

Force Balance Review

Force Balance is an application of Equal but Opposite Forces. By calculating the Force applied to a vehicle based on the damage and known stiffness values, that Force is then applied to the other vehicle, from which stiffness values for that vehicle can then be calculated. An extension of this also allows for the calculation of delta-v and the Kinetic Energy Equivalent Speed (BEV/BES/EBS/EBV) for each vehicle, and the closing speed between the two vehicles. The typical use of Force Balance is when you have one vehicle where you have more confidence in the “known” stiffness values for that vehicle, and/or a crash situation where one of the vehicles either has no stiffness data available, or a crash situation which is unusual or does not fit the normal crash situation such as an under ride.

In each of these tests conducted this year, the test parameters exceed the “normal” application of speed from crush calculations due to one or more of the following - approach speed, area of the vehicle impacted on the target vehicle, and bumper mis-match.

The crush measurements used for the Force Balance analysis in these tests would be considered to be “crude” by most. No jigs were used, no total station, no scanner, none of the high tech tools. These tools would improve the quality of the measurements, and SHOULD be used whenever possible. However, this was undertaken to illustrate that crush measurements can be taken in the field (or in the impound yard) without taking an extreme amount of time.

The measurements were taken to what can be referred to as “inflection points” in the crush damage. These points can also be referred to as bend points. IF equally spaced measurements are required at a later point in time, they can be measured from a scale drawing of the damage profile.

Part of this write up review is to point out the areas which need to be paid attention to as weaknesses in the data and/or the analysis. The calculated speeds should be compared to the instrumented speeds by the reader. The calculations were completed without knowing the actual instrumented impact speeds.

If there are any questions after reviewing this data, please feel free to email or call me, it WILL NOT be a bother.

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Test 1

Gillig Bus

into

Pontiac Grand Am - Side

Crash Test 1 2008 Gillig Transit Bus into the side of a 2003 Pontiac Grand Am

The crash setup mimics a vehicle that began a right turn into a cross street, then came to a stop, but within the curb side travel lane.

This is a good situation in which to apply a Force Balance analysis since there are no sources for stiffness values for the front of the transit bus.

At the same time, a Force Balance analysis in this case suffers since the vehicle with the “known” stiffness values is based on side stiffness, which typically have more uncertainty about them than frontal values. One should keep this in mind when looking at the results.

When conducting a Force Balance analysis, setting the lever arm and angle to the collision face to zero will result in the minimum calculated closing speed. Under this set up, the calculated closing speed based on the average side stiffness values in this test is 29.1 mph, with a plus/minus 1 Standard Deviation range of 26-32 mph.

When the angle to the collision face is changed to 30 degrees on the Pontiac, the calculated closing speed based on the average side stiffness values in this test is 32 mph, with a plus/minus 1 Standard Deviation range of 28.3-35.3 mph.

The two page calculation results for each of these test situations follow.

2002 PONTIAC GRAND AM - Side Impact

2008 GILLIG LOW FLOOR TRANSIT BUS - Front Impact

Curb Weight (pounds):

Occupant + Cargo Weight (pounds):

Total Weight (pounds):

Angle Coll Force to Normal (degrees):

No Damage Speed (mph):

Energy Crush Depth (inches):

Damage Length (inches):

Crush Profile Measurements:

PDOF

Lever Arm Distance (inches):

Yaw Moment of Inertia (lb-ft-sec²):

"Known" Stiffness Values

	A	B
Average	<input type="text" value="141.7"/>	<input type="text" value="207.1"/>
Minimum	<input type="text" value="122.5"/>	<input type="text" value="139.7"/>
Maximum	<input type="text" value="180.5"/>	<input type="text" value="295.9"/>
Std. Deviation	<input type="text" value="26.2"/>	<input type="text" value="65.2"/>

Curb Weight (pounds):

Occupant + Cargo Weight (pounds):

Total Weight (pounds):

Angle Coll Force to Normal (degrees):

No Damage Speed (mph):

Energy Crush Depth (inches):

Damage Length (inches):

Crush Profile Measurements:

PDOF

Lever Arm Distance (inches):

Yaw Moment of Inertia (lb-ft-sec²):

	Unequal Spacing (inches)	Zone Area (inches ²)	Zone Depth(x) (inches)	Area Depth(x) (inches ³)	Zone Depth(y) (inches)	Area Depth(y) (inches ³)	
C1 (inches)	<input type="text" value="0.00"/>	<input type="text" value="42.00"/>	<input type="text" value="252.00"/>	<input type="text" value="4.00"/>	<input type="text" value="1008.00"/>	<input type="text" value="28.00"/>	<input type="text" value="7056.00"/>
C2 (inches)	<input type="text" value="12.00"/>	<input type="text" value="30.00"/>	<input type="text" value="240.00"/>	<input type="text" value="4.33"/>	<input type="text" value="1040.00"/>	<input type="text" value="42.50"/>	<input type="text" value="10200.00"/>
C3 (inches)	<input type="text" value="4.00"/>	<input type="text" value="14.00"/>	<input type="text" value="28.00"/>	<input type="text" value="1.33"/>	<input type="text" value="37.33"/>	<input type="text" value="32.67"/>	<input type="text" value="914.67"/>
C4 (inches)	<input type="text" value="0.00"/>						
C5 (inches)							
C6 (inches)							
C7 (inches)							
C8 (inches)							
C9 (inches)							
C10 (inches)							

	Equal Spacing (inches)	Zone Area (inches ²)	Zone Depth(x) (inches)	Area Depth(x) (inches ³)	Zone Depth(y) (inches)	Area Depth(y) (inches ³)	
C1 (inches)	<input type="text" value="2.50"/>	<input type="text" value="44.00"/>	<input type="text" value="55.00"/>	<input type="text" value="0.83"/>	<input type="text" value="45.83"/>	<input type="text" value="14.67"/>	<input type="text" value="806.67"/>
C2 (inches)	<input type="text" value="0.00"/>						
C3 (inches)							
C4 (inches)							
C5 (inches)							
C6 (inches)							
C7 (inches)							
C8 (inches)							
C9 (inches)							
C10 (inches)							

Average Crush (inches):

Average Crush (inches):

Results

	A	B	Average Force (poundsf)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	Closing Speed (MPH)
Minimum	<input type="text" value="122.5"/>	<input type="text" value="139.7"/>	<input type="text" value="41610.46"/>	<input type="text" value="29987.07"/>	<input type="text" value="17.2"/>	<input type="text" value="23.4"/>	<input type="text" value="25.9"/>
Avg - 2 Std. Deviations	<input type="text" value="89.3"/>	<input type="text" value="76.7"/>	<input type="text" value="23793.41"/>	<input type="text" value="17580.90"/>	<input type="text" value="13.2"/>	<input type="text" value="20.2"/>	<input type="text" value="22.4"/>
Avg - 1 Std. Deviations	<input type="text" value="115.5"/>	<input type="text" value="141.9"/>	<input type="text" value="41881.79"/>	<input type="text" value="30018.06"/>	<input type="text" value="17.2"/>	<input type="text" value="23.4"/>	<input type="text" value="26.0"/>
Average	<input type="text" value="141.7"/>	<input type="text" value="207.1"/>	<input type="text" value="59970.17"/>	<input type="text" value="42501.43"/>	<input type="text" value="20.4"/>	<input type="text" value="26.3"/>	<input type="text" value="29.1"/>
Avg + 1 Std. Deviations	<input type="text" value="167.9"/>	<input type="text" value="272.3"/>	<input type="text" value="78058.55"/>	<input type="text" value="54997.82"/>	<input type="text" value="23.3"/>	<input type="text" value="28.8"/>	<input type="text" value="31.9"/>
Avg + 2 Std. Deviations	<input type="text" value="194.1"/>	<input type="text" value="337.5"/>	<input type="text" value="96146.93"/>	<input type="text" value="67499.69"/>	<input type="text" value="25.8"/>	<input type="text" value="31.1"/>	<input type="text" value="34.5"/>
Maximum	<input type="text" value="180.5"/>	<input type="text" value="295.9"/>	<input type="text" value="84739.89"/>	<input type="text" value="59671.23"/>	<input type="text" value="24.2"/>	<input type="text" value="29.7"/>	<input type="text" value="32.9"/>

Damage Centroid Depth (x) (inches): k²:

Damage Centroid Depth (y) (inches): Eff. Mass Ratio (gamma):

Area of Damage (inches²):

Results

	A	B	Average Force (poundsf)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	bsub1
Minimum	<input type="text" value="1632.3"/>	<input type="text" value="207.2"/>	<input type="text" value="41610.46"/>	<input type="text" value="31846.15"/>	<input type="text" value="5.8"/>	<input type="text" value="2.5"/>	<input type="text" value="11.2"/>
Avg - 2 Std. Deviations	<input type="text" value="986.8"/>	<input type="text" value="75.7"/>	<input type="text" value="23793.41"/>	<input type="text" value="28385.37"/>	<input type="text" value="5.5"/>	<input type="text" value="2.2"/>	<input type="text" value="6.8"/>
Avg - 1 Std. Deviations	<input type="text" value="1641.7"/>	<input type="text" value="209.6"/>	<input type="text" value="41881.79"/>	<input type="text" value="31898.13"/>	<input type="text" value="5.8"/>	<input type="text" value="2.5"/>	<input type="text" value="11.2"/>
Average	<input type="text" value="2238.7"/>	<input type="text" value="389.8"/>	<input type="text" value="59970.17"/>	<input type="text" value="35322.48"/>	<input type="text" value="6.1"/>	<input type="text" value="2.8"/>	<input type="text" value="15.3"/>
Avg + 1 Std. Deviations	<input type="text" value="2790.9"/>	<input type="text" value="605.8"/>	<input type="text" value="78058.55"/>	<input type="text" value="38678.39"/>	<input type="text" value="6.4"/>	<input type="text" value="3.1"/>	<input type="text" value="19.1"/>
Avg + 2 Std. Deviations	<input type="text" value="3307.1"/>	<input type="text" value="850.6"/>	<input type="text" value="96146.93"/>	<input type="text" value="41979.29"/>	<input type="text" value="6.7"/>	<input type="text" value="3.4"/>	<input type="text" value="22.6"/>
Maximum	<input type="text" value="2985.4"/>	<input type="text" value="693.1"/>	<input type="text" value="84739.89"/>	<input type="text" value="39903.48"/>	<input type="text" value="6.5"/>	<input type="text" value="3.2"/>	<input type="text" value="20.4"/>

Damage Centroid Depth (x) (inches): k²:

Damage Centroid Depth (y) (inches): Eff. Mass Ratio (gamma):

Area of Damage (inches²):

2002 PONTIAC GRAND AM - Side Impact

2008 GILLIG LOW FLOOR TRANSIT BUS - Front Impact

Curb Weight (pounds):

Occupant + Cargo Weight (pounds):

Total Weight (pounds):

Angle Coll Force to Normal (degrees):

No Damage Speed (mph):

Energy Crush Depth (inches):

Damage Length (inches):

Crush Profile Measurements:

PDOF

Lever Arm Distance (inches):

Yaw Moment of Inertia (lb-ft-sec²):

"Known" Stiffness Values

	A	B
Average	<input type="text" value="141.7"/>	<input type="text" value="207.1"/>
Minimum	<input type="text" value="122.5"/>	<input type="text" value="139.7"/>
Maximum	<input type="text" value="180.5"/>	<input type="text" value="295.9"/>
Std. Deviation	<input type="text" value="26.2"/>	<input type="text" value="65.2"/>

Curb Weight (pounds):

Occupant + Cargo Weight (pounds):

Total Weight (pounds):

Angle Coll Force to Normal (degrees):

No Damage Speed (mph):

Energy Crush Depth (inches):

Damage Length (inches):

Crush Profile Measurements:

PDOF

Lever Arm Distance (inches):

Yaw Moment of Inertia (lb-ft-sec²):

	Unequal Spacing (inches)	Zone Area (inches ²)	Zone Depth(x) (inches)	Area Depth(x) (inches ³)	Zone Depth(y) (inches)	Area Depth(y) (inches ³)	
C1 (inches)	<input type="text" value="0.00"/>	<input type="text" value="42.00"/>	<input type="text" value="252.00"/>	<input type="text" value="4.00"/>	<input type="text" value="1008.00"/>	<input type="text" value="28.00"/>	<input type="text" value="7056.00"/>
C2 (inches)	<input type="text" value="12.00"/>	<input type="text" value="30.00"/>	<input type="text" value="240.00"/>	<input type="text" value="4.33"/>	<input type="text" value="1040.00"/>	<input type="text" value="42.50"/>	<input type="text" value="10200.00"/>
C3 (inches)	<input type="text" value="4.00"/>	<input type="text" value="14.00"/>	<input type="text" value="28.00"/>	<input type="text" value="1.33"/>	<input type="text" value="37.33"/>	<input type="text" value="32.67"/>	<input type="text" value="914.67"/>
C4 (inches)	<input type="text" value="0.00"/>						
C5 (inches)							
C6 (inches)							
C7 (inches)							
C8 (inches)							
C9 (inches)							
C10 (inches)							

	Equal Spacing (inches)	Zone Area (inches ²)	Zone Depth(x) (inches)	Area Depth(x) (inches ³)	Zone Depth(y) (inches)	Area Depth(y) (inches ³)	
C1 (inches)	<input type="text" value="2.50"/>	<input type="text" value="44.00"/>	<input type="text" value="55.00"/>	<input type="text" value="0.83"/>	<input type="text" value="45.83"/>	<input type="text" value="14.67"/>	<input type="text" value="806.67"/>
C2 (inches)	<input type="text" value="0.00"/>						
C3 (inches)							
C4 (inches)							
C5 (inches)							
C6 (inches)							
C7 (inches)							
C8 (inches)							
C9 (inches)							
C10 (inches)							

Average Crush (inches):

Average Crush (inches):

Results

	Average Force		Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	Closing Speed (MPH)	
	A	B					
Minimum	<input type="text" value="122.5"/>	<input type="text" value="139.7"/>	<input type="text" value="48047.61"/>	<input type="text" value="39982.76"/>	<input type="text" value="19.8"/>	<input type="text" value="25.6"/>	<input type="text" value="28.3"/>
Avg - 2 Std. Deviations	<input type="text" value="89.3"/>	<input type="text" value="76.7"/>	<input type="text" value="27474.26"/>	<input type="text" value="23441.20"/>	<input type="text" value="15.2"/>	<input type="text" value="21.8"/>	<input type="text" value="24.1"/>
Avg - 1 Std. Deviations	<input type="text" value="115.5"/>	<input type="text" value="141.9"/>	<input type="text" value="48360.92"/>	<input type="text" value="40024.07"/>	<input type="text" value="19.8"/>	<input type="text" value="25.7"/>	<input type="text" value="28.3"/>
Average	<input type="text" value="141.7"/>	<input type="text" value="207.1"/>	<input type="text" value="69247.58"/>	<input type="text" value="56668.57"/>	<input type="text" value="23.6"/>	<input type="text" value="29.0"/>	<input type="text" value="32.0"/>
Avg + 1 Std. Deviations	<input type="text" value="167.9"/>	<input type="text" value="272.3"/>	<input type="text" value="90134.24"/>	<input type="text" value="73330.43"/>	<input type="text" value="26.9"/>	<input type="text" value="32.0"/>	<input type="text" value="35.3"/>
Avg + 2 Std. Deviations	<input type="text" value="194.1"/>	<input type="text" value="337.5"/>	<input type="text" value="111020.91"/>	<input type="text" value="89999.59"/>	<input type="text" value="29.8"/>	<input type="text" value="34.7"/>	<input type="text" value="38.3"/>
Maximum	<input type="text" value="180.5"/>	<input type="text" value="295.9"/>	<input type="text" value="97849.19"/>	<input type="text" value="79561.65"/>	<input type="text" value="28.0"/>	<input type="text" value="33.0"/>	<input type="text" value="36.5"/>
Damage Centroid Depth (x) (inches)	<input type="text" value="4.01"/>				k ²	<input type="text" value="2942.47"/>	
Damage Centroid Depth (y) (inches)	<input type="text" value="34.94"/>				Eff. Mass Ratio (gamma)	<input type="text" value="1.00"/>	
Area of Damage (inches ²):	<input type="text" value="520.30"/>						

Results

	Average Force		Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	Closing Speed (MPH)	
	A	B					
Minimum	<input type="text" value="1859.8"/>	<input type="text" value="259.3"/>	<input type="text" value="48047.61"/>	<input type="text" value="33965.42"/>	<input type="text" value="5.9"/>	<input type="text" value="2.7"/>	<input type="text" value="12.3"/>
Avg - 2 Std. Deviations	<input type="text" value="1129.3"/>	<input type="text" value="95.6"/>	<input type="text" value="27474.26"/>	<input type="text" value="29991.97"/>	<input type="text" value="5.5"/>	<input type="text" value="2.3"/>	<input type="text" value="7.5"/>
Avg - 1 Std. Deviations	<input type="text" value="1870.4"/>	<input type="text" value="262.3"/>	<input type="text" value="48360.92"/>	<input type="text" value="34025.05"/>	<input type="text" value="5.9"/>	<input type="text" value="2.7"/>	<input type="text" value="12.3"/>
Average	<input type="text" value="2542.0"/>	<input type="text" value="484.5"/>	<input type="text" value="69247.58"/>	<input type="text" value="37952.09"/>	<input type="text" value="6.2"/>	<input type="text" value="3.0"/>	<input type="text" value="16.8"/>
Avg + 1 Std. Deviations	<input type="text" value="3160.7"/>	<input type="text" value="749.1"/>	<input type="text" value="90134.24"/>	<input type="text" value="41798.26"/>	<input type="text" value="6.5"/>	<input type="text" value="3.3"/>	<input type="text" value="20.9"/>
Avg + 2 Std. Deviations	<input type="text" value="3737.3"/>	<input type="text" value="1047.3"/>	<input type="text" value="111020.91"/>	<input type="text" value="45580.11"/>	<input type="text" value="6.8"/>	<input type="text" value="3.6"/>	<input type="text" value="24.7"/>
Maximum	<input type="text" value="3378.1"/>	<input type="text" value="855.7"/>	<input type="text" value="97849.19"/>	<input type="text" value="43201.96"/>	<input type="text" value="6.7"/>	<input type="text" value="3.4"/>	<input type="text" value="22.3"/>
Damage Centroid Depth (x) (inches)	<input type="text" value="0.83"/>				k ²	<input type="text" value="4563.01"/>	
Damage Centroid Depth (y) (inches)	<input type="text" value="14.67"/>				Eff. Mass Ratio (gamma)	<input type="text" value="1.00"/>	
Area of Damage (inches ²):	<input type="text" value="55.00"/>						

Test 2

**Nissan Sentra
into
Gillig Bus Rear**

Crash Test 2
2014 Nissan Sentra into the Rear of a 2008 Gillig Transit Bus

In this test there is no lever arm or angle to the collision face issues to consider.

