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	JOB NO. J6S3140 St. Louis County, MO Date Prepared: 11/3/2017
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A. CONSTRUCTION REQUIRMENTS

1.0 Description. This provision contains general construction requirements for this project.

2.0 Construction Requirements. Plans for the existing structure(s) are included in the contract with the bridge plans for informational purposes only.

2.1 In order to assure the least traffic interference, the work shall be scheduled so that a lane closure is for the absolute minimum amount of time required to complete the work. A lane shall not be closed until material is available for continuous construction and the contractor is prepared to diligently pursue the work until the closed lane is opened to traffic.

2.2 Bridge work by contractor forces, including erection, shall not be allowed over traffic unless a bridge platform protection system is installed below the work area except for work performed above a deck that is intact. The protection system shall be capable of catching all falling objects such as tools, overhang brackets or materials. Lifting of objects that are heavier than the capacity of the bridge protection system shall not be allowed.

2.3 Provisions shall be made to prevent any debris and materials from falling onto the roadway. Any debris and materials that falls below the bridge and if determined necessary by the engineer, the debris shall be removed as approved by the engineer at the contractor's expense. Traffic under the bridge shall be maintained in accordance with the contract documents.

2.4 Provisions shall be made to prevent damage to any existing utilities. Any damage sustained to the utilities as a result of the contractor's operations shall be the responsibility of the contractor. All costs of repair and disruption of service shall be as determined by the utility owners and as approved by the engineer.

3.0 Coating Information.

3.1 Slab Drains. The slab drains and slab drain brackets shall not be damaged during the contractor's operations. Any damage sustained as a result of the contractor's operations shall be repaired or the material replaced as approved by the engineer at the contractor's expense.

4.0 Method of Measurement. No measurement will be made.

5.0 Basis of Payment. Payment for the above described work will be considered completely covered by the contract unit price for other items included in the contract.

B. DYNAMIC PILE TESTING

1.0 General.

1.1 Scope of Work. Scope of work shall include furnishing all labor, equipment and analysis associated with dynamic testing of driven piles as specified in this special provision. Dynamic Pile Restrike Testing will not be required on this job.

1.2 Performance and Design Requirements. Performance and design conditions for dynamic testing of driven piles shall be in accordance with section 4.0 of this special provision.

1.3 Approved Manufacturers. For the following hardware and software components, only the listed manufacturer is recognized as providing the level of quality required. If the contractor wants to propose a non-listed manufacturer that is considered to provide an equivalent level of quality, this manufacturer shall be identified and supporting documentation provided. Acceptance of the manufacturer as a substitute will be at the discretion of the engineer.

Component	Product	Manufacturer
Pile Driving Modeling - Wave Equation Software	GRLWEAP	Pile Dynamics, Inc.
Pile Driving Monitoring - Hardware & Software	Pile Driving Analyzer - Model PAK	Pile Dynamics, Inc.
Pile Driving Analysis – Signal Matching Software	CAPWAP	Pile Dynamics, Inc.

1.4 Test Requirements. Dynamic pile testing shall be conducted in accordance with the standard test method indicated below.

Standard Test Method	Designation	Conducted By
High-Strain Dynamic Testing of Piles	ASTM D 4945	Contractor

1.5 Qualifications. The contractor shall perform dynamic pile testing utilizing the services of an independent dynamic pile testing consultant and qualified personnel. An engineer with a minimum of 3 years dynamic pile testing and analysis experience or who has achieved Basic or better certification under the High-Strain Dynamic Pile Testing Examination and Certification process of the Pile Driving Contractors Association and Foundation QA shall perform pile driving monitoring. An engineer with a minimum of 5 years dynamic pile testing and analysis experience or who has achieved Advanced or better certification under the High-Strain Dynamic Pile Testing Examination and Certification process of the Pile Driving Contractors Association and Foundation QA shall perform pile driving modeling and pile driving analyses.

