Connection Strength Testing Summary According to ASTM D6638

The following tech sheet summarizes the contents of ASTM D6638 Test Method and provides guidelines when interpreting connection strength data for Allan Block Retaining Wall Design. This summary provides the most commonly used information, but Allan Block does not claim that all information in the test method is represented in this Tech Sheet.

TEST OBJECTIVE

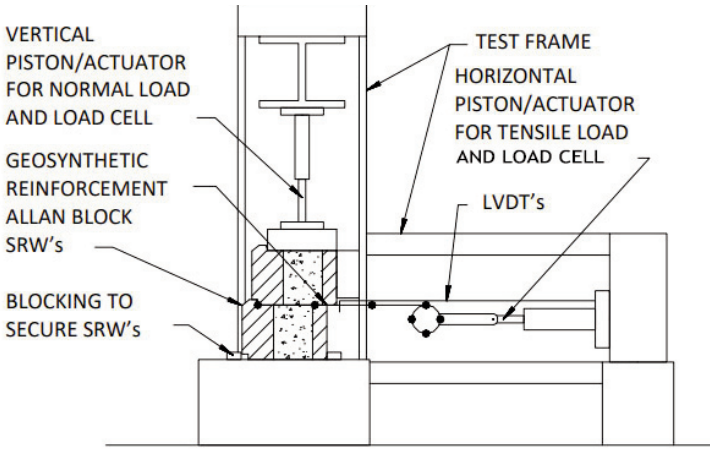
The objective of ASTM D6638, "Standard Test Method for Determining Strength Between Geosynthetic Reinforcement and Segmental Concrete Units" is to define the connection strength between a layer of geosynthetic reinforcement and concrete segmental retaining wall units (SRWs). The result of the test is a linear empirical design equation that is a function of normal load, or the height of the stacked retaining wall units above the connection.

TEST METHOD & PROCEDURE

The test method involves building a test specimen that is as close as possible to a replica of a field construction specimen. This includes using full scale SRW units and geosynthetic reinforcement. The SRW units are filled with granular infill and compacted with a vibratory compactor meeting the Allan Block specifications for installation. The minimum width of the SRW specimen is 42 in (1060 mm) and the minimum width of the geosynthetic specimen is 36 in (910 mm).

The test specimen is constructed in a frame that will not yield under the stresses of the test. The blocks must be secured in the frame, preventing movement during the test. The frame is designed to be able to apply normal load at a uniform constant pressure with a vertical piston/actuator. A horizontal piston/actuator is used to apply a tensile load to a constant deformation rate. Load cells are used on both the vertical normal load and horizontal tensile load to measure the magnitude of the load throughout the test. Finally, two Linear Variable Displacement Transducers (LVDT's) are used to measure the horizontal displacement of the geogrid during the test.

Figure 1 - Connection Strength Testing Frame



The test is run numerous times in order to determine the relationship between connection strength or horizontal tensile load and the vertical normal load. The normal load is varied for each different test run generating different connection strengths at failure. Failure is defined as the Ultimate State. The ultimate (peak) connection load will occur immediately before the system fails such as the geogrid ruptures, the geosynthetic slips out of the SRWs, the SRWs lifts up or the SRWs fracture.

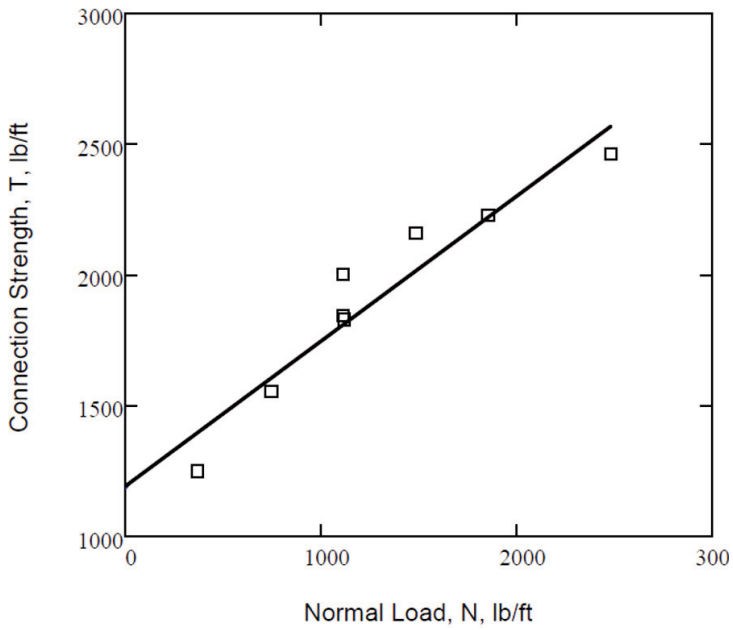
In order to ensure the validity of the test one single normal load level is repeated three times. The results of those three repetitions must agree within 10% from the mean of the three tests.

TEST RESULT INTERPRETATION

The results of the connection strength test are linear design equations. They can be compared to the actual tensile load on any given geosynthetic layer to determine the factor of safety for their connection. The equations are a function of normal load. The normal load is based on the height of wall above the connection elevation and the density of the SRWs including the granular infill.

These equations are empirical, based on the best fit line to the data points. Often in order to fit the data accurately a two segment data fit is used. This results in one equation for the lower normal loads and another for the higher normal loads. In design it is required to identify the normal load that separates the two segments. Therefore, up to two equations are used to describe the ultimate condition.

Figure 2 - Sample Test Result



Example Based on Figure 2: determine the Ultimate State Connection Strength for N = 863 lb/ft

Ultimate State	T_{u1}=1000 lb/ft + N tan 30° or T_{u2} =1800 lb/ft + N tan 8°
Separating Normal Load	1000 lb/ft + N tan 30° = 1800 lb/ft + N tan 8°
	N=(1800 lb/ft – 1000 lb/ft)/(tan 30° - tan 8°) N=1,831 lb/ft
Therefore use T_{u1}	T_{u1} = 1000 lb/ft + (863 lb/ft) tan 30°
	$\boxed{T_{u1} = 1{,}498.3 \text{ lb/ft}}$