

SPECIFICATIONS FOR RETAINING WALLS

REFERENCES

The following references are applicable to the work:

- ACI 318 Building Code Requirements for Reinforced Concrete
- ACI SP-66 American Concrete Institute Detailing Manual
- CRSI Concrete Reinforcing Steel Institute Manual of Practices
- CRSI 63 Recommended Practice for Placing Reinforcing Bars
- ACI 304 Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete
- ACI 306R Cold Weather Concreting
- ASTM C 33 Concrete Aggregates
- ASTM C 94 Ready-mixed Concrete
- ASTM C 150 Portland Cement
- ASTM C 260 Air Entraining Admixtures for Concrete
- ASTM C 494 Chemical Admixtures for Concrete

PRODUCTS

Retaining wall units shall be American Redi-Bloc as produced by a licensed manufacturer. Units are 18" high by 48" wide by 42" deep, and weigh approximately 2,400 pounds each.

Color shall be as specified by the Architect. The units shall be constructed of concrete with a minimum compressive strength of 2,500 psi at 28 days, 4% to 6% entrained air by volume, and a minimum unit weight of 145 pcf. Material shall be protected at the job site and kept free from damage prior to installation.

The foundation course shall be compacted, select, crushed stone conforming to the requirements of Missouri Type 1 Aggregate as set forth in Section 1007 of Missouri Standard Specifications for Highway Construction. MoDOT Class B concrete can be used as a leveling course alternative.

MoDOT Class B concrete shall be used for the construction of the Type B gutter. The concrete shall contain 4% to 7% entrained air by volume. The concrete shall exhibit a minimum compressive strength of 3,000 psi at 28 days.

The reinforced backfill material shall be clean (less than 5 percent by weight passing the No. 200 sieve) crushed stone conforming to Missouri Type 4 Aggregate. Material locally referred to as 1" clean crushed stone shall be acceptable.

The cohesive soil cap shall consist of cohesive soil with a liquid limit not to exceed 45 and a plasticity index (PI) less than 20. The material shall be free of rubble, boulders, cobbles, and gravels, and not contain more than 5 percent by weight organic matter.

The geotextile shall be an 8-ounce nonwoven synthetic filter fabric such as Mirafi 180N or equivalent.

Geogrids shall be Mirafi 2XT and 3XT manufactured by Nicolun Mirafi Group, and as shown on the drawings.

Fence shall be wrought iron, 48" high, and supplied by Florissant Ornamental Iron Works. Fence shall have 1.5" square tube posts, ball post caps, and 1/2" square solid iron pickets on 5" centers. Fence shall be black.

Equivalent products will be considered only upon written request to the Engineer prior to bidding, including product specifications and test data satisfactory to the Engineer.

WALL ERECTION

Foundation soil shall be excavated as required to expose natural undisturbed soil or rock suitable for the support of the wall at the design bearing pressure of 2,500 pounds per square foot (psf), or as directed by the Engineer.

Open excavations shall be observed by the Engineer prior to starting wall construction to verify that the desired bearing stratum is exposed and the base of the excavation is free of loose soil and rock, uncompacted fill, water, frozen material, or other deleterious matter.

Undercut areas shall be filled with compacted material in accordance with compaction requirements set forth elsewhere in these specifications.

The minimum embedment depth is one-half block course (9") below grade. Install first course of wall units at the minimum embedment depth on the prepared leveling course, which shall be compacted to at least 90 percent of standard Proctor. Block units shall be stepped as required to remain at least the minimum embedment depth below grade at all locations.

To ensure that the units are properly aligned, a thin veneer of fine- to medium-grained sand not to exceed 1" in thickness may be spread over the prepared footing to aid in leveling and provide full contact with the prepared footing.

The setback of successive courses shall result in a consistent wall batter of 4.8 degrees.

Sweep all excess material from top of units and install next course in running bond pattern per manufacturer's instructions. See specifications elsewhere on this sheet for geogrid installation procedures.

All elevations shown are finished grade and shall be within 0.1 feet of those shown on the grading plan.

Geogrid Reinforcement

Refer to the construction drawings for required length and elevation of geogrids. Geogrids can have a minimum tolerance of the specified length minus 3". Lengths shorter than this minimum will be rejected. Additional geogrid must be accounted for embedment between block courses.

The placement of the geogrids is shown on the construction drawings. Monitoring of the fill will be necessary to ensure that the geogrids are placed at the specified elevation. Geogrids placed outside of a plus or minus 4" zone of the geogrid design elevation will not be accepted. Removal of unacceptably placed geogrids will be required so that proper elevations can be obtained for the placement of the geogrids.