2.0 Execution.

2.1 Pile Driving Modeling. The contractor shall perform preconstruction wave equation analyses and prepare a summary report of the results. The wave equation analyses shall be used to assess the ability of all proposed pile driving systems to install piles to the required capacity and the desired penetration depth within allowable driving stresses. The report shall include a drivability graph relating pile capacity, blow count and driving stresses to depth. The report shall include a bearing graph relating the pile capacity to the pile driving resistance. The bearing graph shall indicate blow count versus capacity and stroke. The report shall also contain a constant capacity analysis or inspectors chart to assist the engineer in determining the required driving resistance at other field observed strokes. The contractor shall perform wave equation analyses in accordance with section 4.0 of this special provision. Acceptability of the wave equation report and the adequacy of analyses will be determined by the engineer.

2.1.1 Approval by the engineer of the proposed pile driving system will be based upon the wave equation analyses indicating that the proposed system can develop the specified pile capacity at a pile driving rate of 2 to 10 blows per inch at the end of driving, and within allowable driving stresses per *AASHTO LRFD Bridge Construction Specifications*, Section 4.4.1. The contractor shall provide preliminary pile driving criteria based on wave equation analyses and any

anticipated capacity changes after driving, set-up or relaxation, subject to revision based upon dynamic pile testing field measurements

2.1.2 If any changes or modifications are made to the approved pile driving system, additional wave equation analyses in accordance with section 2.1 of this special provision shall be required.

2.2 High-Strain Dynamic Pile Testing.

2.2.1 The contractor shall perform dynamic pile testing at the locations and frequency required in accordance with section 4.0 of this special provision.

2.2.2 Dynamic pile testing involves monitoring the response of a pile subjected to heavy impact applied by the pile hammer at the pile head. The testing shall provide information on the driving stresses, pile capacity, structural integrity and hammer efficiency.

2.2.3 The contractor shall engage an independent dynamic pile testing consultant and qualified personnel in accordance with section 1.5 of this special provision. Prior to testing, the engineer will review and approve the proposed independent dynamic pile testing consultant, the experience and qualifications of assigned personnel, details of the method of testing, a list of equipment, and the method of analysis of test results. The contractor shall provide all available details of the subsurface conditions, pile dimensions and properties, and pile driving systems to the independent dynamic pile testing consultant.

2.2.4 All field testing and measurements shall be made in the presence of the engineer.

2.3 Field Testing.

2.3.1 Equipment. Dynamic pile testing field measurements shall be carried out using approved equipment, software and recording equipment. The data collected at the end of initial driving and the beginning of restrike shall be analyzed using approved signal matching techniques and software.

2.3.2 Monitoring during driving. During pile driving, piles shall be instrumented and monitored with testing equipment satisfying the requirements of section 1.3 of this special provision.

2.3.2.1 The contractor shall install two sets of strain transducers and accelerometers near the top of each pile to be tested, and shall use a compatible measuring and recording system to record the data during driving.

2.3.2.2 The equipment required to be attached to the pile shall be appropriately positioned and fixed to the approval of the engineer.

2.3.2.3 The hammer and all site equipment used shall be capable of delivering an impact force sufficient to mobilize the specified pile capacity indicated in section 4.0 of this special provision without damaging the pile.

2.3.2.4 The testing equipment shall monitor pile stresses during driving to prevent pile damage and ensure pile integrity and capacity. If the testing equipment indicates overstressing or damage to the pile, the contractor shall immediately discontinue driving and notify the engineer.

2.3.2.5 If the testing equipment determines that pile stresses during driving exceed acceptable levels, a new pile driving system, modifications to existing system or new pile installation procedures shall be proposed by the contractor. Approval by the engineer of any proposed changes to the pile driving system or pile installation procedures will be based upon the results of additional wave equation analyses in accordance with section 2.1.2 of this special provision.

2.3.3 Preparation of the Pile Head. The preparation of the pile head for the application of dynamic test load shall involve, where appropriate, trimming the head, cleaning, and building up the pile using materials that shall, at the time of testing, safely withstand the impact stresses. The impact surface shall be flat and at right angles to the pile axis.

2.3.4 Dynamic Measurement and Analysis. Monitoring of pile driving shall begin when pile driving begins. The data shall be recorded and processed immediately in the field by the pile driving monitoring equipment and software. Unless monitoring indicates that additional driving will damage the pile, pile driving and monitoring shall continue until both the specified pile tip elevation and the specified pile capacity are reached. For each pile tested, pile driving analysis using signal matching techniques shall be performed for a selected blow at the end of driving to determine the relative capacities from end bearing and skin friction along the pile.

