

SECTION 01 25 00  
MATERIALS AND EQUIPMENT

PART 1 - GENERAL

1.01 Work Included

Unless specifically indicated otherwise on the plans or in the contract documents, all materials and equipment shall be new and undamaged.

A. Materials and Equipment

1. Materials and equipment incorporated into the work shall conform to applicable specifications and standards. Materials and equipment shall comply with size, make, type, and quality specified or as specifically approved by the Engineer.
2. Manufactured and fabricated products shall be designed, fabricated, and assembled in accordance with the best engineering and shop practices. Like parts of duplicate units are to be manufactured to standard sizes and gauges to be interchangeable. Two or more items of the same kind shall be identical and manufactured by the same manufacturer. Products shall be suitable for the service conditions. Equipment capacities, sizes, and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing. Materials or equipment shall not be used for any purpose other than that for which it is designed or specified.

1.02 Substitutions

- A. Where specific materials and equipment items are identified in the specifications by manufacturer's name or model number, bids shall be based on the products of one of the manufacturers so named or added thereto by addendum during the bidding period.
- B. During the bidding period, all requests for substitutions will be given full consideration by the Engineer; and if approved, an addendum will be issued to incorporate the approved material or equipment into the contract documents.
- C. Requests for substitutions must be received by the Engineer in ample time, not later than ten days before the bid due date, so that any necessary addendum will be received by all prospective bidders before submission of the bids.
- D. After award of the contract, requests for substitutions will be considered only for one of the following reasons:
  1. Increased value to the Owner
  2. Decreased cost to the Owner
  3. Specified items not procurable
- E. Requests for substitutions after award of the contract shall be accompanied by manufacturer's data or other detailed descriptions of the proposed material or equipment.
- F. A request for a substitution constitutes a representation that the Contractor has investigated and determined the proposed product is equal to or superior in all respects to that specified.

- G. The Contractor shall coordinate the installation of an accepted substitution into the project to provide a complete and operable system. Modifications or re-work of other parts of the project resulting because of substitutes will be at the Contractor's expense.
- H. The Engineer shall be the judge of the acceptability of the proposed substitutions.

#### 1.03 Manufacturer's Instructions

- A. When contract documents require that installation of work shall comply with the manufacturer's printed instructions, the Contractor shall obtain and distribute copies of such instructions to the parties involved in the installation, including two sets to the Engineer. The instructions shall be provided in advance of installation. The Contractor shall notify the Engineer in the event job conditions or the requirements of the plans or specifications conflict with the manufacturer's instructions.
- B. The Contractor shall handle, install, connect, clean, condition, and adjust products in accordance with such instructions and in conformity with the specified requirements.
- C. The Contractor shall perform work in accordance with manufacturer's instructions. No preparatory step or installation procedures shall be omitted unless specifically modified or exempted by contract documents.

### PART 2 - PRODUCTS

Not Applicable

### PART 3 - EXECUTION

#### 3.01 Transportation and Handling

- A. The Contractor shall arrange deliveries of products in accordance with construction schedules and coordinate them to avoid conflict with work and conditions at the site.
  - 1. Products shall be delivered in undamaged condition, in the manufacturer's original containers or packaging with identifying labels intact and legible.
  - 2. Immediately upon delivery, the Contractor shall inspect shipments to assure compliance with requirements of contract documents and approved submittals and that products are properly protected and undamaged.
- B. The Contractor shall provide equipment and personnel to handle products by methods to prevent soiling or damage to products or packaging.

#### 3.02 Storage and Protection

- A. Products shall be stored in accordance with the manufacturer's instructions, with seals and labels intact and legible.
  - 1. Products subject to damage by the elements shall be stored in weather tight enclosures.
  - 2. Temperature and humidity shall be maintained within the ranges required by manufacturer's instructions.

- B. The Contractor shall arrange storage in a manner to provide easy access for inspection and make periodic inspections to assure that products are maintained under specified conditions and free from damage or deterioration.
- C. For products specified by naming one or more products or manufacturers and "or equal", the Contractor must submit a request for substitutions for any product or manufacturer not specifically named.

\*\*\*END OF SECTION\*\*\*

SECTION 01 32 14  
SCHEDULE REQUIREMENTS

PART 1 - GENERAL

1.01 Work Included

The Contractor shall develop a detailed schedule, identifying various phases or divisions of work, indicating a start date and duration required for each. The schedule shall be presented to the Engineer or Owner in sufficient detail, as may be required by the Engineer or Owner, for their approval.

Periodically through the life of the project and as required by the Engineer or Owner, the Contractor shall update the schedule and provide copies to the Engineer and Owner.

1.02 Requirements

The Contractor shall schedule work to be performed during normal business hours, unless otherwise directed on the plans or approved by the Engineer or Owner. Work will not be allowed on Saturdays, Sundays, or recognized holidays unless approved by the Engineer or Owner.

Once work has begun on the project, the Contractor shall work continuously and expeditiously to complete all work provided for by the contract.

Project shall be substantially completed in accordance with the date specified in the agreement. Substantial completion is the stage of completion where the project is fit for occupancy and use without hindrance for its intended purpose.

Project shall be fully completed and ready for final payment in accordance with the date specified in the agreement.

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

Not Applicable

\*\*\*END OF SECTION\*\*\*

SECTION 01 33 00  
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 Work Included

- A. This section includes procedures for preparing and transmitting submittals required by specification sections for a product, material, or construction method. Submittals shall include the following:
  - 1. Shop drawings
  - 2. Product data
  - 3. Manufacturer's certificates
  - 4. Design data and calculations
  - 5. Manufacturer's instructions
  - 6. Manufacturer's field service reports
  - 7. Samples
  - 8. Operation and maintenance manuals (timing, quantity, content, and form)
- B. It is the responsibility of the General Contractor to convey the requirements of this section to their sub-contractors and their suppliers and vendors.

1.02 Submittals

- A. Schedule submittals to expedite work. Unless otherwise indicated in this section, submittals shall be submitted within 30 days of date of Notice to Proceed.
- B. Preparation
  - 1. Provide separate submittals for each specification section requiring submittals. Where multiple sections relate to the same system or element and are being provided from the same source, a single combined submittal is acceptable.
  - 2. Coordinate submission of related items. Group submittals of related products in a single transmission.
  - 3. Include all submittal material requested for that section.
  - 4. Identify variations from requirements of contract documents. State product and system limitations which may adversely affect work.
  - 5. Mark or show dimensions and values in same units as specified.
- C. Contractor Responsibilities
  - 1. Review submittals prior to transmittal. Verify compatibility with field conditions and dimensions, product selections and designations, quantities, and conformance of submittal with requirements of contract documents. Return non-conforming submittals to preparer for revision, rather than submitting for review.

2. Coordinate submittals to avoid conflicts between various items of work.
3. Submittal Transmittal Form
  - a. Include with each submittal a transmittal form. A sample copy of an acceptable form is included in Attachment A. The Contractor's standard submittal form may be used, provided it contains essentially the same information as the sample.
  - b. Identify project, Contractor, subcontractor, supplier, manufacturer, pertinent drawing sheet and detail numbers, and associated specification section numbers.
  - c. Sequentially number transmittal forms. Re-submittals shall have original number with a suffix. Acceptable form of number is SS SS SS-NN-T where:
    - i. SS SS SS indicates specification section number;
    - ii. NN indicates different submittals for that specification section; and
    - iii. T indicates the number of times that submittal has been made.
4. Failure of the Contractor to review submittals, prior to transmittal for review, shall be cause for rejection.
5. Incomplete, improperly packaged, and submittals from sources other than the Contractor will not be accepted.

D. Transmittal

Where possible, transmit all submittals electronically. Where electronic submittal is not possible, submit four paper copies for the Engineer's retention, plus as many copies as the Contractor desires returned after review. Samples shall be submitted as described elsewhere in this specification.

E. Review

The Engineer will review and return submittals with comments.

F. Do not fabricate products or begin work which requires submittals until return of reviewed submittal with A/E or SNL SE acceptance.

G. On return, promptly distribute reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.

H. Resubmission

1. Revise and resubmit submittals, as required, within 15 days of return from initial review.
2. Make re-submittals under procedures specified for initial submittals.
3. Identify all changes made since previous submittal.

1.03 Quality Assurance and Quality Control

A. Where required by specification sections, provide quality assurance submittals:

1. Qualification Data

Contractor shall submit written information demonstrating capabilities and experience of firm or person. Include lists of complete projects with names and contact information for references.

2. Manufacturer's Certificates

Submit reference data, affidavits, and certifications on manufacturer's letterhead certifying that products conform to or exceed specified requirements. Certificates may be based on recent or previous test results supplied by manufacturer and accepted by the Engineer.

3. Installer Approval

Certification on manufacturer's letterhead that installer complies with requirements and is approved for installing manufacturer's products.

4. Welding Certificates

Written certification that welding procedures and personnel comply with requirements. Submit record of Welding Procedure Specifications (WPS) and Procedure Qualification Record (PQR) on American Welding Society (AWS) forms. Include names of firms and personnel certified.

5. Field Test Reports

Written reports from qualified testing agency indicating and interpreting results of field tests performed either during or after installation for compliance with specified requirements.

1.04 Submittal Review

A. The Engineer will review submittals for the sole purpose of verifying general conformance with design intent and general compliance with contract documents. Approval of submittal by the Engineer does not relieve the Contractor of responsibility for correcting errors which may exist in submittal, or from meeting requirements of contract documents.

B. Review Time

Initial review will be performed within 14 days of receipt. Reviewer reserves the right to withhold action on a submittal requiring review of related submittals, until related submittal is received. Additional time will be required if processing must be delayed to permit review of related subsequent submittals. The Engineer will review re-submittals within 14 days.

C. Review Actions

After review, submittals will be returned and marked as follows to indicate action taken:

1. Reviewed, No Comments

Part of work covered by submittal may proceed, provided it complies with requirements of contract documents. Final acceptance will depend upon that compliance.

