SP-150175
(New)

SPECIAL PROVISIONS
FOR
VIBRATION MONITORING

Scott County
IM-NHS-074-1(197)5--03-82

Effective Date
April 25, 2017

THE STANDARD SPECIFICATIONS, SERIES 2015, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

150175.01 DESCRIPTION.

A. This specification identifies the Contractor's responsibilities for protecting the utilities listed below from possible vibration damage during excavation of adjacent drilled shafts at Piers 16 (eastbound and westbound) for the new I-74 Bridge over Mississippi River.

B. At a minimum, the following utilities shall be protected per the requirements in this special provision. Additional utilities and/or structures may be protected and monitored as deemed necessary by the Contractor.

1. Utility: 66 inch Sanitary Pipe
Contact: Brian Schmidt, P.E
Director of Public Works
City of Bettendorf, IA
(563) 344-4128

2. Utility: 8.5 foot by 6.5 foot Government Interceptor Sewer
Contact: Brian Schmidt, P.E
Director of Public Works
City of Bettendorf, IA
(563) 344-4128

150175.02 PRECONSTRUCTION SURVEY.

A. Perform a pre-construction condition survey at the designated adjacent utilities, and provide a copy of survey report(s) to the Engineer no later than 30 calendar days prior to starting work. The Contractor shall have a Professional Engineer licensed in the State of Iowa and experienced in evaluating structural vulnerabilities and vibration monitoring perform the survey.

B. At a minimum, document all aspects of the structural condition through observations, actual measurements, plan sketches, photographs, and any other data the preparer may deem appropriate. Submit the survey report to the Engineer electronically.

1. 66 inch Sanitary Pipe.
The Engineer will make available a study that includes a condition assessment with predetermined vibration limits for this utility. The contractor shall perform an updated pre-construction condition survey that includes videotaped documentation, plan sketches indicating existing conditions and vulnerabilities, an evaluation of the risk from construction vibration, and recommendation of maximum safe peak particle velocity (PPV) threshold. The Contractor shall determine the construction methods required to protect the utilities and structures based on the pre-construction survey and the safe vibration threshold.

2. 8.5 foot by 6.5 foot Government Interceptor Sewer.
No information is available concerning the condition of this utility, which is located parallel to and south of the 66 inch sanitary pipe. The Contractor shall conduct a pre-construction survey that includes videotaped documentation, plan sketches indicating existing conditions and vulnerabilities, an evaluation of the risk from construction vibration, and recommendation of maximum safe peak particle velocity (PPV) threshold. The Contractor shall determine the construction methods required to protect these utilities based on the pre-construction survey and the safe vibration threshold.

C. The Contractor is responsible for arranging with the City of Bettendorf the rights-of-access to the utilities and structures in order to engage in condition surveys, and vibration monitoring. The Contractor may commission a preconstruction condition survey of other nearby utilities/structures as they may deem necessary.

150175.03 MONITORING PLAN.

A. Provide to the Engineer a monitoring plan no later than 30 calendar days prior to commencing work. The plan will be reviewed by the Engineer and any comments will be returned to the Contractor within 20 calendar days. The Contractor will then have 10 calendar days to revise the work plan and resubmit a final plan to the Engineer prior to commencing work.

B. The plan shall describe the following:

1. Construction methods and equipment that the Contractor chooses to use to achieve low project vibration levels.

2. Alternative construction methods and equipment that will be used if the PPV threshold is reached or exceeded.

3. Detailed description of the vibration monitoring systems and if necessary catalog cuts of monitoring equipment that will be used; how the equipment will be calibrated and re-calibrated if necessary during the life of the project; description and schematics if necessary of how the independent components will function as a system.

4. Identification of the individual, and their contact information, designated to oversee the vibration monitoring system(s); and the daily recording of activities required in this specification. A brief description of qualifications or resume of the individual is also required.

5. How site monitoring equipment will be deployed to continuously record vibration events, during construction activity. Depending on the equipment deployed and method chosen for networking, it is possible there will need to be both electrical power and telecommunications connections available at multiple remote locations. The monitoring plan will address how the

Contractor will provide utility service to the equipment, protect the equipment from potential vandalism and the elements, and monitor the overall system's day-to-day operation.

6. Details for establishing and deploying an alarm system to announce immediate shut down of all site activities if a vibration event occurs which exceeds the PPV threshold. The alarm system shall provide emails and/or text messages to key Iowa DOT and Contractor site personnel in the event of an exceedance.

