

4N6XPRT StifCalcs[®] Manual

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INTRODUCTION:

The purpose of our writing the 4N6XPRT StifCalcs[®] program is to provide users easier access to the NHTSA Crash Test data. Part of the “easier access” concept is to allow the typical user to:

- Rapidly determine if NHTSA has a test for a certain vehicle with a certain impact location
- Search the database for all tests across the year range the vehicle is the “same”, based upon identifying the desired vehicle Year, Make, and Model
- Search the database for all tests of “Sister” vehicles across the year range the vehicle is the “same” based upon identifying the desired vehicle Year, Make, and Model
- Display all the selected matches from the database broken into their general impact “classes” - Frontal impact, Side impact, Rear impact, and Other impact
- Easily search the database for similar class vehicles when there is no test for a desired vehicle

As a secondary consideration, the program provides some “base” calculations for stiffness values based upon the test data, with the realization that no one set of stiffness values will handle all situations, at least not well. Therefore, for each test we provide multiple sets of A-B-G stiffness values and leave it to the user to pick the appropriate values for their given collision analysis.

We hope that you find the program as useful as we do, and welcome your questions and suggestions for possible improvements.

FREQUENTLY ASKED QUESTIONS:

Why can't I find any tests when I use the BASIC VEHICLE SEARCH, yet the vehicle has been tested by NHTSA?? This is most likely due to an incompatibility in model name between the Sister/Clone list maintained by Greg Anderson and the model name used by NHTSA. Incompatibility can be ANYTHING which is different between the two names - spelling, characters, spacing, etc.

Why can't I find all of the available tests for a vehicle and its Sisters & Clones when I use the BASIC VEHICLE SEARCH?? This is most likely due to an incompatibility in model name(s) between the Sister/Clone list maintained by Greg Anderson and the model name(s) used by NHTSA. Incompatibility can be ANYTHING which is different between the two names - spelling, characters, spacing, etc.

Why can't I find the vehicle manufacturer or model when I use the BASIC VEHICLE SEARCH, yet the vehicle has been tested by NHTSA?? This is most likely due to the vehicle being outside of the year range covered by the Sister/Clone list maintained by Greg Anderson.

Why are there so many Stiffness Values for a given test? Several reasons. First, our presentation of stiffness values mirrors our belief that no one set of values will fit every situation. Second, our presentation allows you to quickly develop a range of damage speeds, in a manner that should be easily explainable to a judge and/or jury, based upon data from one test. Third, there are up to three different sets of crush depths and two crush widths from which to calculate stiffness values, as well as two different methods of calculating average crush. Depending upon which data set(s) you choose to use will determine how many calculated stiffness sheets you will end up with.

Which values do I use?? It depends upon the type of test, Front, Rear, or Side.

Front - The initial point to start at would be Vehicle Width, Trapezoidal Average Crush, 5 mph Rated No Damage Speed. Which set of crush measurements to use is determined by what NHTSA reported along

with your preference.

Rear - The initial point to start at would be Vehicle Width, KE Equivalent Speed, Trapezoidal Average Crush, 5 mph Rated No Damage Speed. Which set of crush measurements to use is determined by what NHTSA reported along with your preference.

Side - The initial point to start at would be Indentation Length, KE Equivalent Speed, Trapezoidal Average Crush, 2 mph Rated No Damage Speed. Which set of crush measurements to use is determined by what NHTSA reported along with your preference.

Must I use the “Trapezoidal Average”? When dealing with equally spaced crush measurements, you CAN use a “Simple average”, but it is still “more correct” to use a “Trapezoidal Average”, and with the 4N6XPRT StifCalcs program determining the Trapezoidal Average is quite painless.

What **IS** a Trapezoidal Average? The trapezoidal average is determined by first calculating the area in each Crush Zone through the formula -

$$\text{Area} = (\text{distance between measurements } C_n \text{ \& } C_{n+1}) * (C_n + C_{n+1}) / 2$$

next, add each of the areas, and then divide that by the total Crush Length (L)

$$\text{Trapezoidal Average Crush Depth} = (\sum[\text{Area}]) / L$$

What **IS** a Simple Average? The “Simple Average” is determined/calculated by adding up all of the crush measurements and then dividing the total by the number of measurements.

What is the Tumbas method/Protocol? Nicholas Tumbas was a co-author of SAE # 880072 - Tumbas, Nicholas S. and Smith Russell A. - which set a number of “standards” for what and how crush is to be measured. CRASH3, together with SAE # 880072, defines three options for the crush measurements. Either two, four or six crush equally spaced measurements are taken which are labelled C1 through to C6 as appropriate. This gives either one, three or five crush zones which are designed to approximate the damage profile.

Which is better, EQUAL or NON-EQUAL spacing between Crush Measurements? Equally spaced crush measurements have the benefit of complying with the commonly accepted crush measurement

techniques/protocols, along with fitting nicely into a set of predefined “short hand” equations for calculating Average Depth, Force, and Energy.

Unfortunately, equally spaced crush depth measurements may not properly depict the crush profile, may require measurements to be taken in an area where they really don’t need to be taken due to the crush profile being a “straight line” at that point, or more commonly both. For that reason, we prefer to use non-equally spaced measurements for most cases.

What follows is a step-by-step walk through for this program. The user should also refer to the NHTSA Reference Manuals provided with this program. If they were loaded, they are accessible from the HELP menu. The NHTSA Reference Manuals discuss the various data points contained in the NHTSA database in detail.

ESSENTIAL FORMULAS:

At the very end of this manual (Starting around page 56) we detail a number of the formulas used to complete the various calculations in the 4N6XPRT StifCalcs[®] program.

BASIC SEARCH:

4N6XPRT StifCalcs

File Print Reports Settings Help Reg To: 4N6XPRT SYSTEMS

Basic Vehicle Search | NHTSA Test Selection | Advanced Vehicle Search | Force Balance

Basic Vehicle Search Powered by the Sister/Clone List

Year Make Model

Reset Year Reset Make Reset Model

Reset

Advanced Search

Start Year	End Year	Make	Model	Clones

Similar Vehicles

Start Year	End Year	Make	Model	Body Styles	Wheelbases

To retrieve data through the basic search method, simply 1) pick the year, 2) pick the make, 3) pick the model, and 4) click on the **NHTSA TEST SELECTION** tab.

When “picking” the Year, Make, and Model, they can either be picked off the drop down list, typed in directly, or a combination of the two.

4N6XPRT StifCalcs - Selected Vehicle: 2008

File Print Reports Settings Help Reg To: 4N6XPRT SYSTEMS

Basic Vehicle Search NHTSA Test Selection Advanced Vehicle Search Force Balance

Basic Vehicle Search Powerd by the Sister/Clone List

Year Make Model

2012
2011
2010
2009
2008
2007
2006
2005
2004
2003
2002
2001
2000

ACURA
ASTON MARTIN
AUDI
BENTLEY
BMW
BUICK
CADILLAC
CHEVROLET
CHRYSLER
DODGE
FERRARI
FORD
GMC
HOLDEN
HONDA
HUMMER

128
135
3
300
328
335
350Z
4RUNNER
5
528
535
550
57
599GTB FIORANO
6
612 SCAGLIETTI

Start Year	End Year	Make	Model	Clones

Similar Vehicles

Start Year	End Year	Make	Model	Body Styles	Wheelbases

As can be seen in the Year box, as you begin to type a entry, the “Pick List” box narrows appropriately. In this case, all of the 1900 years have “disappeared”. This same approach can be used with the Make and Model entries.

4N6XPRT StifCalcs - Selected Vehicle: 2008 CHEVROLET COBALT

File Print Reports Settings Help Reg To: 4N6XPRT SYSTEMS

Basic Vehicle Search NHTSA Test Selection Advanced Vehicle Search Force Balance

Basic Vehicle Search Powerd by the Sister/Clone List

Year Make Model

2008

CHEVROLET

AVALANCHE
AVEO
COBALT
COLORADO
CORVETTE
EQUINOX
EXPRESS
HHR
IMPALA
MALIBU
SILVERADO
SILVERADO HD 2500 / 3500
SUBURBAN
TAHOE
TRAILBLAZER
UPLANDER

Start Year	End Year	Make	Model	Clones
2005	2010	CHEVROLET	COBALT	

Similar Vehicles

Start Year	End Year	Make	Model	Body Styles	Wheelbases
2003	2007	SATURN	ION	2D, 4D	103.2
2005	2010	CHEVROLET	COBALT	2D, 4D	103.3, 133
2007	2009	PONTIAC	G5	2D	103.3

4N6XPRT StifCalcs - Selected Vehicle: 2008 CHEVROLET COBALT

File Print Reports Settings Help Reg To: 4N6XPRT SYSTEMS

Basic Vehicle Search NHTSA Test Selection Advanced Vehicle Search Force Balance

Basic Vehicle Search Powerd by the Sister/Clone List

Year Make Model

Start Year	End Year	Make	Model	Clones
2005	2010	CHEVROLET	COBALT	

Similar Vehicles

Start Year	End Year	Make	Model	Body Styles	Wheelbases
2003	2007	SATURN	ION	2D, 4D	103.2
2005	2010	CHEVROLET	COBALT	2D, 4D	103.3, 133
2007	2009	PONTIAC	G5	2D	103.3

To change the Year, Make, and/or Model values you can begin typing in the new value, or click the appropriate **RESET** button.

As stated previously, when you have the appropriate Year, Make, and Model entered, click on the **NHTSA TEST SELECTION** tab to see which tests are available.

TEST SELECTION:

4N6XPRT StiffCalcs - Selected Vehicle: 2008 CHEVROLET COBALT

File Print Reports Settings Help Reg To: 4N6XPRT SYSTEMS

Basic Vehicle Search NHTSA Test Selection Advanced Vehicle Search Force Balance

Available Test Test Information Occupant Information Vehicle Information Stiffness Calcs

Available Tests in the NHTSA database for a
2005 - 2010 CHEVROLET COBALT
Sister Clone Searched Year Range (2003 - 2010)

Print

Frontal Test(s)

Test No.	Year	Make	Model	Impact Speed	Max Crush	Crush Factor	VDI	PDOF	Test Config	VIN
4487	2003	SATURN	ION	34.8	22.2	21.8	12FDEW5	0	VEHICLE INTO BAR...	1G8AF52F332141088
4984	2004	SATURN	ION	24.9	14.6	16.9	12FDEW2	0	VEHICLE INTO BAR...	1G8AF52F542155463
5188	2004	SATURN	ION	29.6	24.0	14.6	9999999	0	VEHICLE INTO BAR...	1G8AF52F442137343
5326	2005	CHEVROLET	COBALT	34.9	17.5	27.9	12FDEW3	0	VEHICLE INTO BAR...	1G1AK52F757520801
6084	2007	CHEVROLET	COBALT	24.7	16.2	15.1	12FDEW6	0	VEHICLE INTO BAR...	1G1AK55F677150701
6094	2007	CHEVROLET	COBALT	0.0	0.0	0.0		0	LOW RISK DEPLOY...	1G1AK55F677150701
6095	2007	CHEVROLET	COBALT	0.0	0.0	0.0		0	LOW RISK DEPLOY...	1G1AK55F677150701
6669	2009	CHEVROLET	COBALT	0.0	0.0	0.0		0	LOW RISK DEPLOY...	1G1AK58H897127272
6670	2009	CHEVROLET	COBALT	0.0	0.0	0.0		0	LOW RISK DEPLOY...	1G1AK58H897127272
6672	2009	CHEVROLET	COBALT	0.0	0.0	0.0		0	LOW RISK DEPLOY...	1G1AK58H897127272
6673	2009	CHEVROLET	COBALT	0.0	0.0	0.0		0	LOW RISK DEPLOY...	1G1AK58H897127272

Print

Rear Test(s)

Test No.	Year	Make	Model	Impact Speed	Max Crush	Crush Factor	VDI	PDOF	Test Config	VIN
4827	2003	SATURN	ION	29.9	N/A	-0.1	9999999	180	IMPACTOR INTO V...	1G8AF52F032138200

Print

Side Test(s)

Test No.	Year	Make	Model	Impact Speed	Max Crush	Crush Factor	VDI	PDOF	Test Config	VIN
4602	2003	SATURN	ION	38.5	13.2	45.0	09LPEW2	270	IMPACTOR INTO V...	1G8AF52F432145245
4856	2004	SATURN	ION	38.6	11.8	50.4	09LPEW2	297	IMPACTOR INTO V...	1G8AM12F542126995
5260	2005	SATURN	ION	38.4	10.6	55.5		297	IMPACTOR INTO V...	1G8AF52F452123878
5457	2005	SATURN	ION	20.1	14.0	11.5	09LPAN3	285	VEHICLE INTO BAR...	1G8AJ54F552165701
5460	2005	SATURN	ION	33.0	11.3	38.5	03LPAW2	297	IMPACTOR INTO V...	1G8AJ54F552166135
5461	2005	SATURN	ION	33.1	10.2	43.2	03LPAW2	297	IMPACTOR INTO V...	1G8AJ54F652165741
5472	2005	SATURN	ION	20.1	16.7	9.7	09LPAN3	285	VEHICLE INTO BAR...	1G8AJ54F352170654
6442	2005	SATURN	ION	19.3	15.4	9.6	09LPEW2	285	VEHICLE INTO BAR...	1G8AJ54F952124482
6587	2005	SATURN	ION	32.9	10.7	40.5	09LPEW2	270	IMPACTOR INTO V...	1G8AJ54F952124482
5325	2005	CHEVROLET	COBALT	38.1	11.9	48.9		297	IMPACTOR INTO V...	1G1AK52F527526599
5451	2005	CHEVROLET	COBALT	38.5	12.7	46.7	10LPAW3	297	IMPACTOR INTO V...	1G1AK52F527568800

Other Test(s)

No Other Tests: 2005 - 2010

Once you are on the **NHTSA TEST SELECTION** tab, you can select a test for review.

The available tests come from matching the selected Year/Make/Model to the Sister/Clone (Vehicle Interchange) list which is maintained by Greg Anderson, then searching the NHTSA Crash Test database for the tests that meet the Start & End year constraints of the Sister/Clone list and also meet the Make/Model and similar vehicle constraints of the Sister/Clone list.

To select a test, click on the test. Make sure that the little hour glass shows up after clicking on the test. If the hourglass does not show, click on the test again.

4N6XPRT StiffCalcs - Selected Vehicle: 2008 CHEVROLET COBALT

File Print Reports Settings Help Reg To: 4N6XPRT SYSTEMS

Basic Vehicle Search NHTSA Test Selection Advanced Vehicle Search Force Balance

Available Test Test Information Occupant Information Vehicle Information Stiffness Calcs

Available Tests in the NHTSA database for a
2005 - 2010 CHEVROLET COBALT
Sister Clone Searched Year Range (2003 - 2010)

Print

Frontal Test(s)

Test No.	Year	Make	Model	Impact Speed	Max Crush	Crush Factor	VDI	PDOF	Test Config	VIN
4487	2003	SATURN	ION	34.8	22.2	21.8	12FDEW6	0	VEHICLE INTO BAR...	1G8AF52F32141088
4984	2004	SATURN	ION	24.9	14.6	16.9	12FDEW2	0	VEHICLE INTO BAR...	1G8AF52F542155463
5188	2004	SATURN	ION	29.6	24.0	14.6	9999999	0	VEHICLE INTO BAR...	1G8AF52F442137343
5326	2005	CHEVROLET	COBALT	34.9	17.5	27.9	12FDEW3	0	VEHICLE INTO BAR...	1G1AK52F757520801
6094	2007	CHEVROLET	COBALT	24.7	10.2	15.1	12FDEW6	0	VEHICLE INTO BAR...	1G1AK55F7150701
6094	2007	CHEVROLET	COBALT	0.0	0.0	0.0		0	LOW RISK DEPLOY...	1G1AK55F7150701
6095	2007	CHEVROLET	COBALT	0.0	0.0	0.0		0	LOW RISK DEPLOY...	1G1AK55F7150701
6669	2009	CHEVROLET	COBALT	0.0	0.0	0.0		0	LOW RISK DEPLOY...	1G1AK58H897127727
6670	2009	CHEVROLET	COBALT	0.0	0.0	0.0		0	LOW RISK DEPLOY...	1G1AK58H897127727
6672	2009	CHEVROLET	COBALT	0.0	0.0	0.0		0	LOW RISK DEPLOY...	1G1AK58H897127727
6673	2009	CHEVROLET	COBALT	0.0	0.0	0.0		0	LOW RISK DEPLOY...	1G1AK58H897127727

Print

Rear Test(s)

Test No.	Year	Make	Model	Impact Speed	Max Crush	Crush Factor	VDI	PDOF	Test Config	VIN
4827	2003	SATURN	ION	29.9	N/A	-0.1	9999999	180	IMPACTOR INTO V...	1G8AF52F032138200

Print

Side Test(s)

Test No.	Year	Make	Model	Impact Speed	Max Crush	Crush Factor	VDI	PDOF	Test Config	VIN
4602	2003	SATURN	ION	38.5	13.2	45.0	09LPEW2	270	IMPACTOR INTO V...	1G8AF52F432145245
4856	2004	SATURN	ION	38.6	11.8	50.4	09LPEW2	297	IMPACTOR INTO V...	1G8AM12F542126995
5260	2005	SATURN	ION	38.4	10.6	55.5		297	IMPACTOR INTO V...	1G8AF52F45213878
5457	2005	SATURN	ION	20.1	14.0	11.5	09LPAN3	285	VEHICLE INTO BAR...	1G8AJ54F552165701
5460	2005	SATURN	ION	33.0	11.3	38.5	03LPAW2	297	IMPACTOR INTO V...	1G8AJ54F352166135
5461	2005	SATURN	ION	33.1	10.2	43.2	03LPAW2	297	IMPACTOR INTO V...	1G8AJ54F652165741
5472	2005	SATURN	ION	20.1	16.7	9.7	09LPAN3	285	VEHICLE INTO BAR...	1G8AJ54F352170654
6442	2005	SATURN	ION	19.3	15.4	9.6	09LPEW2	285	VEHICLE INTO BAR...	1G8AL54F452167434
6587	2005	SATURN	ION	32.9	10.7	40.5	09LPEW2	270	IMPACTOR INTO V...	1G8AL54F952124482
5325	2005	CHEVROLET	COBALT	38.1	11.9	48.8		297	IMPACTOR INTO V...	1G1AK52F257526599
5451	2005	CHEVROLET	COBALT	38.5	12.7	46.7	10LPAW3	297	IMPACTOR INTO V...	1G1AK52F257668600

Other Test(s)

No Other Tests: 2005 - 2010

When determining which test to select, items to be considered include:

Does the VDI (Vehicle Damage Indicator) clock position match the impact location? - 12 for front, 3 or 9 for side, and 6 for rear tests.

Does the PDOF (Principal Direction of Force) match the impact location? - 0 for front, 90 or 270 for side, an 180 for rear tests. Keep in mind that the Frontal tests can have a PDOF of 180 depending upon the reporting agency.

On frontal tests the test specific CF (Crush Factor) is close to 21, on side or rear tests the CF is close to 27.

The Year/Make/Model of the test vehicle matches the Year/Make/Model of

your subject vehicle.

There are no errors in the crush measurements. You may have to check the **VEHICLE** tab after selecting the test to verify this.

The impact speed of the test is a close match to the suspected impact speed of your subject collision.

These are IDEAL guidelines!!! Unfortunately, it is difficult to get a test that matches all of these guidelines. This is the first area where you can apply your expertise. Review the available tests and determine which test(s) best meet your criteria for this collision.

RESULTS:

Once you have selected a test, you may examine the following tabs for selected information -

The screenshot displays the 4N6XPRT StiffCalcs software interface. The title bar reads "4N6XPRT StiffCalcs - Selected Vehicle: 2008 CHEVROLET COBALT". The menu bar includes "File", "Print Reports", "Settings", "Help", and "Reg To: 4N6XPRT SYSTEMS". The main window has several tabs: "Basic Vehicle Search", "NHTSA Test Selection", "Advanced Vehicle Search", "Force Balance", "Available Test", "Test Information", "Occupant Information", "Vehicle Information", and "Stiffness Calcs". The "Test Information" tab is active, showing a form with the following data:

Test Information			
Test #	6084	NHTSA Test Reference Guide Version #	V5
Test Date	2007-07-12		
Contract #	DTNH22-03-D-11002		
Contract/Study Title	FMVSS 208 FRONTAL IMPACT - 2007 CHEVROLET COBALT		
Test Objective(s)	VEHICLE CRASHWORTHINESS AND OCCUPANT RESTRAINT PERFORMANCE DATA		
Test Type	FMVSS 208 OCCUPANT CRASH PROTEC	Configuration	VEHICLE INTO BARRIER
Closing Speed	39.8 Km/Hr	24.73 MPH	
Impact Angle	0	Offset Distance	0 mm 0.0 inches
Side Impact Point	0 mm 0.0 inches	Test Reference #	BT07071201
Test Performer	MGA RESEARCH	Test Track Surface	CONCRETE
Condition	DRY	Ambient Temperature	21 C 69.8 F
Data Recorder Type	OTHER	Data Link	OTHER
Total Number of Curves	44	Test Commentary	DTS TDAS PRO

Below the Test Information section is the "Fixed Barrier Information" section:

Fixed Barrier Information			
Barrier Type	RIGID	Barrier Shape	LOAD CELL BARRIER
Pole Barrier Diameter	0 mm 0.0 inches	Barrier Commentary	

TEST INFORMATION - look for the following items - Contract/Study Title, Test Objective(s), Test Type, Closing Speed, and Test Commentary - are these consistent with your collision? Is there anything in these areas which raise questions? Is there something here that makes you want to look at a different test, provided it/they are available?

4N6XPRT StifCalcs - Selected Vehicle: 2008 CHEVROLET COBALT

File Print Reports Settings Help Reg To: 4N6XPRT SYSTEMS

Basic Vehicle Search NHTSA Test Selection Advanced Vehicle Search Force Balance

Available Test Test Information Occupant Information Vehicle Information Stiffness Calcs

Select Occupant Location - Vehicle # 1 - 2007 CHEVROLET COBALT

Left Front Center Front Right Front

Left Rear Center Rear Right Rear

Restraints

Head

Chest

Legs

Left Front Seat

Test # 6084 Vehicle # 1 Occupant Location LEFT FRONT SEAT Occupant Seat Position CENTER POSITION

Occupant Type HYBRID III DUMMY Sex MALE Age 0 Size Percentile 50 PERCENTILE Calibration Method HYBRID III

Occupant Height 0.0 mm 0.0 inches Weight 0.0 kg 0.0 pounds

Occupant Manufacturer FIRST TECHNOLOGY S/N 312

Occupant Modification

Occupant Description

Occupant Commentary HEAD TO VISOR

Head to -

Windshield Header 387.0 mm 15.2 inches

Windshield 723.0 mm 28.5 inches

Head

Head to -

Seatback 0.0 mm 0.0 inches

Neck to Seatback 0.0 mm 0.0 inches

Head to -

Side Header 211.0 mm 8.3 inches

Side Window 321.0 mm 12.6 inches

First Contact Region (Head) AIR BAG

Second Contact Region (Head)

Head Injury Criteria (HIC) 64

HIC Time Interval (ms)

Lower 90 Upper 105

OCCUPANT INFORMATION - depending upon the case, multiple fields may be of interest, such as: contact region(s), position with respect to the vehicle, HIC, G's, or force loadings on the dummy, and restraints in use for the test.

The above Screen shows the HEAD information for the LEFT FRONT occupant. When more than one occupant is in the vehicle, you can switch between occupants by clicking on the appropriate non-greyed out occupant location.

The following screens illustrate the CHEST, LEGS, and RESTRAINTS information, which you get to by clicking the appropriate button.

