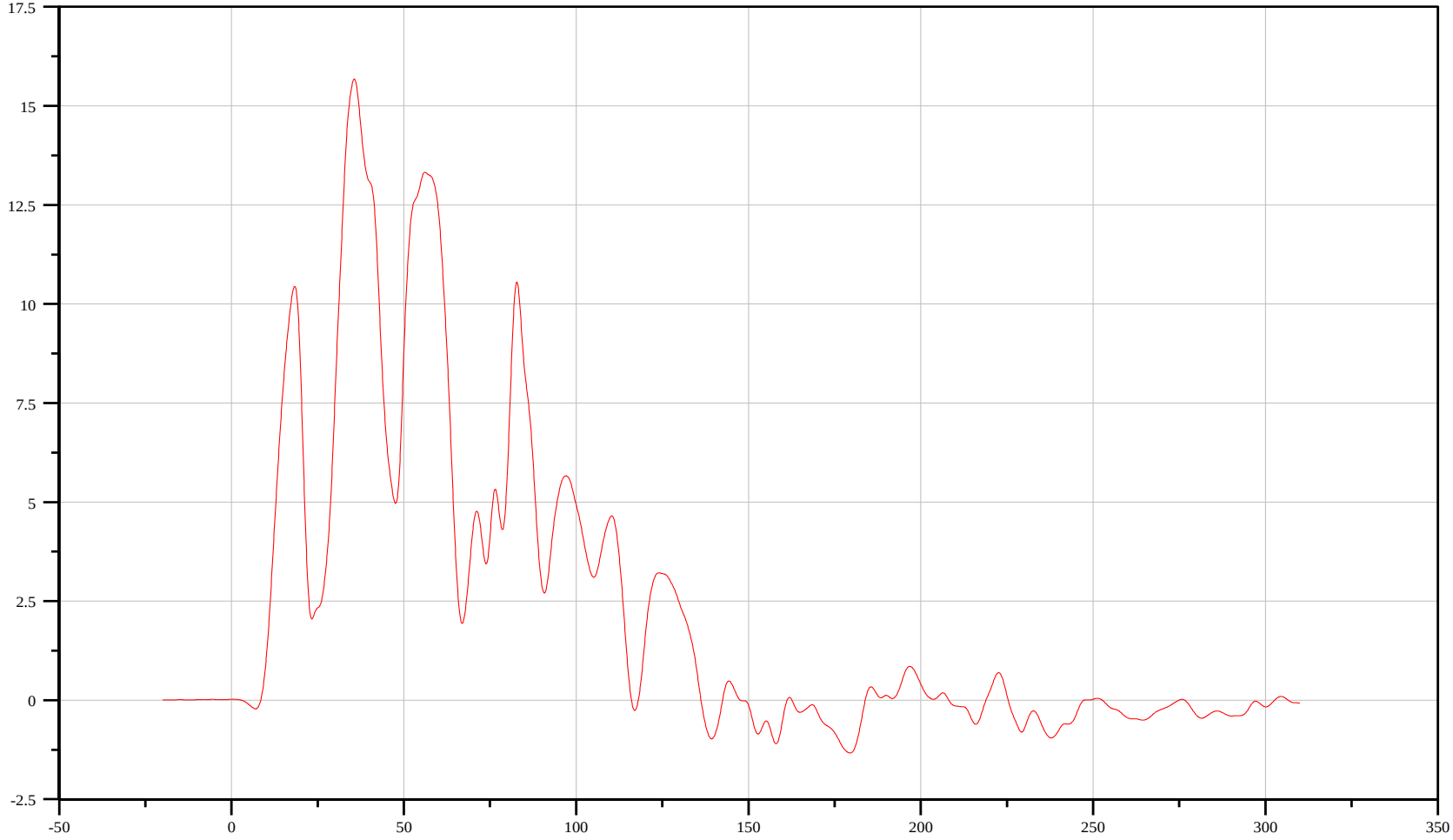
Target Vehicle CG Redundant X-axis Acceleration

