PERMEABLE INTERLOCKING CONCRETE PAVEMENT (PICP):
(1-16-18)(Rev. 2-18-25)

Description

Construct permeable interlocking concrete pavement (PICP) on an open-graded aggregate subbase, base and bedding course. PICP may only be used for parking lots, alleys and residential streets. The pavement surface shall consists of concrete paving units with joints filled with permeable aggregates. Perform the work in accordance with the *Standard Specifications* and this special provision, and with the lines, grades, thickness, and sections shown in the plans or as directed by the Engineer.

PICP will be accepted by the Engineer with respect to paving unit strength, compaction, and measured deflections, and resulting pavement layer thicknesses.

All equipment used for this work shall be reviewed and approved by the Engineer prior to beginning work.

Submit to the Engineer for approval the concrete paver manufacturer's quality control plan and the PICP installation contractor's method statement a minimum of 30 calendar days prior to starting construction. These documents shall address operations necessary in the manufacture, delivery, and placement of the materials.

Materials

Refer to Division 10 of the *Standard Specifications*.

Item	Section
Aggregates	1005
Geocells	1056-6
Geotextile, Type 2	1056
Geotextile, Type 4a	1056
Portland Cement Concrete, Class B	1000
PVC Pipe	1044-6

Concrete paving units shall comply with ASTM C936 including freeze-thaw durability using 3% saline solution in accordance with ASTM C1645. Minimum thickness shall be 3 1/8 inch. Use rectangular paver shapes with spacer bars on the sides and units capable of being installed in herringbone patterns.-Pigment(s) to color the paving units shall comply with ASTM C979.

Open-graded subbase, base, bedding, and jointing aggregate materials aggregates shall comply with Section 1005 of the *Standard Specifications***.** All aggregates shall consist of crushed stone with 90% fractured faces. When subject to vehicular traffic, all aggregates shall have a maximum Los Angeles abrasion loss of 40 per AASHTO T 96 and ASTM C535 as applicable to aggregate sizes. Do not use rounded river gravel. Gradations shall conform to Table 1005-1 of the *Standard Specifications* except that aggregates shall be washed with no more than 2% passing the No. 200

sieve. Comply with the following for pavement layer materials and applicable aggregate gradations:

Materials and Applicable for PICP Pavement Layers	
Pavement Layer	**Characteristics**
Concrete pavers (surface)	Meets ASTM C936
Joint between pavers	Per paver manufacturer's recommendations
Bedding	No.78M
Base	No. 57
Subbase reservoir	No. 4

Use Geotextiles, Type 4a in accordance with Table 1056-1 of the *Standard Specifications*.

Perforated and non-perforated subdrain pipes shall comply with Section 1044-6 for PVC and AASHTO M 278 Class PS46 PVC Pipe Type SP.

The PVC Geomembrane shall be a minimum 30 mil thick, conforming to ASTM D7176, capable of welding and assembly on the job site, front and back covered with non-woven geotextile conforming to Section 1056 of the *Standard Specifications*. Geotextiles, Type 2 shall be used in accordance with Table 1056-1 of the *Standard Specifications*.

Edge Restraints shall consist of concrete materials for restraining the concrete paver surface, bedding, and aggregates beneath and conform to Section 1000 of the *Standard Specifications* for Portland Cement Concrete Class B.

Construction Methods

The Engineer will provide the Contractor with the following for verification: a soils report indicating the soil sample locations and resulting soil classification(s), laboratory Proctor density, laboratory soaked 96-hr CBR soil test results, subgrade infiltration rates tested per ASTM D3385 and infiltration test locations measured on-site at uncompacted or compacted conditions as determined by the Engineer.

The Engineer will also provide the Contractor evidence of NCDEQ approval of the project, stormwater management (quality and quantity) calculations for the subbase thickness per the *NCDEQ Stormwater Design Manual*; structural analysis of the subbase thickness for vehicular applications using Interlocking Concrete Pavement Institute (ICPI) Permeable Interlocking Concrete Pavements Manual, Permeable Design Pro software, and/or ASCE 68-18 *Permeable Interlocking Concrete Pavement*.