2. Reviewed, With Comments

Part of work covered by submittal may proceed, provided it complies with notations and corrections on submittal and requirements of contract documents. Final acceptance will depend upon that compliance.

3. Revise and Resubmit

Do not proceed with part of work covered by submittal including purchasing, fabricating, and delivering. Revise or prepare new submittal in accordance with notations and resubmit.

#### 1.05 Drawings

- A. Where required by specifications or otherwise needed, prepare drawings illustrating portion of work for use in fabricating, interfacing with other work, and installing products. Contract drawings shall not be reproduced and submitted as shop drawings.
- B. When construction is complete, prepare and submit red-lined copies of the contract drawings showing clearly how construction deviated from the design, along with the authority for the deviation or change.
- C. Electronic Format
  - 1. Size printable to: 8½ inches by 11 inches minimum and 24 inches by 36 inches maximum.
  - 2. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawing with reference number.
  - 3. Plans, elevations, sections, and detail shop drawings shall be to scale, with scale indicated.
  - 4. Indicate field verified dimensions. Show relationship of products to adjacent work. Note coordination requirements.
  - 5. Schematics and diagrams shall be logically arranged and presented in a clear, understandable manner with all items labeled.
  - 6. Internal wiring diagrams: Provide internal wiring and elementary ladder diagrams for factory pre-wired equipment.
  - 7. Control diagrams: Show relative positions of each component as a system diagram.

#### 1.06 Product Data

- A. Provide product data such as manufacturer's brochures, catalog pages, illustrations, diagrams, tables, performance charts, and other material which describe appearance, size, attributes, code and standard compliance, ratings, and other product characteristics.
- B. Form
  - 1. Provide all critical information such as reference standards, performance characteristics, capacities, power requirements, wiring and piping diagrams, controls, component parts, finishes, dimensions, and required clearances.
  - 2. Submit only data which are pertinent. Mark each copy of manufacturer's standard printed data to identify products, models, options, and other data pertinent to project.
  - 3. Modify manufacturer's standard schematic drawings and diagrams and supplement standard data to provide specific information applicable to project. Delete information not applicable.
  - 4. Colors and Patterns: Unless color and pattern is specified for product, submit accurate color and pattern charts or samples illustrating manufacturer's full range for selection by the Engineer. Submit two hard copies only.

#### 1.07 Design Data and Calculations

- A. Where required by specification sections, provide basic calculations, analyses, and data to support design decisions and demonstrate compliance with specified requirements. State



assumptions and define parameters. Give general formulas and references. Provide sketches, as required, to illustrate design method and application.

- B. Arrange calculations and data in a logical manner, with suitable text to explain procedures and order.
- C. Indicate name, title, and telephone number of individual performing design and include professional seal of designer where applicable or required.

#### 1.08 Manufacturer's Instructions

- A. Where required by specification sections, provide manufacturer's instructions for activities such as delivery, storage, assembly, installation, wiring, start-up, adjusting, and finishing.
- B. Indicate pertinent portions and identify conflicts between manufacturer's instructions and contract documents.
- C. Where appropriate, include preparation procedures; service connection requirements; critical ambient conditions; foundation requirements; special precautions; adjustment requirements; alignment procedures; leveling; purging; charging; lubrication; and cleaning prior to operation and/or Owner's acceptance.
- D. Installation (e.g., assembly, mounting, or wiring) and start-up instructions shall be submitted and available for review in the field prior to scheduled material or equipment installation.

#### 1.09 Samples

- A. Submit samples to illustrate functional and aesthetic characteristics of products with all integral parts and attachment devices. Include full range of manufacturer's standard finishes, indicating colors, textures, and patterns for Engineer selection.
- B. Submission  
Submit the number of samples specified in individual specification sections. One sample will be retained by the Engineer.
- C. Label with identification related to submittal transmittal form.

#### 1.10 Manufacturer's Field Service Reports

- A. When an individual specification section requires services of manufacturer's field representative, submit report of observations, site decisions, and instructions given to installers.
- B. Form
  - 1. Present complete information in clear concise manner.
  - 2. Bind with titled cover in folder or binder.
- C. Report shall include:
  - 1. Time, location, conditions, and duration of activity;
  - 2. Names of persons performing and witnessing activity;
  - 3. Equipment used;
  - 4. Description of activity, data recorded, and results;

5. Deficiencies found, corrective measures, and results of retesting; and
6. Other pertinent data.

D. Submit report within 30 days of construction site service visit.

1.11 Operation and Maintenance Data

- A. Where required by specification sections, provide operation and maintenance manuals.

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

Not Applicable

\*\*\*END OF SECTION\*\*\*

ATTACHMENT A - SAMPLE SUBMITTAL TRANSMITTAL FORM

Attachment A

SAMPLE SUBMITTAL TRANSMITTAL FORM

PROJECT: \_\_\_\_\_  
CONTRACT NUMBER: \_\_\_\_\_  
SUBMITTAL NUMBER: \_\_\_\_\_ RESUBMITTAL: YES NO  
DATE: \_\_\_\_\_ NUMBER OF COPIES SUBMITTED: \_\_\_\_\_  
SUBMITTAL DESCRIPTION: \_\_\_\_\_

RELATED DESIGN DISCIPLINE (circle):  
Civil                      Landscape                      Architectural                      Structural  
Mechanical              Electrical                      Telecommunications              Security  
Fire Protection              Controls                      Other: \_\_\_\_\_

ASSOCIATED SPECIFICATION SECTION NO: \_\_\_\_\_  
REFERENCED DRAWING SHEET NO: \_\_\_\_\_  
SUBCONTRACTOR/SUPPLIER/MANUFACTURER PROVIDING SUBMITTAL DATA:  
Name: \_\_\_\_\_  
Address: \_\_\_\_\_  
Telephone Number: \_\_\_\_\_

CONTRACTOR:  
Name: \_\_\_\_\_  
Address: \_\_\_\_\_  
Telephone Number: \_\_\_\_\_

CONTRACTOR'S CERTIFICATION:  
The undersigned, as representative of the Contractor for the above project, submits the following and certifies that:

1. Submittal has been reviewed and it is complete and conforms to requirements of contract documents, except as noted.
2. Required dimensions have been field verified and are acceptable for installation of proposed products and construction of proposed work.
3. Required quantities for products and materials covered by this submittal have been verified as correct.
4. Fabrication processes and construction methods proposed in this submittal are acceptable for this project and will result in a complete, functional installation.
5. Submittal has been coordinated with other submittals and work and proposed products and construction will properly interface with other construction.

NAME OF CONTRACTOR REVIEWER: \_\_\_\_\_  
SIGNATURE OF CONTRACTOR REVIEWER: \_\_\_\_\_  
DATE: \_\_\_\_\_

SECTION 01 41 26  
PERMIT REQUIREMENTS

PART 1 - GENERAL

1.01 Work Included

The Contractor shall complete work in accordance with all applicable regulations, laws, and ordinances. Work shall be completed in accordance with permits issued by regulatory agencies.

The Contractor shall obtain permits, including the paying of fees, posting bonds, and providing insurance coverage, to secure permits which have not been obtained by the Owner.

Where permits have been obtained by the Owner, the Contractor shall conduct work and operations consistent with the requirements of the permits.

Where changed conditions or other issues arise such that the conditions of a permit which has been issued cannot be met, the Contractor shall promptly notify the Owner and the permitting agency. The Contractor shall provide such additional information as may be necessary to secure a modification to the original permit to allow the planned work to continue.

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

3.01 Permits to be Obtained by Contractor

A. Permit Applications Completed by the Owner

The Owner has submitted information and reviewed the proposed work with the following agencies. Final permits have not yet been issued. The Contractor is required to obtain the permits for the proposed project including the paying of fees, posting bonds, and providing insurance coverage to secure permits.

<b>Permit Agency</b>	<b>Permit Type</b>	<b>Requirements</b>
EGLE	Flood Plain	Follow permit once this is approved
Webster Township	Building	Execute permit and pay associated fees
Washtenaw County	Soil Erosion and Sedimentation Control	Execute permit and pay associated fees

B. Other Permits to be Obtained by the Contractor

The Contractor is responsible to obtain all permits necessary to complete the proposed work, which have not been obtained by the Owner.

PART 4 - MEASUREMENT AND PAYMENT

Obtaining permits, including the paying of fees, posting bonds, and providing insurance coverage to secure permits, is considered included in other items of work and will not be paid for separately.

\*\*\*END OF SECTION\*\*\*

SECTION 01 50 00  
CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.01 Work Included

This work includes providing temporary facilities and controls during the construction of the project.

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

3.01 Electricity

Electricity for use by the Contractor during the construction of the project shall be provided by the Contractor. The Contractor shall provide such temporary systems necessary to convey the electricity to the work area from the point of supply.

Temporary power supply systems shall comply with all applicable codes.

3.02 Water

The Owner will provide water for construction activities, at the location of existing water lines, faucets, and hydrants. The Contractor shall provide such piping extensions, as necessary, to deliver the water to the location(s) required for construction activities.

3.03 Barriers

The Contractor shall provide barriers to prevent entry to construction areas or hazardous areas.

3.04 Enclosures

The Contractor shall provide temporary weather tight enclosures of openings in exterior surfaces to provide acceptable working conditions, protection of materials from the elements, and to prevent entry of unauthorized persons.

3.05 Protection of Installed Work

The Contractor shall control vehicle and pedestrian traffic and/or provide temporary protective coverings, as required, to protect installed or uncompleted work from damage.

3.06 Water Control

The Contractor shall grade the site to drain. Excavations shall be kept free of water. The Contractor shall provide pumps as required.

Water shall not be run to detrimentally affect adjacent buildings or properties.

### 3.07 Cleaning

The Contractor shall maintain the construction area free of debris and waste material. Debris and waste material resulting from construction operations shall be properly disposed of by the Contractor.

The Contractor shall clean areas, as required, for proper execution of the project work.

### 3.08 Drinking Water

The Contractor shall furnish drinking water for their workers.

