



**LABORATORY TEST REPORT**  
**FOR “ROOF CRUSH RESISTANCE” DROP TESTING**

1986 Ford Econoline E150

Test No.  
SAFE001220-01

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## 1. INTRODUCTION

An inverted drop test was performed on a modified 1986 Ford Econoline E-150 extended cargo van, manufactured by Ford Motor Corporation, to assess the structural stiffness of the roof components and to determine the extent of occupant compartment intrusion when this roof is structurally reinforced.

This report organized in sections containing pertinent test information and data tables as follows:

Section 2	-	Summary of Results
Section 3	-	Test Procedure
Section 4	-	Data Tables
Appendix A	-	Photographs
Appendix B	-	Data Plots
Appendix C	-	Roof Crush Profiles

## 2. SUMMARY OF RESULTS

The test vehicle was dropped while inverted from 17 inches above the ground with a calculated impact speed of approximately 6.5 mph. The peak resultant acceleration as measured at the vehicle floor between the two front seats was 7.0 g's. The maximum static deformation occurred at the front header measuring 5.8" inward and 0" downward for resultant intrusion of 5.8". Structural failures were observed at the top and bottom of the A-pillars on both sides of the vehicle. Minor parallelogramming occurred along the entire length of the vehicle with driver's side deforming inward and the passenger's side deforming outward.

### 3. TEST PROCEDURES

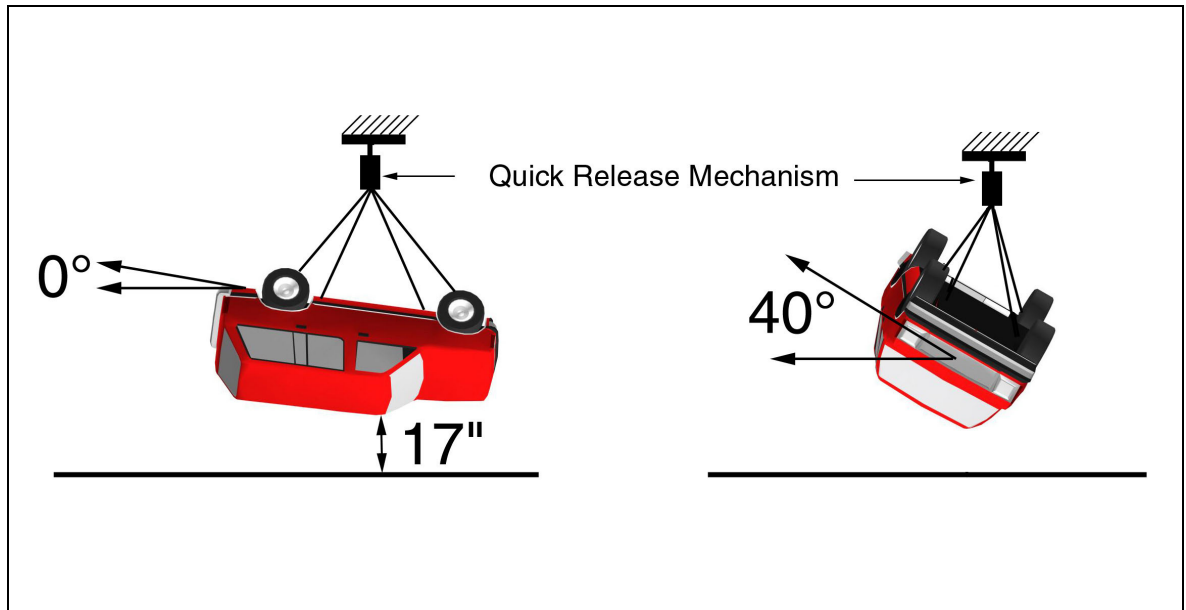
The 1986 Ford Econoline E150 cargo van was subjected to roof drop testing on December 20, 2000. Photographs of the vehicle and test setup are shown in Appendix A. The test procedure is comprised of the following steps:

- 1) Test Vehicle inspection
- 2) Test vehicle preparation and pre-test measurements
- 3) Instrumentation and photography preparation
- 4) Preparation and positioning in test fixture
- 5) Test is conducted
- 6) Post test measurements and data processing

Significant aspects of the test procedure are described in the following paragraph.

The test specimen was inspected for defects. The specimen was positioned and secured to the test fixture with a height of the roof at the 'A' pillar positioned 17 inches above the test surface. The pitch angle was zero degrees ( $0^\circ$ ) and the roll angle was forty degrees ( $40^\circ$ ) as shown on figures 5,6, and 7 of Appendix A. In addition, 1265 lbs. of sandbag ballast was placed on the underside of the vehicle.

#### Drop Test Configuration Diagram



4. DATA TABLES

DATA SHEET NO. 1  
VEHICLE INFORMATION

Test Vehicle General Information:

Date received	<b>7/27/00</b>	Odometer	<b>52497 mi</b>
Make	<b>Ford</b>	Model Year	<b>1986</b>
Model	<b>E-150</b>	Body Style	<b>cargo van</b>
Color	<b>White</b>		

Data from Manufacturer's certification label:

Manufactured by	<b>FORD MOTOR COMPANY</b>	GVWR	<b>6400lb.</b>
Mfr, Date	<b>1/86</b>	GAWR Front	<b>3150 lb.</b>
VIN	<b>IFTEE14N6GHB20786</b>	GAWR Rear	<b>3750 lb.</b>

Data from tire placard label:

