PROGRAM DIVISION BULLETIN

2004-45 **October 22, 2004**

Important Notice Regarding 12- and 15-Passenger Vans

In 2001 the National Highway Traffic Safety Administration (NHTSA) released a report warning the public of the propensity of 12- and 15-passenger vans to roll-over. Since that time both the NHTSA and Public Citizen have released a number of updated reports, all confirming the serious threat to passengers in 12- and 15-passenger vans. Federal law prohibits the sale and use of 12- and 15-passenger vans for the school-related transport of high school age and younger students by public schools. In the past, the AIG Programs Division has taken the stance of modification of the vehicles by removing the rear seats or modifying the rear wheels along with use of experienced drivers only.

On June 1, 2004, the NHTSA released another bulletin confirming the fact that "15-passenger vans have a rollover risk that increases dramatically as the number of occupants increase to full capacity. If fact, the likelihood of a rollover when a van is fully loaded is ***five times greater*** than when the vehicle contains only the driver. The risk of rollover increases significantly at ***speeds over 50 miles per hour***."

Specific problems with 12- and 15-Passenger vans:

- Increased risk of rollover;
- Inability to withstand side-impact crashes;
- High center of gravity with a disproportionate amount of weigh extending behind the rear wheels;
- Poor door latches in the side and rear doors.

Attached within this bulletin are copies of the NHTSA studies for your review.

-continued-

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Stopping Rollovers

The Dual-Wheel Solution for 15-Passenger Vans

Public Citizen

With

C. Tab Turner

November 2002

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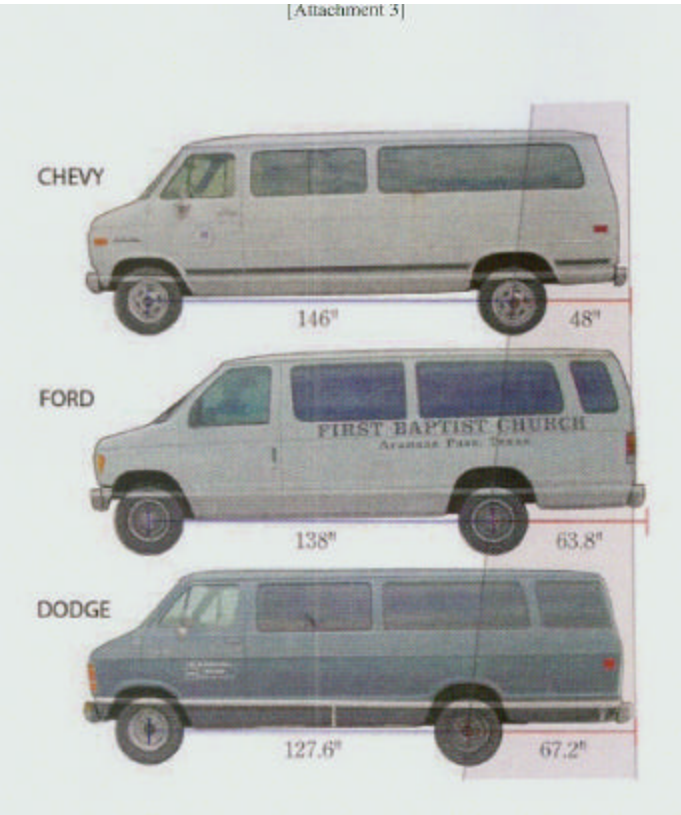
I. Introduction: The Hazards of 15-Passenger Vans

An internet advertisement for the Chevy Express 15-passenger van excitedly exclaims: "Bring on the crowds — [the] Express Passenger Van offers seating for 15 passengers and extra room for cargo on 3500 Extended Wheelplate models." Another ad, for Dodge's Ram Van Passenger Wagon proudly boasts that Dodge's van is a "people-moving power house" that "seats 15 happy campers."[1] *See* Appendix A.

Fifteen-passenger vans are routinely marketed by the automotive industry to schools, colleges and universities, church groups, airport ground transportation services, day care services, organizations for the elderly or disabled people and other entities. Yet the groups would not be enthusiastic customers for these vehicles if they were aware that government research, stability test and real-world crash statistics show that 15-passenger vans are exceedingly dangerous vehicles. For these vans, in fact, the more is not the merrier, and bringing on the crowds is a terrible idea. The vehicles are particularly susceptible to potentially deadly rollover crashes when loaded with as few as five people, which is just one-third of the vehicle's seating capacity, and just get more dangerous as they are loaded with passengers.

Fifteen-passenger vans are routinely used to transport groups of vulnerable passengers such as children and the elderly on field trips, to conventions, on church outings, and to athletic events. Yet church leaders, school officials and others may be totally unaware that the vans have special handling needs and are top-heavy and tippy, with a high risk of rolling over in an emergency maneuver. Despite the hazards posed by driving these vehicles, automakers are not legally required to honor many basic safety protections that would protect passengers when a crash occurs, including crucial safeguards that apply to other passenger-carrying vehicles, such as school buses, sports utility vehicles and smaller vans. Manufacturers' ads also fail to warn potential customers that the more "happy campers," luggage and equipment that are loaded into these vehicles, the more dangerous they become. The result of the combination of these three tragic omissions is that 15-passenger vans strike out when it comes to safety.

Ford and General Motors are the current manufacturers of 15-passenger vans. DaimlerChrysler discontinued production of its versions of the vans in June 2002, a decision which may very well have been prompted by the safety risks, and the liability, posed by the vans. But that still leaves many of these vans on the road manufactured by all three of the automakers. In total, according to experts at the National Highway Traffic Safety Administration (NHTSA), there were about 500,000 15-passenger vans on the road as of July 2001.[2] Between 1990 and 2000, 864 occupants of these vans died in crashes, 424 of them in single-vehicle rollover crashes, producing a vehicle death rate that is far higher than it should be given the relatively small number of these vehicles that are on the road, as well as an extraordinarily high death rate in rollover crashes.[3]



The 15-passenger van is a slapped-together hybrid vehicle, meaning that it combines features of several vehicle types. Originally designed as vans to carry cargo, manufacturers sought ways to inexpensively convert these vehicles for use in carrying passengers without properly re-designing them to handle well on the road or to protect the large numbers of people they are able to transport. Beginning in the early 1970s with the Dodge Maxi Wagon, and in response to an emerging market for these vehicles, the manufacturers cut costs that would have been incurred for a newly designed van to carry passengers safely and for re-tooling factories, by merely making minor modifications to the large cargo vans already coming off the line.

In an economical, but cut-rate, solution, they simply extended the cargo van's length by a foot and one-half beyond the vehicle's rear axle and installed seating capacity to accommodate 15 occupants. This choice means that up to four passengers are seated beyond the rear axle in the rearmost and longest seating area in the van. In addition to lacking important structural safety protections, this extension of the rear of the vehicle to carry occupants and luggage is a major contributor to the instability of the vehicle, creating a "fishtail" effect and other handling difficulties in emergency maneuvers.

In recent years, high-profile rollover crashes of 15-passenger vans have killed or injured many riders in crashes particularly notable for the high numbers of people hurt and the concentration and close association of those affected. A number of such crashes involved college sports teams and church groups, and finally caught the attention of the U.S. Department of Transportation's highway safety

agency, NHTSA. After conducting an inquiry into the problem, NHTSA issued a Consumer Advisory and Research Note in April 2001, and reissued another Consumer Advisory a year later in April 2002.[4] In its consumer warnings, NHTSA highlighted the riskiness of the vans. The National Transportation Safety Board also issued a safety report on November 1, 2002, with recommendations to address the safety hazards of the vans in letters directed to General Motors, Ford and NHTSA.[5] A few insurers of churches and schools are no longer selling policies to insure these vehicles and are raising the rates for existing policyholders.[6]

After years of neglect, the issue has finally begun to receive the attention that it deserves. NHTSA's warnings increased press attention and public scrutiny of these gruesome crashes. The forces now coalescing around the issue are a textbook study of the attention needed before the manufacturers will consider safety to be of paramount value and make needed changes or recall dangerous vehicles. Events contributing to the now-growing clamor to address this issue include the following:

Growing concerns among insurers and the establishment of higher rates or discontinued coverage, particularly among companies insuring churches and schools;

A precipitous drop in sales as word of the problems has spread;[7]

DaimlerChrysler's decision to discontinue manufacturing these vans;

* The recent investigation by the NTSB, and the publication of two consumer alerts by NHTSA;
* Legislation to prohibit post-secondary school use of 15-passenger vans, H.R. 3296, was introduced in Congress by Rep. Mark Udall (D.-CO);
* Increasing public pressure to re-design the vehicles;
* Increasingly frequent litigation on behalf of injured consumers against manufacturers for the deadly design of these vehicles.

Omissions and Special Exemptions in Federal Safeguards Pertaining to 15-Passenger Vans Produce Tragic Results

Fifteen-passenger vans exist in regulatory limbo as loophole vehicles under federal law. Because they are designed to carry over 10 passengers, they are classified as buses, yet they need not meet the more stringent crash protection standards required of large and small school buses. Adding insult to injury, the vehicles also do not have to meet certain protective federal motor vehicle safety standards that apply to smaller vans, sport utility vehicle (SUVs) and passenger cars. They are also essentially orphaned by the ongoing work at the nation's highway safety agency. They are not included in NHTSA's New Car Assessment Program, which conducts crash tests of vehicles and publishes the results, nor are they a subject of the agency's research and pending new rule on a rollover risk testing program.

There are also important loopholes in the laws governing 15-passenger vans that pose a unique threat to the safety of children. If a new "bus" is sold or leased to significantly transport school children

either to or from school, the bus must comply with all federal school bus safety standards, which are designed to provide occupants with a higher level of safety than regular bus standards.[8] Because 15-passenger vans do not meet key federal motor vehicle safety crash standards (FMVSS) for school buses, the law prohibits the sale or lease of *new* 15-passenger vans for significant use in primary and secondary school-related transport. Although both NHTSA and the NTSB recommend that states require that all school children be transported in buses meeting the FMVSS requirements for school buses, neither agency has the jurisdiction to issue such a regulation. Under current law, however, pupil transportation is regulated by the states. Therefore, neither federal body can prohibit schools from buying or leasing *used* 15-passenger vans. In addition, the federal prohibition does not apply to the transport of college students, and colleges and universities use 15-passenger vans regularly, particularly for sports teams.

In addition to these serious safety deficiencies in vehicle performance rules outlined above, drivers of 15-passenger vans do not need a special commercial driver's license to operate the vans.[9] In the absence of such a requirement, many 15-passenger vans are driven by individuals without any significant experience driving such a large vehicle. This is extremely problematic. As described above, due to manufacturer shortcuts, 15-passenger vans have a high center of gravity and poorly designed rear seating area that extends beyond the axle of the vehicle, making them difficult to maneuver. Yet despite the complex handling characteristics of these vans, drivers of these vehicles do not typically receive any specialized training or screening.[10]

These factors result in a lower price tag for 15-passenger vans than for small school buses, and, accompanied by the convenience of avoiding a special certification for drivers, are the central reason that 15-passenger vans appeal to college sports teams, volunteer organizations and groups whose members serve as the driver for a particular occasion. Most owners and users may only now be learning of the dangerous rollover propensity of the vans and the near-total lack of crash protection provided for occupants in a crash.

While two federal government safety agencies have now raised serious questions about the safety of 15-passenger vans, manufacturers continue to try to deny the problem and deflect the blame onto drivers of the vans by claiming that that the vans are safe "if used properly." Carolyn Brown, a spokeswoman for Ford, recently recognized that the handling of these vans can be difficult, yet also blithely said that, "If [a 15-passenger-van] is not overloaded and if it is driven properly, it is a very safe vehicle."[11] And in a briefing for NHTSA officials after issuance of the agency's Research Note on April 2001, Ford also made blanket assertions that the vans were safe, or, at least "appropriate": "Ford 15-passenger E-series vans were designed to accommodate a full occupant load and, when loaded, possess appropriate steering, handling, and stability characteristics."[12]

Summary of the Fix: Short-Term Partial Remedies and Long-Term Solutions

Both NHTSA and the NTSB have issued recommendations to enhance the safety of the 15-passenger vans already on the road. NHTSA's recommendations focus on improving driver skills, decreasing driving speed, increasing the use of safety belts, checking for properly inflated tires,

exercising care not to put any load on the roof, and carefully loading seats in front of the rear axle if there are fewer than 15 passengers. Despite its emphasis on driving skills, NHTSA failed to recommend that the Federal Motor Carrier Safety Administration, which has jurisdiction over this area, require a commercial driver's license to operate the vans. The agency also indicated that it is considering requiring that the vehicles bear a "warning label about rollover and seat belt use."[13] This is a poor response, to say the least. Warning labels are of questionable value in affecting consumer behavior, yet are excellent tools for the manufacturers in litigation to shift the blame for crashes onto drivers.

The NTSB recommends that NHTSA include 15-passenger vans in its pending plan for a dynamic rollover testing program and test these vehicles in crash tests as part of the agency's New Car Assessment Program, which publishes results by make and model for consumers. The NTSB further requested that NHTSA, in conjunction with the manufacturers, test and evaluate technological handling systems, particularly electronic stability control systems, that have potential to assist drivers in maintaining control of these rollover-prone vans.

We support all of the recommendations made by NHTSA and the NTSB as obvious and necessary short-term responses to a public safety emergency, and we particularly commend the NTSB for recommending that 15-passengers vans be brought into NHTSA's work on rollovers. But asking drivers to exercise caution, as NHTSA does, is far from enough — these vans must also be altered to be far easier to control and less prone to roll over than they are today. No driver, no matter how skilled, can safely deal with emergency avoidance maneuvers, such as off-road re-entry maneuvers on the highway where drivers have inadvertently entered the shoulder of the highway and must rejoin traffic, or cope with situations such as tire failures at freeway speeds, without these vans becoming uncontrollable and rolling over.

For that reason, a fix for the vehicles now on the highway is essential. After considerable testing, we have developed recommendations for a concrete and relatively simple change to the vehicle that would directly address the poor handling characteristics of 15-passenger vans, providing vast improvements in rollover prevention for vehicles now in use.

