R-TANK LONG TERM CREEP TEST

When dealing with underground detention systems, it is important to consider the long-term effects of Creep. Creep can be defined as the tendency of a system to deform under a load over time[1].

Virtually all systems, regardless of what type of material they are made from, are subjected to some amount of Creep. As a result, it is useful to ensure the system selected for your project has undergone testing for Creep. R-Tank is one of the only modular systems available with 180 Day Creep Testing which can be used to predict the system's performance over a 40+ year time span.

Creep is dependent on a number of factors including time, temperature, and load. Most underground systems benefit from a very stable temperature range, so time and load are the most important factors affecting Creep.

TIME: Deformation increases over time, so the longer the system is subjected to a load, the more it will Creep. Predicting the amount of future Creep is limited by the duration of the testing performed. Testing data can be extrapolated by two orders of magnitude[2], meaning 180 Day Creep Testing can predict performance for 18,000 days (nearly 50 years).

LOAD: The Loads used in Creep Testing should approximate the in-situ loads that will be experienced. However, using heavier loads will yield more conservative results. Typical dead loads over a standard R-Tank System range from 1.8 psi (for 24" of cover) to 5.4 psi (at 6' of cover). At shallow depths, dynamic loads can significantly increase the total load applied to the System, although these loads occur over a far shorter time span.

To study the effects of Creep on the Long-Term performance of the R-Tank System, an extremely heavy load of 15.22 psi (24,465 lbs) was placed over four unconfined double R-Tank Modules for 180 days. Settlement of the load was measured and recorded during the test, which was performed using guidance from CIRIA C609. Even under this extremely heavy load the R-Tank^{HD} can be predicted to perform successfully for at least 40 years.

Time Elapsed	Initial Settlement (inches / mm)	Creep Displacement (inches / mm)	Creep Strain (%)	Total Strain (%)
90 Days	0.1" / 2.15 mm	0.1909" / 4.85 mm	0.564%	0.814%
180 Days	0.1" / 2.15 mm	0.2004" / 5.09 mm	0.592%	0.842%

This data can be extrapolated to predict the 20 and 40 year creep deflection of the units.

Prediction Period	Initial Settlement (inches / mm)	Creep Displacement (inches / mm)	Creep Strain (%)	Total Strain (%)
20 Years	0.1" / 2.15 mm	0.2516" / 6.39 mm	0.743%	0.993%
40 Years	0.1" / 2.15 mm	0.2610" / 6.63 mm	0.771%	1.021%

Creep testing on the Heavy Duty R-Tank^{HD} (5-Plate) was done using four Double R-Tanks^{HD}, also unconfined.

1. Wikipedia – Creep (Deformation); http://en.wikipedia.org/wiki/Creep_(deformation)
2. CIRIA C680 - Structural Design of Modular Geocellular Drainage Tanks; Steve Wilson, The Environmental Protection Group Ltd.

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