Hawthorne Bridge over MLK Span #38 Girder Repairs - Heat Straightening Specifications:

Lead Abatement – Perform lead abatement at the locations and limits described in the Heat Straightening Bid Request for this Project. Unless otherwise tested, assume that all coatings removed as part of the lead abatement work on the Hawthorne Bridge span over Martin Luther King Jr., Blvd. consist of lead, chromium and cadmium based paints. Lead abatement work includes furnishing and placing materials, labor, and equipment necessary for the removal, storage, handling, management, transportation, disposal and documentation of the existing lead, chromium, and cadmium based coatings. Comply with all applicable federal, State, and local Laws as they pertain to the lead abatement work.

Ensure the following documents are readily available on-site to employees, Subcontractors and inspectors:

- Material Safety Data Sheets (MSDS) for all hazardous substances stored or used on-site.
- Written hazard communication program, including employee training documentation.

The Oregon Occupational Safety and Health Division (OR-OSHA) provides guidance to meet these requirements in their publication "Hazard Communication: A Safe-Work-Practice Guide".

Submit the following documents:

- A job specific written compliance program, according to 29 CFR 1926.62(e)(2), at least 3 Calendar Day before the start of heat straightening. Include compliance procedures for cadmium and chromium VI, according to 29 CFR 1926.1127 and 29 CFR 1926.1126.
- Modifications to the written compliance program within 1 Calendar Day of the modifications.
- Current employee training certificates and medical surveillance information before beginning work that disturbs paint containing lead, cadmium or chromium.
- Within 48 hours of completing or receiving them:
    - Disposal and recycling facility permits.
    - Transport manifests and bill-of-ladings.
    - All disposal receipts.
    - All analytical test results (if applicable).

Obtain Engineer approval for the specific disposal methods for all materials before beginning lead abatement work.

Complete, sign and pay all required fees for all required permits, manifests, and bill-of-lading forms for transport and disposal of the paint and painted materials.

Provide employees trained in lead awareness, according to 29 CFR 1926.62(l), and also trained according to 29 CFR 1926.1126(j)(2) for chromium and 29 CFR 1926.1127(m)(4) for cadmium, during lead, chromium, and cadmium abatement of painted portions of the structures.

Minimize employee exposure to the metals contained in the paint. Use methods and provide containment that prevents release of paint chips to the environment.

Ensure hazardous waste containers are clearly and visibly labeled with the contents and accumulation start date, compatible with the contents and in good condition. Store them in a designated weather-protected area that is secured from public access, has secondary containment adequate to contain a release, and has sufficient aisle space to safely maneuver containers and respond to spills (minimum 30 inches).

Heat Straightening – Prior to work on the girder repairs, the flanges, webs, and stiffeners shall be straightened. Straighten the distorted members using a combination of heat straightening, restraint, and limited applied jacking force. The distorted members shall be straightened to as close as practical to the original element shape and position and such that the anticipated repairs can be implemented with nominal shimming.

Heat straightening shall be performed under the supervision of a professional Engineer experienced with heat straightening of damaged steel members. Submit qualifications and experience of proposed personnel. The heat straightening contractor's organization shall have at least 10 years of experience in conducting heat-straightening repairs for damaged steel structures. During the preceding three-year period, the Contractor shall have conducted an average of at least 5 heat-straightening projects per year. Experience documentation shall include: date of project, location, bridge owner, number and type of members straightened, and duration of project. The Contractor (or the Contractor's field supervisor) shall have a baccalaureate degree from an accredited program in one of the following engineering disciplines and be a licensed professional engineer, in the State of Oregon, qualified to practice in one of the following disciplines: structural, metallurgical, mechanical, or welding engineering.

Heat straightening shall be performed in accordance with the recommendations in the "Guide for Heat-Straightening of Damaged Steel Members" (https://www.fhwa.dot.gov/bridge/steel/heat_guide.pdf) Prepare and submit a Heat Straightening Plan to the Engineer for review and approval. The Plan shall include assessment of the members to be straightened, specific details of the proposed methods, sequences, equipment and tools including sketches and descriptions of proposed heating patterns, temperature and rates, jacking and/or restraint locations, applied jacking forces, stress calculations, temperature verification methods and tools, etc. Heat straightening shall be in accordance with the following requirements:

- Equipment: Heating shall be with an oxygen-fuel combination. The fuel may be propane, acetylene or other similar fuel as may be selected by the contractor, subjected to the Engineer's approval. Heat application shall be by single or multiple orifice tips only. The size of the tip shall be proportional to the thickness of the heated material. No cutting torch heads are permitted. Jacks, come-alongs or other force application devices shall be gauged and calibrated so that the force exerted by the device may be controlled and measured. No external force shall be applied to the structure by the contractor unless it is measured.

- Damage Assessment: Contractor shall identify and document all yield zones, yield lines and associated damage and provide this information to the Engineer prior to initiation of heat straightening by visual inspection and measurements. Suspected areas of cracking

shall be called to the attention of the Engineer and shall be inspected by one or more of the following methods as applicable.

  - Visual Inspection
  - Liquid penetrant examination as described in ASTM E165 (latest edition).
  - Magnetic-Particle testing as described in ASTM E709 (latest edition).
  - Ultrasonic examination as described in section 6, part C of the AWS D1.5 Bridge Welding Code (latest edition).
  - Radiographic examination as described in section 6, part B of the AWS D1.5 Bridge Welding Code (latest edition).

- Heat Application: Heating temperatures shall not exceed 1200 degrees F. Heat material in a single pass following the approved pattern and allowed to cool to below 250 degrees F prior to reheating. Heating patterns and sequences shall be selected to match the type of damage and cross section shape. Vee heats shall be shifted over the yield zone on successive heating cycles. Simultaneous vee heats may be used provided that the clear spacing between vees is greater than the width of the plate element. Repair of previously heat-straightened members in the same region of damage may be conducted once. Further repairs are not recommended unless approved by the Engineer. Use one or more of the following methods for routine, ongoing, documented temperature verification during heat straightening:

  - Temperature sensitive crayons
  - Pyrometer
  - Infrared non-contact thermometer

- Application of Jacking Forces: Jacks shall be placed so that forces are relieved as straightening occurs during cooling. Jacking shall be limited so that the maximum bending moment in the heated zone shall be less than 50 percent of the plastic moment capacity of the member or major bending element. For local damage, the jacking force shall be limited to 50 percent of initial yield of the element. The jacking force shall be adjusted so that the sum of jacking-induced moments and estimated residual moments shall be less than 50 percent of the plastic moment capacity of the member. As an alternative to considering residual moments, the moment due to jacking forces can be limited to 25 percent of the plastic moment capacity of the member during the first two heating cycles. For additional heating cycles, the limit of 50 percent may again be used. Determine and document the maximum jacking force for each damage location, and the proposed sequence of jacking and heating. Copies of the documentation shall be submitted to the Engineer for acceptance before beginning repairs. Modifications due to changing condition shall be submitted to the Engineer. The maximum jacking force may be controlled by measuring the deflection resulting from the jacking force. The deflection limitation can be computed by one of the following methods. The calibration of jacks and electronic temperature monitoring equipment shall be performed and documented monthly, and load cells used for calibration must be certified within a two year period.

- Repair Field Supervision: Jacking forces shall be monitored to insure that limits are not exceeded. Heating patterns shall be approved by the Engineer and monitored to verify that they are followed. Heating temperatures shall be routinely monitored to insure compliance with specified limits.