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Trends in the Static Stability Factor of Passenger Cars, Light Trucks, and Vans

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Abstract

Rollover crashes kill more than 10,000 occupants of passenger vehicles each year. As part of its mission to reduce fatalities and injuries, since model year 2001 NHTSA has included rollover information as part of its New Car Assessment Program (NCAP) ratings. One of the primary means of assessing rollover risk is the static stability factor (SSF), a measurement of a vehicle's resistance to rollover. The higher the SSF, the lower the rollover risk. This report tracks the trend in SSF over time, looking in particular at changes in various passenger vehicle types.

Data are presented for overall fleet average SSFs by vehicle type over a number of model years. Passenger cars, as a group, have the highest average SSF, and these have remained high. SUVs have substantially improved their SSF values over time, especially after model year 2000, whereas those of pickup trucks have remained consistent over the years. Minivans showed considerable improvement since they were first introduced, while full-size vans showed a small but steady improvement. In model year 2003, the sales-weighted average SSF was 1.41 for passenger cars, 1.17 for SUVs, 1.18 for pickup trucks, 1.24 for minivans, and 1.12 for full-size vans.

Introduction and Background

Rollovers are among the most severe traffic crashes, and are of particular concern for occupants of light trucks and vans (LTVs) - including pickup trucks, sport utility vehicles (SUVs), minivans and full-size vans up to 10,000 pounds gross vehicle weight rating (GVWR). While only about 3 percent of all passenger vehicle (passenger car and LTV) crashes involve rollover, according to the 2003 Fatality Analysis Reporting System (FARS), one-third of all passenger vehicle occupants who lost their lives were in vehicles that rolled over, a total of 10,376 rollover deaths. Of these, 4,433 were in passenger cars, 2,639 in SUVs, 2,569 in pickup trucks, 724 in vans, and the remaining 11 in other or unknown types of light trucks. Passenger cars had the lowest rollover fatality rate (23 percent of fatalities were in vehicles that rolled over), while SUVs had the highest, 59 percent. Similarly, according to the General Estimates System (GES), 6 percent of passenger car occupants who were injured were in vehicles that rolled over. LTV rates of rollover-related injured occupants were higher – 9 percent of those injured in vans, 13 percent in pickup trucks, and 20 percent in SUVs. Looking at occupant fatalities per 100,000 registered vehicles, passenger cars had the lowest rate at 3.69, with vans similarly low at a rate of 3.83. The rates for pickup trucks (7.18) and SUVs (10.22) were much higher.¹ Clearly, rollover crashes are a major safety problem for all classes of light vehicles, particularly LTVs.

On June 1, 2000, the National Highway Traffic Safety Administration proposed adding a measure of rollover resistance to the NCAP program, to begin in model year 2001.² It was the agency's belief that consumer information on the rollover risk of passenger cars and LTVs would influence some consumers to purchase vehicles with a lower rollover risk, and inspire manufacturers to produce vehicles with a lower rollover risk. This, in turn, would reduce the number of injuries and fatalities from rollover.

¹ 2003 Fatality Analysis Reporting System (FARS); NHTSA; USDOT.

² 65 FR 34988 (June 1, 2000)

Section 12 of The Transportation Recall Enhancement, Accountability, and Documentation (TREAD) Act,³ enacted November 1, 2000, directed the Secretary of the Department of Transportation to develop a rollover test for motor vehicles, to carry out a program of rollover tests, and to develop and disseminate consumer information on rollover performance.⁴ This responsibility was subsequently delegated to NHTSA. As planned, in model year 2001 NHTSA began including rollover resistance information in its NCAP.

The original rollover resistance ratings were determined solely from the vehicle's static stability factor. The SSF of a vehicle is an at-rest calculation of its rollover resistance, based on its most important geometric properties. Basically, SSF is a measure of how top-heavy a vehicle is. A vehicle's SSF is calculated using the formula:

$$SSF = \frac{T}{2H}$$

where

T=track width

H=height of the center of gravity of the vehicle

The track width is the distance between the centers of the right and left tires along the axle. The location of the center of gravity is measured in a laboratory to determine the average height above the ground of the vehicle's mass. The lower the SSF number, the more likely the vehicle is to roll over in a tripped single-vehicle crash. A higher SSF value equates to a more stable, less top-heavy vehicle. SSF values across all vehicle types typically range from around 1.00 to 1.50. Most passenger cars have values in the 1.30 to 1.50 range. Higher-riding SUVs, pick-up trucks, and vans usually have values in the 1.00 to 1.30 range.⁵

Throughout the development of testing procedures, both linear and logistic regressions were run to determine and verify the relationship between SSF and rollover.^{6 7 8} It was found that the correlation of SSF to rollovers in single-vehicle crashes is exceptionally robust in an area as complex as rollover.

Commenters on the Federal Register announcement had suggested that the rating system did not go far enough, and suggested that a dynamic test be added.⁹ NHTSA sought to expand the information provided in its rollover resistance ratings, and requested comments on the subject of dynamic rollover testing.¹⁰ After evaluating numerous driving maneuver tests for the dynamic

³ Public Law 106-414, 114 Stat. 1800 (2000).

⁴ See 49 U.S.C.30117 (c)

⁵ NHTSA Rollover FAQ: <http://www.safercar.gov/Rollover/pages/faqs.htm> Note that a value of 1.00 does not have any special significance. It is not an index or a minimum. It simply means the track width is exactly double the height. It is a low value of SSF, but some vehicles have had even lower values.

⁶ 65 FR 34988, Appendix (June 1, 2000).

⁷ 66 FR 3388, Appendix 1(January 12, 2001).

⁸ 68 FR 59250, Appendix 2 (October 14, 2003).

⁹ 66 FR 3388, 3403 (January 12, 2001).

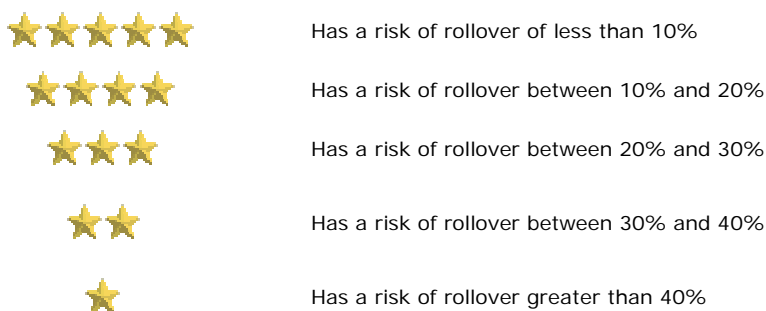
¹⁰ 66 FR 35179 (July 3, 2001).

rollover consumer information, NHTSA published its findings in a notice of proposed rulemaking in the Federal Register.¹¹ The final modifications to the rollover resistance ratings in NCAP, including the addition of dynamic rollover tests, were announced¹² and took effect beginning with model year 2004 vehicles.

The new dynamic maneuvering test used by NHTSA to help evaluate rollover risk utilizes a heavily loaded vehicle (to represent a five-occupant load), and a full tank of gas. Using a fishhook pattern, the vehicle simulates a high-speed collision avoidance maneuver—steering sharply in one direction, then sharply in the other direction—within about one second. Test instruments on the vehicle measure if the vehicle’s inside tires lift off the pavement during the maneuver ("inside" meaning the left wheels if turning left, and the right wheels if turning right). The vehicle is considered to have tipped up in the maneuver if both inside tires lift at least two inches off the pavement simultaneously. The tip-up/no tip-up results are then used with the SSF measurement as inputs in a statistical model that estimates the vehicle’s overall risk of rollover in a single-vehicle crash.¹³

Thus, for model years prior to 2004, rollover resistance ratings were based solely on the SSF. Starting with 2004 model year vehicles, rollover ratings combine both SSF and the tip-up or no tip-up results of the dynamic maneuvering rollover test. The results of this new process of generating rollover ratings, and its effect on future SSF trends as well as the design of future vehicle, are outside the scope of this report. They can be evaluated in the future as data becomes available.

NHTSA’s Web site and Buying A Safer Car brochure provide rollover resistance information as well as ratings for specific make and models of vehicles by model year. Rollover ratings for individual vehicles can be viewed by visiting www.safercar.gov. Passenger vehicles of all types (cars and LTVs) are included. For simplicity, ratings are converted to a graphical star system, similar to NCAP’s impact testing program. A vehicle’s rollover resistance rating is an estimate of its risk of rolling over in a single-vehicle crash, not a prediction of the likelihood of a crash. As the chart below indicates, the lowest-rated vehicles (1 star) are at least four times more likely to roll over than the highest-rated vehicles (5 stars) when involved in a single-vehicle crash.



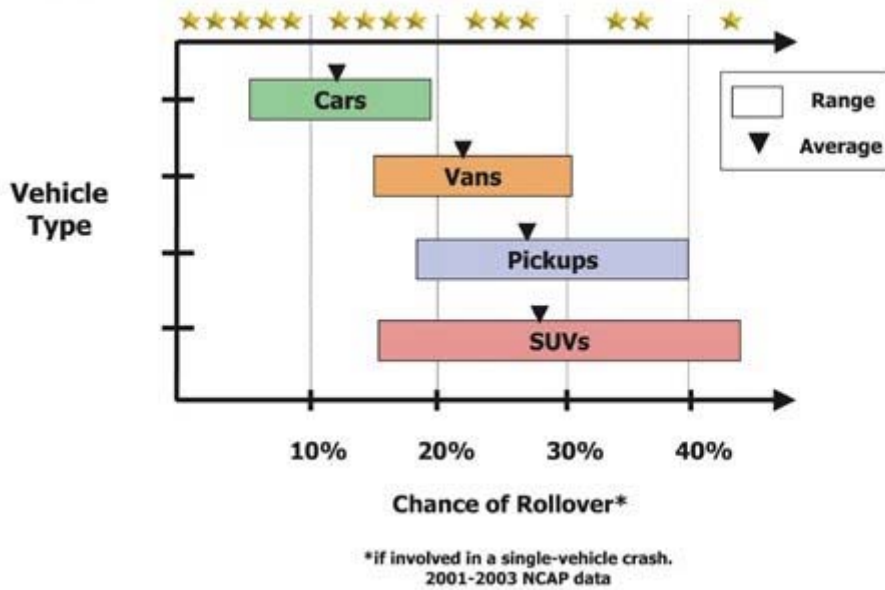
Source: <http://www.safercar.gov/Rollover/pages/RatSysInterpret.htm>

¹¹ 67 FR 62528 (October 7, 2002).

¹² 68 FR 59250 (October 14, 2003).

¹³ <http://www.safercar.gov/Rollover/pages/faqs.htm#dynamic>

Because rollover risk is a function of vehicle design, the different vehicle types tend to have differing patterns of risk. The injury and fatality experience also bear this out, as previously noted. The chart below helps consumers make comparisons across vehicle classes. The information is based on data from all vehicles tested under NHTSA’s 2001-2003 rollover resistance ratings system (SSF only). For example, all passenger cars that were tested have 4- or 5-star ratings, and an average chance of rollover of approximately 12 percent if involved in a single-vehicle crash. The range for passenger cars is approximately 6 percent to 19 percent.



Source: <http://www.safercar.gov/Rollover/pages/RatSysVCompare.htm>

The purpose of this report was to track the trend in SSF over several years for numerous vehicles, to determine whether more recent models have higher SSF values and are therefore less prone to rollover. The rollover ratings are produced for consumer information only; no regulatory requirements specifically related to rollover mitigation are placed on vehicle manufacturers. If consumers use the information to purchase vehicles with higher rollover reliability ratings, then manufacturers would presumably design and produce vehicles to meet that public demand. This report attempts to see if that is what has indeed occurred in the marketplace.

Data Acquisition

In order to examine the trends in the static stability factor over time, it was necessary to locate SSF values for as many different vehicles, over as many model years, as possible. Several

published sources of data^{14 15 16 17} provided such data over a number of years. More recent information was obtained from NHTSA's NCAP data.

An SSF value for a given model year was considered to be the same for all model years of a particular vehicle during which it had not undergone a major redesign. For example, an SSF measurement of 1.334 was obtained for a 1987 Toyota Camry. The Camry was first introduced in model year 1983. Although numerous changes were made over the years (including noticeably increased power and a sleeker look in 1987), it wasn't until 1992 that there was what would be characterized as a major redesign. (An example of a major redesign would include a change in wheelbase – for the Camry this remained at 102.4 inches until model year 1992, when it increased to 103.1.) Thus, the value of 1.334 was used for all model year 1983 through 1991 Toyota Camrys. Another SSF measurement, 1.460, was obtained for the model year grouping 1992 through 1996 (after which there was another major redesign), and this value was used for this set of model years.