4N6XPRT StiffCalcs - Selected Vehicle: 2008 CHEVROLET COBALT

File Print Reports Settings Help Reg To: 4N6XPRT SYSTEMS

Basic Vehicle Search NHTSA Test Selection Advanced Vehicle Search Force Balance

Available Test Test Information Occupant Information Vehicle Information Stiffness Calcs

Select Occupant Location - Vehicle # 1 - 2007 CHEVROLET COBALT

Left Front Center Front Right Front
Left Rear Center Rear Right Rear

Restraints

Head
Chest
Legs

Left Front Seat

Test # 6084 Vehicle # 1 Occupant Location LEFT FRONT SEAT Occupant Seat Position CENTER POSITION

Occupant Type HYBRID III DUMMY Sex MALE Age 0 Size Percentile 50 PERCENTILE Calibration Method HYBRID III

Occupant Height 0.0 mm 0.0 inches Weight 0.0 kg 0.0 pounds

Occupant Manufacturer FIRST TECHNOLOGY S/N 312

Occupant Modification

Occupant Description

Occupant Commentary HEAD TO VISOR

Chest

Chest to - Dash 563.0 mm 22.2 inches First Contact Region (Chest/Abdomen) AIR BAG Second Contact Region (Chest/Abdomen) NONE

Steering Wheel 368.0 mm 14.5 inches Lap Belt Peak Load 0.0 Newtons 0.0 pound Force

Seatback 0.0 mm 0.0 inches Shoulder Belt Peak Load 0.0 Newtons 0.0 pound Force

Arm to Door 113.0 mm 4.4 inches Chest Severity Index 0 Pelvic Peak Lateral Acceleration (g's) 0

Hip to Door 122.0 mm 4.8 inches Thoracic Trauma Index 0 Thorax Peak Acceleration (g's) 41

4N6XPRT StiffCalcs - Selected Vehicle: 2008 CHEVROLET COBALT

File Print Reports Settings Help Reg To: 4N6XPRT SYSTEMS

Basic Vehicle Search NHTSA Test Selection Advanced Vehicle Search Force Balance

Available Test Test Information Occupant Information Vehicle Information Stiffness Calcs

Select Occupant Location - Vehicle # 1 - 2007 CHEVROLET COBALT

Left Front Center Front Right Front
Left Rear Center Rear Right Rear

Restraints

Head
Chest
Legs

Left Front Seat

Test # 6084 Vehicle # 1 Occupant Location LEFT FRONT SEAT Occupant Seat Position CENTER POSITION

Occupant Type HYBRID III DUMMY Sex MALE Age 0 Size Percentile 50 PERCENTILE Calibration Method HYBRID III

Occupant Height 0.0 mm 0.0 inches Weight 0.0 kg 0.0 pounds

Occupant Manufacturer FIRST TECHNOLOGY S/N 312

Occupant Modification

Occupant Description

Occupant Commentary HEAD TO VISOR

Legs

Knees to Dash 211.0 mm 8.3 inches Knees to Seatback 0.0 mm 0.0 inches

First Contact Region (Legs) DASH/PANEL Second Contact Region (Legs)

Left Femur Peak Load -5572.0 Newtons -1252.6 pounds Force Right Femur Peak Load -7315.0 Newtons -1644.5 pounds Force

4N6XPRT StiffCalcs - Selected Vehicle: 2008 CHEVROLET COBALT

File Print Reports Settings Help Reg To: 4N6XPRT SYSTEMS

Basic Vehicle Search NHTSA Test Selection Advanced Vehicle Search Force Balance


Available Test Test Information Occupant Information Vehicle Information Stiffness Calcs

Select Occupant Location - **Vehicle # 1 - 2007 CHEVROLET COBALT**

Left Front Center Front Right Front

Left Rear Center Rear Right Rear

Left Front Seat



Head

Chest

Legs

Test # 6084 Vehicle # 1 Occupant Location LEFT FRONT SEAT Occupant Seat Position CENTER POSITION

Occupant Type HYBRID III DUMMY Sex MALE Age 0 Size Percentile 50 PERCENTILE Calibration Method HYBRID III

Occupant Height 0.0 mm 0.0 inches Weight 0.0 kg 0.0 pounds

Occupant Manufacturer FIRST TECHNOLOGY S/N 312

Occupant Modification

Occupant Description

Occupant Commentary HEAD TO VISOR

Restraints

Restraint #	Type	Mount	Deployment	Comments
1	FRONTAL AIRBAG	STEERING WHEEL	DEPLOYED PROPERLY	PRIMARY
2	NONE	NOT APPLICABLE	NOT APPLICABLE	SECONDARY

4N6XPRT StiffCalcs - Selected Vehicle: 2008 CHEVROLET COBALT

File Print Reports Settings Help Reg To: 4N6XPRT SYSTEMS

Basic Vehicle Search NHTSA Test Selection Advanced Vehicle Search Force Balance

Available Test Test Information Occupant Information Vehicle Information Stiffness Calcs

Vehicle # 1 - 2007 CHEVROLET COBALT

Summary Pre/Post Measurements Notes

Test # 6084 NHTSA Test Vehicle Number 1 VIN 1G1AK55F677150701

Year 2007 Make CHEVROLET Model COBALT Body FOUR DOOR SEDAN

Engine 4 CYLINDER TRANSVERSE FRONT Displacement 2.2 Liter Transmission AUTOMATIC - FRONT WHEEL DRIVE

Vehicle Modification Indicator PRODUCTION VEHICLE Vehicle Modification(s) Description

Post-test Steering Column Shear Capsule Separation UNKNOWN Steering Column Collapse Mechanism UNKNOWN

Vehicle Commentary

Vehicle Length 4548 mm 179.1 inches	Vehicle Test Weight 1493 KG 3291 pounds
Vehicle Wheelbase 2630 mm 103.5 inches	Vehicle Width 1821 mm 71.7 inches
CG behind Front Axle 1149 mm 45.2 inches	Total Length of Indentation 1284 mm 50.6 inches
Center of Damage to CG Axis 0 mm 0.0 inches	Maximum Static Crush Depth 412 mm 16.2 inches
Vehicle Damage Index 12 Principal Direction of Force 0	Pre-Impact Speed 40 kph 24.7 mph

Damage Profile Distance Measurements (Measured Left-to-Right, Rear-to-Front)

DPD 1 276 mm 10.9 inches	Crush from Pre Post Test Damage Measurements <table border="0"> <tr> <th></th> <th>Pre-Test</th> <th>Post-Test</th> <th>Crush Depth</th> </tr> <tr> <td>Left Bumper Corner</td> <td>173.3 inches</td> <td>162.4 inches</td> <td>10.9 inches</td> </tr> <tr> <td></td> <td>4402 mm</td> <td>4126 mm</td> <td>276 mm</td> </tr> <tr> <td>Centerline</td> <td>179.1 inches</td> <td>162.9 inches</td> <td>16.2 inches</td> </tr> <tr> <td></td> <td>4548 mm</td> <td>4137 mm</td> <td>411 mm</td> </tr> <tr> <td>Right Bumper Corner</td> <td>173.4 inches</td> <td>162.0 inches</td> <td>11.4 inches</td> </tr> <tr> <td></td> <td>4405 mm</td> <td>4116 mm</td> <td>289 mm</td> </tr> </table>		Pre-Test	Post-Test	Crush Depth	Left Bumper Corner	173.3 inches	162.4 inches	10.9 inches		4402 mm	4126 mm	276 mm	Centerline	179.1 inches	162.9 inches	16.2 inches		4548 mm	4137 mm	411 mm	Right Bumper Corner	173.4 inches	162.0 inches	11.4 inches		4405 mm	4116 mm	289 mm
		Pre-Test	Post-Test	Crush Depth																									
Left Bumper Corner		173.3 inches	162.4 inches	10.9 inches																									
		4402 mm	4126 mm	276 mm																									
Centerline		179.1 inches	162.9 inches	16.2 inches																									
		4548 mm	4137 mm	411 mm																									
Right Bumper Corner	173.4 inches	162.0 inches	11.4 inches																										
	4405 mm	4116 mm	289 mm																										
DPD 2 365 mm 14.4 inches																													
DPD 3 394 mm 15.5 inches																													
DPD 4 412 mm 16.2 inches																													
DPD 5 374 mm 14.7 inches																													
DPD 6 289 mm 11.4 inches																													

VEHICLE INFO - For the purposes of calculating stiffness values, the following information is important:

Crush Depths - On front and rear tests, there is a possibility for three sets of crush depth measurements: Maximum Crush, Damage Profile Distances (DPD), and Pre test minus Post test measurements. These three sets of measurements can be seen on the top half of the vehicle printout, or on the Vehicle Summary page. Side impact tests may record the Pre test minus Post test measurements, but they are meaningless for the purposes of calculating stiffness values.

Damage Width - There are two possible damage width measurements, Vehicle Width and Total Length of Indentation. Both are applicable to front and rear tests, if present. For side tests, only the Total Length of Indentation is applicable.

Weight - A Vehicle Test Weight is required, and if this is a side or a rear

test, test weights are needed for both the impactor and the target.

Speed - A closing speed is needed.

All of the required information is shown on the Vehicle SUMMARY screen.

The detailed Pre-Test and Post-Test dimensions are shown on the Vehicle PRE/POST MEASUREMENTS screen.

4N6XPRT StifCalcs - Selected Vehicle: 2008 CHEVROLET COBALT

File Print Reports Settings Help Reg To: 4N6XPRT SYSTEMS

Basic Vehicle Search **NHTSA Test Selection** Advanced Vehicle Search Force Balance

Available Test Test Information Occupant Information **Vehicle Information** Stiffness Calcs

Vehicle # 1 - 2007 CHEVROLET COBALT

Summary Pre/Post Measurements Notes

Test # 6084 NHTSA Test Vehicle Number 1 VIN 1G1AK55F677150701

Year 2007 Make CHEVROLET Model COBALT Body FOUR DOOR SEDAN

Engine 4 CYLINDER TRANSVERSE FRONT Displacement 2.2 Liter Transmission AUTOMATIC - FRONT WHEEL DRIVE

Vehicle Modification Indicator PRODUCTION VEHICLE Vehicle Modification(s) Description

Post-test Steering Column Shear Capsule Separation UNKNOWN Steering Column Collapse Mechanism UNKNOWN

Vehicle Commentary

Pre & Post Test Damage Measurements

(Measurements are taken in a longitudinal direction. Except for Engine Block, all measurements are take from the Rear Vehicle Surface forward.)

Left Side				Centerline				Right Side			
Pre-Test		Post-Test		Pre-Test		Post-Test		Pre-Test		Post-Test	
mm	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches
Length of Vehicle at Centerline											
4548.0	179.1	4137.0	162.9								
Engine Block											
0.0	0.0	0.0	0.0								
Front Bumper Corner											
Front of Engine											
0.0	0.0	0.0	0.0								
Firewall											
0.0	0.0	0.0	0.0								
Upper Leading Edge of Door											
0.0	0.0	0.0	0.0								
Lower Leading Edge of Door											
0.0	0.0	0.0	0.0								
Bottom of 'A' Post											
0.0	0.0	0.0	0.0								
Upper Trailing Edge of Door											
0.0	0.0	0.0	0.0								
Lower Trailing Edge of Door											
0.0	0.0	0.0	0.0								
Steering Column											
0.0	0.0	0.0	0.0								
Center of Steering Column to 'A' Post (Horizontal)											
0.0	0.0	0.0	0.0								
Center of Steering Column to Headliner (Vertical)											
0.0	0.0	0.0	0.0								

4N6XPRT StiffCalcs - Selected Vehicle: 2008 CHEVROLET COBALT

File Print Reports Settings Help Reg To: 4N6XPRT SYSTEMS

Basic Vehicle Search NHTSA Test Selection Advanced Vehicle Search Force Balance

Available Test Test Information Occupant Information Vehicle Information Stiffness Calcs

Vehicle # 1 - 2007 CHEVROLET COBALT

Summary Pre/Post Measurements Notes

Test # 6084 NHTSA Test Vehicle Number 1 VIN 1G1AK55F677150701

Year 2007 Make CHEVROLET Model COBALT Body FOUR DOOR SEDAN

Engine 4 CYLINDER TRANSVERSE FRONT Displacement 2.2 Liter Transmission AUTOMATIC - FRONT WHEEL DRIVE

Vehicle Modification Indicator PRODUCTION VEHICLE Vehicle Modification(s) Description

Post-test Steering Column Shear Capsule Separation UNKNOWN Steering Column Collapse Mechanism UNKNOWN

Vehicle Commentary

Bumper Engagement (Inline Impact Only)	Sill Engagement (Side Impact Only)	A-pillar Engagement (Side Impact Only)
0	NOT APPLICABLE	0
Moving Test Cart Angle	Moving Test Cart/Vehicle Crabbed Angle	Vehicle Orientation on Cart Moving Test Cart
DIRECT ENGAGEMENT	0	NOT APPLICABLE
<i>Magnitude of the Tilt Angle Measured between surface of a Rollover Test Cart and the Ground</i>	<i>Magnitude of the Crabbed Angle Measure Clockwise from Longitudinal Vector to Velocity Vector of Vehicle</i>	<i>Magnitude of the Angle Measured between the Vehicle Orientation and Direction of Test Cart Motion</i>

Any Test Notes are shown on the Vehicle NOTES screen.

4N6XPRT StiffCalcs - Selected Vehicle: 2008 CHEVROLET COBALT

File Print Reports Settings Help Reg To: 4N6XPRT SYSTEMS

Basic Vehicle Search NHTSA Test Selection Advanced Vehicle Search Force Balance

Available Test Test Information Occupant Information Vehicle Information Stiffness Calcs

Pre/Post Depth Damage Profile Distance Depths Maximum Vehicle Depth

☒ Vehicle Width ☐ Vehicle Indent ☒ Closing Speed ☒ Trapezoidal Average ☐ Simple Average

Modify **Vehicle # 1 - 2007 CHEVROLET COBALT** A - B - G Average Crush Factor (CF)

NHTSA Crash Test - 6084 Front Impact

Given: Test Vehicle Weight = 3291 pounds Closing Speed = 24.7 mph
Test Vehicle Width = 71.7 inches

Pre/Post Collision Crush Depths (inches)

(Driver Side)	Left Side Crush	Centerline crush	Right Side Crush	(Pass. Side)
	10.9	16.2	11.4	

Crash 3 Stiffness Coefficients

	A	B	G	Smac Stiffness
Minimum Crush = 10.9 inches				189.4
Using a Rated No Damage Speed of 2.5 mph	187.6	153.1	115.0	
Using a Rated No Damage Speed of 5.0 mph	333.0	120.6	460.0	
Using a Rated No Damage Speed of 7.5 mph	436.3	92.0	1034.9	
Using a Rated No Damage Speed of 10.0 mph	497.3	67.2	1839.9	
Average Crush = 13.7 inches				119.9
Using a Rated No Damage Speed of 2.5 mph	149.3	96.9	115.0	
Using a Rated No Damage Speed of 5.0 mph	265.0	76.3	460.0	
Using a Rated No Damage Speed of 7.5 mph	347.1	58.2	1034.9	
Using a Rated No Damage Speed of 10.0 mph	395.7	42.5	1839.9	
Maximum Crush = 16.2 inches				85.8
Using a Rated No Damage Speed of 2.5 mph	126.2	69.3	115.0	
Using a Rated No Damage Speed of 5.0 mph	224.1	54.6	460.0	
Using a Rated No Damage Speed of 7.5 mph	293.5	41.6	1034.9	
Using a Rated No Damage Speed of 10.0 mph	334.6	30.4	1839.9	

Rated No Damage Speed = Impact speed with a barrier resulting in no permanent vehicle deformation
Normal "Rated No Damage Speed" is 2.5 or 5 mph. Some Specific vehicles may, however, have a higher rating

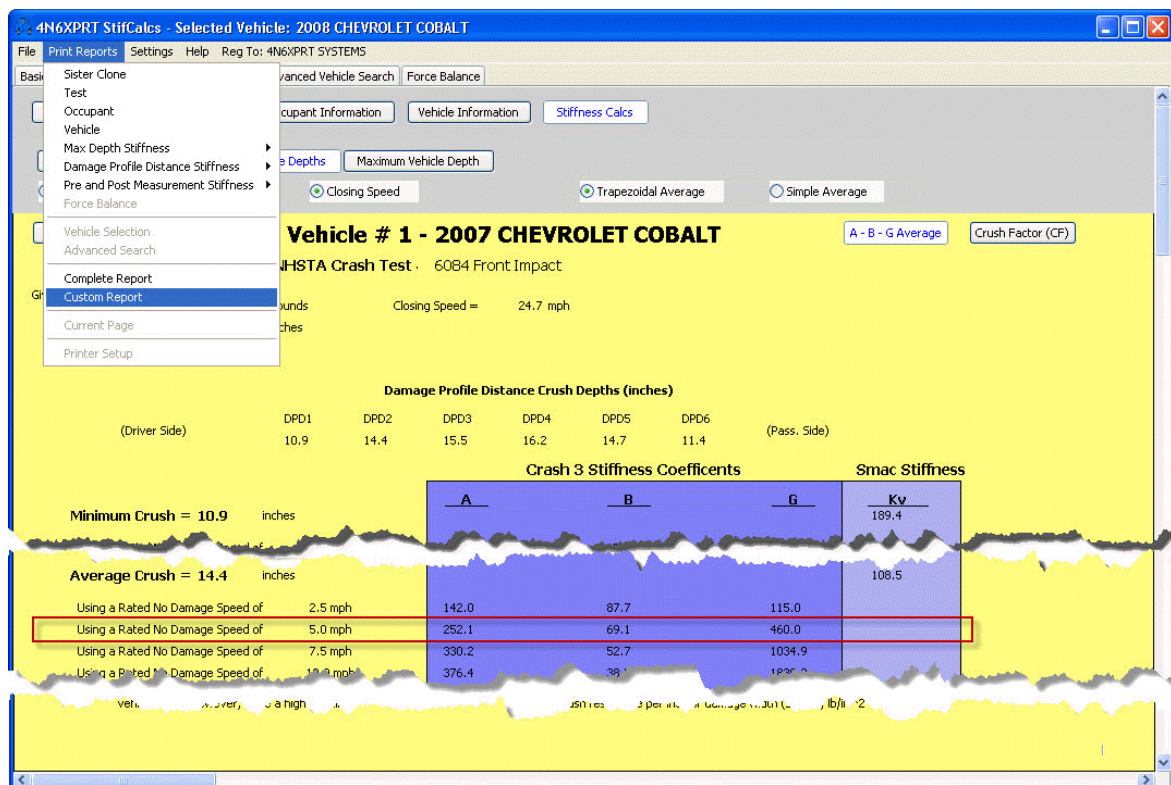
A = Maximum force per inch of damage without permanent damage, lb/in
B = Crush resistance per inch of damage width (Crash), lb/in²
G = Energy dissipated without permanent damage, lb
Kv = Crush resistance per inch of damage width (SMAC), lb/in²

STIFFNESS CALCS - From the damage depths and damage widths reported, we allow you to view stiffness values for each of the combinations. We also allow you to view the differences between the Trapezoidal and "Simple" methods of calculating the average crush depth when appropriate, by "toggling" between the two methods. Finally, we allow you to see the stiffness value change between using the closing speed and KE Equivalent Speed for side and rear tests.

In addition to calculating the CRASH 3 A-B-G values and the Test Specific Crush Factor (CF) value, beginning in 2010 the program calculates the SMAC Kv stiffness value for each crush value - Minimum, Average, and Maximum.

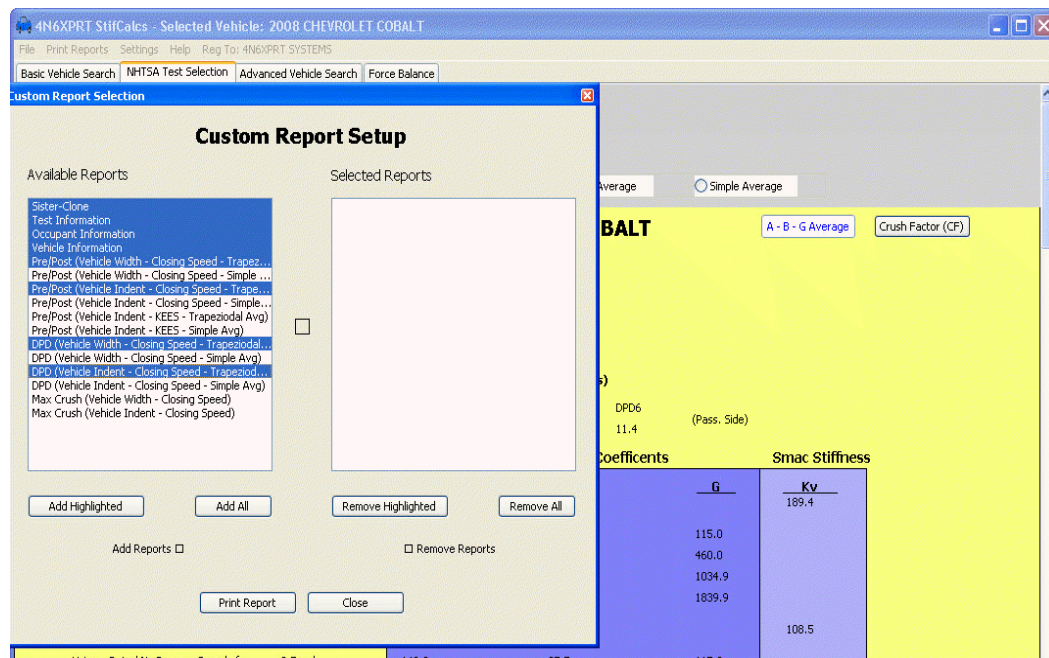
When applying stiffness values to your collision, these are the values to use as your starting point depends upon the impact location:

- Front - The initial starting point would be Vehicle Width, Trapezoidal Average Crush, 5 mph Rated No Damage Speed. Which set of crush measurements to use is determined by what NHTSA reported, along with your preference.
- Rear - The initial starting point would be Vehicle Width, KE Equivalent Speed, Trapezoidal Average Crush, 5 mph Rated No Damage Speed. Which set of crush measurements to use is determined by what NHTSA reported, along with your preference.
- Side - The initial starting point would be Indentation Length, KE Equivalent Speed, Trapezoidal Average Crush, 2 mph Rated No Damage Speed. Which set of crush measurements to use is determined by what NHTSA reported, along with your preference.

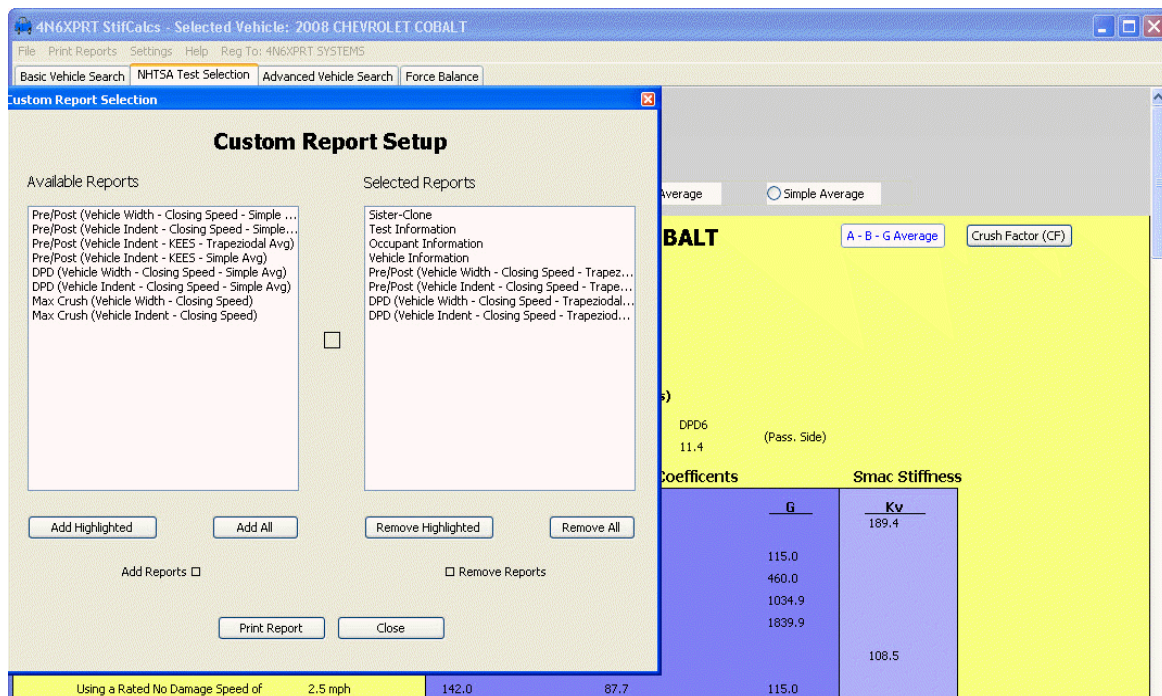


PRINTING:

To Print a report click on the PRINT REPORTS in the top Menu bar. Then, in order to get the pages you are concerned with, click on CUSTOM REPORT.



Next, Highlight the pages you would like to print. Multiple pages can be highlighted by holding the CTRL key down while clicking on the desired pages.



Once the desired pages are highlighted, click the ADD HIGHLIGHTED button.

Finally, click the PRINT REPORT button.

To close the Custom Report box, click the CLOSE button or on the “X” in the upper right corner of the box.

TEST SUMMARY REPORT:

2005 - 2010 CHEVROLET COBALT										
Sister Clone Searched Year Range (2003 - 2010)										
Frontal Test(s)										
Test No.	Year	Make	Model	Impact Speed	Max Crush	Crush Factor	VDI	PDof	Test Config	VIN
4457	2003	SATURN	ION	34.8	22.2	21.8	12FEW6	0	VEHICLE INTO BAR...	1G8AF52F33Z141080
4904	2004	SATURN	ION	24.9	14.6	16.9	12FEW2	0	VEHICLE INTO BAR...	1G8AF52F54Z135463
5188	2004	SATURN	ION	29.6	24.0	13.6	9999999	0	VEHICLE INTO BAR...	1G8AF52F44Z137493
5326	2005	CHEVROLET	COBALT	34.9	17.5	27.9	12FEW3	0	VEHICLE INTO BAR...	1G1AK52F75Z0901
6084	2007	CHEVROLET	COBALT	24.7	16.2	15.1	12FEW6	0	VEHICLE INTO BAR...	1G1AK52F7150701
6094	2007	CHEVROLET	COBALT	0.0	0.0	0.0		0	LOW RISK DEPLOY...	1G1AK55F67150701
6095	2007	CHEVROLET	COBALT	0.0	0.0	0.0		0	LOW RISK DEPLOY...	1G1AK55F67150701
6669	2009	CHEVROLET	COBALT	0.0	0.0	0.0		0	LOW RISK DEPLOY...	1G1AK58H97127727
6670	2009	CHEVROLET	COBALT	0.0	0.0	0.0		0	LOW RISK DEPLOY...	1G1AK58H97127727
6672	2009	CHEVROLET	COBALT	0.0	0.0	0.0		0	LOW RISK DEPLOY...	1G1AK58H97127727
6673	2009	CHEVROLET	COBALT	0.0	0.0	0.0		0	LOW RISK DEPLOY...	1G1AK58H97127727

Rear Test(s)										
Test No.	Year	Make	Model	Impact Speed	Max Crush	Crush Factor	VDI	PDof	Test Config	VIN
4827	2003	SATURN	ION	29.9	N/A	0.1	9999999	180	IMPACTOR INTO V...	1G8AF52F03Z138200

Side Test(s)										
Test No.	Year	Make	Model	Impact Speed	Max Crush	Crush Factor	VDI	PDof	Test Config	VIN
5460	2005	SATURN	ION	33.0	11.3	39.5	03LPAW2	297	IMPACTOR INTO V...	1G8A354F35Z166135
5461	2005	SATURN	ION	33.1	10.6	43.2	03LPAW2	297	IMPACTOR INTO V...	1G8A354F65Z165741
5472	2005	SATURN	ION	20.1	16.7	9.7	09LPAW3	285	VEHICLE INTO BAR...	1G8A354F35Z170654
5442	2005	SATURN	ION	12.3	15.4	9.6	09LPAW2	285	VEHICLE INTO BAR...	1G8A354F45Z167434
6597	2005	SATURN	ION	32.9	10.7	40.5	09LPAW2	270	IMPACTOR INTO V...	1G8A354F95Z124485
5325	2005	CHEVROLET	COBALT	38.1	11.9	48.8	10LPAW3	297	IMPACTOR INTO V...	1G1AK52F25Z06599
5451	2005	CHEVROLET	COBALT	38.5	12.7	46.7	10LPAW3	297	IMPACTOR INTO V...	1G1AK52F25Z06600
5614	2006	CHEVROLET	COBALT	38.4	13.3	44.6	10LPAW3	297	IMPACTOR INTO V...	1G1AK15F66Z558769
5626	2006	CHEVROLET	COBALT	38.5	13.5	43.9	10LPAW3	297	IMPACTOR INTO V...	1G1AK15F66Z558769
6099	2007	CHEVROLET	COBALT	38.4	13.3	44.4	10LPAW3	297	IMPACTOR INTO V...	1G1AK55F67107730
6082	2007	CHEVROLET	COBALT	38.7	14.4	41.5	10LPAW3	297	IMPACTOR INTO V...	1G1AK15F77Z373002

Other Test(s)

No Other Tests: 2005 - 2010

When you are on the AVAILABLE TESTS page of the NHTSA TEST RESULTS tab, you also have the opportunity to print out a TEST SUMMARY report by clicking on the PRINT button above each grouping of tests.

