SP- 230223
(New)

SPECIAL PROVISIONS
FOR
EXISTING BRIDGE MONITORING

Story County
BRF-030-5(271)--38-85

Effective Date
October 15, 2024

THE STANDARD SPECIFICATIONS, SERIES 2023, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

230223.01 DESCRIPTION.

This specification identifies the Contractor's responsibilities to monitor vibrations, tilt, and displacements in the existing bridges during construction of the new structure. It shall be the Contractor's responsibility to obtain a Monitoring Consultant and determine construction methods that will be used to complete the work without causing damage to the existing bridge. Contractor shall perform work in a manner that maintains vibrations, tilt and displacement levels at the existing bridge below levels required by these Special Provisions. The planned monitor locations for vibration, tilt and displacement monitoring include the pier cap level of each Pier and Westbound Abutments of the existing bridge, as shown in Figure 1.

230223.02 PRECONSTRUCTION SURVEY.

A. Original bridge plans and repair plans are available. Refer to the bridge E-files available supplied with the contract documents.

B. Prior inspection reports are available from Iowa DOT upon request.

C. The monitoring consultant will perform a preconstruction condition documentation survey of the existing bridges to provide a record of visible, preexisting distresses and to aid in the development of a final instrumentation and monitoring program.

D. The preconstruction condition documentation survey will document aspects of the structural condition through observations, measurements, sketches, photographs, and other data the monitoring consultant may deem appropriate.

230223.03 INSTRUMENTATION AND MONITORING PLAN.

A. The monitoring consultant will develop an instrumentation and monitoring plan to monitor the existing bridges during construction activities with the potential to result in vibration-related or

movement-related damage. The Instrumentation and monitoring plan shall be prepared and submitted to the Engineer no later than 30 calendar days prior to commencing work that can impact the existing bridges. The Plan will be reviewed by the Engineer. Any comments from the Engineer must be addressed through revision or amendment, resubmittal of the plan, and subsequent approval prior to commencing work.

B. The Contractor shall perform all construction work in a manner that maintains vibration, tilt, and displacements at each of the existing bridge piers and abutments below the alert thresholds established within the instrumentation and monitoring plan. Preliminary vibration, tilt, and displacement protective limits are provided in this special provision; see preliminary alert thresholds section below.

C. The instrumentation and monitoring plan shall describe the following:

1. A vibration monitoring program developed to monitor vibrations at the existing bridges caused by the adjacent construction. The vibration monitoring program shall include the following:
- **a.** Description of the vibration monitoring systems and installation details.
- **b.** Vibration monitoring locations, which will include monitoring on all existing piers and westbound bridge abutments.
- **c.** Vibration data collection protocols, which will include continuous monitoring of vibrations during construction activities with the potential to cause ground-borne vibration.
- **d.** Establishment of a vibration alert threshold and an alert notification system.
- **e.** Protocols to be followed by the Contractor in the event of an exceedance of the vibration alert threshold, which will include immediate review of the construction methods occurring at the time of the event, communication with the Engineer and monitoring consultant, review of tilt and displacement monitoring data, and appropriate actions to prevent damage to the existing bridges.

2. A tilt and displacement monitoring program developed to monitor ground displacement resulting in settlement or rotation of the piers or abutments, or other unanticipated static movements of the existing bridges. Ambient temperature shall be recorded to aid in the distinction between thermal static movements and construction-related movements of the structure. The tilt and displacement monitoring program shall include the following:
- **a.** Description of the tilt and displacement monitoring systems and installation details.
- **b.** Tilt and displacement monitor locations, which will include monitoring on all existing Piers and westbound bridge abutments.
- **c.** Tilt and displacement data collection protocols, which will include discrete readings at a minimum frequency of four times per day during construction activities with the potential to cause vibration, static ground movement, or settlement.
- **d.** Establishment of a tilt alert threshold and displacement alert threshold and an alert notification system
- **e.** Protocols to be followed by the Contractor in the event of an exceedance of the tilt alert threshold or displacement alert threshold, which will include immediate review of the construction methods occurring at the time of the event, communication with the Engineer and monitoring consultant, review of monitoring data, and appropriate actions to prevent further damage to the existing bridge. If the tilt or displacement alert thresholds defined herein are exceeded, the Contractor shall immediately suspend work deemed to contribute to the exceedance and shall immediately consult with the Engineer and monitoring consultant to take appropriate actions to preserve stability of, and maintain traffic on, the existing bridges.