Prior to beginning work, the Contractor shall furnish the following to the Engineer for approval;

(a) Concrete paver manufacturer's quality control plan meeting the requirements of ASTM C936 for the concrete paving products, product delivery method(s), and timing;
(b) Concrete paver manufacturer's test results from an independent testing laboratory demonstrating compliance with ASTM C936;

(c) Contractor's method statement on how and when to provide tests to assure compliance with this specification, storage, staging and installation of pavement materials including starting place(s), pavement patterns, edge details at curbs and around protrusions in the pavement surface;
(d) Minimum 3 lb samples each of subbase, base, and bedding aggregates;
(e) Sieve analysis of same aggregates per AASHTO T 27 that comply with the material and gradation specifications;
(f) Test results for void ratio and bulk density per AASHTO T 19 of aggregates in item (d) demonstrating compliance with the specifications; and
(g) A record of completion issued by the Concrete Masonry and Hardscape Association (CMHA) for the PICP Specialist Course. This certificate shall be held by Contractor's foreman or foremen assigned to work on this project.

Before starting PICP construction, schedule a PICP preconstruction meeting no later than 30 days prior to construction with the Engineer. The Prime Contractor, PICP installation contractor, subcontractor PICP representatives, PICP testing laboratory representative, and the PICP concrete paver manufacturer's representative will attend the PICP preconstruction meeting. The Contractor shall be prepared to discuss the following:
(a) The manufacturer's Quality Control Plan, including testing, paving product delivery, and timing;
(b) The Contractor's Method Statement;
(c) Review accepted submittals; and
(d) Review the project plans, specifications, construction schedule, and material testing requirements for compliance to this specification.

Install PICP as follows:

(A) Preparation of the Subgrade

Excavate to the elevations shown on the project drawings. Excavate and prepare the subgrade in accordance with Section 225 of the *Standard Specifications* with a grading tolerance of ± 1/4 inch from the established grades on vehicular applications and a grading tolerance of ± 1/2 inch in all other applications. Remove any sediment deposited on the soil subgrade from adjacent construction activities.

Do not allow traffic on the soil subgrade other than the necessary and essential construction equipment as authorized by the Engineer.

Proof roll the subgrade in accordance with Section 260 of the *Standard Specifications*. If an area is too small to receive proof rolling equipment, compact the soil subgrade to a proctor density approved by the Engineer. Verify that subgrade preparation and compacted density conform to specified requirements and that final subgrade elevations conform to the drawings. Provide density test results for soil subgrade to the Engineer. Do not proceed with installation of aggregate subbase until subgrade soil conditions are approved by the Engineer.

(B) Geotextile Installation

Store geotextiles such they are free from contamination by sediment. Install geotextiles per Section 270 of the *Standard Specifications* and as indicated in the plans.

(C) PVC Geomembrane Installation

Assemble per manufacturer's instructions. Install geotextile backing such that it covers the entire surface of the installed PVC geomembrane for protection when installed. Install assembled PVC geomembrane and place geotextile over the entire front and back of the PVC for protection during aggregate compaction.

(D) Subsurface Drainage Installation

Install perforated and non-perforated subdrains in accordance with Section 815 of the *Standard Specifications* and as indicated in the plans.

(E) Subbase Aggregate Installation

Keep stockpiled aggregates on the job site free from all organic materials, sediment, debris, and placed as a uniformly graded material. Remove and replace stockpiled or installed aggregates contaminated with sediment with clean, uncontaminated materials.

Do not place subbase aggregate on ponded water on the surface of the soil subgrade. Remove ponded water prior to installation. Do not damage installed subsurface drainpipes, overflow pipes, observation wells, or any inlets and other drainage appurtenances during the PICP installation. Report any damage immediately to the Engineer.

Moisten the aggregate to minimize dust and to facilitate compaction. Spread, and compact the moist subbase layer in maximum 8 inch lifts without wrinkling or folding the geotextile. Equipment tires and tracks shall not ride on the soil subgrade. Instead, equipment shall ride on the placed subbase aggregate to protect geotextile from wrinkling.

For each subbase lift or portion thereof, make at least two passes in the vibratory mode then at least two in the static mode with a minimum 10 ton vibratory roller until there is no visible movement of the No. 4 stone. Do not crush aggregate with the roller. Use a minimum 13,500 lbf reversible plate compactor with a compaction indicator to compact areas that cannot be reached by the vibratory roller. Do not crush the aggregate with the plate compactor. The surface tolerance of the compacted No. 4 subbase shall be ± 1 inch over a 10 ft straightedge.

(F) Curb Installation

Install concrete curbs (edge restraints) in accordance with Section 846 of the *Standard Specifications* on the compacted subbase aggregate as shown in the plans.

(G) Geocell Installation

Where specified in the plans, install geocells per manufacturer's instructions and fill cells with No. 57 base aggregate.

