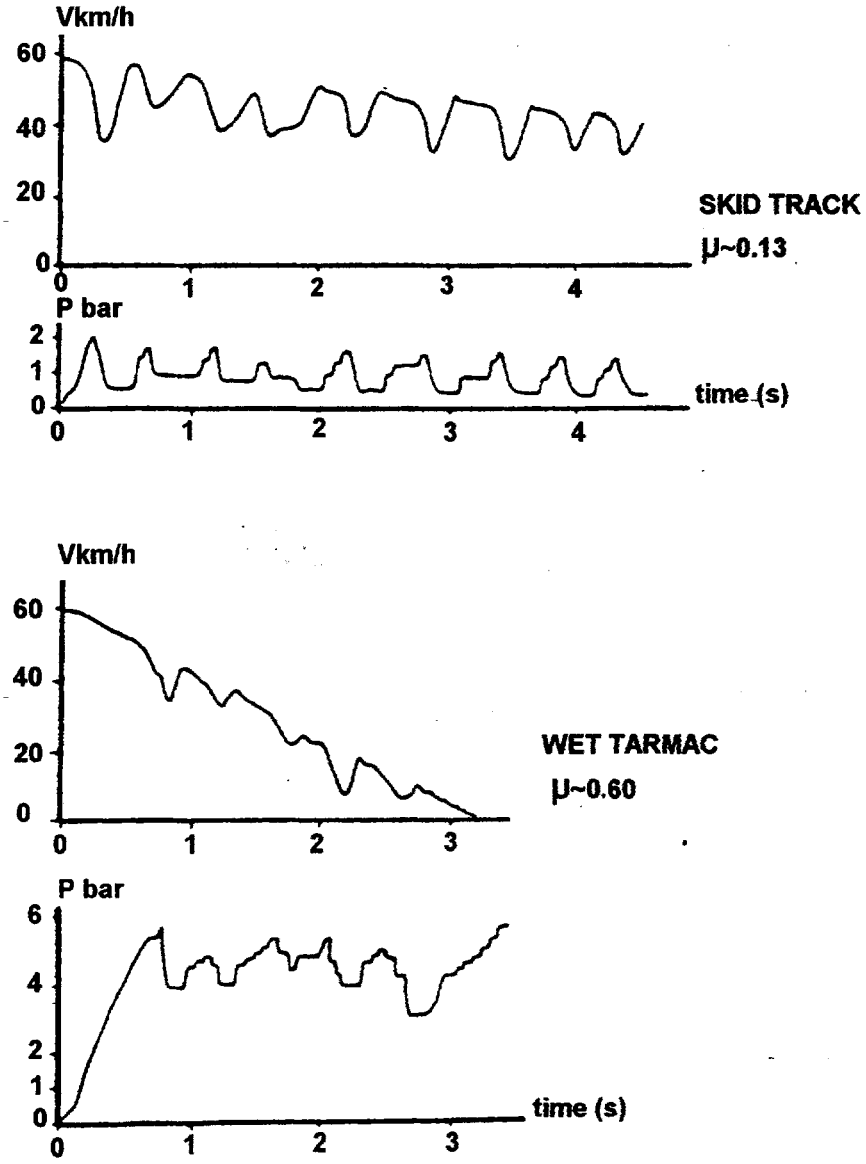

Figure 20 - Wheel Speed and Brale Pressure Response - 1980's Antilock System

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BILLING CODE 4910–59–C

DEPARTMENT OF TRANSPORTATION

National Highway Traffic Safety Administration

49 CFR Part 571

[Docket No. 93–06; Notice 3]

RIN 2127–AD07

Federal Motor Vehicle Safety Standards; Stopping Distance Requirements for Vehicles Equipped With Air Brake Systems

AGENCY: National Highway Traffic Safety Administration (NHTSA), Department of Transportation.

ACTION: Final rule.

SUMMARY: This notice reinstates stopping distance performance requirements in Standard No. 121, *Air Brake Systems,* for medium and heavy vehicles that are equipped with air brake systems. The requirements specify distances in which different types of medium and heavy vehicle configurations must come to a complete stop from 60 mph on a high coefficient of friction surface. The requirements are designed to reduce the number and severity of crashes.

This notice is one part of the agency's comprehensive effort to improve the braking ability of heavy vehicles. In another final rule published elsewhere in today's **Federal Register**, the agency is adopting identical stopping distance requirements for medium and heavy vehicles that are equipped with hydraulic brake systems. In a third final rule that responds to the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991, the agency is requiring medium and heavy vehicles to be equipped with an antilock brake system (ABS) to improve the lateral stability and control of these vehicles during braking.

DATES: *Effective Dates:* The amendments become effective on March 1, 1997. Compliance to § 571.121 with respect to trailers and single unit trucks and buses will be required as of March 1, 1998.

Petitions for Reconsideration: Any petitions for reconsideration of this rule must be received by NHTSA no later than April 10, 1995.

ADDRESSES: Petitions for reconsideration of this rule should refer to Docket 93–06; Notice 3 and should be submitted to: Administrator, National Highway Traffic Safety Administration, 400 Seventh Street SW., Washington, DC 20590.

FOR FURTHER INFORMATION CONTACT: Mr. George Soodoo, Office of Vehicle Safety Standards, National Highway Traffic Safety Administration, 400 Seventh Street SW., Washington, DC 20590 (202–366–5892).

SUPPLEMENTARY INFORMATION:

I. Background

A. Brake Related Crashes

Medium and heavy vehicles [1] are involved in thousands of motor vehicle crashes each year. One of the most important factors that contributes to these crashes is brake system performance. Crashes in which braking is a contributory factor can be further subdivided into (1) crashes due to brake failures or defective brakes, (2) runaways on downgrades, due to maladjusted or overheated brakes, (3) crashes in which vehicles are unable to stop in time, and (4) skidding, jackknifing, or loss-of-control crashes due primarily to locked wheels during braking.

This final rule, reinstating stopping distance requirements for air-braked vehicles and the companion final rule specifying stopping distance requirements for hydraulically braked heavy vehicles will reduce the severity of or prevent crashes attributable to a heavy vehicle's inability to stop in time.[2] In these crashes, the heavy vehicle's brakes function, but do not stop the vehicle quickly enough to avoid a crash. One way to reduce the severity or number of such crashes is to improve heavy vehicle braking performance by reducing the distance needed to stop a vehicle. Even if crashes of this type were not totally prevented by such improvements in performance, the improvements would reduce collision impact speeds, and thus reduce crash severity.

The following estimates regarding heavy vehicle crashes are from NHTSA's 1992 General Estimates System (GES) which is based on data transcribed from a nationally representative sample of state police accident reports (PARs) and the Fatal Accident Reporting System (FARS). NHTSA estimates that in 1992 there were about 168,000 crashes involving heavy combination vehicles (excluding truck tractors when operating bobtail, *i.e.,* without a trailer). These crashes resulted in about 13,600 injuries and 387 fatalities to truck occupants and about 51,500 injuries and 2,452 fatalities to occupants of other involved vehicles. For bobtail truck tractors alone, the agency estimates that there were about 8,400 crashes resulting in about 1,200 injuries and 39 fatalities to truck occupants and about 2,600 injuries and 178 fatalities to occupants of other involved vehicles. For heavy single-unit trucks, the agency estimates that there were about 192,600 crashes resulting in about 15,700 injuries and 165 fatalities to truck occupants and about 48,300 injuries and 891 fatalities to occupants of other involved vehicles. In addition, crashes involving heavy vehicles result in more expensive and severe property damage than crashes involving light vehicles.

It is very difficult to quantify the number of crashes in which a vehicle's brakes are unable to stop the vehicle in time. NHTSA estimates that in 1992 there were about 18,000 crashes involving heavy combination vehicles (excluding bobtail truck tractors). These crashes resulted in about 1,800 injuries and 57 fatalities to truck occupants and about 8,400 injuries and 754 fatalities to occupants of other involved vehicles. For bobtail truck tractors alone, the agency estimates that there were about 260 crashes resulting in about 100 injuries and 7 fatalities to truck occupants and about 240 injuries and 48 fatalities to occupants of other involved

[1] Hereafter, referred to as heavy vehicles.

[2] Today's companion final rule to require heavy vehicles to be equipped with antilock brake systems (ABS) will prevent braking-induced loss-of-control crashes.

vehicles. For heavy single-unit trucks, the agency estimates that there were about 30,100 crashes resulting in about 4,200 injuries and 17 fatalities to truck occupants and about 15,000 injuries and 276 fatalities to occupants of other involved vehicles. The Final Economic Analysis (FEA) provides greater detail about how today's final rules will reduce injuries and fatalities resulting from such crashes.

The agency emphasizes that not all inability-to-stop-in-time crashes are preventable. Nevertheless, improvements to heavy vehicle brake systems should prevent or reduce the severity of a significant number of these crashes.

B. Braking Devices

In order to understand the discussion of braking in this preamble, it is necessary to be familiar with several devices used in braking systems. Therefore, the agency provides a brief explanation of those devices below.

