Terminology SP 1

1. Scope

This standard practice provides terminology as interpreted and defined by the State of Alaska. The definitions of the American Association of State Highway and Transportation Officials (AASHTO) are the ones most commonly followed by DOT&PF.

2. Definitions

Absorption: The increase in the mass of aggregate due to water being absorbed into the pores of the material, but not including water adhering to the outside surface of the particles, expressed as a percentage of the dry mass.

Acceptance sampling and testing: Sampling and testing performed by the State of Alaska, or its designated agent, to evaluate acceptability of the final product. This is also called verification sampling and testing when specifically used to validate the contractor's data.

Admixture: Material other than water, cement, and aggregates in Portland cement concrete (PCC).

Aggregate: Hard granular material of mineral composition, including sand, gravel, slag or crushed stone, used in roadway base and in Portland Cement Concrete (PCC) and Asphalt mixtures.

- **Coarse aggregate:** Aggregate retained on or above the 4.75 mm (No. 4) sieve.
- **Coarse-graded aggregate:** Aggregate having a predominance of coarse sizes.
- **Dense-graded aggregate:** Aggregate having a particle size distribution such that voids occupy a relatively small percentage of the total volume.
- **Fine aggregate:** Aggregate passing the 4.75 mm (No. 4) sieve.
- **Fine-graded aggregate:** Aggregate having a predominance of fine sizes.
- **Mineral filler:** A fine mineral product at least 70 percent of which passes a 75 µm (No. 200) sieve.
- **Open-graded gap-graded aggregate:** Aggregate having a particle size distribution such that voids occupy a relatively large percentage of the total volume.
- **Well-Graded Aggregate:** Aggregate having an even distribution of particle sizes.

Aggregate storage bins: Bins that store aggregate for feeding material to the dryer in an asphalt mixture plant in substantially the same proportion as required in the finished mix.

Agitation: Provision of gentle motion in Portland Cement Concrete (PCC) sufficient to prevent segregation and loss of plasticity.

Air voids: Total volume of the small air pockets between coated aggregate particles in asphalt concrete pavement; expressed as a percentage of the bulk volume of the compacted paving mixture.

Ambient temperature: Temperature of the surrounding air.

Angular aggregate: Aggregate possessing well-defined edges at the intersection of roughly planar faces.

Apparent specific gravity: The ratio of the mass, in air, of a volume of the impermeable portion of aggregate to the mass of an equal volume of water.

Asphalt mixture: A dark brown to black cementitious material in which the predominate constituents are bitumens occurring in nature or obtained through petroleum processing. Asphalt is a constituent of most crude petroleum.

Asphalt binder: Asphalt specially prepared in quality and consistency for use in the manufacture of asphalt mixture pavement.

Asphalt material: Asphalt binder, tack or additives.

Asphalt mixture batch plant: A manufacturing facility for producing asphalt mixture that proportions aggregate by weight and asphalt by weight or volume.

Asphalt mixture continuous mix plant: A manufacturing facility for producing asphalt concrete that proportions aggregate and asphalt by a continuous volumetric proportioning system without specific batch intervals.

Automatic cycling control: A control system in which the opening and closing of the weigh hopper discharge gate, the bituminous discharge valve, and the pug mill discharge gate are actuated by means of automatic mechanical or electronic devices without manual control. The system includes preset timing of dry and wet mixing cycles.

Automatic dryer control: A control system that automatically maintains the temperature of aggregates discharged from the dryer.

Automatic proportioning control: A control system in which proportions of the aggregate and asphalt material fractions are controlled by means of gates or valves that are opened and closed by means of automatic mechanical or electronic devices without manual control.

Bag (of cement): 94 lb of Portland cement. (Approximately 1 ft^3 of bulk cement.)

Base: A layer of selected material constructed on top of subgrade or subbase and below the paving on a roadway.

Bias: The offset or skewing of data or information away from its true or accurate position as the result of systematic error.

Binder: Asphalt cement or modified asphalt cement that binds the aggregate particles into a dense mass.

Boulders: Rock fragment, often rounded, with an average dimension larger than 300 mm (12 in.).

Bulk Density: The mass per volume of a material, including any voids that may occur within the volume.

Bulk specific gravity: The ratio of the mass, in air, of a volume of aggregate or compacted asphalt mixture (including the permeable and impermeable voids in the particles, but not including the voids between particles) to the mass of an equal volume of water.

Bulk specific gravity (SSD): The ratio of the mass, in air, of a volume of aggregate or compacted asphalt mixture, including the mass of water within the voids (but not including the voids between particles), to the mass of an equal volume of water. (See **Saturated Surface Dry**.)

Calibration: A process that establishes the relationship (traceability) between the results of a measurement instrument, measurement system, or a material measure and the corresponding values assigned to a reference standard.

Check: A specific type of inspection and/or measurement performed on equipment and materials to indicate compliance or otherwise with stated criteria.

Clay: Fine-grained soil that exhibits plasticity over a range of water contents, and that exhibits considerable strength when dry. Also, that portion of the soil finer than 2 µm.

Cobble: Rock fragment, often rounded, with an average dimension between 75 and 300 mm (3 and 12 in.).

Cohesionless soil: Soil with little or no strength when dry and unconfined or when submerged, such as sand.

Cohesive soil: Soil with considerable strength when dry and that has significant cohesion when unconfined or submerged.

Compaction: Densification of a soil or asphalt mixture pavement by mechanical means.

Compaction curve (Proctor curve or moisture-density curve): The curve showing the relationship between the dry unit weight or density and the water content of a soil for a given compactive effort.

Compaction test (moisture-density test): Laboratory compaction procedure in which a soil of known water content is placed in a specified manner into a mold of given dimensions, subjected to a compactive effort of controlled magnitude, and the resulting density determined.

Compressibility: Property of a soil or rock relating to susceptibility to decrease in volume when subject to load.

Consolidation: In the placement of Portland cement concrete (PCC) it is the removal of entrapped air by either tamping or vibrating the material.

Constructor: The builder of a project. The individual or entity responsible for performing and completing the construction of a project required by the contract documents. Often called a contractor, since this individual or entity contracts with the owner.

Crusher-run: The total unscreened product of a stone crusher.

Delivery tolerances: Permissible variations from the desired proportions of aggregate and asphalt binder delivered to the pug mill.

Density: The ratio of mass to volume of a substance. Usually expressed in kg/m^3 (lb/ft^3).

Design professional: The designer of a project. This individual or entity may provide services relating to the planning, design, and construction of a project, possibly including materials testing and construction inspection. Sometimes called a “contractor”, since this individual or entity contracts with the owner.

Dryer: An apparatus that dries aggregate and heats it to specified temperatures.

Dry mix time: The time interval between introduction of aggregate into the pug mill and the addition of asphalt binder.

Durability: The property of concrete that describes its ability to resist disintegration by weathering and traffic. Included under weathering are changes in the pavement and aggregate due to the action of water, including freezing and thawing.

Effective diameter (effective size): D_{10}, particle diameter corresponding to 10 percent finer or passing.

Embankment: Controlled, compacted material between the subgrade and subbase or base in a roadway.

Field Operating Procedure (FOP): Procedure used in field testing on a construction site or in a field laboratory. (Based on AASHTO, ASTM or WAQTC test methods.)

Fineness modulus: A factor equal to the sum of the cumulative percentages of aggregate retained on certain sieves divided by 100; the sieves are 150 mm (6”), 75 mm (3”), 37.5 mm (1 ½”), 19.0 mm (3/4”), 9.5 mm (3/8”), 4.75 mm (No. 4), 2.36 mm (No. 8), 1.18 mm (No. 16), 0.60 mm (No. 30), 0.30 mm (No. 50), and 0.15 mm mm (No. 100). Used in the design of concrete mixes. The lower the fineness modulus, the more water/cement paste that is needed to coat the aggregate.

Fines: Portion of a soil or aggregate finer than a 75 µm (No. 200) sieve. Also silts and clays.

Free water: Water on aggregate available for reaction with hydraulic cement. Mathematically, the difference between total moisture content and absorbed moisture content.

Glacial till: Material deposited by glaciation, usually composed of a wide range of particle sizes, which has not been subjected to the sorting action of water.

Gradation (grain-size or particle-size distribution): The proportions by mass of a soil or fragmented rock distributed by particle size.

Gradation analysis (grain size analysis, particle-size or sieve analysis): The process of determining grain-size distribution by separation of sieves with different size openings.

Hot aggregate storage bins: Bins that store heated and separated aggregate prior to final proportioning into the mixer.

Hot mix asphalt (HMA) / Asphalt Mixture: High quality, thoroughly controlled hot mixture of asphalt cement and well-graded, high quality aggregate. The term Warm Mix Asphalt (WMA) is interchangeable with Hot Mix Asphalt (HMA) in this Manual. See WMA for more information.

Hydraulic cement: Cement that sets and hardens by chemical reaction with water.

Independent assurance (IA): Activities that are an unbiased and independent evaluation of all the sampling and testing (or inspection) procedures used in the quality assurance program. [IA provides an independent verification of the reliability of the acceptance (or verification) data obtained by the process control and acceptance testing. The results of IA testing or inspection are not to be used as a basis of acceptance. IA provides information for quality system management.]

In situ: Rock or soil in its natural formation or deposit.

Liquid limit: Water content corresponding to the boundary between the liquid and plastic states.

Loam: A mixture of sand, silt and/or clay with organic matter.

Lot: A quantity of material to be controlled. It may represent a specified mass, a specified number of truckloads, a linear quantity, or a specified time period during production.

Manual proportioning control: A control system in which proportions of the aggregate and asphalt material fractions are controlled by means of gates or valves that are opened and closed by manual means. The system may or may not include power assisted devices in the actuation of gate and valve opening and closing.

Materials and methods specifications: Also called prescriptive specifications. Specifications that direct the Constructor (Contractor) to use specified materials in definite proportions and specific types of equipment and methods to place the material.

Maximum size: One sieve larger than nominal maximum size.

Maximum particle size: First sieve to retain any material.

Mesh: The square opening of a sieve.

Moisture content (Soils and Aggregate): The ratio, expressed as a percentage, of the mass of water in a material to the dry mass of the material.

Moisture content (Asphalt Mixture): The ratio, expressed as a percentage, of the mass of water in a material to the dry mass of the material.

Nominal maximum size: One sieve larger than the first sieve to retain more than 10 percent of the material using an agency specified set of sieves based on cumulative percent retained. Where large gaps between specification sieves exist, intermediate sieve(s) may be inserted to determine nominal maximum size.

Nuclear gauge: Instruments used to measure in-place density, moisture content, or asphalt content through the measurement of nuclear emissions.

Optimum moisture content (optimum water content): The water content at which a soil can be compacted to a maximum dry density by a given compactive effort.

Organic soil: Soil with a high organic content.

Paste: Mix of water and hydraulic cement that binds aggregate in Portland cement concrete (PCC).

Penetration: The consistency of an asphalt material, expressed as the distance in tenths of a millimeter (0.1 mm) that a standard needle vertically penetrates a sample of the material under specified conditions of loading, time, and temperature.

Percent compaction: The ratio of density of a soil, aggregate, or asphalt mixture in the field to maximum density determined by a standard compaction test, expressed as a percentage.

Plant screens: Screens located between the dryer and hot aggregate storage bins that separate the heated aggregates by size.

Plastic limit: Water content corresponding to the boundary between the plastic and the semisolid states.

Plasticity: Property of a material to continue to deform indefinitely while sustaining a constant stress.

Plasticity index: Numerical difference between the liquid limit and the plastic limit and, thus, the range of water content over which the soil is plastic.

Portland cement: Hydraulic cement produced by pulverizing Portland cement clinker.

Portland cement concrete (PCC): A controlled mix of aggregate, Portland cement, and water, and possibly other admixtures.

PCC batch plant: A manufacturing facility for producing Portland cement concrete.

Process control: See Quality control.

Proficiency samples: Homogeneous samples that are distributed and tested by two or more laboratories. The test results are compared to assure that the laboratories are obtaining the same results.

Pugmill: A shaft mixer designed to mix aggregate and cement.

Quality assurance (QA): (1) All those planned and systematic actions necessary to provide confidence that a product or facility will perform satisfactorily in service; or (2) making sure the quality of a product is what it should be. [QA addresses the overall process of obtaining the quality of a service, product, or facility in the most efficient, economical, and satisfactory manner possible. Within this broad context, QA includes the elements of quality control, independent assurance, acceptance, dispute resolution etc. The use of the term QA/QC or QC/QA is discouraged and the term QA should be used. QA involves continued evaluation of the activities of planning, design, development of plans and specifications, advertising and awarding of contracts, construction, and maintenance, and the interactions of these activities.]

Quality assurance specifications: Specifications that require contractor quality control and agency acceptance activities throughout production and placement of a product. Final acceptance of the product is usually based on a statistical sampling of the measured quality level for key quality characteristics. [QA specifications typically are statistically based specifications that use methods such as random sampling and lot-by-lot testing, which let the contractor know if the operations are producing an acceptable product.]

Quality control (QC): Also called *process control*. The system used by a contractor to monitor, assess and adjust their production or placement processes to ensure that the final product will meet the specified level of quality. Quality control includes sampling, testing, inspection and corrective action (where required) to maintain continuous control of a production or placement process.

Reclaimed Asphalt Pavement (RAP): The term given to removed and/or reprocessed pavement materials containing asphalt and aggregates. These materials are typically generated when asphalt pavements are removed either by milling or full-depth removal. When properly crushed and screened, RAP consists of high-quality, well-graded aggregates coated by asphalt binder that may be recycled as a portion of new asphalt mixture pavement.

Random sampling: Procedure for obtaining non-biased, representative samples.

Sand: Particles of rock passing the 4.75 mm (No. 4) sieve and retained on the 75 µm (No. 200) sieve.

Saturated surface dry (SSD): Condition of an aggregate particle, asphalt mixture pavement or Portland cement concrete (PCC) core, or other porous solid when the permeable voids are filled with water, but no water is present on exposed surfaces. (See bulk specific gravity.)

Segregation: The separation of aggregate by size resulting in a non-uniform material.

SHRP: The Strategic Highway Research Program (SHRP) established in 1987 as a five-year research program to improve the performance and durability of roads and to make those roads safe for both motorists and highway workers. SHRP research funds were partly used for the development of performance-based specifications to directly relate laboratory analysis with field performance.

Sieve: Laboratory apparatus consisting of wire mesh with square openings, usually in circular or rectangular frames.

Silt: Material passing the 75 µm (No. 200) sieve that is non-plastic or very slightly plastic, and that exhibits little or no strength when dry and unconfined. Also, that portion of the soil finer than 75 µm and coarser than 2 µm.

Slump: Measurement related to the workability of concrete.

Soil: Natural occurring sediments or unconsolidated accumulations of solid particles produced by the physical and chemical disintegration or rocks, and which may or may not contain organic matter.

Specific gravity: The ratio of the mass, in air, of a volume of a material to the mass of an equal volume of water.

Stability: The ability of an asphalt concrete to resist deformation from imposed loads. Stability is dependent upon internal friction, cohesion, temperature, and rate of loading.

Standard Density: A lab or field derived density value used to determine relative compaction in the field.

Standardization: A process that determines (1) the correction or correction factor to be applied to the result of a measuring instrument, measuring system, material measure or reference material when its values are compared to the values realized by standards, (2) the adjustment to be applied to a piece of equipment when its performance is compared with that of an accepted standard or process.

Stratified random sampling: Procedure for obtaining non-biased, representative samples in which the established lot size is divided into equally-sized sublots.

Subbase: A layer of selected material constructed between the subgrade and the base coarse in a flexible asphalt material pavement roadway, or between the subgrade and Portland Cement Concrete (PCC) pavement in a rigid PCC roadway.

Subgrade: Natural soil prepared and compacted to support a structure or roadway pavement.

Sublot: A segment of a lot chosen to represent the total lot.

Superpave™: Superpave™ (Superior Performing Asphalt Pavement) is a trademark of the Strategic Highway Research Program (SHRP). Superpave™ is a product of the SHRP asphalt research. The Superpave™ system incorporates performance-based asphalt materials characterization with design environmental conditions to improve performance by controlling rutting, low temperature cracking and fatigue cracking. The three major components of Superpave™ are the asphalt binder specification, the mix design and analysis system, and a computer software system.

Theoretical maximum specific gravity (Asphalt Material): The ratio of the mass of a given volume of asphalt mixture with no air voids to the mass of an equal volume of water, both at a stated temperature commonly referred to as the "Rice" value.

Theoretical maximum specific gravity (PCC): The ratio of a given volume of PCC with no air voids to the mass of an equal volume of water, at a stated temperature. Usually determined during the concrete mix design. Can be used to determine percent air in concrete, in conjunction with field determined unit weights.

Topsoil: Surface soil, usually containing organic matter.

Traceability: The property of a result of a measurement whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties.

Uncertainty: A parameter associated with the result of a measurement that defines the range of the values that could be attributed to the measured quantity.

Uniformity coefficient: C_u, a value employed to quantify how uniform or well-graded an aggregate is: $C_u = D_{60}/D_{10}$. 60 percent of the aggregate, by mass, has a diameter smaller than D_{60} and 10 percent of the aggregate, by mass, has a diameter smaller than D_{10}.

Unit weight: The ratio of weight to volume of a substance. The term "density" is more commonly used.

µm: Micro millimeter (micron) used as measurement for sieve size.

Verification of calibration: A process that establishes whether the results of a previously calibrated measurement instrument, measurement system, or material measure are stable.

Verification sampling and testing: See acceptance sampling and testing.

Viscosity: A measure of the resistance to flow; one method of measuring the consistency of asphalt.

- **Absolute viscosity:** A method of measuring viscosity using the "poise" as the basic measurement unit. This method is used at a temperature of 60°C, typical of hot pavement.
- **Kinematic viscosity:** A method of measuring viscosity using the stoke as the basic measurement unit. This method is used at a temperature of 135°C, typical of hot asphalt at a plant.

Void in the mineral aggregate (VMA): The volume of inter-granular void space between aggregate particles of compacted asphalt concrete pavement that includes air and asphalt; expressed as a percentage of the bulk volume of the compacted paving mixture.

Voids filled with asphalt: The portion of the void in the mineral aggregate (VMA) that contains asphalt; expressed as a percentage of the bulk volume of mix or the VMA.

Warm Mix Asphalt (WMA): The generic term for a variety of technologies that allow the producers of asphalt mixtures material to lower the temperatures at which the material is mixed and placed on the road. Reductions from asphalt mixture temperatures of 50 to 100 degrees Fahrenheit are documented. Three general technologies are used at this time to decrease the mix and compaction temperatures including: chemical additives, organic additives (waxes) and foaming with water. Sampling and testing of WMA is done the same as with asphalt mixtures so these terms are interchangeable in this Manual.

Wet mixing period: The time interval between the beginning of application of asphalt material and the opening of the mixer gate.

Zero air voids curve (saturation curve): Curve showing the zero air voids density as a function of water content. Points that define the curve are calculated in accordance with the addendum of WAQTC FOP for AASHTO T 99/ T 180.

Calibration of Mechanical Compaction Hammer/Rammer SP 2

1. Scope

This practice sets forth the apparatus, procedures, and materials necessary to calibrate a mechanical compaction hammer used in ATM 417, WAQTC FOP for AASHTO T 99/T 180, AASHTO T 245; and ASTM D 698/D 1557 in accordance with ASTM D 2168 Test Method A.

There are two parallel procedures providing instruction for verification of physical characteristics and calibration of dynamic characteristics for manual and mechanical Soils and Marshall compaction hammers and compaction pedestals. Physical Characteristics are examined first, verifying mass and critical dimensions of the manual and mechanical compaction hammers and compaction pedestals.

Warning – This test method involves potentially hazardous materials, operations and equipment. This method does not purport to address all of the safety problems associated with it use.

2. Apparatus

- Hand-operated compaction hammers and compaction pedestals conforming to the requirements of WAQTC FOP for AASHTO T 99/T 180, AASHTO T 245; and ASTM D 698/D 1557.
- Mechanical compaction hammers and pedestals conforming to the requirements of ATM 417, WAQTC FOP for AASHTO T 99/T 180, AASHTO T 245, and ASTM D 698/D 1557.
- Proctor and Marshall compaction molds, bases, collars and rubber plugs (roughly 50 mm (2") thick and cut to fit bottom of mold).
- Caliper capable of measuring to an accuracy of 0.005 inch.
- Calibrated ruler readable to 1/32 inch.
- Balance readable to 0.1 gram equipped with suspension apparatus and holder to permit weighing materials while suspended from the center of the scale in a water bath.
- Asphalt thermometer capable of measuring the hot-mix-asphalt temperature to within 5^0 F
- Oven: For asphalt set to 135°C (275°F), or specified compaction temperature, molds, tools and accessories required to prepare and extract six (6) Marshall Specimens.

3. Procedure for Verification of Physical Characteristics

Inspect and adjust the mechanical and hand-operated compaction hammers to conform to the requirements of ATM T 417, WAQTC FOP for AASHTO T 99/ T 180, AASHTO T 245; and ASTM D698 & D1557.

4. Physical Characteristics of Hand-Operated Manual Hammer and Pedestal

1. Asphalt: Inspect and adjust manual Marshall Hammer and compaction pedestal.
    a. Using the caliper, measure and record the diameter of the rammer face by taking two readings 90° apart. The diameter of the face should average a minimum of 3.875 inches measured to the nearest 0.005 inch.
    b. Lift the sliding weight up to the top of the guide rod and measure the drop height of the sliding weight to the nearest 1/16 inch from the bottom of the sliding weight face to the top of the foot sleeve, record measurement. The sliding weight should have a free fall of 18 ± 0.0625 (1/16) inch. Record measurement in decimal form.

c. Remove the handle and sliding hammer weight from the guide rod. Weigh and record the slide weight mass to the nearest 1 gram. The hand-operated hammer should have a 4,536 ± 9 gram (10 ± 0.02 lbs.) sliding weight (including safety finger guard if equipped).

d. Measure and record the dimensions of the wooden post and the steel plate portions of the pedestal. Pedestals should consist of an 8 x 8 x 18 inch wooden post capped with a 12 x 12 x 1 inch steel plate. Verify sturdy construction of the pedestal: The wooden post should be free of cracks or splits and be secured by four angle brackets to a solid concrete slab with the steel cap firmly fastened to the post. The assembly shall be installed so the post is plumb and the cap is level.

2. Soils: Inspect and adjust manual Proctor hammer and compaction pedestal for conformance to AASHTO T 99 or T 180, or for ASTM D698 or D1557.

5. Physical Characteristics of Mechanically Operated Hammer and Pedestal

1. Asphalt: Inspect and adjust the mechanical Marshall Hammer as done in Part 4. Steps 1a, 1b, and 1c. When measuring the slide weight free fall dimension, raise the slide weight up the guide rod until the pick-up pins recede by contact with the disengagement bar, measure and record height from bottom of slide weight face to the top of the foot sleeve. When weighing slide weight, remove disengagement assembly from the top of the guide rod and slide weight off rod.

   a. Measure and record the dimensions of the wooden post and the steel plate portions of the pedestal. Pedestals should consist of an 8 x 8 x 18 inch wooden post capped with a 12 x 12 x 1 inch steel plate.

   b. Verify sturdy construction of the pedestal: The wooden post should be free of cracks or splits and be secured by four angle brackets to a solid concrete slab with the steel cap firmly fastened to the post. The assembly shall be installed so the post is plumb and the cap is level.

2. Soils: Inspect and adjust mechanical Proctor hammer and compaction pedestal for conformance to AASHTO T 99 or T 180, or for ASTM D698 or D1557. Note ASTM D1557 allows use of a sector face hammer.

6. Procedure for Calibration of Dynamic Characteristics of Asphalt Mixes

1. Asphalt preparation:

   a. If asphalt sample is workable, split into at least six equal portions of 1250 ±5 grams using the WAQTC Loaf Method. Place the six equal portions and the remaining asphalt into the oven and heat to compaction temperature, typically 135 ± 5°C (275 ± 9°F). If not workable, place asphalt into oven and allow time for asphalt to return to a plastic state so splitting can be accomplished, split as indicated above, then return the six equal portions and the remaining asphalt to the oven to obtain compaction temperature.

   b. Place Marshall mold assemblies and other asphalt handling tools in oven to preheat to compaction temperature. Use hot plate or oven to heat compaction face of mechanical and manual compaction hammers to 93 - 149°C (200 - 300°F).

