

vehicle scores have not been affected by tire wear. We will consider the results of this exercise in deciding whether any changes in the tire change protocol are necessary.

E. Pavement Temperature

The Alliance and Toyota commented on the potential effect of pavement temperature on Fishhook maneuver results. Toyota has observed increases in pavement friction as an apparent consequence of increases in pavement temperature. It also supplied a computer simulation of Fishhook tests that showed a large decrease in the speed at tip-up with increases in surface friction. Taken together, Toyota's information predicts a decrease in tip-up speed in a Fishhook maneuver of over 15 mph for a 70 degree F increase in pavement temperature. While the risk model for ratings does not depend on tip-up speed, the temperature effects predicted by Toyota would prevent most of the

vehicles that tipped up in a summer test from having tip-up in a winter test. NHTSA ran a number of tests to evaluate the temperature sensitivity of J-Turn and Fishhook tests (NHTSA Technical Report "Testing to Determine the Effects of Ambient Temperature on Dynamic Rollover Testing", docketed with this notice). We tested the 2001 Toyota 4Runner 4WD (with and without yaw stability control enabled) and the 2001 Chevrolet Blazer 2WD on the same test track during cold, moderate and hot ambient temperature. The difference between cold and hot ambient temperature was about 60 degrees F. We do not have pavement temperatures, but there is no reason to believe that the range of pavement temperature is less than the range of ambient temperature. The whole test procedure including the determination of handwheel angles based on the 0.3g steady state curve was repeated at each temperature. The results are given in Table 2. Every test

that failed to cause tip-up in cold weather also failed to cause tip-up in hot weather, and the two tests that caused tip-up in hot weather also caused tip-up in cold weather. Thus, the temperature effect predicted by the commenters did not occur. The tip-up speeds for the Blazer in the right and left Fishhooks repeated to within 1 mph despite differences in ambient temperature of 60 degrees F, seasonal differences in pavement surface, and the use of three different sets of tires. The only temperature effect observed was that the Blazer tipped up in the J-Turn in cold weather but did not in the moderate and hot weather tests. This is the opposite of the temperature effect predicted by the commenters and occurred during a maneuver we no longer intend to use. We do not think it is necessary to set tight surface temperature limits on the test protocol as suggested by the commenters.

TABLE 2.—RESULTS FROM NHTSA J-TURN AND FISHHOOK TESTS AT VARIOUS AMBIENT TEMPERATURE CONDITIONS.

Test vehicle and configuration	Test maneu- ver	Test condi- tion	Ambient tem- perature (°F)	Com- manded handwheel angle (de- grees)	Initial Steer Left			Initial Steer Right		
					Wheel lift, front/rear (inches)		Maneuver entrance speed (mph)	Wheel Lift, front rear (inches)		Maneuver entrance speed (mph)
					Front	Rear		Front	Rear	
Toyota 4Runner, VSC disabled	NHTSA J-Turn ¹	Cold	30	345	0	0	62.1	0	0	61.7
		Moderate	79	354	0	0	60.4	0	0	60.0
		Hot	87	358	0	0	61.8	0	0	60.3
	Fishhook ² ...	Cold	32	280	1	0	51.1	0	1	51.7
		Moderate	74–73	287	0	0	48.0	0	0	48.5
		Hot	89	290	1	0	51.4	0	0	50.8
Toyota 4Runner, VSC enabled ...	NHTSA J-Turn ¹	Cold	28	345	0	0	61.8	0	0	62.4
		Moderate	75	354	0	0	59.4	0	0	58.2
		Hot	90	358	0	0	61.9	0	0	61.6
	Fishhook ² ...	Cold	31	280	0	0	51.3	0	0	51.7
		Moderate	72	287	0	0	48.8	0	0	50.1
		Hot	90	290	0	0	50.7	0	0	51.3
Chevrolet Blazer	NHTSA J-Turn ^{1,3}	Cold	29	381	5–8	5–8	58.0	5–8	5–8	54.8
		Moderate	83	401	0	0	60.9	0	0	62.2
		Hot	86	392	0	0	60.3	0	0	59.4
	Fishhook ^{2,3}	Cold	30	309	5–8	5–8	40.2	2–3	2–3	39.1
		Moderate	74	326	3–4	3–4	40.3	4–5	4–5	40.1
		Hot	90	319	2–3	2–3	39.4	2–3	2–3	38.8

¹ NHTSA J-Turn maximum nominal entrance speed was 60 mph.

² Fishhook maximum nominal entrance speed was 50 mph.

³ Two-wheel lift ≥ 2 inches was observed during tests highlighted in bold.

F. Surface Friction

A practical problem for the repeatability of any limit maneuver test is the possibility that the surface friction properties of the test track will change. Ford commented that computer simulations of several of its SUVs showed that a change in surface coefficient of 0.05 would change the tip-up speed in a fishhook test by as much

as 12 mph in one example (6 mph and 4 mph respectively for two other example vehicles). It also commented that a seasonal variation in surface coefficient of 0.05 could be typical of test tracks, and that its own test track exhibited a long-term trend of an increase in coefficient of 0.02 per year (which would change the tip-up speed of the first example vehicle by 8 mph in

Ford's simulation). Ford's simulations are even more pessimistic than Toyota's regarding the possibility of repeatable Fishhook tip-up speeds given normal variations in surface properties and temperatures. However, we have not observed these large variations in tip-up speed in actual tests. The very close repeatability of tip-up speed for the Blazer in Table 2 extended over likely