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Standard Practice for

# NTPEP Evaluation of Adhesive Concrete Anchor Systems

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**AASHTO Designation: [Number]**



**American Association of State Highway and Transportation Officials  
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## INTRODUCTION

*The National Transportation Product Evaluation Program (NTPEP) was established to minimize the amount of duplicative testing of transportation materials performed by AASHTO member states by providing a process where manufacturer/suppliers submit their products to NTPEP for laboratory and/or field testing. The results of the testing are then shared with member Departments for their use in product quality verification.*

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## 1. SCOPE

- 1.1 This standard practice covers the requirements and testing criteria for the National Transportation Product Evaluation Program (NTPEP) evaluation of adhesive concrete anchor systems (ACAS). The National Transportation Product Evaluation Program serves the member departments of the American Association of State Highway and Transportation Officials (AASHTO).
- 1.2 The results of this program may be used for product quality verification by individual member Departments. If used for quality verification, a letter of certification from the ACASs manufacturer indicating testing was conducted by the NTPEP that supports published values may be required by member Departments.
- 1.3 The values generated from the test protocols referred to in this plan are intended for use in conformance only. These values should not be used to design a project or installation. The NTPEP tests are currently index tests and do not reflect site and / or field conditions to which these materials are typically subjected.

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## 2. REFERENCED DOCUMENTS

- ASTM D2556-1993A, Standard Test Method for Apparent Viscosity of Adhesives Having Shear-Rate-Dependent Flow Properties
- ASTM D543-2006, Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents
- ASTM D1875-2003, Standard Test Method for Density of Adhesives in Fluid Form
- ASTM F1080-1993, Standard Test Method for Determining the Consistency of Viscous Liquids Using a Consistometer
- ASTM D2471-1999, Standard Test Method for Gel Time and Peak Exothermic Temperature of Reacting Thermosetting Resins

- ASTM C882M-2005, Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear
- ASTM D570-1998, Standard Test Method for Water Absorption of Plastics
- ASTM E1356-2008, Standard Test Method for Assignment of the Glass Transition Temperatures by Differential Scanning Calorimetry
- ASTM C531-2000, Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes
- ASTM C580-2002, Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes
- ASTM D638-2010, Standard Test Method for Tensile Properties of Plastics
- ASTM E488M-2010, Standard Test Methods for Strength of Anchors in Concrete Elements
- ASTM A193M-2011, Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
- ASTM C 31-2010, Standard Practice for Making and Curing Concrete Test Specimens in the Field
- ASTM C39M-2011, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

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### 3. SIGNIFICANCE AND USE

- 3.1 This standard practice utilizes laboratory tests to determine properties and evaluate the performance of adhesive concrete anchor systems. This work-plan is intended to assess adhesive anchor systems that are not intended for sustained load applications; for example, dowel connections in concrete pavement slab replacements and concrete barriers on bridge decks.

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### 4. FORM SUBMITTAL, SCHEDULING OF TESTING AND SAMPLING

#### 4.1 *Submittal of Product Evaluation Form(s) and Acceptance of Products for Testing*

- 4.1.1 The manufacturer will submit program payment and a Product Evaluation Form (PEF) for each product planned for NTPEP testing to the NTPEP Manager. After review of the PEF(s) for completeness and accuracy, the NTPEP Manager shall advise the manufacturer/supplier within two weeks of receipt of the PEF as to the approval of the products to be tested. A test number shall be assigned to each. The test number shall indicate the year and month of submission, and a sequential sample number. (i.e., ACAS-99-7-1 (Year-Month-Sample No.) The manufacturer/supplier will be notified by the NTPEP Manager upon approval of the product evaluation form(s).

**Note 1 – Adhesive Concrete Anchor System (ACAS) numbers that are assigned to a Manufacturer’s product will not change for the life of the test. Changes to the Product Name that the manufacturer gives the product at the time of application will not be allowed.**

#### 4.2 *Scheduling of Testing and Product Submittal*

- 4.2.1 All complete PEFs and fees must be received from the manufacturer/supplier prior to sampling taking place. After payment, the manufacturer/supplier shall work with the NTPEP Lead State Member to schedule testing.

#### 4.2.2

The lead state contact person will make arrangements to have the products sampled by the manufacturer, with sampling witnessed by a participating member of NTPEP. At least 256 ounces of sample adhesive shall be provided. ACAS product sampling shall be performed in accordance with the NTPEP adhesive concrete anchor system sampling protocol. Samples shall be representative of a production lot, not specially prepared for test purposes. An inspector from an AASHTO Member Department will obtain and mark the random sample(s) at the point of manufacture, or domestic distribution point. The sample shall be an “off-the-shelf” unit that is packaged as marketed. The manufacturer/supplier shall attach product/material literature and material data safety sheets to the PEF. All collected samples shall be labeled to show the manufacturer’s product code and manufacturer name and shall be shipped by and at the manufacturer’s expense via a carrier with a freight tracking system. All samples shall be shipped within twenty-four hours of sample selection. Samples shall be shipped to the designated NTPEP testing laboratory. Samples shall be labeled by the manufacturer and include the NTPEP test number. The labeling shall be witnessed by the NTPEP designee, which will then be responsible for transportation of the samples to the appropriate testing facility.