Automatic front axle limiting valves (ALVs) automatically limit the amount of braking pressure applied at steering axle brakes. ALVs are typically installed to allay the concern of some drivers about loss of steering control due to front wheel lockup during hard braking and to reduce steering pull due to unequal brake adjustment on the front wheel brakes. However, these devices can actually increase the likelihood of drive axle and trailer lockup because the brakes on the front axle do less than their proportional share of the braking. Therefore, drivers must apply brakes harder to stop the vehicle. Accordingly, stopping distance performance could, in most cases, be improved by eliminating the use of ALVs.

Bobtail proportioning valves (BPVs) automatically reduce brake application pressure to the drive axles of a bobtail truck tractor, thereby allowing greater use of the vehicle's steering-axle braking power. Bobtail tractors demonstrate the worst stopping capability of all vehicle types, primarily because the braking systems of tractors are designed to optimize their stopping distance when they are towing a loaded trailer. Without the trailer, the lack of load on the tractor drive axles can cause premature wheel lockup and reduced stopping capability. An agency study found that, on average, the stopping distance of bobtail tractors is approximately 122 feet longer than that of tractors when connected to loaded trailers.[3] However, significantly shorter stops have been obtained when bobtails are equipped with BPVs.

Load-Sensing Proportioning Valves (LSVs) reduce the likelihood of premature wheel lockup by mechanically sensing drive-axle suspension deflection that results from weight transfer during braking, and adjusting brake proportioning based on different loading conditions. However, LSVs cannot prevent lockup of a vehicle's brakes if they are applied too hard, particularly on a low coefficient of friction surface.

Antilock brake systems (ABSs) automatically control the amount of braking pressure applied to a wheel so as to prevent wheel lock, thus increasing stability and control in emergency stops by preventing skidding, spinning, and jackknifing. Today's stability and control final rule provides a detailed discussion of these devices.

II. NHTSA Activities

A. Regulatory History

In the notice of proposed rulemaking (NPRM) to reinstate stopping distance requirements for air-braked vehicles, NHTSA provided a detailed discussion of the regulatory and judicial history of the stopping distance requirements for air braked vehicles. (58 FR 11009, February 23, 1993). When last in effect, the stopping distance requirements in Standard No. 121 required all heavy vehicles to stop within 293 feet from a speed of 60 mph on a high coefficient of friction surface (*i.e.*, a nonslippery surface typical of dry concrete). (41 FR 8783, March 1, 1976).

In response to a suit challenging Standard No. 121's stopping distance requirements, the United States Court of Appeals for the 9th Circuit invalidated the Standard's stopping distance and ''no lockup'' requirements for trucks, buses, and trailers in *PACCAR* v. *NHTSA,* 573 F.2d 632, (9th Cir. 1978) *cert. denied,* 439 U.S. 862 (1978). The court held that NHTSA was justified in promulgating a standard requiring improved air brake systems and stability mechanisms. However, after reviewing the record about reliability problems with antilock brake systems then in use, the court held that the standard was ''neither reasonable nor practicable at the time it was put into effect.''

The court further stated that:

* * * those parts of the Standard requiring heavier axles and the antilock device should be suspended. The evidence indicates that this can be accomplished if we hold, as we do, that the stopping distance requirements from 60 mph are invalid * * * We hold only that more probative and convincing data evidencing the reliability and safety of vehicles that are equipped with antilock and in use must be available before the agency can enforce a standard requiring its installation.

The stability and control final rule contains a detailed discussion about the *PACCAR* decision and how the agency has responded to the findings in that decision. The Agency has decided to specify different stopping distances for different configurations of heavy vehicles. Today's requirements can further be distinguished from those invalidated in the 1970s by the fact that manufacturers will not need to significantly redesign their brakes or use overly aggressive foundation brakes to comply with the requirements being established in today's final rule.

Even though the stopping distance requirements being specified in today's final rule are generally less stringent for some configurations than those invalidated by the *PACCAR* decision, the agency believes that the braking requirements in today's final rules, taken as a whole, significantly enhance the overall braking performance of air-braked vehicles given the agency's decision to require these vehicles to be equipped with ABS.

B. Agency Research

As a part of its review of heavy vehicle braking, NHTSA has issued two reports on the stopping distance capability of several different types of heavy air-braked vehicles in various loading conditions.[4] The agency also tested some vehicles equipped with ALVs, BPVs, and ABS, thus allowing comparisons of stopping distances with and without these devices. The tests were conducted on school buses, transit buses, single unit trucks, tractor trailers in the loaded and empty conditions and with various equipment (with ABS activated and deactivated, and with and without ALVs and BPVs). Among the conclusions reached by the agency on the basis of the test data were: (1) ALVs significantly degrade straight line stopping performance, especially in the bobtail configuration (with stopping distances as long as 531 feet); (2) BPVs significantly reduce the stopping distances of bobtail tractors; (3) ABSs are effective in providing short, stable stops in all operating conditions; (4) ABSs provide the greatest performance gain in the bobtail configuration, where stable stops as short as 233 feet were obtained; (5) braking performance of bobtail tractors and empty single unit

[3] ''NHTSA Heavy Duty Vehicle Brake Research Program Report No. 1, ''Stopping Capability of Air Braked Vehicles,'' (DOT HS 806 738, April 1985) and Report No. 9, ''Stopping Distances of 1988 Heavy Vehicles.''

[4] NHTSA Heavy Duty Vehicle Brake Research Program Report No. 1, ''Stopping Capability of Air Braked Vehicles,'' (DOT HS 806 738, April 1985) and Report No. 9, ''Stopping Distances of 1988 Heavy Vehicles.'' DOT HS 807 531, February 1990.

trucks could be improved by removing ALVs from both vehicle types and installing BPVs on bobtails; and (6) a stopping distance performance requirement for truck tractors with empty trailers would not provide any additional performance benefits that could not be achieved through specifying requirements for either the bobtail or loaded condition.

C. Heavy Vehicle Safety Report to Congress

In response to section 9107 of the Truck and Bus Regulatory Reform Act of 1988, NHTSA submitted a report to Congress titled ''Improved Brake Systems for Commercial Vehicles.'' (DOT HS 807 706, April 1991.)[5] After discussing crash data concerning heavy vehicle brake systems, the report explained the factors that are related to braking effectiveness, stability and control during braking, and braking system compatibility. The report indicated that stopping distances and vehicle stability could be improved by not equipping heavy vehicles with ALVs and instead equipping them with BPVs, load-sensing proportioning valves, and antilock brake systems.

III. Agency Proposal

On February 23, 1993, NHTSA proposed to amend Standard No. 121 to reinstate stopping distance performance requirements for stops from 60 mph on a high coefficient of friction surface for trucks, truck tractors, and buses that are equipped with air brake systems (58 FR 11009). Based on testing at VRTC, the Agency proposed different stopping distances for different configurations of heavy vehicles. Specifically, the Agency proposed that unloaded single unit trucks and bobtail tractors stop within 335 feet, loaded single unit trucks stop within 310 feet, and all buses stop within 280 feet. The Agency proposed two alternatives for testing a truck tractor in the loaded condition and stated that one of the alternatives would be chosen for the final rule. The first alternative proposed that the truck tractor be tested with a braked control trailer and stop within 280 feet, while the second alternative proposed that the truck tractor be tested with an unbraked control trailer and stop within 355 feet. The Agency explained that its long-term objective is to upgrade the braking efficiency of heavy vehicles to enable them to make controlled, stable stops, under all loading and road surface conditions. The Agency believed that the proposed requirements would reduce the disparity in braking ability between heavy vehicles and passenger cars. On the same day, the Agency proposed identical stopping distance requirements for heavy vehicles equipped with hydraulic brakes (58 FR 11003). The Agency stated that many vehicles were already able to comply with the proposed requirements. The inadequate performance of those vehicles that were not able to comply was due to either poor brake torque balance between the vehicles' axles resulting in premature lockup of the wheels on the vehicles' rear axles or a lack of sufficient total brake torque capability. Those vehicles that exhibited poor brake balance could be brought into compliance by installing ABS, or by adding BPVs and/or eliminating ALVs. Those vehicles that lack sufficient total brake torque capability could be brought into compliance by incorporating relatively minor changes to their foundation brake components involving the substitution of other currently available components.

NHTSA proposed that air-braked vehicles would have to come to a complete stop within a 12-foot-wide lane with restrictions on which wheels would be permitted to lockup during the stop. The proposal requested comments about whether and to what degree wheel lockup during testing would be permitted. Specifically, the Agency proposed to allow unlimited lockup below 20 mph and defined two types of wheel lockup allowed above 20 mph: ''permissible wheel lockup,'' which is defined as 100 percent wheel slip of one or more wheels for a duration of one second or less[6] for testing purposes, and ''limited lockup,'' which is defined as lockup of not more than one wheel per axle or two wheels per tandem. In addition, NHTSA proposed test conditions related to the road test surface, the use of a braked or unbraked control trailer, and the initial brake temperature. NHTSA also proposed specifying a threshold pressure to enhance brake force compatibility between tractors and trailers.