Geogrid is to be laid horizontally on compacted backfill. The geogrid must be connected to the wall units by embedding the geogrid between the block courses and installing the fiberglass pins (where applicable) through the openings in the geogrid. The geogrid must be anchored and pulled taut before the backfill is placed over the geogrid.

Slack in the geogrids will result in undesirable movements of the wall which will require repair by the Contractor at no expense to the Owner. Slack in the geogrid at the wall unit connections shall be removed in the manner and degree established by the Engineer during construction of the wall. It is recommended that a tensioning device or metal forks be used to provide uniform tensioning of all grids throughout the height of the wall.

Wall Backfill

Place reinforced wall backfill material in maximum 9" thick lifts and compact with a minimum of 4 passes (100% coverage) of a vibratory smooth-drum roller with a minimum static weight of 1 ton.

Backfill shall be placed, spread, and compacted in such a manner that minimizes wrinkles and movement of the geogrid. Backfill shall be placed from the wall outward to ensure that the geogrid remains taut during the backfilling operation.

Observations shall be made by a qualified soils technician to verify that the lift thickness and minimum number of roller passes are being obtained during the backfill placement.

Fills and backfills outside the reinforced zone shall be compacted to at least 95 percent of the material's maximum dry density as determined by the standard Proctor (ASTM D 698) method. All soils tests shall be conducted by the Engineer concurrent with the grading and backfilling operations.

Wall Drainage

Install synthetic filter fabric along the back face of the wall as shown on the plans as construction proceeds to prevent the migration of soil fines through the block joints.

Place and compact 18" of cohesive soil to establish the design slope above the reinforced clean rock backfill.

Construct Type B gutter as shown on plans and per MoDOT (Missouri Department of Transportation) specifications. Provide block-out sleeves in gutter to receive fence posts. Install fence per manufacturer's installation guidelines. Grout posts into gutter sleeves.

Cut hole in manhole structure as shown on plans and route Type B gutter to the face of the structure for discharge into the manhole.

Finished grading shall be performed on all walls such that the water will sheet-flow to the Type B gutter, as applicable. Grade and seed per civil drawings by others. Regrade and dress any eroded or disturbed areas within the work area.

Subsequent Protection of Wall

The design of the walls is based on conditions and loads imposed on the walls upon completion of the project. Prior to project completion, the walls are vulnerable to damages caused by construction activity adjacent to the walls. Of particular concern is the use of grading equipment on the retained backfill at the top of the walls.

Only equipment with a weight not exceeding 1 ton can be used in the 3-foot zone immediately behind the back face of the walls. Equipment exceeding this weight limit, including scrapers, high-lifts, dozers, bobcats, backhoes, motor graders, dump trucks, and pavers, must be kept a minimum of 3 feet from the back face of the walls to avoid overstressing the geogrids and pushing the walls out of alignment. This restriction may require the use of hand labor to complete the walls.

Do not allow traffic and equipment to operate at an angle to the walls. Traffic and equipment which do not travel parallel to the walls can impart dynamic forces to the walls which can move the walls out of proper alignment. Any damage caused by the Contractor shall be repaired by the Contractor at no cost to the Owner.

The surface of the wall backfill shall be graded at the end of each day of work to provide positive surface drainage away from the walls. Grading shall include proper contouring of fills in adjacent areas to prevent the flow of surface water into the select backfill work areas.

Uncontrolled infiltration from heavy rains during construction can cause severe erosion and undermining of unit block walls, requiring their removal and reconstruction in some instances. Care must be exercised during construction to prevent the infiltration of surface water into the work area behind the walls. The Contractor shall control surface water during wall construction and make all necessary repairs caused by surface water at no additional expense to the Owner.