4N6XPRT StiffCalc - Selected Vehicle: 2008 CHEVROLET COBALT

File Print Reports Settings Help Reg To: 4N6XPRT SYSTEMS

Basic Vehicle Search NHSTA Test Selection Advanced Vehicle Search Force Balance

Available Test Test Information Occupant Information Vehicle Information Stiffness Calcs

2005 - 2010 CHEVROLET COBALT
Sister Clone Searched Year Range (2003 - 2010)

Print

Test No.	Year	Make	Model	Impact Speed	Max Crush	Crush Factor
4487	2003	SATURN	ION	24.8	22.2	21.8
4584	2004	SATURN	ION	24.9	14.6	16.9
5188	2004	SATURN	ION	22.6	24.0	13.6
5326	2005	CHEVROLET	COBALT	24.9	17.5	22.9
6084	2007	CHEVROLET	COBALT	24.7	16.2	15.1
6094	2007	CHEVROLET	COBALT	0.0	0.0	0.0
6595	2007	CHEVROLET	COBALT	0.0	0.0	0.0
6669	2009	CHEVROLET	COBALT	0.0	0.0	0.0
6670	2009	CHEVROLET	COBALT	0.0	0.0	0.0
6672	2009	CHEVROLET	COBALT	0.0	0.0	0.0
6673	2009	CHEVROLET	COBALT	0.0	0.0	0.0
6794	2009	CHEVROLET	COBALT	0.0	0.0	0.0

Print

Rear Test(s)

Test No.	Year	Make	Model	Impact Speed	Max Crush	Crush Factor
4827	2003	SATURN	ION	29.9	N/A	-0.1

Print

Side Test(s)

Test No.	Year	Make	Model	Impact Speed	Max Crush	Crush Factor
5460	2005	SATURN	ION	33.0	11.3	38.5
5461	2005	SATURN	ION	33.1	10.2	43.2
5472	2005	SATURN	ION	20.1	16.7	9.7
6442	2005	SATURN	ION	19.3	15.4	9.6
6597	2005	SATURN	ION	32.9	10.7	40.5
5325	2005	CHEVROLET	COBALT	30.1	11.9	48.8
5451	2005	CHEVROLET	COBALT	38.5	12.7	46.7
5614	2006	CHEVROLET	COBALT	38.4	13.3	44.6
5682	2006	CHEVROLET	COBALT	38.5	13.5	43.9
6049	2007	CHEVROLET	COBALT	38.4	13.3	44.4
6082	2007	CHEVROLET	COBALT	38.7	14.4	41.5

Other Test(s)

No Other Tests: 2005 - 2010

Advanced Vehicle Search Printout

Please choose the parameters for the report.

NOTE: Default settings are already selected for you

Frontal Tests

No Damage Speed (mph): ☐ 2.5 ☒ 5.0 ☐ 7.5 ☐ 10.0 ☐ Other

Crush Depth (inch): ☒ Average ☐ Max

Crush Length (inch): ☒ Width ☐ Indent

Speed Type: ☐ Closing ☒ KE

Rear Tests

No Damage Speed (mph): ☐ 2.5 ☒ 5.0 ☐ 7.5 ☐ 10.0 ☐ Other

Crush Depth (inch): ☒ Average ☐ Max

Crush Length (inch): ☐ Width ☐ Indent

Speed Type: ☐ Closing ☒ KE

Side Tests

No Damage Speed (mph): ☐ 1.0 ☒ 2.0 ☐ 3.0 ☐ 5.0 ☐ Other

Crush Depth (inch): ☐ Average ☒ Max

Speed Type (inch): ☐ Closing ☒ KE

Default Settings Next Cancel

☐ Include Not Calculated Tests

When one of the PRINT buttons is clicked, the REPORT PARAMETERS box where you set the parameters for the Test Summary Stiffness Calculations pops up.

NO DAMAGE SPEED - The default value for the Front and Rear tests is 5 mph. The default value for Side tests is 2 mph. The default can be changed by clicking the appropriate radio button, or by entering a speed in the OTHER box.

CRUSH DEPTH - The default value for all tests is AVERAGE, however this can be changed to MAXIMUM by clicking the radio button. Using the MAXIMUM crush depth will result in more conservative, i.e. - “softer”, Stiffness values.

CRUSH LENGTH - The default value for the Front and Rear tests is WIDTH, that is, the vehicle width. This can be changed to INDENT, the reported Indentation length, by clicking the radio button. Using the WIDTH for the Crush Length will result in more conservative, i.e. - “softer”, Stiffness values. The only possible Crush Length for Side tests is the reported Indentation Length, so no options are available for the Crush Length for Side tests.

SPEED TYPE - The default Speed Type is KE - Kinetic Energy Equivalent

Speed - for all test types. The user is probably more familiar with using the CLOSING speed in Frontal tests, however, in the instance where a moving barrier is impacting the front of the vehicle, the CLOSING speed will give erroneously high Stiffness values for the same reason that the CLOSING speed will give high values for the Rear and Side tests not all of the moving barrier's Kinetic Energy is consumed in crushing the target vehicle. Some of the energy is retained by the barrier and is exhibited in post impact barrier movement, some is "expended" in crushing the target vehicle (and possibly the barrier), and some is transferred to the target vehicle and is exhibited in post impact barrier movement.

In the case of a vehicle running into a immovable barrier, with no post impact movement in the original direction of travel of the vehicle, the CLOSING speed and the KE speed will be the same.

It is suggested that the user begin using KE speed for all test types to avoid potential errors. With that as a given, there ARE case specific reasons for the user to use CLOSING speed for a Side or Rear test summary.

For this example we clicked the PRINT button for the SIDE tests, and have changed the Crush Depth to MAX.

When you have the parameters set for the test types you are interested in, click the NEXT button.

4N6XPRT StiffCalcs - Selected Vehicle: 2008 CHEVROLET COBALT

File Print Reports Settings Help Reg To: 4N6XPRT SYSTEMS

Basic Vehicle Search NHTSA Test Selection Advanced Vehicle Search Force Balance

Available Test

Display Auto Calculated Tests

Test No	Year	Make	Model	Body Style	No Damage Speed	Crush Distance	KEES	Stiffness A	Stiffness B	Stiffness G	Kv
5472	2005	SATURN	ION	FOUR DOOR SEDAN	2.0	16.7	20.1	42.1	22.8	38.9	28.1
5325	2005	CHEVROLET	COBALT	FOUR DOOR SEDAN	2.0	11.9	26.3	76.4	78.0	37.4	91.4
5682	2006	CHEVROLET	COBALT	TWO DOOR COUPE	2.0	13.5	26.6	80.8	73.9	44.2	86.5
6442	2005	SATURN	ION	FOUR DOOR SEDAN	2.0	15.4	19.3	88.2	49.3	78.9	61.5
6587	2005	SATURN	ION	FOUR DOOR SEDAN	2.0	10.7	22.7	96.6	93.7	49.8	112
6682	2007	CHEVROLET	COBALT	TWO DOOR COUPE	2.0	14.4	26.9	100.5	86.5	58.4	101
5614	2006	CHEVROLET	COBALT	TWO DOOR COUPE	2.0	13.3	26.9	105.9	99.5	56.3	116
6049	2007	CHEVROLET	COBALT	FOUR DOOR SEDAN	2.0	13.3	26.5	110.2	101.6	59.7	118
5260	2005	SATURN	ION	FOUR DOOR SEDAN	2.0	11.1	26.7	113.6	126.5	51.0	147
5451	2005	CHEVROLET	COBALT	FOUR DOOR SEDAN	2.0	12.7	26.6	115.4	111.7	59.7	130
4602	2003	SATURN	ION	FOUR DOOR SEDAN	2.0	13.2	26.7	126.7	118.7	67.6	138
4856	2004	SATURN	ION	OTHER	2.0	11.8	26.6	161.5	168.4	77.5	196

Print

Test No. 4487 4984 5188 5326 6084 6094 6095 6669 6670 6672 6673 6674

Print

Test No. 4827

Print

To select multiple records hold the ctrl key down and click on the records you wish to select

Remove Send A/B Values to Force Balance

Print this Page Print All Pages Cancel

Number of Tests 12

	A	B	G	Kv	CF
Average	101.5	94.2	56.6	110.8	20.0
Minimum	42.1	22.8	37.4	28.1	9.6
Maximum	161.5	168.4	78.9	196.8	25.8
Std Dev	29.3	37.4	13.5	43.0	5.1

Side Test(s)

Test No.	Year	Make	Model	Impact Speed	Max Crush	Crush Factor
5460	2005	SATURN	ION	33.0	11.3	38.5
5461	2005	SATURN	ION	33.1	10.2	43.2
5472	2005	SATURN	ION	20.1	16.7	9.7
6442	2005	SATURN	ION	19.3	15.4	9.6
6587	2005	SATURN	ION	32.9	10.7	40.5
5325	2005	CHEVROLET	COBALT	38.1	11.9	48.8
5451	2005	CHEVROLET	COBALT	38.5	12.7	46.7
5614	2006	CHEVROLET	COBALT	38.4	13.3	44.6
5682	2006	CHEVROLET	COBALT	38.5	13.5	43.9
6049	2007	CHEVROLET	COBALT	38.4	13.3	44.4
6082	2007	CHEVROLET	COBALT	38.7	14.4	41.5

Other Test(s)

No Other Tests: 2005 - 2010

Side Tests

No Damage Speed (mph) 1.0 2.0 3.0 5.0 Other

Crush Depth (inch) Average Max

Speed Type (inch) Closing KE

Default Settings Next Cancel

Include Not Calculated Tests

The tab displayed will be determined by the PRINT button which is clicked. Since the SIDE PRINT button was clicked for this example, the side Test Summary is displayed.

For this example we have further sorted the tests on the “A” value and highlighted the COBALT 4 door tests.

At this point you have the option to:

PRINT THIS PAGE - This button will print the Test Summary only for the page displayed.

PRINT ALL PAGES - This button will print the Test Summary for each test type which has tests available to print.

SEND A/B VALUES TO FORCE BALANCE - This will send the Statistical Summary of the A-B values to the Force Balance module, and allow you

the chance to print the Test Summary page if you have not already done so.

Printing the Test Summary page is important so that you document what data went into the Force Balance calculations.

CANCEL - Allows you to close the Test Summary without doing anything else.

[illegible]

Any of the fields in the ADVANCED VEHICLE SEARCH page can be used singly, or in combination. One must remember, however, that the fields are combined as an AND search which means that all of the criteria input on the page must be met in order for the test to be retrieved. Therefore, it is suggested that the user starts with a BROAD search (though not TOO broad - start with two or three fields/field ranges, such as body style and a weight range), and then narrow the search down depending upon the number of tests retrieved.

When you click the SEARCH button, the tests which meet your search criteria show up in the box along the bottom of the window. When you see a test which you want to look at more closely, note the test number, then click on that

test. This will then put you on the **NHTSA TEST SELECTION** tab, at which point you proceed as you would if you were conducting a BASIC SEARCH.

If NO tests come up for the model you are looking for, or the similar model(s) as identified in the Sister/Clone list, you have the capability to build your own “CLASS” of similar vehicle.

Class based on WEIGHT. The weights contained in the NHTSA Crash Test database are **loaded weights**, not curb. Generally, the additional load is comprised of dummies and test recording instrumentation. This load generally ranges from 500-800 pounds over the curb weight.

The best way to find a base test weight for your search is to look at the weight of the vehicle in some other test. If there are no tests for your desired vehicle in the database, use a curb weight from a published source, such as Expert AutoStats[®], and add your guess of what the load weight desired is. One way of estimating the load weight is.... use your best estimate of the load weight in your collision.

When inputting the weight MIN and MAX values, where you start your range depends upon what type of test you are trying to retrieve.

- For FRONTAL Tests, it is suggested that you start your range as +/- 20 pounds, due to the large number of frontal tests in the database, then expand or contract the range as you find necessary to get a valid number of tests in your search results.
- For REAR Tests, it is suggested that you start your range as +/- 200 pounds, due to the small number of rear tests in the database, then expand or contract the range as you find necessary to get a valid number of tests in your search results.
- For SIDE Tests, it is suggested that you start your range as +/- 100 pounds, then expand or contract the range as you find necessary to get a valid number of tests in your search results.

Class based on WHEELBASE. Determine the wheelbase of your desired class vehicle based upon a test of your desired vehicle, or from a published

source, such as Expert AutoStats®.

Class based on LENGTH. Determine the wheelbase of your desired class vehicle based upon a test of your desired vehicle, or from a published source, such as Expert AutoStats®.

Class based on BODYSTYLE. Select the body style you want to search for within the database.

Class based on IMPACT LOCATION. Select the Impact location(s) you want to search for within the database.

The more criteria used for the “CLASS” the more similar the tests will be to your subject vehicle, but the less likely it will be that you find any tests.

You can also start with one, or two, criteria, search the database, then add criteria and re-search the database to narrow the number of tests to review.

When you click the SEARCH button, the tests which meet your search criteria show up in the box along the bottom of the window. When you see a test which you want to look at more closely, note the test number, then click on that test. This will then put you on the **NHTSA TEST SELECTION** tab, at which point you proceed as you would if you were conducting a BASIC SEARCH.

You also have the opportunity to print a TEST SUMMARY REPORT of the search results.

“CLASS” VEHICLE:

You, the user, should create a CLASS report every time you do vehicle stiffness research. Why?? Several Reasons -

- (1) - Practice, Practice, PRACTICE! The more often you create a CLASS vehicle advanced search, the more easily the process will come to you. As with many skills, if you don't use them, you lose them.

4N6XPRT StiffCalcs - Selected Vehicle: 2008 CHEVROLET COBALT

File Print Reports Settings Help Reg To: 4N6XPRT SYSTEMS

Basic Vehicle Search | NHTSA Test Selection | Advanced Vehicle Search | Force Balance

Advanced Search

Enter as much information as you can about the type of vehicle/test you are looking for then click "search".
Remember the more "restrictions" you put o the search criteria, the fewer tests that will retrieved.

Test Number to

Year Range 1965 to 2011

Make

Model

Body Style

Units
☒ Imperial (lbs, inches)
☐ Metric (kg, mm, Newtons)

Wheel Base Min 102.5 Max 104.5

Vehicle Length

Vehicle Weight

Impact Location
☐ Front ☒ Side
☐ Rear ☐ Other

Specialty Search Criteria
Test Test Type
Barrier Test Configuration

168 Tests Found Search Reset Print

Test Number	Year	Make	Model	Body Style	Wheel Base	Impact Point	Comments
966	1980	CHEVROLET	CITATION	FIVE DOOR HATCHB...	2654	SIDE	NO COMMENTS
967	1980	CHEVROLET	CITATION	FIVE DOOR HATCHB...	2654	SIDE	NO COMMENTS
1522	1988	NISSAN	PICKUP	PICKUP TRUCK	2647	SIDE	VEHICLE LOST LEFT ...
1596	1991	TOYOTA	PICKUP	PICKUP TRUCK	2616	SIDE	NO COMMENTS
1738	1987	DODGE	COLT	FIVE DOOR HATCHB...	2629	SIDE	COLT VISTA WAGON ...
1744	1991	TOYOTA	PICKUP	PICKUP TRUCK	2604	SIDE	NO COMMENT
1749	1989	ISUZU	TROOPER II	FIVE DOOR HATCHB...	2654	SIDE	NO COMMENT
1912	1993	FORD	PROBE	THREE DOOR HATC...	2624	SIDE	NO COMMENTS
1922	1993	OLDSMOBILE	ACHIEVA	TWO DOOR COUPE	2620	SIDE	1993 OLDSMOBILE A...
1923	1993	OLDSMOBILE	ACHIEVA	TWO DOOR COUPE	2625	SIDE	1993 OLDSMOBILE A...
1961	1993	HONDA	CIVIC	TWO DOOR SEDAN	2616	SIDE	1993 HONDA CIVIC 2...
1962	1993	HONDA	CIVIC	TWO DOOR COUPE	2616	SIDE	1993 HONDA CIVIC 2...
1978	1993	TOYOTA	PICKUP	PICKUP TRUCK	2616	SIDE	NO COMMENTS
1989	1993	TOYOTA	PICKUP	PICKUP TRUCK	2616	SIDE	DAMDST IS NEGATIVE
2059	1994	NISSAN	ALTIMA	FOUR DOOR SEDAN	2620	SIDE	NO COMMENTS
2094	1994	TOYOTA	CAMRY	FOUR DOOR SEDAN	2604	SIDE	1994 TOYOTA CAMR...
2096	1994	NISSAN	GALANT	FOUR DOOR SEDAN	2639	SIDE	NO COMMENT
2116	1994	AUDI	90S	FOUR DOOR SEDAN	2624	SIDE	NO COMMENT
2210	1995	SUBARU	LEGACY	STATION WAGON	2629	SIDE	NO COMMENT
2217	1995	NISSAN	GALANT	FOUR DOOR SEDAN	2636	SIDE	NO COMMENTS
2249	1995	MAZDA	323-PROTEGE	FOUR DOOR SEDAN	2604	SIDE	NO COMMENT
2433	1996	DODGE	AVENGER	TWO DOOR COUPE	2640	SIDE	NO COMMENTS
2477	1997	HONDA	CIVIC	FOUR DOOR SEDAN	2620	SIDE	NO COMMENTS
2485	1997	CHEVROLET	CAVALIER	TWO DOOR SEDAN	2640	SIDE	NO COMMENTS
2491	1997	CHEVROLET	CAVALIER	TWO DOOR COUPE	2642	SIDE	NO COMMENTS
2494	1997	SATURN	SL1	FOUR DOOR SEDAN	2604	SIDE	NO COMMENTS
2499	1997	PONTIAC	GRAND AM	FOUR DOOR SEDAN	2630	SIDE	NO COMMENTS
2508	1997	SUBARU	LEGACY	FOUR DOOR SEDAN	2632	SIDE	ENGINE TYPE HORIZ...
2509	1997	PONTIAC	GRAND AM	FOUR DOOR SEDAN	2626	SIDE	NO COMMENTS
2510	1997	MAZDA	626	FOUR DOOR SEDAN	2608	SIDE	NO COMMENTS
2532	1997	FORD	PROBE	THREE DOOR HATC...	2611	SIDE	NO COMMENTS
2537	1997	NISSAN	ALTIMA	FOUR DOOR SEDAN	2624	SIDE	NO COMMENTS
2538	1997	HONDA	CIVIC	FOUR DOOR SEDAN	2620	SIDE	NO COMMENTS
2539	1997	DODGE	NEON	FOUR DOOR SEDAN	2638	SIDE	NO COMMENTS
2547	1997	NISSAN	GALANT	FOUR DOOR SEDAN	2640	SIDE	NO COMMENTS
2666	1998	SATURN	SC2	TWO DOOR COUPE	2605	SIDE	MODEL - SC2
2685	1998	CHEVROLET	CAVALIER	FOUR DOOR SEDAN	2635	SIDE	NO COMMENTS
2692	1998	NISSAN	ALTIMA	FOUR DOOR SEDAN	2626	SIDE	NO COMMENTS
2693	1998	CHEVROLET	CAVALIER	FOUR DOOR SEDAN	2640	SIDE	NO COMMENTS
2715	1998	DODGE	NEON	FOUR DOOR SEDAN	2645	SIDE	NO COMMENTS
2720	1998	SUBARU	LEGACY	FOUR DOOR SEDAN	2639	SIDE	98 SUBARU LEGACY
2723	1998	HONDA	CIVIC	TWO DOOR COUPE	2625	SIDE	1998 HONDA CIVIC DX

Our SEARCH found 168 tests which matched the search criteria of SIDE tests on a vehicle with a reported wheelbase between 102.5 and 104.5 inches.

Multiple Body Styles meet this criteria - 2 door, Pickup, 4 door, Utility, Station Wagon we are looking for cars which have 4 doors - Click the PRINT button to get to a Test Summary Report where the extraneous (non-4 door car tests, in this case) tests can be removed.

4N6XPRT StiffCalcs - Selected Vehicle: 2008 CHEVROLET COBALT

File Print Reports Settings Help Reg To: 4N6XPRT SYSTEMS

Basic Vehicle Search | NHTSA Test Selection | Advanced Vehicle Search | Force Balance

Test Number to

Year Range 1965 to 2011

Make

Model

Body Style

Impact Location

☐ Front ☒ Side

☐ Rear ☐ Other

168 Tests Found

Test Number	Year	Make	Vehicle Type	Vehicle Model	Vehicle Weight	Vehicle Length	Vehicle Width	Vehicle Height	Vehicle Comments
966	1980	CHEVROLET	PICKUP	PICKUP TRUCK	2647	SIDE	VEHICLE LOST LEFT ...		
967	1980	CHEVROLET	PICKUP	PICKUP TRUCK	2616	SIDE	NO COMMENTS		
1522	1988	NISSAN	PICKUP	PICKUP TRUCK	2629	SIDE	COLT VISTA WAGON ...		
1596	1991	TOYOTA	PICKUP	PICKUP TRUCK	2604	SIDE	NO COMMENT		
1738	1987	DODGE	PICKUP	PICKUP TRUCK	2654	SIDE	NO COMMENT		
1744	1991	TOYOTA	PICKUP	PICKUP TRUCK	2624	SIDE	NO COMMENTS		
1749	1989	ISUZU	PICKUP	PICKUP TRUCK	2620	SIDE	1993 OLDSMOBILE A...		
1912	1993	FORD	PICKUP	PICKUP TRUCK	2625	SIDE	1993 OLDSMOBILE A...		
1922	1993	OLDSMOBILE	PICKUP	PICKUP TRUCK					
1923	1993	OLDSMOBILE	PICKUP	PICKUP TRUCK					

Advanced/Vehicle Search Printout

Please choose the parameters for the report.

NOTE: Default settings are already selected for you

Side Tests

No Damage Speed (mph)

☐ 1.0 ☒ 2.0 ☐ 3.0 ☐ 5.0 ☐ Other

Crush Depth (inch)

☐ Average ☒ Max ☐ Other

Speed Type (inch)

☐ Closing ☒ KE

Default Settings Next Cancel

☐ Include Not Calculated Tests

When the PRINT button is clicked, the Report Parameters screen pops up. Set the Test Summary Report Stiffness parameters. Since only SIDE tests have been retrieved, you are only setting for the Side Test parameters.

For this example, and in order to match the COBALT Side Test Sister/Clone Summary we previously looked at, the Crush Depth is set to MAX.

