less than 80 inches in overall width need not be equipped with a high-mounted stoplamp.

S4.1.1.14 Each high-mounted stoplamp shall have an effective projected luminous area not less than 4½ square inches. The signal from the lamp shall be visible through a horizontal angle from 45 degrees to the left to 45 degrees to the right. To be considered visible, the lamp shall provide an unobstructed projected illuminated area of outer lens surface of at least 2 square inches in extent, measured at an angle of 45 degrees to the longitudinal axis of the vehicle.

S4.1.1.15 Each high-mounted stoplamp shall be energized during the final 10 minutes of the vibration test specified in SAE J575e and shall continue to provide illumination upon completion of the test.

5. New paragraphs S4.3.1.8 and S4.3.1.9 would be added to read:

S4.3.1.8 Each high-mounted stoplamp shall have an edge-to-edge separation distance from a stoplamp, tail lamp or turn signal lamp not less than 10 inches when projected on a vertical plane perpendicular to the longitudinal axis of the passenger car.

Alternative 1

S4.3.1.9 Each high-mounted stoplamp shall be mounted not less than 34 inches above the road surface:

(a) If practicable, outside the passenger car with the center of the lamp within 3 inches of the outside bottom edge of the rear window daylight opening, or

(b) If compliance with paragraph (a) of this section is not practicable, inside the passenger car with the center of the lamp not more than 3 inches above the inside bottom edge of the rear window daylight opening and with means provided to minimize reflections inside the vehicle from the light upon the rear window glazing, or

(c) If compliance with neither paragraph (a) nor (b) of this section is practicable, outside the passenger car with the center of the lamp within 3 inches of the outside top edge of the rear window daylight opening.

Aternative 2

S4.3.1.9 Each high-mounted stoplamp shall be mounted inside or outside the passenger car with the center of the lamp not less than 34 inches and not more than 50 inches above the road surface, and not more than 3 inches below the bottom or above the top of the rear window daylight opening. If the lamp is mounted inside the vehicle, means shall be provided to minimize reflections inside the vehicle from the light upon the rear window glazing.

Alternative 3

S4.3.1.9 Each high-mounted stoplamp shall be mounted:

(a) If practicable, outside the passenger car with its center not less than 38 inches above the ground surface and within 3 inches of the bottom of the rear window daylight opening; or

(b) If compliance with paragraph (a) of this section is not practicable, inside the passenger car with its center as near as practicable to 38 inches above the road surface, and with means provided to minimize reflections inside the vehicle from the light upon the rear window glazing.

6. Paragraph S4.5.4. would be revised to read:

S4.5.4 The stoplamp on each vehicle, and the high-mounted stoplamp on each passenger car, shall be activated upon application of the service brakes.

7. The final clause of the first sentence of paragraph S5.1 would be revised to read:

S5.1 * * *, for high-mounted stoplamps, stoplamps, tail lamps, and turn signal lamps designed to conform to respectively, SAE Recommended Practice J186a, and SAE Standards J586c, J585d/J585e, J588e.

Interested persons are invited to submit comments on the proposal. It is requested but not required that 10 copies be submitted.

All comments must be limited not to exceed 15 pages in length. Necessary attachments may be appended to these submissions without regard to the 15 page limit. This limitation is intended to encourage commenters to detail their primary arguments in a concise fashion.

If a commenter wishes to submit certain information under a claim of confidentiality, three copies of the complete submission, including purportedly confidential information, should be submitted to the Chief Counsel, NHTSA, at the street address given above, and seven copies from which the purportedly confidential information has been deleted should be submitted to the Docket Section. Any claim of confidentiality must be supported by a statement demonstrating that the information falls within 5 U.S.C. section 552(b)(4), and that disclosure of the information is likely to result in substantial competitive damage; specifying the period during which the information must be withheld to avoid that damage; and showing that earlier disclosure would result in that damage. In addition, the commenter or, in the case of a corporation, a responsible corporate official authorized to speak for the corporation must certify in writing that each item for which confidential treatment is requested is in fact confidential within the meaning of section 552(b)(4) and that a diligent search has been conducted by the commenter or its employees to assure that none of the specified items has previously been disclosed or otherwise become available to the public.

All comments received before the close of business on the comment closing date indicated above will be considered, and will be available for examination in the docket at the above address both before and after that date. To the extent possible, comments filed after the closing date will also be considered. However, the rulemaking action may proceed at any time after that date, and comments received after the closing date and too late for consideration in regard to the action will be treated as suggestions for future rulemaking. The NHTSA will continue to file relevant material as it becomes available in the docket after the closing date, and it is recommended that interested persons continue to examine the docket for new material.

Those persons desiring to be notified upon receipt of their comments in the rules docket should enclose, in the envelope with their comments, a self addressed stamped postcard. Upon receiving the comments, the docket supervisor will return the postcard by mail.

The engineer and lawyer primarily responsible for this proposal are Marx Elliott and Taylor Vinson.

(Secs. 103, 119, Pub. L. 89-563; 80 Stat. 718 (15 U.S.C. 1392, 1407; delegations of authority at 49 CFR 1.50 and 501.8)

Issued on December 31, 1980.

Michael M. Finkelstein,

Associate Administrator for Rulemaking.

[FR Doc. 81-368 Filed 1-7-81; 8:45 am]

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49 CFR Part 571

[Docket No. 1-11; Notice 8]

Federal Motor Vehicle Safety Standards; Rear Underride Protection

AGENCY: National Highway Traffic Safety Administration (NHTSA).

ACTION: Notice of proposed rulemaking.

SUMMARY: This notice proposes to amend 49 CFR Part 571 by adding a new safety standard, entitled "Rear Underride Protection." This standard is proposed in response to a petition for rulemaking filed by the Insurance Institute for Highway Safety (IIHS). The proposed standard specifies

performance requirements for underride protective devices on most trucks and trailers that have gross vehicle weight ratings (GVWR's) greater than 10,000 pounds. The new standard would reduce the number of deaths and injuries which occur when cars and other vehicles collide with and slide under the rear ends of trucks and trailers. This would be accomplished by reducing the likelihood of underride in a way that minimizes the crash forces to which the occupants of these small vehicles are subjected.

DATES: The proposed effective date is September 1, 1983. Comments must be received on or before April 8, 1981.

ADDRESSES: Comments should refer to the docket and notice numbers and be submitted to: Docket Section, National Highway Traffic Safety Administration, Room 5108, Nassif Building, 400 Seventh Street SW., Washington, D.C. 20590. (Docket Room hours: 7:45 a.m.–4:15 p.m.)

FOR FURTHER INFORMATION CONTACT: Mr. John Tomassoni, Office of Vehicle Safety Standards, National Highway Traffic Safety Administration, Nassif Building, 400 Seventh Street SW., Washington, D.C. 20590. Telephone: (202) 426–2242.