In this report, we explain that installation of two rear wheels ("dual wheels") on each side of a 15-passenger van has been shown in rigorous testing to improve the handling characteristics of the vans, reduce the risk of rollover and create a more stable vehicle. As documented by this report, the concept of using dual rear wheels on vehicles the size of 15-passenger vans to improve traction, improve stability and improve load-carrying capability is not new or unique and has been considered internally by the manufacturers for years. Below is an image of an Oldsmobile 2 and a half ton pick-up truck from 1937 that was equipped with duals rear wheels.

Retrofitting existing 15-passenger vans with these dual rear wheels is a feasible option that would help improve rollover resistance, which is the most glaring safety deficit afflicting the vans. Safety of the vans would still be compromised by the lack of crash protection for occupants, but reducing the risk of rollover is a definite step in the right direction for preventing more deaths and injuries.

We make our recommendation to improve rollover resistance with the important caveat that we believe these vehicles are badly in need of a comprehensive safety-related re-design, in which they can evolve from a slightly modified cargo vehicle to one truly capable of safely transporting people. Substantial improvements in crash protection design, from the roof structure to the interior, are long overdue. If these vans are going to continue to play a significant role in transporting consumers in the future, then we recommend that the manufacturers completely redesign them so that they remain controllable and stable under all foreseeable operating conditions, and that manufacturers equip them with adequate crash protection for passengers that exceed all of the appropriate federal minimum safety standards.

Due to the high occupancy of these vehicles, it is an abomination that the manufacturers have consistently taken advantage of the regulatory loopholes to market and profit from these dangerous designs since the 1970s. Given that manufacturers know that poorly designed vans expose large numbers of consumers to the risk of serious and often fatal injuries at one time, it is our belief that manufacturers have a heightened duty to act with safety in mind, especially given that the vehicles are frequently occupied by our children, our parents and the elderly. An image from a recent crash of a 15-passenger van is below.

A few examples of the tragic consequences of automaker neglect of the safety of these vehicles are provided below.

* On August 3, 2000, a 1995 Ford E-350 15-passenger van owned by the Mississippi County Economic Opportunity Commission was transporting employees on I-55 near Osceola, Arkansas, when a Bridgestone Dueler tire tread peeled apart, causing the driver to lose control. The van rolled over, killing one occupant and injuring the others.[14]

  On May 9, 1999, while driving to Disney World to celebrate their daughter Maria's tenth birthday, the right rear tire of the Jimenez family's rented 1999 Ford Econoline E-350 van blew out. The tire failure caused the van to spin out of control and roll over. Ten-year-old Maria suffered a catastrophic brain injury and is currently in a persistent vegetative state.[15]

  On May 8, 2001, 12 members of the First Assembly of God women's group were driving a church-owned Dodge Ram 3500 extended van on a shopping excursion to a Gainesville, Texas, outlet mall. Sixty-two-year-old Dorothy Griffin lost control of the van when one of the tires suddenly suffered a tread separation. The van uncontrollably swerved into the median and rolled several times. The crash took the lives of four women and injured six others.[16]

  On February 10, 2002, nine members of the Prairie View A&M track and field team were traveling in a Ford E-350 15-passenger van when the driver was forced to make an emergency maneuver. The van rolled over 3 ½ times. Five of the students were killed, including the seat-belted driver.[17]

* Four Memphis youths died on April 4, 2002, when the driver of a day care van lost control of the vehicle and ran into a highway overpass.[18]

* In June of 2002, while driving a Ford E-350 15-passenger van loaded with Oregon firefighters to battle the Hayman wildfire in Colorado, Megan Helm lost control of the van, made a steering maneuver, and the van rolled over four times. Five of the 11 firefighters were killed and the others were injured.[19]

* On July 14, 2002, Leroy Robinson was a passenger with 12 members of his church congregation from Philadelphia in a Dodge 15-passenger van on a church trip when a motor home with a vehicle in tow clipped the van. The van swerved and overturned numerous times killing four church members ages 14, 32, 38 and 40, and injuring several others.[20]

* On July 25, 2001, Shirley Hines was transporting 10 members of Emmanuel Baptist Church in a 1989 Ford E-350 van on I-20 in Louisiana when the right rear tire suddenly suffered a tread separation. The tire failure caused the vehicle to begin swerving violently. Ms. Hines lost control and the van rolled over. The rollover crash claimed the lives of 2 passengers and injured the others.[21]

To understand how this threat to the public arose, we next examine the history and development of the market for 15-passenger vans.

II. Defining the Scope of the Problem with 15-Passenger Vans

The current fleet of 15-passenger vans is made up of the following vehicles:[22]

Chevrolet Express 3500
GMC Savana G3500
GMC Rally/Vandura G3500
Dodge Ram Van/Wagon B3500
Dodge Ram Wagon B350
Ford Econoline E350
Ford Club Wagon E350[23]

During the decade from 1990 to 2000, 15-passenger vans were involved in 1,281 fatal crashes and killed 864 van occupants, 654 occupants of other vehicles and 200 bystanders. 268 single-vehicle rollover crashes resulted in 424 fatalities to van occupants. NHTSA reports that 80 percent of the fatally injured people in 15-passenger vans were not wearing safety belts. [24] This compares to 50 percent for all fatal crashes.

NHTSA has found that the number of occupants in a 15-passenger van has a large effect on the frequency of rollover in fatal crashes. In fatal single-vehicle crashes, cars with 10 or more occupants rolled over 85 percent of the time, compared to 38 percent of the time in those vans with fewer than 10 occupants and 28 percent of the time for those vehicles with fewer than five.[25]

There is no question that 15-passenger vans are over-involved in single-vehicle rollover crashes compared to other passenger vehicles. From 1991 to 2000, 33 percent of passenger vehicles involved in single-vehicle, fatal accidents experienced a rollover, compared to 52 percent for 15-passenger vans involved in such crashes. *A shocking 81 percent of all 15-passenger van occupant fatalities occurred in single-vehicle rollover crashes*.[26]

In its first analytical work focused on 15-passenger vans, NHTSA looked specifically at single-vehicle rollover crashes to ascertain whether these vans, when loaded with passengers, "are unusually susceptible to rollover." Although NHTSA found that 15-passenger vans have a rollover rate comparable to other light trucks and vans when the number of occupants in the van is not considered, they also determined that the rollover rate triples when the vans are loaded with 10 or more occupants, in comparison to the rollover rate when the vans have fewer than 10 occupants. The following chart taken from the NHTSA research note demonstrates the findings:

Number of Rollover Crashes and Rollover Ratios by Occupancy Level of 15-Passenger Vans in Single-Vehicle Crashes[27]

Occupancy Level	All Single Vehicle Crashes	All Rollovers	Rollover Ratio	*Combined Rollover Ratios 1 to 9 and 10 or more occupants*
Fewer than 5	1,815	224	12.30%	12.7%
5 – 9	77	16	20.80%	
10 – 15	55	16	29.10%	35.4%
Over 15	10	7	70.00%	

As NHTSA's Research Note reveals, loading the van with occupants and cargo causes the center of the vehicle's gravity to shift rearward and upward, increasing the likelihood that the vehicle will be difficult to control in emergency situations and more prone to roll over once a loss of control occurs.

In its research, the agency reviewed the available real-world crash data, measured the static stability factor[28] of a typical 15-passenger van, a 7-passenger van and a minivan, and analyzed the handling characteristics of both loaded and unloaded typical vans, using state-of-the-art computer simulation programs designed to model vehicle performance. The agency examined the rollover issue by looking at the vehicle in its static, or resting, condition and by conducting tests of the vehicle's dynamic behavior on the road.

NHTSA found that the *static* measurements of the typical 15-passenger vans – the static stability factor – became worse as the vehicle moved from an unloaded to a loaded condition, increasing the risk of rollover by an amazingly high 40 percent! In lay terms, the higher the center of gravity became with the increase in loading, the more susceptible the vehicle was to rolling over.

In order to analyze the *dynamic* handling behavior of the typical 15-passenger van, the agency conducted computer simulation work using values typical of these vans. The simulated van was

evaluated using a slowly increasing steer maneuver designed to evaluate the understeer characteristics of vehicles, and a simulated 30-mph reverse steer maneuver in which the steering wheel is first turned hard to the right and then turned hard to the left.

In summary, the agency concluded that the simulated 15-passenger van demonstrated dangerous oversteer[29] characteristics when fully loaded in the slowing increasing steer maneuver. The agency stated that "these examples show that the simulated GVW [gross vehicle weight, or fully loaded] 15-passenger van exhibits both lateral and roll instabilities under extreme maneuvers."[30] The tendency of the center of gravity of the vehicle to move up and rearward with loading was found to directly contribute to the directional instability, while the roll instability resulted from the fact that the loaded van tended to spin sideways, which when combined with the high center of gravity, created a significant risk that the vehicle would roll over.[31]

The effect of increased loading on the handling and stability characteristics of vehicles is not a new concept. In 1979, for instance, the Highway Safety Research Institute at the University of Michigan analyzed the problems encountered in calculating the potential for rollover inherent to military vehicles during maneuvers performed on paved, level surfaces. One important conclusion from this research was the discovery that occupant loading had an adverse safety impact on the handling and stability characteristics of the vehicles.[32]

In 1992, NHTSA examined the effect of vehicle loading and variation in vehicles on the static stability factor and tilt table performance of a variety of passenger vehicles. The agency determined that both static stability factor and tilt table performance were adversely affected as passengers were loaded into the vehicles.[33] Additional research work carried out between 1992 and 2001 consistently reached the same conclusion about the risks associated with occupant loading of light trucks and vans.[34]

Ford Motor Company had a uniquely negative experience with the issue of the increased instability that resulted from the loading of occupants and luggage in vans designed to carry people. Like 15-passenger vans, some designs of minivans have proved insufficient to protect passengers when subject to high loading conditions. In late 1992, Value Rent-A-Car Company in Florida, a company owned at the time by Mitsubishi, suffered a rash of rollover accidents involving the Ford Aerostar minivan that it was renting to vacationers in southern Florida. The problem involved a loss of control resulting in rollover crashes when the vehicle was loaded with a full complement of occupants and luggage. As the problem for Value worsened, the company sent a letter to Ford that included the following request:

> This letter is to inform you that Value has experienced a number of accidents involving rollover incidents in the Ford Aerostar vans. We are interested in knowing if you have any information regarding any problems or increased incidents of rollovers for the Ford Aerostar vans. We would appreciate your providing us with any relevant information regarding these concerns, including the vehicles compliance with safety standards. In addition, please provide us with any information you have

> which may be helpful to our renters in handling this vehicle other than the information provided in the owners manual....[35]

The problem was significant to Value because of the high number of people occupying the vans, the high number of crashes that were occurring when the vehicle was loaded with occupants, and the seriousness of the rollover accidents.[36] Value hired an independent vehicle design expert to assist it with the problem, who determined that the Aerostar was designed defectively and therefore was unsafe.[37]

Ford responded to Value's letter by suggesting that Value "not put things like this in writing."[38] Ford suggested a meeting in Detroit to discuss the matter further. At the meeting in Detroit, Ford presented Value representatives with "data" indicating that the Aerostar possibly had a higher center of gravity compared to other similar vans, and argued that the van was "safe" if "used properly." Ford offered to "inspect" the vans involved in crashes and provide Value with a "vehicle handbook."[39]

Unswayed by Ford's presentation, the Value representatives pressed Ford to recall the vehicles and to fix the problem. According to an employee of Value, the following was Ford's response to Value's demand that the Aerostar be recalled and fixed:

> Q. And during the course of this conversation about recalling the Aerostar minivan, Mr. Cline, tell us what Mr. Mavis told you.
> A. Mr. Mavis said they would not recall the minivan, it would be cheaper to pay the claims involving the Aerostar.[40]

Unable to get Ford to act to protect consumers, Value created its own warning sticker for the van. The label, placed on the center of the steering wheel by Value, specifically warned users about the rollover danger associated with the van when loaded with a full complement of occupants and luggage.

Insurance companies have also joined the growing list of those concerned about the safety of 15-passenger vans. GuideOne, an insurer that specializes in insuring churches, church groups and schools, and the Colorado School District Self-Insurer Pool, have both stopped selling new policies for 15-passenger vans and are raising rates on existing policies. Jan Beckstrom, the Chief Operating Officer of GuideOne, has called 15-passenger vans "inherently dangerous" and expressed concern about the impact of crashes on "the health and vitality of the ministries and people involved." The company has begun urging owners of these vehicles to replace them with safer modes of transportation, such as small buses.[41]

III. Loopholes in Federal Safety Standards Afflicting 15-Passenger Vans

Under the existing regulatory scheme, a 15-passenger van is classified as a "bus" because vans are defined as a passenger vehicle that can carry over 10 passengers, and because the gross vehicle weight of these vehicles is approximately 9,500 lbs. In essence, the 15-passenger vehicle is a loophole vehicle under federal safety rules.

Although most consumers think of a bus as a large intercity or transit bus, current federal safety rules have three categories of buses.[42] Although often used like a school bus, the vans do not have to comply with the extra strength requirements for school buses under the existing regulatory scheme.[43] Below is a list of the Federal Motor Vehicle Safety Standards (FMVSSs) that do not apply to 15-passenger vans and yet do apply to, and significantly enhance the safety of, small school buses (vehicles that are the closest in size to 15-passenger vans). A fuller description of applicable and inapplicable standards is contained in Appendix B.