The front bumper of the Nissan Sentra did underide the bus rear bumper. Also significant speed was involved as evidenced by the Nissan's engine which was pushed into the passenger compartment.

The calculated closing speed based on the average front stiffness values for the Sentra in this test is 73.9 mph, with a plus/minus 1 Standard Deviation range of 55.9-88.3 mph.

The two page calculation result for this test situation follows.

2014 NISSAN SENTRA - Front Impact

2008 GILLIG LOW FLOOR TRANSIT BUS - Rear Impact

Curb Weight (pounds):

Occupant + Cargo Weight (pounds):

Total Weight (pounds):

Angle Coll Force to Normal (degrees):

No Damage Speed (mph):

Energy Crush Depth (inches):

Damage Length (inches):

Crush Profile Measurements:

PDOF

Lever Arm Distance (inches):

Yaw Moment of Inertia (lb-ft-sec²):

"Known" Stiffness Values

	A	B
Average	<input type="text" value="402.7"/>	<input type="text" value="176.1"/>
Minimum	<input type="text" value="331.5"/>	<input type="text" value="114.9"/>
Maximum	<input type="text" value="473.8"/>	<input type="text" value="237.3"/>
Std. Deviation	<input type="text" value="100.6"/>	<input type="text" value="86.6"/>

Curb Weight (pounds):

Occupant + Cargo Weight (pounds):

Total Weight (pounds):

Angle Coll Force to Normal (degrees):

No Damage Speed (mph):

Energy Crush Depth (inches):

Damage Length (inches):

Crush Profile Measurements:

PDOF

Lever Arm Distance (inches):

Yaw Moment of Inertia (lb-ft-sec²):

	Equal Spacing (inches)	Zone Area (inches ²)	Zone Depth(x) (inches)	Area Depth(x) (inches ³)	Zone Depth(y) (inches)	Area Depth(y) (inches ³)
C1 (inches)	<input type="text" value="25.00"/>	<input type="text" value="69.00"/>	<input type="text" value="12.50"/>	<input type="text" value="21562.50"/>	<input type="text" value="34.50"/>	<input type="text" value="59512.50"/>
C2 (inches)	<input type="text" value="25.00"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C3 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C4 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C5 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C6 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C7 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C8 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C9 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C10 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

	Unequal Spacing (inches)	Zone Area (inches ²)	Zone Depth(x) (inches)	Area Depth(x) (inches ³)	Zone Depth(y) (inches)	Area Depth(y) (inches ³)
C1 (inches)	<input type="text" value="6.00"/>	<input type="text" value="50.00"/>	<input type="text" value="2.00"/>	<input type="text" value="300.00"/>	<input type="text" value="16.67"/>	<input type="text" value="2500.00"/>
C2 (inches)	<input type="text" value="0.00"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C3 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C4 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C5 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C6 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C7 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C8 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C9 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C10 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Average Crush (inches):

Average Crush (inches):

Results

	A	B	Average Force (poundsf)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	Closing Speed (MPH)
Minimum	<input type="text" value="331.5"/>	<input type="text" value="114.9"/>	<input type="text" value="110538.00"/>	<input type="text" value="256863.76"/>	<input type="text" value="52.1"/>	<input type="text" value="56.1"/>	<input type="text" value="61.7"/>
Avg - 2 Std. Deviations	<input type="text" value="201.5"/>	<input type="text" value="2.9"/>	<input type="text" value="9453.00"/>	<input type="text" value="74428.79"/>	<input type="text" value="28.1"/>	<input type="text" value="31.4"/>	<input type="text" value="34.5"/>
Avg - 1 Std. Deviations	<input type="text" value="302.1"/>	<input type="text" value="89.5"/>	<input type="text" value="87616.20"/>	<input type="text" value="207178.87"/>	<input type="text" value="46.8"/>	<input type="text" value="50.8"/>	<input type="text" value="55.9"/>
Average	<input type="text" value="402.7"/>	<input type="text" value="176.1"/>	<input type="text" value="165779.40"/>	<input type="text" value="376965.35"/>	<input type="text" value="63.1"/>	<input type="text" value="67.1"/>	<input type="text" value="73.9"/>
Avg + 1 Std. Deviations	<input type="text" value="503.3"/>	<input type="text" value="262.7"/>	<input type="text" value="243942.60"/>	<input type="text" value="547160.68"/>	<input type="text" value="76.1"/>	<input type="text" value="80.2"/>	<input type="text" value="88.3"/>
Avg + 2 Std. Deviations	<input type="text" value="603.9"/>	<input type="text" value="349.3"/>	<input type="text" value="322105.80"/>	<input type="text" value="717460.78"/>	<input type="text" value="87.1"/>	<input type="text" value="91.4"/>	<input type="text" value="100.6"/>
Maximum	<input type="text" value="473.8"/>	<input type="text" value="237.3"/>	<input type="text" value="221017.35"/>	<input type="text" value="497226.95"/>	<input type="text" value="72.5"/>	<input type="text" value="76.6"/>	<input type="text" value="84.3"/>
Damage Centroid Depth (x) (inches)	<input type="text" value="12.50"/>				k^2	<input type="text" value="2804.81"/>	
Damage Centroid Depth (y) (inches)	<input type="text" value="34.50"/>				Eff. Mass Ratio (gamma)	<input type="text" value="1.00"/>	
Area of Damage (inches ²):	<input type="text" value="1725.00"/>						

Results

	A	B	Average Force (poundsf)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	bsub1
Minimum	<input type="text" value="2612.3"/>	<input type="text" value="603.1"/>	<input type="text" value="110538.00"/>	<input type="text" value="71303.50"/>	<input type="text" value="8.7"/>	<input type="text" value="5.6"/>	<input type="text" value="20.3"/>
Avg - 2 Std. Deviations	<input type="text" value="346.3"/>	<input type="text" value="10.6"/>	<input type="text" value="9453.00"/>	<input type="text" value="28167.06"/>	<input type="text" value="5.5"/>	<input type="text" value="3.2"/>	<input type="text" value="2.7"/>
Avg - 1 Std. Deviations	<input type="text" value="2209.9"/>	<input type="text" value="431.6"/>	<input type="text" value="87616.20"/>	<input type="text" value="61986.24"/>	<input type="text" value="8.1"/>	<input type="text" value="5.1"/>	<input type="text" value="17.2"/>
Average	<input type="text" value="3459.0"/>	<input type="text" value="1057.4"/>	<input type="text" value="165779.40"/>	<input type="text" value="93245.27"/>	<input type="text" value="10.0"/>	<input type="text" value="6.8"/>	<input type="text" value="26.9"/>
Avg + 1 Std. Deviations	<input type="text" value="4467.1"/>	<input type="text" value="1763.5"/>	<input type="text" value="243942.60"/>	<input type="text" value="123500.02"/>	<input type="text" value="11.5"/>	<input type="text" value="8.1"/>	<input type="text" value="34.7"/>
Avg + 2 Std. Deviations	<input type="text" value="5335.8"/>	<input type="text" value="2516.2"/>	<input type="text" value="322105.80"/>	<input type="text" value="153174.04"/>	<input type="text" value="12.8"/>	<input type="text" value="9.2"/>	<input type="text" value="41.5"/>
Maximum	<input type="text" value="4188.8"/>	<input type="text" value="1550.6"/>	<input type="text" value="221017.35"/>	<input type="text" value="114698.65"/>	<input type="text" value="11.0"/>	<input type="text" value="7.7"/>	<input type="text" value="32.6"/>
Damage Centroid Depth (x) (inches)	<input type="text" value="2.00"/>				k^2	<input type="text" value="4555.08"/>	
Damage Centroid Depth (y) (inches)	<input type="text" value="16.67"/>				Eff. Mass Ratio (gamma)	<input type="text" value="1.00"/>	
Area of Damage (inches ²):	<input type="text" value="150.00"/>						

Test 3

Chevrolet Malibu into Gillig Bus Rear Axle

Crash Test 3

2004 Chevrolet Malibu into the side of a 2008 Gillig Transit Bus

In this test impact was into the side of the bus near the rear axle. Much of the contact area involved the rear tire of the bus.

Again, the minimum calculated closing speed is achieved by setting the angle to the collision face and the lever arm to zero.

Under this set up, the calculated closing speed based on the average front stiffness values for the Malibu in this test is 59.8 mph, with a plus/minus 1 Standard Deviation range of 51.2-67.3 mph.

When the lever arm is changed to 94 inches, the distance the rear axle is behind the bus CG based on its weight distribution, the calculated closing speed based on the average front stiffness values for the Malibu in this test is 65.5 mph, with a plus/minus 1 Standard Deviation range of 56.1-73.7 mph.

The two page calculation results for each of these test situations follow.

2004 CHEVROLET MALIBU - Front Impact

2008 GILLIG LOW FLOOR TRANSIT BUS - Side Impact

Curb Weight (pounds):
 Occupant + Cargo Weight (pounds):
 Total Weight (pounds):
 PDOF Lever Arm Distance (inches):
 Yaw Moment of Inertia (lb-ft-sec²):

Curb Weight (pounds):
 Occupant + Cargo Weight (pounds):
 Total Weight (pounds):
 PDOF Lever Arm Distance (inches):
 Yaw Moment of Inertia (lb-ft-sec²):

Angle Coll Force to Normal (degrees):
 No Damage Speed (mph):
 Energy Crush Depth (inches):
 Damage Length (inches):
 Crush Profile Measurements:
"Known" Stiffness Values

	A	B
Average	<input type="text" value="375.1"/>	<input type="text" value="131.5"/>
Minimum	<input type="text" value="291.3"/>	<input type="text" value="86.7"/>
Maximum	<input type="text" value="496.8"/>	<input type="text" value="232.8"/>
Std. Deviation	<input type="text" value="52.3"/>	<input type="text" value="38.2"/>

Angle Coll Force to Normal (degrees):
 No Damage Speed (mph):
 Energy Crush Depth (inches):
 Damage Length (inches):
 Crush Profile Measurements:

	Unequal Spacing (inches)	Zone Area (inches ²)	Zone Depth(x) (inches)	Area Depth(x) (inches ³)	Zone Depth(y) (inches)	Area Depth(y) (inches ³)	
C1 (inches)	<input type="text" value="25.00"/>	<input type="text" value="23.00"/>	<input type="text" value="736.00"/>	<input type="text" value="16.26"/>	<input type="text" value="11963.83"/>	<input type="text" value="12.34"/>	<input type="text" value="9081.17"/>
C2 (inches)	<input type="text" value="39.00"/>	<input type="text" value="20.00"/>	<input type="text" value="710.00"/>	<input type="text" value="17.81"/>	<input type="text" value="12643.33"/>	<input type="text" value="29.67"/>	<input type="text" value="21066.67"/>
C3 (inches)	<input type="text" value="32.00"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C4 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C5 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C6 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C7 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C8 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C9 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C10 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

	Unequal Spacing (inches)	Zone Area (inches ²)	Zone Depth(x) (inches)	Area Depth(x) (inches ³)	Zone Depth(y) (inches)	Area Depth(y) (inches ³)	
C1 (inches)	<input type="text" value="0.00"/>	<input type="text" value="39.00"/>	<input type="text" value="97.50"/>	<input type="text" value="1.67"/>	<input type="text" value="162.50"/>	<input type="text" value="26.00"/>	<input type="text" value="2535.00"/>
C2 (inches)	<input type="text" value="5.00"/>	<input type="text" value="20.00"/>	<input type="text" value="50.00"/>	<input type="text" value="1.67"/>	<input type="text" value="83.33"/>	<input type="text" value="26.67"/>	<input type="text" value="1333.33"/>
C3 (inches)	<input type="text" value="0.00"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C4 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C5 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C6 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C7 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C8 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C9 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C10 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Average Crush (inches):

Average Crush (inches):

Results

	A	B	Average Force (poundsf)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	Closing Speed (MPH)
Minimum	<input type="text" value="291.3"/>	<input type="text" value="86.7"/>	<input type="text" value="68950.95"/>	<input type="text" value="214655.23"/>	<input type="text" value="44.4"/>	<input type="text" value="44.1"/>	<input type="text" value="49.3"/>
Avg - 2 Std. Deviations	<input type="text" value="270.5"/>	<input type="text" value="55.1"/>	<input type="text" value="45655.53"/>	<input type="text" value="147971.47"/>	<input type="text" value="36.9"/>	<input type="text" value="36.7"/>	<input type="text" value="40.9"/>
Avg - 1 Std. Deviations	<input type="text" value="322.8"/>	<input type="text" value="93.3"/>	<input type="text" value="74400.30"/>	<input type="text" value="232233.43"/>	<input type="text" value="46.2"/>	<input type="text" value="45.9"/>	<input type="text" value="51.2"/>
Average	<input type="text" value="375.1"/>	<input type="text" value="131.5"/>	<input type="text" value="103145.07"/>	<input type="text" value="316789.70"/>	<input type="text" value="54.0"/>	<input type="text" value="53.6"/>	<input type="text" value="59.8"/>
Avg + 1 Std. Deviations	<input type="text" value="427.4"/>	<input type="text" value="169.7"/>	<input type="text" value="131889.84"/>	<input type="text" value="401441.52"/>	<input type="text" value="60.8"/>	<input type="text" value="60.3"/>	<input type="text" value="67.3"/>
Avg + 2 Std. Deviations	<input type="text" value="479.7"/>	<input type="text" value="207.9"/>	<input type="text" value="160634.61"/>	<input type="text" value="486136.23"/>	<input type="text" value="66.9"/>	<input type="text" value="66.3"/>	<input type="text" value="74.0"/>
Maximum	<input type="text" value="496.8"/>	<input type="text" value="232.8"/>	<input type="text" value="179006.08"/>	<input type="text" value="539176.36"/>	<input type="text" value="70.4"/>	<input type="text" value="69.9"/>	<input type="text" value="78.0"/>
Damage Centroid Depth (x) (inches)	<input type="text" value="17.02"/>				k ²	<input type="text" value="3061.62"/>	
Damage Centroid Depth (y) (inches)	<input type="text" value="20.85"/>		Eff. Mass Ratio (gamma)		<input type="text" value="1.00"/>		
Area of Damage (inches ²):	<input type="text" value="1446.09"/>						

Results

	A	B	Average Force (poundsf)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	bsub1
Minimum	<input type="text" value="527.0"/>	<input type="text" value="724.1"/>	<input type="text" value="68950.95"/>	<input type="text" value="22255.26"/>	<input type="text" value="4.9"/>	<input type="text" value="5.1"/>	<input type="text" value="24.2"/>
Avg - 2 Std. Deviations	<input type="text" value="416.6"/>	<input type="text" value="452.4"/>	<input type="text" value="45655.53"/>	<input type="text" value="15331.81"/>	<input type="text" value="4.0"/>	<input type="text" value="4.2"/>	<input type="text" value="19.1"/>
Avg - 1 Std. Deviations	<input type="text" value="550.0"/>	<input type="text" value="788.8"/>	<input type="text" value="74400.30"/>	<input type="text" value="23863.34"/>	<input type="text" value="5.0"/>	<input type="text" value="5.3"/>	<input type="text" value="25.2"/>
Average	<input type="text" value="659.7"/>	<input type="text" value="1134.7"/>	<input type="text" value="103145.07"/>	<input type="text" value="32297.33"/>	<input type="text" value="5.9"/>	<input type="text" value="6.2"/>	<input type="text" value="30.3"/>
Avg + 1 Std. Deviations	<input type="text" value="755.0"/>	<input type="text" value="1486.3"/>	<input type="text" value="131889.84"/>	<input type="text" value="40672.58"/>	<input type="text" value="6.6"/>	<input type="text" value="7.0"/>	<input type="text" value="34.6"/>
Avg + 2 Std. Deviations	<input type="text" value="840.5"/>	<input type="text" value="1841.9"/>	<input type="text" value="160634.61"/>	<input type="text" value="49007.45"/>	<input type="text" value="7.2"/>	<input type="text" value="7.7"/>	<input type="text" value="38.6"/>
Maximum	<input type="text" value="891.2"/>	<input type="text" value="2070.7"/>	<input type="text" value="179006.08"/>	<input type="text" value="54318.30"/>	<input type="text" value="7.6"/>	<input type="text" value="8.1"/>	<input type="text" value="40.9"/>
Damage Centroid Depth (x) (inches)	<input type="text" value="1.67"/>				k ²	<input type="text" value="4555.08"/>	
Damage Centroid Depth (y) (inches)	<input type="text" value="26.23"/>		Eff. Mass Ratio (gamma)		<input type="text" value="1.00"/>		
Area of Damage (inches ²):	<input type="text" value="147.50"/>						

