

Section 2 Site Specific Requirements

Section 2 – 200 - Temporary Erosion Control Measures
Section 2 – 210 - Dust Control and Work Area Maintenance
Section 2 – 220 - Site Preparation
Section 2 – 230 - General Earthwork
Section 2 – 250 - Geogrid

TECHNICAL SPECIFICATIONS

SECTION 2 – 200-TEMPORARY EROSION CONTROL MEASURES

- I. **DESCRIPTION OF WORK.** The CONTRACTOR will furnish all labor, materials, tools, and equipment, and perform all operations necessary for construction of temporary erosion control measures as required.
- II. **MATERIALS**
- A. Silt fence fabric including stakes and/or hay bales used in the implementation of temporary erosion control measures will be supplied by the CONTRACTOR.
- B. All other materials used in the implementation of temporary erosion control measures will be supplied by the CONTRACTOR.
- III. **EXECUTION**
- A. Construction of temporary erosion control measures along the perimeter of the area under construction will be completed prior to any site work.
- B. Sediment barriers shall be used at storm drain inlets; across minor swales and ditches; and at other applications where the structure is of temporary nature and structural strength is not required. Sediment barriers are temporary berms, diversions, staked straw bales, or other barriers that are constructed to retain sediment onsite by retarding and filtering storm runoff.
- C. All temporary erosion control measures will be maintained throughout the course of site construction activities until provisional acceptance of the site vegetation by OWNER, at which time the CONTRACTOR shall remove all remaining temporary erosion control measures, and properly dispose of accumulated sediment onsite in areas approved by OWNER.
- D. OWNER may order additional erosion and sediment control measures to be installed. The CONTRACTOR shall comply with OWNER'S request and immediately install the required controls.
- E. Silt fences and/or stacked straw bales shall be installed at the site down gradient of work areas and surrounding all soil stockpiles as directed by OWNER in the field. The silt fence shall be installed in accordance with the Contract Drawings. Straw bales shall be staked as approved by OWNER.
- F. On slopes, the CONTRACTOR shall provide protection against washouts in a manner which is acceptable to OWNER. Any washout, which occurs either in the CONTRACTOR'S work area or in areas topographically below his work area, shall be regraded and reseeded and mulched at the CONTRACTOR'S expense until an accepted vegetative stand is established.
- IV. **MEASUREMENT AND PAYMENT.** Payment for temporary erosion control measures specified by OWNER will be paid on a unit price basis. All other temporary erosion controls shall be considered an incidental work item for which payment is not measured or made.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 2- 210-DUST CONTROL AND WORK AREA MAINTENANCE

I. DESCRIPTION OF WORK

- A. Dust control will be of paramount importance during construction activities at the site. The CONTRACTOR shall conduct operations and maintain the project site, haul roads, and borrow areas, to minimize the creation and dispersion of dust. Dust control shall be used throughout the work at the Site.
- B. Haul road maintenance of the work area shall be the responsibility of the CONTRACTOR. Haul road maintenance shall be conducted to ensure safe and efficient access. Work area maintenance shall also include the protection of all existing structures (gas, groundwater wells, etc.) that may exist within the limits of construction.

II. MATERIALS

- A. Water for dust control will be from locations designated by OWNER. CONTRACTOR shall note that he is responsible for the equipment necessary to utilize surface water sources and groundwater sources.
- B. Chemical dust suppressants shall not be used.

III. EXECUTION

- A. The CONTRACTOR shall implement strict dust control whenever possible. If new haul roads are required to access work areas, then the CONTRACTOR shall obtain approval from OWNER prior to their construction. Construction of haul roads necessary to conduct the scope of work indicated in this contract shall be part of the contracted work.
- B. Existing access roads shall be used by the CONTRACTOR whenever possible. If new haul roads are required to access work areas, then the CONTRACTOR shall obtain approval from OWNER before their construction. Construction of haul roads necessary to conduct the scope of work indicated in this contract shall be part of the contracted work. The CONTRACTOR shall maintain all haul roads used during execution of work.
- C. Any existing structures (such as monitoring wells, gas probes, etc.) that are to remain are to be protected from damage during construction. Measures taken for this protection shall include flagging and construction of barricades where necessary. Any structure damaged by construction activities shall be repaired and/or replaced by OWNER at the CONTRACTOR'S expense.