The following is a synopsis of current bus categories (including two industry categories, motor coach and specialty bus), summarizing how they "stack up" in terms of federal crash protection requirements:

Required Crash Protection Attributes for Various Bus Types[44]

Type of Bus	Crashworthiness[45] (Joint Strength and Roof Rollover)	High Backed Padded Seats[46]	Minimum Seat Spacing[47]	Seat Belts
Large school bus GVWR > 10,000 lbs	Yes*	Yes*	Yes*	No
Small school bus GVWR = 10,000 lbs	Yes*	Yes*	No	Yes*
Motor coach	Yes**	Yes**	No	No
Specialty bus[48]	No	Varies	No	No
15-passenger van	No	No	No	Yes*

(*Federal Standard)
(**Industry Standard)

In addition to the federal bus safety rules listed above, 15-passenger vans are exempt from a number of federal safety standards that apply to multipurpose passenger vehicles that are similar in weight, such as vans and larger SUVs.[49] Fifteen-passenger vans do not have to comply with a number of key crash protection safety standards that protect the occupants of automobiles and multipurpose passenger vehicles:[50]

* FMVSS 201: **Occupant Protection in Interior Impact** (15-passenger vans exempted from upper interior head protection). This standard specifies requirements to afford impact protection for occupants.[51]

* FMVSS 202: **Head Restraints** (15-passenger vans exempted from placing head restraints in rear seating positions). This standard specifies requirements for head restraints to reduce the frequency and severity of neck injury in rear-end and other collisions.[52]

* FMVSS 206: **Door Locks and Door Retention Components.** This standard specifies requirements for side door locks and side door retention components including latches, hinges

and other supporting means, to minimize the likelihood of occupants being thrown from the vehicle as a result of impact.[53]

* FMVSS 214: **Side Impact Protection** (15-passenger vans exempted from dynamic test). This standard specifies performance requirements for protection of occupants in side impact crashes. Its purpose is to reduce the risk to vehicle occupants in side impact crashes by specifying vehicle crashworthiness requirements in terms of accelerations measured on anthropomorphic dummies in test crashes, by specifying strength requirements for side doors, and by other means.[54]

* FMVSS 216: **Roof Crush Resistance.** This standard establishes strength requirements for the passenger compartment roof. Its purpose is to reduce the crushing of the roof into the passenger compartment in rollover accidents.[55]

* 49 CFR 575.105: **Rollover Warning Label.** This section requires manufacturers of utility vehicles to alert the drivers of those vehicles that they have a higher possibility of rollover than other vehicle types and to advise them of steps that can be taken to reduce the possibility of rollover and/or to reduce the likelihood of injury in a rollover.[56]

However, 15-passenger vans are required to have safety belts installed, as are automobiles, multipurpose passenger vehicles and small school buses. Larger school buses and motor coaches are not subject to this requirement.[57]

As the foregoing discussion illustrates, 15-passenger vans have largely escaped federal regulatory standards for occupant protection. Many, if not all, of these standards are woefully out-of-date and inadequate, such as the roof crush standards (FMVSS 216 applies in the same area to multi-purpose vehicles and FMVSS 220 applies to school buses). Yet even these minimal standards do not apply to 15-passenger vans. The tragic record of fatal crashes shows that the auto industry has taken full advantage of the loopholes and has completely failed to act on its own to protect occupants.

The problem of inadequate crash protection for consumers is compounded by the lack of any meaningful rollover prevention safety standard. Given the multiplicity of loopholes in rules that should be protecting occupants of the vans, the lack of any meaningful rollover resistance safety standard, and the auto industry's predictable failure to act to fix the hazards, it is no surprise that these vans continue to be prone to roll over and that consumers are unreasonably exposed to catastrophic injuries when the vehicles do roll.

IV. NHTSA's and the NTSB's Safety Recommendations Are Inadequate To Solve the Problem

In its April 2001 public warning accompanying its Research Note, NHTSA outlined a number of recommendations that it stated would reduce the risk of rollover injuries in 15-passenger vans. NHTSA's recommendations highlighted the importance of the following steps:

* Drivers should be well-rested and apply safe speeds for weather and road conditions;
* Drivers should be cautious on curved rural roads and safe speeds to avoid running off the road;
* If wheels drop off the highway, drivers should gradually reduce speed and steer back onto the highway;
* Check for properly inflated and treaded tires;
* Use safety belts, with driver enforcing belt-wearing policy;
* Passengers should sit in seats in front of rear axle when not full;
* More than 15 passengers should never be allowed in a 15-passenger van;
* To be aware that vans require more space and reliance on side-view mirrors;
* To be aware that vans do not respond well to abrupt steering maneuvers;
* To be aware that vans require additional braking time.

Although we agree that drivers of all types of vehicles should consider NHTSA's list of "safe driving habits" as good advice, these general expressions of safety ignore the very real design problems associated with these vehicles. As the real world evidence demonstrates, consumers can unfortunately follow each of these "safe driving habits" and still end up in a catastrophic rollover crash while driving or riding in a 15-passenger van.

NHTSA's recommendations ignore or downplay the following factors affecting the safety of 15-passenger vans:

* The vans are difficult to control in emergencies;
* The vehicles, by design, are unstable;
* The vehicles lack adequate crash protection for occupants;
* Safety loopholes exist in the regulatory scheme, thus exempting them from many of the requirements;
* The auto industry has taken advantage of these loopholes and ignored safety;
* The lack of NHTSA research, testing and consumer information on the vans.

The NTSB, by comparison, in its letters to manufacturers and to NHTSA on November 1, 2002, urges NHTSA to conduct research, and testing and to include the vans as a part of the agency's consumer information program. The NTSB also asked NHTSA to test other technological systems, particularly electronic stability control systems, which are designed to help avoid loss of directional control.

Although both NHTSA and the NTSB have identified a problem, neither agency has investigated the reasons why the companies made these horribly unsafe vehicles, how much the manufacturers knew about their dangers, or why consumers are not adequately warned of the hazards. Most importantly, neither agency has asked the most relevant question from a consumer's standpoint: that is, how we can fix these vehicles. This report is a kick-start for that work. We urge both the safety agencies and the auto industry to take immediate action to protect the public in this matter.

V. Manufacturer Knowledge of the Hazards of 15-Passenger Vans

The three manufacturers of 15-passenger vans that are currently on the highways, General Motors, Ford and Chrysler, have known for years about the dangers associated with the vans when loaded at or near the total weight that the vehicle is designed to carry. They have each been sued for deficiencies in the design of the vehicles, and all three are keenly aware of the propensity of 15-passenger vans to roll over. Yet none of these companies have redesigned the vans to prevent rollover and none of them have taken steps to design the vans to reduce injuries from rollover crashes.

The full-size Dodge Ram Wagon passenger van, which was made by Chrysler until recently, is among the oldest vehicles in the 15-passenger van category, having hit showrooms initially in time for the 1971 model year. In June 2002, Chrysler discontinued production of its full-size van. The Dodge Ram Wagon was originally offered on two different wheelbases, a 109.6-inch version, a 127-inch version, as well as a "Maxi" version that added a 26-inch body extension to a long wheelbase truck for 15-passenger seating.

Chrysler, as with other manufacturers, has long recognized the need to design vehicles such as a 15-passenger van so that it slides, rather than rolls over, when a loss of control occurs, at least on paved road surfaces.[58] Chrysler used a battery of dynamic tests to evaluate vehicle dynamics. According to the Chrysler test engineer working on the van, despite the battery of tests available to Chrysler, the company's 15-passenger van was not tested in the Consumers Union evasive maneuver, nor was it tested in the step steer test maneuver, the single lane change test, or the tire blow-out test.[59] In fact, Chrysler's engineer asserted that he never ran any test designed to measure the overturning resistance of the 15-passenger van.[60]

A November 1, 2002, letter to the National Transportation Safety Board from David Perry, an attorney from Corpus Christi, Texas, highlights a loading problem that causes the body of the Chrysler van to move with respect to the suspension and the tires, resulting in added stress on the tires. Mr. Perry explained that:

> The excessive loading on the rear axle is related to the unusually short wheelbase of the vehicle compared to comparable vehicles. Not only is the rear axle substantially overloaded, the overload is concentrated on the left rear tire, due to the positioning of the seating package which biases weight distribution to the left of the centerline of the vehicle. Overloading the left rear tire is likely to have resulted in accelerated oxidation of the tire, and resulted in shortening the fatigue life of the tire.

The Ford E-series van was overhauled in the early 1970's, under a program called the "Nantucket" program.[61] The vehicle was changed from a unibody frame to a body on frame design.[62] The van was introduced in 1975 and the extended length version of the van – the 15-passenger version – was introduced in 1979.[63] The extended length version added 18-inch in the rear, but kept the same wheelbase.[64]

The original E-350 van was a commercial vehicle designed for hauling cargo, not people.[65] The gross vehicle weight was designed to be approximately 9,000 lbs.[66] A "school bus" option was originally created with the vehicle that carried a gross vehicle weight rating of 9,600 lbs. and was equipped with dual rear wheels.[67] The design goal for the vehicle included the general Ford guideline that the vehicle have a sufficient margin of safety between the capability of the vehicle and the capability of the customer in situations that were "typical" in the real world.[68]

Ford recognized the feasibility of using dual rear wheels on the 15-passenger van as early as 1972.[69] *See* Appendix C. The dual rear wheels provided extra load capacity, better traction and improved handling characteristics. Below is one example of a model with dual rear wheels and the text of Ford advertising about the availability of the wheels.

Dual Rear Wheels (DRW) are available with either the 4x2 or 4x4 drive system. Dual rear wheels help increase rear traction, towing stability and provide increased rear axle weight ratings. The Front Suspension on F-250 4x2 models is an independent Twin I-Beam design. The optional Heavy Service Suspension Package includes Heavy service front springs, auxiliary rear springs (SRW) and steering damper. Super Duty F-250 Pickups (and Pickup Box Delete models) feature a Ladder-type Frame with rear kickup that is wider than the Super Duty Chassis Cab frame.

Although Ford created internal rollover resistance design standards in the mid- to late-1980's, the company's internal standards were drafted so as to exclude vehicles that weighed over 8,500 lbs – such as the 15-passenger van -- from having to be tested for, among other things, rollover resistance.[70] Ford's exclusion of vehicles like the E-350 from stability requirements ran contrary to Ford's representation to NHTSA in 1973 that the cut-off for rollover resistance evaluation was 10,000 lbs.[71]

Although Ford's original internal safety design guideline for rollover included static stability factor (defined as the ratio of track width to center of gravity height), it was removed from the final version of the company guideline.[72] The minimum static stability factor established by the guideline was to be 2.10,[73] a figure that the E-350 could clearly not meet. Ford realized early on that static stability factor was a first-order indicator of a vehicle's rollover propensity.[74]

As a result of the exclusion of the E-350 from rollover resistance evaluations, the only dynamic testing required was "subjective" testing, which included testing the vehicle using an acceptability rating scale of 1 to 10.[75] In litigation, Ford has conceded that the vehicle was not tested in limit maneuvers like the J-turn test, which involves a rapid steering turn.[76] Furthermore, stickers warning about the elevated risk of rollover were not placed on the vans as they were with SUVs.[77] Ford has also asserted that even the "subjective" test result documents purporting to show the ratings provided by the Ford engineers "can't be found."[78]

General Motors, which recently settled a 15-passenger van rollover case with Birmingham attorney Ben Hogan, insisted as a condition of the settlement that all of the documents made a part of discovery be returned to the company and maintained under a gag order to avoid any public evaluation of the safety performance of its 15-passenger van.

In short, the Detroit manufacturers have known for years about the design deficiencies in these vehicles, which cause them to roll over, and have tried through settlement gag orders, and closed door meetings with government officials to contain the issue, but the real safety problem has never been addressed.

VI. Tests of 15-Passenger Vans With Single and Dual Wheels Reveal An On-Road Solution

In order to evaluate the dynamic handling characteristics of typical 15-passenger vans, three separate series of tests were conducted. One series of tests were conducted using a General Motors version of the van. The second series of testing included a Ford E-350 version. The third series of tests included the Dodge 15-passenger van. All three series of tests were conducted using vehicles as originally sold and a vehicle modified to include dual rear wheels.

The tests of the 1992 GM Rally STX Van were conducted in New Jersey in November and December of 2000 using a steering controller and included a combination of maneuvers designed to test the limit performance of the vehicle with and without dual rear wheels, while loaded with 10 passengers. Although the GM van demonstrated a dangerous oversteer condition at various loading conditions, the vehicle, with its longer wheelbase, also proved to be more stable from a rollover standpoint than the Ford or Chrysler versions. The vehicle, as modified to include dual rear wheels, performed better than the original vehicle and did not demonstrate either an oversteer condition or a tendency toward rollover in severe turning maneuvers. *See* Appendix D.

The Ford E-350 testing was conducted in Arizona and consisted of three phases. Phase I

included various loading conditions and the use of load range C tires. Phase II included the same loading conditions as in Phase I, but included the use of load range E tires. The final phase of testing included testing of an E-350 van modified so that it was equipped with dual rear wheels, load range D tires, and with various loading conditions representative of the vehicle's gross weight capacity.

In summary, the Arizona testing of the E-350 demonstrated that the van, by design, has a natural tendency to "oversteer" during J-Turn maneuvers in virtually all loading conditions. "Oversteer" has been described as follows:

> Oversteer is a cornering condition where the front of the vehicle turns more sharply than the driver intends during a turn while the rear of the vehicle skids around. For example, if a vehicle is in a turn and an oversteering condition exists, the driver may have the impression that the rear end of the vehicle is swinging out. A vehicle with an oversteer condition is increasingly difficult to control as speed increases.[79]

It is well recognized within the auto industry that oversteer characteristics are dangerous. Some experts have even characterized "oversteer" as constituting a "defect" under the Federal Motor Vehicle Safety Act.[80] The oversteering condition, which is precisely the same condition noticed by NHTSA in its Research Note on 15-passenger vans, results in the vehicle having a very high tendency to move sideways, beginning to spin, in emergency situations.

In contrast, the modified E-350 van – the one equipped with dual rear wheels – behaved appropriately during the same testing and did not demonstrate a dangerous oversteering condition. The modified version remained stable under all test conditions and demonstrated a clear improvement in the overall safety in severe maneuvers. See Appendix C.