2. Once asphalt and other materials have reached compaction temperature, use the extra asphalt to butter the mixing bowl and specimen preparation tools. Loosen up the mechanical compactor mechanism by compacting a portion of the extra asphalt with a minimum of 25 blows. Discard the partially compacted asphalt used to “warm up” the mechanical compactor. Next, alternately compact a Marshall Specimen using the manual compaction hammer and a Marshall Specimen using the mechanical compaction hammer, until three specimens have been produced by each method. Follow the steps below in preparing the specimens.

   a. Remove one Marshall base, mold, and collar assembly from oven when ready to use. Place filter paper in the bottom of the mold.

b. Remove one asphalt portion from oven, place in a mixing bowl, vigorously and briefly mix asphalt and scoop into mold assembly. Using the spatula, vigorously spade the asphalt in the mold 15 times around the perimeter and then 10 times over the interior. Smooth surface of the asphalt in the mold to a rounded, convex shape.

c. Place a piece of filter paper on top of asphalt in mold, place mold assembly on compaction pedestal and secure with mold holder.

d. Apply 50 blows, unless otherwise specified, of compaction effort. (Manual Hammer notes: Hold the hammer axis perpendicular to the mold assembly. AASHTO allows use of a guide bar fixed to the compaction pedestal to maintain perpendicular alignment of the hammer. ASTM prohibits use of guide bar as the natural wandering from true perpendicular produces a kneading action that enhances compaction. Care shall be taken to avoid adding body weight to the hammer by leaning or pressing down on the hammer. Compaction shall be done at a minimum rate of 40 blows per minute. The compaction hammer shall apply only one blow with each fall - that means there shall not be a rebound impact.)

e. Remove mold holder and collar, remove mold from base plate and flip over (180° turn), return mold to base plate, replace collar and mold holder, and apply an additional 50 blows of compaction effort.

f. Remove mold assembly from compaction pedestal; remove collar and base plate from mold specimen, set mold with specimen aside to cool until cohesion of the sample will allow specimen extraction from the mold. (When specimens in the steel mold have cooled to the point where they can be handled without gloves, generally below 60°C (140°F), they can be extracted from the molds without damage if handled carefully.) Marshall Specimens should be allowed to cool over night at room temperature; however cooling may be accelerated by the use of fans.

g. Clean surfaces of compaction equipment used.

3. Perform specific gravity measurements for each Marshall specimen according to AASHTO T 166, Method A.

   a. Measure and record dry weight of cooled specimen.

   b. Immerse specimen in water bath at 25 ± 1°C (77 ± 1.8°F) for 4 ± 1 minute and record the immersed mass.

   c. Remove the specimen from the water and quickly damp dry the specimen with a damp towel to produce a saturated surface dry condition, record the surface dry mass of the specimen.

7. Calibration Comparison and Adjustment for Asphalt Mixes

1. Calculate the bulk specific gravity of the specimens as follows, round and report to the nearest three decimal places, or thousandth:

$$\text{Bulk Specific Gravity} = A / (B - C)$$

Where:
A = mass in grams of sample in air;
B = mass in grams of surface-dry specimen in air; and
C = mass in grams of sample in water.

(Within each set prepared by a given hammer the densities shall not differ by more than 2.5 pcf for ½" and 3/4" mix and 3.0 pcf for 1" mix. If density consistency is not met then specimens shall be discarded and a new set of specimens prepared.)

2. Calculate the percent water absorbed by specimens (on volume basis) as follows:

Percent Water Absorbed by Volume = [(B-A)/ (B-C)]*100

If percent water absorbed by the specimen is greater than 2% then paraffin coated specimens must be used to verify the mechanical compactor with the manual compactor. See AASHTO T275 or ASTM D1188.

3. Calculate the average specific gravity values for the mechanically compacted and the manually compacted specimens independently.

4. Calculate *W*, the percentage difference between the average specific gravity values for the two compaction methods. Calculation:

   W = % Difference =

   | (manual method avg. sp. G. - mechanical method avg. Sp. G.) |*100 / (manual method avg. Sp. G.)

   If the absolute value of the difference between the results of the mechanical vs. the manual compaction method is 2.0% or less, the mechanical compaction hammer is ready for use.

5. If the difference is greater than 2.0%, adjust the weight or of the mechanical hammer and repeat the procedure until the mean value of the mechanical compaction hammer data varies from the mean value of the manual hammer data by 2.0% or less.

8. Procedure for Calibration of Dynamic Characteristics of Soils

1. Obtain at least 30 kg (66 lb) of soil classified as CL in accordance with Unified Soil Classification (ASTM D 2487) with liquid limit less than 50 and PI greater than 7. (ARML soil compaction samples typically meet this classification.)

2. Assure all the soil passes a #4 sieve and is at less than 3% moisture. Dry at 60^0 C or less, if needed. Pass material through splitter to assure uniform mixing.

3. Split out 5 portions of approximately 6500g each. Batch 5 moisture points, cover with plastic wrap and allow points to sit overnight to assure complete hydration of material. Using approximately 3, 5, 7, 9, 11% moisture typically works well for AMRL compaction sample material (Review the AMRL summary report and adjust moisture range as required for the reported proctor result. Use the reported optimum moisture and maximum density to double check the calibration specimen values.)

4. Using soil, as prepared above, determine the optimal moisture and maximum dry unit weight by the method appropriate for the mechanical compactor being calibrated. Pound each moisture point with both the mechanical and manual hammer, passing the sample through the #4 sieve before re-compacting. Be careful to minimize drying of sample while re-sieving material.

5. Plot data points and determine the moisture/density curve for the manual and mechanical hammers.

9. Calibration Comparison and Adjustment for Soils

1. If *W,* the absolute value of the difference between the two maximum dry unit weights is less than 2.0%, the mechanical hammer is satisfactory for immediate use. If the difference *W* is greater than 2.0%, then obtain **TWO** additional sets of data, reusing the previously used soil. Determine *W* for the average of the three data sets for mechanical and manual hammer. If *W* is less than 2.0%, the mechanical hammer is satisfactory for use.

2. If *W* exceeds 2.0%, then add weight to or reduce the drop height of the mechanical hammer until 3 data sets are obtained with *W* less than 2.0%. If addition of greater than 10% of the mechanical hammer weight is needed, the mechanical compactor needs to be adjusted or rebuilt. If weight needs to be removed from the mechanical hammer, recheck and verify all hammer weight and drop height calibrations. If weight removal is STILL indicated, then reduce drop height to obtain *W* less than 2.0%.

10. Report

1. Calibrate all compaction hammers every 12 months or prior to use if the existing calibration is more than one (1) year old.
2. File original calibration certificate and test data with the calibrating laboratory.
3. Keep a copy of the calibration certificate with the Compaction Hammer.

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Reserved for WAQTC Discipline Policy SP 3

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Random Sampling SP 4

1. Significance

Sampling and testing are two of the most important functions in quality assurance (QA). Data from the tests are the tools with which the quality of product is controlled. For this reason, great care must be used in following standardized sampling and testing procedures. This practice is useful for determining the location or time, or both, to take a sample in order to minimize any unintentional bias on the part of the person taking the sample.

The selection procedures and examples in this standard provide a practical approach for ensuring that construction material samples are obtained in a random manner. Additional details concerning the number of sample increments, the number of samples, the quantities of material in each, and the procedures for extracting sample increments or samples from the construction lot or process are contained in the Materials Samples and Testing Frequency tables and the individual test procedures. This standard contains examples using road and paving materials. The concepts outlined here are applicable to the random sampling of any construction material.

2. Scope

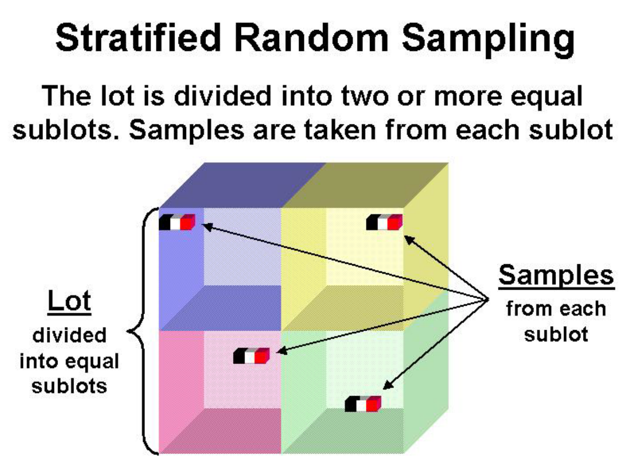
The procedure presented here eliminates bias in sampling materials when followed carefully. Randomly selecting a set of numbers from a table or calculator will eliminate the possibility for bias. Random numbers are used to identify sampling times and/or locations within a lot or sublot. This method does not cover how to sample, but rather how to determine sampling times and/or locations.

3. Sampling Concepts

A lot is the quantity of material evaluated by QA procedures. A lot is a preselected quantity that may represent hours of production, a quantity or number of loads of material, or an interval of time. A lot may be comprised of several portions that are called sublots or units. The number of sublots comprising a lot will be determined by DOT&PF's specifications

Stratified Random Sampling: Stratified random sampling divides the lot into a specified number of sublots or units and then determines each sample location within a distinct sublot.

All random sampling shall be stratified random sampling unless otherwise directed.



4. Instructions for Using the Three-Digit Table of Random Numbers

Table 1 consists of 1,000 numbers from 0.000 to 0.999. Each number appears only once in the Table of 100 rows by 10 columns. The Table is most effectively used when a row and column are randomly selected and the entered value from the Table is then used for sample selection. Several methods of selection of row and column are available including:

Use of the RANDOM function in pocket calculators (if available) to select row and column. For example, for selection of row: the RANDOM function generates 0.620. Then the row to be used is 0.620 × the number of rows = 0.620(100) = 62.0 or 62. Likewise for the column, the RANDOM function generates 0.958 and the column is 0.958 (10) = 9.58 or 10. The random number to be used for the sample is in row 62, column 10 = 0.460.

Similarly, if Microsoft Excel is available, the RAND function can be used to generate random numbers for selection of row and column. This can be accomplished by selecting an open cell in Excel entering: =RAND() or: =rand(). Do this once for a row and a second for column, multiplying as explained above.

Start a digital stop watch and stop it several seconds later, using the decimal part of the seconds as multipliers to determine your Row/Column number(s).

Table 1

Row\ Column	1	2	3	4	5	6	7	8	9	10
1	0.910	0.921	0.889	0.985	0.697	0.562	0.701	0.284	0.534	0.519
2	0.769	0.814	0.210	0.758	0.846	0.113	0.312	0.716	0.975	0.729
3	0.722	0.220	0.726	0.942	0.825	0.177	0.120	0.558	0.979	0.451
4	0.872	0.772	0.338	0.374	0.000	0.387	0.491	0.647	0.445	0.053
5	0.850	0.836	0.145	0.216	0.270	0.109	0.590	0.882	0.740	0.434
6	0.291	0.780	0.782	0.306	0.470	0.712	0.252	0.630	0.231	0.694
7	0.295	0.502	0.615	0.541	0.765	0.092	0.376	0.523	0.551	0.733
8	0.761	0.370	0.278	0.288	0.256	0.352	0.064	0.195	0.334	0.652
9	0.790	0.750	0.402	0.182	0.577	0.391	0.214	0.481	0.680	0.348
10	0.547	0.011	0.355	0.587	0.359	0.310	0.192	0.545	0.487	0.925
11	0.868	0.049	0.505	0.139	0.705	0.007	0.633	0.754	0.124	0.280
12	0.384	0.968	0.483	0.203	0.513	0.583	0.637	0.477	0.957	0.515
13	0.996	0.665	0.658	0.412	0.149	0.673	0.103	0.344	0.619	0.263
14	0.804	0.242	0.662	0.135	0.248	0.173	0.398	0.459	0.744	0.156
15	0.440	0.331	0.128	0.737	0.529	0.313	0.683	0.839	0.636	0.245
16	0.042	0.027	0.337	0.142	0.196	0.036	0.516	0.074	0.666	0.277
17	0.497	0.903	0.444	0.822	0.886	0.230	0.463	0.234	0.185	0.068
18	0.508	0.999	0.469	0.480	0.448	0.544	0.121	0.260	0.843	0.078
19	0.672	0.871	0.540	0.025	0.548	0.978	0.495	0.138	0.202	0.281
20	0.031	0.059	0.241	0.431	0.897	0.198	0.559	0.946	0.206	0.003
21	0.775	0.668	0.441	0.993	0.644	0.634	0.591	0.604	0.341	0.865
22	0.174	0.100	0.324	0.651	0.935	0.110	0.292	0.747	0.213	0.249
23	0.465	0.309	0.961	0.006	0.401	0.950	0.038	0.305	0.907	0.166
24	0.369	0.046	0.484	0.170	0.377	0.416	0.640	0.967	0.399	0.608
25	0.597	0.864	0.063	0.725	0.146	0.687	0.330	0.394	0.693	0.928
26	0.052	0.629	0.351	0.586	0.896	0.020	0.860	0.490	0.881	0.913
27	0.892	0.922	0.360	0.253	0.127	0.067	0.189	0.815	0.084	0.018
28	0.832	0.159	0.178	0.618	0.800	0.255	0.890	0.456	0.757	0.383
29	0.095	0.349	0.157	0.426	0.554	0.992	0.413	0.885	0.924	0.148

Row\ Column	1	2	3	4	5	6	7	8	9	10
30	0.778	0.981	0.237	0.906	0.703	0.970	0.874	0.810	0.949	0.472
31	0.917	0.767	0.002	0.714	0.899	0.867	0.824	0.326	0.621	0.561
32	0.760	0.593	0.589	0.696	0.835	0.600	0.856	0.682	0.415	0.518
33	0.180	0.625	0.550	0.447	0.817	0.689	0.614	0.582	0.678	0.646
34	0.301	0.532	0.329	0.500	0.436	0.575	0.536	0.564	0.671	0.372
35	0.397	0.258	0.653	0.290	0.557	0.418	0.358	0.386	0.888	0.322
36	0.080	0.347	0.244	0.251	0.176	0.187	0.443	0.212	0.315	0.977
37	0.379	0.155	0.411	0.507	0.009	0.041	0.308	0.169	0.137	0.066
38	0.062	0.201	0.831	0.297	0.098	0.998	0.265	0.105	0.094	0.927
39	0.863	0.884	0.916	0.183	0.895	0.130	0.948	0.087	0.920	0.215
40	0.717	0.781	0.984	0.037	0.909	0.706	0.973	0.304	0.877	0.802
41	0.635	0.667	0.934	0.795	0.763	0.592	0.158	0.699	0.838	0.656
42	0.624	0.891	0.731	0.806	0.692	0.617	0.585	0.681	0.980	0.649
43	0.012	0.660	0.457	0.482	0.724	0.553	0.745	0.820	0.503	0.439
44	0.364	0.546	0.514	0.343	0.571	0.407	0.610	0.866	0.336	0.535
45	0.400	0.720	0.261	0.293	0.560	0.421	0.389	0.425	0.218	0.325
46	0.179	0.446	0.279	0.318	0.777	0.243	0.211	0.307	0.222	0.275
47	0.133	0.140	0.969	0.076	0.033	0.631	0.236	0.161	0.396	0.129
48	0.311	0.172	0.663	0.752	0.930	0.154	0.122	0.197	0.485	0.983
49	0.015	0.250	0.517	0.951	0.090	0.855	0.165	0.880	0.805	0.816
50	0.869	0.837	0.848	0.741	0.773	0.008	0.784	0.040	0.912	0.709
51	0.926	0.627	0.958	0.894	0.734	0.723	0.638	0.670	0.937	0.798
52	0.314	0.791	0.047	0.727	0.556	0.823	0.282	0.620	0.588	0.492
53	0.378	0.645	0.136	0.403	0.474	0.346	0.410	0.613	0.435	0.264
54	0.257	0.531	0.499	0.150	0.385	0.289	0.086	0.111	0.353	0.079
55	0.698	0.004	0.175	0.143	0.972	0.997	0.029	0.061	0.965	0.093
56	0.940	0.730	0.794	0.762	0.826	0.858	0.648	0.616	0.787	0.584
57	0.829	0.900	0.953	0.793	0.274	0.566	0.423	0.117	0.809	0.254
58	0.466	0.989	0.419	0.395	0.936	0.579	0.914	0.643	0.286	0.083
59	0.299	0.224	0.449	0.776	0.060	0.473	0.235	0.417	0.898	0.097
60	0.227	0.238	0.205	0.302	0.748	0.878	0.017	0.601	0.186	0.987
61	0.085	0.131	0.526	0.075	0.163	0.430	0.363	0.032	0.104	0.019
62	0.039	0.537	0.043	0.259	0.141	0.494	0.171	0.609	0.428	0.460
63	0.188	0.088	0.654	0.690	0.316	0.438	0.808	0.964	0.193	0.549
64	0.167	0.152	0.462	0.267	0.320	0.160	0.641	0.199	0.677	0.901
65	0.342	0.096	0.099	0.622	0.786	0.028	0.569	0.947	0.755	0.990
66	0.611	0.818	0.932	0.857	0.081	0.408	0.427	0.840	0.207	0.168
67	0.077	0.686	0.594	0.605	0.573	0.669	0.380	0.246	0.908	0.876
68	0.107	0.801	0.718	0.498	0.893	0.707	0.530	0.797	0.453	0.350
69	0.598	0.327	0.406	0.904	0.675	0.626	0.509	0.861	0.382	0.414
70	0.184	0.366	0.555	0.455	0.021	0.323	0.684	0.071	0.268	0.108

Row\ Column	1	2	3	4	5	6	7	8	9	10
71	0.153	0.164	0.132	0.228	0.939	0.070	0.209	0.527	0.887	0.919
72	0.057	0.452	0.266	0.089	0.356	0.217	0.971	0.974	0.051	0.574
73	0.420	0.807	0.732	0.303	0.715	0.743	0.014	0.580	0.873	0.830
74	0.388	0.512	0.833	0.982	0.676	0.373	0.768	0.405	0.659	0.862
75	0.779	0.501	0.736	0.679	0.538	0.010	0.273	0.335	0.581	0.371
76	0.612	0.796	0.764	0.572	0.437	0.576	0.409	0.704	0.467	0.232
77	0.294	0.271	0.811	0.602	0.700	0.995	0.433	0.854	0.239	0.933
78	0.875	0.262	0.367	0.929	0.102	0.623	0.476	0.711	0.819	0.915
79	0.655	0.181	0.345	0.506	0.106	0.570	0.918	0.134	0.528	0.496
80	0.963	0.285	0.650	0.024	0.317	0.520	0.565	0.960	0.542	0.147
81	0.050	0.223	0.986	0.522	0.125	0.751	0.988	0.956	0.300	0.001
82	0.114	0.783	0.533	0.056	0.221	0.381	0.789	0.287	0.058	0.026
83	0.911	0.392	0.847	0.849	0.319	0.298	0.943	0.362	0.944	0.606
84	0.828	0.719	0.954	0.708	0.552	0.458	0.424	0.853	0.905	0.691
85	0.116	0.821	0.191	0.082	0.879	0.488	0.661	0.035	0.595	0.702
86	0.739	0.938	0.045	0.746	0.013	0.504	0.842	0.735	0.759	0.442
87	0.728	0.803	0.771	0.091	0.632	0.664	0.931	0.792	0.225	0.328
88	0.753	0.710	0.475	0.945	0.785	0.657	0.454	0.721	0.118	0.200
89	0.486	0.543	0.034	0.511	0.340	0.404	0.799	0.607	0.883	0.022
90	0.639	0.479	0.269	0.468	0.354	0.365	0.333	0.429	0.464	0.229
91	0.461	0.226	0.123	0.390	0.525	0.493	0.568	0.283	0.115	0.044
92	0.422	0.240	0.208	0.219	0.272	0.112	0.742	0.144	0.065	0.204
93	0.966	0.073	0.030	0.233	0.361	0.596	0.126	0.276	0.994	0.962
94	0.151	0.119	0.194	0.450	0.991	0.959	0.055	0.023	0.072	0.841
95	0.852	0.685	0.162	0.774	0.845	0.738	0.770	0.005	0.339	0.976
96	0.813	0.952	0.069	0.539	0.941	0.048	0.749	0.016	0.766	0.695
97	0.603	0.859	0.628	0.902	0.870	0.827	0.393	0.923	0.812	0.524
98	0.489	0.510	0.521	0.756	0.713	0.478	0.788	0.247	0.296	0.563
99	0.578	0.101	0.567	0.674	0.834	0.375	0.642	0.471	0.321	0.844
00	0.332	0.599	0.955	0.688	0.190	0.357	0.368	0.432	0.054	0.851

5. Alternate Procedures for Random Number Selection

Random numbers may be generated using the RANDOM function in pocket calculators and spreadsheets. For example, the RANDOM function generates 0.620. The number 0.620 should be entered as the random number and multiplied by the quantity under consideration to determine the sample location.

Similarly, if Microsoft Excel is available, the RAND function can be used to generate random numbers for selection of the sample location.

6. Random Number Sampling Procedures

Determine the number of random numbers necessary for each sample location from Table 2.

Table 2

Sample Type or WAQTC Method	# of Random Numbers Required
Oil from plant or truck	1
T 2/T 168 from Belt	1
T 2/T 168 from Truck	1
T 2/T 168 from Roadway	2
T 2/T 168 from Windrow	1
TM 11 Core	2
TM 2 Plastic Concrete	1
TP 83 Grout	1

Multiply the random number by the unit quantity in each sublot to determine sample location. When a sample is taken from a discrete location such as a truck load, and the sample method treats the load as a unit, sample per the procedure from the truck that contains the determined location.

Sample locations are for that sample only and are not reused for other samples. This would apply for samples of in place soil, aggregate, hot mix asphalt or cores. Each would require a separate set of random numbers. When two random numbers are used, such as in hot mix asphalt, the first random number would be multiplied by the length to determine where the sample would be taken along the project. The second would be multiplied by the width to determine where, widthwise, the sample would be taken.

When a test procedure does not allow tests from a portion of the lot being considered, those areas may be deleted from consideration. As an example, paving is 14 feet wide but testing does not allow tests within one foot of the edge. Testing must be done only in the 12 foot section in the middle of the width.

Two random numbers Example:

Given: Sublot length = 3,342 feet (when the 1 foot edge removed, we consider just 3340 feet)
Sublot width = 14 feet (when the 1 foot edge removed, we consider just 12 feet)
Random numbers for Row = 0.0262 and 0.3687
Random numbers for Column = 0.1696 and 0.3410

Find: length and width locations of sample

Solution: First Row number is: 100(0.0262) = 2.62 or Row 3

First Column number is: 10(0.1696) = 1.696 or Column 2

From Table 1, Row 3, Column 2, the random number for Length is: 0.220

So the sample location for length is: 0.220(3,340’) = 734.8 or 735’ from beginning
If sampling material requiring only 1 random number this sample is located.

Second Row number is: 100(0.3687) = 36.87 or Row 37
Second Column number is: 10(0.3410) = 3.41 or Column 3
From Table 1, Row 37, Column 3, the random number for width is: 0.411
So the sample location for width is: 12(0.411) = 5’ from the left edge of the sublot

When developing a sampling plan, determine a new set of random numbers for each sample required. For example, if the testing frequency specified indicates there will be twenty samples from a material, determine twenty different random number identified locations for the plan.

Additional examples are available in the Random Number section of all WAQTC modules and in ASTM D3665.

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ACI 301 Reference SP 5

1. Scope

This standard practice provides a table of equivalents when using ACI Concrete design methods. Since ACI uses ASTM exclusively, this table provides a reference to determine appropriate methods that are standard with DOT&PF.

