

**SECTION 02880  
PERMEABLE BASE FOR SYNTHETIC TURF SYSTEM**

**PART 1 - GENERAL**

1.01 GENERAL REQUIREMENTS

- A. Conform to the General Conditions, Supplementary Conditions, and Division 1.

1.02 DESCRIPTION OF WORK

- A. The scope of the work shall include, earthwork, sub-grade, drainage work, permeable base rock, concrete curbing and turf anchor. All work shall include, but is not limited to all materials and labor to design, permit, furnish and install.

1.03 RELATED SECTIONS

- A. Section 02890 – Synthetic Turf system

1.04 RELATED DOCUMENTS (References and Standards)

- A. ASTM – American Society of Testing Materials
  1. A 615: Standard Specifications for Deformed and Plain Billet Steel Bars for Concrete Reinforcements.
  2. ASTM C29: Test for Unit Weight and Voids in Aggregate
  3. ASTM C 94: Standard Specification for Ready-Mixed Concrete.
  4. ASTM C150: Specifications for Portland Cement (Types I and II)
  5. ASTM C 171: Standard Specification for Sheet Materials for Curing Concrete.
  6. ASTM C 309: Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
  7. ASTM C 494: Standard Specification for Chemical Admixtures for Concrete.
  8. ASTM C 595: Specification for Blended Hydraulic Cements
  9. ASTM C 618: Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
  10. ASTM D 1751: Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non extruding and Resilient Bituminous Types).

1.05 CONTRACTOR QUALIFICATION REQUIREMENTS

- A. Synthetic turf base contractors foreman must have 10 years experience building synthetic turf bases. Contractor shall provide a complete list of the past 10 projects in which the foreman held the lead position. Contractor must supply the following information for each listed project: foreman's role in those projects, contact information, including phone numbers.
- B. Synthetic turf base contractor shall supply a complete list of the past 10 projects in which the Contractor's company was involved in specifics comparable to this project. . Contractor must supply the following information for each listed project: Owner, contact information, including phone numbers.

1.06 NOT USED

1.07 SUBMITTALS

- A. Contractor shall supply (6) copies of all testing data, and product materials data, concrete mix design, rebar shop drawings if applicable, and any product cut sheets, and performance data.
- B. Contractor shall submit a two-pound sample of stone and a sieve and permeability analysis test to the Owner and Landscape Architect for approval prior to delivery to the site. The sieve and permeability analysis must be by an independent testing lab and to the sieve sizes specified below. The sieve tests must be made of the EXACT material to be used and performed no more than 21 days prior to submittal for review.
- C. Contractor shall supply (6) six copies of all maintenance and operations manuals to the owner prior to substantial completion of the project
- D. Sample Warranty of all applicable materials and products.
- E. Submit a concrete job mix formula to the Owner and Landscape Architect at least 15 days prior to delivery of concrete to the job site.
- F. Concrete job mix formula shall be submitted on form 1, attached.
- G. Submit complete rebar schedule, bar details and erection drawings in accordance with ACI 315.

1.08 QUALITY ASSURANCE (Test and Inspection Requirements)

- A. Notification - No site work shall be performed without notifying synthetic turf system installer, Owner and Landscape Architect at least 48 hours prior to commencement of work.
- B. All base rock construction shall be completed by means of fully automated laser controlled LGP excavation equipment for all subgrades and finish grades.

- C. After completion of installation of permeable rock base, notify Owner and Landscape Architect for inspection of finish grade. Contractor to have a laser set up and links rod available for Owner and Landscape Architect to walk the finish grade and approve prior to any work on elastic layer to begin.
- D. Contractor to notify Synthetic Turf Contractor, Owner and Landscape Architect 72 hours prior to completion of finish grade to have their representative on site to approve and or reject the finish grade work. Turf Contractor to have final approval of finish grade.
- E. Use only concrete plants complying with the ASTM C 94 or NRMCA minimum standards.
- F. Contractor shall have sub-grade and top-stone compaction testing completed and paid by the contractor. Supply the owner with copies of the testing and inspection reports.