Front Tire Pressure		Cargo Capacity	
Rear Tire Pressure		# Occupants, Front Seat	
Recommended Tire Size	<b>235/75/15</b>	# Occupants, Rear Seat	
Size of Tires on Vehicle	<b>235/75/15</b>	# Occupants, Third Seat	
Tire Manufacturer	<b>Uniroyal</b>	Total # of Occupants	

Engine and drive train data:

Engine Information		Transmission Information	
Cylinders	<b>8</b>	Type	<b>Automatic</b>
Fuel type	<b>Gasoline</b>	Forward Speeds	<b>4</b>
Displacement	<b>5.0L</b>	Final Drive	
Placement		Overdrive	<b>Yes</b>
Performance Equip.	<b>None</b>	Four Wheel Drive	<b>No</b>

VEHICLE WEIGHTS

Left Front	<b>- lb.</b>	Left Rear	<b>- lb.</b>
Right Front	<b>- lb.</b>	Right Rear	<b>- lb.</b>
Front Axle	<b>2406 lb.</b>	Rear Axle	<b>1977 lb.</b>
VEHICLE WEIGHT	<b>4383 lb.</b>		
+ Ballast	<b>1265 lb.</b>		
-Removed Items <sup>1</sup>	<b>-118.2 lb.</b>		
+Roof Structure Reinforcements <sup>2</sup>	<b>60.9 lb.</b>		
-Roof Structure Removed <sup>3</sup>	<b>-7.4 lb.</b>		
+Installed Front Seats	<b>51.4 lb.</b>		
TEST WEIGHT	<b>5635 lb.</b>		

<sup>1</sup> Removed Items: Fluids, battery, flooring, misc. interior trim, seat belt retractor

<sup>2</sup> Includes tubular reinforcement at B-pillar and rigid foam filling of forward cab roof structure.

<sup>3</sup> Structure removed to install reinforcements

DATA SHEET NO. 2  
STATIC ROOF DROP TEST – DRIVER SIDE

TEST VEHICLE: 1986 FORD ECONOLINE E-150      PROJECTNO: SAFE001220-01  
TEST MODE: ROOF DROP      TEST DATE: 12/20/00

PRETEST VEHICLE PREPARATION:

- A. Vehicle suspended from a drop test fixture, all windows up, doors closed and unlocked, accelerometer positioned. Drop height at impact point  
17 in.
- B. Roll angle of the test vehicle  
40°
- C. Pitch angle of test vehicle  
0°
- D. Initial contact point of roof  
**INITIAL POINT OF CONTACT ALONG PASSENGER SIDE HEADER**
- E. Contact Velocity  
**6.5 MPH**

APPENDIX A  
PHOTOGRAPHS



FIGURE 1. PRE-TEST FRONT VIEW



FIGURE 2. POST-TEST FRONT VIEW



FIGURE 3. PRE-TEST LEFT FRONT  $\frac{3}{4}$  VIEW



FIGURE 4. POST-TEST LEFT FRONT  $\frac{3}{4}$  VIEW

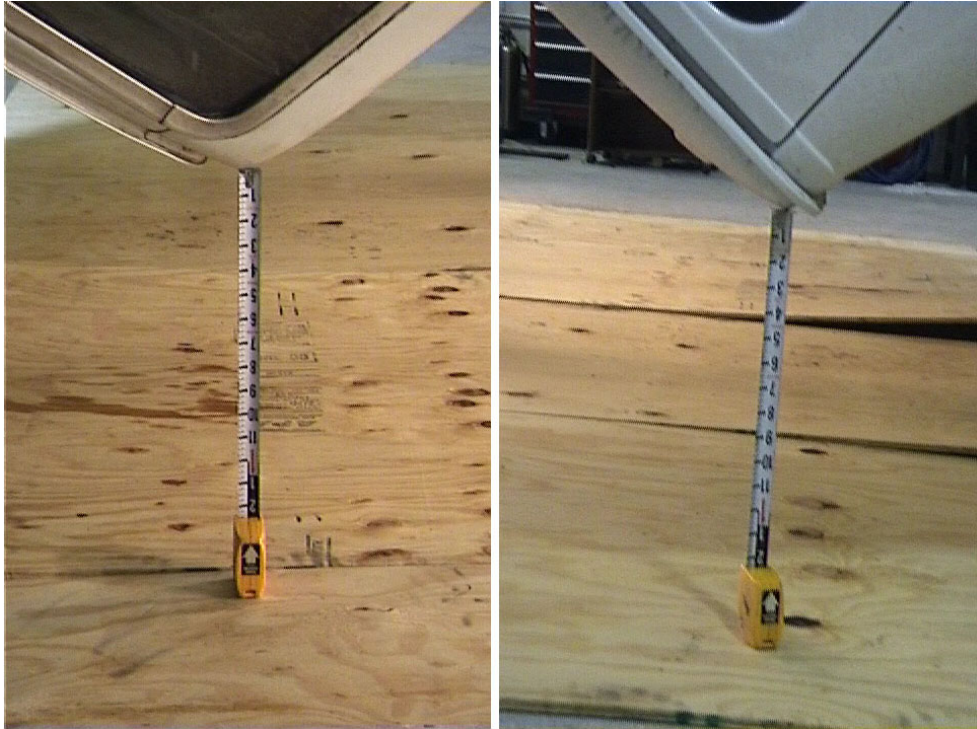


FIGURE 5. PRE-TEST HEIGHT MEASUREMENT (A and F-PILLARS, RESPECTIVELY)



