## Section 00743 – Porous Asphalt Concrete (PAC)

Section 00743, which is not a Standard Specification, is included in this Project by Unique Special Provision.

**Description**

**00743.00 Scope** - This Work consists of constructing one or more Courses of porous asphalt concrete (PAC) Pavement for drainage or stormwater infiltration, plant mixed into a uniformly coated mixture, placed on a prepared foundation, compacted and finished to a specified smoothness to the lines, grades, thickness, and Cross Sections shown or established.

**00743.01 Abbreviations:**

**PAC** - Porous Asphalt Concrete
**TSR** - Tensile Strength Ratio

**VFA** - Voids Filled with Asphalt

**VMA** - Voids in Mineral Aggregate

**00743.02 Definitions:**

**Porous Asphalt Concrete** - A plant mixed, uniformly coated mixture of asphalt cement, open graded Aggregate and additives as required.

**Asphalt Treated Permeable Base** - A plant mixed, uniformly coated mixture of asphalt cement, open graded Aggregate and additives as required. All references to PAC will also apply to ATPB unless otherwise specified.

**Wearing Course** - The top Lift of PAC, regardless of thickness or if under other materials in a pavement section.

**Materials**

**00743.10 Aggregate** - Furnish new Aggregates meeting the following requirements:

**(a) New Coarse and Fine Aggregates** - Produce and stockpile coarse and fine Aggregate from crushed Rock or other inert material of similar characteristics.

No natural or uncrushed blend sand will be allowed in PAC.

**(1) Soundness** - Provide coarse and fine Aggregate with a weighted loss not exceeding 12 percent when subjected to five cycles of the soundness test using sodium sulfate solution according to AASHTO T 104.

**(2) Durability** - Provide Aggregate not exceeding the following maximum values:

|  |  |  |
| --- | --- | --- |
|  | **Test Method** | **Aggregates** |
| **Test** | **ODOT** | **AASHTO** | **Coarse** | **Fine** |
|  |  |  |  |  |
| Abrasion |  | T96 | 30.0% |  |
| DegradationPassing No. 20 sieve | TM208 |  | 30.0% |  |
| Sediment Height | TM208 |  | 3.0” |  |

**(3) Fractured Faces** – Provide crushed Aggregate with not less than the minimum number of fractured faces as determined by AASHTO T 355 as follows:

|  |
| --- |
| **Percent of Fracture (by Weight)** |
| **Type of Mix** | **Material Retained****on 1”, ¾”, ½”****and No. 4 Sieve****(two fractured faces)** | **Material Retained****on No. 8 Sieve****(one fractured face)** |
| ATPB | 75 | 75 |
| PAC | 90 | 75 |

 **(4) Harmful substances** – Do not exceed the following values:

|  |  |  |
| --- | --- | --- |
|  | **Test Method** | **Aggregates** |
| **Test** | **ODOT** | **AASHTO** | **Coarse** | **Fine** |
|  |  |  |  |  |
| Lightweight pieces |  | T113 | 1.0% |  |
| Wood Particles | TM225 |  | 0.10% |  |
| Elongated Pieces(at a ratio of 5:1) | TM229 |  | 10.0% |  |
| Plasticity Index |  | T90 |  | 0 or NP |
| Sand Equivalent |  | T176 |  | 45 min. |

**(b) Reclaimed Asphalt Pavement** – Reclaimed Asphalt Pavement (RAP) material used in the production of new PAC is optional. No more than 30 percent RAP material will be allowed in the new PAC Pavement. Use RAP Aggregates in the PAC that are no larger than the specified maximum allowable Aggregate size before entering the cold feed. Blend the RAP material with new Aggregate to provide a mixture conforming to the JMF within the tolerance specified.

**00743.11 Asphalt Cement, Additives, and Aggregate Treatment** – Furnish the following asphalt cement and additives:

**(a) Asphalt Cement** – Use the grade of asphalt that is specified in the bid item description. A polymer modified asphalt cement is required in the Wearing Course. Provide asphalt cement conforming to the requirement of Oregon Department of Transportation’s (ODOT’s) publication “Standard Specifications for Asphalt Materials”. Copies of the publication are available on ODOT’s website. The applicable specifications are those contained in the current publication on the date the Project is advertised.

**(b) Asphalt Cement Additives** – Use standard recognized asphalt cement additive products that are of known value for the intended purpose and approved for use on the basis of laboratory test and capable of being thoroughly mixed. Do no use asphalt cement additives that have deleterious effect on the asphalt material. Do no use silicone as an additive. Add the following asphalt cement additives when required by the JMF:

* Anti-stripping asphalt cement additives to prevent stripping or separation of asphalt coatings from Aggregates to satisfy the TSR specified in 00643.13.
* Asphalt cement admixtures used to aid in the mixing.

