DRAFT RECLAMATION SAFETY AND HEALTH STANDARDS
RELEASE
Comments on this draft release must be submitted to acryns@usbr.gov by [10/25/20].

Background and Purpose of the Following Draft Reclamation Safety and Health Standards (RSHS)

The RSHS are being updated by the Bureau of Reclamation Safety and Occupational Health Office to reflect new guidance from Reclamation, the Department of the Interior, and the Occupational Safety and Health Administration. This public release is intended to provide the public an opportunity to comment on each updated section in draft form. This process will enhance transparency and eliminate potential confusion about Reclamation’s safety standards.

The RSHS are incorporated into the Reclamation Manual through SAF 01-01, *Occupational Safety and Health Directive – General*. The Reclamation Manual is used to clarify program responsibility and authority and to document Reclamation-wide methods of doing business. All requirements in the Reclamation Manual are mandatory for Reclamation employees.

See the following pages for the draft RSHS.
Section 25

Concrete, Masonry, and Formwork

25.1 Scope

This section establishes safety requirements for concrete, masonry construction, and formwork. It covers safety as it relates to the topics of concrete conveyance, formwork and falsework, shoring, precast concrete, and masonry work. Design and construction of this type of work is specifically addressed in Reclamation’s Concrete Design Manuals.

25.2 General Requirements

All concrete and masonry work must comply with applicable standards and regulations from the Occupational Safety and Health Administration (OSHA) 29 CFR 1926 Subpart Q, Concrete and Masonry Construction, and the American National Standards Institute (ANSI)/American Society of Safety Professionals (ASSP) A10.9-2013 (R2018) Safety Requirements for Concrete and Masonry Work.

25.3 Responsibilities

25.3.1 Area Office Safety Professional

25.3.1.1 Shall review and provide feedback on the work plan (see paragraph 25.5).

25.3.2 Professional Engineer (PE)

25.3.2.1 Shall design and certify all concrete conveyance systems, concrete pumping systems, placing booms and boom supporting structures or equipment, boom mountings, concrete pumps, formwork or vertical shoring installations, precast concrete temporary shoring and bracing systems, and lift-slab operations as safe for intended use.

25.3.3 First-Line Supervisors

25.3.3.1 Shall review work plans.

25.3.3.2 Shall review and sign Job Hazard Analyses (JHAs).

25.3.3.3 Shall ensure all employees are supervised by someone who is, or are themselves, competent in performing assigned duties.

25.3.4 Employees

25.3.4.1 Shall report any change in conditions or hazards to the first-line supervisor or on-site competent person.
25.3.4.2 Shall coordinate with the first-line supervisor to incorporate ergonomic considerations into the work planning, especially prolonged exposure to kneeling, bent over, or awkward body positions.

25.4 Hazard Identification, Assessment, and Safety Measures

25.4.1 Vertical Work
Vertical work, or masonry wall, shall have a limited access zone established prior to the start of construction. The zone shall be equal to the height of the wall, plus 4 feet, running the entire length of the vertical work; established on the unscaffolded side; have restricted access to only personnel actively engaged in doing or supervising the work; and continually established until the concrete vertical work is self-supporting and fully cured or is supported to prevent overturning and prevent collapse. All vertical work over 8 feet in height shall have bracing on both vertical sides until permanent supporting elements of the structure are in place.

25.4.2 Green Cutting, Concrete Sawing, or Abrasive Blasting
A JHA must be created and approved prior to this work. Silica dust hazards shall be addressed and mitigated (see OSHA 1926.1153, Toxic and Hazardous Substances – Respirable crystalline silica). RSHS Section 32, Respiratory Protection, determines protocols for employee protections to silica dust hazards.

25.4.3 Exposed Rebar
Exposed rebar hazards shall be mitigated before work begins. Exposed rebar poses catching, tripping, and impalement hazards.

25.5 Pre-job Briefing and Planning Requirements

25.5.1 Work Plan
The work plan will detail the phases of concrete and masonry operations. Sequencing of structural construction should be developed prior to the creation of the work plan. It will identify all possible safety hazards and plans for mitigation, including those identified in the JHA. It will have clear direction on the use of SAF P01 Appendix A, Stop Work Procedures. It will have a site map with identified staging and work zones, a limited access zone for vertical work and shoring, and plans for erection and removal of formwork, shoring, and vertical work.

