Allen Block Modular Retaining Wall Systems Specification Guidelines

The following specifications provide Allen Block Corporation's typical requirements and recommendations. At the engineer of record's discretion these specifications may be revised to accommodate site specific design requirements.

SECTION 1

Part 1: General

1.1 Scope

Work includes furnishing and installing modular concrete block retaining wall units to the lines and grades designated on the construction drawings and as specified herein.

1.2 Applicable Sections of Related Work

Section 2: Geogrid Wall Reinforcement

1.3 Reference Standards

A. ASTM C1372 Standard Specification for Segmental Retaining Wall Units.

B. ASTM C1262 Evaluating the Freeze thaw Durability of Manufactured CMU's and Related concrete Units

C. ASTM D698 Moisture Density Relationship for Soils, Standard Method

D. ASTM D422 Gradation of Soils

E. ASTM C140 Sample and Testing concrete Masonry Units

1.4 Delivery, Storage, and Handling

A. Contractor shall check the materials upon delivery to assure proper material has been received.

B. Contractor shall prevent excessive mud, cementitious material, and like construction debris from coming in contact with the materials.

C. Contractor shall protect the materials from damage. Damaged material shall not be incorporated in the project (ASTM C1372).

PART 2: MATERIALS

2.1 Modular Wall Units

A. Wall units shall be Allen Block Retaining Wall units as produced by a licensed manufacturer.

B. Wall units shall have minimum 28 day compressive strength of 3000 psi (20.7 MPa) in accordance with ASTM C1372. The concrete units shall have adequate freeze-thaw protection with an average absorption rate in accordance with ASTM C1372 or an average absorption rate of 7.5 lb/ft^3 (120 kg/m^3) for northern climates and 10 lb/ft^3 (160 kg/m^3) for southern climates.

C. Exterior dimensions shall be uniform and consistent. Maximum dimensional deviations on the height of any two units shall be 0.125 in. (3 mm).

D. Wall units shall provide a minimum of 110 lbs total weight per square foot of wall face area (555 kg/m^2). Fill contained within the units may be considered 80% effective weight.

E. Exterior face shall be textured. Color as specified by owner.

2.2 Wall Rock

A. Material must be well-graded compactable aggregate, 0.25 in. to 1.5 in., (6 mm – 38 mm) with no more than 10% passing the #200 sieve. (ASTM D422)

B. Material behind and within the blocks may be the same material.

2.3 Infill Soil

A. Infill material shall be site excavated soils when approved by the on-site soils engineer unless otherwise specified in the drawings. Unsuitable soils for backfill (heavy clays or organic soils) shall not be used in the reinforced soil mass. Fine grained cohesive soils ($\varphi<31$) may be used in wall construction, but additional backfilling, compaction and water management efforts are required. Poorly graded sands, expansive clays and/or soils with a plasticity index (PI) >20 or a liquid limit (LL) >40 should not be used in wall construction.

B. The infill soil used must meet or exceed the designed friction angle and description noted on the design cross sections, and must be free of debris and consist of one of the following inorganic USCS soil types: GP, GW, SW, SP meeting the following gradation as determined in accordance with ASTM D422.

Sieve Size	Percent Passing
4 inch (100 mm)	100 – 75
No. 4 (4.75 mm)	100 – 20
No. 40 (0.425 mm)	0 – 60
No. 200 (0.075 mm)	0 – 35

C. Where additional fill is required, contractor shall submit sample and specifications to the wall design engineer or the onsite soils engineer for approval and the approving engineer must certify that the soils proposed for use has properties meeting or exceeding original design standards.

PART 3: WALL CONSTRUCTION

3.1 Excavation

A. Contractor shall excavate to the lines and grades shown on the construction drawings. Contractor shall use caution not to over-excavate beyond the lines shown, or to disturb the base elevations beyond those shown.

B. Contractor shall verify locations of existing structures and utilities prior to excavation. Contractor shall ensure all surrounding structures are protected from the effects of wall excavation.

