Sample Project

Page Index
1. Specifications
2. General Notes
3. Plan View
4. Elevation View
5. Section View
6. Construction Details
7. Worksheet
8. AB Classic
Disclaimer
Allan Block provides this software as a service for its clients. The sole purpose of this software is to assist engineers in the design of mechanically stabilized retaining walls. The software uses evaluation techniques and engineering principles found in the Allan Block Engineering Manual. (Refer to R0904 and supporting references.) It is the responsibility of the engineer of record to determine the propriety and accuracy of input parameters and to review and verify the correctness of the results. ALLAN BLOCK CORPORATION, ITS LICENSEES OR AGENTS DO NOT ASSUME ANY LIABILITY OR RESPONSIBILITY FOR DAMAGES WHICH MAY RESULT FROM THE USE OR MISUSE OF THIS SOFTWARE.

This software only considers internal, external and internal compound stability of the reinforced composite mass. The internal compound stability calculations are limited to an evaluation zone above the base material and back no further than 2 * H or He + L, whichever is greater. This program DOES NOT address global stability, defined as soil stability below the base material and beyond the limits for internal compound stability. Global Stability should be evaluated to determine if the overall site is stable. It is the responsibility of the owner to ensure the global stability is analyzed. The engineer of record must evaluate the project site for proper water management and all potential modes of failure within the segmental retaining wall evaluation zone. The geotechnical engineering firm contracted by the owner should provide a full global stability opinion of the site including the effects on the segmental retaining wall.

AB Walls 15 contains DEFAULT values for all data inputs that the user MUST change or verify as appropriate for the project conditions being analyzed. These DEFAULT values do NOT ensure a conservative design for any site condition. The final design must provide for proper wall drainage to prevent the buildup of hydrostatic pressures over the service life of the structure. In the event additional water is introduced into the general wall area, either above or below grade, any designs from this software would be invalid unless otherwise noted by the engineer of record. It is also recommended that an independent assessment of the foundation soil for settlement potential and wall deflections for the proposed structure be performed. Changes in the subsoil conditions are not included in this software. These additional potential failure modes should be evaluated by the engineer of record prior to initiating wall construction and may require site inspection by the on-site soils engineer. All installations must conform to the Allan Block Spec Book. (Refer to R0901).

MathCAD files for hand calculations to support the software's consideration of internal, external and internal compound stability of the reinforced composite mass are provided on the software disc. These files are to be configured so that the engineer of record can evaluate the output of the software. Individual equations may be altered at the discretion of the engineer of record.
Specification Guidelines: Allan Block Modular Retaining Wall Systems

The following sections provide Allan Block Corporation’s typical requirements and recommendations. At the engineer of record’s discretion, these specifications may be revised to accommodate specific design requirements.

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: Geotechnical Reinforcement

1.3 References - Standards

A. ASTM C1372 Standard Specification for Segmental Retaining Wall Units

B. ASTM C1799 Evaluating the Freeze- thaw Durability of Manufactured CEMs and Related Concretes

C. ASTM D6588 Moisture Density Relationship for Soils, Standard Method

D. ASTM D5422 Gradation of Soil

E. ASTM C140 Sample and Testing Concrete Masonry Units

1.4 Delivery, Storage, and Handling

A. Contractor shall check the materials upon delivery to ensure 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 Allan Block Retaining Wall units as produced by a licensed manufacturer.

B. Wall units shall have minimum 38 day compressive strength of 3000 psi (20.7 MPa) in accordance with ASTM C1372. This concrete unit shall have adequate freeze-thaw protection with an average absorption rate in accordance with ASTM C1372 or an average absorption rate of 7.5 lib/(ft2)(120 kg/m²) for northern climates and 11 lib/(ft2)(190 kg/m²) for southern climates.

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

D. Wall units shall provide a minimum of 100 lbs total weight per square foot of wall face area (555 kg/m²). Hollow cores to be filled with wall rock and compacted by using plate compactor on top of wall units (see Section 3.5).

E. Unit weight of wall rock may be less than 100% depending on compaction levels.

F. Freeze-thaw Durability: Like all concrete products, dry-cast concrete SRW units are susceptible to freeze-thaw degradation, however, Allen Block Stonemaster SRW units are designed to withstand the freeze-thaw degradation. The standard freeze-thaw cycles of the tests conducted during the qualification of Allen Block Stonemaster SRW units are as follows:

i. Freeze-thaw cycles: 12 cycles (4 in. [10 cm] depth) behind the base course with wall rock. Use unflint or flint rock behind the wall rock and approved soils in front of the base course to firmly lock in place. Check for final alignment and elevation, or if required, compact the soil behind the base course. All excess material shall be swept from top of units.

ii. Freeze-thaw cycles: 12 cycles (4 in. [10 cm] depth) behind the base course. Fill all cavities in and around wall units and to a minimum of 12 in. (30 cm) depth behind wall rock. Block, wall rock and flint soil placed in uniform lifts not exceeding 8 in. (200 mm). Compaction requirements for all soils in areas in and around the reinforced mass shall be compacted to 95% of Standard Proctor (ASTM D698) with a moisture content control of −3% to +5% of optimum.

2.2 Rock Wall

A. Material must be well-graded, competent aggregate, 0.25 in. to 1.5 in. (6 mm - 38 mm) with no more than 10% passing the #200 mesh (425 µm). Material behind and within the block wall may be the same material.

2.3 Infill Soil

A. Infill soil shall be excavated soils when approved by the on-site soils engineer unless otherwise specified in the drawings. Infiltration soils suitable for backfill (heavy or organic) soils shall not be used in the reinforced soil mass. Fine gradation products, especially reconstituted soils or materials with a plasticity index (PI) greater than 20 or a liquid limit (LL) greater than 40 should not be used in wall construction.

B. The infill soil used must exceed the design and construction requirements and be placed with a thickness of at least 30 cm (12 in.) below the finished ground surface. Infill soils shall be placed with a minimum thickness of 12 in. (30 cm) in all locations as specified.

C. Where additional fill is required, contractor shall submit samples 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 have properties meeting or exceeding standard design.

PART 3: WALL CONSTRUCTION

3.1 Contractor Requirements

Contractors shall be trained and certified by the manufacturer or equivalent accredited organization.

A. Allan Block and NCHRA have certification programs that are accredited. Identify when advanced certification levels are appropriate based on site proximity and complexity of project application.

