

Default NHTSA Car Data (Stiffness Coefficients)

Vehicle Stiffness Coefficient Categories

The concept of “stiffness coefficients” as “force deflection characteristics” for use in even the most basic delta-V to “crush” damage analytical models dates back to at least 1981 when the “generic vehicle data” table relating vehicle wheelbase to a class category and then a ranged or averaged pair of “A” and “B” stiffness coefficients was created. In 1984, the categories were broadened for use in programs beyond the original CALSPAN CRASH3 model.

All the same, the majority of data from that period was based on crash tests involving front engine, rear wheel drive cars of pre-1980 vintage. It wasn't until 1996 that there was a broad revision of the generic vehicle stiffness data table. That more recent collection of class-general “A” and “B” stiffness coefficients is offered here.

Source

In the paper “*Updating the vehicle Class Categories*,” SAE 960897, Siddall and Day (a) redefined the class categories to be more representative of modern vehicles and (b) updated the general “A” and “B” stiffness coefficients to more appropriately reflect vehicles currently on the road. While the parameters described in that paper include dimensions, suspension information and inertial information for vehicles within the class, for the purposes of this section of *AR Pro*, the “A” and “B” stiffness coefficients are offered here for use in the 2, 4 and 6 point delta-S/delta-V relative to crush model.

Class groups and stiffness coefficients

Vehicle class groups and general “A” and “B” stiffness coefficients from the Sidall paper for those class groups are listed below. Representative models are selected based on the top ten in sales for each passenger, pickup, multi-purpose and van class:

Passenger Cars

Class 1

Wheelbase: 80.9 - 94.8 in

Representative models: Ford Escort, Hyundai Excel, Honda CRX, Chevrolet Chevette, Chevrolet Spectrum, Toyota Tercel, Dodge Colt, Pontiac Fiero, Mazda 323, Ford Festiva

Stiffness

Impact Area	A (lb/in)	B (lb/in ²)
Front	180.25	72.11
Rear	172.50	64.40
Side	88.25	59.75

Class 2

Wheelbase: 94.8 - 101.6 in

Representative models: Chevrolet Cavalier, Ford Tempo, Chevrolet Camaro, Ford Mustang, Plymouth Reliant, Honda Civic, Dodge Omni, Nissan Sentra, Toyota Corolla, Dodge Shadow

Stiffness

Impact Area	A (lb/in)	B (lb/in ²)
Front	184.69	66.38
Rear	162.33	49.44
Side	100.00	66.20

Class 3

Wheelbase: 101.6 -110.4 in

Representative models: Ford Taurus, Pontiac Grand Am, Chevrolet Lumina, Ford Thunderbird, Toyota Camry, Nissan Maxima, Dodge Dynasty, Honda Accord, Plymouth Acclaim

Stiffness

Impact Area	A (lb/in)	B (lb/in ²)
Front	206.64	69.97
Rear	189.62	51.77
Side	99.75	77.75

Class 4

Wheelbase: 110.4 -117.5 in

Representative models: Buick LeSabre, Chevrolet Caprice, Ford Crown Victoria, Chrysler 5th Ave., Lincoln Town Car, Jaguar XJ6, Lexus LS400, Mercedes S Class, Acura Legend, Infinity Q45

Stiffness

Impact Area	A (lb/in)	B (lb/in ²)
Front	215.40	66.70
Rear	186.00	47.00
Side	137.00	95.00

Class 5

Wheelbase: >117.5in

Representative models: Cadillac Fleetwood, Buick Electra, Mercedes SEL

Stiffness

Impact Area	A (lb/in)	B (lb/in ²)
Front	288.73	113.45
Rear	292.40	138.00
Side	137.00	95.00

Pickup trucks**Class 1**

Wheelbase: <114 in

Representative models: Chevrolet S-10, Ford Ranger, Dodge D-50, Toyota, Nissan, Jeep Commanche, Mazda, Isuzu

Stiffness

Impact Area	A (lb/in)	B (lb/in ²)
Front	266.08	108.92
Rear	258.33	108.83
Side	103.00	92.00

Class 2

Wheelbase: >114 in

Representative models: Chevrolet C/K series, Ford F-Series, Dodge D/W, Jeep J-10, Toyota T-100

