



**INDIANA DEPARTMENT OF TRANSPORTATION
DIVISION OF MATERIALS AND TESTS**

**ACCEPTANCE PROCEDURES FOR
POLISH RESISTANT AGGREGATES
ITM No. 214-16**

1.0 SCOPE.

- 1.1 This method sets forth the acceptance procedures to be used when Aggregate Producers request that polish resistant coarse aggregates be evaluated for use in HMA surface mixtures.
- 1.2 Polish resistant coarse aggregates are specified for use under certain traffic ESAL loading conditions to obtain skid-resistant HMA surface courses.
- 1.3 Coarse aggregates tested in accordance with this procedure shall be dolomite containing less than 10.3 percent elemental magnesium, crushed limestone, or gravel.
- 1.4 This method is a two part process. Part One requires a comparison of the coarse aggregate to an approved dolomite or polish resistant aggregate material using the British Polishing Wheel in accordance with ASTM D3319 and the British Pendulum Tester in accordance with ASTM E303. If the results of the comparison indicate that the coarse aggregate has a Residual Polishing Value (RPV-10) of one less than, equal to, or greater than the RPV-10 value obtained from the approved dolomite or polish resistant aggregate material, then Part Two may be initiated.

Part Two requires that a test section of HMA using the coarse aggregate and a control test section of HMA using an approved dolomite or polish resistant aggregate material be placed on a contract. The coarse aggregate and the approved dolomite or polish resistant aggregate material may be blended with air-cooled blast furnace slag, steel furnace slag, or sandstone coarse aggregate for the two test sections. Acceptance of the coarse aggregate is made on the basis of an evaluation of friction test data obtained after two years of exposure to traffic; however an aggregate may be accepted after one year of exposure to traffic at the discretion of the Department.

- 1.5 The Aggregate Producer will be required to maintain a warranty bond on the HMA surface course of the test section using the proposed polish resistant aggregate. The bond amount shall be sufficient to replace the test section with material satisfactory to the Department. Upon opening the test section to unrestricted traffic, the warranty bond will be in effect for a total of two years. The warranty bond is required to be properly executed by a surety company

satisfactory to the Department and be payable to the State of Indiana. Appendix A shall be used for the warranty bond.

- 1.6** If within two years of exposure to traffic, the average friction number of the proposed polish resistant aggregate is less than the average friction number of the approved dolomite or polish resistant aggregate material, the Department will evaluate the test section to determine if a problem exists. If remedial work is required, the Aggregate Producer shall conduct the work at no cost to the Department. If the Aggregate Producer cannot conduct the remedial work within a timely manner, the Department has the option to execute the warranty bond and have the remedial work conducted by other forces.
- 1.7** This procedure may involve hazardous materials, operations, and equipment and may not address all of the safety problems associated with the use of the test method. The user of the ITM is responsible for establishing appropriate safety and health practices and determining the applicability of regulatory limitations prior to use.

2.0 REFERENCES.

2.1 AASHTO Standards.

- T 11 Materials Finer than 75 μm (No. 200) Sieve in Mineral Aggregates by Washing
 T 27 Sieve Analysis of Fine and Coarse Aggregates

2.2 ASTM Standards.

- D3319 Accelerated Polishing of Aggregates Using the British Wheel
 E274 Skid Resistance of Paved Surfaces Using a Full Scale Tire
 E303 Measuring Surface Frictional Properties Using the British Pendulum Tester
 E524 Smooth Tread Standard Tire for Special-Purpose Pavement Skid Resistance Tests

2.3 ITM Standards.

- 207 Sampling Stockpiled Aggregates

3.0 TERMINOLOGY. Definitions for terms and abbreviations shall be in accordance with the Department's Standard Specifications, Section 101.

4.0 SIGNIFICANCE AND USE. This ITM shall be used to evaluate polish resistant aggregates for use in HMA surface mixtures.

5.0 APPARATUS.

- 5.1 British Wheel, in accordance with ASTM D3319
- 5.2 British Pendulum Tester, in accordance with ASTM E303
- 5.3 Friction vehicle and instrumentation in accordance with ASTM E274
- 5.4 Smooth Tread Standard Tire in accordance with ASTM E524

6.0 GENERAL REQUIREMENTS.

- 6.1 Each Aggregate Producer requesting to have a coarse aggregate tested in accordance with this procedure shall do so in writing to the State Materials Engineer, Division of Materials and Tests with a copy sent to the appropriate District Testing Engineer. Information concerning the type of material, and ledge numbers, if applicable, shall be included.
- 6.2 The approved dolomite or polish resistant aggregate material used in the control test section shall be obtained from one of the following sources.

