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Longer Combination Vehicles Involved in Fatal Crashes, 1991–1996

Introduction

States exercise primary responsibility for setting truck length and weight limits within their borders, as long as they are consistent with Federal regulations. For crash purposes, therefore, there is no nationally uniform definition of a longer combination vehicle (LCV).

The Surface Transportation Assistance Act of 1982 (STAA) required States to permit tractors to pull two trailers, each up to 28.5 feet long, on Interstate highways and on other routes recommended by the States and designated by the Federal Highway Administration. In some States, no doubles were allowed before the STAA.

The Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 defined an LCV as “any combination of a truck tractor and two or more trailers or semi-trailers which operates on the Interstate System at a gross vehicle weight greater than 80,000 pounds.” The legislation also provided that no State could permit multi-trailer trucks longer or heavier than those operating on National Network (NN) routes under existing State laws as on June 1, 1991, thus “freezing” State weight and length limits for these trucks. Since different State laws allowed various size and weight limits on NN highways, State highways, and local roads before 1991, ISTEA froze the existing variation among the States on the Interstate system and other NN routes.

To account for the variation in State definitions and federal statutes, the following definition of an LCV used in this report combines elements from the STAA and ISTEA. An LCV is a truck that meets one or more of the following criteria:

- a truck-tractor with at least two trailers, at least one of which is 29 feet long or longer;
- a truck-tractor with at least two trailers and a gross combination weight (GCW) greater than 80,000 pounds; or
- a truck-tractor with three trailers.

Overlength LCVs have at least one cargo-carrying trailer longer than 28.5 feet. **Overweight** LCVs exceed the weight standard only (i.e., both trailers are within the length standard but the GCW of the vehicle exceeds 80,000 pounds). LCVs categorized as **both** exceed both the weight and length standards. **Triples** are LCVs with three trailers. The term “LCV” in this report includes all LCVs: overlength, overweight, both, and triples. In this report a truck-tractor, two-trailer combination that falls within the length limits established by the STAA of 1982 and the weight limits of the ISTEA or 1991 is classified as an **STAA double**. **Figure 1** provides examples of some LCVs and common non LCVs.

This analysis brief is based on data from the University of Michigan's Trucks Involved in Fatal Accidents (TIFA) file. No comparable data are available for nonfatal crashes. Since only a relatively small number of LCVs are involved in fatal crashes in any given year, 6 years of data, 1991 through 1996, were combined in order to produce a more meaningful sample. Distributions for STAA doubles and other non-LCV tractor-semitrailers are also presented for comparison and perspective.

Crash Involvement Trends, 1991–1996

Table 1 presents the number of fatal involvements for LCVs broken down by whether they are classified as LCVs by their length, weight, both length and weight, or as triple trailers. The table presents data on the number of LCVs involved in fatal crashes for each year from 1991 through 1996, and for comparison also provides the number of STAA doubles and tractor-semitrailers involved in fatal crashes.

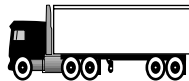
Table 1.
Combination Trucks Involved in Fatal Crashes, 1991–1996.

LCVs	1991	1992	1993	1994	1995	1996	Total	Percent
Overlength	15	16	13	10	19	14	87	39%
Overweight	2	12	6	17	10	9	56	25%
Both	7	14	9	13	20	5	68	31%
Triple Trailers	0	3	1	2	1	3	10	5%
LCV Total	24	45	29	42	50	31	221	100%
STAA Doubles	135	132	139	116	122	145	789	
Tractor-Semitrailers	2,659	2,478	2,635	2,799	2,667	2,943	16,181	

Source: Trucks Involved in Fatal Accidents (TIFA), 1991–1996

Figure 1.
Longer Combination Vehicles and some
Common Non-LCVs.