B. Contractors shall provide a list of projects they have completed.

3.2 Excavation

A. Contractor shall excavate to the lines and grades shown on the construction drawings. Contractor shall use caution to avoid damage to the base structure as described in Section 3.3.

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.

3.3 Foundation Soil Preparation

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

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

C. Foundation soil shall be compacted at 95% Standard Proctor (ASTM D698) to provide a level base surface on which to place the wall units.

D. Base wall units shall be compacted 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.

3.4 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 base surface on which to place the foundation soil.

3.5 Unit Installation

A. Lists units in accordance with the manufacturer’s recommendations for the specific concrete retaining wall unit, as specified herein.

B. Ensure units are in full contact with base. Proper care shall be taken to develop straight lines and smooth contours on the base course and wall face.

C. Units shall be placed with a minimum of 12 in. (30 cm) depth behind the base course with wall rock. Use unflint or flint rock behind the wall rock and approved soils in front of the base course to firmly lock in place. Check for final alignment and elevation or if required, compact the soil behind the base course. All excess material shall be swept from top of units.

3.6 Additional Construction Notes

- Preliminary - Not for Construction
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 well-graded compacted 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. Vertical filter fabric use is not suggested for use with cohesive soils. Clogging of such fabric creates unacceptable hydraulic 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. Vertical Filter fabric may be used to separate the wall rock zone from fine graded, sandy infill soils if the design engineer deems it necessary based on potential water migration from above or below grade, through the reinforced zone into the wall rock on the project. Horizontal filter fabric should be placed above the wall rock column to prevent soils from migrating into the wall rock column.

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-22215); stabilized against ultraviolet (UV) degradation and typically exceeding the values in Table 1, page 7 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 or connected to an underground drainage system 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.
Specification Guidelines: Geogrid Reinforcement Systems

The following specifications are a guide to the construction of geogrid reinforcement systems. These guidelines are intended to ensure the proper installation and performance of geogrid reinforcement systems in various construction applications. The application of these guidelines is at the discretion of the designer. These specifications may be revised to accommodate site-specific design requirements.

SECTION 1: GENERAL

1.1 Scope

This work includes furnishing and installing geogrid reinforcement, wall block, and backfill to the lines and grades specified on the construction drawings and in this section.

1.2 Applicable Sections of Related Work

Section 1: Allan Block Modular Retaining Wall Systems.

1.3 Reference Standards

See specific geogrid manufacturer’s reference standards. Additional Standards:

B. ASTMD5863 - Standard Test Method for Gravel Retaining Wall Systems
C. ASTM D6283 - Standard Test Method for Gravel Retaining Wall Systems
D. ASTM D5532 - Standard Test Method for Static Shear Strength of Soil-Geotextile Systems
E. G12-GEA - Grid Long Term Allowable Design Strength (LATADS)
F. ASTM D6706 - Grid Pullout of Soil

1.4 Delivery, Storage, and Handling

A. Contractor shall inspect the geogrid upon delivery to assure that the proper material has been received.
B. Geogrid shall be stored above 10 F (23 C).
C. Contractor shall prevent excessive mud, cementitious material, or other foreign materials from coming in contact with the geogrid material.

PART 2: MATERIALS

2.1 Definitions

A. Geogrid is a high-density polyethylene or polyester yarns encapsulated in a protective coating specifically fabricated for use in a soil reinforcement application.
B. Concrete retaining wall units are as detailed on the drawings and shall be Allan Block Retaining Wall Units.
C. Drainage panel material is considered to be in 2,222 Retaining Wall Systems.
D. Infiltration is the soil used as fill for the reinforced soil mass.
E. Foundation is the in-situ soil.

2.2 Products

Geogrid shall be as shown on the drawings having the property requirements as described within the manufacturer’s specifications.

2.3 Acceptable Manufacturers

A manufacturer’s product shall be approved by the wall design engineer.

PART 3: WALL CONSTRUCTION

3.1 Foundation Soil Preparation

A. Foundation soil shall be excavated to the lines and grades shown on the construction drawings or as directed by the wall design engineer.
B. Foundation soil shall be examined by the on-site soils engineer to assure that the foundation soil is suitable for the footing.
C. Overexcavated areas shall be filled with compacted backfill material approved by on-site soils engineer.
D. Contractor shall verify the 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 Wall Construction

Wall construction shall be as specified under Section 1, Part 3, Wall Construction.

3.3 Geogrid Installation

A. Install Allan Block wall to designated height of first geogrid layer. Backfill and compact the wall rock and geogrid in layers not to exceed 8 in. (200 mm) lifts below wall to depth equal to designed grid length before grid is installed.
B. Cut geogrid to designed embedment length and place on top of Allan Block to back edge of the raised front to of within 1 in (25 mm) of the concrete retaining wall face when using ALL Block. Extend away from wall approximately 20% above horizontal on compacted in-place geogrid fill.
C. Lay geogrid at the proper elevation and orientation shown on the construction drawings or as directed by the wall design engineer.
D. The installation of the geogrid shall be verified by the contractor and on-site soils engineer. Strength direction is typically perpendicularly to wall face.
E. Follow manufacturer’s guidelines for overlap requirements. In curves and corners, layout shall be as specified in Design Detail 9-3-12: Using Grid with Corners and Curves, see page 14 of the ALL Block Spec Book.
F. Place next course of Allan Block on top of grid and fill block course with wall rock to look in place. Remove slack and folds in grid and stake to hold in place.

G. Adjacent sheets of geogrid shall be butted against each other at the wall face to achieve 100% coverage.
H. Geogrid length shall be continuous. Splicing parallel to the wall face is not allowed.