2232 – Lehigh Hanson Aggregates Midwest Inc.,
Ft. Wayne, IN (Ledges 1-7)

2267 – U.S. Aggregates, Inc. - Pleasant Mills
Decatur IN (Ledges 1001-4)

2535 – U.S. Aggregates - Columbus
Columbus, IN (Ledges 11-12)

2542 – IMI/Sellersburg Plant
Sellersburg, IN (Ledges 11-13)

2651 – Knox County Sand & Gravel
Vincennes, IN

An alternate dolomite or polish resistant aggregate source for the control section will be approved by the Department if the dolomite or polish resistant aggregate material meets the requirements of Part One in 1.4 when compared to the dolomite or polish resistant aggregate from one of the approved sources.

- 6.3 Testing shall be conducted by the Department or by a Department approved Laboratory. The cost of shipping and testing of the coarse aggregate shall be the responsibility of the Aggregate Producer.
- 6.4 Friction testing of the test sections will be conducted by the Department at no expense to the Aggregate Producer.

6.5 Approval of the source as a Polish Resistant Material will be based on results from both Part One and Part Two of this procedure.

7.0 SAMPLING.

7.1 Sampling of the coarse aggregate and approved dolomite or polish resistant aggregates shall be in accordance with ITM 207 in the presence of the Department.

7.2 The samples shall be sufficient in quantity to yield a minimum of 50 lb of material that is passing the 3/8 in. sieve and retained on the No. 4 sieve.

7.3 The samples shall be washed and decanted in accordance with AASHTO T 11.

7.4 The samples shall be sieved in accordance with AASHTO T 27 to obtain the appropriate quantity of material passing the 3/8 in. sieve and retained on the No. 4 sieve required for the test of Part One.

8.0 PROCEDURE.

8.1 Calibration and Testing Using the British Polishing Wheel and British Pendulum Tester (PART ONE).

8.1.1 Control Specimens.

- a)** Control specimens shall be fabricated using a 4 to 1 mixture by weight of 20-30 grade Ottawa sand and polyester resin in accordance with ASTM D3319. The back portion of the specimen shall be finished with the polyester resin to facilitate preparation of the bearing surface of the specimens.
- b)** The specimens may be heated in the molds in an oven at a temperature of 212°F for 2 to 4 hours if warping of the specimen occurs due to shrinkage of the polyester resin. Specimens shall be shaped to an 8 in. radius of curvature by mechanical clamps.
- c)** If the specimens do not properly fit on the road wheel, the bottom of the specimens shall be finished by hand sanding to ensure a proper fit.

8.1.2 Pendulum Calibration. Two sets of four control specimens each shall be prepared and used to calibrate the British Pendulum Tester. The two sets of specimens shall have initial friction values (PV-i) of 29 ± 1 and 38 ± 1 respectively in accordance with ASTM E303. These values shall be designated as the benchmark values for the control specimens. At the

beginning of each polish resistant test, the control specimens shall be tested. The British Pendulum Tester shall be adjusted until the average PV-i values for each of the two calibration groups are within plus or minus one unit from the established averages.

8.1.3 Specimen Preparation and Polish Resistant Calibration.

- a)** Specimens shall be prepared in accordance with ASTM D3319. A minimum of five specimens each shall be prepared for the coarse aggregate and the approved dolomite material.
- b)** Control specimens shall be used to develop consistency in specimen preparation and polishing. Four specimens shall be prepared and included with the test specimens on the British Polishing Wheel. The average of the four control specimens shall have PV-i values of 37 to 39 measured in accordance with ASTM E303. If these criteria are not met, all specimens prepared for the polish resistant test shall be discarded and new specimens prepared.
- c)** After polishing for 10 hours, the RPV-10 values for the four control specimens shall be measured in accordance with ASTM E303. The average RPV-10 value shall be 28 to 30. If this criteria is not met, the results from the polish resistant test shall not be used.
- d)** A control chart shall be prepared and maintained for control specimen RPV-10 values and the corresponding date of test. The average of the four values for each test shall be plotted.

8.1.4 Polishing Machine Tire.

- a)** The Polishing Machine tire shall be a smooth-tread, solid (non-pneumatic), tire approved by the Department.
- b)** The tire shall be replaced when the RPV-10 values of the control specimens have decreased by more than four points from the RPV-10 values obtained from a new tire.
- c)** A control chart shall be prepared and maintained for each tire indicating the tire usage hours and the corresponding RPV-10 values of the control specimens.