4N6XPRT StiffCalcs - Selected Vehicle: 2008 CHEVROLET COBALT

Display Auto Calculated Tests

Test No	Year	Make	Model	Body Style	No Damage Speed	Crush Distance	KEES	Stiffness A	Stiffness B	Stiffness G	Kv
6281	2008	NISSAN	350Z	CONVERTIBLE	2.0	5.9	25.5	282.4	564.7	70.6	
7191	2011	DODGE	CALIBER	FIVE DOOR HATCHBACK	2.0	14.6	20.0	84.4	52.2	68.2	
7193	2011	DODGE	CALIBER	FIVE DOOR HATCHBACK	2.0	8.1	26.5	153.7	232.2	50.9	
966	1980	CHEVROLET	CITATION	FIVE DOOR HATCHBACK	2.0	6.2	13.5	115.4	107.0	62.2	
967	1980	CHEVROLET	CITATION	FIVE DOOR HATCHBACK	2.0	20.5	26.8	43.3	26.1	35.8	
5162	2005	TOYOTA	MATRIX	FIVE DOOR HATCHBACK	2.0	11.1	27.0	112.4	125.9	50.1	
1738	1987	DODGE	COLT	FIVE DOOR HATCHBACK	2.0	13.1	22.4	95.7	74.6	61.4	
5719	2007	DODGE	CALIBER	FIVE DOOR HATCHBACK	2.0	7.5	26.1	202.7	325.0	63.2	
1749	1989	ISUZU	TROOPER II	FIVE DOOR HATCHBACK	2.0	12.9	21.3	76.4	57.1	51.1	
2059	1994	NISSAN	ALTIMA	FOUR DOOR SEDAN	2.0	18.7	35.0	161.7	142.9	91.5	
2094	1994	TOYOTA	CAMRY	FOUR DOOR SEDAN	2.0	15.0	0.0	-8.0	0.5	60.0	
2096	1994	MITSUBISHI	GALANT	FOUR DOOR SEDAN	2.0	15.2	0.0	-8.0	0.5	61.1	
2116	1994	AUDI	90S	FOUR DOOR SEDAN	2.0	10.7	0.0	-9.2	0.9	49.0	
2217	1995	MITSUBISHI	GALANT	FOUR DOOR SEDAN	2.0	12.8	23.0	128.0	105.5	77.7	
2249	1995	MAZDA	323-PROTEGE	FOUR DOOR SEDAN	2.0	12.5	24.2	117.2	103.8	66.1	
2477	1997	HONDA	CIVIC	FOUR DOOR SEDAN	2.0	18.1	27.3	45.1	31.5	32.3	
2499	1997	PONTIAC	GRAND AM	FOUR DOOR SEDAN	2.0	13.9	22.5	50.0	36.9	33.8	
2508	1997	SUBARU	LEGACY	FOUR DOOR SEDAN	2.0	16.4	26.1	122.3	89.9	83.2	
2509	1997	PONTIAC	GRAND AM	FOUR DOOR SEDAN	2.0	15.8	25.9	52.6	39.8	34.8	
2510	1997	MAZDA	626	FOUR DOOR SEDAN	2.0	18.3	26.6	42.4	28.5	31.6	
2537	1997	NISSAN	ALTIMA	FOUR DOOR SEDAN	2.0	16.2	23.0	41.2	26.7	31.8	
2538	1997	HONDA	CIVIC	FOUR DOOR SEDAN	2.0	14.3	23.7	100.7	76.6	66.3	
2539	1997	DODGE	NEON	FOUR DOOR SEDAN	2.0	10.8	23.1	62.7	61.2	32.1	
2547	1997	MITSUBISHI	GALANT	FOUR DOOR SEDAN	2.0	16.5	26.2	46.9	34.5	32.0	
2685	1998	CHEVROLET	CAVALIER	FOUR DOOR SEDAN	2.0	18.1	26.1	48.7	32.3	36.6	
2692	1998	NISSAN	ALTIMA	FOUR DOOR SEDAN	2.0	15.4	22.5	43.9	29.3	32.9	
2693	1998	CHEVROLET	CAVALIER	FOUR DOOR SEDAN	2.0	14.9	22.8	50.6	35.3	36.2	
2715	1998	DODGE	NEON	FOUR DOOR SEDAN	2.0	13.3	26.9	62.0	58.1	33.1	
2720	1998	SUBARU	LEGACY	FOUR DOOR SEDAN	2.0	13.0	22.9	99.7	80.2	62.0	
2743	1998	NISSAN	ALTIMA	FOUR DOOR SEDAN	2.0	19.6	26.1	43.5	26.8	35.3	
2984	1999	MITSUBISHI	GALANT	FOUR DOOR SEDAN	2.0	12.7	22.3	81.8	65.4	51.2	
2994	1999	MITSUBISHI	GALANT	FOUR DOOR SEDAN	2.0	14.0	26.1	97.2	83.6	56.5	
3290	2000	FORD	FOCUS	FOUR DOOR SEDAN	2.0	13.8	26.9	65.2	59.0	36.0	
3307	2000	SATURN	SL1	FOUR DOOR SEDAN	2.0	10.1	20.7	55.5	51.6	29.9	
3463	2001	HONDA	CIVIC	FOUR DOOR SEDAN	2.0	12.7	27.2	66.7	66.4	33.5	
3486	2001	HYUNDAI	ELANTRA	FOUR DOOR SEDAN	2.0	13.0	26.7	88.8	84.4	46.7	
3515	2001	MITSUBISHI	GALANT	FOUR DOOR SEDAN	2.0	13.7	26.2	76.3	67.6	43.0	
3523	1998	CHEVROLET	CAVALIER	FOUR DOOR SEDAN	2.0	20.1	26.6	42.8	26.2	34.9	
3799	2001	FORD	FOCUS	FOUR DOOR SEDAN	2.0	13.7	27.7	66.5	62.2	35.6	
4092	2002	AUDI	A4	FOUR DOOR SEDAN	2.0	10.6	24.8	96.5	103.3	45.1	
4456	2001	FORD	FOCUS	FOUR DOOR SEDAN	2.0	13.2	26.8	69.7	65.4	37.1	
4547	2001	FORD	FOCUS	FOUR DOOR SEDAN	2.0	11.5	22.8	67.5	61.4	37.1	
4562	2001	FORD	FOCUS	FOUR DOOR SEDAN	2.0	14.8	29.0	67.6	61.5	37.1	
4576	2001	FORD	FOCUS	FOUR DOOR SEDAN	2.0	14.8	26.7	56.8	47.3	34.1	
4602	2003	SATURN	ION	FOUR DOOR SEDAN	2.0	13.2	26.7	126.7	118.7	67.6	
4603	2003	SUBARU	LEGACY	FOUR DOOR SEDAN	2.0	11.0	25.6	169.6	182.3	78.9	
4609	2001	FORD	FOCUS	FOUR DOOR SEDAN	2.0	12.3	22.8	62.9	53.4	37.1	
4934	2004	MAZDA	MAZDA3	FOUR DOOR SEDAN	2.0	11.1	26.7	150.2	166.7	67.7	
5046	2004	KIA	SPECTRA	FOUR DOOR SEDAN	2.0	13.7	26.6	89.2	79.7	49.9	
5051	2004	VOLVO	S40	FOUR DOOR SEDAN	2.0	12.6	25.5	136.8	128.0	73.1	
5260	2005	SATURN	ION	FOUR DOOR SEDAN	2.0	11.1	26.7	113.6	126.5	51.0	
5325	2005	CHEVROLET	COBALT	FOUR DOOR SEDAN	2.0	11.9	26.3	76.4	78.0	37.4	

To select multiple records hold the ctrl key down and click on the records you wish to select

Remove Send A/B Values to Force Balance

	A	B	G	Kv	CF
Average	123.7	183.4	61.2	217.8	21.8
Minimum	-9.2	0.5	28.7	0.0	0.0
Maximum	1055.4	8229.7	540.1	9830.3	170.3
Std Dev	140.9	673.5	61.1	804.1	15.1

Print this Page Print All Pages Cancel

Number of Tests 154

154 of the 168 tests found in the database SEARCH had sufficient information to calculate some sort of A-B Stiffness values. As can be seen from the Minimum and Maximum values, some of the tests have rather extreme values.

The extreme values come from, for the most part, crush measurement data which is reported, and contained in the database, but is “in error”.

4N6XPRT StiffCalcs - Selected Vehicle: 2008 CHEVROLET COBALT

Display Auto Calculated Tests

Test No	Year	Make	Model	Body Style	No Damage Speed	Crush Distance	KEES	Stiffness A	Stiffness B	Stiffness G	Kv
6824	2010	MITSUBISHI	LANCER	FOUR DOOR SEDAN	2.0	9.1	26.3	138.5	185.1	51.8	
6863	2010	KIA	FORTE	FOUR DOOR SEDAN	2.0	14.2	19.3	54.9	33.6	44.9	
6867	2010	KIA	FORTE	FOUR DOOR SEDAN	2.0	10.3	26.5	140.5	167.1	59.0	
7106	2011	MAZDA	MAZDA3	FOUR DOOR SEDAN	2.0	10.0	26.6	145.9	179.6	59.3	
7107	2011	MAZDA	MAZDA3	FOUR DOOR SEDAN	2.0	19.8	20.2	40.7	18.7	44.4	
7202	2011	KIA	FORTE	FOUR DOOR SEDAN	2.0	15.5	20.1	51.1	29.9	43.8	
7204	2011	KIA	FORTE	FOUR DOOR SEDAN	2.0	10.6	26.7	181.4	210.5	78.2	
4856	2004	SATURN	ION	OTHER	2.0	11.8	26.6	161.5	168.4	77.5	
1596	1991	TOYOTA	PICKUP	PICKUP TRUCK	2.0	6.2	23.5	200.6	348.8	57.7	
1744	1991	TOYOTA	PICKUP	PICKUP TRUCK	2.0	11.2	23.4	95.0	90.7	49.7	
1978	1993	TOYOTA	PICKUP	PICKUP TRUCK	2.0	12.6	24.5	134.7	120.3	75.4	
2900	1994	TOYOTA	PICKUP	PICKUP TRUCK	2.0	17.7	18.5	105.0	48.9	112.6	
1989	1993	TOYOTA	PICKUP	PICKUP TRUCK	2.0	12.0	24.5	141.2	132.3	75.4	
4616	2003	SUBARU	BAJA	PICKUP TRUCK	2.0	8.2	21.4	138.4	163.6	58.5	
3272	2000	SUBARU	LEGACY	STATION WAGON	2.0	10.5	25.7	167.0	188.1	74.2	
4226	2002	SUBARU	OUTBACK	STATION WAGON	2.0	8.0	25.0	159.4	229.5	55.4	
2210	1995	SUBARU	LEGACY	STATION WAGON	2.0	11.6	23.2	79.1	72.3	43.3	
3280	2000	FORD	FOCUS	THREE DOOR HATCHBACK	2.0	13.4	26.8	87.4	80.9	47.2	
3341	2000	FORD	FOCUS	THREE DOOR HATCHBACK	2.0	11.5	23.3	81.3	75.5	43.8	
2532	1997	FORD	PROBE	THREE DOOR HATCHBACK	2.0	14.9	23.4	49.7	35.8	34.5	
2433	1996	DODGE	AVENGER	TWO DOOR COUPE	2.0	13.6	22.7	52.3	39.7	34.5	
2491	1997	CHEVROLET	CAVALIER	TWO DOOR COUPE	2.0	13.5	23.2	117.3	92.0	74.8	
2666	1998	SATURN	SC2	TWO DOOR COUPE	2.0	1.3	23.5	993.6	8229.7	60.0	
2723	1998	HONDA	CIVIC	TWO DOOR COUPE	2.0	10.4	23.8	86.1	90.7	40.8	
2730	1998	DODGE	NEON	TWO DOOR COUPE	2.0	11.1	23.2	118.8	113.6	62.1	
2740	1998	HONDA	CIVIC	TWO DOOR COUPE	2.0	12.8	27.0	62.9	61.6	32.1	
3018	1999	TOYOTA	CAMRY	TWO DOOR COUPE	2.0	10.0	22.0	105.2	105.6	52.3	
3465	2001	HONDA	CIVIC	TWO DOOR COUPE	2.0	9.6	27.2	87.7	114.6	33.6	
3516	2001	DODGE	STRATUS	TWO DOOR COUPE	2.0	11.7	25.9	88.0	89.5	43.2	
5614	2006	CHEVROLET	COBALT	TWO DOOR COUPE	2.0	13.3	26.9	105.9	99.5	56.3	
5682	2006	CHEVROLET	COBALT	TWO DOOR COUPE	2.0	13.5	26.6	80.8	73.9	44.2	
5854	2007	HONDA	CIVIC	TWO DOOR COUPE	2.0	8.7	26.9	153.6	220.9	53.4	
5983	1995	CHEVROLET	CAVALIER	TWO DOOR COUPE	2.0	15.3	23.1	52.8	36.4	38.3	
6082	2007	CHEVROLET	COBALT	TWO DOOR COUPE	2.0	14.4	26.9	100.5	86.5	58.4	
6245	2008	FORD	FOCUS	TWO DOOR COUPE	2.0	14.1	26.9	64.9	57.6	36.6	
6270	2008	FORD	FOCUS	TWO DOOR COUPE	2.0	13.1	27.3	69.3	66.8	35.9	
2485	1997	CHEVROLET	CAVALIER	TWO DOOR SEDAN	2.0	15.2	26.6	124.8	101.1	77.0	
6752	2009	VOLKSWAGEN	TIGUAN	UTILITY VEHICLE	2.0	7.8	24.7	198.1	288.7	68.0	
2972	1998	HONDA	CRV	UTILITY VEHICLE	2.0	12.0	25.6	105.1	103.0	53.6	
3025	1999	KIA	SPORTAGE	UTILITY VEHICLE	2.0	11.9	22.2	69.8	59.6	40.9	
7113	2011	FORD	ESCAPE	UTILITY VEHICLE	2.0	17.6	20.1	54.9	28.2	53.5	
7117	2011	FORD	ESCAPE	UTILITY VEHICLE	2.0	10.8	25.4	104.4	112.7	48.3	
7154	2011	HONDA	CRV	UTILITY VEHICLE	2.0	8.2	25.7	310.3	449.7	107.0	
3363	2001	CHRYSLER	PT CRUISER	UTILITY VEHICLE	2.0	9.3	25.6	140.9	179.5	55.3	
7155	2011	HONDA	CRV	UTILITY VEHICLE	2.0	16.3	20.1	57.1	31.7	51.4	
7195	2011	SUBARU	FORESTER	UTILITY VEHICLE	2.0	16.0	20.2	56.3	32.0	49.4	
7199	2011	SUBARU	FORESTER	UTILITY VEHICLE	2.0	10.2	26.0	109.7	128.5	46.8	
3530	2001	MAZDA	TRIBUTE	UTILITY VEHICLE	2.0	12.3	26.1	78.4	76.6	40.1	
3560	2001	LEXUS	RX300	UTILITY VEHICLE	2.0	11.0	24.3	109.2	110.3	54.1	
3600	2002	FORD	ESCAPE	UTILITY VEHICLE	2.0	11.9	26.0	86.8	87.7	43.0	
3653	2002	JEEP	LIBERTY	UTILITY VEHICLE	2.0	11.7	23.8	134.9	126.0	72.2	
4082	2002	HONDA	CRV	UTILITY VEHICLE	2.0	11.7	25.6	94.2	94.7	46.8	

To select multiple records hold the **ctrl** key down and click on the records you wish to select

Remove **Send A/B Values to Force Balance**

	A	B	G	Kv	CF
Average	122.7	180.9	61.2	214.8	21.6
Minimum	-9.2	0.5	28.7	0.0	0.0
Maximum	1055.4	8229.7	540.1	9830.3	170.3
Std Dev	140.7	675.0	61.3	805.9	15.1

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Number of Tests 153

The CLASS we are looking to develop is for a 4 door “sedan” (4 door COBALT). Therefore, having already set the wheelbase, the next (two) critical criteria is that the vehicle be a car which has 4 doors (so that the “B” pillar hard point is in the CLASS vehicle). Body Styles which meet this criteria are FIVE DOOR HATCHBACK, FOUR DOOR SEDAN, and STATION WAGON.

Therefore, we sort on Body Type, highlight the body types which do not meet the 4 door Car criteria, and click the REMOVE button. This step can be taken in several steps so that only the appropriate tests are removed.

4N6XPRT StHCalcs - Selected Vehicle: 2008 CHEVROLET COBALT

Display Auto Calculated Tests

Test No	Year	Make	Model	Body Style	No Damage Speed	Crush Distance	KEES	Stiffness A	Stiffness B	Stiffness G	Kv
2116	1994	AUDI	90S	FOUR DOOR SEDAN	2.0	10.7	0.0	-9.2	0.9	49.0	
2094	1994	TOYOTA	CAMRY	FOUR DOOR SEDAN	2.0	15.0	0.0	-8.0	0.5	60.0	
2096	1994	MINISUBISHI	GALANT	FOUR DOOR SEDAN	2.0	15.2	0.0	-8.0	0.5	61.1	
6442	2005	SATURN	ION	FOUR DOOR SEDAN	2.0	34.2	19.3	39.8	10.0	78.9	
7107	2011	MAZDA	MAZDA3	FOUR DOOR SEDAN	2.0	19.8	20.2	40.7	18.7	44.4	
2537	1997	NISSAN	ALTIMA	FOUR DOOR SEDAN	2.0	16.2	23.0	41.2	26.7	31.8	
5472	2005	SATURN	ION	FOUR DOOR SEDAN	2.0	16.7	20.1	42.1	22.8	38.9	
2510	1997	MAZDA	626	FOUR DOOR SEDAN	2.0	18.3	26.6	42.4	28.5	31.6	
3523	1998	CHEVROLET	CAVALIER	FOUR DOOR SEDAN	2.0	20.1	26.6	42.8	26.2	34.9	
6741	2010	TOYOTA	COROLLA	FOUR DOOR SEDAN	2.0	13.4	19.4	42.9	27.9	33.0	
967	1980	CHEVROLET	CITATION	FIVE DOOR HATCHBACK	2.0	20.5	26.8	43.3	26.1	35.8	
2743	1998	NISSAN	ALTIMA	FOUR DOOR SEDAN	2.0	19.6	26.1	43.5	26.8	35.3	
2692	1998	NISSAN	ALTIMA	FOUR DOOR SEDAN	2.0	15.4	22.5	43.9	29.3	32.9	
2477	1997	HONDA	CIVIC	FOUR DOOR SEDAN	2.0	18.1	27.3	45.1	31.5	32.3	
2547	1997	MINISUBISHI	GALANT	FOUR DOOR SEDAN	2.0	16.5	26.2	46.9	34.5	32.0	
5986	1995	HONDA	CIVIC	FOUR DOOR SEDAN	2.0	13.0	23.6	47.6	39.3	28.7	
2685	1998	CHEVROLET	CAVALIER	FOUR DOOR SEDAN	2.0	18.1	26.1	48.7	32.3	36.6	
2499	1997	PONTIAC	GRAND AM	FOUR DOOR SEDAN	2.0	13.9	22.5	50.0	36.9	33.8	
2693	1998	CHEVROLET	CAVALIER	FOUR DOOR SEDAN	2.0	14.9	22.8	50.6	35.3	36.2	
7202	2011	KIA	FORTE	FOUR DOOR SEDAN	2.0	15.5	20.1	51.1	29.9	43.8	
6735	2010	KIA	FORTE	FOUR DOOR SEDAN	2.0	18.5	19.7	51.7	24.7	54.0	
2509	1997	PONTIAC	GRAND AM	FOUR DOOR SEDAN	2.0	15.8	25.9	52.6	39.8	34.8	
6657	2010	MAZDA	MAZDA3	FOUR DOOR SEDAN	2.0	18.2	19.7	53.5	25.9	55.1	
6863	2010	KIA	FORTE	FOUR DOOR SEDAN	2.0	14.2	19.3	54.9	33.6	44.9	
3307	2000	SATURN	SL1	FOUR DOOR SEDAN	2.0	10.1	20.7	55.5	51.6	29.9	
4576	2001	FORD	FOCUS	FOUR DOOR SEDAN	2.0	14.8	26.7	56.8	47.3	34.1	
2715	1998	DODGE	NEON	FOUR DOOR SEDAN	2.0	13.3	26.9	62.0	58.1	33.1	
2539	1997	DODGE	NEON	FOUR DOOR SEDAN	2.0	10.8	23.1	62.7	61.2	32.1	
4609	2001	FORD	FOCUS	FOUR DOOR SEDAN	2.0	12.3	22.8	62.9	53.4	37.1	
6604	2008	FORD	FOCUS	FOUR DOOR SEDAN	2.0	15.0	17.6	63.5	33.1	61.0	
3290	2000	FORD	FOCUS	FOUR DOOR SEDAN	2.0	13.8	26.9	65.2	59.0	36.0	
3799	2001	FORD	FOCUS	FOUR DOOR SEDAN	2.0	13.7	27.7	66.5	62.2	35.6	
3463	2001	HONDA	CIVIC	FOUR DOOR SEDAN	2.0	12.7	27.2	66.7	66.4	33.5	
4547	2001	FORD	FOCUS	FOUR DOOR SEDAN	2.0	11.5	22.8	67.5	61.4	37.1	
4562	2001	FORD	FOCUS	FOUR DOOR SEDAN	2.0	14.8	29.0	67.6	61.5	37.1	
4456	2001	FORD	FOCUS	FOUR DOOR SEDAN	2.0	13.2	26.8	69.7	65.4	37.1	
6606	2008	SUBARU	IMPREZA	FOUR DOOR SEDAN	2.0	12.4	17.7	74.4	47.3	58.5	
3515	2001	MINISUBISHI	GALANT	FOUR DOOR SEDAN	2.0	13.7	26.2	76.3	67.6	43.0	
1749	1989	ISUZU	TROOPER II	FIVE DOOR HATCHBACK	2.0	12.9	21.3	76.4	57.1	51.1	
5325	2005	CHEVROLET	COBALT	FOUR DOOR SEDAN	2.0	11.9	26.3	76.4	78.0	37.4	
2210	1995	SUBARU	LEGACY	STATION WAGON	2.0	11.6	23.2	79.1	72.3	43.3	
2984	1999	MINISUBISHI	GALANT	FOUR DOOR SEDAN	2.0	12.7	22.3	81.8	65.4	51.2	
7191	2011	DODGE	CALIBER	FIVE DOOR HATCHBACK	2.0	14.6	20.0	84.4	52.2	68.2	
3486	2001	HYUNDAI	ELANTRA	FOUR DOOR SEDAN	2.0	13.0	26.7	88.8	84.4	46.7	
5046	2004	KIA	SPECTRA	FOUR DOOR SEDAN	2.0	13.7	26.6	89.2	79.7	49.9	
1738	1987	DODGE	COLT	FIVE DOOR HATCHBACK	2.0	13.1	22.4	95.7	74.6	61.4	
4092	2002	AUDI	A4	FOUR DOOR SEDAN	2.0	10.6	24.8	96.5	103.3	45.1	
6587	2005	SATURN	ION	FOUR DOOR SEDAN	2.0	10.7	22.7	96.6	93.7	49.8	
2994	1999	MINISUBISHI	GALANT	FOUR DOOR SEDAN	2.0	14.0	26.1	97.2	83.6	56.5	
6246	2008	FORD	FOCUS	FOUR DOOR SEDAN	2.0	11.5	27.3	97.2	106.4	44.4	
2720	1998	SUBARU	LEGACY	FOUR DOOR SEDAN	2.0	13.0	22.9	99.7	80.2	62.0	
6744	2010	TOYOTA	COROLLA	FOUR DOOR SEDAN	2.0	9.6	27.2	100.1	131.8	38.0	

To select multiple records hold the ctrl key down and click on the records you wish to select

Remove Send A/B Values to Force Balance

	A	B	G	Kv	CF
Average	118.2	127.2	64.9	150.6	19.8
Minimum	-9.2	0.5	28.7	0.0	0.0
Maximum	1055.4	1346.7	540.1	1571.6	82.7
Std Dev	153.8	200.5	79.0	237.4	10.2

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Number of Tests 89

When the tests are reduced to cars with 4 door Body types, we now have 89 tests. However, there are still some tests with “extreme” stiffness values.

To find and eliminate the EXTREME outliers, we sort the “A” value column, and remove any negative values.

4N6XPRT StiffCalcs - Selected Vehicle: 2008 CHEVROLET COBALT

Display Auto Calculated Tests

Test No	Year	Make	Model	Body Style	No Damage Speed	Crush Distance	KEES	Stiffness A	Stiffness B	Stiffness G	Kv
6721	2010	MAZDA	MAZDA3	FOUR DOOR SEDAN	2.0	9.4	26.7	156.9	206.2	59.7	
4226	2002	SUBARU	OUTBACK	STATION WAGON	2.0	8.0	25.0	159.4	229.5	55.4	
2059	1994	NISSAN	ALTIMA	FOUR DOOR SEDAN	2.0	18.7	35.0	161.7	142.9	91.5	
6079	2008	MITSUBISHI	LANCER	FOUR DOOR SEDAN	2.0	9.3	26.5	162.5	213.5	61.8	
3272	2000	SUBARU	LEGACY	STATION WAGON	2.0	10.5	25.7	167.0	188.1	74.2	
4603	2003	SUBARU	LEGACY	FOUR DOOR SEDAN	2.0	11.0	25.6	169.6	182.3	78.9	
7204	2011	KIA	FORTE	FOUR DOOR SEDAN	2.0	10.6	26.7	181.4	210.5	78.2	
5719	2007	DODGE	CALIBER	FIVE DOOR HATCHBACK	2.0	7.5	26.1	202.7	325.0	63.2	
6749	2010	KIA	FORTE	FOUR DOOR SEDAN	2.0	3.5	26.9	378.8	1346.7	53.3	
5457	2005	SATURN	ION	FOUR DOOR SEDAN	2.0	14.0	20.1	461.0	297.1	357.5	
5460	2005	SATURN	ION	FOUR DOOR SEDAN	2.0	11.3	22.9	1001.0	927.6	540.1	
5461	2005	SATURN	ION	FOUR DOOR SEDAN	2.0	10.2	22.8	1055.4	1081.5	515.0	

To select multiple records hold the ctrl key down and click on the records you wish to select

Remove Send A/B Values to Force Balance

	A	B	G	Kv	CF
Average	123.6	133.0	65.0	157.5	20.7
Minimum	40.7	18.7	28.7	23.0	8.2
Maximum	1055.4	1346.7	540.1	1571.6	82.7
Std Dev	155.3	203.3	80.9	240.7	9.5

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Number of Tests 85

Then we scroll to the bottom of the page and eliminate the values above 200. Alternatively, you could click on the “A” column again, which would change the sort order from “Low to High” to “High to Low” and then eliminate the “high” values.

The “A” value of 200 and above was picked due to experience of working with Side impact tests and familiarity of “normal” side stiffness “A” values. Your criteria may be different.