### 3.09 Sanitary Facilities

The Contractor shall provide sanitary facilities for their workers as required by laws and regulations. The Contractor shall service and clean the facilities as needed or as directed by the Engineer.

### 3.10 Temporary Construction Access

The Contractor shall provide protective construction mats, land bridges, and other means of temporary measures to construct the project. Details of these measures and a staging sequence plan will be provided to the Engineer and Owner for review and approval. No access over existing fairways, greens, wetlands, or woodlands other than the existing cart path route will be permitted without prior approval. All materials and equipment storage and construction access to the site will be limited to the construction staging area indicated on the plans.

The pathway paving project shall limit closure of holes 1-9 or 10-18. One half of the course shall be maintained open for play at all times. Boardwalk repair is limited to foot traffic only. New boardwalks within the course should not be used for construction equipment.

## PART 4 - MEASUREMENT AND PAYMENT

The work of construction facilities and temporary controls is included in the pay item(s) which are specifically listed as pay items on the proposal and will not be paid for separately.

\*\*\*END OF SECTION\*\*\*

SECTION 01 71 13  
MOBILIZATION

PART 1 - GENERAL

1.01 Work Included

Mobilization consists of preparatory work and operations, including but not limited to the following:

- A. The movement of people, equipment, and materials to the project site;
- B. The establishment of the Contractor's facilities to work on the project (offices, storage yards, borrow and disposal sites, etc.);
- C. Expenses incurred prior to beginning work on specific contract pay items;
- D. Pre-construction costs (not bidding costs) which are direct costs to the project, rather than direct costs to specific pay items.

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

3.01 Mobilization

Following Notice of Award, the Contractor shall expeditiously prosecute such work necessary for execution of the contract.

Following Notice to Proceed, the Contractor shall commence such work necessary to prepare for the beginning work on the project.

PART 4 - MEASUREMENT AND PAYMENT

Mobilization is considered included in the work specifically listed on the proposal and will not be paid for separately.

The Contractor will not be paid separately for shutting down the work before its completion, hauling away equipment and materials, and returning equipment to the project site.

\*\*\*END OF SECTION\*\*\*



SECTION 01 71 23.16  
CONSTRUCTION STAKING BY CONTRACTOR

PART 1 - GENERAL

1.01 Work Included

The Contractor is responsible to provide all staking and layout necessary for construction of the project.

1.02 Notifications

In the event that it appears there is an error or contradiction between plan grades, construction stakes, and/or actual conditions, the Contractor shall notify the Owner or Engineer immediately.

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

3.01 Requirements

The Contractor is responsible to provide such layout and control work as may be required for construction of the proposed improvements.

The Contractor shall provide workers competent in the layout and control work necessary. The Contractor shall provide the equipment and materials necessary for establishing the necessary control and layout.

Pipelines, 8 inches or larger that are to be laid at a uniform grade, shall be laid using a laser for alignment control.

3.02 Plan Grades and Alignment

The horizontal alignment of manholes and drainage structures will be from the center of casting, unless otherwise noted.

Final casting elevation for drainage structures and manholes shall be determined by the Engineer after grading is completed.

PART 4 - MEASUREMENT AND PAYMENT

The work of construction staking will not be paid for separately. The cost of construction staking shall be included in the price for completing the construction of the proposed improvements.

\*\*\*END OF SECTION\*\*\*

SECTION 06 10 01  
STRUCTURE TIMBER, BOARDWALK

PART 1 - GENERAL

1.01 Description

This work consists of providing all labor, materials, and equipment necessary to construct the boardwalk, and approach grates as shown on the plans; including all wood, hardware, fasteners, and related construction materials as called for on the plans. Ensure all work is done in accordance with this specification and accompanying drawings, local and state codes, and the Michigan Department of Transportation 2012 Standard Specifications for Construction.

PART 2 - PRODUCTS

2.01 Materials

A. Provide materials in accordance with the following sections in the Michigan Department of Transportation 2012 Standard Specifications for Construction:

Miscellaneous Metals .....	908
Hardware.....	908
Timber and Lumber .....	912

1. Lumber

All lumber, except for cribbing and composite railing members, must be dressed S4S (surfaced four sides) in accordance with ASTM D245. All lumber sizes are nominal. All exposed edges must be free from splinters and have sharp edges sanded smooth.

a. Wood Deck

Size per plans, Southern Pine No. 2, treated.

b. Wood Joists

Size per plans, Southern Pine No. 1, treated.

c. Wood Beams

Size per plans Southern Pine No. 1, treated.

d. Wood Blocking

Size per plans, Southern Pine No. 2, treated.

e. Wood Toe Board

Size per plans, Southern Pine No. 2, treated.

f. Wood Preservative

Pressure-treated with an approved process and preservation in accordance with American Wood Protection Association standards suitable for ground contact. After treatment, re-dry to 19 percent maximum moisture content prior to shipping.

2. Hardware

Provide all hardware and accessories required to properly and completely execute the carpentry for this project, including, but not limited to screws, bolts, nuts, washers, straps,

and similar items, whether specifically mentioned herein or not. Nails must not protrude through the backside of any member unless specifically noted in the contract.

a. Fasteners

Regular hexagon-head hot dipped galvanized ASTM A307 steel bolts, nuts and washers; ASTM A123 for bolts, and ASTM A153 for washers. Hot dipped galvanized, ASTM A653, batch or post-dipped process, with a minimum coating thickness of 1.85 ounces of Zinc per square foot of surface area (G185), of type and size indicated on the contract plans. Deck boards must be fastened to joints with screws.

b. Joist Hangers

Hot dipped galvanized, ASTM A123. Provide joist hangers and fasteners per manufacturer's recommendations that meet the minimum load as shown in the plans.

3. Submittals

Product data conforming to the materials listed above.

### PART 3 - EXECUTION

#### 3.01 Construction

Furnish and install all materials in accordance with the plans, this specification, and sections 709 and 912 of the Michigan Department of Transportation 2012 Standard Specifications for Construction. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit.

Framing Standard: Comply with American Wood Council/American Forest & Paper Association (AF&PA's) "Details for Conventional Wood Frame Construction".

Provide blocking as indicated. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects. Lumber with wane will not be allowed to be used for exposed edges of railing or deck materials. Comply with AWPA M4 for applying a field treatment of copper naphthenate to cut surfaces of preservative-treated lumber. Attach joists by using metal joist hangers as indicated on the plans. Install deck boards with annular rings downward. Do not install boards with knot holes or defects that will affect the walking surface.

Countersink all wood screws. Screws must not protrude above the deck or railing surface.

Install the boardwalk within the construction area with the least amount of disturbance to the surrounding area as possible.

Submit the following to the Engineer for approval at least 14 calendar days prior to the start of construction. A detailed description of the construction procedures proposed for review, including a list of major equipment to be used. Work must not begin until submittal has been received and approved by the Engineer.

A. Field Storage and Handling

If products are stored temporarily at the job site after arrival, wood members must be placed on blocking, well off the ground and be separated by wood blocking so air can circulate around each member. Place water resistance paper over the top but do not use opaque polyethylene.

PART 4 - MEASUREMENT AND PAYMENT

4.01 Pay Items

The work of timber boardwalk will be paid for at the contract unit price for the following pay item(s) which are specifically included on the proposal. Work not specifically listed on the proposal as a pay item is considered included in the pay item(s) which are listed and will not be paid for separately.

<u>Pay Item</u>	<u>Pay Unit</u>
Structure, Timber, Boardwalk	Linear Foot

4.02 Measurement

The work of Structure, Timber, Boardwalk will be measured by area in units of linear feet for the actual length of new boardwalk, authorized, and installed including toe railing.

4.03 Work Included

The work of Structure, Timber, Boardwalk includes furnishing and installing boardwalk and associated work.

\*\*\*END OF SECTION\*\*\*

SECTION 31 25 00  
SOIL EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.01 Work Included

The Contractor shall provide permanent and/or temporary erosion and sedimentation control as called for on the plans and as required by the county soil erosion agent and permit.

1.02 Definitions

A. Major rainfall event – ¼-inch or more precipitation over a period, delineated by dry periods of at least 24 hours.

1.03 References

A. ASTM D3786 – Standard Test Method for Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method

B. ASTM D4355 – Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus

C. ASTM D4491 – Standard Test Method for Water Permeability of Geotextiles by Permittivity

D. ASTM D4533 – Standard Test Method for Trapezoid Tearing Strength of Geotextiles

E. ASTM D4632 – Standard Test Method for Grab Breaking Load and Elongation of Geotextiles

F. ASTM D4751 – Standard Test Method for Determining Apparent Opening Size of a Geotextile

G. ASTM D4833 – Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products

H. Michigan Department of Transportation 2012 Standard Specifications for Construction

1.04 Related Work

A. Section 01 41 26 – Permit Requirements

B. Section 32 92 00 – Turf Establishment

1.05 Permit

The Contractor shall apply for and obtain an Act 451 permit from the local Soil Erosion and Sedimentation Control Enforcing Agent. The Contractor shall pay all permit fees and provide any required bonds or insurance.

1.06 Scheduling

A. Control measures shall be constructed by the Contractor prior to the time construction starts uphill or upstream from the control measure location.

B. The Contractor shall inspect all temporary erosion control measures weekly and within 18 hours of major rainfall events.

- C. Maintenance and replacement of erosion control measures shall be completed by the Contractor when necessary, or as directed by the soil erosion control agent or the Engineer.
- D. Removal and cleanup of temporary control structures shall be provided by the Contractor within one week after the control measure is no longer needed.

1.07 General Soil Erosion and Sedimentation Control Procedures

- A. Keep disturbed areas small.
- B. Stabilize and protect disturbed areas as soon as possible.
- C. Keep storm water runoff velocities low.
- D. Protect disturbed areas from runoff.
- E. Retain sediment within the construction area.

PART 2 - PRODUCTS

2.01 Materials

A. Geotextiles

Geotextiles for filters shall be non-woven, meeting the requirements of the table below.