Date: 10/24/2013
Time: 12:01

Customer: VRTC

20VEHCCGRD00ACXD

TRC Inc. Test Lab: CTF
Test Number: 131024



Filter: CFC_60

Min. Value
-1.33 g at 179.52 ms

Max. Value
15.68 g at 35.60 ms

1997 Neon Into Rear of 2004 Jeep Liberty

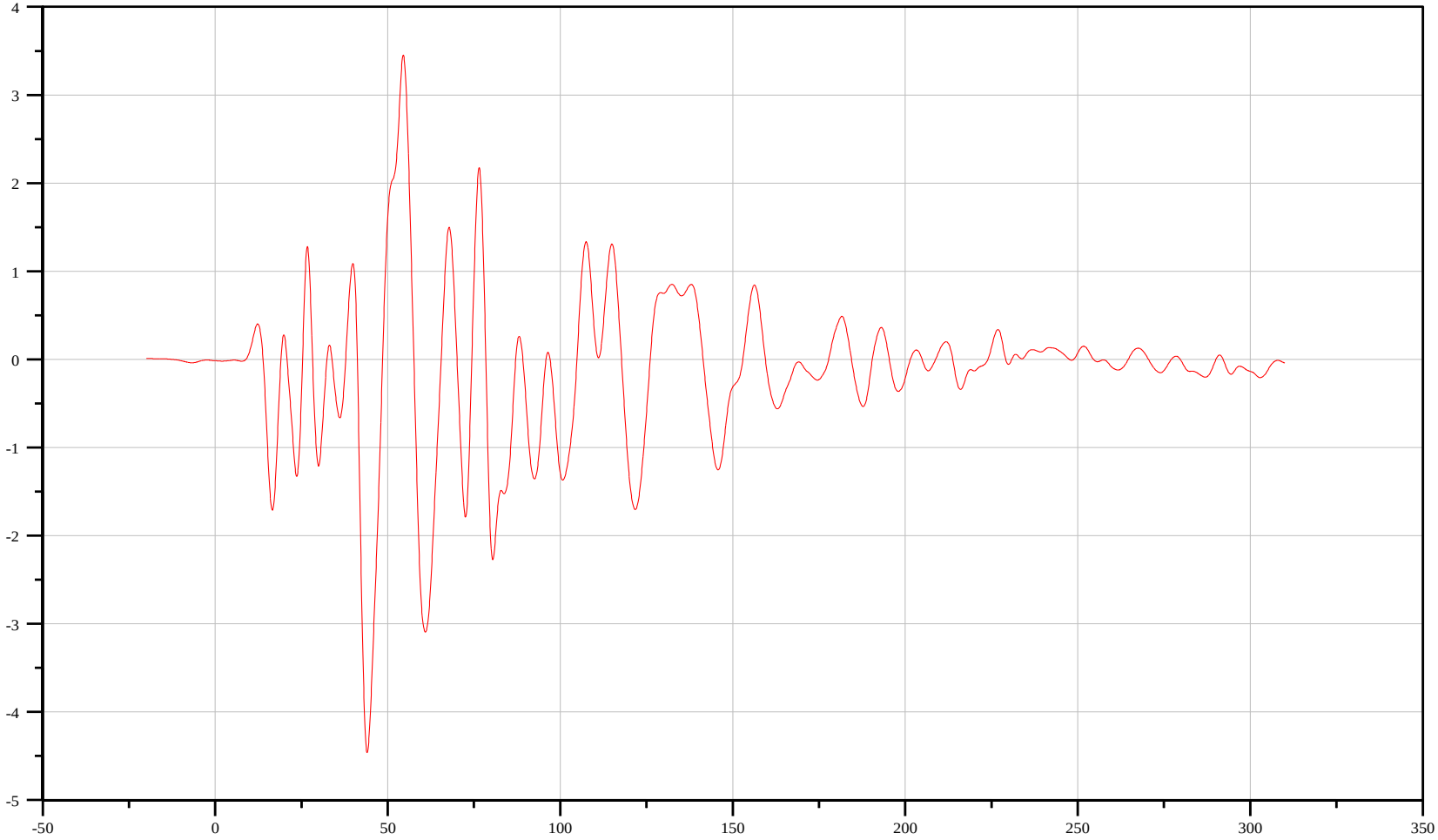
Target Vehicle CG Redundant Y-axis Acceleration

