Section 4.05 Steel Erection

1. Scope

This section establishes steel erection requirements for all Bureau of Reclamation (Reclamation) owned and operated facilities and construction sites. Where this section does not provide specific definitions or instructions, it adopts, by reference, the current editions of the Federal Occupational Safety and Health Administration (OSHA) regulations.

2. General Requirements

a. Planning

All operators must conduct steel erection following the requirements of this section and 29 CFR 1926 Subpart R, Steel Erection. American Society of Safety Professionals (ASSP)/American National Standards Institute (ANSI) A10.13, Safety Requirements for Steel Erection, shall be used as a guideline for steel erection operations.

b. Steel Erection Start

Steel erection operations shall not start until the project manager and, as needed, the contracting officer's representative have verified the steel erector received written notification of concrete/masonry cure and anchor bolt status as required by 29 CFR 1926.752, Site Layout, Site-Specific Erection Plan and Construction Sequence.

c. Fall Protection

All operators shall follow Reclamation Safety and Health Standard (RSHS) Section 1.14, Fall Protection, during steel erection operations, except where specific requirements are provided by this section and 29 CFR 1926.760, Fall Protection.

d. Hoisting and Rigging

All operators shall follow RSHS Section 3.02, Slings and Rigging Hardware, and RSHS Section 3.03, Appendix 3.03-B Hoists, during steel erection operations except where specific requirements are provided by this section and 29 CFR 1926.753, Hoisting and Rigging.

3. Responsibilities

a. Project Manager

- Shall provide written authorization for the commencement of steel erection operations after verifying compliance with all referenced applicable standards including written verification concrete and masonry cure and anchor bolt repairs.

b. Contracting Officer's Representative (COR)

- Shall provide the project manager's written authorization to the contractor for the commencement of steel erection operations after receiving written verification for concrete and masonry cure and anchor bolt repairs.
- Shall verify contractor's personnel involved in steel erection operations receive training as required by this section.

c. Construction Inspector

- Shall inspect steel erection materials for damage during transportation, handling, and storage.

d. First-Line Supervisors

- Shall ensure employees involved in steel erection operations receive training as required by this section.
- Shall suspend steel erection operations if hazardous environmental conditions (e.g., weather) cause an unsafe work environment.

e. Qualified Person

- Shall develop and revise the site-specific steel erection plan.
- Shall provide steel erection training required by this section.

f. People Doing the Work

- Shall complete training required by this section.

4. Training Requirements

Training shall meet the requirements of 29 CFR 1926.761, Training. Qualified person(s) with knowledge, training, and experience in steel erection procedures and operations shall provide all training related to steel erection.

a. Initial

- Fall Hazards. Steel erection personnel exposed to fall hazards shall complete training in the following areas:

    - recognition and identification of fall hazards,
    - use and operation of guardrail systems, perimeter safety cable systems, personal fall arrest systems, positioning device systems, fall restraint systems, safety net systems, and other fall protection systems,
    - procedures for erecting, maintaining, disassembling, and inspecting fall protection systems,
    - procedures to prevent falls to lower levels and through or into holes and openings in walking/working surfaces and walls, and

  - fall protection requirements of this section, Section 1.14, and 29 CFR 1926 Subpart R, and 29 CFR 1926.760.

- Multiple Lift Rigging. Steel erection personnel involved in multiple lift rigging shall complete training in the following areas:

  - hazards associated with multiple lift operations, and
  - procedures and equipment required by this section, Section 3.02, and 29 CFR 1926.753.

- Connectors. Steel erection personnel involved in connector operations shall complete training in the following areas:

  - hazards associated with steel erection connecting operations, and
  - techniques and work practices for establishing, accessing, and conducting connecting operations meeting the requirements of this section and 29 CFR 1926.756, Beams and Columns, and fall protection requirements of this section, Section 1.14, and 29 CFR 1926.760.

- Controlled Decking Zone. Steel erection personnel involved in controlled decking zone operations shall complete training in the following areas:

  - hazards associated with steel erection work within a controlled decking zone, and
  - techniques and work practices for establishing, accessing, and conducting controlled decking zone operations meeting the requirements of this section and 29 CFR 1926.754, Structural Steel Assembly, and fall protection requirements of this section, Section 16, and 29 CFR 1926.760.

b. Refresher

Steel erection personnel who have not conducted steel erection operations 2 years prior to start of work shall complete the initial training outlined in 4.05.4.a.

c. Recordkeeping

The Department of the Interior shall keep and manage Reclamation's training records in the official repository in accordance with the Information Management Handbook.

