



National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: November 1, 2002

In reply refer to: H-02-26 through -28

Honorable Jeffrey W. Runge, M.D.
Administrator
National Highway Traffic Safety Administration
Washington, D.C. 20590

Fifteen-passenger vans, which make up about 0.25 percent of the passenger vehicle fleet in the United States, are frequently used to transport school sports teams, van pools, church groups, and other groups. Although they are involved in a proportionate number of fatal accidents compared to their percentage in the fleet, they are involved in a higher number of single-vehicle accidents involving rollovers than are other passenger vehicles. Data for 1991–2000 in the Fatal Analysis Reporting System (FARS) of the National Highway Traffic Safety Administration (NHTSA) indicate that about 52 percent of the 15-passenger vans involved in single-vehicle, fatal accidents experience a rollover (as a primary or subsequent event) compared to 33 percent of the passenger automobiles involved in such accidents. Additionally, 81 percent of the 15-passenger van occupant fatalities occur in single-vehicle rollover accidents.

Research has shown that among other factors, accidents in rural areas, vehicles with higher occupancy levels, vehicle speed, driver alcohol/drug involvement, and younger driver age are associated with rollover propensity.¹ However, much of the previous work was done on passenger vehicles and excluded 15-passenger vans.² The Safety Board thus conducted analyses on the FARS data for single-vehicle, fatal 15-passenger van accidents that occurred from 1991 through 2000 and found similar results, suggesting that occupancy level and vehicle speed (measured by either travel speed or posted speed limit) are consistently associated with van rollover.³ Other accident characteristics have also been shown to be related to vehicle rollover but with less reliability.

¹ (a) W. Riley Garrott, Barbara Rhea, Rajesh Subramanian, and Gary J. Heydinger, *The Rollover Propensity of Fifteen-Passenger Vans*, Research Note (Washington, DC: NHTSA, April 2001). (b) T.M. Klein, *A Statistical Analysis of Vehicle Rollover Propensity and Vehicle Stability*, SAE Tech. Pap. 920584 (Warrendale, PA: Society of Automotive Engineers, 1992) 135-150. (c) "Consumer Information Regulations; Federal Motor Vehicle Safety Standards; Rollover Resistance; Final Rule [49 CFR Part 575]," *Federal Register* Vol. 66, No. 9, dated January 12, 2001: 3388-3437.

² NHTSA informed Safety Board staff on June 4, 2002, that the agency is currently preparing a technical report that examines single-vehicle, fatal 15-passenger van rollover accidents. According to NHTSA, the FARS data analysis has been extensive and evaluates the effect of several factors such as speed, number of vehicle occupants, vehicle maneuvers, age of the driver, and alcohol involvement on vehicle rollover. NHTSA expects to publish this report in 2002.

³ National Transportation Safety Board, *Evaluation of the Rollover Propensity of 15-passenger Vans*, Safety Report NTSB/SR-02/03 (Washington, DC: NTSB, 2002).

Because these vans are designed to carry 15 passengers and frequently are used by various organizations to transport many passengers to activities, the Safety Board is particularly concerned about the relationship between occupancy level and vehicle rollover. NHTSA research reported in 2001 that 15-passenger vans with 10 or more occupants had three times the rollover ratio than did those with fewer than 10 occupants.⁴ The same analyses conducted by the Safety Board on the FARS data yielded higher rollover ratios for all levels of occupancy levels but similar magnitudes of increase in the rollover ratio when comparing lightly loaded to fully loaded vans. Fifteen-passenger vans with 10–15 occupants had a rollover ratio of 85.0 percent compared with a ratio of 28.3 percent for vans with fewer than 5 occupants.

