

MATERIALS TESTING MANUAL TABLE OF CONTENTS

<u>Introduction</u> (November 2, 2016) <u>Glossary of Terms</u> (July 15, 2005)

The following methods shall be performed in accordance with the respective designation:

| SERIES 100 | SAMPLING (November 8, 2017) |
|------------------|--|
| ARIZ 103b | Sampling Bituminous Materials |
| <u>ARIZ 104f</u> | Sampling Bituminous Mixtures |
| ARIZ 105f | Sampling Soils and Aggregates |
| ARIZ 108 | Sampling Hydrated Lime and Lime Products |
| ARIZ 109 | Sampling Metallic Materials |
| ARIZ 110 | Sampling Miscellaneous Materials |
| | |

Content Determination

| R 60 R 71 R 76 | Sampling Freshly Mixed Concrete Sampling and Amount of Testing of Hydraulic Cement Reducing Field Samples of Aggregate to Testing Size |
|----------------------|--|
| SERIES 200 | SOILS AND AGGREGATES (May 18, 2018) |
| ARIZ 201d | Sieving of Coarse and Fine Graded Soils and Aggregates |
| ARIZ 205c | Composite Grading |
| ARIZ 210c | Specific Gravity and Absorption of Coarse Aggregate |
| ARIZ 211f | Specific Gravity and Absorption of Fine Aggregate |
| ARIZ 212f | Percentage of Fractured Coarse Aggregate Particles |
| ARIZ 220a | Determination of Cement Content Required for Cement Treated Mixtures |
| ARIZ 221a | Moisture-Density Relations of Cement Treated Mixtures |
| ARIZ 222b | Rock Correction Procedure for Maximum Density Determination of Cement |
| | Treated Mixtures |
| ARIZ 223 | Field Density of Cement Treated Mixtures by Sand Cone Method or by |
| | Rubber Balloon Method |
| ARIZ 225b | Maximum Dry Density and Optimum Moisture of Soils by |
| | Proctor Method A |
| ARIZ 226 | Maximum Density and Optimum Moisture of Soils – Methods C and D |
| ARIZ 227d | Rock Correction Procedure for Maximum Dry Density and Optimum Moisture |

| ARIZ 229a | Calibration of Standard Sand and Sand Cone |
|-----------------|--|
| ARIZ 230a | Field Density by the Sand Cone Method |
| ARIZ 232b | Moisture-Density Relationship Using Typical Moisture-Density Curves (One Point Proctor) Method A |
| ARIZ 233d | Flakiness Index of Coarse Aggregate |
| ARIZ 235 | Density and Moisture Content of Soil and Soil-Aggregate Mixtures by the |
| | Nuclear Method |
| ARIZ 236d | Determining pH and Minimum Resistivity of Soils and Aggregates |
| ARIZ 237b | Determining pH and Soluble Salts of Soils |
| ARIZ 238a | Percent Carbonates in Aggregate |
| ARIZ 240a | Sieve Analysis and Separation of Salvaged AC Pavement Particles for Recycled |
| | Asphaltic Concrete |
| ARIZ 241b | Compressive Strength of Molded Cement Treated Base or |
| | Soil-Cement Specimens |
| ARIZ 242a | Sand Equivalent Test for Mineral Aggregate for |
| | Asphaltic Concrete Friction Course |
| ARIZ 244 | Artificial Grading of Mineral Aggregate |
| ARIZ 245a | Maximum Dry Density and Optimum Moisture of Soils by |
| | Proctor Alternate Method D |
| ARIZ 246b | Moisture-Density Relationship using Typical Moisture-Density Curves |
| | (One Point Proctor) Alternate Method D |
| ARIZ 247b | Particle Shape and Texture of Fine Aggregate Using Uncompacted Void Content |
| ARIZ 248 | Alternate Procedures for Sieving of Coarse and Fine Graded |
| | Soils and Aggregates |
| ARIZ 249 | Remolded Ring Samples for Direct Shear, Swell, and Consolidation |
| ARIZ 251a | Combined Coarse and Fine Aggregate Specific Gravity and Absorption |
| | |