IV. Comments on the Proposal

NHTSA received 49 comments in response to the NPRM. Commenters included heavy vehicle manufacturers, brake manufacturers, safety advocacy groups, heavy vehicle users, industry trade associations, and other individuals. The American Automobile Manufacturers Association (AAMA) submitted joint comments on behalf of the eight major domestic manufacturers of heavy vehicles: Chrysler, Ford, Freightliner, General Motors (GM), Mack Trucks, Navistar, PACCAR, and Volvo-GM.

All the commenters supported the Agency's decision to reinstate stopping distance requirements for heavy vehicles equipped with air brakes. However, they offered mixed views about the specific stopping distances being proposed. GM, Navistar, Heavy Duty Brake Manufacturers Council (HDBMC), and Rockwell WABCO stated that the proposed stopping distance requirements are appropriate. In contrast, the Insurance Institute for Highway Safety (IIHS), the Coalition for Consumer Health, and Advocates for Highway Safety (Advocates) believed that the required distances should be much shorter for trucks and buses. Advocates stated that the proposal did little more than ''grandfather'' existing braking capabilities and therefore would not result in the best available braking performance for large trucks.

The American Trucking Association (ATA), IIHS and several other commenters suggested that the Agency should merge the proposed stopping distance and stability requirements into a common rulemaking, thereby allowing the industry to implement a more effective test program.

Commenters also addressed specific issues raised in the NPRM, including vehicle test speed, the test surface specification, the control trailer, wheel lockup restrictions, the initial brake temperature, the failed system test, vehicle loading, the threshold pressure requirements, the parking brake test, the burnish procedures, and the implementation schedule for the requirements. More specific discussions of these comments, and the Agency's responses to them, are set forth below.

V. Agency Decision

A. Overview

Based on the Fatal Accident Reporting System (FARS) and other crash data, test data from the agency's heavy vehicle brake research program, comments on the NPRM, and other available information, NHTSA has decided to amend Standard No. 121 to reinstate stopping distance performance requirements for heavy vehicles that are equipped with air brake systems. Separate requirements for stopping from 60 mph on a high coefficient of friction surface are specified for four different heavy vehicle configurations. The requirements are designed to reduce the

[5] This report may be examined at the Agency's Technical Reference Office, room 5108, at no charge. It is available from the National Technical Information Service (NTIS), Springfield, VA 22161 for a small charge.

[6] As explained below, the final rule refers to this concept as ''momentary wheel lockup.''

distance needed for these vehicles to come to a complete stop, thereby reducing the severity and number of crashes.

As noted above, this notice is one part of the Agency's comprehensive effort to improve the braking ability of heavy vehicles. In a second final rule published elsewhere in today's **Federal Register**, the Agency is adopting identical stopping distance requirements for heavy vehicles that are equipped with hydraulic brake systems. The Agency believes that it is appropriate to specify identical stopping distance requirements for similar vehicles. In a third final rule, the Agency is responding to the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 by requiring each heavy vehicle to be equipped with an antilock brake system to improve its lateral stability and control during braking.

B. Stopping Distance Performance

1. Stopping Distance Requirements

Based on its testing at VRTC, NHTSA proposed different stopping distances for various categories of vehicles when tested at a speed of 60 mph on a surface with a peak friction coefficient (PFC) of 0.9, as follows:

Loaded and Unloaded Buses.....280 ft.
Loaded Truck Tractors with Braked Control Trailer.....280 ft.
Loaded Truck Tractors with Unbraked Control Trailer.....355 ft.
Loaded Single-Unit Trucks .....310 ft.
Unloaded Single-Unit Trucks & Truck Tractors (Bobtail).....335 ft.

The agency proposed different requirements, instead of a single across-the-board requirement like the one invalidated by the *PACCAR* court, because a single requirement for all heavy vehicles with fully operational service brakes would be too stringent for bobtail tractors and unloaded single unit trucks, but not stringent enough for buses and for tractor trailers in the loaded condition.

AAMA and most other industry commenters agreed with the stopping distance values proposed for the various vehicle configurations. AlliedSignal commented that these requirements are compatible with its view of using BPVs to achieve increased deceleration on air-braked tractors, while maintaining lateral stability in the bobtail mode. Nevertheless, it requested that ALVs not be prohibited since it believed that these devices are appropriate on some vehicles, particularly those with large front brakes. AlliedSignal recommended that if an ALV is used on a vehicle, it should be automatically deactivated when the tractor is in the bobtail mode. ATA agreed with the proposal to specify different stopping distances for different types and loadings of vehicles. It also agreed with specifying the same stopping distances for air-braked and hydraulically-braked vehicles of the same type and with the same loading.

Other commenters opposed some of the proposed stopping distance values on the ground that they were too stringent. HDBMC stated that certain vehicles would have difficulty complying with the proposed stopping distances because they are over-braked when the rear axles are unloaded, and under-braked during emergency system stops. Lucas was concerned that the service brake stopping distances obtained during the agency's testing do not have a 10 percent margin less than the proposed 280 feet from 60 mph. In order to obtain an acceptable margin, Lucas stated that vehicle manufacturers will have to equip certain vehicles with larger front brakes, which would represent a major change on some vehicles.

In contrast, other commenters stated that the proposed stopping distances were not sufficiently stringent. Advocates stated that the proposed stopping distances simply ratify the braking distances currently achieved by manufacturers and do not seek to improve real-world braking performance. It stated that except for the 280-foot requirement for buses and loaded tractors with a braked control trailer, all of the other proposed stopping distances are longer than the 293 feet established before *PACCAR*. Similarly, IIHS stated that the proposals do not go far enough toward requiring the best available braking for heavy vehicles.

Based on the comments and other available information, NHTSA has decided to adopt the stopping distances proposed in the NPRM for the following categories of vehicles when tested at a speed of 60 mph on a surface with a PFC of 0.9:

Loaded and Unloaded Buses [7].....280 ft.
Loaded Truck Tractors with Unbraked Control Trailer [8].....355 ft.
Loaded Single-Unit Trucks .....310 ft.
Unloaded Single-Unit Trucks & Truck Tractors (Bobtail).....335 ft.

As it stated in the NPRM, NHTSA agrees with HDBMC that a small number of vehicles will have to be modified to comply with the reinstated stopping distance requirements. The agency notes that the companion final rule requiring heavy vehicles to be equipped with antilock brake systems will improve the braking of those vehicles whose braking performance is limited due to poor brake torque balance, and will enable them to comply with the stopping distance requirements. For those vehicles that will require changes to their foundation brakes, so as to provide greater brake torque capability, the agency believes that adequate leadtime is being provided to minimize the task of achieving compliance with the requirement.

NHTSA notes that while the companion final rule requiring heavy vehicles to be equipped with ABSs will reduce the need to eliminate front axle ALVs on single unit trucks and truck tractors and to install rear axle BPVs on truck tractors, the agency would still encourage vehicle manufacturers to do so. Vehicles without ALVs and/or with BPVs can be braked at higher levels of deceleration before the vehicle's ABS is activated, which the agency believes will improve the vehicle's driveability. The Agency is aware of at least one manufacturer of ABSs that currently recommends the incorporation of BPVs on truck tractors equipped with ABS.

2. Stopping Distance Test Conditions

a. Test Surface Specification

In the NPRM, NHTSA proposed that the 60-mph stopping distance tests be performed on a test surface with a PFC of 0.9, which is typical of dry concrete. In formulating the proposal, the agency considered whether the proposed test surface specification raises practicability or objectivity concerns in light of *PACCAR*. Based on its testing, the agency tentatively concluded that specifying a test surface with a high PFC would reasonably represent stopping on a dry surface and would not be a significant source of variability in the stopping distance tests. The Agency requested comments on the proposed test surface specification.

Several commenters addressed the appropriate PFC for the test. AAMA and Navistar commented that the test surface should be specified at a PFC of 1.0 because that PFC value would remove the influence of test road variability from compliance testing. AAMA provided data that showed that in the course of six months, the PFC varied between 0.85 and 0.95, and averaged 0.90 over ten readings taken approximately twice each month. According to Navistar, its data showed PFCs that ranged from 0.91 to 0.98.

[7] The final rule amending Standard No. 105 discusses in detail the stopping distances applicable to hydraulic-braked school buses.

[8] As explained in the section below titled ''control trailers,'' the agency proposed but decided not to adopt a revised braked control trailer test condition.

AAMA argued that since the majority of actual test surfaces nominally exceed PFC 0.9, a specification of 0.9 would impose a cost burden on manufacturers trying to maintain the test surface near, but below, the 0.9 value. AAMA stated that ''worldwide support'' has been expressed for specifying a test surface with a PFC of 1.0. Volvo GM provided results of the Motor Vehicle Safety Research Advisory Committee (MVSRAC) Antilock Brake System (ABS) Task Force ''Round Robin'' testing, which showed that on high coefficient of friction surfaces with PFCs ranging from 0.87 to 1.00, the stopping distances of the three test vehicles remained relatively constant when tested in the bobtail condition. This indicates stopping performance on a dry surface is not significantly affected by variability. Strait-Stop requested that a tolerance of ± 0.1 relative to 0.9 should be specified to accommodate real-world limitations.