SUPPLEMENTARY INFORMATION:

Background

The safety standard proposed in this notice deals with the problem of rear underride, a problem that has been the concern of the Department of Transportation, the trucking industry, and the public for more than twenty years. Rear underride involves the front of a car or other small vehicle sliding under and colliding with the rear end of a truck or trailer. Underride occurs because the rear end of the struck vehicle is relatively high off the ground and there is too little structure under the rear end to resist the striking vehicle or the structure present is not strong enough to accomplish that purpose. Underride occurs to some extent in most collisions in which a passenger car crashes into a truck rear end. This kind of crash typically results in sustantial damage to the smaller vehicle and injury to the car occupants. In 1978, 500 deaths or more than one (1) percent of all traffic fatalities occurred in collisions involving a vehicle and a heavy truck rear end. Three hundred and thirty-eight (338) of these fatalities were occupants of passenger cars. Sometimes when a car underrides a truck, the rear end of the truck body crashes through the windshield and penetrates the passenger compartment of the automobile. In those cases, the underride is considered "excessive."

Deaths in accidents involving excessive underride usually result from severe head and upper body injuries. It has been estimated that excessive underride occurs in 30–40 percent of the fatal accidents in which passenger cars crash into truck rear ends.

Federal attempts to deal with the problem of rear underride date back to the early 1950's. The initial effort was a regulation, 49 CFR 393.86, *Rear End Protection*, which was established by the Bureau of Motor Carriers of the Interstate Commerce Commission (now the Bureau of Motor Carrier Safety (BMCS) of the Federal Highway Administration) in 1953. This regulation, which is still in effect today, requires most heavy motor vehicles to have a rear end device designed to help prevent underride. It applies to trucks and trailers that are manufactured after December 31, 1952, and that are used in interstate commerce. The rule provides that the ground clearance of the underride guard shall not exceed 30 inches when the vehicle is empty. The device must "be located not more than 24 inches forward of the extreme rear of the vehicle." The guard must be sufficiently wide so that its ends are not more than 18 inches inboard from either side. The regulation further requires that the device "be substantially constructed and firmly attached."

The National Highway Traffic Safety Administration (NHTSA) initiated its rulemaking efforts to improve underride protection for passenger car occupants in 1967. The agency had tentatively determined that a better regulation was needed because of the continuing problem of fatalities and serious injuries occurring in accidents involving excessive underride, and because of the absence of efforts by the vehicle manufacturers generally to go sufficiently beyond the BMCS requirement. In 1969, a rule was proposed that would have required all new trucks and trailers having gross vehicle weight ratings (GVWR's) greater than 10,000 pounds to have rear end protection devices. The ground clearance of the device was not to exceed 18 inches when the vehicle was unloaded. The strength of the device was to be demonstrated by a static test of 75,000 pounds applied with a 4" x 4" test block at the center of the device and 15 inches inboard from either side. The load requirement was subsequently lowered to 50,000 pounds, to be applied with a 4" x 12" test block at any point between the outermost sides of the guard. The displacement of the device was not to exceed 15 inches from the rearmost part of the vehicle.

In 1971, after evaluating cost and accident data and reviewing all information received in response to the notices, NHTSA terminated those rulemaking efforts. The Administrator of the agency concluded that the safety benefits achievable with the particular type of underride guard then contemplated would not be commensurate with the cost of implementing the standard. The agency had estimated that the proposed rule would save 50–100 lives per year at an annual cost to the consumer of $500,000,000. Most of the implementation costs estimated by NHTSA were related to the increase in guard weight which it thought was necessary to meet the proposed requirements.

Efforts to improve underride protection resumed in 1977, after the Auto-Truck Crash Safety Hearing was held by Senator Wendell H. Ford. This hearing was the direct result of a program conducted by the Insurance Institute for Highway Safety (IIHS) in 1976. This program focused on the problem of preventing excessive underride. IIHS performed five tests in which passengers cars were crashed into the rear of a typical semi-trailer van. Two of the tests involved prototype guards developed by IIHS. These guards were essentially rigid. (A rigid guard is one that can withstand a load impact in excess of 100,000 pounds without permanently deforming.) They were lightweight and built with diagonal struts which transmitted the collision forces from the guard bumper to the airframe of the van. These tests demonstrated that high strength underride guard structures can prevent excessive underride with little additional weight.

As a result of the Oversight Hearing and of the petition for rulemaking subsequently filed by IIHS, the Department of Transportation decided to reexamine the problem of rear underride. BMCS and NHTSA jointly initiated a program to explore achieving improved rear end protection through further regulation. An advance Notice of Proposed Rulemaking (ANPRM) was issued on August 29, 1977 (42 Fed. Reg. 43414), and comments were solicited. Many comments were received from manufacturers of trucks and truck equipment, shippers, and the general public. Most of the commenters were in favor of increased underride protection. The question of what vehicles (if any) should be exempted from the guard requirement was that issue most frequently raised. Many of the commenters expressed concern about the effect of an underride device on trucks or trailers equipped with hydraulic tailgates, on-off road vehicles, and other specialized units. The ground clearance and width of the guard were frequently discussed. Most commenters said that the ground clearance of the device should be in the range of 24 to 30 inches, and that the width of the guard should be the same as the width of the vehicle. Another issue that was raised repeatedly in the comments was the strength of the underride guard. Commenters suggested load limits of anywhere from 23,000 to 50,000 pounds.

As parts of this joint program, NHTSA and BMCS let contracts for two research projects. BMCS engaged the Texas Transportation Institute of Texas A&M University (TTI) to develop underride guards that are low cost but are practical and provide effective protection from underride. NHTSA engaged Dynamic Sciences, Inc. (DSI) to develop compliance test procedures. It was intended that these joint contract efforts would generate sufficient data to support a rule applicable to all non-exempt vehicles with GVWR's greater than 10,000 pounds. Vehicles moving in intrastate and interstate commerce would be affected.

The research contracts focused on preventing excessive underride primarily through use of a rigid guard having a low ground clearance. This approach was similar to that followed by IIHS in its 1976 test program. The tests performed by TTI and DSI demonstrated what the IIHS program had shown earlier: that excessive underride could be prevented with rigid guards.

However, these tests further demonstrated that rigid guards increase the deceleration forces experienced by car occupants in a crash and thus increase the risk of injury due to hazards other than underride. Restrained dummies placed in passenger cars that were crashed into the rigid guards at collision speeds of 35 mph or more experienced injury responses that are not within the ranges allowable under FMVSS No. 208. This is significant because accident statistics indicate that at present, most accidents in which a passenger car collides with a heavy vehicle rear end are survivable. Data further indicate that a majority of the fatalities which do occur take place in accidents that do not involve excessive underride.