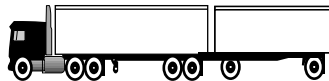
Tractor-
Semitrailer



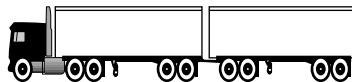
STAA Double-
Trailer



Rocky Mountain
Double



Turnpike
Double



Triple-Trailer
Combination

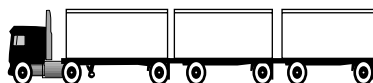


Table 2.
Combination Trucks Involved in Fatal
Crashes by Length, 1991–1996.

Length in Feet	LCVs	STAA Doubles	Tractor- Semitrailers
30-59	1 (0%)	19 (2%)	6,299 (39%)
60-69	30 (14%)	217 (28%)	8,842 (55%)
70-79	65 (29%)	532 (67%)	634 (4%)
80-89	59 (27%)	21 (3%)	17 (0%)
over 89	65 (30%)	0 (0%)	7 (0%)
Unknown	1 (0%)	0 (0%)	382 (2%)
Totals	221 (100%)	789 (100%)	16,181 (100%)

Source: TIFA, 1991–1996

The number of LCVs involved in fatal crashes has fluctuated between 24 and 50 per year over the last 6 years, with an average of about 37 per year (Table 1). An average of 132 STAA doubles and 2,865 non-LCV tractor-semitrailers per year were involved in fatal crashes from 1991 through 1996. Thus, in an average year, LCVs constituted only a very small number — slightly more than 1 percent — of the combination trucks involved in fatal crashes.

Note that STAA double combinations that qualified as LCVs solely because their gross combination weight was over 80,000 pounds at the time of the crash would not be LCVs when empty or with lesser amounts of cargo. STAA doubles classified as LCVs solely by weight constitute a quarter of all LCVs involved in fatal crashes over the 6-year period.

Geographic Distribution of LCV Fatal Crash Involvements

Longer combination vehicles are permitted in 26 States. Every State west of the Mississippi River except for California, Texas, Arkansas, Louisiana, and Minnesota allow LCVs on at least some highways. The western States historically have permitted longer truck combinations, in part because of the great distances and low population densities between urban centers.

Only six States east of the Mississippi permit LCVs: Indiana, Ohio, Michigan, New York, Massachusetts, and Florida. LCVs are restricted to toll roads in all Eastern States except Michigan, which allows LCVs on many major highways. Michigan permits two-trailer combinations to weigh up to 164,000 pounds with the appropriate number and spacing of axles — the highest allowable weight of all States. The operations of triples are tightly restricted to certain roads in 15 sparsely populated Western States, plus the Indiana and Ohio turnpikes.

There were 33 LCVs involved in fatal crashes in Michigan during 1991–1996; this was 15 percent of the national total. Only eight other States averaged more than one LCV involvement in a fatal crash per year, and all are in the far West. In Washington State, there were 29 LCVs involved in fatal crashes during the 6-year period, in Oregon there were 20, and in California there were 22; these three west coast States together accounted for almost one-third of all crashes. The other States that

averaged more than one LCV involvement in a fatal crash per year were Montana and Utah with 18 each over the 1991-1996 period, Idaho and Nevada with 13 and Wyoming with 8.

Physical characteristics of LCVs involved in fatal crashes

Each of the three major types of combination trucks has a distinctive length profile (Table 2). Almost three-fifths (57 percent) of LCVs involved in fatal crashes exceeded 79 feet in overall length, with 30 percent exceeding 89 feet in length. Most of the rest (29 percent) were between 70 and 79 feet long. In contrast, two-thirds (67 percent) of STAA doubles fell between 70 and 79 feet in length, with only 3 percent exceeding 79 feet. Almost all (94 percent) of the tractor-semitrailers involved in fatal crashes were shorter than 70 feet. Almost two-fifths (39 percent) were less than 60 feet long, while none of the LCVs and only 2 percent of the STAA doubles were less than 60 feet in length.

LCVs involved in fatal crashes have a weight distribution very different from STAA doubles and tractor-semitrailers (Table 3). Three-fifths (60 percent) of LCVs involved in 1991-1996 fatal crashes had gross combination weights of more than 80,000 pounds among those vehicles for which a weight could be determined. Close to one-fifth (16 percent) had a GCW exceeding 120,000 pounds. The heaviest vehicle weighed 225,000 pounds and was carrying a bridge beam.

