

November 1989

MOTOR VEHICLE SAFETY

Passive Restraints Needed to Make Light Trucks Safer



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**Resources, Community, and
Economic Development Division**

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November 30, 1989


The Honorable Frank R. Lautenberg
Chairman, Subcommittee on Transportation and Related Agencies
Committee on Appropriations
United States Senate

The Honorable William Lehman
Chairman, Subcommittee on Transportation and Related Agencies
Committee on Appropriations
House of Representatives

In response to your request and subsequent agreement with your offices, this report addresses what the National Highway Traffic Safety Administration needs to do, has done, and is doing to provide light truck occupants the same level of safety as provided to passenger car occupants. Specifically, the report discusses the status of the 16 passenger car safety standards we reported in 1978 that were not applicable to, required reduced requirements for, or exempted certain types of light trucks. Our Program Evaluation and Methodology Division is preparing a separate report addressing your request for a comparison of fatality rates per unit of exposure for each major light truck type and controlling for the potential effects of nonvehicle factors.

As agreed with your offices, unless you publicly announce its contents earlier, we plan no further distribution of this report until 7 days from the date of this letter. At that time, we will send copies to the Secretary of Transportation; the Administrator, National Highway Traffic Safety Administration; and other interested parties. We will make copies available to others upon request.

Our work was performed under the direction of Kenneth M. Mead, Director, Transportation Issues, (202) 275-1000. Major contributors are listed in appendix IV.



J. Dexter Peach
Assistant Comptroller General

Executive Summary

Purpose

Light trucks, including pickup trucks, vans, and multipurpose passenger vehicles, have become very popular as passenger-carrying vehicles. Although about 8,000 light truck occupants died in highway accidents in 1987, these vehicles are not required to meet certain safety standards that apply to passenger cars. For example, light trucks are not now required to have passive restraints (air bags or automatic seat belts). Concern about the increasing number of light truck fatalities led the Chairmen, Subcommittees on Transportation and Related Agencies, House and Senate Committees on Appropriations, to ask GAO to assess what the National Highway Traffic Safety Administration (NHTSA) (1) needs to do, (2) has done, and (3) is doing to provide light truck occupants the same level of safety as provided to passenger car occupants.

Background

The National Traffic and Motor Vehicle Safety Act of 1966, as amended, requires the Secretary of Transportation to establish federal motor vehicle safety standards to reduce injuries and fatalities. The Secretary has delegated this responsibility to NHTSA, which has established 49 safety standards setting minimum performance levels for motor vehicles or motor vehicle equipment sold in the United States.

In earlier years, light trucks were designed and used primarily as cargo-carrying vehicles and cars were designed and used primarily as passenger-carrying vehicles. Light trucks have grown tremendously in popularity as passenger-carrying vehicles. For example, light trucks represented about 15 percent of the vehicle sales market in 1971 and about 31 percent in 1988. Manufacturer representatives expect the light truck sales share to continue upward during the next few years. They increased from 1.8 million in 1971 to 4.9 million in 1988.

In July 1978, GAO reported that 16 passenger car standards either were not applicable to, required noticeably reduced requirements for, or exempted certain types of light trucks.

Results in Brief

Light trucks are still exempted from several of the 16 standards that GAO reported on in 1978. Of these, the passive restraint requirement is the most significant. GAO believes that the passive restraint requirement should be applicable to light trucks for several reasons. First, NHTSA estimates that up to 1,500 lives a year could be saved if passive restraints were installed in all light trucks. Second, about 65 percent of all light truck fatalities resulted from frontal crashes and rollovers with ejection, which are the two crash modes where restraint use is most effective.

Third, NHTSA's data show most light truck occupants do not voluntarily use their manual lap/shoulder belts. And fourth, light trucks now make up about one-third of all vehicle sales, and such sales are expected to continue upward during the next few years. Recently, NHTSA began drafting a proposal to extend passive restraints to light trucks. This rulemaking, one of the first steps in the process, could take several years unless there is substantial agency commitment to its timely completion.

The five largest light truck manufacturers and a major supplier of air bags told GAO that various technical problems must be solved before light trucks can be equipped with passive restraints. GAO found that Ford was the only manufacturer that had firm plans to install passive restraints in some light trucks. All five manufacturers and the major supplier of restraints believe that, if passive restraints are mandated for light trucks, a phased-in approach will be necessary. Such an approach would allow manufacturers and suppliers to set goals, establish priorities, marshal resources, and address technical and supply problems.

Of the remaining 15 standards GAO reported on in 1978, NHTSA has extended 8 to light trucks and has 2 under rulemaking action to extend to light trucks. GAO believes that the remaining five standards do not seriously jeopardize occupant safety. Of these, one was changed to a nonsafety standard, two are being voluntarily applied to most light trucks, and two are applicable to a lesser number of passenger-carrying light trucks because of vehicle design changes.

Principal Findings

Passive Restraints for Light Trucks

NHTSA estimates that up to 1,500 lives could be saved annually if all light trucks were equipped with passive restraints as was required for passenger cars beginning with model year 1987. NHTSA believes this potential for lives saved comes from increasing restraint usage rather than because passive restraints are more effective than manual lap/shoulder belts in protecting occupants in a crash. NHTSA's data show that from 1982 through 1987, light truck fatalities increased about 22 percent from 6,595 deaths to 8,051. About 65 percent of these fatalities resulted from frontal crashes and rollovers in which occupants were ejected—the two crash modes in which manual or automatic restraints would give occupants the greatest benefits. NHTSA's data also show that most

light truck occupants do not voluntarily use their manual belts and therefore do not reap the benefits.

GAO learned from Ford Motor Company, General Motors Corporation, Chrysler Motors Corporation, Nissan, and Toyota Motor Corporate Service of North America, Inc., that passive restraints had not been installed in any light trucks to date and that Ford was the only manufacturer that had plans to do so in the near future. According to the manufacturers, many technical problems must be solved before light trucks can be equipped with passive restraints and that, if they were mandated, a phased-in approach would be necessary. Some manufacturers said that their engineering and testing resources were heavily committed to implementing other NHTSA safety standards.

TRW Vehicle Safety Systems Inc., a major supplier of air bags and automatic belts, told GAO that its air bag production level was operating at capacity. The supplier said that technical problems must be solved before light trucks can be equipped with passive restraints and, if they were mandated, TRW would need 2 to 3 years to develop the additional capacity to meet the increased demand for air bags and motorized belts.

GAO believes the Secretary of Transportation may need to phase-in passive restraints for light trucks as was done for passenger cars. If manufacturers have a timetable for implementation, GAO believes they can (1) work toward a common goal, (2) set priorities and marshal resources, (3) address technical problems, and (4) install passive restraints on a phased-in basis as they have with passenger cars. This will also permit passive restraint suppliers to expand their production capacity to meet a more definable passive restraint demand.

After GAO had substantially completed its audit, NHTSA officials said they were drafting a Notice of Proposed Rulemaking for extending passive restraints to light trucks. GAO commends NHTSA on this action, but a Notice of Proposed Rulemaking is only one step in a process that could take years if not given substantial agency commitment. For example, it took NHTSA about 15 years to establish an acceptable passive restraint requirement for passenger cars.

Light Trucks and Safety Standards

As of October 1989, GAO found that NHTSA had extended to light trucks 8 of the 16 passenger car standards GAO reported on in 1978. These related to hydraulic brakes, theft protection, vehicle identification number, power-operated windows, occupant protection in interior

impact, impact protection from steering control systems, steering control rearward displacement, and head restraints. NHTSA also had initiated rulemaking proceedings to extend to light trucks the side door strength and roof crush standards.

In addition to action on these 10 standards, GAO found that NHTSA has established new dynamic test requirements for manual lap/shoulder belts in light trucks and extended to light trucks the rear-seat lap/shoulder belt requirement established earlier for passenger cars. Also NHTSA is studying the feasibility of (1) improving rollover safety and (2) extending to light trucks the center high-mount stop lamp established for passenger cars in October 1983.

Of the remaining five standards, one was superseded and, in GAO's opinion, four do not significantly jeopardize the safety of light truck occupants.

Recommendation

GAO recommends that the Secretary of Transportation direct NHTSA's Administrator to establish a timetable for promptly moving the light truck passive restraint proposal through the rulemaking process and to periodically report its progress to the Secretary.

Agency Comments

GAO discussed the report's content with NHTSA officials. The officials were in general agreement with the report, and GAO incorporated their clarifying comments as appropriate. However, as requested, GAO did not obtain official agency comments on a draft of this report.

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Abbreviations

ANPRM	Advance Notice of Proposed Rulemaking
DOT	Department of Transportation
FARS	Fatal Accident Reporting System
GAO	General Accounting Office
MPV	Multipurpose Passenger Vehicle
NHTSA	National Highway Traffic Safety Administration
NPRM	Notice of Proposed Rulemaking

Introduction

Federal motor vehicle safety standards are established to reduce deaths and injuries on the nation's highways. While most standards are applicable to all types of passenger-carrying vehicles, some are not applicable to light trucks (see below for definition). Because of light trucks' growing popularity for passenger use and an increasing number of light truck deaths and injuries, the Congress and others have become very concerned about the safety of light truck occupants.

NHTSA's Safety Responsibilities

The National Traffic and Motor Vehicle Safety Act of 1966, as amended (15 U.S.C. 1381 *et seq.*), enacted on September 9, 1966, required the Secretary of Transportation to establish safety standards for motor vehicles and related equipment to reduce traffic accidents, injuries, and fatalities. The Secretary delegated the responsibility to enforce the act to the National Highway Traffic Safety Administration (NHTSA). Its responsibilities include (1) establishing uniform federal safety standards for motor vehicles and some replacement equipment, (2) ensuring that motor vehicles and equipment comply with its standards, (3) investigating possible motor vehicle safety noncompliance, and (4) in cases of noncompliance, directing action to remedy cases of noncompliance. By fulfilling these responsibilities, NHTSA encourages manufacturers to produce safer motor vehicles and associated equipment that reduce the frequency and severity of highway deaths and injuries.

