hot stop test slightly to maintain the same relationship to the cold effectiveness stop.

JAMA and Toyota recommended that the stopping distance for the hot performance test be lengthened to 90 meters. Similarly, Ford requested that the stopping distance be lengthened to 93 meters. In contrast, Advocates objected to the proposed increase in stopping distance from 80 meters in the NPRM, to 86 meters in the 1987 SNPRM, to 89 meters in the 1991 SNPRM. It stated that the increased stopping distances will result in the hot performance test being less likely to evaluate fade since brakes will remain cooler.

After reviewing the available information, NHTSA has decided to specify a stopping distance for the hot performance test of 89 meters, as proposed in the 1991 SNPRM. The agency believes that this stopping distance requirement will ensure adequate braking capability during and after exposure to high brake temperatures caused by prolonged or severe use. The first hot stop is done with a pedal force not greater than the average pedal force recorded during the shortest GVWR cold effectiveness test. The stopping distance for the first hot stop must be less than or equal to the distance corresponding to 60 percent of the deceleration actually achieved on the shortest GVWR cold effectiveness stop. The second hot stop is done with a pedal force not greater than 500N, and the stopping distance on at least one of the two stops must also be less than or equal to 89 m or 0.10V+0.0079V². The agency notes that the results of the second stop may only be used to satisfy the 89 m stopping distance requirement, and not the 60 percent requirement.

In response to Advocates, JAMA, Toyota, and Ford, NHTSA notes that throughout this rulemaking, the hot performance stopping distance has always been determined by a formula based on a constant percentage of the deceleration rate for the cold effectiveness stop, and as the latter was changed, so was the former. Accordingly, the stopping distance proposed in the 1991 SNPRM served to retain the same relationship to the cold effectiveness test. None of the commenters presented compelling reasons why that philosophy should be abandoned.

Ford, GM and MVMA expressed concern about the proposed pedal force test conditions for the hot performance stops. GM stated that the proposed pedal force levels may make it difficult to comply with the stopping distance requirement. GM requested that the agency adopt a pedal force limitation of 500 N (112 lbs.) for both hot stops. Ford recommended using a constant pedal force corresponding to approximately 90 percent in the cold effectiveness deceleration.

NHTSA has decided not to modify the test conditions with respect to pedal force for these tests. The purpose of the hot performance test is to determine how much the stopping performance of the vehicle will be degraded as the result of the brakes being heated, as might happen during a mountain descent or severe stop-and-go driving. The hot performance is measured against two separate criteria. First, the vehicle must attain a specific minimum level of absolute performance. Second, it must attain a specified percentage of the performance actually achieved in the "cold" condition, as measured by the cold effectiveness test, even if that performance was significantly higher than required. In order to determine compliance with the latter requirement, the performance in the hot performance test is compared to the performance of the brakes in the cold effectiveness test. In order for that comparison to be meaningful, the test conditions for the two tests should be as close to identical as possible.

For the cold effectiveness test, the test conditions are that the pedal force must not exceed 500N (112 pounds), and the wheels must not lock for more than 0.1 second. There are two different methods of conducting this test. European testers usually use a constant pedal force throughout any given test run. This constant pedal force is increased in subsequent runs, until the point of wheel lockup is reached, or the constant force reaches the 500N limit, whichever occurs first. In the U.S., testers generally apply an initial "spike" of pedal force, up to the point where the 500N limit is reached or a "chirp" is heard, indicating the start of wheel lockup, and then the driver "backs off" on pedal force to the point where the wheels do not stay locked. The "U.S." method generally produces a slightly shorter stopping distance, but either method is allowed as long as neither limitation (500N or wheel lockup) is violated.

For the hot performance test, the ideal situation would be to exactly duplicate the input (pedal force vs. time curve) from the cold effectiveness test, so the outputs (stopping distances) from the two tests can be compared. If the constant pedal force method has been used for the cold effectiveness test, that is relatively easy to do. If the "U.S." method has been used, however, the input is impossible to duplicate exactly. In order to accommodate both methods of testing, FMVSS No. 135 specifies that the pedal force for the first hot stop is to be not greater than the average pedal force recorded on the best cold effectiveness test run. The agency is aware that this test condition does not ensure that the input from the cold effectiveness test will be duplicated exactly. However, it is an objective test condition, and government and industry experts who have discussed this subject in numerous GRRF ad hoc meetings have not been able to come up with a better approach. Accordingly, unless and until the European and United States industry can agree on a replacement procedure, NHTSA believes it would be inappropriate to modify the requirements.

Ford commented that the mean pedal force requirement left a loophole that would allow ABS equipped vehicles to apply the full 500 N pedal force in the cold effectiveness test and again in the first hot stop. It believed that this would mask the hot versus cold performance.

NHTSA notes that although the situation described by Ford is theoretically possible, it is highly unlikely that a manufacturer would use this "loophole" to build a vehicle with poor hot performance characteristics. The agency notes that such a brake system design would create too great a likelihood that the ABS would allow lockup of greater than 0.1 seconds or that the vehicle would have problems passing the high speed effectiveness or failed-ABS tests.

Ford and Chrysler recommended that only one of the two stops be required to meet the performance requirements. Chrysler stated that the second stop is only run because of test driver uncertainty during the first stop. It cited problems caused by the need for the test driver to obtain the maximum performance from the brake system that, at the end of the heating snubs, has unknown performance requirements. Chrysler believed that if the first stop is invalidated because of wheel lock or driver hesitation, the driver should be permitted to use this knowledge in the second stop.

Chrysler's assertion that the second stop is only run because of test driver uncertainty during the first stop is untrue. The reason a second stop is needed is that there are two separate requirements to be satisfied: a comparison with cold effectiveness performance and a minimum level of absolute performance. The first stop provides the comparison with cold performance, because the pedal force is limited to the average pedal force applied on the best cold effectiveness stop. In most cases, stopping