If more than one SSF value was obtained for a model year grouping, the midpoint model year between two consecutive values would be determined, with the earlier value being used for all model years earlier than that point, and the later value for the more recent years. If two distinct SSF measurements were obtained for the same model year, these were averaged. In some cases, however, while the SSF value was known for a model year grouping, it could not be determined which model year vehicle had been measured. In this case, the value itself was used for the appropriate span of model years. However, if a second value was obtained for a vehicle in that model year grouping, the values were averaged, since a specific model year was not known for one of the values. This was the procedure used to assign SSF values to each model year for a particular vehicle.

Along with covering a span of model years, vehicles that were clones (“sisters,” “corporate cousins”) of one another were also considered to have the same SSF value in cases where the vehicles were virtually identical. These sister vehicles are predominantly comparable, being built on the same platform. Measurements of vehicle height and width were used to determine whether specific models were alike enough to be considered as having the same SSF value, since these would directly affect the SSF. For example, one group of corporate cousins consists of the Dodge Daytona, model years 1984 through 1993; Plymouth Sundance, 1987-1994; Dodge Shadow, 1987-1994; and the Chrysler Laser, 1984-1986. An SSF measurement was available for the 1987 Plymouth Sundance. While the four vehicles all have a wheelbase of 97 inches and are built on the same platform, only the Plymouth Sundance and the Dodge Shadow had identical height and width measurements (52.7 and 67.3 inches, respectively). The Plymouth Laser,

¹⁴ Technical Assessment Paper: Relationship Between Rollover and Vehicle Factors,” National Highway Traffic Safety Administration, Rulemaking, Office of Vehicle Safety Standards, July 1991, available from Docket 91-68-N01.

¹⁵ Harwin, E.A. and Brewer, H.K., “Analysis of the Relationship between Vehicle Rollover Stability and Rollover Risk Using the NHTSA CARDfile Accident Database,” *Journal of Traffic Medicine*, Vol. 18, No. 3, 1990; *Technical Assessment Paper: Relationship between Rollover and Vehicle Factors*, NHTSA Docket No. 91-068-N01-0003, Washington, 1992

¹⁶ Heydinger, G.J., Bixel, R.A., Garrott, W.R., Pyne, M., Howe, J.G., Guenther, D.A., *Measured Vehicle Inertial Parameters – NHTSA's Data through November 1998*, SAE Paper 1999-01-1333, 1999.

¹⁷ 66 FR 3388, 3412-3415 (January 12, 2001).

however, had a height of only 50.3 inches, and a width of 69.3 inches. The Dodge Daytona's height was 51.8 inches, with a width of 69.3 inches. Thus, the SSF for the Sundance was also used for the Shadow, over the full range of model years, but not for either the Laser or Daytona.

In order to determine the trend in SSF in the motor vehicle fleet over time, it was necessary to examine the data weighted by vehicle sales. Thus, vehicles that represented a larger portion of the fleet would correspondingly contribute more to the SSF value for the model year. Registration data from the National Vehicle Population Profile¹⁸ (NVPP) was primarily used to approximate the number of vehicle sales. The number of vehicles of a given model year registered in the following calendar year (e.g., the number of model year 2001 Pontiac Bonnevilles registered in calendar year 2002) is a good estimate of total sales, because by the following year nearly all the vehicles of the model year have been sold, and very few have already been retired. This registration was supplemented with registration and sales information from several years of the Ward's Automotive Yearbook.¹⁹

Exhibit 1 presents, for data used in the analysis, the percentage of each type of vehicle for which both SSF values and sales (approximated from the next year's registration) were obtained. In all cases SSF values were available for earlier model years, but did not provide a large enough sample to be considered representative. At least 35% of the fleet was required in order for the data of that model year and vehicle type to be used. The one exception is full-sized vans, typically more of a commercial vehicle than the other types, which are more consumer oriented. This could account for their lack of available historical SSF values.

The SSF measurements for full-size vans that were available were for those vehicles more likely to be owned and used by individuals rather than commercially. For example, Ford E150 vans were used in the study, but there were no SSF measurements available for E250 or E350 vans. In order to include the full range of passenger vehicles, it was decided to retain the full-size vans, keeping them as a separate group and noting the small sample size. Minivans, however, are well represented, as are all other passenger vehicle types. Knowing that such a large proportion of vehicles were included in the analysis lends confidence that the findings are indeed representative of the fleet for each model year.

¹⁸ R. L. Polk & Co., Cincinnati, OH.

¹⁹ Ward's Communications, Southfield, MI.

Exhibit 1: Percent of Each Vehicle Type with SSF and Sales Data, by Model Year

Model Year	Passenger Cars	SUVs	Pickup Trucks	Mini Vans	Full Vans
1975		46%			
1976		52%			
1977		81%			
1978	50%	59%			
1979	56%	80%			
1980	61%	58%			
1981	61%	62%	49%		
1982	58%	93%	37%		
1983	58%	77%	74%		
1984	61%	92%	51%		
1985	64%	71%	71%	94%	10%
1986	66%	73%	70%	98%	9%
1987	71%	79%	72%	94%	9%
1988	72%	75%	73%	91%	7%
1989	70%	71%	76%	94%	7%
1990	65%	66%	74%	94%	6%
1991	66%	82%	83%	93%	4%
1992	72%	78%	82%	92%	13%
1993	69%	81%	82%	84%	11%
1994	67%	82%	84%	84%	10%
1995	62%	81%	76%	82%	11%
1996	65%	66%	74%	78%	10%
1997	67%	74%	72%	67%	11%
1998	64%	75%	80%	77%	15%
1999	66%	71%	64%	73%	14%
2000	69%	65%	66%	72%	13%
2001	73%	74%	59%	83%	12%
2002	77%	75%	57%	84%	12%
2003	76%	80%	60%	85%	12%

Changes in SSF Over Time

The objective of this report was to monitor the trend in static stability over time. The average SSF value was determined by vehicle type for each model year, weighted by vehicle sales. Thus, a passenger car with sales of 100,000 units would influence the average SSF twice as much as a vehicle selling 50,000.

Exhibit 2 presents the average SSF, by vehicle type, over the model years for which data were available. Several interesting trends are apparent. Passenger cars have had very stable SSF

Exhibit 3 presents the number of different make/models that contributed to the average SSF values presented above. This was not based on registered vehicles or sales data, but the number of unique vehicle make/models that were incorporated into the data. Corporate cousin vehicles were counted as individual vehicles in the table, since they are individual models that a consumer would consider purchasing. In addition, where data were available for both two-wheel and four-wheel drives, these were treated as separate vehicles. Some of the numbers of vehicles here are quite low, but still cover a large portion of the total vehicles sales (see Exhibit 1). These data are presented to provide information on the variety of vehicles used in the analysis.

Exhibit 3: Number of Vehicles used to Determine Average MY SSF

Model Year	Passenger Cars	SUVs	Pickup Trucks	Mini Vans	Full Vans
1975	49	4			
1976	55	6			
1977	62	5			
1978	94	5			
1979	114	5			
1980	115	5			
1981	105	13	15		
1982	107	12	17		
1983	118	15	18		
1984	124	19	18		
1985	125	19	23	11	6
1986	119	19	33	13	6
1987	105	23	34	16	6
1988	108	23	39	17	6
1989	106	26	38	21	6
1990	100	27	38	28	6
1991	83	36	43	31	6
1992	78	36	42	29	7
1993	80	38	41	28	7
1994	66	37	44	28	5
1995	65	36	47	24	5
1996	68	36	42	22	3
1997	76	41	42	22	3
1998	81	45	43	17	3
1999	90	52	42	15	3
2000	94	52	42	14	3
2001	49	68	38	14	3
2002	55	80	36	16	3
2003	62	89	37	14	3

While looking at the SSF of the full fleet of vehicles each model year is quite useful, examining scores for vehicles as they are introduced gives a picture of the changes that occur each year as new vehicles are established. That is, what is the average SSF value for each vehicle type, looking only at the year a specific make/model is introduced or redesigned? This gives a more immediate picture of how vehicles are changing, but does not take into account that the design may stay the same in subsequent model years. For example, the 1983 through 1991 Camry (see above) had an SSF of 1.334, and the redesigned Camry in 1992 had an SSF of 1.460. The value of 1.334 would contribute only to the passenger car average of 1.31 for the model year 1983 in Exhibit 4, while the value of 1.460 would be a factor only in the 1992 average of 1.44. Table entries of N/A signify there were no available data on vehicles introduced or redesigned that model year. These data are presented in Exhibit 4.

**Exhibit 4: Average SSF by Vehicle Type, by Model Year Introduced
(Weighted by Sales Data)**

Model Year	Passenger Cars	SUVs	Pickup Trucks	Mini Vans	Full Vans
1978	1.38	N/A			
1979	1.43	N/A			
1980	1.36	1.05			
1981	1.36	1.12	1.20		
1982	1.38	1.11	1.18		
1983	1.31	1.11	1.09		
1984	1.35	1.06	1.13		
1985	1.36	1.05	1.15	1.11	1.09
1986	1.37	N/A	1.15	1.11	N/A
1987	1.38	1.08	1.25	1.04	N/A
1988	1.36	N/A	1.20	1.21	N/A
1989	1.39	1.14	1.07	1.13	N/A
1990	1.42	1.07	N/A	1.12	N/A
1991	1.39	1.09	1.20	1.21	N/A
1992	1.44	1.08	N/A	1.13	1.11
1993	1.44	1.11	1.15	N/A	N/A
1994	1.45	N/A	1.18	N/A	N/A
1995	1.41	1.13	1.24	1.24	N/A
1996	1.43	1.08	1.15	1.23	1.10
1997	1.43	1.10	1.20	1.18	N/A
1998	1.41	1.15	1.14	1.25	1.14
1999	1.41	1.18	1.22	1.27	N/A
2000	1.40	1.12	1.16	1.21	N/A
2001	1.40	1.20	1.14	1.22	N/A
2002	1.41	1.15	1.17	1.25	N/A
2003	1.39	1.22	1.14	N/A	N/A

Vehicles manufactured, unchanged, over a number of years would contribute to each model year it was available for Exhibit 2, but only once for Exhibit 4. Thus, the data in Exhibit 4 are based

on much smaller samples than those in Exhibit 2, and it is not surprising that the SSF values are more variable in Exhibit 4.

Passenger cars show the drop in SSF values from the early to late 1980s that was also seen in Exhibit 2, along with the following increase. The SSF measurements for passenger cars have remained high and comparatively consistent since then, although the trend after 1997 indicates newly designed models look to have slightly lower SSF values than models introduced in the early 1990s. SUV introductions have relatively consistent SSF values for most of the model years with available data, but do show an increase from about 1998 onward.

Newly introduced pickup truck SSFs range from 1.07 to 1.25, with no discernable pattern. It is clear, though, from comparing these data to those in Exhibit 2, that those newly introduced pickups with low SSF scores are offset by other available models and do not substantially affect the consistent model year average.

Minivans have shown substantial, consistent improvement in SSF values over the most recent decade. The average SSF of those introduced in 1995 through 2002 was about 0.10 higher than the preceding decade (an increase from 1.13 to 1.23). Little data are available for full van introductions, certainly not enough from which to draw inference.

The recently introduced “crossover” utility vehicles (CUVs) are the most consistently stable SUVs that have been manufactured. Real improvement is seen in this group of vehicles. Exhibit 5 presents SSF information on SUVs, separately for standard and crossover models. The original data for all SUV are repeated from Exhibit 2 for reference purposes. 1997 was the first model year with available data for any crossover SUV, so from that point on SSFs are presented separately for standard and crossover vehicles as well as for all SUVs combined.

Exhibit 5: Average SSF by SUV Type, by Model Year

Model Year	All SUV	Standard SUV	Crossover SUV
1991	1.08		
1992	1.09		
1993	1.09		
1994	1.09		
1995	1.09		
1996	1.09		
1997	1.10	1.10	1.19
1998	1.10	1.10	1.19
1999	1.11	1.10	1.19
2000	1.11	1.10	1.19
2001	1.14	1.11	1.22
2002	1.15	1.13	1.21
2003	1.17	1.13	1.22

Note that SSF values for crossover SUVs were clearly higher than standard SUVs since their introduction. In addition, standard SUVs showed no change in SSF for a number of years, but by

model year 2002 were showing a noticeable increase. Even the SSF values for crossover vehicles, which started relatively high, have increased over time. Thus, the SSF values for SUVs have increased, due to both the introduction of crossover vehicles as well as increases in SSF for traditional SUVs. The introduction of crossover vehicles, and their subsequent increase in percentage of fleet vehicles, has been an important factor in the increase in SSF values of SUVs. Exhibit 6 shows the percentage of the SUV fleet made up of crossover vehicles. In the first model year crossover vehicles were introduced, 1997, they made up less than 6 percent of all SUVs. Six years later, more than one out of every three SUVs sold is a crossover vehicle.