2004 CHEVROLET MALIBU - Front Impact

2008 GILLIG LOW FLOOR TRANSIT BUS - Side Impact

Curb Weight (pounds):
 Occupant + Cargo Weight (pounds):
 Total Weight (pounds):
 PDOF Lever Arm Distance (inches):
 Yaw Moment of Inertia (lb-ft-sec²):

Curb Weight (pounds):
 Occupant + Cargo Weight (pounds):
 Total Weight (pounds):
 PDOF Lever Arm Distance (inches):
 Yaw Moment of Inertia (lb-ft-sec²):

Angle Coll Force to Normal (degrees):
 No Damage Speed (mph):
 Energy Crush Depth (inches):
 Damage Length (inches):
 Crush Profile Measurements:
"Known" Stiffness Values

	A	B
Average	<input type="text" value="375.1"/>	<input type="text" value="131.5"/>
Minimum	<input type="text" value="291.3"/>	<input type="text" value="86.7"/>
Maximum	<input type="text" value="496.8"/>	<input type="text" value="232.8"/>
Std. Deviation	<input type="text" value="52.3"/>	<input type="text" value="38.2"/>

Angle Coll Force to Normal (degrees):
 No Damage Speed (mph):
 Energy Crush Depth (inches):
 Damage Length (inches):
 Crush Profile Measurements:

	Unequal Spacing (inches)	Zone Area (inches ²)	Zone Depth(x) (inches)	Area Depth(x) (inches ³)	Zone Depth(y) (inches)	Area Depth(y) (inches ³)	
C1 (inches)	<input type="text" value="25.00"/>	<input type="text" value="23.00"/>	<input type="text" value="736.00"/>	<input type="text" value="16.26"/>	<input type="text" value="11963.83"/>	<input type="text" value="12.34"/>	<input type="text" value="9081.17"/>
C2 (inches)	<input type="text" value="39.00"/>	<input type="text" value="20.00"/>	<input type="text" value="710.00"/>	<input type="text" value="17.81"/>	<input type="text" value="12643.33"/>	<input type="text" value="29.67"/>	<input type="text" value="21066.67"/>
C3 (inches)	<input type="text" value="32.00"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C4 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C5 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C6 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C7 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C8 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C9 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C10 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

	Unequal Spacing (inches)	Zone Area (inches ²)	Zone Depth(x) (inches)	Area Depth(x) (inches ³)	Zone Depth(y) (inches)	Area Depth(y) (inches ³)	
C1 (inches)	<input type="text" value="0.00"/>	<input type="text" value="39.00"/>	<input type="text" value="97.50"/>	<input type="text" value="1.67"/>	<input type="text" value="162.50"/>	<input type="text" value="26.00"/>	<input type="text" value="2535.00"/>
C2 (inches)	<input type="text" value="5.00"/>	<input type="text" value="20.00"/>	<input type="text" value="50.00"/>	<input type="text" value="1.67"/>	<input type="text" value="83.33"/>	<input type="text" value="26.67"/>	<input type="text" value="1333.33"/>
C3 (inches)	<input type="text" value="0.00"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C4 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C5 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C6 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C7 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C8 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C9 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C10 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Average Crush (inches):

Average Crush (inches):

Results

	Average Force (poundsf)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	Closing Speed (MPH)		
Minimum	<input type="text" value="291.3"/>	<input type="text" value="86.7"/>	<input type="text" value="68950.95"/>	<input type="text" value="214655.23"/>	<input type="text" value="44.4"/>	<input type="text" value="40.3"/>	<input type="text" value="54.0"/>
Avg - 2 Std. Deviations	<input type="text" value="270.5"/>	<input type="text" value="55.1"/>	<input type="text" value="45655.53"/>	<input type="text" value="147971.47"/>	<input type="text" value="36.9"/>	<input type="text" value="33.4"/>	<input type="text" value="44.8"/>
Avg - 1 Std. Deviations	<input type="text" value="322.8"/>	<input type="text" value="93.3"/>	<input type="text" value="74400.30"/>	<input type="text" value="232233.43"/>	<input type="text" value="46.2"/>	<input type="text" value="41.9"/>	<input type="text" value="56.1"/>
Average	<input type="text" value="375.1"/>	<input type="text" value="131.5"/>	<input type="text" value="103145.07"/>	<input type="text" value="316789.70"/>	<input type="text" value="54.0"/>	<input type="text" value="48.9"/>	<input type="text" value="65.5"/>
Avg + 1 Std. Deviations	<input type="text" value="427.4"/>	<input type="text" value="169.7"/>	<input type="text" value="131889.84"/>	<input type="text" value="401441.52"/>	<input type="text" value="60.8"/>	<input type="text" value="55.0"/>	<input type="text" value="73.7"/>
Avg + 2 Std. Deviations	<input type="text" value="479.7"/>	<input type="text" value="207.9"/>	<input type="text" value="160634.61"/>	<input type="text" value="486136.23"/>	<input type="text" value="66.9"/>	<input type="text" value="60.5"/>	<input type="text" value="81.1"/>
Maximum	<input type="text" value="496.8"/>	<input type="text" value="232.8"/>	<input type="text" value="179006.08"/>	<input type="text" value="539176.36"/>	<input type="text" value="70.4"/>	<input type="text" value="63.8"/>	<input type="text" value="85.4"/>
Damage Centroid Depth (x) (inches)	<input type="text" value="17.02"/>			k ²	<input type="text" value="3061.62"/>		
Damage Centroid Depth (y) (inches)	<input type="text" value="20.85"/>	Eff. Mass Ratio (gamma)		<input type="text" value="1.00"/>			
Area of Damage (inches ²):	<input type="text" value="1446.09"/>						

Results

	Average Force (poundsf)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	bsub1		
Minimum	<input type="text" value="527.0"/>	<input type="text" value="724.1"/>	<input type="text" value="68950.95"/>	<input type="text" value="22255.26"/>	<input type="text" value="4.9"/>	<input type="text" value="4.7"/>	<input type="text" value="24.2"/>
Avg - 2 Std. Deviations	<input type="text" value="416.6"/>	<input type="text" value="452.4"/>	<input type="text" value="45655.53"/>	<input type="text" value="15331.81"/>	<input type="text" value="4.0"/>	<input type="text" value="3.9"/>	<input type="text" value="19.1"/>
Avg - 1 Std. Deviations	<input type="text" value="550.0"/>	<input type="text" value="788.8"/>	<input type="text" value="74400.30"/>	<input type="text" value="23863.34"/>	<input type="text" value="5.0"/>	<input type="text" value="4.8"/>	<input type="text" value="25.2"/>
Average	<input type="text" value="659.7"/>	<input type="text" value="1134.7"/>	<input type="text" value="103145.07"/>	<input type="text" value="32297.33"/>	<input type="text" value="5.9"/>	<input type="text" value="5.7"/>	<input type="text" value="30.3"/>
Avg + 1 Std. Deviations	<input type="text" value="755.0"/>	<input type="text" value="1486.3"/>	<input type="text" value="131889.84"/>	<input type="text" value="40672.58"/>	<input type="text" value="6.6"/>	<input type="text" value="6.4"/>	<input type="text" value="34.6"/>
Avg + 2 Std. Deviations	<input type="text" value="840.5"/>	<input type="text" value="1841.9"/>	<input type="text" value="160634.61"/>	<input type="text" value="49007.45"/>	<input type="text" value="7.2"/>	<input type="text" value="7.0"/>	<input type="text" value="38.6"/>
Maximum	<input type="text" value="891.2"/>	<input type="text" value="2070.7"/>	<input type="text" value="179006.08"/>	<input type="text" value="54318.30"/>	<input type="text" value="7.6"/>	<input type="text" value="7.4"/>	<input type="text" value="40.9"/>
Damage Centroid Depth (x) (inches)	<input type="text" value="1.67"/>			k ²	<input type="text" value="4555.08"/>		
Damage Centroid Depth (y) (inches)	<input type="text" value="26.23"/>	Eff. Mass Ratio (gamma)		<input type="text" value="0.34"/>			
Area of Damage (inches ²):	<input type="text" value="147.50"/>						

Test 4

Pontiac Montana Extended into Ford F600 Rear

Crash Test 4
2001 Pontiac Montana into the Rear of a pre-1980 Ford F600 Dump Truck

In this test there is no lever arm or angle to the collision face issues to consider.

The Ford has no rear bumper, as such the front of the Pontiac Montana did underide the rear of the dump truck. The tow hitch on the Ford offered little resistance to the impact and was broken off in the impact. Primary contact between the two vehicles at the bumper level was between the Pontiac bumper and the protective “shield” for the rear axle and differential of the Ford. There was also significant contact between the bottom of the dump bed and the Pontiacs hood.

The calculated closing speed based on the average front stiffness values for the Montana in this test is 59.5 mph, with a plus/minus 1 Standard Deviation range of 49.6-68 mph.

The two page calculation result for this test situation follows.

2001 PONTIAC MONTANA EXTENDED - Front Impact

1978 FORD F600 - Rear Impact

Curb Weight (pounds):

Occupant + Cargo Weight (pounds):

Total Weight (pounds):

Angle Coll Force to Normal (degrees):

No Damage Speed (mph):

Energy Crush Depth (inches):

Damage Length (inches):

Crush Profile Measurements:

PDOF

Lever Arm Distance (inches):

Yaw Moment of Inertia (lb-ft-sec²):

"Known" Stiffness Values

	A	B
Average	<input type="text" value="351.4"/>	<input type="text" value="104.5"/>
Minimum	<input type="text" value="303.0"/>	<input type="text" value="79.1"/>
Maximum	<input type="text" value="470.0"/>	<input type="text" value="183.8"/>
Std. Deviation	<input type="text" value="56.9"/>	<input type="text" value="35.9"/>

Curb Weight (pounds):

Occupant + Cargo Weight (pounds):

Total Weight (pounds):

Angle Coll Force to Normal (degrees):

No Damage Speed (mph):

Energy Crush Depth (inches):

Damage Length (inches):

Crush Profile Measurements:

PDOF

Lever Arm Distance (inches):

Yaw Moment of Inertia (lb-ft-sec²):

	Unequal Spacing (inches)	Zone Area (inches ²)	Zone Depth(x) (inches)	Area Depth(x) (inches ³)	Zone Depth(y) (inches)	Area Depth(y) (inches ³)
C1 (inches)	<input type="text" value="29.00"/>	<input type="text" value="72.00"/>	<input type="text" value="2088.00"/>	<input type="text" value="14.50"/>	<input type="text" value="30276.00"/>	<input type="text" value="36.00"/>
C2 (inches)	<input type="text" value="29.00"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C3 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C4 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C5 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C6 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C7 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C8 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C9 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C10 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

	Unequal Spacing (inches)	Zone Area (inches ²)	Zone Depth(x) (inches)	Area Depth(x) (inches ³)	Zone Depth(y) (inches)	Area Depth(y) (inches ³)
C1 (inches)	<input type="text" value="1.00"/>	<input type="text" value="96.00"/>	<input type="text" value="96.00"/>	<input type="text" value="0.50"/>	<input type="text" value="48.00"/>	<input type="text" value="48.00"/>
C2 (inches)	<input type="text" value="1.00"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text" value="4608.00"/>
C3 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C4 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C5 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C6 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C7 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C8 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C9 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C10 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Average Crush (inches):

Average Crush (inches):

Results

	Average Force		Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	Closing Speed (MPH)
	A	B				
Minimum	<input type="text" value="303.0"/>	<input type="text" value="79.1"/>	<input type="text" value="93488.40"/>	<input type="text" value="255773.31"/>	<input type="text" value="44.1"/>	<input type="text" value="38.3"/>
Avg - 2 Std. Deviations	<input type="text" value="237.6"/>	<input type="text" value="32.7"/>	<input type="text" value="42692.40"/>	<input type="text" value="129023.74"/>	<input type="text" value="31.3"/>	<input type="text" value="27.2"/>
Avg - 1 Std. Deviations	<input type="text" value="294.5"/>	<input type="text" value="68.6"/>	<input type="text" value="82220.40"/>	<input type="text" value="228113.67"/>	<input type="text" value="41.7"/>	<input type="text" value="36.2"/>
Average	<input type="text" value="351.4"/>	<input type="text" value="104.5"/>	<input type="text" value="121748.40"/>	<input type="text" value="328342.04"/>	<input type="text" value="50.0"/>	<input type="text" value="43.4"/>
Avg + 1 Std. Deviations	<input type="text" value="408.3"/>	<input type="text" value="140.4"/>	<input type="text" value="161276.40"/>	<input type="text" value="428835.56"/>	<input type="text" value="57.1"/>	<input type="text" value="49.6"/>
Avg + 2 Std. Deviations	<input type="text" value="465.2"/>	<input type="text" value="176.3"/>	<input type="text" value="200804.40"/>	<input type="text" value="529432.25"/>	<input type="text" value="63.5"/>	<input type="text" value="55.1"/>
Maximum	<input type="text" value="470.0"/>	<input type="text" value="183.8"/>	<input type="text" value="208807.20"/>	<input type="text" value="549112.95"/>	<input type="text" value="64.6"/>	<input type="text" value="56.2"/>
Damage Centroid Depth (x) (inches)	<input type="text" value="14.50"/>				k ²	<input type="text" value="3196.19"/>
Damage Centroid Depth (y) (inches)	<input type="text" value="36.00"/>		Eff. Mass Ratio (gamma)		<input type="text" value="1.00"/>	
Area of Damage (inches ²):	<input type="text" value="2088.00"/>					

Results

	Average Force		Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	b _{sub1}
	A	B				
Minimum	<input type="text" value="374.0"/>	<input type="text" value="1573.6"/>	<input type="text" value="93488.40"/>	<input type="text" value="9642.42"/>	<input type="text" value="5.2"/>	<input type="text" value="14.2"/>
Avg - 2 Std. Deviations	<input type="text" value="240.2"/>	<input type="text" value="649.2"/>	<input type="text" value="42692.40"/>	<input type="text" value="4874.25"/>	<input type="text" value="3.7"/>	<input type="text" value="10.1"/>
Avg - 1 Std. Deviations	<input type="text" value="348.3"/>	<input type="text" value="1364.6"/>	<input type="text" value="82220.40"/>	<input type="text" value="8600.52"/>	<input type="text" value="4.9"/>	<input type="text" value="13.4"/>
Average	<input type="text" value="432.5"/>	<input type="text" value="2103.9"/>	<input type="text" value="121748.40"/>	<input type="text" value="12231.23"/>	<input type="text" value="5.9"/>	<input type="text" value="16.1"/>
Avg + 1 Std. Deviations	<input type="text" value="503.9"/>	<input type="text" value="2856.0"/>	<input type="text" value="161276.40"/>	<input type="text" value="15810.85"/>	<input type="text" value="6.7"/>	<input type="text" value="18.4"/>
Avg + 2 Std. Deviations	<input type="text" value="567.0"/>	<input type="text" value="3616.4"/>	<input type="text" value="200804.40"/>	<input type="text" value="19357.34"/>	<input type="text" value="7.4"/>	<input type="text" value="20.4"/>
Maximum	<input type="text" value="579.0"/>	<input type="text" value="3771.1"/>	<input type="text" value="208807.20"/>	<input type="text" value="20072.25"/>	<input type="text" value="7.5"/>	<input type="text" value="20.8"/>
Damage Centroid Depth (x) (inches)	<input type="text" value="0.50"/>				k ²	<input type="text" value="4190.36"/>
Damage Centroid Depth (y) (inches)	<input type="text" value="48.00"/>		Eff. Mass Ratio (gamma)		<input type="text" value="1.00"/>	
Area of Damage (inches ²):	<input type="text" value="96.00"/>					

Test 5

Chevrolet Malibu into Ford F600 Rear Axle

Crash Test 5
2004 Chevrolet Malibu into the side of a pre-1980 Ford F600 Dump Truck

In this test impact was into the side of the Ford at the rear axle. Contact was between the front of the Malibu and the Rear tire and axle of the F600.

No permanent damage to the F600 was observed, yet the Force Balance model REQUIRES there be damage to both vehicles. Under these situations I follow the following procedure:

- 1 - Set the damage profile to a 2 point measurement with a damage length equal to the diameter fo the tire an a 1 inch crush depth on each end.
- 2 - Enter the measured crush file fo the other vehicle as you normally would.

The 1 inch crush depth is used because it is “unitary”, as well as being small, but not too small.

Again, the minimum calculated closing speed is achieved by setting the angle to the collision face and the lever arm to zero.

Under this set up, the calculated closing speed based on the average front stiffness values for the Malibu in this test is 46.3 mph, with a plus/minus 1 Standard Deviation range of 41.4-50.8 mph.