Tests, conducted under the direction of David Perry, an attorney from Corpus Christi, Texas, on the Dodge (Chrysler-manufactured) van included a series of J-Turn maneuvers along with the Consumers Union short course maneuvers at various loading configurations and speeds. The production Dodge van demonstrated a dangerous oversteering condition as well as a tendency to roll over in severe maneuvers. The modified Dodge van (dual rear wheel version), albeit better, also demonstrated two-wheel lift even with the addition of the dual rear wheels. The Dodge van is designed with a very soft suspension, thus allowing for excessive body lean in turning maneuvers. Future testing of the dual rear version will include an evaluation of modified stiffness characteristics designed to evaluate the ability to correct the dangerous two-wheel lift tendency of the vehicle as modified.

As previously indicated, NHTSA's Research Note concluded that the "typical" 15-passenger van has a tendency to *oversteer* with loading and demonstrates a definite rollover tendency due to the shift in the center of gravity up and back with loading. Although Ford Motor Company criticized NHTSA for relying upon a computer simulation to evaluate the handling and stability characteristics of the "typical" 15-passenger van, the actual vehicle testing referenced above proves that NHTSA's

analysis of the dangerous tendencies of the vehicles is accurate.

The testing also illustrated the feasibility of using dual rear wheels to help reduce both the risk of dangerous oversteer in the vans as well as the strong tendency of the unmodified vans to roll over under severe conditions on flat, level surfaces. Given that dual rear wheels are readily available, routinely used with certain models of pickup trucks manufactured by all three of the companies, and have demonstrated a clear improvement in performance, the manufacturers should make this technology available immediately. The cost of the addition of dual rear wheels is estimated to be in the range of $135.00 per vehicle.

An image of a modified van with dual rear wheels is below.

VII. Recommendations: First Fix the Vehicle, And Then Fix the Regulatory and Oversight Regime

The recommendations by NHTSA and the NTSB do not adequately address the real source of the problem with 15-passenger vans. In its warnings, NHTSA focused on driver education, belt usage, and instructions about loading when the van is not full, many of which precautions may reflect unrealistic expectations about the motoring public. The NTSB suggested that NHTSA conduct testing to evaluate the vehicles and suggested that manufacturers and NHTSA consider various devices such as electronic stability control systems to assist drivers in maintaining control of the vehicle.

But the inherent design flaws in these vans cannot adequately be addressed by simply making safe driving recommendations to consumers. The problem with these vehicles most frequently occurs in emergency situations and must be addressed from a design standpoint or more consumers will die unnecessarily. Our policy recommendations address solutions for both existing vehicles on the highway

and the future design and manufacture of 15-passenger vans.

A. A Fix Is Needed for the 15-Passenger Vans on the Highway Now

1. Manufacturers should retrofit all existing 15-passenger vans with, at a minimum, dual rear wheels. Dual rear wheels will decrease the likelihood of dangerous oversteer characteristics and will decrease the risk of rollover in emergency maneuvers. Dual rear wheels are a technologically and economically feasible alternative because the manufacturers currently make large pick-up trucks with dual wheels comparable in size to these vans. Given the rising number of deaths and injuries associated with the vans, the economic cost for the manufacturers is minimal and the ethical obligation is clear.

2. Until this problem is fixed, consumers who are injured and organizations that own these vehicles must turn to the courts to force manufacturers to address the multiple defects in 15-passsenger vans. If the problem is fixed, lawsuits can be prevented.

Federal regulators have indicated that they may not be inclined to act on the problem in a timely fashion, despite the obvious implications of the agency's research. Although NHTSA's Research Note of April 2001 starkly identifies the high likelihood of rollover of these vehicles when they are loaded with five up to the 15 passengers for which they are sold and advertised, NHTSA Administrator Jeffrey Runge told *The New York Times* on August 24, 2002, "This is not a defect issue. It's a behavior issue with drivers and passengers."[81] In contrast, NHTSA's Note concluded that:

> ...the decrease in stability under the fully loaded condition correlates to an increase in the rollover risk of approximately 40 percent. Also, sudden vehicle maneuvers could increase the propensity to roll over. Computer simulation predictions illustrated the adverse affects that fully loading a fifteen-passenger van can have on its handling properties (sudden transition from understeer to oversteer) and rollover propensity.[82]

The concerns described by the agency cannot be remedied by improved driver skills, particularly given the fact that federal and state law allows any licensed driver to be at the wheel with no requirements for a commercial driver's license. NHTSA obstinately has refused for 15 years to require a recall for the discrete numbers of vehicles with a high propensity to rollover or to issue a rollover prevention standard. If NHTSA continues to forsake its duty to require these vehicles to be recalled and to require a real remedy, then consumers and owners must use the courts to seek their remedies to push the manufactures towards a re-design.

3. The safety gap between 15-passenger vans and other vehicles must be closed. As recommended by the NTSB, NHTSA should dynamically test these vehicles, include them in their research programs (from which they are now excluded), apply new rollover consumer information rules (now in progress) to these vehicles, publicize the existing Static Stability Factor information and its Research Note findings concerning 15-passenger vans, and issue a minimum

rollover prevention standard to halt the unnecessary carnage from rollover crashes, which account for a full one-third of all occupant fatalities annually.

4. NHTSA should send a warning package to all owners of these vehicles, alerting them to its Research Note conclusions about the dangers associated with these vehicles. Although a Consumer Advisory is better than nothing, the public must be advised directly of this urgent problem or more consumers will die from a lack of decent information about the risks. The safety precautions recommended by GuideOne Insurance, and modified by Public Citizen, are listed below. These recommendations are more thoughtful than the NHTSA recommendations, and should be fully considered by the agency.

* **Screen all drivers**, requiring that drivers obtain a commercial driver's license;
  Remove the rear seat of the vans to reduce loading behind the vehicle's rear axle;
  Limit the capacity to 10 persons including the driver, which dramatically reduces the risk of rollover;
  Load forward seats first at all times;
* **Communicate with passengers, parents and other parties** about the high risks;
  Do not tow anything behind the vehicle or load the roof;
  Conduct a full safety inspection of the vehicle, including all tires, pre- and post-trip;
* **Include safety items on board**, such as a fire extinguisher, first aid kit and cellular phone (which should not be used during driving);
  Require all passengers and the driver to wear proper safety restraints any time the vehicle is in motion;
  Give the fullest consideration to other, safer transportation options.

5. Insurers, in addition to GuideOne, should immediately get involved by raising policy rates for these vehicles, issuing alerts to owners warning of the dangers associated with the vehicles, and by bringing pressure on the auto industry to fix this problem by design, including a dual wheel retro-fit.

B. Safety Actions for Vehicles Capable of Carrying 10 or More Passengers

1. **Manufacturers must act responsibly.** They must either fix these vehicles or remove them from the highways. These rolling time-bombs must be redesigned to address the rollover issue and to include state-of-the-art crash protection safety devices (including separate steel cage body, special flooring, collision-resistant seats, roof crush and door lock requirements, etc.). These items should be standard equipment on all vehicles, rather than options for the wealthy.

2. **NHTSA must staunch the bleeding immediately.** This can be accomplished by prohibiting further sale of these vehicles until they are redesigned by redefining through regulation the "type" of vehicles that can carry 10 or more passengers. NHTSA has the authority to define the safety rules applicable by "type" of vehicle and should act right away.

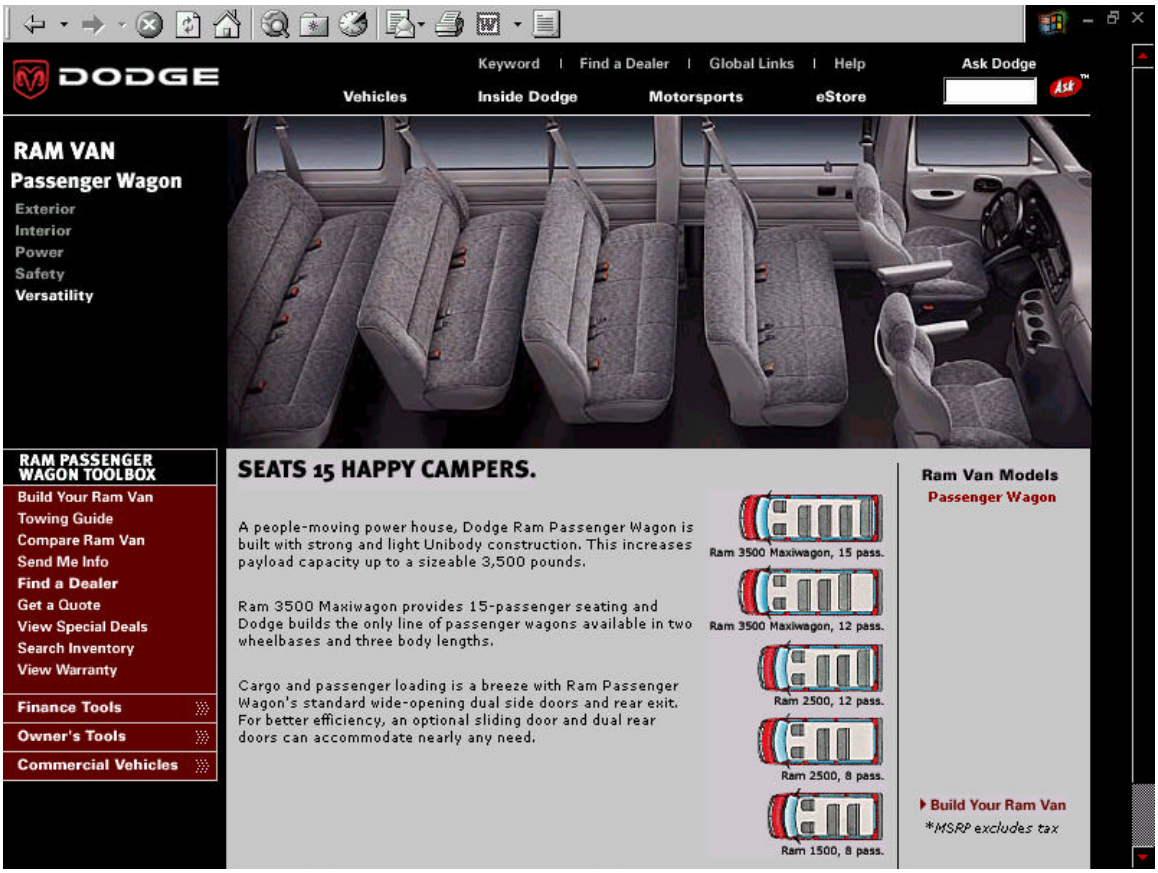
2. **NHTSA must close the safety gap afflicting these vehicles by requiring compliance with updated and improved crash protection standards and by creating mandatory safety standards for rollover resistance that cover these death traps.** As a baby step, NHTSA should apply all existing safety standards, including existing large and small school bus crash protection standards, as applicable, to any vehicles carrying 10 or more passengers. Then NHTSA should bring these vehicles into this century and dramatically improve rollover survival rates for all vehicles by upgrading crashworthiness standards like those for roof crush, door lock and non-pretensioned belts, as well as other standards that are out-of-date and inadequate. NHTSA should also issue new standards for side impact head protection air bags and laminated window glazing to improve vehicle crashworthiness.

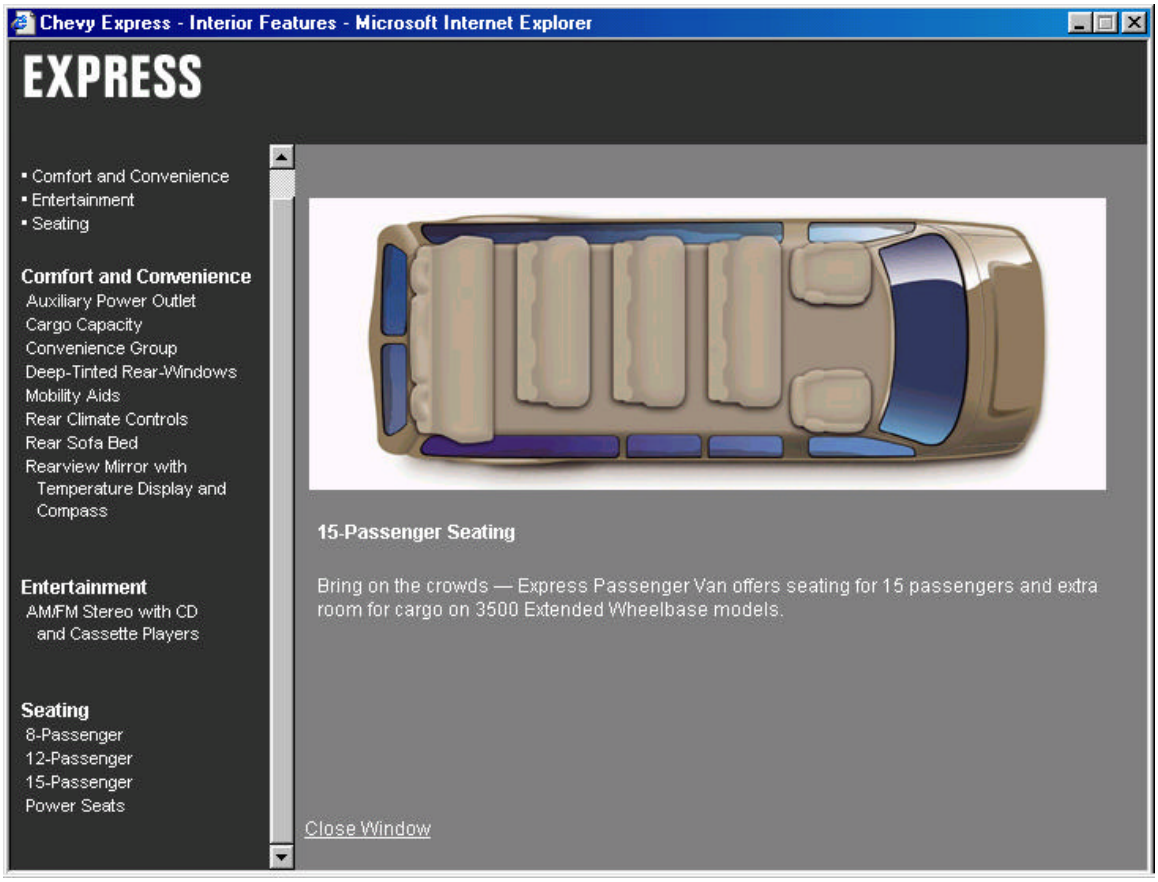
3. Instead of NHTSA merely passing out "safe driving habits" information to the public, NHTSA and the NTSB should ask the **Federal Motor Carrier Safety Administration to immediately amend current rules to require a commercial driver's license for any driver of a vehicle carrying 10 or more passengers,** rather than applying these requirements only to drivers of vehicles with 16 or more passengers.

