REINFORCING STEEL AND POST-TENSIONING SAFETY ISSUES

- p. 1 - Sample Letter to OSHA
- p. 3 - OSHA’s Request for Information - Reinforcing Steel and Post-Tensioning Safety Issues

Sample Letter to OSHA

OSHA Docket Office  
Docket No. OSHA-2010-0058  
Technical Data Center, Room N-2625  
U.S. Department of Labor  
200 Constitution Avenue NW  
Washington, DC 20210

Re: Occupational Safety and Health Administration Docket No. OSHA-2010-0058  
Support for New OSHA Standards for Reinforcing Steel and Post-Tensioning Operations

Attention: Occupational Safety and Health Administration:

On behalf of [insert company name], I am writing to urge the Occupational Safety and Health Administration (OSHA) to pursue rulemaking and adopt new safety standards pertaining to reinforcing steel and post-tensioning operations.

Attached are responses to the Agency’s Request for Information (RFI) pertaining to this proposed rulemaking initiative. We support the position of the industry coalition of reinforcing stakeholders that includes The International Association of Bridge, Structural, Ornamental and Reinforcing Iron Workers, Ironworker Management Progressive Action Cooperative Trust, National Association of Reinforcing Steel Contractors, Concrete Reinforcing Steel Institute, Post Tensioning Institute, Western Steel Council, Department of Reinforcing Ironworkers Advisory Committee, and The Center for Construction Research and Training.

The primary considerations of the industry coalition of reinforcing stakeholders to pursue new OSHA standards for reinforcing steel and post-tensioning operations are based on the following rational.
1. The current OSHA Subpart Q – Concrete and Masonry standard is antiquated and contains limited safety provisions for several recognized hazards associated with reinforcing steel and post-tensioning activities.

2. Fatality and accident trends in the reinforcing steel and post-tensioning industry indicate a direct correlation between accident causation factors and lack of specific regulations.

3. The use of steel reinforcement and post-tensioning in poured in-place concrete is expected to double by 2015 from its 1990 level and may comprise a majority of commercial and industrial construction.

4. The Negotiated Rulemaking process will produce the best safety standard and regulations through the cooperative efforts of OSHA, stakeholders, and experts in the reinforcing steel and post-tensioning industry.

An overview of fatalities, accident trends and causation factors was presented to OSHA from representatives of the Iron Workers International and IMPACT. Subsequent meetings with Agency officials were held to reviewed specific OSHA fatality data relating to the following reinforcing activities. More detailed information and recommendations pertaining to incidents and hazards are provided in the attached responses to Agency’s RFI.

**Examination of Fatalities, Accident Trends and Causation Factors**

1. **Material Handling Injuries** – Many Ironworkers have sustained material handling injuries due to inadequate and unacceptable jobsite conditions. Reinforcing Ironworkers and contractors are currently not provided with the same safety provisions for site conditions as steel erection contractors and Ironworkers under the Subpart R – Steel Erection Standard.

2. **Structural Collapse of Vertical Formwork and Decks** – Fatalities and disabling injury trends have continued to occur due to the lack of specific OSHA standards. The current Subpart Q standard does not adequately address responsibilities to ensure formwork stability. OSHA needs to adopt new standards to address the responsibility for the appropriate parties to inspect the structural integrity of formwork prior to allowing access of personnel and materials.

3. **Structural Collapse of Vertical and Horizontal Columns** – Fatalities and disabling injury trends continue to occur due to the lack of specific guying and bracing requirements for vertical and horizontal columns. The current Subpart Q standard does not adequately address specific requirements and responsibility for guying and bracing of columns.

4. **Impalement by protruding Reinforcing Steel Dowels** – Many serious incidents and legal issues involve the use, inspection, and responsibility to maintain dowel impalement covers during reinforcing steel activities continue to occur in the reinforcing industry. The current Subpart Q standard does not adequately address impalement hazards and responsibilities of appropriate parties to during the reinforcing steel process.

5. **Post-Tensioning Standards** – Serious incidents and fatalities continue to occur involving the use of post-tensioning equipment. The use of post-tensioning cables and equipment is expanding that warrants the need for new OSHA standards. Specific standards pertaining to training and the use of post-tensioning equipment are needed to help prevent workplace hazards and reoccurring incidents during post-tensioning operations.
We strongly urge OSHA to pursue rulemaking and adopt new safety standards pertaining to reinforcing steel and post-tensioning activities. Thank you for your consideration to grant our request.

Sincerely,

(Your name here)
Title and company name

cc: Eric Dean, General Secretary, Iron Workers International; Steven Rank, Executive Director of Safety and Health, Iron Workers International

OSHA’s Request for Information
Reinforcing Steel and Post-Tensioning Safety Issues

Following are specific questions from OSHA’s RFI seeking comments and information from industry stakeholders. We want to provide the Agency with consistent answers to these questions that reflect our position.

A. Post-Tensioning Operations

1. Are there specific post-tensioning hazards not currently addressed by OSHA standards? If so, what are they?

There are several hazards and processes pertaining to post-tensioning operations that are not adequately addressed by the current OSHA standards. Some of the hazards include but are not limited to the following.

   a) Concrete blow-outs on decks, beams, or joists
   b) Explosive release of a cable during tensioning operations
   c) Trips on materials
   d) Falls to exterior of building during jacking operations
   e) Lacerations from cable ends
   f) Impalement from cable ends
   g) Air-hose breaks
   h) Flying debris & equipment

A video that illustrates blow-out hazards during post-tensioning operations can be viewed at: http://www.youtube.com/results?search_query=post+tension+blowout&oq=post+tension+blowout&aq=f&aqi=&aqi=&gs_i=youtube.12...22787.24494.0.26482.7.7.0.0.0.0.130.798.0j7.7.0...0.0.JR29nVaupWw.

