CITY OF FAIRHOPE

PROJECT NO. REC-002-13
FAIRHOPE SOCCER FIELDS

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PROJECT DESCRIPTION

The project will consist of the installation of Soccer Fields on approximately 40 acres as described in the contract documents with all necessary labor, materials, and equipment necessary to install all required improvements within the allotted time. The work will consist of clearing, grubbing, top soil stripping, grading, drainage infrastructure, erosion control and coordination with the City of Fairhope for Utility and irrigation infrastructure installation, as well as grassing, base pavement, curb and gutter, sidewalks, fences, retaining walls and all other items and appurtenances required by the contract as described herein. All items of work shall be performed in a manner consistent with the referenced specifications.

ALDOT SPECIFICATION REFERENCE

SPECIFICATIONS CONCERNING CONSTRUCTION

This project shall be constructed in accordance with the Alabama Department of Transportation Standard Specifications for Highway Construction, 2012 Edition, and any Supplemental Specifications and Special Provisions included herein. The contractor can use the following link to access the standard specifications: http://www.dot.state.al.us/conweb/specifications.htm.

Below is a list of modifications to the Alabama Department of Transportation Standard Specifications for Highway Construction, 2012 Edition that will apply to this project:

- **Contract documents included with this document shall supersede those contained within the Alabama Department of Transportation Standard Specifications for Highway Construction, 2012 Edition.**
- **Item 210A – Unclassified Excavation**
  Payment for this item will be based on plan quantity. Additional Unclassified Excavation above what is called for in the plans shall be approved by the Engineer prior to work being completed.

SECTION 1002

Aluminum Ornamental Fence System

PART 1 - GENERAL

1.01 WORK INCLUDED

The contractor shall provide all labor, materials and all necessary items for the installation of the ornamental aluminum fence system defined herein at FAIRHOPE SOCCER FIELDS.

1.02 RELATED WORK

Section 210 - Earthwork
Section 620 - Concrete

1.03 SYSTEM DESCRIPTION

The manufacturer shall supply a total ornamental aluminum fencing system design. The system shall include all components (i.e., pickets, posts, rails, gates and hardware) required.

1.04 QUALITY ASSURANCE

The contractor shall provide laborers and supervisors who are thoroughly familiar with the type of construction involved and the materials specified.

1.05 REFERENCES

- ASTM B117 - Practice for Operating Salt-Spray (Fog) Apparatus.
- ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.
- ASTM D523 - Test Method for Specular Gloss.
- ASTM D822 - Practice for Conducting Tests on Paint and Related Coatings and Materials using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus.
- ASTM D1654 - Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.
- ASTM D2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
- ASTM D2794 - Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
- ASTM D3359 - Test Method for Measuring Adhesion by Tape Test.

1.06 SUBMITTAL

The manufacturer's submittal package shall be submitted prior to installation to confirm compliance with all requirements for materials specified in this section. Submittal shall include samples of proposed fencing materials and colors. Submittal package shall require 5 complete sets.

1.07 PRODUCT HANDLING AND STORAGE

Upon receipt at the job site, all materials shall be checked to ensure that no damages occurred during shipping or handling. Materials shall be stored in such a manner to ensure proper ventilation and drainage and to protect against damage, weather, vandalism and theft. All materials regardless of state of installation shall remain the contractor's property and responsibility until such time as final acceptance of the City of Fairhope. The City of Fairhope shall be indemnified and held harmless from any claim regarding damage to materials or installation through acts of vandalism, accident, or acts of God.

PART 2 - MATERIALS

2.01 MANUFACTURER

A. Products from manufacturers having five years or more experience manufacturing aluminum fencing will be considered by the engineer for approval in writing 10 days prior to bidding, and they meet all specifications for design, sizes, and fabrication.

2.02 MATERIAL

A. Aluminum material for fence framework (i.e., tubular pickets, rails and posts) shall conform to the requirements of ASTM B221. The aluminum extrusions for posts and rails shall be Alloy and Temper Designation 6005-T52. The aluminum extrusions for pickets shall be Alloy and Temper Designation 6063-T52.

B. Pickets shall be 3/4" square x .045" thick. Horizontal rails shall be 1-1/4" x 1-7/16" Forerunner™ channel with .060" thick top & internal web wall, and .090" thick side walls and shall be punched to allow picket to pass through the top of the rail. The

Forerunner rail shall be constructed with an internal web insert providing a raceway for the pickets to be retained with a 1/8" retaining rod. The number of rails shall vary with the style, height and strength as determined by manufacturer. Fence posts and gate posts shall meet the minimum size requirements of Table 1.

C. Accessories: Aluminum castings shall be used for all post caps, scrolls, finials, and other miscellaneous hardware. Hinges and latches shall be fabricated from aluminum, stainless steel or composite materials.

2.03 FABRICATION

A. Pickets, rails and posts shall be pre-cut to specified lengths. ForeRunner rails shall be pre-punched to accept pickets. Grommets shall be inserted into the pre-punched holes in the rails and pickets shall be inserted through the grommets so that pre-drilled picket holes align with the internal upper raceway of the ForeRunner rails (Note: This can best be accomplished by using an alignment template). Retaining rods shall be inserted into each ForeRunner rail so that they pass through the pre-drilled holes in each picket, thus completing the panel assembly.

B. The manufactured framework shall be subjected to the Manufacturer thermal stratification coating process (high-temperature, in-line, multi-stage, and multi-layer) including, as a minimum, a six-stage pretreatment/wash and an electrostatic spray application of a polyester finish. The topcoat shall be a "no-mar" TGIC polyester powder coat finish with a minimum thickness of 2 mils (0.0508mm). The color shall be (owner to specify color). The stratification-coated framework shall be capable of meeting the performance requirements for each quality characteristic shown in Table 2.

C. Finish: All fence components shall be subject to a six-stage pretreatment/wash followed by an electrostatic spray application of a "no-mar" TGIC polyester powder coat finish with a minimum thickness of 2-4 mils. The color shall be (owner to specify color).

D. Completed panels shall be capable of supporting a 200 lb. load (applied at midspan) without permanent deformation. Panels without rings shall be biasable to a 12.5% change in grade.

E. Swing gates shall be fabricated using 1-1/4" x 1-7/16" Forerunner rail, 1.75" sq. x .125" gate ends, and 3/4" sq. x .080 pickets. Gates that exceed 6' in width will have a 1.75" sq. x .125" intermediate upright. All rail and upright intersections shall be joined by welding. All picket and rail intersections shall also be joined by welding.

PART 3 - EXECUTION

3.01 PREPARATION

All new installation shall be laid out by the contractor in accordance with the construction plans.

3.02 FENCE INSTALLATION

Fence post shall be spaced according to Table 3, plus or minus ½". For installations that must be raked to follow sloping grades, the post spacing dimension must be measured along the grade. Fence panels shall be attached to posts with brackets supplied by the manufacturer. Posts shall be set in concrete footers to a depth recommended by the manufacturer for the give location. (Note: In some cases, local restrictions of freezing weather conditions may require a greater depth). The "Earthwork" and "Concrete" sections of this specification shall govern material requirements for the concrete footer. Posts setting by other methods such as plated posts or grouted core-drilled footers are permissible only if shown by engineering analysis to be sufficient in strength for the intended application.

