



## Iowa Department of Transportation

**SPECIAL PROVISIONS**  
**FOR**  
**GABION BASKET SLOPE FACE REMEDIATION**

**Madison County**  
**SP-637-0(11)--7C-61**

**Effective Date**

**October 19, 2010**

**THE STANDARD SPECIFICATIONS, SERIES OF 2009, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.**

**090097.01 DESCRIPTION.**

The work shall consist of constructing a gabion basket slope face remediation system as shown on the contract plans and approved working drawings and as specified herein.

**A. GABION BASKET CONTRACTOR'S EXPERIENCE REQUIREMENTS AND SUBMITTALS.**

1. The Installer/Contractor shall have successfully completed a minimum of five (5) similar projects using gabion baskets (with similar face area and height).
2. The contractor shall provide an on-site supervisor with a minimum of three (3) years of experience installing gabion baskets.
3. The Qualifications of the Installer/Contractor and on-site supervisor shall be submitted at least seven (7) days prior to the Pre-Construction Meeting for review by the engineer. At a minimum, the submittal shall contain:
  - A brief description of projects demonstrating the requirements of this section
  - The project owners' name, address and current phone number
  - Location of the project
  - Project contract value
  - Scheduled completion date and actual completion date
4. For purposes of complying with the requirements of this section, the gabion basket Installer/Contractor may not use the experience of the manufacturer.

**B. CODES AND STANDARDS.**

**AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)**

- T-99 Moisture-Density Relations of Soils Using a 5.5 Pound Rammer in a 12-inch Drop
- T-180 Moisture-Density Relations of Soils Using a 10 Pound Rammer in a 18-inch Drop

**AMERICAN SOCIETY FOR TESTING AND MATERIALS STANDARDS (ASTM)**

- D-422 Method for Particle Size Analysis of Soils
- D-698 Method for Laboratory Compaction Characteristics of Soils Using Standard Effort
- D-732 Shear Strength of Plastic by the Punch Tool Method
- D-790 Flexural Properties Testing of Plastic
- D-1557 Method for Laboratory Compaction Characteristics of Soils Using Modified Effort
- D-1556 Method for Density and Unit Weight of Soil in-Place by the Sand Cone Method
- D-6938 Methods for Density of Soil and Soil-Aggregate In Place by Nuclear Methods
- D-4253 Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
- D-4254 Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
- D-4595 Tensile Properties of Geotextiles by The Wide-Width Strip Method
- D-6637 Standard Test Method for Determining Tensile Properties of Geogrids by the Single or Multi-Rib Tensile Method
- D-6706 Standard Test Method for Measuring Geosynthetic Pullout Resistance in Soil

**C. AVAILABLE INFORMATION.**

Available information developed by the Contracting Authority includes the following item:

- Terracon Consultants, Inc., Geotechnical Engineering Report, Slope Failure Investigation and Remediation, Pammel State Park, Project No. 08085067-01, dated July 28, 2009.

**D. SPECIAL PROVISIONS.**

The slope face remediation designs presented herein are based on profiles, soil parameters, foundation conditions and loadings stated in referenced documents.

The contractor shall be responsible for the cost of all means of subsoil improvement; cost of additional subsoil exploration; and for all labor tools, equipment and incidentals necessary to complete the work.

Prior to undertaking any grading or excavation of the site, the Contractor shall confirm the location of proposed gabion basket face slope remediation and all underground features, including utility locations within the area of construction.

All work undertaken in the construction of the gabion basket faced slope is subject to the quality control/assurance and special inspection provisions outlined herein, or as required in the contract documents for the project.

Any changes in planned grading, locations of structures or changes in slope profiles should be brought to the attention of Terracon for modification of the design as necessary.

Verify all dimensions and grades prior to gabion basket facing construction.

**E. RELATED SPECIFICATIONS.**

None.