ASTM	Title	WAQTC/AASHTO
A184	Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement	M 54
A 185	Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete	M 55
A 416	Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete	M 203
A 421	Standard Specification for Uncoated Stress-Relieved Steel Wire for Prestressed Concrete	M 204
A 496	Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement	M 225
A 497	Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete	M 221
A 615	Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement	M 31
A 722	Standard Specification for Uncoated High-Strength Steel Bars for Prestressing Concrete	M 275
A 775	Standard Specification for Epoxy-Coated Steel Reinforcing Bars	M 284
A 82	Standard Specification for Steel Wire, Plain, for Concrete Reinforcement	M 32
A 996	Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement	M 322
C 1064	Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete	WAQTC FOP for T 309
C 1107	Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)	TP 83
C 1240	Standard Specification for Silica Fume Used in Cementitious Mixtures	M 307
C 138	Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete	WAQTC FOP for T 121
C 143	Standard Test Method for Slump of Hydraulic-Cement Concrete	WAQTC FOP for T 119
C 150	Standard Specification for Portland Cement	M 85
C 171	Standard Specification for Sheet Materials for Curing Concrete	M 171
C 172	Standard Practice for Sampling Freshly Mixed Concrete	WAQTC TM 2
C 192	Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory	R 39

ASTM	Title	WAQTC/AASHTO
C 231	Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method	WAQTC FOP for T 152
C 260	Standard Specification for Air-Entraining Admixtures for Concrete	M 154
C 309	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete	M 148
C 31	Standard Practice for Making and Curing Concrete Test Specimens in the Field	WAQTC FOP for R 100
C 33	Standard Specification for Concrete Aggregates	M 6/M 80
C 330	Standard Specification for Lightweight Aggregates for Structural Concrete	M 195
C 39	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens	T 22
C 494	Standard Specification for Chemical Admixtures for Concrete	M 194
C 595	Standard Specification for Blended Hydraulic Cements	M 240
C 618 REV A	Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete	M 295
C 685	Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing	M 241
C 881	Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete	M 235
C 989	Standard Specification for Slag Cement for Use in Concrete and Mortars	M 302
D1557	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3(2,700 kN-m/m^3))	WAQTC FOP for T 99/ T 180
D 1751	Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)	M 212
D 1752	Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction	M 153
D 698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft^3 (600 kN-m/m^3))	WAQTC FOP for T 99/ T 180
D 98	Standard Specification for Calcium Chloride	M 144
M 994	Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type)	M 33

Rounding and Precision in Materials Test Reporting SP 6

1. Scope

This standard practice provides a procedure for rounding off numbers generated during the process of calculating materials testing results when a specific test method does not specify rounding procedures.

2. Calculation Procedures

Follow the rounding rules found in Section **4.7 Degree of Accuracy** of the current *Alaska Construction Manual*.

https://dot.alaska.gov/stwddes/dcsconst/constructionmanual.shtml

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Determination of Outlier Test Results SP 7

1. Scope

This standard practice provides a mechanism for rejecting individual test values that may misrepresent the physical properties of a material lot. The method statistically identifies a non-representative "outlier" and justifies its removal from the remaining test data for the lot.

2. General

1. When a test result is clearly a result of a gross deviation from prescribed sampling or testing procedure, the test result should be discarded, without further analysis. When no direct evidence of sampling and/or testing errors exists, the lot data will be statistically evaluated for the presence of an outlier.
2. An outlying test result will be assumed to be non-characteristic of the overall quality of the material tested. Outlying test results will be excluded from the price adjustment calculation, by either documental evidence or through statistical analysis.

3. Basis of Statistical Criteria For Outliers

All test results in a lot are included in the calculation of the numerical value of a sample criterion (or statistic), which is then compared with a critical value based on the theory of random sampling from a normal distribution to determine whether the doubtful test result is to be retained or rejected. The critical value is that value of the sample criterion that would be exceeded by chance with 5% total probability. This 5% probability is the risk of erroneously rejecting a good observation and is the Department's defined outlier threshold limit.

4. Procedure

1. Calculate the arithmetic mean [$\bar{x}$] of all test results for the lot using the following formula:

$$\bar{x} = \frac{\sum X}{n}$$

   Where:
   - $\sum$ = summation of
   - X = individual test value to xn
   - n = total number of test values

   And where: $\bar{x}$ is rounded to the nearest 0.1 percent for density and all sieve sizes except the 0.075 mm (No. 200) sieve.

   $\bar{x}$ is rounded to the nearest 0.01 percent for asphalt content and the 0.075 mm (No. 200) sieve.

2. Calculate sample standard deviation (s) of all test results for the lot using the following formula:

$$s = \sqrt{\frac{n\sum\left(x^2\right) - \left(\sum x\right)^2}{n(n-1)}}$$

   Where:
   - s = standard deviation of the lot
   - ∑(x2) = summation of the squares of individual test values.
   - (∑x)2 = square of the summation of the individual test values.

n = total number of test values

3. The lot standard deviation (s) is rounded to the nearest 0.01 for density and all sieve sizes except the 0.075 mm (No. 200) sieve. The lot standard deviation(s) is rounded to the nearest 0.001 for asphalt content and the 0.075 mm (No. 200) sieve.

   Note 1: This is the sample standard deviation and not the population (sigma) standard deviation. Many computer spreadsheet programs have formulas for population standard deviation and not sample standard deviation.

4. Calculate the difference between the arithmetic mean $(\bar{x})$ and the lowest test result (XL); and between the highest test result (XH) and the arithmetic mean $\bar{x}$

5. Calculate test criterion, TL or TH, of the test result with the greatest difference from the arithmetic mean $(\bar{x})$.

6. If the lowest test result (X_L) has the greatest difference from the arithmetic mean $\bar{x}$, then T_L is calculated as follows:

$$T_L = \frac{(X_L - \bar{x})}{s}$$

7. If the highest test result (X_H) has the greatest difference from the arithmetic mean $(\bar{x})$, then T_H is calculated as follows:

$$T_H = \frac{(X_H - \bar{x})}{s}$$

   Determine critical T value from Table 1.

8. If T_L or T_H, whichever is larger, exceeds the critical T value from Table 1, then that test result is an outlier and will be excluded from the price adjustment calculations. If one or more additional test result(s) has the same value as the outlier, then none of the test results will be outliers and all test results will be included in the price adjustment calculations. If T_L and T_H are equal, then neither test result will be an outlier and all test results will be included in the price adjustment calculations.

   Note 2: This test method will not be reapplied to identify additional "outliers" based on the new arithmetic mean and sample standard deviations calculated after the "outliers" have been excluded.

Table 1
Critical T Values for a Sample Standard Deviation

Number Of Samples, n	Critical T
3	1.155
4	1.481
5	1.715
6	1.887
7	2.020
8	2.126
9	2.215
10	2.290
11	2.355
12	2.412
13	2.462
14	2.507
15	2.549
16	2.585
17	2.620

5. Example 1

1. Consider the following test results on percent asphalt content:

   5.3, 5.6, 5.8, 5.8, 5.9, 5.9, 5.9, 6.0, 6.0 and 6.0

2. Calculate the arithmetic mean $(\bar{x})$:

$$(\bar{x}) = \frac{5.3+5.6+5.8+5.8+5.9+5.9+5.9+6.0+6.0+6.0}{10}$$

$$(\bar{x}) = 5.82\%$$

3. Calculate the sample standard deviation:

$$s = \sqrt{\frac{n\sum\left(x^2\right)-\left(\sum x\right)^2}{n(n-1)}}$$

   Where:
   ∑(x)2 = 339.16
   (∑x)2 = 3,387.24
   n = 10
   s = 0.220

4. The difference between the arithmetic mean $(\bar{x})$ and the lowest test result is:

   (5.82% - 5.3%) = 0.52%

5. The difference between the highest test result and the arithmetic mean $(\bar{x})$ is:

   (6.0% - 5.82%) = .18%

6. Calculate T_L or T_H. Since the lowest test result (5.3%) had the greatest difference from the arithmetic mean $(\bar{x})$ it is evaluated to determine if it is an outlier. TL is calculated as follows:

   T_L = (5.82% - 5.3%) ÷ 0.220
   T_L = 2.364

7. Determine Critical T. From Table 1, the critical T for 10 samples is 2.290. Since T_L = 2.364 is greater than 2.290, the test result of 5.3% is an outlier and is excluded from the price adjustment calculations.

6. Example 2

1. Consider the following test result on percent asphalt content:

   5.3, 5.8, 5.8, 5.8, 5.9, 5.9, 6.0, 6.0, 6.0 and 6.5

2. Calculate arithmetic mean $(\bar{x})$:

   $$x = \frac{5.3+5.8+5.8+5.8+5.9+5.9+6.0+6.0+6.0+6.5}{10}$$

   x = 5.90%

3. Calculate sample standard deviation:

   $$s = \sqrt{\frac{n\sum\left(x^2\right)-\left(\sum x\right)^2}{n(n-1)}}$$

   Where:
   ∑(x)2 = 348.88
   (∑x)2 = 3,481.00
   n = 10
   s = 0.294

4. The difference between the arithmetic mean x and the lowest test result is:

   (5.90% - 5.3%) = 0.6%

5. The difference between the highest test result and the arithmetic mean $(\bar{x})$ is:

   (6.5% - 5.90%) = 0.6%

6. Calculate T_L or T_H. Since the lowest test result (5.3%) and the highest test result (6.5%) have the same difference from the arithmetic mean $(\bar{x})$, both T_L and T_H are calculated.

   T_L = (5.90% - 5.3%) ÷ 0.294
   T_H = (6.5% - 5.90%) ÷ 0.294
   $T_L = T_H$ = 2.041

7. Since T_L and T_H are equal, neither test result is considered to be an outlier and all test results are included in the price adjustment calculation.

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Standard Practice for Standardization of Pressure Type Air Meter SP 8

1. Scope

This practice covers the standardization of pressure type air meters used to determine the air content of freshly mixed concrete. Standardization procedures are developed to meet AASHTO T 152.

Note: This practice is equipment specific for two models of air meters currently in use by regional/field laboratories.

2. Apparatus

- Press-Ur-Meter (Charles R. Watts Company and Gilson)
- Appropriate standardization vessels for the air meters listed. Standardization vessels will have either be a vessel with an internal volume equal to 5 percent of the volume of the measuring bowl, or a vessel to place into the measuring bowl conforming to Note 1 in AASHTO T 152 and also equal to 5 percent. Regardless of type, the effective volume of the vessel should be checked.

3. Standardization Procedure for the Press-Ur-Meter:

1. Fill the measuring bowl with water.
2. Screw the straight tube into the threaded petcock hole on the underside of the cover. Clamp the cover assembly onto the measuring bowl with the tube extending down into the water.
3. With both petcocks open, add water through the petcock having the tubing extension, until all air is forced out the opposite petcock. Leave both petcocks open.
4. Pump air pressure to 0 percent or to the previous Initial Pressure line. Wait a few seconds for the compressed air to cool to ambient temperature, then stabilize the gauge needle at the assumed initial pressure by pumping up or bleeding off air, as necessary.
5. Close both petcocks and immediately press down on the air release lever exhausting the air into the measuring bowl. Wait a few seconds until the gauge needle is stabilized, tapping lightly on the gauge to keep gauge needle from sticking. If all the air was eliminated and the assumed Initial Pressure line was correct, the gauge should read 0 percent. If two or more tests show a consistent variation from 0 percent in the result, then change the Initial Pressure line to compensate for the variation, or remove the gauge glass and reset the gauge needle to 0 percent by turning the gauge's standardization screw. Use the newly established "Initial Pressure" line for subsequent tests.
6. Screw the curved tube into the outer end of the petcock with the straight tube below and, by pressing on the air release lever and controlling the flow with the petcock lever, fill the 5 percent calibrating vessel (345 ml) level full of water from the measuring bowl.
7. Release the air pressure at the free petcock. Open the other petcock and let the water in the curved pipe run back into the measuring bowl. There is now 5 percent air in the measuring bowl.
8. Pump air pressure to the Initial Pressure as determined in Step 5. Wait a few seconds for the compressed air to cool to ambient temperature and then stabilize the gauge needle at the assumed zero point by pumping up or bleeding off air, as necessary.
9. Close both petcocks and immediately press down on the air release lever exhausting the air into the measuring bowl. Wait a few seconds until the gauge needle is stabilized, tapping lightly on the gauge to keep gauge needle from sticking. If all the air was eliminated and the assumed Initial Pressure line was correct, the gauge should read 5 percent.

10. If two or more consistent tests show that the gauge at 5 percent air reads incorrectly in excess of 0.2 percent, then remove the gauge glass and reset the gauge needle to 5 percent by adjusting the gauge's standardization screw.
11. When the gauge reads correctly at 5 percent, additional water may be withdrawn in the same manner to check results at 10 percent.

4. Standardization Using Internal Standardization Vessel

1. Fill the measuring bowl with water.
2. Clamp the cover assembly onto the measuring bowl.
3. With both petcocks open, add water through one petcock, until all air is forced out the opposite petcock. Leave both petcocks open.
4. Pump air pressure to 0 percent or to the previous Initial Pressure Line. Wait a few seconds for the compressed air to cool to ambient temperature, then stabilize the gauge needle at the assumed zero point by pumping up or bleeding off air, as necessary.
5. Close both petcocks and immediately press down on the air release lever exhausting the air into the measuring bowl. Wait a few seconds until the gauge needle is stabilized, tapping lightly on the gauge to keep gauge needle from sticking. If all the air was eliminated and the assumed Initial Pressure line was correct, the gauge should read 0 percent. If two or more tests show a consistent variation from 0 percent in the result, then change the Initial Pressure line to compensate for the variation, or remove the gauge glass and reset the gauge needle to 0 percent by turning the gauge's standardization screw. Use the newly established "Initial Pressure" line for subsequent tests.
6. Release the pressure and remove the cover assembly.
7. Place the Internal Standardization Vessel into the measuring bowl, replace the cover assembly and refill as in step 3.
8. Pump the air pressure to the Initial Pressure Line allowing a few seconds for the gauge needle to stabilize.
9. Verify there is water standing in both petcocks and then close them.
10. Release to air into the measuring bowl by pressing down on the air release lever. Tap the gauge lightly and when stable, the meter should read 5 percent. If two or more consistent tests show that the gauge at 5 percent air reads incorrectly in excess of 0.2 percent, then remove the gauge glass and reset the gauge needle to 5 percent by adjusting the gauge's standardization screw and re-check.

5. Report

1. Report the results of the standardization as well as noting any adjustments or repairs made.
2. Label the meter with a sticker noting the month and year of the standardization.

Reserved SP 9

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Worksheets with Examples SP 10

1. Scope

This standard practice includes copies of all the standard forms developed for use on DOT&PF projects. Examples have been included to help clarify their use.

Example Calculations ATM 202

Calculation

Constant Mass for Aggregates:

Calculate constant mass using the following formula:

$$\frac{M_p - M_n}{M_p} \times 100 = \%\ \text{Change}$$

Where:

M_p = previous mass measurement

M_n = new mass measurement

Example:

Mass of container: 1232.1 g

Mass of container& sample after first drying cycle: 2637.2 g

Mass, M_p, of possibly dry sample: 2637.2 g - 1232.1 g = 1405.1 g

Mass of container and dry sample after second drying cycle: 2634.1 g

Mass, M_n, of dry sample: 2634.1 g - 1232.1 g = 1402.0 g

$$\frac{1405.1\ g - 1402.0\ g}{1405.1\ g} \times 100 = 0.22\%$$

0.22 percent is not less than 0.10 percent, so continue drying

Mass of container and dry sample after third drying cycle: 2633.0 g
Mass, M_n, of dry sample: 2633.0 g - 1232.1 g = 1400.9 g

$$\frac{1402.0g - 1400.9g}{1402.0g} \times 100 = 0.08\%$$

0.08 percent is less than 0.10 percent, so constant mass has been reached for an aggregate, but continue drying for soil.

Moisture Content Aggregate and Soils:

Calculate the moisture content, as a percent, using the following formula:

$$w = \frac{M_W - M_D}{M_D} \times 100$$

Where:

w = moisture content, percent

M_W = wet mass

M_D = dry mass

Example:

Mass of container: 1232.1 g

Mass of container and wet sample: 2764.7 g

Mass, M_W, of wet sample: 2764.7 g - 1232.1 g = 1532.6 g

Mass of container and dry sample (COOLED): 2633.0 g

Mass, M_D, of dry sample: 2633.0 g - 1232.1 g = 1400.9 g

$$w = \frac{1532.6g - 1400.9g}{1400.9g} \times 100 = \frac{131.7g}{1400.9g} \times 100 = 9.39\% \quad report\ 9.4\%$$

Example Calculations ATM 204

Calculate the liquid limit according to Method B as follows:

N	$(N/25)^{0.121}$	N	$(N/25)^{0.121}$
22	0.985	26	1.005
23	0.990	27	1.009
24	0.995	28	1.014
25	1.000		

$$LL = (W_N)(N/25)^{0.121}$$

Where:

LL = liquid limit

W_N = moisture content of sample at N blows

N = number of blows

Example:

W_N = 16.0 % and N = 23

$LL = (16.0)(23/25)^{0.121} = 15.8$, say 16%

Example Calculations ATM 205

The moisture content is the Plastic Limit (PL). It is advisable to run several trials on the same material to ensure a proper determination of the Plastic Limit of the soil.

The Plasticity Index (PI) of the soil is equal to the difference between the Liquid Limit (LL) and the Plastic Limit (PL).

Example Calculation

Container	Container Mass, g	Container and Wet Soil Mass, g	Wet Soil Mass, g	Container and Dry Soil Mass, g	Dry Soil Mass, g
1	14.44	22.65	8.21	21.45	7.01
2	14.18	23.69	9.51	22.81	8.63

Water Mass, g	Moisture Content	Plastic Limit
1.20	17.1	17
0.88	10.2	10

PI = LL – PL

Examples: **#1** **#2**

LL = 34 and PL = 17
PI = 34 – 17 = 17

LL = 16 and PL = 10
PI = 16 – 10 = 6

Example Calculations ATM 207

Volume

1b. Calculate the wet density, in kg/m^3 (lb/ft^3), by dividing the wet mass from Step 7 by the appropriate volume from Table 1 or Table 2.

Example – Methods A or C mold:

Wet mass = 1.916 kg (4.22 lb)

$$\frac{1.1916\ kg}{0.000943\ m^3} = 2023 kg/m^3\ Wet\ Density^* \qquad \frac{4.22\ lb}{0.0333 ft^3} = 126.7 lb/ft^3\ Wet\ Density^*$$

* Differences in wet density are due to rounding in the respective calculations.

Measured Volume

1c. Calculate the wet density, in kg/m^3 (lb/ft^3), by dividing the wet mass by the measured volume of the mold (T 19).

Example – Methods A or C mold:

Wet mass = 1.916 kg (4.22 lb)

Measured volume of the mold = 0.000946m^3 (0.0334 ft^3)

$$\frac{1.1916\ kg}{0.000946\ m^3} = 2025 kg/m^3\ Wet\ Density^* \qquad \frac{4.22\ lb}{0.0334 ft^3} = 126.3 lb/ft^3\ Wet\ Density^*$$

2. Calculate the dry density as follows.

$$\rho_d = \left(\frac{\rho_w}{w + 100}\right) \times 100 \quad or \quad \rho_d = \frac{\rho_w}{\left(\frac{w}{100}\right) + 1}$$

Where:
ρ_d = Dry density, kg/m^3 (lb/ft^3)
ρ_w = Wet density, kg/m^3 (lb/ft^3)
W = Moisture content, as a percentage

Example:

ρ_w = 2030 kg/m^3 (126.6 lb/ft^3) and w = 14.7%

$$\rho_d = \left(\frac{2030\ kg/m^3}{14.7 + 100}\right) \times 100 = 1770\ kg/m^3 \quad \rho_d = \left(\frac{126.6\ lb/ft^3}{14.7 + 100}\right) \times 100 = 110.4\ lb/ft^3$$

or

$$\rho_d = \left(\frac{2030\,kg/m^3}{\frac{14.7}{100}+1} \right) = 1770\ \ kg/m^3 \quad \rho_d = \left(\frac{126.6\,lb/ft^3}{\frac{14.7}{100}+1} \right) = 110.4\,lb/ft^3$$

Example Calculations ATM 207 Appendix A

Sample Calculations English:

Maximum laboratory dry density (D_f):	140.4 lb/ft³
Percent coarse particles (P_c):	27%
Percent fine particles (P_f):	73%
Mass per volume of coarse particles (k):	(2.697) (62.4) = 168.3 lb/ft³

$$D_d = \frac{100 \times D_f \times k}{(D_f \times P_c) + (k \times P_f)} \qquad or \qquad D_d = \frac{100}{\frac{P_f}{D_f} + \frac{P_c}{k}}$$

$$D_d = \frac{100 \times 140.4\,lb/ft^3 \times 168.3\,lb/ft^3}{(140.4\,lb/ft^3 \times 27\%) + (168.3\,lb/ft^3 \times 73\%)}$$

$$or\ \ D_d = \frac{100}{\frac{73\%}{140.4\,lb/ft^3} + \frac{27\%}{168.3\,lb/ft^3}}$$

$$D_d = \frac{2{,}362{,}932\,lb/ft^3}{(3790.8\,lb/ft^3 + 12285.9\,lb/ft^3)} \quad or\ \ D_d = \frac{100}{0.51994\,lb/ft^3 + 0.16043\,lb/ft^3}$$

$$D_d = \frac{2{,}362{,}932\,lb/ft^3}{16{,}076.7\,lb/ft^3} \quad or\ \ D_d = \frac{100}{0.68037\,lb/ft^3}$$

$$D_d = 146.98\,lb/ft^3 \quad report\ 147.0\,lb/ft^3$$

Example Calculations ATM 304

Method A Sample Calculation

Calculate percent retained on and passing each sieve on the basis of the total mass of the initial dry sample. This will include any material finer than 75 µm (No. 200) that was washed out.

Example:

Dry mass of total sample, before washing: 5168.7 g
Dry mass of sample, after washing out the 75µm (No. 200) minus: 4911.3 g
Amount of 75µm (No. 200) minus washed out: 5168.7 g – 4911.3 g = 257.4 g

Gradation on All Sieves

Sieve Size mm	(in.)	Individual Mass Retained, g (IMR)	Individual Percent Retained (IPR)	Cumulative Mass Retained, g (CMR)	Cumulative Percent Retained (CPR)	Calc'd Percent Passing (CPP)	Reported Percent Passing* (RPP)
19.0	(3/4)	0	0	0	0.0	100.0	100
12.5	(1/2)	724.7	14.0	724.7	14.0	86.0	86
9.5	(3/8)	619.2	12.0	1343.9	26.0	74.0	74
4.75	(No. 4)	1189.8	23.0	2533.7	49.0	51.0	51
2.36	(No. 8)	877.6	17.0	3411.3	66.0	34.0	34
1.18	(No. 16)	574.8	11.1	3986.1	77.1	22.9	23
0.600	(No. 30)	329.8	6.4	4315.9	83.5	16.5	16
0.300	(No. 50)	228.5	4.4	4544.4	87.9	12.1	12
0.150	(No. 100)	205.7	4.0	4750.1	91.9	8.1	8
0.075	(No. 200)	135.4	2.6	4885.5	94.5	5.5	5.5
Pan		20.4		4905.9			

*Report 75 µm (No. 200) sieve to 0.1 percent. Report all others to 1 percent.

Check sum:

$$\frac{4911.3\ g - 4905.9\ g}{4911.3\ g} \times 100 = 0.1\%$$

This is less than 0.3 percent therefore the results can be used for acceptance purposes.

Percent Retained:

9.5 mm (3/8) sieve:

$$\frac{619.2\ g}{5168.7\ g} \times 100 = 12.0\% \quad or \quad \frac{1343.9\ g}{5168.7\ g} \times 100 = 26.0\%$$

Percent Passing (Calculated):

9.5 mm (3/8) sieve: $86.0\% - 12.0\% = 74.0\%$ *or* $100\% - 26.0\% = 74.0\%$

Method B Sample Calculation

Sample calculation for percent retained and percent passing each sieve in accordance with Method B when the previously washed 4.75mm (No. 4) minus material is split:

Example:

Dry mass of total sample, before washing: 3214.0 g
Dry mass of sample, after washing out the 75 µm (No. 200) minus: 3085.1 g
Amount of 75 µm (No. 200) minus washed out: 3214.0 g – 3085.1 g = 128.9 g

Gradation on Coarse Sieves

Sieve Size mm	(in.)	Individual Mass Retained, g (IMR)	Individual Percent Retained (IPR)	Cumulative Mass Retained, g (CMR)	Cumulative Percent Retained (CPR)	Calculated Percent Passing (CPP)
16.0	(5/8)	0	0	0	0	100
12.5	(1/2)	161.1	5.0	161.1	5.0	95.0
9.50	(3/8)	481.4	15.0	642.5	20.0	80.0
`4.75	(No. 4)	475.8	14.8	1118.3	34.8	65.2
Pan		1966.7 (**M₁**)		3085.0		

Coarse check sum:

$$\frac{3085.1\ g - 3085.0\ g}{3085.1\ g} \times 100 = 0.0\%$$

This is less than 0.3 percent therefore the results can be used for acceptance purposes.

> ***Note 5:*** The pan mass determined in the laboratory (M_1) and the calculated mass (3085.1 – 1118.3 = 1966.7) should be the same if no material was lost.

The pan (1966.7 g) was reduced in accordance with the FOP for AASHTO T 248, so that at least 500 g are available. In this case, the mass determined was **512.8 g**. This is $\mathbf{M_2}$.