Exhibit 6: Percentage of new SUVs that are Crossover Vehicles

Model Year	Percentage CUV
1997	5.5%
1998	7.4%
1999	9.5%
2000	15.4%
2001	25.5%
2002	29.4%
2003	36.8%

Exhibit 7 presents the percentage of each type of vehicle (standard and crossover, as well as all SUVs) for which data were available. For crossover vehicles, the number of models with available SSF information is also listed. Note that for model year 1997, only one model was used, but accounted for 58 percent of crossover vehicles. Over time, more models became available, and sales of such vehicles increased as well, as shown in Exhibit 6.

Exhibit 7: Percent of Each SUV Type with SSF and Sales Data, by Model Year

Model Year	All SUV	Standard SUV	Crossover SUV
1991	82%		
1992	78%		
1993	81%		
1994	82%		
1995	81%		
1996	66%		
1997	74%	75%	58% (1)
1998	75%	76%	62% (2)
1999	71%	74%	51% (3)
2000	65%	71%	32% (4)
2001	74%	69%	90% (15)
2002	75%	75%	77% (21)
2003	80%	75%	89% (30)

Number of crossover models shown in parentheses

Overall, the news is good. Static stability factor has tended to increase for all vehicles, particularly SUVs, which tended to have the worst SSF values in the earlier years. Exhibit 2 shows that SUVs have recently raised their SSF values well above those of the full-size vans. The popularity of SUVs with consumers makes this a most welcome improvement.

SSF Increases in Specific Vehicles

Greater vehicle stability, as evidenced by increasing SSF values across vehicle types, occurs both as new make/models enter the market and as previous models are redesigned to appeal to a larger number of consumers. In the first category, perhaps the most noteworthy examples are the crossover vehicles that have been introduced in recent years. These are vehicles that have characteristics of two vehicle types, typically combining aspects of a passenger car with a sport utility vehicle. Examples would be the corporate cousins Ford Escape and Mazda Tribute, both introduced in model year 2001. These vehicles (classified as SUVs in this report) had SSF values of 1.23. The introduction of this new type of vehicle has been beneficial in increasing the SSF of SUVs.

A redesigned vehicle can be compared to its earlier model when SSF values are available for both versions, to note improvements that have occurred. Exhibit 8 presents some examples of passenger cars that increased their SSF values by 0.09 or more as part of a major redesign, while Exhibit 9 contains the same information on LTVs. Note that this report concerns vehicles

Exhibit 8: Passenger Cars Redesigned with Increased SSF

Make/Model	Corporate Cousins	Model Years	SSF
Chevrolet Cavalier 2-DR	Pontiac Sunbird 2-DR	1982-1994	1.30
	Pontiac Sunfire 2-DR	1995-2003	1.40
Ford Escort Wagon	Mercury Lynx Wagon	1987-1990	1.26
	Mercury Tracer Wagon	1991-1996	1.38
Ford Crown Victoria	Mercury Grand Marquis	1982-2000	1.40
		2001-2003	1.51
Honda Civic Hatchback		1980-1983	1.30
		1984-1987	1.40
Nissan Maxima		1987-1988	1.34
		1989-1994	1.44
Nissan Sentra 4-DR		1982-1986	1.32
		1987-1994	1.46
Oldsmobile Delta 88 4-DR		1977-1985	1.30
		1986-1999	1.40
Oldsmobile 98 4-DR		1981-1984	1.31
		1985-1987	1.40
Toyota Camry 4-DR		1983-1991	1.34
		1992-1996	1.46

Exhibit 9: LTVs Redesigned with Increased SSF

Make/Model	Model Years	SSF
Ford Bronco 4x4	1980-1984	1.04
	1985-1996	1.13
Ford Bronco II 4x4	1987-1990	0.99
Ford Explorer 2-DR 4x4	1991-1995	1.09
Chevrolet S10 4x4 Blazer 4-DR	1991-2003	1.09
Chevrolet Trailblazer 4x4 4-DR	2002-2003	1.18
Nissan Pathfinder 4x4 4-DR	1990-1995	1.07
	1996-2003	1.16
Ford Aerostar Wagon	1988-1997	1.11
Ford Windstar Wagon	1995-1998	1.24
Toyota Passenger Van	1985-1989	1.11
Toyota Previa Van	1991-1997	1.23

through model year 2003 only; thus that is the last possible model year listed in the Exhibits. Note also, in some cases what is listed as a redesigned vehicle is actually a successor vehicle, replacing a vehicle the manufacturer stopped producing. For example, the Ford Explorer is the successor to the Ford Bronco II. (There may exist other examples, but these are the ones for which NHTSA has before-and-after SSF test results.)

The previous listed examples are all of consecutive (and for some successor vehicles, concurrent) model year redesigns resulting in increased SSF values. Other examples are available in which an earlier vehicle has a substantially lower SSF than its redesigned counterpart, but SSF data are unavailable for some interim period. For example, the SSF for the 1983-1988 Ford Thunderbird is available. No measurement is available for the redesigned version produced from 1989 through 1997. The Thunderbird was not in production from 1998 through 2001, but in 2002 reappeared on a new platform, having undergone a major overhaul. Exhibits 10 and 11 present, for passenger cars and LTVs, respectively, examples of these interrupted or “long term” increases in SSF.

Exhibit 10: Passenger Cars Redesigned with Long-Term Increased SSF

Make/Model	Corporate Cousins	Model Years	SSF
BMW 300		1985-1994	1.20
		1999-2003	1.41
Chevrolet Corvette		1968-1982	1.57
		1997-2003	1.75
Ford Thunderbird 2-DR		1983-1988	1.29
		2002-2003	1.51
Mazda GLC		1981-1983	1.25
Mazda Protégé		1999-2003	1.42
Toyota Corolla	Chevrolet Nova Geo/Chevrolet Prizm	1984-1988	1.30
		1993-2002	1.42
Toyota Cressida 4-DR		1978-1984	1.28
Toyota Avalon 4-DR		1995-2003	1.42
Toyota Starlet Hatchback		1981-1984	1.21
Toyota Tercel Hatchback		1987-1990	1.41
Volkswagen Jetta		1981-1984	1.21
		2000-2003	1.37
Volvo 240		1975-1993	1.23
Volvo S 60		2001-2003	1.49

Exhibit 11: LTVs Redesigned with Long-Term Increased SSF

Make/Model	Corporate Cousins	Model Years	SSF
Chevrolet Suburban		1981-1991	1.02
		2000-2003	1.10
Isuzu Rodeo 4x4 4-DR		1992-1997	1.05
Isuzu Axiom 4x4		2002-2003	1.20
Toyota 4Runner 4x4		1984-1987	0.99
		2003	1.16
Jeep CJ-5		1972-1976	1.01
		1981-1983	1.03
Jeep CJ-7 4x4		1976-1981	1.03
		1982-1982	1.04
		1983-1984	1.05
Jeep Wrangler 4x4		1987	1.16
		1998-2003	1.13

Of course, not every new vehicle has a higher SSF than those that preceded it. If that were the case, the average SSF would have increased even more sharply than seen in Figure 2. The vehicles noted in Exhibits 8 through 11 are presented as some outstanding examples of passenger cars and LTVs that have been redesigned and/or succeeded by vehicles offering substantially improved stability.

As seen in this report, vehicles today are considerably improved with respect to stability as compared to those of the past, particularly in the case of sport utility vehicles. By providing information on SSF, NHTSA has enabled the consumer to make a better-informed purchase. Given the lead time necessary to introduce a new vehicle or redesign an existing vehicle extensively enough to alter its SSF, it is unlikely that market incentives begun in model year 2001 (when NCAP consumer rollover ratings were first available) could have influenced SSF values by model year 2003. However, it seems that by model year 2003, both manufacturers and consumers were in agreement of the need for greater stability in passenger vehicles. Examining trends in SSF over an even longer period of time would enable a more definitive statement on the impact that published NCAP information has had. However, the evidence suggests that manufacturers are responding to the marketplace and incorporating desirable changes into the new vehicle fleet.

Appendix: SSF Measurements and Vehicles Used in Analysis

The tables that follow present the vehicles for which SSF values were obtained. Also shown are the similar (corporate cousin) vehicles and range of models years for which the SSF value was used in the analysis. SSF values are presented here to two decimal places, but exact values as stated in the literature were used in the analysis.

<u>Test Vehicle</u>		SSF	<u>SSF Also Applies to</u>	
Model	Make/Model Year		Model	Make/Model years
Passenger Cars				
2002	Chrysler 300M 4-DR	1.43	1999 2003	Chrysler 300M 4-DR
	²⁰ Chrysler Cordoba	1.47	1978 1979	Chrysler Cordoba
			1978 1979	Dodge Charger/Magnum
1987	Chrysler LeBaron	1.33	1982 1995	Chrysler LeBaron
			1982 1983	Dodge 400
			1984 1986	Dodge 600
1985	Chrysler LeBaron GTS	1.24	1985 1989	Chrysler LeBaron GTS
			1983 1988	Dodge 600 4-DR
			1985 1988	Plymouth Caravelle
1985	Chrysler New Yorker	1.31	1983 1988	Chrysler New Yorker
2003	Chrysler Sebring Convertible	1.51	1996 2003	Chrysler Sebring Convertible
1978	Dodge Diplomat	1.39	1978 1979	Dodge Diplomat
	²¹ Dodge Diplomat	1.44	1980 1989	Dodge Diplomat
			1978 1980	Dodge Aspen
			1978 1980	Plymouth Volare
			1978 1981	Chrysler Lebaron
			1980 1983	Dodge Mirada
			1980 1983	Chrysler Cordoba
			1981 1983	Chrysler Imperial
			1982 1989	Plymouth Gran Fury
			1984 1989	Chrysler New Yorker 5th Ave
1989	Dodge Dynasty LE	1.37	1988 1993	Dodge Dynasty LE
			1988 1993	Chrysler New Yorker
2003	Dodge Intrepid 4-DR	1.45	1993 2003	Dodge Intrepid 4-DR
			1993 2003	Chrysler Concorde 4-DR
1985	Dodge Lancer	1.38	1985 1989	Dodge Lancer
1998	Dodge Neon	1.44	1995 1999	Dodge Neon
			1995 1999	Plymouth Neon
2001	Dodge Neon 4-DR	1.41	2000 2003	Dodge Neon 4-DR
			2000 2001	Plymouth Neon 4-DR
1983	Dodge Omni	1.38	1978 1990	Dodge Omni
			1981 1990	Plymouth Horizon
2003	Dodge Stratus 2-DR	1.44	2001 2003	Dodge Stratus 2-DR
			1995 2003	Chrysler Sebring 2-DR
2001	Dodge Stratus 4-DR	1.49	1995 2003	Dodge Stratus 4-DR
			2001 2003	Chrysler Sebring 4-DR
1985	Plymouth Reliant	1.34	1982 1989	Plymouth Reliant
			1981 1989	Dodge Aries 81-89
1987	Plymouth Sundance	1.36	1987 1994	Plymouth Sundance
			1987 1994	Dodge Shadow 87-94

²⁰ Literature states 1977–79 Cordoba had 1.47 SSF; exact model year of test vehicle not specified.

²¹ Literature states 1980 – 81 Diplomat had 1.44 SSF; exact model year of test vehicle not specified.

Test Vehicle		SSF	SSF Also Applies to	
Model Year	Make/Model		Model years	Make/Model
²² Ford Crown Victoria		1.47	1979 1981	Ford Crown Victoria
			1979 1981	Mercury Grand Marquis
1984 Ford Crown Victoria		1.40	1982 2000	Ford Crown Victoria
			1982 2001	Mercury Grand Marquis
2001 Ford Crown Victoria 4-DR		1.51	2001 2003	Ford Crown Victoria 4-DR
			2002 2003	Mercury Grand Marquis
1985 Ford Escort		1.38	1981 1985	Ford Escort
			1982 1985	Ford EXP
			1981 1985	Mercury Lynx
			1982 1983	Mercury LN7
1986 Ford Escort		1.42	1986 1986	Ford Escort
			1986 1986	Ford EXP
			1986 1986	Mercury Lynx
1989 Ford Escort		1.26	1987 1990	Ford Escort
			1981 1987	Mercury Lynx
2001 Ford Focus		1.33	2000 2003	Ford Focus
2001 Ford Focus Wagon		1.31	2000 2003	Ford Focus Wagon
²³ Ford Mustang		1.43	1979 1984	Ford Mustang
			1979 1986	Mercury Capri
1988 Ford Mustang		1.37	1985 1993	Ford Mustang
2001 Ford Taurus 4-DR		1.43	1996 2003	Ford Taurus 4-DR
			1996 2003	Mercury Sable 4-DR
2002 Ford Taurus Wagon		1.38	1996 2003	Ford Taurus Wagon
			1996 2003	Mercury Sable 4-DR Wagon
1988 Ford Taurus		1.45	1986 1989	Ford Taurus
			1986 1989	Mercury Sable
1992 Ford Taurus		1.40	1990 1995	Ford Taurus
			1990 1995	Mercury Sable
1987 Ford Tempo		1.31	1984 1994	Ford Tempo
			1984 1994	Mercury Topaz
2002 Ford Thunderbird 2-DR Convertible		1.51	2002 2003	Ford Thunderbird 2-DR Convertible
1987 Ford Thunderbird		1.29	1983 1988	Ford Thunderbird
			1983 1988	Mercury Cougar
2003 Jaguar S-Type 4-DR		1.51	2003 2003	Jaguar S-Type 4-DR
1992 Lincoln Continental		1.43	1988 2002	Lincoln Continental
2001 Lincoln LS 4-DR		1.51	2000 2003	Lincoln LS 4-DR
			2000 2002	Jaguar S-Type 4-DR
²⁴ Lincoln Town Car		1.44	1987 1997	Lincoln Town Car
2003 Lincoln Town Car 4-DR		1.48	2003 2003	Lincoln Town Car 4-DR
1986 Buick Century Estate Wagon		1.34	1984 1996	Buick Century Estate Wagon
			1984 1996	Oldsmobile Ciera Wagon
			1984 1990	Chevrolet Celebrity Wagon

²² 1.47 SSF is average of 1980 (1.434) and “1979-81” (1.5) vehicles.