3.03 FENCE INSTALLATION MAINTENANCE

When cutting/drilling rails or posts adhere to the following steps to seal the exposed surfaces; 1) Remove all metal shavings from cut area. 2) Apply custom finish paint matching fence color. Failure to seal exposed surfaces per steps 1 & 2 above will negate warranty. Manufacturer spray cans or paint pens shall be used to finish exposed surfaces; it is recommended that paint pens be used to prevent overspray. Fence shall be installed in accordance with the manufacturer's recommendations to insure that warranty remains in effect.

3.04 GATE INSTALLATION

Gate posts shall be spaced according to the manufacturers' gate drawings, dependent on standard out-to-out gate leaf dimensions and gate hardware selected. Type and quantity of gate hinges shall be based on the application; weight, height, and number of gate cycles. The manufacturers' gate drawings shall identify the necessary gate hardware required for the application. Gate hardware shall be provided by the manufacture of the gate and shall be installed per manufacturer's recommendations.

3.05 CLEANING

The contractor shall clean the jobsite of excess materials; post-hole excavations shall be scattered uniformly away from posts or removed.

Table 1 – Minimum Sizes for Posts			
Fence Posts	Panel Height		
2-1/2" x 2-1/2" x .060" w/ reinforced web	Up to 6' Height		
Gate Leaf	Gate Height		
	Up to & Including 4'	Over 4' Up to & Including 5'	Over 5' Up to & Including 6'
Up to 4'	2 1/2" x 2-1/2" x .060" Alum.	3" x 3" x .120" Alum.	4" x 4" x .250" Alum. or 3" x 3" x 12ga. Steel
4'1" to 6'	3" x 3" x .120" Alum.	4" x 4" x .250" Alum. or 3" x 3" x 12ga. Steel	3" x 3" x 12ga. Steel
6'1" to 8'	4" x 4" x .250" Alum. or 3" x 3" x 12ga. Steel	4" x 4" x 11ga. Steel	4" x 4" x 11ga. Steel

Table 2 – Coating Performance Requirements		
Quality Characteristics	ASTM Test Method	Performance Requirements
Adhesion	D3359 – Method B	Adhesion (Retention of Coating) over 90% of test area (Tape and knife test).
Corrosion Resistance	B117 & D1654	Corrosion Resistance over 1000 hours (Scribed per D1654; failure mode is accumulation of 1/8" coating loss from scribe or medium #8 blisters).
Impact Resistance	D2794	Impact Resistance over 60 inch lb. (Forward impact using 0.625" ball).
Weathering Resistance	D822, D2244, D523 (60° Method)	Weathering Resistance over 1,000 hours (Failure mode is 60% loss of gloss or color variance of more than 3 delta-E color units).

Table 3 – Manufacturer Plus – Post Spacing By Bracket Type					
Span	8' Nominal (91-3/4" Rail)				
Post Size	2-1/2"	2-1/2"	3"	2-1/2"	3"
Bracket Type	Manufacturer Plus Line Boulevard (ABB3)	Manufacturer Plus Swivel* (ABB2)		Manufacturer Plus Flat Mount (ABB1)	
Post Settings ± 1/2" O.C.	95"	*95"	*95-1/2"	95"	95-1/2"
Span	6' Nominal (73-1/16" Rail)				
Post Size	2-1/2"	2-1/2"	3"	2-1/2"	3"
Bracket Type	Manufacturer Plus Line Boulevard (ABB3)	Manufacturer Plus Swivel* (ABB2)		Manufacturer Plus Flat Mount (ABB1)	
Post Settings ± 1/2" O.C.	76-1/4"	*76-1/4"	*76-3/4"	76-1/4"	76-3/4"
*Note: When using ABB2 swivel brackets on either or both ends of a panel installation, care must be taken to ensure the spacing between post and adjoining pickets meets applicable codes. This will require trimming one or both ends of the panel.					

3.06 WARRANTY

All fencing, materials and installation of materials shall be warrantied for a period of no less than 2 years.

Section 1003
Chain Link Fencing and Framework

PART 1 – GENERAL

1.01 WORK INCLUDED

The contractor shall provide all labor, materials and appurtenances necessary for installation of the color chain link fencing system defined herein at **Fairhope Soccer Fields.**

1.02 RELATED WORK

– Paving and Surfacing
– Cast-In-Place Concrete
– Unit Masonry

1.03 SYSTEM DESCRIPTION

The contractor shall supply a total color chain link fencing system of the design, style and strength defined herein. The system shall include all components (i.e., framework, chain link fabric, gates and fittings) required.

1.04 QUALITY ASSURANCE

The contractor shall provide laborers and supervisors who are thoroughly familiar with the type of construction involved and materials and techniques specified.

1.05 REFERENCES

A. American Society for Testing and Materials (ASTM) Standards: A90/A90M - Test Method for Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings. A653/A653M - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process. A924/A924M - Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process. B6 - Specification for Zinc. B117 - Practice for Operating Salt Spray (Fog) Apparatus. D1499 - Practice for Operating Light- and Water-Exposure Apparatus (Carbon-Arc Type) for Exposure of Plastics. D3359 - Test Methods for Measuring Adhesion by Tape Test. E8/E8M - Test Methods for Tension Testing of Metallic Materials. F567 - Practice for Installation of Chain-Link Fence. F626 - Specification for Fence Fittings. F668 - Specification for Poly (Vinyl Chloride) (PVC)-Coated Steel Chain-Link Fence Fabric. F900 - Specification for Industrial and Commercial Swing Gates. F934 - Specification for Standard Colors for Polymer-Coated Chain Link Fence Materials. F969 - Practice for Construction of Chain-Link Tennis Court Fence. F1043 - Specification for Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework. F1184 - Specification for Industrial and Commercial Horizontal Slide Gates.

B. American Association of State Highway and Transportation Officials (AASHTO) Standards: M181 - Standard Specification for Chain-Link Fence.

C. United States Federal Supply Service General Services Administration Specifications: RR-F-191/3 - Federal Specification Sheet for Fencing, Wire and Post, Metal (Chain-Link Fence Posts, Top Rails and Braces) - Detail Specification.

1.06 SUBMITTAL

The manufacturer's literature shall be submitted prior to installation. Samples of fencing materials shall be provided with submittals along with color options. A total of 5 complete packages shall be submitted.

1.07 PRODUCT HANDLING AND STORAGE

Upon receipt at the job site, all materials shall be checked to ensure that no damages occurred during shipping or handling. Materials shall be stored in such a manner to ensure proper ventilation and drainage and to protect against damage, weather, vandalism and theft. All materials regardless of state of installation shall remain the contractor's property and responsibility until such time as final acceptance of the City of Fairhope. The City of Fairhope shall be indemnified and held harmless from any claim regarding damage to materials or installation through acts of vandalism, accident, or acts of God.