- IV. **MEASUREMENT AND PAYMENT.** Payment for dust control and work area maintenance shall be considered an incidental work item for which payment is not measured or made.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 2 – 220-SITE PREPARATION

I. DESCRIPTION OF WORK

- A. The CONTRACTOR will furnish all labor, materials, tools, and equipment, and perform all operations necessary to prepare the site for the Project.
- B. The Work of this Section shall include, but not necessarily be limited to, grubbing, excavating, separating, hauling, stockpiling, backfilling, and grading.
- C. The CONTRACTOR shall conform to the dimensions, lines, and grades specified on the Drawings.

II. DEFINITIONS

- A. Structures and Surface Features: Existing structures and surface features including buildings, pavements, curb and gutter, signs, posts, fences, trees, shrubs, landscaped surface features, gas extraction wells, vertical and horizontal, temporary header lines, condensate lines, tarps, and other miscellaneous items.
- B. Utilities: Existing gas mains, water mains, steam lines, electric lines and conduits, telephone and other communication lines and conduits, sewer pipe, cable television, other utilities, and appurtenances.
- C. Clearing and Grubbing: Cutting and disposing of trees, brush, windfalls, logs, and other vegetation, and removing and disposing of roots, stumps, stubs, grubs, logs, and other timber.
- D. Salvaged Topsoil: Natural loam, sandy loam, silt loam, silty clay loam, of clay loam humus bearing soils available from overlaying portions of areas to be excavated for construction. Salvaged topsoil will be removed and stockpiled as shown on the Drawings.

III. PROJECT/SITE CONDITIONS. Do not block or obstruct roads or streets with excavated or grubbed materials, except as authorized by OWNER.

IV. PROTECTION

- A. Protect existing utilities against damage.
- B. Contact utilities' "Diggers Hot Line" before beginning excavation.
- C. Locate existing underground utilities by hand excavation.
- D. If uncharted utilities are encountered during excavation, stop work and notify OWNER. Repair damaged utilities at CONTRACTOR'S expense.

- E. Preserve and protect groundwater monitoring and gas extraction wells. Replace damaged or destroyed monitoring and extraction wells at CONTRACTOR'S expense.
- F. Cap or remove and relocate services. Protect, support, and maintain conduits, wires, pipes or other utilities that are to remain in place during work.

V. PREPARATION

- A. Provide 3 working days notice, prior to beginning construction, to OWNERS of existing utilities, structures, and surface features.
- B. Remove obstructions such as mounds of dirt, stone or debris located within limits of construction. Obstructions such as culverts, end walls, and guard posts may be removed if replaced when need for removal is completed. Replace to original condition.

VI. STRIPPING TOPSOIL

- A. Cut or mow and remove grass, weeds, and other vegetation before stripping topsoil.
- B. Remove topsoil to entire depth in areas where construction is to be performed. Stockpile where indicated on Drawings or designated by OWNER. Stockpile for proper drainage.
- C. Strip stockpile area of vegetation prior to stockpiling.
- D. Stripped topsoil shall be free from clay, stones, vegetation, and debris.

VII. RESTORATION

- A. Restore existing utilities, surface, features, and structures to condition equal to condition which existed prior to construction.
- B. Replace to original condition or better, damaged landscape work within and outside of construction limits.

VIII. SUBGRADE PREPARATION

- A. Prior to fill placement, the subgrade should be compact, dry and free from debris, ice, and snow. Fill shall not be placed over frozen soil unless otherwise approved by OWNER.
- B. Subgrade preparation should be followed immediately by fill placement. Deterioration of the subgrade between excavation and initial fill placement shall be the responsibility of the CONTRACTOR and shall be repaired at the CONTRACTOR'S expense.

