in S6.2 not apply to S7.1.3(j) (*i.e.*, that the road surface with a PFC of 0.9 not apply to burnish procedures).

NHTSA agrees with Honda that this provision needs to be clarified since burnish is merely a conditioning procedure for brakes and does not actually test for a specified stopping distance on a road of a particular adhesion quality. The PFC of the road surface has no effect on the burnish. Accordingly, S7.1.3 is modified to include a sentence stating that ''The road test surface conditions specified in S6.2 do not apply to the burnish procedure.''

5. Adhesion Utilization

*a. General.* In the NPRM (Notice 1) and both SNPRMs (Notices 4 and 5), NHTSA proposed adhesion utilization requirements to ensure that a vehicle's brake system is able to utilize the available adhesion at the tire-road interface to ensure stable stops within a specified distance. Adhesion utilization is addressed to some extent by FMVSS No. 105's (and the proposed standard's) service brake effectiveness requirements, since stops must be made within specified distances without leaving a lane of specified width. Under both standards, however, all of those stops are made on a high friction surface. The existing standard does not include any requirements concerning stops made on lower friction surfaces, such as wet roads. Therefore, unlike most of the proposed requirements for FMVSS No. 135, the adhesion utilization requirements do not have any corresponding requirement in FMVSS No. 105.

NHTSA notes that the proposed adhesion utilization requirements evolved considerably over the course of the NPRM and two SNPRM's. Persons interested in the reasons for that evolution, leading up to the proposal set forth in the 1991 SNPRM, are referred to those three notices.

In the 1991 SNPRM, NHTSA proposed a two-step procedure for assessing adhesion utilization based on a determination of the vehicle's brake balance: a wheel lock sequence test and then, for those vehicles that did not pass the wheel lock sequence test, a torque wheel test. The purpose of the wheel lock sequence test is to identify those vehicles that are heavily front biased, since such vehicles would be considered to have inherently good stability characteristics. The purpose of the torque wheel test is to evaluate more precisely those vehicles that fail the wheel lock sequence test, since torque wheels directly measure braking forces. The agency believed that this approach, which is based on a suggestion from the Organization Internationale des Constructeurs d'Automobiles (OICA), would accommodate vehicles that are heavily front biased in their brake balance and those that are closer to neutral balance. The agency believed that this proposal would ensure an appropriate level of safety as well as facilitate harmonization since GRRF agreed to adopt this approach as part of its harmonized adhesion utilization procedures.

CAS opposed the adhesion utilization tests proposed in the 1991 SNPRM. It requested that the agency specify other methods of adhesion utilization to produce objective results for all passenger cars. CAS was concerned that vehicles that marginally pass the wheel lock sequence test would undergo no further testing of front-to-rear brake balance. Instead of the proposed adhesion utilization tests, CAS suggested the use of Hunter Manufacturing's low-speed plate brake tester.

NHTSA believes that the adhesion utilization tests being adopted in today's final rule provide the most practicable and appropriate methods to evaluate a vehicle's adhesion utilization. The wheel lock sequence test screens out vehicles with front bias, which have inherently superior stability.[4] CAS appears to misunderstand the agency's regulatory framework, since a vehicle either passes or fails a requirement in a FMVSS; there is no provision for a marginal pass. For instance, a vehicle that ''marginally passes'' FMVSS No. 105 still complies with the standard. Therefore, the agency believes CAS's argument is not relevant to the regulatory framework set forth by statute and incorporated in the Federal motor vehicle safety standards. The agency further notes that the Hunter test apparatus is a simplified version of the road transducer pad that the NHTSA in light of comments by the industry considered prior to selecting torque wheels as the most acceptable method of measuring adhesion utilization. Therefore, the agency believes that it would be inappropriate to require this method of evaluating compliance.

Advocates stated that the real-world effects of the adhesion utilization test are uncertain and that NHTSA has not demonstrated a connection between real-world situations and the wheel lock sequence results. Advocates further commented that there is more to braking stability than front-axle bias and that plow-out skids will result in lane departures and stopping distances that are too long for safety purposes, even for vehicles with front axle bias and ABS.

Advocates further stated that

> Real-world crash results for cars tested under the two-part Adhesion Utilization protocol may not be favorable for significant numbers of production cars. The truncation of the testing protocol that has accompanied the proposed two-stage system of the current SNPRM comprising the Wheel-lock Sequence and Torque Wheel (especially due to adoption of the 90% efficiency rationale) creates a ''window'' of allowable production variability that can permit a significant, but unquantifiable, percentage of assembly-line vehicles to be rear-brake biased. Under certain operating conditions, especially those uncontrolled by the reduced performance specifications of the current proposed rule, such as the elimination of a low-coefficient surface test, many cars may experience serious instability under severe braking. The plain fact is that even if both parts of the two-stage test as proposed are used for a given car model, this still will not ensure that all cars will have appropriate front-brake bias and does not foreswear the potential for an unknown number of production units to be susceptible of serious spin-out crashes in panic braking situations. Despite advocating the two-stage test in this SNPRM, the agency itself obviously still harbors doubts over its adequacy to detect cars with rear-brake bias.

Advocates has expressed two concerns. Their first concern is that, by having a simple wheel lock sequence test, manufacturers would produce cars that have too much front axle bias in their brake systems, because such a vehicle would always pass the wheel lock sequence test. The extreme example of this would be a car with no brakes at all on the rear wheels. Such a vehicle would always be dynamically stable, but if braked to the point of wheel lockup would provide no ability to steer. This concern by Advocates ignores the adhesion utilization requirement is only one of many requirements in the standard, and therefore is not the sole factor in determining brake system design. If a manufacturer were to produce a car with too much front bias, it would compromise the vehicle's ability to satisfy other requirements of the standard, such as service brake stopping distances, partial failure, failed power assist, and parking brake requirements.

Advocates' second concern is that, because of the 10% allowance for test variability, a vehicle could pass the torque wheel test and still be rear-biased, and therefore ''susceptible of serious spin-out crashes.'' While it is theoretically possible for a vehicle to be slightly rear-biased and still pass the torque wheel test, NHTSA believes this

[4] A heavily front biased vehicle will skid but remain stable heading forward, since the front wheels will lock first. In contrast, a rear biased vehicle will spin out, since the rear wheels will lock first and those wheels would tend to lead.