DSI also tested a production underride device that is typical of guards currently available to and purchased by truck and trailer manufacturers in the American market ("current guards"). This guard was not able to prevent small cars from excessively underriding test trailers at collision speeds above 30 mph. In these tests, the dummies experienced injury responses that are not within the permissible limits of FMVSS No. 208. When small cars were crashed into current guards, the guards did not fail, i.e., did not permanently deform in some manner. In tests of large cars at 30 mph, underride was excessive in offset collisions but not when the collision was centric. Occupant injury responses were within the allowable limits of FMVSS No. 208 in these tests of large cars, and in all tests the guards did not fail. Occupant responses were also within the permissible ranges of Standard No. 208 when the large car was crashed into the guard at 40 mph. However, in this test underride was excessive, and the guard was permanently deformed.

In addition, the TTI program tested a hydraulic energy-absorbing guard manufactured by Quinton-Hazell Automotive Ltd. (Quinton-Hazell). (An energy-absorbing guard is one that dissipates the energy of the impact in a controlled manner.) The Quinton-Hazell device was very effective both at preventing excessive underride, reducing occupant injury responses, and reducing damage to the colliding vehicle.

TTI also conducted two tests in which passenger vehicles were crashed into a van that had no guard but whose adjustable rear wheels were set in the rearmost position. The purpose of these tests was to determine the effectiveness of rear tandems as an underride deterrent. The tests demonstrated that the rear wheels, when placed at the extreme rear of the truck or trailer, prevent excessive underride at approximately 35 mph. Further, the restrained dummies used in these tests experienced injury responses that are within the allowable limits of FMVSS No. 208.

To gain further insight into the consequences of guard design, NHTSA then performed a comparative engineering risk analysis. This analysis used a car crash simulation model to determine the relative effectiveness of different underride guards. The model, known as the Underride Crash Analysis Model (UCAM), was used to simulate the crash of an automobile into the rear end of a heavy duty commercial vehicle equipped with an underride guard. The output of UCAM was then used as input into the Risk Analysis Model (RAM). RAM computes the probability of a serious or fatal injury to restrained and unrestrained occupants under a variety of conditions which include car size, speed of the automobile, the position of the rear wheels on the truck or trailer, and occupant free travel distance. (Occupant free travel distance is the distance that an occupant travels from his or her seating position to his or her point of impact with the vehicle interior.) The algorithm used in the RAM to calculate the overall risk of injury under each set of conditions was designed to incorporate the effects of those parameters which have a significant impact on the level of injury suffered by unrestrained and restrained occupants. For unrestrained occupants, the most important parameters are the extent to which the car underrides the truck and the velocity of the occupants with respect to the compartment itself. For restrained occupants, the significant parameters are the extent of underride and the combination of the relative velocity and the level of acceleration experienced by the occupants. For a given set of conditions describing a crash, the UCAM provides the RAM with values of these parameters for the simulated occupants. The RAM then uses these values and a postulated functional relationship describing the effect of each on the risk of serious injury to compute the overall risk of serious injury to the occupants of the automobile.

This analytical procedure is explained in further detail in "Procedure for Determining the Risk of Injury to Passenger Car Occupants Involved in Rear End Collisions with Heavy Vehicles," a report prepared by Automated Science Group, Inc., "Factors Influencing the Risk of Injury in Passenger Car and Other Vehicle Collisions with Heavy Truck Rear End," by Conrad Cooke, and an SAE publication titled "An Approach to Developing Underride Guard Requirements for Improved Occupant Protection" (SAE No. 801422). These documents have been placed in the docket.

The objective of the analysis was to learn which type of guard provides the best *overall* protection for passenger car occupants. The analysis did not concentrate (as the earlier test programs had done) solely on determing which guard most effectively prevented excessive underride. The guards analyzed included rigid, energy-absorbing, moderate strength, and current guards. (A moderate strength guard is one that will permanently deform when subjected to a load of approimately 45,000 pounds.) The extent of occupant injury in truck rear end crashes in which there is no underride guard whatsoever was also analyzed. The effectiveness of each guard was analytically quantified by determining the risk of injury rated 3 or above on the

Abbreviated Injury Scale (AIS), which covers the range of injuries from serious to fatal. The results of the risk analysis showed that energy-absorbing guards provide the best overall protection for car occupants in accidents in which cars crash into the rear ends of trucks. Conventional guards presently on the market provide the least protection. Moderate strength guards, although not as good as rigid guards in reducing the risk of excessive underride, produced an overall risk of injury for both restrained and unrestrained occupants which was approximately the same as that of the rigid guard. The performance of the moderate strength guard was reasonably comparable to the energy-absorbing guard.

The Proposed Rule

In light of the IIHS, TTI, and DSI test programs and the comparative risk analysis, the agency is proposing to mandate the use of underride guards that are at least as strong as moderate strength guards. The NHTSA's objective in developing the proposed rule was to maximize overall occupant protection while minimizing cost and effect on trucking operations. The details of the rule were modeled on existing European Economic Community (EEC Directive 79/490/EEC) and Swedish regulations, which basically mandate an underride guard capable of withstanding a load of 45,000 pounds on the vertical support members combined. This harmonization of the proposed standard and European requirements is consistent with the Trade Agreements Act of 1979.

The proposed rule would apply to most trucks and trailers having GVWR's greater than 10,000 pounds, primarily to vans and platform trailers whose ground clearance at the rear of the vehicle is greater than 55 cm. As set out in paragraph S3, truck tractors, "low chassis" vehicles, and "wheels back" vehicles would be exempted. A "low chassis" vehicle is a truck or trailer having a chassis which extends behind the rearmost point on the rear tires and whose lower surface at the rear of the chassis meets the configurational requirements for underride guards that are specified in the rule. It is contemplated that vehicles such as moving vans that have low beds would be exempted by this provision. To qualify as a "wheels back" truck or trailer under the proposed rule, the rear axle must be permanently fixed and the rearmost part of the tires on that axle must be not more than 30 cm (11.8 inches) from the rear extremity of the vehicle. (The "vehicle rear extremity" is defined in the rule as the rearmost point on the vehicle that is more than 55 cm above the ground. Protrusions such as taillights, hinges, and latches are excluded from this determination.) Truck tractors, low chassis vehicles, and wheels back vehicles are exempted from the proposed requirements because the rear end structure of these vehicles is an adequate underride deterent. "Special purpose" vehicles are also exempted in paragraph S3. A "special purpose" vehicle is a truck or trailer having work-performing equipment that is located at the lower rear of the vehicle and whose function would be significantly impaired if an underride guard meeting the requirements of this standard were attached to the vehicle. Trucks or trailers equipped with well-drilling rigs or fertilizer, salt or sand spreaders are examples of special purpose vehicles. Finally, the proposed rule does not apply to pole trailers. The agency believes that requiring underride guards on such vehicles would provide little benefit to car occupants. Since the poles carried by these trailers usually overhang the back end of the vehicles for a considerable distance, the danger of underride is due not to the structure of the trailer but to the structure of the cargo.