- C. All subgrades must be inspected and approved by OWNER prior to fill placement. Sufficient time must be given to OWNER to inspect and perform any necessary tests on the subgrade.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 2 – 230-GENERAL EARTHWORK

I. DESCRIPTION OF WORK

- A. The CONTRACTOR shall furnish all labor, materials, tools, supervision, transportation, and installation equipment necessary to perform all related work as specified herein, as shown on the Drawings, and in accordance with Site Soils Report.
- B. The work of this Section shall include, but not necessarily be limited to: excavating, separating, hauling, stockpiling, backfilling, compacting, and grading of soils. The work of this Section may pertain in whole or in part to construction as depicted on the contract drawings or discussed within this document. The work of this Section also includes dewatering and protection completed portions of the work.
- C. The CONTRACTOR shall conform to the dimensions, lines, and grades specified on the Drawings.

II. REFERENCES

- A. Latest version of American Society for Testing and Materials (ASTM) standards:
 - 1. ASTM D 422, Standard Test Method for Particle-Size Analysis of Soils.
 - 2. ASTM D 698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - 3. ASTM D 1556, Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
 - 4. ASTM D 1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 - 5. ASTM D 2216, Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock.
 - 6. ASTM D 2487, Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
 - 7. ASTM D 2922, Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 - 8. ASTM D 2937, Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method.

9. ASTM D 3017, Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
10. ASTM D 4220, Standard Practices for Preserving and Transporting Soil Samples.
11. ASTM D 4318, Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

III. SUBMITTALS AND QUALIFICATIONS

- A. The CONTRACTOR shall submit to the OWNER and Technical Representative for review a letter describing the proposed methods of construction, including stripping, dewatering, excavation, filling, compaction, and backfilling for the various portions of the work. The review shall be for method only. The CONTRACTOR shall remain responsible for the adequacy and safety of the methods.
- B. The CONTRACTOR shall submit to the Technical Representative the soil samples from borrow sources for all proposed fill materials a minimum of 14 days prior to starting soil liner construction, unless otherwise approved by the Technical Representative. Technical Representative will run the following tests:
 1. The results of grain-size analyses conducted on the proposed material in accordance with ASTM D 422.
 2. The results of liquid and plastic limit tests conducted on the proposed material in accordance with ASTM D 4318.
 3. The results of a moisture-density relation test (ASTM D 698).
- C. The CONTRACTOR shall notify the OWNER'S Representative in writing at least 7 days in advance of intention to perform the work of this Section.
- D. If work is interrupted for reasons other than inclement weather, the CONTRACTOR shall notify the OWNER and Technical Representative a minimum of 24 hours prior to the resumption of work.

IV. CONSTRUCTION QUALITY ASSURANCE. The CONTRACTOR shall be aware of the activities outlined in this specification and account for these activities in the construction schedule.

V. PROTECTION

- A. The CONTRACTOR shall contact utility companies and locate, mark and protect all existing utilities before commencement of construction.
- B. The CONTRACTOR shall protect trees, shrubs, lawns, rock outcroppings and other features remaining as part of final landscaping.

- C. The CONTRACTOR shall protect benchmarks, survey markers, fences, roads, sidewalks, paving, curbs and other existing structures from damage due to the CONTRACTOR'S activities.
- D. The CONTRACTOR shall repair damage caused by the construction operations.
- E. Erosion control must be maintained. Erosion control measures shall be as noted on the grading plan or as directed by the OWNER.

VI. SOIL BACKFILL MATERIAL (if applicable). The soil backfill material shall be the on-site soil materials, or other materials, as approved by the OWNER or Technical Representative. The backfill material shall be free of debris, foreign objects, roots, organics and other materials considered deleterious by the Technical Representative. The soil shall be free of rock fragments greater than 3 inches in the maximum dimension.