²³ Literature states 1979 – 81 Mustang had 1.43 SSF; exact model year of test vehicle not specified.

²⁴ Literature states 1990 – 96 Town Car had 1.44 SSF; exact model year of test vehicle not specified.

Test Vehicle		SSF	SSF Also Applies to	
Model	Make/Model		Model	Make/Model
Year			years	
1986	Buick Electra	1.41	1985	1996 Buick Electra
1980	Buick LeSabre	1.39	1978	1985 Buick LeSabre
	²⁵ Buick LeSabre	1.39	1992	1996 Buick Roadmaster
			1986	1999 Buick LeSabre
2003	Buick Park Avenue 4-DR	1.43	1987	1999 Pontiac Bonneville
	²⁶ Buick Regal	1.40	2003	2003 Buick Park Avenue 4-DR
			1978	1981 Buick Regal
			1978	1987 Oldsmobile Cutlass
			1978	1988 Chevrolet Monte Carlo
			1978	1986 Pontiac Grand Prix
2003	Buick Regal 4-DR	1.41	1997	2003 Buick Regal 4-DR
	²⁷ Buick Skylark	1.38	1997	2003 Buick Century 4-DR
			1992	1997 Buick Skylark
			1992	1998 Oldsmobile Achieva
			1992	1998 Pontiac Grand Am
2003	Cadillac CTS 4-DR	1.40	2003	2003 Cadillac CTS 4-DR
	²⁸ Cadillac Deville	1.42	1978	1983 Cadillac Deville
			1985	1993 Cadillac Brougham
2002	Cadillac Deville 4-DR	1.48	2000	2003 Cadillac Deville 4-DR
	²⁹ Chevrolet Camaro	1.60	1978	1981 Chevrolet Camaro
			1978	1981 Pontiac Firebird
	³⁰ Chevrolet Camaro	1.53	1982	1992 Chevrolet Camaro
			1982	1992 Pontiac Firebird
	³¹ Chevrolet Camaro	1.50	1993	2002 Chevrolet Camaro
			1993	2002 Pontiac Firebird
1983	Chevrolet Caprice	1.30	1978	1996 Chevrolet Caprice
			1978	1985 Olds Delta 88
1984	Chevrolet Caprice Wagon	1.40	1978	1993 Chevrolet Caprice Wagon
			1978	1991 Buick Estate Wagon
			1978	1992 Olds Custom Cruiser
			1978	1989 Pontiac Safari
			1981	1984 Buick Electra Wagon
			1992	1996 Buick Roadmaster Wagon
1983	Chevrolet Cavalier 2-DR	1.28	1982	1994 Chevrolet Cavalier 2-DR
2003	Chevrolet Cavalier 2-DR	1.39	1995	2003 Chevrolet Cavalier 2-DR
1985	Chevrolet Cavalier 4-DR/wagon	1.32	1982	1994 Chevrolet Cavalier 4-DR/wagon
			1985	1994 Pontiac Sunbird

²⁵ Literature states 1992 – 96 LeSabre had 1.39 SSF; exact model year of test vehicle not specified.

²⁶ Literature states 1978 – 81 Regal had 1.40 SSF; exact model year of test vehicle not specified.

²⁷ Literature states 1992 – 97 Skylark had 1.38 SSF; exact model year of test vehicle not specified.

²⁸ Literature states 1981 – 84 DeVille/Broughm had 1.42 SSF; exact model year of test vehicle not specified

²⁹ Literature states 1974 – 81 Camaro had 1.60 SSF; exact model year of test vehicle not specified.

³⁰ Literature states 1988 – 92 Camaro had 1.53 SSF; exact model year of test vehicle not specified.

³¹ Literature states 1993 – 98 Camaro had 1.50 SSF; exact model year of test vehicle not specified.

Test Vehicle		SSF	SSF Also Applies to	
Model	Make/Model		Model	Make/Model
Year			years	
2001	Chevrolet Cavalier 4-DR	1.35	1995 2003	Chevrolet Cavalier 4-DR
			1995 2002	Pontiac Sunfire 4-DR
1979	Chevrolet Chevette	1.38	1978 1979	Chevrolet Chevette
			1981 1987	Pontiac T-1000
1980	Chevrolet Chevette	1.22	1980 1987	Chevrolet Chevette
³²	Chevrolet Citation	1.38	1980 1985	Chevrolet Citation
			1980 1984	Pontiac Phoenix
			1980 1984	Oldsmobile Omega
			1980 1985	Buick Skylark
³³	Chevrolet Corsica	1.30	1987 1996	Chevrolet Corsica
1973	Chevrolet Corvette	1.57	1978 1982	Chevrolet Corvette
2002	Chevrolet Corvette	1.75	1997 2003	Chevrolet Corvette
2001	Chevrolet Impala 4-DR	1.36	2001 2003	Chevrolet Impala 4-DR
³⁴	Chevrolet Lumina	1.34	1990 2001	Chevrolet Lumina
³⁵	Chevrolet Malibu	1.40	1978 1981	Chevrolet Malibu
			1978 1985	Oldsmobile Cutlass
			1979 1980	Buick Century
			1982 1986	Pontiac Bonneville
2002	Chevrolet Malibu 4-DR	1.40	1997 2003	Chevrolet Malibu 4-DR
2003	Chevrolet Monte Carlo 2-DR	1.42	2000 2003	Chevrolet Monte Carlo 2-DR
			1997 2003	Pontiac Grand Prix 4-DR
1980	Oldsmobile 98	1.31	1978 1984	Oldsmobile 98
1986	Oldsmobile 98	1.40	1985 1987	Oldsmobile 98
			1986 1999	Oldsmobile-Delta 88
			1997 1998	Oldsmobile Regency
1985	Oldsmobile Ciera A	1.36	1982 1996	Oldsmobile Ciera
			1982 1989	Chevy Celebrity
			1982 1996	Buick Century
³⁶	Oldsmobile 98	1.38	1988 1996	Oldsmobile-98
			1985 1993	Cadillac Deville
2003	Pontiac Bonneville 4-DR	1.45	2000 2003	Pontiac Bonneville 4-DR
			2003 2003	Buick LeSabre 4-DR
1984	Pontiac Fiero	1.47	1984 1988	Pontiac Fiero
1990	Pontiac Grand Am	1.35	1985 1991	Pontiac Grand Am
			1985 1991	Oldsmobile Cutlass Calais
			1986 1991	Buick Skylark
2003	Pontiac Grand Am 2-DR	1.41	1999 2003	Pontiac Grand Am 2-DR
			1999 2003	Oldsmobile Alero 2-DR
³⁷	Pontiac Grand Prix	1.41	1988 1996	Pontiac Grand Prix

³² Literature states 1980 – 81 Citation had 1.38 SSF; exact model year of test vehicle not specified.

³³ Literature states 1988 – 96 Corsica had 1.30 SSF; exact model year of test vehicle not specified.

³⁴ Literature states 1995 – 98 Lumina had 1.34 SSF; exact model year of test vehicle not specified.

³⁵ Literature states 1978 – 81 Malibu had 1.40 SSF; exact model year of test vehicle not specified.

³⁶ Literature states 1991 – 96 Oldsmobile 98 had 1.38 SSF; exact model year of test vehicle not specified.

³⁷ Literature states 1988 – 96 Grand Prix had 1.41 SSF; exact model year of test vehicle not specified.

<u>Test Vehicle</u>		SSF	<u>SSF Also Applies to</u>	
Model	Make/Model		Model	Make/Model
Year			years	
1978	Pontiac Lemans	1.34	1978	1981 Pontiac Lemans
2003	Pontiac Sunfire 2-DR	1.40	1995	2003 Pontiac Sunfire 2-DR
2003	Saturn Ion 4-DR	1.38	2003	2003 Saturn Ion 4-DR
2002	Saturn L 100 4-DR	1.42	2000	2003 Saturn L 100 4-DR
	³⁸ Saturn SL Z	1.39	1991	1995 Saturn SL Z
1998	Saturn SL Z	1.35	1996	2001 Saturn SL Z
1980	AMC Concord	1.36	1978	1982 AMC Concord
	³⁹ Audi 4000 2-DR	1.36	1981	1987 Audi 4000 2-DR
1984	Audi 4000 4-DR	1.38	1980	1987 Audi 4000 4-DR
2003	Audi A4 4-DR	1.42	2002	2003 Audi A4 4-DR
2003	Audi TT 2-DR Convertible	1.51	2003	2003 Audi TT 2-DR Convertible
1981	BMW 3-Series	1.20	1978	1993 BMW 3-Series
2002	BMW 3 Series 4-DR	1.41	1999	2003 BMW 3 Series 4-DR
2002	Mini Cooper	1.44	2002	2003 Mini Cooper
2002	Daewoo Nubira	1.39	1999	2003 Daewoo Nubira
1988	Pontiac Lemans	1.35	1988	1993 Pontiac Lemans
2002	Acura 3.2 TL 4-DR	1.44	1999	2003 Acura 3.2 TL 4-DR
2002	Acura RSX	1.39	2002	2003 Acura RSX
1991	Honda Accord	1.47	1990	1993 Honda Accord
2001	Honda Accord	1.45	1994	2002 Honda Accord
2003	Honda Accord 2-DR	1.44	1998	2003 Honda Accord 2-DR
	⁴⁰ Honda Civic Hatchback	1.30	1980	1983 Honda Civic Hatchback
1984	Honda Civic Hatchback	1.40	1984	1987 Honda Civic Hatchback
2002	Honda Civic 2-DR Hatchback	1.35	2002	2003 Honda Civic 2-DR Hatchback
1982	Honda Civic Sedan/Wagon	1.32	1981	1983 Honda Civic Sedan/Wagon
	⁴¹ Honda Civic	1.48	1979	1982 Honda Prelude
1998	Honda Civic	1.43	1992	1995 Honda Civic
2003	Honda S2000 Convertible	1.57	1996	2003 Honda Civic
1989	Dodge Colt	1.39	2000	2003 Honda S2000 Convertible
			1989	1992 Dodge Colt
			1989	1992 Plymouth Colt
			1990	1992 Mitsubishi Mirage
			1992	1992 Eagle Summit
2001	Hyundai Accent 4-DR	1.42	2001	2003 Hyundai Accent 4-DR
2003	Hyundai Elantra 4-DR	1.38	2001	2003 Hyundai Elantra 4-DR
1987	Hyundai Excel	1.23	1986	1989 Hyundai Excel
			1988	1989 Mitsubishi Precis
2002	Hyundai Sonata 4-DR	1.45	1995	2003 Hyundai Sonata 4-DR
2002	Mitsubishi Eclipse 2HB	1.46	2000	2003 Mitsubishi Eclipse 2HB
2003	Mitsubishi Galant 4-DR	1.43	1994	2003 Mitsubishi Galant 4-DR
2002	Mitsubishi Lancer 4-DR	1.37	2002	2002 Mitsubishi Lancer 4-DR

³⁸ Literature states 1990 – 95 SL Z had 1.39 SSF; exact model year of test vehicle not specified.

³⁹ Literature states 1980 – 87 Audi 4000 2 Door had 1.36 SSF; exact model year of test vehicle not specified.

⁴⁰ 1.30 SSF is average of 1983 (1.328) and “1980-83” (1.27) vehicles.

⁴¹ Literature states 1992 – 95 Civic had 1.48 SSF; exact model year of test vehicle not specified.