NHTSA has established 49 minimum performance safety standards for motor vehicles or motor vehicle equipment sold in the United States. The initial standards became effective on January 1, 1968. In developing these standards, NHTSA initially adopted 17 standards that the General Services Administration had established in June 1965 to govern its purchase of new cars.

The 1966 act specified that each standard is to be practicable, meet the need for motor vehicle safety, and provide objective criteria to determine compliance with the standard. In prescribing standards, NHTSA is required to consider (1) relevant motor vehicle safety data, (2) whether the proposed standard is reasonable, practical, and appropriate, and (3) the extent to which the standard will carry out the act's purposes.

Vehicle Types

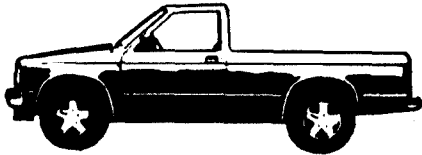
NHTSA uses different vehicle types for purposes of applying safety standards.¹ Some of the major types are: passenger car, truck, multipurpose passenger vehicle, bus, trailer, and motorcycle. NHTSA's definition of these follows:

1. Passenger car is a motor-powered vehicle, except a multipurpose passenger vehicle, motorcycle, or trailer, designed for carrying 10 persons or less.
2. Truck is a motor-powered vehicle, except a trailer, designed for transportation of property or special purpose equipment.
3. Multipurpose passenger vehicle (MPV) is a motor-powered vehicle, except a trailer, designed to carry 10 persons or less which is constructed on a truck chassis or has special features for off-road operation.
4. Bus is a motor-powered vehicle, except a trailer, designed for carrying more than 10 persons.
5. Trailer is a vehicle with or without motor power designed to carry persons or property and to be drawn by another motor vehicle.
6. Motorcycle is a motor-powered vehicle having a seat or saddle for the use of a rider and designed to travel on not more than three wheels in contact with the ground.

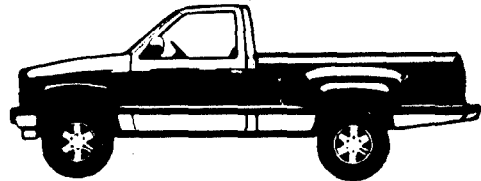
Our review focuses on safety standards for trucks and multipurpose passenger vehicles having a gross vehicle weight rating of less than 10,000 pounds. Unless otherwise indicated, we refer to these vehicle types as "light trucks." Our light truck classification includes a wide variety of vehicles, such as small pickup trucks, standard pickup trucks, small vans, standard vans, multipurpose passenger vehicles, forward control vehicles, open-body vehicles with fold down or removable windshields, and walk-in vans. Figure 1.1 illustrates the various light truck types.

¹On May 7, 1987, NHTSA granted a petition by the Insurance Institute of Highway Safety to update its vehicle classification system. NHTSA issued a Notice of Proposed Rulemaking (NPRM) on October 12, 1988, proposing two options for classifying vehicles. On July 27, 1989, NHTSA officials told us that because of the large number of light truck rulemakings in process, this rulemaking has been tabled until the end of 1989.

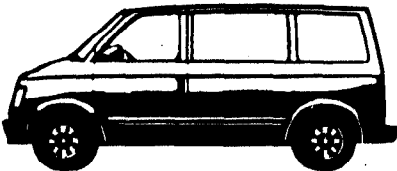
Figure 1.1: Light Truck Types



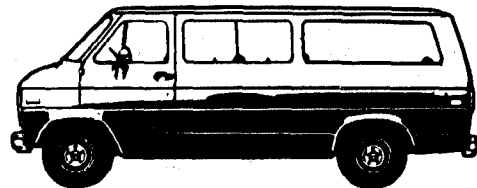
Small Pickup Truck



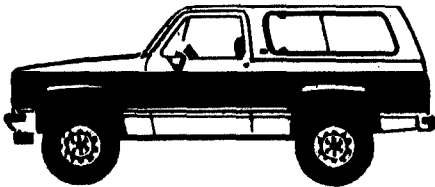
Standard Pickup Truck



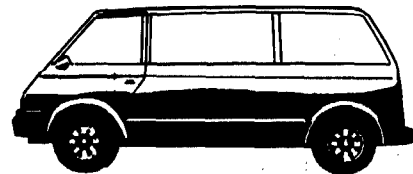
Small Van



Standard Van



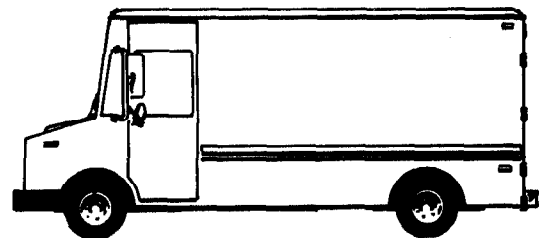
Multipurpose Passenger Vehicle
(Utility Vehicle)



Forward Control Vehicle



Open-Body Vehicle



Walk-In Van

Light Truck Popularity

In recent years, light trucks have been converted from cargo-carrying work vehicles to passenger-carrying vehicles and now represent a larger share of the new-vehicle market. In 1988, light truck sales totaled about 4.9 million compared with 1.8 million in 1971. In terms of the total vehicle market, light truck sales represented about 15 percent in 1971 and about 31 percent in 1988. Manufacturer representatives expect the light truck sales share to continue upward during the next few years.

Light Truck Fatalities

In conjunction with the increased popularity of light trucks, the number of light truck fatalities is also increasing. As shown in table 1.1, the number of light truck fatalities increased from 6,595 in 1982 to 8,051 in 1987, an increase of about 22 percent.

Table 1.1: Light Truck Fatalities, 1982-87

Calendar year	Registered light trucks (in thousands)	Light truck fatalities	Fatalities per 100,000 vehicles	
			Light trucks	Passenger cars
1982	28,290	6,595	23.3	21.6
1983	29,094	6,425	22.1	20.9
1984	30,498	6,720	22.0	20.8
1985	32,643	6,931	21.2	20.0
1986	34,374	7,495	21.8	21.1
1987	35,826	8,051	22.5	20.9

Source: Compiled by GAO from NHTSA data.

As table 1.1 shows, although light truck fatalities have increased, such fatalities per 100,000 registered vehicles have decreased somewhat during the 6-year period. Also, in comparison to passenger cars, the number of fatalities per 100,000 light trucks during the 6-year period has been only slightly higher than fatalities per each 100,000 passenger cars (light trucks averaged 22.2 fatalities per 100,000 vehicles and cars averaged 20.9). Moreover, light trucks have performed much better than passenger cars in side- and rear-impact collisions but much worse in rollovers. For example, as shown in table 1.2, the 1987 side-and rear-impact fatalities per each 100,000 light trucks was about 50 percent fewer than the number of such passenger car fatalities. On the other hand, rollover fatalities involving light trucks were over 2 times greater than passenger car rollover fatalities.

Table 1.2: 1987 Fatalities Per 100,000 Vehicles

	Point of collision					Total
	Rollover	Frontal	Side	Rear	Unknown	
Passenger car	5.00	8.67	5.71	0.75	0.78	20.91
Light truck	10.44	7.69	2.96	0.34	1.05	22.48
Ratio, car to light truck	1 to 2.09	1 to .89	1 to .52	1 to .45	1 to 1.35	1 to 1.08

Source: NHTSA's Fatal Accident Reporting System.

Further analysis shows that a wide variance also existed in rollover fatalities among the different subgroups of light trucks. For example, in 1987, multipurpose passenger vehicles, other than vans, experienced 14.8 fatalities per 100,000 registered vehicles, while small vans experienced about 4 fatalities per each 100,000 vehicles. Table 1.3 shows the number of 1987 rollover fatalities per 100,000 vehicles experienced by each light truck subgroup.

Table 1.3: 1987 Rollover Fatalities Per 100,000 Vehicles

Vehicle type	Fatalities per 100,000 vehicles
Small vans	3.98
Standard vans	4.94
Small pickups	10.48
Standard pickups	8.41
MPVs	14.81

Source: NHTSA's Fatal Accident Reporting System.

Congressional Concern About Safety of Light Truck Occupants

In recent years the safety of light truck occupants has been of much concern to the Congress. Because of the trend toward greater use of light trucks as passenger vehicles, the House Committee on Appropriations directed NHTSA to prepare a report assessing the magnitude and nature of safety problems associated with light trucks and to submit a plan of action to improve their safety. On the basis of the resulting report dated May 1987, the Committee concluded that little had been done since 1981 to conduct the underlying research and analysis or to perform other work necessary to develop improved safety requirements for light trucks. Subsequently, the Congress appropriated \$1.68 million in fiscal year 1988 and \$2.78 million in fiscal year 1989 to accelerate and expand needed light truck safety research activities. Also, in its report on the 1988 budget, the House Committee on Appropriations directed NHTSA to submit a plan for its occupant containment research program.

The Senate has also been active in encouraging improvements in the safety of light trucks. In a May 22, 1989, letter to the Secretary of Transportation, the Senate Committee on Commerce, Science, and Transportation said that the lack of basic safety features in light trucks is the single most important highway safety issue confronting the Committee. The Committee urged the Secretary to move forward with rulemaking to extend appropriate safety standards to light trucks. Moreover, in the 101st Congress, the Committee introduced legislation to require the Department of Transportation to initiate or complete rulemaking to extend several passenger car safety standards to light trucks within specified time frames. The standards included requirements for passive restraints in front outboard seating positions, head restraints, roof crush resistance, side-door strength, rollovers, rear-seat lap/shoulder belts, and high-mount stop lamps. After holding hearings on this legislation on April 5, 1989, the Committee ordered the proposed legislation reported, without opposition.