#### 1.09 DELIVERY, STORAGE AND PROTECTION

- A. Permeable aggregate shall be delivered to site in proper trucks so as to not segregate product.
- B. Aggregate shall be delivered with proper moisture content and must be protected for weather events that will wash out the fines in the product.
- C. Properly protect aggregate and sub-grades to be in compliance with approved TESC requirements of governing jurisdiction.

#### 1.10 FIELD VERIFICATION

- A. A representative, designated by the turf system manufacturer, will be present intermittently to observe the Contractor's operation, to perform tests and measurements, and to adjust the work as necessary to meet field conditions. Such observations, tests, measurements and work adjustments shall not alter the requirements of the drawings or specifications nor imply any superintendence or control of the Contractor's operation, nor warranty the Contractor's work. Relative compaction of compacted soils will be determined in general accordance with the American Society for Testing and Materials (ASTM) Test Methods D1557 (modified proctor) and D2167, D2922, or D3017.

#### 1.11 WARRANTY

- A. Contractor shall supply a one year warranty on all labor and workmanship of the base, concrete, drainage, and materials required to install all items within the specifications, and shown on schematic drawings.
- B. All product warranties by all suppliers or product manufacturers shall be included and provided within the maintenance and operations manual.

### **PART 2 -PRODUCTS**

#### 2.01 BASE BID CONCRETE MATERIALS

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A. Concrete in a Freshly-Mixed and Unhardened State

1. Concrete in a freshly-mixed and unhardened state shall comply with ASTM C 94 except as expressly and specifically modified and designated herein.

Modifications and designations shall be as follows:

- a. Cement (See ASTM C 94 4.1.1) shall contain not more than 0.80 percent total alkalis (Na<sub>2</sub>O\_0.658 K<sub>2</sub>O)
- b. Pozzolan shall conform to ASTM C 618 Class F or Class C. A certificate of Compliance shall be provided on request. Total weight of Pozzolan shall not exceed 18 percent of the weight of cement.
- c. Quality of Concrete (see ASTM C 94 5.1):

CLASS:	3000- 1
Size of coarse aggregate, inches	1 ½
Slump, inches	4
Entrained air, percent +/- 1 ½%	4.5
Alternate for determining proportions	3
Compressive Strength, PSI	3000
Age, days	28
Probability of tests falling below specified strength, one out of	5
Minimum content of cement plus pozzolan lbs. per c.y.	570
Admixtures – Water reducing admixtures conforming to ASTM C 494, Type A or D will be permitted at Contractor’s option.	

- d. All concrete for the work shall be Class 3000- 1 ½ unless otherwise shown on the drawings.

B. Joint Fillers

1. Joint Fillers shall comply with ASTM D 1751

C. Grout

1. Metallic: One of the following, or equal, for general applications:

“Embeco” (Master Builders Company)

- a. “Ferrolith G” (Sonneborn Building Products, Inc.)
- b. “Ferrotex” (National Pulverized Metals, Co., Chicago, IL.)

2. Non-Metallic: One of the following, or equal, for setting base plates:

- e. “Five Star Grout” (U.S. Grout Corp.)
- f. “Sealtight 588” (W.R. Meadows, Inc.)
- g. “Upcon” (The Upcon Co.)

- h. “Masterflow 928” (Master Builders Company)
  - 3. Epoxy: One of the following, or equal, for setting equipment:
    - a. “Sika-Dur Hi-Mod”, “Cement Epoxy” (Sika Chemical Corp.)
    - b. “Five Start Epoxy Grout” (U.S. Grout Corp.)
    - c. “Ceilcote 648CP” (Ceilcote Co.)
- D. Curing Material
  - 1. Liquid Membrane Curing Compound: ASTM C 309, Type 2, formulated to be removable after 28 days, and guaranteed not to affect the bond of applied finishes.
  - 2. Polyethylene Sheeting: Of approved manufacture, 4 mils thick.
  - 3. Reinforced Building Paper: ASTM C 171.
- E. Attach metal tags for identification.