<u>Test Vehicle</u>		SSF	<u>SSF Also Applies to</u>	
Model	Make/Model Year		Model	Make/Model years
2003	Mitsubishi Lancer 4-DR	1.42	2003	2003 Mitsubishi Lancer 4-DR
2002	Jaguar X-Type 4-DR	1.43	2002	2003 Jaguar X-Type 4-DR
1991	Ford Festiva	1.34	1988	1993 Ford Festiva
2003	Kia Optima 4-DR	1.45	2001	2003 Kia Optima 4-DR
2002	Kia Rio	1.36	2001	2003 Kia Rio
	⁴² Ford Escort	1.38	1991	1996 Ford Escort
	⁴³ Ford Escort	1.37	1990	1994 Mazda Protégé
	⁴⁴ Ford Probe	1.41	1997	2003 Ford Escort
			1991	1999 Mercury Tracer
			1993	1997 Ford Probe
			1993	1997 Mazda Mx-6
1986	Mazda 323	1.34	1986	1989 Mazda 323
2003	Mazda 6 4-DR	1.46	2003	2003 Mazda 6 4-DR
	⁴⁵ Mazda GLC	1.25	1978	1980 Mazda GLC
2003	Mazda Miata/MX-5 2-DR Convertible	1.59	1990	2003 Mazda Miata/MX-5 2-DR Convertible
1998	Mazda Protege	1.40	1995	1998 Mazda Protege
2003	Mazda Protege 4-DR	1.42	1999	2003 Mazda Protege 4-DR
1987	Mercedes 190	1.28	1984	1993 Mercedes 190
2003	Mercedes C Sedan	1.35	2001	2003 Mercedes C Sedan
2003	Mercedes E Sedan	1.45	1996	2003 Mercedes E Sedan
1980	Datsun 200SX	1.26	1980	1983 Datsun 200SX
	⁴⁶ Datsun 210	1.25	1978	1982 Datsun 210
1979	Datsun 280ZX	1.42	1979	1989 Datsun 280ZX
2003	Nissan 350z 2-DR	1.57	2003	2003 Nissan 350z 2-DR
2002	Nissan Altima 4-DR	1.44	2002	2003 Nissan Altima 4-DR
1986	Nissan Maxima	1.35	1985	1986 Nissan Maxima
1988	Nissan Maxima	1.34	1987	1988 Nissan Maxima
			1987	1989 Nissan Stanza Sedan
			1991	1996 Infiniti G20
	⁴⁷ Nissan Maxima	1.44	1989	1994 Nissan Maxima
2002	Nissan Maxima 4-DR	1.38	2000	2003 Nissan Maxima 4-DR
1983	Nissan Sentra	1.32	1982	1986 Nissan Sentra
1987	Nissan Sentra	1.36	1987	1990 Nissan Sentra
	⁴⁸ Nissan Sentra	1.46	1991	1994 Nissan Sentra
1998	Nissan Sentra	1.40	1995	2002 Nissan Sentra
			1996	1998 Nissan 200SX 2-DR
2003	Nissan Sentra 4-DR	1.38	2003	2003 Nissan Sentra 4-DR

⁴² Literature states 1991 – 96 Escort had 1.38 SSF; exact model year of test vehicle not specified.

⁴³ Literature states 1997 – 2001 Escort had 1.37 SSF; exact model year of test vehicle not specified.

⁴⁴ Literature states 1993 – 97 Probe had 1.41 SSF; exact model year of test vehicle not specified.

⁴⁵ 1.25 SSF is average of 1979 (1.279) and “pre-1980” (1.22) vehicles.

⁴⁶ 1.25 SSF is average of 1974 3-door hatchback (1.278), 1979 wagon (1.272) and “No model year given” (1.19) vehicles.

⁴⁷ Literature states 1989 – 94 Maxima had 1.44 SSF; exact model year of test vehicle not specified.

⁴⁸ Literature states 1991 – 94 Sentra had 1.46 SSF; exact model year of test vehicle not specified.

<u>Test Vehicle</u>		SSF	<u>SSF Also Applies to</u>	
Model Year	Make/Model		Model years	Make/Model
1985	Nissan Stanza	1.29	1982	1986 Nissan Stanza
⁴⁹	Renault Le Car	1.16	1978	1983 Renault Le Car
2003	Saab 9-5 4-DR	1.37	1999	2003 Saab 9-5 4-DR
2002	Subaru Impreza Station Wagon 4-DR	1.37	2002	2003 Subaru Impreza Station Wagon 4-DR
1991	Subaru Justy GL	1.23	1987	1994 Subaru Justy GL
2002	Subaru Legacy 4-DR	1.42	2000	2003 Subaru Legacy 4-DR
2002	Subaru Legacy 4-DR Wagon	1.37	2000	2003 Subaru Legacy 4-DR Wagon
1991	Chevrolet/Geo Metro	1.32	1989	1994 Chevrolet/Geo Metro
			1989	1994 Suzuki Swift
1998	Chevrolet/Geo Metro	1.29	1995	2000 Chevrolet/Geo Metro
			1995	2001 Suzuki Swift
⁵⁰	Geo Prizm	1.38	1990	1992 Geo Prizm
			1989	1989 Chevrolet Nova
2002	Lexus ES300 4-DR	1.36	2002	2002 Lexus ES300 4-DR
2003	Lexus ES300 4-DR	1.37	2003	2003 Lexus ES300 4-DR
2003	Lexus IS300 4-DR	1.47	2001	2003 Lexus IS300 4-DR
2002	Toyota Avalon 4-DR	1.42	1995	2003 Toyota Avalon 4-DR
1987	Toyota Camry Hatchback	1.38	1983	1987 Toyota Camry Hatchback
1987	Toyota Camry	1.33	1983	1991 Toyota Camry
⁵¹	Toyota Camry	1.46	1992	1996 Toyota Camry
			1992	1996 Lexus ES-250/300
2001	Toyota Camry	1.45	1997	2001 Toyota Camry
2002	Toyota Camry 4-DR	1.40	2002	2003 Toyota Camry 4-DR
1976	Toyota Corolla	1.32	1978	1979 Toyota Corolla
1987	Toyota Corolla	1.30	1984	1988 Toyota Corolla
			1985	1988 Chevrolet Nova
⁵²	Toyota Corolla	1.36	1989	1991 Toyota Corolla
2001	Toyota Corolla 4-DR	1.42	1997	2002 Toyota Corolla 4-DR
			1993	2002 Geo/Chevrolet Prizm 4-DR
2003	Toyota Corolla 4-DR	1.34	2003	2003 Toyota Corolla 4-DR
1982	Toyota Cressida	1.28	1978	1984 Toyota Cressida
2001	Toyota Echo 4-DR	1.32	2000	2003 Toyota Echo 4-DR
1986	Toyota MR2	1.49	1985	1989 Toyota MR2
1982	Toyota Starlet	1.21	1981	1984 Toyota Starlet
⁵³	Toyota Tercel	1.41	1987	1994 Toyota Tercel
⁵⁴	Toyota Tercel	1.39	1995	1998 Toyota Tercel
1991	Volvo 240	1.23	1978	1993 Volvo 240
			1978	1982 Volvo 260

⁴⁹ 1.16 SSF is average of 1977 (1.15) and “No model year given” (1.5) vehicles.

⁵⁰ Literature states 1989 – 92 Prizm had 1.38 SSF; exact model year of test vehicle not specified.

⁵¹ Literature states 1992 – 96 Camry had 1.46 SSF; exact model year of test vehicle not specified.

⁵² Literature states 1989 – 92 Corolla had 1.46 SSF; exact model year of test vehicle not specified.

⁵³ Literature states 1991 – 94 Tercel had 1.41 SSF; exact model year of test vehicle not specified.

⁵⁴ Literature states 1995 – 98 Tercel had 1.39 SSF; exact model year of test vehicle not specified.

<u>Test Vehicle</u>		SSF	<u>SSF Also Applies to</u>	
Model Year	Make/Model		Model years	Make/Model
1991	Volvo 740	1.38	1986 1992	Volvo 740
			1983 1990	Volvo 760
			1998 1998	Volvo 90 Series
2003	Volvo S60 4-DR	1.49	2001 2003	Volvo S60 4-DR
1971	Volkswagen Beetle	1.32	1978 1979	Volkswagen Beetle
2001	Volkswagen Jetta 4-DR	1.37	2000 2003	Volkswagen Jetta 4-DR
2002	Volkswagen Jetta 4-DR Wagon	1.34	2001 2003	Volkswagen Jetta 4-DR Wagon
2003	Volkswagen New Beetle	1.39	1998 2003	Volkswagen New Beetle
2003	Volkswagen Passat 4-DR	1.41	1998 2003	Volkswagen Passat 4-DR
	⁵⁵ VW Cabriolet	1.25	1985 1993	VW Cabriolet
1983	VW Jetta	1.21	1981 1984	VW Jetta
	⁵⁶ VW Rabbit	1.28	1978 1984	VW Rabbit
1987	Yugo GV	1.22	1986 1987	Yugo GV
1988	Yugo GV	1.22	1988 1991	Yugo GV

⁵⁵ 1.25 SSF is average of 1983 Jetta (1.21) and “1975-84” Rabbit (1.28), sister vehicles of the Cabriolet. These individual vehicles were included in the analysis with their respective SSF values.

⁵⁶ Literature states 1975 – 84 Rabbit had 1.28 SSF; exact model year of test vehicle not specified.

<u>Test Vehicle</u>		SSF	<u>SSF Also Applies to</u>	
Model Year	Make/Model		Model years	Make/Model
Sport Utility Vehicles				
1977	Jeep Cherokee	1.17	1975 1983	Jeep Cherokee
1984	Jeep Cherokee 4x4	1.11	1984 1984	Jeep Cherokee 4x4
1997	Jeep Cherokee 4x4	1.08	1997 2001	Jeep Cherokee 4x4
	⁵⁷ Jeep CJ-5	1.01	1975 1976	Jeep CJ-5
1981	Jeep CJ-5	1.03	1981 1983	Jeep CJ-5
1981	Jeep CJ-7	1.03	1976 1981	Jeep CJ-7
	⁵⁸ Jeep CJ-7	1.04	1982 1982	Jeep CJ-7
1983	Jeep CJ-7	1.05	1983 1984	Jeep CJ-7
1984	Jeep Wagoneer 4WD	1.08	1984 1992	Jeep Wagoneer 4WD
1987	Jeep Wrangler 4x4	1.16	1987 1987	Jeep Wrangler 4x4
1988	Jeep Wrangler 4x4	1.13	1988 2003	Jeep Wrangler 4x4
2003	BMW X5 4-DR 4x4	1.14	2000 2003	BMW X5 4-DR 4x4
2001	Chrysler PT Cruiser 4-DR	1.26	2001 2003	Chrysler PT Cruiser 4-DR
2001	Dodge Durango 4-DR 4x2	1.20	1999 2003	Dodge Durango 4-DR 4x2
1998	Dodge Durango 4-DR 4x4	1.14	1998 1999	Dodge Durango 4-DR 4x4
2001	Dodge Durango 4-DR 4x4	1.16	2000 2003	Dodge Durango 4-DR 4x4
1991	Dodge RamCharger 4x4	1.13	1980 1993	Dodge RamCharger 4x4
2001	Jeep Grand Cherokee 4x2	1.09	1993 2003	Jeep Grand Cherokee 4x2
2001	Jeep Grand Cherokee 4x4	1.11	1993 2003	Jeep Grand Cherokee 4x4
2002	Jeep Liberty 4-DR 4x2	1.10	2002 2002	Jeep Liberty 4-DR 4x2
2003	Jeep Liberty 4-DR 4x2	1.12	2003 2003	Jeep Liberty 4-DR 4x2
2002	Jeep Liberty 4-DR 4x4	1.12	2002 2002	Jeep Liberty 4-DR 4x4
2003	Jeep Liberty 4-DR 4x4	1.15	2003 2003	Jeep Liberty 4-DR 4x4
1978	Ford Bronco	1.06	1975 1979	Ford Bronco
1983	Ford Bronco 4x4	1.04	1980 1984	Ford Bronco 4x4
1985	Ford Bronco 4x4	1.13	1985 1996	Ford Bronco 4x4
1984	Ford Bronco II 4x4	1.05	1984 1986	Ford Bronco II 4x4
1988	Ford Bronco II 4x4	0.99	1987 1990	Ford Bronco II 4x4
1987	Ford Bronco II 4x2	1.04	1987 1988	Ford Bronco II 4x2
1989	Ford Bronco II 4x2	0.99	1989 1990	Ford Bronco II 4x2
2001	Ford Escape 4-DR 4x2/4x4	1.23	2001 2003	Ford Escape 4-DR 4x2/4x4
			2001 2003	Mazda Tribute 4-DR 4x2/4x4
1998	Ford Expedition 4-DR	1.07	1997 2003	Ford Expedition 4-DR
			1998 1999	Lincoln Navigator 4-DR
	⁵⁹ Ford Explorer 2-DR 4x2	1.07	1991 1994	Ford Explorer 2-DR 4x2
			1992 1994	Mazda Navajo
1992	Ford Explorer 2-DR 4x4	1.09	1991 1995	Ford Explorer 2-DR 4x4
			1991 1994	Mazda Navajo 4x4

⁵⁷ Literature states 1972 – 75 CJ-5 had 1.01 SSF; exact model year of test vehicle not specified.