Based on the industry-government cooperative testing to evaluate the effect of fluctuations of PFC on vehicle stopping performance, NHTSA reaffirms its belief that a PFC of 0.9 reasonably represents a typical dry surface and will not be a significant source of variability in the stopping distance tests. (Public Files Docket PF88–01, MVSRAC ABS Task Force, Round Robin No. 1). Testing indicates that the expected minor variability of a high coefficient of friction surface appears to have a negligible impact on vehicle stopping distance performance. Variation of the average stopping distances for the six different surfaces (with PFCs ranging from 0.89 to 0.94) was small, with the deviation from the average being only 5 feet. Accordingly, the agency believes that any variability in the stopping performance on a high coefficient of friction surface is more likely due to variation in the vehicle's performance rather than test surface variability. NHTSA has decided that a test road surface specification of PFC 1.0 would result in practicability problems for the agency, since it would have to conduct compliance testing on a surface with a PFC higher than 1.0. Such a surface is difficult to find. The agency also notes that General Motors conducted an extensive survey of actual road surfaces, which indicated that a PFC of 0.9 is fairly typical.

NHTSA notes that AAMA's claim that there is worldwide support for specifying a PFC of 1.0 is incorrect. The agency notes that when the issue was discussed by the ECE in the context of the international harmonization of brake standards, the decision was to specify a PFC of 0.9[9]. Moreover, when the Organization International des Constructeurs d'Automobiles (OICA) proposed adopting a PFC of 1.0, no country supported such a requirement.

NHTSA has decided not to adopt Strait-Stop's request to specify a tolerance for the test surface. The agency notes that in specifying the test conditions applicable to the test surface, the agency does not provide a range of permissible test surfaces. Instead, the braking standards set forth specific, objective criteria for the test surface according to which the agency conducts its compliance testing.

b. Wheel Lockup Restrictions

In the NPRM, NHTSA proposed that the straight line stopping distance test be conducted without locking more than one wheel per axle or two wheels per tandem at speeds greater than 20 mph. In addition, the agency proposed to allow unlimited lockup at 20 mph or below, and to allow permissible wheel lockup for testing purposes. NHTSA believed that allowing limited wheel lockup combined with permissible wheel lockup at speeds above 20 mph would ensure a safe and reasonably repeatable test condition, while providing an indication of a vehicle's stability up to the vehicle's braking performance limit. These provisions addressing wheel lockup were based on the previously mentioned stopping distance tests conducted at VRTC. NHTSA requested comments about the degree to which lockup should be permitted and under what circumstances, including whether to allow unrestricted wheel lockup of test vehicles.

Commenters addressed four distinct issues with respect to the wheel lockup restrictions: (1) Specifying various types of lockup that would be allowed; (2) applying the wheel lockup restrictions to ABS equipped axles; (3) applying the wheel lockup restrictions to certain other axles; and (4) applying the wheel lockup restrictions to emergency system stops.

AlliedSignal, ATA, AAMA, and Strait-Stop commented that the wheel lockup restrictions were not clear. AlliedSignal suggested that ''permissible'' and ''limited'' be replaced by one term, and that wheel lockup be defined as 100 percent wheel slip at both wheels on an axle or more than two wheels on a tandem for a duration greater than one continuous second. AAMA requested that ''wheel lock restriction'' be defined ''as 100 percent wheel slip of both wheels of an axle, or more than two wheels on a tandem, for a duration greater than one continuous second.'' Strait-Stop requested that permissible wheel lockup be defined as lockup of one or more wheels at 100 percent slip for a reasonable time. ATA stated that the proposed regulatory language does not clearly indicate whether unlimited wheel lockup is permitted at speeds below 20 mph.

After reviewing these comments, NHTSA has decided to adopt the proposed concepts pertaining to wheel lockup restrictions in the stopping distance test, with some modifications to enhance the provision's clarity. Aside from defining wheel lockup as 100 percent slip, and renaming ''permissible wheel lockup'' as ''momentary wheel lockup,'' NHTSA has decided that it is clearer to specify the concept directly in the stopping distance requirement in S5.3.1 instead of defining the various types of lockup (*e.g.*, momentary (permissible) lockup, limited lockup, unlimited lockup) and then referencing them in S5.3.1. Accordingly, a vehicle is required to stop with wheel lockup permitted under the following conditions. At vehicle speeds above 20 mph, one wheel on any axle or two wheels on any tandem may lock up for any duration. At vehicle speeds above 20 mph, wheels on certain axles (*i.e.*, nonsteerable axles other than the two rearmost nonliftable, nonsteerable axles) may lock up for any duration. At vehicle speeds above 20 mph, any wheel not permitted to lock, as described in the two conditions above, may lock up repeatedly, with each lockup condition having a duration of one second or less. At vehicle speeds of 20 mph or less, any wheel may lock up for any duration. These exceptions allowing certain types of lockup are based on the above-mentioned tests conducted at VRTC.

In establishing the requirements applicable to wheel lockup restrictions, NHTSA examined the commenters' recommended definitions for wheel lockup restriction. The Agency believes that these definitions achieve only part of the Agency's objective in establishing wheel lockup restrictions. The Agency interprets AAMA's definition as allowing both wheels on an axle to lock up (100 percent slip) for up to one second. However, AAMA's recommended definition is unclear about whether one wheel is allowed to remain locked up for the duration of the stop. NHTSA believes that it would be necessary to add additional wording to AAMA's definition to achieve the same

[9] Eleventh Informal Meeting on Harmonization of Brake Standards, August 26–27, 1991 and 29th Meeting of Experts on Brakes and Running Gear, August 28–30, 1991.

objective that is already achieved by the Agency's requirements.

Several commenters stated that the wheels on any axle controlled by ABS should be excluded from wheel lockup constraints. Rockwell International stated that the proposed stopping distance regulation will become obsolete soon, since the references to permissible and limited wheel lockup will be superseded by the ABS regulation. Rockwell WABCO stated that the proposed stability and control rulemaking will resolve problems with respect to the wheel lockup definitions. AAMA expressed its concern that imposing wheel lockup constraints on ABS-equipped vehicles could pose practicability problems during tests. For example, AAMA said that the test driver could be required to modulate brake pressure in order to prevent wheel lockup on axles not equipped with ABS, at the same time the ABS is cycling.

NHTSA believes that the requirements in S5.3.1 continue to be necessary, notwithstanding the Agency's decision to require heavy vehicles to be equipped with antilock brake systems. The Agency believes that the limited lockup and momentary lockup restrictions will not impose any unreasonable or currently unachievable performance requirement on antilock systems during the stopping distance test, since the amount of lockup allowed by these restrictions is considerably greater lockup than allowed by any currently available antilock system. The antilock requirement specifies that an ABS on a truck tractor must control ''the wheels of at least one front axle of the vehicle and the wheels of at least one rear axle * * *'' Therefore, if a vehicle is equipped with ABS on only one axle of a rear tandem, the limited and momentary lockup requirements ensure that the vehicle can be braked without excessive wheel lockup of the wheels, including those controlled by ABS. Even if both non-ABS-controlled wheels of the tandem lock for the duration of the stop (they meet the limited lockup requirement test), the ABS-controlled wheels would then be allowed to lock for a duration of one second or less, at speeds above 20 mph. The Agency, therefore, does not agree with the claims that the backup restrictions would prohibit ABS on some vehicles, or that they would pose practicability problems for test drivers.

NHTSA believes that AAMA's concern about problems with specifying wheel lockup restrictions is unrealistic. The Agency is unaware of any currently used antilock system that would allow wheel lockups that would not comply with the above restrictions.

Rockwell WABCO further stated that the wheel lock issue can be resolved by requiring the vehicle to remain in the 12-foot-wide lane during testing to the stopping distance requirements.

NHTSA believes that Rockwell WABCO's suggestion that the sole requirement be that a vehicle stay within a 12-foot-wide lane does not adequately take into consideration that on a smooth, flat, and straight surface, a vehicle with locked wheels might possibly stay within the lane. Accordingly, such a stop would not fully demonstrate the capability of a vehicle to provide stable stops at the limit of the vehicle's braking performance.

Several commenters recommended that the wheel lockup restrictions not be applicable to emergency system stops. AAMA recommended that wheel lockup constraints only apply to full service stops ''to avoid compromises to full system performance for the sake of partial system wheel lock.''

NHTSA agrees with these comments. In its present form, the restrictions on wheel lockup in Standard No. 121 appear in S5.3.1, and thus do not apply to the emergency stops specified in S5.7.1. The NPRM did not propose to extend those restrictions to emergency braking, and the Agency is not making such a change in this final rule.

c. Control Trailer

In the NPRM, NHTSA proposed two alternatives for testing a truck tractor in the loaded condition. The first alternative proposed the use of a braked control trailer, which would be similar to the current braked control trailer. The second alternative proposed the use of an unbraked control trailer.