(H) Base Installation

Moisten the aggregate to minimize dust and to facilitate compaction. Spread and compact the base layer of No. 57 aggregate in one 4 in. thick lift. On this layer, make at least two passes in the vibratory mode and follow with at least two in the static mode with a minimum 10 t vibratory roller until there is no visible movement of the base aggregate. Do not crush aggregate with the roller. Use a minimum 13,500 lbf reversible plate compactor with a compaction indicator to compact areas that cannot be reached by the vibratory roller. Do not crush the aggregate with the plate compactor. The surface tolerance the compacted base should not deviate more than. ± ½ in. over a 10 ft straightedge.

After base compaction is complete, check deflections with a lightweight deflectometer (LWD) per test method ASTM E2583 or ASTM E2835 with a 12 in. diameter bearing plate on a combined base and subbase thicknesses 12 in. or greater. After three preloading weight drops, the average deflection from three additional weight drops shall be no greater than 0.6 mm. Measure deflections in location for every 500 sq ft of base area or as directed by the Engineer. Use LWD equipment to record test locations via GPS and deflection data for each test location. Provide the deflection test results to the Engineer.

(I) Bedding Aggregate, Concrete Pavers, and Jointing Aggregate Surface Course Installation

Moisten the aggregate to minimize dust and to facilitate compaction. Spread and screed the 78A bedding aggregate on the compacted base aggregate. Maintain a consistent 2 inch thickness. Fill voids left by removed screed rails with bedding aggregate. Do not compact the screeded layer. The surface tolerance of the screeded bedding layer shall be ± 3/8 inches over a 10 foot straightedge. Do not subject screeded bedding material to any pedestrian or vehicular traffic.

Lay the concrete paving units on the screeded 78A bedding layer in the pattern(s) shown in the plans. Adjust joint lines as needed as paving proceeds such that lines are straight in all directions. Fill gaps at the edges of the paved area and around protrusions in the pavement with cut units. Cut pavers subject to tire traffic shall be no smaller than one-third of a whole unit. Cut pavers with a powered masonry saw.

Compact and seat an area of installed concrete pavers into the bedding material using a low-amplitude, 75-90 Hz reversible plate compactor capable of at least 5,000 lbf. Make at least two passes over the entire area with the plate compactor. Replace any cracked paving units with whole units. Once an area of concrete pavers is installed, fill the openings and joints with jointing aggregate. Remove excess aggregate on the surface by sweeping pavers clean. Compact the pavers again by making at least two passes over the entire area with the plate

compactor. Apply additional aggregate into the joints as needed, filling them completely. Remove excess aggregate by sweeping the surface clean.

All concrete pavers more than 6 feet from any incomplete unpaved area must be fully compacted and joints filled at the completion of each day. The final surface tolerance of compacted pavers shall not deviate more than ± 3/8 inches under a 10 foot long straightedge. The surface elevation of concrete pavers shall be 1/8 inches to 1/4 inches above adjacent drainage inlets, concrete collars or channels.

After sweeping the surface clean, check final surface elevations for conformance to the drawings. There shall be no greater than 1/8 inch difference in height between adjacent pavers. Joint or bond lines for shall not vary more than ± 1/2 inch from a 50 foot taut string line drawn over the joints. Verify the surface infiltration at a minimum of 100 inches/hour using test method ASTM C1781. Report the infiltration rate(s) to the Engineer.

After work in this section is complete, protect the PICP from sediment deposition and damage due to other subsequent construction activity on the site. Return to site after 10 (ten) months and not to exceed 12 (twelve) months from the completion of the work to remediate any area that does not conform to the following:

(a) Surface elevation of pavers 1/8 to 1/4 inches above adjacent drainage inlets;
(b) Concrete collars or channels no greater than 1/8 inch difference in height between adjacent pavers; and
(c) Joint or bond lines shall not vary more than ± 1/2 inch from a 50 foot taut string line drawn over the joints. Fill paver joints with stones, replace broken or cracked pavers, and re-level settled pavers to initial elevations. Any additional work shall be considered part of original bid price with no additional compensation.

731-14 MEASUREMENT AND PAYMENT

Permeable Interlocking Concrete Pavement will be measured and paid in square yards of pavement completed and accepted. In measuring this quantity, the width and length will be the width and length specified in the plans. Payment includes, but is not limited to, the PICP structure, the materials and work items in this special provision, and all incidentals necessary to complete the work.

Pay Item	**Pay Unit**
Permeable Interlocking Concrete Pavement	Square Yard