None of the STAA doubles and only 3 percent of the tractor-semitrailers weighed over 80,000 pounds. Almost half (48 percent) of the STAA Doubles and 40 percent of the tractor-semitrailers fell into the 60,001 to 80,000 pound range, as opposed to only 7 percent of LCVs. At the low end of the scale, 18 percent of LCVs, 24 percent of STAA doubles, and 35 percent of tractor-semitrailers had gross combination weights of 40,000 pounds or less.

LCVs involved in fatal crashes show a wider variety of cargo body types than STAA doubles or tractor-semitrailers (Table 4). Almost two-thirds (64 percent) of the STAA doubles and over half (54 percent) of tractor-semitrailers had van type cargo compartments. By contrast only 25 percent of LCV cargo bodies were vans. Another 30 percent of LCVs involved in fatal crashes were dump cargo bodies, 25 percent were flatbeds, and 16 percent were tank type cargo bodies. Flatbeds accounted for 18 percent of STAA double involvements and 19 percent of tractor-trailer involvements. The other cargo body types for these combinations accounted for considerably less of the fatal involvements.

Tractor-semitrailers are the primary workhorse in the general truck transportation industry, and STAA doubles are commonly used for long-haul transport of general freight. Thus, both employ mostly vans to carry their cargo. Flatbeds are able to accommodate extra long loads, such as bridge or building beams, that would not fit in an enclosed van. Dump truck cargo bodies can carry very heavy loads, such as gravel, that do not need to be carried in an enclosed container. For these reasons flatbeds and dump cargo bodies are more common among LCVs.

Table 3.
Combination Truck Involved in Fatal Crashes by Gross Combination Weight, 1991-1996.

Gross Combination Weight-pounds	LCVs	STAA Doubles	Tractor-Semitrailers
up to 40,000	40 (18%)	189 (24%)	5,583 (35%)
40,001-60,000	18 (8%)	192 (24%)	2,250 (14%)
60,001-80,000	15 (7%)	377 (48%)	6,538 (40%)
80,001-100,000	47 (22%)	0 (0%)	428 (3%)
100,001-120,000	49 (22%)	0 (0%)	59 (0%)
over 120,000	36 (16%)	0 (0%)	15 (0%)
Unknown	16 (7%)	31 (4%)	1,308 (8%)
Totals	221 (100%)	789 (100%)	16,181 (100%)

Source: TIFA, 1991-1996

Table 4.
Combination Trucks Involved in Fatal Crashes by Cargo Body Type, 1991-1996.

Cargo Body Type	LCVs	STAA Doubles	Tractor-Semitrailers
Van	56 (25%)	504 (64%)	8,732 (54%)
Flatbed	56 (25%)	140 (18%)	3,030 (19%)
Tank	36 (16%)	36 (4%)	1,625 (10%)
Dump	67 (31%)	93 (12%)	1,766 (11%)
Other/Unknown	6 (3%)	16 (2%)	1,028 (6%)
Total	221 (100%)	789 (100%)	16,181 (100%)

Source: TIFA, 1991-1996

Table 5.
Combination Trucks Involved in Fatal Crashes by Trip Type, 1991-1996.

Trip Type	LCVs	STAA Doubles	Tractor-Semitrailers
Local	63 (27%)	153 (19%)	3,706 (23%)
51-200 miles	114 (53%)	421 (54%)	4,159 (26%)
Over 200 miles	39 (18%)	189 (24%)	6,919 (43%)
Unknown	5 (2%)	26 (3%)	1,397 (8%)
Total	221 (100%)	789 (100%)	16,181 (100%)

Source: TIFA, 1991-1996

Carriers and trip types of LCVs involved in fatal crashes

Just over three-fourths (76 percent) of LCVs and just under three-fourths (74 percent) of STAA doubles

Researcher

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Distribution

This Analysis Brief is being distributed according to a standard distribution. Direct distribution is being made to the Resource Centers and Divisions.

