

Circumstances Surrounding Fatal Crashes Involving 15-Passenger Vans, 1985 – 2004

by

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16. Abstract The objective of this report was to document the circumstances surrounding fatal crashes that involved at least one 15-passenger van over the twenty year period, 1985 – 2004. The study covered 1,610 vans and drivers and a total of 8,594 occupants. The study found that restraint use was very low among the occupants of these vehicles. Fifty-six percent of the drivers killed were unrestrained, as were 57% of front-seat passengers, and 71% of rear seat occupants. Restraint use also fell as occupancy rose. Overall, only 19% of those killed were restrained. Rollover was a major factor in these crashes. Sixty-three percent of those killed died in a crash involving a rollover. As has been found in previous research, the likelihood of rollover rose dramatically with increases in occupancy beyond 7-8 occupants. Tire failure was an issue in both rollovers and fatalities. Nearly 10% of the fatalities and 16% of incapacitating injuries occurred in crashes involving a tire-related factor. Ninety-six percent of the vehicles with a tire failure rolled over.			
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Objective

The objective of this research was to understand the circumstances surrounding fatal crashes involving 15-passenger vans over the 20-year period, 1985 – 2004. Using data compiled by the National Highway Traffic Safety Administration's Fatality Analysis Reporting System (FARS), 1,610 such vehicles were identified.¹

Of particular interest were the following items:

- Number of occupants and injury status
- Restraint use by vehicle occupants and related injury severity
- Tire failure
- Rollover
- Age of driver and class of driver's license
- Driver related factors

Background

Both the National Highway Traffic Safety Administration and the National Transportation Safety Board have been investigating the safety of 15-passenger vans since the late 1990's. NHTSA's consumer advisories have gotten progressively more strident, culminating in a November, 2004 admonition that: "NHTSA's recommendation is that pre-school and school aged children should not be transported in these vehicles due to safety concerns."² Under NHTSA's rules, it is illegal to sell a new 15-passenger van to a school for regular use in transporting children,³ and both NHTSA and NTSB have issued strong recommendations that pre-school and school-aged children should only be transported in vehicles that meet NHTSA's school bus safety standards (no 15- or 12-passenger van meets these standards).⁴

¹ Identifying 15-passenger vans is not a trivial task. NHTSA developed a SAS algorithm to differentiate 15-passenger vans from other full size vans (passenger and cargo), as displayed in Appendix B of the May 2004 report "Analysis of Crashes Involving 15-Passenger Vans" (Subramanian, 2004). This algorithm was used to search FARS data. The search identified 2,163 such vans involved in fatal crashes 1985 – 2004. However a closer inspection of the data found many mismatches between the vehicle identification number and the Body Type (should be Type 21) cited in the FARS report. Thirty-one inappropriate Body Types were identified (Body Type codes 2,4 6, 9, 14, 15, 16, 20, 22, 23, 24, 25, 28, 29, 30, 31, 32, 38, 40, 41, 42, 48, 49, 50, 55, 56, 58, 59, 73, 77, and 97), reducing the number of 15-passenger vans in this study to 1,610. While some of these aberrant codings may be correct, reflecting vehicle modifications after original manufacture, 1,610 is probably a conservative underestimate of the actual number of vans, because of likely mis-codings of Body Type in FARS. All vans in the present study match Body Type 21 with the correct VIN as specified in the NHTSA report (Subramanian, 2004).

² See <http://www.nhtsa.gov/cars/problems/studies/15PassVans/15passvan.html>

³ See <http://www.ed.gov/print/about/offices/list/oii/nonpublic/transportation.html>

⁴ See <http://www.nhtsa.dot.gov/cars/rules/interps/files/17730.drn.htm> and <http://www.ntsbn.gov/publicn/1999/SIR9902.pdf>.

