

4.2.2 Fuel Tank Loading

Prior to beginning a Slowly Increasing Steer or Fishhook maneuver test series, the fuel tank of the vehicle is to be completely filled at the beginning of testing and may not be less than 75% of capacity during any part of the testing. This criterion is in agreement with that defined in FMVSS 135.

4.2.3 Stability Control System

If equipped, vehicles are tested with stability control systems active. Stability control is not to be deactivated for any Slowly Increasing Steer or Fishhook maneuver.

4.3 Road Test Surface

Tests are conducted on a dry, uniform, solid-paved surface. Surfaces with irregularities, such as dips and large cracks, are unsuitable, as they may confound test results.

4.3.1 Pavement Friction

All maneuvers are to be performed on a dry, high- μ road test surface.

Unless otherwise specified, the road test surface produces a peak friction coefficient (PFC) of approximately 0.9 when measured using an American Society for Testing and Materials (ASTM) E1136 standard reference test tire, in accordance with ASTM Method E 1337-90, at a speed of 64.4 km/h (40 mph), without water delivery. This criterion is in agreement with that defined in FMVSS 135.

4.3.2 Slope

The test surface has a consistent slope between level and 2%. All tests are to be initiated in the direction of positive slope (uphill).

4.4 Ambient Conditions

4.4.1 Ambient Temperature

The ambient temperature shall be between 0° C (32° F) and 40° C (104° F). This criterion is in agreement with that defined in FMVSS 135.

4.4.2 Wind Speed

The maximum wind speed shall be no greater than 10 m/s (22 mph).

4.5 Calibration Data

It is strongly recommended that calibration data be collected prior to tests of each configuration to assist in resolving uncertain test data. NHTSA typically records the following data at the beginning of each test day for each test vehicle configuration.

- The distance measured by the speed sensor along a straight line between the end points of a surveyed linear roadway standard of 1000 feet or more (observed and recorded manually from the speed sensor display).
- Five to fifteen seconds of data from all instrument channels as the configured and prepared test vehicle is driven in a straight line on a level, uniform, solid-paved road surface at 60 mph.

4.6 Tire Break-In Procedure

Prior to each test series, the tires must be "scrubbed in" to wear away mold sheen and be brought up to operating temperature. Test vehicles are to be driven around a circle 100 feet in diameter at a speed that produces a

lateral acceleration of approximately 0.5 to 0.6 g. Using this circle, three clockwise laps are to be followed by three counterclockwise laps. Once the six laps of the circle are complete, the driver is to input, sinusoidal steering at a frequency of 1 Hz and a handwheel amplitude (δ_{ss}) corresponding to 0.5–0.6 g for 10 cycles while maintaining a vehicle speed of 35 mph. A total of four passes using sinusoidal steering are to be used. The handwheel magnitude of the final cycle of the final pass is to be twice that of δ_{ss} . These four sinusoid passes typically require an area similar in size to that required by the Fishhook maneuver. The steering machine should be programmed to execute the sinusoids. There should be only a minimal delay between the completion of the tire break-in and the start of a test series to allow for the collection of a static data file, steering machine and data acquisition system adjustment, and final driver briefing.

4.7 Static Datums

At the completion of the tire break-in procedure and before the start of a test series, fifteen seconds of data are collected from all instrument channels with the test vehicle at rest, the engine running, the transmission in "Park" (automatic transmission) or in neutral with the parking brake applied (manual transmission), and the front of the test vehicle facing in the direction of positive gradient (uphill) on the test surface. The static data files are used in post processing to establish datums for each instrument channel.

4.8 Vehicle Gear Selection

All tests are performed with automatic transmissions in "Drive" or with manual transmissions in the highest gear capable of sustaining the desired test speed (Slowly Increasing Steer) or Maneuver Entrance Speed (Fishhook), with one exception:

Slowly Increasing Steer tests may be performed with automatic transmissions in lower gears if 50 mph cannot be maintained in "Drive" and the gear selection does not result in engine overspeeding. In some cases, 50 mph cannot be maintained through to the end of the steering schedule regardless of the gear selection due to low engine power or chassis responses that result in the loss of traction or spin out. It has been NHTSA's experience, however, that maximum lateral acceleration is generally achieved well before the maneuver's maximum handwheel angle is attained.

Manual transmission clutches are to remain engaged during all maneuvers.

4.9 Outrigger Adjustment

The initial clearance between the road surface and the bottom of the NHTSA outrigger skid pads is approximately 14 inches for the "standard" outriggers and approximately 12 inches for the "short" outriggers with the test vehicle at rest on a level surface. Note that the Multi-Passenger Configuration may compress the suspension more than the Nominal Load Configuration (reducing outrigger clearance). As such, outrigger height adjustment may be required when transitioning from one load configuration to the next.

Outrigger height adjustment may be required during a test series. If an outrigger skid pad contacts the road surface during a test run wherein there is no two-wheel lift, the outrigger at the affected end of the vehicle is raised 0.75 inches and the test run is repeated at the same maneuver entrance speed. If both outriggers make contact with the test surface during a test run wherein there is no two-wheel lift, both outriggers are raised 0.75 inches and the test run is repeated at the same maneuver entrance speed.

4.10 Videotape Documentation

It is recommended that all test runs be documented on videotape. NHTSA videotapes Slowly Increasing Steer tests from a viewpoint several hundred feet outside the circular path of the test vehicle. Fishhook maneuver tests are videotaped from a viewpoint that facilitates observation of the inboard side of the vehicle so as to best record instances of two-wheel lift. For both maneuvers, it is recommended the zoom of the camera be adjusted during each test such that the vehicle fills the view frame to the greatest extent possible.

4.11 Summary of Tests To Be Performed for Each Vehicle

For each test vehicle, testing will be performed according to the following plan:

1. Installation of new tires
2. Tire break-in
3. Slowly Increasing Steer Maneuver test series in the Nominal Load or Multi-Passenger Configuration
4. Tire change
5. Tire break-in
6. NHTSA Fishhook maneuver test series in the Nominal Load or Multi-Passenger Configuration with additional tire changes and break-ins as indicated in the maneuver protocol

4.12 Summary of Metrics Measured For Each Vehicle

1. Overall handwheel position at 0.3 g in the Nominal Load Configuration
2. Two-Wheel Lift in NHTSA Fishhook maneuver in Nominal Load or Multi-Passenger Configuration (Yes/No)
3. Rim-to-Pavement Contact or Tire Debeading in Nominal Load or Multi-Passenger Configuration (Yes/No)

4.13 Post Processing

Data are filtered in post processing with a 6-Hz 12-pole, 2-pass, phaseless digital Butterworth filter. All accelerations are corrected for CG displacement (see Section 2.5.1.3). Laser height measurements are filtered with a one-pass 200 ms running average technique.

Post processing also includes roll effects correction for lateral acceleration as follows.

$$a_{yc} = a_{ym}\cos\Theta - a_{zm}\sin\Theta$$

where,

a_{yc} is the corrected lateral acceleration (i.e., the vehicle's lateral acceleration in a plane horizontal to the test surface)

a_{ym} is the measured lateral acceleration in the vehicle reference frame

a_{zm} is the measured vertical acceleration in the vehicle reference frame