4N6XPRT StfCalcs - Selected Vehicle: 2008 CHEVROLET COBALT

Display Auto Calculated Tests

Test No	Year	Make	Model	Body Style	No Damage Speed	Crush Distance	KEES	Stiffness A	Stiffness B	Stiffness G	Kv
2249	1995	MAZDA	323-PROTEGE	FOUR DOOR SEDAN	2.0	12.5	24.2	117.2	103.8	66.1	
4092	2002	AUDI	A4	FOUR DOOR SEDAN	2.0	10.6	24.8	96.5	103.3	45.1	
2537	1997	NISSAN	ALTIMA	FOUR DOOR SEDAN	2.0	16.2	23.0	41.2	26.7	31.8	
2059	1994	NISSAN	ALTIMA	FOUR DOOR SEDAN	2.0	18.7	35.0	161.7	142.9	91.5	
2743	1998	NISSAN	ALTIMA	FOUR DOOR SEDAN	2.0	19.6	26.1	43.5	26.8	35.3	
2692	1998	NISSAN	ALTIMA	FOUR DOOR SEDAN	2.0	15.4	22.5	43.9	29.3	32.9	
7191	2011	DODGE	CALIBER	FIVE DOOR HATCHBACK	2.0	14.6	20.0	84.4	52.2	68.2	
7193	2011	DODGE	CALIBER	FIVE DOOR HATCHBACK	2.0	8.1	26.5	153.7	232.2	50.9	
2685	1998	CHEVROLET	CAVALIER	FOUR DOOR SEDAN	2.0	18.1	26.1	48.7	32.3	36.6	
2693	1998	CHEVROLET	CAVALIER	FOUR DOOR SEDAN	2.0	14.9	22.8	50.6	35.3	36.2	
3523	1998	CHEVROLET	CAVALIER	FOUR DOOR SEDAN	2.0	20.1	26.6	42.8	26.2	34.9	
967	1980	CHEVROLET	CITATION	FIVE DOOR HATCHBACK	2.0	20.5	26.8	43.3	26.1	35.8	
966	1980	CHEVROLET	CITATION	FIVE DOOR HATCHBACK	2.0	6.2	13.5	115.4	107.0	62.2	
2538	1997	HONDA	CIVIC	FOUR DOOR SEDAN	2.0	14.3	23.7	100.7	76.6	66.3	
3463	2001	HONDA	CIVIC	FOUR DOOR SEDAN	2.0	12.7	27.2	66.7	66.4	33.5	
2477	1997	HONDA	CIVIC	FOUR DOOR SEDAN	2.0	18.1	27.3	45.1	31.5	32.3	
5986	1995	HONDA	CIVIC	FOUR DOOR SEDAN	2.0	13.0	23.6	47.6	39.3	28.7	
6049	2007	CHEVROLET	COBALT	FOUR DOOR SEDAN	2.0	13.3	26.5	110.2	101.6	59.7	
5325	2005	CHEVROLET	COBALT	FOUR DOOR SEDAN	2.0	11.9	26.3	76.4	78.0	37.4	
5451	2005	CHEVROLET	COBALT	FOUR DOOR SEDAN	2.0	12.7	26.6	115.4	111.7	59.7	
1738	1987	DODGE	COLT	FIVE DOOR HATCHBACK	2.0	13.1	22.4	95.7	74.6	61.4	
6744	2010	TOYOTA	COROLLA	FOUR DOOR SEDAN	2.0	9.6	27.2	100.1	131.8	38.0	
6741	2010	TOYOTA	COROLLA	FOUR DOOR SEDAN	2.0	13.4	19.4	42.9	27.9	33.0	
3486	2001	HYUNDAI	ELANTRA	FOUR DOOR SEDAN	2.0	13.0	26.7	88.8	84.4	46.7	
5885	2007	HYUNDAI	ELANTRA	FOUR DOOR SEDAN	2.0	10.6	26.5	151.0	175.2	65.1	
4547	2001	FORD	FOCUS	FOUR DOOR SEDAN	2.0	11.5	22.8	67.5	61.4	37.1	
4562	2001	FORD	FOCUS	FOUR DOOR SEDAN	2.0	14.8	29.0	67.6	61.5	37.1	
4576	2001	FORD	FOCUS	FOUR DOOR SEDAN	2.0	14.8	26.7	56.8	47.3	34.1	
4609	2001	FORD	FOCUS	FOUR DOOR SEDAN	2.0	12.3	22.8	62.9	53.4	37.1	
4456	2001	FORD	FOCUS	FOUR DOOR SEDAN	2.0	13.2	26.8	69.7	65.4	37.1	
6604	2008	FORD	FOCUS	FOUR DOOR SEDAN	2.0	15.0	17.6	63.5	33.1	61.0	
6246	2008	FORD	FOCUS	FOUR DOOR SEDAN	2.0	11.5	27.3	97.2	106.4	44.4	
3290	2000	FORD	FOCUS	FOUR DOOR SEDAN	2.0	13.8	26.9	65.2	59.0	36.0	
3799	2001	FORD	FOCUS	FOUR DOOR SEDAN	2.0	13.7	27.7	66.5	62.2	35.6	
6269	2008	FORD	FOCUS	FOUR DOOR SEDAN	2.0	11.3	26.8	115.1	125.8	52.6	
5575	2005	SUZUKI	FORENZA	FOUR DOOR SEDAN	2.0	10.9	22.9	139.9	134.4	72.9	
6739	2010	KIA	FORTE	FOUR DOOR SEDAN	2.0	12.6	26.9	112.2	110.4	57.0	
7202	2011	KIA	FORTE	FOUR DOOR SEDAN	2.0	15.5	20.1	51.1	29.9	43.8	
6735	2010	KIA	FORTE	FOUR DOOR SEDAN	2.0	18.5	19.7	51.7	24.7	54.0	
6863	2010	KIA	FORTE	FOUR DOOR SEDAN	2.0	14.2	19.3	54.9	33.6	44.9	
7204	2011	KIA	FORTE	FOUR DOOR SEDAN	2.0	10.6	26.7	181.4	210.5	78.2	
6785	2010	KIA	FORTE	FOUR DOOR SEDAN	2.0	8.3	26.6	121.0	180.0	40.7	
6867	2010	KIA	FORTE	FOUR DOOR SEDAN	2.0	10.3	26.5	140.5	167.1	59.0	
2547	1997	MITSUBISHI	GALANT	FOUR DOOR SEDAN	2.0	16.5	26.2	46.9	34.5	32.0	
2994	1999	MITSUBISHI	GALANT	FOUR DOOR SEDAN	2.0	14.0	26.1	97.2	83.6	56.5	
3515	2001	MITSUBISHI	GALANT	FOUR DOOR SEDAN	2.0	13.7	26.2	76.3	67.6	43.0	
2984	1999	MITSUBISHI	GALANT	FOUR DOOR SEDAN	2.0	12.7	22.3	81.8	65.4	51.2	
2217	1995	MITSUBISHI	GALANT	FOUR DOOR SEDAN	2.0	12.8	23.0	128.0	105.5	77.7	
2499	1997	PONTIAC	GRAND AM	FOUR DOOR SEDAN	2.0	13.9	22.5	50.0	36.9	33.8	

To select multiple records hold the ctrl key down and click on the records you wish to select

Remove Send A/B Values to Force Balance

	A	B	G	Kv	CF
Average	92.6	91.6	50.0	108.2	19.9
Minimum	40.7	18.7	28.7	23.0	8.2
Maximum	181.4	232.2	91.5	271.7	34.7
Std Dev	39.9	58.2	14.8	67.8	6.5

Number of Tests 80

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There are still 80 “valid” tests which meet our CLASS requirements of 4 door Car with a wheelbase between 102.5-104.5 inches.

The physical constraints of the program is that 34 tests fit on one printed page. More than 34 tests cause the statistical summary to partially, or wholly, “spill over” to an additional page. 80 tests would require 3 printed pages.

Sorting the remaining tests on the MODEL name, we can see the three COBALT tests have an “A” stiffness value range of ~76 to ~115.

4N6XPRT StfCalcs - Selected Vehicle: 2008 CHEVROLET COBALT

Display Auto Calculated Tests

Test No	Year	Make	Model	Body Style	No Damage Speed	Crush Distance	KEES	Stiffness A	Stiffness B	Stiffness G	Kv
2539	1997	DODGE	NEON	FOUR DOOR SEDAN	2.0	10.8	128.1	62.7	61.2	32.1	73.3
3799	2001	FORD	FOCUS	FOUR DOOR SEDAN	2.0	13.7	27.7	66.9	62.2	35.6	72.3
3463	2001	HONDA	CIVIC	FOUR DOOR SEDAN	2.0	12.7	27.2	66.7	66.4	33.5	77.4
4547	2001	FORD	FOCUS	FOUR DOOR SEDAN	2.0	11.5	22.8	67.5	61.4	37.1	73.8
4562	2001	FORD	FOCUS	FOUR DOOR SEDAN	2.0	14.8	29.0	67.6	61.5	37.1	71.0
4456	2001	FORD	FOCUS	FOUR DOOR SEDAN	2.0	13.2	26.8	69.7	65.4	37.1	76.4
3515	2001	MINISUBISHI	GALANT	FOUR DOOR SEDAN	2.0	13.7	26.2	76.3	67.6	43.0	79.3
5325	2005	CHEVROLET	COBALT	FOUR DOOR SEDAN	2.0	11.9	26.3	76.4	78.0	37.4	91.4
2210	1995	SUBARU	LEGACY	STATION WAGON	2.0	11.6	23.2	79.1	72.3	43.3	86.6
2984	1999	MINISUBISHI	GALANT	FOUR DOOR SEDAN	2.0	12.7	22.3	81.8	65.4	51.2	78.9
3486	2001	HYUNDAI	ELANTRA	FOUR DOOR SEDAN	2.0	13.0	26.7	88.8	84.4	46.7	98.6
5046	2004	KIA	SPECTRA	FOUR DOOR SEDAN	2.0	13.7	26.6	89.2	79.7	49.9	93.7
1738	1987	DODGE	COLT	FIVE DOOR HATCHBACK	2.0	13.1	22.4	95.7	74.6	61.4	89.9
4092	2002	AUDI	A4	FOUR DOOR SEDAN	2.0	10.6	24.8	96.5	103.3	45.1	122
6587	2005	SATURN	ION	FOUR DOOR SEDAN	2.0	10.7	22.7	96.6	93.7	49.8	112
2994	1999	MINISUBISHI	GALANT	FOUR DOOR SEDAN	2.0	14.0	26.1	97.2	83.6	56.5	98.0
6246	2008	FORD	FOCUS	FOUR DOOR SEDAN	2.0	11.5	27.3	97.2	106.4	44.4	124
2720	1998	SUBARU	LEGACY	FOUR DOOR SEDAN	2.0	13.0	22.9	99.7	80.2	62.0	96.3
5902	2007	KIA	SPECTRA	FOUR DOOR SEDAN	2.0	12.2	26.4	100.1	99.6	50.3	116
2538	1997	HONDA	CIVIC	FOUR DOOR SEDAN	2.0	14.3	23.7	100.7	76.6	66.3	91.3
6182	2008	SUBARU	IMPREZA	FOUR DOOR SEDAN	2.0	10.9	26.4	101.8	113.8	45.5	133
6049	2007	CHEVROLET	COBALT	FOUR DOOR SEDAN	2.0	13.3	26.5	110.2	101.6	59.7	118
6739	2010	KIA	FORTE	FOUR DOOR SEDAN	2.0	12.6	26.9	112.2	110.4	57.0	128
5162	2005	TOYOTA	MATRIX	FIVE DOOR HATCHBACK	2.0	11.1	27.0	112.4	125.9	50.1	146
5260	2005	SATURN	ION	FOUR DOOR SEDAN	2.0	11.1	26.7	113.6	126.5	51.0	147
6269	2008	FORD	FOCUS	FOUR DOOR SEDAN	2.0	11.3	26.8	115.1	125.8	52.6	147
966	1980	CHEVROLET	CITATION	FIVE DOOR HATCHBACK	2.0	6.2	13.5	115.4	107.0	62.2	147
5451	2005	CHEVROLET	COBALT	FOUR DOOR SEDAN	2.0	12.7	26.6	115.4	111.7	59.7	130
2249	1995	MAZDA	323-PROTEGE	FOUR DOOR SEDAN	2.0	12.5	24.2	117.2	103.8	66.1	123
2508	1997	SUBARU	LEGACY	FOUR DOOR SEDAN	2.0	16.4	26.1	122.3	89.9	83.2	105
4602	2003	SATURN	ION	FOUR DOOR SEDAN	2.0	13.2	26.7	126.7	118.7	67.6	138
2217	1995	MINISUBISHI	GALANT	FOUR DOOR SEDAN	2.0	12.8	23.0	128.0	105.5	77.7	126

To select multiple records hold the ctrl key down and click on the records you wish to select

Remove Send A/B Values to Force Balance

Print this Page Print All Pages Cancel

	A	B	G	Kv	CF
Average	95.8	90.1	51.6	106.8	20.6
Minimum	62.7	61.2	32.1	71.0	11.7
Maximum	128.0	126.5	83.2	147.8	26.1
Std Dev	19.6	21.4	12.7	25.7	3.6

Number of Tests 32

Test No	Year	Make	Model	Body Style	No Damage Speed	Crush Distance	KEES	Stiffness A	Stiffness B	Stiffness G	Kv
2499	1997	PONTIAC	GRAND AM	FOUR DOOR SEDAN	2.0	12.30	26.30	128.0	105.5	77.7	126
2508	1997	SUBARU	LEGACY	FOUR DOOR SEDAN	2.0	2632	2632	SIDE	NO COMMENTS		
2509	1997	PONTIAC	GRAND AM	FOUR DOOR SEDAN	2.0	2626	2626	SIDE	ENGINE TYPE HORIZ...		
2510	1997	MAZDA	626	FOUR DOOR SEDAN	2.0	2608	2608	SIDE	NO COMMENTS		
2532	1997	FORD	PROBE	THREE DOOR HATC...	2.0	2611	2611	SIDE	NO COMMENTS		
2537	1997	NISSAN	ALTIMA	FOUR DOOR SEDAN	2.0	2624	2624	SIDE	NO COMMENTS		
2538	1997	HONDA	CIVIC	FOUR DOOR SEDAN	2.0	2620	2620	SIDE	NO COMMENTS		
2539	1997	DODGE	NEON	FOUR DOOR SEDAN	2.0	2638	2638	SIDE	NO COMMENTS		
2547	1997	MINISUBISHI	GALANT	FOUR DOOR SEDAN	2.0	2640	2640	SIDE	NO COMMENTS		
2666	1998	SATURN	SC2	TWO DOOR COUPE	2.0	2605	2605	SIDE	MODEL - SC2		
2685	1998	CHEVROLET	CAVALIER	FOUR DOOR SEDAN	2.0	2635	2635	SIDE	NO COMMENTS		
2692	1998	NISSAN	ALTIMA	FOUR DOOR SEDAN	2.0	2626	2626	SIDE	NO COMMENTS		

Sorting on the “A” value again, and removing all tests with an “A” value less than 60 or above 130 (+/- 15 “points” of the Min/Max Cobalt values) reduces the number of tests to 32. Since this is a number of tests which will fit on a single page, it is a test selection which we can use without generating too much paper.

This grouping has the added advantage of being a “tight” grouping of tests which incorporate the three COBALT 4 door sedans tested by NHTSA and a “fair” +/- number of tests above and below those tests.

At this point, we can click one of the two PRINT buttons, or click the SEND A/B VALUES TO FORCE BALANCE button, which will, as previously stated, allow you to print out this Test Summary report.

The screenshot shows the '4N6XPRT StiffCalcs - Selected Vehicle: 2008 CHEVROLET COBALT' window. The 'Display Auto Calculated Tests' tab is active, showing a list of tests with columns for Test No, Year, Make, Model, Body Style, No Damage Speed, Crush Distance, KEES, Stiffness A, Stiffness B, Stiffness G, and Kv. A dialog box is overlaid on the window, asking if the user wants to send A and B values to the Force Balance Module. The 'Print Tests Page' button is circled in green. Below the dialog box, there is a summary table with columns A, B, G, Kv, and CF. The table shows Average, Minimum, Maximum, and Std Dev values for the selected tests. At the bottom, there is a 'Number of Tests' section showing 32 tests.

Test No	Year	Make	Model	Body Style	No Damage Speed	Crush Distance	KEES	Stiffness A	Stiffness B	Stiffness G	Kv
2539	1997	DODGE	NEON	FOUR DOOR SEDAN	2.0	10.8	23.1	62.7	61.2	32.1	73.3
3799	2001	FORD	FOCUS	FOUR DOOR SEDAN	2.0	13.7	27.7	66.5	62.2	35.6	72.3
3463	2001	HONDA	CIVIC	FOUR DOOR SEDAN	2.0	12.7	27.2	66.7	66.4	33.5	77.4
4547	2001	FORD	FOCUS	FOUR DOOR SEDAN	2.0	11.5	22.8	67.5	61.4	37.1	73.8
4562	2001	FORD	FOCUS	FOUR DOOR SEDAN	2.0	14.8	29.0	67.6	61.5	37.1	71.0
4456	2001	FORD	FOCUS	FOUR DOOR SEDAN	2.0	13.2	26.8	69.7	65.4	37.1	76.4
3515	2001	MITSUBISHI	GALANT	FOUR DOOR SEDAN	2.0	13.7	26.2	76.3	67.6	43.0	79.3
5325	2005	CHEVROLET	COBALT	FOUR DOOR SEDAN	2.0	11.9	26.3	76.4	78.0	37.4	91.4
2210	1995	SUBARU	LEGACY	STATION WAGON	2.0	11.6	23.2	79.1	72.3	43.3	86.6
2984	1999	MITSUBISHI	GALANT	FOUR DOOR SEDAN	2.0	12.7	22.3	81.8	65.4	51.2	78.9
3486	2001	HYUNDAI	ELANTRA	FOUR DOOR SEDAN	2.0	13.0	26.7	88.8	84.4	46.7	98.6
5046	2004	KIA	SPECTRA	FOUR DOOR SEDAN	2.0	13.7	26.6	89.2	79.7	49.9	93.2
1738	1987	DODGE	COLT	FIVE DOOR HATCHBACK	2.0	13.1	22.4	95.7	74.6	61.4	89.9
4092	2002	AUDI	A4	FOUR DOOR SEDAN	2.0	10.6	24.8	96.5	103.3	45.1	122
6587	2005	SATURN	ION	FOUR DOOR SEDAN	2.0	10.7	22.7	96.6	93.7	49.8	112
2994	1999	MITSUBISHI	GALANT	FOUR DOOR SEDAN	2.0	14.0	26.1	97.2	83.6	56.5	98.0
6246	2008	FORD	FOCUS	FOUR DOOR SEDAN	2.0	11.5	27.3	97.2	106.4	44.4	124
2720	1998	SUBARU	LEGACY	FOUR DOOR SEDAN	2.0	13.0	22.9	99.7	80.2	62.0	96.3
5902	2007	KIA	SPECTRA	FOUR DOOR SEDAN	2.0	12.2	26.4	100.1	99.6	50.3	116
2538	1997	HONDA	CIVIC	FOUR DOOR SEDAN	2.0	14.3	23.7	100.7	76.6	66.3	91.3
6182	2008	SUBARU	IMPREZA	FOUR DOOR SEDAN	2.0	10.9	26.4	101.8	113.8	45.5	133
6049	2007	CHEVROLET	COBALT	FOUR DOOR SEDAN	2.0	13.3	26.5	110.2	101.6	59.7	118
6739	2010	KIA	FORTE	FOUR DOOR SEDAN	2.0	12.6	26.9	112.2	110.4	57.0	128
5162	2005	TOYOTA	MATRIX	FIVE DOOR HATCHBACK	2.0	11.1	27.0	112.4	125.9	50.1	146
5260	2005	SATURN	ION	FOUR DOOR SEDAN	2.0	11.1	26.7	113.6	126.5	51.0	147
6269	2008	FORD	FOCUS	FOUR DOOR SEDAN	2.0	11.3	26.9	115.1	125.9	52.6	147
966	1980	CHEVROLET	CITATION	FIN							62.2
5451	2005	CHEVROLET	COBALT	FO							59.7
2249	1995	MAZDA	323-PROTEGE	FO							66.1
2508	1997	SUBARU	LEGACY	FO							83.2
4602	2003	SATURN	ION	FO							67.6
2217	1995	MITSUBISHI	GALANT	FO							77.7

	A	B	G	Kv	CF
Average	95.8	90.1	51.6	106.8	20.6
Minimum	62.7	61.2	32.1	71.0	11.7
Maximum	128.0	126.5	83.2	147.8	26.1
Std Dev	19.6	21.4	12.7	25.7	3.6

Number of Tests 32

Test No	Year	Make	Model	Body Style	No Damage Speed	Crush Distance	KEES	Stiffness A	Stiffness B	Stiffness G	Kv	Comments
2499	1997	PONTIAC	GRAND AM	FOUR DOOR SEDAN	2630							NO COMMENTS
2508	1997	SUBARU	LEGACY	FOUR DOOR SEDAN	2632							ENGINE TYPE HORIZ...
2509	1997	PONTIAC	GRAND AM	FOUR DOOR SEDAN	2626							NO COMMENTS
2510	1997	MAZDA	626	FOUR DOOR SEDAN	2608							NO COMMENTS
2532	1997	FORD	PROBE	THREE DOOR HATCHBACK	2611							NO COMMENTS
2537	1997	NISSAN	ALTIMA	FOUR DOOR SEDAN	2624							NO COMMENTS
2538	1997	HONDA	CIVIC	FOUR DOOR SEDAN	2620							NO COMMENTS
2539	1997	DODGE	NEON	FOUR DOOR SEDAN	2638							NO COMMENTS
2547	1997	MITSUBISHI	GALANT	FOUR DOOR SEDAN	2640							NO COMMENTS
2666	1998	SATURN	SC2	TWO DOOR COUPE	2605							MODEL - SC2
2685	1998	CHEVROLET	CAVALIER	FOUR DOOR SEDAN	2635							NO COMMENTS
2692	1998	NISSAN	ALTIMA	FOUR DOOR SEDAN	2626							NO COMMENTS

If you have not already printed the Test Summary report for the CLASS vehicle you have created, do so at this point.

FORCE BALANCE:

4N6XPRT StiffCalcs - Selected Vehicle: 2008 CHEVROLET COBALT

AutoStats Lite Vehicle 1

Year of Vehicle: 2008
 Make: CHEVROLET
 Model: COBALT
 Number of Doors:
 Bodystyle of Vehicle:
 Enter the Year of the desired vehicle. Then Select the Manufacturer. Followed by the Model. Then Press 'Select Vehicle.'
 Add additional Information to Narrow the Search in the Bottom Box.

Model	Body Style	Curb Weight
COBALT	4 DOOR SEDAN	3216
COBALT	2 DOOR COUPE	2991
COLORADO	2 DOOR 4X2 PICKUP	3398
COLORADO	2 DOOR 4X4 PICKUP	3623
COLORADO CREW CAB	4 DOOR 4X2 PICKUP	3752
COLORADO CREW CAB	4 DOOR 4X4 PICKUP	4002
COLORADO EXT CAB	4 DOOR 4X2 PICKUP	3622
COLORADO EXT CAB	4 DOOR 4X4 PICKUP	3802
CORVETTE	2 DOOR COUPE	3179
CORVETTE	2 DOOR CONVERTIBLE	3199
CORVETTE Z06	2 DOOR COUPE	3132
EQUINOX	4 DOOR 4X2 UTILITY	3660
EQUINOX	4 DOOR 4X4 UTILITY	3776
EQUINOX FCV	4 DOOR 4X2 UTILITY	4370
EXPRESS 1500	3 DOOR CARGO VAN	4832
EXPRESS 1500	3 DOOR PASSENGER ...	5245
EXPRESS 1500 AWD	3 DOOR CARGO VAN	5110
EXPRESS 1500 AWD	3 DOOR PASSENGER ...	5556
EXPRESS 2500	3 DOOR CARGO VAN	5002
EXPRESS 2500	3 DOOR PASSENGER ...	5864
EXPRESS 2500 AWD	3 DOOR CARGO VAN	5280
EXPRESS 2500 EXTENDED	3 DOOR CARGO VAN	5170

Select COBALT 4 DOOR SEDAN (CW: 3216)

Vehicle 2

Curb Weight (pounds):
 Occupant + Cargo Weight (pounds):
 Total Weight (pounds): 0
 Angle Coll Force to Normal (degrees): 0
 No Damage Speed (mph):
 Energy Crush Depth (inches): N/A
 Auto-Calculate Energy Crush Depth ☒
 Damage Length (inches):
 Crush Profile Measurements:
 Crush Spacing: ☒ Equal ☐ Non-Equal
 Impact Location: ☐ Front ☐ Side
 Zone Depth(x) (inches)
 Area Depth(x) (inches²)
 Zone Depth (inches)

	Spacing	Zone Area	Zone Depth(x) (inches)	Area Depth(x) (inches ²)	Zone Depth (inches)
C1 (in.)					
C2 (in.)					
C3 (in.)					
C4 (in.)					
C5 (in.)					
C6 (in.)					
C7 (in.)					
C8 (in.)					
C9 (in.)					
C10 (in.)					

Average Crush (inches): N/A

Results

	A	B	Average Force (pounds)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	Closing Speed (mph)
Minimum	62.7	61.2	N/A	N/A	N/A	N/A	N/A
Avg - 2 Std. Deviations	56.6	47.3	N/A	N/A	N/A	N/A	N/A

When you send the A/B values from a Test Summary to the Force Balance module, the first thing that comes up is AS (AutoStats) Lite for the vehicle identified by the basic search.

If you have not completed a Basic Search prior to the Force Balance module, the Year, Make, and Model fields will be blank.

Once you have that data input into the appropriate fields, click the SELECT button at the bottom of the form.