PART 2 - MATERIALS

2.01 MANUFACTURER

2.01MANUFACTURER

A. Products from manufacturers having five years or more experience manufacturing fencing will be considered by the engineer for approval in writing 10 days prior to bidding, and they meet all specifications for design, sizes, and fabrication. Information regarding Manufacturer product for coated chain link fencing and color options shall be provided prior to approval of ordering materials.

2.02 MATERIAL – STEEL FRAMEWORK

A. The steel material used to manufacture shall be zinc-coated steel strip, galvanized by the hot-dip process conforming to the criteria of ASTM A653/A653M and the general requirements of ASTM A924/A924M. Including fence post caps.

B. The zinc used in the galvanizing process shall conform to ASTM B6. Weight of zinc shall be determined using the test method described in ASTM A90 and shall conform to the weight range allowance for ASTM A653, Designation G-90.

C. The framework shall be manufactured in accordance with commercial standards to meet the strength (50,000 psi minimum yield strength) and coating requirements of ASTM F1043, Group IC, Electrical Resistance Welded Round Steel Pipe, light industrial weight.

D. The exterior surface of the electrical resistance weld shall be recoated with the same type of material and thickness as the basic zinc coating.

E. The manufactured framework shall be subjected to the coating process, a complete thermal stratification coating process (multi-stage, high-temperature, multi-layer) including, as a minimum, a six-stage pretreatment/wash (with zinc phosphate), an electrostatic spray application of an epoxy base, and a separate electrostatic spray application of a polyester finish. Including fence posts, post caps, top rails and hardware.

F. The material used for the base coat shall be a (gray color) thermosetting epoxy; the minimum thickness of the base coat shall be two (2) mils. The material used for the finish coat shall be a thermosetting "no-mar" TGIC polyester powder; the minimum thickness of the finish coat shall be two (2) mils. The stratification coated pipe shall demonstrate the ability to endure a salt-spray resistance test in accordance with ASTM B117 without loss of adhesion for a minimum exposure time of 3,500 hours. Additionally, the coated pipe shall demonstrate the ability to withstand exposure in a weather-ometer apparatus for 1,000 hours without failure in accordance with ASTM D1499 and to show satisfactory adhesion when subjected to the cross-hatch test, Method B, in ASTM D3359. The polyester finish coat shall not crack, blister or split under normal use.

G. The color of all frameworks shall be **(specify Black, Green or Brown)** in accordance with ASTM F934. City of Fairhope shall specify color.

H. The strength of fencing shall conform to the requirements of ASTM F1043; the minimum weight shall not be less than 90% of the nominal weight (see Table 1). The strength of line, end, corner and pull posts shall be determined by the use of 4' or 6' cantilevered beam test. The top rail shall be determined by a 10' free-supported beam test (see Table 1). An alternative method of determining pipe strength is by the calculation of bending moment (see Table 1). Conformance with this specification can be demonstrated by measuring the yield strength of a randomly selected piece of pipe from each lot and calculating the section modulus. The yield strength shall be determined according to the methods described in ASTM E8. For materials under this specification, the 0.2 offset method shall be used in determining yield strength. Terminal posts, line posts and top/bottom rails shall be precut to specified lengths.

2.03MATERIAL – FENCE FABRIC

A. The material for chain link fence fabric shall be manufactured from galvanized steel wire. The weight of zinc shall meet the requirements of ASTM F668, Table 4. Galvanized wire shall be PVC-coated to meet the requirements of ASTM F668. The class of the fence fabric shall be **(specify Class 1 - Extruded, Class 2A - Extruded and Bonded or Class 2B - Fused and Bonded).**

B. Selvage: Top edge **shall be knuckled** and bottom edge **shall be knuckled.**

C. Color: The coating color for the fence fabric shall be **(specify Black, Green or Brown).** Reference ASTM F668 and ASTM F934. Color to be approved by the City of Fairhope prior to ordering of materials.

D. Wire Size: The size of the steel wire core shall be **8** gauge and the finished size of the coated wire shall be **0.162** inches.

E. Height and Mesh Size: The fabric height shall be **as shown on construction plan (6 feet)** high with a mesh size of **2** inches.

2.04 MATERIAL – FENCE FITTINGS

The material for fence fittings shall be manufactured to meet the requirements of ASTM F626. The coating for all fittings shall be the same color coating system required for the framework (see 2.02); the color of all fittings and fasteners shall be **(specify Black, Green or Brown)** in accordance with ASTM F934. All fasteners shall be stainless steel.

2.05 MATERIAL – GATES

Swing gates shall be manufactured and coated to meet the requirements of ASTM F900. Slide gates shall be manufactured to meet the requirements of ASTM F1184. The color of all gates shall be **(specify Black, Green or Brown)** in accordance with ASTM F934. Color to be specified by the City of Fairhope.

PART 3 – EXECUTION

3.01 PREPARATION

All new installation shall be laid out by the contractor in accordance with the construction plan.

3.02 INSTALLATION

Install chain link fence in accordance with ASTM F567. Fence posts shall be set at spacings of a maximum of 10' o.c. Gate posts shall be spaced according to the gate openings specified in the construction plans. The "Paving and Surfacing," "Cast-In-Place Concrete" and "Unit Masonry" sections of this specification shall govern post base placement and material requirements. Install fabric on security side and attach with 9 gauge coated steel wire ties to line posts at 15 inches o.c. , within 4 inch of top and bottom of fabric, to rails, braces and tension wire at 24 inches o.c. using 9 gauge steel clips (hog rings).

3.03 CLEANING

The contractor shall clean the jobsite of excess materials. Post hole excavations shall be scattered uniformly away from posts or removed.

TABLE 1

Fence Industry	Decimal O.D. Equivalent		Pipe Wall Thickness		Weight		Section Modulus		Min. Yield Strength		Max. Bending Moment	Calculated Load (lbs.)		
								x		=		10' Free Supported	Cantilever	
O.D.	Inches	(mm)	Inches	(mm)	lb./ft.	(kg/m)	Inches		psi		lb. in.		4'	6'
1-3/8"	1.315	33.40	.080	2.03	1.06	1.57	.0900	x	50,000	=	4,500	150	N/A	N/A
1-5/8"	1.660	42.16	.095	2.16	1.43	2.13	.1574	x	50,000	=	7,870	262	164	109
2"	1.900	48.26	.090	2.29	1.74	2.59	.2208	x	50,000	=	11,040	N/A	230	154
2-1/2"	2.375	60.33	.095	2.41	2.32	3.45	.3734	x	50,000	=	18,670	N/A	389	259
3"	2.875	73.03	.111	2.82	3.26	4.85	.6365	x	50,000	=	31,825	N/A	663	442

TABLE 2

Finished Gauge	Finished OD (NOM)	Core Diameter (NOM)	PVC Coating Thickness	Mesh Sizes Available	Fabric Extrusion Type	Minimum Breaking Strength
6	.162 (4.11 mm)	.120 (3.05 mm)	.015 - .025 (0.38 - 0.64 mm)	2 (50 mm); 1-3/4 (44 mm); 1 (25 mm)	CLASS 1, 2A	850#
9	.148 (3.76 mm)	.097 (2.46 mm)	.015 - .025 (0.38 - 0.64 mm)	2 (50 mm); 1-3/4 (44 mm); 1-1/4 (32 mm); 1 (25 mm)	CLASS 1, 2A	650#

Section 1004
Wood Fencing

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section describes the specific requirements for wood fencing (wood fencing furnished and installed as specified herein and as shown on the contract drawings).