AAMA, ATA, HDBMC and Rockwell WABCO supported the use of an unbraked control trailer. They believed that its use would eliminate many sources of test result variability and would produce test results that are consistent, comparable, and useful. Rockwell WABCO stated that a braked control trailer with ABS could lead to test performance variations since there are many different trailer antilock systems now available. It believed that it would be extremely difficult to define the required performance of the control trailer and the antilock system necessary to have a consistent ''test fixture'' for the stopping distance standard.

Strait-Stop objected to the use of an unbraked control trailer, stating that its use would render the stopping distance performance of the combination vehicle meaningless. Trade International Corporation (TIC) did not explicitly support either of the two control trailer alternatives, but objected to the mandated use of ''electronically controlled systems'' to the exclusion of any other type of system, for the braked control trailer ABS.

NHTSA has decided to specify the use of an unbraked control trailer to test a truck tractor in the loaded condition. The Agency notes that this decision, which is consistent with the views of most commenters, will eliminate test variability and produce test results that are consistent, comparable, and useful. Contrary to Strait-Stop's assertion, the Agency, along with most commenters, believes that the test results on unbraked control trailers provide meaningful comparative information. This is so because the stopping ability of all tractors will be evaluated in the same relative context (*i.e.*, all tractors would be mated to a similar unbraked control trailer). An unbraked control trailer is easier to standardize than a braked control trailer since there is no need to specify the foundation brakes and the antilock brake system. The section on control trailers in the stability and control final rule provides a more extensive discussion of this issue.

d. Vehicle Loading

In the NPRM, NHTSA proposed that tractors would be loaded with an unbraked control trailer, which would be loaded above the kingpin only, such that the tractor is at GVWR and the trailer's axle is at 4,500 pounds, with the tractor's fifth wheel adjusted so that the load on each axle is proportional to the axle's respective GAWR. (See alternative 2, S6.1.10.4.)

AAMA requested that the Agency add the phrase ''without exceeding the GAWR of any tractor or trailer axle.'' AAMA stated that for some vehicles, it is impossible to load the tractor to its GVWR through the kingpin without exceeding the drive axle GAWR. Due to limited fifth wheel adjustment on some vehicles, virtually all of the ballast added at the fifth wheel is borne by the tractor's rear axle, with very little transferred to the front axle.

After reviewing AAMA's comment, NHTSA has decided to amend S6.1.10.4 to include the phrase ''without exceeding the GAWR of any tractor or trailer axle.'' The Agency believes that this modification is consistent with the proposal's intent to have the loading proportional to each axle's respective GAWR. The Agency is aware that this modification will result in some tractors being tested slightly below their GVWR. However, since actual users will be similarly incapable of loading the vehicle to its GVWR without exceeding

GAWR, the reduced amount should not adversely affect motor vehicle safety.

e. Initial Brake Temperature

In the NPRM, NHTSA proposed an initial brake temperature of 250 °F to 300 °F. The Agency tentatively concluded that specifying a high brake temperature would reduce cooling time between stops and therefore allow vehicle testing to proceed faster. All the commenters that addressed this issue opposed the proposed adoption of such a high initial brake temperature.

Based on these comments and the available test data, NHTSA has concluded that an initial brake temperature of between 150 °F to 200 °F range is more appropriate than the proposed temperature range. As explained in detail in the stability and control final rule, testing using the 150 °F to 200 °F temperature range is more repeatable and results in less variation between runs, compared to testing conducted at an initial brake temperature of 250 °F to 300 °F, particularly for the emergency brake stops.

f. Emergency Stopping Distance Requirements

Although the NPRM did not propose to change the current emergency stopping distance requirements in Standard No. 121, several commenters recommended changes. AMA, ATA, Allied Signal, HDBMC, and Rockwell International recommended that the Agency eliminate the stopping distance performance requirements for a loaded truck tractor's emergency braking system when tested with an unbraked control trailer. They stated that a failed primary or a failed secondary brake system does not realistically simulate any real-world vehicle situation that can occur during a single brake system failure. They further stated that this requirement would impose extremely unrealistic loads on the functioning truck tractor brakes. AAMA stated that the emergency brake systems are not designed to stop a loaded unbraked control trailer, and that Standard No. 121 already includes a requirement in S5.7.3(c) stating that a loss of primary or secondary tractor brakes should not result in a loss of trailer brakes. Test data submitted by AAMA and Allied Signal showed stopping distances in excess of 2,000 feet for the failed primary (rear) brakes on a tractor with a loaded unbraked control trailer. The stopping test distances submitted for failed secondary (front) brakes on the tractor with a loaded unbraked control trailer were within the current requirement of 613 feet. Based on these considerations, the commenters recommended that the tractor's emergency brake system be tested in the bobtail configuration only.

After reviewing the comments and other available information, NHTSA has decided to apply the emergency brake system test for truck tractors only in the unloaded (bobtail) condition for both the failed primary and failed secondary conditions. According to test data obtained through the Agency's testing and provided by commenters, emergency brake system testing presents a unique problem for a loaded truck tractor with an unbraked control trailer. With either a primary or secondary failure of the tractor's brakes, the loaded combination would be braked only by the front axle or rear axle brakes, since the control trailer is unbraked. As a result, the stopping distances would be extremely long, particularly in the case of the failed rear brakes system. In addition, such a situation does not realistically simulate failed truck tractor systems since in real-world situations, the trailer brakes are intact.

g. Burnish Procedure

Even though this rulemaking did not address burnish procedures, AAMA and HDBMC requested that the Agency indefinitely allow using the old or the new burnish procedure as an option.

The Agency believes that the effective date for the ''new'' burnish procedure should be considered in Docket No. 70–27, Notice 33, and Docket No. 83–07, Notice 5, independently from the stopping distance effective dates.[10] Given that the industry has been aware since August 1993 that the new burnish procedures would be required after September 1994, NHTSA believes that vehicle manufacturers have had sufficient time to conduct any additional testing and to make any necessary design changes in order to meet the requirements of Standard No. 121 with the new burnish procedure. Moreover, since the new procedures have been in effect since September 1, 1994, the issue of extending the option formerly allowed is moot. Therefore, NHTSA has decided to terminate the rulemaking on the burnish issue.

[10] On August 30, 1993, NHTSA issued an interim final rule and an NPRM addressing whether the old burnish procedures should be allowed indefinitely (58 FR 45459). Optional compliance with the ''new'' procedures had been permissible since 1988 and was extended to September 1994. The Agency also proposed extending optional compliance until March 1996. The Agency requested comments about whether the new burnish procedures should become the sole specified procedures or whether the old burnish procedures should be allowed for an additional period of time.

h. Parking Brake Test

AAMA requested that the agency modify the parking brake procedure in this rulemaking by specifying an initial brake temperature of 150–200 °F, and a ''compounding technique'' for consistency of grade holding and drawbar procedures. Compounding is described as a full treadle service brake application preceding the application of the parking brakes. AAMA claimed that during its testing to respond to the stopping distance NPRMs, it realized that different manufacturers use different parking brake test procedures. Therefore, its stated reason for proposing a change is to avoid having compliance issues arise due to alleged test procedure ambiguities.

NHTSA has neither addressed this issue in the NPRM nor conducted research about compounding. Therefore, the Agency has determined that it would be inappropriate at this time to modify the Standard to specify such a compounding test procedure. If the Agency were to decide in the future that it may be desirable to amend the Standard to require this test condition, it would issue an NPRM to provide the industry and other interested parties an opportunity to comment about such a modification.

As discussed above, NHTSA has agreed to AAMA's request to specify an initial brake temperature of between 150–200 °F for the service brake performance tests. As so modified, the parking brake test procedure explicitly specifies that the parking brake test be conducted ''under the conditions of S6.1,'' which specifies the initial brake temperature for the test. Therefore, any ambiguity that allegedly results from the higher initial brake temperature is no longer present.

C. Threshold Pressure Requirement

In the NPRM, NHTSA proposed to establish a requirement for threshold pressure [11] levels of 6.0±0.5 psi for truck tractors and trailers equipped with an air brake system. The Agency tentatively concluded that such a requirement would improve the brake balance on combination vehicles and reduce the potential for vehicle instability when lightly loaded. The Agency requested comments about the need for establishing threshold pressures and whether the proposed threshold pressure and its range were appropriate and feasible.

All commenters recognized the need to improve tractor trailer compatibility

[11] ''Threshold pressure'' is the brake application pressure at which the brakes actually begin to generate braking torque.

and supported the intent of the proposed threshold pressure requirement. However, AAMA, Midland-Grau, and Rockwell opposed establishing a threshold pressure requirement until additional research could be conducted.[12] The commenters requested that the Agency not issue such a requirement until a cooperative industry and government effort can be conducted to better define the performance and safety improvements of a threshold pressure and tolerance requirement.

Most commenters believed that selecting a target threshold pressure value of 6.0 psi, which was approved by the SAE Brake Committee in 1985, would not be realistic for current combination vehicles. In addition, HDBMC stated that small differences in threshold pressure are irrelevant to whether a tractor trailer combination can achieve the prescribed stopping distances. HDBMC noted that SAE Recommended Practice J1505, ''Brake Force Distribution Test Code'' (May 1985) was developed primarily to reduce maintenance costs by improving brake drum and lining life and to enable fleets to standardize threshold pressures. It further stated that the testing conducted to establish SAE J1505 was limited to S-Cam brakes and vehicles with a GAWR of 16,000 to 20,000 pounds. S-Cam brakes on larger vehicles, wedge brakes (which have higher threshold pressures) and disc brakes were not tested.