Silt fence geotextiles shall meet the requirements of the following table and shall be designed to collect eroded sediment transported in storm water runoff. The fabric shall have at least 70 percent minimum retained strength after 500 hours of U.V. exposure when tested according to ASTM D4355.

Geotextile Category	Property/Test Method					
	Grab Tensile Strength (min) ASTM D4632 lbs	Trapezoid Tear Strength (min) ASTM D4533 lbs	Puncture Strength (min) ASTM D4833 lbs	Mullen burst strength (min) ASTM D3786 psi (a)	Permittivity ASTM D4491 Per second	Apparent Opening Size (max) ASTM D4751 (b) Millimeters
Filters	90	45	45	140	0.5	0.21
Silt Fence	100(c)	45	--	--	0.1	0.60
(a) ASTM D3786. The fluid displacement rate for the Mullen burst test equipment must be 170± 5 ml/minute. Subtract tare strength from the ultimate burst strength as specified by ASTM. (b) Filtration opening size (FOS, Canadian General Standards Board, method 148.1 No. 10) is permitted as an alternate test method to ASTM D4751 for non-woven geotextiles. (c) Elongation at the specified grab tensile strength not to exceed 40 percent for silt fence.						

B. Stone

Unless otherwise directed, stone shall meet the requirements of Series 6A as specified in Michigan Department of Transportation 2012 Standard Specifications for Construction.

## 2.02 Mixtures

### A. Seed

Seed shall meet the requirements of Section 32 92 00 – Turf Establishment.

## 2.03 Fabricated Items

### A. Silt Fence

Geotextile for silt fences shall meet the requirements of Section 2.01. The geotextile shall be attached to machine pointed No. 2 common grade hardwood posts, using at least 5 staples through wood lath a minimum of  $\frac{3}{8}$ -inch thick and 2 feet long. Post spacing shall not exceed  $6\frac{1}{2}$  feet. Posts must be of sufficient length and cross-section to support the installed silt fence under full sediment load; however, posts shall have cross-sectional area of at least  $2\frac{1}{4}$  square inches and shall be a minimum of 36 inches in length. Silt fence fabric must be a minimum height of  $2\frac{1}{2}$  feet. Silt fence shall have at least two permanent markings or affixed labels per assembled roll which positively identifies the fabricator.

### B. Mulch Blankets

Mulch blankets shall meet the requirements of Section 32 92 00 – Turf Establishment.

### C. Filter Sacks

All materials shall adhere to the requirements of the Michigan Department of Transportation 2012 Standard Specifications for Construction, except fabric drop, which shall consist of a geotextile filter sack inserted into the drainage structure under the cover.

Filter sack shall be as manufactured by “Siltsack”, “Catch-All”, “Ultra-Urban Filter”, “Flogard + Plus”, or approved equal. The filter sacks shall be installed and maintained in accordance with the manufacturer’s specifications.

### D. Turbidity Curtain

All materials shall adhere to the requirements of Section 916.07 of the Michigan Department of Transportation 2012 Standard Specifications for Construction.

## PART 3 - EXECUTION

### 3.01 General Requirements

The Contractor shall perform work on the project in a manner which prevents or reduces erosion and controls sedimentation. The Contractor shall provide controls which keep sedimentation from the project area, within the limits of the project area, and out of any lake, river, stream, wetland, or storm drain.

The Contractor shall install appropriate controls or measures to control or prevent erosion or sedimentation from the project area before beginning any earth disturbance operations. Temporary erosion and sedimentation control measures shall be maintained by the Contractor, until such times as disturbed areas have become permanently stabilized.

During the life of the project, the Contractor shall provide any additional soil erosion or sedimentation control measures necessary to address specific problems which develop in and adjacent to the project area.

### 3.02 Time Limitations

Grading operations shall be completed as soon as practical. Permanent soil erosion controls for disturbed areas shall be completed within 5 calendar days of the completion of grading, except that permanent measures shall be completed within 24 hours when the disturbed area is within 150 feet of a lake, stream, river, or wetland area.

Temporary soil erosion measures shall be implemented when it is not practical to complete the permanent measures.

### 3.03 Area Limitations

For linear projects (roads, sewers, water main, etc.), the length of the disturbed area shall be limited to ½-mile, unless otherwise approved by the Engineer.

Areas outside the project right-of-way or outside the grading limits shown on the drawings shall not be disturbed, unless otherwise approved by the Engineer.

### 3.04 Construction of Erosion and Sedimentation Controls

The Contractor shall provide all permanent and temporary erosion and sedimentation controls shown on the drawings, required by the permitting agency, or necessary to appropriately control erosion and sedimentation from the project area.

#### A. Check Dams

Check dams shall be installed and maintained across ditches and watercourses, which might convey surface runoff from disturbed areas within the project area, or where shown on the drawings or required by the Engineer or permitting agency.

#### B. Silt Fence

The Contractor shall furnish, erect, and maintain silt fence around the perimeter of the project area where earth will be disturbed and sediment from the disturbed area could be conveyed.

#### C. Filters

Fabric or stone filters shall be installed in waterways or in advance of inlets to drainage courses or storm sewers.

#### D. Sediment Traps and Basins

Sediment traps shall be excavated upstream of check dams and where shown on the drawings or directed by the Engineer or permitting agency. Check dams shall be installed downstream of the sediment traps and basins prior to the sediment traps and basins being excavated.

#### E. Seeding

Earth areas shall be stabilized with turf immediately following the completion of earthwork and grading activities. Where permanent seeding cannot be completed, earth areas shall be stabilized with temporary seeding. Areas which are properly seeded temporarily for stabilization shall be permanently seeded, as shown, as the work can be appropriately completed.

#### F. Mulch Blankets

Areas susceptible to erosion from moving water, which are not to be paved, shall be seeded and protected with high velocity mulch blankets.



### 3.05 Maintenance and Erosion and Sedimentation Control

The Contractor shall maintain all temporary erosion and sedimentation controls until such time as the permanent measures have been completed and established.

The Contractor shall inspect all erosion and sedimentation controls weekly and within 18 hours of a major rain event.

Damaged controls or measures shall be replaced or repaired. Sediment shall be cleaned from traps, sumps, basins, filters, and fences periodically. Sediment shall be removed to prevent the accumulation of sediment from exceeding half of the volume of traps, sumps, and basins. Sediment or debris along silt fences shall be removed before the accumulation reaches half the height of the fence.

Sediment and debris removed from soil erosion and sedimentation control devices shall be disposed of properly by the Contractor. Sediment shall not be used for fill or backfill in the project area, except when an area is specifically designated on the plans or by the Engineer.

Drainage filters shall be cleaned when an accumulation of silt might reduce flow and result in flooding.

Any sediment from the construction area which enters storm sewers or drainage ditches shall be removed by the Contractor. Since sediment can be carried great distances within storm sewers, it may be necessary for many segments of downstream storm sewer segments to be televised, jetted, and vacuumed. If the Engineer believes that the Contractor has allowed or provided the potential for sediment to enter storm sewers or drainage courses, the Contractor will be responsible for the costs of inspection and removing sediment from downstream drains, whether it can be conclusively proven that the sediment was the result of the Contractor's actions (or inaction).

### 3.06 Removal of Erosion and Sedimentation Control Devices

Temporary soil erosion and sedimentation control devices shall be removed or obliterated by the Contractor when the permanent measures are in place and established. Any areas damaged by the removal of the temporary devices shall be corrected by the Contractor.

Mulch used for temporary erosion control may either be removed or worked into the soil before the permanent topsoil and seeding is completed.

## PART 4 - MEASUREMENT AND PAYMENT

The work of erosion control will be paid for at the contract unit price for the actual quantity of the following pay item(s), which are shown on the drawings or authorized by the Engineer and are specifically listed as pay item(s) on the proposal.

Pay Item  
Silt Fence

Pay Unit  
Linear Foot

Work not specifically listed as a pay item is considered included in the pay item(s) specifically listed on the proposal and will not be paid for separately. This work includes providing and maintaining all erosion and sedimentation control measures shown on the plans, required by the permitting agency, or necessary to

minimize erosion and sedimentation from the project area. This work also includes removal of temporary controls once the permanent measures have become established.

\*\*\*END OF SECTION\*\*\*

SECTION 32 92 00  
TURF ESTABLISHMENT

PART 1 - GENERAL

1.01 Work Included

This work includes soil preparation, seeding, fertilizing, and mulching on those areas designated for turf establishment.

1.02 References

A. Michigan Department of Transportation Qualified Products List

1.03 Related Work

A. Section 31 25 00 – Soil Erosion and Sedimentation Control

1.04 Performance Requirements for Guaranteed Growth and Smooth Ground Surface

The Contractor is responsible to provide turf, substantially free of bare spots and free of weeds. The ground in turf areas shall be smooth, graded to provide positive drainage, and graded to provide a smooth transition to adjacent areas. The Engineer will determine when the requirements of guaranteed growth and smooth ground surface have been met.

Materials, requirements, and methods described in this specification are provided to establish minimum levels. Where the Contractor believes that other materials or methods are appropriate for the specific site conditions or better suited to the Contractor's schedule, the Contractor shall submit details of the alternative materials and/or methods to the Engineer for approval.

The Contractor shall provide re-seeding, watering, and herbicides, as necessary, to achieve the desired results.

There will be no adjustment in project cost for re-seeding, watering, application of herbicides, or using alternative methods of turf establishment.

1.05 Areas Designated for Turf Establishment

All areas disturbed by the Contractor's activities or as a result of the project, which are not to be restored with a pavement or aggregate surface, are to be restored with turf, unless specifically directed otherwise.

Turf shall be established on borrow areas and areas where excess soil is stockpiled.

When shown on the drawings or directed by the Engineer, the Contractor shall establish turf in other areas.

## PART 2 - PRODUCTS

### 2.01 Materials

#### A. Topsoil

Topsoil shall be a humus-bearing, natural mineral soil of loam, sandy loam, silty loam, or clay loam classification. Topsoil shall neither be excessively acidic or alkaline.