1.02 RELATED SECTIONS

A. - Paving and Surfacing

B. - Cast-In-Place Concrete

C. - Unit Masonry

1.03 SUBMITTALS

A. Changes in specifications may not be made after the published date of bid. All submittals of substitutions must be approved 72 hours before bid date.

B. Shop drawings of fences and gates with all dimensions, details, and finishes. Drawings must include post foundations.

C. Provide shipping list for materials used, endorsed with the manufacturer's voucher certifying that the material used in the wood fencing system complies with these specifications. Sample materials

1.04 PRODUCT HANDLING AND STORAGE

Upon receipt at the job site, all materials shall be checked to ensure that no damages occurred during shipping or handling. Materials shall be stored in such a manner to ensure proper ventilation and drainage and to protect against damage, weather, vandalism and theft. All materials regardless of state of installation shall remain the contractor's property and responsibility until such time as final acceptance of the City of Fairhope. The City of Fairhope shall be indemnified and held harmless from any claim regarding damage to materials or installation through acts of vandalism, accident, or acts of God.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Products from manufacturers having five years or more experience manufacturing wood fencing will be considered by the engineer for approval in writing 10 days prior to bidding, and they meet all specifications for design, sizes, and fabrication.

B. Provide wood fencing system as a complete system with all gates, hardware, appurtenances and other components produced by a single manufacturer, including custom erection accessories, fittings, clamps and fastenings as may be necessary or required.

2.02 WOOD FENCE

Style: Dog-eared Pickets
Height: 6 feet

A. Provide sizes and dimensions per the Contract Drawings, satisfying ASTM F 537.

B. Pickets: (Size) 5/8" x 5 ½" x 6' (min.) Rails: (Size) 2"x4"x8'(min.)

Posts: (Size) 4"x4"x8' (min.)

2.03 SETTING MATERIALS

A. Concrete: Minimum 28 day compressive strength of 3,000 psi (20 MPa).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify areas to receive fencing are completed to final grades and elevations.

B. Ensure property lines and legal boundaries of work are clearly established.

3.02 INSTALLATION

A. Install wood fencing system in compliance with ASTM F 537.

B. Line posts spaced not more than 8'-0" on centers, unless otherwise indicated.

C. Check each post for vertical and top alignment, and maintain in position during placement and finishing operations.

3.03 GATE INSTALLATION

A. Install gates plumb, level and secure using bolt-on hardware supplied by the manufacturer.

B. Adjust hardware for smooth operation.

3.04 ACCESSORIES

A. Install post caps and other accessories to complete fence.

3.05 CLEANING

A. Clean up debris and remove from the site.

3.06 WARRANTY

All fencing, materials and installation of materials shall be warrantied for a period of no less than 2 years.

Section 1005
SPECIFICATION FOR SEGMENTAL RETAINING WALL SYSTEMS

PART 1: GENERAL

1.01 Description

A. Work shall consist of furnishing materials, labor, equipment and supervision to install a segmental retaining wall system in accordance with plans and specifications and in reasonably close conformity with the lines, grades, design and dimensions shown on plans or established by Owner or Owner's engineer.

1.02 Reference Standards

A. Segmental Retaining Wall Units

1. **ASTM C 140** - Sampling and Testing Concrete Masonry Units
2. **ASTM C 1372** – Standard Specification for Dry-Cast Segmental Retaining Wall Units

B. Geosynthetic Reinforcement

1. **ASTM D 4595** – Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method
2. **ASTM D 5262** – Standard Test Method for Evaluating the Unconfined Tension Creep and Creep Rupture Behavior of Geosynthetics
3. **ASTM D 5321** – Standard Test Method For Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic by Direct Shear Method
4. **ASTM D 5818** - Standard Practice for Exposure and Retrieval of Samples to Evaluate Installation Damage of Geosynthetics
5. **ASTM D 6706** – Standard Test Method for Measuring Geosynthetic Pullout Resistance in Soil

C. Soils

1. **ASTM D 698** – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort
2. **ASTM D 2487** – Standard Practice for Classification of Soils for Engineering Purposes
3. **ASTM D 422** – Standard Test Method for Particle-Size Analysis of Soils
4. **ASTM D 4318** – Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils
5. **ASTM G 51** – Standard Test Method for Measuring pH of Soil for Use in Corrosion Testing

D. Drainage Pipe

1. **ASTM F 758**– Standard Specification for Smooth-Wall Polyvinyl Chloride (PVC) Plastic Underdrain Systems for Highway, Airport or Similar Drainage
2. **ASTM F 405** – Standard Specification for Corrugated Polyethylene (PE) Pipe and Fittings

E. Engineering Design
   1. "NCMA Design Manual for Segmental Retaining Walls," Third Edition

F. Where specifications and reference documents conflict, the Wall Design Engineer shall make the final determination of applicable document.

1.03 Submittals

A. Materials Submittals: The Contractor shall submit manufacturers' certifications two weeks prior to start of work stating that the SRW units and geosynthetic reinforcement meet the requirements of Section 2 of this specification. Color options shall be provided with submittal information.

B. Design Submittal: The Contractor shall submit two sets of detailed design calculations and final retaining wall plans for approval at least two weeks prior to the beginning of wall construction. All calculations and drawings shall be prepared and sealed by a professional Civil Engineer (P.E.) in the State of Alabama– (Wall Design Engineer) experienced in SRW design and licensed in the state where the wall is to be built.

1.04 Delivery, Storage and Handling

A. Contractor shall check materials upon delivery to ensure that the specified type and grade of materials have been received and proper color and texture of SRW units have been received.

B. Contractor shall store and handle materials in accordance with manufacturer's recommendations and in a manner to prevent deterioration or damage due to moisture, temperature changes, contaminants, corrosion, breaking, chipping or other causes.

C. Contractor shall prevent excessive mud, wet concrete, epoxies and similar materials that may affix themselves from coming in contact with materials.

D. Contractor shall protect materials from damage; no damaged material shall be incorporated into the segmental wall.

E. Geosynthetic shall be protected from UV exposure and the protective covering on geosynthetic shall remain until immediately before installation and shall be stored at temperatures above -10 degrees F.

F. Upon receipt at the job site, all materials shall be checked to ensure that no damages occurred during shipping or handling. Materials shall be stored in such a manner to ensure proper

ventilation and drainage and to protect against damage, weather, vandalism and theft. All materials regardless of state of installation shall remain the contractor's property and responsibility until such time as final acceptance of the City of Fairhope. The City of Fairhope shall be indemnified and held harmless from any claim regarding damage to materials or installation through acts of vandalism, accident, or acts of God.