3.4 Fill Placement

A. Fill soil shall be placed in lifts and compacted as specified under Section 1, Part 3.5, Unit Installation.
B. Infiltration shall be placed, spread, and compacted in such a manner that minimizes the development of slack or movement of the geogrid.
C. Only hand-operated compaction equipment shall be allowed within 3 ft (0.9 m) behind the wall. This area shall be defined as the consolidation zone. Compaction in this zone shall begin by running the plate compactor directly on the block and then constructing in parallel paths to the wall face with the entire consolidation layer has been compacted. A minimum of 100% of the consolidation area shall be compacted.
D. Site-rovado and compaction are required to a minimum lift thickness of 6 in. (150 mm), Section 1, Part 3.5, Page 3 of the ALL Block Spec Book.
E. When fill is placed and compaction cannot be defined in terms of Standard Proctor Density, then the compaction shall be performed using ordinary compaction process and compacted so that no deformation is observed from the compaction equipment or to the satisfaction of the engineer of record or the site soils engineer.
F. Tracked construction equipment shall be operated directly on the geogrid. A minimum fill thickness of 8 in. (200 mm) is required prior to operation of tracked vehicles over the geogrid. Trimming of tracked vehicles should be kept to a minimum to prevent tracks from disturbing the fill and damaging the geogrid.
G. The fill soil shall be compacted to achieve 95% Standard Proctor (ASTM D698). Soil tests of the in-situ soil shall be submitted to the on-site soils engineer for review and approval prior to the placement of any material. The contractor is responsible for achieving the specified compaction requirements. The on-site soils engineer may direct the contractor to remove, correct, or amend any soil found not in compliance with these written specifications.
H. An independent testing firm should be hired by the owner to provide services.
I. Independent firm to keep inspection log and provide written reports at predetermined intervals to the owner.
J. Testing frequency should be shown to establish a proper compaction protocol to consistently achieve the minimum compaction requirements set by the design requirements. If full time inspection and testing at 8 inch (200 mm) lift is not feasible, the following shall be done:
   a. One test for every 8 inches (20 cm) of vertical fill placed and compacted, for every 25 linear feet (7.6 m) of retaining wall length, starting on the first course of block.
   b. Verify compaction test locations to cover the entire area of reinforced zones; including the area compacted by the hand-operated compaction equipment.
   c. Once protocol is deemed acceptable, testing can be conducted randomly at locations and frequencies determined by the on-site soils engineer.
   d. Slopes above the wall must be compacted and checked in a similar manner.

3.5 Special Considerations

A. Geogrid can be interconnected by periodic penetration of a column, pier, or footing structure.
B. Geogrid can be interconnected by periodic penetration of a column, pier, or footing structure.
C. Retaining walls with geogrid reinforcement shall consist of vertical and horizontal reinforcing with rebar and grout.
D. If site conditions will not allow geogrid embedment length, consider the following alternatives:
   i. Minimize Reinforced Walls - Soil Nailing - Increased Wall Stability - Earth Anchors - Double Allan Block Wall - Rock Bolts -In-Place Concrete
   ii. Site Design Details Page 16 and 17 of the ALL Spec Book.
E. Allan Block may be used in a wide variety of water applications as indicated in Section 3, Part 1.5.
Specification Guidelines: Water Management

The following specifications provide Allcon 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 3

PART 1: GENERAL DRAINAGE

1.0 General

Rainfall or other water sources such as irrigation activities collected by the ground surface atop the retaining wall can be considered as surface water. Drainage design shall take into consideration the management of this water. A. At the end of each day's construction and at final completion, grade the backfill to avoid water accumulation behind the wall in or the reinforced area.

B. Surface water shall not be allowed to pond or be trapped in the area above the wall or at the toe of the wall. C. Existing slopes adjacent to retaining wall or slopes created during the grading process shall include drainage details so that surface water will not be allowed to drain over the top of the slope face and/or wall. This may require a minimum of 2 percent grade.

D. Irrigation activities at the site shall be controlled and managed reasonably. If an irrigation system is employed, the design engineer or irrigation manufacturer shall provide details and specifications for required equipment to ensure against overflow which could damage the structural integrity of the retaining wall system.

E. Surface water that cannot be diverted from the wall shall be collected with surface drainage swales and drained laterally in order to dispose of the water around the wall structure. Construction of a typical swale system shall be in accordance with Design Detail 5: Swales of the Allcon Spec Book.

1.1 Grading

The grading and re-contouring of land in order to prepare it for site development is grading. Site grading shall be designed to route water around the wall. A. Establish final grade with a positive gradient away from the wall structure. Concentrations of surface water runoff shall be managed by providing necessary structures, such as paved driveways, surface swales, catch basins, etc.

B. Grading designs must divert sources of concentrated surface flow, such as parking lots, away from the wall.

1.2 Drainage System

The internal drainage systems of the retaining wall can be described as the means of eliminating the buildup of water within the structure. Drainage systems that infiltrate the soils below the wall. Drainage system design will be a function of the water conditions, site conditions, and specific drainage conditions include toe and slope drainage collection pipes and blanket or chimney drainage pipe. Note: A cut off drain system shall be installed to fully drain the retaining wall structure for complete drainage details to completely drain the retaining wall structure for complete drainage conditions. The material shall consist of the specified for wall rock outlined in Section 1, 0.2 Wall Rock.

B. All walls will be constructed with a 1 in. (25 mm) diameter drain pipe placed at the lowest possible elevation within the 12 in. (300 mm) of wall rock. This drain pipe is referred to as a toe drain, Section 3, 1.4 Toe Drain.

C. Geogrid reinforced walls will be constructed with an additional 4 in. (100 mm) drainage pipe at the back bottom of the reinforced soil mass. This drain pipe is referred to as a backup drain, Section 3, 3.3 Heel Drain.

1.4 Toe Drain

A toe drain pipe should be located at the back of the wall rock behind the wall as close to the bottom of the wall as allowed while still maintaining a positive gradient for drainage to daylight, or a storm water management system. Toe drain pipes are not considered for incidental water management not as a primary drainage system. A. For site configurations with bottoms of the area in a level plane it is recommended that a minimum one percent grade be maintained on the placement of the pipe with outlets on 30 ft (15 m) centers, or 100 ft (30 m) centers if the pipe is curved between the outlets. This would provide for a maximum height above the bottom of the base in a flat configuration of no more than 6 in. (150 mm).

B. All pipes must be connected to the toe drain pipe. All pipes should be positioned with the holes located down. Allcon Block does not require that toe drain pipes be wrapped when installed into base rock complying with the specified wall rock material.

C. Pipes shall be routed to storm drain where appropriate or through or under the wall at low points when the job site grading and site layout allows for routing. Appropriate details shall be included to prevent pipes from being crushed, plugged, or infested with rodents.

D. On sites where the natural drop in grade exceeds the one percent minimum, drain pipes outlets shall be on 100 ft (300 m) centers maximum. This will provide outlets in the event that excessive water flow exceeds the capacity of pipe over long stretches.

E. When the toe drain pipe must be routed to accommodate outlets through the wall, face of the toe drain, refer to Design Detail 4: Alternate Drains, Page 13 of the Allcon Spec Book.