Simulations conducted for the NHTSA research illustrated the adverse effects that a fully loaded 15-passenger van can have on the vehicle's handling properties and rollover propensity. Fully loading or nearly loading a 15-passenger van causes the center of gravity to move rearward and upward, which increases the vehicle's rollover propensity and could increase the potential for driver loss of control in emergency maneuvers.⁵

NHTSA has been evaluating vehicle rollover for several years. In the late 1990s, NHTSA launched a vehicle dynamic rollover propensity research program. Phases I, II, and III evaluated a broad range of dynamic testing maneuvers that might induce on-road, untripped rollovers. The program tested 12 vehicles (3 passenger cars, 3 light trucks, 3 sport utility vehicles, 2 eight-passenger vans, and 1 seven-passenger van) but no 15-passenger vans. As a result of the Transportation Recall Enhancement, Accountability, and Documentation (TREAD) Act of 2000, NHTSA is conducting phases IV, V, and VI of its dynamic rollover propensity program. These phases of research will continue to look at additional testing maneuvers and examine various influences on rollover testing. Two test maneuvers and two load conditions are proposed in NHTSA's notice of proposed rulemaking issued October 7, 2002 (*Federal Register*, Vol. 67, No. 194). NHTSA has informed the Safety Board that 15-passenger vans will not be included in this testing because the *Federal Motor Vehicle Safety Standards* (FMVSS) define a motor vehicle designed to carry more than 10 persons as a bus (Title 49 *Code of Federal Regulations* Part 571.3).

NHTSA originally proposed rulemaking concerning vehicle rollovers in 1973 with an advance notice of proposed rulemaking on minimum performance rollover resistance. It has periodically taken rulemaking action since; however, there are no rollover standards at present for any highway vehicle.

⁴ Garrott and others, 2001.

⁵ (a) NHTSA simulations, reported in Garrott and others, 2001. (b) NHTSA press release packet, April 15, 2002. (c) General vehicle dynamics of how increasing the center of gravity height affects rollover are discussed in Thomas D. Gillespie, "Rollover," Chapter 9 in *Fundamentals of Vehicle Dynamics* (Warrendale, PA: Society of Automotive Engineers, 1992) 309-333.

In 2001, NHTSA's New Car Assessment Program (NCAP) was expanded to include consumer information on the rollover risk of passenger cars and light, multipurpose passenger vehicles and trucks.⁶ The expansion does not extend to vehicles that carry more than 10 passengers. The program's rollover resistance rating system, available beginning with model year 2001 vehicles, estimates the risk of rolling over in a single-vehicle crash; the system does not predict the likelihood of such a crash.

The NCAP rollover resistance rating is based on the static stability factor (SSF). The SSF used is based on measurements for a driver-only load condition. Static measures of stability (SSF, tilt table ratio, and critical sliding velocity) have been shown to be important factors in understanding vehicle rollover. NHTSA, in its 2001 research, compared the static stability factors of two 7-passenger vans and a 15-passenger van under lightly loaded and fully loaded conditions. Although the SSF decreased for all three vans from the lightly loaded condition to the fully loaded condition, the change was the greatest for the 15-passenger van: the SSF decreased 3 percent for one 7-passenger van, 5 percent for the other 7-passenger van, and 11 percent for the 15-passenger van.

In response to the Department of Transportation and Related Agencies Appropriations Act of 2001 (Public Law 106-346), the National Research Council of the National Academy of Sciences (NAS) completed a review of NHTSA's rollover resistance rating system.⁷ It concluded that the SSF captures important vehicle characteristics related to rollover propensity and is strongly correlated with the outcome of actual crashes (rollover or no rollover). However, it also concluded that the NCAP rollover resistance rating system, which uses numbers of stars to indicate rollover risk, is likely to be of limited use in presenting practical information to the public. The NAS report recommended, in part, that NHTSA should (a) "pursue its research on driving maneuver tests for rollover resistance . . . with the objective of developing one or more dynamic tests that can be used to assess transient vehicle behavior leading to rollover"; and (b) "develop revised consumer information on rollover that incorporates the results of one or more dynamic tests on transient vehicle behavior to complement the information from static measures, such as SSF."

Although NHTSA has initiated rulemaking activities concerning vehicle rollovers, established a vehicle rollover resistance rating system, and is currently examining dynamic testing procedures, these programs do not extend to 15-passenger vans. Given their high rate of rollover involvement in single-vehicle accidents, particularly under fully loaded conditions for which they are designed and are being used, the Safety Board believes that 15-passenger vans should be included in dynamic testing and proposed rollover resistance ratings for this class of vehicle. Information from the dynamic testing also has the potential to develop a dynamic testing protocol that could supplement the NCAP rollover resistance rating system. Therefore, the Safety Board recommends that NHTSA include 15-passenger vans in its dynamic testing

⁶ The NCAP program was established in 1978 with the purpose of providing consumers with a measure of the relative safety potential of vehicles in frontal crashes. NCAP information includes results from frontal and side crash tests as well as rollover resistance ratings. The ultimate goal of the program is to improve occupant safety by providing market incentives for vehicle manufacturers to voluntarily design their vehicles to better protect occupants in a crash rather than by regulatory devices.