In order to account for the fact that only a portion of the minus 4.75mm (No. 4) material was sieved, the mass of material retained on the smaller sieves is adjusted by a factor equal to M_1/M_2. The factor determined from M_1/M_2 must be carried to three decimal places. Both the individual mass retained and cumulative mass retained formulas are shown.

<u>Individual Mass Retained:</u>

M_1 = total mass of the minus 4.75mm (No. 4) before reducing.
M_2 = mass before sieving from the reduced portion of the minus 4.75 mm (No. 4).

$$\frac{M_1}{M_2} = \frac{1{,}966\ g}{512.8\ g} = 3.835$$

Each "individual mass retained" on the fine sieves must be multiplied by this adjustment factor.

For example, the overall mass retained on the 2.00mm (No. 10) sieve is:

3.835 × 207.1 g = 794.2 g, as shown in the following table:

Final Gradation on All Sieves

Calculation by Individual Mass

Sieve Size mm	(in.)	Individual Mass Retained, g (IMR)	Adjusted Individual Mass Retained (AIMR)	Individual Percent Retained (IPR)	Calc'd Percent Passing (CPP)	Reported Percent Passing* (RPP)
16.0	(5/8)	0	0	0.0	100.0	100
12.5	(1/2)	161.1	161.1	5.0	95.0	95
9.5	(3/8)	481.4	481.4	15.0	80.0	80
4.75	(No. 4)	475.8	475.8	14.8	65.2	65
2.0	(No. 10)	207.1 *× 3.835*	794.2	24.7	40.5	40
0.425	(No. 40)	187.9 *× 3.835*	720.6	22.4	18.1	18

Sieve Size mm	(in.)	Individual Mass Retained, g (IMR)	Adjusted Individual Mass Retained (AIMR)	Individual Percent Retained (IPR)	Calc'd Percent Passing (CPP)	Reported Percent Passing* (RPP)
0.210	(No. 80)	59.9 × *3.835*	229.7	7.1	11.0	11
0.075	(No. 200)	49.1 × *3.835*	188.3	5.9	5.1	5.1
Pan		7.8 × *3.835*	29.9			
Dry mass of total sample, before washing: 3214.0 g						

*Report 75 µm (No. 200) sieve to 0.1 percent. Report all others to 1 percent.

Fine check sum:

$$\frac{512.8\ g - 511.8\ g}{512.8\ g} \times 100 = 0.2\%$$

This is less than 0.3 percent therefore the results can be used for acceptance purposes.

For Percent Passing (Calculated) see "Calculation" under Method A.

Cumulative Mass Retained:

M_1 = mass of the minus 4.75 mm (No. 4) before split
M_2 = mass before sieving of the split of the minus 4.75 mm (No. 4)

$$\frac{M_1}{M_2} = \frac{1{,}966\ g}{512.8\ g} = 3.835$$

Each "cumulative mass retained" on the fine sieves must be multiplied by this adjustment factor then the cumulative mass of plus 4.75 mm (No. 4) portion of sample is added to equal the adjusted cumulative mass retained .

For example, the adjusted cumulative mass retained on the 0.425 mm (No. 40) sieve is:

$$3.835 \times 395.0\ g\ =\ 1514.8\ g$$

1514.8 + 1118.3 g = 2633.1: "Total Cumulative Mass Retained" as shown in the following table:

Final Gradation on All Sieves

Calculation by Cumulative Mass

Sieve Size mm	(in.)	Cumulative Mass Retained, g (CMR)	Adjusted Cumulative Mass Retained, g (ACMR)	Total Cumulative Mass Retnd., g (TCMR)	Cumulative Percent Retnd. (CPR)	Calc'd Percent Passing (CPP)	Reported Percent Passing* (RPP)
16.0	(5/8)	0		0	0.0	100.0	100
12.5	(1/2)	161.1		161.1	5.0	95.0	95
9.5	(3/8)	642.5		642.5	20.0	80.0	80
4.75	(No. 4)	1118.3		1118.3	34.8	65.2	65
2.0	(No. 10)	207.1 × *3.835*	794.2 + *1118.3*	1912.5	59.5	40.5	40
0.425	(No. 40)	395.0 × *3.835*	1514.8 + *1118.3*	2633.1	81.9	18.1	18
0.210	(No. 80)	454.9 × *3.835*	1744.5 + *1118.3*	2862.8	89.1	10.9	11
0.075	(No. 200)	504.0 × *3.835*	1932.8 + *1118.3*	3051.1	94.9	5.1	5.1
Pan		511.8 × *3.835*	1962.8 + *1118.3*	3081.1			

*Report 75 µm (No. 200) sieve to 0.1 percent. Report all others to 1 percent.

Fine check sum:

$$\frac{512.8\ g - 511.8g}{512.8\ g} \times 100 = 0.2\%$$

This is less than 0.3 percent therefore the results can be used for acceptance purposes.

For Percent Passing (Calculated) see "Calculation" under Method A.

Method C Sample Calculation

Sample calculation for percent retained and percent passing each sieve in accordance with Method C when the minus 4.75mm (No. 4) material is reduced and then washed:

Dry Mass of total sample:	3304.5 g
Dry Mass of minus 4.75mm (No. 4) reduced portion before wash, $M_{-\#4}$:	527.6
Dry Mass of minus 4.75mm (No. 4) reduced portion after wash:	495.3

Gradation on Coarse Sieves

Sieve Size mm	(in.)	Cumulative Mass Retained, g (CMR)	Calc'd Percent Retained (CPR)	Calc'd Percent Passing (CPP)	Reported Percent Passing* (RPP)
16.0	(5/8)	0	0.0	100.0	100
12.5	(1/2)	125.9	3.8	96.2	96
9.50	(3/8)	604.1	18.3	81.7	82
4.75	(No. 4)	1295.6	39.2	60.8	61
Pan		2008.9			
Total Dry Sample = 3304.5					

Coarse check sum:

$$\frac{3304.5\ g - 3304.5\ g}{3304.5\ g} \times 100 = 0.0\%$$

This is less than 0.3 percent therefore the results can be used for acceptance purposes.

The pan (2008.9 g) was reduced in accordance with the FOP for AASHTO T 248, so that at least 500 g are available. In this case, the mass determined was $M_{-\#4}$ = **527.6 g**.

Final Gradation on All Sieves

Calculation by Cumulative Mass

Sieve Size mm	(in.)	Cumulative Mass Retained, g ($CMR_{-\#4}$)	Cumulative Percent $Retained_{-\#4}$ ($CPR_{-\#4}$)	Calc'd Percent $Passing_{-\#4}$ ($CPP_{-\#4}$)	Calc'd Percent Passing (CPP)	Reported Percent Passing* (RPP)
16.0	(5/8)	0	0.0		100.0	100
12.5	(1/2)	125.9	3.8		96.2	96
9.5	(3/8)	604.1	18.3		81.7	82
4.75	(No. 4)	1295.6	39.2		**60.8**	61
2.0	(No. 10)	194.3	36.8	63.2	38.4	38

0.425	(No. 40)	365.6	69.3	30.7	18.7	19
0.210	(No. 80)	430.8	81.7	18.3	11.1	11
0.075	(No. 200)	484.4	91.8	8.2	5.0	5.0
Pan		495.1				
Dry mass (M) of minus 4.75 mm (No. 4) sample, before washing: 527.6 g Dry mass of minus 4.75 mm (No. 4) sample, after washing: 495.3 g						

*Report 75 µm (No. 200) sieve to 0.1 percent. Report all others to 1 percent

Fine check sum:

$$\frac{495.3\ g - 495.1\ g}{495.3\ g} \times 100 = 0.04\%$$

This is less than 0.3 percent therefore the results can be used for acceptance purposes.

Also note that for minus No. 4 material using this method that:

$$CPP = \frac{CPP_{\#4} \times (M_{-\#4} - CMR_{-\#4})}{M_{-\#4}}$$

Example Calculations ATM 305

Example:

F = 632.6 g, Q = 97.6 g, N = 352.6 g
% Q =

$$\frac{97.6\ g}{632.6\ g + 97.6\ g + 352.6\ g} \times 100 = 9.0\% \qquad \%\text{Q} = \mathbf{9}\%$$

Calculate the mass percentage of fractured faces to the nearest 1 percent using the following formula:

$$\text{P} = \frac{\frac{Q}{2} + F}{F + Q + N} \times 100$$

Where:
P = Percent of fracture
F = Mass of fractured particles
Q = Mass of questionable or borderline particles
N = Mass of unfractured particles

Example:

F = 632.6 g, Q = 97.6 g, N = 352.6 g

$$\text{P} = \frac{\frac{97.6\ g}{2} + 632.6\text{ g}}{632.6\ g + 97.6\ g + 352.6\ g} \times 100 \qquad \mathbf{P = 63}\%$$

Example Calculations ATM 306

Calculate the cumulative percent retained of each size group flat and elongated (F&E) in relation to the total plus 4.75 mm (No. 4).

F&E Group CPR = (CPR ÷ #4 CPR) ×100

Example:

CPR=35%, #4 CPR=58%

Group CPR=(35%÷58%) ×100 **F&E Group CPR = 60%**

Calculate the individual percent retained of each group:

F&E Group Individual Percent Retained (IPR) = F&E Group CPR - Next Larger Group CPR

Example:

F&E Group CPR=100%, Next Larger Group CPR=60%

F&E Group Individual Percent Retained (IPR) = 100% – 60%, **IPR=40%**

Calculate the percent flat and elongated for each size group.

% F&E for Size Group = [(Mass F&E Size Group) / (Size Group Mass)] × 100

Example:

Mass F&E Size Group=3.3g, Size Group Mass=104.9g

% F&E for Size Group (B) = [(104.9) / (3.3)] × 100 **B=3.1%**

Calculate the weighted percent for each size to 0.1%.

Weighted % F&E Size Group = (% F&E for Size Group × F&E Group IPR) ÷ 100

Example:

% F&E for Size Group=3.1%, F&E Group IPR=40%

Weighted % F&E Size Group = 3.1% × 40%) ÷ 100 **Weighted % F&E Size Group=1.2%**

Calculate the total percentage of FnE by determining the sum of all the weighted % F&E for Size Groups.

Total Weighted %F&E=1.1%+1.2% **Total Weighted %F&E=2%**

Example Calculations ATM 308

Perform calculations and determine values using the appropriate formula below. In these formulas, A = oven dry mass, B = SSD mass, and C = weight in water.

Bulk specific gravity (G_{sb})

$$G_{sb} = \frac{A}{B - C}$$

Bulk specific gravity, SSD (G_{sb} SSD)

$$G_{sb}SSD = \frac{B}{B - C}$$

Apparent specific gravity (G_{sa})

$$G_{sa} = \frac{A}{A - C}$$

Absorption

$$\text{Absorption} = \frac{B - A}{A} \times 100$$

Sample	A	B	C	B - C	A - C	B - A
1	2030.9	2044.9	1304.3	740.6	726.6	14.0
2	1820.0	1832.5	1168.1	664.4	651.9	12.5
3	2035.2	2049.4	1303.9	745.5	731.3	14.2

Sample	G_{sb}	G_{sb} SSD	G_{sa}	Absorption
1	2.742	2.761	2.795	0.7
2	2.739	2.758	2.792	0.7
3	2.730	2.749	2.783	0.7

These calculations demonstrate the relationship between G_{sb}, G_{sb} SSD, and G_{sa}. G_{sb} is always lowest, since the volume includes voids permeable to water. G_{sb} SSD is always intermediate. G_{sa} is always highest, since the volume does not include voids permeable to water. When running this test, check to make sure the values calculated make sense in relation to one another.

Example Calculations ATM 406

Calculate the asphalt binder content of the sample as follows:

$$P_b = \frac{M_i - M_f}{M_i} \times 100 - C_f - MC$$

Where:

P_b = the corrected asphalt binder content as a percent by mass of the HMA sample
M_f = the final mass of aggregate remaining after ignition
M_i = the initial mass of the HMA sample prior to ignition
C_f = correction factor as a percent by mass of the HMA sample
MC= moisture content of the companion HMA sample, percent, as determined by the FOP for AASHTO T 329 (if the specimen was oven-dried prior to initiating the procedure, MC=0).

Example

Correction Factor	=	0.42
Moisture Content	=	0.04
Initial Mass of Sample and Basket	=	5292.7
Mass of Basket Assembly	=	2931.5
M_i	=	2361.2
Total Mass after First ignition + basket	=	5154.4

Sample Mass after First ignition = 2222.9

Sample Mass after additional 15 min ignition = 2222.7

$$\frac{2222.9 - 2222.7}{2222.9} \times 100 = 0.009$$

Not greater than 0.01 percent, so Mf = 2222.7

$$P_b = \frac{2361.2 - 2222.7}{2361.2} \times 100 - 0.42 - 0.04 = 5.41\%$$

P_b= 5.41%

Example Calculations ATM 407

Constant Mass:

Calculate constant mass using the following formula:

$$\%Change = \frac{M_p - M_n}{M_p} \times 100$$

Where:

M_p = previous mass measurement
M_n = new mass measurement

Example:

Mass of container: 232.6 g
Mass of container and sample after first drying cycle: 1361.8 g
Mass, M_p, of possibly dry sample: 1361.8 g – 232.6 g = 1129.2 g
Mass of container and possibly dry sample after second drying cycle: 1360.4 g
Mass, M_n, of possibly dry sample: 1360.4 g – 232.6 g = 1127.8 g

$$\frac{1129.2\ g - 1127.8\ g}{1129.2\ g} \times 100 = 0.12\%$$

0.12 percent is not less than 0.05 percent, so continue drying the sample.

Mass of container and possibly dry sample after third drying cycle: 1359.9 g
Mass, M_n, of dry sample: 1359.9g – 232.6g = 1127.3g

$$\frac{1127.8\ g - 1127.3\ g}{1127.8\ g} \times 100 = 0.04\%$$

0.04 percent is less than 0.05 percent, so constant mass has been reached.

Moisture Content:

Calculate the moisture content, as a percent, using the following formula.

$$Moisture\ Content = \frac{M_i - M_f}{M_f} \times 100$$

Where:

M_i = initial, moist mass
M_f = final, dry mass

Example:

M_i = 1134.9 g
M_f = 1127.3 g

$$Moisture\ Content = \frac{1134.9\ g - 1127.3\ g}{1127.3\ g} \times 100 = 0.674, \text{say } 0.67\%$$

Example Calculations ATM 408

Using the aggregate sample obtained from the FOP for AASHTO T 308, determine and record the mass of the sample to 0.1 g (M). This mass shall agree with the mass of the aggregate remaining after ignition (M_f from T 308) within 0.10 percent. If the variation exceeds 0.10 percent the results cannot be used for acceptance.

$$\frac{M_{f\,(T308)} - M_{(T30)}}{M_{f\,(T308)}} \times 100$$

Where:
$M_{(T30)}$ = 2422.3 g
$M_{f(T308)}$ = 2422.5 g

$$\frac{2422.5\text{ g} - 2422.3\text{ g}}{2422.5\text{ g}} \times 100 = 0.01\%$$

CHECK SUM

Total mass of material after sieving must agree with mass before sieving to within 0.2 percent.

$$\frac{dry\ mass\ after\ washing - total\ mass\ after\ sieving}{dry\ mass\ after\ washing} \times 100$$

PERCENT RETAINED:

Where:
IPR = Individual Percent Retained
CPR = Cumulative Percent Retained
M = Total Dry Sample mass before washing
IMR = Individual Mass Retained
CMR = Cumulative Mass Retained

$$\text{IPR} = \frac{IMR}{M} \times 100 \quad \textbf{OR} \quad \text{CPR} = \frac{CMR}{M} \times 100$$

PERCENT PASSING and REPORTED PERCENT PASSING:

Where:
PP = Calculated Percent Passing
PCP = Previous Calculated Percent Passing
RPP = Reported Percent Passing

$$PP = PCP - IPR \quad \boldsymbol{OR} \quad PP = 100 - CPR$$

$$RPP = PP + \text{Aggregate Correction Factor}$$

Example:

Dry mass of total sample, before washing (M): 2422.3 g

Dry mass of sample, after washing out the 75 µm (No. 200) minus: 2296.2 g

Amount of 75 µm (No. 200) minus washed out: 2422.3 g – 2296.2g = 126.1 g

Percent Retained 75 µm / No. 200:

$$\frac{63.5 \text{ g}}{2422.3 \text{ g}} \times 100 = 2.6\% \quad or \quad \frac{2289.6 \text{ g}}{2422.3 \text{ g}} \times 100 = 94.5\%$$

Percent Passing: 8.1% – 2.6% = 5.5% or 100 %– 94.5% = 5.5%

Reported Percent Passing: 5.5% + (-0.6%) = 4.9%

Gradation on All Screens

Sieve Size mm	**(in.)**	**Mass Retained (g) (MR)**	**Percent Retained (PR)**	**Cumulative Mass Retained (g) (CMR)**	**Cumulative Percent Retained (CPR)**	**Calc'd Percent Passing (PP)**	**Agg. Corr. Factor from T 308 (ACF)**	**Reported Percent Passing (RPP)**
19.0	(3/4)	0.0		0.0	0	100.0		100
12.5	(1/2)	346.9	14.3	346.9	14.3	85.7		86
9.5	(3/8)	207.8	8.6	554.7	22.9	77.1		77
4.75	(No. 4)	625.4	25.8	1180.1	48.7	51.3		51
2.36	(No. 8)	416.2	17.2	1596.3	65.9	34.1		34
01.18	(No. 16)	274.2	11.3	1870.5	77.2	22.8		23
0.600	(No. 30)	152.1	6.3	2022.6	83.5	16.5		16
0.300	(No. 50)	107.1	4.4	2129.7	87.9	12.1		12
0.150	(No. 100)	96.4	4.0	2226.1	91.9	8.1		8
75 µm	(No. 200)	63.5	2.6	2289.6	94.5	5.5	-0.6	4.9
Pan		5.7		2295.3				

Check sum:

$$\frac{2296.2\ g - 2295.3\ g}{2296.2\ g} \times 100 = 0.04\%$$

This is less than 0.2 percent therefore the results can be used for acceptance purposes.

Example Calculations ATM 409

Flask Procedure

$$G_{mm} = \frac{A}{A + D - E} \times R \qquad or \qquad G_{mm} = \frac{A}{A_{SSD} + D - E} \times R$$

(for mixtures containing uncoated materials)

Where:

A = Mass of dry sample in air, g

A_{SSD} = Mass of saturated surface-dry sample in air, g

D = Mass of flask filled with water at 25°C (77°F), g, determined during the Standardization of Flask procedure

E = Mass of flask filled with water and the test sample at test temperature, g

R = Factor from Table 2 to correct the density of water – use when a test temperature is outside 25 ±1°C (77 ±2°F)

Example (in which two increments of a large sample are averaged):

Increment 1	Increment 2
A = 2200.3 g	A = 1960.2 g
D = 7502.5 g	D = 7525.5 g
E = 8812.3 g	E = 8690.8 g
Temperature = 26.2°C	Temperature = 25.0°C

$$G_{mm_1} = \frac{2200.3\text{ g}}{2200.3\text{ g} + 7502.5\text{ g} - 8812.3\text{ g}} \times 0.99968 = 2.470$$

$$G_{mm_2} = \frac{1960.2\text{ g}}{1960.2\text{ g} + 7525.5\text{ g} - 8690.8\text{ g}} \times 1.00000 = 2.466$$

Allowable variation is: 0.014

2.470 - 2.466 = 0.004, which is < 0.014, so they can be averaged.

Average

2.470 - 2.466 = 0.004 0.004 ÷ 2 = 0.002 0.002 + 2.466 = 2.468

Or 2.470 + 2.466 = 4.936 4.936 ÷ 2 = **2.468**

Example Calculations ATM 409

Calculations - Method A (Suspension)

$$G_{mb} = \frac{A}{B - C}$$

Where:

A = Mass of dry specimen in air, g

B = Mass of SSD specimen in air, g

C = Weight of specimen in water at 25 ±1°C (77 ±1.8°F), g

$$Percent\ Water\ Absorbed\ (by\ volume) = \frac{B - A}{B - C} \times 100$$

Example:

$$G_{mb} = \frac{4833.6\ g}{4842.4\ g - 2881.3\ \text{g}} = 2.465$$

$$\%\ \boldsymbol{Water\ Absorbed\ (by\ volume)} = \frac{\mathbf{4842.4\ g - 4833.6\ g}}{\mathbf{4842.4\ g - 2881.3\ g}} \times \mathbf{100 = 0.4\%}$$

Example Calculations ATM 504

- **Density –** Calculate the net mass, M_m, of the concrete in the measure by subtracting the mass of the measure from the gross mass of the measure plus the concrete. Calculate the density, W, by dividing the net mass, M_m, by the volume, V_m, of the measure as shown below.

$$W = \frac{M_m}{V_m}$$

Example: $W = \frac{36.06\ lb}{0.2494\ ft^3} = 144.6\ \ lb/ft^3$

- **Yield –** Calculate the yield, Y, or volume of concrete produced per batch, by dividing the total mass of the batch, W_1, by the density , W, of the concrete as shown below.

$W = \frac{W_1}{W}$ Example: $Y = \frac{3978lb}{27 \times 144.6lb/ft^3} = 1.02\ yd^3$

Note 5: The total mass, W_1, includes the masses of the cement, water, and aggregates in the concrete.

- **Cement Content –** Calculate the actual cement content, N, by dividing the mass of the cement, N_t, by the yield, Y, as shown below.

Note 6: Specifications may require Portland cement content and cementitious materials content

$N = \frac{N_t}{Y}$ Example: $N = \frac{602\ lb}{1.02\ yd^3} = 590\ \ lb/yd^3$

- **Water Content** – Calculate the mass of water in a batch of concrete by summing the:
  - water added at batch plant
  - water added in transit
  - water added at jobsite
  - free water on coarse aggregate
  - free water on fine aggregate
  - liquid admixtures (if the agency requires this)

This information is obtained from concrete batch tickets collected from the driver. Use the following conversion factors.

To Convert From	To	Multiply By
Liters, L	Kilograms, kg	1.0
Gallons, gal	Kilograms, kg	3.785
Gallons, gal	Pounds, lb	8.34
Milliliters, mL	Kilograms, kg	0.001
Ounces, oz	Milliliters, mL	28.4
Ounces, oz	Kilograms, kg	0.0284
Ounces, oz	Pounds, lb	0.0625
Pounds, lb	Kilograms, kg	0.4536

Calculate the mass of free water on aggregate as follows:

$$Free\ Water\ Mass = Total\ Aggregate\ Mass - \frac{Total\ Aggregate\ Mass}{1 + (Free\ Water\ Percentage/100)}$$

Example:

Total Aggregate Mass =7804 lb
Free Water Percentage = 1.7*
∗ To determine Free Water percentage:
Total moisture content of the aggregates – absorbed moisture = Free Water

$$Free\ Water\ Mass = 7804\ lb - \frac{7804\ lb}{1 + (1.7\%/100)}$$

Example for actual water content:

Water added at batch plant = 79 gal
Water added in transit =
Water added at jobsite = 11 gal
90 gal = 751 lb

Coarse aggregate: 7804 lbs @ 1.7% free water
Fine aggregate: 5489 lb @ 5.9% free water

$$CA\ Free\ Water = 7804\ lb - \frac{7804\ lb}{1 + (1.7\%/100)} = 130\ lb$$

$$FA\ Free\ Water = 5489\ lb - \frac{5489\ lb}{1 + (5.9\%/100)} = 306\ lb$$

Mass of water in batch = 751 lb + 130 lb + 306 lb = 1187 lb

Water/Cement Ratio – Calculate the water/cement ratio by dividing the mass of water in a batch of concrete by the mass of cementitious material in the batch. The masses of the cementitious materials are obtained from concrete batch tickets collected from the driver.