⁵⁸ 1.04 SSF is average of 1981 (1.033) and 1983 (1.0505) vehicles.

⁵⁹ Literature states 1991 – 94 Explorer had 1.07 SSF; exact model year of test vehicle not specified.

<u>Test Vehicle</u>		SSF	<u>SSF Also Applies to</u>	
Model Year	Make/Model		Model years	Make/Model
	⁶⁰ Ford Explorer 2-DR 4x2	1.06	1995 2003	Ford Explorer 2-DR 4x2 Ford Explorer 2-DR 4x4 Ford Explorer 4-DR
1992	Ford Explorer 4-DR 4x2	1.07	1991 1995	Ford Explorer 4-DR 4x2
2002	Ford Explorer 4-DR 4x2	1.10	2002 2003	Ford Explorer 4-DR 4x2 Mercury Mountaineer 4-DR
1991	Ford Explorer 4-DR 4x4	1.09	1991 1995	Ford Explorer 4-DR 4x4
2002	Ford Explorer 4-DR 4x4	1.14	2002 2003	Ford Explorer 4-DR 4x4 Mercury Mountaineer 4-DR
2002	Ford Explorer Sport 2-DR 4x2	1.05	2001 2003	Ford Explorer Sport 2-DR 4x2
2002	Ford Explorer Sport 2-DR 4x4	1.07	2001 2003	Ford Explorer Sport 2-DR 4x4
2001	Mercury Mountaineer 4-DR	1.06	1997 2001	Mercury Mountaineer 4-DR
1998	Mercury Mountaineer 4-DR 4x4	1.07	1997 2001	Mercury Mountaineer 4-DR 4x4
2002	Buick Rendezvous 4-DR 4x2	1.18	2002 2003	Buick Rendezvous 4-DR 4x2
2002	Buick Rendezvous 4-DR 4x4	1.21	2002 2003	Buick Rendezvous 4-DR 4x4
2002	Chevrolet Avalanche 4-DR 4x4	1.12	2002 2003	Chevrolet Avalanche 4-DR 4x4 Chevrolet Avalanche 4-DR4x2 Cadillac Escalade Ext 4-DR 4x4
1983	Chevrolet S10 Blazer 2-DR	1.08	1981 1983	Chevrolet S10 Blazer 2-DR GMC S15 Jimmy 2-DR
2002	Chevrolet S10 Blazer 2-DR	1.03	1984 2003	Chevrolet S10 Blazer 2-DR GMC S15 Jimmy 2-DR
1984	Chevrolet S10 4x4 Blazer 2-DR	1.11	1983 1987	Chevrolet S10 4x4 Blazer 2-DR GMC S15 4x4 Jimmy 2-DR
1989	Chevrolet S10 4x4 Blazer 2-DR	1.10	1988 1989	Chevrolet S10 4x4 Blazer 2-DR GMC S15 4x4 Jimmy 2-DR
1990	Chevrolet S10 4x4 Blazer 2-DR	1.06	1990 1991	Chevrolet S10 4x4 Blazer 2-DR GMC S15 4x4 Jimmy 2-DR
1992	Chevrolet S10 4x4 Blazer 2-DR	1.07	1992 2003	Chevrolet S10 4x4 Blazer 2-DR GMC S15 4x4 Jimmy 2-DR
1998	Chevrolet S10 4x2 Blazer 4-DR	1.09	1991 2002	Chevrolet S10 4x2 Blazer 4-DR GMC S15 4x2/4x4 Jimmy 4-DR Olds Bravada 4x4
2001	Chevrolet S10 4x4 Blazer 4-DR	1.09	1991 2003	Chevrolet S10 4x4 Blazer 4-DR
1978	Chevrolet K-10 Blazer	1.12	1975 1980	Chevrolet K-10 Blazer
1982	Chevrolet K10/V10 4x4 Blazer	1.17	1981 1991	Chevrolet K10/V10 4x4 Blazer GMC K15/V15 4x4 Jimmy
1998	Chevrolet K1500 4x4 Suburban	1.08	1992 1999	Chevrolet K1500 4x4 Suburban Chevrolet K2500 4x4 Suburban GMC K1500 4x4 Suburban GMC K2500 4x4 Suburban
1982	Chevrolet K20/V20 4x4 Suburban	1.02	1985 1991	Chevrolet K20/V20 4x4 Suburban GMC K25/V25 4x4 Suburban

⁶⁰ Literature states 1995 – 98 Explorer had 1.06 SSF; exact model year of test vehicle not specified.

<u>Test Vehicle</u>		SSF	<u>SSF Also Applies to</u>	
Model Year	Make/Model		Model years	Make/Model
2001	Chevrolet Suburban 4-DR 4x2	1.13	2000 2003	Chevrolet Suburban 4-DR4x2
2001	Chevrolet Suburban 4-DR 4x4	1.14	2001 2003	GMC Yukon Denali 4-DR
	⁶¹ Chevrolet Tahoe 2-DR 4x4	1.12	2000 2003	Chevrolet Suburban 4-DR 4x4
			1992 1999	Chevrolet Tahoe 2-DR 4x4
			1992 1997	GMC Yukon 2-DR 4x4
1998	Chevrolet Tahoe 4-DR 4x4	1.13	1995 1999	Chevrolet Tahoe 4-DR 4x4
			1995 1999	GMC Yukon 4-DR 4x4
2001	Chevrolet Tahoe 4-DR 4x4	1.14	2000 2003	Chevrolet Tahoe 4-DR 4x4
			2000 2003	GMC Yukon 4-DR 4x4
			2002 2003	Cadillac Escalade 4-DR 4x4
2002	Chevrolet Trailblazer 4-DR 4x2	1.16	2002 2003	Chevrolet Trailblazer 4-DR 4x2
			2002 2003	GMC Envoy 4-DR 4x2
			2003 2003	Oldsmobile Bravada 4-DR 4x2
2002	Chevrolet Trailblazer 4-DR 4x4	1.18	2002 2003	Chevrolet Trailblazer 4-DR 4x4
			2002 2003	GMC Envoy 4-DR 4x4
			2003 2003	Oldsmobile Bravada 4-DR 4x4
1984	GMC C25/R25 Suburban	1.01	1981 1991	GMC C25/R25 Suburban
			1981 1991	Chevrolet C20/R20 Suburban
1990	GMC K15/V15 4x4 Suburban	1.10	1981 1991	GMC K15/V15 4x4 Suburban
2001	GMC S15 4x4 Jimmy 4-DR	1.03	2000 2001	GMC S15 4x4 Jimmy 4-DR
			2000 2001	7802 Olds Bravada 4x4
2001	GMC Yukon 4-DR 4x2	1.12	2000 2003	GMC Yukon 4-DR 4x2
2003	Oldsmobile Bravada 4x4	1.17	2003 2003	Oldsmobile Bravada 4x4
2001	Pontiac Aztek 4-DR 4x2	1.21	2001 2003	Pontiac Aztek 4-DR 4x2
2001	Pontiac Aztek 4-DR 4x4	1.26	2001 2003	Pontiac Aztek 4-DR 4x4
2002	Saturn Vue 4-DR 4x2	1.19	2002 2003	Saturn Vue 4-DR 4x2
2002	Saturn Vue 4-DR 4x4	1.22	2002 2003	Saturn Vue 4-DR 4x4
2002	Acura MDX 4-DR 4x4	1.29	2001 2003	Acura MDX 4-DR 4x4
2002	Honda CR-V 4x2	1.17	2002 2003	Honda CR-V 4x2
1998	Honda CR-V 4x4 97-2001	1.19	1997 2001	Honda CR-V 4x4
2002	Honda CR-V 4x4	1.16	2002 2003	Honda CR-V 4x4
2003	Honda Element 4-DR 4x2	1.14	2003 2003	Honda Element 4-DR 4x2
2003	Honda Element 4-DR 4x4	1.12	2003 2003	Honda Element 4-DR 4x4
2003	Honda Pilot 4-DR 4x4	1.30	2003 2003	Honda Pilot 4-DR 4x4
2002	Hyundai Santa Fe 4-DR 4x2	1.18	2001 2003	Hyundai Santa Fe 4-DR 4x2
2002	Hyundai Santa Fe 4-DR 4x4	1.20	2002 2003	Hyundai Santa Fe 4-DR 4x4
1991	Isuzu Amigo 4x4	1.12	1989 1994	Isuzu Amigo 4x4
2002	Isuzu Axiom 4-DR 4x4	1.20	2002 2003	Isuzu Axiom 4-DR 4x4
2002	Isuzu Axiom 4-DR 4x2	1.14	2002 2003	Isuzu Axiom 4-DR 4x2
2001	Isuzu Rodeo 4-DR 4x2	1.15	1998 2003	Isuzu Rodeo 4-DR 4x2
			1998 2002	Honda Passport 4x2
1991	Isuzu Rodeo 4x4	1.08	1991 1991	Isuzu Rodeo 4x4
1992	Isuzu Rodeo 4x4	1.05	1992 1997	Isuzu Rodeo 4x4

⁶¹ Literature states 1992 – 98 Tahoe had 1.12 SSF; exact model year of test vehicle not specified.

<u>Test Vehicle</u>		SSF	<u>SSF Also Applies to</u>	
Model Year	Make/Model		Model years	Make/Model
1998	Isuzu Rodeo 4-DR 4x4	1.20	1998 2002	Isuzu Rodeo 4x4
1994	Isuzu Trooper 4-DR 4x4	1.07	1992 1994	Isuzu Trooper 4x4
1996	Isuzu Trooper 4-DR 4x4	1.09	1995 2002	Isuzu Trooper 4x4
			1996 1999	Acura SLX 4x4
1984	Isuzu Trooper II 4x4	1.02	1984 1986	Isuzu Trooper II 4x4
1988	Isuzu Trooper II 4x4	1.01	1987 1991	Isuzu Trooper II 4x4
2003	Kia Sorento 4-DR 4x2	1.14	2003 2003	Kia Sorento 4-DR 4x2
2003	Kia Sorento 4-DR 4x4	1.16	2003 2003	Kia Sorento 4-DR 4x4
1999	Mercedes-Benz ML 320/450	1.12	1998 2003	Mercedes-Benz ML 320/450
2003	Mercedes-Benz ML-Class 4x4	1.15	2000 2003	Mercedes-Benz ML-Class 4x4
1987	Dodge Raider 2-DR 4x4	0.99	1987 1987	Dodge Raider 2-DR4x4
	⁶² Dodge Raider 2-DR 4x4	1.03	1985 1987	Mitsubishi Montero 2-DR
			1988 1988	Dodge Raider 2-DR4x4
1989	Dodge Raider 2-DR4x4	1.07	1988 1988	Mitsubishi Montero 2-DR
			1989 1989	Dodge Raider 2-DR 4x4
			1989 1990	Mitsubishi Montero 2-DR
	⁶³ Mitsubishi Montero 4-DR 4x4	0.95	1992 2000	Mitsubishi Montero 4-DR 4x4
2001	Mitsubishi Montero Sport 4-DR4x2	1.07	2000 2003	Mitsubishi Montero Sport 4-DR 4x2
2001	Mitsubishi Montero Sport 4-DR 4x4	1.11	2000 2003	Mitsubishi Montero Sport 4-DR 4x4
2003	Mitsubishi Outlander 4-DR 4x2	1.18	2003 2003	Mitsubishi Outlander 4-DR 4x2
2003	Mitsubishi Outlander 4-DR 4x4	1.22	2003 2003	Mitsubishi Outlander 4-DR 4x4
2003	Nissan Murano 4-DR 4x2/4x4	1.30	2003 2003	Nissan Murano 4-DR 4x2/4x4
1987	Nissan Pathfinder 2-DR 4x4	1.07	1987 1990	Nissan Pathfinder 2-DR 4x4
2001	Nissan Pathfinder 4-DR 4x2	1.07	1996 2003	Nissan Pathfinder 4-DR 4x2
1991	Nissan Pathfinder 4-DR 4x4	1.07	1990 1995	Nissan Pathfinder 4-DR 4x4
2001	Nissan Pathfinder 4-DR 4x4	1.16	1996 2003	Nissan Pathfinder 4-DR 4x4
2001	Nissan Xterra 4-DR 4x2	1.09	2000 2003	Nissan Xterra 4-DR 4x2
2001	Nissan Xterra 4-DR 4x4	1.12	2000 2002	Nissan Xterra 4-DR 4x4
2001	Subaru Forester 4-DR 4x4	1.19	1998 2002	Subaru Forester 4-DR 4x4
2003	Subaru Forester 4-DR 4x4 Wagon	1.24	2003 2003	Subaru Forester 4-DR 4x4 Wagon
1991	Chevrolet Geo Tracker 4x4	1.14	1989 1994	Chevrolet Geo Tracker 2-DR 4x4
			1989 1994	Suzuki Sidekick 2-DR 4x4
1998	Chevrolet Geo Tracker 4x4	1.13	1995 1998	Chevrolet Geo Tracker 2-DR 4x4
	⁶⁴ Chevrolet Geo Tracker 4-DR 4x4	1.13	1995 1998	Suzuki Sidekick 2-DR 4x4
			1996 1998	Chevrolet Geo Tracker 4-DR 4x4
			1991 1998	Suzuki Sidekick 4-DR4x4
2002	Chevrolet Tracker 2-DR 4x2	1.23	1999 2003	Chevrolet Tracker 2-DR 4x2
			1999 2002	Suzuki Vitara 2-DR 4x2
2002	Chevrolet Tracker 2-DR 4x4	1.18	1999 2003	Chevrolet Tracker 2-DR 4x4
			1999 2002	Suzuki Vitara 2-DR 4x4
2001	Chevrolet Tracker 4-DR 4x2	1.16	1999 2003	Chevrolet Tracker 4-DR 4x2
			1999 2003	Suzuki Grand Vitara 4-DR 4x2

⁶² 1.03 SSF is average of 1987 (0.99) and 1989 (1.07) vehicles.