25.5.2 Job Hazard Analysis
A JHA for specific tasks, such as formwork, pouring, shoring, scaffolding, etc., shall be created (see RSHS Section 4, *Work Safety Planning* for details).

### 25.5.3 Precast Plan

Precast concrete operations plans shall be designed by a PE. It shall include detailed instructions, installation drawings, clear information on delivery and staging, equipment and method for placement, support and shoring during installation, connections and couplings, and lift planning. The precast plan may be included in the work plan, as stated in paragraph 25.5.1.

### 25.6 Hazardous Environmental Conditions (Weather/Other)

#### 25.6.1 Rain and Stormwater Runoff

Drainage for precipitation at the excavation work site shall direct rainwater away from the concrete formwork and fresh pours. Use diversion ditches, dikes, or other means to prevent rainwater or other precipitation from entering the work site. Use safe measures to prevent stormwater runoff from entering the work site.

#### 25.6.2 Weather-related Electricity

Work shall cease if weather-related electrical conditions are inbound. Any electrical event within 5 miles of the work site shall immediately cease work until the event is no longer within the radius.

#### 25.6.3 Wind

Loose materials and spoil piles must be managed so wind will not blow the materials into the active work area or where personnel are working. Wind should be monitored for stability hazard and personnel working on scaffolding. Blowing particles or materials shall not interfere with the ability of workers to safely complete duties.

### 25.7 Personal Protective Equipment (PPE)

Employees placing or finishing concrete must wear applicable protective equipment, but never less than long-sleeved shirts, long pants, rubber safety boots, gloves, hardhat, and eyeglasses with side shields. Make eyewash facilities available at each placement or finishing operation. Employees engaged in green cutting must wear eye and face protection. Employees engaged in wet or dry abrasive blasting using silica sand must wear an approved abrasive blasting air-line respirator, heavy-duty footwear, and hardhat.

### 25.8 Safe Practices
25.8.1 Plants and Equipment

Refer to RSHS Section 20, Mobile and Stationary Mechanized Equipment, for additional mechanized construction equipment requirements.

25.8.1.1 Batching and Screening Plants. Ensure concrete batching and screening plants, aggregate production plants, hoppers, bins, silos, and related equipment are designed with a safety factor to prevent structural failure or collapse. Ensure batching plants, aggregate plants, and conveyor systems are equipped with mechanical dust control, water spray systems, and/or other acceptable means to keep airborne dust concentrations within acceptable exposure limits. Comply with permit-required confined space and hazardous energy control procedures when entering silos, storage bins, tunnels, shafts, or similar enclosed areas.

25.8.1.2 Bulk Storage Bins. Bulk storage bins, containers, and silos must have conical or tapered bottoms and be able to start material flow mechanically or pneumatically.

25.8.1.3 Loading Skips. Ensure protective guardrails are installed on each side of 1 cubic yard or larger loading skips. Equip loading skips with a mechanical device to clear material.

25.8.1.4 Bull Floats. Where bull float handles may contact energized electrical conductors, establish a hazardous energy control clearance and lock out the power to those conductors.

25.8.1.5 Powered Concrete Trowels. Equip manually guided powered and rotating concrete troweling machines with a control switch or positive mechanical release device which automatically stops trowel rotation when the operator releases the equipment handle.

25.8.1.6 Concrete Buggies. Handles of concrete buggies must not extend beyond the wheels on either side.

25.8.1.7 Concrete Buckets. Concrete buckets equipped with hydraulic or pneumatically operated gates, must have positive safety latches, or similar safety devices, to prevent premature or accidental dumping. Buckets must be designed so aggregate does not accumulate on the bucket’s top and sides. Do not ride concrete buckets or permit personnel under buckets being raised or lowered into position by cranes or cableways. Do not route elevated concrete buckets over employees. Concrete buckets with manually operated gates must be self-closing. Maintain all buckets in
structurally sound condition. A PE must approve any alterations which affect structural competency.

25.8.1.8 **Transmix Trucks.** Transmix trucks and concrete pumping trucks, including operating procedures, must conform with requirements set in RSHS Section 20.