Availability

This Analysis Brief is available from the Office of Data Analysis and Information Systems, Telephone: (202) 366-1861.

Key Words

longer combination vehicle, triple, STAA double, tractor semi-trailer, overlength, overweight.

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involved in fatal crashes in 1991-1996 were operated by carriers in interstate commerce. An even greater number (83 percent) of tractor-semitrailers were operated by interstate carriers. The fact that about one-quarter of STAA doubles and LCVs were operated by intrastate carriers likely reflects individual State regulations limiting the number and type of roads on which STAA doubles and LCVs can operate, and whether LCVs can operate on any roads in a State.

LCVs involved in fatal crashes were more likely to have been dispatched on short trips than STAA doubles and tractor-semitrailers. Only 19 percent of STAA doubles and 23 percent of tractor-semitrailers were on trips of less than 50 miles when they were involved in a fatal crash, while 29 percent of LCVs were on local trips (Table 5). Moreover, half of the LCVs and STAA doubles were on trips between 51 and 200 miles, compared to only 26 percent of the tractor-semitrailers. At the long trip end of the scale, only 18 percent of LCVs were on trips of more than 200 miles in length, while the number for STAA doubles was 24 percent and for tractor-semitrailers the number climbs to 43 percent.

The concentration of LCVs on short trips reflects cargo that is extra long or extra heavy and does not have to be moved great distances. On the other hand, much tractor-semitrailer traffic is cross-country in nature. The short LCV trips are also a product of restrictions that prevent LCVs from entering surrounding States or using many roads in their home States.

Fatal crash events

For all three configurations, the first harmful crash event is typically a collision with another vehicle on the roadway. For LCVs involved in fatal crashes, 73 percent of the first harmful events were collisions with another vehicle in transport. For STAA doubles it was an almost identical 74 percent, and for tractor-semitrailers the number was a slightly higher 79 percent. Collisions with a fixed object — such as sign posts or bridge abutments or trees — and collisions with a pedestrian or bicyclist were the second and third most common first event for all three truck combinations.

Rollovers, which includes any number of quarter turns from the upright position, are often associated with serious traffic crashes. LCVs rolled over in 23 percent of the fatal crashes in which they were involved, compared with 19 percent of STAA doubles, and only 12 percent of tractor-semitrailers.

A large majority of large truck rollovers in fatal crashes occur after another crash event, usually a collision with another vehicle. Rollovers were the first harmful crash event in only 7 percent of LCV fatal crashes, compared with 3 percent of STAA doubles, and 4 percent of tractor-semitrailers. However, even though the percentage of first event rollovers is small, the LCV proportion of rollovers is about twice as high as that for STAA doubles and tractor-semitrailers. One explanation for this difference is that the greater weight of many LCVs may raise their centers of gravity and lower the rollover threshold.

Summary

Of the 17,191 truck combinations involved in fatal crashes examined here, 221 (1.3 percent) were LCVs. Of these, 10 were triple-trailer combinations. The operation of LCVs is limited to very few roads. East of the Mississippi River, LCVs are allowed on only a small number of major turnpikes, except in Michigan. The limitations under which LCVs operate are reflected in the miles they travel. According to the 1997 highway cost allocation study conducted by the FHWA, LCVs accounted for 2 percent of all miles driven by the combination trucks in 1994.

Based on the data presented in this brief, no conclusions can be made on the relative safety of LCVs compared to other truck combinations. First, data on mileage driven mentioned above are based strictly on trailer number and length, while the definition of LCV used in this study is based partly on weight. Second, since travel by LCVs is rare, it is difficult to calculate the precise number of miles driven. Similarly, LCV fatal crashes are so infrequent that the number varies greatly from year to year. For example, LCV crashes dropped from 46 in 1992 to 31 in 1993 (down 33 percent), then rose to 43 in 1994 (up 39 percent). Based on the existing data, LCVs do not appear to be considerably more or less safe than other combination trucks. A more definitive conclusion could be reached only after further collection of data and additional analysis.