The proposed standard sets out certain configuration requirements in paragraph S5.1. The width, height, ground clearance and longitudinal placement of the guard are specified. The ground clearance of the proposed device must not exceed 55 cm (21.65 inches) at any point along its full width.

This maximum clearance point was chosen for two reasons. First, the guard must be low enough to engage at least some part of the engine in a small car if the guard is to prevent excessive underride. The beds of most heavy trucks and trailers without guards have a ground clearance of roughly 48 inches. On virtually every passenger car on the road today, the height of the hood at the front of the vehicle in the center is between 30 and 35 inches. If the guard on an unloaded vehicle has a clearance of 30 inches, it will barely engage the hood edge of today's cars when they are not braking. This is the ground clearance of the underride device mandated by BMCS Regulation 393.86. If there is braking during the impact, a guard with a ground clearance of 23 inches will engage the engine of 50 percent of the cars on the road today. A guard with a ground clearance of 22 inches will engage the engine of virtually all of today's cars if there is no braking. Such a guard will engage the engine of most vehicles even if braking takes place.

Second, the guard clearance must be sufficiently high so that normal trucking operations such as TOFC (Trailer On Flat Car) and RO-RO (Roll On-Roll Off) are not restricted. ("Roll On-Roll Off" is a trucking operating in which trailers are driven on board a ship that is used to transport the trailers to their destination at which point the trailers are driven off.) A 15-degree departure angle is considered the minimum for trailers to clear ramps and obstacles. If the center of a vehicle's rear tandem axles are fixed more than 6.5 feet from a guard having a ground clearance considerably less than 22 inches, the vehicle will most likely have difficulty negotiating ramps.

In light of these factors, a maximum ground clearance of 21.65 inches (55 cm) was chosen. The agency believes that this clearance point adequately balances both considerations. NHTSA strongly encourages truck and trailer manufacturers to place underride guards as low as possible on a particular vehicle design. At low speeed, damage to the impacting vehicle is minimized if the underride guard engages the bumper of the car. The front bumpers of automobiles are currently required to have a ground clearance of 16-20 inches.

The width of the proposed guard is specified in paragraph S5.1.1. The guard must be wide enough to ensure engagement of the colliding vehicle even if the impact is off-center. An offset collision might occur if the driver of the passenger car were attempting to take an evasive maneuver before the crash. The agency believes that the width it specifies in the proposed standard satisfies this concern. Under paragraph S5.1.1, the underride device must be wide enough that its outermost edges are within 10 cm (3.94 inches) of the outermost sides of the vehicle. This requirement must be met at a height not greater than 55 cm. By specifying the maximum height at which the width measurement can be made, the rule assures that the guard is sufficiently wide at heights that are adequate to prevent excessive underride. Because of the possibility of offset collisions, the guard would also have to be continuous across the back of the vehicle. Thus in paragraph S5.1.1, the rule requires that the device be laterally continuous at a height of 55 cm or less.

The cross sectional height of the proposed guard is set forth in paragraph S5.1.3. At any point across the full width of the device, the cross sectional height of the guard must be at least 10 cm (3.94 inches). The agency believes that this minimum size requirement will ensure that the underride device engages a significant amount of the passenger car's structure.

Paragraph S5.1.4 of the proposed standard specifies the longitudinal placement of the guard on the truck or trailer. For maximum protection of car occupants, the underride device should be as close to the rear of the vehicle as possible. The proposed rule dictates that the guard be placed not more than 30 cm (11.8 inches) from the rear extremity of the truck or trailer. This measurement is to be made longitudinally from the rear extremity of the vehicle to any point along the full width of the device at a height of 55 cm or less.

The strength requirements of the rule are set forth in paragraph S5.2. The standard requires that the guard as installed be capable of withstanding separately applied loads without being displaced more than a specified distance. The loads are intended to prove the integrity of the attachments and main structural members of the device. A static test is used because of cost and ease of performance. Three load values are specified in the rule. A force (P_1) of 50,000 Newtons (11,240 pounds) is to be applied to the guard at a position of 30 cm (11.8 inches) inboard from either the right or left side of the vehicle. Then P_2, a force of 50,000 Newtons, is to be applied to the lateral center of the device. These two load forces are designed to test the strength of the underride guard near its outermost edges and at its center. P_1 ensures that the device will provide adequate protection in an offset collision. P_2 will determine whether the horizontal part of the underride device is strong enough to withstand the collision and to transmit the impact's force to the vertical struts. P_3, a force of 100,000 Newtons (22,480 pounds), is to be applied at any point within a range of 35 to 50 cm (13.8 to 19.7 inches) from either side of the vehicle longitudinal axis. This force must be applied successively to either side of the guard at the same distance from the vehicle longitudinal axis. P_3 is designed to test the strength of the vertical struts. The total applied load of 45,000 pounds ensures that the guard is at least moderately strong.

When the loads are applied by the load block, the guard cannot deflect forward more than 40 cm (15.7 inches), as measured longitudinally from the extreme rear of the vehicle to the center of the load block face plane. The measurement must be made during the force application when the specified force level is reached. The maximum displacement of 40 cm permits energy-absorbing guards (such as the hydraulic Quinton-Hazell device) to be used while ensuring that the device does not deflect so far that it fails to resist underride adequately. NHTSA realizes that the proposed rule permits guards to deflect as much as 40 cm, while wheels back vehicles must have the rearmost part of the tires on the rear axle no more than 30 cm from the vehicle rear extremity. However, the agency believes that permitting the use of the energy-absorbing guards that need this extra distance to operate effectively justifies the discrepancy.

The proposed rule specifies that a new, untested guard is to be used for each test. This is the procedure that the agency will follow in performing its compliance tests. However, a manufacturer is not required to follow this procedure in determining in the exercise of due care whether his guard complies with the proposed rule. Thus, a manufacturer may test a particular underride guard more than once. However, the agency believes that in doing so the manufacturer may be subjecting his guard to requirements that are more stringent than those set out in the rule. As long as a manufacturer acts with due care, he can certify that his underride devices comply with the standard based on analytical means also. In making that analysis, the manufacturer must be certain that the design takes into account normal manufacturing variations so that his guards will comply with the standard when they are tested by the agency.