25.8.2 **Masonry Construction**

Establish a limited access zone when erecting a masonry wall. The limited access zone must equal the height, plus 4 feet, and must run the length of the wall. Establish the limited access zone before starting construction and locate it on the un-scaffolded side. Only employees directly involved in the construction of the wall may enter the limited access zone. The limited access zone must remain in place until the wall is adequately supported to prevent collapse. The supports must be able to withstand a load of at least 15 pounds per square inch. Walls over 8 feet high must have supports until permanent elements of the structure are in place.

25.8.2.1 **Equipment.** Guard masonry saws with a semicircular enclosure over-blade and a slotted horizontal hinged bar mounted underneath the guard enclosure to retain fragments of shattered blades. Equip saws with dust-control systems or make provisions for wet sawing which controls airborne dust concentrations.

25.8.2.2 **Scaffolding.** Masonry scaffolding shall have a loading capacity, at a minimum, of 50 pounds per square foot (psf). Scaffolding shall comply with RSHS Section 13, *Walking and Working Surfaces*. Employees working 4 feet or more above any ground or adjacent working surface shall be protected by guardrails, safety net, or personal fall protection system.

25.8.3 **Concrete Conveyance Systems**

The manufacturer, or a PE, must design and certify all concrete conveyance systems and supporting equipment as safe for intended use. Only competent personnel shall assemble, operate, maintain, inspect, and test the systems in accordance with requirements set forth in the manufacturer’s instructions, PE’s specifications, or these standards. Protect all operating platforms with guardrails and guard all dangerous moving parts.

25.8.4 **Reinforcing Steel**

25.8.4.1 **Lateral Supports.** Laterally support reinforcing steel for walls, piers, columns, and similar structures to prevent overturning or collapse. The lateral supports for reinforcing steel must be able to withstand the forces applied during construction.
25.8.4.2 **Rigging.** Securely tie together bundles of reinforcing steel before moving by crane or cableway to prevent slipping. Use two-part slings to handle steel more than 20 feet long.

25.8.4.3 **Impalement.** Cover exposed rebar onto or into which employees could fall to eliminate the hazard of impalement. Do not use plastic cap coverings for impalement protection, but you may use them to cover the ends of horizontal rebar. Cover vertically protruding rebar with wood troughs or other substantial material.

25.8.4.4 **Positioning Device Systems.** Employees must use a positioning device when working in a stationary location 4 feet, or higher, above any adjacent work surfaces or when placing and tying reinforcing steel in walls, piers, columns, etc. Employees must use a personal fall arrest system when moving on reinforcing steel higher than 24 feet above adjacent surfaces.

25.8.4.5 **Walkways.** Reinforcing mats used as walkways must have planking to ensure safe footing.

25.8.4.6 **Prohibited Uses.** Do not use reinforcing steel as guy attachments at any anchorage points for scaffolding hooks, stirrups, or as a load-bearing member of any lifting device.

25.8.4.7 **Wire Mesh Mats.** Secure wire mesh reinforcing mats at each end to prevent recoiling. Secure unrolled wire mesh on each side before cutting.

25.8.4.8 **Post Tensioning Operations.** Do not permit employees, except those essential to post-tensioning operations, behind the jack during tensioning operations. Erect signs and barricades to limit employee access to the post-tensioning area.

25.8.5 **Formwork and Falsework**

In addition to the specific requirements set forth in this section, the design and erection of formwork or falsework shall be in accordance with the latest edition of the American Concrete Institute (ACI) 347 Guide to Formwork for Concrete, and ACI 318 Building Code Requirements for Reinforced Concrete, and the current edition of ANSI A10.9 Safety Requirements for Masonry and Concrete Work.

25.8.5.1 **Safety Factor.** Design, erect, brace, and maintain formwork, falsework, structural shoring, and bracing to safely support all vertical and lateral loads. Incorporate the minimum safety factors as specified in ANSI A10.9 in the design and erection of all framework, shoring, falsework, and formwork accessories.
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#### 25.8.5.2 Construction Loads.
Do not impose any construction loads on the partially completed structures unless such loading has been considered in the design and is shown on the formwork design drawings or specifications.

#### 25.8.5.3 Drawings and Plans.
A PE must approve and sign detailed design calculations and working drawings for all formwork or vertical shoring installations when any of the following conditions exist:

- The height, as measured from the top of the sills to the soffit of the superstructure, exceeds 14 feet;
- Individual horizon span lengths exceed 16 feet; and/or
- Provisions are made for vehicular or railroad traffic through the falsework or vertical shoring.