Topsoil shall be screened and free of stones, roots, debris, and other foreign matter. Topsoil which is stripped from the project area shall be removed, transported, and stockpiled in a manner which prevents it from becoming mixed with sub-soils.

#### B. Fertilizer

Fertilizers shall be standard, commercial packaged or bulk products in granular or liquid form. Each container of packaged fertilizer shall be marked by the manufacturer with the following information: manufacturer name; lot number; date; analysis of contents, including the minimum percentages of total nitrogen, available phosphoric acid, and soluble potash; and the net weight. Bulk fertilizer shall be accompanied with an invoice indicating the manufacturer name; lot number; date; analysis of contents, including the minimum percentages of total nitrogen, available phosphoric acid, and soluble potash; and the net weight or volume.

Fertilizer for seeding and sodding shall be comprised of both a water insoluble component and a water soluble component. The water insoluble nitrogen must be from ureaformaldehydes and/or coarse grade isobutylidene diurea.

Fertilizer shall provide 33 pounds of actual water insoluble nitrogen per acre. The water soluble component of the fertilizer shall provide 65 pounds of actual nitrogen, phosphorus, and potassium nutrient per acre, in equal proportions. The water soluble component of the fertilizer shall include urea, diammonium phosphate, and potassium chloride.

#### C. Mulch

##### 1. Loose Mulch

Mulch shall be straw or marsh hay, in an air-dried condition. Mulch material must be clean, undamaged, and rot-free. It must be substantially free of weed seed and other objectionable foreign matter.

##### 2. Turf Mulch Blankets

Mulch blankets shall be manufactured by a company currently listed on the Michigan Department of Transportation's Qualified Products List.

Mulch blankets shall have a net covering on both sides of the blanket and shall be manufactured from either excelsior or straw. Excelsior blankets shall be manufactured from a uniform layer of interlocking excelsior fibers cut from sound, green timber, with an average dry weight of 12 ounces per square yard. Straw blankets shall be made of a uniform layer of clean wheat straw, free of weeds and weed seed, with the straw and net covering securely stitched together to form a uniform mat having an average dry weight of 8 ounces per square yard.

3. Mulch Anchoring

Mulching anchoring shall be manufactured by Enviroscope S2000BD Double Net Straw Blanket or approved equal.

Latex-based anchoring shall have a composition, by weight, of 48 percent styrene, 50 percent butadiene, and 2 percent additive, 42 percent to 46 percent solids, and a pH of 8.5 to 10.

Recycled newsprint mulch shall be comprised of specifically prepared, biodegradable, shredded newspaper particles consisting of recycled newsprint fibers. The recycled newsprint must contain a wetting agent, defoaming agent, and nontoxic dyestuff that will impart a bright green or blue color. The dyestuff must adhere tightly to the fiber. Recycled newsprint shall meet the following minimum requirements:

Moisture content (total weight)	12 percent maximum
Shredded high-grade newsprint (oven dry)	96 percent minimum
Tackifier, by weight	1½ percent to 3 percent
Water holding capacity (water per 3½ ounces of fiber)	32 ounces minimum

Wood fiber shall be specially prepared, biodegradable, air-dried virgin wood fibers manufactured from 100 percent whole wood chips. The wood fiber must be manufactured with a tackifier. Recycled materials are not acceptable. The fibers must be dyed with a green or blue biodegradable dye to aid in visual metering during construction. The process and materials must not contain growth or germination inhibiting materials. The wood fiber must conform to the following specifications:

Moisture content (total weight)	12 percent maximum
Organic wood fiber (oven dry)	95 percent minimum
Tackifier, by weight	3 percent to 5 percent
Water holding capacity (water per 3½ ounces of fiber)	35 ounces minimum

Guar gum tackifiers shall contain a minimum of 95 percent guar gum by weight. The remaining components shall be dispersing and crosslinking additives.

Other tackifiers may include water soluble natural vegetable gums, or guar gums blended with gelling and hardening agents, or a water soluble blend of hydrophilic polymers, viscosifiers, sticking aids, and other gums.

4. Mulch Netting

Netting shall have a mesh size not larger than 1½ inches by 2 inches and not smaller than ½-inch by ½-inch. The netting shall be fabricated from a plastic formulated from or treated with a chemical which will promote the breakdown of the net within the first growing season after its placement. The net shall have sufficient strength to hold the mulch in place and still deteriorate rapidly upon exposure to sunlight. Steel staples or pins shall not be used for anchoring of netting.

D. Weed Control

Herbicides must be approved for use by the Michigan Department of Agriculture and the U.S. Environmental Protection Agency.

2.02 Seeding Mixtures

Seed shall be furnished in durable bags, each with a tag indicating the seed supplier, lot number, date, mixture proportions, purity, germination, and net weight.

Seed mixtures shall meet the requirements of one or more of the following mixtures, or other mixtures that are approved in advance by the Engineer. Where the Contractor believes that another mixture is appropriate for areas within the limit of the project, the Contractor shall request that the Engineer review and approve the substituted mixture(s). Requests for substitutions shall include the name of the seed supplier, the mixture proportions, the purity, and the germination.

Species	Purity, Minimum (percent)	Germination (percent)	Seed Mixture						
			Mixture Proportions (percent by weight)						
			TDS	THV	TUF	TGM	THM	CR	TSM
Kentucky Blue Grass	98	85	5	15	10	10	30		
Perennial Ryegrass	96	85	25	30	20	20	20		50
Hard Fescue	97	85	25		20	30			
Creeping Red Fescue	97	85	45	45	40	40	50		
Fults Salt Grass	98	85		10	10				
Cereal Rye	85	85						100	
Spring Oats	85	85							50

PART 3 - EXECUTION

3.01 Preparation for Turf Establishment

A. Topsoil Stripping

Prior to performing any excavation, filling, grading, or other earthwork, the Contractor shall strip and stockpile topsoil for later use on the project. Excess topsoil shall not be removed from the project site unless specifically provided elsewhere in the contract documents.

B. Finish Grading

The areas that are to be seeded shall be properly graded, sloped, and shaped with an allowance for the thickness of the topsoil layer. The earth bed upon which topsoil will be placed shall be friable to a depth of at least 4 inches. Earth beds not in a friable condition shall be harrowed with a disk, spring tooth drag, or similar equipment.

C. Placement and Preparation of Topsoil

Topsoil shall be spread on the prepared areas to a depth of 3 inches (in place, after rolling or compaction), unless otherwise shown on the plans or proposal. After spreading, any large clods or lumps shall be broken and all stones larger than 1-inch diameter, rocks, roots, litter, and other foreign debris shall be raked up and disposed of by the Contractor. After spreading and raking, the topsoil surface shall be in a friable condition and the surface shall be reasonably close to the proposed grades and cross section.

The topsoil surface shall be shaped to provide proper drainage. Where proposed grades are not shown on the plans, the topsoil surface shall be graded to provide a smooth transition between the new construction and the existing, adjacent ground.

Excess topsoil shall be stockpiled in a location acceptable to the Owner and neatly trimmed to present a neat appearance.

3.02 Turf Establishment

A. Permanent Seeding and Fertilizing

Disturbed areas shall be seeded upon completion of earthwork and grading operations. Disturbed areas shall be stabilized with temporary seeding if permanent seeding cannot be completed.

Seed mixtures for permanent seeding shall be appropriate for the soil type and location, as indicated in the following table. The Contractor may propose and submit alternative mixtures to the Engineer for review and approval. It is the Contractor’s responsibility to provide turf areas which are substantially free of bare spots and generally weed-free.

Mixture Designation	Soil Type	Location
TDS	Dry Sandy to Sand Loam	Rural or Urban
THV	Heavy	Rural
TUF	All Types	City Streets
TGM	Medium to Heavy	All
THM	Loamy to Heavy	Residential / Commercial

Fertilizer and seed shall be applied uniformly on areas prepared for seeding. Seed shall be applied at a rate of 220 pounds per acre. Seed and fertilizer may be applied by drilling, broadcasting, or hydraulically. Seed and fertilizer shall be applied before applying mulch. Seed and fertilizer shall be lightly raked or rolled into the prepared topsoil surface.

Neither broadcast seeding nor hydraulic seeding shall be performed during windy weather.

There shall be provisions for mixing or agitating the seed – fertilizer mixture used for hydraulic seeding to keep it evenly distributed in suspension. Mixtures shall be applied within an hour of mixing the seed with water; unused portions shall be discarded.

B. Temporary Seeding

Temporary seeding shall be completed when the permanent seeding cannot be completed because of seasonal conditions. Temporary seeding shall be applied at a rate of 100 pounds per acre, and shall be of the following designation.

Mixture Designation	Soil Type	Location
CR	All Types	Temporary, less than 6 months
TSM	All Types	Temporary, more than 6 months

Before completion of the contract, the Contractor shall complete permanent seeding of all areas which are temporary seeded.

C. Dormant Seeding

Dormant seeding should be used only when necessary to complete a project when seasonal conditions are not conducive to permanent seeding. Dormant seeding shall not be completed on frozen ground. Dormant seeding shall be completed, as required, for permanent seeding.

The Contractor is responsible to establish turf which is substantially free of bare spots and generally free of weeds.

### 3.03 Mulching

#### A. Mulch Placement

Immediately after the seed has been set into the topsoil surface by light raking or rolling, the Contractor shall spread mulch and anchor it as appropriate. Mulching shall not be performed during windy conditions.

Loose mulch shall be placed thick enough to shade the ground, conserve moisture, and resist erosion, but open enough to allow sunlight to penetrate and air to circulate.

The Contractor shall maintain mulched areas and repair any areas where damage from erosion, wind, traffic, fire, or other causes occur.

Mulch shall be applied at a uniform rate of 2 tons per acre, except that a rate of 3 tons per acre is required with dormant seeding.

#### B. Mulch Anchoring

Mulch anchoring (tackifiers) shall be sprayed immediately after the mulch is placed. Spraying shall not be performed when wind might prevent the proper placement of the adhesive. The Contractor shall provide protection measures, as necessary, to protect traffic, signs, structures, and other objects from being marked or disfigured by tackifier materials.

