

steering action if the absolute value of the vehicle roll rate stayed too long at a value that was very low but not low enough to trigger reversal. It explained that tests in which excessive dwell times occurred would be less severe and possibly not cause a tip-up that would have occurred with a shorter dwell.

Automotive Testing Inc. commented at length on the same phenomenon. It observed that the low but steady roll rate above 1.5 degrees/sec that can delay the triggering of steering reversal is a result of tire deflections continuing the roll motion of the whole vehicle after the point of maximum roll of the suspension system. It believes that a default trigger negates the design of the maneuver to let the vehicle motions select the steering response, but describes some ways of using filtering of the roll rate signal to cause the steering to trigger earlier in these cases. But it acknowledges that letting the vehicle react to the actual roll motion of the whole vehicle rather than to a roll signal distorted by signal processing may be preferable.

At this point we are preserving the consistent application of the fishhook steering algorithm. We do not believe that commenters have presented us a substantive reason to depart from this application. If the vehicle tips up despite a long dwell time, there is no change in test result. If the vehicle does not tip, it will be retested with a reduced steering angle according to the current procedure, which may change the roll frequency harmonics and dwell time. We will observe the steering reversal dwell times during the first group of tests and, if necessary, reconsider the commenter's observations on this issue.

#### *H. Fifteen-Passenger Vans*

The National Transportation Safety Board, Public Citizen and others commented on the rollover issues surrounding fifteen-passenger vans. NHTSA agrees that it is important to investigate the commenters' concerns about the rollover susceptibility of fifteen-passenger vans. To do this, we will conduct an evaluation of fifteen-passenger vans' rollover susceptibility at different loading conditions and evaluate available electronic stability control systems on these vehicles.

#### *I. Tip-up Criterion*

Mechanical Systems Analysis, Inc. and several other commenters suggested that the tip-up criterion of 2 inches simultaneous wheel lift is too conservative. It recommended a criterion of 20 degrees body roll instead because suspension bouncing on test

surface irregularities could influence performance under our criterion. Other similar recommendations were given for body roll angles between 15 and 20 degrees. The 2 inch wheel lift criterion is met at about 11 degrees of body roll on average.

NHTSA's tests were performed on a very smooth test area at TRC of Ohio. The tip-up criterion maximized driver safety and minimized tire wear by allowing us to increase speed in 5 mph increments with a reasonable expectation of avoiding sudden violent tip-ups that could "pole-vault" the vehicle on its outriggers. However, we observed tip-ups at lower than expected speeds during tests at other facilities (DPG and APG as described above) that were probably influenced by surface irregularity as described by the commenter. We believe that our tip-up criterion is appropriate for an excellent facility like TRC, but we agree that the criterion should be revisited if NCAP tests were to take place at a facility with a more irregular surface.

#### *J. Testing of Passenger Cars v. Light Trucks*

Consumers Union and IIHS recommended that we not test passenger cars in order to devote all the available time and resources for maneuver tests to light trucks. We agree that it is very unlikely that passenger cars will tip up in the maneuver test. We have tested passenger cars at the low end of the SSF range for passenger cars without observing any tip-ups. It seems reasonable to rate passenger cars using the "no tip-up" curve of the risk model along with SSF measurements. However, we prefer to track whether this continues to be true. Hence, we will continue to test a few passenger cars each year at the low end of the SSF range to reinforce the "no tip-up" assumption. Therefore, two passenger cars are listed in Table 5.

#### *K. Testing With Stability Control Systems*

Toyota suggested that NHTSA should selectively choose vehicles with optional equipment that assists the driver in controlling the vehicle such as electronic yaw stability control, while in a previous comment Honda suggested the opposite policy. Honda believed that even a vehicle with standard stability control should be tested with it turned off if the vehicle has an "off" switch. It has been NHTSA's policy for rollover resistance ratings that we test vehicles most representative of those sold. Also, we are interested in the potential safety benefits of electronic yaw stability control and have alerted consumers to

its purpose and availability on individual models in our present consumer information. Therefore, when it is standard equipment or optional equipment found on the majority of vehicles of a particular model, we will test with stability control turned on and report that the test vehicle was so equipped. Also, if the market penetration of a stability control option is too low for NHTSA to choose it for inclusion on our test vehicle, we will consider optional NCAP tests at the manufacturer's expense.

### **VIII. Final Form for Rollover Resistance Ratings—Alternative I**

#### *A. Combined Ratings*

NHTSA will use the statistical model shown in Figure 4 to combine the vehicle's SSF measurement and its performance in the Fishhook maneuver with 5-occupant loading as a prediction of its rollover rate per single-vehicle crash. The predicted rollover rate will be translated into a star rating in the same way used in the present rollover resistance ratings: one star for a rollover rate greater than 40 percent; two stars, greater than 30 percent; three stars, greater than 20 percent; four stars, greater than 10 percent; five stars, less than or equal to 10 percent.

The decision to combine the static (SSF) and the dynamic (maneuver test) vehicle measurements in a single rollover resistance rating is consistent with the view of most commenters that separate ratings would be confusing to consumers. It is also the best way of achieving NHTSA's goal of presenting risk-based ratings because it maximizes the vehicle information used to make the prediction of the rate of rollovers per single-vehicle crash. Those who favored separate static and dynamic ratings expressed concern that the influence of electronic stability control would be small in the combined rating. It is true that electronic stability control will not have a great influence on rollover resistance ratings because the dynamic test result has less predictive power than the static measurement on rollover rate and the effect of electronic (yaw) stability control on the dynamic test is also modest. We believe that the potential benefit of electronic stability control lies in helping drivers to stay on the road and away from tripping devices rather than providing much increase in rollover resistance, especially regarding tripped rollovers. Rather than reduce the rate of rollovers in single-vehicle crashes, electronic stability control may reduce the number of single-vehicle crashes in the first place. However, its effectiveness in reducing single-vehicle