



Ground Clearance Test

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. This procedure describes a validation test for the global groundline criteria. It is only intended to be used if a violation of the groundline criteria exists in Computer Aided Design (CAD).

1.2 Applicability. For all passenger cars only.

1.3 Remarks. This test procedure describes the dynamic ground clearance test of the complete vehicle. For a partial test (e.g., oil drain plug), only relevant tests need to be performed. For test events for specific design criteria, see Appendix A, Table A1.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

None

2.3 Additional References. None.

3 Resources

3.1 Facilities. Proving ground with the following:

- 120 mm curb
- 18 cm curb
- 20% ramp or 16 degree/8 degree driveway ramp
- 13 degree driveway ramp
- 16 degree driveway ramp
- Speed humps (constructed of wood, if unavailable) (see Appendix E for location of currently existing speed humps: Figure E1 (Dudenhofen Proving Ground) and Figure E2 (Milford Proving Ground)).

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.

3.2 Equipment. Not applicable.

3.3 Test Vehicle/Test Piece.

3.3.1 This test should use the worst case production variant taking build variation into account. Prior review of the groundlines in CAD data should be done to determine the proper suspension/tire combination.

3.3.2 Vehicle should be loaded to Gross Vehicle Weight Rating (GVWR) according to the latest release status.

3.3.2.1 Tires, springs, stabilizers, dampers, and jounce bumpers shall conform to the latest release status.

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November 2014

Page 1 of 15

Documents

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3.3.2.2 Versions with optional leveling systems shall not be considered.

3.3.2.3 A trailer hitch shall only be installed, if the test result (unintentional protection effect) will not be affected.

3.4 Test Time.

Calendar time: 1 days
Test hours: 0 hours
Coordination hours: 0 hours

3.5 Test Required Information. Not applicable.

3.6 Personnel/Skills. Special expertise is required. Specific training to perform test maneuvers.

4 Procedure

4.1 Preparation.

4.1.1 Set tire pressure according to placard pressure for vehicle load.

4.1.2 The engine position shall be checked visually in cooperation with the Engine Development department.

4.2 Conditions.

4.2.1 Environmental Conditions. Not applicable.

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.

4.3 Instructions.

4.3.1 Vehicle Load.

4.3.1.1 Gross Weight. The vehicle shall be loaded to the Gross Weight Rating (GWR)

4.3.1.2 Distribution of the GWR. For the test of the dynamic ground clearance of the front vehicle structure, the load shall be distributed to reach permissible front-axle weight. The permissible rear-axle weight shall be used to test the rear vehicle structure.

If the axle load reserve is < 5% of the gross vehicle weight, the payload should be distributed evenly. The wheel loads shall be noted using Appendix C, Data Sheet C1.

4.3.1.3 Trim Height. The vehicle shall be loaded to test load. The trim height shall be measured either at the four (4) wheel cutouts measure P and R, J and K, and Z and D heights according to Appendix G, Figures G1 and G2. Deviations of ≤ 2 mm are permissible.

The trim height shall be noted using Appendix C, Data Sheet C2.

4.3.2 Curb Test. At walking speed (4 km/h to 5 km/h), drive onto a curb of 12 cm height and back off. Repeat at very low speed (1 km/h). For driving pattern(s), see Figure 1. If testing at Milford Proving Grounds (MPG), use 120 mm curb with Traffic safety approval.

4.3.2.1 Drive on in forward direction and back off (driving pattern a).

4.3.2.2 Drive on in rearward direction and back off (driving pattern a).

4.3.2.3 Drive on in forward direction at an angle of 45 degrees to the right and back off (driving pattern b).

4.3.2.4 Drive on in rearward direction at an angle of 45 degrees to the right and back off (driving pattern b).

4.3.2.5 Drive on in forward direction at an angle of 45 degrees to the left and back off (driving pattern c).

4.3.2.6 Drive on in rearward direction at an angle of 45 degrees to the left and back off (driving pattern c).

4.3.2.7 Drive on and off the curb with the maximum steering angle to the left several times. The lateral distance of the vehicle to the curb of ≈ 0.5 m to 1 m shall be varied (driving pattern d).

4.3.2.8 Repeat 4.3.2.7 but with maximum steering angle to the right (driving pattern d).

4.3.2.9 Drive across the curb radius with the front wheel of one (1) vehicle side so that the vehicle is located over the curb as far as possible (driving pattern e).

4.3.2.10 Drive on and off with the vehicle parallel to the curb. Two (2) wheels shall be on the curb, two (2) on the road each time. The test shall be repeated several times changing the distance to the curb (driving pattern f).