Latex based adhesive shall be mixed at a rate of at least 15 gallons of adhesive with a minimum of 250 pounds of recycled newsprint and 375 gallons of water.

Recycled newsprint shall be mixed at a minimum rate of 750 pounds of newsprint with 1,500 gallons of water.

Wood fiber shall be mixed at a minimum rate of 750 pounds of wood fiber with 1,500 gallons of water.

Guar gum shall be mixed at a minimum rate of 100 pounds of dry adhesive and a minimum of 250 pounds of recycled newsprint and 1,300 gallons of water.

Other tackifiers shall be mixed at a minimum rate of 100 pounds of dry adhesive with a minimum of 250 pounds of recycled newsprint with 1,300 gallons of water.

#### C. Mulching Netting

When netting is used to secure mulch, it shall be secured with anchors, staples, or pins. The net shall be spread over the mulch so that a worker can walk between adjacent widths of the net. The edges of adjacent widths of net shall be pulled together and held in place with net anchors. Net anchors shall be spaced not more than 30 inches apart along the edges, joints, and centerline. The net shall not be installed in direct contact with the ground. If the Contractor elects to use mulch netting or blankets, the Contractor will be required to remove the netting fabric once the turf is established.

#### D. Mulch Blankets

Mulch blankets shall be installed within one day of seeding. The side edges of blankets shall



be overlapped by 2 inches. Blanket ends shall be shingle lapped 6 inches. Non-metallic staples or pegs shall be placed along all joint edges and along blanket centerlines at a maximum spacing of 2 feet. Blankets in waterways shall be shingle lapped 12 inches on the downslope edge. If the Contractor elects to use mulch netting or blankets, the Contractor will be required to remove the netting fabric once the turf is established.

High velocity blankets shall be installed on slopes of 1:2, or steeper, on ditch bottoms, on ditch side slopes (to an elevation 1 foot above the ditch bottom), and where specifically shown on the drawings or directed by the Engineer.

### 3.04 Weed Control

Weed control shall be provided by the Contractor, as necessary, to develop turf areas which are relatively free of weeds. Herbicides shall be applied in accordance with federal, state, and local regulations. Herbicides shall be applied in accordance with manufacturer's instructions. Herbicides shall be applied by commercial applicators, licensed in the State of Michigan and certified by the Michigan Department of Agriculture in the appropriate category(ies).

Target weeds shall be sprayed in the newly seeded turf when the new turf grass is sufficiently established to withstand the application of herbicide. Herbicide application shall be repeated if the first application failed to control target weeds.

The Contractor shall take appropriate measures to preserve and protect adjacent property from damages resulting from the application of herbicides. Herbicides shall not be applied when wind may carry it to adjacent areas.

## PART 4 - MEASUREMENT AND PAYMENT

### 4.01 Pay Items

When Turf Establishment is specifically listed as a pay item on the proposal, payment will be at the contract unit price for the following pay item(s).

<u>Pay Item</u>	<u>Pay Unit</u>
Turf Establishment	Lump Sum

### 4.02 Measurement

Payment for the work of Turf Establishment will be based on the actual cost for performing the work, as determined by the Engineer.

After bidding, the Contractor shall provide the Engineer with a breakdown of how the Contractor's bid price for Turf Establishment was determined, including the cost for individual tasks such as topsoiling, seeding, fertilizer, mulching, re-seeding, and weed control. An estimated quantity of each task shall be included.

The Engineer will review the Contractor's breakdown to determine its reasonableness for the anticipated work of Turf Establishment. If the Contractor's price for Turf Establishment is believed by the Engineer to be too low for the work required, the Engineer will develop an estimate of the cost of Turf Establishment. If the Engineer's estimate is greater than the Contractor's bid price, additional retainage (from other work completed by the Contractor) will

be held to make up the difference. Payment for Turf Establishment will be based on either the contract price or the Engineer's estimate, whichever is greater.

The Contractor will be paid for the work of Turf Establishment proportionally to the progress on completing the work in accordance with the contract requirements, except that at least 25 percent of the cost will be held as retainage until the turf has become established and meets the performance requirements established.

#### 4.03 Work Included

The lump sum price will not be adjusted for re-seeding or re-working areas where turf does not become suitably established. The cost of watering, mowing, and weed control (if necessary) is included in the contract price for Turf Establishment and will not be paid for separately.

There will be no adjustment in the price for Turf Establishment based on variations in the area actually established with turf.

The work of Turf Establishment includes furnishing, placing, and preparing a topsoil surface. Where the existing topsoil from the project area is of inadequate quantity or quality to provide the required topsoil surface for Turf Establishment, the cost of furnishing topsoil from offsite is included in the contract price for Turf Establishment and will not be paid for separately.

The work of preparing the subsoil and furnishing and placing topsoil are included in the pay item of Sod and will not be paid for separately.

Temporary seeding required for erosion control or because of seasonal limitations is included in the contract price for Turf Establishment and will not be paid for separately.

\*\*\*END OF SECTION\*\*\*

SECTION 31 66 15  
HELICAL PILES

ROWE: WCPRC

1 of 11

07-19-21

**a. Description.** This work consists of designing, furnishing, installing, and load testing helical piles and bracket assemblies in accordance with the project plans, industry standard design methodology, the standard specifications, and this special provision. Install each helical pile at the location and to the elevation, minimum length, and load capacities shown on the plans.

The following definitions apply when used herein and on the plans:

1. Allowable Pile Capacity. Ultimate pile capacity divided by a factor of safety as designated on the plans. If the factor of safety is not designated on the plans then the factor of safety will be 2.0.
2. Alignment Load (AL). A small load applied to a helical pile during testing to keep the testing equipment correctly positioned.
3. Brackets. Cap plate or other termination device that is bolted, slipped over, or welded to the end of a helical pile after completion of installation, to facilitate attachments to structures or embedment in cast-in-place structures.
4. Designer. A Professional Engineer, licensed in the State of Michigan, who is retained by the Contractor and is responsible for the design and working drawings required herein.
5. Elastic Movement. The recoverable movement measured during a helical pile test.
6. Extension Section. Helical pile section(s), which follow the lead section into the ground and extend the helical lead to the appropriate depth. Extension section(s) consist of a central shaft and may have helical bearing plates affixed to the shaft.
7. Helical Pile. Manufactured steel foundation element with one or more helical bearing plates that is rotated into the ground to support structures. The element consists of a lead or starter section, extension section(s), brackets, and a pile cap.
8. Installation Torque. The resistance generated by a helical pile when installed into soil. The installation resistance is a function of the soil type and the size and shape of the various components of the helical pile.
9. Lead Section. The first section of a helical pile to enter the ground, lead sections consist of a central shaft with a tapered end and one or more helical bearing plates affixed to the shaft.
10. Manufacturer. The individual or legal entity that performs part of the work required through a contract agreement with the Contractor. This includes an individual or legal entity that owns the patent, product trademark, product copyright, or product name for the approved helical pile system.

11. Minimum Pile Penetration Elevation. The elevation shown on the plans to or below which the bottom of piles must be installed.

12. Shop Drawings. A submittal consisting of drawings and calculations related to the design, installation, and load testing of the helical pile system by the Contractor.

13. Torque Strength Rating. The maximum torque energy you can apply to the helical pile foundation during installation in soil, i.e., allowable or safe torque.

14. Unsupported Length. Unsupported shaft lengths shall include the length of the shaft in air, water, or in fluid soils.

15. Verification Load Test. A helical pile load test performed to verify the helical pile ultimate capacity based on the construction methods proposed. Verification load tests are performed on non-production piles, prior to installation of production piles.

**b. Materials.** Unless noted otherwise, it is the responsibility of the Contractor to select the appropriate type and design strength of helical plates, shaft connections, shafts, brackets, and the overall helical pile system to support the load capacities and criteria specified on the project plans. Materials used for helical piles must meet the requirements of ICC-ES AC358. In addition, all helical piles must be manufactured to the following criteria.

1. Central Steel Shaft. The central shaft must consist of high strength structural steel tube, pipe, or solid steel bars meeting the requirements of *ASTM A36*, *A252 Grade 3*, *A500 Grade C*, or *A576 Grade 1045* or *Grade 1530*.

2. Helix Bearing Plate. Bearing plate material must conform to *ASTM A572 Grade 50* or *A1018 Grade 55*.

3. Bolts, Nuts, and Washers. Must meet the material and hot-dip galvanizing requirements of subsection 906.07 of the MDOT 2012 Standard Specifications for Construction.

4. Brackets. Bracket must conform to *ASTM A36*, *ASTM A572 Grade 50*, or *ASTM A958 Grade SC 1045*. Piles must have U-shape bracket sleeves to mount lateral support beams for joist and deck structure.

5. Couplings. Couplings, if applicable, must conform to *ASTM A958*.

6. Corrosion Protection. At minimum, all helical piles and hardware must have corrosion protection consisting of hot-dip galvanization in conformance with *ASTM A153* and *ASTM A123*, as applicable.

**c. Construction.** Furnish, design, install, and load test the helical piles in accordance with the project plans, this special provision, and the approved shop drawings.

1. Qualifications.

A. Manufacturer. The manufacturer must be a company specializing in the manufacturing and distribution of these products. Manufacturer's qualifications are to be submitted to the Engineer in accordance with subsection c.2.A of this special provision. The submittal must include:

(1) A product catalog and evidence showing the manufacturer has at least ten years of experience in the design and manufacture of helical piles.

(2) Current ICC-ES product evaluation report or complete description of product testing and engineering calculations used to assess product capacity.

B. Contractor. The Contractor performing the work described in the contract must be a company specializing in the installation of helical piles. The submittal must include:

(1) Evidence the Contractor has completed training in the proper methods for installation of helical piles and brackets.

(2) Documentation that the Contractor's full-time onsite supervisor and drillers performing the work have completed at least ten projects and have three years of experience installing similar types of helical piles in similar subsurface conditions to this project. Documentation must, at minimum, include project name, description, dates, number and type of helical piles, project location, and client contact information.