For all formwork and vertical shoring installations not discussed above, one of the following must approve and sign the formwork plan or shoring layout:

- PE;
- Manufacturer’s authorized representative; or
- Contractor’s representative qualified in using and erecting formwork and vertical shoring.

Make drawings or plans showing the jack layout, formwork, shoring, working decks, and scaffolding available at the jobsite.

#### 25.8.5.4 Form Anchors.
Design form anchors which support forms and scaffolding with a minimum safety factor of 3. Impose no load on form anchors or concrete anchorages until the concrete has set the minimum period set forth in paragraph 25.8.8. Form sections supported by form anchors must be no more than 50 feet long and must be designed and installed so no forces, incurred by form or anchorage failure, can transfer to an adjacent section.

#### 25.8.5.5 Housekeeping.
In all areas where persons must work or pass, promptly remove and stockpile all stripped forms and shoring. Pull or cut protruding nails, wire ties, and other unneeded accessories to avoid hazards.

#### 25.8.5.6 Fall Protection.
Employees, when working 4 feet or more above any adjacent work surface (and not protected by fixed scaffolding, guardrails, or safety net), must use a personal fall protection system. Employees working in a stationary position may use a positioning system, but only until relocating.

#### 25.8.6 Vertical Shoring
25.8.6.1 **Additional Loading.** Temporarily store reinforcing rods, materials, or equipment on top of formwork only if structures have been designed or strengthened to support the additional loading. Do not load eccentric loads on shore heads or similar members, unless these members are designed for intended loading.

25.8.6.2 **Sills.** Sills used in shoring must be sound, rigid, and able to carry the maximum intended load.

25.8.6.3 **Inspection.** The first-line supervisor or project lead shall conduct visual inspections of vertical work and shoring during erection, prior to use, and during use. Ensure all equipment conforms to the shoring layout and there is no damaged equipment. Immediately reinforce or reshore any damaged or weakened shoring equipment. Work shall stop if the inspection indicates critical failure potential or unmitigated hazards. Work shall resume when the first-line supervisor or project lead has addressed the issue and the hazard is abated.

25.8.6.4 **Reshoring.** Provide reshoring when necessary to safely support slabs and beams after stripping or where such structures are subject to superimposed loads.

25.8.6.5 **Removal of Shoring.** Remove shoring equipment only after concrete has reached the minimum strength required in the formwork and shoring design and a PE or supervisor has inspected and approved the placement. Plan removal to not overload in-place shoring equipment.

25.8.7 **Vertical Slip Forms**

Vertical slip forms shall be designed by a PE experienced in slip-form design. A copy of the designs must be available on the jobsite. The first-line supervisor must have experience with vertical slip forms and shall oversee all vertical slip form operations. The first-line supervisor must be present on the deck during slipping.

25.8.7.1 **Jack Supports.** Design steel rods or pipe on which the jacks climb (or by which forms are lifted) for that purpose. Encase supports in concrete or anchor them. Supports anchored or secured by form anchors must use two or more independent form anchors, separated a minimum of 5 vertical feet.

25.8.7.2 **Vertical Loading.** Position jacks and vertical supports so the vertical loads are distributed equally. Do not exceed the capacity of the jacks.

25.8.7.3 **Line and Plumb.** Keep the form structure in line and plumb during jacking operations.
25.8.7.4 **Lifting.** When lifting, proceed steadily and evenly. Do not exceed the predetermined safe rate of lift.

25.8.7.5 **Bracing.** Provide lateral and diagonal form bracing to prevent excessive distortion of the structure during jacking.

25.8.7.6 **Holding Devices.** Provide jacks or other lifting devices with mechanical dogs and other automatic holding devices for protection in case the power supply or lifting mechanism fails.

25.8.7.7 **Scaffolding and Platforms.** Vertical lift forms must have scaffolding or work platforms which completely encircle the area of placement.

25.8.8 **Releasing and Moving Forms**
A lift plan is required when raising or moving forms by crane, cableway, A-frame, or another mechanical lifting device. Personnel shall not ride forms or scaffolding during lifts. Personnel shall not be directly underneath any lifted forms.