## 2.02 STEEL REINFORCEMENT REBAR

- A. Reinforcement Bars
  - 1. No. 4 or larger, bars shall conform to ASTM A615, Grade 60.

## 2.03 TURF ANCHOR NAILER

- A. Nailer shall be a recycled plastic 2 x 4 type material and provided on all field side of
  - 1. Product shall be grey in color, and shall be aTrex like, or approved equal product.
- B. Nailer shall be anchored with an approved concrete wedge anchor. Anchor shall be installed at each end and every 2’.
  - 1. Product shall be a ¼ x 4” drive anchor, made by Powers, model 043-211-1, or approved equal.

## 2.04 BASEBALL BASES, HOMEPLATE, PITCHING RUBBER AND BASE ANCHORS

- A. Contractor shall provide four sets of bases. One each for 90’, 80’, 70’, 60’ base paths.
- B. Contractor shall also provide fully furnished and installed pitchers rubber in the clay mound.
- C. Contractor shall provide home plate and its anchor fully furnished and installed in the project.

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- D. Contractor shall provide full cut sheet, model number of product proposed for approval by the Owner and Landscape Architect prior to installation.
- E. The following suppliers can be used for the project
  - 1. Hollywood base Co
  - 2. Bolco Major League Bases
  - 3. Sportsadvantage – 1800-264-4529

**2.05 CRUSHED STONE**

- A. Permeable material used for permeable base construction shall conform to the following specifications:

<b>Gradation Sieve Size</b>	<b>Percent Passing Base Stone</b>	<b>Percent Passing Top Stone</b>
1 ¼"	100	
1"	90	
¾"	80	
½"	50-80	100
3/8"	40-60	95
¼"		75
No. 4 mesh	20-40	62
No. 8 mesh	15-30	35
No. 16 mesh		20
No. 30 mesh	5-20	10-20
No. 100 mesh	2-10	2-10
No. 200 mesh	2-6	2-6

- B. **RESTRICTIONS**
  - 1. Fragmentation must be at 100%
  - 2. Depending on the type of rock present in the crushed stone mix, other mechanical characteristics might be necessary for approval.
- C. **BASE STONE**
  - 1. Shall be a minimum of 6" compacted depth across the entire field area.
- D. **TOP STONE**

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1. Shall be a minimum of 2” compacted depth installed over the base stone materials. Top stone shall be per the specifications above to properly bridge and create a compact, solid surface for installation of synthetic turf system.

**E. MIRAFI FABRIC**

1. The subgrade shall be covered in its entirety with a Mirafi geotextile fabric meeting the following specifications.
2. The geotextile shall be woven from high-tenacity long-chain synthetic polymers composed of at least 95 percent by weight of polyolefins or polyesters. They shall form a stable network such that the filaments or yarns retain their dimensional stability relative to each other, including selvages.

**- SUBGRADE STABILIZATION GEOTEXTILE**

Property	Test Method	Units	Required Value	
<b>Reinforcement Properties</b>			MD <sup>1</sup>	CD <sup>1</sup>
Ultimate Tensile Strength	ASTM D 4595	kN/m (lbs/ft)	47.3 (3240)	39.4 (2700)
Tensile Strength @ 2% Strain	ASTM D 4595	kN/m (lbs/ft)	7.9 (540)	7.9 (540)
Tensile Strength @ 5% Strain	ASTM D 4595	kN/m (lbs/ft)	19.8 (1356)	19.8 (1356)
Coefficient of Interaction -Ci (sand)	ASTM D 5321	--	0.8	
Permittivity	ASTM D 4491	sec <sup>-1</sup>	0.52	
Apparent Opening Size	ASTM D 4751	mm (U.S. Sieve)	0.6 (30)	
Sewn Seam Strength <sup>2</sup>	ASTM D 4884	kN/m (lbs/ft)	24.6 (1688)	
<b>Survivability Index Values</b>			MD <sup>1</sup>	CD <sup>1</sup>
Grab Tensile Strength	ASTM D 4632	N (lbs)	1780 (400)	1100 (250)
Tear Strength	ASTM D 4533	N (lbs)	800 (180)	440 (100)
Puncture Strength	ASTM D 4833	N (lbs)	800 (180)	
Burst Strength	ASTM D 3786	kPa (psi)	5506 (800)	
Ultraviolet Stability (after 500 hrs)	ASTM D 4355	%	70	