8.1.5 Pendulum Testing and Reporting.

- a) Specimens shall be tested in accordance with ASTM E303. Broken specimens and specimens with aggregate missing in the slider or contact area shall be discarded. Tests shall be made until four consecutive measurements give the same RPV-10 value.
- b) The test value for any aggregate shall be the average from a minimum of four specimens.
- c) If the coarse aggregate RPV-10 value is one less, equal to or greater than the approved dolomite or polish resistant aggregate RPV-10 value, the Aggregate Producer may request to proceed to Part Two of this procedure.
- d) Copies of the test information shall be sent to the Aggregate Producer and the Department and shall include the following:
 - 1. Coarse aggregate source identification
 - 2. Type of material
 - 3. Ledges of the aggregate, if applicable
 - 4. Date sampled
 - 5. Individual(s) obtaining sample of coarse aggregate
 - 6. PV-i and RPV-10 values for the control specimens
 - 7. Control chart for the RPV-10 values of the control specimens
 - 8. Control chart for the tire usage hours
 - 9. RPV-10 values of the coarse aggregate material
 - 10. RPV-10 values of the approved dolomite or polish resistant aggregate material

8.2 TEST SECTIONS (PART TWO).

8.2.1 Test Section Selection.

- a) Upon evaluation and approval of the polish resistant data, a contract will be selected by the Department for placement of the coarse aggregate and approved dolomite or polish resistant aggregate material test sections. The contract will have traffic ESAL's equal to or greater than 3,000,000 and have continuous uninterrupted traffic over the test sections.
- b) A 1 mi test section of HMA using the coarse aggregate material shall be placed adjacent to a 1 mi test section of HMA using the approved dolomite or polish resistant aggregate material. Both test sections shall be placed in the same Driving Lane. The two test sections shall be located between any major intersections on the contract.

8.2.2 Friction Testing.

- a) Each test section will be tested by the Department in accordance with ASTM E274. A smooth tire in accordance with ASTM E524 and a 40 mph test speed will be used.
- b) Friction testing will be performed after six months, one year, eighteen months, and two years of exposure to traffic.

9.0 ACCEPTANCE CRITERIA.

- 9.1** After two years exposure to traffic, if the coarse aggregate HMA friction values are equal to or greater than the approved dolomite or polish resistant aggregate HMA friction values, the material will be approved as a Polish Resistant Aggregate.

-or-

After three years exposure to traffic, if the coarse aggregate HMA friction values are equal to or greater than an average of 35.0, with no individual location value less than 30.0, the material will be approved as a Polish Resistant Aggregate.

- 9.2** The Department will maintain a list of Approved Polished Resistant Aggregates including those aggregates meeting the requirements outlined herein. The list will include two categories as follows:

- 9.2.1** Coarse aggregates that are approved for use in HMA surface mixtures for contracts with traffic ESAL's equal to or greater than 3,000,000 and less than 10,000,000.
- 9.2.2** Coarse aggregates that are approved for use when blended with air-cooled blast furnace slag, steel furnace slag, or sandstone in HMA surface mixtures for contracts with traffic ESAL's equal to or greater than 10,000,000.

The aggregate source and ledge number(s), if applicable, will be placed on the Approved List in the ESAL category that the contract used to approve the aggregate was within.

- 9.3** The aggregate will remain on the Department Approved List unless the material is not performing satisfactorily, as determined by the Department.

**POLISH RESISTANT AGGREGATE PRODUCER
ITM 214
WARRANTY BOND**

Know all persons by these presents that we, _____ as principal and _____ as surety, are held and firmly bound unto the State of Indiana (hereinafter referred to as obligee) in the full and just sum of \$ _____, lawful money of the United States of America, for the payment of which, well and truly to be made, we bind ourselves, our heirs, administrators, executors, successors, and assigns, jointly and severally, firmly by these presents.

The condition of the above obligation is that for two (2) years after the date the test section of HMA pavement located on _____, reference point _____ to reference point _____ is
(Beginning Point) (Ending Point)
completed and opened to unrestricted traffic; such warranty is to be in accordance with the Indiana Test Method 214 which is made a part of this bond for warranted test section of HMA pavement. If the principal satisfactorily fulfills the above condition, then this obligation shall be null and void; otherwise such obligation is to remain in full force and effect.

It is agreed that no modifications, omissions, or additions in or to the terms of the ITM 214 or the contract or in or to the plans or specifications shall affect the obligation of the surety on its bond.

In witness whereof, we hereunto set our hands and seal.

Name: _____

Name: _____

Address: _____

Address: _____

By: _____

By: _____

Signature Surety Title

Signature Principle Title

(Print or Typed) Surety

(Print or Typed) Principal

State of Indiana, County of _____ SS:

State of Indiana, County of _____ SS:

Personally appeared before me,

Personally appeared before me,

as surety and acknowledge the executions of the
above bond

as surety and acknowledge the executions of the
above bond

this _____ day of _____, 20 _____

this _____ day of _____, 20 _____

By _____

By _____

Signature Notary Public

Signature Notary Public

(Print of Typed) Notary

(Print of Typed) Notary

My Commission Expires _____, 20 _____

My Commission Expires _____, 20 _____

(County of Residence)

(County of Residence)