3.2 Foundation Soil Preparation

A. Foundation soil shall be defined as any soils located beneath a wall.

B. Foundation soil shall be excavated as dimensioned on the plans and compacted to a minimum of 95% of Standard Proctor (ASTM D698) prior to placement of the base material.

C. Foundation soil shall be examined by the on-site soils engineer to ensure that the actual foundation soil strength meets or exceeds assumed design strength. Soil not meeting the required strength shall be removed and replaced with acceptable material.

3.3 Base

A. The base material shall be the same as the Wall Rock material (Section 2.2) or a low permeable granular material.

B. Base material shall be placed as shown on the construction drawing. Top of base shall be located to allow bottom wall units to be buried to proper depths as per wall heights and specifications.

C. Base material shall be installed on undisturbed native soils or suitable replacement fills compacted to a minimum of 95% Standard Proctor (ASTM D698).

D. Base shall be compacted at 95% Standard Proctor (ASTM D698) to provide a level hard surface on which to place the first course of blocks. The base shall be constructed to ensure proper wall embedment and the final elevation shown on the plans. Well-graded sand can be used to smooth the top 1⁄2 in. (13 mm) on the base material.

E. Base material shall be a 4 in. (100 mm) minimum depth for walls under 4 ft (1.2 m) and a 6 in. (150 mm) minimum depth for walls over 4 ft (1.2 m).

3.4 Unit Installation

A. The first course of wall units shall be placed on the prepared base with the raised lip facing up and out and the front edges tight together. The units shall be checked for level and alignment as they are placed.

B. Ensure that units are in full contact with base. Proper care shall be taken to develop straight lines and smooth curves on base course as per wall layout.

C. Fill all cores and cavities and a minimum of 12 in. (300 mm) behind the base course with wall rock. Use infill soils behind the wall rock and approved soils in front of the base course to firmly lock in place. Check again for level and alignment. Use a plate compactor to consolidate the area behind the base course. All excess material shall be swept from top of units.

D. Install next course of wall units on top of base course. Position blocks to be offset from seams of blocks below. Perfect “running bond” is not essential, but a 3 in. (75 mm) minimum offset is recommended. Check each block for proper alignment and level. Fill all cavities in and around wall units and to a minimum of 12 in. (300 mm) depth behind block with wall rock. For taller wall application the depth of wall rock behind the block should be increased; walls from 15 ft (4.57 m) to 25 ft (7.62 m) should have a minimum of 2 ft (0.61 m) and walls above 25ft (7.62 m) should have a minimum of 3 ft (0.9 m). Spread infill soil in uniform lifts not exceeding 8 in. (200 mm) in uncompacted thickness and compact to 95% of Standard Proctor (ASTM D698) behind the consolidation zone.

E. The consolidation zone shall be defined as 3 ft (0.9 m) behind the wall. Compaction within the consolidation zone shall be accomplished by using a hand operated plate compactor and shall begin by running the plate compactor directly on the block and then compacting in parallel paths from the wall face until the entire consolidation zone has been compacted. A minimum of two passes of the plate compactor are required with maximum lifts of 8 in. (200 mm). Expansive or fine-grained soils may require additional compaction passes and/or specific compaction equipment such as a sheepsfoot roller.Maximum lifts of 4 inches (100 mm) may be required to achieve adequate compaction within theconsolidation zone. Employ methods using lightweight compaction equipment that will not disrupt the stability or batter of the wall. Final compaction requirements in the consolidation zone shall beestablished by the engineer of record.

F. Install each subsequent course in like manner. Repeat procedure to the extent of wall height.

G. As with any construction work, some deviation from construction drawing alignments will occur. Variability in construction of SRWs is approximately equal to that of cast-in-place concrete retaining walls. As opposed to cast-in-place concrete walls, alignment of SRWs can be simply corrected or modified during construction. Based upon examination of numerous completed SRWs, the following recommended minimum tolerances can be achieved with good construction techniques.