## **F. DEFINITIONS.**

1. Geogrid – a triaxial geogrid used for mechanical stabilization and manufactured from a punched polypropylene sheet, which is then oriented in three substantially equilateral directions so that the resulting ribs have a high degree of molecular orientation, which continues at least in part through the mass of the integral node.
2. Gabion Basket – a gabion galvanized welded wire mesh formed in a configuration to provide a facing during slope remediation system construction.
3. Type 1 Geotextile – a woven engineering fabric intended for localized shear reinforcement with separation characteristic.
4. Type 2 Geotextile – a spun-bound non-woven engineering fabric intended for tensile reinforcement with high filtration and permeability characteristics.
5. Granular Backfill – Compacted Class A road stone meeting IDOT 4120.04 which is placed underneath the roadway as outlined on the plans.
6. Drainage Fill – Fill materials meeting IDOT 4115 placed to fill voids behind the gabion baskets.
7. Mudmat – a lean concrete cover placed on top of bedrock to reduce the potential for weathering.
8. Foundation Soil - rock or in-situ soil beneath the gabion basket facing.
9. Drain – a drain consisting of geotextile fabric and drainage fill provided for internal drainage behind the gabion baskets.
10. Engineer – Iowa Department of Transportation.
11. Geotechnical Engineer- Terracon Consultants, Inc.

## **G. CONSTRUCTION SITE SURVEY.**

Prior to start of any gabion basket facing construction activity, the Contractor and Engineer shall jointly inspect the site to observe and document the pre-construction condition of the site, existing structures and facilities.

## **H. INCLINOMETER INSTRUMENTATION AND READINGS.**

### **1. General.**

#### **a. Scope.**

The Contractor is responsible for furnishing all labor, equipment, and materials for installation, testing, maintenance, protection, and recording the installation of instrumentation specified herein. The instrumentation shall consist of three (3) inclinometers to be monitored during construction activity. Inclinometers shall be located as close to the west edge of the road as practical and at a sufficient distance to avoid disturbance during construction. The base of inclinometer installations shall extend a minimum of 10 feet below the river bed elevation. Inclinometers shall be located at the following stations:

Station 137+30

Station 138+40

Station 139+40

An initial reading shall be obtained on the inclinometers prior to the start of construction, and readings obtained weekly throughout the duration of construction. Inclinometer profile plots shall be submitted to the office of the Engineer on a weekly basis.

**b. Installation Subcontractor.**

The Instruments are to be installed by a subcontractor experienced with the installation of these types of instruments. The Contractor shall submit in writing at least 30 days before installation of instruments the name and qualifications of the subcontractor. The qualifications shall include the experience of the subcontractor, the personnel to be utilized and their experience, and the equipment to be used. If the subcontractor is not acceptable to the Engineer, the Contractor shall provide a subcontractor acceptable to the Engineer.

**c. Recording Installation.**

The installation and testing of each instrument shall be recorded on forms approved by the Engineer. The completed forms shall be provided to the Engineer. The exact location and elevation of all instrumentation shall be surveyed and recorded on the completed forms.

**d. Maintenance and Protection.**

The Contractor shall maintain and protect instrumentation from damage by construction activities throughout construction. Any instruments that are damaged or destroyed shall be repaired or replaced, to the satisfaction of the Engineer, at no additional cost to the Owner.

**e. Manuals.**

Prior to instrumentation installation, the Contractor shall furnish the Owner with two copies of all operation manuals, installation manuals, specification sheets, parts lists, and equipment diagrams produced by the Manufacturer for the instruments specified herein.

**f. Inspection.**

The Engineer or other Owner's Representatives shall be notified prior to any work on instrumentation installation, testing and recording.

**2. Inclinometers.**

The inclinometer installation, including but not limited to the probe, cable, casing, data acquisition (red-out box), and software for managing and printing data shall be inclusive of a single manufacturer.

**a. Inclinometer Data Reduction Software.**

- 1) The Data Reduction Software should allow the Engineer to access for immediate status checks and be able to plot graphs of absolute position/depth, displacement/time, and various combinations of incremental and cumulative displacement against depth.
- 2) It shall have the capability of giving graphics output on DXY and HPGL plotter, dot matrix printers, and HP Laser jet and Post Script Laser printers.

**b. Installation.**

The inclinometer casing shall be installed in strict accordance with the manufacturer's instructions.

**3. Data Collection.**

- a. The specialty subcontractor shall collect data, following the guidelines included in the manufacturers' instruction manuals, and as detailed in the approved submittal.
- b. No inclinometer will be accepted or paid for until satisfactory initial readings are obtained.
- c. Data shall be recorded on the approved forms. Field data records shall include at least the following: project name, instrument type, date, time, observer, readout unit number, instrument number, readings, remarks, visual observations, and other causal data including weather, temperature, and construction activities.
- d. Instrumentation shall be monitored in accordance with the Monitoring Schedule. Monitoring frequencies given are provided as a guide and may be varied based on degree and location of construction activity, the rate at which the readings are changing, and climatic conditions at the site.