**PART 3 -EXECUTION**

**3.01 GENERAL**

- A. Excavating and grading shall be performed in conformance with the alignment, grade and cross-sections indicated on the drawings.

**3.02 CONCRETE CURBING CONSTRUCTION SPECIFICS**

- A. Preparation
  1. Clean existing concrete surfaces thoroughly before placing abutting fresh concrete.
- B. Concrete curbing for synthetic turf shall be a 6” x 12” concrete curb. Finish shall be medium broom with ½” radius corners.
- C. Curbing shall have appropriate control and construction joints installed.

- D. Curbing shall have 2 No 4 bars placed inside the curbing and shall have a minimum clearance of 3” from all outside edges of curbing.
- E. Concrete Placement, Consolidation, Curing and Protection
  - 1. Concrete shall be placed, consolidated, cured and protected in accordance with American Concrete Institute recommended practice. The following ACI standards and reports are guides to good practice and shall be used by the Contractor:
    - a. ACI 304: Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
    - b. ACI 305: Hot Weather Concreting
    - c. ACI 306: Cold Weather Concreting
    - d. ACI 308: Recommended Practice for Curing Concrete
    - e. ACI 309: Recommended Practice for Consolidation of Concrete
- F. Placing Metal Reinforcement
  - 1. Place in accordance with ACI 318, Chapters 7 and 12.
  - 2. All reinforcement steel must be tied securely with 16 gauge or larger annealed iron wire, in accordance to clearance guidelines and proper location per drawing.
  - 3. Place steel with concrete cover in accordance with ACI 318, Chapter 7, Paragraph 7.7, unless otherwise indicated.
  - 4. Splice steel not less than 30-bar diameter for ASTM A615, Grade 40, and 43-bar diameter for ASTM A615, Grade 60, unless otherwise indicated. For plain bars, splice not less than twice that deformed bars.
- G. Embedded Items
  - 1. Conform to ACI 301, Chapter 6
  - 2. Accurately set anchorage devices and structural steel connections by line and transit, and coordinate the locating of all anchorage devices to be set for the accommodation of the work of other trades.
  - 3. Locate anchor belts as shown on the drawings and on shop drawings. Obtain necessary templates for mechanical and electrical equipment as required for the proper setting of anchor bolts and other items.

3.03 TURF NAILER

- A. After installation of the concrete curbing the contractor shall install the nailer, prior to final placement of the topstone rock for synthetic turf base.
- B. Nailer shall be installed using concrete anchors as specified.
- C. Nailer shall be anchored at both end of board, and every 2' along entire length of product installed.
- D. Nailer shall be installed to an approved dimension below grade, as specified by the synthetic turf carpet supplier. Contractor shall verify finish grade of nailer with turf contractor.
- E. Any anchors that do not fully drive into concrete shall be removed and new anchor installed adjacent on either side of the previous anchor that failed to install fully.

