



# Existing Structures – Structure Rehabilitation – Repairing Structures – Heat-Straighten Steel Girders

## Revision and Approval

Revision	Date	Nature of Changes	Approved By
0	11-23-2022	Original Issue	Richard Foley

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## Background

This process establishes Structure Construction (SC) responsibilities, and procedures for authorization of submittals and construction of heat-straightening damaged steel girders.

Administration of construction work performed for heat-straightening existing steel girders requires careful attention as this work is often performed on existing structures over traffic that have been damaged by high load hits.

Heat-straightening of existing girders is typically an emergency response to damage such as a high load hit. Because any damage sustained could compromise the capacity of the structure, close coordination with Structures Maintenance & Investigations ([SM&I](#)) is necessary.

Prior to reviewing this Bridge Construction Memo (BCM), it is essential to review the [Contract Specifications](#) (CS), Section 60-3.05D, *Existing Structures – Structure Rehabilitation – Repairing Structures – Heat-Straighten Steel Girders*, that this BCM is based on as identified in the title block above. The information in the *Contract Specifications* typically will not be repeated in the text of this BCM.

# Process Inputs

1. Submittals

## Procedure

1. All work associated with this process is charged as [Project Direct – Construction](#).
2. Inspection of field work for this process is [Continuous](#).
3. Before construction begins the Structure Representative (SR) or delegate must:
  - a. Verify Structure Maintenance & Investigations (SM&I) Bridge Maintenance Design Engineer (BMDE) identified the bridge closure limits near the damaged structure members. These bridge closure limits will be in place prior to starting the heat-straightening contract work. SM&I BMDE may impose additional live load and traffic restrictions. The live load and traffic restrictions may require additional closure limits on the structure during the heat-straightening process (see step 4.h. below).
  - b. Secure tools (temperature indicating crayon and temperature gun, etc.) to measure the temperature of the steel.
  - c. Review the [contract documents](#) and the following BCMs for submittal reviews and construction requirements. The SR should also review applicable field procedures with SC staff:
    - i. [BCM 48-3](#), *Temporary Structures – Temporary Supports*
    - ii. [BCM 48-5](#), *Temporary Structures – Jacking* (If required to access damaged members or complete repair of the superstructure)
    - iii. [BCM 55-1.01C](#), *Steel Structures – Submittals*
    - iv. [BCM 55-1.03](#), *Steel Structures – Construction*
    - v. [BCM 59-2](#), *Structural Steel Coatings – Painting Structural Steel*
    - vi. [BCM 11](#), *Welding*, for guidance on reviewing the quality control plan for welding.
  - d. Review and authorize or reject for resubmittal the following submittals:
    - i. The shop drawings for heat-straightening steel girders per the CS, Section 60-3.05D(1)(c), *Existing Structures – Structure Rehabilitation – Repairing Structures – Heat-Straighten Steel Girders – General – Submittals*. The SR performs a concurrent review with the Materials Engineering and Testing Services Representative ([METS Rep](#)) and SM&I BMDE. Note that SM&I would provide goals (targets) for the repair work that must be achieved prior to returning the bridge to service.

- ii. If temporary supports are required for the girder or the structure during the heat-straightening procedure, review the submittals for temporary supports for the structure including shop drawings for temporary supports, per the contract requirements in the CS, Section 48-5, *Temporary Structures – Jacking*, and guidance in BCM 48-5.
- iii. The debris containment and collection plan per the contract requirements in the CS, Section 14-11.13B(2), *Environmental Stewardship – Hazardous Waste and Contamination – Disturbance of Existing Paint Systems on Bridges – Submittals – Debris Containment and Collection Plan*.
- iv. The lead compliance plan per the contract requirements in the CS, Section 7-1.02K(6)(j)(ii), *Legal Relations and Responsibility to the Public – Laws – Labor Code – Occupational Safety and Health Standards – Lead Safety – Lead Compliance Plan*.
- v. The welding quality control plan, which requires a concurrent review with the METS Rep, per the contract requirements in the CS, Section 11-2.03B, *Welding – Welding Quality Control – Submittals – Welding Quality Control Plan*.
- vi. The painting quality work plan, per the contract requirements in the CS, Section 59-2.01A(3)(c), *Painting Structural Steel – General – Submittals – Painting Quality Work Plan*.
- e. For contracts with a pay item, *Work Area Monitoring*, review contract requirements in the CS, Section 14-11.13D, *Environmental Stewardship – Hazardous Waste and Contamination – Disturbance of Existing Paint Systems on Bridges – Work Area Monitoring*, and:
  - i. Identify the designated work area(s) that will be used to monitor the containment system, for which the Contractor will collect and analyze ambient soil samples and provide a report with soil test results that includes a recommendation for corrective action of the containment system if the specified exposure levels of the contaminant are exceeded.
  - ii. Inform the Contractor where the designated work area(s) is/are, that the Contractor will monitor for contaminant exposure.
  - iii. Verify the required soil samples from the designated areas are collected prior to the start of work as specified in the *Contract Specifications*.
- f. Notify the Contractor when the submittals are authorized per *Contract Specifications*, Section 5-1.23, *Control of Work – Submittals*, and guidance in [BCM C-11](#), *Shop Drawing Review of Temporary Structures*.
- g. Review the project specific *Code of Safe Practices (COSP)*. Coordinate with the Bridge Construction Engineer to obtain fitted respirators when applicable

(for example, for removal of lead-based paint from existing steel) and medical clearance for those using respirators.