When the lever arm is changed to 74 inches, the distance the rear axle is behind the bus CG based on its weight distribution, the calculated closing speed based on the average front stiffness values for the Malibu in this test is 52.9 mph, with a plus/minus 1 Standard Deviation range of 41.4-50.8 mph.

The two page calculation results for each of these test situations follow.

2004 CHEVROLET MALIBU - Front Impact

Curb Weight (pounds):

Occupant + Cargo Weight (pounds):

Total Weight (pounds):

Angle Coll Force to Normal (degrees):

No Damage Speed (mph):

Energy Crush Depth (inches):

Damage Length (inches):

Crush Profile Measurements:

PDOF

Lever Arm Distance (inches):

Yaw Moment of Inertia (lb-ft-sec²):

"Known" Stiffness Values

	A	B
Average	<input type="text" value="376.9"/>	<input type="text" value="132.7"/>
Minimum	<input type="text" value="291.3"/>	<input type="text" value="86.7"/>
Maximum	<input type="text" value="496.8"/>	<input type="text" value="232.8"/>
Std. Deviation	<input type="text" value="52.4"/>	<input type="text" value="38.0"/>

	Unequal Spacing (inches)	Zone Area (inches ²)	Zone Depth(x) (inches)	Area Depth(x) (inches ³)	Zone Depth(y) (inches)	Area Depth(y) (inches ³)
C1 (inches)	<input type="text" value="22.00"/>	<input type="text" value="25.00"/>	<input type="text" value="562.50"/>	<input type="text" value="11.25"/>	<input type="text" value="6329.17"/>	<input type="text" value="12.59"/>
C2 (inches)	<input type="text" value="23.00"/>	<input type="text" value="18.00"/>	<input type="text" value="324.00"/>	<input type="text" value="9.23"/>	<input type="text" value="2991.00"/>	<input type="text" value="26.17"/>
C3 (inches)	<input type="text" value="13.00"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C4 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C5 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C6 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C7 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C8 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C9 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C10 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Average Crush (inches):

Results

	A	B	Average Force (poundsf)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	Closing Speed (MPH)
Minimum	<input type="text" value="291.3"/>	<input type="text" value="86.7"/>	<input type="text" value="44699.66"/>	<input type="text" value="90611.55"/>	<input type="text" value="28.9"/>	<input type="text" value="30.6"/>	<input type="text" value="40.0"/>
Avg - 2 Std. Deviations	<input type="text" value="272.1"/>	<input type="text" value="56.7"/>	<input type="text" value="30986.96"/>	<input type="text" value="66478.72"/>	<input type="text" value="24.7"/>	<input type="text" value="27.4"/>	<input type="text" value="35.8"/>
Avg - 1 Std. Deviations	<input type="text" value="324.5"/>	<input type="text" value="94.7"/>	<input type="text" value="48960.10"/>	<input type="text" value="99516.30"/>	<input type="text" value="30.3"/>	<input type="text" value="31.7"/>	<input type="text" value="41.4"/>
Average	<input type="text" value="376.9"/>	<input type="text" value="132.7"/>	<input type="text" value="66933.24"/>	<input type="text" value="132826.95"/>	<input type="text" value="35.0"/>	<input type="text" value="35.4"/>	<input type="text" value="46.3"/>
Avg + 1 Std. Deviations	<input type="text" value="429.3"/>	<input type="text" value="170.7"/>	<input type="text" value="84906.38"/>	<input type="text" value="166228.30"/>	<input type="text" value="39.1"/>	<input type="text" value="38.9"/>	<input type="text" value="50.8"/>
Avg + 2 Std. Deviations	<input type="text" value="481.7"/>	<input type="text" value="208.7"/>	<input type="text" value="102879.52"/>	<input type="text" value="199670.81"/>	<input type="text" value="42.9"/>	<input type="text" value="42.0"/>	<input type="text" value="54.9"/>
Maximum	<input type="text" value="496.8"/>	<input type="text" value="232.8"/>	<input type="text" value="113888.42"/>	<input type="text" value="219411.83"/>	<input type="text" value="44.9"/>	<input type="text" value="43.7"/>	<input type="text" value="57.1"/>
Damage Centroid Depth (x) (inches)	<input type="text" value="10.51"/>				k ²	<input type="text" value="3061.62"/>	
Damage Centroid Depth (y) (inches)	<input type="text" value="17.55"/>		Eff. Mass Ratio (gamma)		<input type="text" value="1.00"/>		
Area of Damage (inches ²):	<input type="text" value="886.50"/>						

1978 FORD F600 - Side Impact

Curb Weight (pounds):

Occupant + Cargo Weight (pounds):

Total Weight (pounds):

Angle Coll Force to Normal (degrees):

No Damage Speed (mph):

Energy Crush Depth (inches):

Damage Length (inches):

Crush Profile Measurements:

PDOF

Lever Arm Distance (inches):

Yaw Moment of Inertia (lb-ft-sec²):

	Equal Spacing (inches)	Zone Area (inches ²)	Zone Depth(x) (inches)	Area Depth(x) (inches ³)	Zone Depth(y) (inches)	Area Depth(y) (inches ³)
C1 (inches)	<input type="text" value="1.00"/>	<input type="text" value="45.00"/>	<input type="text" value="45.00"/>	<input type="text" value="0.50"/>	<input type="text" value="22.50"/>	<input type="text" value="22.50"/>
C2 (inches)	<input type="text" value="1.00"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text" value="1012.50"/>
C3 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C4 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C5 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C6 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C7 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C8 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C9 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C10 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Average Crush (inches):

Results

	A	B	Average Force (poundsf)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	bsub1
Minimum	<input type="text" value="1813.3"/>	<input type="text" value="173.4"/>	<input type="text" value="44699.66"/>	<input type="text" value="42685.09"/>	<input type="text" value="11.0"/>	<input type="text" value="9.4"/>	<input type="text" value="16.8"/>
Avg - 2 Std. Deviations	<input type="text" value="1289.5"/>	<input type="text" value="87.7"/>	<input type="text" value="30986.96"/>	<input type="text" value="40560.30"/>	<input type="text" value="10.7"/>	<input type="text" value="8.4"/>	<input type="text" value="12.0"/>
Avg - 1 Std. Deviations	<input type="text" value="1971.1"/>	<input type="text" value="204.9"/>	<input type="text" value="48960.10"/>	<input type="text" value="43336.10"/>	<input type="text" value="11.1"/>	<input type="text" value="9.7"/>	<input type="text" value="18.3"/>
Average	<input type="text" value="2614.4"/>	<input type="text" value="360.4"/>	<input type="text" value="66933.24"/>	<input type="text" value="46040.00"/>	<input type="text" value="11.4"/>	<input type="text" value="10.9"/>	<input type="text" value="24.3"/>
Avg + 1 Std. Deviations	<input type="text" value="3225.2"/>	<input type="text" value="548.5"/>	<input type="text" value="84906.38"/>	<input type="text" value="48682.92"/>	<input type="text" value="11.7"/>	<input type="text" value="11.9"/>	<input type="text" value="29.9"/>
Avg + 2 Std. Deviations	<input type="text" value="3807.9"/>	<input type="text" value="764.5"/>	<input type="text" value="102879.52"/>	<input type="text" value="51273.27"/>	<input type="text" value="12.0"/>	<input type="text" value="12.9"/>	<input type="text" value="35.3"/>
Maximum	<input type="text" value="4152.5"/>	<input type="text" value="909.2"/>	<input type="text" value="113888.42"/>	<input type="text" value="52836.87"/>	<input type="text" value="12.2"/>	<input type="text" value="13.4"/>	<input type="text" value="38.5"/>
Damage Centroid Depth (x) (inches)	<input type="text" value="0.50"/>				k ²	<input type="text" value="4190.36"/>	
Damage Centroid Depth (y) (inches)	<input type="text" value="22.50"/>		Eff. Mass Ratio (gamma)		<input type="text" value="1.00"/>		
Area of Damage (inches ²):	<input type="text" value="45.00"/>						

2004 CHEVROLET MALIBU - Front Impact

Curb Weight (pounds):

Occupant + Cargo Weight (pounds):

Total Weight (pounds):

Angle Coll Force to Normal (degrees):

No Damage Speed (mph):

Energy Crush Depth (inches):

Damage Length (inches):

Crush Profile Measurements:

PDOF

Lever Arm Distance (inches):

Yaw Moment of Inertia (lb-ft-sec²):

"Known" Stiffness Values

	A	B
Average	<input type="text" value="376.9"/>	<input type="text" value="132.7"/>
Minimum	<input type="text" value="291.3"/>	<input type="text" value="86.7"/>
Maximum	<input type="text" value="496.8"/>	<input type="text" value="232.8"/>
Std. Deviation	<input type="text" value="52.4"/>	<input type="text" value="38.0"/>

	Unequal Spacing (inches)	Zone Area (inches ²)	Zone Depth(x) (inches)	Area Depth(x) (inches ³)	Zone Depth(y) (inches)	Area Depth(y) (inches ³)
C1 (inches)	<input type="text" value="22.00"/>	<input type="text" value="25.00"/>	<input type="text" value="562.50"/>	<input type="text" value="11.25"/>	<input type="text" value="6329.17"/>	<input type="text" value="12.59"/>
C2 (inches)	<input type="text" value="23.00"/>	<input type="text" value="18.00"/>	<input type="text" value="324.00"/>	<input type="text" value="9.23"/>	<input type="text" value="2991.00"/>	<input type="text" value="26.17"/>
C3 (inches)	<input type="text" value="13.00"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C4 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C5 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C6 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C7 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C8 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C9 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C10 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Average Crush (inches):

Results

	A	B	Average Force (poundsf)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	Closing Speed (MPH)
Minimum	<input type="text" value="291.3"/>	<input type="text" value="86.7"/>	<input type="text" value="44699.66"/>	<input type="text" value="90611.55"/>	<input type="text" value="28.9"/>	<input type="text" value="26.8"/>	<input type="text" value="45.7"/>
Avg - 2 Std. Deviations	<input type="text" value="272.1"/>	<input type="text" value="56.7"/>	<input type="text" value="30986.96"/>	<input type="text" value="66478.72"/>	<input type="text" value="24.7"/>	<input type="text" value="24.0"/>	<input type="text" value="41.0"/>
Avg - 1 Std. Deviations	<input type="text" value="324.5"/>	<input type="text" value="94.7"/>	<input type="text" value="48960.10"/>	<input type="text" value="99516.30"/>	<input type="text" value="30.3"/>	<input type="text" value="27.7"/>	<input type="text" value="47.3"/>
Average	<input type="text" value="376.9"/>	<input type="text" value="132.7"/>	<input type="text" value="66933.24"/>	<input type="text" value="132826.95"/>	<input type="text" value="35.0"/>	<input type="text" value="31.0"/>	<input type="text" value="52.9"/>
Avg + 1 Std. Deviations	<input type="text" value="429.3"/>	<input type="text" value="170.7"/>	<input type="text" value="84906.38"/>	<input type="text" value="166228.30"/>	<input type="text" value="39.1"/>	<input type="text" value="34.0"/>	<input type="text" value="58.0"/>
Avg + 2 Std. Deviations	<input type="text" value="481.7"/>	<input type="text" value="208.7"/>	<input type="text" value="102879.52"/>	<input type="text" value="199670.81"/>	<input type="text" value="42.9"/>	<input type="text" value="36.7"/>	<input type="text" value="62.7"/>
Maximum	<input type="text" value="496.8"/>	<input type="text" value="232.8"/>	<input type="text" value="113888.42"/>	<input type="text" value="219411.83"/>	<input type="text" value="44.9"/>	<input type="text" value="38.3"/>	<input type="text" value="65.3"/>

Damage Centroid Depth (x) (inches) k^2

Damage Centroid Depth (y) (inches) Eff. Mass Ratio (gamma)

Area of Damage (inches²):

1978 FORD F600 - Side Impact

Curb Weight (pounds):

Occupant + Cargo Weight (pounds):

Total Weight (pounds):

Angle Coll Force to Normal (degrees):

No Damage Speed (mph):

Energy Crush Depth (inches):

Damage Length (inches):

Crush Profile Measurements:

PDOF

Lever Arm Distance (inches):

Yaw Moment of Inertia (lb-ft-sec²):

	Equal Spacing (inches)	Zone Area (inches ²)	Zone Depth(x) (inches)	Area Depth(x) (inches ³)	Zone Depth(y) (inches)	Area Depth(y) (inches ³)
C1 (inches)	<input type="text" value="1.00"/>	<input type="text" value="45.00"/>	<input type="text" value="45.00"/>	<input type="text" value="0.50"/>	<input type="text" value="22.50"/>	<input type="text" value="22.50"/>
C2 (inches)	<input type="text" value="1.00"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text" value="1012.50"/>
C3 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C4 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C5 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C6 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C7 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C8 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C9 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C10 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Average Crush (inches):

Results

	A	B	Average Force (poundsf)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	bsub1
Minimum	<input type="text" value="1813.3"/>	<input type="text" value="173.4"/>	<input type="text" value="44699.66"/>	<input type="text" value="42685.09"/>	<input type="text" value="11.0"/>	<input type="text" value="8.2"/>	<input type="text" value="16.8"/>
Avg - 2 Std. Deviations	<input type="text" value="1289.5"/>	<input type="text" value="87.7"/>	<input type="text" value="30986.96"/>	<input type="text" value="40560.30"/>	<input type="text" value="10.7"/>	<input type="text" value="7.4"/>	<input type="text" value="12.0"/>
Avg - 1 Std. Deviations	<input type="text" value="1971.1"/>	<input type="text" value="204.9"/>	<input type="text" value="48960.10"/>	<input type="text" value="43336.10"/>	<input type="text" value="11.1"/>	<input type="text" value="8.5"/>	<input type="text" value="18.3"/>
Average	<input type="text" value="2614.4"/>	<input type="text" value="360.4"/>	<input type="text" value="66933.24"/>	<input type="text" value="46040.00"/>	<input type="text" value="11.4"/>	<input type="text" value="9.5"/>	<input type="text" value="24.3"/>
Avg + 1 Std. Deviations	<input type="text" value="3225.2"/>	<input type="text" value="548.5"/>	<input type="text" value="84906.38"/>	<input type="text" value="48682.92"/>	<input type="text" value="11.7"/>	<input type="text" value="10.4"/>	<input type="text" value="29.9"/>
Avg + 2 Std. Deviations	<input type="text" value="3807.9"/>	<input type="text" value="764.5"/>	<input type="text" value="102879.52"/>	<input type="text" value="51273.27"/>	<input type="text" value="12.0"/>	<input type="text" value="11.3"/>	<input type="text" value="35.3"/>
Maximum	<input type="text" value="4152.5"/>	<input type="text" value="909.2"/>	<input type="text" value="113888.42"/>	<input type="text" value="52836.87"/>	<input type="text" value="12.2"/>	<input type="text" value="11.7"/>	<input type="text" value="38.5"/>

Damage Centroid Depth (x) (inches) k^2

Damage Centroid Depth (y) (inches) Eff. Mass Ratio (gamma)

Area of Damage (inches²):

The following pages repeat the Force Balance results at full size for easier reading.

Also included is the test data that establishes the stiffness values for each of the “known” vehicles in these crash tests.