VII. FAMILIARIZATION

- A. Prior to implementing any work described in this Section, the CONTRACTOR shall become thoroughly familiar with the site, the site conditions, and all portions of the work falling within this Section.
- B. Inspection:
 - 1. Prior to implementing any of the work in this Section, the CONTRACTOR shall carefully inspect the installed work of all other Sections and verify that all work is complete to the point where the installation of this Section may properly commence without adverse impact.
 - 2. If the CONTRACTOR has any concerns regarding the installed work of other Sections, he/she should immediately notify the OWNER in writing within 48 hours of the site visit. Failure to notify the OWNER or continuance with earthworks will be construed as CONTRACTOR'S acceptance of the related work of all other Sections.

VIII. PREPARATION

- A. The CONTRACTOR shall establish and identify required lines and levels.
- B. The CONTRACTOR shall maintain benchmarks, monuments, and other reference points and re-establish if disturbed or destroyed, at no cost to OWNER.
- C. Before start of grading, the CONTRACTOR shall establish the location and extent of utilities in the work areas. The CONTRACTOR shall notify utilities to remove and relocate lines which are in the way of construction and are not to be relocated as a part of the Work covered by these specifications.

- D. The CONTRACTOR shall maintain, protect, reroute, or extend as required existing utilities to remain which pass through the work area.
- E. The CONTRACTOR shall develop access to the construction area in accordance with the requirements of the Drawings.
- F. The CONTRACTOR shall install silt fences as shown on the Drawings, immediately down-slope of each area to be disturbed prior to the beginning of work in that area. The CONTRACTOR shall maintain the silt fences for the duration of construction. Accumulated sediment behind the silt fences shall be disposed of on-site by the CONTRACTOR in a manner approved by the OWNER or Technical Representative.
- G. Diversion ditches, either permanent or temporary, shall be constructed in accordance with the Drawings. The CONTRACTOR shall be responsible for constructing diversion ditches as required to divert run-on around the construction area. The construction of temporary ditches not shown on the Drawings shall not be undertaken until the CONTRACTOR'S plan for constructing the ditches is approved by the OWNER or Technical Representative.
- H. The CONTRACTOR shall install barriers and other devices to protect areas adjacent to construction.

IX. STOCKPILING

- A. Prior to the start of excavation, the CONTRACTOR shall prepare a written excavation plan. The plan shall indicate the areas and sequence of excavation, and the anticipated classification of the excavated material (e.g., topsoil, fill to be used as recompacted soil). This excavation plan must be reviewed and approved by the OWNER or Technical Representative. The CONTRACTOR shall take into account that the stockpiling portion of the excavation plan may be modified during construction based on the results of conformance testing of the excavated material.
- B. Excavated materials classified as fill shall be stockpiled in designated areas free of incompatible soil, clearing debris, or other objectionable materials. Stockpile areas will be shown on the Drawings or designated by the OWNER or Technical Representative.
- C. Excavated material classified as spoil shall be segregated from fill and stockpiled or disposed of in the manner shown on the Drawings or as specified by the OWNER or Technical Representative.
- D. Excavated material classified as topsoil shall be segregated from fill and stockpiled in the manner shown on the Drawings or as specified by the OWNER or Technical Representative.

- E. Stockpiles of fill, spoil, or topsoil shall be no steeper than 3:1 (horizontal:vertical) without approval of the Technical Representative, graded to drain, sealed by tracking parallel to the slope with a dozer or other means approved by the Technical Representative, and dressed daily during periods when fill is taken from the stockpile. The CONTRACTOR may cover fill stockpiles with plastic sheeting or other material approved by the Technical Representative in order to preserve the moisture content of the fill.
- F. Stockpiles that will remain out of active use for a period greater than seven months shall either be covered as described previously or stabilized by revegetation in accordance with the requirements for revegetation.

X. EXCAVATION - GENERAL

- A. Excavation shall be performed, at a minimum, to the lines and grades indicated on the Drawings. Additional excavation shall be performed to achieve a stable working base or to "bridge" over weak subgrade materials. The limits of additional excavation shall be determined by the Technical Representative.
- B. Excavated materials shall be transported to stockpile or placement locations, as indicated on the Drawings or as directed by the OWNER.