NHTSA research has also noted the high propensity for 15-passenger vans to rollover when fully loaded and resulted in a May, 2005 consumer advisory “NHTSA Restates Rollover Warning for Users of 15-Passenger Vans”.⁵

As with the notorious Ford Explorer rollover crashes, rear tire failure has been implicated in 15-passenger van crashes.⁶ Under-inflation can lead to tire failure, and a 2005 NHTSA study found that 56% of all vans had at least one tire under-inflated by 25% or more, twice the percentage of passenger cars sampled. Six percent of vans had all four tires under-inflated by 25% or more, a rate double that of passenger cars.⁷

Because of their handling characteristics, especially during emergency maneuvers caused by a tire failure or a roadway departure, NHTSA recommends that only experienced drivers should drive 15-passengers.⁸ The National Transportation Safety Board further recommends that 12- and 15-passenger vans be reclassified as commercial vehicles, thereby requiring drivers of these vehicles to hold a valid commercial driver’s license (CDL), with a passenger transportation endorsement.⁹

Findings

a. Occupants and injury

There were 8,594 occupants in the 1,610 vans in this study. Injury data were available for 8,535, and are listed in Figure 1, using the KABCO scale.¹⁰

Of the 1,227 occupants who were killed, 273 were drivers in seating position 11 (left front seat), which means that one-fifth (22%) of the drivers of the vans in this study were killed. One hundred and fifteen of these drivers were driving alone.

⁵ See http://www.nhtsa.dot.gov/portal/site/nhtsa/template.MAXIMIZE/menuitem.f2217bee37fb302f6d7c121046108a0c/?javax.portlet.tpst=1e51531b2220b0f8ea14201046108a0c_ws_MX&javax.portlet.prp_1e51531b2220b0f8ea14201046108a0c_viewID=detail_view&javax.portlet.begCacheTok=token&javax.portlet.endCacheTok=token&itemID=89f08610c7514010VgnVCM1000002c567798RC_RD&viewType=standard&pressReleaseYearSelect=2005

⁶ See <http://www.nts.gov/Pressrel/2003/030715.htm> and <http://www.vanangels.org/>

⁷ See <http://www-nrd.nhtsa.dot.gov/pdf/nrd-30/NCSA/RNotes/2005/809846.pdf>

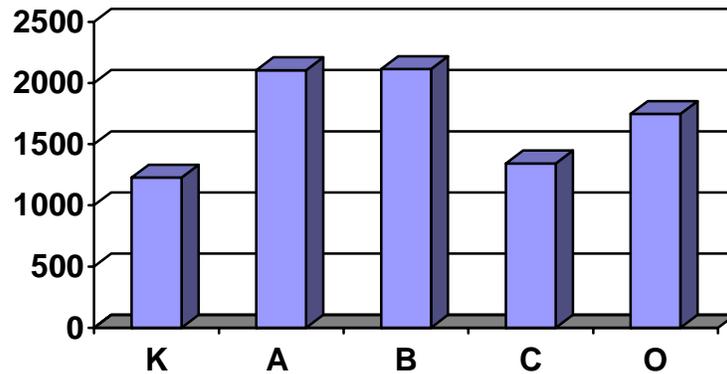
⁸ See <http://nhtsa.gov/cars/problems/studies/15PassVans/index.htm>

⁹ See <http://www.nts.gov/Pressrel/2003/030715.htm>

¹⁰ K = Killed; A = incapacitating injury; B = non-incapacitating injury; C = possible injury; O = no injury

Figure 1

Injury Status of Occupants of 15-Passenger Vans Involved in Fatal Crashes, 1985 - 2004



b. Restraint use and injury

Of the 273 drivers who were killed, 153 (56%) were unrestrained. Even lower restraint use was typical for passengers killed.

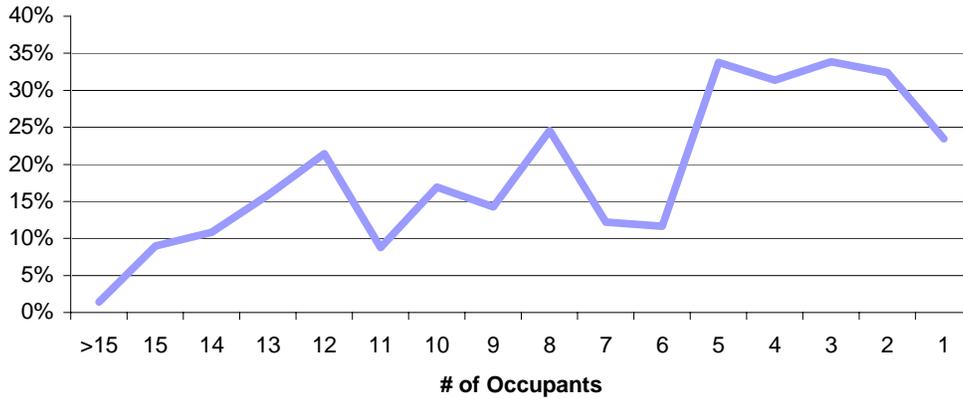
For right-front seat passengers, 68 of 120 who were killed were unrestrained (57%). Of 660 rear passengers killed, 466 (71%) were unrestrained. Overall, 66% of the 1227 occupants who were killed were unrestrained, 19% were restrained, and restraint use was unknown for 15%.