Test 1

Gillig Bus

into

Pontiac Grand Am - Side

2002 PONTIAC GRAND AM - Side Impact

Curb Weight (pounds):
 Occupant + Cargo Weight (pounds):
 Total Weight (pounds):

PDOF
 Lever Arm Distance (inches):
 Yaw Moment of Inertia (lb-ft-sec²):

Angle Coll Force to Normal (degrees):
 No Damage Speed (mph):
 Energy Crush Depth (inches):
 Damage Length (inches):
 Crush Profile Measurements:

"Known" Stiffness Values		
	A	B
Average	<input type="text" value="141.7"/>	<input type="text" value="207.1"/>
Minimum	<input type="text" value="122.5"/>	<input type="text" value="139.7"/>
Maximum	<input type="text" value="180.5"/>	<input type="text" value="295.9"/>
Std. Devation	<input type="text" value="26.2"/>	<input type="text" value="65.2"/>

	Unequal Spacing (inches)	Zone Area (inches ²)	Zone Depth(x) (inches)	Area Depth(x) (inches ³)	Zone Depth(y) (inches)	Area Depth(y) (inches ³)	
C1 (inches)	<input type="text" value="0.00"/>	<input type="text" value="42.00"/>	<input type="text" value="252.00"/>	<input type="text" value="4.00"/>	<input type="text" value="1008.00"/>	<input type="text" value="28.00"/>	<input type="text" value="7056.00"/>
C2 (inches)	<input type="text" value="12.00"/>	<input type="text" value="30.00"/>	<input type="text" value="240.00"/>	<input type="text" value="4.33"/>	<input type="text" value="1040.00"/>	<input type="text" value="42.50"/>	<input type="text" value="10200.00"/>
C3 (inches)	<input type="text" value="4.00"/>	<input type="text" value="14.00"/>	<input type="text" value="28.00"/>	<input type="text" value="1.33"/>	<input type="text" value="37.33"/>	<input type="text" value="32.67"/>	<input type="text" value="914.67"/>
C4 (inches)	<input type="text" value="0.00"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C5 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C6 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C7 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C8 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C9 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C10 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Average Crush (inches):

Results

	A	B	Average Force (poundsf)	Damage Energy (ft*lbs)	KE Speed (mph)	Closing Delta V (mph)	Closing Speed (MPH)
Minimum	<input type="text" value="122.5"/>	<input type="text" value="139.7"/>	<input type="text" value="41610.46"/>	<input type="text" value="29987.07"/>	<input type="text" value="17.2"/>	<input type="text" value="23.4"/>	<input type="text" value="25.9"/>
Avg - 2 Std. Deviations	<input type="text" value="89.3"/>	<input type="text" value="76.7"/>	<input type="text" value="23793.41"/>	<input type="text" value="17580.90"/>	<input type="text" value="13.2"/>	<input type="text" value="20.2"/>	<input type="text" value="22.4"/>
Avg - 1 Std. Deviations	<input type="text" value="115.5"/>	<input type="text" value="141.9"/>	<input type="text" value="41881.79"/>	<input type="text" value="30018.06"/>	<input type="text" value="17.2"/>	<input type="text" value="23.4"/>	<input type="text" value="26.0"/>
Average	<input type="text" value="141.7"/>	<input type="text" value="207.1"/>	<input type="text" value="59970.17"/>	<input type="text" value="42501.43"/>	<input type="text" value="20.4"/>	<input type="text" value="26.3"/>	<input type="text" value="29.1"/>
Avg + 1 Std. Deviations	<input type="text" value="167.9"/>	<input type="text" value="272.3"/>	<input type="text" value="78058.55"/>	<input type="text" value="54997.82"/>	<input type="text" value="23.3"/>	<input type="text" value="28.8"/>	<input type="text" value="31.9"/>
Avg + 2 Std. Deviations	<input type="text" value="194.1"/>	<input type="text" value="337.5"/>	<input type="text" value="96146.93"/>	<input type="text" value="67499.69"/>	<input type="text" value="25.8"/>	<input type="text" value="31.1"/>	<input type="text" value="34.5"/>
Maximum	<input type="text" value="180.5"/>	<input type="text" value="295.9"/>	<input type="text" value="84739.89"/>	<input type="text" value="59671.23"/>	<input type="text" value="24.2"/>	<input type="text" value="29.7"/>	<input type="text" value="32.9"/>
Damage Centroid Depth (x) (inches)	<input type="text" value="4.01"/>				k ²	<input type="text" value="2942.47"/>	
Damage Centroid Depth (y) (inches)	<input type="text" value="34.94"/>				Eff. Mass Ratio (gamma)	<input type="text" value="1.00"/>	
Area of Damage (inches ²):	<input type="text" value="520.30"/>						

2008 GILLIG LOW FLOOR TRANSIT BUS - Front Impact

Curb Weight (pounds):
 Occupant + Cargo Weight (pounds):
 Total Weight (pounds):

PDOF
 Lever Arm Distance (inches):
 Yaw Moment of Inertia (lb-ft-sec²):

Angle Coll Force to Normal (degrees):

No Damage Speed (mph):

Energy Crush Depth (inches):

Damage Length (inches):

Crush Profile Measurements:

	Equal Spacing (inches)	Zone Area (inches ²)	Zone Depth(x) (inches)	Area Depth(x) (inches ³)	Zone Depth(y) (inches)	Area Depth(y) (inches ³)
C1 (inches)	<input type="text" value="2.50"/>	<input type="text" value="44.00"/>	<input type="text" value="0.83"/>	<input type="text" value="45.83"/>	<input type="text" value="14.67"/>	<input type="text" value="806.67"/>
C2 (inches)	<input type="text" value="0.00"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C3 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C4 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C5 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C6 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C7 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C8 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C9 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C10 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Average Crush (inches):

Results

	A	B	Average Force (poundsf)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	b _{sub1}
Minimum	<input type="text" value="1632.3"/>	<input type="text" value="207.2"/>	<input type="text" value="41610.46"/>	<input type="text" value="31846.15"/>	<input type="text" value="5.8"/>	<input type="text" value="2.5"/>	<input type="text" value="11.2"/>
Avg - 2 Std. Deviations	<input type="text" value="986.8"/>	<input type="text" value="75.7"/>	<input type="text" value="23793.41"/>	<input type="text" value="28385.37"/>	<input type="text" value="5.5"/>	<input type="text" value="2.2"/>	<input type="text" value="6.8"/>
Avg - 1 Std. Deviations	<input type="text" value="1641.7"/>	<input type="text" value="209.6"/>	<input type="text" value="41881.79"/>	<input type="text" value="31898.13"/>	<input type="text" value="5.8"/>	<input type="text" value="2.5"/>	<input type="text" value="11.2"/>
Average	<input type="text" value="2238.7"/>	<input type="text" value="389.8"/>	<input type="text" value="59970.17"/>	<input type="text" value="35322.48"/>	<input type="text" value="6.1"/>	<input type="text" value="2.8"/>	<input type="text" value="15.3"/>
Avg + 1 Std. Deviations	<input type="text" value="2790.9"/>	<input type="text" value="605.8"/>	<input type="text" value="78058.55"/>	<input type="text" value="38678.39"/>	<input type="text" value="6.4"/>	<input type="text" value="3.1"/>	<input type="text" value="19.1"/>
Avg + 2 Std. Deviations	<input type="text" value="3307.1"/>	<input type="text" value="850.6"/>	<input type="text" value="96146.93"/>	<input type="text" value="41979.29"/>	<input type="text" value="6.7"/>	<input type="text" value="3.4"/>	<input type="text" value="22.6"/>
Maximum	<input type="text" value="2985.4"/>	<input type="text" value="693.1"/>	<input type="text" value="84739.89"/>	<input type="text" value="39903.48"/>	<input type="text" value="6.5"/>	<input type="text" value="3.2"/>	<input type="text" value="20.4"/>
Damage Centroid Depth (x) (inches)	<input type="text" value="0.83"/>				k ²	<input type="text" value="4555.08"/>	
Damage Centroid Depth (y) (inches)	<input type="text" value="14.67"/>		Eff. Mass Ratio (gamma)		<input type="text" value="1.00"/>		
Area of Damage (inches ²):	<input type="text" value="55.00"/>						

2002 PONTIAC GRAND AM - Side Impact

Curb Weight (pounds):
 Occupant + Cargo Weight (pounds):
 Total Weight (pounds):

PDOF
 Lever Arm Distance (inches):
 Yaw Moment of Inertia (lb-ft-sec²):

Angle Coll Force to Normal (degrees):
 No Damage Speed (mph):
 Energy Crush Depth (inches):
 Damage Length (inches):
 Crush Profile Measurements:

"Known" Stiffness Values		
	A	B
Average	<input type="text" value="141.7"/>	<input type="text" value="207.1"/>
Minimum	<input type="text" value="122.5"/>	<input type="text" value="139.7"/>
Maximum	<input type="text" value="180.5"/>	<input type="text" value="295.9"/>
Std. Devation	<input type="text" value="26.2"/>	<input type="text" value="65.2"/>

	Unequal Spacing (inches)	Zone Area (inches ²)	Zone Depth(x) (inches)	Area Depth(x) (inches ³)	Zone Depth(y) (inches)	Area Depth(y) (inches ³)	
C1 (inches)	<input type="text" value="0.00"/>	<input type="text" value="42.00"/>	<input type="text" value="252.00"/>	<input type="text" value="4.00"/>	<input type="text" value="1008.00"/>	<input type="text" value="28.00"/>	<input type="text" value="7056.00"/>
C2 (inches)	<input type="text" value="12.00"/>	<input type="text" value="30.00"/>	<input type="text" value="240.00"/>	<input type="text" value="4.33"/>	<input type="text" value="1040.00"/>	<input type="text" value="42.50"/>	<input type="text" value="10200.00"/>
C3 (inches)	<input type="text" value="4.00"/>	<input type="text" value="14.00"/>	<input type="text" value="28.00"/>	<input type="text" value="1.33"/>	<input type="text" value="37.33"/>	<input type="text" value="32.67"/>	<input type="text" value="914.67"/>
C4 (inches)	<input type="text" value="0.00"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C5 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C6 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C7 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C8 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C9 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C10 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Average Crush (inches):

Results

	A	B	Average Force (poundsf)	Damage Energy (ft*lbs)	KE Speed (mph)	Closing Delta V (mph)	Closing Speed (MPH)
Minimum	<input type="text" value="122.5"/>	<input type="text" value="139.7"/>	<input type="text" value="48047.61"/>	<input type="text" value="39982.76"/>	<input type="text" value="19.8"/>	<input type="text" value="25.6"/>	<input type="text" value="28.3"/>
Avg - 2 Std. Deviations	<input type="text" value="89.3"/>	<input type="text" value="76.7"/>	<input type="text" value="27474.26"/>	<input type="text" value="23441.20"/>	<input type="text" value="15.2"/>	<input type="text" value="21.8"/>	<input type="text" value="24.1"/>
Avg - 1 Std. Deviations	<input type="text" value="115.5"/>	<input type="text" value="141.9"/>	<input type="text" value="48360.92"/>	<input type="text" value="40024.07"/>	<input type="text" value="19.8"/>	<input type="text" value="25.7"/>	<input type="text" value="28.3"/>
Average	<input type="text" value="141.7"/>	<input type="text" value="207.1"/>	<input type="text" value="69247.58"/>	<input type="text" value="56668.57"/>	<input type="text" value="23.6"/>	<input type="text" value="29.0"/>	<input type="text" value="32.0"/>
Avg + 1 Std. Deviations	<input type="text" value="167.9"/>	<input type="text" value="272.3"/>	<input type="text" value="90134.24"/>	<input type="text" value="73330.43"/>	<input type="text" value="26.9"/>	<input type="text" value="32.0"/>	<input type="text" value="35.3"/>
Avg + 2 Std. Deviations	<input type="text" value="194.1"/>	<input type="text" value="337.5"/>	<input type="text" value="111020.91"/>	<input type="text" value="89999.59"/>	<input type="text" value="29.8"/>	<input type="text" value="34.7"/>	<input type="text" value="38.3"/>
Maximum	<input type="text" value="180.5"/>	<input type="text" value="295.9"/>	<input type="text" value="97849.19"/>	<input type="text" value="79561.65"/>	<input type="text" value="28.0"/>	<input type="text" value="33.0"/>	<input type="text" value="36.5"/>
Damage Centroid Depth (x) (inches)	<input type="text" value="4.01"/>				k^2	<input type="text" value="2942.47"/>	
Damage Centroid Depth (y) (inches)	<input type="text" value="34.94"/>				Eff. Mass Ratio (gamma)	<input type="text" value="1.00"/>	
Area of Damage (inches ²):	<input type="text" value="520.30"/>						

2008 GILLIG LOW FLOOR TRANSIT BUS - Front Impact

Curb Weight (pounds):
 Occupant + Cargo Weight (pounds):
 Total Weight (pounds):

PDOF
 Lever Arm Distance (inches):
 Yaw Moment of Inertia (lb-ft-sec²):

Angle Coll Force to Normal (degrees):

No Damage Speed (mph):

Energy Crush Depth (inches):

Damage Length (inches):

Crush Profile Measurements:

	Equal Spacing (inches)	Zone Area (inches ²)	Zone Depth(x) (inches)	Area Depth(x) (inches ³)	Zone Depth(y) (inches)	Area Depth(y) (inches ³)
C1 (inches)	<input type="text" value="2.50"/>	<input type="text" value="44.00"/>	<input type="text" value="0.83"/>	<input type="text" value="45.83"/>	<input type="text" value="14.67"/>	<input type="text" value="806.67"/>
C2 (inches)	<input type="text" value="0.00"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C3 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C4 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C5 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C6 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C7 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C8 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C9 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C10 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Average Crush (inches):

Results

	A	B	Average Force (poundsf)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	b _{sub1}
Minimum	<input type="text" value="1859.8"/>	<input type="text" value="259.3"/>	<input type="text" value="48047.61"/>	<input type="text" value="33965.42"/>	<input type="text" value="5.9"/>	<input type="text" value="2.7"/>	<input type="text" value="12.3"/>
Avg - 2 Std. Deviations	<input type="text" value="1129.3"/>	<input type="text" value="95.6"/>	<input type="text" value="27474.26"/>	<input type="text" value="29991.97"/>	<input type="text" value="5.5"/>	<input type="text" value="2.3"/>	<input type="text" value="7.5"/>
Avg - 1 Std. Deviations	<input type="text" value="1870.4"/>	<input type="text" value="262.3"/>	<input type="text" value="48360.92"/>	<input type="text" value="34025.05"/>	<input type="text" value="5.9"/>	<input type="text" value="2.7"/>	<input type="text" value="12.3"/>
Average	<input type="text" value="2542.0"/>	<input type="text" value="484.5"/>	<input type="text" value="69247.58"/>	<input type="text" value="37952.09"/>	<input type="text" value="6.2"/>	<input type="text" value="3.0"/>	<input type="text" value="16.8"/>
Avg + 1 Std. Deviations	<input type="text" value="3160.7"/>	<input type="text" value="749.1"/>	<input type="text" value="90134.24"/>	<input type="text" value="41798.26"/>	<input type="text" value="6.5"/>	<input type="text" value="3.3"/>	<input type="text" value="20.9"/>
Avg + 2 Std. Deviations	<input type="text" value="3737.3"/>	<input type="text" value="1047.3"/>	<input type="text" value="111020.91"/>	<input type="text" value="45580.11"/>	<input type="text" value="6.8"/>	<input type="text" value="3.6"/>	<input type="text" value="24.7"/>
Maximum	<input type="text" value="3378.1"/>	<input type="text" value="855.7"/>	<input type="text" value="97849.19"/>	<input type="text" value="43201.96"/>	<input type="text" value="6.7"/>	<input type="text" value="3.4"/>	<input type="text" value="22.3"/>
Damage Centroid Depth (x) (inches)	<input type="text" value="0.83"/>					k ²	<input type="text" value="4563.01"/>
Damage Centroid Depth (y) (inches)	<input type="text" value="14.67"/>				Eff. Mass Ratio (gamma)		<input type="text" value="1.00"/>
Area of Damage (inches ²):	<input type="text" value="55.00"/>						

**Available Test Results
Side Impact Test Summary**

Report Filter Settings

Year Range: 1999 - 2005
Make: PONTIAC
Model: GRANDAM

Test Number	Vehicle Info	No			-----Indention Length-----				Crush Factor
		Damage Average Speed (mph)	Crush (inch)	KEES (mph)	-----Stiffness Values-----				
					A	B	G	Kv	
3527	2000 PONTIAC GRAND AM TWO DOOR COUPE	2.0	7.3	26.2	122.5	203.9	36.8	239.1	37.7
2983	1999 OLDSMOBILE ALERO FOUR DOOR SEDAN	2.0	9.4	22.2	130.2	139.7	60.7	168.7	21.0
3227	2000 PONTIAC GRAND AM TWO DOOR COUPE	2.0	8.6	26.2	133.8	188.8	47.4	221.3	32.0
3040	1999 PONTIAC GRAND AM FOUR DOOR SEDAN	2.0	7.3	26.1	180.5	295.9	55.0	347.1	37.0
Average (AVG)					141.7	207.1	50.0	244.0	31.9
Minimum (MIN)					122.5	139.7	36.8	168.7	21.0
Maximum (MAX)					180.5	295.9	60.7	347.1	37.7
Standard Deviation (STDev-sample)					26.2	65.2	10.3	74.9	7.8
Number of Tests (n)					4				

Test 2

**Nissan Sentra
into
Gillig Bus Rear**

2014 NISSAN SENTRA - Front Impact

Curb Weight (pounds):
 Occupant + Cargo Weight (pounds):
 Total Weight (pounds):

PDOF
 Lever Arm Distance (inches):
 Yaw Moment of Inertia (lb-ft-sec²):

Angle Coll Force to Normal (degrees):
 No Damage Speed (mph):
 Energy Crush Depth (inches):
 Damage Length (inches):
 Crush Profile Measurements:

"Known" Stiffness Values		
	A	B
Average	<input type="text" value="402.7"/>	<input type="text" value="176.1"/>
Minimum	<input type="text" value="331.5"/>	<input type="text" value="114.9"/>
Maximum	<input type="text" value="473.8"/>	<input type="text" value="237.3"/>
Std. Devation	<input type="text" value="100.6"/>	<input type="text" value="86.6"/>

	Equal Spacing (inches)	Zone Area (inches ²)	Zone Depth(x) (inches)	Area Depth(x) (inches ³)	Zone Depth(y) (inches)	Area Depth(y) (inches ³)
C1 (inches)	<input type="text" value="25.00"/>	<input type="text" value="69.00"/>	<input type="text" value="12.50"/>	<input type="text" value="21562.50"/>	<input type="text" value="34.50"/>	<input type="text" value="59512.50"/>
C2 (inches)	<input type="text" value="25.00"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C3 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C4 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C5 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C6 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C7 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C8 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C9 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C10 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Average Crush (inches):