Example:

Cement: 2094 lb
Fly Ash: 397 lb
Water: 1187 lb

$$W/C = \frac{1187\ lb}{2094\ lb + 397\ lb} = 0.476$$

Report 0.48

STATE OF ALASKA
DOT & PF

FOP for T 180 Modified Proctor FIELD WORKSHEET

☐ Acceptance ☐ Verification ☐ Info. ☐ IA ☐ QC

Sample No:

Project Name:

Federal No: AKSAS No:

Material: Source:

Item No: Location:

Sampled by / Qualification No: Date: Quantity Represented:

Standard Density — Modified Proctor — WAQTC FOP for T 180		**METHOD: D**					
COMPACTION TEST		1	2	3	4	5	6
A	Mass of Mold						
B	Mass of Mold + Wet Soil						
M	Mass of Wet Sample **B - A**						
MOISTURE CONTENT — WAQTC FOP for T 255 / T 265		**'W = [(Mw - MD) / MD] x 100**					
C	Container						
D	Container + Moist Sample						
Mw	Moist sample **D - C**						
E	Container + Dry Sample						
MD	Dry Sample **E - C**						
'W	Moisture Content, %						
Pw	Wet Density						
Pd	Dry Density						

Gradation, % Pass	
3" / 75mm	
2" / 50mm	
½" / 37.5mm	
1" / 25mm	
3/4" / 19mm	
1/2" / 12.5mm	
3/8" / 9.5mm	
#4 / 4.75mm	
#8 / 2.36mm	
#16 / 1.18mm	
#30 / .600mm	
#50 / .300mm	
#100 / .150mm	
#200 / .075mm	

ZAV Curve Calculations: $Ws = \frac{(62.4)(Gsa) - (Yd)}{(Yd)(Gsa)} \times 100$

Assumed Gsa: (if no T 85)

Dry Density (Yd) Input for ZAV Curve: 1 ___ 2 ___

Ws % Water Content for complete saturation

1 ___ 2 ___

V Mold Volume =

Pw Wet Density = **(M ÷ V)**

Pd Dry Density = **Pw / [1 + (W / 100)]**

SPECIFIC GRAVITY — WAQTC FOP for T 85		
b	SSD Aggregate Mass	
c	Aggregate Weight in Water	
a	Dry Aggregate Mass	
Gsb	**BULK** Specific Gravity = **a / (b - c)**	
	SSD Specific Gravity = **b / (b - c)**	
Gsa	Apparent Specific Gravity = **a / (a - c)**	
	Absorption = **[(b - a) / a] x 100**	

MAXIMUM DENSITY (0.1 lb/ft³ or 1 kg/m³)	
OPTIMUM MOISTURE (0.1%)	

Remarks:

DRY DENSITY vs. MOISTURE CONTENT

DRY DENSITY, (lb/ft³ or kg/m³)

% % % % % % %

MOISTURE CONTENT, (%)

Tested by / Date:

Checked by / Date:

STATE OF ALASKA
DOT & PF

FOP for T 180 Modified Proctor
FIELD WORKSHEET

☑ Acceptance ☐ Verification ☐ Info. ☐ IA ☐ QC

Sample No: BC-SD-1

Project Name: Alaska Highway, MP 1267-1314 Rehabilitation

Federal No: HHE-0A4-3(19) AKSAS No: 63485

Material: Base Course, D-1 Source: MS-62-2-005-5

Item No: 301(1) Location: MP 1280, Alaska Highway

Sampled by / Qualification No: J. Groves / #365 Date: 07/24/08 Quantity Represented: Source

Standard Density — Modified Proctor — WAQTC FOP for T 180 **METHOD: D**

COMPACTION TEST		1	2	3	4	5	6
A	Mass of Mold	12.67	12.67	12.67	12.67	12.67	
B	Mass of Mold + Wet Soil	23.26	23.51	23.68	23.65	23.64	
M	Mass of Wet Sample B - A	10.59	10.84	11.01	10.98	10.97	
MOISTURE CONTENT — WAQTC FOP for T 255 / T 265	**'W = [(Mw - MD) / MD] x 100**						
C	Container	1620.5	1700.5	1670.2	1426.0	1692.3	
D	Container + Moist Sample	2636.0	2710.5	2692.3	2438.7	2703.5	
Mw	Moist sample D - C	1015.5	1010.0	1022.1	1012.7	1011.2	
E	Container + Dry Sample	2604.3	2674.9	2651.5	2392.0	2649.2	
MD	Dry Sample E - C	983.8	974.4	981.3	966.0	956.9	
'W	Moisture Content, %	3.2	3.7	4.2	4.8	5.7	
Pw	Wet Density	141.0	144.3	146.6	146.2	146.1	
Pd	Dry Density	136.6	139.2	140.7	139.5	138.2	

Gradation, % Pass	
3" / 75mm	
2" / 50mm	
½" / 37.5mm	
1" / 25mm	100
3/4" / 19mm	95
1/2" / 12.5mm	72
3/8" / 9.5mm	59
#4 / 4.75mm	35
#8 / 2.36mm	23
#16 / 1.18mm	15
#30 / .600mm	12
#50 / .300mm	9
#100 / .150mm	6
#200 / .075mm	4.2

ZAV Curve Calculations: $Ws = \frac{(62.4)(Gsa) - (Yd)}{(Yd)(Gsa)} \times 100$

Assumed Gsa: (if no T 85)

Dry Density (Yd) Input for ZAV Curve: 1: 136.6 2: 140.7

Ws % Water Content for complete saturation

1: 11.2 2: 9.8

V Mold Volume = 0.0751

Pw Wet Density = **(M ÷ V)**

Pd Dry Density = **Pw / [1 + (W / 100)]**

SPECIFIC GRAVITY — WAQTC FOP for T 85		
b	SSD Aggregate Mass	2784.3
c	Aggregate Weight in Water	1810.7
a	Dry Aggregate Mass	2765.0
Gsb	BULK Specific Gravity = a / (b - c)	2.840
	SSD Specific Gravity = b / (b - c)	2.860
Gsa	Apparent Specific Gravity = a / (a - c)	2.897
	Absorption = [(b - a) / a] x 100	0.7

MAXIMUM DENSITY (0.1 lb/ft³ or 1 kg/m³)	
OPTIMUM MOISTURE (0.1%)	

Remarks:

DRY DENSITY vs. MOISTURE CONTENT

DRY DENSITY, (lb/ft³ or kg/m³)

% % % % % % %

MOISTURE CONTENT, (%)

Tested by / Date:

Checked by / Date:

STATE OF ALASKA
DOT & PF
Construction

ATM 213

WAQTC FOP for AASHTO T 310
FIELD WORKSHEET (METHOD A)

☐ Acceptance ☐ Information ☐ Assurance

Project Name: ____________________

State No: ____________________ 2005

Material: ____________________ Source ____________________

Item No. ________ Spec. ________ Gauge Serial No. ____________________

FIELD DENSITY TEST NUMBER								
STATION								
C/L REFERENCE								
GRADE REFERENCE								
QUANTITY REPRESENTED								
DATE TESTED			☐ AASHTO T 180		☐ ASTM D 1557		☐ ATM T-12	
STANDARD DENSITY BY:								
Lab Number								
(A) Standard Density (Maximum Lab)								
Optimum Moisture								
(B) Bulk Specific Gravity								
DENSITY DETERMINATION								
Probe Depth	Reading #1	Reading#2	Reading #1	Reading #2	Reading #1	Reading#2	Reading #1	Reading#2
Wet Density, lbm/f³ Gauge Readings								
(C) Average Wet Density								
(D) Dry Density (calculated) C/[1+(M/100)]								
If Gauge Moisture is used C/[1+E/100)]								
MOISTURE CONTENT								
%Gauge Moisture								
(E) Average % Moisture (gauge)								
(F) Wet Mass + Tare								
(G) Dry Mass + Tare								
(H) Moisture Mass F-G								
(J) Tare								
(K) Dry Mass G - J								
(M) % Moisture (actual) [H / K] x 100								
OVERSIZE CORRECTION (Circle Size)	3/4" / #4		3/4" / #4		3/4" / #4		3/4" / #4	
(P) Wet Mass + Tare (Under Nuke)								
(Q) Tare								
(R) Wet Mass P - Q								
(T) Dry Mass oven dried or R / [1 + (M / 100)]								
(V) Oversize Mass + Tare								
(W) Tare								
(X) Oversize Mass V - W								
(Y) % Oversize (X / T) x 100								
% Passing 100 - Y								
(Z) Corrected Std. Density (see chart)								
% COMPACTION D/Z x 100								

REMARKS: ____________________

Signature: ____________________

Checked by: ____________________

Date: ____________________

STATE OF ALASKA
DOT & PF

WAQTCFOP for T 310 (METHOD A)
FIELD DENSITY WORKSHEET

☑ Acceptance ☐ Verification ☐ Info. ☐ IA ☐ QC

Project Name: **AMATS: Old Glenn Highway, South Birchwood Loop to Peters Creek**
Federal No: **HED-0558(7)** AKSAS No: **50946**
Material: Subbase, Grading C Source: Moose Horn Pit / Granite
Item No: 304(1) Spec. (min.) 95% Gauge S/N: 33529

	FIELD DENSITY TEST NUMBER	SB - D - 44			
	STATION	332 + 55			
	$^C/_L$ REFERENCE	6' Lt. C/L			
	GRADE REFERENCE	Top of Subbase			
	QUANTITY REP'D OR PIPE/STRUCT. NO.	5,000 tons			
	DATE TESTED	09/11/10			

STANDARD DENSITY WAQTC FOP for T 180: ☐ A ☐ B ☐ C ☑ D / ☐ ATM 212

	Standard Density Lab Number	SB-SD-1			
Df	Standard Density T 99/T 180 (Maximum Lab	140.4			
	Optimum Moisture	7.0			
B	Specific Gravity ☑ +¾" Bulk ☐ –#4 App.	2.75			

DENSITY DETERMINATION

	Probe Depth		8"								
			Reading #1	Reading #2	Reading #1	Reading #2	Reading #1	Reading #2	Reading #1	Reading #2
	Wet Density, (lb/ft³ or kg/m³)	Gauge	151.8	151.6						
C	**Average Wet Density**	Gauge	151.7							
Pd	Dry Density (gauge) C / [1 + (E / 100)]		144.8							
Pd	Dry Density (actual) / [1 + (W / 100)]									

MOISTURE CONTENT Use WAQTC FOP for T 255/T 265 or use gauge moisture (E) if it is within 1% of actual moisture (W).

	% Moisture	Gauge	4.7	4.8						
E	**Average % Moisture**	Gauge	4.8							
F	Wet Mass + Container									
G	Dry Mass + Container									
J	Container									
W	**% Moisture** (actual) [(F – G) / (G – J)] x 100									

GRADATION / OVERSIZE CORRECTION *T 99 / T 180 Note: If % Oversize (Pc) is less than or equal to 5%, no correction is required.

	ATM 212 or *WAQTC FOP for T 224	☑ 3/4" ☐ #4	☐ 3/4" ☐ #4	☐ 3/4" ☐ #4	☐ 3/4" ☐ #4
P	Wet Mass + Container	16.81			
Q	Container	2.21			
Mm	Wet Mass P – Q	14.60			
Md	Dry Mass Mm/[1+(E / 100)] or Mm/[1+(W / 100)]	13.93			
T	+3/4" or +#4 Mass + Container	5.76			
V	Container	2.21			
M_{DC}	+3/4" or +#4 Mass T – V	3.55			
Pc	% Coarse Particles (M_{DC} / Md) x 100	25			
Pf	% Fines 100 – Pc	75			
	T 180 – Corrected Std. Density (**Dd formula**)	147.1			
	ATM 212 – Vibratory Standard (Lab Chart)				
	% Compaction Pd / Max. Std. Density) x 100	**98**			

Dd = (100 * Df * *k*) / [(Df * Pc) + (*k* * Pf)] ⇒ *k* = (62.4 lb/ft³ * B) or (1000 kg/m³ * B)

TCTT = Too Coarse To Test

Signature / Qualification No. / Date: M. Goldfarb / #538 / 9-11-10 Checked by / Date: W. Nelson / 9-12-10

REMARKS:

STATE OF ALASKA
DOT & PF

SOILS & AGGREGATE, METHOD A FIELD WORKSHEET

☐ Acceptance ☐ Verification ☐ Info. ☐ IA ☐ QC

Sample No: ____________

Project Name: ____________

Federal No: ____________ AKSAS No: ____________

Material: ____________ Source: ____________

Item No: ____________ Location: ____________

Sta. / Sampled from: ____________ Sampled by / Qual. No: ____________

C/L & Grade Reference: ____________ Quantity Represented: ____________ Date: ____________

FRACTURE — WAQTC FOP for T 335

☐ Single Face ☐ Double Face ☐ All Face

Fractured Mass **F**		%Q = [Q / (F + Q + N)] x 100	
Questionable Mass **Q**		* % Questionable ⇒	
Unfractured Mass **N**		*Recount if > 15%	
% Fracture		⇐ [(F + (Q/2)) / (F + Q + N)] x	
Test by / date:		⇐ Spec.	

MOISTURE CONTENT — WAQTC FOP for T 255 / T 265

			Constant Mass	
C	Container		Time	Gross Mass / Net Mass
A	Moist Mass + Container			
Mw	Wet Mass **A – C**			
B	Dry Mass + Container			
Md	Dry Mass **B – C**			
W	**Moisture, %**			
W = [(Mw – Md) / Md] x 100 ⇧			% Change ⇒	
Test by / date:		%Change = [(Mp – Mn) / Mp] x 100		

Mp = Previous Mass Measured / Mn = New Mass Measured

LIQUID AND PLASTIC LIMIT — WAQTC FOP for T 89 and T 90

		LL	PL	
N	Number of Blows		☒	
C	Container			
A	Moist Mass + Container			
Mw	Moist Mass **A – C**			
B	Dry Mass + Container			
Md	Dry Mass **B – C**			PL
W	Moisture Content, % [(Mw – Md) / Md] x 100			
LL	W x (N / 25)$^{0.121}$			LL Spec
Test by / date:	Plasticity index LL – PL			PI Spec

GRADATION — WAQTC FOP for T 27 / T 11 – Method A

mm / USC	Increment 1	Increment 2	Cumulative Mass Retained **C**	Cumulative %Retained (C / M) x 100	%Passing = 100 – %Retained	Specs.
*75 / 3"						
50 / 2"						
*37.5 / 1½"						
25 / 1"						
*19.0 / 3/4"						
12.5 / 1/2"						
*9.5 / 3/8"						
6.3 / 1/4"						
*4.75 / #4						
*2.36 / #8						
2.00 / #10						
*1.18 / #16						
.850 / #20						
*.600 / #30						
.425 / #40						
*.300 / #50						
*.150 / #100						
.075 / #200						
Cum. Pan				⇐ **G**	Check Sum (≤ 0.3%) [(A - G) / A] x 100 =	
Cumulative Mass AFTER Sieving						
Dry Mass AFTER Wash BEFORE Sieving				⇐ **A**	Test by / date:	
Original Dry Mass				⇐ **M**		

FM ⇒			⇐ Fineness Modulus Target (From MD)
	to		⇐ FM Limits (±0.2 of Mix Design FM)
(FM = Fineness Modulus = Total of % Retained of *Sieves / 100)			

Remarks: ____________

Signature / Date: ____________

Checked by / Date: ____________

STATE OF ALASKA
DOT & PF

SOILS & AGGREGATE, METHOD A FIELD WORKSHEET

☑ Acceptance ☐ Verification ☐ Info. ☐ QC

Sample No: FA-G-1

Project Name:	Haines Front Street to Park Street		
Federal No:	HHE-095-6(032)	AKSAS No:	69999
Material:	Fine Concrete Aggregate	Source:	Glacier Northwest
Item No:	501(1)	Location:	Bellevue, Washington
Sta. / Sampled from:	Stockpile, HNS Ready Mix	Sampled by / Qual. No:	P. Harmon # 007
C/L & Grade Reference:	N/A	Quantity Represented:	100 CY
		Date:	03/24/11

FRACTURE — WAQTC FOP for T 335

☐ Single Face ☐ Double Face ☐ All Face

Fractured Mass F		%Q = [Q / (F + Q + N)] x 100	
Questionable Mass Q		* % Questionable =	
Unfractured Mass N		*Recount if > 15%	
% Fracture		⇐ [(F+(Q/2)) / (F+Q+N)] x 100	
Test by /date:		⇐ Spec.	

MOISTURE CONTENT — WAQTC FOP for T 255 / T 265

			Constant Mass	
C	Container	626.3	Time	Gross Mass / Net Mass
A	Moist Mass + Container	1776.3	12:00 PM	1735.9
				1109.6
Mw	Wet Mass A – C	1150.0	12:30 PM	1735.6
				1109.3
B	Dry Mass + Container	1736.7		
Md	Dry Mass B – C	1110.4		
W	**Moisture, %**	3.6		
W = [(Mw – Md) / Md] x 100 ⇑			%Change =	0.03
Test by /date: P.H 3/24/11		%Change = [(Mp – Mn) / Mp] x 100		
Mp = Previous Mass Measured / Mn = New Mass Measured				

GRADATION — WAQTC FOP for T 27 / T 11 – Method A

mm / USC	Increment 1	Increment 2	Cumulative Mass Retained C	Cumulative %Retained (C / M) x 100	%Passing = 100 – %Retained	Specs.
*75 / 3"						
50 / 2"						
*37.5 / 1½"						
25 / 1"						
*19.0 / 3/4"						
12.5 / 1/2"						
*9.5 / 3/8"			0.0	0.0	100	**100**
6.3 / 1/4"						
*4.75 / #4			30.9	5.4	95	**95 - 100**
*2.36 / #8			89.2	15.6	84	**80 - 100**
2.00 / #10						
*1.18 / #16			254.4	44.4	56	**50 - 85**
.850 / #20						
*.600 / #30			338.2	59.0	41	**25 - 60**
.425 / #40						
*.300 / #50			441.1	77.0	23	**10 - 30**
*.150 / #100			520.9	90.9	9	**2 - 10**
.075 / #200			556.8	97.2	2.8	**3.0 max**
Cum. Pan			557.7	⇐ G	Check Sum (≤ 0.3%) [(A - G) / A] x 100 =	
Cumulative Mass AFTER Sieving						
Dry Mass AFTER Wash BEFORE Sieving			558.2	⇐ A	0.1%	
Original Dry Mass			573.0	⇐ M	Test by /date: P.H. 3/24/11	

LIQUID AND PLASTIC LIMIT — WAQTC FOP for T 89 and T 90

		LL	PL	
N	Number of Blows		☒	
C	Container			
A	Moist Mass + Container			
Mw	Moist Mass A – C			
B	Dry Mass + Container			
Md	Dry Mass B – C			PL
W	Moisture Content, % [(Mw – Md) / Md] x 100			
LL	W x (N / 25)$^{0.121}$			LL Spec
Test by /date:	Plasticity index LL – PL			PI Spec

FM ⇒	2.92	2.78	⇐ Fineness Modulus Target (From MD)
2.58	to	2.98	⇐ FM Limits (±0.2 of Mix Design FM)
(FM = Fineness Modulus = Total of % Retained of *Sieves / 100)			

Remarks:

Signature / Date: Patrick H. Harmon / #007 / 3-24-11

Checked by / Date: CJK / 3-25-11

STATE OF ALASKA
DOT & PF

SOILS & AGGREGATE, METHOD B FIELD WORKSHEET

☐ Acceptance ☐ Verification ☐ Info. ☐ IA ☐ QC

Sample No: ____________

Project Name: ____________

Federal No: ____________ AKSAS No: ____________

Material: ____________ Source: ____________

Item No: ____________ Location: ____________

Sta. / Sampled from: ____________ Sampled by / Qual. No: ____________

C/L & Grade Reference: ____________ Quantity Represented: ____________ Date: ____________

FRACTURE — WAQTC FOP for T 335

☐ Single Face ☐ Double Face ☐ All Face

Fractured Mass **F**		%Q = [Q / (F + Q + N)] x 100
Questionable Mass **Q**		* % Questionable =
Unfractured Mass **N**		*Recount if > 15%
% Fracture		⇐ [(F+(Q/2)) / (F+Q+N)] x 100
Test by / date:		⇐ Spec. (min.)

MOISTURE CONTENT — WAQTC FOP for T 255 / T 265

			Constant Mass	
C	Container		Time	Gross Mass / Net Mass
A	Moist Mass + Container			
Mw	Wet Mass **A – C**			
B	Dry Mass + Container			
Md	Dry Mass **B – C**			
W	**Moisture, %**			
W = [(Mw – Md) / Md] x 100 ⇑			% Change =	
Test by / date:			% Change = [(Mp – Mn) / Mp] x 100	

Mp = Previous Mass Measured / Mn = New Mass Measured

LIQUID AND PLASTIC LIMIT — WAQTC FOP for T 89 and T 90

		LL	PL	
N	Number of Blows		╳	
C	Container			
A	Moist Mass + Container			
Mw	Moist Mass **A – C**			
B	Dry Mass + Container			
Md	Dry Mass **B – C**			PL
W	Moisture Content, % [(Mw – Md) / Md] x 100			
LL	W x (N / 25)$^{0.121}$			LL Spec.
Test by / date:	Plasticity index LL – PL			PI Spec.

Remarks: ____________

GRADATION — WAQTC FOP for T 27 / T 11 – Method B

mm / USC	Increment 1	Increment 2	Cumulative Mass Retained **C**	Cumulative %Retained (C / M) x 100	%Passing = 100 – %Retained	Specs.
*75 / 3"						
50 / 2"						
*37.5 / 1½"						
25 / 1"						
*19.0 / 3/4"						
12.5 / 1/2"						
*9.5 / 3/8"						
6.3 / 1/4"						
*4.75 / #4			D			
Indiv. Pan				⇐ **M1**	CA Check Sum (≤ 0.3%)	
Cumulative Mass AFTER Sieving = (D + M1)				⇐ **G**	[(A – G) / A] x 100 =	
Dry Mass AFTER Wash BEFORE Sieving				⇐ **A**		
Original Dry Mass				⇐ **M**	Test by / date:	
			⇐ **F = (M1 / M2) (0.001)**			

mm / USC	Cumulative Mass **B**	Total Sample Cumulative Mass **C** = [F x B] + D	Cumulative %Retained (C / M) x 100	%Passing = 100 – %Retained	Specs.
*2.36 / #8					
2.00 / #10					
*1.18 / #16					
.850 / #20					
*.600 / #30					
.425 / #40					
*.300 / #50					
*.150 / #100					
.075 / #200					
Cum. Pan **P**		╳			
M2 ⇒		⇐ – #4 Mass Actually Sieved		FA Check Sum (≤ 0.3%)	
		Test by / date:		[(M2 – P) / M2] x 100 =	

FM ⇒			⇐ Fineness Modulus Target (From MD)
	to		⇐ FM Limits (±0.2 of Mix Design FM)
(FM = Fineness Modulus = Total of % Retained of *Sieves / 100)			

Signature / Date: ____________

Checked by / Date: ____________

STATE OF ALASKA
DOT & PF

SOILS & AGGREGATE, METHOD B FIELD WORKSHEET

☑ Acceptance ☐ Verification ☐ Info. ☐ QC

Sample No: BC-G-1

Project Name: Phillips Field Road Upgrades

Federal No: STP-0070(3) AKSAS No: 63481

Material: Base Course, D-1 Source: MS-02-001-32

Item No: 301(1) Location: 13 Mile, Miller Road

Sta. / Sampled from: 28+50 / Roadway Sampled by / Qual. No: MK / #508

C/L & Grade Reference: 12 Rt. / -6" Top BC Quantity Represented: 2000 tons Date: 07/20/10

FRACTURE — WAQTC FOP for T 335

☑ Single Face ☐ Double Face ☐ All Face

Fractured Mass **F**	1113.4	%Q = [Q / (F + Q + N)] x 100	
Questionable Mass **Q**	132.3	* %Questionable =	8
Unfractured Mass **N**	352.6	*Recount if > 15%	
% Fracture	74	⇐ [(F+(Q/2)) / (F+Q+N)] x	
Test by/date: PH 7-21-10	70%	⇐ Spec. (min.)	

MOISTURE CONTENT — WAQTC FOP for T 255 / T 265

			Constant Mass	
C	Container	672.1	Time	Gross Mass / Net Mass
A	Moist Mass + Container	3783.8	1:15 PM	3681.3
Mw	Wet Mass A – C	3111.7		3009.2
B	Dry Mass + Container	3681.9	1:45 PM	3679.8
				3007.7
Md	Dry Mass B – C	3009.8		
W	**Moisture, %**	3.4		
W = [(Mw – Md) / Md] x 100 ⇑			%Change =	0.05
Test by/date: PH 7-20-10			%Change = [(Mp – Mn) / Mp] x 100	

Mp = Previous Mass Measured / Mn = New Mass Measured

LIQUID AND PLASTIC LIMIT — WAQTC FOP for T 89 and T 90

		LL	PL	
N	Number of Blows	23		
C	Container	14.20	14.18	
A	Moist Mass + Container	34.22	23.89	
Mw	Moist Mass A – C	20.02	9.71	
B	Dry Mass + Container	31.45	22.79	
Md	Dry Mass B – C	17.25	8.61	PL
W	Moisture Content, % [(Mw – Md) / Md] x 100	16.1	12.8	13
LL	W x (N / 25)$^{0.121}$	16		LL Spec.
Test by/date: PH 7-21-10	Plasticity index LL – PL	3	6 max.	PI Spec.