3.04 SUBSURFACE DRAINAGE

- A. All subsurface laterals shall be designed by contractor's engineer, and installed per plans.
- B. Lateral drain lines shall be 4" perforated, ADS or equal product
- C. Laterals shall be buried in a pea gravel like materials
- D. Laterals shall have a minimum of 2" of clean materials below the pipe, above subgrade materials
- E. Lateral lines shall NOT, be covered by a geotextile fabric. If geotextile is required by permitting, it shall only be on sides, and bottom of lateral line trench. Covering of top of lateral drainage trench shall not be permitted.
- F. Collector drains shall be installed per the slopes designed by the contractors' engineer. Pipes shall be installed, connected and fully mudded into any and all catch basins, or drop boxes designed.
- G. All collector pipes shall be bedded per contractor's engineer. Owner and Landscape Architect will verify proper installation.
- H. All pipes shall be installed per slopes and grades shown on contractors approved plans, shop drawings, and permitted drawings.

3.05 PERMEABLE CRUSHED ROCK BASE

- A. The base stone shall be installed in a 6" lift across the sub-grade and compacted.
- B. Top stone shall be 2" depth of topstone. Stone shall be placed in such a manner to control moisture content, and to control segregation of the fines from the stone.

- C. All stone shall be placed with fully automated equipment per section 1.08B (Quality Assurance).

### 3.06 GEOTEXTILE FABRIC

- A. The geotextile shall be laid smooth without wrinkles or folds on the prepared subgrade in the direction of construction traffic. Adjacent geotextile rolls shall be overlapped. Overlaps shall be in the direction as shown on the plans and in accordance with the manufacturer's requirements.

### 3.07 SITE PREPARATION

- A. The Contractor shall strip all debris and organic matter from areas to be graded for the synthetic turf base.
- B. All drain line spoils shall be removed from subgrade and all subgrade areas shall be rolled and compacted to 95% and compaction test results submitted to Synthetic Turf Contractor, Owner and Landscape Architect for approval and for the records.

### 3.08 SUBGRADE EXCAVATION AND GRADING

- A. The subgrade shall be excavated to create a positive slope towards the subsurface drainpipes. Unless otherwise specified on the drawings, the minimum slope of the subgrade shall be 1%.
- B. Following rough grading of the subgrade, the exposed soil shall be moisture conditioned to near the optimum moisture content and compacted to at least 90 percent relative compaction (modified proctor) to produce a firm non-yielding surface.
- C. No work shall be completed in this section until subgrade is 100% completed and accepted by the Landscape Architect and Owner or their representative.
- D. Subgrade after compaction and inspection shall be covered with a mirafi geotextile fabric between all drain line locations. Fabric shall be non woven, and be approved.

### 3.09 COMPACTED FILL

- A. Any fill material placed to create the planned subgrade shall be per Florida DOT standards for Common Burrow Specification and placed in layers eight inches or less in loose thickness, moisture conditioned to near the optimum moisture content and compacted to achieve at least 90 percent relative compaction, unless otherwise specified.
- B. Perform field density tests to determine the degree of compaction obtained. Where compaction is less than that required, additional compactive effort and/or adjustment of the moisture content shall be performed, as necessary, until the required compaction is obtained.
- C. Place and compact approved fill material in accordance with the specifications. In the case of the required density is not met, reduce the rate of haul, furnish additional

spreading and/or compaction equipment, remove and replace the fill material, or make any other adjustments necessary to achieve a satisfactorily compacted fill.

- D. No fill shall be compacted during periods of rain or on ground that is saturated or has standing water. Soil that has been over-saturated by rain or any other means shall not be used until the moisture content is within limits required by the Owner and Landscape Architect.

### 3.10 SUBGRADE SLOPES AND FINAL GRADES

- A. Final subgrade grades shall conform to the lines and grades shown on the drawings. The measured grades shall not deviate more than 0.06 feet from the planned grades and not vary more than 0.04 feet in 10 feet in any direction. Laser grading is required.
- B. All subgrade grades shown on the drawings shall be completed by the Contractor and inspected. If survey is required for finish grades all testing and special inspections shall be by Contractor.

### 3.11 BASE ANCHORS

- A. All baseball base anchors shall be installed into the synthetic turf base per manufacturer's instructions and specifications.
- B. Height of base anchors shall be installed per plans.
- C. Anchor installation shall be per approved shop drawings.

