



Consumer Reports Avoidance Maneuver Procedure

1 Introduction

Note: Nothing in this standard supercedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

1.1 Purpose. The primary purpose of this procedure is to subjectively evaluate the vehicle's directional stability while executing a double lane change maneuver as prescribed by the Consumer Reports publication relative to a benchmark vehicle.

1.2 Applicability. This test procedure applies to any two axle pneumatic rubber tired vehicle at all load conditions.

1.3 Remarks. This test procedure describes a method for assessing vehicle direction control characteristics during a double lane change. This maneuver is defined by the Consumer Reports publication as an avoidance maneuver. The maneuver consists of an alignment lane, an offset gate, and a recovery lane. The subjective assessment is relative to a benchmark vehicle and is described as a difference in a subjective rating (defined by GMW14264) relative to a reference or benchmark vehicle. The objective assessment is the recorded entrance speed of the maneuver. From this point forward, there is no pedal input from the driver. This test is standard development work. It should be used to assess the vehicle throughout development.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

ISO 9001 SAE J670E
ISO 15037-1

2.2 GM Standards/Specifications.

GMW14264

2.3 Additional References.

Vehicle Technical Specification (VTS) Template

3 Resources

3.1 Facilities.

3.1.1 Calibration. The test facilities and equipment shall be in good working order and shall have a valid calibration label.

3.1.2 Alternatives. Alternative test facilities and equipment may also be used. However, all measuring variables as specified in this standard shall be determined correctly with respect to their physical definition.

3.1.3 The test facilities and test equipment shall be in good working order and shall have a valid calibration record.

3.1.4 The test requires a uniform paved surface that is wide enough to provide two lanes and appropriate run-off to safely perform the maneuver. The road surface gradient shall not exceed 2.5%.

3.1.5 The path for the test vehicle should be demarked by traffic cones. All traffic cones should have an outline marked on the pavement with paint or chalk to ensure proper placement. The traffic cones shall be set up in three segments:

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3.1.5.1 Alignment Lane. The alignment lane is 18.29 m (60 ft) long (from center of first traffic cone to center of last traffic cone) and 2.44 m (8 ft) wide (from the inside of the traffic cone to inside of opposite traffic cone). Traffic cones should be placed every 3.05 m (10 ft).

3.1.5.2 Offset Gate. The offset gate is marked by two cones, 3.66 m (12 ft) wide (from inside to inside). The distance between the end of the alignment lane and the offset gate is 18.29 m (60 ft). The distance between the offset gate and the recovery lane is 18.29 m (60 ft).

3.1.5.3 Recovery Lane. The recovery lane is 18.29 m (60 ft) long (center to center) and 3.66 m (12 ft) wide (inside to inside). Traffic cones should be placed every 3.05 m (10 ft).

3.1.6 The vehicle path shall always be a left turn followed by a right turn.

3.1.7 See Appendix A for a diagram of the maneuver.

3.2 Equipment. As this procedure is primarily designed to subjectively assess vehicle performance while executing the Consumer Reports Avoidance Maneuver, no instrumentation is necessary other than the following:

3.2.1 Corrected Vehicle Speedometer. In the event that instrumentation is used to gain additional insight to vehicle performance, the following instrumentation may be considered.

3.2.2 Data Acquisition System (DAS).

3.2.3 Instrumented steering wheel with steering wheel angle transducer.

3.2.4 Speed and Sideslip Transducer.

3.2.5 Roll Transducer.

3.2.6 Yaw Velocity Transducer.

3.2.7 Lateral Acceleration Transducer.

3.2.8 Longitudinal Acceleration Transducer.

3.2.9 Appropriate Cabling.

3.3 Test Vehicle/Test Piece. This test procedure applies to any two axle, pneumatic rubber tired vehicle at all load conditions.

3.4 Test Time.

Calendar time: 0 days

Test hours: 1 day

Coordination hours: 1 day

3.5 Test Required Information.

3.5.1 (Optional) Channel Assignment and Full Scale Value:

- Steering Wheel Angle: 200 degrees.
- Vehicle Speed: 150 km/h.
- Vehicle Yaw Rate: 50 degrees.
- Vehicle Roll Rate: 10 degrees.
- Lateral Acceleration: 10 m/s².
- Longitudinal Acceleration: 10 m/s².
- Sideslip Angle: 40 degrees.

3.5.2 (Optional) Channels may be added as needed.

3.5.3 (Optional) If Instrumentation is used, Sample Rate is 100 Samples per second.

3.5.4 (Optional) If Instrumentation is used, Filter Frequency is 25 Hz.

3.6 Personnel/Skills. Operator must be qualified and documented as capable to run this test as required by ISO 9001 Requirements for Quality Management Systems.

4 Procedure

4.1 Preparation.

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4.1.1 Remove all loose equipment from the passenger compartment including tools, spare parts, extra transducers, and personal belongings.

4.1.2 (Optional) Instrumentation Installation.

4.1.2.1 The yaw velocity and lateral acceleration transducers are to be installed in the front passenger seat footwell in a level position. Record the fore aft location of the motion package relative to the front wheel centerline on the vehicle, the lateral location relative to the vehicle centerline, and the vertical location relative to the ground in the Test Vehicle Description Sheet (TVD). Refer to Appendix B for a sample TVD.

4.1.2.2 The data acquisition computer must be fastened securely to the seat to prevent it from being dislodged in the event of unexpected loss of control.

4.1.3 Vehicle Preparation.

4.1.3.1 The test vehicle should be inspected to ensure that the proper tires and suspension components are installed, and that all chassis components are in operational condition.

