



Designation: D8259/D8259M – 21

Standard Test Method for Rotary Wheel Testing (RWT) of Compacted Asphalt Mixtures¹

This standard is issued under the fixed designation D8259/D8259M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reappraisal. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reappraisal.

1. Scope

1.1 This test method describes a procedure for testing the rutting and moisture susceptibility of asphalt specimens using the Rotary Wheel Tester (RWT). Superpave Gyrotory Compactor (SGC) specimens (Test Method D6925) are wrapped, conditioned, submerged in water, and confined between three metal wheels in continuous synchronized rotation with each wheel applying a fixed load around the periphery of the specimen. The system records the number of load cycles applied to the specimen, the deformation of the specimen (rut depth), the loading rate, the temperature of the water, and Sigma, which is an indication of specimen roundness.

1.2 The test method is used to determine the premature rutting susceptibility of asphalt mixtures by measuring rut depth as a function of number of load cycles throughout the test.

1.3 This test method also measures the potential for moisture damage effects because the specimens are submerged in temperature-controlled water during preconditioning and for the duration of the test.

1.4 The parameters of the test are shown in Table 1. See an example of the test parameters used in Appendix X1.

NOTE 1—This test uses a typical specimen produced by a Superpave gyrotory compactor.

NOTE 2—The ruggedness study identified air void content as the most influential factor evaluated and recommended a tolerance of $\pm 0.25\%$ to minimize the effect of air void content on the test results. The precision study evaluated three asphalt mixtures with specimen air void contents ranging from 2.87 % to 3.23 %, from 4.28 % to 4.64 %, and from 5.77 % to 6.19 %. Precision statements covering the air void content ranges of 2.75 % to 4.75 % and 5.75 % to 6.25 % can be found in Section 10. Lemke and Bahia (2019) found that an asphalt mixture with 7 % air void content was more susceptible to rutting than a mixture with 3 % air void content and that the test results for the 7 % AV mixture did not differentiate between control factors such as test temperature and mixture source like the mixture with 3 % air void content did.

NOTE 3—The University of Wisconsin at Madison Modified Asphalt Research Center (2017) reported that the City of LA selected the test

temperature of 60 °C [140 °F] because “(1) it approximates the observed high average temperature of most pavements, (2) it is close to the high temperature performance grade classification of the asphalt binder used in most local applications, (3) it allows a test to be performed in an accelerated time frame (about 2 h excluding preconditioning time), and (4) research on rut testing has shown [that] the asphalt binder seems to have the most control over the test results at lower test temperatures.” The ruggedness study was completed at 60 °C [140 °F] using PG 64-10 with 50 % RAC asphalt mixture. The precision study was completed at 60 °C [140 °F] using PG 64-10 with 50 % RAC asphalt mixture for two of the mixtures evaluated and using PG 76-22 for the third mixture considered. One may wish to consider lower test temperatures because Lemke and Bahia (2019) reported reducing the test temperature from 60 °C [140 °F] to 52 °C [125.6 °F] when testing PG 58S-28 and PG 58H-28 asphalt because of premature failure. Note 8 includes a suggestion for selecting an alternative test temperature based on the binder if one chooses to do so.

NOTE 4—The University of Wisconsin at Madison Modified Asphalt Research Center (2017) reported that the City of LA selected 6900 load cycles as the maximum load cycles because “initial observations from tests showed that most samples tested showed their performance well before these values (6900 load cycles and 6.0 mm [0.24 in.]) were attained ... while those that exhibited low rut depth in the field and no moisture susceptibility showed test result curves that behaved as asymptotes to their initial creep slope until the maximum number of cycles (30 000 cycles) of the machine was attained.” 6900 load cycles was used in both the ruggedness and precision work as well. The machine has an allowable range of 300 to 30 000 load cycles.

NOTE 5—The University of Wisconsin at Madison Modified Asphalt Research Center (2017) reported that the City of LA selected 6.0 mm [0.24 in.] as the maximum rut depth because “initial observations from tests showed that most samples tested showed their performance well before these values (6900 load cycles and 6.0 mm [0.24 in.]) were attained ... while those that exhibited low rut depth in the field and no moisture susceptibility showed test result curves that behaved as asymptotes to their initial creep slope until the maximum number of cycles (30 000 cycles) of the machine was attained.” 6.0 mm [0.24 in.] was used in both the ruggedness and precision work as well.

NOTE 6—The University of Wisconsin at Madison Modified Asphalt Research Center (2017) reported that the City of LA selected 70 CPM as the loading rate because that is what its RWT was set at by the factory. 70 CPM was used in both the ruggedness and precision work as well. The machine has an allowable range of 60 to 90 CPM.

NOTE 7—The University of Wisconsin at Madison Modified Asphalt Research Center (2017) reported that the City of LA selected an applied load of 334 N [75 lb] because that is what its RWT was set at by the factory. 334 N [75 lb] was used in both the ruggedness and precision work as well. The machine has an allowable range of 334 to 489 N [75 to 110 lb] in 22-N [5-lb] increments. Applied loads of greater than 334 N [75 lb] are not recommended based on experience.

1.5 Criteria for the evaluation and interpretation of test results shall be developed for local conditions and material

¹ This test method is under the jurisdiction of ASTM Committee D04 on Road and Paving Materials and is the direct responsibility of Subcommittee D04.20 on Mechanical Tests of Asphalt Mixtures.

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