- e. In addition to the monitoring frequencies given, the Contractor shall take any additional readings which the Contractor believes are required to ensure the safety of personnel and the work, at no additional cost to the owner.
- f. Inclinometer readings shall be made in accordance with the manufacturer's instruction manual. An inclinometer reading is defined as a set of readings at 1.5 foot intervals throughout the casing, and a second set at 180 degrees to the first set. An initial inclinometer reading shall consist of the average of three readings as defined above. A subsequent reading shall be a single reading. Check-sums (sum of two readings 180 degree apart, at each depth) shall be examined in the field, and shall remain within +20 readout units of the mean of all check-sums for that reading.

**4. Data Reduction, Processing, Plotting and Reporting.**

- a. The specialty subcontractor shall reduce, process, plot and report data, following the guidelines included in the manufacturers' instruction manuals, as detailed in the approved submittal, and in the approved format. All data shall be processed and reports generated using IBM PC compatible software.
- b. Choose scales so that observations fill the space available, but do not use exaggerated scales that would magnify minor changes to make them appear alarmingly large.
- c. Plots should be slightly darker than the underlying grid so that when copied both are visible but the plots stand out. Data points should be visible.
- d. Plot elevations and depths on the vertical axis.
- e. Plots should be self-explanatory. Show project name, the type of instrument, the scale and units of measurement, and the time of measurement.
- f. Use sketches on the plot to show the locations of the instrument relative to the construction activity and the geology.
- g. Maintain consistency of scales so that plots can be compared.
- h. All plots should be initiated by the person responsible for their preparation.
- i. Whenever possible, summary plots should be on a single sheet of report sized paper.
- j. Plots of inclinometer data shall be "cumulative change" data, showing absolute horizontal deformation versus depth. If, in the opinion of the Engineer, inclinometer data show significant deformation, additional plots shall be prepared to show horizontal deformation at a given depth versus time.

**5. Damage To Instrumentation.**

- a. The Contractor shall protect all instruments and appurtenant fixtures, leads, connections, and other components of instrumentation systems from damage due to construction operations, weather, traffic and vandalism.
- b. If an instrument is damaged, the specialty subcontract shall repair or replace the damage instrument at no costs to the Owner. The Engineer will be the sole judge of whether repair or replacement is required. The Engineer may impose a work stoppage in the vicinity of the damaged instrument until it is again operational, at no additional cost to the Owner.

**6. Availability Of Data.**

Raw, reduced and plotted data shall be submitted to the Engineer within 24 hours of reading an instrument.

**I. PRE-CONSTRUCTION MEETING.**

A pre-construction meeting will be scheduled by the Engineer and held prior to the start of gabion basket wall construction. The Engineer, prime Contractor, gabion basket facing specialty Contractor, excavation Contractor and geotechnical instrumentation specialist (if applicable) shall attend the meeting. Attendance is mandatory. The pre-construction meeting will be conducted to clarify the construction requirements for the work, to coordinate the construction schedule and activities, and to identify contractual relationships and delineation of responsibilities amongst the prime Contractor and the various Subcontractors—specifically those pertaining to excavation for

the gabion basket facing, anticipated subsurface conditions, gabion basket facing installation and structure survey control and site drainage control.

**090097.02 MATERIALS.**

Furnish materials new and without defects. Remove defective materials from the jobsite at no additional cost. Materials for gabion basket slope face remediation system shall consist of the following.

**A. STRUCTURAL GEOGRIDS.**

The geogrids shall be manufactured from a punched polypropylene sheet, which is then oriented in three substantially equilateral directions so that the resulting ribs have a high degree of molecular orientation, which continues at least in part through the mass of the integral node. The geogrid reinforcement shall have a minimum radial stiffness of 15,430 lb/ft at 0.5 percent strain.