Prior GAO Reports

In a report to the Congress entitled Unwarranted Delays by the Department of Transportation to Improve Light Truck Safety (CED-78-119, July 6, 1978), we reported that 16 passenger car safety standards either were not applicable to, required noticeably reduced requirements for, or exempted certain types of light trucks. Table 1.4 shows the 16 passenger car standards.

Table 1.4: Passenger Car Safety Standards Not Required for All Light Trucks in 1978

Number	Title
105	Hydraulic brake systems
114	Theft protection
115	Vehicle identification number
117	Retreaded pneumatic tires
118	Power-operated window systems
201	Occupant protection in interior impact
202	Head restraints
203	Impact protection for the driver from steering control systems
204	Steering control rearward displacement
208	Occupant crash protection (passive restraint requirement)
211	Wheel nuts, wheel discs, and hub caps
212	Windshield mounting
214	Side-door strength
215	Exterior protection
216	Roof crush resistance—passenger cars
219	Windshield zone intrusion

Other GAO reports related to NHTSA's safety standards are:

- Passive Restraints for Automobile Occupants—A Closer Look (CED-79-93, July 27, 1979).
- Enforcement of Federal Standards Can Be Enhanced (GAO/RCED-87-2, Dec. 15, 1986).
- Motor Vehicle Safety: Selected Rulemakings by the National Highway Traffic Safety Administration (GAO/RCED-89-11FS, Jan. 6, 1989).

The first report concluded that test data did not fully support NHTSA's quantification of passive restraint life-saving and injury prevention benefits. This report also concluded that testing conducted after the mandate indicated a potential danger from a deploying air bag exists for out-of-position occupants. The second report disclosed that NHTSA's selection process did not ensure that each standard is tested over a period of time. This report also disclosed that NHTSA had established neither a system of management controls governing the processing of investigation and civil penalty cases involving safety standards nor guidelines concerning which investigation cases the Office of Vehicle Safety Compliance should forward to its Chief Counsel's office for penalty assessment. The third report addressed NHTSA's rulemaking review and approval process for three specific rulemaking subjects—rear-seat lap/shoulder belts, side-impact protection, and head restraints for light trucks. We found

that none of these rulemaking actions had been finalized after being in process between 21 and 27 months.

Objectives, Scope, and Methodology

We conducted this review at the request of the Chairmen, House and Senate Subcommittees on Transportation and Related Agencies, Committees on Appropriations. They asked us to determine what NHTSA needs to do, has done, and/or is doing to ensure that light truck occupants receive the same level of safety provided passenger car occupants.

Our review work was conducted primarily at NHTSA headquarters in Washington, D.C. We reviewed Federal Motor Vehicle Safety Standards and other applicable regulations and their applicability to light trucks. We obtained and analyzed documents on NHTSA research and development and rulemaking activities. In addition, we interviewed various NHTSA headquarters officials in the Offices of Rulemaking, Research and Development, and Plans and Policy to determine what NHTSA has done, is doing, and plans to do on light truck safety. We also visited NHTSA's Vehicle Research and Test Center in East Liberty, Ohio, to determine what research and development activities were recently completed, ongoing, and/or planned for light trucks.

We interviewed consumer safety group officials, including the presidents of the Center for Auto Safety, Insurance Institute for Highway Safety, and the Public Citizen (who was also a former NHTSA Administrator), to identify light truck safety problems and to obtain their views on what NHTSA should be doing to ensure the safety of light truck occupants.

We contacted representatives of Chrysler, Ford, General Motors, Nissan, and Toyota to determine what each is doing or plans to do on extending passive restraints to light trucks and to identify any related technical and/or supply problems. We also contacted TRW Vehicle Safety Systems, Inc., a major producer of passive restraints, to obtain information on the supply potential for air bags and automatic belts.

We obtained data from NHTSA's Fatal Accident Reporting System (FARS) to identify the number of fatalities involving light trucks for the period from 1982 through 1987. The data were categorized by type of accident and type of vehicle to determine what kind of accidents resulted in the greatest number of fatalities and the types of vehicles involved.

Chapter 1
Introduction

Our audit work was performed from January 1989 to July 1989 in accordance with generally accepted government auditing standards. We discussed the factual information in this report with NHTSA officials involved in establishing vehicle safety standards. The officials were in general agreement with the report and we incorporated their clarifying comments as appropriate. However, as requested, we did not obtain official agency comments on a draft of this report.

Passive Restraint Requirement Should Be Extended to Light Trucks

NHTSA estimates that as many as 1,500 lives could be saved annually if all light trucks were equipped with passive restraints (air bags or automatic seat belts). These restraints became mandatory in some passenger cars beginning with the 1987 model year but were not required for light trucks. NHTSA has not required passive restraints in light trucks because manufacturers have not had the technical, engineering, and supply resources to effectively implement them in both passenger cars and light trucks.

Light truck fatalities increased from 6,595 to 8,051 (about 22 percent) from calendar year 1982 to 1987. About 65 percent of these fatalities resulted from frontal impacts and rollovers with ejection—the crash modes in which occupants could receive the greatest benefit from manual or automatic restraints. Most light truck occupants, however, do not voluntarily use their manual lap/shoulder belts and therefore do not reap the benefits. NHTSA believes that passive restraints will increase the use of restraints and therefore save lives.

The five manufacturers—Ford, General Motors, Chrysler, Nissan, and Toyota—we queried have not voluntarily installed passive restraints in any of their light trucks and only Ford had plans to do so in the near term. Some manufacturers said that their engineering and testing resources are heavily committed to the implementation of other NHTSA safety requirements. All five manufacturers said that many technical problems must be solved before passive restraints can be installed in light trucks and that, if they were mandated, a phased-in approach would be necessary.

On July 27, 1989, after we had substantially completed our audit work, NHTSA officials told us that they were drafting a Notice of Proposed Rulemaking for extending passive restraints to light trucks. The draft NPRM was forwarded to the Secretary of Transportation for approval on October 12, 1989. We concur in this action and believe that NHTSA should proceed as quickly as possible to a final rule establishing passive restraints for light trucks. Although the requirement may have to be phased in over several years, as was done for passenger cars, establishing a rule and setting time frames for implementation will give manufacturers and suppliers a better basis for setting priorities, marshaling resources, and addressing technical problems. Also, it would require all manufacturers to work toward a common goal and allow suppliers to expand their production capacity with reasonable assurances of an increased demand.

Standard 208: Occupant Crash Protection—Passive Restraint Requirement

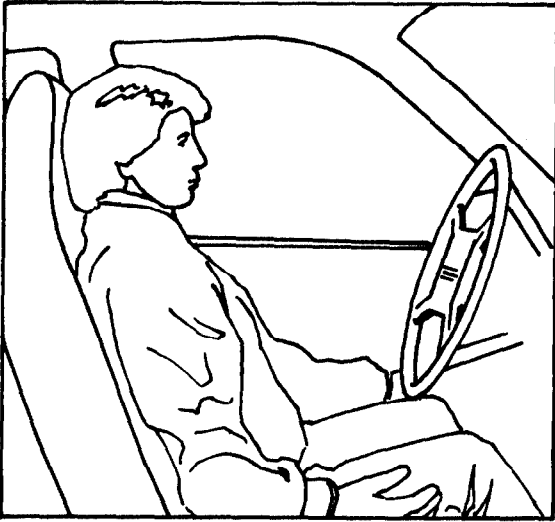
On July 11, 1984, after about 15 years of development and controversy, NHTSA issued a final rule amending standard 208, Occupant Crash Protection, to require that passenger cars be equipped with passive restraints—restraints that provide safety benefits to occupants without any action on their part (see app. I for a listing of the events leading to the establishment of passive restraints). For orderly implementation, NHTSA allowed manufacturers to phase in the requirement over a 4-model-year period by requiring that (1) 10 percent of model year 1987 passenger cars, (2) 25 percent of model year 1988, (3) 40 percent of model year 1989, and (4) 100 percent of model year 1990 and beyond be equipped with air bags or automatic belts in the front-outboard seating position. NHTSA encouraged the use of air bags in the final rule by allowing each vehicle that was equipped with a driver-side air bag and any type of passive restraint for the passenger side to count as 1.5 vehicles toward meeting the percentage requirement. In response to a Ford Motor Company petition and to further encourage the use of air bags, NHTSA revised this provision in August 1985 to allow for a 1.0 vehicle credit for each car equipped with a driver-side air bag combined with a manual lap/shoulder belt for the front passenger side during the phase-in period. Again, in response to a Ford Motor Company petition, NHTSA, in March 1987, extended the 1.0 vehicle credit provision to September 1, 1993. The Insurance Institute for Highway Safety supported this extension because it believed that the extension would result in more air bag-equipped cars, which in turn would save more lives.

Figures 2.1 and 2.2 illustrate the different types of passive restraints being used in passenger cars.

Chapter 2
Passive Restraint Requirement Should Be
Extended to Light Trucks

Figure 2.1: Air Bag, Driver-Side Deployment

1.



0 SEC . Ready to
Protect

2.



LESS THAN

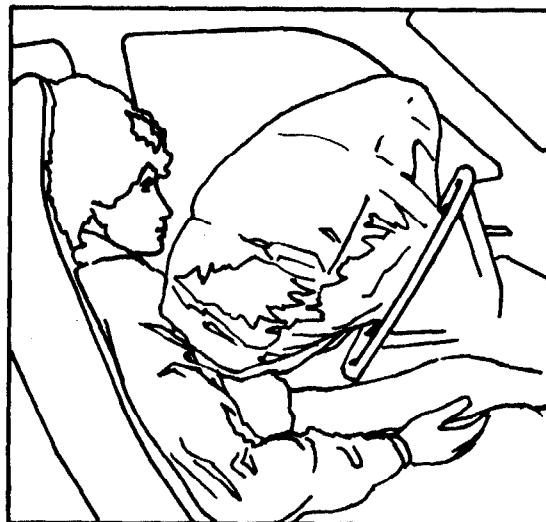
1/10 SEC . Instant
Inflation

3.