⁶³ Literature states 1992 – 2000 Montero had 0.95 SSF; exact model year of test vehicle not specified.

⁶⁴ Literature states 1989 – 98 Tracker had 1.13 SSF; exact model year of test vehicle not specified.

<u>Test Vehicle</u>		SSF	<u>SSF Also Applies to</u>	
Model Year	Make/Model		Model years	Make/Model
2001	Chevrolet Tracker 4-DR 4x4	1.15	1999 2003	Chevrolet Tracker 4-DR 4x4
			1999 2003	Suzuki Vitara 4-DR4x4
			1999 2003	Suzuki Grand Vitara 4-DR 4x4
1988	Suzuki Samurai 4x4	1.09	1984 1995	Suzuki Samurai 4x4
2001	Lexus RX300 4-DR 4x2	1.20	1999 2003	Lexus RX300 4-DR 4x2
	⁶⁵ Toyota 4Runner 90-95	1.07	1990 1995	Toyota 4Runner 4x2
2001	Toyota 4Runner 4-DR 4x2	1.08	1996 2002	Toyota 4Runner 4-DR 4x2
2003	Toyota 4Runner 4-DR 4x2	1.15	2003 2003	Toyota 4Runner 4-DR 4x2
1987	Toyota 4Runner 4x4	0.99	1984 1987	Toyota 4Runner 4x4
1989	Toyota 4Runner 4x4	1.08	1988 1989	Toyota 4Runner 4x4
1990	Toyota 4Runner 4x4	1.00	1990 1995	Toyota 4Runner 4x4
1998	Toyota 4Runner 4x4	1.06	1996 1999	Toyota 4Runner 4x4
2001	Toyota 4Runner 4x4	1.06	2000 2002	Toyota 4Runner 4x4
2003	Toyota 4Runner 4-DR 4x4	1.17	2003 2003	Toyota 4Runner 4-DR 4x4
2002	Toyota Highlander 4-DR 4x2	1.20	2001 2003	Toyota Highlander 4-DR 4x2
2002	Toyota Highlander 4-DR 4x4	1.20	2001 2003	Toyota Highlander 4-DR 4x4
1979	Toyota Landcruiser 72-80	0.97	1976 1979	Toyota Landcruiser
1991	Toyota 4Runner 4x4	1.05	1991 1997	Toyota Landcruiser
2001	Toyota RAV4 4-DR4x2	1.19	2001 2003	Toyota RAV4 4-DR 4x2
2001	Toyota RAV4 4-DR 4x4	1.22	2001 2003	Toyota RAV4 4-DR 4x4
2002	Toyota Sequoia 4-DR 4x2	1.14	2001 2003	Toyota Sequoia 4-DR 4x2
2002	Toyota Sequoia 4-DR 4x4	1.14	2001 2003	Toyota Sequoia 4-DR 4x4

⁶⁵ Literature states 1990 – 95 4Runner had 1.07 SSF; exact model year of test vehicle not specified.

<u>Test Vehicle</u>		SSF	<u>SSF Also Applies to</u>	
Model	Make/Model		Model	Make/Model
Year			years	
<i>Pickup Trucks</i>				
1991	Dodge D100 Pickup	1.28	1986 1991	Dodge D100 Pickup
1983	Dodge D150 Pickup	1.24	1981 1986	Dodge D150 Pickup
1991	Dodge D150 Pickup	1.28	1987 1993	Dodge D150 Pickup
1987	Dodge Dakota 4x2	1.26	1987 1996	Dodge Dakota 4x2
2002	Dodge Dakota 4x2	1.23	1997 2003	Dodge Dakota 4x2
			2000 2003	Dodge Dakota Quad Cab 4x2
1991	Dodge Dakota 4x4	1.21	1987 1996	Dodge Dakota 4x4
2002	Dodge Dakota 4x4	1.13	1997 2003	Dodge Dakota 4x4
1998	Dodge Dakota Club Cab 4x2	1.25	1997 2002	Dodge Dakota Club Cab 4x2
1992	Dodge Dakota Club Cab 4x4	1.24	1991 1996	Dodge Dakota Club Cab 4x4
2001	Dodge Dakota Extended Cab 4x4	1.17	2001 2002	Dodge Dakota Club Cab 4x4
2003	Dodge Dakota Quad Cab 4x4	1.13	2000 2003	Dodge Dakota Quad Cab 4x4
2002	Dodge Ram 1500 4-DR 4x2	1.19	2002 2003	Dodge Ram 1500 4-DR 4x2
			2002 2003	Dodge Ram 1500 Quad Cab 4x2
1998	Dodge Ram 1500 Club Cab Pickup	1.22	1995 2001	Dodge Ram 1500 Club Cab Pickup
2001	Dodge Ram 1500 Quad Cab 4x4	1.16	1998 2001	Dodge Ram 1500 Quad Cab 4x4
2002	Dodge Ram 1500 Quad Cab 4x4	1.15	2002 2003	Dodge Ram 1500 Quad Cab 4x4
			2002 2003	Dodge Ram 1500 Pickup
2001	Dodge Ram 1500 Quad Cab Pickup	1.22	1998 2001	Dodge Ram 1500 Club Cab Pickup
			1994 2001	Dodge Ram 1500 Quad Cab 4x4
1980	Plymouth Arrow	1.30	1981 1982	Plymouth Arrow
			1983 1984	Mitsubishi Pickup
1981	Ford F100 2WD	1.24	1981 1984	Ford F100 2WD
1987	Ford F-150 Pickup	1.19	1981 1988	Ford F-150 Pickup
1990	Ford F-150 Pickup	1.19	1989 1990	Ford F-150 Pickup
1991	Ford F-150 Pickup	1.23	1991 1991	Ford F-150 Pickup
1992	Ford F-150 Pickup	1.24	1992 1996	Ford F-150 Pickup
1998	Ford F-150 Pickup	1.18	1997 2000	Ford F-150 Pickup
2001	Ford F-150 Pickup	1.22	2001 2003	Ford F-150 Pickup
1984	Ford F-150 4x4 Pickup	1.15	1981 1984	Ford F-150 4x4 Pickup
1985	Ford F-150 4x4 Pickup	1.20	1985 1996	Ford F-150 4x4 Pickup
2001	Ford F-150 4x4 Pickup	1.12	2003 2003	Ford F-150 4x4 Pickup
1987	Ford F-150 Supercab Pickup	1.19	1985 1996	Ford F-150 Supercab Pickup
2002	Ford F-150 Supercab Pickup	1.23	1997 2003	Ford F-150 Supercab Pickup
1987	Ford F-150 Supercab Pickup 4x4	1.08	1985 1987	Ford F-150 Supercab Pickup 4x4
⁶⁶	Ford F-150 Supercab Pickup 4x4	1.15	1988 1996	Ford F-150 Supercab Pickup 4x4
2002	Ford F-150 Extended Cab 4x4	1.16	1997 2003	Ford F-150 Extended Cab 4x4
2002	Ford F-150 Supercrew 4-DR 4x2	1.19	2001 2003	Ford F-150 Supercrew 4-DR 4x2
2002	Ford F-150 Supercrew 4-DR 4x4	1.08	2001 2003	Ford F-150 Supercrew 4-DR 4x4
1984	Ford F250 Pickup	1.11	1981 1997	Ford F250 Pickup
1985	Ford F250 4x4 Pickup	1.11	1981 1997	Ford F250 4x4 Pickup
1985	Ford Ranger	1.09	1983 1987	Ford Ranger

⁶⁶ Literature states 1988 – 96 F-150 Supercab had 1.15 SSF; exact model year of test vehicle not specified.

Test Vehicle		SSF	SSF Also Applies to	
Model	Make/Model		Model	Make/Model
Year			years	
1991	Ford Ranger	1.13	1988 1991	Ford Ranger
1992	Ford Ranger	1.12	1992 1992	Ford Ranger
	⁶⁷ Ford Ranger	1.17	1993 1997	Ford Ranger
			1993 1997	Ford Ranger Supercab
			1994 1997	Mazda B Pickup
			1994 1997	Mazda B Cab-Plus Pickup
2002	Ford Ranger 2-DR 4x2	1.14	1998 2003	Ford Ranger 2-DR 4x2
			1998 2003	Mazda B-Series 2-DR 4x2
1986	Ford Ranger 4x4	1.03	1983 1992	Ford Ranger 4x4
			1986 1992	Ford Ranger Supercab 4x4
1997	Ford Ranger 4x4	1.07	1993 1997	Ford Ranger 4x4
			1994 1997	Mazda B-Series 2-DR 4x4
2002	Ford Ranger 4x4	1.05	1998 2003	Ford Ranger 4x4
			1998 2001	Mazda B-Series 2-DR 4x4
1991	Ford Ranger Supercab	1.14	1986 1991	Ford Ranger Supercab
1992	Ford Ranger Supercab	1.13	1992 1992	Ford Ranger Supercab
2001	Ford Ranger Supercab	1.13	1998 2003	Ford Ranger Supercab
			1998 2003	Mazda B-Series Extended Cab 4x2
1997	Ford Ranger Supercab 4x4	1.07	1993 1997	Ford Ranger Supercab 4x4
			1994 1997	Mazda B Cab-Plus 4x4
2001	Ford Ranger Supercab 4x4	1.04	1998 2003	Ford Ranger Supercab 4x4
			1998 2003	Mazda B-Series Extended Cab 4x4
1988	GMC Sierra K1500 4x4 Pickup	1.12	1988 1998	GMC Sierra K1500 4x4 Pickup
1981	Chevrolet C10/R10 Pickup	1.22	1981 1987	Chevrolet C10/R10 Pickup
1991	Chevrolet C10 Pickup	1.20	1988 1994	Chevrolet C10 Pickup
1998	Chevrolet C10 Pickup	1.23	1995 1998	Chevrolet C10 Pickup
	⁶⁸ Chevrolet C10 X-Cab Pickup	1.22	1991 1999	Chevrolet C10 X-Cab Pickup
			1991 1999	GMC Sierra C1500 X-Cab Pickup
1991	Chevrolet K10 4x4 Pickup	1.14	1988 1991	Chevrolet K10 4x4 Pickup
1992	Chevrolet K10 4x4 Pickup	1.14	1992 1998	Chevrolet K10 4x4 Pickup
	⁶⁹ Chevrolet K10 4x4 X-Cab Pickup	1.14	1991 1999	Chevrolet K10 4x4 X-Cab Pickup
			1991 1999	Chevrolet K10 4x4 X-Cab Pickup
1982	Chevrolet K20/V20 4x4 Pickup	1.19	1981 1983	Chevrolet K20/V20 4x4 Pickup
1985	Chevrolet K20/V20 4x4 Pickup	1.14	1984 1987	Chevrolet K20/V20 4x4 Pickup
1981	Chevrolet LUV	1.24	1981 1981	Chevrolet LUV
	⁷⁰ Chevrolet S10 Maxicab Pickup	1.19	1988 1993	Chevrolet S10 Maxicab Pickup
			1988 1993	Chevrolet T10 4x4 Maxicab Pickup
			1988 1993	GMC S15/Sonoma Maxicab Pickup
			1988 1993	GMC T15/Sonoma 4x4 Maxicab

⁶⁷ Literature states 1993 – 97 Ranger had 1.17 SSF; exact model year of test vehicle not specified.