PART 2: MATERIALS

2.01 Segmental Retaining Wall Units

A. SRW units shall be machine formed, Portland cement concrete blocks specifically designed for retaining wall applications. SRW units currently approved for this project are:

B. Color of SRW units shall be approved by the City of Fairhope.

C. Finish of SRW shall be approved by the City of Fairhope.

D. SRW unit face geometry shall be approved by the City of Fairhope.

E. SRW unit height shall be determined by the wall manufacturer.

F. SRW units shall provide a minimum weight of 110 psf wall face area.

G. SRW units shall be solid through the full depth of the unit.

H. SRW units shall have a depth (front face to rear) to height ratio that will allow for the wall to be placed in the give area as designated on the plans.

I. SRW horizontal and vertical gap tolerances shall comply with manufacturer recommendations.

J. SRW units shall have interlocking geometry or pinned connections as determined by the manufacture.

K. SRW units shall be sound and free of cracks or other defects that would interfere with the proper placing of the unit or significantly impair the strength or permanence of the structure. Any cracks or chips observed during construction shall fall within the guidelines outlined in ASTM C 1372.

L. Concrete SRW units shall conform to the requirements of ASTM 1372 and have a minimum net average 28 days compressive strength of 3000 psi. Compressive strength test specimens shall conform to the saw-cut coupon provisions of ASTM C140.

M. SRW units' molded dimensions shall not differ more than $\pm$ 1/8 inch from that specified, as measured in accordance with ASTM C 140. This tolerance does not apply to

architectural surfaces, such as split faces.

2.02 Omitted.

2.03 Geosynthetic Reinforcement

A. Geosynthetic reinforcement shall consist of high-tenacity PET geogrids, HDPE geogrids, or geotextiles manufactured for soil reinforcement applications. The type, strength and placement of the geosynthetic reinforcement shall be determined by procedures outlined in this specification and the NCMA Design Manual for Segmental Retaining Walls (3rd Edition 2009) and materials shall be specified by Wall Design Engineer in their final wall plans and specifications. The manufacturers/suppliers of the geosynthetic reinforcement shall have demonstrated construction of similar size and types of segmental retaining walls on previous projects.

B. The type, strength and placement of the reinforcing geosynthetic shall be as determined by the Wall Design Engineer, as shown on the final, Alabama P.E.-stamped retaining wall plans.

2.04 Leveling Pad

A. Material for leveling pad shall consist of compacted sand, gravel, or combination thereof (USCS soil types GP,GW, SP, & SW) and shall be a minimum of 6 inches in depth. Lean concrete with a strength of 200-300 psi and 3 inches thick maximum may also be used as a leveling pad material. The leveling pad should extend laterally at least a distance of 6 inches from the toe and heel of the lowermost SRW unit.

2.05 Drainage Aggregate

A. Drainage aggregate shall be angular, clean stone or granular fill meeting the following gradation as determined in accordance with ASTM D422:

Sieve Size	Percent Passing
1 inch	100
3/4 inch	75-100
No. 4	0-60
No. 40	0-50
No. 200	0-5

2.06 Drainage Pipe

A. The drainage collection pipe shall be a perforated or slotted PVC, or corrugated HDPE pipe. The drainage pipe may be wrapped with a geotextile to function as a filter.

B. Drainage pipe shall be manufactured in accordance with ASTM F 405 or ASTM F 758.

2.07 Reinforced Backfill Soil

A. The reinforced soil material shall be free of debris. Unless otherwise noted on the final, P.E.-sealed, retaining wall plans prepared by the Wall Design Engineer, the reinforced material shall consist of the inorganic USCS soil types GP, GW, SW, SP, SM, meeting the following gradation, as determined in accordance with ASTM D422:

Sieve Size	Percent Passing
1 inch	100
No. 4	20-100
No. 40	0-60
No. 200	0-35

B. The maximum particle size of poorly-graded gravels (GP) (no fines) should not exceed 3/4 inch unless expressly approved by the Wall Design Engineer and the long-term design strength (LTDS) of the geosynthetic is reduced to account for additional installation damage from particles larger than this maximum.

C. The plasticity of the fine fraction shall be less than 20.

D. The pH of the backfill material shall be between 3 and 9 when tested in accordance with ASTM G 51.

2.10 Geotextile Filter

A. Drainage geotextile shall consist of geosynthetic specifically manufactured for use as a preamble soil filter that retains soil while still allowing water to pass throughout the life of the structure. The type and placement of the geotextile filter material shall be as required by the Wall Design Engineer in their final wall plans and specifications.

PART 3: DESIGN PARAMETERS

3.01 Soil

A. The following soil parameters, as determined by a licensed Geotechnical Engineer in the State of Alabama shall be used for the preparation of the final design:

	Unit Weight (γ) (pcf)	Internal Friction Angle (ϕ) (degrees)	Cohesion (c) (psf)
Reinforced Fill	_____	_____	0
Retained Soil	_____	_____	0

Foundation Soil _____ _____ _____

(If internal friction angles are not available for the above section, the specifier can provide the USCS soil type classification for the reinforced, retained, and foundation soils and/or attach the geotechnical investigation report for this project.)

B. Should the actual soil conditions observed during construction differ from those assumed for the design, design shall be reviewed by the Wall Design Engineer at the Owner's Geotechnical Engineer's direction.

3.02 Design

A. The design analysis for the final, P.E.-stamped retaining wall plans prepared by the Wall Design Engineer shall consider the external stability against sliding and overturning, internal stability and facial stability of the reinforced soil mass, and shall be in accordance with acceptable engineering practice and these specifications. The internal and external stability analysis shall be performed in accordance with the "NCMA Design Manual for Segmental Retaining Walls, 3rd Edition" using the recommended minimum factors of safety in this manual.

B. External stability analysis for bearing capacity, global stability, and total and differential settlement shall be the responsibility of the Owner and the Owner's Geotechnical Engineer. The Geotechnical Engineer shall perform bearing capacity, settlement estimates, and global stability analysis based on the final wall design provided by the Wall Design Engineer and coordinate any required changes with the Wall Design Engineer.

C. While vertical spacing between geogrid layers may vary, it shall not exceed 2.0 feet maximum in the wall design.

D. The geosynthetic placement in the wall design shall have 100% continuous coverage parallel to the wall face. Gapping between horizontally adjacent layers of geosynthetic (partial coverage) will not be allowed.

PART 4:CONSTRUCTION

4.01 Inspection

A. The Owner or Owner's Engineer is responsible for verifying that the materials supplied by the Contractor meet all the requirements of the specification. This includes all submittals for materials and design, qualifications and proper installation of wall system.

B. Contractor's field construction supervisor shall have demonstrated experience and be qualified to direct all work at the site.

4.02 Excavation

A. Contractor shall excavate to the lines and grades shown on the project grading plans. Contractor shall take precautions to minimize over-excavation. Over-excavation shall be filled with compacted infill material, or as directed by the Wall Design Engineer, at the Contractor's expense.

B. Contractor shall verify location of existing structures and utilities prior to excavation. Contractor shall ensure all surrounding structures are protected from the effects of wall excavation. Excavation support, if required, is the responsibility of the Contractor.

4.03 Foundation Preparation

A. Following the excavation, the foundation soil shall be examined by the Owner's Engineer to assure actual foundation soil strength meets or exceeds the assumed design bearing strength. Soils not meeting the required strength shall be removed and replaced with infill soils, as directed by the Owner's Geotechnical Engineer.

