Allowing momentary wheel lockup during compliance testing will not affect a vehicle's real world ability to lock or not lock its wheels. Rather, this provision merely acknowledges that momentary lockup may inadvertently occur during compliance testing due to road surface irregularities, as test drivers attempt to achieve the shortest stops possible. Therefore, this provision ensures that entire test runs are not invalidated due to such an occasional occurrence.

NHTSA also notes that while Advocates claimed that the proposal to permit momentary lockup during stops represents "a significant modification of the current FMVSS No. 105 test procedure" whose real-world safety implications are unknown, FMVSS No. 105 in fact generally permits lockup of one wheel during stopping distance tests. The provision being adopted today thus represents a more stringent test condition, not a less stringent one.

In response to Bendix's comment, the momentary lockup is not a situation that a driver is supposed to detect and respond to; it is simply an allowance for a minor, inadvertent occurrence during testing. Therefore, Bendix's request to permit a longer lockup period is not necessary or appropriate.

Honda and Ford recommended that S7.2.1(f) be changed to define wheel lock as an angular velocity of zero, rather than the current definition of 10 percent of vehicle speed. They reasoned that it would be difficult to read the definite value with a 10 percent margin, because speed recorded on the data sheet changes gradually and the data also includes vehicles vibration.

The wording proposed for S7.2.1(f) was not intended to redefine wheel lockup as 10 percent of vehicle speed (90 percent wheel slip). Rather, it was intended to provide a practical criterion for making a determination that wheel lockup (100 percent wheel slip) exists, given the limitations of current instrumentation and recording devices. The proposal was based on the agency's experience at the Vehicle Research & Test Center (VRTC). Much of the vehicle testing that NHTSA has relied on to formulate FMVSS No. 135 was conducted at VRTC. This testing indicated that, with the instrumentation used by VRTC, it would be difficult to accurately measure zero angular velocity, due to spurious "signal noise". Thus, it would be extremely difficult to ascertain when a wheel reached an angular velocity of zero.

The comments expressed by Ford and Honda indicate that they have experienced similar problems with "signal noise" due to vibration and "drift" of the signal when reading the vehicle speed trace, which make it more difficult to relate the wheel rotational speed measurement to that variable than to read its absolute value. The difference between the agency's experience and that of Ford and Honda is probably due to differences in the instrumentation packages used.

After further reviewing this issue, NHTSA has decided to remove the proposed S7.2.1(f) entirely, because it was probably biased toward a particular type of instrumentation, and the agency does not want to impose unnecessary restrictions on what instrumentation is used to test for compliance with the standard. In order to clarify the meaning of wheel lockup, a definition stating that wheel lockup means 100 percent wheel slip has been added to S4. This definition is the same as has recently been added to both FMVSS No. 105 Hydraulic Brake Systems, and FMVSS No. 121, Air Brake Systems.

As a practical matter, NHTSA notes that there is essentially no difference between the method proposed in Notice 5 and that recommended by Ford and Honda. Once a wheel reaches 90 percent slip, complete lockup will be essentially instantaneous. As clarified in this final rule, there is no question of what is meant by wheel lockup. How that is measured is left to individual testing organizations, as is true for other aspects of standard.

## 2. Road Test Sequence

In the 1991 SNPRM (Notice 5), NHTSA proposed the following road test sequence: Burnish and wheel lock sequence at gross vehicle weight rating (GVWR); wheel lock sequence, ABS performance, and the torque wheel test at lightly loaded vehicle weight (LLVW); the torque wheel, cold effectiveness, high speed effectiveness, stops with engine off at GVWR; cold effectiveness, high speed effectiveness, failed ABS, failed proportional valve, and hydraulic circuit failure at LLVW; and hydraulic circuit failure, failed ABS, failed proportional valve, power brake unit failure, the static and dynamic parking brake tests, heating snubs, hot performance, brake cooling, recovery performance, and final inspection at GVWR.

JAMA and GRRF supported the proposed road test sequence, even though R13H does not specify a test sequence. GM recommended modifying the test sequence by eliminating two of the four ballast changes (*i.e.*, reduce the times needed to switch between lightly loaded and fully loaded). It also recommended not including the full ABS test and the dynamic parking brake test.

As explained below, NHTSA has decided not to include the full ABS test and the dynamic parking brake test. Nevertheless, the agency believes that it would be inappropriate to change the test sequence for the sake of reducing the test preparation effort. The agency emphasizes that the test sequence being adopted specifies that the GVW and LLVW wheel lock sequence tests be conducted first, since their results determine whether the torque wheel test needs to be conducted. The agency further notes that the test sequence being adopted permits removal of the torque wheels as soon as that test is completed. This is important since the torque wheels might get wet or otherwise adversely affected if they were not removed. Based on these considerations, the agency has determined that it would be inappropriate to switch the test sequence, which would result in fewer ballast changes.

## 3. Pre-Burnish

FMVSS No. 105 specifies a preburnish requirement to evaluate brakes in the brand new condition. In the initial NPRM (Notice 1), NHTSA proposed a similar requirement for the harmonized standard. However, in the 1987 SNPRM (Notice 4), the agency explained that it no longer believed a pre-burnish test was necessary for safety, given the relatively short period of time that the vehicle's brakes remain in the pre-burnished condition.

In comments to both SNPRMs, Advocates and CAS strongly opposed deleting this test. They stated that it takes hundreds of miles of use before brakes are properly burnished, especially for vehicles used in rural areas, in which long distances may be traveled with few brake applications. Advocates stated that certain brakes, most particularly disc-type brakes, are highly resistant to burnishing. That organization argued that the agency acknowledged this high mileage need for proper burnishing in the 1985 NPRM, but attempted to rationalize this concession in the first SNPRM. It also argued that stopping distance performance may be considerably greater before burnish than afterwards.

Advocates stated that deleting a preburnish test would allow manufacturers to produce and sell cars whose preburnish, on-the-road braking capability is unknown. It stated that it does not believe this is in the best interests of traffic safety, and that it does not believe the agency can allow cars to be sold and used that have no regulatory control