Date: 10/24/2013
Time: 12:01

Customer: VRTC

20VEHCCGRD00ACYD

TRC Inc. Test Lab: CTF
Test Number: 131024



Filter: CFC_60

Min. Value
-4.46 g at 44.00 ms

Max. Value
3.45 g at 54.48 ms

1997 Neon Into Rear of 2004 Jeep Liberty

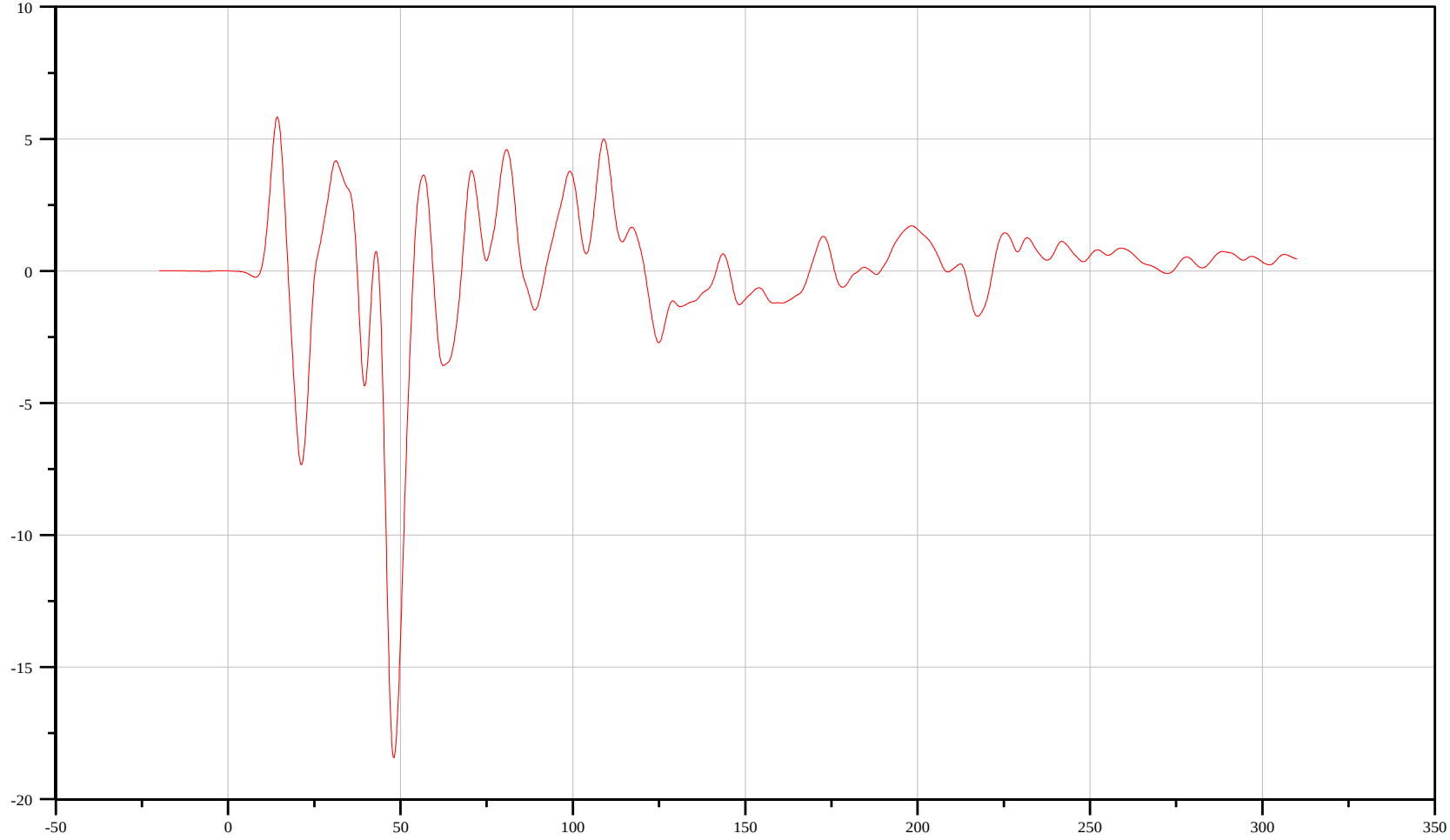
Target Vehicle CG Redundant Z-axis Acceleration