VERTICAL CONTROL:	±1.25 in. (32 mm) max. over 10 ft (3 m) distance
HORIZONTAL LOCATION CONTROL:	Straight lines ±1.25 in. (32 mm) over a 10 ft (3 m) distance.
ROTATION:	From established plan wall batter: 2.0°
BULGING:	1.0 in. (25 mm) over a 10 ft (3.0 m) distance

3.5 Additional Construction Notes

A. When one wall branches into two terraced walls, it is important to note that the soil behind the lower wall is also the foundation soil beneath the upper wall. This soil shall be compacted to a minimum of 95% of Standard Proctor (ASTM D698) prior to placement of the base material. Achieving proper compaction in the soil beneath an upper terrace prevents settlement and deformation of the upper wall. One way is to replace the soil with wall rock and compact in 8 in. (200 mm) lifts. When using on-site soils, compact in maximum lifts of 4 in. (100 mm) or as required to achieve specified compaction.

B. Filter fabric use is not suggested for use with cohesive soils. Clogging of such fabric creates unacceptable hydrostatic pressures in soil reinforced structures. When filtration is deemed necessary in cohesive soils, use a three dimensional filtration system of clean sand or filtration aggregate.

C. Embankment protection fabric is used to stabilize rip rap and foundation soils in water applications and to separate infill materials from the retained soils. This fabric should permit the passage of fines to preclude clogging of the material. Embankment protection fabric shall be a high strength polypropylene monofilament material designed to meet or exceed typical Corps of Engineers plastic filter fabric specifications (CW-02215); stabilized against ultraviolet (UV) degradation and typically exceeding the values in Table 1, page 8 of the AB Spec Book.

D. Water management is of extreme concern during and after construction. Steps must be taken to ensure that drain pipes are properly installed and vented to daylight and a grading plan has been developed that routes water away from the retaining wall location. Site water management is required both during construction of the wall and after completion of construction.

3.6 Manufacturers Recommendations- Operations and Maintenance

While Concrete Segmental Retaining Walls are considered to be robust in resisting the effects of deicing chemicals, chlorides can be harmful to concrete, steel and other building materials depending on the type, concentration and frequency of application. Reports recently published by the University of Kansas, and other agencies, shed new light on the degree of physical and chemical damage certain types of deicers cause. They found:

A. At lower concentrations, sodium chloride/rock salt (NaCl) and calcium chloride ($CaCl_2$) have a relatively small negative impact.

B. At low concentrations magnesium chloride ($MgCl_2$) and calcium magnesium chloride (CMA) can cause measureable damage.

C. At higher concentrations, NaCl has a greater but still relatively small negative effect.

D. At high concentrations, $CaCl_2$, $MgCl_2$ and CMA can attack cement paste causing significant damage that results in the loss of material, reduced strength and increased porosity.

Note: While not evaluated in this study it is our opinion that Potassium Chloride based deicers can adversely affect concrete

In light of this information, we recommend sand as the preferred method for providing skid and slip resistance. It can be applied liberally and as often as needed for traction control against slipping and skidding on pedestrian and vehicular pavements. Sand provides a visual reference of its presence and can be felt underfoot as a tangible medium aiding foot traffic. Clean, untreated sand has no corrosive effect on steel, metal, clay brick, cast in-place concrete or concrete pavers. It can be swept or vacuumed off of rugs placed at entryways to collect sand before it is tracked into buildings or it can be swept into the walkway joints.

Sand offers other distinct advantages over ice melt chemicals. Ice is most slippery when wet. Unlike deicing chemicals, sand provides traction as ice melts. Further, as deicers dissolve snow and ice, the chemicals create melt water. As the melt water accumulates on the surface it dilutes the deicer and re-freezes requiring additional applications of deicer. The nature of the process results in higher concentrations of deicing chemical being applied then the safe limits recommended by the deicer manufacturer.

CONSULT THE ALLEN BLOCK ENGINEERING DEPARTMENT FOR DETAILS AT 800-899-5309.
Specification subject to change without notice, this was last updated on 03/02/2009.