4.1.3.2 Ballast the vehicle to the requested weight and weight distribution.

Note: All equipment and ballast inside the passenger compartment of the vehicle must be securely held in place. External ballast must be contained in a ballast box, and a metal retaining screen installed between the cargo compartment and the passenger cab.

4.1.3.3 The fuel tank should be topped off, and the vehicle test weights determined.

4.1.3.4 Outriggers should only be considered for high profile, early mule vehicles that may have questionable vehicle durability.

4.1.4 Tire Preparation.

4.1.4.1 Tire pressures should be set to the manufacturer's recommended cold pressure unless otherwise stated on the test request.

4.1.4.2 Note the condition of the tires. New tires should be conditioned by driving 10 km at 100 km/h, including moderate cornering (0.5g) and several heavy brake stops (no locked wheels). Obviously worn tires should be noted and appropriate wear state checked on the Test Vehicle Description.

4.1.5 Operator Precautions.

4.1.5.1 Helmet and seat belts must be worn during the test in accordance with the regulations of the test facility.

4.1.5.2 The test operator must inform the testers using the facility of his presence using the mobile phone or radio system in accordance with the regulations of the test facility.

4.1.6 Additional information regarding industry standard Vehicle Dynamics test methods and terminology may be found in SAE J670E "Vehicle Dynamics Terminology" and ISO 15037-1 "Vehicle Dynamics Test Methods for Road Vehicles" respectively.

4.2 Conditions.

4.2.1 Environmental Conditions. The test is normally run on dry, clean asphalt surfaces that are clear of debris. Wet surfaces may be specified in special cases.

4.2.2 Test Conditions. Deviations from the requirements of this standard shall have been agreed upon. Such requirements shall be specified on component drawings, test certificates, reports, etc.

During development, the vehicle can be tested under conditions of interest. For Vehicle Technical Specification (VTS) validation, the vehicle is to be tested with Driver and Equipment, see Appendix C.

During development, the vehicle can be tested with and without Electronic Stability Control (ESC) activated. For VTS validation, the vehicle is to be tested with ESC active if the vehicle is equipped with ESC.

4.3 Instructions.

4.3.1 (Optional) Turn on instrumentation and data acquisition equipment. Allow 5 minutes for equipment to warm up.

4.3.2 (Optional) Stop the vehicle on the test road with the instrumentation and data acquisition running. With front wheels straight ahead and hands off steering wheel, balance the data acquisition system.

4.3.3 Typical maximum vehicle speeds for completing the maneuver are 70 km/h to 100 km/h (45 mph to 60 mph). Accurate and repeatable data is best obtained by completing the maneuver at a low speed and

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gradually increasing the speed on subsequent attempts to become familiar with the test vehicle at high g-levels.

4.3.4 Approach the course at the test speed, directing the vehicle into the alignment lane. The throttle must be released 7.62 m (25 ft) from the end of the alignment lane. The speed of the vehicle at this location is the recorded entrance speed for the maneuver. A traffic cone, timing strip, or other marker can be placed outside of the course to designate this location. No braking or throttle input is allowed from the driver until the vehicle has exited the recovery lane. For manual transmission vehicles, the vehicle should be left in gear. This gear should be appropriate for normal driving relative to the entrance speed. Any stability control systems intervention is allowed.

4.3.5 Turn In. Towards the end of the alignment lane, turn the vehicle left to align the vehicle to enter the offset gate. The apex of this turn should be as close as possible to the last cone on the left side of the alignment lane. Different steering input rates can be assessed on subsequent runs.

4.3.6 Turn Back After turn in, steer the vehicle back to the right so that it goes through the offset gate and is aligned to enter the recovery lane. The apex of this turn should be as close as possible to the cone on the right side of the offset gate.

4.3.7 Recovery Make steering corrections necessary to enter and exit the recovery lane.

4.3.8 Criteria for Successful Completion of Maneuver All traffic cones should remain upright and in their respective marked boxes throughout the maneuver with no throttle or braking input from the driver. Reset all traffic cones before repeating the maneuver.

4.3.9 Conduct as many runs as needed at this test speed to get a feel for the vehicle's response.

4.3.10 Repeat steps 4.3.4 thru 4.3.9, gradually increasing entrance speed until the maneuver can no longer be successfully completed.

4.3.11 Repeat steps 4.1 thru 4.3.10 for the benchmark vehicle.

4.3.12 For the Highest Successful Completion Speed. Assess the turn in stability and responsiveness of the vehicle relative to the benchmark vehicle. The assessment shall be recorded as the subjective rating difference between test and benchmark vehicles.

4.3.13 For the Highest Successful Completion Speed. Assess the turn back stability and responsiveness of the vehicle relative to the benchmark vehicle. The assessment shall be recorded as the subjective rating difference between test and benchmark vehicles.

4.3.14 For the Highest Successful Completion Speed. Assess the ease of recovery stability and responsiveness of the vehicle relative to the benchmark vehicle. The assessment shall be recorded as the subjective rating difference between test and benchmark vehicles.

4.3.15 Complete the subjective evaluation form, see Appendix D.

5 Data

5.1 Calculations. Not applicable.

5.2 Interpretation of Results. Not applicable.

5.3 Test Documentation. Make sure the subjective evaluation form is complete (see Appendix D). All required information should be recorded on the Test Vehicle Description (TVD).

5.3.1 (Optional) If objective data was measured, the data stored on the data acquisition system should be uploaded to the appropriate network data storage location for processing using documented procedures and the data filenames specified on the test request sheet.

5.3.2 (Optional) Inform assigned engineer when the objective data file is loaded. Be prepared to provide a full vehicle description at this time. This should include the following:

- Vehicle description and number.
- Vehicle option content.
- Wheelbase and track.
- Steering wheel diameter.
- Location (x, y, z) of the inertial transducers.

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