XI. SHEETING, SHORING, AND BRACING

- A. When necessary, the CONTRACTOR shall furnish, put in place, and maintain such sheeting, bracing, etc., as may be required to support the sides of the excavation and to prevent movement.
- B. Care shall be taken to prevent voids outside the sheeting.
- C. If voids are formed, they shall be immediately filled and compacted.
- D. CONTRACTOR shall be responsible for performance and safety on all sheeting, shoring, and bracing

XII. UNAUTHORIZED EXCAVATION

- A. All excavation outside or below the proposed lines and grades shown on the Drawings shall be considered unauthorized excavation.
- B. The CONTRACTOR shall backfill areas of unauthorized excavation with the type material necessary (e.g., soil, rock, or concrete) in accordance with this Section at no cost to the OWNER, to insure the stability of the structure or construction involved.

XIII. OBSTRUCTIONS

- A. Obstructions shown on the Drawings are for information only and do not guarantee their exact locations nor exclude the presence of other obstructions.
- B. The CONTRACTOR shall exercise due care in excavating adjacent to existing obstructions and shall not disturb same.
- C. In the event obstructions are disturbed, the CONTRACTOR shall repair or replace them as quickly as possible to the condition existing prior to their disturbance. This repair or replacement will not be a pay item.
- D. If desired by the utility OWNER, the CONTRACTOR shall pay for the repair or replacement work performed by the forces of the utility company or other appropriate party.
- E. If replacement or repair of disturbed obstructions is not performed after a reasonable period of time, the OWNER may have the necessary work done and deduct the cost of same from payments to the CONTRACTOR.

XIV. CLEAN-UP AND DISPOSAL OF DEBRIS

- A. The CONTRACTOR shall remove surplus materials and debris from site.
- B. The CONTRACTOR shall satisfactorily dispose of all excess excavated material that cannot be used.

XV. PUMPING AND DRAINAGE

- A. At all times during construction, the CONTRACTOR shall provide, maintain and operate proper equipment and facilities to remove all water entering excavations and keep such excavations dry so as to obtain a satisfactory subgrade to allow the construction of the recompacted soil.
- B. Drainage shall be disposed of only in an area approved by the OWNER and Technical Representative.

XVI. SURVEY CONTROL

- A. The CONTRACTOR shall survey the location and elevation of the excavation. He shall also survey the location and elevation of the top of subgrade shown on the Drawings. Surveying shall be performed in general accordance with the QA\QC.
- B. The CONTRACTOR shall provide Record Drawings of the location and elevation of the excavation and the top of subgrade, in accordance with the requirements of the QA\QC. The CONTRACTOR shall submit this drawing to the OWNER or OWNER'S Authorized Representative at least 48 hours prior to the start of fill

placement. The CONTRACTOR may submit a partial Record Drawing to obtain approval for a portion of work. The OWNER or Technical Representative will define the minimum requirements for a partial submittal.

XVII. ROUGH GRADING

- A. The CONTRACTOR shall rough grade site to required levels, profiles, contours and elevations ready for finish grading and surface treatment.
- B. Prior to placing fill material over undisturbed subsoil or upon completion of excavation to subgrade, the subgrade shall be proof rolled with loaded dump truck or similar pneumatic tired vehicle under the observation of the Technical Representative. Should subgrade soils pump, yield or fail to achieve density required, the CONTRACTOR shall disc, blade, scarify and allow to dry. The CONTRACTOR shall then recompact the soil in layers as specified under the observation of the Technical Representative. This procedure shall be repeated as necessary as the weather permits, to facilitate the drying and recompaction of the soil. After recompaction, the subgrade shall be proof rolled under the observation of the Technical Representative.
- C. Should efforts to achieve required density be unsuccessful, the CONTRACTOR shall excavate the material and replace with suitable backfill in layers as specified. Undercutting shall not be permitted except at the direction of the Technical Representative.

