

ASCE LID Permeable Pavement Retrofit

Recipient: ASCE Foundation

Grant: \$104,500

Completion: 2020

Fact Sheet 24



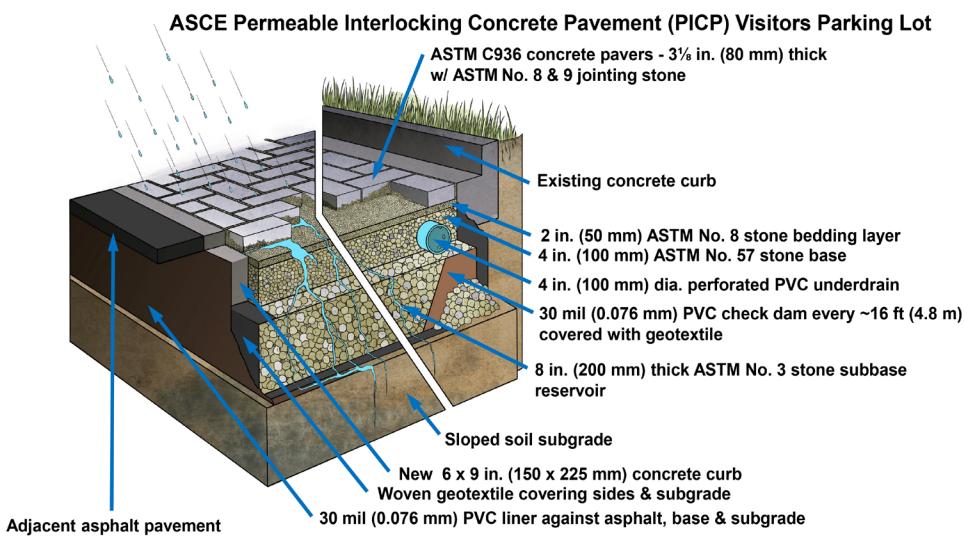
Background and Need

The American Society of Civil Engineers (ASCE) Foundation owns a six-story office building in Reston, Virginia surrounded by several acres of asphalt pavement for parking ~300 vehicles. The building serves as the headquarters for this civil engineering society that consists of over 100,000 members. When the asphalt pavement was in need of milling and replacement in 2018, the American Society of Civil Engineers asked its Foundation for an approach that would demonstrate the Society's commitment to sustainable environmental design via low impact redevelopment, specifically through runoff and pollution reduction.

The ASCE Foundation reached out to Society members (including ICPI staff) and vendors to donate design time, money and materials for a demonstration retrofit project for the parking lot. This resulted in a design and donations that captured and infiltrated about half of the runoff from the asphalt parking lot. The ICPI Foundation donated the construction of permeable interlocking concrete pavement (PICP) visitor parking consisting of 17 spaces and 7 for disabled users at the entrance.

Objectives

The PICP design objectives were to reduce as much runoff as possible through infiltration. The visitor parking paved with about 4,000 sf (400 m²) of PICP would also create a favorable first impression for guests. Upon receiving soil infiltration test results, the PICP was designed using the Interlocking Concrete Pavement Institute's Permeable Design Pro software. The 100-year storm event could be easily managed by a cross section consisting of monofilament geotextile on the soil subgrade, 8 in. (200 mm) of No. 3 stone, 4 in. (100 mm) of No. 57 stone, 2 in. of No. 8 stone and 3.125 in. (80 mm) thick permeable interlocking concrete pavers with No. 8 in the joints topped with No. 9 stone.



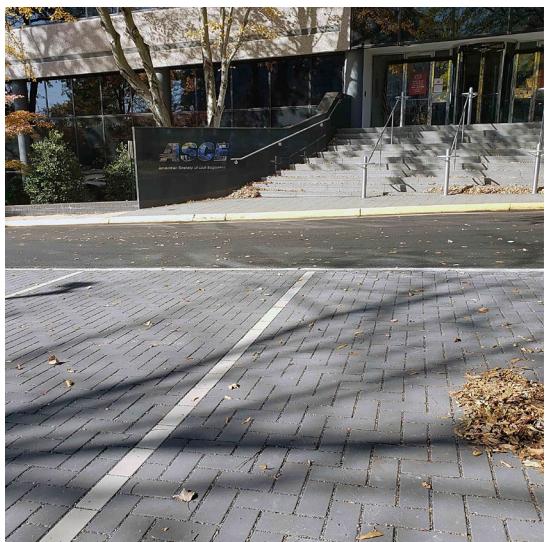
The design shown at left included a perforated 4 in. (100 mm) PVC underdrain running along the back of the pavement within the No. 57 layer. The underdrain was connected to an adjacent catch basin to manage overflow events. Since the site subgrade sloped between 3% and 5%, check dams were placed every 16 to 20 ft (5 to 6 m) to slow lateral flows and increase infiltration. These are built

