

Appendix I. Fishhook Maneuver Test Procedure

1.0 Introduction

1.1 General

This document describes the test procedure used by the National Highway Traffic Safety Administration's (NHTSA) New Car Assessment Program (NCAP) to evaluate light vehicle dynamic rollover propensity. The procedure is comprised of one characterization maneuver and one rollover resistance maneuver.

1.2 Rollover Resistance Requirements of the TREAD Act

Section 12 of the "Transportation Recall, Enhancement, Accountability and Documentation (TREAD) Act of November 2000" reflects the desire of Congress to supplement SSF [Static Stability Factor] with a dynamic stability test using vehicle maneuvers. Congress directed NHTSA to "develop a dynamic test on rollovers by motor vehicles for a consumer information program; and carry out a program conducting

such tests." NHTSA's NCAP Light Vehicle Dynamic Rollover Propensity Test Procedure described in this document was developed as part of NHTSA's effort to fulfill the requirements of the TREAD Act.

1.3 Recent NHTSA Light Vehicle Dynamic Rollover Propensity Research

During the spring through fall of 2001 NHTSA performed an extensive assessment of many test track maneuvers potentially capable of quantifying on-road, untripped rollover propensity. In brief, five vehicle characterization and nine dynamic rollover propensity maneuvers were studied. Each maneuver was either discarded or retained for subsequent program phases. The 2001 research project is documented in [1].

During the spring through fall of 2002 NHTSA performed a comprehensive evaluation of rollover resistance for a broad spectrum of twenty-six light vehicles. The test vehicles were evaluated with one Characterization maneuver and two Rollover Resistance maneuvers. Up to two load configurations per vehicle were used. The 2002 research project is documented in [2].

2.0 Test Equipment

2.1 Vehicle Load Configurations

NHTSA's dynamic rollover propensity test procedure uses one of two loading configurations: Nominal or Multi-Passenger. A description of each configuration is provided below.

Both vehicle load configurations include instrumentation, a steering machine, and outriggers.

Test vehicle bumper assemblies are removed for outrigger installation. The reduction in vehicle weight due to the removal of the bumpers is offset by the additional weight of the outriggers and their mounting system. The outrigger system typically outweighs the bumper assemblies.

2.1.1 Nominal Load Configuration

The Nominal Load Configuration consists of the driver, instrumentation, steering machine, outriggers, and full tank of fuel. Weight and location specifications for the data acquisition system and steering machine are presented in Table I.1 and Figure I.1.

TABLE I.1.—EQUIPMENT LOCATION AND WEIGHT

Equipment	Location	Weight, typical (lbs)
Data Acquisition System	Front passenger seat	58
Steering Machine	Handwheel	31
Steering Machine Electronics Box	Passenger row foot well behind the front passenger seat. If vehicle does not have a rear passenger row foot well, the Electronics Box should be placed in the front passenger seat foot well.	39

Non-pickup truck vehicles with only front designated seating positions use the Nominal Load Configuration.

2.1.2 Multi-Passenger Configuration

The Multi-Passenger Configuration includes all elements of the Nominal Load Configuration plus ballast in the form of water dummies. Water dummies are installed as follows:

For vehicles with three or more designated rear seating positions, three 175 lb water dummies are used. The water dummies shall be positioned on the rear seats (second seating row) closest to driver and front passenger seats (first seating row). If there are only two seating positions in the second seating row, the third water dummy shall be placed in the center of the third seating row, provided it is a designated seating position. Refer to Figure I.2.

For vehicles with two designated rear seating positions, two 175 lb water dummies shall be positioned in the rear seats. Refer to Figure I.3.

For pickups with only front designated seating positions, three 175 lb water dummies will be used. The water dummies shall be positioned behind the cab in a manner that emulates a second seating row. If it is not possible to fit three water dummies directly behind the cab, the third water dummy shall be placed in the center of a simulated third seating row. Refer to Figure I.4.

For pickups with two seating rows, three 175 lb water dummies will be used. If the second seating row includes three designated seating positions, each water dummy shall be placed in these positions. If the second seating row includes two designated seating positions, two 175 lb water dummies shall be positioned in the second seating row of the cab, and the third water dummy shall be positioned behind the cab in a manner that emulates the center seating position of a third seating row. Refer to Figure I.5.

For all vehicles, if the Multi-Passenger Configuration results in the vehicle exceeding its Gross Vehicle Weight Rating (GVWR) and/or rear Gross Axle Weight Rating (GAWR), the weight of each dummy will be equally reduced until the GVWR and/or rear GAWR are no longer exceeded. The weight of the water dummies shall not be reduced if only the front GAWR is exceeded and the front axle weight does not exceed the front GAWR by more than 50 pounds, *i.e.*, if the Multi-Passenger Configuration results in the vehicle exceeding its front GAWR, and its GVWR and/or rear GAWR, the weight of each dummy will be equally reduced until the GVWR and rear GAWR are no longer exceeded and the front GAWR is not exceeded by more than 50 pounds.

For non-pickup truck vehicles with only front designated seating positions, the Multi-Passenger Configuration is omitted from the test matrix.

2.2 Safety Outriggers

Safety outriggers are installed on all test vehicles during all test maneuvers. NHTSA uses outriggers machined from 6Al-4V titanium. NHTSA's "short" outriggers are used for vehicles with baseline weights under 3,500 pounds in a baseline condition (as delivered); "standard" outriggers are used for vehicles with baseline weights from 3,500 and 7,000 pounds; and "long" outriggers are used for vehicles with baseline weights from 7,001 to 10,000 pounds. Information on NHTSA's titanium outrigger system is documented in [3].

2.3 Tires

All tires must be new, and of the same make, model, size, and DOT specification of those installed on vehicles when purchased new. Tire inflation pressures are to be in accordance with the recommendations indicated on each vehicle's identification placard.

2.3.1 Tire Mounting Technique

When mounting tires to the rims used for testing, no tire mounting lubricant should be used. Lubricant is not used due to uncertainty surrounding the occurrences of tire debanding observed during NHTSA's rollover research. To eliminate the possibility of tire lubricant contributing to this phenomenon, it should not be used. Because no lubricant is used, care must be taken to confirm that the tire is fully seated on the