5. Hazard Identification, Assessment, and Safety Measures

a. Job Hazard Analysis (JHA)

The first-line supervisor shall complete a JHA for all steel erection operations. As needed, the JHA and exposure assessment shall be part of the site-specific erection plan.

b. Material Inspection

Qualified personnel shall inspect steel erection materials prior to installation for damage during transportation, handling, and storage.

6. Pre-job Briefing and Planning Requirements

a. Hoisting Planning

The steel erector shall develop a site-specific hoisting plan which outlines hoist selection, site preparation, hoist placement, equipment inspections, hoisting of personnel, working under loads, and multiple lift rigging procedures.

b. Steel Erection Planning

The steel erector shall conduct steel erection operations following the methods, steps, and requirements as outlined in 29 CFR 1926 Subpart R or develop a site-specific erection plan. A qualified person shall develop the site-specific erection plan and make the plan available at the work site. The first-line supervisor and staff as appropriate will hold preconstruction conferences and site visits to develop and review the site-specific erection plan. The site- specific erection plan shall include:

- a sequence of erection activity detailing delivery, staging, and storage of material and coordination with other construction activities,
- a site-specific hoisting plan which describes the crane and derrick selection and placement procedures detailing site preparation, path for overhead loads, rigging supplies/equipment, and critical lifts,
- a description of steel erection activities and procedures, including stability considerations requiring temporary bracing and guying, erection bridging terminus point, anchor rod (anchor bolt) notifications regarding repair, replacement and modifications, columns and beams (including joists and purlins), connections, decking, and ornamental and miscellaneous iron,
- the requirements for personal protective equipment (PPE) at the site,
- a description of the fall protection procedures used to comply with this section and 29 CFR 1926.760,
- a description of the procedures used to prevent and provide protection from falling objects to comply with 29 CFR 1926.759, Falling Object Protection,
- a description of the special procedures required for hazardous tasks not routinely conducted during steel erection projects,
- verification each employee completed training for performing steel erection operations required by 29 CFR 1926.761, Training, (e.g., fall hazard prevention and protection procedures, multiple lift rigging procedures, connector procedures, and controlled decking zone procedures),
- a list of qualified and competent persons,

- a description of procedures used in the event of rescue or emergency response,
- identification of the site and project, and
- the date(s) and signature(s) of the qualified person(s) responsible for the plan's preparation and modification.

7. Hazardous Environmental Conditions (Weather/Other)

The first-line supervisor shall suspend steel erection operations if the hazards from wind, rain, lightning, hail, ice, heat exposure, or air quality cause an unsafe work environment.

8. PPE

The first-line supervisor or other qualified person shall select PPE according to requirements of the job and document the selected PPE in the JHA and, as required, the site-specific erection plan. PPE must meet the requirements of RSHS Section 1.07, Personal Protective Equipment.

9. Safe Practices

a. Concrete and Masonry Cure

Steel erection shall not start until written verification that concrete in the footings, piers, and walls, and mortar in the masonry piers and walls, has attained either 75 percent of the intended minimum compressive design strength or sufficient strength to support loads imposed during steel erection (based on requirements of the American Society for Testing and Materials International standard test method of field-cured samples).

b. Anchor Rod Repairs

Steel erection shall not start until written verification that qualified personnel complete any anchor rod (anchor bolt) repairs, replacements, or field modifications with the approval of the project structural engineer of record and receipt by the COR.

c. Site Layout

- Control. The steel erection site shall have established safe areas and methods to control the access of people and vehicles.
- Access Roads. The steel erection site shall have access roads into and through the worksite for the safe delivery and movement of derricks, cranes, trucks, materials, and other necessary equipment.
- Storage and Work Area. The steel erection site shall have a firm, graded, and drained area for storage of equipment and materials and for operation of equipment.

d. Hoisting

Operators shall inspect cranes used for steel erection operations prior to each shift. First-line supervisors or other qualified persons shall pre-plan all routes for suspended loads to ensure no

employee works directly below a suspended load, except employees engaged in the initial connection and/or employees necessary for hooking or unhooking the steel. A qualified rigger trained to use hooks with self-closing safety latches, or equivalent, to prevent unintentional displacement, shall rig all hoisted materials.