Only with these important steps will these vehicles be made adequately safe for the transportation of groups of school children, the elderly, infants and students. Ford, General Motors and DaimlerChrysler have an obligation to ensure that these communities do not suffer from horrible crashes that inflict deadly injuries. Users of these vehicles must be warned of the risk. The 15-passenger vans currently on the highway must be made better by the installation of dual wheels and the egregious safety design of this dangerous vehicle must ultimately be fixed.

Appendix A

Marketing of 15-Passenger Van Encourages Over-Loading of the Vehicle




Chevy Express - Interior Features - Microsoft Internet Explorer
EXPRESS
• Comfort and Convenience
• Entertainment
• Seating
Comfort and Convenience
Auxiliary Power Outlet
Cargo Capacity
Convenience Group
Deep-Tinted Rear-Windows
Mobility Aids
Rear Climate Controls
Rear Sofa Bed
Rearview Mirror with Temperature Display and Compass
Entertainment
AM/FM Stereo with CD and Cassette Players
Seating
8-Passenger
12-Passenger
15-Passenger
Power Seats
15-Passenger Seating
Bring on the crowds — Express Passenger Van offers seating for 15 passengers and extra room for cargo on 3500 Extended Wheelbase models.
Close Window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PHOTOS | COMPARISONS | CURRENT OFFERS
CHEVY SHOWROOM VIEW COMPLETE LINEUP
CHEVY EXPRESS PASSENGER VAN
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MAKE LIFE EASIER.
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Appendix B

Appendix B: Applicability of FMVSS to Multipurpose Passenger Vehicles (MPVs), 15-Passenger Vans (15-P), Small School Buses (SSB)[1] and Large School Buses (LSB)[2]

Pre-Crash Standard	#	MPV	15-P	SSB	LSB
"Controls and Displays"	101	✓	✓	✓	✓
"Transmission Shift Lever Sequence, Starter Interlock, and Transmission Braking Effect"	102	✓	✓	✓	✓
"Windshield Defrosting and Defogging Systems"	103	✓	✓	✓	✓
"Windshield Wiping and Washing Systems"	104	✓	✓	✓	✓
"Hydraulic Brake Systems"[3]	105	✓ (GVWR > 7,716lbs)	✓	✓	✓
"Brake Hoses"	106	✓	✓	✓	✓
"Lamps, Reflective Devices, and Associated Equipment"	108	✓	✓	✓	✓
"New Pneumatic Tires"	109	See FMVSS # 119	See FMVSS # 119	See FMVSS # 119	See FMVSS # 119
"Tire Selection and Rims"	110	See FMVSS # 120	See FMVSS # 120	See FMVSS # 120	See FMVSS # 120
"Rearview Mirrors"	111	✓	✓	✓	
"Hood Latch System"	113	✓	✓	✓	✓
"Motor Vehicle Brake Fluids"	116	✓	✓	✓	✓
"Retreaded Pneumatic Tires"	117				
"Power-Operated Window, Partition, and Roof Panel Systems"	118	✓			
"New Pneumatic Tires for Vehicles Other Than Passenger Cars"	119	✓	✓	✓	✓
Tire Selection and Rims for Motor Vehicles Other Than Passenger Cars"	120	✓	✓	✓	✓
"Air Brake Systems"	121			✓	✓
"Accelerator Control Systems"	124	✓	✓	✓	✓
"New Non-Pneumatic Tires for Passenger Cars"	129				
"School Bus Pedestrian Safety Devices"	131			✓	✓
"Passenger Car Brake Systems"	135	✓ (GVWR ≤ 7,716lbs)			
"Rollover Warning Label	49 CFR §575.105	✓ (wheelbase ≤ 110 in)			

[1] School Bus with a GVWR ≤ 10,000 lbs
[2] School Bus with a GVWR >10,000 lbs
[3] 49 CFR § 571.105, S5.5 requires that each vehicle with a GVWR greater than 10,000 lbs be equipped with an antilock brake system that controls the wheels of at least one front and one rear axle.

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Occupant Protection Standards	#	MPV	15-P	SSB	LSB
"Occupant Protection in Interior Impact"	201	✓	✓ (Upper - Interior Head Protection Excluded)	✓	
"Head Restraints" (Outboard Front Seating Positions)	202	✓	✓	✓	✓
"Head Restraints" (Rearward Seating Positions)	202			See FMVSS # 222	See FMVSS # 222
"Impact Protection for the Driver from the Steering Control System" (Driver)	203	✓	✓	✓	
"Steering Control Rearward Displacement"	204	✓	✓	✓	
"Glazing Materials"	205	✓	✓	✓	✓
"Door Locks and Door Retention Components"	206	✓			
"Seating Systems" (Driver)	207	✓	✓	✓	✓
"Occupant Crash Protection" (Driver)	208	✓	✓	✓	✓
"Occupant Crash Protection" (Passenger Safety Belts)	208	✓	✓	✓	
"Seat Belt Assemblies"	209	✓	✓	✓	✓
"Seat Belt Assembly Anchorages"	210	✓	✓	✓	✓
"Windshield Mounting"	212	✓	✓	✓	
"Side Impact Protection"	214	✓ (Static Test Only for GVWR > 6000 lbs)	✓ (Static Test Only)	✓	
"Roof Crush Resistance"	216	✓ (Only for GVWR ≤ 6000 lbs)		See FMVSS # 220	See FMVSS # 220
"Bus Emergency Exits and Window Retention and Release"	217		✓	✓	✓
"Windshield Zone Intrusion"	219	✓	✓	✓	
"School Bus Rollover Protection"[4]	220			✓	✓
"School Bus Body Joint Strength"	221			✓	✓
"School Bus Passenger Seating and Crash Protection"	222			✓	✓
"Child Restraint Anchorage Systems"	225	✓ (Only for GVWR ≤ 8500 lbs)	✓	✓	

[4] 49 CFR § 571.220, S4.(b) requires each emergency exit of the vehicle be capable of opening both during and following the application of force. Roof exits excluded.

Postcrash Standards	#	MPV	15-P	SSB	LSB
"Fuel System Integrity"[5] (Front, rear and lateral barrier test)	301	✓	✓	✓	✓
"Flammability of Interior Materials"	302	✓	✓	✓	✓
"Fuel System Integrity of Compressed Natural Gas Vehicles"	303	✓	✓	✓	✓
"Compressed Natural Gas Fuel Container Integrity"	304	✓	✓	✓	✓

[5] 49 CFR § 571.301 S6.5 requires that large school buses be able to withstand a moving contoured barrier crash test at any point and angle.

Appendix C

LIGHT TRUCK STRATEGY REVIEW

Nantucket Extended Length Van/Bus

LAI asked lots of questions about buses.

- Background and Present Situation
  - Ford, Chevrolet, and Dodge all offer short and long wheelbase van and bus models.
    - Long wheelbase models (77% of Ford sales) provide 9-1/2 feet of cargo space and 12 passenger seating capacity.
  - Only Dodge offers an extended (rear overhang) version of its long wheelbase model, the Maxi Van/Bus.
    - Provides 11 feet of clear cargo space and 15 passenger seating capacity.
    - Dominates certain market segments, such as carpet installation and airport limousine service.
    - Accounts for about 20% of Dodge production.
  - The 1975 Nantucket program includes short (124") and long (138") wheelbase van and bus models, but does not provide an extended model, except for the 158" cutaway.
- Product Alternatives
  - Two alternative configurations were studied:
    - A bustleback (18" longer rear overhang) version, fully competitive with Dodge's Maxi, providing 11 feet of cargo length and 15 passenger capacity.
    - A van/bus version of the 158" wheelbase cutaway providing 12 feet of cargo space and 15 passenger seating with luggage space.
  - Annual volume projected at 25,000 and 31,000 units (including 6,000 and 12,000 incremental units) for the bustleback and cutaway derivatives, respectively.
  - Preliminary product investment estimated at $12 million for the bustleback and $19 million for the cutaway derivative.
  - Profits for the bustleback alternative are projected at about $5 million annually, a 40% after tax return on investment versus $9 million profits and 50% return for the cutaway derivative.
  - The 158" cutaway derivative was selected as the preferred alternative since it is a superior product and is more profitable.
  - Engineering resource priorities, however, require that this program be deferred to 1977, in order to implement the "MUST" programs (Club Cab, Bronco replacement, motor home chassis, and tandem rear axle Nantucket cutaway).
  - To minimize future downtime and investment, $0.9 million was approved by Mr. Innes for AAD to proceed with the necessary provisions in the base Ohio Truck Plant for later introduction of extended models based on the 158" cutaway.
- Planned Action

  3rd Q/74 - Program approval (1977 model).

In order to meet the requirements of FMVSS 208 for model year 1976, the seat assemblies must have provisions for adding an occupant sensing switch in the 1976 models and pedestal provisions for adding a switch that will sense when the seat is positively locked in the forward position for 1976 models. Also a sensing switch will be added to the lap belt retractor on 1976 models. The seat will be structured internally to comply with the requirements of FMVSS 201 and 202.

The seat trim will be super-soft Corinthian grain vinyl with either argyle cloth or super-soft Corinthian grain vinyl inserts. The all vinyl Captain's Chair will be available on all models. However, the argyle cloth inserts will be restricted to Chateau models. The seat trim will be color-keyed to the interior and will be available in all colors except gray.

158" WB Cutaway

A 158" wheelbase cutaway has been approved as an added starter and will require:

- Increased capacity dual wheels - the riveted construction dual wheels must be rerated from 2050# to 2100# capacity.
- Rear suspension - an additional spring of 3300 lbs. capacity is required and is incremental to the base program.
- Rear axle - the axle will be of unique tread for the dual wheels.
- 351 or 460 CID engine with automatic transmission and power steering.

The vehicle will retain the 4200 lb. front axle and 7400 lb. rear axle from the base E-350. The load center of the load area will be defined to prevent overloading of the axles and provide a reasonable weight distribution for acceptable handling.

Sidemounted Auxiliary A/C-Heater

An auxiliary A/C (and/or auxiliary heater) system will be packaged between the L.H. "B" pillar and the first vertical body side strainer. This sidewall system will direct conditioned air rearward through a duct located just below the L.H. beltline and extending back to approximately the ℄ of rear axle.

A switch to allow separate operation of the auxiliary unit blower will be packaged on the right side of the main unit control. Function of the auxiliary will be modulated by the main unit control.

High Capacity Heater

A new high capacity heater will be released. Heater core size will be 6x10x2" (replacing the base 6x8x2" core). The heater core case and seal will be larger than the base heater to accommodate the larger core. Identification of the heater as a "High Output" unit will be incorporated on the surface of the heater assembly.

Appendix D

Stability Test Footage for 15-Passenger Vans With Single and Dual Rear Wheels

The video consists of two sets of stability test footage.

SET I

Testing

* 1996 E350 Ford Club Wagon
  4-Door Extended Passenger XL
  V8 engine, Rear Wheel Drive
  Testing performed by Safety Engineering & Forensic Analysis, Inc.
* 3941 E. Chandler Blvd. – Phoenix, AZ
  Nov. 28, 29 and Dec. 7, 2000

Test Vehicle

* Wheelbase: 138 inches
* Overall length: 211.8 inches
* Overall track width: 79.3 inches
* Overall curb height: 80.7 inches
  Curb weight: 4040 lbs.
* GVWR: 9001-10000 Class H
  Hydraulic Brake System
  VIN # 1FBJS31H5THA55008
* Tires P225/75R15

Equipment

Outrigger system
Video tape recorders

Test Sequences

Part I: Tests 1-6
Reverse steers with single and dual rear wheels

Part II: Tests 7-15

J-turns with single and dual rear wheels

1	regular	reverse steer	47 mph	180/180	simulated load of 10 w/outriggers
2	dual	reverse steer	50 mph	180/300	simulated load of 10 w/outriggers
3	regular	reverse steer	45 mph	180/180	simulated load of 10 w/outriggers
4	regular	reverse steer	45 mph	180/180	simulated load of 10 w/outriggers
5	regular	reverse steer	45 mph	180/180	simulated load of 10 w/outriggers
6	regular	reverse steer	47 mph	180/180	simulated load of 10 w/outriggers
7	regular	j-turn	50 mph	120	simulated load of 10 w/outriggers
8	dual	j-turn	50 mph	120	simulated load of 10 w/outriggers
9	dual	j-turn	45 mph	210	simulated load of 10 w/outriggers
10	regular	j-turn	45 mph	200	GVW w/outriggers
11	regular	j-turn	45 mph	200	GVW w/outriggers
12	regular	j-turn	45 mph	200	GVW w/outriggers
13	regular	j-turn	45 mph	200	GVW w/outriggers
14	regular	j-turn	45 mph	200	GVW w/outriggers
15	regular	j-turn	45 mph	200	GVW w/outriggers

Test Results

In J-turn maneuvers with single rear wheels, in virtually all loading conditions, tendency to oversteer with wheel lift in some tests.
With dual rear wheels, remained stable under all test conditions.