Restraint use also fell as occupancy rose, as illustrated in Figure 2. Seventy of the occupants of the vans in this study who were killed were in vans loaded beyond their design capacity of 15 occupants. Only one of these 70 occupants was restrained. Seventy-eight occupants died in vans loaded to their design capacity of 15; only 7 (9%) were restrained.

Even among uninjured occupants restraint use was low. Of the 1,747 uninjured occupants, only 55% were known to have been restrained. No restraint use was coded for 26% and restraint use was unknown for the rest.

Figure 2

% Restraint Use by 15-Passenger Van Occupants by Occupancy

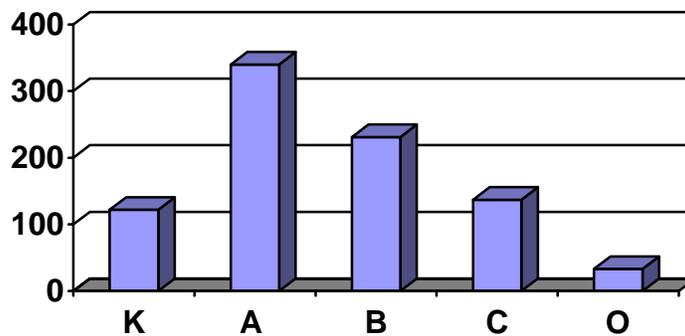


c. Tire failure

Seventy-seven of the 1,610 vans in this study had one or more tires coded as a “vehicle related factor.” As can be seen in Figure 3, these were particularly severe crashes. Nearly 10% (122) of all the occupant fatalities in this study occurred in these 77 vans, along with 16% of all incapacitating injuries.

Figure 3

Injury Status of Occupants of 15-Passenger Vans Involved in Fatal Crashes, 1985 - 2004, with Tire-Related Vehicle Factor



One reason that crashes involving a tire issue were so severe is that 74 of the vehicles (96%) rolled over.

Vehicle occupancy levels seem to be related to tire failure, as illustrated in Figure 4. Similarly, tires failures appear to be related to vehicle age, as illustrated in Figure 5, with most tire-related issues arising in vehicles 4 – 8 years old.

Figure 4

**# of 15-Passenger Van Crashes in Which at Least One Occupant Died, 1985 - 2004
with Tires Cited as a Vehicle-Related Factor, by # of Occupants**

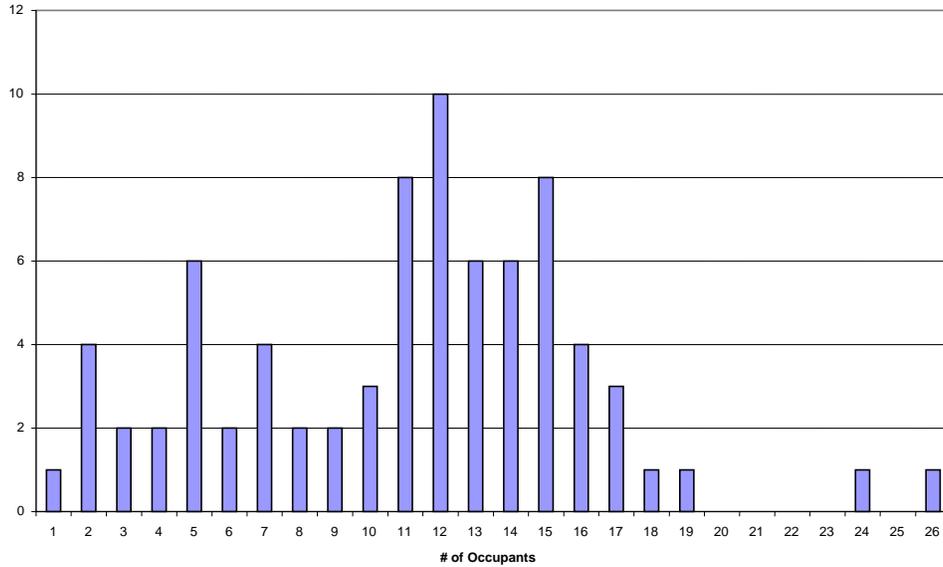
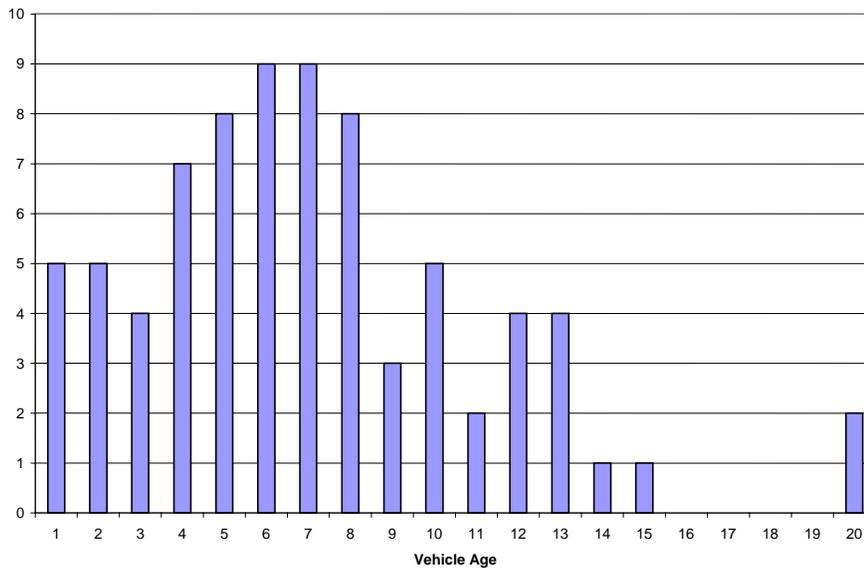