Several commenters addressed the threshold pressure level that should be established if the Agency decided to adopt a threshold pressure requirement. Mr. Crail recommended that the tolerance range be increased from 6.0±0.5 psi to 6.0±1.0 psi to accommodate the variation in relay valves, brake chamber return springs and foundation brake return springs. AAMA stated that a tolerance for air brake components of ±3.73 psi was appropriate. Lucas suggested a tolerance of +3 psi and that the Agency should apply this tolerance to only tractor drive axles and trailer axles with 16.5 inch S-cam drum brakes. ATA recommended a tolerance of between 2 to 11 psi.

After reviewing the comments and other available information, NHTSA has decided not to establish a pressure threshold requirement at this time. The Agency notes that additional research and testing needs to be conducted on this matter since there currently is insufficient information to set a threshold pressure tolerance for combination vehicles. The brake components that affect the threshold pressure, such as internal friction in the relay valves and the return springs in the brake chamber and foundation brakes, provide a tolerance close to 4 psi. Therefore, establishing a threshold pressure requirement, even with a broad tolerance, could pose compliance problems for the industry. In addition, additional research needs to be conducted on brakes other than S-cam brakes.

NHTSA emphasizes that after additional cooperative testing is completed, a threshold pressure requirement could be proposed that would improve the braking performance of a combination vehicle, particularly at low application pressures typical of normal stops.

D. Requirements for Brake Linings

ATA and Mack Trucks requested that NHTSA issue a rule requiring replacement brake linings to be of the same quality and have the same friction characteristics as the linings used by original equipment manufacturers.

The issue of aftermarket brake linings is the subject of a separate NHTSA rulemaking action, and will not be addressed by this notice. If the Agency tentatively concludes that such requirements for aftermarket brake linings are in the interest of motor vehicle safety, then it will issue a proposal to adopt such requirements.

E. Implementation Schedule

In the NPRM, NHTSA proposed that the stopping distance requirements become effective two years after the final rule's publication.

AAMA supported the proposed effective date, provided that the agency incorporated its recommended modifications in the final rule. Rockwell recommended that the stopping distance requirements and the stability performance requirements be combined so that the effective dates for both rulemakings are concurrent. Several commenters on the stability and control NPRM, including AAMA, made the same suggestion. AAMA noted that since ABS can directly influence achievable stopping distance, it is important to optimize brake system performance by taking both stopping distance and stability into account.

On April 12, 1994, NHTSA published a supplemental notice of proposed rulemaking that proposed the following implementation schedule for both the stopping distance and lateral stability and control requirements:

Truck tractors—2 years after final rule (1996)
Trailers—3 years after final rule (1997)
Air-braked single unit trucks and buses—3 years after final rule (1997)
Hydraulic-braked single unit trucks and buses—4 years after final rule (1998).
(59 FR 17326).

The Agency reasoned that making the effective dates for the two rulemakings concurrent would promote a more orderly implementation process, avoid the need for manufacturers to redesign the brakes on individual vehicles twice, and reduce the development and compliance costs that manufacturers would face as a result of these regulations. NHTSA requested comments about the implementation schedule proposed in the supplemental notice.

As the stability and control final rule discusses in detail in the section titled ''implementation schedule,'' NHTSA has decided to adopt an implementation schedule similar to the one proposed in the SNPRM. Specifically, truck tractors manufactured on or after March 1, 1997 will have to be equipped with ABS and comply with the braking-in-a-curve test and high coefficient of friction stopping distance requirements; trailers and single-unit air-braked trucks and buses manufactured on or after March 1, 1998 will have to be equipped with ABS, and, except for trailers, comply with the high coefficient of friction stopping distance requirements; and hydraulic-braked trucks and buses manufactured on or after March 1, 1999 will have to be equipped with ABS and comply with the high coefficient of friction stopping distance requirements. The Agency has decided that these effective dates, which were widely supported by vehicle manufacturers, brake manufacturers, and safety advocacy groups, will provide for an efficient implementation of the heavy vehicle braking rulemakings.

F. Intermediate and Final Stage Manufacturers/Trailer Manufacturers

Vehicle manufacturers must certify that each of their vehicles complies with all applicable Federal motor vehicle safety standards. While this statutory certification requirement is straightforward with respect to vehicles produced by a single manufacturer, it is more complex for vehicles produced in two or more stages. With such multistage vehicles, one or more manufacturers produce an ''incomplete vehicle'' which requires further manufacturing operations by another manufacturer to become a completed vehicle. As defined in 49 CFR 568.3, an incomplete vehicle includes, at a

[12] Only Mr. Robert Crail, a brake engineer, favored adopting a requirement to improve pressure compatibility between tractors and trailers.

minimum, a frame and chassis structure, power train, steering system, suspension system, and braking system. Incomplete vehicles may be grouped in two categories: (1) Chassis-cabs (which are incomplete vehicles with fully completed occupant compartments that require only the addition of cargo-carrying, work-performing, or load-bearing components to perform their intended functions and become completed vehicles (49 CFR 567.3)) which are certified by the chassis-cab manufacturer (49 CFR 567.5), and (2) incomplete vehicles other than chassis-cabs (''non chassis-cabs''), which are not certified by the incomplete vehicle manufacturer.

The National Truck Equipment Association (NTEA) commented that manufacturers of multi-stage vehicles may not be able to demonstrate compliance with the proposed amendments because they may not be able, in all cases, to ''pass through'' the incomplete vehicle manufacturer's certification. NTEA claims that these manufacturers will not have a practicable and objective means of demonstrating compliance, since they lack the financial resources and capabilities to sponsor testing to the requirements. Therefore, NTEA suggested that the Agency exclude multi-stage vehicles from the proposed road testing requirements.

As explained below, NHTSA has concluded that the stopping distance requirements do not pose an unreasonable burden for final stage manufacturers. NHTSA is aware of the concerns of final stage manufacturers about road testing their vehicles. However, the final stage manufacturers can avoid the necessity of conducting independent testing by staying within the limits (''the envelope'') set by the incomplete vehicle manufacturer. In fact, S6 of Standard No. 121 currently provides that ''Compliance of vehicles manufactured in two or more stages may, at the option of the final-stage manufacturer, be demonstrated to comply with this standard by adherence to the instructions of the incomplete manufacturer provided with the vehicle in accordance with § 568.4(a)(7)(ii) and § 568.5 of title 49 of the Code of Federal Regulations.''[13] In the final rule adding this provision in response to the 9th Circuit's decision in *PACCAR*, the Agency stated that it provides directly in the regulation ''an alternative to road testing * * * that would constitute 'due care' in certification by any final-stage manufacturer that adopted it, whatever its resources and engineering expertise.'' (43 FR 48646, October 19, 1978.)

With respect to chassis-cabs, the name of each manufacturer in the chain of production is required to appear on one or more certification labels that are permanently affixed to the vehicle. (49 CFR Parts 567 and 568.) Under these regulations, certification of an incomplete vehicle that is a chassis-cab can ''pass through'' to the final stage manufacturer, provided that the final stage manufacturer takes the precautions necessary to ensure it does not invalidate the certification. The final stage manufacturer must ensure that it completes the vehicle without exceeding the GVWR and GAWRS assigned by the chassis-cab manufacturer, altering any brake system component, moving the center of gravity of the completed vehicle with the body installed outside the ''envelope'' of specifications provided by the chassis manufacturer, or otherwise violating that envelope. If the final stage manufacturer complies with all of the chassis-cab manufacturer's specifications, the final stage manufacturer can base its certification of compliance with the braking standard entirely upon the statement of the chassis-cab manufacturer and therefore will not have to recertify the vehicle.

The provision in S6 also applies to non-chassis-cabs, since the manufacturer of a non-chassis-cab is required to furnish documentation that indicates a means of compliance with applicable standards to intermediate or final stage manufacturers (49 CFR 568.4), and the final stage manufacturer is required to identify the incomplete manufacturer on the certification label that the final stage manufacturer places on the completed vehicle. As with chassis-cabs, the final stage manufacturer can avoid the necessity of conducting independent testing by staying within the envelope set by the incomplete manufacturer.

Based on the above considerations, the final stage manufacturer would only be required to certify compliance independently in those cases in which the final vehicle violates those specifications. NTEA commented that there are situations in which the final stage manufacturer ''must exceed the 'envelope' of restrictions provided by the chassis manufacturer due to customer specifications.'' The Agency believes that in virtually all such cases the body or equipment that is specified by the customer could be fitted on a different truck chassis having a larger ''envelope''. Moreover, when the customer has an overriding need to specify a particular truck chassis that cannot be completed with the desired body or equipment without exceeding the envelope, it is reasonable to expect the customer to bear the additional cost burden of assuring that the completed vehicle complies with the standard. In such situations, it is reasonable to require the final stage manufacturer to accept responsibility for certification, given the important safety concerns discussed below. The Agency emphasizes, however, that it is not necessary for final stage manufacturers to make this choice. They can instead select an appropriate incomplete vehicle that can be completed without departing from the envelope specified by the incomplete vehicle manufacturer.