**(c) Fiber Additives** – The dosage of fiber additives shall be either 0.3 percent cellulose fibers or 0.4 percent mineral fibers by total mixture mass added at batch plant or automated for larger drum plants. Unless otherwise specified, fibers shall be added at a weight of 5 pounds per ton of PAC mix.

**00743.12 Mix Type and Broadband Limits** – Furnish the mix type specified in the Contract Documents within the broadband limits according to the following:

**(a) Mix Type** – Furnish the types of PAC shown or as directed.

**(b) Broadband Limits** – Provide a JMF for the specified mix type within the control points listed below:

|  |  |  |  |
| --- | --- | --- | --- |
| Sieve Size | ⅜” PAC | ½” PAC | ¾” PAC |
| Control Points(% passing by Weight) | Control Points(% passing by Weight) | Control Points(% passing by Weight) |
| 1” |  |  |  |  | 99 | 100 |
| ¾” |  |  | 99 | 100 | 85 | 95 |
| ½” | 99 | 100 | 90 | 98 | 35 | 68 |
| ⅜” | 90 | 100 | - | - | - | - |
| No. 4 | 22 | 40 | 18 | 32 | 2 | 10 |
| No. 8 | 5 | 15 | 3 | 15 | 0 | 5 |
| No. 200 | 1.0 | 5.0 | 1.0 | 5.0 | 0.0 | 2.0 |
| AsphaltCement | \* | \* | \* | \* | 2.5 | 3.5 |

\*Per JMF

**00743.13 Job Mix Formula Requirements** – Do not begin production of PAC for use on the Project until the JMF is reviewed by the Engineer and written consent is provided to proceed. The JMF proposed for use on the Project will be evaluated based on the criteria identified in 00643.13(b) and the latest ODOT Contractor Mix Design Guidelines for Asphalt Concrete. For all mixes, complete TSR testing at least once per calendar year. A new JMF is required if the asphalt cement grade or source, any additives, or the source of the Aggregate change during production.

**(a) Contractor Provided Job Mix Formula** – Have CMDT prepare, sign, and submit a JMF to the Engineer for each mixture required at least 10 Calendar Days before the anticipated use of PAC, and according to the latest copy of the ODOT Contractor Mix Design Guidelines for Asphalt Concrete. If requested, submit material samples 10 Calendar Days before use.

**(b) Job Mix Formula Requirements** – Provide a JMF meeting the following mixture requirements:

|  |  |  |
| --- | --- | --- |
|  | **⅜” and ½” PAC** | **¾” ATPB** |
| Design Method | ODOT | ODOT |
| Air Voids, % | 16.0 – 20.0 | - |
| Draindown, % | 70 – 80 | - |
| TSR\*, % minimum | 80 | - |
| Coating, % minimum | - | 90 |
| VFA, % | 30 – 50 | - |

* Run the TSR for open graded mixtures on a surrogate dense graded mixture. If a dense graded JMF has been prepared for the same material sources in the last year, the results for the most recent TSR may be applied to the porous asphalt mixture. If not, prepare the TSR test samples for a desnse graded mix using the equivalent top size stone and material from the same sources, which will represent the porous asphalt mixture.

**00743.14 Tolerances and Limits** – Produce and place PAC within the following JMF tolerances and limits:

|  |  |
| --- | --- |
| **Gradation****Constituent** | **PAC Type** |
| **½”** | **⅜”** | **ATPB** |
| 1” |  |  | 99 – 100% |
| ¾” | 99 – 100% |  | 85 – 95% |
| ½” | 90 – 98% | 99 – 100% | 35 -68% |
| **⅜”** | - | 90 – 100% | - |
| No. 4 | JMF ± 5% | JMF ± 5% | JMF ± 5% |
| No. 8 | JMF ± 4% | JMF ± 4% | JMF ± 4% |
| No. 30 | JMF ± 4% | JMF ± 4% | - |
| No. 200 | JMF ± 2.0% | JMF ± 2.0% | JMF ± 2.0% |

|  |  |
| --- | --- |
| **Constituent of Mixture** | **PAC All Types** |
| Asphalt Cement – ODOT TM 321(Cold Feed/Meter) | JMF ± 0.20% |
| Asphalt Cement – AASHTO T 308 (Ignition)And ODOT TM 323 | JMF ± 0.50% |
| RAP Content – ODOT TM 321 | JMF ± 2.0% |
| Moisture content at time of discharge from the mixing plant – AASHTO T 329\* | 1.10% max. |

 \*Does not apply to ¾” ATPB

When a JMF tolerance applies to a constituent, full tolerance will be given even if it exceeds the control points established in 00643.12(b).

