TECHNICAL REFERENCE

REACTIVE CORE MAT® BIOLOGICAL CLOGGING

Reactive Core Mat® (RCM), as manufactured, has a certified hydraulic conductivity of 10^{-3} cm/s per modified ASTM D4491. There are impacts that need to be considered in the long-term field flow rate of RCM, including sediment clogging and biological clogging (biofouling). Koerner (2005) discusses 'reduction factors' to account for the effect of five potential impacts on flow rate in the following equation.

$$q_{allow} = q_{ult}\left(\frac{1}{RF_{SCB} \times RF_{CR} \times RF_{IN} \times RF_{CC} \times RF_{BC}}\right)$$

where q_{allow} = allowable flow rate
q_{ult} = ultimate flow rate
RF_{SCB} = reduction factor for soil clogging and blinding
RF_{CR} = reduction factor for creep reduction of void space
RF_{IN} = reduction factor for adjacent materials intruding into geotextile void space
RF_{CC} = reduction factor for chemical clogging
RF_{BC} = reduction factor for biological clogging

Koerner (2005) has compiled a table (Table 1.12) of typical ranges of reduction factors.

	Range of Reduction Factors				
Application	Soil Clogging And Binding [1]	Creep Reduction Of Voids	Intrusion Into Voids	Chemical Clogging[2]	Biological Clogging
Retaining wall filters	2.0-4.0	1.5-2.0	1.0-1.2	1.0-1.2	1.0-1.3
Underdrain filters	2.0-10	1.0-1.5	1.0-1.2	1.2-1.5	2.0-4.0[3]
Erosion control filters	2.0-10	1.0-1.5	1.0-1.2	1.0-1.2	2.0-4.0
Landfill filters	2.0-10	1.5-2.0	1.0-1.2	1.2-1.5	2.0-5.0 [3]
Gravity drainage	2.0-4.0	2.0-3.0	1.0-1.2	1.2-1.5	1.2-1.5
Pressure drainage	2.0-3.0	2.0-3.0	1.0-1.2	1.1-1.3	1.1-1.3

[1] If stone riprap or concrete blocks cover the surface of the geotextile, use the upper values or include an addition reduction factor.
[2] Values can be higher, particularly for high alkalinity groundwater.
[3] Values can be higher for turbidity and/or microorganism contents greater than 5000 mg/l.

Soil clogging typically results in a range of two to ten times decrease in geotextile flow rate. Sediment clogging can be evaluated with a modified version of ASTM D5101, the geotextile gradient ratio test, using representative samples of the RCM and site sediment (see TR-844). Site-specific conditions can result in higher values. However, using a sand bedding layer over the sediments can help mitigate the effect of soil clogging. This can be tested as well using the RCM, sand bedding layer and sediment in the gradient ratio test ASTM D5101. Creep, intrusion and chemical clogging typically have modest effect on flow, as shown in the table.

Biological fouling typically results in a range of one to five times decrease in geotextile flow rate. The higher values are for use in landfill and in contact with landfill leachate, an extreme condition. Biofouling has not been reported to have a significant effect on the hydraulic performance of any types of RCM installed to date. Approximately 35,000 square feet of organoclay RCM was installed at McCormick and Baxter Superfund site in fall 2005. A six inch sand bedding layer was placed over the sediment. Three years later in fall 2008 the RCM area was inspected and RCM specimens were exhumed. There was a biological film visible on the RCM. Third party laboratory tested indicated that the exhumed RCM had a hydraulic conductivity per modified ASTM D4491 of 5.9 x 10^{-2} cm/s. A virgin sample from the same RCM lot tested by the third party laboratory yielded a hydraulic conductivity of 1.7x10^{-1} cm/s. This yields an approximate three times decrease in hydraulic conductivity. Some of this decrease may be attributable to the other factors, such as soil clogging. The hydraulic conductivity was still well above the certified hydraulic conductivity.

Typically there would need to be orders of magnitude decrease in hydraulic conductivity to significantly affect RCM flow rate. Site-specific conditions can result in higher values, but typically geotextiles and RCM flow rates are not significantly affected by biofouling.

References

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JLT Laboratories, Inc. Report 08LG1421.01. Canonsburg, PA. 2008.
Koerner, R.M., Designing with Geosynthetics, Fifth Edition. Pearson Prentice Hall, Upper Saddle River, NJ. 2005