SET II

Limit Response Testing

1992 GMC Rally STX Van
* Automotive Testing, Inc.
Nov. 27, 28 and Dec. 7, 2000
Raceway Park – Englishtown, NJ

Test Vehicle

Wheelbase: 146 inches
Track Width: 68.6 inches
Curb Height: 82 inches
VIN: 2GJGG39K5N4502523
Accident Loading Condition (10 passengers)
Tires: LT225/75R16 Michelin and LT 245/75R16 Firestone

Equipment

* Humphrey Accelerometer
  Data System
  Heitz Sprint I Programmable Steering Machine
  Outrigger System
* Video Tape Recorders

Test Sequence

Part I

J-Turns with Single Rear Wheels

1 single	j-turn	50 mph	90 degrees	tire 225
2 single	j-turn	50 mph	120 degrees	tire 225
3 single	j-turn	50 mph	120 degrees	tire 225
4 single	j-turn	50 mph	120 degrees	tire 225
5 single	j-turn	50 mph	150 degrees	tire 225
6 single	j-turn	50 mph	180 degrees	tire 225

J-Turns with Dual Rear Wheels

1 dual	j-turn	50 mph	120 degrees	tire 225
2 dual	j-turn	50 mph	180 degrees	tire 225
3 dual	j-turn	50 mph	240 degrees	tire 225
4 dual	j-turn	50 mph	330 degrees	tire 225
5 dual	j-turn	50 mph	120 degrees	tire 245
6 dual	j-turn	50 mph	180 degrees	tire 245
7 dual	j-turn	50 mph	210 degrees	tire 245

Part II

* Reverse Steers with Single Rear Wheels

1 single	reverse steer	50 mph	180/180 degrees	tire 225
2 single	reverse steer	50 mph	180/240 degrees	tire 225
3 single	reverse steer	50 mph	180/300 degrees	tire 225
4 single	reverse steer	50 mph	150/150 degrees	tire 245
5 single	reverse steer	50 mph	180/180 degrees	tire 245
6 single	reverse steer	45 mph	180/180 degrees	tire 245
7 single	reverse steer	45 mph	180/180 degrees	tire 245
8 single	reverse steer	47 mph	180/180 degrees	tire 245

9 single	reverse steer	47 mph	180/180 degrees	tire 245
10 single	reverse steer	50 mph	180/180 degrees	tire 245
11 single	reverse steer	52 mph	180/180 degrees	tire 245

Reverse Steers with Dual Rear Wheels

1 dual	reverse steer	45 mph	180/180 degrees	tire 225
2 dual	reverse steer	50 mph	180/180 degrees	tire 225
3 dual	reverse steer	50 mph	180/240 degrees	tire 225
4 dual	reverse steer	50 mph	180/300 degrees	tire 225

Test Results

With single rear wheels at .65 lateral acceleration, unstable oversteer.
With dual rear wheels, van remains stable in all tests.

Endnotes

[1] *See* http://www.chevrolet.com/express/model_passenger.htm (visited November 10, 2002); http://www.dodge.com/passenger_wagon/versatility/index.html (visited November 7, 2002). While Dodge (Daimler/Chrysler) no longer manufactures 15-passenger vans, these vehicles are still potentially available for the transportation of children under state law.

[2] Conversation of Rajesh Subramanian, Statistician, National Center for Statistics and Analysis (NCSA) with Ed Ricci, Policy Analyst, Public Citizen, Nov. 7, 2002.

[3] *Id*.

[4] *See* NHTSA Consumer Advisory, April 9, 2001, http://www.nhtsa.dot.gov/nhtsa/announce/press/2001/pressdisplay.cfm?year=2001&filename=ca-010409.html; W. Riley Garrott, "The Rollover Propensity of Fifteen-Passenger Vans," April 2001, NHTSA Research Note; NHTSA, *NHTSA Repeats Rollover Warning To Users of 15-Passenger Vans*, April 15, 2002, http://www.nhtsa.dot.gov/nhtsa/announce/press/pressdisplay.cfm?year=2002&filename=pr27-02.html.

[5] Safety recommendation letter from National Transportation Safety Board to William Clay Ford, Jr., Chairman and Chief Executive Office, Ford Motor Company and Mr. G. Richard Wagoner, Jr., President and Chief Executive Officer, General Motors Corporation, Nov. 1, 2002, H-02-29.

[6] GuideOne Insurance News Release, *GuideOne Insurance takes a Stand on Dangerous 15-Pssenger Vans,* Aug. 13, 2002.

[7] The data show a steep decline in sales of large vans, which include but are not limited to 15-passenegr vans, from 412,893 in 2000 to 349,110 in 2001. *See* 2002 Market Data Book, "U.S. Truck Production- 2001 Calendar Year," *Automotive News*, May 27, 2002, at 17-18; 2002 Market Data Book, "U.S. light Truck Sales, North America, Built and Imported, 2001 Calendar Year," *Automotive News*, May 27, 2002, at 34-35.

[8] *See* 49 U.S.C. § 30125.

[9] Unless a vehicle has a gross vehicle weight rating above of 26,001 pounds *or is designed to transport 16 or more passengers including the driver*, a commercial driver's license is not required under federal law. *See* 49 CFR § 383.5.

[10] National Association of State Directors of Pupil Transportation (NASDPTS), "Vans Used for School Transportation," http://www.nasdpts.org/papervans.html; s*ee also* 49 U.S.C. §31308.

[11] Treaster, Joseph, "Some Insurers Halt Coverage for Vans Linked to Rollovers," *The New York Times*, Aug. 24, 2002, at A1.

[12] Ford Motor Co. Analysis of NHTSA's April 2001Research Note entitled, "The Rollover Propensity of Fifteen-Passenger Vans," filed on Feb. 8, 2002 to Docket ID NHTSA-2002-11505.

[13] *See* NHTSA, *NHTSA Repeats Rollover Warning To Users of 15-Passenger Vans*, April 15, 2002, http://www.nhtsa.dot.gov/nhtsa/announce/press/pressdisplay.cfm?year=2002&filename=pr27-02.html.

[14] *Wilson, et al v. Ford Motor Co. & Bridgestone/Firestone*, U.S. Dist. Ct. of Arkansas, Civil # CV3-2002-080 (2002).

[15] Moore, Miles, "Ford At Fault in Crash Case," *Rubber and Plastics News*, Oct. 1, 2001, Vol. 31, Number 5.

[16] Plungis, Jeff, "Trial Puts Van Safety Concerns Under Spotlight," *The Detroit News*, Oct. 4, 2002; "Passenger Vans At High Risk for Rollovers," *NBC Nightly News*, May 7, 2002.

[17] Asher, Mark, "Van Use Takes Turn for Worse; Spate of Crashes Has College Officials Rethinking Travel Plans," *The Washington Post*, Mar. 2, 2000, at D03.

[18] Power, Stephen, "U.S. Is Preparing Another Warning About Large Vans," *The Wall Street Journal*,. April 12, 2002.

[19] Henderson, Diedtra, "Deadly Van Crash: In 3 seconds, 5 Firefighters' Lives Were Lost," *The Denver Post*, June 30, 2002.

[20] Oral statement of Mary Joe Robinson, driver of the van, in preparation for press conference at Public Citizen on November 8, 2002.

[21] Oral statement of Shirley Hines, driver of the van, in preparation for press conference at Public Citizen on November 8, 2002.

[22] As of June 2002, DaimlerChrysler, which manufactured two of the vehicles listed below, stopped making 15-passenger vans. Safety recommendation letter from National Transportation Safety Board to William Clay Ford, Jr., Chairman and Chief Executive Office, Ford Motor Company and Mr. G. Richard Wagoner, Jr., President and Chief Executive Officer, General Motors Corporation, Nov. 1, 2002, H-02-29.

[23] W. Riley Garrott, "The Rollover Propensity of Fifteen-Passenger Vans," April 2001, NHTSA Research Note. Compiled in consultation with vehicle manufacturers as Vehicle Identification Number does not identify whether a van is a 15-passenger van.
[24] Conversation with Joseph Carra, Director, National Center for Statistics and Analysis, November 8, 2002.
[25] *Id*.
[26] Safety recommendation letter from National Transportation Safety Board to William Clay Ford, Jr., Chairman and Chief Executive Office, Ford Motor Company and Mr. G. Richard Wagoner, Jr., President and Chief Executive Officer, General Motors Corporation, Nov. 1, 2002, H-02-29.
[27] W. Riley Garrott, "The Rollover Propensity of Fifteen-Passenger Vans," April 2001, NHTSA Research Note. pp. 1, 3.
[28] The Static Stability Factor (SSF) of a vehicle is one half the track width, t, divided by h, the height of the center of gravity above the road.
[29] Oversteer is a cornering condition where the front of the vehicle turns more sharply than the driver intends during a turn while the rear of the vehicle skids around. For example, if a vehicle is in a turn and an oversteering condition exists, the driver may have the impression that the rear end of the vehicle is swinging out. A vehicle with an oversteer condition is increasingly difficult to control as speed increases. *See* Submission of Bridgestone/Firestone to NHTSA regarding defect investigation of the Ford Explorer, May 31, 2001.
[30] Gross vehicle weight is the value specified by the manufacturer as the loaded weight of a single-vehicle.
[31] W. Riley Garrott, "The Rollover Propensity of Fifteen-Passenger Vans," April 2001, NHTSA Research Note, at 1, 3.
[32] Sharp and Segal: "An Investigation of the Rollover Dynamics of a Military Vehicle," University of Michigan Highway Safety Research Institute 79-40, 1979.
[33] W. Riley Garrott, "The Variation of Static Rollover Metrics with Vehicle Loading Between Similar Vehicles," SAE paper 920583, 1992.
[34] *See, e.g*., Heydinger, et al, "Effects of Loading on Vehicle Handling," SAE paper 980228 (1998).
[35] Letter from Value Rent-A-Car to Ford Motor Company regarding the safety of the Aerostar minivan, Nov. 4, 1992.
[36] Deposition of John Salagaj by C. Tab Turner, Value Rent-A-Car Vice President of Operations, June 6, 1994, at 28.
[37] Deposition of Jack Cline, Employee of Value Claims Department, July 7, 1994, at 30.
[38] *Id*. at 51.
[39] *Id*. at 75-77.
[40] Testimony of Jack Cline on April 14, 1997, at 425.
[41] GuideOne Insurance News Release, *GuideOne Insurance takes a Stand on Dangerous 15-Passenger Vans*, Aug. 13, 2002; Treaster, Joseph, "Some Insurers Halt Coverage for Vans Linked to Rollovers," *The New York Times*, Aug. 24, 2002, at A1.
[42] The three categories are: 1) bus, which is any vehicle configured to carry 16 or more passengers; 2) small school buses, which is a school bus less than 10,000 lbs. gross vehicle weight; 3) large school bus, which is a bus weighing 10,001 lbs. or more in gross vehicle weight. Another legal category for buses was proposed in a rulemaking published by NHTSA on November 5, 2002, to be defined as a "multifunction school activity bus." These buses would meet school bus standards, except for the flashing lights and pedestrian-protection projecting stop sign arm. It is anticipated these vehicles would be used by childcare facilities for extracurricular activities and coordinated transportation systems, perhaps in lieu of 15-passenger vans. *See* 67 F.R. 67373, 67376.
[43] *See* 49 CFR § 571.131, 49 CFR § 571.220, 49 CFR § 571.221, 49 CFR § 571.222.
[44] National Transportation Safety Board, Highway Special Investigation Report, *Pupil Transportation in Vehicles Not Meeting Federal School Bus Standards*, June 8, 1999, NTSB/SIR-00/02 at 9.
[45] These are required by the following federal standards: FMVSS 220: School Bus Rollover Protection. This standard establishes performance requirements for school bus rollover protection. Its purpose is to reduce the number of deaths and the severity of injuries that result from failure of the school bus body structure to withstand forces encountered in rollover crashes, s*ee* 49 CFR § 571.220; FMVSS 221: School Bus Body Joint Strength. This standard establishes requirements for the strength of the body panel joints in school bus bodies. Its purpose is to reduce deaths and injuries resulting from the structural collapse of school bus bodies during crashes, *See* 49 CFR § 571.221.
[46] FMVSS 222: School Bus Seating and Crash Protection. This standard establishes occupant protection requirements for school bus passenger seating and restraining barriers. Its purpose is to reduce the number of deaths and the severity of injuries that result from the impact of school bus occupants against structures within the vehicle

during crashes and sudden driving maneuvers, *See* 49 CFR § 571.222.

[47] *See id.*

[48] *Specialty bus* is the industry term for the small buses that are commonly used as shuttle or tour buses. No Federal standard provides definition for a specialty bus or motor coach. *Id*. at 2.

[49] *See* Appendix A: "Applicability of FMVSS to Multipurpose Passenger Vehicles (MPVs), 15-Passenger Vans (15-P), Small School Buses (SSB) and Large School Buses (LSB)."

[50] "Multipurpose Passenger Vehicle (MPV) means a motor vehicle with motive power, except a low-speed vehicle or trailer, designed to carry 10 persons or less which is constructed either on a truck chassis or with special features for occasional off-road operation." *See* 49 CFR § 571.3.

[51] *See* 49 CFR § 571.201.

[52] *See* 49 CFR § 571.202.

[53] *See* 49 CFR § 571.206.

[54] *See* 49 CFR § 571.214.

[55] *See* 49 CFR § 571.216.

[56] *See* 49 CFR § 575.105.

[57] But even this apparent safety advantage may not be as significant as it may appear, as the NTSB stated in its 1989 study *Crashworthiness of Small Poststandard School Buses*, "Unrestrained passengers on a school bus are less likely to be ejected than occupants of passenger cars because they are not seated next to a door, windows are usually partitioned, seatbacks are usually closer and higher, and passengers are farther from the windshield. " NTSB/SS-89/02.

[58] Deposition of Monroe White, Chrysler official, by C. Tab Turner, June 2002, at 26.

[59] *Id*. at 75-76.

[60] *Id*. at 80.

[61] Testimony of Ford Engineer Kenneth Snodgrass on April 12, 1999, at 11.

[62] *Id*.

[63] *Id*. at 12.

[64] *Id*. at 99.

[65] *Id*. at 89.

[66] *Id*. at 92.

[67] *Id*. at 137-39.

[68] *Id*. at 39.

[69] Ford internal document from 1972 (On file with C. Tab Turner).

[70] Testimony of Ford engineer Kenneth Snodgrass on April 14, 1997, at 59.

[71] *Id*. at 106.

[72] *Id*. at 92.

[73] *Id*. at 100.

[74] *Id*. at 102.

[75] *Id*. at 109.

[76] *Id*. at 109.

[77] *Id*. at 112.

[78] *Id*. at 114.