FIGURE 6. PRE-TEST PITCH ANGLE MEASUREMENT

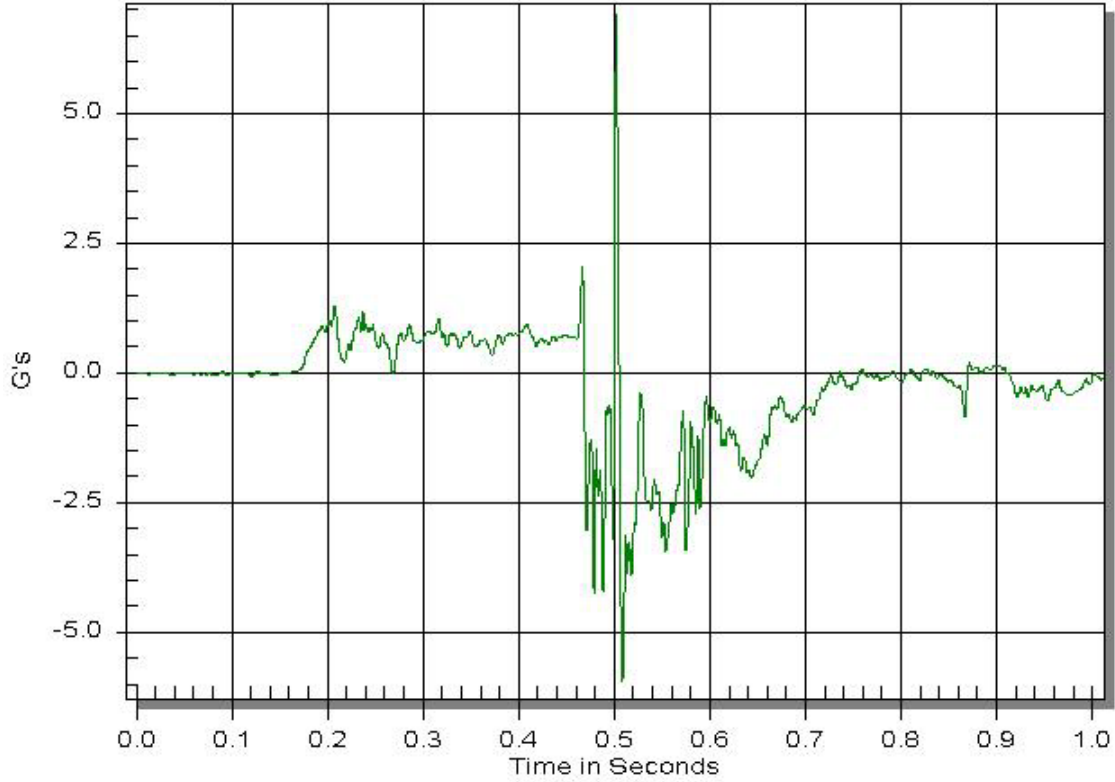


FIGURE 7. PRE-TEST ROLL ANGLE MEASUREMENT

APPENDIX B  
DATA PLOTS

### Acceleration in X-Direction

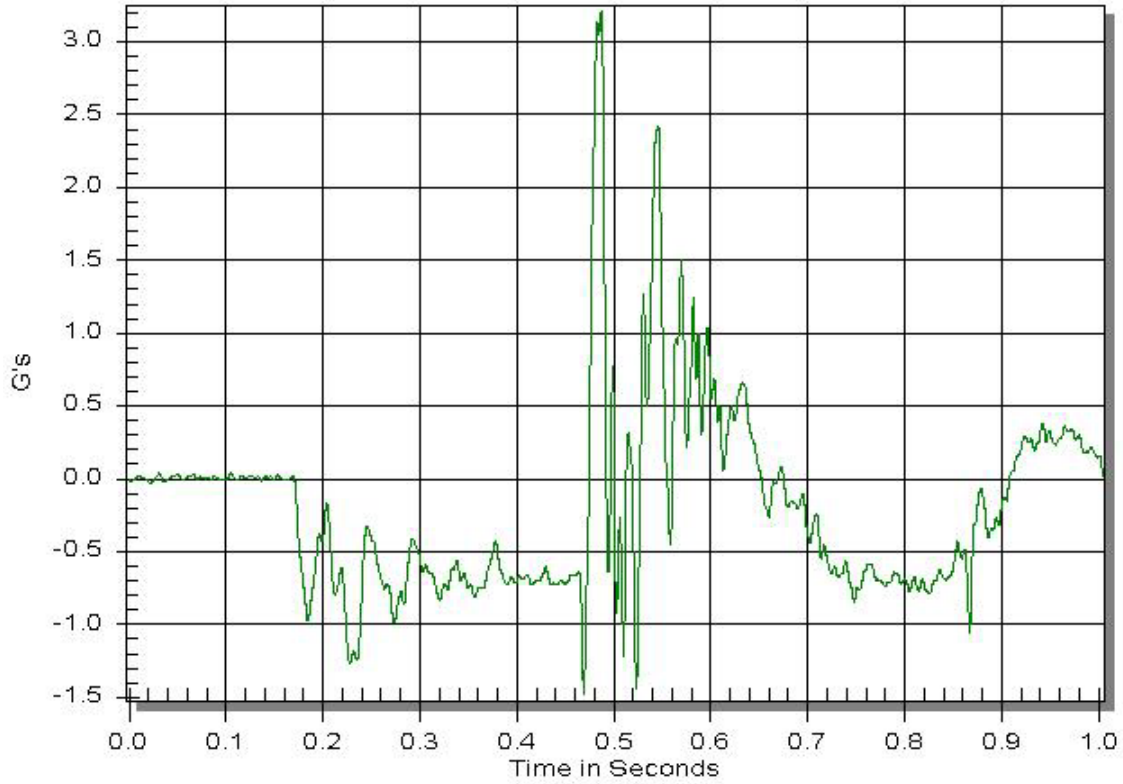
Ymin -5.968 @ 508.3, Ymax 6.911 @ 501.9



Curve Description:	<b>Accelerometer in X-direction</b>	Test Program:	<b>Modified Drop Test</b>
Maximum Value:	<b>6.911 G's</b> at <b>502 ms</b>	Test Vehicle:	<b>1986 Ford E150</b>
Minimum Value:	<b>-5.968 G's</b> at <b>508 ms</b>	Date of Test:	<b>12/20/00</b>
Filter Class:	<b>60</b>		