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## 5. TESTING CRITERIA

### 5.1.1 Adhesive Concrete Anchor Systems (ACAS)

Determine the *apparent viscosity* in accordance with ASTM D2556-1993A.

Determine the resistance to chemical reagents in accordance with ASTM D543-2006 Method A. Procedures I and II utilizing the following reagents:

- a) 87 octane gasoline with less than 10% ethanol
- b) Sulfuric acid (30%, specific gravity 1.84)
- c) 10% Sodium chloride solution
- d) 5% NaOH solution

Determine the *density* of each component in accordance with ASTM D1875-2003.

Determine the *consistency* in accordance with ASTM F1080-1993.

Determine the *gel time* in accordance with ASTM D2471-1999.

Determine the *bond strength* in accordance with ASTM C882-2005.

Determine the *water absorption* in accordance with ASTM D570-1998.

Determine the *glass transition temperature* in accordance with ASTM E1356-2008.

Determine the *coefficient of shrinkage and thermal expansion* in accordance with ASTM C531-2000.

Use 35°F to 100°F for thermal expansion.

Determine the *flexural strength and modulus of elasticity* in accordance with ASTM C580-2002.

Samples shall be cured as prescribed by the manufacturer.

Determine the *tensile strength* in accordance with ASTM D638-2010. Samples shall be cured as prescribed by the manufacturer.

Determine the *confined tensile strength* on single anchors in accordance with the ASTM E488-2010.

Test five replicates and report the coefficient of variation. Anchors shall be confined sufficiently utilizing steel plate to prevent breakout via concrete failure. Use 1/2" -13 and 3/4" -10 plain finished 125 ksi threaded anchor rods meeting the requirements of ASTM A193-2011 Grade B7. Anchor rods shall be embedded 3.0" and 4.5" respectively. Structural test members shall be fabricated utilizing Portland cement concrete with a compressive strength of 4500 ± 500 psi after 28 days of cure. The compressive strength specimens shall be fabricated in accordance with ASTM C 31-2010 and tested in accordance with ASTM C 39-2011. Incorporate #57 coarse aggregate (Oolitic Limestone and/or granite), silica sand, type I Portland cement with 25% class F fly ash to achieve the required strength with a slump range of 3.5" ± 0.5" and an air content of 5-7%. Optimize the total aggregate gradation (including sand); the particle size distribution shall result in a sieve analysis where 8% to -18% of the total mass is captured by each sieve ranging from the #100 sieve to the 1" sieve.

Determine the resistance to freeze thaw cycling by exposing 2 samples (one at each embedment depth, 1/2 inch diameter rod; fabricate the samples as prescribed for confined tension) to 50 cycles

of alternating temperature. One cycle will consist of 8 hours at  $10 \pm 5^\circ\text{F}$ , 8 hours at  $100 \pm 5^\circ\text{F}$ , with a  $6 \pm 1$  hour transition period. Following the completion of 50 cycles bring the sample to  $73^\circ\text{F}$  and perform confined tensile testing as prescribed above.

Analyze each individual liquid component of the ACAS by Fourier transform infrared spectroscopy, FTIR, using the horizontal attenuated total reflectance method, HATR. FTIR spectra shall be collected at 32 scans from  $4000\text{cm}^{-1}$  to  $400\text{cm}^{-1}$  using a Germanium (Ge) or Diamond crystal. Prepare and collect each spectrum in duplicate. Acceptable duplicate spectra shall have a minimum similarity index of 0.90 as calculated by algorithmic spectral analysis. Label each spectral file with the corresponding ACAS submission number, component identification, and duplicate designation.

Report each spectra, in the collected spectral file format and PDF format, the crystal used for collection, and the similarity index of the duplicate spectra.

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## 6. TEST REPORT REVIEW AND TEST RESULT APPEALS

- 6.1 The testing agency shall submit a draft report to the lead state contact person and the NTPEP Manager within 20 business days after completion of all testing. Each submitting organization shall receive a copy of the portion of the report dealing with their specific products. The submitting organization may appeal the results of the testing program in accordance with the AASHTO/NTPEP appeals procedures. Re-testing of the materials will be performed by the testing agency, and only on the relevant sample forwarded for testing. No additional sample material will be received for re-testing. Prior to re-test, the manufacturer/supplier making the appeal shall submit a fee to NTPEP to cover the costs of re-testing. Should the results of the re-test up-hold the appeal, the fee shall be reimbursed to the submitting organization. Upon agreement between the organization appealing the test results and the NTPEP Manager, either the original set or re-test set of data shall be published.

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## 7. REPORTING OF TEST DATA

- 7.1 Evaluation data will be compiled and made available to all participating states and testing companies through the AASHTO/NTPEP DataMine. This report will include data only. No judgment as to a product's acceptability will be made in this report. End user participants will establish individual criteria for product acceptability.

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## 8. TESTING FREQUENCY

- 8.1 Following the initial testing of a product, it must be re-tested every-three-years to remain published in the test report.

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## 9. TESTING FEES

The fees designated by NTPEP for testing are to be paid at time of application.

**Note 3** - A re-test fee for challenged results shall be refundable if retesting upholds the challenge. To be paid only if test results are challenged.