1.5 Heel Drain

The purpose of the heel drain is to pick up any water that migrates from behind the retaining wall structure at the cut and raise the water away from the reinforced mass during the construction process and for incidental water for the life of the structure. A. The piping used at the back of the reinforced mass shall have a one percent minimum grade over the length, but it is not critical for it to be positioned at the very bottom of the cut. Additionally the entire length of the pipe may be vented at one point and should not be tied into the toe drain.

B. The pipe may be a rigid pipe with holes at the bottom with an integral check discouraging the pipe or a corrugated perforated flexible pipe with a seal to filter out fines when required based on soil conditions. For infill soils with a high percentage of sand and/or gravel the heel drain pipes does not need to be surrounded by a filter layer. All con blocks with soils containing fine granular cohesive soils having a PI of greater than 6 and LL of 30 or greater, 1 cubic foot (0.03 cubic meter) of drainage rock is required around the pipe for each 1 ft (30 cm) of pipe length.

1.6 Ground Water

Ground water can be defined as water that occurs within the soil. It may be present because of surface infiltration or water table fluctuation. Ground water movement must not be allowed to come in contact with the retaining wall. A. If water is encountered in the area of the wall during excavation or construction, a drainage system (chimney, blanket, or drain) will be required to divert it to the wall face.

B. Blanket drain lines shall be provided at the toe of the wall. Blanket drain lines shall be installed at not more than 3 ft (90 cm) intervals with a minimum of 2 in. (50 mm) diameter pipe. Allcon Block recommends installing a minimum of 2 ft (60 cm) of drainage rock around the pipe for each 3 ft (90 cm) of pipe length.

C. When non-drainable soils (soils with friction angles less than 30 degrees) are used in the reinforced zone, the backfill of a chimney and blanket drain should be added to minimize water penetration into the reinforced zone.

D. Refer to Design Detail 5: Chimney and Blanket Drain, Page 13 of the Allcon Spec Book.

E. Drain material must be consistent with wall rock material. For more information on wall rock material see Specification Guidelines: Allcon Block Modular Retaining Wall Systems, section 2.1.

1.7 Concentrated Water Sources

All collection devices such as roof downspouts, storm sewers, and curb gutters are concentrated water sources. They must be designed to accommodate maximum flow rates and to vent outside of the wall area. A. All roof downspouts of nearby structures shall be sized with adequate capacity to carry storm water from the roof area away from the wall area. They shall be connected to a drainage system in closed dail and routed around the retaining wall area.

B. Site layout must take into account locations of retaining wall structures and all site drainage paths. Drainage paths should always be away from retaining wall structures.

C. Storm sewers and catch basins shall be located away from retaining wall structures and designed so as not to introduce any incidental water into the reinforced soil mass.

D. A path of storm sewer overflow must be incorporated into the site layout to direct water away from the retaining wall structure.

1.8 Water Application

Retaining walls constructed in conditions that allow standing or moving water to come in contact with the wall face are considered water applications. These walls require specific design and construction steps to ensure performance. Refer to Design Detail 7 and 8: Water Applications, Page 13 of the Allcon Spec Book.

Trenches shall be raised to the low water elevation to aid in the evacuation of water from the reinforced mass as water level fluctuates.

B. Retention of water should be at the infill mass and up the back of the infill mass to a height of 12 inches (30 cm) higher than the determined high water mark. If the high water mark is unknown, the entire infill zones should be constructed with wall rock.

C. A retention wall that is to be raised to the low water elevation to aid in the evacuation of water from the reinforced mass as water level fluctuates.

D. Concave spillway protection should be extended to a height of 12 inches (30 cm) higher than the determined high water mark.

E. 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 embankment. Embankment protection fabric shall be a high strength polypropylene nonwoven material designed to meet or exceed typical NTIPE specifications; stabilized against ultraviolet (UV) degradation and typically meets or exceeds the values in Table 1.

Table 1: Embankment Protection Fabric Specifications

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness</td>
<td>0.03 mm</td>
</tr>
<tr>
<td>Density</td>
<td>2200 g/m²</td>
</tr>
<tr>
<td>Permeability</td>
<td>0.0001 cm/sec</td>
</tr>
</tbody>
</table>

D. For walls having moving water or wave action, natural or manufactured rip rap in front of the wall to protect the toe of the wall from scour is recommended.
General Notes

Construction Notes

1. Soil loading considered in this design and calculations are based on the following parameters:

<table>
<thead>
<tr>
<th>Friction Angle (°)</th>
<th>Cohesion (kPa)</th>
<th>Unit Weight (kN/m³)</th>
<th>Soil Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infill Soil</td>
<td>30</td>
<td>0</td>
<td>120</td>
</tr>
<tr>
<td>Retained Soil</td>
<td>30</td>
<td>0</td>
<td>120</td>
</tr>
<tr>
<td>Foundation Soil</td>
<td>30</td>
<td>0</td>
<td>120</td>
</tr>
</tbody>
</table>

2. Actual soil parameters must meet or exceed these listed conditions to be used in wall construction. In general, gullies, gullies, and gullies (friction angle greater than or equal to 32 degrees; 90 degrees) are recommended as infill soils. Fine-grained cohesive soils (friction angle less than 32 degrees; 90 degrees) may be used as infill soils, but additional reinforcing and foundation efforts are required. Allen Block Corporation has not verified these design parameters. Consult a qualified Geotechnical Engineer or others prior to wall construction.

3. Substitution of fill soils are strictly prohibited unless approved by the engineer of record.

4. In this analysis, the effective friction angle without the addition of cohesion is used to determine the design strength of the soil when calculating lateral forces. At the discretion of the engineer of record, cohesion may be used when calculating the ultimate bearing capacity even though it is typically ignored.

5. Stability and settlement factors are not considered in this design.

6. Hydrostatic loading is not considered in this analysis. Sufficient drainage must be provided such that hydrostatic loading ( pore pressure) does not develop in the reinforced zone.

7. Retaining walls must be designed to resist earth pressures up to 95% Standard Proctor Density. For any wall over 10 feet (3 meters), with a surcharge or contains cohesive soils, composite test frequency and location shall be determined by the engineer of record as otherwise specified.

8. All filled slopes above walls shall be placed and compacted in accordance with the requirements for all other reinforced material.


10. Retaining walls must be installed and constructed according to the contract drawings. The retaining wall plan view shall be placed and compacted in accordance with the requirements for all other reinforced material.