B. Foundation soil shall be proof-rolled and compacted to 95% standard Proctor density and inspected by the Owner's Geotechnical Engineer prior to placement of leveling pad materials.

4.04 Leveling Pad Construction

A. Leveling pad shall be placed as shown on the final, P.E.-sealed retaining wall plans with a minimum thickness of 6 inches. The leveling pad should extend laterally at least a distance of 6 inches from the toe and heel of the lowermost SRW unit.

B. Granular leveling pad material shall be compacted to provide a firm, level bearing surface on which to place the first course of units. Well-graded sand can be used to smooth the top 1/4 inch to 1/2 inch of the leveling pad. Compaction will be with mechanical plate compactors to achieve 95% of maximum standard Proctor density (ASTM D 698).

4.05 SRW Unit Installation

A. All SRW units shall be installed at the proper elevation and orientation as shown on the final, P.E.-sealed wall plans and details or as directed by the Wall Design Engineer. The SRW units shall be installed in general accordance with the manufacturer's recommendations. The specifications and drawings shall govern in any conflict between the two requirements.

B. First course of SRW units shall be placed on the leveling pad. The units shall be leveled side-to-side, front-to-rear and with adjacent units, and aligned to ensure intimate contact with the leveling pad. The first course is the most important to ensure accurate and acceptable results. No gaps shall be left between the front of adjacent units. Alignment may be done by means of a string line or offset from base line to the back of the units.

C. All excess debris shall be cleaned from top of units and the next course of units installed on top of the units below.

D. Two VERSA-Tuff connection pins shall be inserted through the pin holes of each upper-course unit into receiving slots in lower-course units. Pins shall be fully seated in the pin slot below. Units shall be pushed forward to remove any looseness in the unit-to-unit connection.

E. Prior to placement of next course, the level and alignment of the units shall be checked and corrected where needed.

F. Layout of curves and corners shall be installed in accordance with the wall plan details or in general accordance with SRW manufacturer's installation guidelines. Walls meeting at corners shall be interlocked by overlapping successive courses.

G. Procedures C. through F. shall be repeated until reaching top of wall units, just below the height of the cap units. Geosynthetic reinforcement, drainage materials, and reinforced backfill shall be placed in sequence with unit installation as described in Section 4.06, 4.07 and 4.08.

4.06 Geosynthetic Reinforcement Placement

A. All geosynthetic reinforcement shall be installed at the proper elevation and orientation as shown on the final P.E.-sealed retaining wall plan profiles and details, or as directed by the Wall Design Engineer.

B. At the elevations shown on the final plans, (after the units, drainage material and backfill have been placed to this elevation) the geosynthetic reinforcement shall be laid horizontally on compacted infill and on top of the concrete SRW units, to within 1 inch of the front face of the unit below. Embedment of the geosynthetic in the SRW units shall be consistent with SRW manufacturer's recommendations. Correct orientation of the geosynthetic reinforcement shall be verified by the Contractor to be in accordance with the geosynthetic manufacturer's recommendations. The highest-strength direction of the geosynthetic must be perpendicular to the wall face.

C. Geosynthetic reinforcement layers shall be one continuous piece for their entire embedment length. Splicing of the geosynthetic in the design-strength direction (perpendicular to the wall face) shall not be permitted. Along the length of the wall, horizontally adjacent sections of geosynthetic reinforcement shall be butted in a manner to assure 100% coverage parallel to the wall face.

D. Tracked construction equipment shall not be operated directly on the geosynthetic reinforcement. A minimum of 6 inches of backfill is required prior to operation of tracked vehicles over the geosynthetic. Turning should be kept to a minimum. Rubber-tired equipment may pass over the geosynthetic reinforcement at slow speeds (less than 5 mph).

E. The geosynthetic reinforcement shall be free of wrinkles prior to placement of soil fill. The nominal tension shall be applied to the reinforcement and secured in place with staples, stakes or by hand tensioning until reinforcement is covered by 6 inches of fill.

4.07 Drainage Aggregate and Drainage Material Placement

A. Drainage aggregate shall be installed to the line, grades and sections shown on the final P.E.-sealed retaining wall plans. Drainage aggregate shall be placed to the minimum thickness shown on the construction plans between and behind units (a minimum of 1 cubic foot for each exposed square foot of wall face unless otherwise noted on the final wall plans).

B. Drainage collection pipes shall be installed to maintain gravity flow of water outside the reinforced-soil zone. The drainage collection pipe shall be installed at the locations shown on the final construction drawings. The drainage collection pipe shall daylight into a storm sewer or along a slope, at an elevation below the lowest point of the pipe within the aggregate drain. Drainage laterals shall be spaced at a maximum 50-foot spacing along the wall face.

4.08 Backfill Placement

A. The reinforced backfill shall be placed as shown in the final wall plans in the maximum compacted lift thickness of 8 inches and shall be compacted to a minimum of 95% of standard Proctor density (ASTM D 698) at a moisture content within -1% point to +3% points of optimum. The backfill shall be placed and spread in such a manner as to eliminate wrinkles or movement of the geosynthetic reinforcement and the SRW units.

B. Only hand-operated compaction equipment shall be allowed within 3 feet of the back of the wall units. Compaction within the 3 feet behind the wall units shall be achieved by at least three passes of a lightweight mechanical tamper, plate, or roller.

C. At the end of each day's operation, the Contractor shall slope the last level of backfill away from the wall facing and reinforced backfill to direct water runoff away from the wall face.

D. At completion of wall construction, backfill shall be placed level with final top of wall elevation. If final grading, paving, landscaping and/or storm drainage installation adjacent to the wall is not placed immediately after wall completion, temporary grading and drainage shall be provided to ensure water runoff is not directed at the wall nor allowed to collect or pond behind the wall until final construction adjacent to the wall is completed.

4.09 SRW Caps

A. SRW caps shall be properly aligned and glued to underlying units with adhesive, a flexible, high-strength concrete adhesive. Rigid adhesive or mortar are not acceptable.

B. Caps shall overhang the top course of units by 3/4 inch to 1 inch. Slight variation in overhang is allowed to correct alignment at the top of the wall.

4.10 Construction Adjacent to Completed Wall

A. The Owner or Owner's Representative is responsible for ensuring that construction by others adjacent to the wall does not disturb the wall or place temporary construction loads on the wall that exceed design loads, including loads such as water pressure, temporary grades, or equipment loading. Heavy paving or grading equipment shall be kept a minimum of 3 feet behind the back of the wall face. Equipment with wheel loads in excess of 150 psf live load shall not be operated within 10 feet of the face of the retaining wall during construction adjacent to the wall. Care should be taken by the General Contractor to ensure water runoff is directed away from the wall structure until final grading and surface drainage collection systems are completed.

END OF SECTION

Section 1006

Gabion Mat-Galvanized & PVC Coated

1.0 Description

This work shall consist of furnishing, assembling and filling woven wire mesh containers with rock to form gabion gabions as specified in the contract in conformity with the dimensions, lines and grades shown on the plans, or as determined by the engineer and manufacturer. These specifications are in accordance with ASTM A975 and include gabion mats.