3. Summary of the proposed means and methods of construction for all construction phases and tasks with the potential to produce ground vibration, ground movement, or settlement that may affect portions of the existing bridges. The summary shall include:
- **a.** Detailed description of construction methods and equipment, including type of equipment, equipment model, and technical specifications for all construction phases and tasks with

the potential to produce ground vibration, ground movement, or settlement that may affect the existing bridges.

b. Detailed description of alternate methods or equipment to be used if alert thresholds are exceeded to ensure that vibrations, tilt, and displacements are kept below the established alert thresholds (defined below).

4. Alert response plan summarizing the response protocols that will be followed in the event of an exceedance of the vibration, tilt, or displacement Alert Thresholds established in the Instrumentation and monitoring plan. The alert response plan shall detail the following information and protocols to be followed by the Contractor in the event of an exceedance of the monitoring alert thresholds:

a. Identification of the individuals, and their contact information, of the Contractor's site personnel designated to receive and respond to alert notifications from the vibration, tilt, and displacement monitoring system(s).

b. Method for coordinating with the monitoring consultant to promptly review the monitoring data and construction activities that occurred at the time of the exceedance.

c. Establish a protocol for the identification of the activity or construction equipment that caused the vibration, tilt, or displacement threshold to be exceeded.

d. Daily activity log of vibration-inducing activity to ensure the identification of the cause of any vibration, tilt, and/or displacement event. A daily activity log for the duration of the construction project shall be maintained either in written or electronic form.

e. In the event of a verified exceedance of the tilt alert threshold or displacement alert threshold, a Professional Engineer licensed in the State of Iowa and retained by the Contractor shall conduct a post-alert condition survey of the existing bridge. This alert response plan shall detail the method for coordinating with the Engineer and conducting the post-alert condition survey. The post-alert condition survey shall include a comparative evaluation of the condition of the existing bridge relative to the preconstruction condition documented within the preconstruction condition documentation report issued by the monitoring consultant. The Contractor shall submit a written post-alert condition survey report signed by the Contractor's engineer, summarizing the results of the survey, and clearly identifying any visible and/or measurable changes in conditions relative to the preconstruction condition.

D. In the event that the vibration, tilt, or displacement alert thresholds are exceeded at any monitor location, the Contractor shall immediately suspend work with the potential to have caused vibration or movement of the existing bridge and shall follow the alert response plan. Suspension of the work shall remain in effect until, to the satisfaction of the Engineer, the cause of the exceedance has been identified, the alert response plan has been executed, and if necessary the means and methods of construction have been adjusted to reduce the potential for further exceedance of the alert thresholds. A written recommendation from the Contractor's engineer to resume work shall be submitted to the Engineer prior to authorization to resume work.

230223.04 VIBRATION, TILT, AND DISPLACEMENT ALERT THRESHOLDS.

A. The alert thresholds defined in this special provision represent the preliminary vibration, tilt and displacement alert thresholds recommended for monitoring of the existing bridge. The preliminary thresholds assume that monitoring will be conducted on the pier caps of all existing piers and westbound bridge Abutments of the existing bridges. The monitoring locations and alert thresholds may be revised within the final instrumentation and monitoring plan.

B. **Vibration:** All piers and abutments - Vibration alert threshold: 2.0 inches/second (ips) peak particle velocity (PPV), regardless of frequency.