1/10 SEC . Protected
Occupant

4.

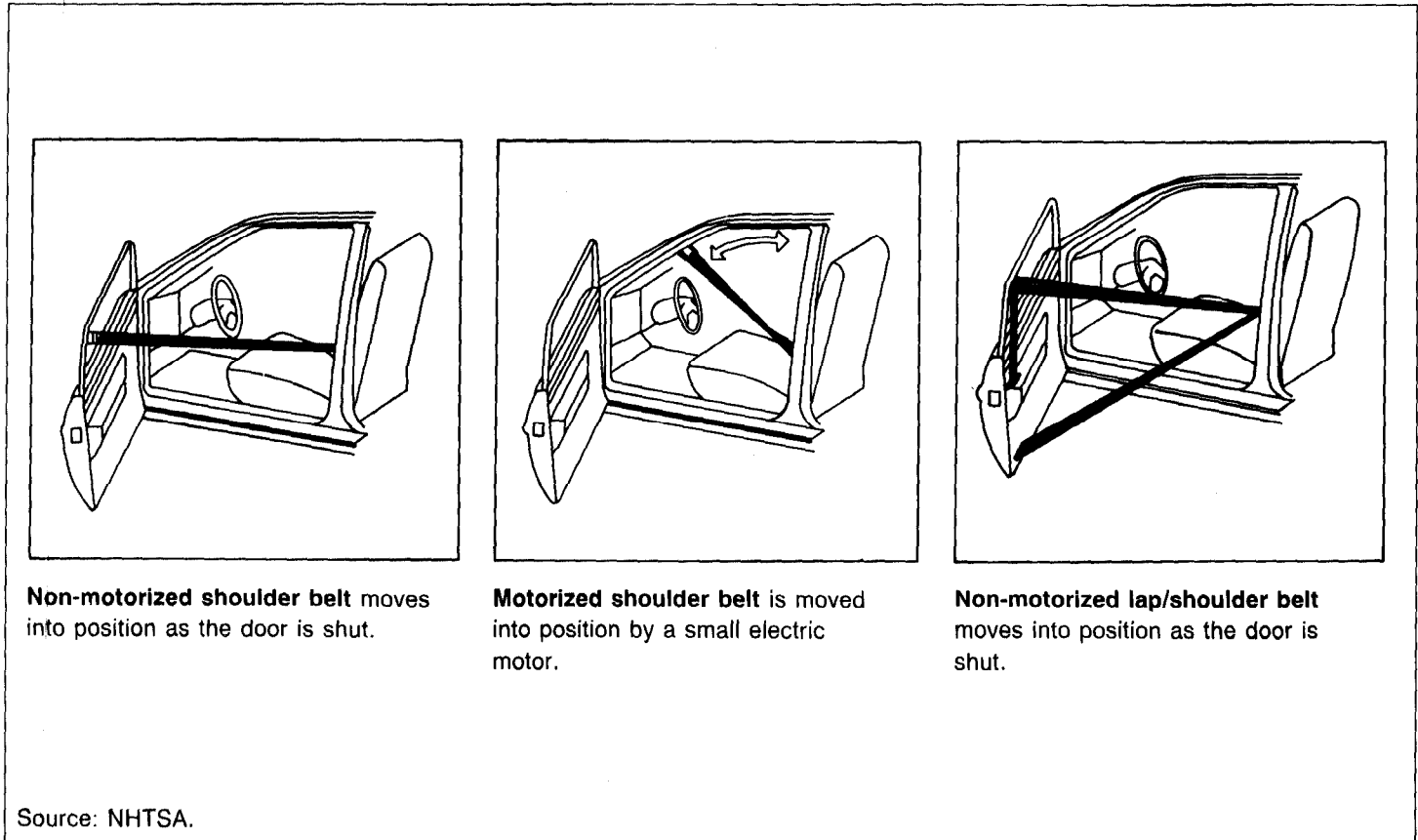


LESS THAN

1 SEC . Deflation

Source: NHTSA

Figure 2.2: Types of Automatic Safety Belts



Passive Restraints Could Reduce Light Truck Fatalities

NHTSA estimated that between 1,200 and 1,500 additional lives could be saved annually if all light trucks were equipped with air bags or automatic belts. Passive restraints can potentially save lives because of greater occupant use, not because they are more effective than manual lap/shoulder belts when used.¹ In fact, NHTSA has determined that manual lap/shoulder belts when used are more effective than either air bags or automatic belts and almost as effective as air bags and lap/shoulder belts combined. According to NHTSA's data, manual lap/shoulder belts are 60 percent effective in preventing fatalities, automatic belts are 55 percent effective, air bags are 28 percent effective, and air bags with lap/shoulder belts are 64 percent effective.

¹The effectiveness of a restraint system is the percent of reduction in fatalities or injuries sustained by restrained occupants as compared with unrestrained occupants.

We observed that about 65 percent of all light truck fatalities that occurred during the 6-year period from 1982 through 1987 resulted from frontal crashes and rollovers with ejection—the two crash modes in which the use of restraints are most effective. Most light truck occupants, however, chose not to use their manual lap/shoulder belts, and light trucks are more prone to be involved in rollovers. When a rollover occurs, unrestrained occupants are more likely to be ejected from the vehicle and seriously injured or killed.

Frontal Crash and Rollovers With Ejection Fatalities Are High

Our analysis of NHTSA's FARS data from 1982 through 1987 showed that about 65 percent of all light truck fatalities resulted from frontal crashes and rollovers with ejection. In comparing crash modes, air bags and/or belts are the most effective in reducing fatalities resulting from frontal crashes and rollovers with ejection. Table 2.1 shows frontal and rollover fatalities for the various light truck types and for passenger cars.

Table 2.1: Light Truck and Passenger Car Fatalities, 1982-87

Vehicle type	No. of fatalities	Percent of total fatalities by crash mode		
		Frontal	Rollovers with ejection	Frontal and rollovers with ejection
Small vans	701	43.5	22.8	66.3
Standard vans	4,232	43.8	22.4	66.2
Small pickups	8,527	38.0	28.5	66.5
Standard pickups	20,308	37.0	27.5	64.5
MPVs	5,158	20.8	49.0	69.8
Others and unknowns	3,291	30.4	27.4	57.8
Total light trucks	42,217	35.5	29.7	65.2
Total passenger cars	141,888	41.2	13.4	54.6

Table 2.1 shows that while the percent of fatalities by frontal crashes and by rollover crashes with ejection varied substantially between MPVs and other subgroups, the combined fatalities of these two crash modes were about the same for each subgroup. For example, frontal crashes accounted for 43.8 percent of all standard van fatalities and only 20.8 percent of MPV fatalities. On the other hand, rollovers with ejection accounted for 49 percent of all MPV fatalities and only 22.4 percent of the standard van fatalities. Collectively, these two crash modes accounted for 69.8 percent of the total MPV fatalities, 66.2 percent of the

total standard van fatalities, and 65.2 percent of all light truck fatalities. As discussed in chapter 3, NHTSA is now conducting research to determine causes of rollover for MPVs as well as other vehicles.

Table 2.1 also shows that the percentage of frontal fatalities to total fatalities was somewhat less for light trucks than for passenger cars. On the other hand, the percentage of rollovers with ejection fatalities in light trucks was more than double the percentage for passenger cars.

Seat Belt Usage

According to NHTSA's estimates, light truck occupants use seat belts about one-third less than passenger car occupants. While belt use is greater in states that have mandatory seat belt use laws, 9 of the 34 states that have such laws do not include light truck occupants.²

NHTSA's data on seat belt use by passenger car drivers and front-out-board passengers in 19 cities between March and August 1988 showed that 45.6 percent of the drivers and 41.8 percent of the passengers were wearing seat belts at the time of observation. The driver-use rate was about 3 percentage points higher than the driver-use rate 1 year earlier and about 30 percentage points higher than it was in 1984 when the passive restraint requirement was finalized. Belt use by drivers in cities in states with mandatory use laws averaged 51 percent, ranging from 28.9 percent in New York City to 67.8 percent in Houston, Texas. For cities that were not under mandatory use laws, driver belt use averaged 32.5 percent, ranging from 17.6 percent in Providence, Rhode Island, to 44.1 percent in Phoenix, Arizona.

Although a separate study of belt use for light trucks has not been done, NHTSA estimates, from the data in its National Accident Sampling System and state files, that belt use by light truck occupants is about two-thirds that of passenger car occupants. Applying this factor to the 1988 passenger car study results, we estimate that only about 30 percent of the drivers and 28 percent of the passengers of light trucks regularly use seat belts. NHTSA estimates that light truck occupant-use rate would be 50 percent for the 3-point detachable automatic belt, 70 percent for all other automatic belt types, and 98 percent for air bags.

²Includes the District of Columbia.

NHTSA's Recent Action

NHTSA did not make the passive restraint rule applicable to light trucks because manufacturers did not have sufficient technical, engineering, and supply resources to develop and install passive restraints in passenger cars and light trucks simultaneously. In April 1989, NHTSA's Associate Administrator for Rulemaking testified before the Subcommittee on Transportation and Related Agencies, House Committee on Appropriations, that NHTSA's concern about overtaxing the industry had lessened somewhat and that extensive research would not be required to equip light trucks with passive restraints. He said that NHTSA was reexamining the issue and a decision would be made after the selection of a new Administrator. On July 27, 1989, NHTSA officials told us that they were drafting an NPRM for extending passive restraints to light trucks. The draft was forwarded to the Secretary of Transportation for approval on October 12, 1989.