2.0 Materials

2.1 Woven Mesh Gabion

2.1.1 Wire (Zinc Coated)

All tests on wire must be performed prior to manufacturing the mesh.

- Tensile strength: both the wire used for the manufacture of gabion gabions and the lacing wire, shall have a maximum tensile strength of 75,000 psi (515 MPa), in accordance with ASTM A641/A641M.
- Elongation: the test must be carried out on a sample at least 12 in. (30 cm) long. Elongation shall not be less than 12%, in accordance with ASTM A370.
- Zinc coating: minimum quantities of zinc according to ASTM A641/A641M, Class III soft temper coating.
- Adhesion of zinc coating: the adhesion of the zinc coating to the wire shall be such that, when the wire is wrapped six turns round on a mandrel having four times the diameter of the wire, it does not flake or crack when rubbing it with the bare fingers, in accordance with ASTM A641/A641M for zinc coating.

2.1.2 PVC (Polyvinyl Chloride) Coating

When specified in the plans:

- Specific gravity: 81-84 pcf 1.30-1.35 kg/dm3, in accordance with ASTM D792, Table 1,
- Hardness: between 50 and 60 Shore D, according to ASTM D2240,
- Tensile strength: not less than 2,985 psi (20.6 MPa), according to ASTM D412,
- Modulus of elasticity: not less than 2,700 (18.6 MPa), in accordance with ASTM D412,
- Abrasion resistance: the percentage of the weight loss shall be less than 12%, according to ASTM D1242.
- Heat Aging Test: prior to UV and Abrasion degradation, the PVC polymer coating shall have a projected durability life of 69 years when tested in accordance with UL 746B.

The accelerated aging tests are:

- Salt spray test: test period 3,000 hours, test method ASTM B117,

- Exposure to UV rays: test period 3,000 hours at 145°F (63°C), test method ASTM D1499 and ASTM G152.
- Brittleness temperature: no higher than 15°F (- 9°C), or lower temperature when specified by the purchaser, when tested in accordance with ASTM D746.

The properties after aging tests shall be as follows:

- Appearance of coated mesh: no cracking, stripping or air bubbles, and no appreciable variation in color;
- Specific gravity: variations shall not exceed 6%;
- Hardness: variations shall not exceed 10%;
- Tensile strength: variations shall not exceed 25%;
- Modulus of elasticity: variations shall not exceed 25%;
- Abrasion resistance: variations shall not exceed 10%;
- Brittleness temperature: shall not exceed +18°C.

2.1.3 Galvanized and PVC coated wire mesh gabions (8 x 10 mesh type):

- PVC coating thickness: Nominal – 0.02 in (0.5 mm), Minimum – 0.015 in (0.38 mm)
- Mesh Wire: Diameter – 0.106 in. (2.70 mm) internal, 0.146 in. (3.70 mm) external
- Selvedge Wire: Diameter – 0.134 in. (3.40 mm) internal, 0.174 in. (4.40 mm) external
- Mesh Opening: Nominal Dimension D = 3.25 in. (83 mm), as per Fig. 1.

2.1.4 Galvanized and PVC coated lacing wire and internal stiffeners:

- PVC coating thickness: Nominal – 0.02 in (0.5 mm), Minimum – 0.015 in (0.38 mm)
- Lacing wire: Diameter – 0.087 in. (2.20 mm) internal, 0.127 in. (3.20 mm) external
- Cross Tie/Stiffener wire: Diameter - 0.087 in. (2.20 mm) internal, 0.127 in. (3.20 mm) external
- Preformed Stiffener: Diameter – 0.134 in. (3.4 mm) internal, 0.174 in. (4.4 mm) external

2.1.5 Steel Mesh Properties

- Mesh Tensile Strength shall have a minimum strength of 2900 lb/ft (42.3 kN/m) when tested in accordance with ASTM A975 section 13.1.1
- Punch Test Resistance shall have a minimum resistance of 5300 lb (23.6 kN) when tested in accordance with ASTMA975 section 13.1.4
- Connection to selvedges shall have a minimum resistance of 1200 lb/ft (17.5 kN/m) when tested in accordance with ASTM A975.

2.1.6 Spenax Fasteners (Overlapping Fasteners)

- Stainless Steel overlapping fasteners may be used in lieu of, or to complement, lacing wire for basket assembly and installation.
- High tensile fasteners shall have a nominal spacing of 4 in. (100 mm) not to exceed 6 in (150 mm) for all assembly and installation. This is based on a 1,200 lb/ft (17.5 kN/m) pull apart

resistance for galvanized and PVC coatedwire mesh with this spacing (ASTM A975 section 13.1.2).

- Fasteners used for assembly and installation of the units on the field shall be tested for compliance with the ASTM A975 section 13.1.2.2 Pull-Apart Resistance. Producer or supplier of the wire mesh shall provide certification nolater than 15 days prior of starting construction.
- When tested in accordance with section 13.1.2.1, the average maximum resistance of the fasteners from the field shall not be lower than 90% of the resistance provided in the certification.
- Stainless Steel Fasteners: Diameter = 0.120 in. (3.05 mm), according to ASTM A313/A313M, Type 302, Class I.
- Tensile strength: 222,000 to 253,000 psi (1530-1744 MPA) in accordance with ASTM A764 (2001).
- Proper installation of rings: A properly formed Spenax fastener shall have a nominal overlap of one (1) in. after closure (Fig. 2).

2.2 Tolerances

- Gabion Mats: ± 5 % on the length and width, and ± 10 % on the height.
- Mesh opening: Tolerances on the hexagonal, double twisted wire mesh opening shall not exceed ± 10% on the nominal dimension D values (see Fig.1).
- Wire Tolerance: zinc coating, in accordance with ASTM A641/A641M, Class III soft temper coating.

Fig. 1

Mesh Type	Nominal Dimension D
8 x 10	3.25 in. (83 mm)

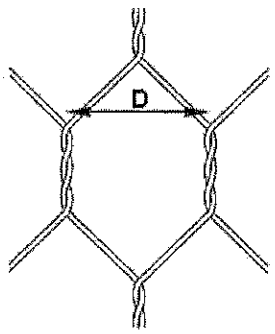
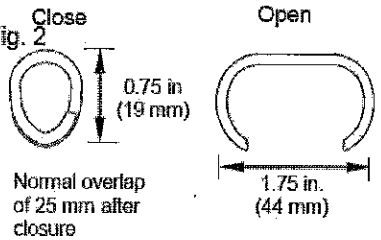


Fig. 2



2.3 Standard Unit Size

Table of sizes for gabions			
L=Length ft (m)	W=Width ft (m)	H=Height ft (m)	# of cells
6 (1.8)	3 (0.9)	3 (0.9)	2
9 (2.7)	3 (0.9)	3 (0.9)	3
12 (3.6)	3 (0.9)	3 (0.9)	4
6 (1.8)	3 (0.9)	1.5 (0.45)	2
9 (2.7)	3 (0.9)	1.5 (0.45)	3
12 (3.6)	3 (0.9)	1.5 (0.45)	4
6 (1.8)	3 (0.9)	1 (0.3)	2
9 (2.7)	3 (0.9)	1 (0.3)	3
12 (3.6)	3 (0.9)	1 (0.3)	4
4.5 (1.4)	3 (0.9)	3 (0.9)	1

All sizes and dimensions are nominal. Tolerances of ± 5% of the width, and length height, of the gabions shall be permitted.