2.3.4.1 Restrike tests shall be performed at the frequency indicated in section 4.0 of this special provision. The time interval between end of initial driving and beginning of restrike shall be in accordance with section 4.0 of this special provision. During restrike, the pile shall be instrumented and monitored similar to during initial driving. For each restrike test, pile driving analysis using signal matching techniques shall be performed for a selected blow from the beginning of restrike to determine the relative capacities from end bearing and skin friction along the pile.

2.3.4.2 The restrike test shall be performed with a warmed up hammer and shall consist of striking the pile for 20 blows or until the pile penetrates an additional 3 inches whichever occurs first unless testing equipment indicates overstressing or damage to the pile. If such overstressing or damage to the pile is indicated, the contractor shall immediately discontinue driving and notify the engineer. In the event initial restrike testing indicates a pile capacity below the specified capacity additional driving may be required as directed by the engineer.

2.3.4.3 The engineer may request use of pile driving monitoring equipment and software on additional piles if inconclusive results are obtained or unusual driving conditions are encountered.

2.3.4.4 Pile bearing capacity and integrity shall be evaluated based on the standard procedure used in practice.

2.3.4.5 Tabular records of the dynamic pile testing field measurements obtained at the end of initial driving shall be immediately provided to the engineer by the contractor.

2.3.5 Results.

2.3.5.1 Preliminary Reports. The contractor shall prepare a preliminary report for each pile tested for review by the engineer. Each report shall contain tabular as well as graphical presentation of the dynamic test results versus depth. Each report shall also indicate the pile

driving criteria for the additional piles to be installed at the substructure unit of the pile tested. Each preliminary report shall include the following:

(a) The maximum force applied to the pile head.

(b) The maximum pile head velocity.

(c) The maximum energy imparted to the pile.

(d) The assumed soil damping factor and wave speed.

(e) Static capacity estimate.

(f) The maximum compressive and tensile forces in the pile .

(g) Pile integrity.

(h) Blows per inch.

(i) Stroke.

(j) Summary results of pile driving analysis from selected blow analyzed using signal matching techniques and software.

2.3.5.2 Summary Report. The contractor shall prepare a summary report of all piles tested for review by the engineer. The report shall include the results of hammer performance, pile driving stresses, and pile capacity during initial driving and restrike for all piles tested. The report shall also include the following:

(a) Date of testing and date of pile installation.

(b) Pile identification number and location.

(c) All information given in preliminary reports as follows:

(1) Length of pile below commencing surface.

(2) Total length of pile, including projection above commencing surface at time of test.

(3) Length of pile from instrumentation position to tip.

(d) Hammer type, drop, and other relevant details.

(e) Blow selected for signal matching analysis.

(f) Maximum compressive and tensile stresses, stroke, and capacity versus penetration depth.

(g) Temporary compression.

(h) Pile integrity and location of damage, if any.

(i) Force/velocity versus time trace.

(j) Force/velocity match curve.

(k) Resistance distribution along the pile.

(l) Detailed graphical and tabular results from blow analyzed using signal matching techniques and software.

3.0 Schedule of Contract Submittals.

Item Number	Submittal Item	Type	Calendar Days	Event/Date	Liquidated Damages Apply
1	Proposed independent dynamic pile testing consultant, and a listing of assigned personnel and their experience and qualifications.	DOCS	45 Before	Start of Pile Driving Monitoring	No
2	Details of the components, method of testing, pile driving equipment and materials to be used, and the results of wave equations analyses.	DOCS	15 Before	Start of Pile Driving Monitoring	No
3	Two copies of each Preliminary Report as defined in section 2.3.5.1 of this special provision	DOCS	3 After	Completion of Each Field Test	No
4	Four copies of the Summary Report as defined in section 2.3.5.2 of this special provision	DOCS	7 After	Completion of All Field Tests	No