Figure 5

**# of 15-Passenger Van Crashes in Which at Least One Occupant Died, 1985 - 2004
with Tires Cited as a Vehicle-Related Factor, by Vehicle Age**



d. Rollover

Rollover was a factor in the crashes in which 778 (63%) of the 1,227 van occupants died. Rollover was the first event in crashes which killed 423 and a subsequent event (e.g., after a tire failure) in 355 deaths. No rollover was involved in the deaths of 449.

Confirming NHTSA's findings noted earlier, rollover was a particular issue when vans were fully loaded or overloaded, as illustrated in Figures 6-7. Figure 6 illustrates the percent of vehicle occupants killed in rollover versus non-rollover crashes by vehicle occupancy. Figure 7 illustrates the number of vehicle occupants killed in rollover versus non-rollover crashes by vehicle occupancy.

Figure 6

% of 15-Passenger Van Occupants Killed by Rollover Event and # of Vehicle Occupants, 1985 - 2004

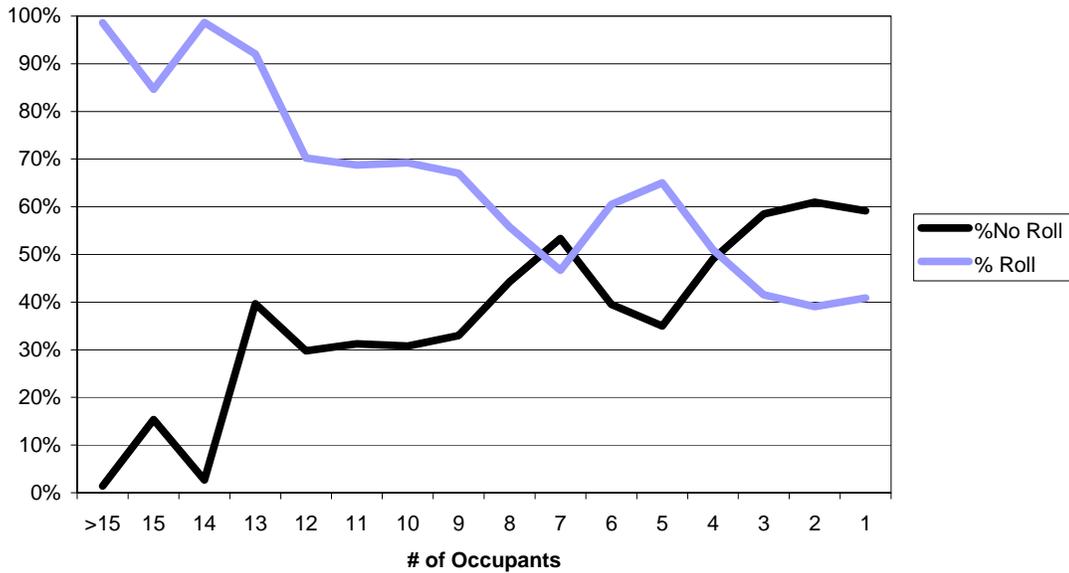
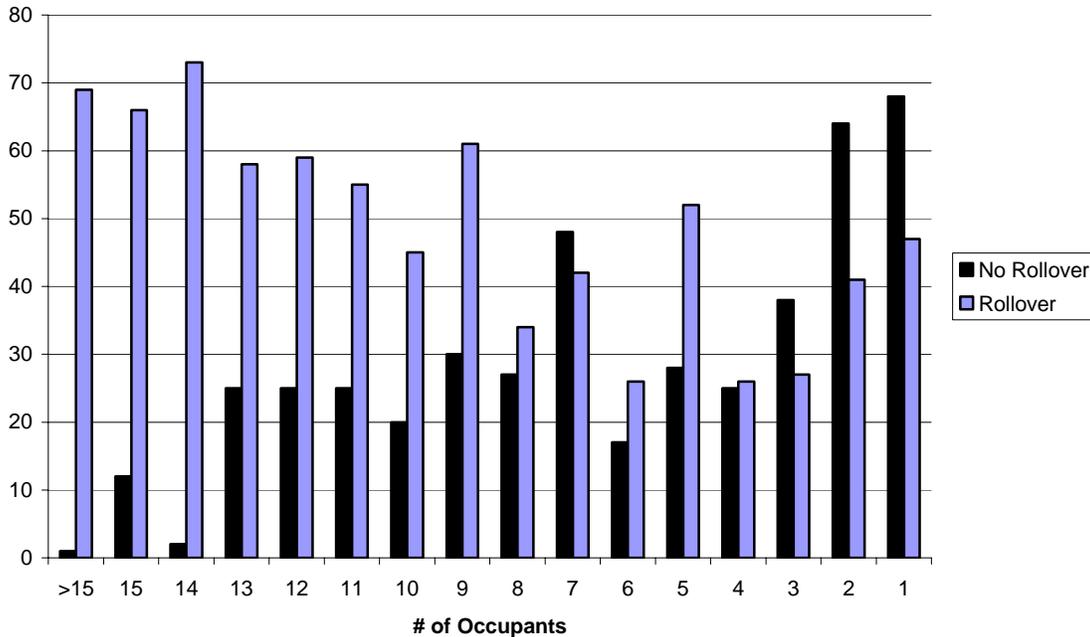


Figure 7

**# of Occupants Killed in 15-Passenger Van Crashes with and without Rollover
by # of Vehicle Occupants, 1985 - 2004**



e. Driver Age and Class of License

Figure 8 illustrates the age ranges of the 1,610 drivers in this study. Nearly half (47%) were between the ages of 26 and 45. Only 17% of the drivers in this study were 25 or younger.

The vast majority (84%) of the drivers did not hold a commercial driver's license (CDL). Twelve percent held a valid CDL.

f. Driver Related Factors

As illustrated in Figure 9, the most commonly coded driver-related factor was none (Code 0), followed by failure to keep in proper lane (Code 28), unsafe speed (Code 44), inattention (Code 6), and failure to yield right-of-way (Code 38). Nearly one out of every five drivers (18%) was coded for failure to keep in the proper lane. This percentage is lower than the national average for all drivers, which was 23.9% for 1995 – 2004.¹¹ Similarly, the percentage for unsafe speed (15%) was well below the national average of 20.2% over this same period.

¹¹ See individual years at <http://www-fars.nhtsa.dot.gov/FinalReport.cfm?stateid=0&title=people&title2=drivers&year=1995>

Figure 8

Age Ranges of Drivers of 15-Passenger Vans Involved in Fatal Crashes, 1985 - 2004