12. Quality Assurance Requirements:

A qualified engineer of record shall supervise the wall construction to verify field and site soil conditions. In the event that the Site Geotechnical Engineer does not perform this work, a qualified Geotechnical Engineer/Technician shall be consulted to ensure the Allen Block Wall is constructed with proper soil parameters.

Surface Drainage Notes:

1. Rainfall and other water sources such as irrigation activities can be defined as natural water. The retaining wall design shall take into consideration the management of this water.

2. Site grading shall be designed to route surface water around and away from the wall.

3. Adequate drainage systems are required to completely drain the area around the retaining wall structure.

4. Drain piping, toe drain, should be located at the back of the wall drain line behind the wall as close as the bottom of the wall. Adequate soil drainage systems must be installed to drain the area around the retaining wall structure.

5. Adequate drainage systems must be installed and the wall design must consider the presence of water within the soil mass.

6. Ground water is encountered during construction, an adequate drainage system must be installed or the wall design must consider the presence of water within the soil mass.

7. Overflow swale, outlet swale, must be designed to allow for sufficient capacity to accommodate the maximum flow rate and outlet outside the retaining wall area.

8. Retaining walls in conditions that allow standing water to overflow the wall face are considered water applications. These walls require specific design and construction steps to ensure performance.
Elevation View

Note: Panel Sections cover the total over all height of each panel. See individual panel section drawings for geogrid strength and lengths, wall surcharge and slope above information.
Elevation View
Elevation View 5 - 5 of 6

Note: Panel Sections cover the total over all height of each panel. See individual panel section drawings for geogrid strength and lengths, wall discharge and slope above information.
## AB Wall Material and Labor Estimate Worksheet

**Material Estimate (Using Elevation View):**

<table>
<thead>
<tr>
<th>Material</th>
<th>Quantity</th>
<th>Unit</th>
<th>Overage</th>
<th>Quantity</th>
<th>Cost</th>
<th>Total</th>
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</thead>
<tbody>
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<td>AB Class</td>
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<td>$0.00</td>
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<tr>
<td>Wall Cap</td>
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<td>Blocks</td>
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<td>$0.00</td>
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<td>Stress SO 200</td>
<td>324.8</td>
<td>yd³</td>
<td>0 %</td>
<td>324.8</td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>Base Rock</td>
<td>17.23</td>
<td>ton</td>
<td>0 %</td>
<td>17.2</td>
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<td>$0.00</td>
</tr>
<tr>
<td>Wall Rock</td>
<td>68.3</td>
<td>ton</td>
<td>0 %</td>
<td>68.3</td>
<td>$0.00</td>
<td>$0.00</td>
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<tr>
<td>1 Sod Type</td>
<td>73.4</td>
<td>yd³</td>
<td>0 %</td>
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<td>Drain Pipe</td>
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<td>ft</td>
<td>0 %</td>
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**Labor Estimate**

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<th>Labor Estimate</th>
<th>Length/Area</th>
<th>Unit</th>
<th>Cost/HR</th>
<th>Total</th>
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<tr>
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Labor Total: $0.00

**Engineering Estimate**

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<th>Cost/ft²</th>
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</table>

Engineering Total: $0.00

Subtotal: $0.00

Profit: 0%

Overhead: 0%

Project Total: $0.00

Cost/ft²: $0.00

---

*Note: All quantities and costs are approximate and subject to change based on actual conditions on site.*

This material and labor estimate is provided for planning purposes only and does not guarantee availability or pricing. The user must consult the vendor's catalog for the most current information. The user assumes all responsibility for any errors or omissions in the material and labor estimate. The vendor shall not be held liable for any damages resulting from the use of this material and labor estimate.
Disclaimer

Allan Block provides this software as a service for its clients. The sole purpose of this software is to assist engineers in the design of mechanically stabilized retaining walls. The software uses evaluation techniques and engineering principles found in the Allan Block Engineering Manual. (Refer to R0904 and supporting references.) It is the responsibility of the engineer of record to determine the propriety and accuracy of input parameters and to review and verify the correctness of the results. ALLAN BLOCK CORPORATION, ITS LICENSEES OR AGENTS DO NOT ASSUME ANY LIABILITY OR RESPONSIBILITY FOR DAMAGES WHICH MAY RESULT FROM THE USE OR MISUSE OF THIS SOFTWARE.

This software only considers internal, external and internal compound stability of the reinforced composite mass. The internal compound stability calculations are limited to an evaluation zone above the base material and back no further than 2 \* H or He + L, whichever is greater. This program DOES NOT address global stability, defined as soil stability below the base material and beyond the limits for internal compound stability. Global Stability should be evaluated to determine if the overall site is stable. It is the responsibility of the owner to ensure the global stability is analyzed. The engineer of record must evaluate the project site for proper water management and all potential modes of failure within the segmental retaining wall evaluation zone. The geotechnical engineering firm contracted by the owner should provide a full global stability opinion of the site including the effects on the segmental retaining wall.

AB Walls 15 contains DEFAULT values for all data inputs that the user MUST change or verify as appropriate for the project conditions being analyzed. These DEFAULT values do NOT ensure a conservative design for any site condition. The final design must provide for proper wall drainage to prevent the buildup of hydrostatic pressures over the service life of the structure. In the event additional water is introduced into the general wall area, either above or below grade, any designs from this software would be invalid unless otherwise noted by the engineer of record. It is also recommended that an independent assessment of the foundation soil for settlement potential and wall deflections for the proposed structure be performed. Changes in the subsoil conditions are not included in this software. These additional potential failure modes should be evaluated by the engineer of record prior to initiating wall construction and may require site inspection by the on-site soils engineer. All installations must conform to the Allan Block Spec Book. (Refer to R0901).