Remarks:

GRADATION — WAQTC FOP for T 27 / T 11 — Method B

mm / USC	Increment 1	Increment 2	Cumulative Mass Retained C	Cumulative %Retained (C / M) x 100	%Passing = 100 – %Retained	Specs.
*75 / 3"						
50 / 2"						
*37.5 / 1½"						
25 / 1"			0.0	0.0	100	**100**
*19.0 / 3/4"			251.8	3.1	97	**70 - 100**
12.5 / 1/2"			1253.8	15.5	85	
*9.5 / 3/8"			2222.1	27.5	73	**50 - 80**
6.3 / 1/4"			3291.5	40.7	59	
*4.75 / #4			4067.7 **D**	50.3	50	**35 - 65**
Indiv. Pan			4022.8	⇐ **M1**	CA Check Sum (≤ 0.3%)	
Cumulative Mass AFTER Sieving = (D + M1)			8090.5	⇐ **G**	[(A – G) / A] x 100 =	
Dry Mass AFTER Wash BEFORE Sieving			8094.6	⇐ **A**	0.1%	
Original Dry Mass			8094.7	⇐ **M**	Test by/date:	
	7.531		⇐ **F = (M1 / M2) (0.001)**		PH 7-20-10	

mm / USC	Cumulative Mass B	Total Sample Cumulative Mass C = [F x B] + D	Cumulative %Retained (C / M) x 100	%Passing = 100 – %Retained	Specs.
*2.36 / #8	153.6	5224.5	64.5	36	**20 - 50**
2.00 / #10	181.1	5431.6	67.1	33	
*1.18 / #16	238.9	5866.9	72.5	28	
.850 / #20	289.6	6248.7	77.2	23	
*.600 / #30	316.5	6451.3	79.7	20	
.425 / #40	364.9	6815.8	84.2	16	
*.300 / #50	438.1	7367.0	91.0	9	**8 - 30**
*.150 / #100	457.1	7510.1	92.8	7	
.075 / #200	487.8	7741.3	95.6	4.4	**0 - 6**
Cum. Pan P	533.1				
M2 ⇒	534.2	⇐ – #4 Mass Actually Sieved		FA Check Sum (≤ 0.3%)	
		Test by/date: PHH 7-21-10		[(M2 – P) / M2] x 100 = 0.2%	

FM ⇒			⇐ Fineness Modulus Target (From M D)
	to		⇐ FM Limits (±0.2 of Mix Design FM)

(FM = Fineness Modulus = Total of % Retained of *Sieves / 100)

Signature / Date: Pat Harmon / #007 / 7-21-10

Checked by / Date: MK / 7-22-10

STATE OF ALASKA
DOT & PF

SOILS & AGGREGATE, METHOD C FIELD WORKSHEET

☐ Acceptance ☐ Verification ☐ Info. ☐ IA ☐ QC **Sample No:** ____________

Project Name: ____________

Federal No: ____________ AKSAS No: ____________

Material: ____________ Source: ____________

Item No: ____________ Location: ____________

Sta. / Sampled from: ____________ Sampled by / Qual. No: ____________

C/L & Grade Reference: ____________ Quantity Represented: ____________ Date: ____________

FRACTURE — WAQTC FOP for T 335		
☐ Single Face ☐ Double Face ☐ All Face		
Fractured Mass **F**		%Q = [Q / (F + Q + N)] x 100
Questionable Mass **Q**		* %Questionable ⇒
Unfractured Mass **N**		*Recount if > 15%
% Fracture		⇐ [(F + (Q/2)) / (F + Q + N)] x
Test by/date: PH 7-21-10		⇐ Spec. (min.)

MOISTURE CONTENT — WAQTC FOP for T 255 / T 265			**Constant Mass**	
C	Container		**Time**	Gross Mass / Net Mass
A	Moist Mass + Container			
Mw	Wet Mass **A – C**			
B	Dry Mass + Container			
Md	Dry Mass **B – C**			
W	**Moisture, %**			
W = [(Mw – Md) / Md] x 100 ⇧			%Change =	
Test by/date:	%Change = [(Mp – Mn) / Mp] x 100			
Mp = Previous Mass Measured / Mn = New Mass Measured				

QUID AND PLASTIC LIMIT — WAQTC FOP for T 89 and T		LL	PL	
N	Number of Blows		╳	
C	Container			
A	Moist Mass + Container			
Mw	Moist Mass **A – C**			
B	Dry Mass + Container			
Md	Dry Mass **B – C**			PL
W	Moisture Content, % [(Mw – Md) / Md] x 100			
LL	$W \times (N / 25)^{0.121}$			LL Spec
Test by/date:	Plasticity Index LL – PL			PI Spec

GRADATION — WAQTC FOP for T 27 / T 11 — Method C						
mm / USC	Increment 1	Increment 2	Cumulative Mass Retained **C**	Cumulative %Retained (C / M) x 100	%Passing = 100 – %Retained	Specs.
150 / 6"						
100 / 4"						
*75 / 3"					**t**	
50 / 2"						
*37.5 / 1½"						
25 / 1"						
*19.0 / 3/4"						
12.5 / 1/2"						
*9.5 / 3/8"						
6.3 / 1/4"						
*4.75 / #4			**D**			
Indiv. Pan				⇐ **M1**	CA Check Sum (≤ 0.3%)	
Dry Mass AFTER Sieving = (D + M1)				⇐ **G**	[(M – G) / M] x 100 =	
Original Dry Mass BEFORE Sieving				⇐ **M**		
					Test by/date:	

mm / USC	Cumulative Mass Ret. $CMR_{\#4}$	$CPR_{\#4}$ = $(CMR_{\#4} / M_{\#4}) \times 100$	$CPP_{\#4}$ = $100 - CPR_{\#4}$	%Passing = $(CPP_{\#4} \times CPP_{\#4}) / 100$	Specs.
*2.36 / #8					
2.00 / #10					
*1.18 / #16					
.850 / #20					
*.600 / #30					
.425 / #40					
*.300 / #50					
*.150 / #100					
.075 / #200				**s**	
Cum. Pan **P**		#200 on – 3" = [(s / t) x 100] ⇒			
H ⇒		⇐ DRY Mass AFTER Wash		FA Check Sum (≤ 0.3%) [(H – P) / H] × 100 =	
$M_{\#4}$ ⇒		⇐ –#4 Mass BEFORE Wash			
		Test by/date:			

Remarks: ____________

FM ⇒			⇐ Fineness Modulus Target (From MD)
	to		⇐ FM Limits (±0.2 of Mix Design FM)
(FM = Fineness Modulus = Total of % Retained of *Sieves / 100)			

Signature / Date: ____________

Checked by / Date: ____________

STATE OF ALASKA DOT & PF

SOILS & AGGREGATE, METHOD C FIELD WORKSHEET

☑ Acceptance ☐ Verification ☐ Info. ☐ QC **Sample No: EXA-G-1**

Project Name: Phillips Field Road Upgrades

Federal No: STP-0070(3) AKSAS No: 63481

Material: Unclass. Ex.-Useable Type A Source: Existing

Item No: 203(3) Location: Project Limits

Sta. / Sampled from: 28+50 / Roadway Sampled by / Qual. No: MK / #508

C/L & Grade Reference: 12' Rt. / -24" Top Embankment Quantity Represented: 10,000 tons Date: 07/20/10

FRACTURE — WAQTC FOP for T 335

☐ Single Face ☐ Double Face ☐ All Face

Fractured Mass **F**		%Q-[Q/(F+Q+N)]x100	
uestionable Mass **Q**		% Questionable	
Unfractured Mass **N**		*Recount if > 15%	
% Fracture		⇐ [(F+(Q/2))/(F+Q+N)]x	
Test by/date: PH 7-2		⇐ Spec. (min.)	

ISTURE CONTENT — WAQTC FOP for T 255 / T

			Constant Mass	
C	Container	672.1	Time	Gross Mass / Net Mass
A	Moist Mass + Container	1534	#####	1499.7
Mw	Wet Mass **A – C**	861.7		827.6
			#####	1499.3
B	Dry Mass + Container	1500		827.2
Md	Dry Mass **B – C**	827.6		
W	**Moisture, %**	4.1		
W = [(Mw – Md) / Md] x 100 ⇧			%Change =	0.05

Test by/date: PH 7-2; Change = [(Mp – Mn) / Mp] x 10

= Previous Mass Measured / Mn = New Mass Meas

QUID AND PLASTIC LIMIT — WAQTC FOP for T 89 an

		LL	PL	
N	Number of Blows	23	⨯	
C	Container	14.20	14.18	
A	Moist Mass + Container	34.22	23.89	
Mw	Moist Mass **A – C**	20.02	9.71	
B	Dry Mass + Container	31.45	22.79	
Md	Dry Mass **B – C**	17.25	8.61	PL
W	Moisture Content, % [(Mw – Md) / Md] x 100	16.1	12.8	13
LL	W x (N / 25)^0.121	16		LL Spec
Test by/date: PH 7-21-10	Plasticity Index **LL – PL**	3	6 max.	PI Spec.

GRADATION — WAQTC FOP for T 27 / T 11 — Method C

mm / USC	Increment 1	Increment 2	Cumulative Mass Retained **C**	Cumulative % Retained	% Passing = 100 – %Retained	Specs.
150 / 6"	0.0	0.0	0.0	100.0	100	
100 / 4"	1468.8	1977.4	3446.2	5.5	95	
*75 / 3"	2460.0	2866.7	5326.7	8.5	**t** 92	
50 / 2"	8975.4	11763.2	20738.6	33.2	67	
*37.5 / 1½"	10354.2	13456.4	23810.6	38.2	62	
25 / 1"	15674.3	17444.3	33118.6	53.1	47	
*19.0 / 3/4"	18543.6	19555.3	38098.9	61.1	39	
12.5 / 1/2"	19541.2	20339.7	39880.9	63.9	36	
*9.5 / 3/8"	21841.7	22437.9	44279.6	71.0	29	
6.3 / 1/4"						
*4.75 / #4	22633.8	23948.6	46582.4 **D**	74.7	25	**20 – 55**
Indiv. Pan	6876.9	8918.3	15795.2	⇐ **M1**	CA Check Sum (≤ 0.3%)	
Dry Mass AFTER Sieving = (D + M1)			62377.6	⇐ **G**	[(M – G) / M] x 100 =	
Original Dry Mass BEFORE Sieving			62378.8	⇐ **M**	0.0	
					Test by/date: PH 7-20-10	

mm / USC	Cumulative Mass Ret.	CPR-#4 = (CMR-#4/M-#4)x100	CPP-#4 = 100-CPR-#4	% Passing = (CPP-#4 x CPP#4)/100	Specs.
*2.36 / #8	163.9	18.3	81.7	21	
2.00 / #10					
*1.18 / #16	298.7	33.4	66.6	17	
.850 / #20					
*.600 / #30	427.9	47.9	52.2	13	
.425 / #40					
*.300 / #50	566.7	63.4	36.6	9	
*.150 / #100	725.6	81.1	18.9	5	
.075 / #200	808.6	90.4	9.6	**s** 2.4	
Cum. Pan **P**	827.5	200 on – 3" = [(s / t) x 100]		**2.6**	***0 – 6**
H ⇒	827.9	⇐ DRY Mass AFTER Wash		FA Check Sum (≤ 0.3%)	
M-#4 ⇒	894.3	⇐ – #4 Mass BEFORE Wa		[(H – P) / H] x 100 =	
		Test by/date: PH 7-21-10		0.0	

FM ⇒			⇐ Fineness Modulus Target (From MD)
	to		⇐ FM Limits (±0.2 of Mix Design FM)
(FM = Fineness Modulus = Total of % Retained of *Sieves / 100)			

Remarks:

#200 determined on minus 3-inch material

Deleterious Free

Signature / Date: Pat Harmon / #007 / 07-21-10

Checked by / Date: MK / 7-22-10

STATE OF ALASKA
DOT & PF

AGGREGATE, SAND EQUIVALENT / FLAT & ELONGATED FIELD WORKSHEET

☐ Acceptance ☐ Verification ☐ Info. ☐ IA ☐ QC **Sample No:** ______

Project Name: ______
Federal No: ______ AKSAS No: ______
Material: ______ Source: ______
Item No: ______ Location: ______
Sta. / Sampled from: ______ Sampled by: ______
C/L & Grade Reference: ______ Qualification No: ______ Date Sampled: ______

Sand Equivalent — WAQTC FOP for T 176

Sedimentation Time	

Trial No.	1	2	3
Sand Reading **(SR)**			
Clay Reading **(CR)**			
Sand Equivalent **(SE)***			
Sedimentation Time			

Average SE

***SE = (SR ÷ CR) * 100**

Test by/date:

Flat and Elongated — ATM 306

Ratio: ☐ 1:5 ☐ 1:3 ☐ 1:2

Size Fraction mm	Size Fraction in.	% Retained (Original Gradation)	F&E Group CPR (Rel. to +No. 4)	F&E Group IPR	Size Group Mass	Mass F&E Size Group	% F&E Size Group **(B)**	Weighted % F&E Size Group
-37.5 to +19.0	-1½ to +¾							
-19.0 to +9.5	-¾ to +⅜							
-9.5 to +4.75	-⅜ to +No. 4							
							Total Weighted %	

F&E Group CPR = (Smallest Sieve in Group % Retained ÷ % No. 4 Retained) x 100

F&E Group IPR = F&E Group CPR – Next Larger Group CPR

% F&E Size Group **(B)** = [(Mass F&E Size Group) ÷ (Size Group Mass)] x 100

Weighted F&E Size Group = [**(B)** x F&E Group IPR] ÷ 100

Test by/date:

CPR = Cumulative Percent Retained
IPR = Individual Percent Retained

Remarks: ______

Signature / Date: ______
Checked by / Date: ______

STATE OF ALASKA DOT & PF

AGGREGATE, SAND EQUIVALENT / FLAT & ELONGATED FIELD WORKSHEET

☑ Acceptance ☐ Verification ☐ Info. ☐ IA ☐ QC

Sample No: HMA-DA-11

Project Name: Atka Airport Runway Extension & Resurfacing

Federal No: AIP 3-02-0394-005-2008 AKSAS No: 59621

Material: HMA, Type IIB Source: Atka Quarry

Item No: P-401 Location: Atka, AK

Sta. / Sampled from: Coldfeed Sampled by: J. Christensen

C/L & Grade Reference: N/A Qualification No: 165 Date Sampled: 07/10/10

Sand Equivalent — WAQTC FOP for T 176

Sedimentation Time: 20 min.

Trial No.	1	2	3
Sand Reading **(SR)**	4.1	4.3	4.1
Clay Reading **(CR)**	6.3	6.7	6.5
Sand Equivalent **(SE)***	66	65	64
Sedimentation Time	20 min.	20 min.	20 min.

Average SE: **65**

***SE = (SR ÷ CR) * 100**

Test by/date: J.C. / 7-10-10

Flat and Elongated — ATM 306

Ratio: ☑ 1:5 ☐ 1:3 ☐ 1:2

Size Fraction mm	Size Fraction in.	% Retained (Original Gradation)	F&E Group CPR (Rel. to +No. 4)	F&E Group IPR	Size Group Mass	Mass F&E Size Group	% F&E Size Group **(B)**	Weighted % F&E Size Group
-37.5 to +19.0	-1½ to +¾							
-19.0 to +9.5	-¾ to +⅜	35	60	60	753.6	14.5	1.9	1.1
-9.5 to +4.75	-⅜ to +No. 4	58	100	40	104.9	3.3	3.1	1.2

Total Weighted %: **2**

Test by/date: J.C. / 7-12-10

F&E Group CPR = (Smallest Sieve in Group % Retained ÷ % No. 4 Retained) x 100

F&E Group IPR = F&E Group CPR – Next Larger Group CPR

% F&E Size Group **(B)** = [(Mass F&E Size Group) ÷ (Size Group Mass)] x 100

Weighted F&E Size Group = [**(B)** x F&E Group IPR] ÷ 100

CPR = Cumulative Percent Retained

IPR = Individual Percent Retained

Remarks:

Signature / Date: J. Christensen / #165 / 7-12-10

Checked by / Date: B. Anderson / 7-13-10

STATE OF ALASKA
DOT & PF

HOT MIX ASPHALT (HMA)
FIELD WORKSHEET

☐ Acceptance ☐ Verification ☐ Info. ☐ IA ☐ QC **Sample No:**

Project Name:			
Federal No:		AKSAS No:	
Type Mix:		Agg. Source:	
Item No:		Asph. Cement Source / Type:	
Sta. / Location:		Sampled by / Qualification No:	
C/L Offset:	Sample Method:	Date / Time Sampled:	
Lift:	Quantity Rep'd: Lot:	Sublot:	Mix Design No:	Date Tested:

AC Content of HMA by Nuclear Method — ATM 405

Gauge Make & Model:			
Gauge Serial No:			
Calib. No:		Calib. Date:	
	*Sample Temperature		⇐ *N/A if using 3241-C
	Sample Pan Mass		
	Calib. / Target Mass		± 5g
		16 Min. Count	Background Count
	Gauge Count		
A	Uncorrected AC		Gauge, 0.01 %
W	Moisture Content		T 329, 0.01 %
	Corrected AC A - W		0.1 %
Test by/date:			⇐ Specs.

AC Content of HMA by Ignition — WAQTC FOP for T 308 (External Balance)

☑ Method A	Furnace No. / ID:		
☐ Method B	Furnace Temp:		☐ °F ☐ °C
B	Basket Assembly Mass		0.1 g
C	Sample Mass + Basket Assembly		Before Ignition
Mi	Initial Sample Mass C - B		0.1 g
	Furnace Mass: Basket + Sample		± 5g of Mass C
D	Basket Assembly + Sample Mass		0.1 g, After Ignition
Mf	Final Sample Mass D - B		Aggregate Mass
BC	Loss, % [((Mi - Mf) / Mi) x 100]		Binder Content, 0.01%
Cf	AC Correction Factor		Oven Specific
A	UnCorrected AC BC - Cf		0.01 %
W	Moisture Content		T 329, 0.01 %
Pb	Corrected AC A - W		0.1 %
Test by/date:			⇐ Specs.

Moisture of HMA — WAQTC FOP for T 329

Oven, °F:	Sample, °F:	Time In:	Time Out:	Constant Mass
				% Change @ <0.05% = [(Mp - Mn) / Mp] x 100
C	Container, 0.1 g			1635 | % Change
A	Wet + Container			90 min.
B	Dry + Container			+30 min.
Mi	Moist Mass A - C			+30 min.
Mf	Dry Mass B - C			+30 min.
W	Moisture Content, % [(Mi - Mf) / Mf] x 100		% Wet Mass 0.5% max	Mp = Previous Net Mass Mn = New Net Mass
Test by/date:				⇐ Specs.

MSG of HMA Mix — WAQTC FOP for T 209 — Flask Method

D	Mass of Flask + Lid + Water @ 77°F, 0.1 g	
B	Mass of Flask + Lid, 0.1 g	
C	Mass of Flask + Lid + Sample, 0.1 g	
A	Mass of Dry Sample in Air C - B	
E	Flask + Lid + De-aired Water + Sample, 0.1 g	
R	Temperature Correction Factor * (Table 2 in FOP)	
	*Use only if a test temperature other than 77°F is used. R = 1 for water @ 77°F	
	Temp. of Water, °F = MSG = [A / (A + D - E)] x R	
Test by/date:	Mix Design MSG:	

⇓ Remarks — Gauge / Ignition Printout ⇓

Bulk Specific Gravity — WAQTC FOP for T 166 / T 275

Oven Temp:

	Method C / A	Panel	Joint
C	Weight in Water, 0.1 g		
B	Mass at SSD, 0.1 g		
X	Dry Mass + Pan, 0.1 g		
Y	Pan		
A	Dry Mass in Air, 0.1 g (X - Y)		
BSG	Bulk SpG, 0.001 A / (B - C)		
	Absorption, 0.1 [(B - A) / (B - C)] x 100		
	Lot MSG		
	Compaction, % (BSG / MSG) x 100		
Test by/date:	Specs. ⇒	-	-

Constant Mass

% Change @ <0.05% = [(Mp - Mn) / Mp] x 100

Mp = Previous Net Mass Mn = New Net Mass	Panel		% Change
Initial Gross		Initial Net	
Mass @ ~2 hrs.		Net	
Mass @ ~2 hrs.		Net	

Core Thickness (inches)

Panel		Joint	
	0.00	Avg.	0.00
⇒		⇒	

Signature / Date: Checked by / Date:

STATE OF ALASKA
DOT & PF

HOT MIX ASPHALT (HMA) FIELD WORKSHEET

☑ Acceptance ☐ Verification ☐ Info. ☐ IA ☐ QC

Sample No: HMA-OD-11

Project Name:	Old Glenn Highway: Fire Lake to South Birchwood
Federal No:	STP-0558(6)
AKSAS No:	58061
Type Mix:	HMA, Type IIB
Agg. Source:	Premier Pit/ Pruhs Const
Item No:	401(1)
Asph. Cement Source / Type:	Tesoro / PG 52-28
Sta. / Location:	240+50
Sampled by / Qualification No:	S. February / #557
C/L Offset:	8' RT (right panel)
Sample Method:	Plate
Date / Time Sampled:	9-22-10/ 12:48 PM
Lift:	Top
Quantity Rep'd: Lot:	1
Sublot:	11
Mix Design No:	2010A-2181
Date Tested:	9/22/2010

AC Content of HMA by Nuclear Method — ATM 405

Gauge Make & Model:	Troxler 3241-C		
Gauge Serial No:	781		
Calib. No:	2010A-2181	Calib. Date:	6/25/2010
*Sample Temperature	NA	⇐	*N/A if using 3241-C
Sample Pan Mass	562		
Calib. / Target Mass	7900	± 5g	
	16 Min. Count		Background Count
Gauge Count	4618		2112
A Uncorrected AC	5.43	Gauge, 0.01 %	
W Moisture Content	0.04	T 329, 0.01 %	
Corrected AC A - W	5.4	0.1 %	
Test by/date: WM/9-22-10	5.0 -5.8	⇐ Specs.	

AC Content of HMA by Ignition — WAQTC FOP for T 308 (External Balance)

☑ Method A	Furnace No. / ID:	10118848	
☐ Method B	Furnace Temp:	538	☐ °F ☑ °C
B	Basket Assembly Mass	2987.8	0.1 g
C	Sample Mass + Basket Assembly	5366.7	Before Ignition
Mi	Initial Sample Mass C - B	2378.9	0.1 g
	Furnace Mass: Basket + Sample	5363.4	± 5g of Mass C
D	Basket Assembly + Sample Mass	5235.7	0.1 g, After Ignition
Mf	Final Sample Mass D - B	2247.9	Aggregate Mass
BC	Loss, % [((Mi - Mf) / Mi) x 100]	5.51	Binder Content, 0.01%
Cf	AC Correction Factor	0.37	Oven Specific
A	UnCorrected AC BC - Cf	0.04	0.01 %
W	Moisture Content	5.10	T 329, 0.01 %
Pb	Corrected AC A - W	5.0 -5.8	0.1 %
Test by/date:	WM/9-22-10	5.0 - 5.8	⇐ Specs.

Moisture of HMA — WAQTC FOP for T 329

Oven, °F:	Sample, °F:	Time In:	Time Out:	Constant Mass	
235	180	1:15PM	3:15PM	% Change @ <0.05% = [(Mp - Mn) / Mp] x 100	% Change
C	Container, 0.1 g	237.1		1635	
A	Wet + Container	2359.5	90 min.	2359.30	
B	Dry + Container	2358.7	+30 min.	2358.70	0.03
Mi	Moist Mass A - C	2122.4	+30 min.		
Mf	Dry Mass B - C	2121.6	+30 min.		
W	Moisture Content, % [(Mi - Mf) / Mf] x 100	0.04	Mp = Previous Net Mass, Mn = New Net Mass		
Test by/date:	WM/9-22-10	0.5% max	⇐ Specs.		