- i. Refer to the Respirator Q&A in the [Safety tab](#) of the SC Intranet, for additional guidance on respirators.
  - h. At least one week before work begins, inform the SM&I BMDE and the METS Rep when the work to heat-straighten the steel girder will begin. The designer and METS Rep need to be available to consult if additional damage is discovered, the damage is not as anticipated, or the heat-straightening is unsuccessful and/or not progressing as anticipated, etc. If any of this occurs, the Contractor may need to submit a revised submittal that must be reviewed and authorized.
4. During construction the SR or delegate must:
- a. Verify the heat-straightening work is performed in accordance with the authorized submittals (including any restraints or jacks used in the straightening work). Restraints and jacks are used to keep the heat-straightened member from moving in an unintended manner or unintended direction. The heating and cooling cycles described in the authorized submittals is the primary mechanism of the repair process.
  - b. For contracts with a pay item, *Work Area Monitoring*:
    - i. Verify the Contractor collects and tests the required number of ambient soil samples before starting work, as well as within 36 hours of any cleaning operations of the existing steel at the designated work area(s) for monitoring.
    - ii. Review the report(s) with the soil test results.
    - iii. If corrective action of the containment system is needed, verify the corrective action is taken as specified in the *Contract Specifications*.
  - c. When air monitoring is performed:
    - i. Collect and review the Air Monitoring Report.
    - ii. Verify the air monitoring is performed per the:
      1. Contract requirements in the CS, Section 14-11.13D, *Environmental Stewardship – Hazardous Waste and Contamination – Disturbance of Existing Paint Systems on Bridges – Work Area Monitoring*.
      2. Guidance in the *Construction Manual*, [Section 7-107F](#), *Disturbance of Existing Paint Systems on Bridge*.
  - d. After the existing paint is removed and the girder is cleaned, verify the extent of damage is similar to what was anticipated. Secure the site and take job photos to document condition of the damaged steel girder. Consult the

- designer if the damage is not as anticipated or if additional damage is discovered.
- e. Confirm that the Contractor verifies all controlling field dimensions before ordering or fabricating any material.
  - f. Verify the temporary supports for the structure is constructed per the authorized shop drawings:
    - i. Confirm that temporary supports for the structure remain in place until the girder cools.
  - g. If jacking of the superstructure is required to allow access to damaged members or to complete the superstructure repair, follow the requirements of [BCM 48-5](#), *Temporary Structure – Jacking*, and Section 48-5, *Jacking* of the *Contract Specifications*. Monitor jacking sequences and design values in the authorized submittals.
  - h. SM&I will set the live load and traffic restrictions on the structure during the heat-straightening work (See step 3.a. above). The SR, in coordination with the District, shall prohibit live traffic in the limits set by design and under any steel girder being heat-straightened. Check the contract documents for additional lane closure requirements, allowable lane closure times, and durations.
  - i. Verify the girder steel temperature using temperature indicating crayons and/or a temperature gun. Verify that the maximum allowable temperatures for different types of girder heating (preliminary, spot and vee heats) are not exceeded.
  - j. Verify that the heat-straightening procedures are working as intended. The member undergoing the heat-straightening process should move in the anticipated direction during the cooling cycle. Any warping, distortion, or movement of the member in an unanticipated direction is an indication that the process is not working as intended. If the heat-straightening of the girders is not working as anticipated stop the work and consult the SM&I BMDE and METS Rep. The Contractor may have to revise the previously authorized submittals.
  - k. In accordance with [Deputy Directive 109](#), *Bridge Emergency Response*, discuss with the SM&I BMDE to determine who has the authority to reopen a damaged structure to traffic following repair or stabilization.
  - l. Measure and record the bridge clearance after field work is complete per [BCM C-12](#), *Notice of Change of Structure Clearance or Permit Rating*.
  - m. When welding is performed, review the welding report submitted by the Contractor to verify conformance with the authorized Welding Quality Control Plan (WQCP). Refer to BCM 11, *Welding*, for guidance.

- n. When welding is performed at the jobsite, collect certificates of compliance from the welding Quality Control Manager (QCM), for each item of work for which welding is performed.
  - o. Document all inspection, construction, and quality assurance activities, pertinent to this BCM, in the Daily Reports per [BCM C-7](#), *Daily and Weekly Reports*.
5. Following construction, the SR or delegate must:
- a. File all project documentation (correspondence, submittals, certificates of compliance, Daily Reports, etc.) in the appropriate category in the project records as specified in the *Construction Manual*, [Section 5-102](#), *Organization of Project Documents*.
6. Additional resources include:
- a. [AASHTO Guide for Heat-Straightening of Damaged Steel Bridge Members](#)
  - b. Caltrans project [Heat Straightening of Bridge on 101 Freeway](#) (video)
  - c. Caltrans Transportation Library [Engineering Workbench](#) (requires a one-time account setup with Caltrans email, and subsequent login)

## **Process Outputs**

1. Authorized submittals
2. Daily Reports
3. Straightened Steel Girder(s)

## **Attachments**

None