Manufacturers' Views

We asked five major light truck manufacturers about what they had done and planned to do to equip light trucks with passive restraints and what technical and resource problems they would face if NHTSA were to extend the passive restraint rule to light trucks. In summary, the manufacturers have not installed passive restraints in any light trucks to date, and only Ford had plans to do so in the near future. Four manufacturers said that their engineering and testing resources are still heavily committed to the implementation of other NHTSA safety requirements, such as passive restraints for passenger cars and dynamic testing requirements and steering column rearward displacement requirements for light trucks. All five manufacturers said that many technical issues, such as sensors for off/on road use, steering column angles, and short front ends, must be resolved before light trucks can be equipped with passive restraints. Also, they said that, if passive restraints were mandated, a phased-in approach would be necessary. Three manufacturers, commenting specifically on a phase-in time frame, said a 5-year minimum lead time would be required or that the requirement should not be effective before the 1995 model year. Selected comments we received follow.

Ford Motor Company

Ford said that extensive planning, design, testing, and development of passive restraints for light trucks is being done, concentrating on supplemental driver-side air bag systems for vans. It said that some vans would probably be equipped with driver-side air bags by September 1, 1991, and Ford plans to have a substantial portion of its light trucks equipped with air bags or motorized automatic belts by the mid-1990s.

Ford cautioned that the air bags were being designed to supplement the manual lap/shoulder belts and not to meet all passive restraint test requirements with unbelted dummies. To meet these requirements, Ford said that substantial added testing and potential redesign and redevelopment of front end structures, safety belts, instrument panels, seats, and/or steering columns would be required. Ford also said that its and its supplier's restraint systems engineering and testing resources are fully committed to meeting the passive restraint requirements for passenger cars, meeting the manual belt dynamic test requirements for light trucks, voluntarily providing rear shoulder belts in light trucks, and broadening the application of air bags to additional vehicle lines.

Concerning our question on what technical and supply problems would be encountered to extend passive restraints to light trucks, Ford said that if automatic belt systems, particularly detachable door-mounted, nonmotorized lap/shoulder belts were used, the technical and supply problems would be minimal. However, Ford expects to encounter difficult technical problems if air bags are used to meet dynamic test criteria with unbelted test dummies. In addition to the technical problem discussed above concerning vans, Ford said that (1) each truck family has a wider range of weights than passenger car families; (2) driver and front passenger seating packages differ from those in cars and cover a wider range of occupant seating attitudes; (3) trucks have a wider range of steering column angles; (4) vans have short front ends, more upright windshield angles, and more spacious front passenger areas and will require larger air bags, which could increase the risk to out-of-position occupants; and (5) little is known about sensors that would be required to operate under on-road and off-road conditions.

Ford said that it would not expect to encounter major supply problems of air bags if passive restraints in light trucks were phased in beginning with model year 1995. However, Ford expects air bag supply to be very tight through the 1994 model year because the 1.0 credit option to meet the passive restraint requirement with a driver-only air bag system will expire early in the 1994 model year. If NHTSA were to adopt an overly aggressive timetable, Ford said that it would have no recourse except to adopt detachable door-mounted, nonmotorized lap/shoulder belt systems for some of its truck line families.

General Motors
Corporation

General Motors told us that major engineering resources at its Truck and Bus Group are deeply committed to the analysis, design, and testing efforts necessary to implement the additional steering column rearward

displacement requirements and dynamic manual seat belt requirements for light trucks, which both become effective September 1, 1991. General Motors said it is working on the fundamental technological development that will be required to design, develop, and market a production-feasible passive restraint system for light trucks but does not have definitive plans to offer passive restraints as standard or optional equipment in these vehicles, nor will it establish such plans until the analysis, design, and test efforts are more complete.

While General Motors said it is not in a position now to speculate on expected technical and/or supply problems if the passive restraint requirement was extended to light trucks, substantial uncertainty exists as to whether passenger car passive restraint systems can be used because light trucks have stiffer front ends, on/off road capability, higher crash pulse decelerations, and, in the case of vans, short front ends. Concerning supply problems, General Motors said it is continuing to work with its restraint system suppliers as its passive restraint work on light trucks progresses, anticipating that an adequate supply will be available when needed. General Motors said that the extension of passive restraints to light trucks may require a careful, phased-in approach that will not interfere with the requirements of full-frontal air bags in passenger cars (which will not likely occur until the 1994 model year).

Chrysler Motors
Corporation

Chrysler said that automatic restraints have not been marketed in any light trucks and it does not plan to do so in the 1990 model year. Chrysler said it is only now getting to the point where it can study the implications of installing passive restraints in light trucks because extensive engineering and test facility resources are being used to meet other NHTSA-mandated occupant restraint safety requirements. Requirements cited include installing automatic restraints in all passenger cars, developing rear-seat lap/shoulder belts in passenger cars and light trucks, developing passenger-side automatic restraints for 1994 model year cars equipped with driver-side air bags, and meeting dynamic crash test requirements for manual lap/shoulder belts in light trucks for model year 1992.

Chrysler said that, although the feasibility of installing passive restraints in passenger cars has been proven, many technical issues must be resolved before they can be installed in light trucks. Concerning the use of air bags, Chrysler said that light trucks (1) have a more upright steering column angle and the air bags may not achieve the natural alignment with the driver; (2) have more upright seating positions,

which may create unique problems for knee bolster placement as well as ingress/egress problems; (3) have stiff and/or short front structures so that sensing the crash and deploying an air bag at the proper time may not be feasible; and (4) are used off-road where the jars and jolts may be enough to trigger an air bag.

Chrysler said that if NHTSA were to mandate passive restraints for light trucks, a phase-in would be the only viable approach. Chrysler also said it does not appear that an automatic seat belt supply problem would exist; however, if air bags are used, it foresees a limited number of suppliers and limited production capability, which could result in a shortage.

**Nissan Motor Company,
Ltd.**

Nissan said that the installation of passive restraints in light trucks has never been practically considered. While Nissan is currently reviewing its development plans for installing passive restraints in light trucks, no decision has yet been reached as to the timing or direction of its plans. Nissan said its efforts are focused on meeting the passive restraint requirement for both front seating positions in passenger cars, developing basic technology to meet manual belt injury criteria requirements for light trucks that become effective September 1, 1991, and improving its light truck frontal crash test performance in NHTSA's New Car Assessment Program. Because of these efforts, Nissan said its personnel and facilities for automatic crash protection are already fully committed and it would be extremely difficult to do work on passive restraints for light trucks at the same time.

According to Nissan, a minimum of 5 years lead time would be required for planning and producing passive restraints for light trucks. Also, Nissan said a phased-in approach would permit a more orderly development and allow the company to manage the strain on its engineering resources more efficiently. In addition, Nissan said it could not comment on potential passive restraint supply problems that may arise because it has not yet advanced to the stage where it could do so.

Nissan believes there are unique technical problems in installing passive restraints in light trucks, different from those in passenger cars, which need to be surmounted. As an example, Nissan said that light trucks have a different frame structure that brings about a major difference in the energy-absorbing characteristics of the vehicle body. Moreover, Nissan said that even with the same model, differences in drivetrain and

cabin shape would bring about substantial differences in crash test performance. Nissan also said that to consider individual vehicle-related countermeasures for each vehicle type would necessitate considerable lead time.

Toyota Motor Corporate
Services of North America,
Inc.

Toyota said it has investigated the use of passive restraints in light trucks but has not conducted any research, nor is it ready to announce any specific development plans. Further, Toyota said that because any passive restraint system is more complex than a manual belt system, the burden of such a system is both immense and formidable.

Toyota said that it had not begun to look into what technical problems would need to be overcome before air bags could be installed in light trucks. However, Toyota said that from its experience in designing and developing driver-side air bags for passenger cars, it would expect to encounter extreme difficulty in (1) designing light trucks to meet occupant injury criteria, (2) determining suitable locations for the air bag activating sensors, and (3) setting parameters for sensors so that the air bag would not deploy when used off-road and yet deploy as required in a low-speed collision.

Toyota said manufacturers must be given a reasonable and adequate amount of lead time to resolve the many technical problems associated with the installation of passive restraints in light trucks. Also, Toyota said that 4 years would be needed to develop and adopt passive restraints for these vehicles. Further, Toyota said that as a practical matter, it is not feasible to add passive restraints to light trucks at any time other than when a full model change is made, which occurs about every 6 years. If NHTSA makes passive restraints mandatory in these vehicles, it is essential they be phased in as was done for passenger cars. Such a phase-in is also necessary for parts and component suppliers to allow for designing, tooling, and expanding their manufacturing facilities.

Supplier's Views

To determine the availability of automatic belts, air bags, and related equipment and the time needed to expand production, we contacted the Vice President of Business Planning and Development, TRW Vehicle Safety Systems, Inc.—a major supplier of both air bags and automatic belts. The official said TRW is currently operating at capacity in its production of air bags and that there is very little potential for increasing the production within a year. He said that substantial engineering would

be required to extend passive restraints to light trucks. Further, he estimated it would take at least 2 to 3 years to develop the capacity to produce air bags and motorized belts for these vehicles. The official also said that the sooner TRW knew what the requirements were going to be, the better it could increase its production to meet the demand.

Conclusions

Light trucks should have safety features comparable to those in passenger cars. However, NHTSA has not required light trucks to be equipped with passive restraints, as it had done for passenger cars, because manufacturers did not have sufficient resources to develop and install passive restraints simultaneously in both passenger cars and light trucks.

Light truck sales grew from about 15 percent of the new-vehicle market in 1971 to about 31 percent in 1988, and sales are expected to continue to grow. Along with this growing popularity, the number of light truck fatalities increased about 22 percent from 1982 to 1987. The number of fatalities were greater than they could have been because most light truck occupants do not voluntarily use manual lap/shoulder belts. NHTSA estimates that between 1,200 and 1,500 lives could be saved annually if all light trucks were equipped with passive restraints.