**B. GEOTEXTILES.**

**1. Type 1 Geotextile.**

- a. Type 1 geotextile shall be a woven geotextile consisting of slit film engineering material.
- b. The minimum physical properties of the Type 1 geotextile will include the following:
  - Tensile Strength (ASTM D4632) – 315 lbs.
  - Burst Strength (ASTM D3786) - 650 psi.
  - Puncture Strength (ASTM D4833) - 125 lbs.
  - Permeability – 4 gpm/ft<sup>2</sup>

**2. Type 2 Geotextile.**

- a. Type 2 geotextile shall be a non woven geotextile consisting of spun-bound 100% continuous filament polyester needle punched engineering fabric.
- b. The minimum physical properties of the Type 2 geotextile will include the following:
  - Tensile Strength (ASTM D4632) – 150 lbs.
  - Burst Strength (ASTM D3786) - 280 psi.
  - Puncture Strength (ASTM D4833) - 85 lbs.
  - Permeability – 110 gpm/ft<sup>2</sup>

3. The manufacturer shall furnish the Engineer with written certification that all geotextile used for construction meets or exceeds the minimum properties required.

**C. GABION BASKETS.**

1. Gabion baskets shall be in the following sizes (LxWxH): 6 feet by 3 feet by 3 feet, 6 feet by 6 feet by 3 feet, 9 feet by 6 feet by 3 feet, and 12 feet by 6 feet by 3 feet.
2. Gabion baskets shall be constructed of 9 gauge galvanized steel, 3 inch by 3 inch welded wire mesh with closure ties per manufacturer's specifications to meet the configuration indicated by the plans.

**D. STONE FILLED WALL FACE MATERIAL FOR GABION BASKETS.**

1. Rock for filling the gabion baskets shall be as listed:
  - a. 100% passing 12 inches
  - b. 0-5% passing 4 inches
2. Rock fill and color shall be approved by the Engineer.

**E. GRANULAR BACKFILL.**

Granular backfill where required shall consist of crushed stone meeting IDOT 4120.04.

**F. DRAINAGE FILL.**

Drainage fill where required to fill voids behind the gabion baskets shall consist of materials meeting IDOT 4115.

**G. MUDMAT (LEAN CONCRETE).**

Where required by the plans, a mudmat (lean concrete) shall be placed at locations determined by the geotechnical engineer. Mudmat shall have a minimum 28-day unconfined compressive strength of 1500 psi.

**H. DELIVERY, STORAGE AND HANDLING.**

**1. Geogrid and Geotextiles.**

- a. Contractor shall check to ensure that the proper materials have been received upon delivery.
- b. All geotextiles shall be stored above -20°F.
- c. Contractor shall prevent mud, wet cement, epoxy, and like material which may affix themselves to the gridwork, from coming in contact with the geogrid and geotextile material.
- d. Rolled geogrid and geotextile material may be laid flat or stood on end for storage.
- e. Geogrids and geotextiles shall be stored according to manufacturer's recommendations.

**2. Gabion Baskets.**

- a. Contractor shall check to ensure that the proper materials have been received upon delivery.
- b. All gabion baskets shall be stored in a manner to prevent mud, water and like materials from coming in contact with the materials.
- c. Gabion baskets shall be stacked horizontally versus being stood on end.

**090097.03 CONSTRUCTION.**

**A. EXCAVATION.**

1. The excavation shall be carried to the lines and grades shown on the construction drawings and to the extent necessary to place the gabion basket facing at the required depth and as required to place the bottom gabion baskets. Contractor shall be careful not to disturb base or existing bedrock, soils/fills beyond the lines shown, and as required by the geotechnical engineer, except for that necessary to comply with applicable safety regulations.
2. Excavations will be made in a manner which will not disturb the existing construction on the site. Contractor will provide protection or will construct the wall in such a manner to maintain the integrity of existing improvements during construction.
3. In-situ materials excavated from the location of the gabion basket facing shall be stockpiled on-site at locations designated by the Engineer and in locations which will not interfere with the execution of the work.

**B. SUBGRADE PREPARATION.**

1. Subgrade shall be excavated as required for placement of the gabion baskets as shown on the construction drawings, or as directed by the Geotechnical Engineer.