7. Establish a protocol for the identification of the activity or equipment that caused the PPV threshold to be exceeded.

8. Description of the process which will be used to verify that the equipment will function as planned before starting work and the process which will be used to verify (daily) that the equipment remains in calibrated working order.

9. Detail a protocol including responsible parties to be notified if an exceedance occurs. This includes, but is not limited to the construction superintendent and the Iowa DOT lead inspector.

10. Daily activity log of vibration activity to ensure the identification of the cause of any vibration event. A daily log shall be maintained either in written or electronic form.

150175.04 PRE-CONSTRUCTION SITE PREPARATION.
At the utilities designated in Article 150175.01:

A. Vibration Monitoring.

1. In accordance with the project's monitoring plan, all monitoring equipment shall be initially installed and maintained during the vibration monitoring in accordance with manufacturer's recommendations, calibration standards, and specifications. No site work can begin until all monitoring equipment is deployed and verified to be operating in accordance with factory recommendations and specifications.

2. Vibrations are to be measured at the ground surface, directly above the spring line (edge) of each utility, at a point closest to the nearest caisson to be installed. This will require that a unique sensor location will be necessary for each caisson. The vibration sensing element of each monitoring unit is to be securely attached to the ground using spiked feet and buried so that the top surface of the sensor is flush with the ground surface.

B. Proof of Installation.
Demonstrate that the installed equipment will continuously and accurately measure vibrations, electronically log the vibration history (date/time stamp), and provide a communication notice system that notifies site personnel should the PPV threshold be exceeded. The monitoring equipment shall remain in-place and in operation throughout excavation of adjacent drilled shafts at pier 16 (eastbound and westbound).

150175.05 VIBRATION LIMITS.
After a thorough conditions evaluation, propose in the pre-construction survey a unique PPV limit for the monitored utilities/structures. The PPV limit proposed shall be determined by a qualified expert in the field of vibration monitoring. If the Engineer agrees that the level proposed will reasonably protect the utilities/structures, that PPV limit will be added to the contract documents. In no case shall the PPV level exceed 2.0 inches per second (ips) at any frequency below 100 Hz as measured at the monitor locations described in Article 150175.04, A. To ensure the PPV limit is not exceeded, an alert threshold shall be implemented to signal any vibration event that equals or exceeds 80% of the PPV limit.

150175.06 DEMOLITION/CONSTRUCTION.
Periodically check to ensure that the monitoring system(s) are continuously operating within manufacture's specifications during the project. Immediately cease work if the alarm at either structure indicates the PPV trigger hreshold is reached or exceeded causing a vibration event. In the event of an exceedance the Engineer shall be notified immediately. The shut-down shall remain in effect until, to the Engineer's satisfaction, the cause of the exceedance has been identified and the potential for another exceedance has been addressed by either replacing faulty monitoring equipment; the work process has been modified; or a recommended change to the equipment being used has been provided. Work shall not resume until approved by the Engineer.

150175.07 POST-CONSTRUCTION SURVEY.
Perform a post-construction survey and analysis at the designated adjacent utilities/structures to determine if any structural changes are the result of the construction activity. Provide the Engineer with a copy of all post construction survey reports, daily log summaries for vibration and crack monitors, and analysis documents comparing pre and post structural condition prior to contract acceptance.

150175.08 PROHIBITED METHOD OF CONSTRUCTION.
Perform excavation and installation of permanent and/or temporary casing for the drilled shafts using methods and means with minimum to no vibration transmitted to adjacent utilities/structures. Installation of permanent and/or temporary casing using vibration method is prohibited.

150175.09 METHOD OF MEASUREMENT.
The item Vibration Monitoring will be measured as a lump sum unit of work.

150175.10 BASIS OF PAYMENT.
Vibration Monitoring will be paid for at the contract lump sum price. This price shall be full payment for pre-construction surveys; installing, monitoring, and removing vibration monitoring equipment; preparing and providing a report documenting vibration data collected during this project; notification of vibration events; post-construction surveys; reports; and all labor, equipment and materials necessary to complete the work as described. There will be no compensation for delays as the result of exceeding the PPV trigger threshold or delays from faulty or damaged monitoring equipment. There will be no compensation for adjustment of construction activities or equipment to reduce the vibration levels to less than the PPV limit, should an exceedance occur.