In preparing the proposed test procedure, the agency gave consideration to the techniques suggested in previous research work, the techniques used by various manufacturers, and suggestions provided by manufacturing associations. Special attention was given to the procedures employed in the EEC regulation. Some of the features of this EEC standard were found to be appropriate for the proposed rule (as evidenced by the testing and the comparative risk analysis), and they were accordingly incorporated in the regulation. These features include the magnitude of the P_3 load requirement, the geometrics of the load applications, and the guard configurational requirements. The test procedures employed in the proposed standard, however, differ from those found in the EEC rule in several important respects.

First, the EEC regulation allows the test block to articulate. The rule does not set forth any specifics about the nature of the articulation; it merely states that the articulation must be "suitable." In failing to specify the magnitude of the articulation, the location of the joint with respect to the contact surface, etc., the EEC standard fails to control significant variables in the test procedure that can have significant effects on the test results. As a result, the agency has tentatively concluded that the EEC test procedure should not be followed on this point. In the interests of simplicity, NHTSA has further tentatively concluded that the test block used in the test procedure should be prevented from articulating.

Second, the load to be applied to the center and outer edges of the horizontal member of the device was raised from approximately 5,000 pounds to 11,240 pounds. NHTSA increased the load limit because the agency believes that 5,000 pounds is an inadequate test. Finally, the EEC requirements permit the loads to be applied to be directly proportional to the GVWR of the vehicle up to a specified load value. The agency believes that direct proportionality is inappropriate, because the forces generated in collisions of passenger cars and heavy vehicles are essentially the same for all vehicles having a GVWR greater than 10,000 pounds. The EEC requirements would allow vehicles with GVWR's less than 25,000 pounds to use guard structures that have a lower load capacity than that of current guards. As a result, NHTSA has tentatively decided not to follow the EEC regulation on this point.

Alternatives to the Proposed Rule

In developing the proposed rule, several alternatives were considered and tentatively rejected. One possible alternative that was urged by IIHS was to require the use of the rigid guard. NHTSA has tentatively rejected this option for two reasons. First, while rigid guards are excellent at preventing excessive underride, they increase the deceleration forces experienced by car occupants in a crash, and thus increase the risk of injury due to hazards other than underride. As noted above, this is significant because it appears from accident statistics that most crashes of passenger cars into the rear ends of trucks and trailers do not now result in fatalities. A majority of those crashes that do result in deaths do not involve excessive underride.

Second, rigid guards that are lightweight have diagonal support members which tend to restrict rearward slider movement. (A sliding undercarriage or a slider is a mechanism that permits the rear wheels of a trailer to be positioned in various locations along the longitudinal axis of the vehicle. The slider is positioned by carriers to achieve a preferred balance between regulated maximum axle load and maneuverability as necessary.) This was true of the underride devices used by IIHS in their test program. Because restricting slider motion causes payload displacement, these rigid guards are more expensive to use. Great Dane Trailers, Inc. contends that for every foot of slider restriction, 1720 pounds of payload are displaced.

The agency has tentatively decided not to require energy-absorbing guards such as the hydraulic Quinton-Hazell device. This energy-absorbing guard is commercially available and is in service today in Europe. As evidenced by the TTI tests and the comparative risk analysis, hydraulic guards are very effective both at preventing excessive underride and at reducing occupant injury responses. Despite their apparent advantages, NHTSA will not mandate the use of energy-absorbing underride devices at this time because the agency feels that they are heavy and costly to use. Also, developing test procedures for energy-absorbing guards would require further study on the part of the agency. However, by permitting the guard to deflect as much as 40 cm during the force applications, the proposed rule allows manufacturers to put energy-absorbing guards on their vehicles if they so desire. Such guards which are able to move during normal trucking operations may be attractive to manufacturers desiring to reduce damage potential due to docking impacts and obstacle engagement. NHTSA encourages the use of energy-absorbing guards in light of their ability to mitigate injuries, as evidenced by the testing and the risk analysis.

Another possible solution to the underride problem that was considered by the agency is applying BMCS Regulation 393.86, *Rear End Protection*, to all trucks and trailers having GVWR's greater than 10,000 pounds. This option, however, was tentatively rejected for two reasons. First, as noted above, that rule permits underride guards to have a ground clearance as high as 30 inches. Guards with a clearance that high will barely engage the engine of most passenger cars in a rear end collision. Second, the BMCS regulation as written does not set forth specific, objective load requirements for underride guards. The rule requires only that "the bumpers or devices * * * be substantially constructed and firmly attached." The BMCS standard thus does not insure that all underride devices are at least minimally capable of preventing excessive underride.

In developing the proposed rule, NHTSA also considered the possibility of eliminating rear overhang by requiring back wheels to be located at the extreme rear of the vehicle. As shown in the TTI tests, the rear wheels when located in the extreme aft position provide good protection against excessive underride. Further, the restrained dummies used in these tests experiences injury responses that were within the allowable limits of FMVSS No. 208. The wheels back option also has some cost advantages. First, it negates the need for an underride guard. Second, it requires the rear wheel assembly to be permanently fixed on trucks and trailers. Vehicles so equipped are generally lower in weight and cost than vehicles equipped with a slider. Despite these advantages, the agency has tentatively decided to exempt "wheels back" vehicles from the standard instead of mandating that design for all vehicles. This would have the effect of making the use of the wheels back design an optional method of compliance. NHTSA has decided not to require the rear wheels to be fixed in the extreme aft position because such a requirement eliminates the flexibility provided by the slider. Since the wheels back design places an operational burden on the user, NHTSA has decided not to mandate its use.

One option that the agency is still considering is making the rear ends of heavy trucks and trailers more conspicuous through the use of lights, reflective tape, etc. The cost of this option is estimated at $80 to $200 per vehicle. NHTSA continues to study this option as a requirement in addition to the proposed standard.

NHTSA stresses that the requirements set forth in the proposed rule are *minimum* requirements. If adopted, truck and trailer manufacturers and owners would be able to place any type of underride guard—rigid, energy-absorbing, moderate strength, etc.—on their vehicle that meets the requirements of the rule. In light of the results of the risk analysis, however, the agency suggests that manufacturers interested in guards stronger than moderate load design consider using hydraulics or other means to absorb energy rather than merely making the guards more rigid.

Under the proposed rule, truck owners would be able to use hinged guards if they so desire. Such underride devices may enable truck operators to avoid the operational difficulties that might be caused in some situations by a standard guard. Comment is requested whether, assuming that hinged guards are permitted by the final rule, such guards could be expected to be properly positioned and secured on vehicles whenever those vehicles are used on public roads and highways.