GENERAL NOTES

- 1) Identifying underground utility locations shall be the responsibility of the Contractor. Underground utilities, if present, shall be located prior to excavation, grading, and wall construction.
- 2) Notify the Engineer immediately if running water is encountered. Do not proceed with work until method of dealing with rock or running water is approved.
- 3) The Contractor shall obtain and pay for all permits which may be required for this project.
- 4) It shall be the responsibility of the Contractor to provide and preserve all survey stakes during construction.
- 5) Care shall be taken to prevent damage to edges of existing pavement, curbs, and structures. Damaged pavement, curbs, and structures shall be repaired or replaced as directed by the Owner.
- 6) Fill where necessary to establish the required grades for the wall construction. All fills shall be placed in maximum 8-inch-thick loose lifts and mechanically compacted to at least 95 percent of the material's standard Proctor (ASTM D 698) maximum dry density at a moisture content conducive to achieving the required compaction criterion.
- 7) All disturbed areas shall be finish-graded, raked, and vegetated, or paved to prevent soil erosion of exposed ground surfaces.
- 8) Provide siltation control, and keep streets and adjacent properties clean and free of dirt, mud, and debris in accordance with applicable regulations.
- 9) The surface of the wall backfill shall be graded at the end of each day of work to provide positive surface drainage away from the walls. Grading shall include proper contouring of fills in adjacent areas to prevent the flow of surface water into the select backfill work area. Uncontrolled infiltration from heavy rains during construction can cause severe erosion and undermining of unit block walls, requiring their removal and reconstruction in some instances. Care must be exercised during construction to prevent the infiltration of surface water into the work area behind the walls.
- 10) Changes to any aspect of the design depicted on the plans, including, but not limited to, the length, elevation, and type of geogrid, backfill material, and block face units, shall not be made without the written permission of Midwest Testing, Inc.
- 11) Drawings will not be to scale if reduced or enlarged. Use dimensions and elevations.
- 12) Maintain a stable cut slope and protect existing utilities during construction.
- 13) The existing locations, elevations, grades, and alignments are based on drawings produced by Wolverton & Associates.
- 14) Block course and geogrid elevations and dimensions as shown on the drawings are based on construction using 18-inch-high block units.

RETAINING WALL DESIGN

The following parameters and requirements were used in the development of the design depicted hereon:

Component	Total Unit Weight, pcf	Cohesion, psf	Friction Angle, ø	Hydrostatic Pressure, psf
Reinforced fill	110	0	3ø	0
Retained fill				
Soil	130	0	32	0
Rock	145	0	42	0
Foundation (rock)	145	0	42	0

Internal Stability of Wall

Minimum factor of safety for geogrid strength	1.5
Minimum factor of safety for geogrid pullout	1.5
Geogrid coverage ratio	1.0
Friction angle along geogrid-soil interface	27.45°
Pullout resistance factor	0.8*tanø
Scale-effect correction factor	0.8

External Stability of Wall

Factor of safety for sliding considerations	1.5
Factor of safety for overturning considerations	2.0
Maximum eccentricity (e/L ratio)	0.1667

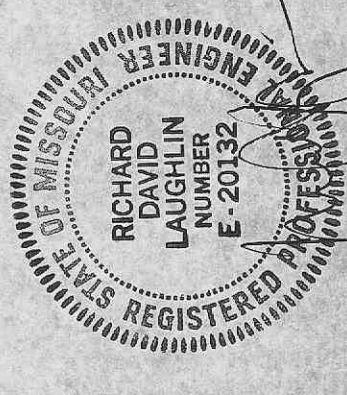
External Loading

Surcharge load = 100 psf (landscaped areas)
 Maximum slope above wall = 3H:1V (max.)
 Maximum height of slope = varies (10' max.)

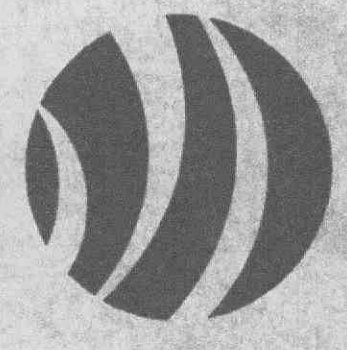
Bearing Conditions

All walls shall bear on natural undisturbed soil or compacted fill suitable for 2000 psf. The design of the walls includes a factor of safety of at least 3 against a general bearing capacity failure.

REVISIONS	
NO.	DATE



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SPECIFICATIONS
 Segmental Retaining Walls
 Woodlawn Shopping Center
 O'Fallon, Missouri

JOB NO.	4776
DRAWN BY	MLH
DESIGNED BY	MLH
APPROVED BY	RDL
DATE	1/20/04

NOTIFICATION OF TESTING

It shall be the responsibility of the Contractor to notify the Geotechnical Engineer or testing agency of the need for testing the following work: foundation and leveling pad preparation, geogrid placement, compaction of fill and backfill materials, and drain construction. At a minimum, notification for the testing shall be made by 5:00 p.m. the day before testing is needed. Failure to notify that testing is needed shall not relieve the Contractor of his responsibility to fully comply with these plans and specifications.

DISCLAIMER OF RESPONSIBILITY

I hereby specify that the documents intended to be authenticated by my seal are limited to this sheet. Copies have been retained by the professional engineer. I hereby disclaim any responsibility to subsequent changes to this drawing and all other drawings, specifications, estimates, reports, or other documents or instruments relating to or intending to be used for any part of the architectural or engineering project or survey unless the changes are made by me or with my written permission.

PROTECTION OF WORK

Contractor shall slope the backfill surface away from the wall at the end of each day of work such that surface runoff is directed away from the face of the wall. Contractor shall not allow runoff from adjacent areas to enter the wall construction area.

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