### Acceleration in Y-Direction

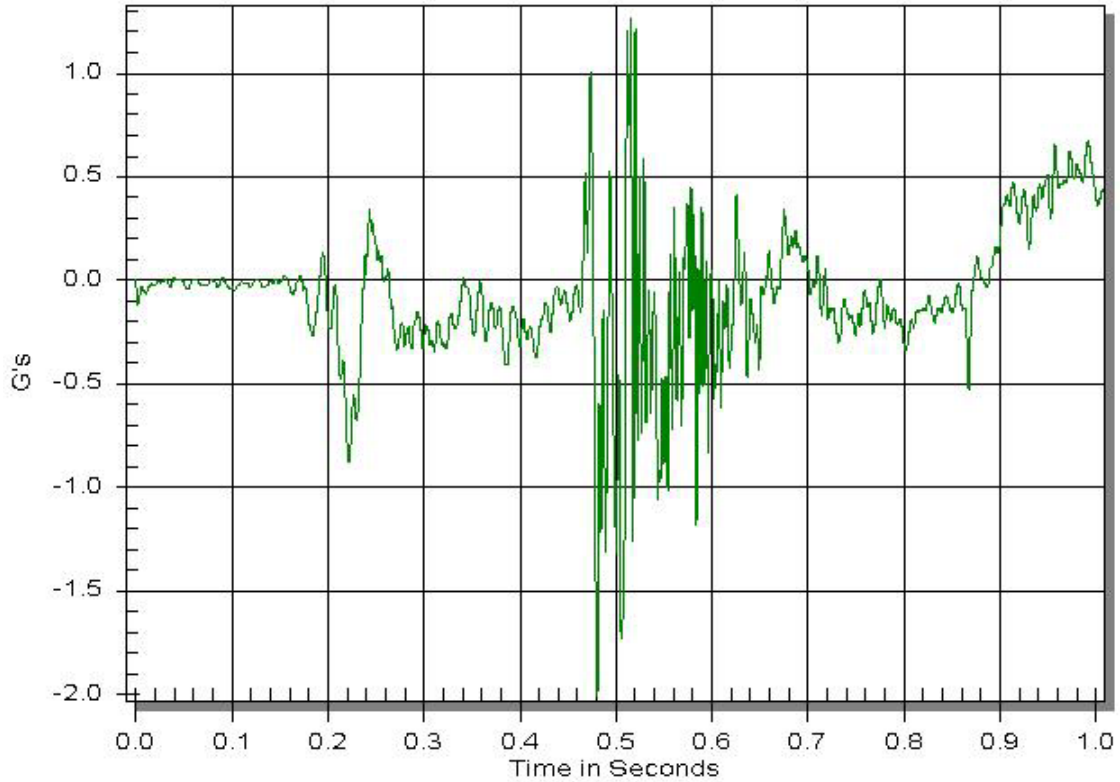
Ymin -1.475 @ 468.9, Ymax 3.686 @ 2544.9



Curve Description:	<b>Accelerometer in Y-direction</b>	Test Program:	<b>Modified Drop Test</b>
Maximum Value:	<b>3.686 G's</b> at <b>2545 ms</b>	Test Vehicle:	<b>1986 Ford E150</b>
Minimum Value:	<b>-1.475 G's</b> at <b>469 ms</b>	Date of Test:	<b>12/20/00</b>
Filter Class:	<b>60</b>		