### 3.12 PERMEABLE BASE AND TOP STONE

- A. The specified base stone shall be carefully placed and compacted over the subgrade and/or drainpipe to the grades and elevations shown on the drawings. If the thickness of the planned base stone exceeds 6 inches, the stone shall be placed in horizontal layers not to exceed 6 inches and each layer proof rolled to 95 percent relative compaction (modified proctor) with a vibratory smooth drum roller. Testing shall be done using the nuclear method.
- B. Moisture Content of the stone shall be 4% - 7% of dry weight to ensure no migration of fines during transport and installation. Installation of base stone shall not be permitted during periods of heavy rainfall or moisture. Segregation of fines during transport will not be acceptable and stockpiling. Field specialty contractor is to apply water during construction to keep proper moisture content. In case of inclement weather contractor is to protect stone already on site and in place to ensure fines do not wash out of materials. This means covering all work with visquine and sandbags or other means to keep visquine in place during weather.
- C. Each layer of materials shall be uniformly spread and not move more than 10' from location of import onto site. Any rock materials that are seen to have been worked more than once with equipment shall be removed.

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- D. Base stone for the synthetic field shall be placed to a 6” compacted thickness with a finish grade with no slope on infield area as indicated on drawings.
- E. Top stone for the synthetic turf field to be 2” compacted depth. Approval of the subgrade fill materials shall be completed and tested for compaction prior to any work being done in this area.
- F. Finished surface shall be proof rolled with a vibratory smooth double drum roller to provide a non-yielding, smooth, flat surface. Compaction must be to 95%-modified proctor.
- G. Final crushed rock base grades shall conform to the lines and grades shown on the drawings. The measured grades shall not deviate more than 0.04 feet from the planned grades and not vary more than 0.04 feet in 10 feet in any direction. Laser grading is required.
- H. The top surface of the base stone shall be flat from the centerline toward the sideline as shown on the drawings.
- I. All base stone grades shown on the drawings shall be completed by the Contractor and inspected by the Landscape Architect and synthetic turf representative prior to commencing with the subsequent work items.
- J. Finished base stone must meet the minimum permeability rate acceptable to the synthetic turf manufacturer. The Contractor will do a bucket test at 6 locations as directed by the Owner, Landscape Architect and synthetic turf manufacturer. The Contractor will record the permeability rate for approval by the Landscape Architect and the synthetic turf manufacturer.

**GIBSON PARK NEW CONSTRUCTION  
 SYNTHETIC TURF FIELD  
 FORM 1  
 JOB MIX FORMULA (READY-MIXED CONCRETE)**

Contractor's Name \_\_\_\_\_  
 Supplier Name \_\_\_\_\_  
 Batch Plant Location \_\_\_\_\_  
 Cement Type \_\_\_\_\_  
 Pozzolan Type \_\_\_\_\_  
 Sand Type \_\_\_\_\_  
 Coarse Aggregate Type \_\_\_\_\_  
 Maximum Size of Coarse Aggregate \_\_\_\_\_  
 Entrained Air (%) \_\_\_\_\_  
 Water Reducing Agent \_\_\_\_\_  
 Slump (Inches) \_\_\_\_\_

**PROPORTIONS**

Water	_____	Gal/C.Y.	_____	Lbs/C.Y.
Cement	_____	Bags/C.Y	_____	Lbs/C.Y.
Pozzolan	_____%	% of Cement	_____	Lbs/C.Y.
Sand Size 1	_____%	% of Total Aggregate	_____	Lbs/C.Y.
Size 2	_____%	% of Total Aggregate	_____	Lbs/C.Y.
C.A. Size 1	_____%	% of Total Aggregate	_____	Lbs/C.Y.
Size 2	_____%	% of Total Aggregate	_____	Lbs/C.Y.
Size 3	_____%	% of Total Aggregate	_____	Lbs/C.Y.
		Total Weight	_____	Lbs/C.Y.
		Unit Weight	_____	Lbs/C.F.

**END OF SECTION**