**00743.16 Sampling and Testing** – For each 1,000 tons of placement, have a CAT-1 perform a minimum of one of each of the following test methods as modified in the MFTP:

* Asphalt Content:
	+ Mixes with RAP – AASHTO T 308 with ODOT TM 323 determined by Calibration Factor
	+ Mixes without RAP – AASHTO T 308 with ODOT TM 323 determined Calibration Factor or ODOT TM 321
* Gradation:
	+ Mixes with RAP – AASHTO T 30
	+ Mixes without RAP – AASHTO T 30 or AASHTO T 27/11
* Mix Moisture – AASHTO T 329

When less than 1,000 tons of mix is placed in a Day, perform a minimum of one series of tests per Day. Provide test results to the Engineer by the middle of the following work shift.

If less than three samples are obtained on a Project, the Contractor may supplement test results with the Engineer’s approval by:

* Accelerating testing.
* Provide test results from other project with the same JMF within the past 120 days of first date of JMF production.
* Test back up samples.

Provide a minimum of three test results. Provide samples or split samples to the Engineer when requested.

**00743.17 Acceptance** – If the average for each mix gradation constituent and asphalt content is with the specification limits, the material will be accepted. If the average asphalt content or one or more gradation constituents is not within the specification limits, the material will be accepted according to 00150.25 of ODOT Standard Construction Specifications for Construction 2018.

**Equipment**

**00743.20 Pavers** – provide pavers specifically designed to spread and finish asphalt concrete Pavement to a uniform texture in the widths, thicknesses, lines, grades and Cross Section specified. When approved, alternate equipment may be used for areas where the use of a paver is impracticable.

**00743.21 Compactors** – Provide self-propelled steel-wheeled rollers specifically designed to compact asphalt concrete Pavement and capable of reversing without backlash. Provide a sufficient number of approximately weighted rollers to compact the mixture.

**Labor**

**00743.30 Quality Control Personnel** – Provide technicians having CAT-1, CMDT, and CAgT technical certifications.

**Construction**

**00743.40 Season and Temperature Limitations** – Place PAC when the temperature of the surface that is to be paved is not less than 50 ˚F.

**00743.41 Prepaving Conference** – Have a prepaving conference with all Contractor Supervisory personnel, all Subcontractors who are to be involved in the paving Work, and the Engineer. Meet at a mutually agreed time to discuss all methods of accomplishing all phases of the paving Work.

**00743.42 Preparation of Underlying Surfaces** – All bases and foundations on which the Pavement is to be constructed shall meet the applicable Specifications and be approved before beginning paving operations. Recondition existing bases and foundations according to Section 00610 of ODOT Standard Construction Specifications for Construction 2018. Trim broken or ragged edges to firm material when directed.

The pavement surface shall be dry before the preparation Work and paving.

**00743.43 Mixing and Placement Temperatures** – Establish the allowable mixing and placement temperature ranges by the JMF. Measure the mixture temperature at the discharge of the mixture. Measure the placement temperature behind the paver. The maximum mixture temperature of the PAC at the mixer is 350˚F. The minimum placement temperature of the PAC behind the paver is 205˚F.

**00743.44 Hauling, Depositing, and Placing** – Haul, deposit, and place PAC according to the following:

**(a) Hauling** – Cover PAC if rain or cold air temperatures are encountered any time between loading and placement.

If excessive stopping of the paving machine occurs during paving operations, the Engineer may suspend operations until the mixture delivery rate matches the paving machine operation.

**(b) Depositing** – Deposit PAC from the hauling vehicles so segregation is prevented.

**(c) Placing** – Place the mixture in the number of Lifts and Courses, and to the compacted thickness for each Lift and Course, as shown. Place each Course in one Lift unless otherwise specified. Do not exceed a compacted thickness of 4 inches for any Lift unless approved. Limit the minimum Lift thickness to twice the maximum Aggregate size in the mix.

Uncompacted mixture behind the paver with temperatures below the minimum specified in 00743.43 will be rejected unless otherwise specified allowed by the Engineer.

Do not place PAC during rain or other adverse weather conditions, unless allowed by the Engineer. PAC in transit at the time adverse conditions occur may be placed if:

* It has been covered during transit.
* The PAC temperature is satisfactory.
* It is placed on a foundation free from pools or flow of water.