Results

	A	B	Average Force (poundsf)	Damage Energy (ft*lbs)	KE Speed (mph)	Closing Delta V (mph)	Closing Speed (MPH)
Minimum	<input type="text" value="331.5"/>	<input type="text" value="114.9"/>	<input type="text" value="110538.00"/>	<input type="text" value="256863.76"/>	<input type="text" value="52.1"/>	<input type="text" value="56.1"/>	<input type="text" value="61.7"/>
Avg - 2 Std. Deviations	<input type="text" value="201.5"/>	<input type="text" value="2.9"/>	<input type="text" value="9453.00"/>	<input type="text" value="74428.79"/>	<input type="text" value="28.1"/>	<input type="text" value="31.4"/>	<input type="text" value="34.5"/>
Avg - 1 Std. Deviations	<input type="text" value="302.1"/>	<input type="text" value="89.5"/>	<input type="text" value="87616.20"/>	<input type="text" value="207178.87"/>	<input type="text" value="46.8"/>	<input type="text" value="50.8"/>	<input type="text" value="55.9"/>
Average	<input type="text" value="402.7"/>	<input type="text" value="176.1"/>	<input type="text" value="165779.40"/>	<input type="text" value="376965.35"/>	<input type="text" value="63.1"/>	<input type="text" value="67.1"/>	<input type="text" value="73.9"/>
Avg + 1 Std. Deviations	<input type="text" value="503.3"/>	<input type="text" value="262.7"/>	<input type="text" value="243942.60"/>	<input type="text" value="547160.68"/>	<input type="text" value="76.1"/>	<input type="text" value="80.2"/>	<input type="text" value="88.3"/>
Avg + 2 Std. Deviations	<input type="text" value="603.9"/>	<input type="text" value="349.3"/>	<input type="text" value="322105.80"/>	<input type="text" value="717460.78"/>	<input type="text" value="87.1"/>	<input type="text" value="91.4"/>	<input type="text" value="100.6"/>
Maximum	<input type="text" value="473.8"/>	<input type="text" value="237.3"/>	<input type="text" value="221017.35"/>	<input type="text" value="497226.95"/>	<input type="text" value="72.5"/>	<input type="text" value="76.6"/>	<input type="text" value="84.3"/>
Damage Centroid Depth (x) (inches)	<input type="text" value="12.50"/>				k ²	<input type="text" value="2804.81"/>	
Damage Centroid Depth (y) (inches)	<input type="text" value="34.50"/>				Eff. Mass Ratio (gamma)	<input type="text" value="1.00"/>	
Area of Damage (inches ²):	<input type="text" value="1725.00"/>						

2008 GILLIG LOW FLOOR TRANSIT BUS - Rear Impact

Curb Weight (pounds):
 Occupant + Cargo Weight (pounds):
 Total Weight (pounds):

PDOF
 Lever Arm Distance (inches):
 Yaw Moment of Inertia (lb-ft-sec²):

Angle Coll Force to Normal (degrees):

No Damage Speed (mph):

Energy Crush Depth (inches):

Damage Length (inches):

Crush Profile Measurements:

	Unequal Spacing (inches)	Zone Area (inches ²)	Zone Depth(x) (inches)	Area Depth(x) (inches ³)	Zone Depth(y) (inches)	Area Depth(y) (inches ³)
C1 (inches)	<input type="text" value="6.00"/>	<input type="text" value="50.00"/>	<input type="text" value="2.00"/>	<input type="text" value="300.00"/>	<input type="text" value="16.67"/>	<input type="text" value="2500.00"/>
C2 (inches)	<input type="text" value="0.00"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C3 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C4 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C5 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C6 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C7 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C8 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C9 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C10 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Average Crush (inches):

Results

	A	B	Average Force (poundsf)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	b _{sub1}
Minimum	<input type="text" value="2612.3"/>	<input type="text" value="603.1"/>	<input type="text" value="110538.00"/>	<input type="text" value="71303.50"/>	<input type="text" value="8.7"/>	<input type="text" value="5.6"/>	<input type="text" value="20.3"/>
Avg - 2 Std. Deviations	<input type="text" value="346.3"/>	<input type="text" value="10.6"/>	<input type="text" value="9453.00"/>	<input type="text" value="28167.06"/>	<input type="text" value="5.5"/>	<input type="text" value="3.2"/>	<input type="text" value="2.7"/>
Avg - 1 Std. Deviations	<input type="text" value="2209.9"/>	<input type="text" value="431.6"/>	<input type="text" value="87616.20"/>	<input type="text" value="61986.24"/>	<input type="text" value="8.1"/>	<input type="text" value="5.1"/>	<input type="text" value="17.2"/>
Average	<input type="text" value="3459.0"/>	<input type="text" value="1057.4"/>	<input type="text" value="165779.40"/>	<input type="text" value="93245.27"/>	<input type="text" value="10.0"/>	<input type="text" value="6.8"/>	<input type="text" value="26.9"/>
Avg + 1 Std. Deviations	<input type="text" value="4467.1"/>	<input type="text" value="1763.5"/>	<input type="text" value="243942.60"/>	<input type="text" value="123500.02"/>	<input type="text" value="11.5"/>	<input type="text" value="8.1"/>	<input type="text" value="34.7"/>
Avg + 2 Std. Deviations	<input type="text" value="5335.8"/>	<input type="text" value="2516.2"/>	<input type="text" value="322105.80"/>	<input type="text" value="153174.04"/>	<input type="text" value="12.8"/>	<input type="text" value="9.2"/>	<input type="text" value="41.5"/>
Maximum	<input type="text" value="4188.8"/>	<input type="text" value="1550.6"/>	<input type="text" value="221017.35"/>	<input type="text" value="114698.65"/>	<input type="text" value="11.0"/>	<input type="text" value="7.7"/>	<input type="text" value="32.6"/>
Damage Centroid Depth (x) (inches)	<input type="text" value="2.00"/>				k ²	<input type="text" value="4555.08"/>	
Damage Centroid Depth (y) (inches)	<input type="text" value="16.67"/>			Eff. Mass Ratio (gamma)		<input type="text" value="1.00"/>	
Area of Damage (inches ²):	<input type="text" value="150.00"/>						

**Available Test Results
Front Impact Test Summary**

Report Filter Settings

Year Range: 2013 - 2015
Make: NISSAN
Model: SENTRA

Test Number	Vehicle Info	No			Vehicle Width				Crush Factor
		Damage Average Speed (mph)	Crush (inch)	KEES (mph)	Stiffness		Values		
					A	B	G	Kv	
9079	2015 NISSAN SENTRA FOUR DOOR SEDAN	5.0	17.4	35.2	331.5	114.9	478.4	156.0	28.4
8068	2013 NISSAN SENTRA FOUR DOOR SEDAN	5.0	11.9	34.9	473.8	237.3	473.0	323.3	40.8
Average (AVG)					402.7	176.1	475.7	239.6	34.6
Minimum (MIN)					331.5	114.9	473.0	156.0	28.4
Maximum (MAX)					473.8	237.3	478.4	323.3	40.8
Standard Deviation (STDev-sample)					100.6	86.6	3.8	118.3	8.7
Number of Tests (n)					2				

Test 3

Chevrolet Malibu into Gillig Bus Rear Axle

2004 CHEVROLET MALIBU - Front Impact

Curb Weight (pounds):
 Occupant + Cargo Weight (pounds):
 Total Weight (pounds):

PDOF
 Lever Arm Distance (inches):
 Yaw Moment of Inertia (lb-ft-sec²):

Angle Coll Force to Normal (degrees):
 No Damage Speed (mph):
 Energy Crush Depth (inches):
 Damage Length (inches):
 Crush Profile Measurements:

"Known" Stiffness Values		
	A	B
Average	<input type="text" value="375.1"/>	<input type="text" value="131.5"/>
Minimum	<input type="text" value="291.3"/>	<input type="text" value="86.7"/>
Maximum	<input type="text" value="496.8"/>	<input type="text" value="232.8"/>
Std. Devation	<input type="text" value="52.3"/>	<input type="text" value="38.2"/>

	Unequal Spacing (inches)	Zone Area (inches ²)	Zone Depth(x) (inches)	Area Depth(x) (inches ³)	Zone Depth(y) (inches)	Area Depth(y) (inches ³)
C1 (inches)	<input type="text" value="25.00"/>	<input type="text" value="736.00"/>	<input type="text" value="16.26"/>	<input type="text" value="11963.83"/>	<input type="text" value="12.34"/>	<input type="text" value="9081.17"/>
C2 (inches)	<input type="text" value="39.00"/>	<input type="text" value="710.00"/>	<input type="text" value="17.81"/>	<input type="text" value="12643.33"/>	<input type="text" value="29.67"/>	<input type="text" value="21066.67"/>
C3 (inches)	<input type="text" value="32.00"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C4 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C5 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C6 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C7 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C8 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C9 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C10 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Average Crush (inches):

Results

	A	B	Average Force (poundsf)	Damage Energy (ft*lbs)	KE Speed (mph)	Closing Delta V (mph)	Closing Speed (MPH)
Minimum	<input type="text" value="291.3"/>	<input type="text" value="86.7"/>	<input type="text" value="68950.95"/>	<input type="text" value="214655.23"/>	<input type="text" value="44.4"/>	<input type="text" value="44.1"/>	<input type="text" value="49.3"/>
Avg - 2 Std. Deviations	<input type="text" value="270.5"/>	<input type="text" value="55.1"/>	<input type="text" value="45655.53"/>	<input type="text" value="147971.47"/>	<input type="text" value="36.9"/>	<input type="text" value="36.7"/>	<input type="text" value="40.9"/>
Avg - 1 Std. Deviations	<input type="text" value="322.8"/>	<input type="text" value="93.3"/>	<input type="text" value="74400.30"/>	<input type="text" value="232233.43"/>	<input type="text" value="46.2"/>	<input type="text" value="45.9"/>	<input type="text" value="51.2"/>
Average	<input type="text" value="375.1"/>	<input type="text" value="131.5"/>	<input type="text" value="103145.07"/>	<input type="text" value="316789.70"/>	<input type="text" value="54.0"/>	<input type="text" value="53.6"/>	<input type="text" value="59.8"/>
Avg + 1 Std. Deviations	<input type="text" value="427.4"/>	<input type="text" value="169.7"/>	<input type="text" value="131889.84"/>	<input type="text" value="401441.52"/>	<input type="text" value="60.8"/>	<input type="text" value="60.3"/>	<input type="text" value="67.3"/>
Avg + 2 Std. Deviations	<input type="text" value="479.7"/>	<input type="text" value="207.9"/>	<input type="text" value="160634.61"/>	<input type="text" value="486136.23"/>	<input type="text" value="66.9"/>	<input type="text" value="66.3"/>	<input type="text" value="74.0"/>
Maximum	<input type="text" value="496.8"/>	<input type="text" value="232.8"/>	<input type="text" value="179006.08"/>	<input type="text" value="539176.36"/>	<input type="text" value="70.4"/>	<input type="text" value="69.9"/>	<input type="text" value="78.0"/>
Damage Centroid Depth (x) (inches)	<input type="text" value="17.02"/>				k ²	<input type="text" value="3061.62"/>	
Damage Centroid Depth (y) (inches)	<input type="text" value="20.85"/>				Eff. Mass Ratio (gamma)	<input type="text" value="1.00"/>	
Area of Damage (inches ²):	<input type="text" value="1446.09"/>						

2008 GILLIG LOW FLOOR TRANSIT BUS - Side Impact

Curb Weight (pounds):
 Occupant + Cargo Weight (pounds):
 Total Weight (pounds):

PDOF
 Lever Arm Distance (inches):
 Yaw Moment of Inertia (lb-ft-sec²):

Angle Coll Force to Normal (degrees):
 No Damage Speed (mph):
 Energy Crush Depth (inches):
 Damage Length (inches):

Crush Profile Measurements:

	Unequal Spacing (inches)	Zone Area (inches ²)	Zone Depth(x) (inches)	Area Depth(x) (inches ³)	Zone Depth(y) (inches)	Area Depth(y) (inches ³)
C1 (inches)	<input type="text" value="0.00"/>	<input type="text" value="39.00"/>	<input type="text" value="1.67"/>	<input type="text" value="162.50"/>	<input type="text" value="26.00"/>	<input type="text" value="2535.00"/>
C2 (inches)	<input type="text" value="5.00"/>	<input type="text" value="20.00"/>	<input type="text" value="1.67"/>	<input type="text" value="83.33"/>	<input type="text" value="26.67"/>	<input type="text" value="1333.33"/>
C3 (inches)	<input type="text" value="0.00"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C4 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C5 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C6 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C7 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C8 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C9 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C10 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Average Crush (inches):

Results

	A	B	Average Force (poundsf)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	b _{sub1}
Minimum	<input type="text" value="527.0"/>	<input type="text" value="724.1"/>	<input type="text" value="68950.95"/>	<input type="text" value="22255.26"/>	<input type="text" value="4.9"/>	<input type="text" value="5.1"/>	<input type="text" value="24.2"/>
Avg - 2 Std. Deviations	<input type="text" value="416.6"/>	<input type="text" value="452.4"/>	<input type="text" value="45655.53"/>	<input type="text" value="15331.81"/>	<input type="text" value="4.0"/>	<input type="text" value="4.2"/>	<input type="text" value="19.1"/>
Avg - 1 Std. Deviations	<input type="text" value="550.0"/>	<input type="text" value="788.8"/>	<input type="text" value="74400.30"/>	<input type="text" value="23863.34"/>	<input type="text" value="5.0"/>	<input type="text" value="5.3"/>	<input type="text" value="25.2"/>
Average	<input type="text" value="659.7"/>	<input type="text" value="1134.7"/>	<input type="text" value="103145.07"/>	<input type="text" value="32297.33"/>	<input type="text" value="5.9"/>	<input type="text" value="6.2"/>	<input type="text" value="30.3"/>
Avg + 1 Std. Deviations	<input type="text" value="755.0"/>	<input type="text" value="1486.3"/>	<input type="text" value="131889.84"/>	<input type="text" value="40672.58"/>	<input type="text" value="6.6"/>	<input type="text" value="7.0"/>	<input type="text" value="34.6"/>
Avg + 2 Std. Deviations	<input type="text" value="840.5"/>	<input type="text" value="1841.9"/>	<input type="text" value="160634.61"/>	<input type="text" value="49007.45"/>	<input type="text" value="7.2"/>	<input type="text" value="7.7"/>	<input type="text" value="38.6"/>
Maximum	<input type="text" value="891.2"/>	<input type="text" value="2070.7"/>	<input type="text" value="179006.08"/>	<input type="text" value="54318.30"/>	<input type="text" value="7.6"/>	<input type="text" value="8.1"/>	<input type="text" value="40.9"/>
Damage Centroid Depth (x) (inches)	<input type="text" value="1.67"/>				k ²	<input type="text" value="4555.08"/>	
Damage Centroid Depth (y) (inches)	<input type="text" value="26.23"/>		Eff. Mass Ratio (gamma)		<input type="text" value="1.00"/>		
Area of Damage (inches ²):	<input type="text" value="147.50"/>						

2004 CHEVROLET MALIBU - Front Impact

Curb Weight (pounds):
 Occupant + Cargo Weight (pounds):
 Total Weight (pounds):

PDOF
 Lever Arm Distance (inches):
 Yaw Moment of Inertia (lb-ft-sec²):

Angle Coll Force to Normal (degrees):
 No Damage Speed (mph):
 Energy Crush Depth (inches):
 Damage Length (inches):
 Crush Profile Measurements:

"Known" Stiffness Values		
	A	B
Average	<input type="text" value="375.1"/>	<input type="text" value="131.5"/>
Minimum	<input type="text" value="291.3"/>	<input type="text" value="86.7"/>
Maximum	<input type="text" value="496.8"/>	<input type="text" value="232.8"/>
Std. Devation	<input type="text" value="52.3"/>	<input type="text" value="38.2"/>

	Unequal Spacing (inches)	Zone Area (inches ²)	Zone Depth(x) (inches)	Area Depth(x) (inches ³)	Zone Depth(y) (inches)	Area Depth(y) (inches ³)
C1 (inches)	<input type="text" value="25.00"/>	<input type="text" value="736.00"/>	<input type="text" value="16.26"/>	<input type="text" value="11963.83"/>	<input type="text" value="12.34"/>	<input type="text" value="9081.17"/>
C2 (inches)	<input type="text" value="39.00"/>	<input type="text" value="710.00"/>	<input type="text" value="17.81"/>	<input type="text" value="12643.33"/>	<input type="text" value="29.67"/>	<input type="text" value="21066.67"/>
C3 (inches)	<input type="text" value="32.00"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C4 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C5 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C6 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C7 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C8 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C9 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C10 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Average Crush (inches):