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November 2014

Page 2 of 15

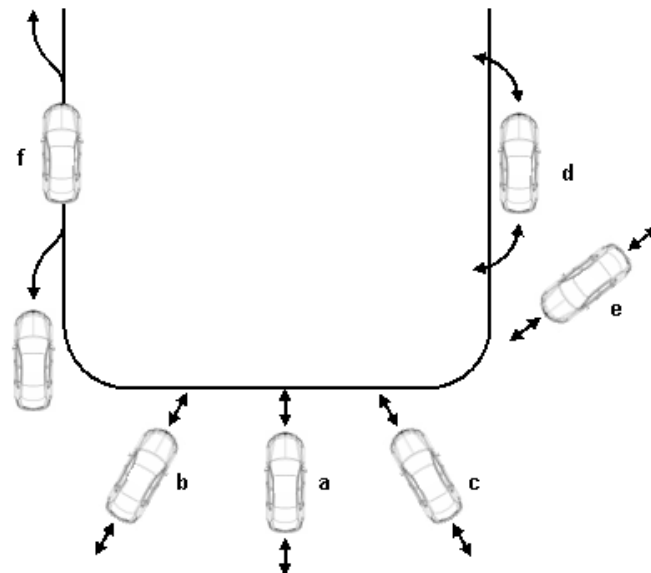


Figure 1: Driving Pattern for Curb Test

4.3.3 Ramp Parking Garage. The ramp (Figure 2) shall be run forward and rearward with parking lot speed (10 km/h). The test should be performed at Gross Vehicle Mass (GVM).

Twenty percent substitute break over portion of 16 degree/8 degree ramp, if 20% ramp is unavailable. Approach ramp at an angle to minimize approach angle, and only use data from break over portion for this event.

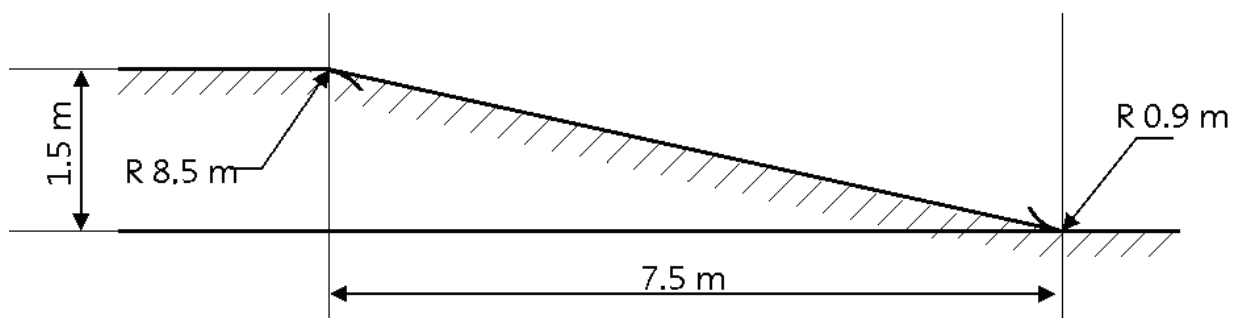


Figure 2: Ramp Parking Garage (Substitute Break Over at 16 Degree/8 Degree Ramp, in Unavailable)

4.3.4 Thirteen (13) Degree U.S. Ramp. Drive onto and off of the 13 degree U.S. ramp in a forward and rearward direction at walking speed (4 km/h to 5 km/h). The angle between the vehicle longitudinal axis and the lower bend in the ramp profile shall be changed from 0 degrees to 9 degrees as shown in Figure 3

4.3.5 Sixteen (16) Degree U.S. Ramp. Drive onto and off of the 16 degree U.S. ramp in a forward and rearward direction at creep speed (1 km/h to 2 km/h). The angle between the vehicle longitudinal axis and the lower bend in the ramp profile shall be changed from 0 degrees to 9 degrees as shown in Figure 3.

Note: Heavy contact and damage to soft components is expected during the 16 degree ramp testing. This test should only be done, if the 15 degree approach angle criteria has been violated in CAD. If it is performed, it should be done last. Contact to hard mounted components should be light and cause no permanent deformation.

