

braked straight trucks and two hydraulic-braked buses, all equipped with ABS, were used in the tests to aid in determining if the braking-in-a-curve performance test for tractors should be applied to single-unit vehicles. The vehicles were subjected to all the requirements of Standards No. 105 and No. 121, including the braking-in-a-curve performance tests.

The braking-in-a-curve tests began with the determination of a maximum drive-through speed, followed by the determination of the maximum brake-through speed. As defined in Standard No. 121, "maximum drive-through speed" is the fastest constant speed that a vehicle can be driven through at least 200 feet of curve arc length without departing the lane. "Maximum brake-through speed" is defined as the fastest speed at which a full brake application can be made while the vehicle is in the curve, without the vehicle departing the lane. Determination of the maximum brake-through speed provided data on the potential margin of compliance or non-compliance for the test vehicles.

In the agency's testing, both trucks and school buses were tested in loaded-to-GVWR and lightly loaded conditions. The trucks were ABS equipped chassis-cabs without bodies or equipment that would normally be installed by a second-stage manufacturer. However, to simulate the lightly loaded condition of completed vehicles, a 2,500 lb load frame with an integrated roll bar was installed on the chassis cabs. Trucks tested in the loaded-to-GVWR condition were weighted to their GVWRs, with the axle loads in proportion to their GAWRs. Two ABS equipped school buses were also tested in loaded-to-GVWR and lightly loaded conditions. The loaded-to-GVWR tests on the school buses were conducted with sand bags placed on the floor and seats so the total vehicle weight was equal to its GVWR, with axle loads in proportion to their GAWRs.

The braking-in-a-curve tests were conducted on a low friction wetted surface. The test curve had a 12-foot-wide lane with a 500-foot radius of curvature (marked from the center of the lane). Traffic cones were placed on both sides of the lane at 20-foot intervals. The surface had a cross slope of one percent and approximately zero longitudinal slope. The peak coefficient of friction (PFC) of the surface during the time of the testing ranged from 0.34 to 0.41. The effect of the cross slope was such that the test condition was considered to be worst case, since it may not be possible to conduct all road testing on a completely level road surface, due to variability and water run-off design

requirements. The lower end of the PFC range was also considered to be a worst-case test condition.

The results of the testing at VRTC indicated that the braking-in-a-curve test is practicable, repeatable, and safe for single unit vehicles. Six of the seven vehicles tested met the performance requirements now in effect for tractors, *i.e.*, they stayed in the lane in at least three out of four stops when subjected to maximum braking at 75 percent of the maximum drive-through speed. In fact, these six vehicles remained in the lane during all four stops at 75 percent of the drive-through speed, all with a large margin of compliance.

III. Notice of Proposed Rulemaking

On December 21, 1999, the agency published a notice of proposed rulemaking in the **Federal Register** (64 FR 71377) containing the agency's proposal for a braking-in-a-curve test for single-unit trucks and buses. NHTSA proposed that the braking-in-a-curve test be conducted in two different conditions: with the vehicle lightly loaded, and with the vehicle loaded-to-GVWR. The agency proposal also specified the same road test geometry now in effect for tractors, namely a 12-foot-wide lane with a 500-foot radius measured at the center of the lane with the test surface having a peak friction coefficient (PFC) of 0.5. The proposal also specified that the test speed is 75 percent of the maximum drive-through speed or 30 mph, whichever is lower. The brake pedal force specification proposed in the notice called for a pressure of 150 pounds to be achieved at the brake pedal within 0.2 seconds from the initial application and maintained for the duration of the stop. The proposal specified that the brake temperature at the time of testing is to be between 150 and 200° F and the test performed with the transmission in neutral or the clutch pedal depressed. Finally, the agency proposal specified that in 3 of 4 consecutive stops, the test vehicle is to remain in the 12 foot wide marked lane when tested in both the lightly loaded condition and when loaded-to-GVWR in proportion to each GAWR.

Since the braking-in-a-curve test is one brake test in a test sequence, the agency proposed that the braking-in-a-curve test for air-braked single-unit trucks and buses be conducted immediately after the burnish procedure as indicated in Table I of Standard No. 121, with the loaded-to-GVWR tests followed by the lightly loaded tests. We also proposed that the braking-in-a-curve test for hydraulic-braked single-unit trucks and buses be conducted

immediately after the post-burnish brake adjustment in S7.4.2.2, with the loaded-to-GVWR tests followed by the lightly loaded tests.

In order to provide manufacturers with sufficient lead time to comply with the proposed requirements, the proposal indicated that the effective date for the braking-in-a-curve test requirements, for both air and hydraulic-braked single unit trucks and buses, be two years after publication of the final rule in the **Federal Register**.

IV. Public Comments

NHTSA received comments about its proposal from vehicle and brake manufacturers as well as safety and trade groups. Three vehicle manufacturers, DaimlerChrysler Corporation (DaimlerChrysler), Ford Motor Company (Ford) and Mitsubishi Motors R&D of America Incorporated (Mitsubishi), submitted comments. Comments were also received from Haldex Brake Products Corporation (Haldex), Bendix Commercial Vehicle Systems (BCVS) and Bosch Braking Systems Corporation (Bosch). Several trade associations, National Truck Equipment Association (NTEA), Heavy Duty Brake Manufacturers Council (HDBMC), American Trucking Associations (ATA) and Truck Manufacturers Association (TMA), offered their views. One safety group, Advocates for Highway Safety (Advocates), submitted comments as well.

With the exception of TMA and NTEA, the commenters generally supported the agency proposal. However, many of the commenters argued that requiring that the braking-in-a-curve test be run in both the loaded-to-GVWR and lightly loaded conditions was unnecessary and that the lightly loaded test alone was sufficient. In addition, a number of commenters indicated dissatisfaction with the proposed test sequence and some of the proposed test conditions. Other commenters indicated their belief that the agency's proposal underestimated the compliance burdens that the proposal, if adopted, would impose on final stage manufacturers and alterers.

One commenter addressed what it believed to be shortcomings in the configuration of the test curve. Advocates stated that the proposed test configuration—a zero longitudinal slope, 500-foot continuous curve radius, 12-foot wide lane and one percent side slope—does not approach worst-case real-world operating condition. In addition to criticizing the severity of the test, Advocates viewed the proposed test as not sufficiently demanding and