25.8.8.1 **Lifting.** When raising or moving forms by crane, cableway, A-frame, or similar mechanical lifting device, securely attach the forms to wire rope slings with a minimum safety factor of 8. Equip the panels and form sections with hoisting brackets to attach slings. Remove loose tools and materials before moving forms. Use taglines for controlling forms whenever necessary to protect personnel or structures.

25.8.8.2 **Releasing.** Adequately brace or secure vertical and overhead forms before releasing them. Before releasing and moving forms, relocate employees at lower levels who may be exposed to falling materials.

25.8.8.3 **Form Removal.** Do not remove forms, shoring, and bracing until the concrete being supported is sufficiently strong to support its weight with all loads placed on it.

25.8.9 **Precast Concrete**
Brace precast concrete walls, structural framing, or tilt-up wall panels until after permanent connections are made.

25.8.9.1 **Temporary Bracing.** A PE must design temporary bracing for precast concrete walls, structural framing, or tilt-up wall panels. Such bracing must provide at least 15 psf on projected surfaces.
### 25.8.9.2 Suspended Loads
Do not allow employees under precast concrete members being lifted or tilted into position.

### 25.8.9.3 Lifting Inserts
The lifting inserts for tilt-up concrete members must be able to support at least 2 times the maximum intended load. Other types of lifting inserts for precast concrete members must be able to support at least 4 times the maximum intended load. Lifting hardware must be able to support at least 5 times the maximum intended load.

### 25.8.10 Lift-Slab Operations
A PE experienced in lift-slab construction shall design and plan all lift-slab operations. Such plans shall include detailed instructions and design drawings which prescribe the method of erection and ensure lateral stability of the structure.

#### 25.8.10.1 Jacks/Lifting Units
Mark jacks/lifting units to show the rated capacity established by the manufacturer. Do not load jacks/lifting units beyond the rated capacity. Install a safety device for jacks/lifting units to ensure loads will remain supported in any position if jacks malfunction.

#### 25.8.10.2 Jacking Operations
Synchronize jacking operations so the slab will remain level at all support points to within a ½-inch tolerance. If leveling is automatically controlled, install a device which will stop the operation when tolerance is exceeded or when the jacking system malfunctions. If manual controls maintain leveling, locate these controls in a central location; an experienced, competent person must attend the controls during lifting. Limit the maximum number of manually controlled jacks/lifting units on one slab so the operator can maintain the slab level. The maximum number must not exceed 14. During jacking operations, only essential employees may remain in the building/structure.

#### 25.8.10.2.1 Wedges
When making temporary connections to support slabs, secure wedges with tack welding, or an equivalent method, to prevent them from falling out of position. Release lifting rods only after securing column wedges.

#### 25.8.10.2.2 Welding
A certified welder must perform all welding on temporary and permanent connections. Do not execute load transfer from jack/lifting units to building columns until the welds on the column shear plates cool to air temperature.

#### 25.8.10.2.3 Secure Installation
Make sure jacks/lifting units are secured to building columns so to not dislodge or dislocate. Design and install equipment so the lifting rods cannot slip out of position.
25.9 Definitions

**Concrete Conveyance Systems**
Mechanical devices used to move concrete from the receiving hopper of the delivery system to the point of use. (pumps, tremies, conveyor belts, hoses, etc.).

**Green Cutting**
Roughening of concrete surface by using high-pressure water cutting equipment. Typically done for impermeable construction joints where material joint systems are not possible to use.

**Formwork**
The total system of support for freshly placed or partially cured concrete including the mold or sheathing that contacts the concrete as well as all supporting members, hardware, and bracing.

**Shoring**
Temporary vertical support member in a formwork system, designed to carry the weight of the formwork, concrete, and construction loads.

**Vertical Slip Form**
A form that is raised as concrete is placed; moves vertically to form walls, bins, or slips.

25.10 References

Occupational Safety and Health Administration. 29 CFR 1926, Subpart Q, Concrete and Masonry Construction. [https://www.osha.gov/laws-regs/regulations/standardnumber/1926](https://www.osha.gov/laws-regs/regulations/standardnumber/1926)


American National Standards Institute/American Society of Safety Professionals. A10.9-2013 (R2018), Safety Requirements for Concrete and Masonry Work.


American Concrete Institute. ACI 347 - Guide to Formwork for Concrete.

American Concrete Institute. ACI 318 – Building Code Requirements for Structural Concrete.