4N6XPRT StiffCalc - Selected Vehicle: 2008 CHEVROLET COBALT

File Print Reports Settings Help Reg To: 4N6XPRT SYSTEMS

Basic Vehicle Search | NHTSA Test Selection | Advanced Vehicle Search | Force Balance

Load previously saved comparison Save current comparison Clear All Data Force Re-Calculations Print

Select Vehicle 1 From AS Lite Vehicle 1 Manual Input Clear Vehicle 1 Data

2008 CHEVROLET COBALT

Curb Weight (pounds): 3216

Occupant + Cargo Weight (pounds):

Total Weight (pounds): 3216

Angle Coll Force to Normal (degrees): 0

No Damage Speed (mph): 2

Energy Crush Depth (inches): N/A

Auto-Calculate Energy Crush Depth ☒

Damage Length (inches):

Crush Profile Measurements:

Crush Spacing ☒ Equal ☐ Non-Equal

Impact Location ☒ Front ☒ Side ☐ Rear ☐ Other

PDF: Lever Arm Distance (inches): N/A

Yaw Moment of Inertia (lb-ft-sec²): 2106.48

Auto-Calculate Yaw Moment ☒

Vehicle 1 Crush Measurements

	A	B
Average	95.8	90.1
Minimum	62.7	61.2
Maximum	128.0	126.5
Std. Deviation	19.6	21.4

	Zone Depth(x) (inches)	Area Depth(x) (inches ²)	Zone Depth(y) (inches)	Area Depth(y) (inches ²)
C1 (in.)				
C2 (in.)				
C3 (in.)				
C4 (in.)				
C5 (in.)				
C6 (in.)				
C7 (in.)				
C8 (in.)				
C9 (in.)				
C10 (in.)				

Average Crush (inches): N/A

Results

	A	B	Average Force (pounds)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	Closing Speed (mph)
Minimum	62.7	61.2	N/A	N/A	N/A	N/A	N/A
Avg - 2 Std. Deviations	56.6	47.3	N/A	N/A	0.0	N/A	N/A
Avg - 1 Std. Deviations	76.2	68.7	N/A	N/A	0.0	N/A	N/A
Average	95.8	90.1	N/A	N/A	N/A	N/A	N/A
Avg + 1 Std. Deviations	115.4	111.5	N/A	N/A	0.0	N/A	N/A
Avg + 2 Std. Deviations	135.0	126.5	N/A	N/A	0.0	N/A	N/A

Select Vehicle 2 From AS Lite Vehicle 2 Manual Input Clear Vehicle 2 Data

Vehicle 2

Curb Weight (pounds):

Occupant + Cargo Weight (pounds):

Total Weight (pounds): 0

Angle Coll Force to Normal (degrees): 0

No Damage Speed (mph):

Energy Crush Depth (inches): N/A

Auto-Calculate Energy Crush Depth ☒

Damage Length (inches):

Crush Profile Measurements:

Crush Spacing ☒ Equal ☐ Non-Equal

Impact Location ☐ Front ☐ Side ☐ Rear ☐ Other

PDF: Lever Arm Distance (inches): N/A

Yaw Moment of Inertia (lb-ft-sec²): 1.00

Auto-Calculate Yaw Moment ☒

Vehicle 2 Crush Measurements

	A	B
Average		
Minimum		
Maximum		
Std. Deviation		

	Zone Depth(x) (inches)	Area Depth(x) (inches ²)	Zone Depth(y) (inches)	Area Depth(y) (inches ²)
C1 (in.)				
C2 (in.)				
C3 (in.)				
C4 (in.)				
C5 (in.)				
C6 (in.)				
C7 (in.)				
C8 (in.)				
C9 (in.)				
C10 (in.)				

Average Crush (inches): N/A

Results

	A	B	Average Force (pounds)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	bSub1
Minimum	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Avg - 2 Std. Deviations	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Avg - 1 Std. Deviations	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Average	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Avg + 1 Std. Deviations	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Avg + 2 Std. Deviations	N/A	N/A	N/A	N/A	N/A	N/A	N/A

This is what the Force Balance page looks like after entering the AS Lite information and A-B values for Vehicle 1 (your KNOWN vehicle with “Good” Stiffness values).

This can also be reached without any data imports by just clicking on the Force Balance tab and filling in all the fields manually.

4N6XPRT StiffCalc - Selected Vehicle: 2008 CHEVROLET COBALT

AutoStats Lite Vehicle 2

Year of Vehicle: 2005
 Make: FORD
 Model:
 Enter the Year of the desired vehicle. Then Select the Manufacturer. Followed by the Model. Then Press 'Select Vehicle.'

Number of Doors:
 Bodystyle of Vehicle:
 Model:
 CROWN VICTORIA 4 DOOR SEDAN
 CROWN VICTORIA COMMERCIAL LWB 4 DOOR SEDAN
 E150 3 DOOR CARGO VAN
 E150 3 DOOR PASSENGER VAN
 E250 3 DOOR CARGO VAN
 E250 HD 3 DOOR CARGO VAN
 E250 SUPER 3 DOOR CARGO VAN
 E250 SUPER 3 DOOR PASSENGER VAN
 E350 3 DOOR CARGO VAN
 E350 3 DOOR PASSENGER VAN
 E350 HD SUPER
 E350 SUPER 3 DOOR CARGO VAN
 E350 SUPER 3 DOOR PASSENGER VAN
 E350 SUPER
 E350 SUPER
 ESCAPE 4 DOOR 4X2 UTILITY
 ESCAPE 4 DOOR 4X4 UTILITY
 ESCAPE HYBRID 4 DOOR 4X2 UTILITY
 ESCAPE HYBRID 4 DOOR 4X4 UTILITY
 EXCURSION 4 DOOR 4X2 UTILITY
 EXCURSION 4 DOOR 4X4 UTILITY
 EXPEDITION 4 DOOR 4X2 UTILITY
 EXPEDITION 4 DOOR 4X4 UTILITY
 EXPEDITION MSP SPECIAL SERVICE PACKAGE 4 DOOR 4X2 UTILITY
 EXPLORER 4 DOOR 4X2 UTILITY
 EXPLORER 4 DOOR 4X4 UTILITY
 EXPLORER MSP SPECIAL SERVICE PACKAGE 4 DOOR 4X2 UTILITY
 EXPLORER SPORT TRAC 4 DOOR 4X2 PICKUP

C4 (in.)
 C5 (in.)
 C6 (in.)
 C7 (in.)
 C8 (in.)
 C9 (in.)
 C10 (in.)

Average Crush (inches): N/A

Results

	A	B	Average Force (pounds)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	Closing Speed (mph)
Minimum	62.7	61.2	N/A	N/A	N/A	N/A	N/A
Avg - 2 Std. Deviations	56.6	47.3	N/A	N/A	0.0	N/A	N/A
Avg - 1 Std. Deviations	76.2	68.7	N/A	N/A	0.0	N/A	N/A
Average	95.8	90.1	N/A	N/A	N/A	N/A	N/A
Avg + 1 Std. Deviations	115.4	111.5	N/A	N/A	0.0	N/A	N/A
Avg + 2 Std. Deviations	135.0	129.0	N/A	N/A	0.0	N/A	N/A

Vehicle 2

Force Re-Calculations **Print**

Select Vehicle 2 From AS Lite **Vehicle 2 Manual Input** **Clear Vehicle 2 Data**

Curb Weight (pounds):
 Occupant + Cargo Weight (pounds):
 Total Weight (pounds): 0
 Angle Coll Force to Normal (degrees): 0
 No Damage Speed (mph):
 Energy Crush Depth (inches): N/A
 Auto-Calculate Energy Crush Depth ☒

Damage Length (inches):
 Crush Profile Measurements:
 Crush Spacing: ☒ Equal ☐ Non-Equal

PDOF
 Lever Arm Distance (inches): N/A
 Yaw Moment of Inertia (lb-ft-sec²): 1.00
 Auto-Calculate Yaw Moment ☒

Impact Location
☐ Front ☐ Side ☐ Rear ☐ Other

	Spacing	Zone Area	Zone Depth(x) (inches)	Area Depth(x) (inches ²)	Zone Depth(y) (inches)	Area Depth(y) (inches ²)
C1 (in.)						
C2 (in.)						
C3 (in.)						
C4 (in.)						
C5 (in.)						
C6 (in.)						
C7 (in.)						
C8 (in.)						
C9 (in.)						
C10 (in.)						

Average Crush (inches): N/A

Results

	A	B	Average Force (pounds)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	bSub1
Minimum	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Avg - 2 Std. Deviations	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Avg - 1 Std. Deviations	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Average	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Avg + 1 Std. Deviations	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Avg + 2 Std. Deviations	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Enter the vehicle data for Vehicle 2, either using AS LITE as shown, or via MANUAL INPUT.

4N6XPRT StifCalcs - Selected Vehicle: 2008 CHEVROLET COBALT

File Print Reports Settings Help Reg To: 4N6XPRT SYSTEMS

Basic Vehicle Search | NHTSA Test Selection | Advanced Vehicle Search | Force Balance

Load previously saved comparison Save current comparison Clear All Data Force Re-Calculations Print

Select Vehicle 1 From AS Lite Vehicle 1 Manual Input Clear Vehicle 1 Data

2008 CHEVROLET COBALT

Curb Weight (pounds): 3216

Occupant + Cargo Weight (pounds):

Total Weight (pounds): 3216

Angle Coll Force to Normal (degrees): 0

No Damage Speed (mph): 2

Energy Crush Depth (inches): N/A

Auto-Calculate Energy Crush Depth ☒

Damage Length (inches):

Crush Profile Measurements:

Crush Spacing ☒ Equal ☐ Non-Equal

Impact Location ☒ Front ☒ Side ☐ Rear ☐ Other

PDOF Lever Arm Distance (inches): N/A

Yaw Moment of Inertia (lb-ft-sec²): 2106.48

Auto-Calculate Yaw Moment ☒

Vehicle 1 Crush Measurements

	A	B
Average	95.8	90.1
Minimum	62.7	61.2
Maximum	128.0	126.5
Std. Deviation	19.6	21.4

	Spacing	Zone Area	Zone Depth(x) (inches)	Area Depth(x) (inches ²)	Zone Depth(y) (inches)	Area Depth(y) (inches ²)
C1 (in.)						
C2 (in.)						
C3 (in.)						
C4 (in.)						
C5 (in.)						
C6 (in.)						
C7 (in.)						
C8 (in.)						
C9 (in.)						
C10 (in.)						

Average Crush (inches): N/A

Results

	A	B	Average Force (pounds)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	Closing Speed (mph)
Minimum	62.7	61.2	N/A	N/A	N/A	N/A	N/A
Avg - 2 Std. Deviations	56.6	47.3	N/A	N/A	0.0	N/A	N/A
Avg - 1 Std. Deviations	76.2	68.7	N/A	N/A	0.0	N/A	N/A
Average	95.8	90.1	N/A	N/A	N/A	N/A	N/A
Avg + 1 Std. Deviations	115.4	111.5	N/A	N/A	0.0	N/A	N/A
Avg + 2 Std. Deviations	135.0	122.0	N/A	N/A	0.0	N/A	N/A

Select Vehicle 2 From AS Lite Vehicle 2 Manual Input Clear Vehicle 2 Data

2005 FORD EXPEDITION

Curb Weight (pounds): 5342

Occupant + Cargo Weight (pounds):

Total Weight (pounds): 5342

Angle Coll Force to Normal (degrees): 0

No Damage Speed (mph):

Energy Crush Depth (inches): N/A

Auto-Calculate Energy Crush Depth ☒

Damage Length (inches):

Crush Profile Measurements:

Crush Spacing ☒ Equal ☐ Non-Equal

Impact Location ☐ Front ☐ Side ☐ Rear ☐ Other

PDOF Lever Arm Distance (inches): N/A

Yaw Moment of Inertia (lb-ft-sec²): 4296.26

Auto-Calculate Yaw Moment ☒

	A	B
Average		
Minimum		
Maximum		
Std. Deviation		

	Spacing	Zone Area	Zone Depth(x) (inches)	Area Depth(x) (inches ²)	Zone Depth(y) (inches)	Area Depth(y) (inches ²)
C1 (in.)						
C2 (in.)						
C3 (in.)						
C4 (in.)						
C5 (in.)						
C6 (in.)						
C7 (in.)						
C8 (in.)						
C9 (in.)						
C10 (in.)						

Average Crush (inches): N/A

Results

	A	B	Average Force (pounds)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	bSub1
Minimum	N/A	N/A	N/A	N/A	0.0	N/A	N/A
Avg - 2 Std. Deviations	N/A	N/A	N/A	N/A	0.0	N/A	N/A
Avg - 1 Std. Deviations	N/A	N/A	N/A	N/A	0.0	N/A	N/A
Average	N/A	N/A	N/A	N/A	0.0	N/A	N/A
Avg + 1 Std. Deviations	N/A	N/A	N/A	N/A	0.0	N/A	N/A
Avg + 2 Std. Deviations	N/A	N/A	N/A	N/A	0.0	N/A	N/A

At this point, we have Vehicle Year, Make, Model information, Curb Weight, and Yaw Moment of Inertia values entered for both vehicles. We also have the No Damage Value and Impact surface indicated for Vehicle 1.

4N6XPRT StifCals - Selected Vehicle: 2008 CHEVROLET COBALT

File Print Reports Settings Help Reg To: 4N6XPRT SYSTEMS

Basic Vehicle Search | NHTSA Test Selection | Advanced Vehicle Search | Force Balance

Load previously saved comparison Save current comparison Clear All Data Force Re-Calculations Print

Select Vehicle 1 From AS Lite Vehicle 1 Manual Input Clear Vehicle 1 Data

2008 CHEVROLET COBALT

Curb Weight (pounds): 3216

Occupant + Cargo Weight (pounds):

Total Weight (pounds): 3216

Angle Coll Force to Normal (degrees): 0

No Damage Speed (mph): 2

Energy Crush Depth (inches): 11.66

Auto-Calculate Energy Crush Depth ☒

Damage Length (inches): 86

Crush Profile Measurements: 7

Crush Spacing: ☐ Equal ☒ Non-Equal

Impact Location: ☐ Front ☒ Side ☐ Rear ☐ Other

Vehicle 1 Crush Measurements

	A	B
Average	95.8	90.1
Minimum	62.7	61.2
Maximum	128.0	126.5
Std. Deviation	19.6	21.4

	Spacing	Zone Area	Zone Depth(x) (inches)	Area Depth(x) (inches ²)	Zone Depth(y) (inches)	Area Depth(y) (inches ²)
C1 (in.)	0	2.00	1.00	0.33	0.33	1.33
C2 (in.)	1	5.00	7.50	0.78	5.83	58.33
C3 (in.)	2	5.00	22.50	2.48	55.83	291.67
C4 (in.)	7	59.00	796.50	7.27	5791.83	168248.3
C5 (in.)	20	10.00	150.00	7.78	1166.67	6666.67
C6 (in.)	10	5	25.00	3.33	83.33	666.67
C7 (in.)	0					
C8 (in.)						
C9 (in.)						
C10 (in.)						

Average Crush (inches): 11.66

Results

	A	B	Average Force (pounds)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	Closing Speed (mph)
Minimum	62.7	61.2	33372.60	41697.79	19.7	N/A	N/A
Avg - 2 Std. Deviations	56.6	47.3	26142.93	32972.10	17.5	N/A	N/A
Avg - 1 Std. Deviations	76.2	68.7	37712.48	47338.18	21.0	N/A	N/A
Average	95.8	90.1	49282.03	61706.24	24.0	N/A	N/A
Avg + 1 Std. Deviations	115.4	111.5	60851.58	76075.14	26.6	N/A	N/A
Avg + 2 Std. Deviations	135.0	129.0	72491.12	90444.47	29.0	N/A	N/A

Select Vehicle 2 From AS Lite Vehicle 2 Manual Input Clear Vehicle 2 Data

2005 FORD EXPEDITION

Curb Weight (pounds): 5342

Occupant + Cargo Weight (pounds):

Total Weight (pounds): 5342

Angle Coll Force to Normal (degrees): 0

No Damage Speed (mph): 5

Energy Crush Depth (inches): 3.00

Auto-Calculate Energy Crush Depth ☒

Damage Length (inches): 50

Crush Profile Measurements: 2

Crush Spacing: ☒ Equal ☐ Non-Equal

Impact Location: ☒ Front ☐ Side ☐ Rear ☐ Other

	Spacing	Zone Area	Zone Depth(x) (inches)	Area Depth(x) (inches ²)	Zone Depth(y) (inches)	Area Depth(y) (inches ²)
C1 (in.)	5	50.00	150.00	1.72	258.33	19.44
C2 (in.)	1					
C3 (in.)						
C4 (in.)						
C5 (in.)						
C6 (in.)						
C7 (in.)						
C8 (in.)						
C9 (in.)						
C10 (in.)						

Average Crush (inches): 3.00

Results

	A	B	Average Force (pounds)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	bSub1
Minimum	682.7	217.4	33372.60	17679.19	10.0	N/A	28.0
Avg - 2 Std. Deviations	578.0	155.9	26142.93	15047.07	9.2	N/A	23.7
Avg - 1 Std. Deviations	740.7	255.9	37712.48	19233.78	10.4	N/A	30.4
Average	882.1	363.0	49282.03	23307.85	11.4	N/A	36.2
Avg + 1 Std. Deviations	1009.0	475.0	60851.58	27304.35	12.4	N/A	41.4
Avg + 2 Std. Deviations	1128.1	590.6	72491.12	31326.45	13.0	N/A	46.2

We now see that the No-Damage value and impact surface for Vehicle 2 have been input. Also input are the Crush Profile information for both Vehicle 1 and Vehicle 2.

The screenshot displays the 4N6XPRT StiffCalcs software interface. It is divided into two main sections for Vehicle 1 (2008 CHEVROLET COBALT) and Vehicle 2 (2005 FORD EXPEDITION). Each section contains input fields for vehicle specifications and checkboxes for calculation options. Red arrows point to the 'Auto-Calculate Yaw Moment' checkboxes, and purple arrows point to the 'Auto-Calculate Energy Crush Depth' checkboxes. Below the input fields, there are tables for 'Vehicle 1 Crush Measurements' and 'Vehicle 2 Crush Measurements' showing various depth and area values.

Vehicle 1: 2008 CHEVROLET COBALT

Curb Weight (pounds): 3216
 Occupant + Cargo Weight (pounds):
 Total Weight (pounds): 3216
 Angle Coll Force to Normal (degrees): 0
 No Damage Speed (mph): 2
 Energy Crush Depth (inches): 11.66
 Auto-Calculate Energy Crush Depth: ☒
 Auto-Calculate Yaw Moment: ☒
 Yaw Moment of Inertia (lb-ft-sec²): 2106.48
 Average Crush (inches): 11.66

Vehicle 2: 2005 FORD EXPEDITION

Curb Weight (pounds): 5342
 Occupant + Cargo Weight (pounds):
 Total Weight (pounds): 5342
 Angle Coll Force to Normal (degrees): 0
 No Damage Speed (mph): 5
 Energy Crush Depth (inches): 3.00
 Auto-Calculate Energy Crush Depth: ☒
 Auto-Calculate Yaw Moment: ☒
 Yaw Moment of Inertia (lb-ft-sec²): 4296.26
 Average Crush (inches): 3.00

There are two check boxes for each vehicle that may raise questions

AUTO-CALCULATE YAW MOMENT - When this box is checked, the Yaw Moment of Inertia is calculated based on the following formulas and the Total weight of Vehicle + Occupant(s) & Cargo.

If the Vehicle is a Van, SUV, Pickup, or has a curb weight greater than 8000 pounds, the Yaw Moment will be calculated as:

$$1.03 * \text{Total Weight} - 1343$$

Otherwise, the Yaw Moment will be calculated as:

$$1.03 * \text{Total Weight} - 1206$$

AUTO-CALCULATE ENERGY CRUSH DEPTH - When this box is checked, the “ENERGY CRUSH DEPTH” field equals the AVERAGE CRUSH field. When it is unchecked, you can enter some other value, allowing you to quickly complete a “rough check” on someone else's numbers without having to enter their crush profile.

ENERGY CRUSH DEPTH - This is the Crush Depth (C_{avg}) data field used for the “RESULTS” calculations of b_1 (b_{Sub1}) and F_{avg} (Average Force). When

the Auto-Calculate box is checked, it is equal to the calculated Average Crush from the crush profile you entered.

Note that in this example the Crush Profile CRUSH SPACING for vehicle 1 is based on NON-Equal spacing, where the CRUSH SPACING for Vehicle 2 is based on Equal spacing.

The advantage of NON-Equal spacing over Equal Crush spacing is that the measurements are better able to “describe” the crush profile of the vehicle by catching the “inflection points” in the crush profile.

Something else to note is that the Delta V and Closing Speed values are N/A ... in order to calculate these values, you MUST input values for the LEVER ARM for both vehicles, and have a value in place for ANGLE COL FORCE TO NORMAL (DEGREES) for both vehicles.

Both of these values can be found in a variety of ways, one of which is through the use of a CRASH 3 program.

4N6XPRT StifCalcs - Selected Vehicle: 2008 CHEVROLET COBALT

File Print Reports Settings Help Reg To: 4N6XPRT SYSTEMS

Basic Vehicle Search | NHTSA Test Selection | Advanced Vehicle Search | Force Balance

Load previously saved comparison Save current comparison Clear All Data Force Re-Calculations Print

Select Vehicle 1 From AS Lite Vehicle 1 Manual Input Clear Vehicle 1 Data

Select Vehicle 2 From AS Lite Vehicle 2 Manual Input Clear Vehicle 2 Data

2008 CHEVROLET COBALT

Curb Weight (pounds): 3216
 Occupant + Cargo Weight (pounds): 0
 Total Weight (pounds): 3216
 Angle Coll Force to Normal (degrees): 0
 No Damage Speed (mph): 2
 Energy Crush Depth (inches): 11.66

2005 FORD EXPEDITION

Curb Weight (pounds): 5342
 Occupant + Cargo Weight (pounds): 0
 Total Weight (pounds): 5342
 Angle Coll Force to Normal (degrees): 0
 No Damage Speed (mph): 5
 Energy Crush Depth (inches): 3.00

PDF: Lever Arm Distance (inches): N/A
 Yaw Moment of Inertia (lb-ft-sec²): 4296.26
 Auto-Calculate Yaw Moment ☒

Impact Location: ☒ Front ☐ Side ☐ Rear ☐ Other

Crush Spacing: ☒ Equal ☐ Non-Equal

	Spacing	Zone Area	Zone Depth(x) (inches)	Area Depth(x) (inches ²)	Zone Depth(y) (inches)	Area Depth(y) (inches ²)
1 (in.)	5	50.00	150.00	1.72	258.33	19.44
2 (in.)	1					
3 (in.)	0					
4 (in.)	0					
5 (in.)	0					
6 (in.)	0					
7 (in.)	0					
8 (in.)	0					
9 (in.)	0					
10 (in.)	0					

Average Crush (inches): 11.66

Results

	A	B	Average Force (pounds)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	Closing Speed (mph)
Minimum	62.7	61.2	33372.60	41697.79	19.7	N/A	N/A
Avg - 2 Std. Deviations	56.6	47.3	26142.93	32972.10	17.5	N/A	N/A
Avg - 1 Std. Deviations	76.2	68.7	37712.48	47338.18	21.0	N/A	N/A

2005 FORD EXPEDITION Results

	A	B	Average Force (pounds)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	bSub1
Minimum	682.7	217.4	33372.60	17679.19	10.0	N/A	28.0
Avg - 2 Std. Deviations	578.0	155.9	26142.93	15047.07	9.2	N/A	23.7
Avg - 1 Std. Deviations	740.7	255.9	37712.48	19233.78	10.4	N/A	30.4

At this point, you have the A-B values necessary for a CRASH 3 analysis. Saying that you have enough Post Impact information to complete a CRASH 3 analysis, it is suggested that you **SAVE CURRENT COMPARISON** and complete your CRASH 3 analysis.

4N6XPRT StifCalcs - Selected Vehicle: 2008 CHEVROLET COBALT

File Print Reports Settings Help Reg To: 4N6XPRT SYSTEMS

Basic Vehicle Search | NHTSA Test Selection | Advanced Vehicle Search | Force Balance

Load previously saved comparison Save current comparison Clear All Data Force Re-Calculations Print

Select Vehicle 1 From AS Lite Vehicle 1 Manual Input Clear Vehicle 1 Data

Select Vehicle 2 From AS Lite Vehicle 2 Manual Input Clear Vehicle 2 Data

2008 CHEVROLET COBALT

Curb Weight (pounds): 3216
 Occupant + Cargo Weight (pounds): 0
 Total Weight (pounds): 3216
 Angle Coll Force to Normal (degrees): 0
 No Damage Speed (mph): 2
 Energy Crush Depth (inches): 11.66

2005 FORD EXPEDITION

Curb Weight (pounds): 5342
 Occupant + Cargo Weight (pounds): 0
 Total Weight (pounds): 5342
 Angle Coll Force to Normal (degrees): 0
 No Damage Speed (mph): 5
 Energy Crush Depth (inches): 3.00

PDF: Lever Arm Distance (inches): N/A
 Yaw Moment of Inertia (lb-ft-sec²): 4296.26
 Auto-Calculate Yaw Moment ☒

Impact Location: ☒ Front ☐ Side ☐ Rear ☐ Other

Crush Spacing: ☒ Equal ☐ Non-Equal

4N6XPRT StifCalcs - Selected Vehicle: 2008 CHEVROLET COBALT

The File (2008_CHEVROLET_COBALT_VS_2005_FORD_EXPEDITION_73752.forcebalance) has been Saved to C:\Documents and Settings\Daniel Vornhof\My Documents\2008_CHEVROLET_COBALT_VS_2005_FORD_EXPEDITION_73752.forcebalance.

OK

As part of the SAVE you receive a confirmation that the data file has been saved.