[79] Submission of Bridgestone/Firestone to NHTSA regarding defect investigation of the Ford Explorer, May 31, 2001.

[80] *Id*.

[81] Treaster, Joseph, "Some Insurers Halt Coverage for Vans Linked to Rollovers," *The New York Times*, Aug. 24, 2002, at A1.

[82] W. Riley Garrott, "The Rollover Propensity of Fifteen-Passenger Vans," April 2001, NHTSA Research Note.

U.S. Department
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**National Highway
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Research Note

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The Rollover Propensity of Fifteen-Passenger Vans

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1. Introduction

Fifteen-passenger vans[1] are in widespread use for the transportation of college sports teams, van pools, church outings, and other similar groups. There have been a number of widely-publicized single vehicle crashes that have involved fifteen-passenger vans transporting college sports teams in the last year. All but one of these crashes have involved rollover of the fifteen-passenger van.

These crashes have raised the question as to whether fifteen-passenger vans, especially loaded fifteen-passenger vans, are unusually susceptible to rollover. Fifteen-passenger vans differ from most light truck vehicles in that they have a large payload capacity and the occupants sit fairly high up in the vehicle. Therefore, when loaded the vehicle may have a much worse rollover propensity than when unloaded.

To examine this issue, a brief study has been performed. This study is composed of three parts: a review of crash data to look at the record of fifteen-passenger vans; measurement of the Static Stability Factors (SSF) of a fifteen-passenger van, a seven-passenger van, and a minivan; and a simulation analysis of the handling characteristics of an unloaded and loaded fifteen-passenger van.

[1]While these vehicles actually have seating positions for a driver plus fourteen passengers, they are typically called fifteen-passenger vans. Also, these vehicles are actually classified as buses under 49 CFR 571.3.

2. Crash Data Analysis

To examine the rollover experience of fifteen-passenger vans in the population of crashes, the crash data in NHTSA=s State Data System were analyzed. The State Data System is a census of crashes from 17 participating states. The data, comprised of fatal, injury or property-damage-only (PDO) crashes, are recorded in the system based on the reporting thresholds in the states concerned. The reporting thresholds for the participating states vary. This study was performed using the crash data from Florida, Maryland, Missouri, New Mexico, Ohio, Pennsylvania and Utah for crash years 1994 through 1997. These seven states were chosen for this study because of the availability of the Vehicle Identification Numbers (VINs) and rollover scenario variables that were essential for the study. The VINs were decoded to determine the vehicle make and models from which the fifteen-passenger vans were identified.

Seven vehicle models, and all model years during which they were sold as fifteen-passenger or comparable vans, were identified. This list was compiled in consultation with vehicle manufacturers and by inferring the seating capacity from the vehicle=s manual. The make-models identified are:

- Chevrolet Express 3500
- GMC Savana G3500
- Dodge Ram Van/Wagon B3500
- Dodge Ram Wagon B350
- Ford Econoline E350
- Ford Club Wagon E350
- GMC Rally/Vandura G3500

The make-models of the vehicles were derived from the reported VINs in the State Data System. The issue of seating capacity, i.e., if the van was a fifteen-passenger van, can neither be determined from the VIN nor is it available in the data system. The seating arrangement is usually decided at the retail level (dealership, etc.) according to the needs of the customer. In the vehicles listed above, only part of the fleet is finally configured as fifteen-passenger vans while some are used as cargo vans. The VIN was used, to the extent possible, to determine if the vans were used to transport passengers or cargo. The Gross Vehicle Weight (GVW) of a fifteen-passenger van was used as a standard to extract comparable passenger vans from the dataset. However, there is no way to ensure that these vehicles actually were configured as fifteen passenger vans.

This analysis examines the *propensity* of these vehicles to rollover in all single vehicle crashes. The issue of rollover propensity considered the effect of higher occupancy levels in the vans.

Passenger vans that were involved only in single vehicle crashes were identified for the purpose of this study. In single vehicle crashes, rollover resistance metrics in combination with vehicle maneuvers may be more of a predictor of rollovers as compared to multiple vehicle crashes where the impact dynamics may be the significant factor in initiating the rollover event.

The crash data were examined to determine the correlation, if any, of the increased risk of rollover with higher occupancy levels.

The calculated rollover ratios are ratios of the numbers of rollovers to the numbers of all single vehicle crashes. The rollover ratios in this research note were not calculated using the same crash selection criteria or the same state crash reporting thresholds as were used in studies published in NHTSA's notices establishing the NCAP rollover resistance ratings. However, they are useful for comparing the vehicles and load conditions addressed here on a common basis, but cannot be used for comparisons to the rollover risk levels reported in the NCAP ratings.

Looking at all rollovers, regardless of the number of vehicle occupants, fifteen-passenger vans have almost the same rollover ratio as does a comparison group: all light trucks and vans (LTVs).

The occupancy levels of the vehicles were determined from the crash data. The rollover ratios have been depicted in Table 1 by the occupancy levels of the fifteen-passenger vans. The rollover ratios were observed over four categories of occupancy levels: under 5, 5-9, 10-15 and over 15 occupants.

Table 1: Number of Crashes, Rollovers and Rollover Ratios by Occupancy Level of Fifteen-Passenger Vans in Single Vehicle Crashes

Occupancy Level	All SV Crashes	All Rollovers	Rollover Ratio	*Combined Rollover Ratios 1 to 9 and 10 or more occupants*
Less than 5	1,815	224	12.3%	*12.7%*
5-9	77	16	20.8%	
10-15	55	16	29.1%	*35.4%*
Over 15	10	7	70.0%	

As seen in Table 1, the propensity to roll over increases with the occupancy level. It can be inferred from Table 1 that a fifteen-passenger van that has over 15 occupants runs almost six times the risk of rolling over as compared to a fifteen-passenger van that has less than 5 occupants (70.0 vs. 12.3 rollovers per 100 crashes), when involved in a single vehicle crash. When confining the analysis to two groups, less than 10 occupants and 10 or more occupants, the rollover ratio for the vehicles with 10 occupants or more occupants is almost 3 times (35.4 percent vs. 12.7 percent) that of vehicles with less than 10 occupants. As previously stated, even though efforts were made to include only vehicles that were intended to transport passengers, there still may be some vehicles that may have been cargo or special-use vans, especially in the category of crashes with less than 5 occupants. Since the rollover propensity of these types of cargo is not

known, the complete removal of cargo vans from this analysis might change the observed occupant loading effect on the propensity to roll over.

3. Rollover Propensity Metrics of Fifteen-Passenger Vans

NHTSA had S.E.A., Inc. measure the lightly and fully loaded inertial parameters of a fifteen-passenger and a seven-passenger van. Past NHTSA research has measured the lightly and fully loaded inertial parameters of several minivans; one of these was selected for comparative purposes. Information about the vehicles for which the inertial parameters were obtained is shown in Table 2. Note that in Table 2 the Lightly Loaded Weight (LLW) column contains the weight of the vehicle with a weight equivalent to fiftieth percentile male dummy in the driver's seat and no other cargo while Gross Vehicle Weight (GVW) is achieved by placing weights equivalent to fiftieth percentile male dummies in every seating position plus ballast (simulated luggage) in the rear cargo space.

Table 2: Information About Vehicles for which Inertial Parameters Were Measured

Vehicle	Max. No. Occupants	Track Width (in)	Wheelbase (in)	LLW (lbs)	GVW (lbs)
1998 Dodge Caravan	7	63.50	113.60	3,816	5,000
1998 Ford E150 Club Wagon	7	69.70	138.00	5,658	7,000
2000 Ford E350 XLT Super Duty	15	68.20	138.15	6,415	9,100

Table 3 shows the lightly and fully loaded measured inertial parameters for each of these three vehicles. Note that the center of gravity height of the fifteen-passenger van rises by 4.0 inches as the vehicle is loaded versus 1.4 inches for the seven-passenger van and 0.9 inches for the minivan.

Table 4 shows a rollover propensity metric, Static Stability Factor (one-half of the vehicle's track width divided by its center of gravity height), in both the lightly and fully loaded conditions for all three of these vehicles. As this table shows, the Static Stability Factors of all three vehicles decrease from the lightly loaded to the fully loaded conditions. The largest change is for the fifteen-passenger van. Based on NHTSA=s Rollover Ratio versus Static Stability Factor regression trend line, this change in Static Stability Factor is predicted to increase the rollover ratio by approximately 40 percent. NHTSA uses this trend line to give consumer information on the rollover resistance of passenger cars, vans, pickups trucks, and SUVs. This trend line is based solely on Static Stability Factors measured with only the driver present in the vehicle because this is the most common configuration in which private consumer vehicles are driven. NHTSA is developing information with which to inform consumers of the sensitivity of rollover resistance to the weight of the additional passengers. This consumer information program does not extend to vehicles which carry more than ten occupants.

Table 3: Measured Vehicle Inertial Parameters

Vehicle	Center of Gravity Height (in)		Moments of Inertia (ft-lb-sec^2)					
			Roll		Pitch		Yaw	
	@LLW	@GVW	@LLW	@GVW	@LLW	@GVW	@LLW	@GVW
1998 Dodge Caravan	25.5	26.4	603	704	2,410	3,128	2,588	3,292
1998 Ford E150 Club Wagon	30.1	31.5	939	1,046	4,848	5,617	4,987	5,731
2000 Ford E350 XLT Super Duty	31.9	35.9	1,078	1,393	6,709	9,410	6,901	9,531

Table 4: Lightly and Fully Loaded Static Stability Factors for the Three Vehicles

Vehicle	Static Stability Factor		
	@LLW	@GVW	Percent Change
1998 Dodge Caravan	1.24	1.20	-3%
1998 Ford E150 Club Wagon	1.16	1.11	-5%
2000 Ford E350 XLT Super Duty	1.07	0.95	-11%

4. Handling Characteristics of Loaded and Unloaded Fifteen-Passenger Vans

The preceding section discusses the rollover propensity of lightly and heavily loaded passengers vans. Loading the vehicles to GVW has an adverse affect on the rollover propensity due to the increase in center-of-gravity height. Loading the vans with passengers and cargo also moves the center of gravity rearward, increasing the vertical load on the rear tires. Table 5 contains values for longitudinal distance from the front axle to the center of gravity, a, and for percent weight on the rear axle.

Values for all three vehicles measured at LLW and GVW are provided in Table 5. In the case of the fifteen-passenger van, the longitudinal center of gravity moves nearly 18 inches towards the rear of the vehicle when it is loaded to GVW. At GVW, the fifteen-passenger van has over 65 percent of its weight on the rear axle. The seven-passenger van and minivan measured have just over 50 percent of their weight on their rear axles at GVW.

Table 5: Longitudinal Center-of-Gravity Location and Percent Weight on Rear Axle

Vehicle	Wheelbase (in)	@LLW		@GVW	
		a* (in)	% Weight Rear Axle	a* (in)	% Weight Rear Axle
1998 Dodge Caravan	113.6	46.8	41.2 %	59.1	52.0 %
1998 Ford E150 Club Wagon	138.0	62.1	45.0 %	70.9	51.4 %
2000 Ford E350 XLT Super Duty	138.2	72.4	52.4 %	90.3	65.3 %

*a: Longitudinal distance from front axle to vehicle center of gravity

To show the effects of occupant loading on the handling of fifteen-passenger vans, computer simulation runs were performed at the driver-only (LLW) and fifteen-occupant plus simulated luggage (GVW) load conditions using the vehicle dynamics simulation Vehicle Dynamics Analysis, Non-Linear (VDANL). The measured values for center-of-gravity location and inertia properties were used in the simulation vehicle models. However, the suspension and tire parameters used to represent the fifteen-passenger van were not directly measured; rather they were based on existing parametric data, to roughly represent those of a fifteen-passenger van. As such, the simulation results presented here are not provided to represent the actual behavior of a specific fifteen-passenger van. Nonetheless, the results are presented to show the effects of loading the vehicle to GVW.

The first maneuver simulated is a slowly increasing steer maneuver using a steering rate of five degrees per second and a constant vehicle speed of 30 mph. This maneuver is useful for determining the understeer and load transfer characteristics of a vehicle. Figures 1 through 4 contain simulation results from the slowly increasing steer maneuver for both the LLW and GVW conditions.

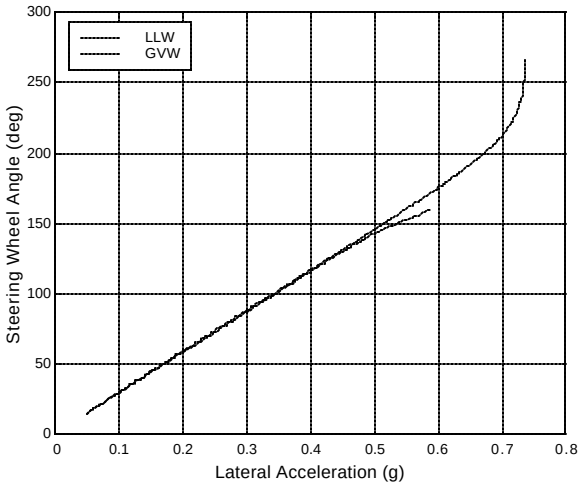

Figure 1: Lateral Acceleration Versus Steering Input
30 mph Slowly Increasing Steer Maneuver

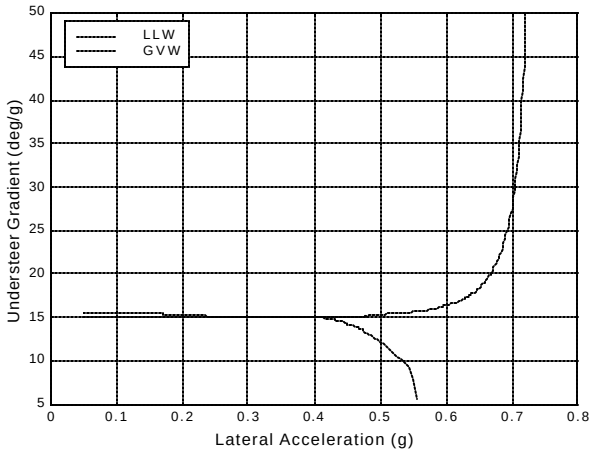

Figure 2: Understeer Gradient
30 mph Slowly Increasing Steer Maneuver

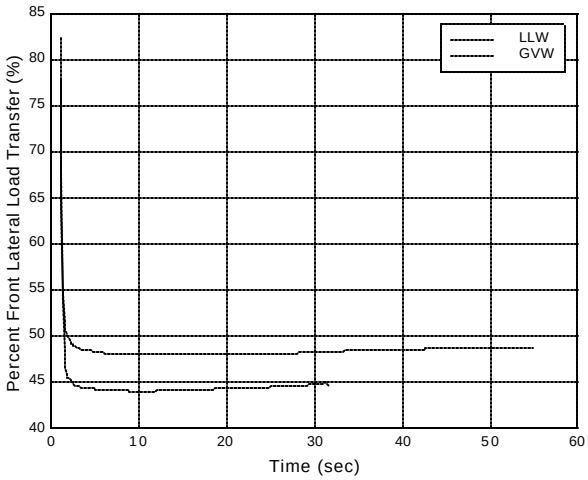

Figure 3: Percent Front Lateral Load Transfer
30 mph Slowly Increasing Steer Maneuver

Figure 1 contains plots of lateral acceleration versus steering wheel angle, while Figure 2 contains plots of understeer gradient (SAE Understeer Gradient). At GVW the simulated vehicle exhibits a transition towards oversteer above 0.4 g. lateral acceleration, while the LLW vehicle exhibits limit understeer.