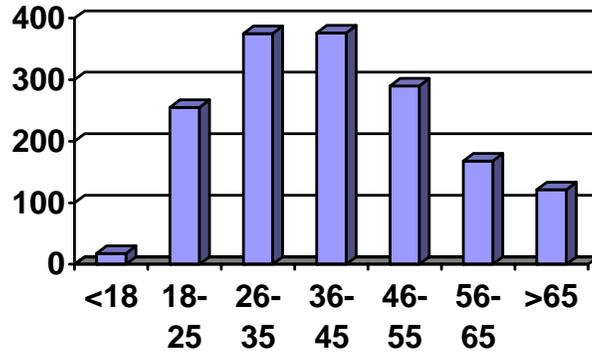
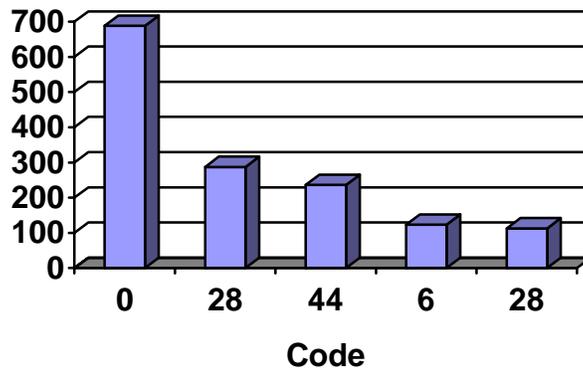


Figure 9

5 Most Coded Driver-Related Factors in 15-Passenger Van Fatal Crashes, 1985 - 2004



Discussion

The findings in this study are generally consistent with those in previous research on 15-passenger van crashes (Garott, *et al*, 2001), (Subramanian, 2004). Rollover is a major factor in fatal crashes involving these vehicles. Sixty-three percent of the fatalities observed in this study occurred in crashes involving rollover. Tire failure, when it occurs, almost always (96% of the time) results in rollover.

Likelihood of rollover increased with increasing numbers of occupants above 7-8. Unfortunately, restraint use also generally fell with increased occupancy, with the most occupied vehicles having the lowest levels of restraint use.

Indeed, restraint use among the occupants of these vehicles at all levels of occupancy was low. In this study only 19% of the vehicle occupants who were killed were restrained, as compared to just 14% in the NHTSA study by Subramanian (Subramanian, 2004).¹² Even among uninjured occupants, only 55% were known to have been restrained.

A tire-related factor was noted in only 77 (5%) of the 1,610 vehicles in this study. Yet nearly 10% of all occupant fatalities and 16% of incapacitating injuries occurred in these vehicles. That is probably the case because 74 of the 77 vans (96%) rolled over. Tire problems were most prevalent among vehicles four to eight years old and among those carrying 11 – 15 occupants.

Because CDL holders are typically better trained and more experienced in handling unwieldy vehicles, the National Transportation Safety Board and others have recommended that 15-passenger van drivers should hold a CDL. Only 12% of the drivers of the vans in this study held a valid commercial driver's license.

While young drivers have been involved in some of high-profile crashes involving 15-passenger vans, such as the February, 2000 crash involving a van carrying the Prairie View A&M University track team in which four were killed and six seriously injured,¹³ only 17% of the drivers in this study were 25 or younger. Nearly half (47%) were between the ages of 26 and 45.

Only 43% of the drivers of these vehicles were coded with no “driver-related factor.” Failure to keep in proper lane and unsafe speed were the two most frequently coded driver-related factors, though both were cited less frequently than the national average for drivers of all types of vehicles involved in fatal crashes.

Conclusions

The propensity for 15-passenger vans to roll over in fatal crashes, together with low restraint use by the occupants of these vehicles, is a deadly combination. The deadliness of the combination grows with vehicle occupancy above 7 – 8 persons, when vehicles become more likely to roll over yet restraint use by occupants falls. All occupants of these vehicles should be restrained at all times.

¹² The difference may be due to the different time periods examined – 1990 – 2002 in the NHTSA study and 1985 – 2004 in this report or the many apparently aberrant Body Types included in the NHTSA study but eliminated from this report (see footnote 1 for details).

¹³ The vehicle was driven by a 21-year-old student athlete (National Transportation Safety Board, 2003)

Tire failure, while not common, almost inevitably leads to rollover and severe injuries or deaths. Tire maintenance is a critical issue for these vehicles. Tires 4 – 8 years old would appear to merit particular attention. Particular attention should also be directed to tires on vehicles carrying 11 or more passengers.

As recommended by both NHTSA and the NTSB, because of their unwieldy handling characteristics, especially during emergency maneuvers, 15-passenger vans should be driven only by properly trained drivers – preferably those holding a commercial driver’s license with a passenger endorsement. Driver age and general experience alone – 83% of the drivers in this study were age 26 or older – does not insure proper preparation to drive these vehicles safely.

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