Some of the manufacturers that build multi-stage vehicles and choose not to stay within the envelope are small businesses that may be unable to conduct their own road tests. While manufacturers must certify that their vehicles meet all applicable safety standards, this does not mean that every final stage manufacturer must independently conduct the specific tests set forth in an applicable standard. A final stage manufacturer may also certify compliance to the stopping distance standard based on, among other things, engineering analyses and computer simulations. Moreover, manufacturers need not conduct these operations themselves. They can utilize the services of independent engineers and testing laboratories. They can also join together through trade associations to sponsor testing or analysis. Finally, they can rely on testing and analysis performed by other parties, including brake manufacturers. Brake manufacturers typically perform extensive analyses and tests of their products and, in order to sell those products, have a strong incentive to provide their customers, the vehicle manufacturers, with information that can be used to certify the vehicle to the applicable brake standards. Some manufacturers of motor vehicle components currently provide this type of information to vehicle manufacturers. Based on the above considerations, NHTSA has concluded that manufacturers can certify compliance with the stopping distance requirements by means other than road testing.

Moreover, road testing to establish compliance with the braking requirements does not involve expensive and destructive crash testing, which cost $18,000 or more, not

[13] In today's **Federal Register** notice amending Standard No. 105 with respect to stopping distances of hydraulically-braked vehicles, the Agency is also modifying that Standard to include identical language about compliance by final stage manufacturers so that this concept expressly applies to hydraulic-braked vehicles manufactured in two or more stages, as well.

including the cost of the vehicle which is destroyed as a result of the test. Thus, while brake testing does involve some expense (the Agency estimates that a complete compliance test series for Standard No. 121 would cost $5,000), it should be feasible for manufacturers, including small manufacturers (especially in groups or through associations), to certify compliance, particularly since the road testing does not require destruction of their vehicles.

Furthermore, NHTSA is not authorized when establishing safety standards to differentiate between manufacturers on the basis of their size or financial resources. While the agency must ''consider whether any such proposed standard is reasonable, practicable and appropriate for the particular type of motor vehicle or motor vehicle equipment for which it is prescribed,'' (49 U.S.C. 30111(b)(3), formerly section 103(f)(3) of the Vehicle Safety Act), the legislative history of the Vehicle Safety Act reveals that any differences between standards for different classes of vehicles ''of course [are to] be based on the type of vehicle rather than its place of origin *or any special circumstances of its manufacturer*.'' S. Rept. 1301, 2 U.S. Code, Cong. & Admin. News, 2714 (1966), cited in *Chrysler Corp.* v. *D.O.T.*, 472 F.2d 659, 679 (6th Cir. 1972).

Strong policy reasons underlie Congress' refusal to differentiate between vehicles on the basis of the manufacturers' ''special circumstances.'' To protect unsuspecting members of the public from exposure to unreasonable risks posed by unsafe vehicles, there is good reason to require that every vehicle meet all ''minimum performance standards'' that are prescribed for vehicles of its type.

Moreover, the statute does not authorize NHTSA to grant permanent exemptions from safety standards to small manufacturers who otherwise would be covered by those standards. See *Nader* v. *Volpe*, 475 F.2d 916, 918 (D.C. Cir. 1973). While Nader involved a single manufacturer that sought to be permanently exempted from safety standards, its reasoning applies equally to classes of manufacturers that seek such exemptions. Although the Safety Act was amended after the Nader decision to permit small manufacturers to seek temporary exemptions from safety standards if they can demonstrate that compliance with the standard would cause them ''substantial economic hardship'' and that they have made a good faith effort to comply (49 U.S.C. 30113, formerly section 123 of the Vehicle Safety Act), Congress has severely restricted the agency's authority to grant such exemptions to very narrow, limited circumstances. NTEA is in effect seeking a permanent exemption from Standard No. 121 that the statute does not permit.

NHTSA emphasizes that there are important safety reasons that necessitate having a final stage manufacturer certify the completed vehicle if it does not stay within the envelope set by the incomplete vehicle manufacturer. For instance, if a final stage manufacturer adds additional components so that the completed vehicle's GVWR exceeds the recommended maximum GVWR weight specified in the envelope for the vehicle, the vehicle's braking performance could be adversely affected. As an example, a brake system designed to bring a 15,000 pound vehicle to a stable and short stop would obviously not be able to safely stop a 20,000 pound vehicle. Moreover, the brakes on such an underbraked vehicle would be prone to overheating. While it is relatively easy to understand the degradation in performance in such a gross example, the potential for reduced, safety-related performance also exists in situations were the ''violation'' of the envelope is much smaller. Similarly, if the center of gravity is made too high, a vehicle would likely be overbraked on its rear axle(s) and thus be prone to instability caused by wheel lockup.

NHTSA emphasizes that the kinds of crashes that result when a heavy vehicle is unable to stop to avoid another vehicle are very serious. As part of the cost effectiveness analysis contained in the Final Economic Analysis (FEA) for this final rule, the agency used 1992 GES data to identify a group of crashes involving heavy vehicles defined as ''unable-to-stop-in-time'' crashes. The agency examined these crashes and the number and severity of the resulting injuries in evaluating the impact of this regulation. One means of comparing the relative severity of various types of crashes is to ''convert'' the injuries at different levels of severity into ''equivalent fatalities'' [14] and to divide that by the number of crashes that resulted in those injuries. The resulting ratio, equivalent fatalities per crash, can be calculated for various types of crashes and compared to indicate the relative severity of different crash types. Using 1992 GES data, estimates were made of the equivalent fatalities per crash for multiple-vehicle crashes involving all types of vehicles, 0.01402 equivalent fatalities per crash, for multiple-vehicle crashes involving heavy vehicles, 0.02089 equivalent fatalities per crash, and for the ''unable-to-stop-in-time'' crashes mentioned above, 0.03634. Comparing the rates of equivalent fatalities indicate that not only are multiple-vehicle crashes involving heavy vehicles 49% more severe than all multiple-vehicle crashes, but the ''unable-to-stop-in-time'' crashes, which are the types of crashes affected by this final rule, are 159% more severe than all multiple-vehicle crashes in general. Also using 1992 GES data, the agency made separate estimates of the rate of equivalent fatalities per crash for the heavy vehicle occupants and the occupants of other involved vehicles. This was done for both multiple-vehicle crashes involving heavy vehicles and for the ''unable-to-stop-in-time'' crashes. The comparison of these rates shows that the ''unable-to-stop-in-time'' crashes are 31% more severe in terms of injuries to the heavy vehicle occupant and 79% more severe for the occupants of other involved vehicles than multiple-vehicle crashes involving heavy vehicles.

[14] The basic methodology used to convert injuries at various levels of severity into equivalent fatalities is outlined in the FEA for this final rule.

G. Costs

As explained in detail in the FEA, the costs associated with the rulemaking involve additional testing costs and hardware/equipment costs. The agency estimates the minimum initial testing costs associated with reinstating stopping distance requirements for all heavy air-braked vehicles would be about $6 million. As noted in the FEA, the estimated annual compliance testing costs in years following the effective dates of this final rule are estimated to be about $2 million. Assuming the industry continues to produce about 208,500 heavy Class 5–8 air-braked vehicles per year (which are the largest heavy vehicles and tractor trailers), the initial testing cost per vehicle would be about $29 and for later years the testing cost per vehicle would be about $10.

The hardware and equipment costs of meeting the proposed stopping distance requirements for air braked heavy vehicles are based on the anticipated improvements to heavy vehicles. The agency notes that all of the changes made to meet these requirements would affect vehicles operating in the fully loaded, or nearly fully loaded configurations.

These improvements in braking performance, which are achieved by substituting air chambers, slack adjusters and brake linings, are estimated to be necessary on about 104,000 air-braked vehicles, including both truck tractors and single-unit trucks. The average cost per vehicle of

these changes is estimated to be $50, resulting in a total cost of $5.21 million, which is the total estimated cost for vehicle modifications necessitated by this final rule.

The total estimated initial cost impact of this proposal is $11.21 million ($6.0 million in compliance test costs plus $5.21 million in vehicle modification costs), which for an estimated annual production of 208,500 air-braked equipped vehicles, is an average of about $54 per vehicle.

The total estimated outyear cost impact of this proposal is $7.21 million ($2.0 million in compliance test costs plus $5.21 million in vehicle modification costs), which for an estimated annual production of 208,500 air braked equipped vehicles, is an average of about $35 per vehicle.

VI. Rulemaking Analyses and Notices

A. Executive Order 12866 and DOT Regulatory Policies and Procedures

This rulemaking document was not reviewed under E.O. 12866. NHTSA has considered the impact of this rulemaking action under the Department of Transportation's regulatory policies and procedures. This action has been determined to be not ''significant'' under those policies and procedures.