MathCAD files for hand calculations to support the software's consideration of internal, external and internal compound stability of the reinforced composite mass are provided on the software disc. These files are to be configured so that the engineer of record can evaluate the output of the software. Individual equations may be altered at the discretion of the engineer of record.
Wall Design Variables

AB Classic
Section Height 4.67 ft
Total Panel Height 5.33 ft
Block Height 0.667 ft
Angle of Backset 6 Deg.
Depth of Block 0.99 ft
Length of Block 1.47 ft

Surcharge Parameters
100 psf Live Load @ 7.5 ft
(Directly measured from the air gap)

Safety Factors Static External
Actual Sliding
3.62 >= 1.5
Actual Overturning
7.8 >= 2

Infill Soil
Friction Angle 30 Deg.
Unit Weight 120 psf

Retained Soil
Friction Angle 30 Deg.
Unit Weight 120 psf

Foundation Soil
Friction Angle 30 Deg.
Unit Weight 120 psf
Cohesion 0 psf

Bearing Capacity
Factor of Safety 6.79
\( \Sigma_{\text{ult}} = 4706.66 \text{ psf} \)
\( \Sigma_{\text{max}} = 693.19 \text{ psf} \)

Internal Compound Stability
Factor of Safety 2.75

Course Number 0

Wall Rock Requirements
Variable Depth
Height 4.67 ft
Depth 1 ft

Section 1 of 6
Section 0 ft - 34.5 ft

Base Information:
Base Width: 2 ft
Base Depth: 0.5 ft
Base From Toe: 0.5 ft

Geogrid Information:
4 x Strata SG 200 @ 3.5 ft
Number Of Geogrid 4

Allan Block Disclaimer:
This software only considers internal, external and internal conserved stability of the reinforced composite wall. The internal compound stability calculations are limited by an equivalent stress imposed by the mass incident and block walls. The external soil block walls must be designed in accordance with the applicable building codes. The user should ensure that the structure design complies with all applicable building codes and standards.

Preliminary - Not for Construction
### Wall Design Variables

- **Ka** = Active Earth Pressure Coefficient \( \text{Infill} = 0.254 \)
- **Kar** = Active Earth Pressure Coefficient Retained = 0.254
- **H** = Wall Height = 5.33 ft
- **He** = Effective Height = 5.33 ft
- **i** = Slope = 0 Deg.
- **i_int** = Effective Slope = 0 Deg.
- **i_ext** = Effective Slope = 0 Deg.
- **Setback** = 90 - Beta Angle = 6.42 Deg.
- **Wf** = Weight of Facing = 680.88 plf
- **Wt** = Total Weight = 2404.68 plf
- **Fa** = Active Force = 433.55 plf
- **Fv** = Vertical Force = 148.28 plf
- **Fh** = Horizontal Force = 407.41 plf
- **Fr** = Resistance Force = 1473.95 plf

### Internal Design Calculations (Static)

#### Section: 1

<table>
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<tr>
<th>Geogrid Number</th>
<th>Geogrid Elevation ft</th>
<th>Geogrid Length ft</th>
<th>Tensile Force plf</th>
<th>Allowable Load plf</th>
<th>Factor Safety Overstress</th>
<th>Factor Safety Pullout Block</th>
<th>Factor Safety Pullout Soil</th>
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</tbody>
</table>

#### Geogrid Legend

- **A** - Strata SG 200
- **B** - Strata SG 350
- **C** - Strata SG 500
- Min. Length of Geogrid: 3.5 ft

---

Preliminary - Not for Construction
Internal Compound Stability Results:
The calculated values listed below are the worst case slip arcs for each block course. The highlighted is the worst case of all courses. To improve the internal compound stability safety factors the designer can lessen grid spacing, increase the infill soil strength requirements, increase geogrid strength or consider lengthening the geogrids. These calculations in no way represent a global stability analysis. If a global stability analysis is deemed necessary, a global stability program must be used.

### Internal Compound Stability Results

**Section: 1**

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Factor of Safety (Static)</th>
<th>$S_F$ (plf)</th>
<th>$SV_u : S_{Conn}$ (plf)</th>
<th>$SF$ (plf)</th>
<th>$SF_{grid}$ (plf)</th>
<th>$SDynF$ (plf)</th>
<th>$SW_t$ (plf)</th>
<th>$SQ$ (plf)</th>
<th>$SQ_{opt}$ (plf)</th>
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Preliminary - Not for Construction
Wall Design Variables

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<th>AB Classic</th>
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<td>Section Height 4.67 ft</td>
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<tr>
<td>Total Panel Height 5 ft</td>
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<tr>
<td>Block Height 0.567 ft</td>
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<tr>
<td>Angle of Slopback 6 Deg.</td>
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<tr>
<td>Depth of Block 0.99 ft</td>
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<tr>
<td>Length of Block 1.47 ft</td>
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Surcharge Parameters

- 100 psi Live Load @ 7.5 ft
- Debris Material from Site of wall

Safety Factors Static External

- Actual Sliding: 2.61 ≥ 1.5
- Actual Overturning: 5.14 ≥ 2

Infill Soil

- Friction Angle 30 Deg. |
- Unit Weight 120pcf

Retained Soil

- Friction Angle 30 Deg. |
- Unit Weight 120pcf

Foundation Soil

- Friction Angle 30 Deg. |
- Unit Weight 120pcf |
- Cohesion 0 psf

Bearing Capacity

- Factor of Safety 5.54 |
- Sigma_uil = 4706.65 psf |
- Sigma_max = 849.59 psf

Internal Compound Stability

Factor of Safety 1.98 |
Course Number 0

Wall Rock Requirements

Variable Depth |
Height |
Bottom: 5.33 ft |
1 ft

Preliminary - Not for Construction
Wall Design Variables
Kal = Active Earth Pressure Coefficient Infill = 0.286
Kar = Active Earth Pressure Coefficient Retained = 0.278
H = Wall Height = 6 ft
He = Effective Height = 7.06 ft
He, i = Effective height = 6.35 ft
i = Slope = 18.4 Deg.
I_int = Effective Slope = 9.46 Deg.
I_ext = Effective Slope = 7.56 Deg.
Setback = 90 - Beta Angle = 6.42 Deg.
Wf = Weight of Facing = 765.99 plf
Wt = Total Weight = 3065.28 plf
Fa = Active Force = 833.12 plf
Fv = Vertical Force = 284.95 plf
Fah = Horizontal Force = 782.88 plf
Ff = Resistance Force = 2051.76 plf

Internal Design Calculations (Static)
Section: 2

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<thead>
<tr>
<th>Geogrid Number</th>
<th>Geogrid Elevation ft</th>
<th>Geogrid Length ft</th>
<th>Tensile Force plf</th>
<th>Allowable Load plf</th>
<th>Factor Safety Overstress</th>
<th>Factor Safety Pullout Block</th>
<th>Factor Safety Pullout Soil</th>
<th>Efficiency</th>
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<tbody>
<tr>
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Geogrid Legend
A - Strata SG 200
B - Strata SG 350
C - Strata SG 500
Min. Length of Geogrid: 4 ft
Internal Compound Stability Results:
The calculated values listed below are the worst case slip arcs for each block course. The highlighted is the worst case of all courses. To improve the internal compound stability safety factors the designer can lessen grid spacing, increase the infill soil strength requirements, increase geogrid strength or consider lengthening the geogrids. These calculations in no way represent a global stability analysis. If a global stability analysis is deemed necessary, a global stability program must be used.