Date: 10/24/2013
Time: 12:01

Customer: VRTC

20VEHCCGRD00ACZD

TRC Inc. Test Lab: CTF
Test Number: 131024



Filter: CFC_60

Min. Value
-18.43 g at 48.08 ms

Max. Value
5.83 g at 14.24 ms

1997 Neon Into Rear of 2004 Jeep Liberty

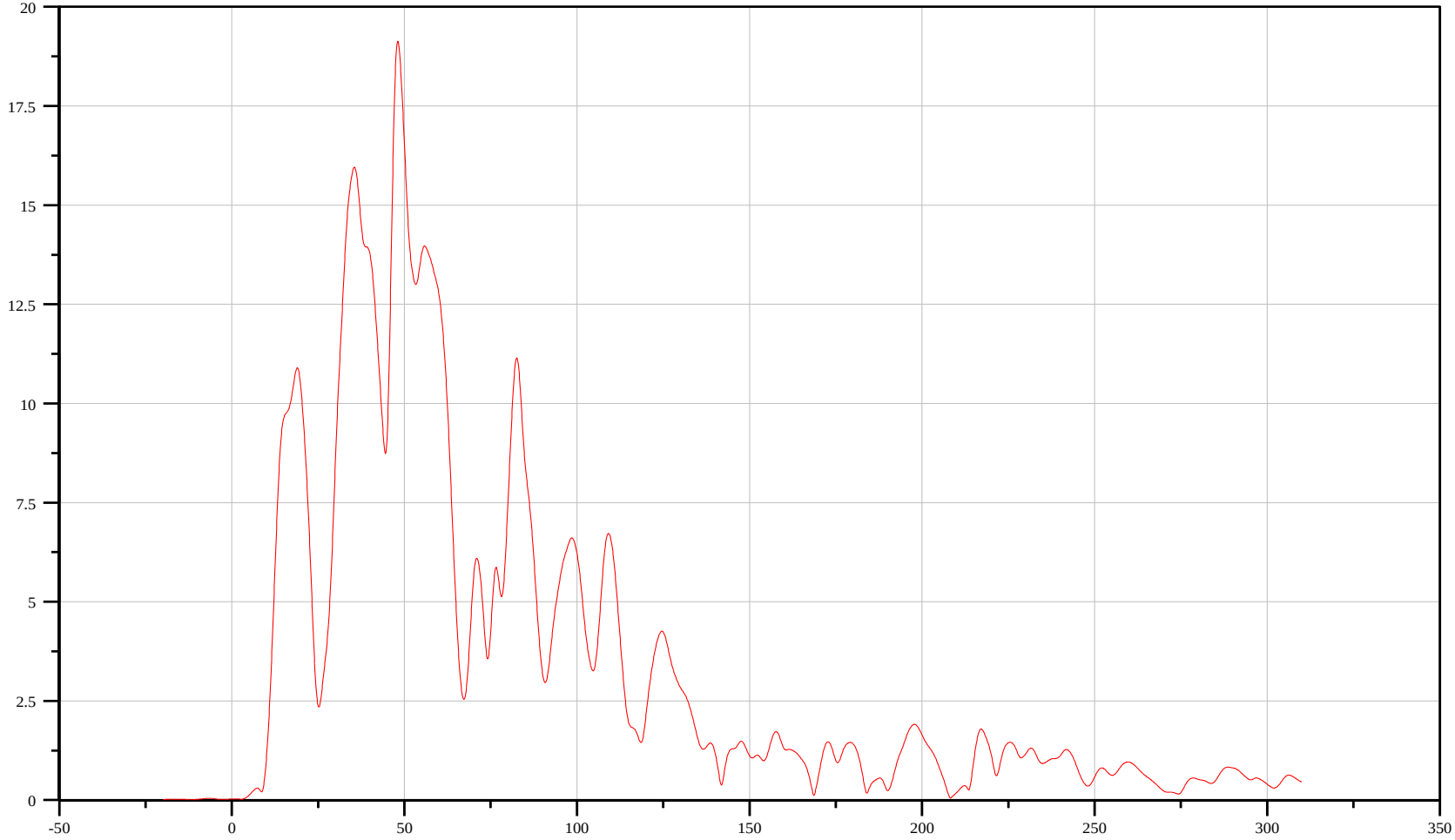
Target Vehicle CG Redundant Acceleration Resultant

Date: 10/24/2013
Time: 12:01

Customer: VRTC

20VEHCCGRD00ACRD

TRC Inc. Test Lab: CTF
Test Number: 131024



Filter: CFC_60

Min. Value
0.01 g at -11.92 ms

Max. Value
19.13 g at 48.08 ms