PAVER SURFACE INFILTRATION LABORATORY TESTING REPORT

Report Number: 82191489.0001
Service Date: 11/27/19
Report Date: 11/27/19

Terracon
700 NE 55th Ave
Portland, OR 97213-3150
503-659-3281

Client

Western Interlock Inc
Attn: Landon Pegg
10095 Rickrealle Rd
Rickreall, OR 97371

Project

Western Interlock Paver Infiltration Testing
700 Ne 55th Ave
Portland, OR 97213

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Summary: Terracon representative performed ASTM C1781 – modified to simulate field installation in a laboratory environment – on pavers and aggregates provided by Western Interlock. Three total paver installation patterns were tested for water infiltration utilizing the Camino Permeare paver mix. Two separate sizes of Camino Permeare were used to create these patterns; nominal 9” x 6” pavers and nominal 6” x 6” pavers. The values of inches per hour of water infiltration substantially exceeded any level of record historic precipitation in the Pacific Northwest. Therefore, it may be stated that, assuming the pavers are installed in accordance with Western Interlock instructions, the pavers and aggregates will not be the limiting factor for drainage rate of a paver surface.

Modifications to ASTM C1781: ASTM C1781-18, the Standard Test for Surface Infiltration Rate of Permeable Unit Pavement Systems, is intended to performed as a field test on previously installed, in-situ permeable unit pavement surfaces. As no previously installed surfaces composed of Western Interlock’s Camino Permeare pavers were available for testing in strict accordance with C1781, a simulated installation was created in the Terracon laboratory (see Test Apparatus and Preparation). A further modification is that C1781 requires a minimum of three separate sub-tests per surface; rather than create three separate surfaces for each installation pattern, three separate tests were performed on the same surface, with at least one hour passing in between tests, to allow the pavers and aggregate to drain.

Limitations: As this testing was not performed on materials installed on subgrade, the influence of individual site conditions on the infiltration rate as determined by testing the laboratory-constructed system cannot be directly inferred; however, to expand on the final sentence in the Summary, the limiting factor for drainage of a Camino Permeare surface properly installed in accordance with Western Interlock’s instructions will be the subgrade, and not the paver / aggregate system. We recommend that if drainage of a site’s subgrade – whether native or installed – are of concern, field infiltration testing be performed to determine a realistic inches per hour infiltration rate for installation of Western Interlock pavers on that site. The effects of sedimentation over time on the infiltration rate is outside of the scope of this testing.

Test Apparatus and Preparation: The tests were performed on a paver surface installed within a wood frame. The frame’s interior dimensions were a length of 22½”, a width of 22½”, and a height of 14¾”. A grid of woven steel mesh with openings approximately 4.75 mm square was securely attached to the base of the frame, allowing material to be retained inside the frame while allowing water to pass out. On top of the steel mesh, a 6” layer of open-graded 2” – 1” ballast rock from Knife River, Coffin Butte was placed; the layer was assembled by hand to ensure that the rocks were locked against each other; this was tested by applying a 20,000 lb force to the full surface of the layer utilizing a compression machine, with no visible deflection. The next layer was a 4” depth of open-graded ¾” - ½” drain rock from Reed. It was similarly hand-installed and checked against deflection. Atop this, a 1½” layer of ¼” - #10 levelling material from Reed was placed and smoothed to a

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level surface without compaction. Finally, one of three installation patterns were put in place, with pavers sawcut as necessary to ensure a close fit with the frame's edges (less than ¼"). Levelling course material was then swept into the gaps between the pavers and between the pavers and the frame, and consolidated with a slender rod until the material was firm and unyielding, with the level falling slightly beneath the surface of the pavers. Finally, a piece of timber was carefully struck against the surface of the pavers to ensure the surface was flat.

Test Process: As per ASTM C1781, an impermeable ring was sealed to the paver surface with plumber's putty. The interior diameter of the ring was 11.58", and it was composed of rigid plastic. The surface was then pre-wetted with 8.0 lbs of municipal tap water, with the infiltration time noted to determine the mass of water to be used in the actual testing. In all cases, the infiltration time of the pre-wetting mass of water was less than 30 seconds, and so 40.0 lbs of tap water was utilized for the three infiltration sub-tests performed on each installation pattern. At least one hour was allowed to pass in between tests, to allow the pavers and aggregate to drain.