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Factor of Safety (Static)</th>
<th>SFr (pflf)</th>
<th>SVu : SConn (pflf)</th>
<th>SFs (pflf)</th>
<th>SFgrid (pflf)</th>
<th>SDynF (pflf)</th>
<th>SWT (pflf)</th>
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</table>
Section 3 of 6

Section 58 ft - 62.3 ft

Base Information:
- Base Width: 2 ft
- Base Depth: 0.5 ft
- Base From Toe: 0.5 ft

Geogrid Information:
- 1 x Strata SG 200 @ 7 ft
- 1 x Strata SG 300 @ 4 ft

Number Of Geogrid 4

Wall Design Variables

AB Classic
- Section Height: 4.67 ft
- Total Panel Height: 6 ft
- Block Height: 0.667 ft
- Angle of Setback: 6 Deg.
- Depth of Block: 0.99 ft
- Length of Block: 1.47 ft

Surcharge Parameters
- 160 psf Live Load @ 7.5 ft
  (Effective stress measured from face of wall)

Safety Factors Static External
- Actual Sliding: 2.61 >= 1.5
- Actual Overturning: 5.14 >= 2

Infill Soil
- Friction Angle: 30 Deg.
- Unit Weight: 120 psf

Retained Soil
- Friction Angle: 30 Deg.
- Unit Weight: 120 psf

Foundation Soil
- Friction Angle: 30 Deg.
- Unit Weight: 120 psf
- Cohesion: 0 psf

Bearing Capacity
- Factor of Safety: 5.99
- Sigma_ult: 5069.43 psf
- Sigma_max: 949.59 psf

Internal Compound Stability
- Factor of Safety: 1.98
- Course Number: 0

Wall Rock Requirements
- Variable Depth:
  - Height: 5.33 ft
  - Depth: 4 ft

Preliminary - Not for Construction
Wall Design Variables

- $K_a = \text{Active Earth Pressure Coefficient}$
- $K_r = \text{Active Earth Pressure Coefficient Retained} = 0.278$
- $H = \text{Wall Height} = 6 \text{ ft}$
- $H_e = \text{Effective Height} = 7.06 \text{ ft}$
- $i = \text{Slope} = 18.4 \text{ Deg.}$
- $i_{\text{int}} = \text{Effective Slope} = 9.46 \text{ Deg.}$
- $i_{\text{ext}} = \text{Effective Slope} = 7.56 \text{ Deg.}$
- $\text{Setback} = 90 - \text{Beta Angle} = 6.42 \text{ Deg.}$
- $W_f = \text{Weight of Facing} = 765.99 \text{ plf}$
- $W_t = \text{Total Weight} = 3063.28 \text{ plf}$
- $F_a = \text{Active Force} = 833.12 \text{ plf}$
- $F_{av} = \text{Vertical Force} = 284.95 \text{ plf}$
- $F_h = \text{Horizontal Force} = 782.88 \text{ plf}$
- $F_r = \text{Resistance Force} = 2051.76 \text{ plf}$

Internal Design Calculations (Static)

**Section: 3**

<table>
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<th>Geogrid Number</th>
<th>Geogrid Elevation ft</th>
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<th>Factor Safety Overstress</th>
<th>Factor Safety Pullout Block</th>
<th>Factor Safety Pullout Soil</th>
<th>Efficiency</th>
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<tbody>
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Geogrid Legend
- A - Strata SG 200
- B - Strata SG 350
- C - Strata SG 500
- Min. Length of Geogrid: 4 ft

Preliminary - Not for Construction
Internal Compound Stability Results:
The calculated values listed below are the worst case slip arcs for each block course. The highlighted is the worst case of all courses. To improve the internal compound stability safety factors the designer can lessen grid spacing, increase the infill soil strength requirements, increase geogrid strength or consider lengthening the geogrids. These calculations in no way represent a global stability analysis. If a global stability analysis is deemed necessary, a global stability program must be used.

Internal Compound Stability Results:
Section: 3

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<th>SFs (plf)</th>
<th>SFgrid (plf)</th>
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<td>Friction Angle 30 Deg.</td>
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<td>Foundation Soil</td>
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**Section 4 of 6**

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Allen Block provides this software as a service for its clients. The sole purpose of this software is to assist engineers in the design of masonry composite retaining walls. The software contains evaluation techniques and supporting analysis based on the Allen Block Engineering Manual (Refer to AB001 and supporting references.)

This software is intended to be used by professional engineers for pre-design and analysis purposes. It is intended to be utilized to determine preliminary design parameters for possible further analysis by an engineer of record. It is the responsibility of the engineer of record to review, analyze, and verify the results. The software provides parametric analysis and design guidance for use by professional engineers. It is not to be used as a substitute for professional engineering judgment.

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**Preliminary - Not for Construction**
### Wall Design Variables
- $K_{ai} = \text{Active Earth Pressure Coefficient Infill} = 0.286$
- $K_{ar} = \text{Active Earth Pressure Coefficient Retained} = 0.279$
- $H = \text{Wall Height} = 6 \text{ ft}$
- $He = \text{Effective Height} = 7.06 \text{ ft}$
- $He_int = \text{Effective Height} = 6.35 \text{ ft}$
- $i = \text{Slope} = 18.4 \text{ Deg.}$
- $\gamma = \text{Effective Slope} = 9.46 \text{ Deg.}$
- $\gamma_ext = \text{Effective Slope} = 7.56 \text{ Deg.}$
- $Setback = 90 - \text{Beta Angle} = 6.42 \text{ Deg.}$
- $W_f = \text{Weight of Facing} = 765.99 \text{ plf}$
- $W_t = \text{Total Weight} = 3065.28 \text{ plf}$
- $F_a = \text{Active Force} = 833.12 \text{ plf}$
- $F_v = \text{Vertical Force} = 284.95 \text{ plf}$
- $F_h = \text{Horizontal Force} = 782.88 \text{ plf}$
- $F_r = \text{Resistance Force} = 2031.76 \text{ plf}$

### Internal Design Calculations (Static)
#### Section: 4

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<th>Geogrid Elevation ft</th>
<th>Geogrid Length ft</th>
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<th>Allowable Load plf</th>
<th>Factor Safety Overstress</th>
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---

**Geogrid Legend**
- A - Strata SG 200
- B - Strata SG 350
- C - Strata SG 500
- Min. Length of Geogrid: 4 ft

---

**Preliminary - Not for Construction**
Internal Compound Stability Results:
The calculated values listed below are the worst case slip arc for each block course. The highlighted is the worst case of all courses. To improve the internal compound stability safety factors the designer can lessen grid spacing, increase the infill soil strength requirements, increase geogrid strength or consider lengthening the geogrids. These calculations in no way represent a global stability analysis. If a global stability analysis is deemed necessary, a global stability program must be used.