4N6XPRT StifCalc - Selected Vehicle: 2008 CHEVROLET COBALT

File Print Reports Settings Help Reg To: 4N6XPRT SYSTEMS

Basic Vehicle Search | NHTSA Test Selection | Advanced Vehicle Search | Force Balance

Load previously saved comparison Save current comparison Clear All Data Force Re-Calculations Print

Open

Look in: My Documents

My Recent Documents

Desktop

My Documents

My Computer

My Network

File name: 2008_CHEVROLET_COBALT_VS_2005_FOR

Files of type: ForceBalance (*.forcebalance)

Open Cancel

Vehicle 2

Select Vehicle 2 From AS Like Vehicle 2 Manual Input Clear Vehicle 2 Data

Curb Weight (pounds):

Occupant + Cargo Weight (pounds):

Total Weight (pounds): 0

Angle Coll Force to Normal (degrees): 0

No Damage Speed (mph):

Energy Crush Depth (inches): N/A

Auto-Calculate Energy Crush Depth ☒

Damage Length (inches):

Crush Profile Measurements:

Crush Spacing ☒ Equal ☐ Non-Equal

PDF

Lever Arm Distance (inches): N/A

Yaw Moment of Inertia (lb-ft-sec²): 1.00

Auto-Calculate Yaw Moment ☒

Impact Location

☐ Front ☐ Side ☐ Rear ☐ Other

Average Crush (inches): N/A

Results

	A	B	Average Force (pounds)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	Closing Speed (mph)
Minimum							
Avg - 2 Std. Deviations							
Avg - 1 Std. Deviations							
Average							
Avg + 1 Std. Deviations							
Avg + 2 Std. Deviations							

Crush Spacing

	Spacing	Zone Area	Zone Depth(x) (inches)	Area Depth(x) (inches ²)	Zone Depth(y) (inches)	Area Depth(y) (inches ²)
C1 (in.)						
C2 (in.)						
C3 (in.)						
C4 (in.)						
C5 (in.)						
C6 (in.)						
C7 (in.)						
C8 (in.)						
C9 (in.)						
C10 (in.)						

Average Crush (inches): N/A

Results

	A	B	Average Force (pounds)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	bSub1
Minimum							
Avg - 2 Std. Deviations							
Avg - 1 Std. Deviations							
Average							
Avg + 1 Std. Deviations							
Avg + 2 Std. Deviations							

Once you complete your CRASH 3 analysis, you can come back, LOAD PREVIOUSLY SAVED COMPARISON, and enter Values for the Lever Arm for both vehicles, and change the Angle Col Force to Normal from "0" to some other value if appropriate.

4N6XPRT StiffCals - Selected Vehicle: 2008 CHEVROLET COBALT

File Print Reports Settings Help Reg To: 4N6XPRT SYSTEMS

Basic Vehicle Search | NHTSA Test Selection | Advanced Vehicle Search | Force Balance

Load previously saved comparison Save current comparison Clear All Data Force Re-Calculations Print

Select Vehicle 1 From AS Lite Vehicle 1 Manual Input Clear Vehicle 1 Data

2008 CHEVROLET COBALT

Curb Weight (pounds): 3216

Occupant + Cargo Weight (pounds):

Total Weight (pounds): 3216

Angle Coll Force to Normal (degrees): 0

No Damage Speed (mph): 2

Energy Crush Depth (inches): 11.66

Auto-Calculate Energy Crush Depth ☒

Damage Length (inches): 86

Crush Profile Measurements: 7

Crush Spacing: ☐ Equal ☒ Non-Equal

Impact Location: ☐ Front ☒ Side ☐ Rear ☐ Other

PDOF: Lever Arm Distance (inches): 0

Yaw Moment of Inertia (lb-ft-sec²): 2106.48

Auto-Calculate Yaw Moment ☒

Vehicle 1 Crush Measurements

	A	B
Average	95.8	90.1
Minimum	62.7	61.2
Maximum	128.0	126.5
Std. Deviation	19.6	21.4

	Spacing	Zone Area	Zone Depth(x) (inches)	Area Depth(x) (inches ²)	Zone Depth(y) (inches)	Area Depth(y) (inches ²)
C1 (in.)	0					
C2 (in.)	1	2.00	1.00	0.33	0.33	1.33
C3 (in.)	2	5.00	7.50	0.78	5.83	58.33
C4 (in.)	7	5.00	22.50	2.48	55.83	291.67
C5 (in.)	20	59.00	796.50	7.27	5791.83	168248.3
C6 (in.)	10	10.00	150.00	7.78	1166.67	6666.67
C7 (in.)	0	5.00	25.00	3.33	83.33	666.67
C8 (in.)						
C9 (in.)						
C10 (in.)						

Average Crush (inches): 11.66

Results

	A	B	Average Force (pounds)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	Closing Speed (mph)
Minimum	62.7	61.2	33372.60	41697.79	19.7	18.6	29.8
Avg - 2 Std. Deviations	56.6	47.3	26142.93	32972.10	17.5	16.7	26.8
Avg - 1 Std. Deviations	76.2	68.7	37712.48	47338.18	21.0	19.7	31.5
Average	95.8	90.1	49282.03	61706.24	24.0	22.2	35.6
Avg + 1 Std. Deviations	115.4	111.5	60851.58	76075.14	26.6	24.5	39.3
Avg + 2 Std. Deviations	135.0	132.0	73491.12	90444.47	29.0	26.6	42.6

Select Vehicle 2 From AS Lite Vehicle 2 Manual Input Clear Vehicle 2 Data

2005 FORD EXPEDITION

Curb Weight (pounds): 5342

Occupant + Cargo Weight (pounds):

Total Weight (pounds): 5342

Angle Coll Force to Normal (degrees): 0

No Damage Speed (mph): 5

Energy Crush Depth (inches): 3.00

Auto-Calculate Energy Crush Depth ☒

Damage Length (inches): 50

Crush Profile Measurements: 2

Crush Spacing: ☒ Equal ☐ Non-Equal

Impact Location: ☒ Front ☐ Side ☐ Rear ☐ Other

PDOF: Lever Arm Distance (inches): 0

Yaw Moment of Inertia (lb-ft-sec²): 4296.26

Auto-Calculate Yaw Moment ☒

Vehicle 2 Crush Measurements

	Spacing	Zone Area	Zone Depth(x) (inches)	Area Depth(x) (inches ²)	Zone Depth(y) (inches)	Area Depth(y) (inches ²)
C1 (in.)	5	50.00	150.00	1.72	258.33	19.44
C2 (in.)	1					
C3 (in.)						
C4 (in.)						
C5 (in.)						
C6 (in.)						
C7 (in.)						
C8 (in.)						
C9 (in.)						
C10 (in.)						

Average Crush (inches): 3.00

Results

	A	B	Average Force (pounds)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	bSub1
Minimum	682.7	217.4	33372.60	17679.19	10.0	11.2	28.0
Avg - 2 Std. Deviations	578.0	155.9	26142.93	15047.07	9.2	10.1	23.7
Avg - 1 Std. Deviations	740.7	255.9	37712.48	19233.78	10.4	11.8	30.4
Average	882.1	363.0	49282.03	23307.85	11.4	13.4	36.2
Avg + 1 Std. Deviations	1009.0	475.0	60851.58	27304.35	12.4	14.8	41.4
Avg + 2 Std. Deviations	1125.1	590.6	73491.12	31326.45	13.0	16.0	46.2

This shows the Force Balance analysis with Lever Arm and Angle Coll Force to Normal values of "0", which will give the most conservative numbers for the Delta V and Closing Speed values.

2008 CHEVROLET COBALT - Side Impact

Curb Weight (pounds):	3216	POOF	Lever Arm Distance (inches):	0.00
Occupant + Cargo Weight (pounds):	0	Yaw Moment of Inertia (lb-ft-sec ²):	2106.48	
Total Weight (pounds):	3216			
Angle Coil Force to Normal (degrees):	0.0	"Known" Stiffness Values Average: 95.8 A B Minimum: 62.7 61.2 Maximum: 128.0 126.5 Std. Deviation: 19.6 21.4		
No Damage Speed (mph):	2.0			
Energy Crush Depth (inches):	11.66			
Damage Length (inches):	86.0			
Crash Profile Measurements:	7			

Unequal Spacing	Zone Area	Depth(x)	Area	Depth(y)	Area
(inches)	(inches ²)	(inches)	(inches ²)	(inches)	(inches ²)
C1 (inches)	2.00	1.00	0.33	1.33	1.33
C2 (inches)	1.00				
C3 (inches)	5.00	7.50	5.83	7.78	58.33
C4 (inches)	5.00	22.50	2.48	12.96	291.67
C5 (inches)	7.00	59.00	7.27	5791.83	211.23
C6 (inches)	20.00	10.00	150.00	7.78	1166.67
C7 (inches)	10.00	5.00	25.00	3.33	83.33
C8 (inches)	0.00				
C9 (inches)					
C10 (inches)					
Average Crush (inches):	11.66				

Results

A	B	Average Force (pounds)	Damage Energy (ft+lbs)	KE Speed (mph)	Delta V Speed (MPH)	Closing Speed
Minimum	62.7	61.2	33372.60	41697.79	19.7	18.6
Avg - 2 Std. Deviations	56.6	47.3	26142.93	32972.10	17.5	16.7
Avg - 1 Std. Deviations	76.2	68.7	37712.48	47338.18	21.0	19.7
Average	95.8	90.1	49282.03	61706.24	24.0	22.2
Avg + 1 Std. Deviations	115.4	111.5	60851.58	76075.14	26.6	24.5
Avg + 2 Std. Deviations	135.0	132.9	72421.13	90444.47	29.0	26.6
Maximum	128.0	126.5	68912.13	86043.68	28.3	26.0
Damage Centroid Depth (X) (inches)	7.09					3037.10
Damage Centroid Depth (Y) (inches)	175.49					1.00
Area of Damage (inches ²):	1002.50					
						Eff. Mass Ratio (gamma)

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 Serial Number: 11N-030201SC02301

2005 FORD EXPEDITION - Front Impact

Curb Weight (pounds):	5342	POOF	Lever Arm Distance (inches):	0.00
Occupant + Cargo Weight (pounds):	0	Yaw Moment of Inertia (lb-ft-sec ²):	4296.26	
Total Weight (pounds):	5342			
Angle Coil Force to Normal (degrees):	0.0	"Known" Stiffness Values Average: 95.8 A B Minimum: 62.7 61.2 Maximum: 128.0 126.5 Std. Deviation: 19.6 21.4		
No Damage Speed (mph):	5.0			
Energy Crush Depth (inches):	3.00			
Damage Length (inches):	50.0			
Crash Profile Measurements:	2			

Unequal Spacing	Zone Area	Depth(x)	Area	Depth(y)	Area
(inches)	(inches ²)	(inches)	(inches ²)	(inches)	(inches ²)
C1 (inches)	5.00	50.00	1.72	258.33	19.44
C2 (inches)	1.00	150.00			2916.67
C3 (inches)					
C4 (inches)					
C5 (inches)					
C6 (inches)					
C7 (inches)					
C8 (inches)					
C9 (inches)					
C10 (inches)					
Average Crush (inches):	3.00				

Results

A	B	Average Force (pounds)	Damage Energy (ft+lbs)	KE Speed (mph)	Delta V Speed (MPH)	Closing Speed
Minimum	682.7	217.4	33372.60	17679.19	10.0	11.2
Avg - 2 Std. Deviations	578.0	155.9	26142.93	15047.07	9.2	10.1
Avg - 1 Std. Deviations	740.7	255.9	37712.48	19233.78	10.4	11.8
Average	882.1	363.0	49282.03	23307.85	11.4	13.4
Avg + 1 Std. Deviations	1009.0	475.0	60851.58	27304.35	12.4	14.8
Avg + 2 Std. Deviations	1125.1	590.6	72421.13	31243.22	13.2	16.0
Maximum	1090.9	555.2	68912.13	30053.81	13.0	15.6
Damage Centroid Depth (X) (inches)	1.72					3728.11
Damage Centroid Depth (Y) (inches)	19.44					1.00
Area of Damage (inches ²):	150.00					
						Eff. Mass Ratio (gamma)

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The printed output appears as shown above.

4N6XPRT StifCals - Selected Vehicle: 2008 CHEVROLET COBALT

File Print Reports Settings Help Reg To: 4N6XPRT SYSTEMS

Basic Vehicle Search | NHTSA Test Selection | Advanced Vehicle Search | Force Balance

Load previously saved comparison Save current comparison Clear All Data Force Re-Calculations Print

Select Vehicle 1 From AS Lite Vehicle 1 Manual Input Clear Vehicle 1 Data

2008 CHEVROLET COBALT

Curb Weight (pounds): 3216

Occupant + Cargo Weight (pounds): 0

Total Weight (pounds): 3216

Angle Coll Force to Normal (degrees): 20

No Damage Speed (mph): 2

Energy Crush Depth (inches): 11.66

Auto-Calculate Energy Crush Depth ☒

Damage Length (inches): 86

Crush Profile Measurements: 7

Crush Spacing ☐ Equal ☒ Non-Equal

Impact Location ☐ Front ☒ Side ☐ Rear ☐ Other

PDOF Lever Arm Distance (inches): 20

Yaw Moment of Inertia (lb-ft-sec²): 2106.48

Auto-Calculate Yaw Moment ☒

Vehicle 1 Crush Measurements

	A	B
Average	95.8	90.1
Minimum	62.7	61.2
Maximum	128	126.5
Std. Deviation	19.6	21.4

	Spacing	Zone Area	Zone Depth(x) (inches)	Area Depth(x) (inches ²)	Zone Depth(y) (inches)	Area Depth(y) (inches ²)
C1 (in.)	0					
C2 (in.)	1					
C3 (in.)	2					
C4 (in.)	7					
C5 (in.)	20					
C6 (in.)	10					
C7 (in.)	0					
C8 (in.)	0					
C9 (in.)	0					
C10 (in.)	0					

Average Crush (inches): 11.66

Results

	A	B	Average Force (pounds)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	Closing Speed (mph)
Minimum	62.7	61.2	35514.38	47221.68	21.0	18.8	32.6
Avg - 2 Std. Deviations	56.6	47.3	27820.72	37340.05	18.7	16.9	29.3
Avg - 1 Std. Deviations	76.2	68.7	40132.78	53609.27	22.4	19.9	34.6
Average	95.8	90.1	52444.84	69880.73	25.5	22.6	39.1
Avg + 1 Std. Deviations	115.4	111.5	64756.89	86153.14	28.3	24.9	43.1
Avg + 2 Std. Deviations	135.0	133.0	77068.95	102425.60	30.0	27.0	46.0

Select Vehicle 2 From AS Lite Vehicle 2 Manual Input Clear Vehicle 2 Data

2005 FORD EXPEDITION

Curb Weight (pounds): 5342

Occupant + Cargo Weight (pounds): 0

Total Weight (pounds): 5342

Angle Coll Force to Normal (degrees): 10

No Damage Speed (mph): 5

Energy Crush Depth (inches): 3.00

Auto-Calculate Energy Crush Depth ☒

Damage Length (inches): 50

Crush Profile Measurements: 2

Crush Spacing ☒ Equal ☐ Non-Equal

Impact Location ☒ Front ☐ Side ☐ Rear ☐ Other

PDOF Lever Arm Distance (inches): 0

Yaw Moment of Inertia (lb-ft-sec²): 4296.26

Auto-Calculate Yaw Moment ☒

Vehicle 2 Crush Measurements

	A	B
Average	95.8	90.1
Minimum	62.7	61.2
Maximum	128	126.5
Std. Deviation	19.6	21.4

	Spacing	Zone Area	Zone Depth(x) (inches)	Area Depth(x) (inches ²)	Zone Depth(y) (inches)	Area Depth(y) (inches ²)
C1 (in.)	5					
C2 (in.)	1					
C3 (in.)	0					
C4 (in.)	0					
C5 (in.)	0					
C6 (in.)	0					
C7 (in.)	0					
C8 (in.)	0					
C9 (in.)	0					
C10 (in.)	0					

Average Crush (inches): 3.00

Results

	A	B	Average Force (pounds)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	bSub1
Minimum	704.4	231.5	35514.38	18822.67	10.3	11.3	28.9
Avg - 2 Std. Deviations	597.0	166.3	27820.72	15990.58	9.5	10.2	24.5
Avg - 1 Std. Deviations	764.0	272.3	40132.78	20495.66	10.7	12.0	31.4
Average	909.1	385.6	52444.84	24880.92	11.8	13.6	37.3
Avg + 1 Std. Deviations	1039.3	503.9	64756.89	29183.83	12.8	15.0	42.7
Avg + 2 Std. Deviations	1169.5	622.0	77068.95	33504.92	13.4	16.2	47.6

An illustration of what happens to the Delta V and Closing Speeds when the Lever Arm and Angle Col Force are values other than "0" appear above. These values should be compared to the printout previously discussed.

In short, the speeds are higher.

CLASS vs SISTER/CLONE Summary Comparison:

One of the purposes of going through building the CLASS vehicle, even though there were Sister/Clone tests for the Cobalt, was to compare the CLASS values to Sister/Clone values. Another purpose was to restrict the CLASS vehicle to a 4 door vehicle only, and thus incorporate the B-Pillar "hard point"

Sister/Clone -

4N6XPRT StiffCalc@s Force Balance - Page 1 of 2

2008 CHEVROLET COBALT - Side Impact

Curb Weight (pounds):	3216	PDF	Lever Arm Distance (inches):	0.00																
Occupant + Cargo Weight (pounds):	0	Yaw Moment of Inertia (lb-ft-sec ²):	2106.48																	
Total Weight (pounds):	3216																			
Angle Coll Force to Normal (degrees):	0.0	Known Stiffness Values																		
No Damage Speed (mph):	2.0	<table border="1"> <tr> <td>Average</td> <td>101.5</td> <td>B</td> <td>94.2</td> </tr> <tr> <td>Minimum</td> <td>42.1</td> <td></td> <td>22.8</td> </tr> <tr> <td>Maximum</td> <td>161.5</td> <td></td> <td>168.4</td> </tr> <tr> <td>Std Deviation</td> <td>29.3</td> <td></td> <td>37.4</td> </tr> </table>			Average	101.5	B	94.2	Minimum	42.1		22.8	Maximum	161.5		168.4	Std Deviation	29.3		37.4
Average	101.5	B	94.2																	
Minimum	42.1		22.8																	
Maximum	161.5		168.4																	
Std Deviation	29.3		37.4																	
Emergency Crush Depth (inches):	11.66																			
Damage Length (inches):	86.0																			
Crush Profile Measurements:	7																			

Unequal Spacing	Zone Area	Depth(x)	Area	Depth(y)	Zone	Area
(inches)	(inches ²)	(inches)	(inches ²)	(inches)	(inches)	(inches ²)
C1 (inches)	0.00	1.00	0.33	0.33	1.33	1.33
C2 (inches)	1.00	5.00	7.50	5.83	7.78	58.33
C3 (inches)	2.00	5.00	22.50	2.48	55.83	281.67
C4 (inches)	7.00	59.00	796.50	7.27	5791.83	211.23
C5 (inches)	20.00	10.00	150.00	7.78	1166.67	44.44
C6 (inches)	10.00	5.00	25.00	3.33	83.33	26.67
C7 (inches)	0.00					666.67
C8 (inches)						
C9 (inches)						
C10 (inches)						
Average Crush (inches):	11.66					

Results

A	B	Average Force (pounds)	Damage Energy (ft-lbs)	KE Speed (mph)	Delta V (mph)	Closing Speed (MPH)
Minimum	42.1	22.8	13238.60	17292.95	12.7	12.6
Ang -2 Std. Deviations	42.9	19.4	11568.95	15408.41	12.0	12.0
Ang -1 Std. Deviations	72.2	56.8	31575.60	39985.38	19.3	18.2
Average	101.5	94.2	51582.25	64636.46	24.6	22.7
Ang +1 Std. Deviations	130.8	131.6	71588.90	89298.47	28.9	26.4
Ang +2 Std. Deviations	160.1	169.0	91595.55	113964.15	32.6	29.7
Maximum	161.5	168.4	91355.00	113737.44	32.6	29.7
Damage Control Depth (x) (inches)	7.09				k2	3037.10
Damage Control Depth (y) (inches)	175.49					
Area of Damage (inches ²):	1002.50				Eff. Mass Ratio (gamma)	1.00

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4N6XPRT StiffCalc@s Force Balance - Page 2 of 2

2005 FORD EXPEDITION - Front Impact

Curb Weight (pounds):	5342	PDF	Lever Arm Distance (inches):	0.00																
Occupant + Cargo Weight (pounds):	0	Yaw Moment of Inertia (lb-ft-sec ²):	4296.26																	
Total Weight (pounds):	5342																			
Angle Coll Force to Normal (degrees):	0.0	Known Stiffness Values																		
No Damage Speed (mph):	5.0	<table border="1"> <tr> <td>Average</td> <td>101.5</td> <td>B</td> <td>94.2</td> </tr> <tr> <td>Minimum</td> <td>42.1</td> <td></td> <td>22.8</td> </tr> <tr> <td>Maximum</td> <td>161.5</td> <td></td> <td>168.4</td> </tr> <tr> <td>Std Deviation</td> <td>29.3</td> <td></td> <td>37.4</td> </tr> </table>			Average	101.5	B	94.2	Minimum	42.1		22.8	Maximum	161.5		168.4	Std Deviation	29.3		37.4
Average	101.5	B	94.2																	
Minimum	42.1		22.8																	
Maximum	161.5		168.4																	
Std Deviation	29.3		37.4																	
Emergency Crush Depth (inches):	3.00																			
Damage Length (inches):	50.0																			
Crush Profile Measurements:	2																			

Unequal Spacing	Zone Area	Depth(x)	Area	Depth(y)	Zone	Area
(inches)	(inches ²)	(inches)	(inches ²)	(inches)	(inches)	(inches ²)
C1 (inches)	5.00	50.00	150.00	1.72	256.33	2916.67
C2 (inches)	1.00					
C3 (inches)						
C4 (inches)						
C5 (inches)						

2008 CHEVROLET COBALT - Side Impact

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

Angle Coil 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
 Average A B
 Minimum
 Maximum
 Std Deviation

Unequal Spacing	Zone Area	Zone Depth(x)	Area Depth(x)	Zone Depth(y)	Area Depth(y)
(inches ²)	(inches ²)	(inches)	(inches ²)	(inches)	(inches ²)
C1 (inches)	<input type="text" value="0.00"/>	<input type="text" value="2.00"/>	<input type="text" value="1.00"/>	<input type="text" value="0.33"/>	<input type="text" value="1.33"/>
C2 (inches)	<input type="text" value="1.00"/>	<input type="text" value="5.00"/>	<input type="text" value="7.50"/>	<input type="text" value="0.78"/>	<input type="text" value="5.83"/>
C3 (inches)	<input type="text" value="2.00"/>	<input type="text" value="5.00"/>	<input type="text" value="22.50"/>	<input type="text" value="2.48"/>	<input type="text" value="55.83"/>
C4 (inches)	<input type="text" value="7.00"/>	<input type="text" value="59.00"/>	<input type="text" value="796.50"/>	<input type="text" value="7.27"/>	<input type="text" value="5791.83"/>
C5 (inches)	<input type="text" value="20.00"/>	<input type="text" value="10.00"/>	<input type="text" value="150.00"/>	<input type="text" value="7.78"/>	<input type="text" value="1166.67"/>
C6 (inches)	<input type="text" value="10.00"/>	<input type="text" value="5.00"/>	<input type="text" value="25.00"/>	<input type="text" value="3.33"/>	<input type="text" value="83.33"/>
C7 (inches)	<input type="text" value="0.00"/>				
C8 (inches)					
C9 (inches)					
C10 (inches)					

Average Crush (inches):

Results

	A	B	Average Force (pounds)	Damage Energy (ft+lbs)	KE Speed (mph)	Delta V (mph)	Closing Speed (MPH)
Minimum	<input type="text" value="62.7"/>	<input type="text" value="61.2"/>	<input type="text" value="33372.60"/>	<input type="text" value="41897.79"/>	<input type="text" value="19.7"/>	<input type="text" value="18.6"/>	<input type="text" value="29.8"/>
Avg - 2 Std. Deviations	<input type="text" value="56.6"/>	<input type="text" value="47.3"/>	<input type="text" value="26142.93"/>	<input type="text" value="32972.10"/>	<input type="text" value="17.5"/>	<input type="text" value="16.7"/>	<input type="text" value="26.8"/>
Avg - 1 Std. Deviations	<input type="text" value="76.2"/>	<input type="text" value="68.7"/>	<input type="text" value="37712.48"/>	<input type="text" value="47338.18"/>	<input type="text" value="21.0"/>	<input type="text" value="19.7"/>	<input type="text" value="31.5"/>
Average	<input type="text" value="95.8"/>	<input type="text" value="90.1"/>	<input type="text" value="49282.03"/>	<input type="text" value="61706.24"/>	<input type="text" value="24.0"/>	<input type="text" value="22.2"/>	<input type="text" value="35.6"/>
Avg + 1 Std. Deviations	<input type="text" value="115.4"/>	<input type="text" value="111.5"/>	<input type="text" value="60851.58"/>	<input type="text" value="76075.14"/>	<input type="text" value="26.6"/>	<input type="text" value="24.5"/>	<input type="text" value="39.3"/>
Avg + 2 Std. Deviations	<input type="text" value="135.0"/>	<input type="text" value="132.9"/>	<input type="text" value="72421.13"/>	<input type="text" value="90444.47"/>	<input type="text" value="29.0"/>	<input type="text" value="26.6"/>	<input type="text" value="42.6"/>
Maximum	<input type="text" value="128.0"/>	<input type="text" value="126.5"/>	<input type="text" value="68912.13"/>	<input type="text" value="86043.68"/>	<input type="text" value="28.3"/>	<input type="text" value="26.0"/>	<input type="text" value="41.6"/>
Damage Centroid Depth (x) (inches)	<input type="text" value="7.09"/>						<input type="text" value="307.10"/>
Damage Centroid Depth (y) (inches)	<input type="text" value="175.49"/>						<input type="text" value="1.00"/>
Area of Damage (inches ²):	<input type="text" value="1002.50"/>						