⁶⁸ Literature states 1988 – 98 C10 X-cab had 1.22 SSF; exact model year of test vehicle not specified.

⁶⁹ Literature states 1988 – 98 K10 X-cab had 1.14 SSF; exact model year of test vehicle not specified.

⁷⁰ Literature states 1988 – 93 S10 Maxicab had 1.19 SSF; exact model year of test vehicle not specified.

<u>Test Vehicle</u>		SSF	<u>SSF Also Applies to</u>	
Model Year	Make/Model		Model years	Make/Model
2001	Chevrolet S10 Maxicab Pickup	1.14	1994 2002	Chevrolet S10 Maxicab Pickup
			1994 2003	Chevrolet T10 4x4 Maxicab Pickup
			1994 2002	GMC S15/Sonoma Maxicab Pickup
			1994 2003	GMC T15/Sonoma 4x4 Maxicab
			1997 2000	Isuzu Hombre Spacecab Pickup
			1998 2000	Isuzu Hombre Spacecab 4x4
2003	Chevrolet S10 Maxicab Pickup	1.15	2003 2003	Chevrolet S10 Maxicab Pickup
			2003 2003	GMC S15/Sonoma Maxicab Pickup
1986	Chevrolet S10 Pickup	1.21	1981 1987	Chevrolet S10 Pickup
			1981 1987	GMC S15 Pickup
1991	Chevrolet S10 Pickup	1.24	1988 1994	Chevrolet S10 Pickup
			1988 1994	GMC S15/Sonoma Pickup
1998	Chevrolet S10 Pickup	1.15	1995 2003	Chevrolet S10 Pickup
			1995 2003	GMC S15/Sonoma Pickup
			1996 2000	Isuzu Hombre Pickup
2001	Chevrolet Silverado Extended Cab 4x2	1.27	1999 2003	Chevrolet Silverado Extend Cab 4x2
			1999 2003	GMC Sierra Extended Cab 4x2
2001	Chevrolet Silverado Extended Cab 4x4	1.19	1999 2003	Chevrolet Silverado Extend Cab 4x2
			1999 2003	GMC Sierra Extended Cab 4x4
1987	Chevrolet T10 4x4 Pickup	1.17	1982 1987	Chevrolet T10 4x4 Pickup
			1982 1987	GMC T15 4x4 Pickup
1992	Chevrolet T10 4x4 Pickup	1.24	1988 2000	Chevrolet T10 4x4 Pickup
			1988 2000	GMC T15/Sonoma 4x4 Pickup
			1998 2000	Isuzu Hombre 4x4 Pickup
1985	GMC C15/R15 Pickup	1.23	1981 1987	GMC C15/R15 Pickup
1991	GMC Sierra C1500 Pickup	1.16	1988 1998	GMC Sierra C1500 Pickup
1987	GMC K35/V35 4x4 Pickup	1.21	1985 1988	GMC K35/V35 4x4 Pickup
1991	Isuzu 4x4 P'up Standard Bed	1.16	1988 1995	Isuzu 4x4 P'up Standard Bed
1986	Isuzu P'up Standard Bed	1.27	1982 1987	Isuzu P'up Standard Bed
1984	Mazda B2000	1.21	1981 1984	Mazda B2000
⁷¹	Nissan Longbed Pickup	1.20	1986 1995	8109 Nissan Longbed Pickup
2001	Nissan Frontier 4x2 Pickup	1.14	1998 2001	Nissan Frontier 4x2 Pickup
2001	Nissan Frontier 4x4 Pickup	1.13	1998 2003	Nissan Frontier 4x4 Pickup
1998	Nissan Frontier King Cab Pickup	1.17	1998 2003	Nissan Frontier King Cab Pickup
1987	Nissan King Cab Pickup	1.17	1986 1997	Nissan King Cab Pickup
1988	Nissan Std-Bed 4x4 Pickup	1.11	1986 1997	Nissan Std-Bed 4x4 Pickup
			1986 1988	Nissan Longbed 4x4 Pickup
			1986 1997	Nissan King Cab 4x4 Pickup
1985	Nissan Standard-Bed Pickup	1.22	1984 1986	Nissan Standard-Bed Pickup
1988	Nissan Standard-Bed Pickup	1.16	1987 1988	Nissan Standard-Bed Pickup
1989	Nissan Standard-Bed Pickup	1.17	1989 1997	Nissan Standard-Bed Pickup
1980	Toyota 4x4 Longbed Pickup	1.07	1981 1983	Toyota 4x4 Longbed Pickup

⁷¹ Literature states 1986 – 95 Nissan Longbed Pickup had 1.20 SSF; exact model year of test vehicle not specified.

<u>Test Vehicle</u>		SSF	<u>SSF Also Applies to</u>	
Model Year	Make/Model		Model years	Make/Model
⁷²	Toyota 4x4 Longbed Pickup	1.07	1984 1992	Toyota 4x4 Longbed Pickup
			1989 1995	Toyota 4x4 Pickup Xcab Longbed
1986	Toyota 4x4 Pickup Shortbed	1.08	1984 1995	Toyota 4x4 Pickup Shortbed
1989	Toyota Pickup Longbed	1.26	1984 1993	Toyota Pickup Longbed
1986	Toyota Pickup Shortbed	1.23	1984 1987	Toyota Pickup Shortbed
1988	Toyota Pickup Shortbed	1.24	1988 1995	Toyota Pickup Shortbed
1986	Toyota Pickup Xtracab Longbed	1.23	1986 1995	Toyota Pickup Xtracab Longbed
2003	Toyota Tacoma Extended Cab 4x4	1.12	2001 2003	Toyota Tacoma Extended Cab 4x4
⁷³	Toyota Tacoma Pickup	1.26	1995 2003	Toyota Tacoma Pickup
			1995 2003	Toyota Tacoma Pickup Xtracab
2002	Toyota Tundra Access Cab 4x2	1.16	2000 2003	Toyota Tundra Access Cab 4x2
2001	Toyota Tundra Extended Cab 4x4	1.15	2000 2003	Toyota Tundra Extended Cab 4x4

⁷² Literature states 1989 – 94 Toyota Longbed Pickup had 1.07 SSF; exact model year of test vehicle not specified.

⁷³ Literature states 1995 – 98 Tacoma Pickup had 1.26 SSF; exact model year of test vehicle not specified.

<u>Test Vehicle</u>		SSF	<u>SSF Also Applies to</u>		
Model	Make/Model		Model	Make/Model	years
Year					
<i>Minivans</i>					
2001	Chrysler Voyager	1.20	2001	2003	Chrysler Voyager
1992	Dodge Caravan Cargo	1.23	1991	1995	Dodge Caravan Cargo
1987	Dodge Caravan	1.13	1985	1987	Dodge Caravan
			1985	1987	Plymouth Voyager
1988	Dodge Caravan	1.18	1988	1990	Dodge Caravan
			1988	1990	Plymouth Voyager
1991	Dodge Caravan	1.22	1991	1991	Dodge Caravan
1992	Dodge Caravan	1.20	1992	1995	Dodge Caravan
1998	Dodge Caravan	1.25	1996	2000	Dodge Caravan
			1996	2000	Plymouth Voyager
1991	Plymouth Voyager	1.22	1991	1991	Plymouth Voyager
1992	Plymouth Voyager	1.22	1992	1995	Plymouth Voyager
1990	Plymouth Grand Voyager	1.21	1988	1990	Plymouth Grand Voyager
			1988	1990	Dodge Grand Caravan
1991	Plymouth Grand Voyager	1.20	1991	1995	Plymouth Grand Voyager
			1991	1995	Dodge Grand Caravan
			1991	1995	Dodge Caravan Cargo Ext
1998	Plymouth Grand Voyager	1.22	1996	2000	Plymouth Grand Voyager
			1996	2000	Dodge Grand Caravan
2001	Dodge Grand Caravan	1.23	2001	2003	Dodge Grand Caravan
			2001	2003	Chrysler Town & Country LX
1992	Ford Aerostar 4x4 Extended Wagon	1.13	1990	1997	Ford Aerostar 4x4 Extended Wagon
1986	Ford Aerostar Wagon	1.11	1986	1987	Ford Aerostar Wagon
1988	Ford Aerostar Wagon	1.11	1988	1997	Ford Aerostar Wagon
1992	Ford Aerostar 4x4 Wagon	1.15	1990	1994	Ford Aerostar 4x4 Wagon
1988	Ford Aerostar Cargo Van	1.10	1986	1997	Ford Aerostar Cargo Van
			1989	1994	Ford Aerostar Ext Van
⁷⁴	Ford Windstar Wagon	1.24	1995	1998	Ford Windstar
2001	Ford Windstar	1.26	1999	2003	Ford Windstar
2001	Mercury Villager Van	1.27	2001	2002	Mercury Villager Van
1988	Chevrolet Astro Passenger Van	1.12	1985	1992	Chevrolet Astro Van
			1985	1992	GMC Safari Pass Van
			1985	1992	GMC Safari Cargo Van
			1990	1992	Chevrolet Astro Ext Psgr Van
			1990	1992	Chevrolet Astro Ext Cargo Van
			1990	1992	GMC Safari Ext Pass Van
			1990	1992	GMC Safari Ext Cargo Van

⁷⁴ Literature states 1995 – 98 Windstar had 1.24 SSF; exact model year of test vehicle not specified.

<u>Test Vehicle</u>		SSF	<u>SSF Also Applies to</u>	
Model	Make/Model		Model	Make/Model
Year			years	
1998	Chevrolet Astro Passenger Van	1.13	1993 1994	Chevrolet Astro Van
			1993 1994	GMC Safari Pass Van
			1993 1994	GMC Safari Cargo Van
			1993 2002	Chevrolet Astro Ext Cargo Van
			1993 2003	Chevrolet Astro Ext Psgr Van
			1993 2003	GMC Safari Ext Pass Van
			1993 2003	GMC Safari Ext Cargo Van
1990	Chevrolet Lumina APV	1.13	1990 1996	Chevrolet Lumina APV
			1990 1996	Olds Silhouette
			1990 1996	Pontiac Trans Sport
			1992 1996	Chevrolet APV Cargo Van
1998	Chevrolet Venture Van	1.18	1997 2003	Chevrolet Venture Van
			1997 1998	Pontiac Trans Sport
			1999 1999	Pontiac Montana
2001	Oldsmobile Silhouette	1.18	1997 2003	Oldsmobile Silhouette
2001	Honda Odyssey	1.32	1999 2003	Honda Odyssey
2002	Kia Sedona Van	1.25	2002 2003	Kia Sedona Van
2001	Mazda MPV	1.21	2000 2003	Mazda MPV
1991	Mazda MPV 4x4 Wagon	1.16	1989 1998	Mazda MPV 4x4 Wagon
1989	Mazda MPV Cargo Van	1.17	1989 1992	Mazda MPV Cargo Van
			1989 1998	Mazda MPV Wagon
1987	Nissan Van	1.02	1987 1990	Nissan Van
1987	Toyota Cargo Van	1.05	1985 1989	Toyota Cargo Van
⁷⁵	Toyota Passenger Van 4WD	1.08	1987 1989	Toyota Passenger Van 4WD
			1987 1989	Toyota Cargo 4x4 Van
1986	Toyota Passenger Van	1.11	1985 1989	Toyota Passenger Van
1991	Toyota Previa Van 2WD/4WD	1.23	1991 1997	Toyota Previa Van
2001	Toyota Sienna	1.25	1998 2003	Toyota Sienna
1984	VW Vanogan Van	1.03	1985 1991	VW Vanogan Van
			1985 1987	VW Vanogan Kombi
			1985 1991	VW Camper+R33
			1990 1991	VW Multi-Van

⁷⁵ 1.08 SSF is average of 1987 (1.048) and “1984-90” (1.11) vehicles.

<u>Test Vehicle</u>		SSF	<u>SSF Also Applies to</u>	
Model Year	Make/Model		Model years	Make/Model
<i>Full-Size Vans</i>				
1987	Dodge B150 Ram Van	1.09	1985 1997	Dodge B150 Ram Van
2001	Dodge B150 Ram Van	1.14	1998 2003	Dodge B150 Ram Van
2001	Ford E-150	1.11	1992 2003	Ford E-150
1984	Ford E-150 Club Wagon	1.09	1985 1985	Ford E-150 Club Wagon
1987	Ford E-150 Club Wagon	1.11	1986 1991	Ford E-150 Club Wagon
1998	Ford E-150 Club Wagon	1.11	1992 2003	Ford E-150 Club Wagon
1988	Chevrolet G10 Pass Van	1.08	1985 1993	Chevrolet G10 Pass Van
			1985 1995	Chevrolet G20 Pass Van
			1985 1993	GMC G10 Pass Van
			1985 1995	GMC G20 Pass Van 85-95

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