MSG of HMA Mix — WAQTC FOP for T 209 — Flask Method

D	Mass of Flask + Lid + Water @ 77°F, 0.1 g	7363.8
B	Mass of Flask + Lid, 0.1 g	2984.8
C	Mass of Flask + Lid + Sample, 0.1 g	5027.5
A	Mass of Dry Sample in Air C - B	2042.7
E	Flask + Lid + De-aired Water + Sample, 0.1 g	8597.6
R	Temperature Correction Factor * (Table 2 in FOP)	1.00000
	*Use only if a test temperature other than 77°F is used. R = 1 for water @ 77°F	
Temp. of Water, °F = 76.4	MSG = [A / (A + D - E)] x R	2.525
Test by/date: WM 9-22-10	Mix Design MSG:	2.511

⇓ *Remarks — Gauge / Ignition Printout* ⇓

Bulk Specific Gravity — WAQTC FOP for T 166 / T 275

Oven Temp: 230 F

	Method C / A	Panel	Joint
C	Weight in Water, 0.1 g	1223.4	
B	Mass at SSD, 0.1 g	2098.3	
X	Dry Mass + Pan, 0.1 g	2327.8	
Y	Pan	236.4	
A	Dry Mass in Air, 0.1 g (X - Y)	2091.4	
BSG	Bulk SpG, 0.001 A / (B - C)	2.390	
	Absorption, 0.1 [(B - A) / (B - C)] x 100	0.8	
	Lot MSG	2.525	
	Compaction, % (BSG / MSG) x 100	94.7	
Test by/date: WM / 9-23-10	Specs. ⇒	92 - 98	-

Constant Mass

% Change @ <0.05% = [(Mp - Mn) / Mp] x 100

Mp = Previous Net Mass, Mn = New Net Mass

		Pan		% Change
Initial Gross		Initial Net		
Mass @ +2 hrs.		Net		
Mass @ +2 hrs.		Net		

Core Thickness (inches)

Panel		Joint	
	1.75		
	2.00		
	2.00		
	1.92	Avg.	0.00
⇒	2.0"	⇒	

Signature / Date: William Nelson /#320/ 9-23-10 Checked by / Date: Billy Martin / 9-23-10

STATE OF ALASKA
DOT & PF

HMA Extracted Aggregate Gradation
FOP for T 30 - FIELD WORKSHEET

☐ Acceptance ☐ Verification ☐ Info. ☐ IA ☐ QC **Sample No:** ______

Project Name: ______
Federal No: ______ AKSAS No: ______
Material: ______ Source: ______
Item No: ______ Location: ______
Sta. / Sampled from: ______ Sampled by / Qual. No: ______
C/L & Grade Reference: ______ Quantity Represented: Lot: ______ Sublot: ______ Date / Time: ______

FRACTURE — WAQTC FOP for T 335

☐ Single Face ☐ Double ☐ All Face

Fractured Mass **F**		% Q = [Q / (F + Q + N)] x 100	
Questionable Mass **Q**		* % Questionable ⇒	
Unfractured Mass **N**		*Recount if > 15%	
% Fracture		⇐ [(F+(Q/2)) / (F+Q+N) x 100	
Test by/date:		⇐ Spec. (min.)	

MOISTURE CONTENT — WAQTC FOP for T 255 / T 265

			Constant Mass	
C	Container		Time	Gross Mass / Net Mass
A	Moist Mass + Container			
Mw	Wet Mass **A – C**			
B	Dry Mass + Container			
Md	Dry Mass **B – C**			
W	**Moisture, %**			
W = [(Mw – Md) / Md] x 100 ⇧			% Change ⇒	
Test by/date:		% Change = [(Mp – Mn) / Mp] x 100		

Mp = Previous Mass Measured / Mn = New Mass Measured

Liquid and Plastic Limit — WAQTC FOP for T 89 and T 90

		LL	PL	
N	Number of Blows		X	
C	Container			
A	Moist Mass + Container			
Mw	Moist Mass **A – C**			
B	Dry Mass + Container			
Md	Dry Mass **B – C**			PL
W	Moisture Content, % [(Mw – Md) / Md] x 100			
LL	W x (N / 25)$^{0.121}$			LL Spec.
Test by/date:	Plastic Index **LL – PL**			PI Spec.

HMA AGGREGATE GRADATION — WAQTC FOP for T 30

mm / USC	Cumulative Mass Retained **C**	Cumulative % Retained (C / M) x 100	% Passing = 100 – % Retained	***Aggregate Correction Add	***Aggregate Correction Subtract	Reported % Passing	Specs.
50 / 2"							–
*37.5 / 1½"							–
25 / 1"							–
*19.0 / 3/4"							–
12.5 / 1/2"							–
*9.5 / 3/8"							–
6.3 / 1/4"							–
*4.75 / #4							–
*2.36 / #8							–
2.00 / #10							–
*1.18 / #16							–
.850 / #20							–
*.600 / #30							–
.425 / #40							–
*.300 / #50							–
*.150 / #100							–
.075 / #200			*				–
Pan (only)		⇐ **P**	* #200 = {[(M – A) + P] / M} x 100				

Cumulative Mass AFTER Sieving		⇐ **G**	Test by/date:
Dry Mass AFTER Wash BEFORE Sieving		⇐ **A**	
Dry Sample Mass BEFORE Wash		⇐ **M** **(within 0.1% of Mf, FOP for T 308)	

**(M) vs. (Mf) check (≤ 0.1%):
$[(Mf_{(T308)} - M_{(T30)}) / Mf_{(T308)}] \times 100 =$
[(____ – ____) / ____] x 100 = ____ (≤ 0.1%?)

☐ Wetting Agent Used

Check Sum (≤ 0.2%)
[(A – G) / A] x 100 =

****To adjust sieves correctly for aggregate correction, you must input numbers from the HMA Correction Factors Worksheet. Use minus sign in subtract column. Enter "0" in column if no adjustment.*

FM ⇒			⇐ Fineness Modulus Target (From MD)
	to		⇐ FM Limits (± 0.2 of Mix Design FM)
(FM = Fineness Modulus = Total of % Retained of *Sieves / 100)			

Remarks: ______

Copy to Contractor / Date: ______
Tested by / Qual. #: ______
Signature / Date: ______
Checked by / Date: ______

STATE OF ALASKA
DOT & PF

HMA Extracted Aggregate Gradation
FOP for T 30 - FIELD WORKSHEET

☑ Acceptance ☐ Verification ☐ Info. ☐ IA ☐ QC

Sample No: HMA-G-1

Project Name: Haines Highway-Ferry Terminal to Union Street
Federal No: NH-095-6(18) AKSAS No: 72170
Material: HMA, Type II B Source: Haines Quarry & U.S. Oil
Item No: 401(1) Location: Haines, AK
Sta. / Sampled from: 133+00 Sampled by / Qual. No: Joe Example #110
C/L & Grade Reference: 6' Rt., Top Lift Quantity Represented: Lot: 1 Sublot: 1 Date / Time: 03/24/10 9:00 AM

FRACTURE — WAQTC FOP for T 335		
☑ Single Face ☐ Double Face ☐ All Face		
Fractured Mass **F**	1165.2	% Q = [Q / (F + Q + N)] x 100
Questionable Mass **Q**	21.5	* % Questionable ⇒ 2
Unfractured Mass **N**	73.1	*Recount if > 15%
% Fracture	93	⇐ [(F+(Q/2)) / (F+Q+N) x 100
Test by/date: JE 3-24-10	**80%**	⇐ Spec. (min.)

MOISTURE CONTENT — WAQTC FOP for T 255 / T 265			**Constant Mass**	
			Time	Gross Mass / Net Mass
C	Container	448.4		
A	Moist Mass + Container	2684.3	4:00 PM	2584.3 / 2135.9
Mw	Wet Mass **A – C**	2235.9	4:30 PM	2584.1 / 2135.7
B	Dry Mass + Container	2584.0		
Md	Dry Mass **B – C**	2135.6		
W	**Moisture, %**	4.7	% Change ⇒	0.01
	W = [(Mw – Md) / Md] x 100 ⇧			
Test by/date: JE#110/3-24-10	% Change = [(Mp – Mn) / Mp] x 100			
Mp = Previous Mass Measured / Mn = New Mass Measured				

LIQUID AND PLASTIC LIMIT — WAQTC FOP for T 89 and T 90		LL	PL	
N	Number of Blows	23		
C	Container	14.20	14.18	
A	Moist Mass + Container	34.22	23.89	
Mw	Moist Mass **A – C**	20.02	9.71	
B	Dry Mass + Container	31.45	22.79	
Md	Dry Mass **B – C**	17.25	8.61	PL
W	Moisture Content, % [(Mw – Md) / Md] x 100	16.1	12.8	13
LL	$W \times (N / 25)^{0.121}$	16		LL Spec.
Test by/date: JE #110 / 3-25-10	Plastic Index **LL – PL**	3	4 Max.	PI Spec.

HMA AGGREGATE GRADATION — WAQTC FOP for T 30

mm / USC	Cumulative Mass Retained **C**	Cumulative % Retained (C / M) x 100	% Passing = 100 – % Retained	***Aggregate Correction Add	***Aggregate Correction Subtract	Reported % Passing	Specs.
50 / 2"							–
*37.5 / 1½"							–
25 / 1"							–
*19.0 / 3/4"	0.0	0.0	100.0	0.0	0.0	100	100 – 100
12.5 / 1/2"	501.1	22.3	77.7	0.0	0.0	78	71 – 83
*9.5 / 3/8"	818.0	36.4	63.6	0.0	0.0	64	56 – 68
6.3 / 1/4"							–
*4.75 / #4	1259.9	56.1	43.9	0.0	0.0	44	36 – 48
*2.36 / #8	1551.7	69.1	30.9	0.0	0.0	31	23 – 35
2.00 / #10							–
*1.18 / #16	1729.7	77.0	23.0	0.0	0.0	23	16 – 26
.850 / #20							–
*.600 / #30	1858.2	82.7	17.3	0.0	0.0	17	11 – 19
.425 / #40							–
*.300 / #50	1967.8	87.6	12.4	0.0	0.0	12	7 – 15
*.150 / #100	2052.1	91.4	8.6	0.0	0.0	9	5 – 11
.075 / #200	2115.5	94.2	* 5.8	0.0	0.0	5.8	3.5 – 7.5
Pan (only)	20.0	⇐ **P**	* #200 = {[(M – A) + P] / M} x 100				

Cumulative Mass AFTER Sieving	2135.5	⇐ **G**	Test by/date: 3/24/10
Dry Mass AFTER Wash BEFORE Sieving	2135.9	⇐ **A**	Joe Example # 110
Dry Sample Mass BEFORE Wash	2246.4	⇐ **M** **(within 0.1% of Mf, FOP for T 308)	

**(M) vs. (Mf) check (≤ 0.1%):
$[(Mf_{(T308)} - M_{(T30)}) / Mf_{(T308)}] \times 100 =$
[(2247.9 – 2246.4) / 2247.9] x 100 = 0.1 (≤ 0.1%?)

☑ Wetting Agent Used

Check Sum (≤ 0.2%)
[(A – G) / A] x 100 =
0.0

***To adjust sieves correctly for aggregate correction, you must input numbers from the HMA Correction Factors Worksheet. Use minus sign in subtract column. Enter "0" in column if no adjustment

FM ⇒			⇐ Fineness Modulus Target (From MD)
	to		⇐ FM Limits (± 0.2 of Mix Design FM)
(FM = Fineness Modulus = Total of % Retained of *Sieves / 100)			

Remarks:

Copy to Contractor / Date: 03/24/10
Tested by / Qual. #: Joe Example / # 110
Signature / Date:
Checked by / Date: MK / 3-25-10

STATE OF ALASKA
DOT & PF

ATM 406
HOT MIX ASPHALT (HMA)
FIELD WORKSHEET

☐ Acceptance ☐ Verification ☐ Info. ☐ IA ☐ QC **Sample No:**

Project Name:
Federal No: AKSAS No:
Type Mix: Agg. Source:
Item No: Asph. Cement Source / Type:
Sampled by / Qualification No:
Sta. / Location: Date / Time Sampled:
C/L Offset: Sublot: Mix Design No: Date Tested:
Lift: Quantity Rep'd: Lot:

uclear Method — ATM 405

Gauge Make & Model:	
Gauge Serial No:	
Calib. No:	Calib. Date:

*N/A if using 3241-C

*Sample Temperature		←
Sample Pan Mass		
Calib. / Target Mass		±

Background Count

16 Min. Count

	Gauge Count		
A	Uncorrected AC		Gauge, 0.01 %
W	Moisture Content		T 329, 0.01 %
	Corrected AC A - W		0. ⇐ Specs.
Test by/date:			

AC Content of HMA by Ignition — WAQTC FOP for T 308 (External Balance)

☑ Method A	Furnace No. / ID:		
☐ Method B	Furnace Temp:		☐ °F ☐ °C
B	Basket Assembly Mass		0.1 g
C	Sample Mass + Basket Assembly		Before Ignition
Mi	Initial Sample Mass C - B		0.1 g
	Furnace Mass: Basket + Sample		± 5g of Mass C
D	Basket Assembly + Sample Mass		0.1 g, After Ignition
Mf	Final Sample Mass D - B		Aggregate Mass
BC	Loss, % [((Mi - Mf) / Mi) x 100]		Binder Content, 0.01%
Cf	AC Correction Factor		Oven Specific
A	UnCorrected AC BC - Cf		0.01 %
W	Moisture Content		T 329, 0.01 %
Pb	Corrected AC A - W		0.1 %
Test by/date:			⇐ Specs.

— WAQTC FOP for T 329

Oven, °F:	Sample, °F:	Time In:	Time Out:

C	Container, 0.1 g	
A	Wet + Container	
B	Dry + Container	
Mi	Moist Mass A - C	
Mf	Dry Mass B - C	
W	Moisture Content, % [(Mi - Mf) / Mi] x 100	
Test by/date:		% Wet Mass 0.5% max

...nt Mass
@ <0.05% =
[(
% Change
#
90
⇐ Specs

MSG of HMA Mix — WAQTC FOP for T 209 — Flask Method

D	Mass of Flask + Lid + Water @ 77°F, 0.1 g	
B	Mass of Flask + Lid, 0.1 g	
C	Mass of Flask + Lid + Sample, 0.1 g	
A	Mass of Dry Sample in Air C - B	
E	Flask + Lid + De-aired Water + Sample, 0.1 g	
R	Temperature Correction Factor * (Table 2 in FOP)	
	*Use only if a test temperature other than 77°F is used. R = 1 for water @ 77°F	
Temp. of Water, °F =	**MSG = [A / (A + D - E)] x R**	
Test by/date:	Mix Design MSG:	

Bulk Specific Gravity — WAQTC FOP for T 166 / T 275 Oven Temp:

	Method C / A	Panel	Joint
C	Weight in Water, 0.1 g		
B	Mass at SSD, 0.1 g		
X	Dry Mass + Pan, 0.1 g		
Y	Pan		
A	Dry Mass in Air, 0.1 g (X - Y)		
BSG	Bulk SpG, 0.001 A / (B - C)		
	Absorption, 0.1 [(B - A) / (B - C)] x 100		
	Lot MSG		
	Compaction, % (BSG / MSG) x 100		
Test by/date:	Specs. ⇒	-	-

Constant Mass

% Change @ <0.05% = [(Mp - Mn) / Mp] x 100

Mp = Previous Net Mass / Mn = New Net Mass		Pan		% Change
Initial Gross		Initial Net		
Mass @ +2 hrs.		Net		
Mass @ +2 hrs.		Net		

Core Thickness (inches)

Panel		Joint	
	0.00	Avg.	0.00
⇒		⇒	

⇓ Remarks — Gauge / Ignition Printout ⇓

Checked by / Date:

Rev.1/31/06

STATE OF ALASKA
DOT & PF

ATM 406
HMA Correction Factors
FIELD WORKSHEET

☐ Acceptance ☐ Verification ☐ Info. ☐ IA ☐ QC

Sample No:

Project Name:
Federal No: AKSAS No:
Material: Agg.Source:
Item No: Location:
WAQTC FOP for T 308, Method: Mix Design No.: Furnace No. / ID:

ASPHALT CEMENT CORRECTION WAQTC FOP for T 308					
Mix Design %AC #1		After Burn %AC #1		%AC Diff. #1	
Mix Design %AC #2		After Burn %AC #2		%AC Diff. #2	
Cf	AC CORRECTION FACTOR (average of differences)				

CORRECTION FACTORS

AGGREGATE CORRECTION		Sample #1	Sample #2
D	Sample & Basket Assembly		
B	Basket Assembly		
Mf	Mass after Ignition **(D -B)**		

HMA AGGREGATE GRADATION WAQTC FOP for T 30				AGGREGATE CORRECTION WAQTC FOP for T 308					
	Correction Factor Blank Sample			Correction Factor Sample #1			Correction Factor Sample #2		
mm / USC	Cumulative Mass Retained **C**	Cumulative % Retained (C / M) x 100	% Passing = 100 – % Retained	Cumulative Mass Retained **C**	Cumulative % Retained (C / M) x 100	% Passing = 100 – % Retained	Cumulative Mass Retained **C**	Cumulative % Retained (C / M) x 100	% Passing = 100 – % Retained
25 / 1"									
19.0 / 3/4"									
12.5 / 1/2"									
9.5 / 3/8"									
4.75 / #4									
2.36 / #8									
1.18 / #16									
.600 / #30									
.300 / #50									
.150 / #100									
.075 / #200									
Cum. Pan Mass			⇐Check Sum ≤0.2			⇐Check Sum ≤0.2			⇐Check Sum ≤0.2
Dry Mass After Wash		**Dry Mass After Wash**			**Dry Mass After Wash**				
M **Mass Before Wash**		M **Mass Before Wash**			M **Mass Before Wash**				

Calculate & Report % Passing to 0.1%

mm / USC	Allowable Difference	Blank Sample % Passing	Sample #1 % Passing	Sample #2 % Passing	Difference from Blank Sample #1	Difference from Blank Sample #2	Average Difference	*Sieves to Adjust Add	*Sieves to Adjust Subtract
25 / 1"	± 5.0 %								
19.0 / 3/4"	± 5.0 %								
12.5 / 1/2"	± 5.0 %								
9.5 / 3/8"	± 5.0 %								
4.75 / #4	± 5.0 %								
2.36 / #8	± 5.0 %								
1.18 / #16	± 3.0 %								
.600 / #30	± 3.0 %								
.300 / #50	± 3.0 %								
.150 / #100	± 3.0 %								
.075 / #200	± 0.5 %								

Adjust Sieves for FOP for T 30 Gradation: Use "0" if adjustment N/A; use minus sign for negative numbers in subtract column.

Remarks:

Signature / Date:
**Checked by / Date:

Rev.12/31/05

STATE OF ALASKA DOT & PF NUCLEAR DENSITY GAUGE MOISTURE OFFSET WORKSHEET	Project Name: ________ Federal No: ________ AKSAS No: ________ Material: ________ Source: ________ Item No: ________ Location: ________ Gauge Serial No. / Model No: ________

OVEN DRY MOISTURE (0.1%)	GAUGE MOISTURE (0.1%)
1) ________	1) ________
2) ________	2) ________
3) ________	3) ________
4) ________	4) ________
5) ________	5) ________
________ (A)* AVERAGE	________ (B)* AVERAGE

A — B = ________ (C)*

OFFSET FACTOR (k) = $\frac{C}{100 + B}$ x 1000 = [ ] ** / ***

NOTE:
*Round (A), (B), & (C) to one decimal place.
**Report offset factor (k value) as a whole number.
***Remember to maintain the appropriate algebraic symbol (– or +

MOISTURE CONTENT — WAQTC FOP for T 255 / T 265			
%M = [(a – b) / (b – c)] x 100			
	c	a	b
Sample #:	Tare Mass	Wet Mass + Tare	Dry Mass + Tare
1			
2			
3			
4			
5			

Remarks: ________

Signature / Qualification No. / Date: ________

Checked by / Date: ________

STATE OF ALASKA
DOT & PF

NUCLEAR DENSITY GAUGE
MOISTURE OFFSET WORKSHEET

Project Name: **Old Glenn Highway, South Birchwood Loop to Peters Creek**
Federal No: **ARA-0558(7)** AKSAS No: **50946**
Material: Borrow, Type A Source: Moose Horn Pit / Granite
Item No: 206(6A) Location: Chugiak, AK
Gauge Serial No. / Model No: 33402 / Troxler 3430

	OVEN DRY MOISTURE (0.1%)	**GAUGE MOISTURE (0.1%)**
1)	6.9	7.5
2)	4.5	5.1
3)	3.7	4.2
4)	5.1	5.8
5)	4.2	4.8
AVERAGE	4.9 **(A)***	5.5 **(B)***

A — B = -0.6 **(C)***

$$\text{OFFSET FACTOR (k)} = \frac{C}{100 + B} \times 1000 = \boxed{-6}$$ ** / ***

NOTE:
*Round (A), (B), & (C) to one decimal place.
**Report offset factor (k value) as a whole number.
***Remember to maintain the appropriate algebraic symbol (– or +)

MOISTURE CONTENT — WAQTC FOP for T 255 / T 265			
%M = [(a – b) / (b – c)] x 100			
	c	**a**	**b**
Sample #:	Tare Mass	Wet Mass + Tare	Dry Mass + Tare
1	1.25	11.97	11.28
2	1.12	12.02	11.55
3	1.83	13.53	13.11
4	1.46	12.66	12.12
5	1.55	11.88	11.46

Remarks:

Signature / Qualification No. / Date: Cleve Cooper / #002 / 3-29-11
Checked by / Date: Tom Fisher / 3-30-11

STATE OF ALASKA
DOT & PF
Construction

ATM 412 Control Strip
FIELD WORKSHEET

☑ Acceptance ☐ Information ☐ Assurance

Project Name: Kotzebue A/P & Safety Area Improvements
State No: AIP 3-02-0160-016 2010
Material RAP Source Existing
Item No. P-161 Spec. 98% Gauge Serial No. 22929

FIELD DENSITY TEST NUMBER		RAP-D-46		RAP-D-47		RAP-D-47R		RAP-D-48	
STATION		112+27		423+08		422+77		440+69	
STATION									
STATION									
C/L REFERENCE		12' RCL		06' LCL		CL		5' RCL	
C/L REFERENCE									
C/L REFERENCE									
GRADE REFERENCE		Top RAP		Top RAP		Top RAP		Top RAP	
QUANTITY REPRESENTED		1000 tons		1000 tons		1000 tons		1000 tons	
DATE TESTED									
STANDARD DENSITY BY:		☑ ATM 412		☐ ASTM D 1557		☐ ATM T-12			
Lab Number		RAP-SD-4		RAP-SD-4		RAP-SD-4		RAP-SD-4	
(A) Standard WETDensity (Field Establishe		150.4		150.4		150.4		150.4	
Optimum Moisture		N/A		N/A		N/A		N/A	
(B) Bulk Specific Gravity		N/A		N/A		N/A		N/A	
DENSITY DETERMINATION									
Probe Depth		Backscatter		Backscatter		Backscatter		Backscatter	
		Reading #1	Reading#2	Reading #1	Reading #2	Reading #1	Reading#2	Reading #1	Reading#2
Wet Density, lbm/f3	Gauge Readings	147.4	147.8	142.3	139.7	148.1	147.4	149.2	148.7
Wet Density, lbm/f4	Gauge Readings								
Wet Density, lbm/f5	Gauge Readings								
(C) Average Wet Density		147.6		141.0		147.8		149.0	
% COMPACTION	C/A x 100	**98%**		**91%**		**98%**		**99%**	

REMARKS: ______

Signature: ______
Checked by: ______
Date: ______

STATE OF ALASKA
DOT & PF
Construction

ATM 412 Control Strip
FIELD WORKSHEET

☐ Acceptance ☐ Information ☐ Assurance

Project Name: ____________________
State No: ____________________
Material ____________________ Source ____________________
Item No. ________ Spec. ________ Gauge Serial No. ____________________

FIELD DENSITY TEST NUMBER									
STATION									
STATION									
STATION									
C/L REFERENCE									
C/L REFERENCE									
C/L REFERENCE									
GRADE REFERENCE									
QUANTITY REPRESENTED									
DATE TESTED									
STANDARD DENSITY BY:			☐ ATM 412		☐ ASTM D 1557		☐ ATM T-12		
Lab Number									
(A) Standard Density (Field Established)									
Optimum Moisture									
(B) Bulk Specific Gravity									
DENSITY DETERMINATION									
Probe Depth		Backscatter		Backscatter		Backscatter		Backscatter	
		Reading #1	Reading#2	Reading #1	Reading #2	Reading #1	Reading#2	Reading #1	Reading#2
Wet Density, lbm/f3	Gauge Readings								
Wet Density, lbm/f4	Gauge Readings								
Wet Density, lbm/f5	Gauge Readings								
(C) Average Wet Density									
% COMPACTION	C/A x 100								

