

Hydraulic Performance - Transmissivity and Permeability



A Whitepaper by:

Mike Yeats

Physical properties are defined by ASTM testing standards, The Aluminum Association Design Manual, The Naval Facilities Design Manual DM 7.2, The US Army Corps of Engineers General Design Guide: PVC Sheet Pile and/or standard engineering practice. The values shown are nominal and may vary. The information found in this document is believed to be true and accurate. No warranties of any kind are made as to the suitability of any CMI product for particular applications or the results obtained there from. Crane Materials International is a Crane Building Products® company. ShoreGuard®, The ShoreGuard Seawall System™, C-Loc®, TimberGuard®, GeoGuard®, Dura Dock®, Shore-All®, GatorGates®, GatorDock Elite™, ArmorWare™, ArmorRod™, Box Profile™, UltraComposite™, Elite Wall™, Elite Panel™, Elite Fascia Panel™, Flat Panel™, XCR™, XCR Technology™, XCR Vinyl™, GatorBridge™, Gator Aluminum™, Gator Sheet Piling™, GatorDock™, I-Beam Lock™, Textured Slate™, Crane Materials International™ logo, CMI Sheet Piling Solutions™, Aqua Terra System™, Endurance™, Endurance CSP™, Polaris™, Eclipse™, GridSpine™, 21 Poly™, PileClaw™, SheerScape™, SheerScape Retaining Wall Systems™, Sheer Panel™ and CMI Waterfront Solutions™ are trademarks, service marks or trade names of Crane Materials International. United States and International Patent numbers 4,674,921; 4,690,588; 5,292,208; 5,145,287; 6,000,883; 6,033,155; 6,053,666; D420,154; 6,575,667; 7,059,807; 7,056,066; 7,025,539; 7,393,482; 5,503,503; 5,803,672; 6,231,271; 1,245,061CA and other patents pending. © 2011 Crane Materials International. All Rights Reserved.

The movement of water can severely sabotage an engineer's efforts by degrading the strength of underlying soil and causing washout of structures, or by transporting chemicals to unwanted locations.

The long-term transmissivity and permeability capabilities of CMI's vinyl sheet piling are outstanding due to their corrosion and chemical resistance, lower cost, and tight interlocks, which have been designed to utilize the latest in sheet piling sealants. The ability to reduce flow is further enhanced by our full box section sheet piling, which have up to 1/3 the interlocks of conventional sheet piling.

Casagrande, using conventional flow net techniques, evaluated the ability of sheet piling to cut off water flow. The evaluation revealed that the efficiency of a cut-off wall was related to both the percent open area and the distribution of the interlocks.

The cut off efficiency will therefore be higher when the interlocks are broadly spaced. CMI's two-foot-wide full box sheet piling offer a 20% higher cut off efficiency versus typical sheet piling.

Geotechnics, an independent laboratory, measured the rate of water flow through our sheet piling interlocks. The results of testing for groundwater heads up to 32 feet fell within most regulatory tolerances. While the leakage through the standard interlock is minimal, applying a hydrophilic sealant will reduce the flow to an even greater extent.

Interlock Sealants

The use of hydrophilic sealants in the interlocks of sheet piling has been a common practice for many years. The ability of the sealant to expand several times its volume when coming in contact with water can effectively seal the interlocks. Sealants from Adeka Ultra-Seal are available in paste form, P-201, or a two-part liquid form, A-30. For more information about hydrophilic sealants, go to www.adeka.com.



P-201

- One-part system available in tubes
- Cure time is temperature and humidity dependent does not require interlock ends to be taped or pilings to be level
- Two times expansion by volume
- Approximately 120 feet of interlock coverage per gallon

A-30

- Two-part system requires mixing prior to application
- Quick cure time, even in sub-freezing temperatures
- Pour able consistency of heavy oil
- Interlocks must be level and ends taped
- Three times expansion by volume
- Approximately 130 feet of interlock coverage per gallon