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Factor of Safety (Static)</th>
<th>SFr (plf)</th>
<th>SVu SConn (plf)</th>
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Wall Design Variables

- **AB Classic**
  - Section Height: 4.67 ft
  - Total Panel Height: 4.67 ft
  - Block Height: 6.67 ft
  - Angle of Saffman 6 Deg.
  - Depth of Block: 0.99 ft
  - Length of Block: 1.47 ft

- **Surcharge Parameters**
  - 100 psf Live Load @ 7.5 ft

- **Safety Factors Static External**
  - Actual Sliding: 3.59 > 1.0
  - Actual Overturning: 7.75 > 1.0

- **Infill Soil**
  - Friction Angle: 30 Deg.
  - Unit Weight: 120 psf

- **Retained Soil**
  - Friction Angle: 30 Deg.
  - Unit Weight: 120 psf

- **Foundation Soil**
  - Friction Angle: 30 Deg.
  - Unit Weight: 120 psf
  - Cohesion: 0 psf

- **Bearing Capacity**
  - Factor of Safety: 8.08
  - Sigma_u: 5221.92 psf
  - Sigma_max: 608.76 psf

- **Internal Compound Stability**
  - Factor of Safety: 2.47
  - Course number: 0

Wall Rock Requirements

- **Variable Depth**
  - Height: 4 ft
  - Depth: 1 ft

---

**Allan Block Disclaimer**

Allan Block makes software available as a service for its clients. The sole purpose of this software is to assist engineers in the design of mechanically stabilized retaining walls. The software uses evaluation techniques and engineering analysis unique to the Allan Block Engineering Manual. (Refer to Section 5 and supporting references.)

The engineer or user should verify all calculations and assumptions used in the design of the retaining wall. The software is provided "as is" without warranty of any kind, expressed or implied, including but not limited to the implied warranties of merchantability and fitness for a particular purpose. Allan Block Engineering is not responsible for any errors or omissions in the software or any resulting consequences.

The engineer or user is responsible for the design and construction of the retaining wall. This software is not intended for use by the general public. The engineer or user should consult with a professional engineer for all retaining wall design projects.

The engineer or user should not rely solely on the software for retaining wall design. The engineer or user is responsible for ensuring that the design satisfies all applicable codes and standards. The engineer or user should consult with a professional engineer for all retaining wall design projects.

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---

**Section 5 of 6**

**Geogrid Information:**

- **3 x Strata SG 200 @ 3 ft**
- **Number Of Geogrid 3**

---

**Preliminary - Not for Construction**
Wall Design Variables

Kai = Active Earth Pressure Coefficient Infill = 0.254
Kar = Active Earth Pressure Coefficient Retained = 0.254
H = Wall Height = 4.67 ft
He = Effective Height = 4.67 ft
He_e = Effective Height = 4.67 ft
I = Slope = 0 Deg.
I_int = Effective Slope = 0 Deg.
I_ext = Effective Slope = 0 Deg.

Setback = 90 - Beta Angle = 6.42 Deg.
Wf = Weight of Facing = 595.77 plf
Wt = Total Weight = 1824.08 plf
Fa = Active Force = 331.94 plf
Fv = Vertical Force = 113.53 plf
Fh = Horizontal Force = 311.92 plf
Fr = Resistance Force = 1118.68 plf

Internal Design Calculations (Static)

Section: 5

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<th>Geogrid Number</th>
<th>Geogrid Elevation ft</th>
<th>Geogrid Length ft</th>
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**Internal Compound Stability Results:**

The calculated values listed below are the worst case slip arcs for each block course. The highlighted is the worst case of all courses. To improve the internal compound stability safety factors the designer can lessen grid spacing, increase the infill soil strength requirements, increase geogrid strength or consider lengthening the geogrids. These calculations in no way represent a global stability analysis. If a global stability analysis is deemed necessary, a global stability program must be used.

**Internal Compound Stability Results:**

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Factor of Safety (Static)</th>
<th>SFr (plf)</th>
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Section 6 of 6
Section 226.2 ft - 287.2 ft

Base Information:
- Base Width: 2 ft
- Base Depth: 0.5 ft
- Base From Toe: 0.5 ft

Geogrid Information:
- 2 x Strata SG 200 @ 3 ft
- Number Of Geogrid 2

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Wall Design Variables
Kai = Active Earth Pressure Coefficient Infill = 0.254
Kar = Active Earth Pressure Coefficient Retained = 0.254
H = Wall Height = 2.67 ft
He = Effective Height = 2.67 ft
i = Slope = 0 Deg.
i_ext = Effective Slope = 0 Deg.
Setback = 90 - Beta Angle = 6.42 Deg.
Wf = Weight of Facing = 340.44 plf
Wt = Total Weight = 1042.33 plf
Fa = Active Force = 108.39 plf
Fah = Horizontal Force = 101.85 plf
Fr = Resistance Force = 623.19 plf

Internal Design Calculations (Static)
Section: 6

<table>
<thead>
<tr>
<th>Geogrid Number</th>
<th>Geogrid Elevation ft</th>
<th>Geogrid Length ft</th>
<th>Tensile Force plf</th>
<th>Allowable Load plf</th>
<th>Factor Safety Overstress</th>
<th>Factor Safety Pullout Block</th>
<th>Factor Safety Pullout Soil</th>
<th>Efficiency</th>
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<td>4.78</td>
<td>7.1</td>
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Geogrid Legend
A - Strata SG 200
B - Strata SG 350
C - Strata SG 500
Min. Length of Geogrid: 3 ft

Preliminary - Not for Construction
Internal Compound Stability Results:
The calculated values listed below are the worst case slip arcs for each block course. The highlighted values in this table represent the worst case of all courses. To improve the internal compound stability requirements, increase the geogrid strength or specify a geogrid that meets the specified strength. The calculations in no way represent a global stability analysis, if a global stability analysis is deemed necessary, a global stability program must be used.