A FEA setting forth the agency's detailed analysis of the benefits and costs of this rulemaking (along with the other rules issued today) has been prepared and been placed in the docket. This rulemaking is based on the FEA and all additional data available to the agency. The Agency estimates that reinstating the stopping distance requirements for Standard No. 121 will result in an average of approximately 3.2 lives saved per year and 84 injuries prevented per year. As mentioned above, the agency estimates that the initial annual costs attributable to these requirements are approximately $11.21 million ($6.00 million for compliance testing and $5.21 million for net equipment costs) and the outyear annual costs attributable to these requirements are approximately $7.21 million ($2.00 million for compliance testing and $5.21 million for net equipment costs).

Based on its analysis, the agency concludes that the requirements will improve safety by ensuring that all heavy vehicles are capable of stopping within a specified, safe distance. Based on information detailed in the previous section, the agency believes that implementing the stopping distance requirements for heavy vehicles will not result in significant costs since most of these vehicles currently comply with the reinstated requirements. For those vehicles that do not currently comply with the requirements, the agency believes that they could be upgraded by substituting other with currently produced braking components for those now used on these vehicles.

Since these components are not significantly more expensive than those used in poorer performing brake systems, the net cost of substituting these components will not be significant and is estimated to be about $50 for each vehicle that requires such changes.

B. Regulatory Flexibility Act

NHTSA has also considered the impacts of this notice under the Regulatory Flexibility Act. I hereby certify that this rule will not have a significant economic impact on a substantial number of small entities. There may be a small number of intermediate and final stage manufacturers that are small businesses that may be impacted by this final rule, but as discussed previously, the Agency does not believe that that impact is substantial, particularly in comparison to the possible crash-related consequences of vehicles produced by such manufacturers not complying with the rule.

C. Paperwork Reduction Act

In accordance with the Paperwork Reduction Act of 1980 (P.L. 96–511), there are no requirements for information collection associated with this rule.

D. National Environmental Policy Act

NHTSA has also analyzed this rule under the National Environmental Policy Act and determined that it will not have a significant impact on the human environment. No changes in existing production or disposal processes will result, except that there is a reduction in these factors resulting from the removal of the ALV. There will be a weight increase of a few pounds per tractor with the installation of a BPV on tractors, but such a small increase should not have any significant effect on fuel consumption. Nor should production and disposal processes have a significant adverse affect on the environment.

E. Executive Order 12612 (Federalism)

NHTSA has analyzed this rule in accordance with the principles and criteria contained in E.O. 12612, and has determined that this rule will not have significant federalism implications warranting the preparation of a Federalism Assessment.

F. Civil Justice Reform

This final rule does not have any retroactive effect. Under 49 U.S.C. 30103, whenever a Federal motor vehicle safety standard is in effect, a State may not adopt or maintain a safety standard applicable to the same aspect of performance which is not identical to the Federal standard, except to the extent that the State requirement imposes a higher level of performance and applies only to vehicles procured for the State's use. 49 U.S.C. 30161 sets forth a procedure for judicial review of final rules establishing, amending or revoking Federal motor vehicle safety standards. That section does not require submission of a petition for reconsideration or other administrative proceedings before parties may file suit in court.

List of Subjects in 49 CFR Part 571

Imports, Motor vehicle safety, Motor vehicles, Rubber and rubber products, Tires.

In consideration of the foregoing, this notice amends Standard No. 121, Air Brake Systems, in Title 49 of the Code of Federal Regulations at Part 571 as follows:

PART 571—[AMENDED]

1. The authority citation for Part 571 continues to read as follows:

Authority: 49 U.S.C. 322, 30111, 30115, 30117, and 30166, delegation of authority at 49 CFR 1.50.

§ 571.121 [Amended]

2. Section 571.121, is amended by removing the undesignated text following paragraph (g) in S3; in S4 by adding the definition for ''Wheel lockup;'' by revising S5.3.1, S5.3.1.1, and Table II; by deleting S5.3.2, S5.3.2.1, and S5.3.2.2; by reserving S5.3.2, and by revising S5.7.1 to read as follows:

* * * * *

Wheel lockup means 100 percent wheel slip.

* * * * *

S5.3.1 *Stopping distance—trucks and buses.* When stopped six times for each combination of vehicle type, weight, and speed specified in S5.3.1.1, in the sequence specified in Table I, each truck tractor manufactured on or after March 1, 1997 and each single unit vehicle manufactured on or after March 1, 1998 shall stop at least once in not more than the distance specified in Table II, measured from the point at which movement of the service brake control begins, without any part of the vehicle leaving the roadway, and with wheel lockup permitted only as follows:

(a) At vehicle speeds above 20 mph, any wheel on a nonsteerable axle other than the two rearmost nonliftable, nonsteerable axles may lock up, for any duration. The wheels on the two rearmost nonliftable, nonsteerable axles may lock up according to (b).

(b) At vehicle speeds above 20 mph, one wheel on any axle or two wheels on any tandem may lock up for any duration.

(c) At vehicle speeds above 20 mph, any wheel not permitted to lock in (a) or (b) may lock up repeatedly, with each lockup occurring for a duration of one second or less.

(d) At vehicle speeds of 20 mph or less, any wheel may lock up for any duration.

Table I.—Stopping Sequence

1. Burnish.
2. Stops with vehicle at gross vehicle weight rating:
   (a) 60 mph service brake stops on a peak friction coefficient surface of 0.9, for a truck tractor with a loaded unbraked control trailer, or for a single-unit vehicle.
   (b) 30 mph service brake stops on a peak friction coefficient surface of 0.5, for a truck tractor with a loaded unbraked control trailer.
   (c) 60 mph emergency brake stops on a peak friction coefficient surface of 0.9, for a single-unit vehicle. Truck tractors are not required to be tested in the loaded condition.
3. Parking brake test with vehicle loaded to GVWR.
4. Stops with vehicle at unloaded weight plus up to 500 lbs.
   (a) 60 mph service brake stops on a peak friction coefficient surface of 0.9, for a truck tractor or for a single-unit vehicle.
   (b) 30 mph service brake stops on a peak friction coefficient surface of 0.5, for a truck tractor.
   (c) 60 mph emergency brake stops on a peak friction coefficient surface of 0.9, for a truck tractor or for a single-unit vehicle.
5. Parking brake test with vehicle at unloaded weight plus up to 500 lbs.
6. Final inspection of service brake system for condition of adjustment.

S5.3.1.1 Stop the vehicle from 60 mph on a surface with a peak friction coefficient of 0.9 with the vehicle loaded as follows: (a) loaded to its GVWR, (b) in the Bobtail configuration (truck-tractors only) plus up to 500 pounds, and (c) at its unloaded vehicle weight (except for a truck tractor) plus up to 500 pounds (including driver and instrumentation). If the speed attainable in two miles is less than 60 mph, the vehicle shall stop from a speed in Table II that is 4 to 8 mph less than the speed attainable in 2 miles.

TABLE II.—STOPPING DISTANCE

[In feet]

Vehicle speed in miles per hour	Service brake				Emergency brake	
	PFC 0.9 (1)	PFC 0.9 (2)	PFC 0.9 (3)	PFC 0.9 (4)	PFC 0.9 (5)	PFC 0.9 (6)
20	32	35	38	40	83	85
25	49	54	59	62	123	131
30	70	78	84	89	170	186
35	96	106	114	121	225	250
40	125	138	149	158	288	325
45	158	175	189	200	358	409
50	195	216	233	247	435	504
55	236	261	281	299	520	608
60	280	310	335	355	613	720

Note: (1) Loaded and unloaded buses; (2) Loaded single unit trucks; (3) Unloaded truck tractors and single unit trucks; (4) Loaded truck tractors tested with an unbraked control trailer; (5) All vehicles except truck tractors; (6) Unloaaded truck tractors.

* * * * *

S5.7.1 *Emergency brake system performance.* When stopped six times for each combination of weight and speed specified in S5.3.1.1, except for a loaded truck tractor with an unbraked control trailer, on a road surface having a PFC of 0.9, with a single failure in the service brake system of a part designed to contain compressed air or brake fluid (except failure of a common valve, manifold, brake fluid housing, or brake chamber housing), the vehicle shall stop at least once in not more than the distance specified in Column 5 of Table II, measured from the point at which movement of the service brake control begins, except that a truck-tractor tested at its unloaded vehicle weight plus up to 500 pounds shall stop at least once in not more than the distance specified in Column 6 of Table II. The stop shall be made without any part of the vehicle leaving the roadway.

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Issued on: March 1, 1995.

Ricardo Martinez, M.D.

Administrator.

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49 CFR Part 571

[Docket No. 93–07; Notice 3]

RIN 2127–AE21

Federal Motor Vehicle Safety Standards; Stopping Distance Requirements for Vehicles Equipped With Hydraulic Brake Systems

AGENCY: National Highway Traffic Safety Administration (NHTSA), Department of Transportation.

ACTION: Final rule.

SUMMARY: This final rule establishes stopping distance performance requirements in Standard No. 105, Hydraulic Brake Systems, for trucks,