with impermeable liners consisting of 40 mil (1 mm) thick flexible PVC. This material was also placed against the boundaries of the PICP to prevent ingress of water into the adjacent, undisturbed asphalt pavement and base.

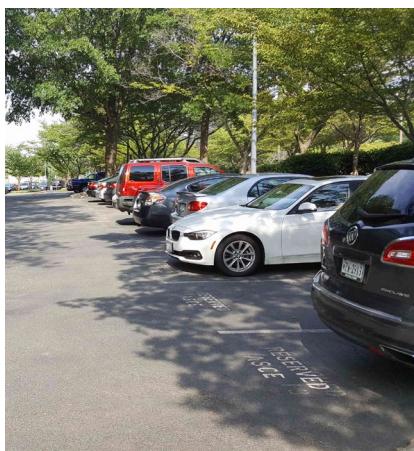
Excavation, geosynthetics, curbs, aggregate subbase and base were constructed by Total Development Solutions from Bristow, Virginia. The 4 x 8 x 3.125 in. (100 x 200 X 80 mm) thick permeable pavers were installed in a 90° herringbone pattern by Imperial Stone Paving, Elkridge, Maryland in the fall of 2020. When installed, the concrete pavers created 10 mm wide joints providing ~10% opening across the surface area. The pavers were manufactured with non-hydraulic cement with reduced energy requirements compared to (hydraulic) Portland cement. In addition, the concrete pavers were cured (hardened) with CO₂ during manufacturing which further lowered their carbon footprint.

Outcomes

Other LID practices installed on the site were a bioswale, pervious concrete, and a biofilter catch basin as well as landscaping replacing the asphalt pavement. The PICP parking area provides a flagship entrance to the building, clearly reinforcing ASCE's design values of sustainability and resiliency as shown in the photos below. There is also a sign explaining the PICP to visitors and high-school age civil engineers in the making.



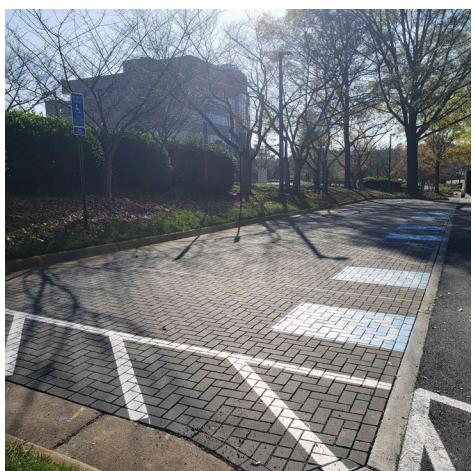
ASCE building entrance



Before: asphalt pavement



After: PICP lower parking lot



PICP upper parking lot

ICPI staff performed surface infiltration testing in accordance with *ASTM C1781 Standard Test Method for Surface Infiltration Rate of Permeable Unit Pavement Systems* about one month after installation and found the infiltration rate to be 587 and 820 in./hr. (14,910 and 20,828 mm/hr). Surface infiltration rate testing verifies proper functioning of the permeable paver system upon installation and can be performed annually to monitor infiltration. The very high infiltration rates measured are well above ICPI's recommended, post-construction acceptance minimum of 100 in./hr (2,500 mm/hr). The PICP and adjoining areas are cleared of loose debris with a leaf blower which helps assure continual, high infiltration rates.

A video link by ASCE on the entire LID retrofit project is found here: <https://vimeo.com/528369173>



Two infiltration tests were conducted using ASTM C1781 a month after completion. The lower half of the parking lot tested at 820 in./hour (20,828 mm/hr) and the upper lot at 587 in./hour (14,910 mm/hr).