4.0 High-Strain Dynamic Pile Testing Specification.

Item	Requirement
Wave Equation Analysis	Minimum of 1 and sufficient additional analyses as needed to define performance for all combinations of piles, driving systems and subsurface conditions anticipated.
Dynamic Testing Pile Capacity	Nominal Axial Pile Compressive Resistance or 2.25 times the Design Bearing shown on the plans or as required by engineer
End of Initial Driving Test Frequency	As shown in the contract plans
Restrike Test Frequency	As shown in the contract plans
Time Interval between End of Initial Driving and Restrike	Minimum of 7 days or as required by the engineer
Pile Driving Analyses using Signal Matching Techniques	For each End of Initial Driving Test and each Restrike Test

5.0 Method of Measurement. Dynamic pile testing and dynamic pile restrike testing will be measured per each.

6.0 Basis of Payment. Payment for the above described work, including all material, equipment, tools, labor and any other incidental work necessary to complete this item, will be considered completely covered by the contract unit price for "Dynamic Pile Testing" and "Dynamic Pile Restrike Testing".

C. GALVANIZED STRUCTURAL STEEL PILE

1.0 Description. This job special provision contains general requirements for furnishing, coating and placing galvanized steel piles as shown on the plans and shall be in addition to the requirements of Sec 702.

2.0 Material. Structural steel piles shall be galvanized in accordance with ASTM A123 and Sec 1080. Repairs to the galvanized coating and field galvanizing shall be in accordance with ASTM A780. Zinc rich paints will not be allowed. Repairs and field galvanizing will not be required where the pile will be encased in concrete or below the limits specified in section 3.0 of this job special provision. Protective Coatings specified in Sec 702 will not be required for galvanized piles.

3.0 Construction Requirements.

3.1 Galvanizing material shall be omitted or removed 1 inch clear of weld locations. The method used to omit or remove the galvanizing material shall be masking, grinding or other methods as approved by the engineer. If a weld location falls within an area where galvanizing is required, clean the weld area making sure to remove all welding slag. Then field galvanize the weld area in accordance with ASTM A780. Zinc rich paints will not be allowed.

3.2 The entire pile length shall be galvanized.

4.0 Method of Measurement. Galvanized Structural Steel Pile in place will be the actual length to the nearest linear foot for that portion of the pile that remains permanently in the

structure. See Sec 702 Basis of Payment for any additional length authorized by the engineer resulting from pile splices. No separate measurement will be made for pile that is not galvanized.

5.0 Basis of Payment. The accepted quantity of galvanized and non galvanized pile in place will be paid for at the contract unit price for Galvanized Structural Steel Pile. No direct payment will be made for incidental items necessary to complete the work unless specifically provided as a pay item in the contract.

D. FORM LINERS

1.0 Description. This work item shall consist of constructing the form liner aesthetic treatment on mechanically stabilized earth (MSE) wall systems as shown on the plans and described in this special provision.

2.0 Materials.

2.1 Shop Drawings. Contractor shall provide complete shop drawings of all aesthetic treatments.

2.2 Formwork. Formwork for aesthetic treatment of the concrete facing panels for the MSE wall systems shall be a type that produces uniform results consistent in both, pattern and depth of relief with the project design aesthetics. The contractor shall be responsible to coordinate the aesthetic treatments of all components to meet the design aesthetic criteria described herein and as shown on plans. No mixing of pattern numbers or manufacturers will be permitted. The form liner pattern shall be one of the patterns listed on the plans or approved equal.

2.3 Form Ties. Wall form ties shall be placed in a uniform pattern. In surface areas receiving the aesthetic treatment form liner, all form ties shall be placed in the simulated stone surface. Form ties shall be fiberglass ties that shall hold the forms in the correct alignment. The color of the ties shall closely match the concrete wall color. Ties shall be ground flush with the surface of concrete prior to pressure washing.

2.4 Form Release Agent. Form release agents shall be the manufacturer's standard non-staining, non-petroleum based and compatible with surface sealer finish coating. Form release agents shall be applied to all surfaces of the form liner at the manufacturer's recommended rate.

2.5 Gaskets. Closed cell compressible neoprene of such thickness as is appropriate to assure leakage prevention shall be used to prevent joint leakage. One face shall be coated with an adhesive tape to assure proper positioning at the time of form closure. The neoprene shall be sufficiently compressible as to assure virtual "zero" separation of the forms as a result of the use of this product.