| R 58 | Dry Preparation of Disturbed Soil and Soil-Aggregate Samples for Test |
|-------|---|
| R 76 | Reducing Field Samples of Aggregate to Testing Size |
| T 19 | Unit Weight and Voids in Aggregate |
| T 89 | Determining the Liquid Limit of Soils |
| T 90 | Determining the Plastic Limit and Plasticity Index of Soils |
| T 96 | Resistance to Abrasion of Small Size Coarse Aggregate by use of the |
| | Los Angeles Machine |
| T 104 | Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate |
| T 135 | Wetting-and-Drying Test of Compacted Soil-Cement Mixtures |
| T 136 | Freezing-and-Thawing Tests of Compacted Soil-Cement Mixtures |
| T 176 | Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test |
| T 190 | Resistance to R-Value and Expansion Pressure of Compacted Soils |
| | |

| T 217 | Determination of Moisture in Soils by Means of a |
|-------|---|
| | Calcium Carbide Gas Pressure Moisture Tester |
| T 220 | Determination of Strength of Soil-Lime Mixtures |
| T 255 | Total Moisture Content of Aggregate by Drying |
| T 265 | Laboratory Determination of Moisture Content of Soils |

ASTM procedures commonly used in this series are shown below:

D4791 Flat and Elongated Particles in Coarse Aggregate

SERIES 300 CONCRETE (November 2, 2016)

| ARIZ 308a | Method of Adjusting Concrete Mixes for Variations in Moisture Content |
|-----------------|--|
| ARIZ 309a | Testing Impervious Materials and Compounds for Curing Concrete |
| ARIZ 310a | Measuring Texture Depth of Portland Cement Concrete with Metal Tine Finish |
| ARIZ 311a | Method of Test for Flow of Grout Mixtures (Flow Cone Method) |
| ARIZ 314c | Compressive Strength of Cylindrical Concrete Specimens |
| ARIZ 315 | Precast Mortar Blocks Test |
| ARIZ 317a | Obtaining and Testing Drilled Cores and Sawed Beams of Concrete |
| ARIZ 318a | Estimating the Development of Concrete Strength by the Maturity Method |

AASHTO procedures commonly used in this series are shown below:

| T 22 | Compressive Strength of Cylindrical Concrete Specimens |
|-------|---|
| T 23 | Making and Curing Test Specimens in the Field |
| T 97 | Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading |
| T 119 | Slump of Portland Cement Concrete |
| T 121 | Weight per Cubic Foot, Yield, and Air Content (Gravimetric) of Concrete |
| T 126 | Making and Curing Concrete Test Specimens in the Laboratory |
| T 152 | Air Content of Freshly Mixed Concrete by the Pressure Method |
| T 231 | Capping Cylindrical Concrete Specimens |

| C31 | Making and Curing Concrete Test Specimens in the Field |
|------|---|
| C39 | Compressive Strength of Cylindrical Concrete Specimens |
| C78 | Flexural Strength of Concrete |
| C138 | Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete |
| C143 | Slump of Hydraulic-Cement Concrete |
| C172 | Sampling Freshly Mixed Concrete |
| C173 | Air Content of Freshly Mixed Concrete by Volumetric Method |
| | |