e. Fall Protection

- Program. All fall protection programs must include each phase of steel erection and detailed steps to protect, prevent, and eliminate, to the extent possible, an employee's exposure to falls.
- Walking and Working Surfaces. Job sites must provide guardrail systems, safety net systems, personal fall arrest systems, positioning device systems, or fall restraint systems on walking/working surfaces with an unprotected side or edge more than 15 feet above a lower level to protect personnel from fall hazards.
- Connectors. Job sites must provide guardrail systems, safety net systems, personal fall arrest systems, positioning device systems, or fall restraint systems on walking/working surfaces with an unprotected side or edge more than two stories, or 30 feet, above a lower level to protect connector operation personnel from fall hazards. At heights over 15 and up to 30 feet above a lower level, connector operation personnel shall use a personal fall arrest system, positioning device system, or fall restraint system and wear equipment necessary to tie-off; or first-line supervisors must provide personnel with other means of protection from fall hazards in accordance with 1.11. Walking and Working Surfaces.
- Controlled Decking Zone. Job sites must provide personal fall arrest systems, positioning devices systems, or fall restraint systems at the controlled deck zone leading edge more than two stories, or 30 feet, above a lower level to protect personnel from fall hazards.
- Multi-Story Structures. After completion of metal decking, personnel must install safety cables to provide fall protection at the final interior and exterior perimeters of each floor.
- Steel Joist Restriction. Personnel shall not use steel joists and steel joist girders as fall arrest system anchorage points unless a qualified person provides written direction.
- Metal Decking Openings. The steel erector personnel shall install continuous decking, protection, and coverings for all openings in the metal decking per the requirements of 29 CFR 1926.754.

f. Permanent Flooring

- Installation. Personnel shall install permanent floors as steel erection progresses. Personnel must not install more than eight stories between the erection and uppermost permanent floors, except where the design maintains structural integrity.
- Bolting and Welding. Personnel shall erect no more than four floors, or 48 feet, of unfinished bolting or welding floors above the foundation or uppermost permanently secured floor, except where the design maintains structural integrity.

g. Temporary Flooring

- Installation. Personnel must maintain a fully planked, decked floor or safety nets within two stories, or 30 feet, directly under any steel erection work.
- Planking. Planking or decking shall support the minimum working load of 50 pounds per square foot. Wood planking shall be a minimum of 2-inches thick, full dimension, undressed, solid lumber, or equivalent material (e.g., laminated boards). Personnel shall install planking flush and secure to prevent movement.
- Safety Nets. Personnel must install safety nets when the distance above lower levels exceed two stories or 30 feet. The safety nets must clear the surface of structures below. Job sites must use safety nets manufactured in accordance with ASSP/ANSI A10.11, Safety Requirements for Personnel Nets.

h. Structural Steel Erections

The hoisting, placing, connecting, and bracing of structural steel components shall follow methods, steps, and requirements outlined in 29 CFR 1926 Subpart R or the site-specific erection plan.

i. Bolting

- Drift Pins. Employees knocking out bolts and drift pins must prevent materials from falling to lower levels.
- Impact Wrenches. Impact wrenches shall have a locking device for retaining the socket.
- Containers. When aloft, personnel must secure containers for storing and carrying bolts, drift pins, and rivets against accidental displacement.
- Drilling and Reaming. A team of two shall operate drilling and reaming machines unless the handle is firmly secured to resist the torque reaction should the reaming or drilling bit bind.

j. Fire Protection

- Fire Protection. The project manager must follow the requirements of RSHS Section 1.09, Fire Prevention and Protection, to develop a fire prevention plan, fire emergency action plan, and fire response plan for steel erection projects.
- Welding and Cutting. All personnel must follow the requirements of Section 1.09 and RSHS Section 1.15, Hand Tools, Power Tools, Pressure Vessels, Compressors, and Welding, to prevent sparks or fires.

⚠ RSHS Appendix A: Definitions

RSHS Appendix A (Definitions) is available to print at:
https://www.usbr.gov/safety/rshs/index.html.

⚠ RSHS Appendix B: Additional References and Citations

RSHS Appendix B (Additional References and Citations) is available to print at:
https://www.usbr.gov/safety/rshs/index.html.