(3) List of installation equipment and detailed description of proposed method of installation.

C. Designer. The design of the helical piles must be done by a licensed design professional specialized in the engineering and design of helical piles. The designer must have the following qualifications:

(1) A Professional Engineer licensed in the State of Michigan.

(2) Documentation indicating the designer has designed at least five projects utilizing helical piles. Documentation must, at minimum, include project name, description, dates, number and type of helical piles, project location, and client contact information.

## 2. Submittals.

A. Qualifications. Submit manufacturer, Contractor, and designer qualifications in accordance to subsections c.1.A, c.1.B, and c.1.C.

Submit to the Engineer three copies of the project reference list and a personnel list at least 30 calendar days before the planned start of helical pile construction. Provide a summary of each individual's experience in the personnel list and be complete enough for the Engineer to determine whether each individual satisfies the required qualifications. The Engineer will approve or reject the Contractor's and manufacturer's qualifications within 15 calendar days after receipt of a complete submission. Additional time required due to incomplete or unacceptable submittals will not be justification for

time extension or impact or delay claims. All such costs associated with incomplete or unacceptable submittals are to be borne by the Contractor.

Work is not to be started, nor materials ordered, until the Engineer's written approval of the Contractor's, manufacturer's, and designer's experience and personnel qualifications is given. The Engineer may suspend the work if the Contractor uses non-approved personnel, manufacturer or designer. If work is suspended, the Contractor is fully liable for all resulting costs, and no adjustment in contract time will accrue due to the suspension.

B. Shop Drawings. Prepare and submit to the Engineer shop drawings for the helical piles intended for use on the project at least 30 calendar days prior to start of installation. The shop drawings must include the following:

- (1) Overall plan drawing showing helical pile location, number, and product identification number(s).
- (2) Type and size of steel shaft and helix configuration (number and diameter of helix plates).
- (3) Maximum allowable mechanical compression and tensile strength of the helical piles. Include the Torque Strength Rating.
- (4) Helical piles respective design capacities from the drawings.
- (5) Planned installation depth and cut-off elevation and the number and type of lead and extension sections.
- (6) Designer's recommended allowable pile capacity to installation torque ratio and minimum final installation torque(s) for the helical test pile(s).
- (7) Product identification numbers and designations for all the brackets and number and size of connection bolts or couplers. Details illustrating helical pile attachment to structure relative to grade beam, column pad, pile cap, etc.
- (8) Corrosion protection coating on helical piles and bracket assemblies.

C. Design Calculations. The designer is to prepare and submit detailed design calculations to the Engineer for the helical piles intended for use on the project. Design must be in accordance with the *AASHTO Standard Specifications for Highway Bridges* and other published design methodologies as approved by the Engineer. All submittals must be sealed and stamped by the designer and submitted at least 30 calendar days prior to the start of installation. The analysis must take into account the notes and design details from the plans and must include, but is not limited to, the following items:

- (1) Reduction in the dimensions of the structural elements based on anticipated corrosion loss over the design life for the subsurface and environmental conditions encountered at the project site.

(2) Ultimate and allowable pile capacities. Consider affects from down drag, buckling, and expansive soils.

(3) Minimum installation depth to reach bearing stratum and to achieve pullout capacity, if applicable. At a minimum, the top helical pile shall be installed below the frost depth of 42 inches below ground level.

(4) One hand calculation for a typical helical anchor location, which illustrates conformance of the computer programs utilized to design the axial pile capacity.

(5) Lateral resistance of the shaft, if applicable.

(6) Estimated pile head movement at the allowable pile capacities.

(7) Design the helical pile attachment to distribute the loads to the substructure and/or superstructure does not exceed those in the *AASHTO Standard Specifications for Highway Bridges*.

D. Calibration Reports. Submit to the Engineer calibration information certified by an independent testing agency for the torque measurement device. Calibration information must have been tested within 30 days of the start of helical pile installation. Calibration information must include, but is not limited to, the name of the testing agency, identification number or serial number of device calibrated, calibration data, and the date of calibration.

E. Installation Record. Submit to the Engineer a Daily Installation Log during helical pile installation. This log must contain the following information for each helical pile:

(1) Name of project and Contractor.

(2) Name of Contractor's supervisor during installation.

(3) Date and time of installation.

(4) Name and model of installation equipment and type of torque indicator used.

(5) Location of helical pile by grid location or assigned identification number.

(6) Type and configuration of lead section with length of shaft and number and size of helical bearing plates.

(7) Type and configuration of extension sections, with length and number and size of helical bearing plates, if any.

(8) Installation duration and observations.

(9) Total length installed.

(10) Final elevation of top of shaft and cut-off length, if any.

(11) Final plumbness or inclination of shaft.

(12) Installation torque at minimum 3-foot depth intervals.

(13) Final installation torque. The final torque shall be the average torque for the last 3 feet of penetration. The average torque shall be defined as the average of the last three readings recorded at 1-foot intervals.

(14) Comments pertaining to interruptions, obstructions, or other relevant information.

(15) Verified allowable pile axial load capacity.

3. Subsurface Data. Review the available soil boring logs from the subsurface investigation(s). Upon request, a copy of the geotechnical data report outlining the subsurface exploration conducted during the design phase will be provided. If, during construction, the Contractor determines the actual subsurface conditions differ substantially from those reported on the boring logs, notify the Engineer in writing within 48 hours of such determination.

The data indicated on the available boring logs are not intended as representation or warranties of continuity of such conditions. It is expressly understood that the Owner will not be responsible for interpretations or conclusions drawn therefrom by the Contractor. Additional soil test borings and other exploratory procedures may be performed by the Contractor at no additional cost to the Owner.

4. Installation Equipment. The equipment must be capable of applying adequate down pressure (crowd) and torque simultaneously to ensure normal advancement of the helical piles to the ultimate pile capacities and the minimum pile penetration elevation(s) as shown on the plans. The equipment must be capable of continuous position adjustment to maintain proper alignment and position.

A. Torque Motor. Helical piles are to be installed with high torque, low RPM torque motors, which allow the helical plates to advance with minimal soil disturbance. The torque motor must be hydraulically powered with clockwise and counter-clockwise rotation capability. The torque motor must be adjustable with respect to revolutions per minute during installation. Percussion drilling equipment is prohibited. The torque motor must have a minimum torque capacity 15 percent greater than the torsional strength rating of the central steel shaft to be installed for the project. The connection between the torque motor and the installation rig must have no more than two pivot hinges oriented 90 degrees from each other.

B. Drive Tool. The connection between the torque motor and helical pile must be in-line, straight, and rigid, and must consist of a hexagonal, square, or round kelly bar adapter and helical shaft socket. To ensure proper fit, the drive tool must be manufactured by the helical pile manufacturer and used in accordance with the manufacturer's installation instructions.



C. Connection Pins. Attach the central shaft of the helical pile to the drive tool by smooth tapered pins matching the number and diameter of the specified shaft connection bolts. Maintain the connection pins in good condition allowing safe operations at all times. Inspect the pins regularly for wear and deformation. Replace pins with identical pins when worn or damaged.

D. Torque Indicator. Ensure the torque indicator is capable of providing continuous installation torque measurement during installation. Ensure the torque indicator is capable of torque measurements of 500 foot-pounds or less. Calibrate torque indicators that are mounted in-line with the installation tooling either on-site or at an appropriately equipped test facility. Re-calibrate indicators that measure torque as a function of hydraulic pressure following any maintenance performed on the torque motor. Re-calibrate torque indicators if, in the opinion of the Engineer, reasonable doubt exists as to the accuracy of the torque measurements. If recalibration is directed by the Engineer in writing and the calibration is off by less than 500 foot-pounds, the recalibration will be paid for as extra work. Otherwise, recalibrations will be paid for by the Contractor at no cost to the Owner.

5. Installation Procedures. The helical pile installation technique is to be determined by the Contractor such that it is consistent with the geotechnical, logistical, environmental, and load carrying conditions of the project.

A. Position the lead section at the location depicted on the working drawings. Battered helical piles can be positioned perpendicular to the ground to assist in initial advancement into the soil before the required batter angle is established. The equipment must be capable of continuous position adjustment to maintain proper helical pile alignment. Apply constant axial force (crowd) while rotating helical piles into the ground. Apply sufficient crowd to ensure the helical pile advances into the ground a distance equal to at least 80 percent of the blade pitch per revolution during normal advancement.

B. Advance the helical pile sections into the soil in a smooth, continuous manner at a rate of rotation between 5 RPMs and 40 RPMs. Adjust the rate of rotation and magnitude of down pressure for different soil conditions and depths.

C. Provide extension sections to obtain the required minimum overall length and installation torque as shown on the shop drawings. Use coupling bolt(s) and nuts torqued in accordance with the manufacturer's guidelines to connect sections together.

D. Do not exceed the manufacturer's Torque Strength Rating of the helical pile during installation.

E. The Contractor must adjust the elevation of the top end of the shaft to the elevation shown on the shop drawings or as required. This adjustment may consist of cutting off the top of the shaft and drilling new holes to facilitate installation of brackets to the orientation shown on the shop drawings. Alternatively, installation may continue until the final elevation and orientation of the pre-drilled bolt holes are in alignment. Do not reverse the direction of torque and back-out the helical pile to obtain the final elevation.

F. Install brackets in accordance with helical pile manufacturer's details or as shown on the shop drawings.

G. Ensure all helical pile components, including the shaft and bracket, are isolated from making a direct electrical contact with any concrete reinforcing bars or other non-galvanized metal objects since these contacts may alter corrosion rates.

H. Obstructions. Terminate the installation and remove the pile if the helical pile encounters refusal or is deflected by a subsurface obstruction. Remove the obstruction, if feasible, and reinstall the helical pile. Backfill and compact the resulting excavation before reinstalling the pile. Install the helical pile at an adjacent location, subject to review and approval by the Engineer, if the obstruction can't be removed. Removal of such obstructions will be incidental to helical pile installation.