| C231 C617 C1064 | Air Content of Freshly Mixed Concrete by Pressure Method Capping Cylindrical Concrete Specimens Temperature of Freshly Mixed Concrete | |
|---|---|--|
| C1231 | Unbonded Caps for Concrete Cylinders | |
| SERIES 400 | BITUMINOUS MIXTURES (May 18, 2018) | |
| ARIZ 406d ARIZ 410f | Moisture Content of Bituminous Mixtures Compaction and Testing of Bituminous Mixtures Utilizing Four Inch Marshall Apparatus | |
| ARIZ 411a ARIZ 412b ARIZ 413 | Determination of Bituminous Distributor Truck Transverse Spread Rate Density of Compacted Bituminous Mixtures by the Nuclear Method Extraction of Asphalt from Bituminous Mixtures by Soxhlet Extraction | |
| ARIZ 415d ARIZ 416e | Bulk Specific Gravity and Bulk Density of Compacted Bituminous Mixtures Preparing and Splitting Field Samples of Bituminous Mixtures for Testing | |
| ARIZ 417e ARIZ 421 | Maximum Theoretical Specific Gravity and Density of Field Produced Bituminous Mixtures (Rice Test) Bituminous Material Content of Asphaltic Concrete Mixtures by the | |
| <u>ARIZ 422</u> | Nuclear Method Compaction and Testing of Bituminous Mixtures Utilizing 152.4 mm (Six Inch) Marshall Apparatus | |
| ARIZ 424d ARIZ 427a | Determination of Air Voids in Compacted Bituminous Mixtures Asphalt Binder Content of Asphaltic Concrete Mixtures by the Ignition Furnace Method | |
| ARIZ 428 | Asphalt Binder Content of Asphaltic Concrete Mixtures Containing Reclaimed Asphalt Pavement (RAP) by the Ignition Furnace Method | |
| ARIZ 429 ARIZ 430 | Field Shear Vane Test for Cold Recycled Asphalt Determining In-Place Flow of Cold Recycled Asphalt with the Marshall Hammer | |
| AASHTO procedures commonly used in this series are shown below: | | |
| T 164 T 283 T 312 | Quantitative Extraction of Asphalt Binder from Hot Mix Asphalt (HMA) Resistance of Compacted Bituminous Mixtures to Moisture Induced Damage Preparing and Determining the Density of Asphalt Mixture Specimens by Means of Superpave Gyratory Compactor | |
| SERIES 500 | BITUMINOUS MATERIALS (December 4, 2015) | |
| ARIZ 502b ARIZ 504 ARIZ 505a ARIZ 509a | Percentage of Uncoated Particles Using Asphalt Emulsions Vacuum Recovery of Asphalt Emulsion Residue Asphalt Rejuvenating Agent Residue Insoluble in Petroleum Ether Rapid Determination of Asphaltenes and Chemical Reactivity of Asphalts | |

ARIZ 511 Recovery of Asphalt from Extraction Solution

ARIZ 512b Residue by Evaporation

AASHTO procedures commonly used in this series are shown below:

| M 82 | Cutback Asphalt (Medium-Curing Type) |
|-------|--|
| M 320 | Performance Graded Asphalt Binder |
| R 28 | Accelerated Aging of Asphalt Binder Using a Pressurized Aging Vessel (PAV) |
| T 44 | Solubility of Bituminous Materials |
| T 48 | Flash and Fire Points by Cleveland Open Cup |
| T 49 | Penetration of Bituminous Materials |
| T 50 | Float Test for Bituminous Materials |
| T 51 | Ductility of Bituminous Materials |
| T 53 | Softening Point of Bitumen (Ring and Ball Apparatus) |
| T 55 | Water in Petroleum Products and Bituminous Materials by Distillation |
| T 59 | Testing Emulsified Asphalts |
| T 72 | Saybolt Viscosity |
| T 79 | Flash Point with Tag Open-Cup Apparatus for Use with Material Having a Flash |
| | Less Than 93.3 °C (200 °F) |
| T 201 | Kinematic Viscosity of Asphalts |
| T 202 | Viscosity of Asphalts by Vacuum Capillary Viscometer |
| T 228 | Specific Gravity of Semi-Solid Bituminous Materials |
| T 240 | Effect of Heat and Air on a Moving Film of Asphalt (Rolling Thin Film Oven Test) |
| T 301 | Elastic Recovery Test of Bituminous Materials by Means of a Ductilometer |
| T 313 | Determining the Flexural Creep Stiffness of Asphalt Binder Using the |
| | Bending Beam Rheometer (BBR) |
| T 315 | Determining the Rheological Properties of Asphalt Binder Using a Dynamic |
| | Shear Rheometer (DSR) |
| T 316 | Viscosity Determination of Asphalt Binder Using Rotational Viscometer |
| T 350 | Multiple Stress Creep Recovery (MSCR) Using Dynamic Shear Rheometer (DSR) |

ASTM procedures commonly used in this series are shown below:

| D5329 | Hot-Applied Sealants and Fillers for Joints and Cracks in Pavement |
|-------|---|
| D7741 | Apparent Viscosity of Asphalt-Rubber Using a Rotational Handheld Viscometer |

SERIES 600 CEMENT AND RELATED MATERIALS (July 15, 2005)

| T 21 | Organic Impurities in Fine Aggregates for Concrete |
|------|--|
| T 71 | Effect of Organic Impurities in Fine Aggregate on Strength of Mortar |

| T 105 | Chemical Analysis of Hydraulic Cement |
|-------|---|
| T 106 | Compressive Strength of Hydraulic Cement Mortar |
| | (Using 50 mm or 2-in. Cube Specimens) |
| T 107 | Autoclave Expansion of Portland Cement |
| T 129 | Normal Consistency of Hydraulic Cement |
| T 131 | Time of Setting of Hydraulic Cement by Vicat Needle |
| T 133 | Density of Hydraulic Cement |
| T 137 | Air Content of Hydraulic Cement Mortar |
| T 153 | Fineness of Portland Cement by Air Permeability Apparatus |
| T 162 | Mechanical Mixing of Hydraulic Cement Pastes and |
| | Mortars of Plastic Consistency |