### Acceleration in Z-Direction

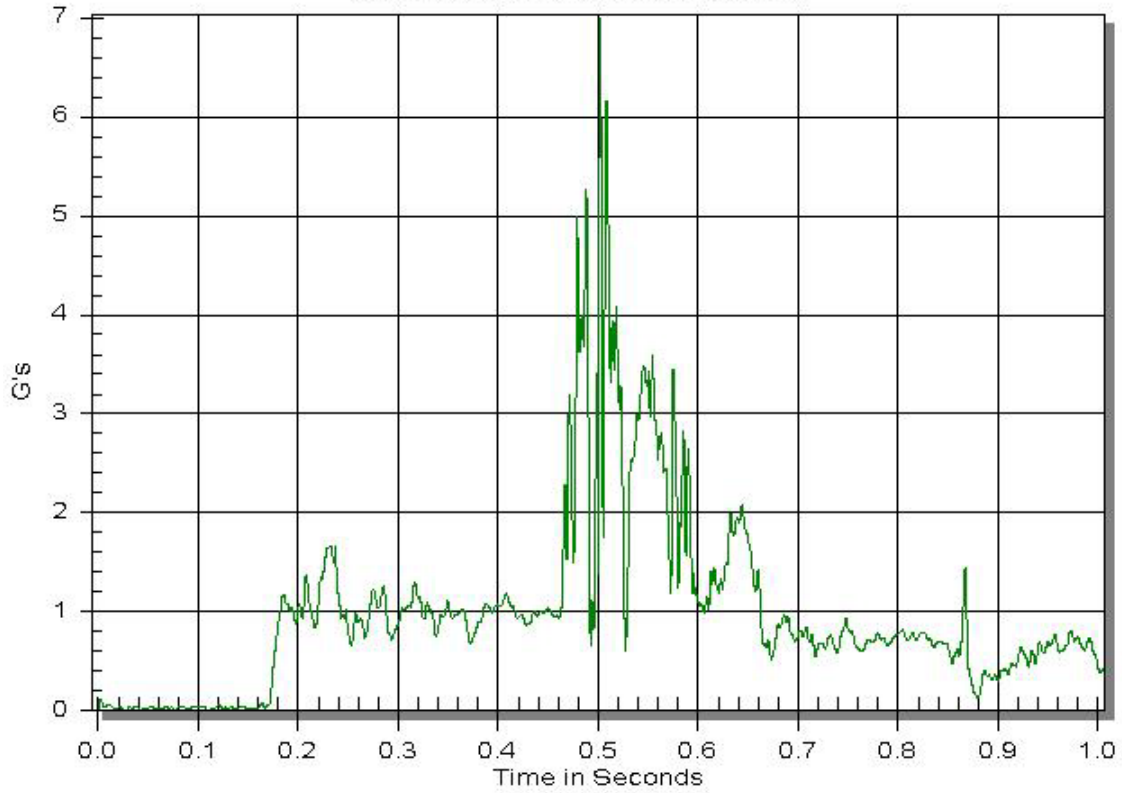
Ymin -2.003 @ 480.4, Ymax 1.270 @ 515.3



Curve Description:	<b>Accelerometer in Z-direction</b>	Test Program:	<b>Modified Drop Test</b>
Maximum Value:	<b>1.270G's</b> at <b>515 ms</b>	Test Vehicle:	<b>1986 Ford E150</b>
Minimum Value:	<b>-2.003 G's</b> at <b>480 ms</b>	Date of Test:	<b>12/20/00</b>
Filter Class:	<b>60</b>		

