

in these maneuvers were too few to establish a definitive correlation. Only three vehicles tipped up in the J-Turn light maneuver, and six vehicles tipped up in the Fishhook light maneuver. Only one more vehicle tipped up in the J-Turn heavy maneuver than in the Fishhook light, and the prediction of the model with J-Turn heavy was consistent with expectations that tip-up in the test predicts greater rollover risk. However, the extra vehicle in the J-Turn heavy tip-up group was the Ford Ranger 2 WD with a very large sample size of over 8,000 single-vehicle crashes (nearly 10 percent of the entire data base).

Next we computed a logistic regression model combining SSF with the dynamic variables for both maneuvers, Fishhook heavy and J-Turn heavy, that were observed to have a directionally correct result when entered into the model individually. The variable for J-Turn heavy was rejected by the logistic regression program as not statistically significant in the presence of the Fishhook heavy variable. In other words, the predictions based on tip-up in the Fishhook heavy maneuver do not change whether or not the vehicle also tips up in the J-Turn heavy maneuver.

Figure 4 shows the final model that uses Fishhook heavy as the only necessary dynamic variable. This model has a risk prediction for vehicles that tip up in the dynamic maneuver tests based on the greatest number of vehicles possible in our 25 vehicle data base. All 11 vehicles that tipped up in any maneuver are represented on the tip-up curve, and the 14 vehicles without tip-up are represented on the other curve. The risk curve in Figure 4 representing vehicles that tipped up in the Fishhook heavy maneuver is very similar to the logistic regression model based on SSF only in Figure 3 (that was based on the rollover rates of 100 vehicles). This result is logical because the SSF only model was optimized for best fit in the 1.00 to 1.25 SSF range that included all vehicles tipping up in dynamic maneuver tests. Also, the fact that the risk curve of the logistic regression model in Figure 3 that was based on the SSF of 100 vehicles closely matches the risk curve in Figure 4 that was based on 11 vehicles that tipped up in the dynamic tests suggests that the curve in Figure 4 is robust. However, the small difference in Figure 4 between the risk curve for vehicles that tip up in the dynamic test and the risk curve for those that do not tip up suggests that the predictive power of tip-up in the dynamic test may not be great.

Our testing and logistic regression analysis was sufficient to assign a

greater rollover risk to vehicles that tipped up in the most severe maneuver than to those that did not tip up at all. However, the extra risk was small, and we were not able to distinguish a rollover risk difference between vehicles that tipped up in the less severe Fishhook maneuver with a two occupant load from those that tipped up only with a five occupant load. In general, vehicles that tip up in the Fishhook maneuver with a two occupant load also tip up at a slower entry speed in the Fishhook maneuver with a five occupant load than those that do not. Therefore, our data does not allow us to distinguish rollover risk differences between vehicles on the basis of maneuver entry speed for tip-up. The objective of using different load conditions and different maneuvers instead of different speeds in a single maneuver to provide a range of test severity was to reduce the sensitivity of the result to extraneous factors such as tire wear.

It is noteworthy that the final rollover risk model required results from only the fishhook maneuver. This is an advantage from the standpoint of minimizing the practical problems of the effects of tire wear during a test series and of deviations from uniformity of surface friction at a test facility. The fishhook maneuver produces less wear on the test tires and requires only about 2 or 3 lane widths of uniform test surface versus 10 or more lane widths for the J-Turn maneuver. The commenters also considered it more representative of a real driving situation than the J-Turn.

VII. Comments to the NPRM Notice and Agency Response

We received 39 comments to the NPRM notice from vehicle manufacturers, equipment suppliers, test labs, public interest groups, the National Transportation Safety Board, the Insurance Institute for Highway Safety, attorneys, and members of the public. Mainly, the comments addressed whether the static and dynamic measurements should be used for separate ratings of rollover resistance or for a combined rating based on a risk model. The nature of the dynamic maneuver tests, testing of 15-passenger vans, and several practical testing issues such as the extraneous effects of tire wear, surface condition and ambient temperature were also addressed. The notice also introduced the related subject of handling ratings that was not part of the TREAD Act requirements. We received a number of valuable comments on handling tests, and we are still soliciting information. However,

the subject of this notice is confined to the TREAD Act requirements for dynamic rollover ratings.

A. Combined or Separate Rollover Resistance Ratings

The main question posed in the NPRM notice was whether the rollover resistance ratings should reflect the combined statistical power of SSF and dynamic tests for predicting rollover risk or whether ratings of rollover risk using SSF alone should continue, supplemented with a qualitative comparison of dynamic test performance. The document gave alternative A as a risk model determined by logistic regression analysis of state crash reports of single-vehicle crashes for about 25 vehicles with known SSF and dynamic test results. That process led to the risk model described in Section VI, however the mathematical calculation of the model could not be performed until the completion of a lengthy dynamic test program. Alternative B in the notice was a continuation of rollover risk prediction using SSF-only plus qualitative separate dynamic scores of A, B, C, D, or E signifying the number of maneuvers in which the vehicle tripped up without a risk interpretation.

Commenters representing TRW Automotive, National Automobile Dealers Association (NADA), General Motors (GM), Alliance of Automobile Manufacturers (Alliance), Association of International Automobile Manufacturers (AIAM), Insurance Institute for Highway Safety (IIHS), Bosch, Consumers Union, Advocates for Highway and Auto Safety (Advocates), Toyota, Continental-Teves and Public Citizen remarked directly on the question of combined versus separate use of SSF and dynamic maneuver tests in rollover resistance ratings. Except for Continental-Teves and Bosch, the commenters were in favor of ratings that combined the SSF and dynamic maneuver tests in a single rating. Consumers Union specifically supported the logit risk model operating on a moderate risk scenario (in which rollover rates vary in the approximate range of 0.075 to 0.55 across the range of vehicles) as a way of combining the SSF and dynamic maneuver tests. It commented that using the risk model it described was consistent with the recommendations of the NAS study. We believe the risk model we have developed is consistent with recommendation of NAS and Consumers Union. It is the logit model with the risk scenario (of demographic and road condition variables) that represents the average crash conditions of 293,000 actual single-vehicle crashes.