2. Subgrade shall be examined by the Geotechnical Engineer to confirm that the actual foundation conditions meet or exceed assumed design assumptions. Subgrade conditions not meeting the required strength shall be removed and replaced with acceptable material.
3. Over-excavated areas shall be replaced with compacted granular backfill material or soils approved by the Geotechnical Engineer to the lines and grade shown on the construction drawings.
4. Granular backfill shall be placed in loose lifts not exceeding 8 inches in thickness, compacted to a minimum of 95 percent of the maximum density as determined by AASHTO T-99, or ASTM D-698. The moisture content of the granular backfill prior to, and during compaction shall be uniformly distributed throughout each layer and shall be within a range of 2% below to 2% above optimum moisture content.

**C. GABION BASKET INSTALLATION.**

1. Gabion baskets shall be assembled per manufacturer's requirements.
2. The partial gabion basket at the top of wall shall be field adjusted accordingly to achieve the top of wall elevations shown on the plans.
3. The first course of gabion baskets shall be placed on full contact with the prepared foundation. The units shall be checked for proper elevation and alignment.
4. Install stiffeners across the corners of the gabion basket on all exterior sides of the structure before filling the gabion basket.
5. Slide the flat end of the push rod over the end of the hook on the stiffener. Rotate the push rod up and around to twist the end of the stiffener. Secure the stiffener in preparation for backfill operation.
6. Backfill with free drainage stone as specified herein.
7. Fill the gabion baskets in 12 inch lifts until gabion baskets are filled. Fill must be flush or slightly above the top of the gabion.
8. Hog rings should be used to hold the lid and upper basket in place before the installation of spiral binders. One spiral may be used to connect the lid and upper basket.
9. Gabion baskets shall be installed to the extent shown on the plans.
10. Where required on the plans, the contractor shall place sonotubes in the gabion basket for the installation of guard rails. Sonotube installation in the gabion basket shall be per gabion basket manufacturer's recommendations.
11. Install each subsequent course in like manner. Repeat procedure to the full extent of wall height.

**D. GEOGRID INSTALLATION.**

Geogrid shall be installed at locations shown on the construction drawings. Geogrid installation shall be in accordance with the manufacturer's recommendations or as directed by the geotechnical engineer.



**E. GRANULAR BACKFILL AND DRAINAGE FILL PLACEMENT.**

1. Granular backfill and drainage fill shall be placed and compacted in lifts not to exceed 6 inches where hand compaction is used, or 8 inches where heavy mechanical compaction equipment is used.
2. Granular backfill and drainage fill shall be compacted to a minimum of 95 percent of the maximum density as determined by AASHTO T-99 or ASTM D-698. The moisture content of the granular backfill material prior to and during compaction shall be uniformly distributed throughout each layer and shall be within a range of 2% below, to 2% above optimum moisture content. If a well defined maximum density curve cannot be generated by impact compaction in the laboratory, the granular backfill shall be compacted to a minimum of 70 percent of relative density as determined by ASTM D-4253 and D-4254.
3. Granular backfill and drainage fill shall be compacted in all areas to the lines and grades shown on the plans.

**F. GEOTEXTILE INSTALLATION.**

Geotextile shall be placed at the locations and extent shown on the Construction drawings.

**G. SITE DRAINAGE.**

1. At the end of each day's operation, the Contractor shall slope the last lift of granular backfill away from the wall face to rapidly direct runoff away from the wall face.
2. The Contractor shall not allow surface runoff from adjacent areas to enter the construction site.

**090097.04 METHOD OF MEASUREMENT.**

- A.** Measurement will be made as follows for the quantity, as specified or directed by the Engineer:

Unless otherwise defined on the plans, the materials, labor, and equipment for installing gabion basket slope face remediation system will be measured and paid for on the basis of the square feet of vertical face area, and will include components (gabion baskets, granular backfill, drainage fill, geogrid, geotextile, sonotubes) and installation of the gabion basket facing as required. The gabion basket slope face remediation system is measured in square feet using the front face area from the bottom of wall elevation to the top of wall elevation as defined in the contract plans.

- B.** The final pay quantities will be the design quantity increased or decreased by any changes authorized by the Engineer.

**090097.05 BASIS OF PAYMENT.**

- A.** The quantities accepted for payment will be paid for at the contract unit prices for Gabion Basket Slope Face Remediation System.
- B.** The gabion basket slope face remediation system will be paid for on the basis of complete installation of the gabion basket slope face remediation system including labor, equipment and components listed herein and on the drawings.