C. **Tilt and Displacement.**

- All piers and abutments - Vertical displacement alert threshold: +/- 0.75 inches.
- Out-of-plane (roughly east-west / parallel to the bridge centerline) and in-plane (roughly

north-south / transverse to the bridge centerline) horizontal displacement alert thresholds as follows:

Abutment/ Pier Number	Out-of-plane Tilt (+/- Degrees)	In-plane Tilt (+/- Degrees)	Out-of-plane Displacement (+/- Inches)	In-plane Displacement (+/- Inches)
West Abutment	0.10	0.10	0.5	0.5
Pier 1	0.10	0.10	0.50	0.5
Pier 2	0.20	0.10	1.00	0.5
East Abutment	0.10	0.10	0.5	0.5

230223.05 METHOD OF MEASUREMENT AND BASIS OF PAYMENT.

A. The lump sum bid item Existing Bridge Monitoring will be full compensation for all labor and materials required for pre-construction survey; Monitoring consultant; Instrumentation and monitoring plan; and vibration, tilt, and displacement monitoring systems. The means and methods of work required to achieve compliance with these special provisions shall be considered incidental to the work.

B. There will be no compensation for delays as the result of exceedance of the vibration, tilt, or displacement Alert Thresholds, or for adjustment of construction activities or equipment should an exceedance occur. There will be no additional payments for Contractor's response to exceeding the alert thresholds, including but not limited to, coordination with monitoring consultant and Engineer, post-alert data reviews, and post-alert condition surveys and associated reporting.

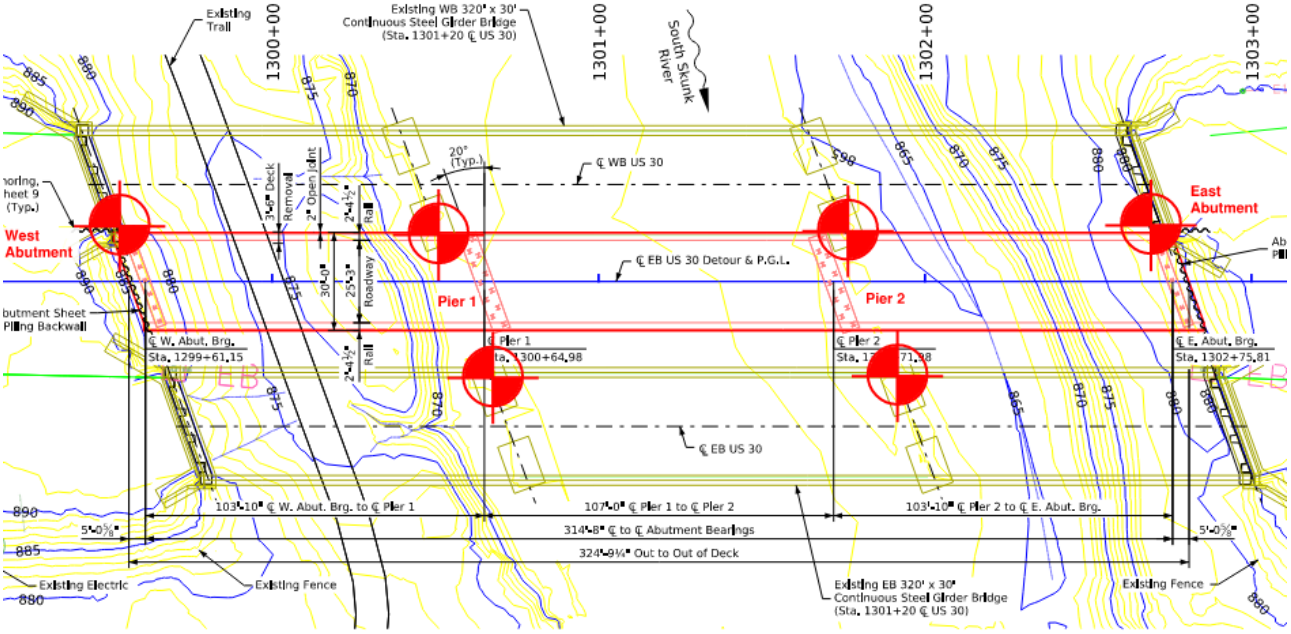

Figure 1: Preliminary Monitor Locations.