2.4 Fabrication

Gabion shall be manufactured with all components mechanically connected at the production facility with the exception of the lid, which is produced separately from the base. The base, sides and ends of the gabion gabions shall be woven into a single unit. The diaphragms are connected to the base in the factory. All perimeter edges of the mesh forming the base and lid shall be selvedged with selvedge wire.

The gabion is divided into cells by means of diaphragms positioned at approximately 3 ft. (1 m) centers. The diaphragms shall be secured in position to the base so that no additional lacing is necessary at the jobsite. See Figure 3.

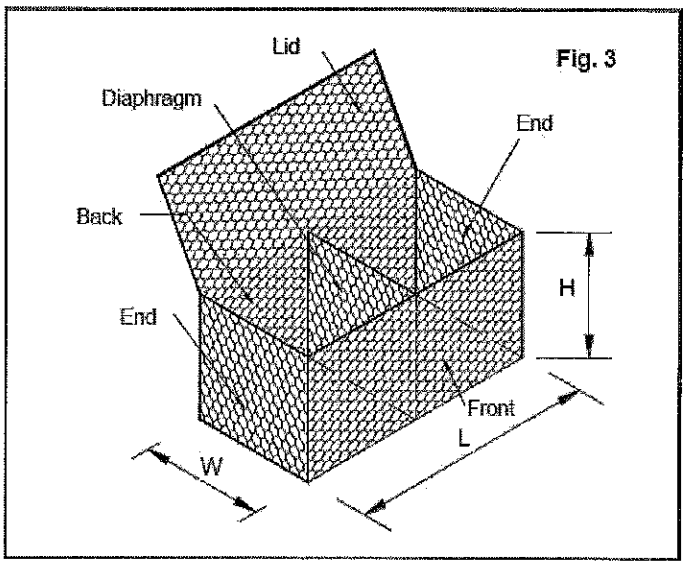


Fig. 3

2.5 Rock

The rock for gabions shall be hard, angular to round, durable and of such quality that they shall not disintegrate on exposure to water or weathering during the life of the structure. Gabion rocks shall range between 4 in. (0.10 m) and 8 in. (0.20 m). The range in sizes shall allow for a variation of 5%

oversize and/or 5% undersize rock, provided it is not placed on the gabion exposed surface. The size shall be such that a minimum of three layers of rock must be achieved when filling the gabions.

3.0 Construction Requirements

3.1 Assembly

The units are assembled individually by erecting the sides, ends, and diaphragms, ensuring that all panels are in the correct position, and the tops of all sides are aligned. The four corners shall be connected first, followed by the internal diaphragms to the outside walls. All connections should use lacing wire or fasteners as previously described in Section 2.1.4 and Section 2.1.6.

The procedure for using lacing wire consists of cutting a sufficient length of wire, and first looping and/or twisting to secure the lacing wire to the wire mesh. Proceed to lace with alternating double and single loops through every mesh opening approximately every 6 in. (150 mm), pulling each loop tight and finally securing the end of the lacing wire to the wire mesh by looping and/or twisting.

The use of fasteners shall be in accordance with the manufacturer's recommendations as specified in Section 2.1.6.

3.2 Installation

After initial assembly, the gabions are carried to their final position and are securely joined together along the vertical and top edges of their contact surfaces using the same connecting procedure(s) described in Section 3.1. Whenever a structure requires more than one layer, the upper empty baskets shall also be connected to the top of the lower layer along the front and back edges of the contact surface using the same connecting procedure(s) described in Section 3.1.

3.3 Filling

Gabions shall be filled with rock as specified in Section 2.5. During the filling operation some manual stone placement is required to minimize voids. The exposed faces of vertical structures may be carefully hand placed to give a neat, flat, and compact appearance. Care shall be taken when placing fill material to ensure that the sheathing on the PVC coated baskets is not damaged.

The cells shall be filled in stages so that local deformation may be avoided. That is, at no time shall any cell be filled to a depth exceeding 1-foot (0.30 m) higher than the adjoining cell. It is also recommended to slightly overfill the baskets by 1 to 2 in. (25 to 50 mm) to allow for settlement of the rock. Behind gabion walls, compact the backfill material simultaneously to the same level as the filled gabions.

3.4 Internal Connecting Wires

Mac Tie preformed stiffeners or lacing wire can be used as internal connecting wires when a structure requires more than one layer of gabions to be stacked on top of each other. Internal Connecting Wires with lacing wire shall connect the exposed face of a cell to the opposite side of the cell. Internal Connecting Preformed stiffeners shall connect the exposed face of a cell to the adjacent side of the cell. Preformed stiffeners are installed at 45° to the face/side of the unit, extending an equal distance along

each side to be braced (approximately 1 ft. (300 mm)). An exposed face is any side of a gabion cell that will be exposed or unsupported after the structure is completed.

3.4.1 3 Feet (1 m) High Gabions

3 feet (1 m) high gabions shall be filled in three layers, 1 foot (300 mm) at a time. Connecting wires/bracings shall be installed after the placement of each layer, that is, at 1 foot (300 mm) high and 2 feet (600 mm) high.

3.4.2 1.5 Feet (0.5 m) High Gabions

1.5 feet (0.5 m) high gabions do not require connecting wires/bracings unless the baskets are used to build vertical structures. In some cases, these units shall be filled in two layers, 9 in. (230 mm) at a time. Connecting wires shall be installed after the placement of the first layer, which is at 9 in. (230 mm) high.

3.5 Lid Closing

Once the gabion baskets are completely full, the lids will be pulled tight until the lid meets the perimeter edges of the basket. A tool such as a lid closer can be used. The lid must then be tightly laced and/or fastened along all edges, ends and tops of diaphragm(s) in the same manner as described in Section 3.1.

3.6 Mesh cutting and folding

Where shown on the drawings or otherwise directed by the engineer, the gabions shall be cut, folded and fastened together to suit site conditions. The mesh must be cleanly cut and surplus mesh either folded back or overlapped so that it can be securely fastened together with lacing wire or fasteners in the manner described in Section 3.1. Any reshaped gabions shall be assembled, installed, filled and closed as specified in the previous sections.

4.0 Method of Measurement

4.1 The payment quantities for excavation shall be determined by the outside limits of the gabion structure. Quantities will be determined from cross sections and the linear distance, and paid for under the appropriate excavation bid items.

4.2 The quantity to be paid for "In place gabions" shall be the number of cubic meters or cubic yards of gabions measured in their final position. Project conditions and material availability will determine the actual size of gabions to be used.

4.3 Excavated material beyond the limits of the gabions shall be backfilled with gravel, crushed rock or other material approved by the engineer.

4.4 This bid price shall include the installed in place cost of all materials, equipment, and labor, including gabions, rock, and backfill material.

5.0 Basis of Payment

Accepted gabions will be paid for at the unit price for each pay item included in the contract.