We recognize that any technical and resource problems of both manufacturers and suppliers must be addressed, but we also believe that the problems should not be the justification for failing to initiate rulemaking to extend passive restraints to light trucks. Such problems could be planned for in setting time frames for implementation, and manufacturers could install passive restraints on a phased-in basis as they did for passenger cars. If manufacturers and suppliers knew what was required, they would have a better basis for setting goals, establishing priorities, marshaling resources, and addressing technical and supply problems.

We commend NHTSA on its action to draft an NPRM for the Secretary of Transportation's approval to extend the passive restraint requirement to light trucks. But an NPRM is only one step in a process that could take years if not given substantial agency commitment. Passive restraints for passenger cars took about 15 years from the issuance of an Advance Notice of Proposed Rulemaking to an acceptable final rule.

Recommendation

We recommend that the Secretary of Transportation direct the Administrator, National Highway Traffic Safety Administration, to establish a

Chapter 2
Passive Restraint Requirement Should Be
Extended to Light Trucks

timetable for promptly moving the light truck passive restraint proposal through the rulemaking process and to periodically report on its progress to the Secretary.

NHTSA Has Improved Light Truck Safety

Light trucks manufactured today meet more stringent safety standards than those manufactured in the past. Moreover, other safety standards are in various stages of development for application to light trucks. We reported in July 1978 that 16 safety standards that were applicable to passenger cars either were not applicable to, required noticeably reduced requirements for, or exempted certain types of light trucks. Since that time, NHTSA has extended to light trucks eight of these standards relating to hydraulic brakes, theft protection, vehicle identification number, power-operated windows, occupant protection from interior impact, impact protection from steering control systems, steering control rearward displacement, and head restraints. Additionally, NHTSA established new dynamic test requirements for manual lap/shoulder belts in light trucks and extended to light trucks the rear-seat lap/shoulder belt requirement established for cars in June 1989.

NHTSA has also initiated rulemaking proceedings to extend to light trucks the side-door strength and roof crush standards—2 more of the 16 standards. Additionally, NHTSA is studying the feasibility of (1) improving rollover safety and (2) extending the center high-mount stop lamp requirement established for cars effective September 1, 1985. This increased attention to improving the safety of light truck occupants resulted in large part from continuous actions by the Congress, as discussed in chapter 1 of this report. (See apps. II and III for details on the current status of light truck rulemaking and research and development.)

Except for not extending the passive restraints requirement of Standard 208, as discussed in chapter 2, the remaining 5 of the 16 standards not extended to light trucks do not significantly jeopardize the safety of their occupants.

Standards Extended to Light Trucks Since the Late 1970s

After our July 1978 report, NHTSA extended six standards to light trucks—one in March 1979, three in November 1979, and two more in December 1980. NHTSA extended three additional standards (two in whole and one in part) to light trucks in November 1987, June 1988, and September 1989 after the Congress expressed concern over NHTSA's lack of activity for protecting light truck occupants. Also, in November 1987, NHTSA expanded the application of one standard to additional light trucks and in October 1989, extended another standard to light trucks. Table 3.1 shows the standards extended to light trucks and the dates NHTSA took final action.

Table 3.1: Standards Extended to Light Trucks, Dates of Action

Standard number	Title	Date of final action
115	Vehicle identification number	3/15/79
201	Occupant protection in interior impact	11/20/79
203	Impact protection for the driver from steering control systems	11/20/79
204	Steering control rearward displacement	11/20/79 11/18/87
105	Hydraulic brake systems	12/22/80
114	Theft protection	12/22/80
208	Occupant crash protection: Dynamic test requirement for manual lap/shoulder belt Rear-seat lap/shoulder belt requirement	11/18/87 10/27/89
118	Power-operated window systems	6/21/88
202	Head restraints	9/19/89

Standard 115

Vehicle Identification Number. On March 15, 1979, NHTSA issued a final rule to extend the vehicle identification number standard to light trucks. The effective date of this change was September 1, 1980. NHTSA said that the vehicle identification number is the cornerstone of the safety defect and standard noncompliance recall program and an important element in quality control and in vehicle theft recovery. Also, it is a useful informational tool for analyzing accident reports used in safety research and rulemaking.

Standards 201, 203, and 204

Occupant Protection in Interior Impact, Impact Protection for the Driver From the Steering Control System, and Steering Control Rearward Displacement. On November 20, 1979, NHTSA issued a final rule to extend to light trucks the interior impact standard (201), the driver impact protection from the steering control system standard (203), and the steering control rearward displacement standard (204), all effective September 1, 1981. Standard 204 applied to light trucks with an unloaded vehicle weight of 4,000 pounds or less. NHTSA estimated that the 4,000-pound limit covered about 75 percent of all light trucks sold at the time.

On the basis of a comparison of injuries sustained by occupants of passenger cars manufactured before standard 201 became effective with injuries sustained after the effective date of the standard for passenger cars, NHTSA estimated that the extension to light trucks would reduce severe-to-fatal injuries by 9.3 percent. On the basis of its comparison of

two sets of driver injuries incurred in frontal crashes before and after standards 203 and 204 went into effect for passenger cars, NHTSA estimated that the application of these standards to light trucks would reduce severe-to-fatal driver injuries by 3.7 percent.

Additionally, on November 18, 1987, NHTSA increased the number of vehicles affected by Standard 204 by issuing a final rule to extend it to all light trucks with an unloaded weight of 5,500 pounds or less. NHTSA estimated that this change would save between 12 and 23 lives and reduce serious injuries by 146 to 275 each year. The effective date is September 1, 1991.

Standard 105

Hydraulic Brake System. NHTSA issued a final rule on December 22, 1980, establishing braking requirements for light trucks with hydraulic brakes. The effective date of this requirement was September 1, 1983. According to NHTSA, the precise benefits were very difficult to estimate because of limited accident data and studies. Nevertheless, NHTSA concluded that braking is an extremely important safety factor and that stopping distances can economically be made significantly shorter for light trucks. On the basis of a detailed accident investigation study, NHTSA estimated that a 5-percent reduction in stopping distance would reduce the number of accidents by 5 to 10 percent.

Standard 114

Theft Protection. On December 22, 1980, NHTSA issued a final rule extending the theft protection standard to light trucks to be effective September 1, 1983. According to NHTSA, this rule should deter joyrider thieves who were involved in about 1 of every 350 accidents and accounted for 5,600 disabling injuries and 150 fatalities involving stolen vehicles each year. NHTSA estimated that this change may result in as many as 25 lives saved and 1,120 fewer injuries annually.

Standard 208

Occupant Crash Protection. On November 18, 1987, NHTSA issued a final rule extending to light trucks, with a gross vehicle weight of 8,500 pounds or less and an unloaded vehicle weight of 5,500 pounds or less, the dynamic test requirement of manual lap/shoulder belts in the front outboard seats. This change will go into effect on September 1, 1991. The dynamic test requirements for manual lap/shoulder belts were adopted for passenger cars on March 21, 1986, and would have gone into effect on September 1, 1989, if the passive restraint requirements had been rescinded as a result of the enactment of state safety belt use

laws covering two-thirds of the population. NHTSA said that the rule's requirements will improve the overall level of safety performance provided by light trucks.

Standard 118

Power-Operated Window System. On June 21, 1988, NHTSA issued a final rule to extend the power-operated window standard to light trucks. The effective date of this extension was December 21, 1988. NHTSA determined that this rule change was not major and therefore did not compute the costs and benefits because manufacturers were already meeting the standard's requirements for all light trucks being equipped with power windows.

Standard 202

Head Restraints. On September 19, 1989, NHTSA issued a final rule to extend the applicability of the head restraint standard to light trucks. Head restraints have been required in the front-outboard seats of passenger cars since 1969.

The NPRM for this rule was issued in response to two petitions from private citizens. On October 7, 1986, a citizen petitioned NHTSA to require head restraints in vehicles other than passenger cars. On August 25, 1987, another citizen petitioned NHTSA to issue a safety standard that would, "minimize spinal, cerebral, cranial, and vertebral injuries that occur when light trucks are involved in rear-end collisions." On the basis of its analysis of whiplash injuries of light truck occupants between 1982 and 1985, NHTSA estimated that the new requirement will reduce the severity of 510 to 870 injuries each year.

**Rear-Seat Lap/Shoulder
Belt Requirement of
Standard 208**

Occupant Crash Protection. On October 27, 1989, NHTSA issued a final rule extending the rear-seat lap/shoulder belt requirement to light trucks to be effective September 1, 1991. NHTSA established this requirement in passenger cars, other than convertibles, on June 9, 1989. Initially, NHTSA had proposed the requirement to be applicable to light trucks as well as passenger cars, but on the basis of a number of concerns and objections raised by commenters on the NPRM, NHTSA decided not to delay this requirement for passenger cars while it analyzed and evaluated the comments and formulated the agency's response and appropriate regulatory action. The concerns raised included (1) vehicle types other than passenger cars that should be equipped with rear-seat lap/shoulder belts, (2) the retractors with which the belts should be equipped, (3) compatibility with child restraints systems, (4) definition

of an "outboard" seat, (5) details of the comfort and convenience requirements, and (6) requirements for tension-relieving devices of the belts.

When issuing the final rule for passenger cars, NHTSA said that it would give high priority to a rulemaking action addressing the other proposals to ensure that the incremental benefits are available in a timely manner. NHTSA also said that its information showed that manufacturers plan to voluntarily install rear-seat lap/shoulder belts in over 95 percent of the light trucks manufactured on or after September 1, 1991—the date the requirements will be effective for light trucks.

Standards Under Rulemaking or Research and Development for Possible Rulemaking

The safety of light truck occupants is one of NHTSA's priority program areas and is receiving an increased amount of rulemaking and research and development attention. In addition to the standards that have already been extended to light trucks, NHTSA has initiated rulemaking proceedings to extend to light trucks the standards for side-door strength and roof crush. Also, NHTSA is studying the feasibility of (1) improving rollover safety of light trucks and (2) extending to light trucks the center high-mount stop lamp requirement. A discussion of NHTSA's activities regarding these standards follow.