Costs and Benefits of the Proposed Rule

The agency has analyzed the costs and benefits of the proposed rule as mandated by Executive Order No. 12221. A regulatory evaluation was done and has been placed in the public docket. Copies are available from the Docket Section at the address given above. NHTSA estimates that the proposed requirements could have prevented as many as 60 fatal injuries per year, if they had been fully implemented in the period from 1977 to 1979. An even greater number of serious injuries would have been prevented. This is the benefit anticipated for passenger car and light truck occupants. In light of the increasing number of vehicles on the road and the trend toward smaller cars, it is expected that the number of lives saved and injuries avoided in the future will be even greater. It is estimated that the proposed rule would apply to 339,000 trucks and trailers a year according to 1978 statistics. about 85% of these vehicles would carry guards presently on the market in the absence of the requirements proposed today. The aggregate cost of the guard installation is estimated at $9.890 million for heavy trucks per year and $8.840 million per year for trailers. The cost of installing the proposed device is expected to be on the average $50 more per guard than the cost of installing current guards. It is estimated that today's guards weigh approximately 60 pounds and cost the consumer about $35 per guard. It is expected that the proposed guard will weigh 100 pounds and wil lcost the consumer around $85. An added fuel cost of about $500,000 per year at today's fuel prices is projected for the entire fleet of about 339,000 affected vehicles. The penalty for payload displacement is calculated at $15,000 for the fleet.

The Problems Presented by Hydraulic Tailgates and Small Manufacturers

One question repeatedly raised in the comments filed in response to the ANPRM was whether mandating an underride guard would prevent truck owners from installing and using hydraulic tailgates. The agency anticipates that many vehicles with these tailgates will fall within the special purpose vehicle exemption provided in paragraph S3. However, NHTSA believes that this issue warrants further study, and encourages interested parties to file comments on this topic. The agency is particularly interested in hearing the views and reviewing the designs of manufacturers of hydraulic tailgates that are compatible with the proposed guard.

Another issue of concern to the agency in developing the proposed rule was the problems of small manufacturers. NHTSA is aware that compliance with new safety standards can be very expensive for a manufacturer who has limited resources. The agency realizes that there may be particular concern about the ability of small manufacturers to use and certify sophisticated hydraulic or other energy-absorbing guards. NHTSA believes, however, that small manufacturers would be able to comply with the proposed rule at a reasonable cost and without the use of sophisticated guards. Underride devices that meet the proposed requirements resembling commercial guards of today can be readily designed. Such a guard can be fabricated totally from commercially available components with cut and weld procedures. Static tests as contemplated by the proposed standard would be relatively cheap and easy to perform. If a small manufacturer does not have the staff or facilities to perform the compliance tests, he could contract out the work, or simply reproduce a sample of the frame rails used on his vehicles and test that sample with his underride device. Another option for the small manufacturer would be to purchase underride guards from a component manufacturer who has already done the compliance testing, and install the devices on his vehicles in a manner instructed by the component manufacturer to ensure certification. Therefore, NHTSA believes that small manufacturers would not experience significant problems in meeting the proposed requirements. However, the agency encourages comments on this issue.

Leadtime Requirements

The proposed effective date for the rule is September 1, 1983. The agency realizes that small manufacturers and final stage assemblers will need sufficient time to develop or purchase guards that comply with the rule. NHTSA is also aware of the concerns of large manufacturers, who will need adequate time to develop guards for the variety of vehicle models they produce. However, the agency believes that a leadtime of approximately two years is sufficient because designing and producing the proposed guard requires only marginally more effort than that required to produce and install conventional guards available today. NHTSA invites comments on the proposed leadtime, but emphasizes that claims for a longer leadtime must be substantiated.

Comments

Interested persons are invited to submit comments on the proposed rule. It is requested but not required that ten (10) copies be submitted.

All comments must be limited to 15 pages in length. Necessary attachments may be appended to these submissions without regard to the 15 page limit. This limitation is intended to encourage commenters to detail their primary arguments in a concise fashion.

If a commenter wishes to submit certain information under a claim of confidentiality, three copies of the complete submission, including purportedly confidential information, should be submitted to the Chief Counsel, National Highway Traffic Safety Administration, at the street address given above, and seven copies from which the purportedly confidential information has been deleted should be submitted to the Docket Section. Any claim of confidentiality must be supported by a statement demonstrating that the information falls within 5 U.S.C. 552(b)(4), and that disclosure of the information is likely to result in substantial competitive damage; specifying the period during which the information must be withheld to avoid that damage; and showing that earlier disclosure would result in that damage. In addition, the commenter or, in the case of a corporation, a responsible corporate official authorized to speak for the corporation must certify in writing that each item for which confidential treatment is requested is in fact confidential within the meaning of section 552(b)(4) and that a diligent search has been conducted by the commenter or its employees to assure that none of the specified items has previously been disclosed or otherwise become available to the public.

All comments received before the close of business on the comment closing date indicated above will be considered, and will be available for examination in the Docket Room at the above address both before and after that date. To the extent possible, comments filed after the closing date will also be considered. However, the rulemaking action may proceed at any time after that date. Comments received after the closing date and too late for consideration in regard to the proposed action will be treated as suggestions for future rulemaking. NHTSA will continue after the closing date to file relevant material in the docket as it becomes available. It is recommended that interested persons continue to examine the docket for new material.

Those persons desiring to be notified upon receipt of their comments should enclose, in the envelope with their comments, a self-addressed stamped postcard. Upon receiving the comments, the docket supervisor will return the postcard by mail.

The requirements and procedures proposed in this notice may be altered in any rule that might be forthcoming, in response to comments and further agency analysis.

The engineer and attorney primarily responsible for the development of this notice are John Tomassoni and Joan M. Griffin, respectively.

(Secs. 103, 119, Pub. L. 89–563, 80 Stat. 718 (15 U.S.C. 1392, 1407); delegation of authority at 49 CFR 1.50)

Issued on December 30, 1980.

Michael M. Finkelstein,

Associate Administrator for Rulemaking.

In consideration of the foregoing, it is proposed that Part 571 be amended by adding § 571.2——, *Rear Underride Protection* (49 CFR 571.2——), as set forth below:

§ 571.2—— Standard No. 2——, Rear Underride Protection.

S1. *Scope.* This standard establishes rear underride protection requirements for heavy vehicles.

S2. *Purpose.* The purpose of this standard is to reduce the number of deaths and serious injuries occurring in rear underride accidents that involve heavy vehicles.

S3. *Applicability.* This standard applies to trucks and trailers that have gross vehicle weight ratings (GVWR's) greater than 10,000 pounds. It does not apply to truck tractors, pole trailers, wheels back vehicles, low chassis vehicles, or special purpose vehicles.