### Resultant Acceleration

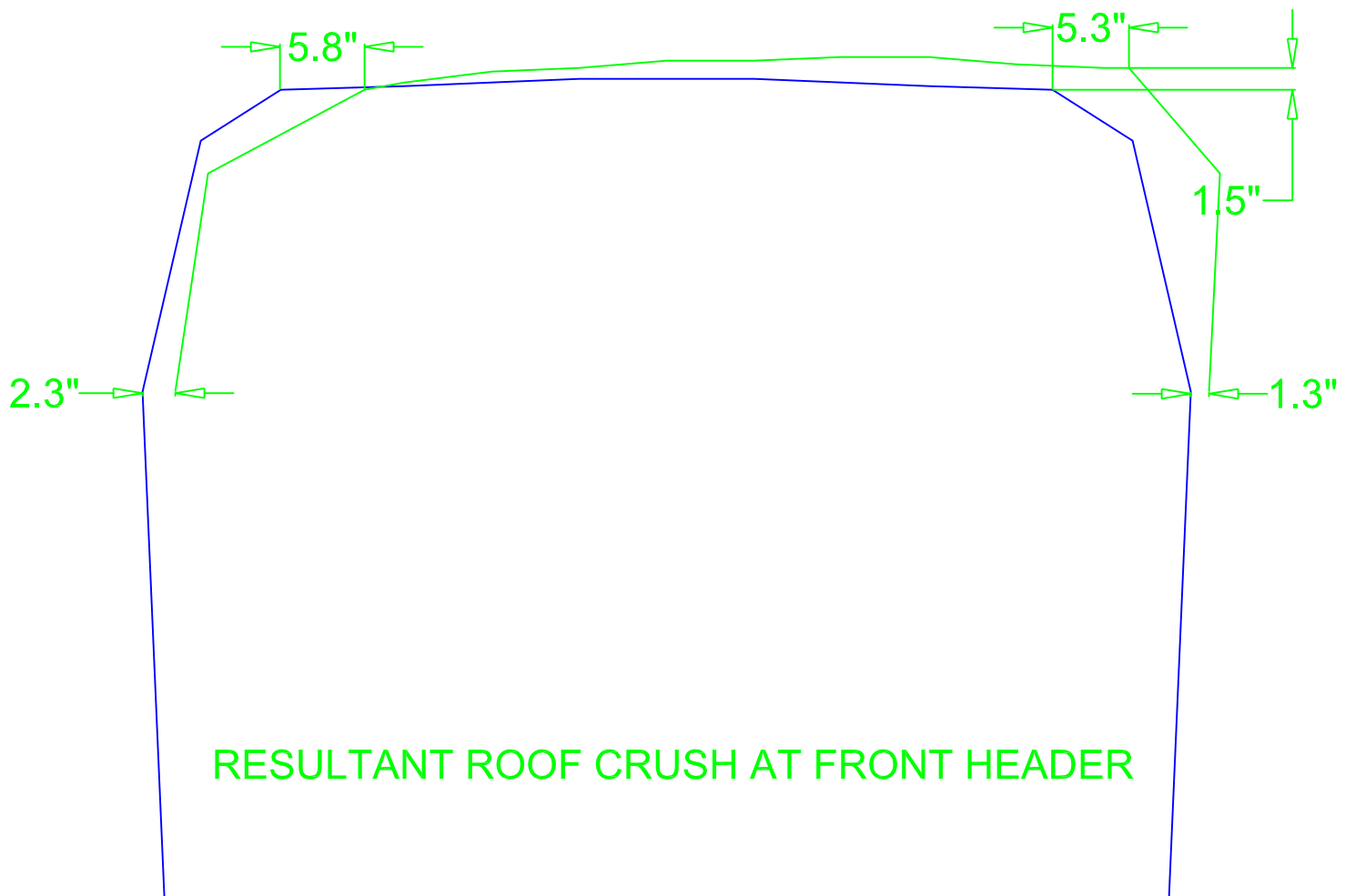
Ymin 0.000 @ 0.0, Ymax 6.993 @ 501.9



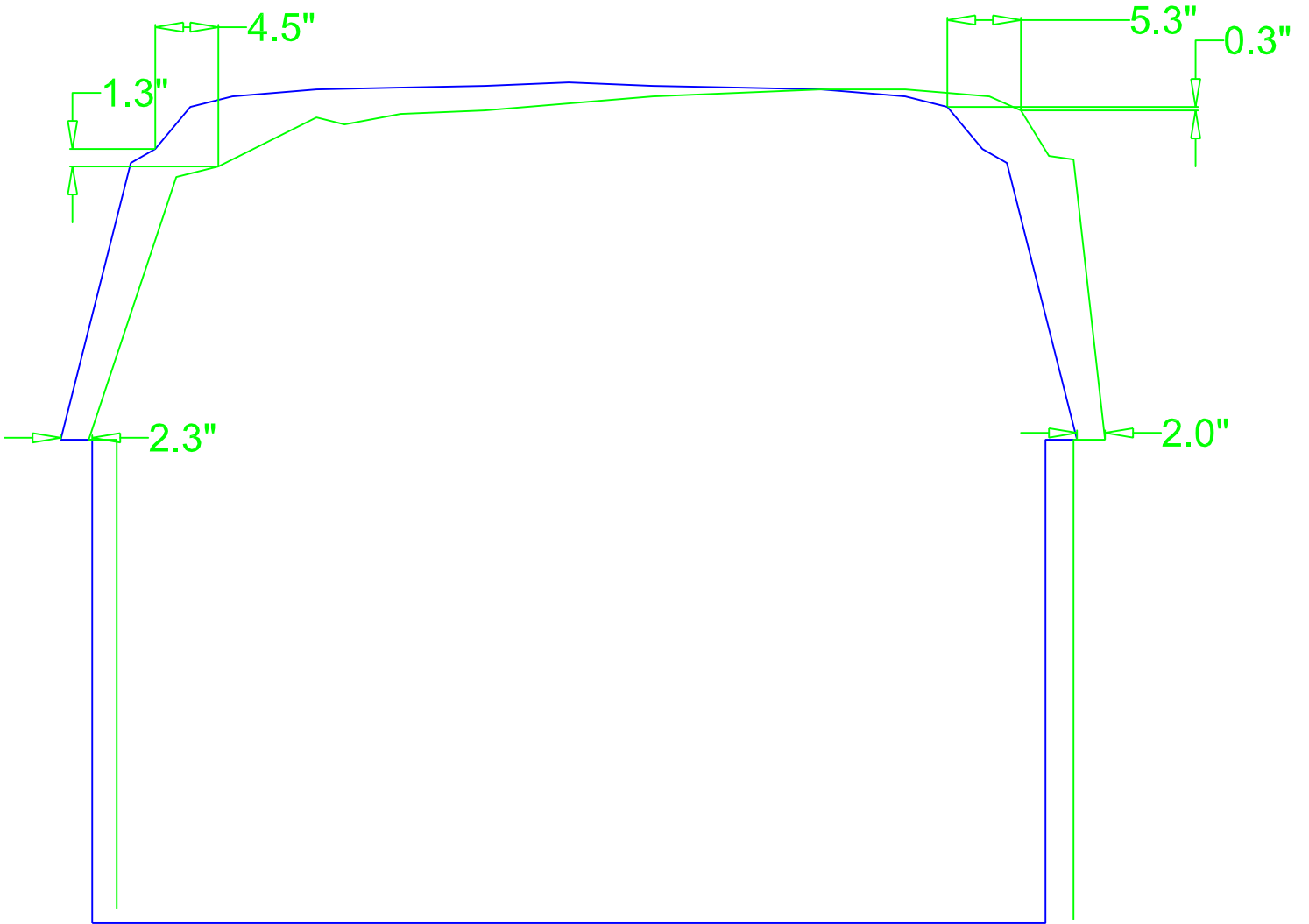
Curve Description:	<b>Resultant Acceleration</b>	Test Program:	<b>Modified Drop Test</b>
Maximum Value:	<b>6.993G's</b> at <b>502 ms</b>	Test Vehicle:	<b>1986 Ford E150</b>
Minimum Value:	<b>0.000 G's</b> at <b>0 ms</b>	Date of Test:	<b>12/20/00</b>
Filter Class:	<b>60</b>		