Results

	A	B	Average Force (poundsf)	Damage Energy (ft*lbs)	KE Speed (mph)	Closing Delta V (mph)	Closing Speed (MPH)
Minimum	<input type="text" value="291.3"/>	<input type="text" value="86.7"/>	<input type="text" value="68950.95"/>	<input type="text" value="214655.23"/>	<input type="text" value="44.4"/>	<input type="text" value="40.3"/>	<input type="text" value="54.0"/>
Avg - 2 Std. Deviations	<input type="text" value="270.5"/>	<input type="text" value="55.1"/>	<input type="text" value="45655.53"/>	<input type="text" value="147971.47"/>	<input type="text" value="36.9"/>	<input type="text" value="33.4"/>	<input type="text" value="44.8"/>
Avg - 1 Std. Deviations	<input type="text" value="322.8"/>	<input type="text" value="93.3"/>	<input type="text" value="74400.30"/>	<input type="text" value="232233.43"/>	<input type="text" value="46.2"/>	<input type="text" value="41.9"/>	<input type="text" value="56.1"/>
Average	<input type="text" value="375.1"/>	<input type="text" value="131.5"/>	<input type="text" value="103145.07"/>	<input type="text" value="316789.70"/>	<input type="text" value="54.0"/>	<input type="text" value="48.9"/>	<input type="text" value="65.5"/>
Avg + 1 Std. Deviations	<input type="text" value="427.4"/>	<input type="text" value="169.7"/>	<input type="text" value="131889.84"/>	<input type="text" value="401441.52"/>	<input type="text" value="60.8"/>	<input type="text" value="55.0"/>	<input type="text" value="73.7"/>
Avg + 2 Std. Deviations	<input type="text" value="479.7"/>	<input type="text" value="207.9"/>	<input type="text" value="160634.61"/>	<input type="text" value="486136.23"/>	<input type="text" value="66.9"/>	<input type="text" value="60.5"/>	<input type="text" value="81.1"/>
Maximum	<input type="text" value="496.8"/>	<input type="text" value="232.8"/>	<input type="text" value="179006.08"/>	<input type="text" value="539176.36"/>	<input type="text" value="70.4"/>	<input type="text" value="63.8"/>	<input type="text" value="85.4"/>
Damage Centroid Depth (x) (inches)	<input type="text" value="17.02"/>				k ²	<input type="text" value="3061.62"/>	
Damage Centroid Depth (y) (inches)	<input type="text" value="20.85"/>				Eff. Mass Ratio (gamma)	<input type="text" value="1.00"/>	
Area of Damage (inches ²):	<input type="text" value="1446.09"/>						

2008 GILLIG LOW FLOOR TRANSIT BUS - Side Impact

Curb Weight (pounds):
 Occupant + Cargo Weight (pounds):
 Total Weight (pounds):

PDOF
 Lever Arm Distance (inches):
 Yaw Moment of Inertia (lb-ft-sec²):

Angle Coll Force to Normal (degrees):

No Damage Speed (mph):

Energy Crush Depth (inches):

Damage Length (inches):

Crush Profile Measurements:

	Unequal Spacing (inches)	Zone Area (inches ²)	Zone Depth(x) (inches)	Area Depth(x) (inches ³)	Zone Depth(y) (inches)	Area Depth(y) (inches ³)
C1 (inches)	<input type="text" value="0.00"/>	<input type="text" value="39.00"/>	<input type="text" value="1.67"/>	<input type="text" value="162.50"/>	<input type="text" value="26.00"/>	<input type="text" value="2535.00"/>
C2 (inches)	<input type="text" value="5.00"/>	<input type="text" value="20.00"/>	<input type="text" value="1.67"/>	<input type="text" value="83.33"/>	<input type="text" value="26.67"/>	<input type="text" value="1333.33"/>
C3 (inches)	<input type="text" value="0.00"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C4 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C5 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C6 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C7 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C8 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C9 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C10 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Average Crush (inches):

Results

	A	B	Average Force (poundsf)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	b _{sub1}
Minimum	<input type="text" value="527.0"/>	<input type="text" value="724.1"/>	<input type="text" value="68950.95"/>	<input type="text" value="22255.26"/>	<input type="text" value="4.9"/>	<input type="text" value="4.7"/>	<input type="text" value="24.2"/>
Avg - 2 Std. Deviations	<input type="text" value="416.6"/>	<input type="text" value="452.4"/>	<input type="text" value="45655.53"/>	<input type="text" value="15331.81"/>	<input type="text" value="4.0"/>	<input type="text" value="3.9"/>	<input type="text" value="19.1"/>
Avg - 1 Std. Deviations	<input type="text" value="550.0"/>	<input type="text" value="788.8"/>	<input type="text" value="74400.30"/>	<input type="text" value="23863.34"/>	<input type="text" value="5.0"/>	<input type="text" value="4.8"/>	<input type="text" value="25.2"/>
Average	<input type="text" value="659.7"/>	<input type="text" value="1134.7"/>	<input type="text" value="103145.07"/>	<input type="text" value="32297.33"/>	<input type="text" value="5.9"/>	<input type="text" value="5.7"/>	<input type="text" value="30.3"/>
Avg + 1 Std. Deviations	<input type="text" value="755.0"/>	<input type="text" value="1486.3"/>	<input type="text" value="131889.84"/>	<input type="text" value="40672.58"/>	<input type="text" value="6.6"/>	<input type="text" value="6.4"/>	<input type="text" value="34.6"/>
Avg + 2 Std. Deviations	<input type="text" value="840.5"/>	<input type="text" value="1841.9"/>	<input type="text" value="160634.61"/>	<input type="text" value="49007.45"/>	<input type="text" value="7.2"/>	<input type="text" value="7.0"/>	<input type="text" value="38.6"/>
Maximum	<input type="text" value="891.2"/>	<input type="text" value="2070.7"/>	<input type="text" value="179006.08"/>	<input type="text" value="54318.30"/>	<input type="text" value="7.6"/>	<input type="text" value="7.4"/>	<input type="text" value="40.9"/>
Damage Centroid Depth (x) (inches)	<input type="text" value="1.67"/>				k ²	<input type="text" value="4555.08"/>	
Damage Centroid Depth (y) (inches)	<input type="text" value="26.23"/>		Eff. Mass Ratio (gamma)		<input type="text" value="0.34"/>		
Area of Damage (inches ²):	<input type="text" value="147.50"/>						

Available Test Results
Front Impact Test Summary

Report Filter Settings

Year Range: 2004 - 2007

Make: CHEVROLET

Model: MALIBU

Test Number	Vehicle Info	No		Closing Speed (mph)	Vehicle Width Stiffness Values				Crush Factor
		Damage Speed (mph)	Average Crush (inch)		A	B	G	Kv	
5183	2004 SAAB 9-3 FOUR DOOR SEDAN	5.0	16.5	29.5	291.3	86.7	489.2	125.7	21.2
6056	2007 SAAB 9-3 FOUR DOOR SEDAN	5.0	19.4	34.7	334.5	102.4	546.6	139.8	24.8
5191	2004 CHEVROLET MALIBU FOUR DOOR SEDAN	5.0	16.4	29.7	341.3	102.7	567.0	148.5	21.5
6448	2008 CHEVROLET MALIBU FOUR DOOR SEDAN	5.0	11.9	24.7	360.3	119.2	544.3	187.3	20.5
6998	2011 CHEVROLET MALIBU FOUR DOOR SEDAN	5.0	18.6	35.1	360.9	117.1	556.0	159.3	26.6
5851	2006 SAAB 9-3 FOUR DOOR SEDAN	5.0	11.3	24.7	364.5	126.8	524.0	199.1	21.6
5271	2005 CHEVROLET MALIBU FOUR DOOR SEDAN	5.0	18.4	35.0	366.4	119.1	563.3	162.2	26.5
4863	2004 CHEVROLET MALIBU FOUR DOOR SEDAN	5.0	17.0	35.5	371.3	133.4	516.8	180.7	29.7
6268	2008 CHEVROLET MALIBU FOUR DOOR SEDAN	5.0	17.7	34.9	378.9	128.0	560.7	174.5	27.5
5250	2005 PONTIAC G6 FOUR DOOR SEDAN	5.0	17.0	35.3	393.2	139.8	552.9	189.7	29.2
5844	2007 SATURN AURA FOUR DOOR SEDAN	5.0	15.6	35.1	442.4	170.2	574.9	231.5	31.5
6997	2011 CHEVROLET MALIBU FOUR DOOR SEDAN	5.0	6.4	20.1	496.8	232.8	530.2	412.8	25.0
Average (AVG)					375.1	131.5	543.8	192.6	25.5
Minimum (MIN)					291.3	86.7	489.2	125.7	20.5
Maximum (MAX)					496.8	232.8	574.9	412.8	31.5
Standard Deviation (STDev-sample)					52.3	38.2	24.7	75.0	3.7
Number of Tests (n)					12				

Test 4

Pontiac Montana Extended into Ford F600 Rear

2001 PONTIAC MONTANA EXTENDED - Front Impact

Curb Weight (pounds):
 Occupant + Cargo Weight (pounds):
 Total Weight (pounds):

PDOF
 Lever Arm Distance (inches):
 Yaw Moment of Inertia (lb-ft-sec²):

Angle Coll Force to Normal (degrees):
 No Damage Speed (mph):
 Energy Crush Depth (inches):
 Damage Length (inches):
 Crush Profile Measurements:

"Known" Stiffness Values		
	A	B
Average	<input type="text" value="351.4"/>	<input type="text" value="104.5"/>
Minimum	<input type="text" value="303.0"/>	<input type="text" value="79.1"/>
Maximum	<input type="text" value="470.0"/>	<input type="text" value="183.8"/>
Std. Devation	<input type="text" value="56.9"/>	<input type="text" value="35.9"/>

	Unequal Spacing (inches)	Zone Area (inches ²)	Zone Depth(x) (inches)	Area Depth(x) (inches ³)	Zone Depth(y) (inches)	Area Depth(y) (inches ³)
C1 (inches)	<input type="text" value="29.00"/>					
C2 (inches)	<input type="text" value="29.00"/>	<input type="text" value="2088.00"/>	<input type="text" value="14.50"/>	<input type="text" value="30276.00"/>	<input type="text" value="36.00"/>	<input type="text" value="75168.00"/>
C3 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C4 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C5 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C6 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C7 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C8 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C9 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C10 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Average Crush (inches):

Results

	A	B	Average Force (poundsf)	Damage Energy (ft*lbs)	KE Speed (mph)	Closing Delta V (mph)	Closing Speed (MPH)
Minimum	<input type="text" value="303.0"/>	<input type="text" value="79.1"/>	<input type="text" value="93488.40"/>	<input type="text" value="255773.31"/>	<input type="text" value="44.1"/>	<input type="text" value="38.3"/>	<input type="text" value="52.6"/>
Avg - 2 Std. Deviations	<input type="text" value="237.6"/>	<input type="text" value="32.7"/>	<input type="text" value="42692.40"/>	<input type="text" value="129023.74"/>	<input type="text" value="31.3"/>	<input type="text" value="27.2"/>	<input type="text" value="37.3"/>
Avg - 1 Std. Deviations	<input type="text" value="294.5"/>	<input type="text" value="68.6"/>	<input type="text" value="82220.40"/>	<input type="text" value="228113.67"/>	<input type="text" value="41.7"/>	<input type="text" value="36.2"/>	<input type="text" value="49.6"/>
Average	<input type="text" value="351.4"/>	<input type="text" value="104.5"/>	<input type="text" value="121748.40"/>	<input type="text" value="328342.04"/>	<input type="text" value="50.0"/>	<input type="text" value="43.4"/>	<input type="text" value="59.5"/>
Avg + 1 Std. Deviations	<input type="text" value="408.3"/>	<input type="text" value="140.4"/>	<input type="text" value="161276.40"/>	<input type="text" value="428835.56"/>	<input type="text" value="57.1"/>	<input type="text" value="49.6"/>	<input type="text" value="68.0"/>
Avg + 2 Std. Deviations	<input type="text" value="465.2"/>	<input type="text" value="176.3"/>	<input type="text" value="200804.40"/>	<input type="text" value="529432.25"/>	<input type="text" value="63.5"/>	<input type="text" value="55.1"/>	<input type="text" value="75.6"/>
Maximum	<input type="text" value="470.0"/>	<input type="text" value="183.8"/>	<input type="text" value="208807.20"/>	<input type="text" value="549112.95"/>	<input type="text" value="64.6"/>	<input type="text" value="56.2"/>	<input type="text" value="77.0"/>
Damage Centroid Depth (x) (inches)	<input type="text" value="14.50"/>				k ²	<input type="text" value="3196.19"/>	
Damage Centroid Depth (y) (inches)	<input type="text" value="36.00"/>				Eff. Mass Ratio (gamma)	<input type="text" value="1.00"/>	
Area of Damage (inches ²):	<input type="text" value="2088.00"/>						

1978 FORD F600 - Rear Impact

Curb Weight (pounds):
 Occupant + Cargo Weight (pounds):
 Total Weight (pounds):

PDOF
 Lever Arm Distance (inches):
 Yaw Moment of Inertia (lb-ft-sec²):

Angle Coll Force to Normal (degrees):
 No Damage Speed (mph):
 Energy Crush Depth (inches):
 Damage Length (inches):

Crush Profile Measurements:

	Unequal Spacing (inches)	Zone Area (inches ²)	Zone Depth(x) (inches)	Area Depth(x) (inches ³)	Zone Depth(y) (inches)	Area Depth(y) (inches ³)
C1 (inches)	<input type="text" value="1.00"/>	<input type="text" value="96.00"/>	<input type="text" value="0.50"/>	<input type="text" value="48.00"/>	<input type="text" value="48.00"/>	<input type="text" value="4608.00"/>
C2 (inches)	<input type="text" value="1.00"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C3 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C4 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C5 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C6 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C7 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C8 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C9 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C10 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Average Crush (inches):

Results

	A	B	Average Force (poundsf)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	b _{sub1}
Minimum	<input type="text" value="374.0"/>	<input type="text" value="1573.6"/>	<input type="text" value="93488.40"/>	<input type="text" value="9642.42"/>	<input type="text" value="5.2"/>	<input type="text" value="14.2"/>	<input type="text" value="74.0"/>
Avg - 2 Std. Deviations	<input type="text" value="240.2"/>	<input type="text" value="649.2"/>	<input type="text" value="42692.40"/>	<input type="text" value="4874.25"/>	<input type="text" value="3.7"/>	<input type="text" value="10.1"/>	<input type="text" value="47.6"/>
Avg - 1 Std. Deviations	<input type="text" value="348.3"/>	<input type="text" value="1364.6"/>	<input type="text" value="82220.40"/>	<input type="text" value="8600.52"/>	<input type="text" value="4.9"/>	<input type="text" value="13.4"/>	<input type="text" value="69.0"/>
Average	<input type="text" value="432.5"/>	<input type="text" value="2103.9"/>	<input type="text" value="121748.40"/>	<input type="text" value="12231.23"/>	<input type="text" value="5.9"/>	<input type="text" value="16.1"/>	<input type="text" value="85.6"/>
Avg + 1 Std. Deviations	<input type="text" value="503.9"/>	<input type="text" value="2856.0"/>	<input type="text" value="161276.40"/>	<input type="text" value="15810.85"/>	<input type="text" value="6.7"/>	<input type="text" value="18.4"/>	<input type="text" value="99.8"/>
Avg + 2 Std. Deviations	<input type="text" value="567.0"/>	<input type="text" value="3616.4"/>	<input type="text" value="200804.40"/>	<input type="text" value="19357.34"/>	<input type="text" value="7.4"/>	<input type="text" value="20.4"/>	<input type="text" value="112.3"/>
Maximum	<input type="text" value="579.0"/>	<input type="text" value="3771.1"/>	<input type="text" value="208807.20"/>	<input type="text" value="20072.25"/>	<input type="text" value="7.5"/>	<input type="text" value="20.8"/>	<input type="text" value="114.6"/>
Damage Centroid Depth (x) (inches)	<input type="text" value="0.50"/>				k ²	<input type="text" value="4190.36"/>	
Damage Centroid Depth (y) (inches)	<input type="text" value="48.00"/>		Eff. Mass Ratio (gamma)		<input type="text" value="1.00"/>		
Area of Damage (inches ²):	<input type="text" value="96.00"/>						

**Available Test Results
Front Impact Test Summary**

Report Filter Settings

Year Range: 1999 - 2004
Make: PONTIAC
Model: MONTANA

Test Number	Vehicle Info	No		Closing Speed (mph)	Vehicle Width Stiffness Values				Crush Factor
		Damage Speed (mph)	Average Crush (inch)		A	B	G	Kv	
2963	1998 CHEVROLET VENTURE VAN	5.0	25.1	37.8	303.0	79.1	579.9	105.1	22.7
2552	1997 CHEVROLET VENTURE VAN	5.0	23.2	35.3	311.2	81.2	596.6	110.2	21.5
5087	2001 CHEVROLET VENTURE MINIVAN	5.0	22.3	35.0	316.4	85.0	588.4	115.8	21.9
3070	1998 CHEVROLET VENTURE VAN	5.0	18.3	29.8	323.7	87.7	597.5	126.7	19.4
2895	1998 CHEVROLET VENTURE VAN	5.0	17.6	29.0	339.7	92.8	622.1	135.4	19.1
2750	1998 CHEVROLET VENTURE VAN	5.0	21.7	35.1	346.5	96.3	622.9	131.0	22.8
2902	1998 CHEVROLET VENTURE VAN	5.0	20.0	37.5	401.0	130.4	616.5	173.6	28.2
3676	2001 CHEVROLET VENTURE MINIVAN	5.0	15.2	34.7	470.0	183.8	601.0	250.9	31.7
Average (AVG)					351.4	104.5	603.1	143.6	23.4
Minimum (MIN)					303.0	79.1	579.9	105.1	19.1
Maximum (MAX)					470.0	183.8	622.9	250.9	31.7
Standard Deviation (STDev-sample)					56.9	35.9	15.9	48.3	4.3
Number of Tests (n)					8				

Test 5

Chevrolet Malibu into Ford F600 Rear Axle

2004 CHEVROLET MALIBU - Front Impact

Curb Weight (pounds):
 Occupant + Cargo Weight (pounds):
 Total Weight (pounds):

Angle Coll Force to Normal (degrees):

No Damage Speed (mph):

Energy Crush Depth (inches):

Damage Length (inches):

Crush Profile Measurements:

PDOF
 Lever Arm Distance (inches):
 Yaw Moment of Inertia (lb-ft-sec²):