XVIII. SUBGRADE PREPARATION

- A. The CONTRACTOR shall grade subgrade. Uneven areas and low spots shall be eliminated. Debris, roots, branches, stones, etc., in excess of 1 inch in size shall be removed. Subsurface soils which have been contaminated with petroleum products shall be removed.
- B. Areas which are to receive stabilizing base for paving shall be cut out to subgrade elevation.
- C. Subgrade shall be brought to required levels, profiles and contours. Changes in grade shall be gradual. Slopes shall be blended into level areas.
- D. Subgrade shall be cultivated to a depth of 6 inches where topsoil is to be placed. Cultivation shall be repeated in areas where equipment, used for hauling and spreading topsoil, has compacted sub-soil.
- E. All subgrades that are to receive stabilizing base shall be proof-rolled under the observation of the Technical Representative prior to placement of road base gravel. If soft spots are found, the Technical Representative will direct removal, backfilling and recompacting.

XIX. SOIL BACKFILL (if applicable)

- A. The CONTRACTOR shall perform soil backfilling with material meeting the requirements of this Section in loose lifts not exceeding nine (9) inches in thickness.
- B. Soil backfill materials shall meet the requirements as described herein:
- C. When backfilling in unimproved areas the CONTRACTOR shall:
 - i. Dispose of and replace all soft or yielding material which is unsuitable for backfill with suitable material.
 - ii. Deposit backfill to the surface of the ground by dragline, bulldozer, or other suitable equipment in such a manner.
 - iii. In areas of trench excavation, neatly round sufficient surplus excavated material to compensate for after settlement.
 - iv. Dispose of all surplus excavated material.

XX. COMPACTION. Fill materials shall be compacted to a minimum density of 95 percent of the maximum dry density as determined by ASTM D 698.

XXI. FINISH GRADING. All earthwork shall be shaped to the lines and grades indicated on the Drawings, with proper allowance for topsoil, where specified. Slopes shall be free of roots and loose stones exceeding 3 inch diameter. Rounded surfaces shall be neatly and smoothly trimmed. All new grading shall be blended into the surrounding, existing terrain.

XXII. FIELD QUALITY CONTROL

- A. The minimum frequency and details of quality assurance testing are provided in the QA\QC. The CONTRACTOR shall be aware of all field quality assurance activities, as these may affect his schedule.
- B. All perforations resulting from testing the recompacted soil shall be filled with soil compacted to the satisfaction of the OWNER and Technical Representative.
- C. If a defective area is discovered in the earthwork, the Technical Representative shall immediately determine the extent and nature of the defect. The Technical Representative shall determine the extent of the defective area by additional tests, observations, a review of records, or other means that the Technical Representative deems appropriate.
- D. After determining the extent and nature of a defect, the CONTRACTOR shall correct the deficiency at his expense to the satisfaction of the Technical Representative.

- E. Additional testing shall be performed to verify that the defect has been corrected before any additional work is performed by the CONTRACTOR in the area of the deficiency.

XXIII. PRODUCT PROTECTION

- A. The CONTRACTOR shall use all means necessary to protect all prior work, including all materials and completed work of other Sections.
- B. In the event of damage, the CONTRACTOR shall immediately make all repairs and replacements necessary, to the approval of the OWNER or Technical Representative at no additional cost to OWNER.
- C. Small perforations in the recompacted soil resulting from the Technical Representative's nuclear density testing shall be backfilled by the Technical Representative. All other perforations of holes shall be backfilled and recompacted by the CONTRACTOR.
- D. At the end of each day, the CONTRACTOR shall verify that the entire work area was left in a state that promotes surface drainage off and away from the area and from finished work. If threatening weather conditions are forecast, compacted surfaces shall be seal-rolled to protect finished work.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 2 – 250-GEOGRID

Specification for Biaxial Geogrid Base Course and Subgrade Reinforcement for Paved and Unpaved Roadways

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes – Biaxial geogrid reinforcement of base course and/or subgrade reinforcement in the construction of paved or unpaved roadways, parking areas, and similar installations. Design details for geogrid base course and subgrade reinforcement, including geogrid type, pavement cross-sections and all associated details, shall be as shown on the construction drawings.