REMARKS: ____________________

Signature: ____________________
Checked by: ____________________
Date: ____________________

STATE OF ALASKA
DOT & PF

CONCRETE PLACEMENT REPORT

☐ Acceptance ☐ Verification ☐ Info. ☐ IA ☐ QC

PROJECT NAME: ______ **POUR No:** ______
FEDERAL No: ______ AKSAS No: ______
ITEM No: ______ TICKET No: ______ DATE: ______
TRUCK No. ______ NRMCA Certified? ☐ Yes ☐ No Mix Design No: ______

BATCH (SCALE) WEIGHTS

- **A.** Coarse Aggregate (CA) ______
- **B.** Intermediate Aggregate (IA) ______
- **C.** Fine Aggregate or Sand (FA) ______
- **D.** Cements* ______ + ______ * + ______ = Total: ______
- **E.** Water from batch ticket: ______ (gallons x 8.33) ______
- **E1.** plus water added at site: ______ (gallons x 8.33) ______
- **F.** Total Batch Weight (A + B + C + D + E + E1) ______

* D2 and D3 for Fly Ash, Slag or Silica Fume

Type of Construction: ______
Bridge No: ______ Station(s): ______
Portion of Structure or Section Represented: ______

Quantity Represented: ☐ 50 CY ☐ 1/2 Days Pour ☐ 200 CY ☐ Precast Member
Source / Manufacturer of Concrete: ______
Brand & Type of Cement (MD): ______

AGGREGATE MOISTURE CORRECTIONS

CA
- a. Moistures (decimal) ______ (free water) + ______ (absorption *) = ______ (total moisture)
- b. Dry Weight [A / (1 + total moisture)] ______
- c. SSD Weight [b* (1 + absorption)] ______

IA
- d. Moistures (decimal) ______ (free water) + ______ (absorption *) = ______ (total moisture)
- e. Dry Weight [B / (1 + total moisture) ______
- f. SSD Weight [e * (1 + absorption)] ______

FA
- g. Moistures (decimal) 0.0227 (free water) + 0.012 (absorption *) = 0.0347 (total moisture)
- h. Dry Weight [C / (1 + total moisture) 0
- j. SSD Weight [h * (1 + absorption)] 0

* from Mix Design

Class of Concrete: ______ (A, A-A, P, DS, Other)
Mix time: ______
Pour time: Start: ______ Finish: ______
Weather Conditions: ______
Concrete Sampled from: ______
Concrete Wasted: ______
Concrete Rejected: ______
Test Specimen Identification: ☐ Compressive ☐ Flexural
Specimens making procedure: ______
Initial cure procedure: ______
No. of Test Specimens and sizes: ______

WATER WEIGHT CORRECTIONS

- **G.** Free Water in CA (A - c) ______
- **H.** Free Water in IA (B - f) ______
- **J.** Free Water in FA (C - j) ______
- **K.** Total Water Weight (E + E1 + G + H + J) ______
- **L.** Total Water in Gallons (K / 8.34) ______

Remarks: ______

Admixture	MD oz/cy	oz/batch from ticket	oz/cy	% off MD

TEST DATA

Concrete Temperature (°F): ______ Slump (in): ______
Air Content, % (– *Agg. Corr. Factor from MD*) ______ ______
M. Density, (pcf) ______

⇩ **SPECIFICATIONS** ⇩ ______ ______
⇩ **MD TEST RESULT DATA** ⇩ ______ ______ ______

BATCH DATA

- **N.** Sacks of Cement per Batch (D / 94) ______
- **P.** Yield, CY per Batch [(F / M) / 27] ______
- **R.** Water / Cementitious Ratio, lbs. / lbs. (K / D) ______
- **S.** % 2nd cementitious material [D2 /(Total) x 100] ______
- **T.** % 3rd cementitious material [D3 /(Total) x 100] ______
- **U.** % Sand [j / (c + f + j)] x 100 ______
- **V.** Mix Ratios 1 : (c / D) : (f / D) : (j / D) ______ (CA) : ______ (IA) : ______ (FA)

⇩ **MD Checks** ⇩
___ Cement Factor, Sacks/CY (MD): ______
W / Cm, lbs. / lbs. (MD) ______
% 2nd cementitious material (MD): ______
% 3rd cementitious material (MD): ______
% Sand (MD): ______
Mix Ratios (MD) 1: ______ (CA) : ______ (IA) : ______ (FA)

SSD BATCH WEIGHTS REDUCED FOR 1 CY

			% off MD
Coarse Aggregate	(c / P)	______	______
Intermediate Aggregate	(f / P)	______	______
Fine Aggregate	(j / P)	______	______
Cement Content	(D / P)	______	______
Water	(K / P)	______	______

⇩ SPECIFICATIONS ⇩		Batch Weights / CY (from MD)
* ______ – ______	± 2% of	______
* ______ – ______	± 2% of	______
* ______ – ______	± 2% of	______
______ – ______	± 1% of	______
______ – ______	± 3% of	______

INSPECTOR / QUAL. No: ______ CHECKED BY: ______ DATE ______

PROJECT ENGINEER: ______ DATE ______

STATE OF ALASKA
DOT & PF
CONCRETE PLACEMENT REPORT

☐ Acceptance ☐ Verification ☐ Info. ☐ IA ☐ QC

PROJECT NAME: **Glenn Hwy., MP 109-118 Resurface, Box Culverts** POUR No: **27**
FEDERAL No: **IM-0A1-5(27)** AKSAS No: **52095**
ITEM No: **514(1)** TICKET No: 227426 DATE: 7/30/11
TRUCK No. 459 NRMCA Certified? ☐ Yes ☐ No Mix Design No: **Cast5 SCC 6500**

BATCH (SCALE) WEIGHTS

A.	Coarse Aggregate	(CA)	11380
B.	Intermediate Aggregate	(IA)	4900
C.	Fine Aggregate or Sand	(FA)	16360
D.	Cements* 7090 + ____ * + ____ = Total:		7090
E.	Water from batch ticket: ____	(gallons x 8.33)	2480
E1.	plus water added at site: ____	(gallons x 8.33)	
F.	Total Batch Weight (A + B + C + D + E + E1)		42210

* D2 and D3 for Fly Ash, Slag or Silica Fume

Type of Construction: Box Culvert Section, 14'x12'x4'
Bridge No: n/a Station(s): MP 114.5
Portion of Structure or Section Represented: BC-2

Quantity Represented: ☐ 50 CY ☐ 200 CY ☐ 1/2 Days Pour ☑ Precast Member
Source / Manufacturer of Concrete: AS&G
Brand & Type of Cement (MD): ABI Type III

AGGREGATE MOISTURE CORRECTIONS

CA	a. Moistures (decimal)	-0.0038 (free water) + 0.010 (absorption *) = 0.0062 (total moisture)	
CA	b. Dry Weight [A / (1 + total moisture)]		11310
CA	c. SSD Weight [b* (1 + absorption)]		11423
IA	d. Moistures (decimal)	0.0049 (free water) + 0.010 (absorption *) = 0.0149 (total moisture)	
IA	e. Dry Weight [B / (1 + total moisture)]		4828
IA	f. SSD Weight [e * (1 + absorption)]		4876
FA	g. Moistures (decimal)	0.0227 (free water) + 0.012 (absorption *) = 0.0347 (total moisture)	
FA	h. Dry Weight [C / (1 + total moisture)]		15811
FA	j. SSD Weight [h * (1 + absorption)]		16001

* from Mix Design

Class of Concrete: SCC (A, A-A, P, DS, Other)
Mix time: 12:27:00 PM
Pour time: Start: 1:13 PM Finish: ____
Weather Conditions: Sunny 65
Concrete Sampled from: Truck Chute
Concrete Wasted: none
Concrete Rejected: none
Test Specimen Identification: ☑ Compressive ☐ Flexural
Specimens making procedure: WAQTC FOR for AASHTO T23
Initial cure procedure: WAQTC FOR for AASHTO T23
No. of Test Specimens and sizes: 4 ea., 4"x8"

WATER WEIGHT CORRECTIONS

G.	Free Water in CA	(A - c)	-43
H.	Free Water in IA	(B - f)	24
J.	Free Water in FA	(C - j)	359
K.	Total Water Weight	(E + E1 + G + H + J)	2820
L.	Total Water in Gallons	(K / 8.34)	338.1

Remarks: ____

Admixture	MD oz/cy	oz/batch from ticket	oz/cy	% off MD
Micro Air	6.45	60.00	5.5	-15%
PS-1466	65.8	532.00	48.8	-26%
BASF VMA	39.4	388.00	35.6	-10%

TEST DATA

		⇩ SPECIFICATIONS ⇩	⇩ MD TEST RESULT DATA ⇩
Concrete Temperature (°F): 67 Slump (in):	27.00	30" max. Spread	11"
Air Content, % (– Agg. Corr. Factor from MD)	6.0	6.0% ± 1.5%	6.0%
M. Density, (pcf)	143.2		143.8

BATCH DATA

				⇩ MD Checks ⇩	
N.	Sacks of Cement per Batch	(D / 94)	75.4	Cement Factor, Sacks/CY (MD):	6.9
P.	Yield, CY per Batch	[(F / M) / 27]	10.9		
R.	Water / Cementitious Ratio, lbs. / lbs.	(K / D)	0.40	W / Cm, lbs. / lbs. (MD)	.45 max
S.	% 2nd cementitious material	[D2 /(Total) x 100]	N/A	% 2nd cementitious material (MD):	n/a
T.	% 3rd cementitious material	[D3 /(Total) x 100]	N/A	% 3rd cementitious material (MD):	n/a
U.	% Sand	[j / (c + f + j)] x 100	49.5	% Sand (MD):	40%
V.	Mix Ratios 1 : (c / D) : (f / D) : (j / D)		1.61 (CA) : 0.69 (IA) : 2.26 (FA)	Mix Ratios (MD) 1:	____ (CA) : ____ (IA) : ____ (FA)

SSD BATCH WEIGHTS REDUCED FOR 1 CY

			% off MD	⇩ SPECIFICATIONS ⇩		Batch Weights / CY (from MD)
Coarse Aggregate	(c / P)	1048	0.4%	* 1023 – 1065	± 2% of	1044
Intermediate Aggregate	(f / P)	447	1.7%	* 431 – 449	± 2% of	440
Fine Aggregate	(j / P)	1468	0.1%	* 1438 – 1496	± 2% of	1467
Cement Content	(D / P)	650	-1.1%	651 – 665	± 1% of	658
Water	(K / P)	259	-12.3%	286 – 304	± 3% of	295

INSPECTOR / QUAL. No: 568 CHECKED BY: ____ DATE ____

PROJECT ENGINEER: ____ DATE ____

STATE OF ALASKA
DOT & PF

RELATIVE STANDARD DENSITY of SOILS by the CONTROL STRIP METHOD

ATM 309 - FIELD WORKSHEET

☐ Acceptance ☐ Information

Sample No: ____________

Project Name: ____________

Federal No: ____________ AKSAS No: ____________

Material: ____________ Source: ____________

Item No: ____________ Gauge Model: ____________ Gauge S/N: ____________

Lane: ________ Width: ________ Station to Station: ____________ Std. Count: ____________

Date: ____________

Initial (Control Strip) readings shall be taken in backscatter position. The final (ten random location) readings shall be performed in direct transmission when practicable. All readings are to be **Dry Density.*

***Continue the compaction & testing cycle until there is a pass with less than 1 lb/ft^3 increase in the average dry density of the test locations; and a second consecutive pass with less than 1 lb/ft^3 increase in the average dry density of the test locations.*

Equipment:	Pass #:	*Location 1	*Location 2	*Location 3	**Average:	Remarks:
Roller #1:	1					
	2					
Roller Brand:	3					
Roller Model Number:	4					
Roller Type:	5					
	6					
Compaction Mode: Vibe or Static (Circle)	7					
Roller #2:	1					
	2					
Roller Brand:	3					
Roller Model Number:	4					
Roller Type:	5					
	6					
Compaction Mode: Vibe or Static (Circle)	7					

Locations ⇒	1	2	3	4	5	6	7	8	9	10	
Reading 1 (1 minute)											**Relative Standard Density**
Reading 2 (1 minute)											
Average Dry Density											

Reading 1 (% moisture)											**Average Moisture**
Reading 2 (% moisture)											
Average % Moisture											

Remarks: ____________

Signature / Qualification No / Date: ____________

Checked by / Date: ____________

Rev. 06/01/2018

STATE OF ALASKA
DOT & PF
Construction

ATM 213 - In-place Density Report for ATM 309- Control Strip SD

☑ Acceptance ☐ Information ☐ Assurance

Project Name: ______________________
State No: ______________________
Material ______________________ Source ______________________
Item No. ________ Spec. ________ Gauge Serial No. ________

FIELD DENSITY TEST NUMBER								
STATION								
STATION								
STATION								
C/L REFERENCE								
C/L REFERENCE								
C/L REFERENCE								
GRADE REFERENCE								
QUANTITY REPRESENTED								
DATE TESTED								
STANDARD DENSITY BY:		☐ ATM 309						
Lab Number								
(A) Standard Density (Field Established)								
Optimum Moisture		N/A		N/A		N/A		N/A
(B) Bulk Specific Gravity		N/A		N/A		N/A		N/A
DENSITY DETERMINATION								
Probe Depth		Backscatter		Backscatter		Backscatter		Backscatter
		Reading #1	Reading#2	Reading #1	Reading #2	Reading #1	Reading#2	Reading #1	Reading#2
Wet Density, lbm/f[3]	Gauge Readings								
Wet Density, lbm/f[4]	Gauge Readings								
Wet Density, lbm/f[5]	Gauge Readings								
(C) Average Wet Density								
% COMPACTION	C/A x 100							

REMARKS: ______________________

Signature: ______________________
Checked by: ______________________
Date: ______________________

STATE OF ALASKA
DOT & PF

ATM 315: RIP RAP GRADATION FIELD WORKSHEET

☐ Acceptance ☐ Verification ☐ Info. ☐ IA ☐ QC

Sample No: ______________

Project Name: ______________________________

Federal No: ______________________ AKSAS No: __________

Material: ______________________ Source: ______________

Item No: ______________________ Location: ______________

Measure (LxWxH)	Weight (lb-Kg)	Measure (LxWxH)	Weight (lb-Kg)	Measure (LxWxH)	Weight (lb-Kg)
Total Wt.		Total Wt.		Total Wt.	
% of Sample		% of Sample		% of Sample	

Unit Weight = Apparent SpG ________ x 62.43 lb/ft^3 or 1,000 Kg/m^3

Weight of Rock = Volume of Rock x Unit Weight

Total Weight of Sample

Spec. Percentages		Circle one				Spec. Weight
Min.	Max.	>	>/=	<	</=	#:
Min.	Max.	>	>/=	<	</=	#:
Min.	Max.	>	>/=	<	</=	#:

Test Results %	Weights

Remarks: ______________________________

____

____

____

____

Signature / Date: ______________________

Checked by / Date: ______________________

Rev. 01/05

STATE OF ALASKA
DOT & PF

In-Place Density of Bituminous Mixes
WAQTCTM 8 - FIELD WORKSHEET

☐ Acceptance ☐ Verification ☐ Info. ☐ IA ☐ QC

Sample No: ______

Project Name: ______

Federal No: ______ AKSAS No: ______

Material: ______ Source: ______

Item No: ______ Specification: ______ Quantity Represented: ______

Gauge Model No: ______ Gauge Serial No: ______ Density Standard (pcf): ______ Standard No/ID: ______

*Correlation Factor: ______ Location and Area Represented: ______ Date: ______

FIELD DENSITY TEST NUMBER	1	2	3	4	5	6	7	8	9	10
STATION										
$^{C}/_{L}$ REFERENCE (Offset)										
GRADE REFERENCE										
QUANTITY REPRESENTED										

DENSITY DETERMINATION ☐ Backscatter Mode (Reading #2 is rotated 90° from Reading #1)

			1	2	3	4	5	6	7	8	9	10
D	Wet Density, lbs/ft^3 (Difference ? 2.5 lbs/ft^3)	Reading #1										
		Reading #2										
E	Average Wet Density											
F	Adjusted Density	(use *Correlation Factor)										
G	% Compaction	(E or F / Density Std.) x 100										

CORRELATION with CORES

	WAQTC FOP for AASHTO T 166		Core 1	Core 2	Core 3	Core 4	Core 5	Core 6	Core 7	Core 8	Core 9	Core 10
H	Core Thickness	(inches)										
A	Mass of Dry Specimen in Air											
B	Mass of SSD Specimen in Air											
C	Weight of Specimen in Water											
J	Bulk Specific Gravity (0.001)	A / (B – C)										
K	Unit Weight = Bulk SpG x 62.4	(pcf)										
E	Average Wet Density	(from E above)										
L	Difference = Unit Weight – Average Wet Density	K – E										

☐ Filler Material (Native Fines) used?

Average Difference: ______

Standard Deviation (? 2.5): ______

Remarks ______

Test by / Qualification No: ______

Signature / Date: ______

Checked by / Date: ______

STATE OF ALASKA
DOT & PF

In-Place Density of Bituminous Mixes
WAQTCTM 8 - FIELD WORKSHEET

☑ Acceptance ☐ Verification ☐ Info. ☐ IA ☐ QC

Sample No: CABC-D-1

Project Name: POW - Craig-Klawock Highway Reconditioning

Federal No: HDP-0003-93 AKSAS No: 68744

Material: Crushed Asphalt Base Course Source: Project Grindings

Item No: 308(1) Specification: 98% min. Quantity Represented: 5,000 S.Y.

Gauge Model No: 3430 Gauge Serial No: 33529 Density Standard (pcf): 145.5 Standard No/ID: CABC-SD-2

*Correlation Factor: N/A Location and Area Represented: Sta. 31+00 to 50+00 Date: 06/24/10

FIELD DENSITY TEST NUMBER	1	2	3	4	5	6	7	8	9	10
STATION	31+25	36+35	41+35	46+40	49+95	50+00	48+85	44+00	39+50	34+75
$^C/_L$ REFERENCE (Offset)	6'Rt.	4'Rt.	3'Rt.	8'Rt.	5'Rt.	10'Lt.	4'Lt.	6'Lt.	3'Lt.	8'Lt.
GRADE REFERENCE	Top CABC	Top CABC	Top CABC	Top CABC	Top CABC	Top CABC	Top CABC	Top CABC	Top CABC	Top CABC
QUANTITY REPRESENTED	375'	375'	375'	375'	375'	375'	375'	375'	375'	375'

DENSITY DETERMINATION ☑ Backscatter Mode (Reading #2 is rotated 90° from Reading #1)

			1	2	3	4	5	6	7	8	9	10
D	Wet Density, lbs/ft³ (Difference ? 2.5 lbs/ft³)	Reading #1	143.5	145.2	144.1	143.8	142.9	146.0	145.6	144.3	143.9	146.2
		Reading #2	144.2	145.3	144.6	145.0	144.4	144.7	144.9	143.9	145.2	144.8
E	Average Wet Density		143.9	145.3	144.4	144.4	143.7	145.4	145.3	144.1	144.6	145.5
F	Adjusted Density	(use *Correlation Factor)										
G	% Compaction	(E or F / Density Std.) x 100	98.9	99.9	99.2	99.2	98.8	99.9	99.9	99.0	99.4	100.0

CORRELATION with CORES

	WAQTC FOP for AASHTO T 166		Core 1	Core 2	Core 3	Core 4	Core 5	Core 6	Core 7	Core 8	Core 9	Core 10
H	Core Thickness	(inches)										
A	Mass of Dry Specimen in Air											
B	Mass of SSD Specimen in Air											
C	Weight of Specimen in Water											
J	Bulk Specific Gravity (0.001)	A / (B - C)										
K	Unit Weight = Bulk SpG x 62.4	(pcf)										
E	Average Wet Density	(from E above)										
L	Difference = Unit Weight – Average Wet Density	K - E										

☑ Filler Material (Native Fines) used?

Average Difference:

Standard Deviation (? 2.5):

Remarks

Density Strip Average = 99.4%

Test by / Qualification No: C.J. McKellan#999

Signature / Date:

Checked by / Date: NJ/6-26-10

STATE OF ALASKA
DOT & PF

Sand Cone ATM 211

☐ Acceptance ☐ Verification ☐ Info. ☐ QC

Sample No: ______________

Project Name: ______________

Federal No: ______________ AKSAS No: ______________

Material: ______________ Source: ______________

Item No: ______________ Location: ______________

Sta. / Sampled from: ______________ Sampled by / Qual. No: ______________

$^{C}/_{L}$ & Grade Reference: ______________ Quantity Represented: ______________ Date: ______________

Determination of Bulk Density of Sand and Cone Correction Factor

Bulk Density

Mf		Mass of filled calibration container
Mt		Mass of the calibration container
V		Volume of the container in cubic feet
Pb		Bulk Density

$$Pb = \frac{mf - mt}{V}$$

Cone Correction Factor

Mi		Mass of Filled Aparatus
Mf		Mass of Aparatus After Filling Cone
C		Cone Correction Factor

$$C = \frac{mi - mf}{Pb}$$

Density Determination

Mi		Mass of Filled Aparatus
Mf		Mass of Aparatus After Filling Hole
Vh		Volume of Hole
Md		Mass of Dry Material from Hole
Pd		Dry Density
D		Corrected Standard Density
%C		Percent Compaction

$$Vh = \frac{mi - mf}{Pb} - C$$

$$Pd = \frac{Md}{Pb}$$

Remarks

____

____

____

____

Signature ______________

Checked ______________

Rev. 03/07/11

Reserved SP 11

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Materials Sample Identification System SP 12

Table VII, Materials Sample Identification System, also see ACM 5.4			
Each materials sample taken on a construction contract project will be assigned a four part number that identifies the type of sample, the type of material, the test that will be performed on the sample and the sequential number of the test in that series on that type of material and sample. When a test sample fails to meet the specifications, the test number is circled in the Materials Testing Summary. A retest of a failing test is identified by adding the letter *"A"* after the test number for the first retest; a second retest adds the letter "B", and so on. Samples sent to the regional lab for testing will also be identified by this system, in addition to the project name and number, the location the sample was taken, and the name of the sampler. This sample identification system will be used on test results from the field lab and from the regional lab, and on the Materials Testing Summary form.			
Types of Samples			
Acceptance	No prefix	Information	I
Independent Assurance	A	Quality	Q
Types of Materials			
Aggregate Base Course (C-1, D-1 etc)	BC ( )	Gas Line Conduit	GC
Aggregate Surface Course	SC	Hot Mix Asphalt	HMA
Asphalt Cement	AC	Grout	GR
Asphalt Pathway	AP	Manhole Type (1, II, III)	MH( )
Asphalt Sidewalk	AS	Medium Cure Liquid Asphalt	MC
Asphalt Surface Treatment	AST	Mineral Filler	MF
Asphalt Treated Base Course	ATB	Performance Grade Liquid Asphalt	PG
Bed Course Material	BCM	Porous Backfill	PB
Bedding and Backfill	BB	Reclaimed Asphalt Pavement	RAP
Borrow Material Type *(A,* B, C)	BM( )	Rip Rap	RR
Common Excavation	CX	Rock Excavation	RX
Concrete Cylinder	CYL		
Concrete Coarse Aggregate	CA	Sewer Conduit	SC
Concrete Fine Aggregate	FA	Sidewalk	SW
Cover Coat Grading B	CCB	Stone Mastic Asphalt	SMA
Crushed Asphalt Base Course	CABC	Structural Backfill Material	SF
Culvert	C	Structural Plate Pipe	SPP
Ditch Lining	DL	Subbase (A, B, C, D, E)	SB( )
Electrical Conduit	EC	Telephone Conduit	TC
Electrical - Miscellaneous	EL	Television Conduit	TV
Emulsified Asphalt Materials	EAM	Top Soil	TS
Emulsified Treated Base	ETB	Type A Inlet	AI
Field Inlet	FI	Unclassified Excavation	EX
Filter Blanket	FB	Useable Excavation, Type *(A,* B, C)	EX( )
Filter Material	FM	Waste	EXW
Fire Hydrant	FH	Water Conduit	WC
Foundation Fill	FF	Waterline	WL
Gabion Backfill	GB	Warm Mix Asphalt	WMA
Types of Tests			
Correction Factor - Ignition Oven	CF	Mix Design	MD
Field Density	D	Moisture	M
Fracture Count	F	Oil Content	0
Gradation	G	Plastic Index	PI
Joint Density	DJ	Plastic Limit	PL
Mat Density	DM	Strength (Concrete)	S
Liquid Limit	LL	Standard Density	SD

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