2.6 Aggregates.

2.6.1 Aggregate Source. The aggregate incorporated into the concrete mix of all aesthetic concrete MSE Wall components shall be from the same source. The purpose for this provision is to ensure uniformity of materials and color once areas are pressure washed and aggregates become exposed. Single-source shall be interpreted as one contiguous rock quarry, gravel pit

or dredging location. This provision in no way alters the specification requirements for aggregate quality specified in other sections of the project specifications.

2.6.2 Aggregate Gradation. Concrete mixes supplied for the construction of the aesthetic treatments shall be in accordance with the following requirements. The concrete aggregate for the aesthetic treatment mix shall be Gradation E in accordance with Sec 1005 for any areas where aesthetic treatment is formed monolithically with the structure. This requirement for aggregate size is necessary to permit concrete mixture to flow freely and fill completely into reveals and form liner proposed in the aesthetic treatment. Gradation E aggregate shall meet the aggregate source requirements.

2.7 Joint Materials. Bond breaker material shall be polyethylene tape, coated paper, metal foil or similar type materials. The backup material shall be compressible, non-shrink, non-reactive with the sealant and non-absorptive material type such as extruded butyl or polychloroprene foam rubber. The joint sealant shall be an elastomeric, multi-component sealant, in accordance with Federal Specification TT-S-227, Type II. The sealant color shall match the pressure washed concrete surface color.

3.0 Construction Requirements.

3.1 Reveals and Texture. All reveals and texture shall be continuous from element to element through construction joints and around corners. Techniques shall be utilized to ensure true continuous texture between separate elements. Sand blasting will not be permitted for cleaning concrete surface, as sand blasting will reduce the special surface texture specified. Pressure washing with water is the preferred method of removing laitance. Pressure washing cleaning shall provide a minimum pressure of 3000 psi at a rate of 3 to 4 gallons per minute (11.4 to 15.1 L/min) using a fan nozzle held perpendicular to the surface at a distance of 2 to 3 feet. The completed surface shall be free of blemishes, discolorations, surface voids and conspicuous form marks to the satisfaction of the engineer.

3.2 Sample Test Panels. Sample test panels shall be constructed to demonstrate the contractor's workmanship for all form liner textures and patterns as shown on the plans. The sample test panels may also be used for demonstration special surface finish if approved by the engineer. The architectural surface treatment of the finished work shall achieve the same final effect as demonstrated on the approved sample test panels. The materials used in construction of the sample test panels shall be in accordance with all standards as listed in this specification and the plans. The concrete mix shall be consistent with the project specifications and criteria. The minimum size of the sample test panels shall be 6 x 6 feet x 8 inches. The form liner finish shall be demonstrated in a vertical strip covering one-half to three-quarters of the sample test panel(s).

3.3 Patches. Holes and defects in concrete surface shall be filled within 48 hours of when the forms are removed. The same patching materials and techniques shall be used that were approved on sample test panels. The patches shall be made with a stiff mortar made with the same material sources as the concrete. The mortar mix proportions shall be adjusted so the dry patch matches the dry adjacent concrete. White cement shall be added to the mortar mix if necessary to lighten the mortar mix.

3.4 Joints. Joints shall be sealed when the sealant, air and concrete temperatures are above 40°F. Joints shall be primed and filled flush with joint sealant in accordance with the manufacturer's recommendation. All construction control and expansion joints shall occur within

the vertical joints as shown in the elevation views on the plans. All vertical expansion joints shall be filled with preformed fiber expansion joint filler covered with bond break tape and sealed with elastomeric, multi-component sealant.

4.0 Method of Measurement. Final measurement will not be made except for authorized changes during construction or where significant errors are found in the contract quantity. The revision or correction will be computed and added to or deducted from the contract quantity.

4.1 Form Liners on MSE Wall Systems. No measurement of form liners on MSE wall systems shall be made.

5.0 Basis of Payment.

5.1 Form Liners on MSE Wall Systems. Payment for the above described work, including all material, additional concrete, equipment, labor and any other incidental work necessary to complete this item, will be considered completely covered by the contract unit price for "MSE Wall Systems".