Work consists of:

1. Furnishing biaxial geogrids in accordance with the specifications and as shown on the construction drawings.
 2. Storage, cutting, and placement of biaxial geogrids in accordance with the specifications and in close conformity with the lines, grades, and dimensions shown on the construction drawings or as approved by the Engineer.
- B. Related Sections
1. Section 02200 - Site Preparation
 2. Section 02300 - Earthwork
 3. Section 02700 - Bases, Ballasts, Pavements, and Appurtenances

1.02 DEFINITIONS

- A. Geogrid - A biaxial polymeric grid formed by a regular network of integrally connected tensile elements with apertures of sufficient size to allow interlocking with surrounding soil, rock, or earth to function primarily as reinforcement.
- B. Minimum Average Roll Value (MARV) - Value based on testing and determined in accordance with ASTM D4759-92.
- C. Traffic Benefit Ratio (TBR) (also known as Traffic Improvement Factor or TIF) - A ratio comparing the performance of a pavement cross-section with a geogrid-reinforced base course to a similar cross-section without geogrid reinforcement, based on the number of cycles to failure, with failure defined as a selected depth of rut.
- D. True Initial Modulus in Use - The ratio of tensile strength to corresponding zero strain. The tensile strength is measured via ASTM D6637 at a strain rate of 10 percent per minute. Values shown are MARVs.
- E. Subgrade Reinforcement – Placement of a geogrid immediately over a soft subgrade soil in order to improve the bearing capacity and mitigate deformation of the subgrade soil. The goal of this application may be to reduce undercut requirements, improve

construction efficiency, reduce the amount of aggregate subbase/base material required, provide a stiff working platform for pavement construction, or combination of these.

- I. Base Reinforcement - Placement of a geogrid beneath or within the aggregate base course of a flexible pavement system to improve the performance of the system. The goal of this application may be to reduce the amount of aggregate base material required (reducing initial cost), increase the life of the pavement (reduce life-cycle cost), or a combination of the two.

1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM)
 1. D6637 Standard Test Method for Determining Tensile Properties of Geogrids by the Single or Multi-rib Tensile Method
 2. D4354-96 Practice for Sampling of Geosynthetics for Testing
 3. D4759-92 Practice for Determining the Specification Conformance of Geosynthetics
 4. D5818 Practice for Obtaining Samples of Geosynthetics from a Test Section for Assessment of Installation Damage
- B. Geosynthetic Research Institute (GRI)
 1. GRI-GG2 Standard Test Method for Geogrid Junction Strength
- C. American Association of State Highway and Transportation Officials (AASHTO)
 1. AASHTO Recommended Practice for Geosynthetic Reinforcement of the Aggregate Base Course of Flexible Pavement Structures, AASHTO PP46-01, April 2001 Interim Edition of the AASHTO Provisional Standards.
 2. Standard Specification for Highway Bridges (1997 Interim)
 3. AASHTO Guide for Design of Pavement Structures (1993)
- D. Geosynthetic Materials Association (GMA)
 1. Geosynthetic Reinforcement of the Aggregate Base/Subbase Courses of Pavement Structures (2000).

1.04 SUBMITTALS

- A. Submit geogrid product sample approximately 4 inches by 7 inches or larger.
- B. Submit geogrid product data sheet and certification from the Manufacturer that the geogrid product supplied meets the requirements of sub-part 2.02 of this Section.
- C. Submit Manufacturer's installation instructions and general recommendations.

1.05 QUALITY ASSURANCE

- A. Pre-Construction Conference - Prior to the installation of the geogrid, the Contractor shall arrange a meeting at the site with the geogrid material supplier and the geogrid installer. A representative of the geogrid supplier shall be available on an "as needed" basis during construction for technical support and assistance.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Storage and Protection

1. Prevent excessive mud, wet concrete, epoxy, or other deleterious materials from coming in contact with and affixing to the geogrid materials.
2. Store at temperatures above -20 degrees F (-29 degrees C).
3. Rolled materials may be laid flat or stood on end.
4. Geogrid materials should not be left directly exposed to sunlight for a period longer than recommended by the manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. The approved source of geogrid is _____, Address, City, State, (000) 000.0000 or their designated representative.