S4. *Definitions.*

"Low chassis vehicle" means a truck or trailer having a chassis which extends behind the rearmost point on the rear tires and whose rear lower surface meets the configurational requirements for underride guards specified in S5.1.1 and S5.1.2. The "chassis" is the load-supporting frame on a truck or trailer, exclusive of any appurtenances which might be added to accommodate cargo.

"Rear extremity" means the rearmost point on a vehicle that falls above a horizontal plane located 55 cm (21.65 inches) above the ground when the vehicle is loaded to its GVWR and when the vehicle's cargo doors, tailgate, or other permanent structures are positioned as they normally are when the vehicle is being driven. Nonstructural protrusions such as taillights, hinges and latches are excluded from the determination of the rearmost point.

"Side extremity" means the outermost point on the sides of the vehicle that falls vertically above a horizontal plane located 55 cm (21.65 inches) above the ground and horizontally between a transverse vertical plane tangent to the vehicle rear extremity and a transverse vertical plane located 30 cm (11.8 inches) forward of that plane when the vehicle is loaded to its GVWR. Nonstructural protrusions such as taillights, hinges, and latches are excluded from the determination of the outermost point.

"Special purpose vehicle" means a truck or trailer having work-performing equipment that is located at the lower rear of the vehicle and whose function would be significantly imparied if an underride guard meeting the requirements of this standard were attached to the vehicle.

"Wheels back" vehicle is a vehicle having a permanently fixed rear axle. The rearmost part of the tires on that axle is not more than 30 cm (11.8 inches) from a transverse vertical plane tangent to the rear extremity of the vehicle.

S5. *Requirements.* Each vehicle shall be equipped with an underride guard that complies with the requirements of S5.1 and S5.2.

S5.1. *Configuration* (see Figure 1).

S5.1.1. The outermost edges of the underride guard shall be located within 10 cm (3.94 inches) of longitudinal vertical planes tangent to the side extremities, when measured transversely at a height of 55 cm or less. The underride guard shall be laterally continuous at a height of 55 cm or less.

S5.1.2. The vertical distance between the lower surface of the underride guard and the ground shall not exceed 55 cm (21.65 inches) at any point along the full width of the device when the vehicle is unloaded but has its full capacity of fuel and its tires are inflated in accordance with the vehicle manufacturer's recommendations.

S5.1.3. The cross sectional height of the underride guard shall not be less than 10 cm (3.94 inches) at any point across the full width of the device.

S5.1.4. The rearmost surface of the underride guard shall be located not more than 30 cm (11.8 inches) forward of a transverse vertical plane tangent to the rear extremity of the vehicle when measured longitudinally to any point across the full width of the underride guard at a height of 55 cm or less.

S5.2. *Strength.* When the underride guard of the vehicle is subjected to any of the force levels specified in S6.6(a) Test 1 and S6.6(b) Test 2 in accordance with the procedures and conditions specified in S6, the guard should not deflect so as to permit the center point on the contact surface of the test block specified in S6.5 to travel longitudinally forward more than 40 cm (15.7 inches) from the rear extremity of the vehicle.

S6. *Test conditions and procedures.*

S6.1. The vehicle is unloaded but has its maximum capacities of engine fuel, oil and coolant.

S6.2. The tires are inflated in accordance with the vehicle manufacturer's recommendations.

S6.3 The vehicle is placed on level ground.

S6.4. Restrain the vehicle so that it remains in place during the tests. No restraints are placed on the vehicle rearward of the centerline of the rearmost axle. The methods used to restrain the vehicle do not impair the movement of the underride guard or the test block specified in S6.5 during the testing.

S6.5. The test block used for determining compliance with S5.2 is a rectangular solid made of rigid steel. It is 20 cm (7.9 inches) ±1 mm in height and 20 cm (7.9 inches) ±1 mm in width. One of the 20 cm by 20 cm ends of the block is used as the contact surface. Each edge of the contact surface has a radius of curvature of 5±1 mm.

S6.6. Using the test block, subject the underride guard to the tests specified in paragraphs (a) and (b) of this section, as shown in Figure 2. An underride guard that has not been subjected to either of the tests is used for each test.

(a) Test 1. Apply a force (P_1) of 50,000 Newtons (11,240 pounds) to the guard 30 cm (11.8 inches) inboard of the longitudinal vertical plane tangent to the outermost point on the sides of the vehicle (either the right or the left side), and then apply a force (P_2) of 50,000 Newtons (11,240 pounds) to the same guard where it intersects the longitudinal vertical plane passing through the vehicle longitudinal axis.

(b) Test 2. Apply a force (P_3) of 100,000 Newtons (22,480 pounds) to the guard at any point not less than 35 cm (13.8 inches) and not more than 50 cm (19.7 inches) to the left of the longitudinal vertical plane passing through the vehicle longitudinal axis, and then apply the same force to the same guard at the point located at the same distance to the right of that plane.

S6.7. At the beginning of each force application, the test block is located as specified in paragraphs (a) through (c) of this section.

(a) The contact surface of the test block is touching the underride guard.

(b) The center point of the contact surface is located:

(1) In the same longitudinal plane as the point specified in S6.6; and

(2) In the horizontal plane which is tangent to the lowest point on the underride guard in the longitudinal vertical plane specified in paragraph (b)(1) of this section.

(c) The longitudinal axis of the test block and of the mechanism which propels the test block are parallel to the vehicle longitudinal axis.

S6.8. Each of the forces specified in S6.6 is reached in not less than one minute and not more than two minutes by increasing the application of force at a constant rate.

S6.9. During each force application, the longitudinal axis of the test block and the mechanism which propels the test block remain parallel to the vehicle longitudinal axis and at the same distance from that axis and the ground as at the beginning of the force application.

S6.9. When the force specified in S6.6 is initially reached, measure the distance which the center point of the test block contact surface has traveled longitudinally forward from the rear extremity of the vehicle.