Stiffness

Impact Area	A (lb/in)	B (lb/in ²)
Front	219.60	68.40
Rear	290.67	123.00

Side	78.00	40.00
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Vans

Class 1

Wheelbase: <115.4 in

Representative models: Dodge Caravan, Chevrolet AstroVan, Ford Aerostar, Chevrolet Lumina, Toyota Previa, Mazda MPV, Volkswagon Vanagon, Toyota Van, Nissan Van

Stiffness

Impact Area	A (lb/in)	B (lb/in ²)
Front	309.00	135.00
Rear	281.00	118.50
Side	96.00	78.00

Class 2

Wheelbase: >115.4 in

Representative models: Chevrolet van, Ford van, Dodge van

Stiffness

Impact Area	A (lb/in)	B (lb/in ²)
Front	358.75	154.75
Rear	312.00	141.73
Side	137.00	95.00

Multi-purpose vehicles

Class 1

Wheelbase: <104.5 in

Representative models: Chevrolet S-10 Blazer, Jeep Cherokee, Ford Bronco II, Toyota 4-Runner, Geo Tracker, Dodge Raider, Suzuki Samauri, Jeep Wrangler, Nissan Pathfinder

Stiffness

Impact Area	A (lb/in)	B (lb/in ²)
Front	266.08	108.92
Rear	258.33	108.83
Side	103.00	92.00

Class 2

Wheelbase: >104.5 in

Representative models: Ford bronco, Chevrolet Suburban, Chevrolet K-5 Blazer, Ford Explorer, Dodge RamCharger, Isuzu Trooper, Toyota Land Cruiser, Isuzu Rodeo

Stiffness

Impact Area	A (lb/in)	B (lb/in ²)
Front	219.60	68.40
Rear	290.67	123.00
Side	78.00	40.00

Limitations

No stiffness coefficients have been published for tractors, trailers, motor homes, motorcycles, motorcycle sidecars, bicycles. For that reason, these vehicles fall outside the limits and assumptions of the

underlying "CRASH 3" model.

The following is pre-1996 (circa 1984) data:

**Vehicle Stiffness
Categories by
Wheelbase and
Weight and Default
Data**

	MI	SU	CO	IN	FU	LG	VN	PU	FW	MB
Wheelbase (in)	80.9-94.8	94.8-101.6	101.6-110.4	110.4-117.5	117.5-123.2	123.2-150	109-130			120.0
Track (in)	51.1	54.6	58.9	61.8	63.7	63.7	67.6	Select Category		60.0
Length (in)	159.8	174.9	196.2	212.8	223.7	229.4	183.6	1 – 6 according		100.0
Width (in)	60.8	67.2	72.6	77.0	79.8	79.8	79.0	to wheelbase		78.0
a (in)	45.1	46.3	51.3	54.7	58.1	60.1	48.5			54.0
b (in)	48.1	50.1	55.5	59.2	63.0	65.1	68.5			66.0
XF (in)	76.0	83.3	89.8	98.8	101.08	104.2	75.6			84.0
XR (in)	83.8	91.6	106.4	114.0	121.9	125.2	107.0			96.0
YS (in)	30.4	33.6	36.3	38.5	39.9	39.9	39.5			50.
Kg (in ²)	2006	2951	3324	3741	4040	4229	3713			4024
M (lb-sec ² /in)	5.70	7.90	9.18	10.99	12.59	13.74	11.20			10.35
Curb Weight (lb)	2469	2753	3247	3947	4565	5009	4000			4000

**STIFFNESS
COEFFICIENTS**

Front (F) A (lb/in)	302	259	317	356	325	325	383	480	373
Front (F) B (lb/in ²)	47	43	56	34	37	37	126	50	38
Rear (B) A	366	391	410	357	297	297	300	346	
Rear (B) B	38	41	44	13	70	70	55	25	
Side (R,L) A	77	140	173	143	177	177			
Side (R,L) B	37	67	57	50	47	47			

DEFINITIONS:

a = Distance from c.g. to front axle.

b = Distance from c.g. to rear axle.

XF = Distance from c.g. to front of vehicle.

XR = Distance from c.g. to rear of vehicle (measured in negative direction).

YS = Distance from c.g. to side of vehicle.

Kg = Radius of gyration, squared.

M = Vehicle mass, including 2 passenger loading.

MI = Miniature

SU = Subcompact

CO = Compact

IN = Intermediate

FU = Full Size

LG = Large

VN = Van

PU = Pickup

FW = Front Wheel Drive