2.02 MATERIALS

- A. Biaxial Subgrade/Base Reinforcement Geogrid – The geogrid shall be integrally formed and deployed as a single layer having the following characteristics (ALL VALUES ARE MINIMUM AVERAGE ROLL VALUES UNLESS A RANGE OR CHARACTERISTIC IS INDICATED):

REINFORCEMENT PROPERTIES		TEST METHOD	MARV VALUES	
			Lbs/ft	kN/m
Ultimate Strength	MD	ASTM 6637	2,388	34.9
	XMD		3,870	56.5
Initial Modulus	MD	ASTM 6637	178,000	2,598
	XMD		172,900	2,524
Load at 2% Strain	MD	ASTM 6637	526	7.7
	XMD		578	8.4
Load at 5% Strain	MD	ASTM 6637	792	11.5
	XMD		1,042	15.2
Sum of Junction Strength Criteria	MD	GRI GG2	3,403	49.6
	XMD		4,213	61.5
Coefficient of Pullout Interaction		ASTM 6706 Sandy Gravel Sand	C _i = 1.0	
Aperture Size		Measured	MD	1.0 in.
			XMD	1.0 in.

Standard Roll Size: 12' x 150'

- B. Alternate Subgrade/Base Reinforcement Materials – Alternate structural soil reinforcement materials will be considered in accordance with the following conditions:

1. Geotextile materials will not be considered as an alternate to geogrid materials for subgrade improvement or base/sub-base reinforcement applications. A

geotextile may be used in the cross-section to provide separation, filtration or drainage; however, no structural contribution will be attributed to the geotextile.

2. Alternate geogrid materials shall not be used unless submitted to the Engineer and pre-approved in writing by the Engineer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. The Contractor shall check the geogrid upon delivery to verify that the proper material has been received. The geogrid shall be inspected by the Contractor to be free of flaws or damage occurring during manufacturing, shipping, or handling.

3.02 PREPARATION

- A. The subgrade soil shall be prepared as indicated on the construction drawings or as directed by the Engineer.

3.03 INSTALLATION

- A. The geogrid shall be laid at the proper elevation and alignment as shown on the construction drawings.
- B. The geogrid shall be installed in accordance with the installation guidelines provided by the manufacturer or as directed by the Engineer.
- C. The geogrid may be temporarily secured in place with ties, staples, pins, sand bags or backfill as required by fill properties, fill placement procedures or weather conditions or as directed by the Engineer.
- D. The geogrid shall be joined (overlapped) based on the following CBR values:

Soil CBR	Method of Joining
Greater than 3	300 mm (12 in.) overlap
1 – 3	600 mm (24 in.) overlap
0.5 – 1	900 mm (36 in.) overlap or with mechanical ties
Less than 0.5	1000 mm (40 in.) with mechanical ties or Bodkin

3.04 GRANULAR FILL PLACEMENT OVER GEOGRID

- A. Granular fill material shall be placed in lifts and compacted as directed under Section 02300 and Section 02700. Granular fill material shall be placed, spread, and compacted in such a manner that minimizes the development of wrinkles in the geogrid and/or movement of the geogrid.
- B. A minimum loose fill thickness of 6 inches is required prior to operation of tracked vehicles over the geogrid. Turning of tracked vehicles should be kept to a minimum to prevent tracks from displacing the fill and damaging the geogrid. Rubber-tired equipment may pass over the geogrid reinforcement at slow speeds (less than 10 mph).

3.05 INSPECTION

- A. The Owner or Owner's representative may randomly inspect geogrid before, during and after (using test pits) installation.

- B. Any damaged or defective (i.e. damaged coating, separated junctions, separated layers, tears, etc.) will be repaired/replaced in accordance with section 3.06

3.06 REPAIR

- A. Any roll of geogrid damaged before, during and after installation shall be replaced by the Contractor at no additional cost to the Owner.
- B. Proper replacement shall consist of replacing the affected area + 3ft (1m) of geogrid to either side of the affected area.

3.07 PROTECTION

- A. Follow the Manufacturer's recommendations regarding protection from exposure to sunlight.

END OF SECTION