APPENDIX C  
ROOF CRUSH PROFILES

EXEMPLAR VEHICLE  
MODIFIED DROPPED VEHICLE

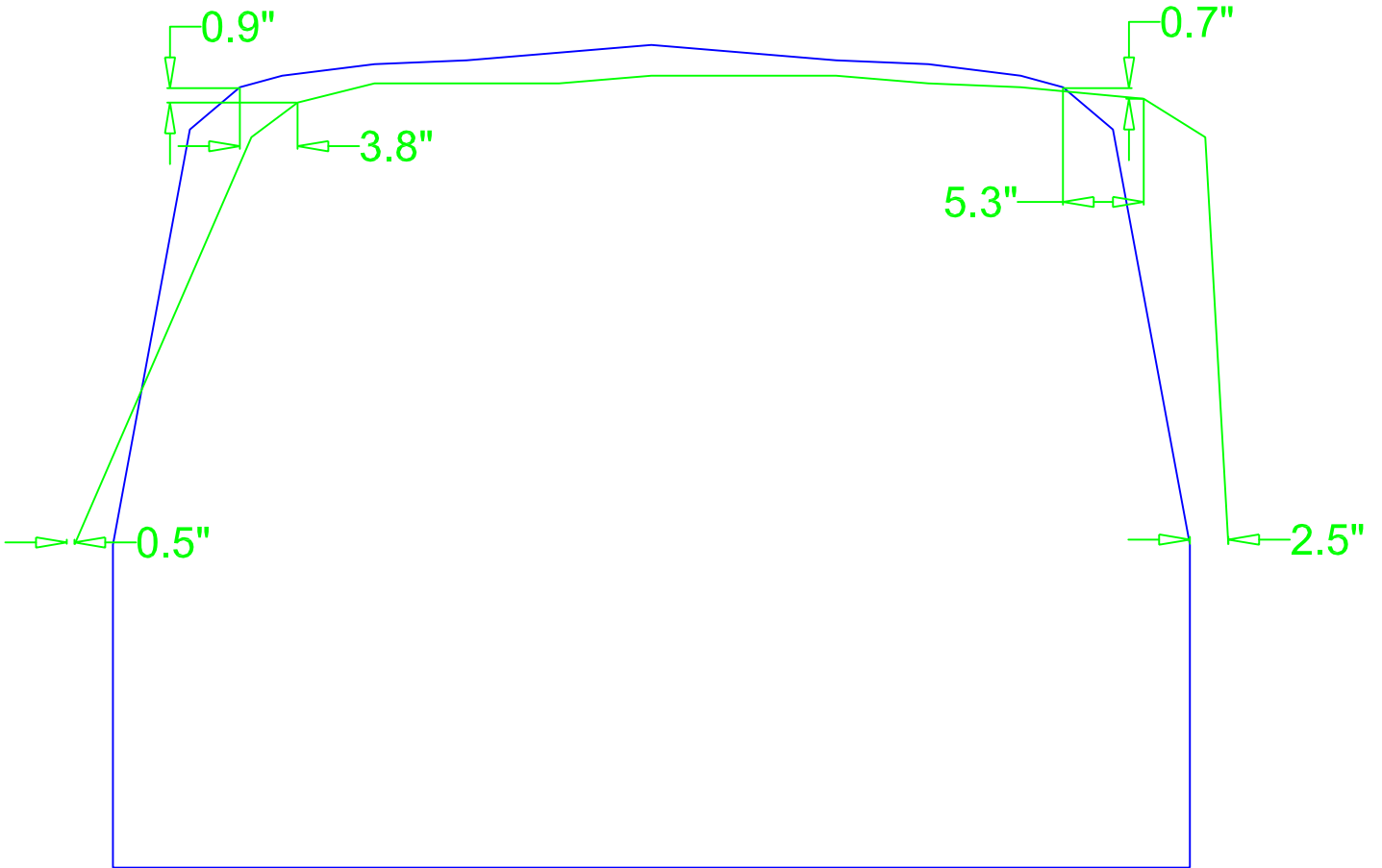


EXEMPLAR VEHICLE  
MODIFIED DROPPED VEHICLE



RESULTANT ROOF CRUSH AT LEADING EDGE OF B-PILLAR

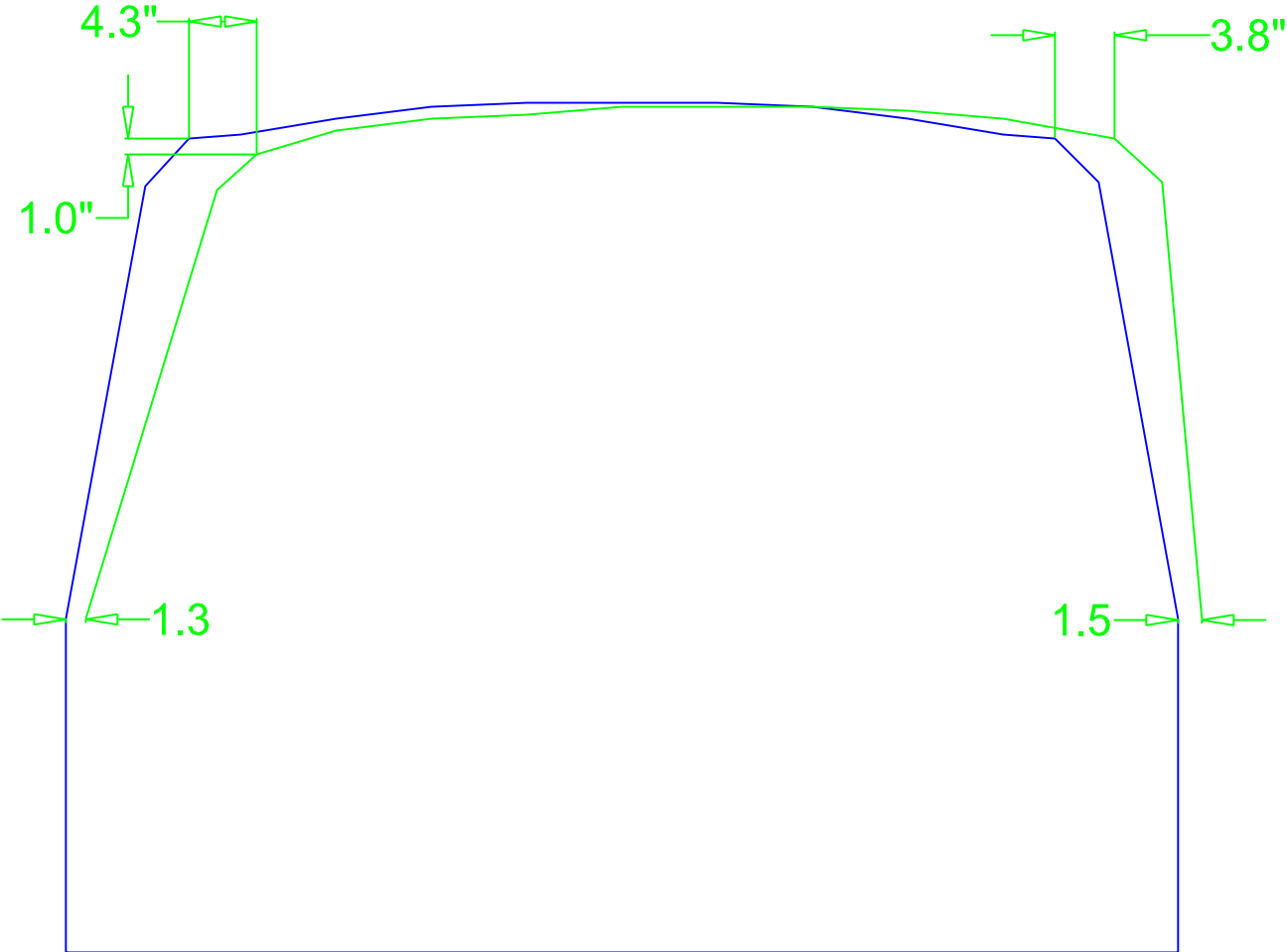
EXEMPLAR VEHICLE  
MODIFIED DROPPED VEHICLE



**RESULTANT ROOF CRUSH 20"  
REARWARD OF LEADING EDGE OF B-PILLAR**