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November 2014

Page 3 of 15



Documents

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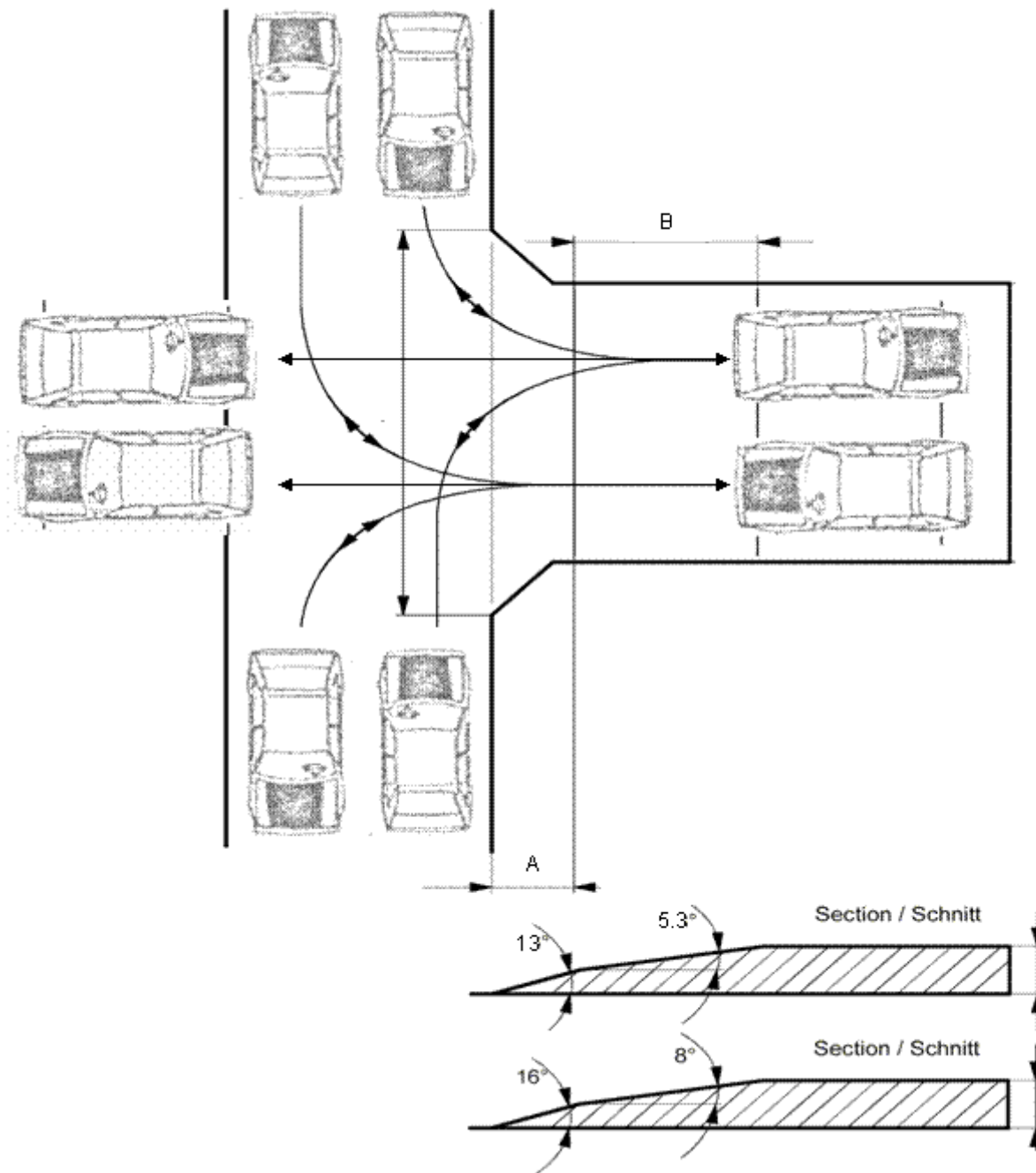


Figure 3: U.S. Ramp Driving Pattern

4.3.6 Driving on the Speed Humps. The speed humps shall be driven onto and off of at walking speed (4 km/h to 5 km/h) at an angle of 90 degrees. For dimensions and data regarding speed humps see Appendix D, Table D1, Figure D1 and Table D2.

4.3.7 U.S. 18 cm Curbstone. Drive at walking speed (4 km/h to 5 km/h) until the tire contacts the curbstone, or the vehicle stops. Perform test in the forward and rearward direction.

5 Data

5.1 Calculations. Not applicable.

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Page 4 of 15



Documents

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5.2 Interpretation of Results.

5.2.1 Architectural Criteria. The architecture should enable a variant such that only light contact occurs during all tests except the 18 cm curb and 16 degree driveway ramp (see Appendix A, Table A1 and Appendix B, Figure B1 for details). The contact should not cause scratches to painted appearance surfaces or permanent deformation.

Heavy contact and damage to soft components and scratches to painted surfaces are acceptable during the 16 degree driveway ramp test. Hard mounted components can be scratched, but they should not exhibit significant yielding or lose function.

Contact is acceptable between the chassis structure during the 18 cm curbstone test. The contact can cause scratches to the chassis structure.

The following parts shall not be damaged during any test:

- Brake lines
- Brake cables
- Fuel lines
- Fuel tank
- Drive shaft(s)

5.2.2 Special Vehicle Criteria. For some vehicle variants (especially sport or economy), damage not impairing function, or strength can be allowed, but it must be documented and the Vehicle Chief Engineer and functional groups responsible for component must buy-in.

The following parts shall not be damaged during any test:

- Brake lines
- Brake cables
- Fuel lines
- Fuel Tank
- Drive shaft(s)

5.3 Test Documentation.

5.3.1 Evidence of ground contact shall be determined after each test.

5.3.2 Take photos of any contact and inform the areas of engineering concern.

5.3.3 The results and measured values shall be noted in the corresponding data sheets. With reference to this test procedure, the data sheets shall be added to a test report. See Appendix F, Data Sheet F1 for evaluation sheet.

6 Safety

This standard may involve hazardous materials, operations, and equipment. This standard does not propose to address all the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

7 Notes

7.1 Glossary.

Axle Load Reserve: Difference between the GVWR and the total of both permissible axle loads.

7.2 Acronyms, Abbreviations, and Symbols.

CAD	Computer Aided Design
GSSLT	Global Subsystem Leadership Team
GVWR	Gross Vehicle Weight Rating
GVM	Gross Vehicle Mass
GWR	Gross Weight Rating

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November 2014

Page 5 of 15