Standard 214

Side Impact Protection. On August 16, 1988, NHTSA issued an Advance Notice of Proposed Rulemaking (ANPRM) announcing that it is considering proposing requirements to reduce side-impact deaths and injuries to light truck occupants and to request public comments to assist NHTSA in developing the proposal. In addition to considering extending the passenger car side-impact standard to light trucks,¹ NHTSA stated that it may be possible to develop a test requirement for light trucks to reduce the risk of thorax and pelvis injuries. Also, NHTSA stated that it may be possible to develop requirements to address head injuries by using padding or reducing the stiffness of impacted surfaces and to address door and window ejections through use of stronger door latches and window glazing and design changes. Further, NHTSA is considering whether separate requirements should be developed to address side impact with fixed objects such as poles and trees.

¹The standard requires each door to resist crush forces that are applied by pressing a steel cylinder inward against the door's outside surface.

This ANPRM is tied very closely to two NPRMs (issued in January 1988) and an ANPRM (also issued in August 1988) to upgrade the requirements of Standard 214, side-door strength for passenger cars. One NPRM proposed to require an additional test in which a passenger car must protect its occupants in a full-scale crash test in which the car is struck on either side by a moving barrier simulating another vehicle, using newly developed test dummies to measure the potential for injuries to an occupant's thorax and pelvis. The other NPRM proposed the specifications and qualifications for that dummy.

According to the ANPRM for passenger cars, NHTSA is considering proposing requirements to reduce the risk of head and neck injuries and/or ejections in side-impact crashes in passenger cars through using padding, reducing the stiffness of impacted surfaces, developing stronger side-door latches, and incorporating different glazing and frames in new side windows. NHTSA is also considering whether additional requirements are needed to better protect occupants when a passenger car is involved in a side collision with a stationary object, such as a pole or tree. The comment period for the passenger car rulemakings, as well as the light truck ANPRM, closed in October 1988.

Commenters expressed major concerns with several aspects of these proposed rulemakings and called for further study and development before a final rule. First, concerning the ANPRM for light trucks, domestic and foreign manufacturers believe that the extension of the passenger car side-impact standard to light trucks is not warranted and the other proposals require further study before incorporating into a safety standard. Concerning the proposed rulemaking for passenger cars, many commenters said that the side-impact dummy requires further development to improve its biofidelity, the moving deformable barrier was too stiff and did not represent the front face of a light truck, and the thoracic trauma index is insufficient to predict all torso injuries and risk and does not correlate well with the degree of injury in all real world side impacts.

On October 27, 1989, the Secretary of Transportation concurred in transmitting an NPRM on side-door strength for light trucks to the Office of Management and Budget for review. NHTSA officials told us that they would decide on other rulemakings to upgrade side impact protection requirements for passenger cars and light trucks by the end of December 1989.

Standard 216

Roof Crush. Passenger cars are required to meet minimum roof strength requirements to reduce the likelihood of roof collapse and resulting deaths and injuries in rollover accidents.² Accident data clearly show that light trucks are more prone to rollover than passenger cars. However, NHTSA had not extended this standard to light trucks because of the belief that most light trucks already met the passenger car roof strength requirements and the lack of evidence directly connecting injury in rollover accidents and roof crush. NHTSA's query of manufacturers in December 1988 and January 1989 confirmed its belief that most light trucks manufactured today already meet the passenger car roof crush requirements.

Notwithstanding the findings, NHTSA has reconsidered its position and has drafted an NPRM for extending the roof crush standard to light trucks. According to NHTSA officials, the strength requirement to be proposed for light trucks would require a roof crush of not more than 5 inches when a force equal to 1.5 times the vehicle weight is applied. They said that because light trucks weigh more than passenger cars, the 5,000-pound limit would not provide a desired level of safety. On October 27, 1989, NHTSA transmitted an NPRM on roof crush for light trucks for publication in the Federal Register.

Rollover Safety

On September 1, 1988, in response to a June 2, 1988, petition by the Consumers Union of the United States, Inc., NHTSA agreed to initiate rulemaking proceedings to establish a minimum standard to protect against unreasonable risk of rollovers. In accepting the petition, NHTSA said that it had already initiated research into the rollover issue to determine whether rulemaking is appropriate.

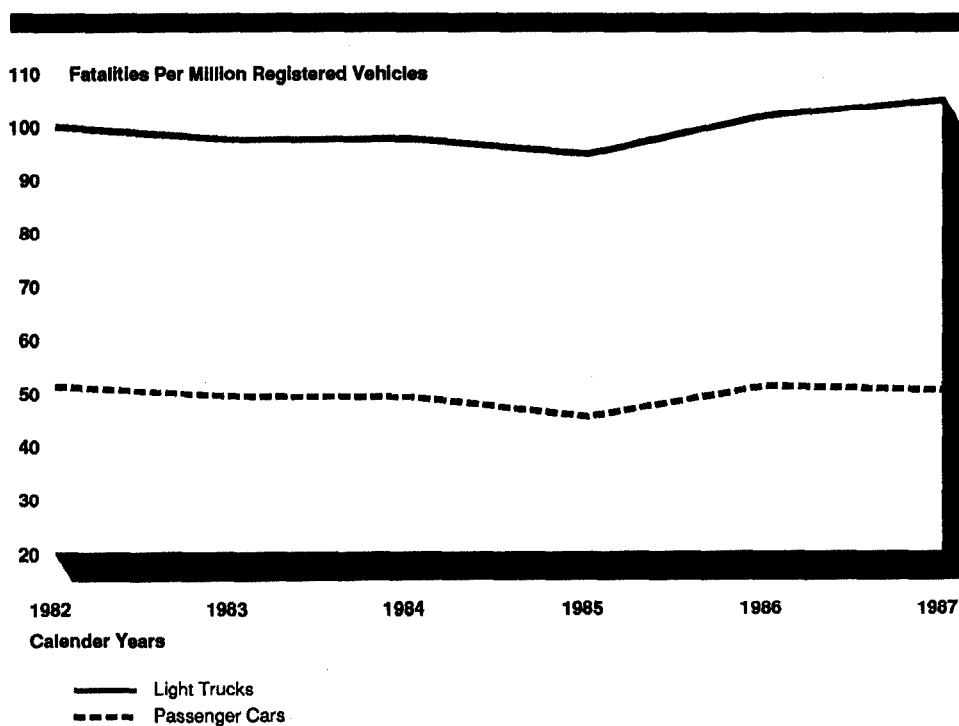
In its April 1988 Status Report on Priority Programs, NHTSA identified rollover research as a high priority area in response to a directive by the House Committee on Appropriations requiring NHTSA to develop a research program plan to improve protection of light truck occupants. The report also shows that NHTSA's research is addressing both the propensity of light trucks to roll over (crash avoidance research) and the safety performance of light trucks when a rollover occurs (crash worthiness research). Ongoing and recently completed rollover research includes (1) analysis of pickup truck rollover frequency, (2) analysis of the dynamic stability and rollover propensity of light trucks, and (3) the

²The roof shall not collapse more than 5 inches when a force is applied equal to 1.5 times the vehicle's weight or 5,000 pounds, whichever is less.

qualitative ranking of vehicle-specific rollover tests with respect to road conditions. (See app. III for a listing of NHTSA rollover research and its status.)

Rollover research could contribute greatly to the safety of light truck occupants. Our analysis of FARS data showed that rollovers accounted for almost 45 percent of all light truck fatalities during calendar years 1982 through 1987. Moreover, as depicted in figure 3.2, our analysis also showed that the rollover fatality rate per million registered light trucks was about double the fatality rate per million registered passenger cars.

Figure 3.1: Light Truck and Passenger Car Rollover Fatalities



According to NHTSA officials, the outcome of its research will probably not be one overall rollover standard. Instead, according to the officials, it could result in several rulemaking actions to improve rollover safety, such as requirements for antilock brakes, center of gravity, stability, and door latch strength. NHTSA estimated that it will be ready to make internal rulemaking decisions on rollover safety by the spring of 1990.

Standard 108

Lamps, Reflective Devices, and Associated Equipment. On October 13, 1983, NHTSA issued a final rule requiring the installation of a center high-mount stop lamp on passenger cars manufactured on and after September 1, 1985. Research funded by NHTSA and others showed that the center high-mount light reduced rear-end collisions from 44 to 58 percent. Based upon this research, NHTSA estimated that had all passenger cars been equipped with the stop lamp in 1980, there would have been 900,000 fewer accidents and 40,000 fewer injuries.

On September 21, 1989, NHTSA officials told us that they will proceed with a rulemaking to require a center high-mount stop lamp in light trucks. The officials estimated that an NPRM would be sent to the Office of the Secretary of Transportation in early 1990 for approval.

Other Standards Not
Extended to Light Trucks

NHTSA has not extended standards for retreaded pneumatic tires (Standard 117); wheel nuts, wheel discs, and hub caps (Standard 211); windshield mounting (Standard 212); and windshield zone intrusion (Standard 219). Also NHTSA superseded the exterior protection standard (Standard 215) by establishing nonsafety requirements for the impact resistance of vehicles in low speed front and rear collisions. According to NHTSA, Standard 211 is being voluntarily complied with by light truck manufacturers, and Standard 117 is applicable to most light trucks because they use passenger car tires rather than truck tires. Moreover, NHTSA developed for us information showing that Standards 212 and 219—which exempt forward control vehicles, walk-in vans, and open-body vehicles with fold-down or removable windshields—apply to most passenger-carrying vehicles. In our opinion, the five standards do not significantly jeopardize the safety of light truck occupants.

