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AB Tech Sheet

Connection and Shear Test Summaries

The following tech sheet provides the basic understanding of Allan Block results of the two most widely used tests in the design of Segmental Retaining Walls, the determination of geogrid connection and block shear strength, ASTM D6638 and D6916 respectively.

ASTM D6638: CONNECTION TESTING

Allan Block has always been a leader in the SRW industry by thoroughly testing our products to the highest of industry standards. ASTM D6638 determines the grid pullout capacities or connection strength of a SRW to the geogrid reinforcement. Allan Block's patented "Rock-Lock Connection" provides a continuous positive interlocking of the geogrid to the aggregate filled cores of the Allan Block unit. (See Figure 1) Allan Block has completed ASTM D6638 tests at the University of Wisconsin – Platteville, Bathurst Clarabut Geotechnical Testing (BCGT), and the National Concrete Masonry Association (NCMA) test facilities among others on many different grid families. The results in Figure 2 are for TenCata Miragrid 3XT. The strength of the Rock-Lock connection allows the connection strength to well exceed the Long Term Allowable Design Strength (LTDS) as the normal loads increase. In fact, the lower strength grids perform so efficiently with the Rock-Lock connection that the Ultimate strength nearly reaches the grids LTDS at the lowest applied normal load or the y-intercept. For these and other test summaries please contact the Allan Block Engineering Department.

FIGURE 1

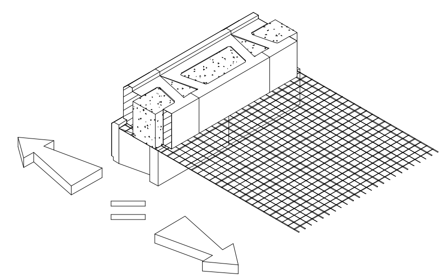


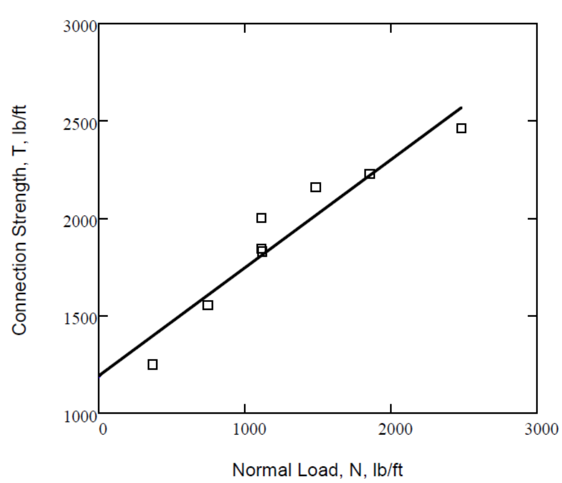
FIGURE 2

Miragrid 3XT

Design Equations

Ultimate Connection Strength
Segment 1
Tu = 1193 lb/ft + N tan (29°)
(Tu = 17.4 kN/m + N tan (29°))
maximum = 2463 lb/ft (24.6 kN/m)

Long Term Allowable Strength
LTDS = 1999 lb/ft (29.1 kN/m)



ASTM D6916: INTERFACE SHEAR STRENGTH

Shear testing has been commonly used to determine the effective internal shear resistance of one course of block relative to the next. Figure 3 shows the three pieces that together make up the total resistance, Shear Key (Upper Lip), Block-to-Block Friction and the aggregate Rock Lock. Testing was performed on AB products having a 2 inch (50mm) lip, a 1.5 inch (38mm) lip, and the AB Rocks which was a 2.5 inch (64mm) lip. The AB Rocks unit tested so well they did not shear under test conditions. The shear equations are shown in Figure 4. Testing with a layer of geogrid between courses is designed to be a worst-case condition as the grid acts as a slip surface reducing the contributions from Block Friction and aggregate Rock Lock. In the case of the 2 inch lip results, they were so great with the grid layer in place that a block-to-block test was not run.

FIGURE 3

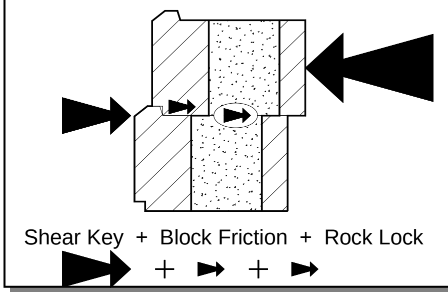


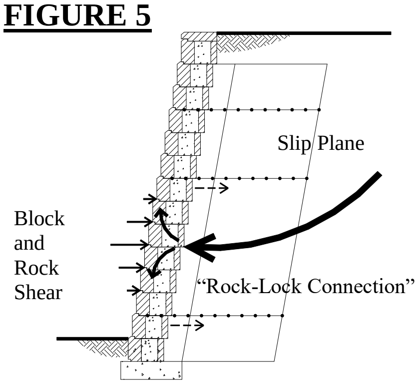
FIGURE 4 Shear Test Results

AB 2" (50mm) Lip w/ Geogrid Layer
Vu=2614 + N tan (41.98°)
(Vu = 38.1 kN/m + tan (41.98°))

AB 1.5" (38mm) Lip w/ Geogrid Layer
Vu_1=1381.6 lb/ft + N tan (32.21°)
(Vu_1 = 20.1 kN/m + tan (32.21°))

New design theories are recognizing the added benefit of a high shear connection between layers of stackable block when analyzing resistance to geogrid pullout. Careful analysis reveals that in order for geogrid to be dislodged from its position between two blocks, one of two things must happen. Either the entire wall facing must rotate forward or there must be relative motion between blocks. Once a wall reinforced with geogrid has been properly constructed, minimal stresses are present at the back of the entire wall. This negates the possibility that the controlling factor will be forward rotation of the entire wall facing.

FIGURE 5



LOCALIZED WALL STABILITY

To achieve relative motion between blocks in an SRW wall, the design consideration that will most often be the governing feature may be referred to as the localized stability. In the event that a slip plane is formed between layers of reinforcement, (caused by excessive hydrostatic pressure, a surcharge or slope above the reinforced mass, or excessive spacing between reinforcement layers) grid pullout and shear act together as critical design elements. In this failure mode, some displacement must occur in the connection of at least one of the bordering grid layers, and one or more courses of block must fail in shear. In this design condition the shear capacity between units must be added to the block-to-grid connection strength to account for what really happens in the wall. For a failure of this type to occur, the forces behind the wall must be greater than the shear and pullout strengths combined. This overlooked design feature provides for a transfer of a portion of the tensile loads away from the positive grid interlock and distributes these loads throughout the face of the wall.

COMPETITIVE ADVANTAGE

The raised front shear lip and granular infill in an Allan Block Wall provides a better engineering solution than the pin type interlock systems offered by many other retaining wall systems. By understanding this concept, you will understand why Allan Block retaining walls perform better than the competition.