Test Results: The results are presented divided into the three installation patterns of Camino Permeare tested. Each installation pattern was pre-wetted, then tested three times for infiltration. The time elapsed and infiltration rate (in inches per hour) for each sub-test are shown, as well as the average values for the installation pattern. Inside ring diameter and water masses are noted in Test Process.

Western Interlock; Camino Permeare, 9" x 6" and 6" x 6"; Muster K Installation Pattern

Pre-Wetting Elapsed Time: 11 Seconds

	Elapsed Time	Infiltration Rate
Subtest 1:	45.2 seconds	837 inches per hour
Subtest 2:	48.2 seconds	785 inches per hour
Subtest 3:	44.4 seconds	825 inches per hour
Average:	**45.9 seconds**	**825 inches per hour**

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Western Interlock; Camino Permeare, 9” x 6”; Herringbone Installation Pattern

Pre-Wetting Elapsed Time: 13 Seconds

	Elapsed Time	Infiltration Rate
Subtest 1:	47.2 seconds	802 inches per hour
Subtest 2:	42.3 seconds	895 inches per hour
Subtest 3:	43.6 seconds	868 inches per hour
Average:	**44.4 seconds**	**855 inches per hour**

Western Interlock; Camino Permeare, 6” x 6”; Step Bond Installation Pattern

Pre-Wetting Elapsed Time: 14 Seconds

	Elapsed Time	Infiltration Rate
Subtest 1:	50.1 seconds	755 inches per hour
Subtest 2:	47.7 seconds	793 inches per hour
Subtest 3:	52.1 seconds	726 inches per hour
Average:	**50.0 seconds**	**855 inches per hour**

Services: Perform modified ASTM C1781 on material delivered to laboratory by paver manufacturer to determine infiltration rate of paver / aggregate system in a simulated field installation.
Terracon Rep.: Charles Schneider
Reported To:
Contractor:
Report Distribution:
(1) Western Interlock Inc, Landon Pegg

Reviewed By: Charles Schneider
Laboratory Manager

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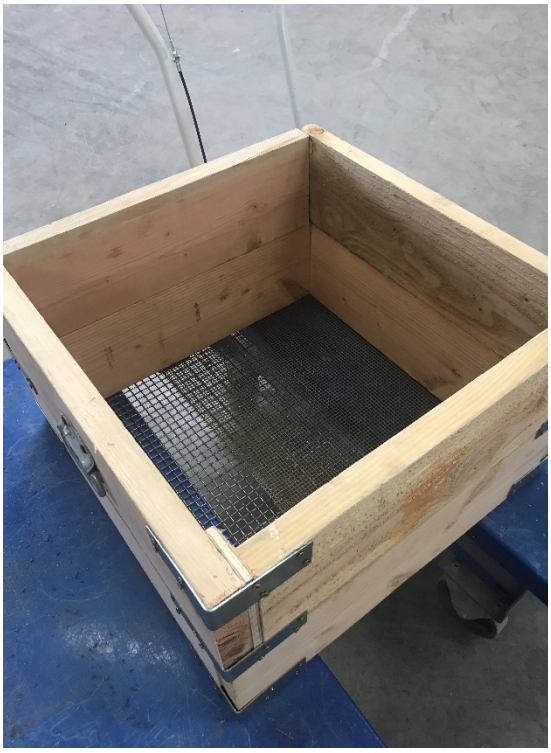

Photo #1 Empty Frame

Photo #2 Frame with Ballast Layer

Photo #3 With Levelling Course

Western Interlock Paver Infiltration Testing	Site Plan: Frame Setup	Terracon
	Report Number: 82191489.0001	
700 Ne 55th Ave	Technician: Charles Schneider	700 NE 55th Ave
Portland, OR 97213	Date: 11/27/19	Portland, OR 97213-3150
	Scale: Not to Scale	**503-659-3281**

Photo #4 Muster K as Installed

Photo #5 Muster K as Prepped (Pre-Test)

Photo #6 Herringbone as Installed

Photo #7 Herringbone as Prepped (Pre-Test)

Western Interlock Paver Infiltration Testing	Site Plan: Muster K and Herringbone	Terracon
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Photo #8 Step Bond as Installed

Photo #9 Step Bond as Prepped (Post-Test)

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