"Known" Stiffness Values		
	A	B
Average	<input type="text" value="376.9"/>	<input type="text" value="132.7"/>
Minimum	<input type="text" value="291.3"/>	<input type="text" value="86.7"/>
Maximum	<input type="text" value="496.8"/>	<input type="text" value="232.8"/>
Std. Devation	<input type="text" value="52.4"/>	<input type="text" value="38.0"/>

	Unequal Spacing (inches)	Zone Area (inches ²)	Zone Depth(x) (inches)	Area Depth(x) (inches ³)	Zone Depth(y) (inches)	Area Depth(y) (inches ³)
C1 (inches)	<input type="text" value="22.00"/>	<input type="text" value="562.50"/>	<input type="text" value="11.25"/>	<input type="text" value="6329.17"/>	<input type="text" value="12.59"/>	<input type="text" value="7083.33"/>
C2 (inches)	<input type="text" value="23.00"/>	<input type="text" value="324.00"/>	<input type="text" value="9.23"/>	<input type="text" value="2991.00"/>	<input type="text" value="26.17"/>	<input type="text" value="8478.00"/>
C3 (inches)	<input type="text" value="13.00"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C4 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C5 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C6 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C7 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C8 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C9 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C10 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Average Crush (inches):

Results

	A	B	Average Force (poundsf)	Damage Energy (ft*lbs)	KE Speed (mph)	Closing Delta V (mph)	Closing Speed (MPH)
Minimum	<input type="text" value="291.3"/>	<input type="text" value="86.7"/>	<input type="text" value="44699.66"/>	<input type="text" value="90611.55"/>	<input type="text" value="28.9"/>	<input type="text" value="30.6"/>	<input type="text" value="40.0"/>
Avg - 2 Std. Deviations	<input type="text" value="272.1"/>	<input type="text" value="56.7"/>	<input type="text" value="30986.96"/>	<input type="text" value="66478.72"/>	<input type="text" value="24.7"/>	<input type="text" value="27.4"/>	<input type="text" value="35.8"/>
Avg - 1 Std. Deviations	<input type="text" value="324.5"/>	<input type="text" value="94.7"/>	<input type="text" value="48960.10"/>	<input type="text" value="99516.30"/>	<input type="text" value="30.3"/>	<input type="text" value="31.7"/>	<input type="text" value="41.4"/>
Average	<input type="text" value="376.9"/>	<input type="text" value="132.7"/>	<input type="text" value="66933.24"/>	<input type="text" value="132826.95"/>	<input type="text" value="35.0"/>	<input type="text" value="35.4"/>	<input type="text" value="46.3"/>
Avg + 1 Std. Deviations	<input type="text" value="429.3"/>	<input type="text" value="170.7"/>	<input type="text" value="84906.38"/>	<input type="text" value="166228.30"/>	<input type="text" value="39.1"/>	<input type="text" value="38.9"/>	<input type="text" value="50.8"/>
Avg + 2 Std. Deviations	<input type="text" value="481.7"/>	<input type="text" value="208.7"/>	<input type="text" value="102879.52"/>	<input type="text" value="199670.81"/>	<input type="text" value="42.9"/>	<input type="text" value="42.0"/>	<input type="text" value="54.9"/>
Maximum	<input type="text" value="496.8"/>	<input type="text" value="232.8"/>	<input type="text" value="113888.42"/>	<input type="text" value="219411.83"/>	<input type="text" value="44.9"/>	<input type="text" value="43.7"/>	<input type="text" value="57.1"/>
Damage Centroid Depth (x) (inches)	<input type="text" value="10.51"/>					k ²	<input type="text" value="3061.62"/>
Damage Centroid Depth (y) (inches)	<input type="text" value="17.55"/>					Eff. Mass Ratio (gamma)	<input type="text" value="1.00"/>
Area of Damage (inches ²):	<input type="text" value="886.50"/>						

1978 FORD F600 - Side Impact

Curb Weight (pounds):
 Occupant + Cargo Weight (pounds):
 Total Weight (pounds):

PDOF
 Lever Arm Distance (inches):
 Yaw Moment of Inertia (lb-ft-sec²):

Angle Coll Force to Normal (degrees):

No Damage Speed (mph):

Energy Crush Depth (inches):

Damage Length (inches):

Crush Profile Measurements:

	Equal Spacing (inches)	Zone Area (inches ²)	Zone Depth(x) (inches)	Area Depth(x) (inches ³)	Zone Depth(y) (inches)	Area Depth(y) (inches ³)
C1 (inches)	<input type="text" value="1.00"/>	<input type="text" value="45.00"/>	<input type="text" value="0.50"/>	<input type="text" value="22.50"/>	<input type="text" value="22.50"/>	<input type="text" value="1012.50"/>
C2 (inches)	<input type="text" value="1.00"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C3 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C4 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C5 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C6 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C7 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C8 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C9 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C10 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Average Crush (inches):

Results

	A	B	Average Force (poundsf)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	b _{sub1}
Minimum	<input type="text" value="1813.3"/>	<input type="text" value="173.4"/>	<input type="text" value="44699.66"/>	<input type="text" value="42685.09"/>	<input type="text" value="11.0"/>	<input type="text" value="9.4"/>	<input type="text" value="16.8"/>
Avg - 2 Std. Deviations	<input type="text" value="1289.5"/>	<input type="text" value="87.7"/>	<input type="text" value="30986.96"/>	<input type="text" value="40560.30"/>	<input type="text" value="10.7"/>	<input type="text" value="8.4"/>	<input type="text" value="12.0"/>
Avg - 1 Std. Deviations	<input type="text" value="1971.1"/>	<input type="text" value="204.9"/>	<input type="text" value="48960.10"/>	<input type="text" value="43336.10"/>	<input type="text" value="11.1"/>	<input type="text" value="9.7"/>	<input type="text" value="18.3"/>
Average	<input type="text" value="2614.4"/>	<input type="text" value="360.4"/>	<input type="text" value="66933.24"/>	<input type="text" value="46040.00"/>	<input type="text" value="11.4"/>	<input type="text" value="10.9"/>	<input type="text" value="24.3"/>
Avg + 1 Std. Deviations	<input type="text" value="3225.2"/>	<input type="text" value="548.5"/>	<input type="text" value="84906.38"/>	<input type="text" value="48682.92"/>	<input type="text" value="11.7"/>	<input type="text" value="11.9"/>	<input type="text" value="29.9"/>
Avg + 2 Std. Deviations	<input type="text" value="3807.9"/>	<input type="text" value="764.5"/>	<input type="text" value="102879.52"/>	<input type="text" value="51273.27"/>	<input type="text" value="12.0"/>	<input type="text" value="12.9"/>	<input type="text" value="35.3"/>
Maximum	<input type="text" value="4152.5"/>	<input type="text" value="909.2"/>	<input type="text" value="113888.42"/>	<input type="text" value="52836.87"/>	<input type="text" value="12.2"/>	<input type="text" value="13.4"/>	<input type="text" value="38.5"/>
Damage Centroid Depth (x) (inches)	<input type="text" value="0.50"/>				k ²	<input type="text" value="4190.36"/>	
Damage Centroid Depth (y) (inches)	<input type="text" value="22.50"/>			Eff. Mass Ratio (gamma)		<input type="text" value="1.00"/>	
Area of Damage (inches ²):	<input type="text" value="45.00"/>						

2004 CHEVROLET MALIBU - Front Impact

Curb Weight (pounds):
 Occupant + Cargo Weight (pounds):
 Total Weight (pounds):

Angle Coll Force to Normal (degrees):
 No Damage Speed (mph):
 Energy Crush Depth (inches):
 Damage Length (inches):
 Crush Profile Measurements:

PDOF
 Lever Arm Distance (inches):
 Yaw Moment of Inertia (lb-ft-sec²):

"Known" Stiffness Values		
	A	B
Average	<input type="text" value="376.9"/>	<input type="text" value="132.7"/>
Minimum	<input type="text" value="291.3"/>	<input type="text" value="86.7"/>
Maximum	<input type="text" value="496.8"/>	<input type="text" value="232.8"/>
Std. Devation	<input type="text" value="52.4"/>	<input type="text" value="38.0"/>

	Unequal Spacing (inches)	Zone Area (inches ²)	Zone Depth(x) (inches)	Area Depth(x) (inches ³)	Zone Depth(y) (inches)	Area Depth(y) (inches ³)
C1 (inches)	<input type="text" value="22.00"/>	<input type="text" value="562.50"/>	<input type="text" value="11.25"/>	<input type="text" value="6329.17"/>	<input type="text" value="12.59"/>	<input type="text" value="7083.33"/>
C2 (inches)	<input type="text" value="23.00"/>	<input type="text" value="324.00"/>	<input type="text" value="9.23"/>	<input type="text" value="2991.00"/>	<input type="text" value="26.17"/>	<input type="text" value="8478.00"/>
C3 (inches)	<input type="text" value="13.00"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C4 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C5 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C6 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C7 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C8 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C9 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C10 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Average Crush (inches):

Results

	A	B	Average Force (poundsf)	Damage Energy (ft*lbs)	KE Speed (mph)	Closing Delta V (mph)	Closing Speed (MPH)
Minimum	<input type="text" value="291.3"/>	<input type="text" value="86.7"/>	<input type="text" value="44699.66"/>	<input type="text" value="90611.55"/>	<input type="text" value="28.9"/>	<input type="text" value="26.8"/>	<input type="text" value="45.7"/>
Avg - 2 Std. Deviations	<input type="text" value="272.1"/>	<input type="text" value="56.7"/>	<input type="text" value="30986.96"/>	<input type="text" value="66478.72"/>	<input type="text" value="24.7"/>	<input type="text" value="24.0"/>	<input type="text" value="41.0"/>
Avg - 1 Std. Deviations	<input type="text" value="324.5"/>	<input type="text" value="94.7"/>	<input type="text" value="48960.10"/>	<input type="text" value="99516.30"/>	<input type="text" value="30.3"/>	<input type="text" value="27.7"/>	<input type="text" value="47.3"/>
Average	<input type="text" value="376.9"/>	<input type="text" value="132.7"/>	<input type="text" value="66933.24"/>	<input type="text" value="132826.95"/>	<input type="text" value="35.0"/>	<input type="text" value="31.0"/>	<input type="text" value="52.9"/>
Avg + 1 Std. Deviations	<input type="text" value="429.3"/>	<input type="text" value="170.7"/>	<input type="text" value="84906.38"/>	<input type="text" value="166228.30"/>	<input type="text" value="39.1"/>	<input type="text" value="34.0"/>	<input type="text" value="58.0"/>
Avg + 2 Std. Deviations	<input type="text" value="481.7"/>	<input type="text" value="208.7"/>	<input type="text" value="102879.52"/>	<input type="text" value="199670.81"/>	<input type="text" value="42.9"/>	<input type="text" value="36.7"/>	<input type="text" value="62.7"/>
Maximum	<input type="text" value="496.8"/>	<input type="text" value="232.8"/>	<input type="text" value="113888.42"/>	<input type="text" value="219411.83"/>	<input type="text" value="44.9"/>	<input type="text" value="38.3"/>	<input type="text" value="65.3"/>
Damage Centroid Depth (x) (inches)	<input type="text" value="10.51"/>				k ²	<input type="text" value="3061.62"/>	
Damage Centroid Depth (y) (inches)	<input type="text" value="17.55"/>				Eff. Mass Ratio (gamma)	<input type="text" value="1.00"/>	
Area of Damage (inches ²):	<input type="text" value="886.50"/>						

1978 FORD F600 - Side Impact

Curb Weight (pounds):
 Occupant + Cargo Weight (pounds):
 Total Weight (pounds):

PDOF
 Lever Arm Distance (inches):
 Yaw Moment of Inertia (lb-ft-sec²):

Angle Coll Force to Normal (degrees):

No Damage Speed (mph):

Energy Crush Depth (inches):

Damage Length (inches):

Crush Profile Measurements:

	Equal Spacing (inches)	Zone Area (inches ²)	Zone Depth(x) (inches)	Area Depth(x) (inches ³)	Zone Depth(y) (inches)	Area Depth(y) (inches ³)
C1 (inches)	<input type="text" value="1.00"/>	<input type="text" value="45.00"/>	<input type="text" value="0.50"/>	<input type="text" value="22.50"/>	<input type="text" value="22.50"/>	<input type="text" value="1012.50"/>
C2 (inches)	<input type="text" value="1.00"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C3 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C4 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C5 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C6 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C7 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C8 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C9 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
C10 (inches)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Average Crush (inches):

Results

	A	B	Average Force (poundsf)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	b _{sub1}
Minimum	<input type="text" value="1813.3"/>	<input type="text" value="173.4"/>	<input type="text" value="44699.66"/>	<input type="text" value="42685.09"/>	<input type="text" value="11.0"/>	<input type="text" value="8.2"/>	<input type="text" value="16.8"/>
Avg - 2 Std. Deviations	<input type="text" value="1289.5"/>	<input type="text" value="87.7"/>	<input type="text" value="30986.96"/>	<input type="text" value="40560.30"/>	<input type="text" value="10.7"/>	<input type="text" value="7.4"/>	<input type="text" value="12.0"/>
Avg - 1 Std. Deviations	<input type="text" value="1971.1"/>	<input type="text" value="204.9"/>	<input type="text" value="48960.10"/>	<input type="text" value="43336.10"/>	<input type="text" value="11.1"/>	<input type="text" value="8.5"/>	<input type="text" value="18.3"/>
Average	<input type="text" value="2614.4"/>	<input type="text" value="360.4"/>	<input type="text" value="66933.24"/>	<input type="text" value="46040.00"/>	<input type="text" value="11.4"/>	<input type="text" value="9.5"/>	<input type="text" value="24.3"/>
Avg + 1 Std. Deviations	<input type="text" value="3225.2"/>	<input type="text" value="548.5"/>	<input type="text" value="84906.38"/>	<input type="text" value="48682.92"/>	<input type="text" value="11.7"/>	<input type="text" value="10.4"/>	<input type="text" value="29.9"/>
Avg + 2 Std. Deviations	<input type="text" value="3807.9"/>	<input type="text" value="764.5"/>	<input type="text" value="102879.52"/>	<input type="text" value="51273.27"/>	<input type="text" value="12.0"/>	<input type="text" value="11.3"/>	<input type="text" value="35.3"/>
Maximum	<input type="text" value="4152.5"/>	<input type="text" value="909.2"/>	<input type="text" value="113888.42"/>	<input type="text" value="52836.87"/>	<input type="text" value="12.2"/>	<input type="text" value="11.7"/>	<input type="text" value="38.5"/>
Damage Centroid Depth (x) (inches)	<input type="text" value="0.50"/>				k ²	<input type="text" value="4190.36"/>	
Damage Centroid Depth (y) (inches)	<input type="text" value="22.50"/>			Eff. Mass Ratio (gamma)		<input type="text" value="0.43"/>	
Area of Damage (inches ²):	<input type="text" value="45.00"/>						

Available Test Results
Front Impact Test Summary

Report Filter Settings

Year Range: 2004 - 2007

Make: CHEVROLET

Model: MALIBU

Test Number	Vehicle Info	No		Closing Speed (mph)	Vehicle Width Stiffness Values				Crush Factor
		Damage Speed (mph)	Average Crush (inch)		A	B	G	Kv	
5183	2004 SAAB 9-3 FOUR DOOR SEDAN	5.0	16.5	29.5	291.3	86.7	489.2	125.7	21.2
6056	2007 SAAB 9-3 FOUR DOOR SEDAN	5.0	19.4	34.7	334.5	102.4	546.6	139.8	24.8
5191	2004 CHEVROLET MALIBU FOUR DOOR SEDAN	5.0	16.4	29.7	341.3	102.7	567.0	148.5	21.5
6448	2008 CHEVROLET MALIBU FOUR DOOR SEDAN	5.0	11.9	24.7	360.3	119.2	544.3	187.3	20.5
6998	2011 CHEVROLET MALIBU FOUR DOOR SEDAN	5.0	18.6	35.1	360.9	117.1	556.0	159.3	26.6
5851	2006 SAAB 9-3 FOUR DOOR SEDAN	5.0	11.3	24.7	364.5	126.8	524.0	199.1	21.6
5271	2005 CHEVROLET MALIBU FOUR DOOR SEDAN	5.0	18.4	35.0	366.4	119.1	563.3	162.2	26.5
4863	2004 CHEVROLET MALIBU FOUR DOOR SEDAN	5.0	17.0	35.5	371.3	133.4	516.8	180.7	29.7
6268	2008 CHEVROLET MALIBU FOUR DOOR SEDAN	5.0	17.7	34.9	378.9	128.0	560.7	174.5	27.5
5250	2005 PONTIAC G6 FOUR DOOR SEDAN	5.0	17.0	35.3	393.2	139.8	552.9	189.7	29.2
5844	2007 SATURN AURA FOUR DOOR SEDAN	5.0	15.6	35.1	442.4	170.2	574.9	231.5	31.5
6997	2011 CHEVROLET MALIBU FOUR DOOR SEDAN	5.0	6.4	20.1	496.8	232.8	530.2	412.8	25.0
Average (AVG)					375.1	131.5	543.8	192.6	25.5
Minimum (MIN)					291.3	86.7	489.2	125.7	20.5
Maximum (MAX)					496.8	232.8	574.9	412.8	31.5
Standard Deviation (STDev-sample)					52.3	38.2	24.7	75.0	3.7
Number of Tests (n)					12				