**00743.45 Longitudinal Joints** – At longitudinal joints, bond, compact and finish the PAC equal to the Pavement against which it is placed.

**(a) Location** – Place the PAC in Panel widths which hold the number of longitudinal joints to a minimum. Offset the longitudinal joints in one Pavel by at least 6-inches from the longitudinal joints in the panel immediately below.

**(1) Base Course** – Place Base Course longitudinal joints within 12 inches of the edge of a lane, or within 12 inches of the center of a lane, except in irregular areas, unless otherwise shown.

**(2) Wearing Course** – Do not construction longitudinal joints within the width of a Traffic Lane. Construct longitudinal joints at either skip lines or fog lines unless otherwise approved. On Median lanes and on Shoulder areas, construct longitudinal joints only at lane lines or at points of change in the transverse slopes, as shown or as directed.

**(b) Drop-Offs:**

* Provide warning signs and markings according to Section 00225 where abrupt or slope edge drop-offs 1 inch or more in height occur.
* Protect edges from being broken down.

**00743.49 Compaction** – After the PAC has been spread, struck off, and surface irregularities and other defects remedied, roll it uniformly until compacted. Compaction of PAC to a specified density will not be required. Continue the breakdown and intermediate rolling until the entire surface been compacted with at least four coverages by the rollers. Perform additional coverages to complete finish rolling of the PAC.

**Maintenance**

**00743.60 Correction of Defects** – Correct all defects in material and Work, as directed, at no additional cost to the Agency, according to the following:

**(a) Fouled Surfaces** – Repair and clean fouled surfaces that would prevent full bond between successive Lifts of mixture.

**(b) Boils, Slicks and Oversized Material** – Replace boils, slicks, and oversized material with fresh mixture. If problems with boils and slicks continue to occur, stop production until a plan for eliminating the boils and slicks is approved by the Engineer.

**(c) Roller Damage to Surface** – Correct surface damage from roller with additional fresh mixture or by other means approved by the Engineer.

**Finishing and Cleaning Up**

**00743.70 Pavement Smoothness** – Furnish a 12-foot straightedge and test as specified. Additional testing may be required. Mark areas not meeting the surface tolerance.

**(a) Travel Lanes** – Test wearing Course with the 12-foot straightedge in travel lanes parallel to and perpendicular to the centerline, as directed. The Pavement surface shall not vary by more than ¼ inch.

**(b) Utility Appurtenances** – If the Contractor constructs or adjusts Utility appurtenances the tolerances of 00643.70(a) apply. If the Utility appurtenances are adjusted by others, these tolerances do not apply.

**(c) Shoulders, Paved Medians, Parking Lanes, and Parking Lots** – Straightedge testing in Shoulders, paved Medians, parking lanes, and parking lots is not required.

**00743.71 Correction of Pavement Roughness** – Correct Equipment of paving operation procedures when test show the Pavement smoothness does not comply with 00743.70. In addition, do the following:

**(a) Methods** – Correct wearing Course surface roughness to the required tolerances, using one of the following methods as approved by the Engineer:

* Remove and replace wearing surface lift.
* Profile to a maximum depth of 0.3 inch with abrasive grinders equipped with a cutting head compromised of multiple diamond blades.

**(b) Time Limit** – Complete correction of all surface roughness within 14 Calendar Day of completion of paving.

**00743.72 Opening to Traffic** – Allow PAC to cure at least 72 hours before opening to traffic, unless otherwise directed.

**Measurement**

**00743.80 Measurement** – The quantities of PAC will be measure on the weight basis.

No deductions will be made for asphalt cement, mineral filler, lime, anti-strip, or any other additives used in the mixture.

**Payment**

**00743.90 Payment** - The accepted quantities of PAC incorporated into the Project, whether or not recycled Materials are used, will be paid for at the Contract unit price, per ton, for the item “\_\_\_\_Mixture, Level \_\_\_”

The following will be inserted into the blanks:

* The types of PAC (½ inch PAC, ⅜ inch PAC, and ¾ inch ATPB) will be inserted in the first blank.
* The Level of PAC (1, 2, 3) and grade will be inserted in the second blank and any other mix design criteria.

Payment will be payment in full for furnishing and placing Materials, and for furnishing all Equipment, labor, and incidentals necessary to complete the Work as specified.

No separate or additional payment will be made for Levelling Work, QC testing, asphalt cement, mineral filler, lime and anti-stripping, fibers, or other additives.