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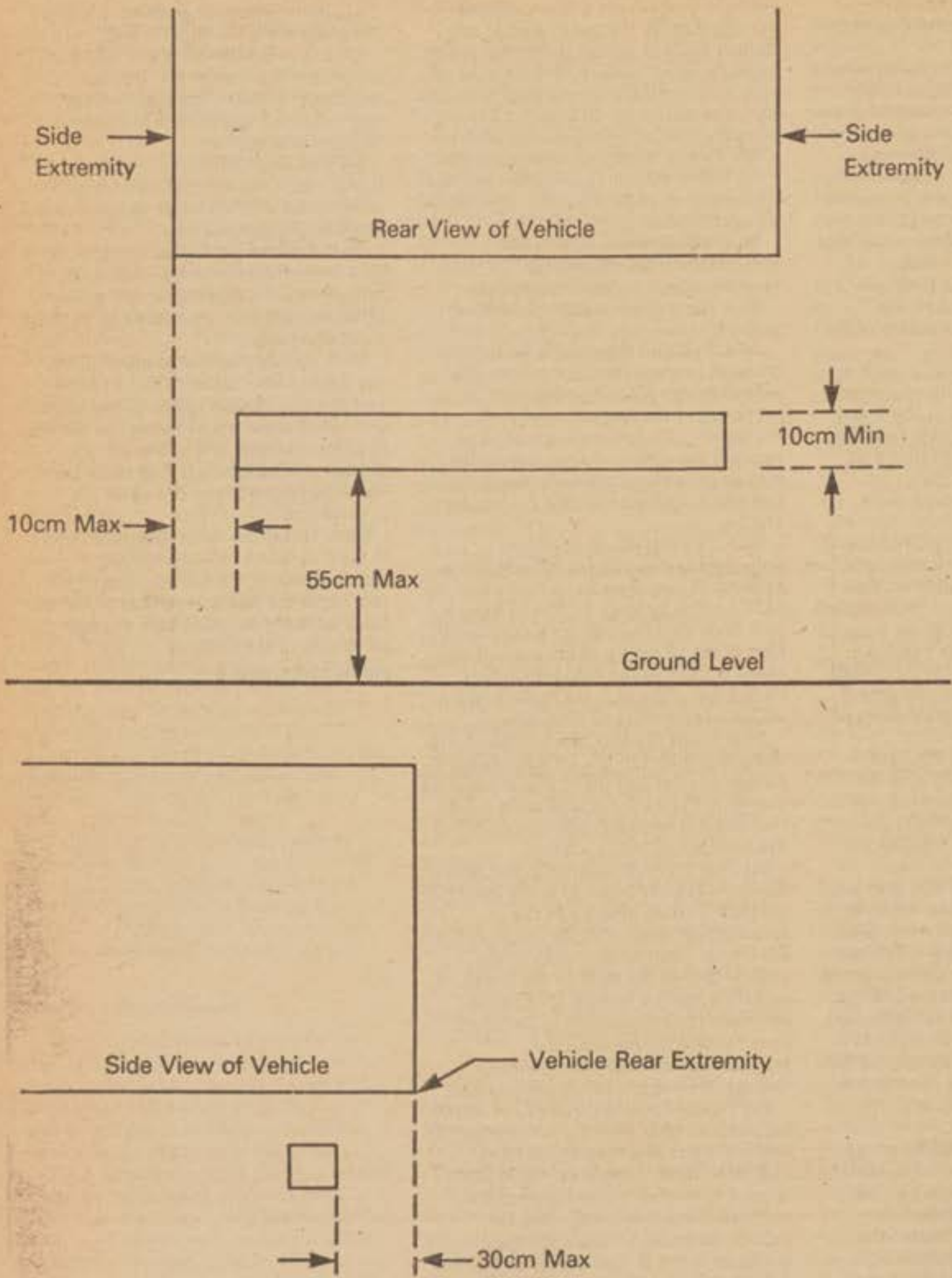

Figure 1
Configuration Requirements

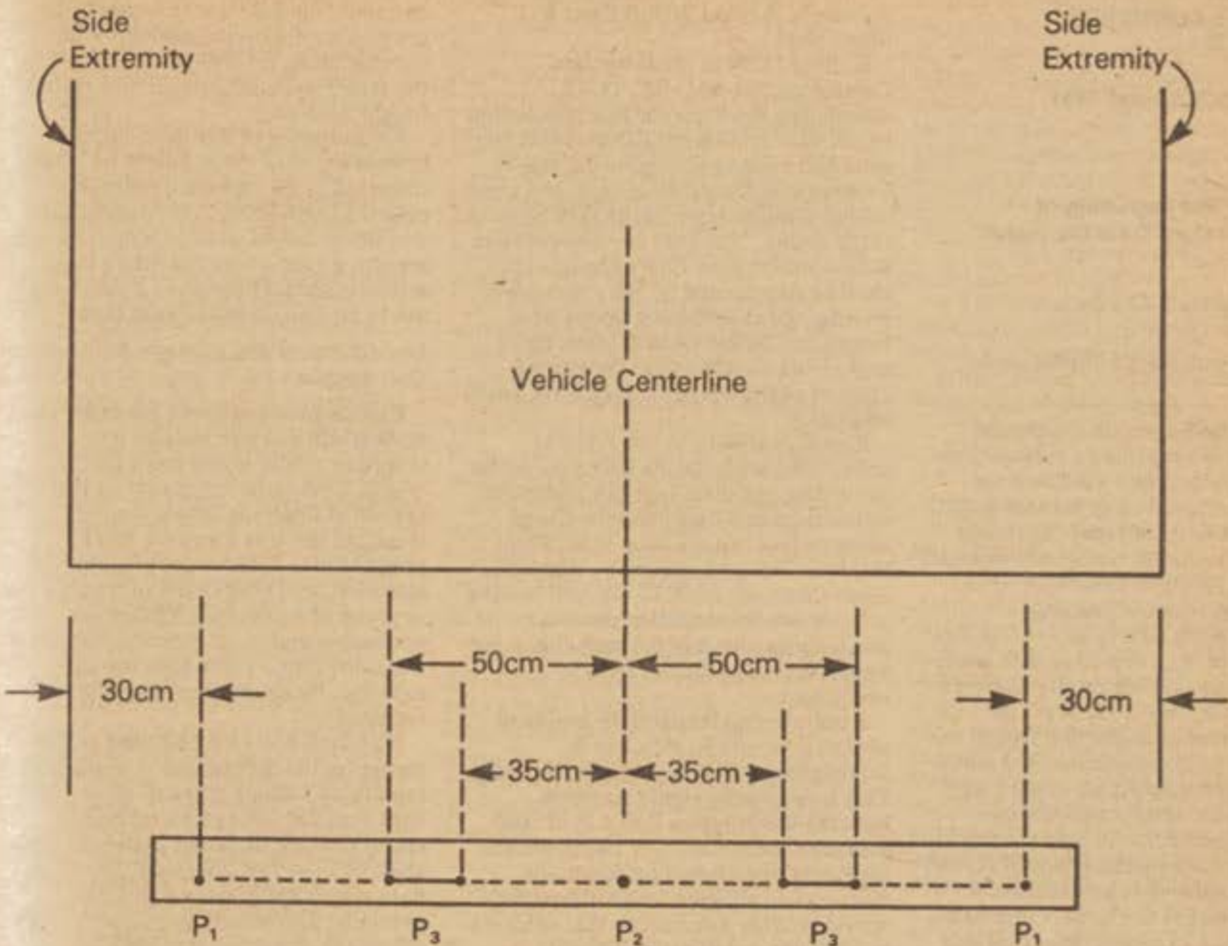

Figure 2
Performance Requirements

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