LEAKAGE RATE TEST RESULTS

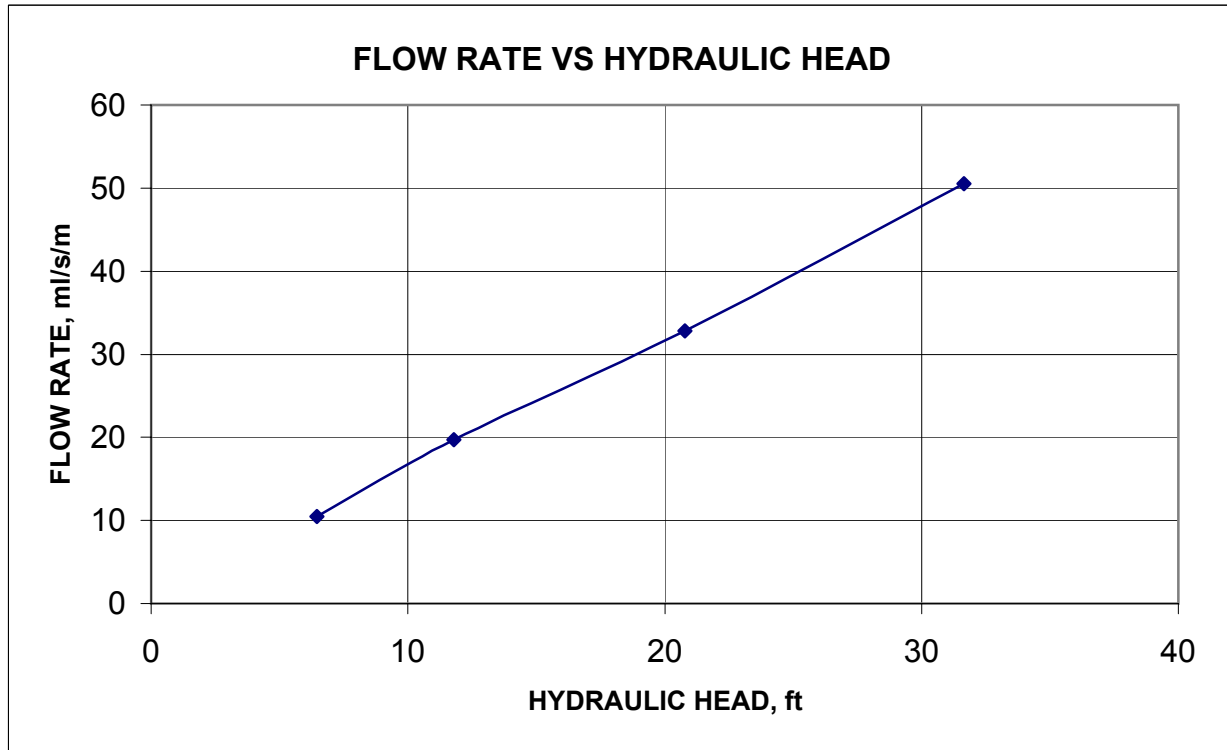


CLIENT: CRANE MATERIALS INTERNATIONAL
 PROJECT: LEAKAGE RATE TESTING
 PROJECT NO.: L01116-01
 LAB I.D. NO.: L01116-01-02
 MATERIAL: 9000 / 9900
 JOINT CONDITION: TENSION

PANEL WIDTH, w-in= 24
 WALL THICKNESS, t-in= 0.36
 TEST SPEC. LENGTH, L-in= 10.00

LEAK TEST DATA					Flow Rate per Meter of Joint ml/s/m	Hydraulic Gradient i	Transmissivity m ² /s	"Equivalent" Permeability* cm/s
Pressure Head h,psi	Pressure Head ft of Water	Flow Volume q, ml	Coll. Time t,sec	Flow Rate ml/s				
2.8	6.47	160	60	2.7	10.5	215	4.87E-08	8.00E-06
5.1	11.78	300	60	5.0	19.7	392	5.02E-08	8.23E-06
9	20.79	500	60	8.3	32.8	692	4.74E-08	7.77E-06
13.7	31.64	770	60	12.8	50.5	1054	4.79E-08	7.86E-06

*Equivalent Permeability of the wall section assuming that leakage is distributed uniformly across the panel width and the thickness for head loss is equal to the wall thickness.



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DATE: 11-13-03



LEAKAGE RATE TEST RESULTS

CLIENT: **CRANE MATERIALS INTERNATIONAL**
 PROJECT: **LEAKAGE RATE TESTING**
 PROJECT NO.: **L01116-04**
 LAB I.D. NO.: **L01116-04-01**
 MATERIAL: **9000 / 9900**
 JOINT SEALANT: **ADEKA A-50**

PANEL WIDTH, w-in= **24**
 WALL THICKNESS, t-in= **0.28**
 TEST SPEC. LENGTH, L-in= **10**

Elapsed Time hrs	LEAK TEST DATA					Flow Rate per Meter of Joint ml/s/m	Hydraulic Gradient i	Transmissivity m ² /s	"Equivalent" Permeability* cm/s
	Pressure Head h,psi	Pressure Head ft of Water	Flow Volume q, ml*	Coll. Time t,sec	Flow Rate ml/s				
2	5.1	11.78	<1	23000	0.0	0.0	504	3.39E-13	<5.6E-11
2	13.7	31.64	<1	7200	0.0	0.0	1355	4.04E-13	<6.6E-11

* A unit of 1ml is arbitrarily used as a "detection limit" for the purposes of calculating a permeability value.

*Equivalent Permeability of the wall section assuming that leakage is distributed uniformly across the panel width and the thickness for head loss is equal to the wall thickness.

NOTES: 1) No visible leak sites during the tests.

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