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 Serial Number: 11R-030201SC02301

2005 FORD EXPEDITION - Front Impact

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

Angle Coil 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	Zone Area	Zone Depth(x)	Area Depth(x)	Zone Depth(y)	Area Depth(y)
(inches ²)	(inches ²)	(inches)	(inches ²)	(inches)	(inches ²)
C1 (inches)	<input type="text" value="5.00"/>	<input type="text" value="50.00"/>	<input type="text" value="150.00"/>	<input type="text" value="1.72"/>	<input type="text" value="258.33"/>
C2 (inches)	<input type="text" value="1.00"/>				<input type="text" value="19.44"/>
C3 (inches)					<input type="text" value="2916.67"/>
C4 (inches)					
C5 (inches)					
C6 (inches)					
C7 (inches)					
C8 (inches)					
C9 (inches)					
C10 (inches)					

Average Crush (inches):

Results

	A	B	Average Force (pounds)	Damage Energy (ft+lbs)	KE Speed (mph)	Delta V (mph)	B Sub
Minimum	<input type="text" value="68.7"/>	<input type="text" value="217.4"/>	<input type="text" value="33372.60"/>	<input type="text" value="17679.19"/>	<input type="text" value="10.0"/>	<input type="text" value="11.2"/>	<input type="text" value="28.0"/>
Avg - 2 Std. Deviations	<input type="text" value="578.0"/>	<input type="text" value="155.9"/>	<input type="text" value="26142.93"/>	<input type="text" value="15047.07"/>	<input type="text" value="9.2"/>	<input type="text" value="10.1"/>	<input type="text" value="23.7"/>
Avg - 1 Std. Deviations	<input type="text" value="746.7"/>	<input type="text" value="255.9"/>	<input type="text" value="37712.48"/>	<input type="text" value="19233.78"/>	<input type="text" value="10.4"/>	<input type="text" value="11.8"/>	<input type="text" value="30.4"/>
Average	<input type="text" value="882.1"/>	<input type="text" value="363.0"/>	<input type="text" value="49282.03"/>	<input type="text" value="23307.85"/>	<input type="text" value="11.4"/>	<input type="text" value="13.4"/>	<input type="text" value="36.2"/>
Avg + 1 Std. Deviations	<input type="text" value="1009.0"/>	<input type="text" value="475.0"/>	<input type="text" value="60851.58"/>	<input type="text" value="27304.35"/>	<input type="text" value="12.4"/>	<input type="text" value="14.8"/>	<input type="text" value="41.4"/>
Avg + 2 Std. Deviations	<input type="text" value="1125.1"/>	<input type="text" value="590.6"/>	<input type="text" value="72421.13"/>	<input type="text" value="31243.22"/>	<input type="text" value="13.2"/>	<input type="text" value="16.0"/>	<input type="text" value="46.2"/>
Maximum	<input type="text" value="1090.9"/>	<input type="text" value="555.2"/>	<input type="text" value="68912.13"/>	<input type="text" value="30053.81"/>	<input type="text" value="13.0"/>	<input type="text" value="15.6"/>	<input type="text" value="44.8"/>
Damage Centroid Depth (x) (inches)	<input type="text" value="1.72"/>						<input type="text" value="3729.11"/>
Damage Centroid Depth (y) (inches)	<input type="text" value="19.44"/>						<input type="text" value="1.00"/>
Area of Damage (inches ²):	<input type="text" value="150.00"/>						

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and then we have

CLASS -

Close examination of these two reports shows that, because the CLASS vehicle was “tighter”, we have a narrower Closing Speed range with the CLASS vehicle (26.8-42.6 mph) vs the Sister/Clone vehicle (19.3-47.6 mph). Yet the Closing Speed based on the AVERAGE A-B values are very close
(Class = 35.6 mph vs. Sister/Clone = 36.4 mph)

You can, and will, achieve this agreement in data with practice. Further, the confidence and experience you will gain with the Force Balance Module, and input of the A-B values into your CRASH 3 program, will allow you to testify with confidence when you have to rely solely upon a CLASS vehicle for stiffness data.

ESSENTIAL FORMULAS:

CRASH 3 Stiffness Value Calculations:

1 mph	= 17.6 inch/sec
gravity = g	= acceleration due to gravity
$g = 32.3 \text{ feet/sec}^2$	= 386.4 inch/sec^2
KEES	= Kinetic Energy Equivalent Speed (mph)
Δv_{test}	= Speed(mph) * 17.6 = inch/second
Crush = C	= crush depth used for calculations, in 4N6XPRT StifCalcs [®] the Crush depth used could be the minimum, average, or maximum depth = inches
$\text{Crush}_{\text{avg}} = C_{\text{avg}}$	= calculated average crush = inches
Weight = W	= vehicle weight = pounds
b_0	= “No Damage Speed” - For FRONT and REAR Tests initial assumption is 5 mph = 88 inch/second, for SIDE Tests initial assumption is 2 mph = 35.2 inch/sec.
L	= damage length (inch)

The KEES speed is calculated with the following formula:

$$\text{KEES} = ([W_{\text{Barrier}} * \text{SPEED}_{\text{Closing}}^2] / [W_{\text{Barrier}} + W_{\text{Vehicle}}])^{0.5}$$

$$b_1 = \text{slope} = \text{inches} / [\text{inch} * \text{sec}]$$

Note - depending upon the author the unit notation could also appear as [\[inch/second\]/inch](#) or [1/second](#).

$$b_1 = (\Delta v_{\text{test}} - b_0) / \text{Crush}$$

$$\text{“A” coefficient} = \text{pound/inch}$$

A = Maximum force per inch of damage without permanent damage

$$A = (W * b_0 * b_1) / (g * L_{\text{test}})$$

“B” coefficient = pound/inch²

B = Crush resistance per inch of damage width

$$B = (W * b_1 * b_1) / (g * L_{\text{test}})$$

“G” coefficient = pound

G = Energy dissipated without permanent damage

$$G = (A * A) / (2 * B)$$

SMAC Stiffness Value Calculation:

“Kv” coefficient = pound/inch²

Kv = The linear spring constant for the increasing/decreasing loads of a collision

$$Kv = (W * b_1 * b_1) / (g * L_{\text{test}})$$

Test Specific Crush Factor (CF) Stiffness Value Calculation:

“CF” = unitless

CF = Crush Factor = Resistance to crush

$$CF = \Delta v_{\text{test(mph)}} * \Delta v_{\text{test(mph)}} / (30 * \text{Crush}/12)$$

Force Balance Calculations:

To perform an accurate Force Balance crush analysis, four things are needed: 1) “good” stiffness coefficients for one of the vehicles, Crush profile measurements from which the 2) area of damage and 3) depth of the damage centroid from the damage face can be calculated, and 4) the angle the collision force makes with respect to the damage face.

Additionally, to calculate Closing Speed and Delta-V's, a PDOF Lever Arm distance for each vehicle is needed.

Variables to be used in the formula notation are:

E	=	total damage energy (inch-pound)
A	=	stiffness coefficient (pound/inch)
B	=	stiffness coefficient (pound/inch ²)
G	=	stiffness coefficient (pound)
\bar{x}	=	depth of the damage centroid from the undamaged surface
A_D	=	area of damage (inch ²)
L	=	damage length (inch)
F	=	collision force (pounds)
F_x	=	collision force normal (perpendicular) to the undamaged surface (pounds)
α	=	angle the collision force makes with a line normal (perpendicular) to the collision surface face (degrees)
$(1 + \tan^2 \alpha)$	=	magnification factor to adjust for a collision force that is not normal to the undamaged surface (unitless)
F_{avg}	=	average collision force (pounds)
C_{avg}	=	average crush depth (inches)
F_1	=	average collision force for Vehicle 1 (pounds) - <i>This is the vehicle with the “best” set of A-B Stiffness values. It may be EITHER the bullet or the target vehicle</i>
$C_{2 avg}$	=	average crush depth for Vehicle 2 (inches)
A_2	=	stiffness coefficient for Vehicle 2 (pound/inch)- <i>This is to be solved for by balancing against the calculated average collision Force exerted on Vehicle 1</i>
B_2	=	stiffness coefficient for Vehicle 2 (pound/inch ²)- <i>This is to be solved for by balancing against the calculated average collision Force exerted on Vehicle 1</i>
L_2	=	damage length for Vehicle 2 (inch)
α_2	=	angle the collision force makes with a line normal (perpendicular) to the collision surface face for Vehicle 2 (degrees)
I_z	=	Yaw Moment of Inertia (pound-foot-second ²)
k	=	Radius of Gyration (feet)
h	=	PDOF Lever Arm Distance (inches)
γ	=	Effective mass ratio - Gamma (unitless)
Delta V	=	The change in velocity experienced by the vehicle in a Linear Direction based purely upon the damage sustained (mph)

Closing Speed = The speed at which the two “damage surfaces” approached each other just before impact in a Linear Direction based purely upon the damage sustained (mph)

The general equation for calculating damage energy is:

$$E = [(A + B\bar{x}) * A_D + (A^2 * L) / (2 * B)] * (1 + \tan^2 \alpha)$$

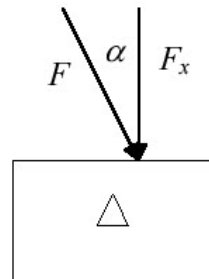
One of the foundations of the Force Balance model is that collision forces adhere to Newton’s Third Law which states: *For every force exerted on a body by another body, there is an equal but opposite force reacting on the first body by the second.* The **average** collision force can be calculated by:

$$F_{avg} = [(A + B * C_{avg}) * L] / 2$$

where C_{avg} can be calculated by:

$$C_{avg} = A_D / L$$

Crush measurements and energy calculations are based on a normal collision force. When the collision force is not normal to the original undamaged surface, the angle between the collision force and the normal (perpendicular) component needs to be determined. To visualize this angle, refer to the diagram below.



The angle acts as a “magnification” factor on the calculated force, and is accounted for in the $(1 + \tan^2 \alpha)$ portion of the damage energy calculation. The good thing about this angle is that use of a 0 degree angle (as in, no angle) results in the most conservative energy values and thus conservative resulting speeds.

$$F = F_x / \cos \alpha$$

In terms of our A-B Stiffness values, the Force can be calculated as:

$$F = [(A + B * C_{avg}) * L] / (2 * \cos \alpha)$$

The b_0 value for Vehicle 2 is assumed. The Force on Vehicle 1 has been calculated, and because of Newton's Third Law, is known to be the Force acting on Vehicle 2 as well. The weight, average crush, and Force angle α for vehicle 2 are all known. Calculation of the b_1 is all that remains to be done in order for the A and B stiffness values for Vehicle 2 to be calculated.

$$b_1 = -1 * (W_2 * b_0) \pm [(W_2 * b_0)^2 - 4 * (W_2 * C_{2avg}) * (-2 * g * F_1 * \cos \alpha)]^{0.5} / [2 * (W_2 * C_{2avg})]$$

Once b_1 for Vehicle 2 has been determined, the appropriate values are plugged in to the formulas displayed in the CRASH 3 section above to calculate the A-B-G stiffness values.

The screenshot displays the 4N6XPRT StifCalc software interface. The top menu bar includes File, Print Reports, Settings, Help, and Reg To: 4N6XPRT SYSTEMS. Below the menu bar are tabs for Basic Vehicle Search, NHTSA Test Selection, Advanced Vehicle Search, and Force Balance. The main window is divided into two sections for vehicle input and results.

2008 CHEVROLET COBALT Input:

- Curb Weight (pounds): 3216
- Occupant + Cargo Weight (pounds): 0
- Total Weight (pounds): 3216
- Angle Coll Force to Normal (degrees): 0
- No Damage Speed (mph): 2
- Energy Crush Depth (inches): 11.66
- Auto-Calculate Energy Crush Depth: ☒
- Damage Length (inches): 86
- Crush Profile Measurements: 7
- Crush Spacing: ☒ Equal ☐ Non-Equal
- Impact Location: ☒ Front ☐ Side ☐ Rear ☐ Other
- Vehicle 1 Crush Measurements:

	A	B
Average	95.8	90.1
Minimum	62.7	61.2
Maximum	128	126.5
Std. Deviation	19.6	21.4

2005 FORD EXPEDITION Input:

- Curb Weight (pounds): 5342
- Occupant + Cargo Weight (pounds): 0
- Total Weight (pounds): 5342
- Angle Coll Force to Normal (degrees): 0
- No Damage Speed (mph): 5
- Energy Crush Depth (inches): 3.00
- Auto-Calculate Energy Crush Depth: ☒
- Damage Length (inches): 50
- Crush Profile Measurements: 2
- Crush Spacing: ☒ Equal ☐ Non-Equal
- Impact Location: ☒ Front ☐ Side ☐ Rear ☐ Other

Results for 2008 CHEVROLET COBALT:

	A	B	Average Force (pounds)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	Closing Speed (mph)
Minimum	62.7	61.2	33372.60	41697.79	19.7	18.6	29.8
Avg - 2 Std. Deviations	56.6	47.3	26142.93	32972.10	17.5	16.7	26.8
Avg - 1 Std. Deviations	76.2	68.7	37712.48	47338.18	21.0	19.7	31.5
Average	95.8	90.1	49282.03	61706.24	24.0	22.2	35.6
Avg + 1 Std. Deviations	115.4	111.5	60851.58	76075.14	26.6	24.5	39.3
Avg + 2 Std. Deviations	135.0	132.0	73421.13	90444.47	29.0	26.6	42.6

Results for 2005 FORD EXPEDITION:

	A	B	Average Force (pounds)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	bSub1
Minimum	682.7	217.4	33372.60	17679.19	10.0	11.2	28.0
Avg - 2 Std. Deviations	578.0	155.9	26142.93	15047.07	9.2	10.1	23.7
Avg - 1 Std. Deviations	740.7	255.9	37712.48	19233.78	10.4	11.8	30.4
Average	882.1	363.0	49282.03	23307.85	11.4	13.4	36.2
Avg + 1 Std. Deviations	1009.0	475.0	60851.58	27304.35	12.4	14.8	41.4
Avg + 2 Std. Deviations	1135.7	589.6	73421.13	31320.45	13.0	16.0	46.2

Zone Area = Each **Zone Area** segment is calculated as

$$[(C_n + C_{n+1}) / 2] * \text{Spacing}$$

Zone Depth(x) = Each **Zone Depth(x)** segment is calculated as

$$[(C_n)^2 + (C_n * C_{n+1}) + (C_{n+1})^2] / [3 * (C_n + C_{n+1})]$$

Area Depth(x) = Each **Area Depth(x)** segment is calculated as

$$\text{Zone Area} * \text{Zone Depth(x)}$$

Zone# = The number of the zone segment - i.e. - the segment between C_1 and C_2 would be 1, between C_7 and C_8 would be 7.

Zone Depth(y) = Each **Zone Depth(y)** segment is calculated as

$$\text{Spacing} * [(-1)*(C_{n+1}) + (-2)*(C_n) + 3*Zone\#*C_n + 3*Zone\#*(C_{n+1})] / [3 * (C_n + C_{n+1})]$$

Area Depth(y) = Each **Area Depth(y)** segment is calculated as

$$\text{Zone Area} * \text{Zone Depth(x)}$$

Average Crush_{Trapezoidal} = $C_{avg} = \sum[\text{Zone Area}] / L$

4N6XPRT StifCalc - Selected Vehicle: 2008 CHEVROLET COBALT

File Print Reports Settings Help Reg To: 4N6XPRT SYSTEMS

Basic Vehicle Search | NHTSA Test Selection | Advanced Vehicle Search | Force Balance

Angle Coll Force to Normal (degrees): 0

No Damage Speed (mph): 2

Energy Crush Depth (inches): 11.66

Auto-Calculate Energy Crush Depth ☒

Impact Location: ☐ Front ☒ Side ☐ Rear ☐ Other

Vehicle 1 Crush Measurements:

	A	B
Average	95.8	90.1
Minimum	62.7	61.2
Maximum	128	126.5
Std. Deviation	19.6	21.4

Damage Length (inches): 86

Crush Profile Measurements: 7

Crush Spacing: ☐ Equal ☒ Non-Equal

	Spacing	Zone Area	Zone Depth(x) (inches)	Area Depth(x) (inches²)	Zone Depth(y) (inches)	Area Depth(y) (inches²)
C1 (in.)	0					
C2 (in.)	1	2.00	1.00	0.33	0.33	1.33
C3 (in.)	2	5.00	7.50	0.78	5.83	7.78
C4 (in.)	7	5.00	22.50	2.48	55.83	12.96
C5 (in.)	20	59.00	796.50	7.27	5791.83	211.23
C6 (in.)	10	10.00	150.00	7.78	1166.67	44.44
C7 (in.)	0	5.00	25.00	3.33	83.33	26.67
C8 (in.)	0					
C9 (in.)	0					
C10 (in.)	0					

Average Crush (inches): 11.66

Results

	A	B	Average Force (pounds)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	Closing Speed (mph)
Minimum	62.7	61.2	33372.60	41697.79	19.7	18.6	29.8
Avg - 2 Std. Deviations	56.6	47.3	26142.93	32972.10	17.5	16.7	26.8
Avg - 1 Std. Deviations	76.2	68.7	37712.48	47338.18	21.0	19.7	31.5
Average	95.8	90.1	49282.03	61706.24	24.0	22.2	35.6
Avg + 1 Std. Deviations	115.4	111.5	60851.58	76075.14	26.6	24.5	39.3
Avg + 2 Std. Deviations	135.0	132.9	72421.13	90444.47	29.0	26.6	42.6
Maximum	128.0	126.5	68912.13	86043.68	28.3	26.0	41.6

e Centroid Depth (x) (inches): 7.09

e Centroid Depth (y) (inches): 175.49

Area of Damage (inches²): 1002.50

k²: 3037.10

Eff. Mass Ratio (gamma): 1.00

Load previously saved comparison Save current comparison

Angle Coll Force to Normal (degrees): 0

No Damage Speed (mph): 5

Energy Crush Depth (inches): 3.00

Auto-Calculate Energy Crush Depth ☒

Impact Location: ☒ Front ☐ Side ☐ Rear ☐ Other

Vehicle 2 Crush Measurements:

	A	B
Average	68.2	217.4
Minimum	62.7	217.4
Maximum	1090.9	555.2

Damage Length (inches): 50

Crush Profile Measurements: 2

Crush Spacing: ☒ Equal ☐ Non-Equal

	Spacing	Zone Area	Zone Depth(x) (inches)	Area Depth(x) (inches²)	Zone Depth(y) (inches)	Area Depth(y) (inches²)
C1 (in.)	5	50.00	150.00	1.72	258.33	19.44
C2 (in.)	1					
C3 (in.)	0					
C4 (in.)	0					
C5 (in.)	0					
C6 (in.)	0					
C7 (in.)	0					
C8 (in.)	0					
C9 (in.)	0					
C10 (in.)	0					

Average Crush (inches): 3.00

Results

	A	B	Average Force (pounds)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	bSub1
Minimum	68.2	217.4	33372.60	17679.19	10.0	11.2	28.0
Avg - 2 Std. Deviations	578.0	155.9	26142.93	15047.07	9.2	10.1	23.7
Avg - 1 Std. Deviations	740.7	255.9	37712.48	19233.78	10.4	11.8	30.4
Average	882.1	363.0	49282.03	23307.85	11.4	13.4	36.2
Avg + 1 Std. Deviations	1009.0	475.0	60851.58	27304.35	12.4	14.8	41.4
Avg + 2 Std. Deviations	1125.1	590.6	72421.13	21326.45	10.9	16.0	46.2
Maximum	1090.9	555.2	68912.13	30053.81	13.0	15.6	44.8

e Centroid Depth (x) (inches): 1.72

e Centroid Depth (y) (inches): 19.44

Area of Damage (inches²): 150.00

k²: 3729.11

Eff. Mass Ratio (gamma): 1.00

Print

For Each KNOWN A-B pair, the Following is calculated:

$$\begin{aligned} \text{Average Force}_1 &= F = [(A + B \cdot C_{\text{avg}}) \cdot L] / (2 \cdot \cos \alpha) \\ E_1 &= [(A_1 + B_1 \cdot \bar{x}_1) \cdot A_{D1} + (A_1^2 \cdot L_1) / (2 \cdot B_1)] \cdot (1 + \tan^2 \alpha_1) \\ \text{KE Speed}_1 &= [(30 \cdot E_1) / W_1]^{0.5} \\ k_1^2 &= [([L_1 / (W_1 / g)]^{0.5}) \cdot 12]^2 \\ \gamma_1 &= k_1^2 / (k_1^2 + h_1^2) \end{aligned}$$

$$\begin{aligned} \text{Average Force}_2 &= \text{Average Force}_1 \\ \text{Vehicle 2 } b_1 &= -1 \cdot (W_2 \cdot b_0) \pm [(W_2 \cdot b_0)^2 - 4 \cdot (W_2 \cdot C_{2\text{avg}}) \cdot (-2 \cdot g \cdot F_1 \cdot \cos \alpha)]^{0.5} / [2 \cdot (W_2 \cdot C_{2\text{avg}})] \end{aligned}$$

$$\begin{aligned} A_2 &= (W_2 \cdot b_0 \cdot b_1) / (g \cdot L_{2\text{test}}) \\ B_2 &= (W_2 \cdot b_1 \cdot b_1) / (g \cdot L_{2\text{test}}) \end{aligned}$$

$$\begin{aligned}
G_2 &= (A_2 * A_2) / (2 * B_2) \\
E_2 &= [(A_2 + B_2 \bar{x}_2) * A_{D2} + (A_2^2 * L_2) / (2 * B_2)] * (1 + \tan^2 \alpha_2) \\
KE \text{ Speed}_2 &= [(30 * E_2) / w_2]^{0.5} \\
k_2^2 &= [([I_{22} / (w_2 / g)]^{0.5}) * 12]^2 \\
\gamma_2 &= k_2^2 / (k_2^2 + h_2^2)
\end{aligned}$$

If a PDOF Lever Arm distance and Angle between the Collision Force and Normal Force have been entered, the following speeds can be calculated:

$$\Delta V_1 = [2 * \gamma_1 * (E_1 + E_2) / ((W_1/g) * (1 + ((\gamma_1 * W_1/g) / (\gamma_2 * W_2/g))))]^{0.5} * 3600/5280$$

$$\Delta V_2 = [\Delta V_1 * (W_1/g) / (W_2/g)]$$

$$\text{Closing Speed} = [(\Delta V_1 * (5280/3600) / \gamma_1) + (\Delta V_2 * (5280/3600) / \gamma_2)] * 3600/5280$$

4N6XPRT SHFCalcs - Selected Vehicle: 2008 CHEVROLET COBALT

File Print Reports Settings Help Reg To: 4N6XPRT SYSTEMS

Basic Vehicle Search NHTSA Test Selection Advanced Vehicle Search Force Balance

Average Crush (inches): 11.66

Results

	A	B	Average Force (pounds)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	Closing Speed (mph)
Minimum	62.7	61.2	33372.60	41697.79	19.7	18.6	29.8
Avg - 2 Std. Deviations	56.6	47.3	26142.93	32972.10	17.5	16.7	26.8
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Maximum	128.0	126.5	68912.13	86043.68	28.3	26.0	41.6

e Centroid Depth (x) (inches): 7.09 k²: 3037.10
e Centroid Depth (y) (inches): 175.49 Eff. Mass Ratio (gamma): 1.00
Area of Damage (inches²): 1002.50

Load previously saved comparison Save current comparison

Results

Average Crush (inches): 3.00

	A	B	Average Force (pounds)	Damage Energy (ft*lbs)	KE Speed (mph)	Delta V (mph)	bSub1
Minimum	682.7	217.4	33372.60	17679.19	10.0	11.2	28.0
Avg - 2 Std. Deviations	578.0	155.9	26142.93	15047.07	9.2	10.1	23.7
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Avg + 2 Std. Deviations	1125.1	590.6	72421.13	21326.45	10.9	16.0	46.2
Maximum	1090.9	555.2	68912.13	30053.81	13.0	15.6	44.8

e Centroid Depth (x) (inches): 1.72 k²: 3729.11
e Centroid Depth (y) (inches): 19.44 Eff. Mass Ratio (gamma): 1.00
Area of Damage (inches²): 150.00

Print

$$\text{Damage Centroid depth}(x) = \bar{x} = \frac{\sum[\text{Area Depth}(x)]}{\sum[\text{Zone Area}]}$$

$$\text{Damage Centroid depth}(y) = \bar{y} = \frac{\sum[\text{Area Depth}(y)]}{\sum[\text{Zone Area}]}$$

$$\text{Area of Damage} = L * C_{\text{avg}}$$

Selected References:

For the formulas used to calculate the Yaw Moment of Inertia, we refer you to SAE # 881767, “**Vehicle Inertial parameters - measured values and approximations**” by W.R. Garrott, M. W. Monk, and J. P. Chrstos

For more information on the Force Balance process, we refer you to:
“**Balancing Collision Forces in Crush / Energy Analysis**” by Nathan Shigemura and Andrew Rich available from the IPTM Webstore
<http://www.iptm.org/webstore/> under Crash Investigation Publications.

Several SAE papers discuss the Force Balance method, among them -
970942 / 1999-01-0079 / 2005-01-1188 and **2005-01-1205**.

For more information on Crush Energy calculations, as well as Accident Investigation and Reconstruction calculations in general, we refer you to:
Fundamentals of Traffic Crash Reconstruction Volume 2 of the Traffic Crash Reconstruction Series by John Daily, Nathan Shigemura, and Jeremy Daily available from the IPTM Webstore
<http://www.iptm.org/webstore/> under Crash Investigation Publications.