ASTM procedures commonly used in this series are shown below:

| C25 | Chemical Analysis of Limestone, Quicklime, and Hydrated Lime |
|------|--|
| C110 | Physical Testing of Quicklime, Hydrated Lime, and Limestone |

SERIES 700 CHEMICAL AND SPECIALTY (December 4, 2014)

| ARIZ 702a | Testing of Paint, Varnish, Lacquer, and Related Material |
|------------------|--|
| ARIZ 714b | Sampling and Sieving of Crumb Rubber |
| ARIZ 719c | Heating and Drying Materials in Microwave Oven |
| ARIZ 725a | Tensile Proof Dowel Test |
| | |
| <u>ARIZ 726a</u> | Reflectance, Dry Opacity, and Yellowness Index of Traffic Paint |
| ARIZ 727a | Chloride in Hardened Concrete |
| ARIZ 729b | Exchangeable Sodium in Topsoil |
| ARIZ 732a | Calcium Carbonate in Topsoil (Neutralization Potential of Topsoil) |
| ARIZ 733b | Sulfate in Soils |
| ARIZ 734 | Determination of Portland Cement Content in Cement Treated Base Material |
| ARIZ 735a | Testing of Thermoplastic Pavement Marking Material |
| ARIZ 736b | Chloride in Soils |
| ARIZ 738 | Chloride in Concrete Admixtures |
| ARIZ 742 | Mean Macrotexture Depth of Milled Pavement |
| ARIZ 743 | Titanium Dioxide in Paints and Thermoplastics |
| ARIZ 744 | Rock Salt in Crash Barrel Sand |

| T 26 | Quality of Water To Be Used in Concrete |
|------|--|
| T 42 | Preformed Expansion Joint Filler for Concrete Construction |
| T 65 | Mass (Weight) of Coating on Iron and Steel Articles with |
| | Zinc or Zinc-Alloy Coatings |

T 244 Mechanical Testing of Steel Products

AASHTO procedures commonly used in this series are shown below:

Rubber Properties - Durometer Hardness

Roundness of Glass Spheres

| D4491 | Water Permeability of Geotextiles by Permittivity |
|------------------|--|
| E18 | Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials |
| SERIES 800 | DESIGN (March 31, 2017) |
| ARIZ 801a | Evaluation of Profiles |
| ARIZ 802h | Effect of Water on Strength of Compacted Bituminous Mixtures |
| | (Immersion Compression Test) |
| ARIZ 805b | Centrifuge Kerosene Equivalent of Aggregate, Including K-Factor |
| <u>ARIZ 806e</u> | Maximum Theoretical Specific Gravity of Laboratory Prepared |
| | Bituminous Mixtures (Rice Test) |
| ARIZ 807 | Design of Slurry Seal |
| ARIZ 814b | Design of Asphaltic Concrete Friction Course |
| <u>ARIZ 815d</u> | Marshall Mix Design Method for Asphaltic Concrete |
| ARIZ 819a | Design of Exposed Aggregate Seal Coats |
| ARIZ 822 | Determination of Additive or Asphalt Blend Required for |
| | Modification of Asphalt Viscosity |
| ARIZ 825a | Method of Test for Determining the Quantity of Asphalt Rejuvenating Agent |
| | Required for an Asphaltic Pavement |
| ARIZ 829a | Evaluation of Pavement Smoothness |
| ARIZ 832a | Marshall Mix Design Method for Asphaltic Concrete (Asphalt-Rubber) [AR-AC] |
| ARIZ 833 | Marshall Mix Design Method for Asphaltic Concrete with |
| | Reclaimed Asphalt Pavement (RAP) |
| | |

APPENDIX

D1155 D2240

| Appendix A1 | Rounding Procedure (December 4, 2015) |
|-------------|---|
| Appendix A2 | Metric Guide (July 15, 2005) |
| Appendix A3 | Equipment Calibration and Verification (September 28, 2012) |