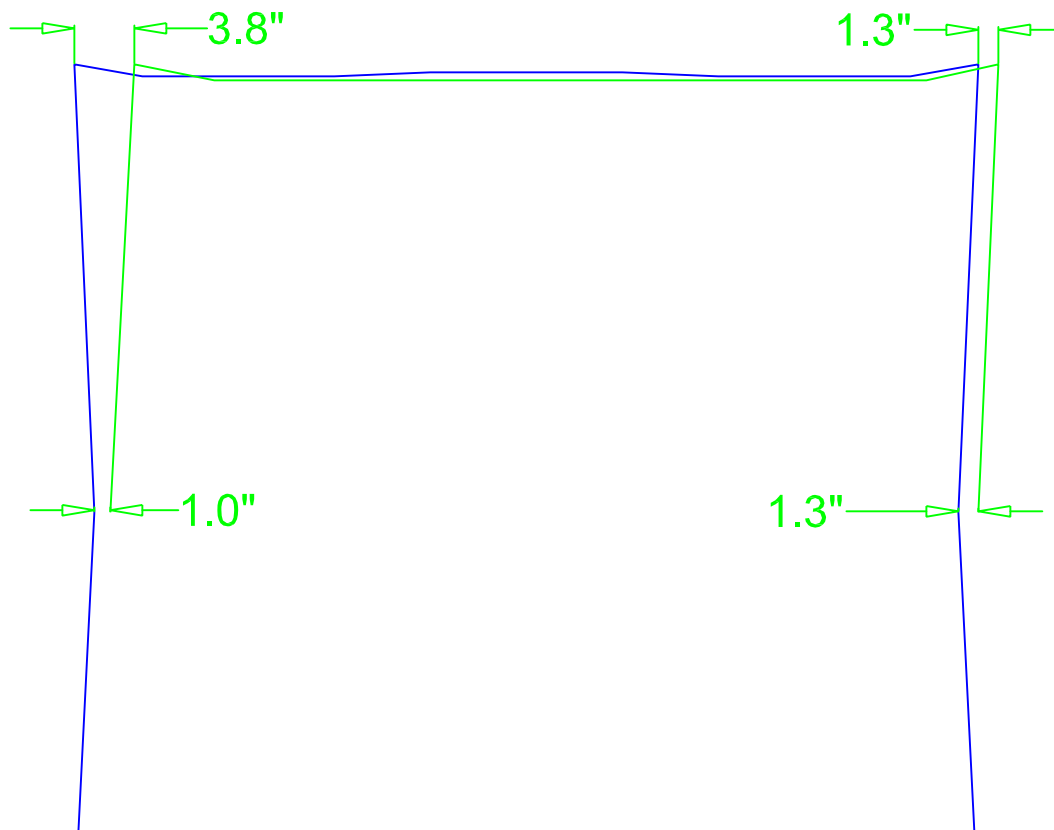
NOTE: Modified roof profile is 1/2" lower due to roll bar under headliner

EXEMPLAR VEHICLE  
MODIFIED DROPPED VEHICLE



RESULTANT ROOF CRUSH 59.5"  
REARWARD OF LEADING EDGE OF B-PILLAR

EXEMPLAR VEHICLE  
MODIFIED DROPPED VEHICLE



RESULTANT CRUSH AT REAR DOOR OPENING  
(130" REARWARD OF LEADING EDGE OF B-PILLAR)