6. Helical Pile Testing. Perform verification testing of helical piles according to *ASTM D1143*, except as modified herein. Perform the testing under the direction of a Professional Engineer licensed in the State of Michigan. Determine the site-specific K factor based on load test results to correlate torque to allowable pile capacity. Summarize the test data in a report to be sealed by the Professional Engineer. Submit the report to the Engineer within 24 hours of each load test. Notify the Engineer in writing three working days prior to any load test. Do not perform load tests without the Engineer being on site to witness the load test.

Do not exceed 80 percent of the following helical pile structural elements during load testing: steel yield in tension, steel yield in compression, and steel buckling in compression. Costs associated with increasing the strength of the verification test pile structural elements above the strength required for production piles will be borne by the Contractor.

A. Testing Equipment and Data Recording. Testing equipment includes, but is not limited to dial gauges, dial gauge supports, jack and pressure gauges, electronic load cell, reaction piles, and a reaction frame. The load cell is required only for the creep test portion of the verification test. Submit a written description of the load test setup and jack, pressure gauge, and load cell calibration reports according to subsection c.2 herein. Design the testing reaction frame to be sufficiently rigid and of adequate dimensions to prevent excessive deformation of the testing equipment. Align the jack, bearing plates stressing anchorage such that unloading and repositioning of the equipment will not be required during the test. Apply the test load with a hydraulic jack and measure the load with a pressure gauge graduated in no more than 50 psi increments or less. Use a jack and gauge with a pressure range not more than twice the anticipated maximum test pressure. Select a jack with ram travel sufficient to allow the test to be performed without repositioning during the test. Monitor the creep test load hold during verification tests with both the pressure gauge and the electronic load cell. Use the load cell to accurately maintain a constant load hold during the creep test load hold increment of the verification test. Measure the pile top movement with a dial gauge capable of measuring to 0.001 inch and a travel sufficient to allow the test to be performed without having to reset the gauge. Align the gauge to be parallel to the axis of the helical pile. Support the gauge independent from the jack, pile, or reaction frame. Use a minimum of four dial gauges evenly distributed around the test pile. Record the load test data.

B. Verification Load Testing. Perform a pre-production verification load test to verify the design of the helical pile and the construction methods used to install the helical pile meet specifications. Do not use production piles as reaction piles during load tests. Unless otherwise specified on the plans, install one sacrificial verification test pile per structure. Install verification test piles at locations approved by the Engineer. The verification helical pile must be identical to those used in production and installed using the same methods to be used for installing production piles.

Do not locate reaction piles closer than 5 feet to the verification pile. Reaction piles must meet the approval of the Engineer. Perform verification load tests by incrementally loading the helical pile in compression according to Table 1. Depending on performance, the Engineer will determine whether a 10-minute or a 60-minute creep load hold is appropriate. If the pile top movement measured between 1 and 10 minutes exceeds 0.04 inches, maintain an additional 50 minutes of load hold during the creep test. Record pile top movements during each hold period at time intervals of 1, 2, 3, 4, 5, 6, 10, 20, 30, 50, and 60 minutes. Reset dial gauges to zero after the initial alignment load (AL) is applied. The acceptance criteria for helical pile verification load tests are:

(1) Failure of the test pile does not occur before the maximum test load is applied. Failure is defined as the lesser of:

(i) The slope of the load versus deflection curve (at the end of the load increment) exceeds 0.025 inch/kip, or

(ii) Where attempts to further increase the test load simply results in continued pile movement.

(2) Test pile supports the allowable pile capacity with not more than 1.00 inch of total vertical movement at the top of the pile from its position prior to testing.

(3) At the end of the creep test load period, a creep rate not greater than 0.04 inch/log cycle time (1 to 10 minutes) and not greater than 0.08 inch/log cycle time (6 to 60 minutes or the last log cycle if held longer) and linear or decreasing creep rate.

The Engineer will provide written approval or rejection of the helical pile design and construction techniques within seven working days of the completion of the verification load test.

If site conditions vary across the project limits, additional load tests may be necessary as determined by the Engineer.

Verification piles constructed using methods different from the methods submitted for production piles will be rejected and additional verification test pile(s) will be required at no additional cost to the Owner. If the verification pile fails to meet the acceptance criteria, the Engineer may modify the design of the production piles, or require the Contractor to make modifications to the construction methods, or both. Modifications may include, but not be limited to, modifying the installation methods, or changing the helical pile materials. Any modification to the construction procedure that necessitates changes to the structure requires the Engineer's review and approval.

Do not install production piles until the verification load test results have been reviewed and accepted by the Engineer. At the completion of verification testing, remove testing equipment and remove test piles and reaction piles or cut off piles to an elevation directed by the Engineer.

**Table 1: Verification Load Test Schedule**

Step	Load (a)(b)	Hold Time, minutes	Step	Load (a)(b)	Hold Time, minutes
1	AL	-	19	AL	1
2	0.10 R <sub>n</sub>	3	20	0.10 R <sub>n</sub>	1
3	0.20 R <sub>n</sub>	3	21	0.20 R <sub>n</sub>	1
4	0.30 R <sub>n</sub>	3	22	0.30 R <sub>n</sub>	1
5	AL	1	23	0.40 R <sub>n</sub>	1
6	0.10 R <sub>n</sub>	1	24	0.50 R <sub>n</sub>	1
7	0.20 R <sub>n</sub>	1	25	0.60 R <sub>n</sub>	1
8	0.30 R <sub>n</sub>	1	26	0.70 R <sub>n</sub>	1
9	0.40 R <sub>n</sub>	3	27	0.80 R <sub>n</sub>	3
10	0.50 R <sub>n</sub>	10 or 60 (creep test)	28	0.90 R <sub>n</sub>	3
11	AL	1	29	1.00 R <sub>n</sub>	10
12	0.10 R <sub>n</sub>	1	30	0.75 R <sub>n</sub>	5
13	0.20 R <sub>n</sub>	1	31	0.50 R <sub>n</sub>	5
14	0.30 R <sub>n</sub>	1	32	0.25 R <sub>n</sub>	5
15	0.40 R <sub>n</sub>	1	33	AL	5
16	0.50 R <sub>n</sub>	1			
17	0.60 R <sub>n</sub>	3			
18	0.70 R <sub>n</sub>	3			
a. R <sub>n</sub> denote nominal resistance (ultimate pile capacity). b. AL denotes alignment load. AL is equal to 0.025 R <sub>n</sub> .					

7. Production Helical Piles.

A. Advance production helical piles until all the following criteria are satisfied:

(1) Allowable pile capacity is verified by achieving the required Installation Torque. The required Installation Torque must be determined from the site-specific K factor based on the verification load test results. The required Installation Torque is defined as the average of the last three readings recorded at 1-foot intervals, unless a more stringent specification is noted on the designer’s shop drawings. The maximum rotational speed must not exceed 12 RPM when torque is monitored.

(2) Minimum depth as depicted on the plans is obtained.

B. If the manufacturer’s Torque Strength Rating of the helical pile is obtained during installation and the minimum pile depth has not been reached, the Contractor and designer must submit revised shop drawings and design calculations for review and approval by the Engineer.

If the Contractor chooses to reinstall a pile in the same location, the topmost helix of the new lead section of the helical pile must be terminated at least 3 feet beyond the terminating depth of the original helical pile.

C. If the final Installation Torque is not achieved at the estimated length shown on the shop drawings, the Contractor has the following options:

(1) Install the helical pile deeper using additional extension sections until the required Installation Torque is obtained.

(2) Remove the helical pile and install a new one with additional and/or larger diameter helical bearing plates. This option may require an additional pile load test to determine the new K factor, as determined by the Engineer. No additional compensation for any additional pile load tests will be provided for in this option.

(3) Submit other options to the Engineer in writing for review and approval.

(4) Additional materials and work necessary to reach the required helical pile capacity, including engineering analysis and redesign, is to be furnished without cost to the Owner and without an extension of the completion dates for the project.

D. The helical pile must be sized to reach the allowable pile capacity and the minimum helical pile penetration elevation. No additional compensation for changes in the helical pile will be allowed unless differing site conditions are determined by the Engineer.

8. Construction Tolerances.

A. Horizontal Alignment. Ensure the helical pile actual centerlines are within 2 inches of plan centerlines at the plan elevation for the top of the shaft. Tolerances for bracket assembly placement are ±1 inch in both directions perpendicular to the shaft and ±1/4 inch in a direction parallel with the shaft, unless otherwise specified.

B. Plumb. Tolerance for departure from the design orientation angles is ±5 degrees.

C. Top of Pile Elevation. Ensure helical pile is cut off at the design cut-off elevation.

D. Submit a plan for remedial action to the Engineer for approval, for helical piles not constructed within the required tolerances which are considered unacceptable. The Contractor is responsible for correcting all unacceptable piles to the satisfaction of the Engineer. Materials and work necessary to complete corrections for out-of-tolerance helical piles, including engineering analysis and redesign, must be furnished without cost to the Owner and without an extension of the completion dates for the project. Do not begin repair operations until receiving the Engineer's approval of the remedial action plan.

d. **Measurement and Payment.** The completed work, as described, will be measured and paid for at the contract unit price using the following pay items:

<b>Pay Item</b>	<b>Pay Unit</b>
Helical Pile Equipment, Furn .....	Lump Sum

Helical Pile.....	Each
Helical Pile, Load Test.....	Each

1. **Helical Pile Equipment, Furn** includes furnishing and removing equipment for constructing and installation of the helical pile.

2. **Helical Pile** includes all labor, operating the equipment, fabrication, designing, shop drawings, and materials to install the helical pile and associated brackets as shown on the plans and in this special provision, including any removal of obstructions encountered during installation.

3. **Helical Pile, Load Test** will be measured per each helical pile tested and accepted. Helical Pile, Load Test includes the testing apparatus, data collection and reports, the sacrificial helical piles serving as reaction piles, the sacrificial helical pile on which the verification load test is being performed, and obtaining acceptance from the Engineer.