⁷ Transportation Research Board, National Research Council. *An Assessment of the National Highway Traffic Safety Administration's Rating System for Rollover Resistance*. Prepublication copy.

program. The dynamic testing should test the performance of 15-passenger vans under various load conditions.

In April 2001, following several high publicity 15-passenger van accidents, NHTSA published a consumer advisory containing a cautionary warning to users of 15-passenger vans about an increased rollover risk under certain conditions. NHTSA issued a second consumer advisory in April 2002. The NCAP program also serves as an available source of consumer information about the safety potential of vehicles in crashes; however, the NCAP rollover resistance rating system does not currently include 15-passenger vans. The Safety Board believes that, at a minimum, the rollover resistance rating system should be extended to include 15-passenger vans. Therefore, the Safety Board recommends that NHTSA extend the NCAP rollover resistance program to 15-passenger vans, especially for various load conditions. The inclusion of 15-passenger vans in NHTSA's dynamic testing program, as recommended in the preceding paragraph, would provide valuable information by which to supplement the rollover resistance rating system. Thus, the Board also recommends that NHTSA, in extending the rollover resistance program to 15-passenger vans, use the dynamic testing results of 15-passenger vans to supplement the static measures of stability in the NCAP rollover resistance program.

Various technological systems have been developed to assist drivers in maintaining control of the vehicle; for example, antilock brakes, traction control, lane departure systems, and electronic stability control (ESC) systems. Antilock brakes use speed sensors, valves, pumps, and controllers to stop the vehicle in a safe manner. Traction control systems sense when a tire is slipping or losing traction and automatically activate the brakes or slow down engine speed. Lane departure systems typically alert the driver when the vehicle has departed from the driving lane. ESC systems are computer-controlled systems that attempt to stabilize the vehicle by monitoring a vehicle's movement and the direction the driver is steering. If the driver inputs and the vehicle response do not correspond, computer controls intervene to enhance the driver's ability to maintain control of the vehicle by selectively braking individual wheel(s), or changing power applied to the wheels. Future ESC systems will likely include inputs to steering and differential power control to the wheels.

Some of these technologies are currently available on certain motor vehicles, including some sport utility vehicles and minivans. Antilock brakes are currently available on 15-passenger vans, but traction control systems, lane departure systems, and ESC systems are not. Given the rollover propensity of 15-passenger vans, such technological systems may have potential to assist drivers in maintaining control of these vehicles. The Safety Board therefore recommends that NHTSA, in conjunction with the manufacturers of 15-passenger vans, evaluate, and test as appropriate, the potential of technological systems, particularly electronic stability control systems, to assist drivers in maintaining control of 15-passenger vans. The Board has issued a companion recommendation to the manufacturers of 15-passenger vans.

Therefore, the National Transportation Safety Board recommends that the National Highway Traffic Safety Administration:

Include 15-passenger vans in the National Highway Traffic Safety Administration dynamic testing program. The dynamic testing should test the performance of 15-passenger vans under various load conditions. (H-02-26)

Extend the National Car Assessment Program (NCAP) rollover resistance program to 15-passenger vans, especially for various load conditions, and use the dynamic testing results of 15-passenger vans, as described in Safety Recommendation H-02-26, to supplement the static measures of stability in the NCAP rollover resistance program. (H-02-27)

Evaluate, in conjunction with the manufacturers of 15-passenger vans, and test as appropriate, the potential of technological systems, particularly electronic stability control systems, to assist drivers in maintaining control of 15-passenger vans. (H-02-28)

The Safety Board also issued a safety recommendation to the manufacturers of 15-passenger vans.

Please refer to Safety Recommendations H-02-26 through -28 in your reply. If you need additional information, you may call (202) 314-6177.

Acting Chairman CARMODY, and Members HAMMERSCHMIDT, GOGLIA, and BLACK concurred in these recommendations.

By: Carol J. Carmody
Acting Chairman