Chronology of Events Concerning Passive Restraints for Passenger Cars

July 1969	An Advance Notice of Proposed Rulemaking (ANPRM) issued proposing to equip passenger vehicles with inflatable occupant restraints and passive occupant restraint systems.
May 1970	A Notice of Proposed Rulemaking (NPRM) issued to propose a requirement that all passenger cars and light trucks offer full passive restraint protection after January 1, 1973, and January 1, 1974, respectively.
March 1971	Final rule issued requiring full passive protection in passenger cars after August 15, 1975, and in light trucks after August 15, 1977.
September 1971	Chrysler filed a brief in the U.S. Court of Appeals challenging the National Highway Traffic Safety Administration's (NHTSA) occupant crash protection rulemaking as not being practicable, objective, or reasonable. The court generally agreed with NHTSA.
February 1972	NHTSA amended the standard to allow, during the period from August 1973 to August 1975, the installation of an interlock system preventing a vehicle from starting if a front seat occupant failed to fasten the seat belt.
February 1973	The U.S. Court of Appeals invalidated portions of the interlock option that relied on the crash dummy for measuring injury criteria.
June 1973	Standard amended to delete requirements that (1) seat belts in front-outboard seating positions meet injury criteria and (2) front-center seats have interlock system.
March 1974	An NPRM issued to propose new occupant crash protection requirements for passive restraints beginning September 1, 1976.
October 1974	The Congress passed legislation prohibiting interlock requirement in safety standards.
April 1975	An NPRM issued to extend the date to require full passive restraints in passenger cars from August 15, 1975, to August 31, 1976. Adopted August 13, 1975.
June 1976	An NPRM announcing the Secretary of Transportation's wish to reopen discussion on passive restraints because of questions concerning cost-effectiveness and suspected hazards.
August 1976	NHTSA slipped the date for full passive restraints implementation to August 31, 1977.
January 1977	The Department of Transportation (DOT) announced agreements with Ford, General Motors, and Volkswagen to manufacture a demonstration fleet of air bag-equipped cars. These agreements introduced a minimum 3-year delay in implementing passive restraints.
June 1977	Final rule requiring passive restraints to be installed in some passenger cars manufactured on and after September 1, 1981, and in all passenger cars manufactured on and after September 1, 1983.
June 1977	Resolutions introduced in the House and Senate to overturn the passive restraint requirement.
September 1977	Pacific Legal Foundation filed suit against DOT contesting the June 1977 ruling and requesting that the ruling be set aside.
October 1977	The Congress rejected proposed legislation to overturn the passive restraint rule.
January 1978	Ralph Nader and Public Citizen filed suit challenging the Secretary's decision to delay and phase in the standard and requested that implementation be speeded up.
February 1979	The court dismissed both Pacific Legal Foundation's and Public Citizen's suits, thereby affirming the Secretary's June 1977 ruling.
October 1981	NHTSA rescinded passive restraint provisions primarily because it found that only minimal safety benefits would result from automatic belts, which all major manufacturers planned on using for compliance.
June 1983	U.S. Supreme Court found that NHTSA had failed to present an adequate basis and explanation for rescinding the requirement.
August 1983	NHTSA suspended the passive restraint requirement for 1 year while it reexamined the issues.
July 1984	NHTSA issued a final rule requiring that passive restraints be phased in over a 4-year period. All passenger cars are required to have such restraints in model year 1990 and thereafter.

Source: National Transportation Safety Board Report (NTSB-SEE-79-5, Sept. 28, 1979) and NHTSA's summary of the final rule published in the Federal Register on July 17, 1984 (Vol. 49, No. 138).

Summary of NHTSA's Rulemaking Plan for Light Trucks

	Completion date		Slippage (months)
	Estimated April 1988	Estimated/actual August 1989	
Power windows			
Decision on final rule to extend safety standard 118 to light trucks. (Final rule issued June 1988.)	May 1988	June 1988	1
Head restraints			
NPRM on light truck safety problems involving head restraints. (Final rule issued September 19, 1989.)	Spring 1988	Dec. 1988	6
Occupant crash protection			
Next rulemaking decision on rear-seat shoulder belts on passenger cars and light trucks. (Final rule for cars issued June 1989 and final rule for light trucks issued October 27, 1989.)	June 1988	June 1988	•
Side-door strength			
ANPRM to request public comments on options to provide protection to the head, thorax, and pelvis of light truck and multipurpose passenger vehicle occupants in side impact crashes. (The Secretary approved the transmission of an NPRM to the Office of Management and Budget for review on October 27, 1989.)	Spring 1988	Aug. 1988	2
Roof crush			
Decision on rulemaking to extend safety standard 216 to light trucks. (NPRM was transmitted by NHTSA on October 27, 1989, for publication in the <u>Federal Register</u> .)	Dec 1988	Sept. 1989	9
Definitions (vehicle classification)			
Decision on rulemaking (NPRM issued October 1988).	Summer 1988	Oct. 1988	1

Summary of NHTSA's Research Plan for Light Truck Safety

	Completion date		Slippage (months)
	Estimated April 1988	Estimated/ actual August 1989	
Rollover			
A new data base is being set up which provides specific information about accidents pertaining to rollover	Oct. 1988	July 1989	9
Analysis of pickup truck rollover frequency	Mar. 1989	Oct. 1989	7
Analysis of existing tripped rollover model	Oct. 1989	June 1988	Early
Analysis of the dynamic stability and rollover propensity of light trucks	Mar. 1989	Aug. 1989	5
Explanation of why some vehicle characteristics are related to rollover involvement	May 1988	July 1989	14
Report on the qualitative ranking of vehicle-specific rollover tests with respect to road conditions	Mid-1990	July 1991	12
Update existing rollover initiation test device	April 1988	Feb. 1989	10
Performance of four rollover tests	Aug. 1988	Oct. 1989	14
Initial research finding from rollover tests	Oct. 1988	Oct. 1989	12
Investigate stability and control characteristics of light trucks and vans (started Oct. 1987, not shown in April 1988 plan)	-	Dec. 1989	•
Vehicle dynamic and geometric parameter measurement (center of gravity, moments of inertia, etc.) (ongoing program started March 1988, not shown in April 1988 plan)	-	None	•
Analysis of National Accident Sampling System data on vehicle and roadway factors leading to rollover	New	Mar. 1990	•
Examine both tripped and maneuver-induced rollover using intermediate level models	New	Sept. 1989	•
High camber angle tire testing	New	Aug. 1989	•

(continued)

Appendix III
Summary of NHTSA's Research Plan for Light
Truck Safety

		Completion date		Slippage (months)
		Estimated April 1988	Estimated/ actual August 1989	
Vehicle dynamic stability and rollover—examine relationships between vehicle directional control and stability characteristics and loss-of-control accidents	New		Feb. 1990	•
Survey of existing rollover research and test facilities—identify and evaluate laboratories with facilities or procedures suitable for rollover/vehicle dynamic measurement (phase I of a two-phase program)	New		Dec. 1989	•
Influence of handling properties on rollover rates	New		Sept. 1990	•
Frontal crash protection				
Vehicle testing and computer modeling results	Oct. 1988		Nov. 1988	1
Analysis of component and full sled tests will address light trucks and multipurpose passenger vehicles	Oct. 1988		July 1989	9
Research to address the risk of facial injury with respect to various steering wheel designs	Aug. 1988		July 1988	Early
Side-impact protection				
Modify the side-impactor test device and perform dynamic tests on three pickups and one minivan	April 1988		April 1989	12
Report containing the results of computer simulation and full system test	Oct. 1988		May 1989	7
Hydraulic brakes				
Research project to determine the effect of variable load proportioning valves, antilock brake systems, and the effects of age on the variability of brake balance	Mid-1989		July 1989	•
Ongoing research to determine the effect of light truck antilock brake systems on certain accident types	Mar. 1989		Oct. 1989	7
Analysis of braking and stability of high-lift vehicles	Early 1990		Late 1990	6

(continued)

**Appendix III
Summary of NHTSA's Research Plan for Light
Truck Safety**

	Completion date		Slippage (months)
	Estimated April 1988	Estimated/ actual August 1989	
Lighting			
Evaluation of center high-mount stop lamps on light trucks and vans	Late 1988	July 1989	9
Research on conspicuity and glare	Mid-1989	Sept. 1989	2

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Glossary

Biofidelity	The extent to which an anthropomorphic test device (dummy) mimics the response of a living human in a particular event.
Crash Pulse	The deceleration rate of a vehicle measured during an impact, usually recorded at the frame or main load-bearing member.
Dynamic Test Requirements	Injury reduction criteria that light trucks equipped with manual lap/shoulder belts for the front-outboard seats must comply with when the vehicle is traveling longitudinally forward at any speed up to and including 30 mph, and crashed into a fixed collision barrier that is perpendicular or at any angle up to 30 degrees in either direction from the perpendicular, to the line of travel.
Forward Control Vehicle	Vehicle in which more than half of the engine length is rearward of the foremost point of the windshield base and the steering wheel hub is in the forward quarter of the vehicle length.
Knee Bolster	A protective device located near the lower portion of the dashboard to prevent occupants from sliding under the dashboard and to absorb occupant lower torso energy in a controlled manner during a crash.
Open-body Vehicle	Vehicle that has no occupant compartment top or an occupant compartment top that can be installed or removed by the user at his convenience.
Thoracic Trauma Index	A new acceleration-based injury criteria developed by NHTSA for use in assessing the probability of an injury to the thorax and abdomen in a side impact crash.
Steering Control Rearward Displacement	The distance a steering column and shaft moves rearward toward the driver in a crash.

Walk-In Van

A vehicle generally used for making commercial deliveries that has a floor-to-roof sliding door permitting a person to enter/exit without stooping.

Windshield Zone Intrusion

The area set up to protect occupants from the possibility of vehicle components coming through or into contact with the windshield in a crash.

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