The fact that a heavily laden vehicle's understeer characteristics are similar to its lightly loaded condition at low lateral accelerations but different at higher lateral accelerations is a topic of concern. This sort of transition is known to cause safety problems, particularly for drivers who normally only drive smaller passenger vehicles and who are therefore unfamiliar with a loaded fifteen-passenger van's responsiveness and limits.

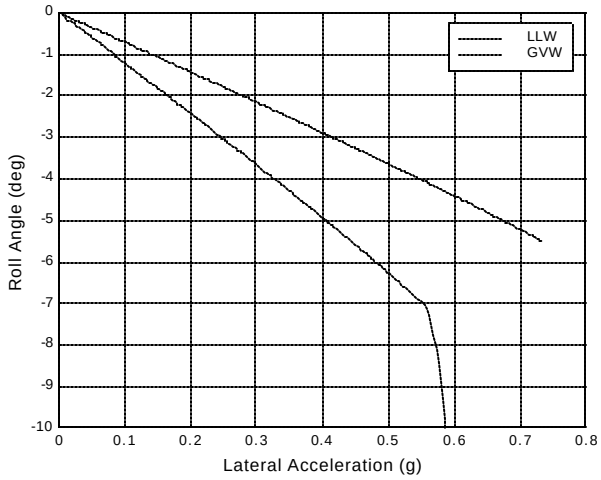

Figure 4: Lateral Acceleration Versus Roll Angle
30 mph Slowly Increasing Steer Maneuver

The simulated vehicle is modeled to have 60% of its overall roll stiffness on the front suspension. Figure 3 shows the percent front lateral load transfer. The GVW vehicle has less load transfer at the front axle. This is because the center of gravity is more rearward than the LLW condition. The reductions in the front lateral load transfer and percent weight on the front axle, result in the simulated vehicle becoming oversteer at large lateral accelerations.

Figure 4 shows lateral acceleration versus roll angle. The roll gradient (roll angle per g. of lateral acceleration) is considerably greater for the GVW condition because the vehicle center of gravity is higher. The simulation predicted a rollover for the GVW vehicle.

The following presentation of simulation predictions during a reverse steer maneuver will be used to further explain the mechanisms leading up to a rollover event.

Figure 5 shows the steering input and lateral acceleration responses for a simulated 30 mph reverse steer maneuver (a maneuver in which the steering wheel is first turned to the right and then turned to the left). Figure 6 shows the roll angle and roll rate responses, and Figure 7 the vehicle side-slip angle (beta) and yaw rate responses. The simulated LLW vehicle remains stable throughout this maneuver while the GVW vehicle rolls over. The rollover is preceded by high side-slip angle, indicating a reduction in rear axle cornering capability. After crossing zero approximately 3.0 seconds into this maneuver, the side-slip angle rapidly increases to 20 degrees by 5.0 seconds. The absolute value of the yaw rate is large throughout this time period, indicating that the vehicle is spinning out. The vehicle continues with ever increasing side-slip until the point of imminent rollover; which starts near 4.5 seconds when both the roll angle and roll rate begin to increase significantly.

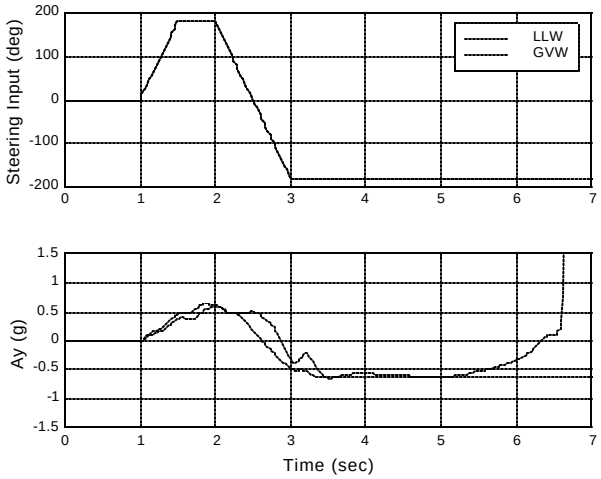

Figure 5: Steering Input and Lateral Acceleration
30 mph Reverse Steer Maneuver

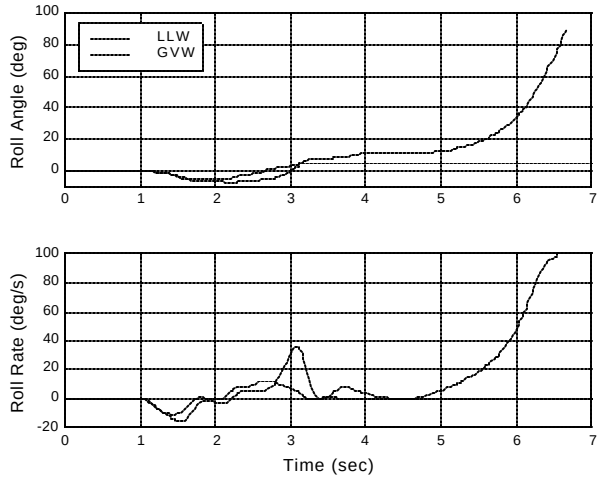

Figure 6: Roll Angle and Roll Rate
30 mph Reverse Steer Maneuver

Figures 8 and 9 contain phase plane plots of roll angle versus roll rate and side-slip angle versus yaw rate, respectively. Both figures show stable, convergent responses for the LLW vehicle; and instabilities for the GVW vehicle at the points where the curves diverge.

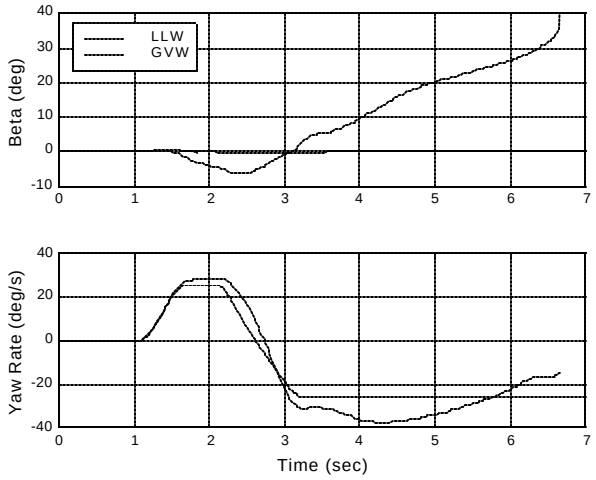

Figure 7: Side-Slip Angle (Beta) and Yaw Rate
30 mph Reverse Steer Maneuver

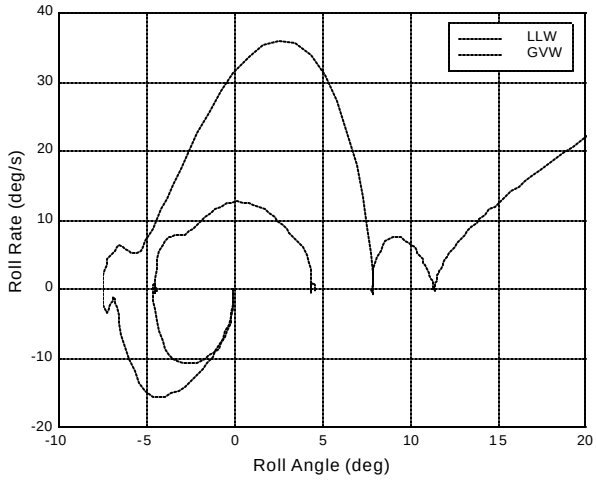

Figure 8: Roll Angle Versus Roll Rate
30 mph Reverse Steer Maneuver

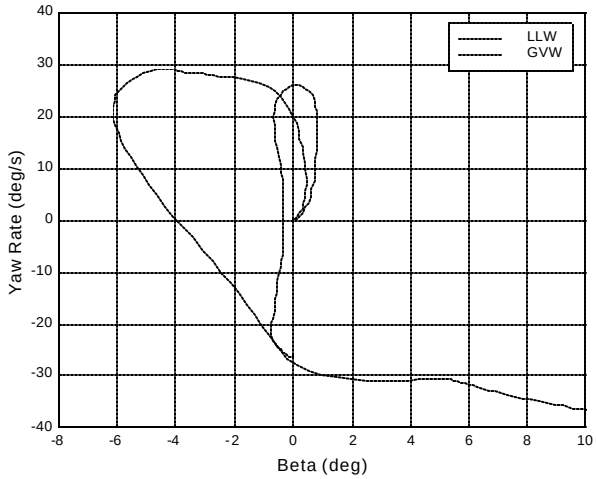

Figure 9: Side-Slip Angle (Beta) Versus Yaw Rate
30 mph Reverse Steer Maneuver

These examples show that the simulated GVW fifteen-passenger van exhibits both lateral and roll instabilities under extreme maneuvers. The facts that the center of gravity is higher and further rearward both contribute to the lateral instability. The roll instability results from the facts that the GVW vehicle spins out and that the center of gravity is higher. Note that these instabilities are probably not unique to fifteen-passenger vans; other vehicles with high payload to empty weight ratios may well have similar instabilities.

As mentioned, these simulation results do not represent the response of any specific fifteen-passenger van. These predictions, which do not rely on the measured suspension and tire properties of an actual fifteen-passenger, are presented to illustrate the effects of loading the vehicle to its GVW. Actual vehicles are likely to have different suspension and tire properties than those used in these simulation models. Also, some vehicles rely on using higher rear tire pressures to maintain appropriate handling responses at limit conditions. Nonetheless, the results presented do illustrate potential handling problems that may occur for a heavily loaded fifteen-passenger van. The essential message is that the handling of this vehicle changes between the two loading conditions during extreme maneuvers and that a fully-loaded van is inherently less stable than an unloaded one.

5. Conclusions

Analyses of crash databases and measurement of rollover propensity metrics indicate that fifteen-passenger vans might be more likely to roll over when fully loaded with occupants than when lightly loaded. For all occupant loadings, fifteen-passenger vans have an overall rollover ratio comparable to that of all light trucks and vans (LTVs). Analysis considering the number of occupants in the vehicle showed that fifteen-passenger vans with ten or more occupants had three times the rollover ratio than those with fewer than ten occupants.

All three sizes of vans for which rollover propensity metrics were measured during NHTSA=s field tests had an increase in rollover propensity, measured using SSF, from the driver-only loading condition to the 15-occupant loading condition. However, the effects of occupant loading were greater for the fifteen-passenger van than for the seven-passenger van or the minivan. In measuring the inertial parameters of a fully loaded fifteen-passenger van versus a lightly loaded van, the decrease in stability under the fully-loaded condition correlates to an increase in the rollover risk of approximately 40 percent. Also, sudden vehicle maneuvers could increase the propensity to roll over. Computer simulation predictions illustrated the adverse affects that fully loading a fifteen-passenger van can have on its handling properties (sudden transition from understeer to oversteer) and rollover propensity.

For additional copies of this research note, please call (202) 366-4198 or fax request to (202) 366-3189. For questions regarding the data reported in this research note, please call Rajesh Subramanian (202) 366-5371 of the National Center for Statistics and Analysis or Riley Garrott (937) 666-4511 of the Vehicle Research & Test Center. This research note and other general information on highway traffic safety may be accessed by Internet users at http://www.nhtsa.dot.gov/people/ncsa.

Due to the severe nature of possible injuries and deaths associated with 12- and 15-passenger vans, along with the well documented studies confirming these problems, AIG Programs can no longer accept these vehicles for insurance coverage. This bulletin is to notify all of our programs that we must communicate to our insureds the need to have a formal disposal plan in place according to the time tables listed below.

Disposal Protocols

- *Effective January 1, 2005,* **new accounts are eligible for coverage ONLY if they have a clearly documented plan in place to dispose of all 12 and 15 passenger vans** *by their renewal the following year***.**

- *Effective March 1, 2005,* **all renewal accounts must have a clearly documented plan in place to dispose of all 12 and 15 passenger vans** *by the renewal the following year***.**

- *Effective August 1, 2005,* **any new accounts with 12 or 15 passenger vans** *will not be eligible* **for any programs written by the AIG Programs Division.**

These protocols affect coverage for both primary automobile and excess liability!

We know some of our programs have a heavy amount of exposure to 12- and 15-passenger vans, however the potential of these vehicles becoming part of a class action suit are very real and will impact not only the public but our insureds, your sub-producers and each of you who administer these programs. Please contact your Program Manager with any questions.


PC15PassVanReport.pdf


"NHTSA Repeats Rollover Warning to l


15VanRollNote.pdf

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