2. What are the most common post-tensioning-related injuries, and what procedures or techniques are available to prevent them?
The most common injuries include but are not limited to broken bones, impalement, lacerations, blunt force trauma from jack or cables, eye punctures, etc.

a) Serious struck-by injuries from the hydraulic rams have occurred to Ironworkers during the stressing operation. This involves several factors such as the ram “rifling” due to excess bare strand behind the anchor; the ram slipping off the cable due to worn jack grippers; the cable not perpendicular to the anchor due to improper concrete placement; the cable being pulled out of the dead end or coupler due to the wedges not being properly back stressed; honeycombing of concrete causing the stressing anchor to slip or blowout; improper placement of cable and/or bursting steel/anchor reinforcement; cable breaking due to improper cleaning of the anchor cavity causing the wedges to seat unevenly; cable stressed in excess of specified pressure; personnel standing to close to the ram.
b) The other common accident is lacerations caused from improperly unrolling the cable and cables being placed through the beam-side.
c) Workers entering areas where post-tensioning operations are occurring have been hurt and specific standards are need to bar them from entering these areas. The controlling contractor is the best entity to ensure that other trades are not allowed in these areas.
d) The procedure to avoid these injuries is proper training such as the training that is performed by the Ironworkers through apprentice, journeyman upgrading programs, and the Post-Tensioning Institute (PTI).

Procedures and techniques to prevent serious injuries during post-tensioning operations include the following proposed requirements.

a) Need for notification - No stressing operations shall commence prior to the controlling contractor providing written documentation to the company performing the stressing operation that the minimum specified initial concrete compressive strength has been achieved.
b) Expanded requirements - No one shall be permitted to stand behind, in line with or directly above the stressing equipment or the full length of the tendon(s), including the fixed end anchorage.
c) Signage requirements - Signs and barriers shall be erected to limit access into the stressing area only to personnel engaged in stressing or de-tensioning operations.
d) Controlling contractor involvement - The controlling contractor shall bar other construction processes from being worked in barricaded areas during stressing operations.
e) Access requirements - The controlling contractor shall ensure that an adequate safe work platform of a minimum of (3) feet (this can include an extension of formwork) including handrails, or equivalent, is provided for stressing tendons, cutting tendon tails, and grouting. All work platforms shall be clear of any materials not related to the work process.
f) Preventing falling object hazards - Stressing equipment shall be secured during
operation to prevent accidental displacement.

g) Competent person requirements - Prior to stressing, stressing equipment must have current stressing equipment calibrations per contract specifications available on-site. A competent person shall verify adequacy of stressing equipment calibrations and inspect the stressing equipment for visible signs of defects immediately before stressing and periodically during the stressing operations. The use of stressing equipment shall conform to the manufactures recommendations.

h) Stability requirements - During stressing operations methods shall be employed to insure that supporting shoring does not fall due to cambering of concrete during stressing operations. Dead loads and construction loads (including those due to stressing) shall be considered in the design of the forms and shoring.

3. Should a competent person inspect jacking equipment for visible signs of defects or other signs of failure before and during jacking operations? Are such inspections currently standard practice in the industry?

Yes, a competent or qualified person must inspect post-tensioning for visible defects. This person should be one who processes a Level 2 certification equivalent to that provided through PTI. We are not familiar with the single family residential PT market and their practices and experience levels. Some of the inspection items include the following.

a) Ensure that equipment is calibrated from the supplier prior to use
b) Proper operation of stressing jacks and gauges
c) Placement of post-tensioning tendons (location and profile) in beams and joists
d) Anchorage reinforcement and placement of back-up bars

4. What safety checks are necessary before post-tensioning activity occurs?

In addition to checking the equipment as discussed above, the following checks should performed.

a) Ensure that equipment is calibrated from the supplier prior to use.
b) Ensure proper operation of stressing jacks and gauges.
c) Proper placement of post-tensioning tendons (location and profile).
d) Ensure anchorage reinforcement and placement of back-up bars.
e) The concrete should be inspected to insure there are no voids or honeycombing, especially in the anchor zone.
f) The concrete should have reached the specified compressive strength.
g) Ensure building perimeter has adequate space to safely install and use equipment
h) The personnel performing the stressing operations need to be properly trained.
i) Proper warning signs need to be posted insuring there is no one in the stressing area.
j) A dedicated power source of sufficient amperage as well as the proper extension cord must be available; the calibration chart has been reviewed to insure that the proper calibrated gauge and ram are used together and that the personnel performing the stressing are aware as to what pressure the cables are to be
5. Are there engineering issues relating to post-tensioning operations that affect the safety of employees?

Yes, concrete strength verification prior to stressing, particularly how to handle colder climates concerns and proper curing concrete before stressing. Issues or concerns related to congested PT areas, particularly cantilevered concrete slabs, these are two examples of areas where blow out of slabs can occur during stressing.

The force produced by stressing a single cable can reach 47 kips. The force in tendons with multiple cables such as those used in bridges can be many times higher. The uplift forces created by the cable combined with the engineered drape (eccentricity) is what gives the concrete the strength to support the load. Too much force could cause the slab to deflect as will not enough force. The same goes for transfer beams in which the cables are stressed in stages as the load is increased. Large “sweeps” or bends also must be properly engineered and reinforced to prevent blowouts.

Following are some specific engineering issues relating to post-tensioning operations that affect the safety of employees.

a) Strength of concrete – concrete must have adequate compressive strength before tendons can be stressed.

b) Orientation of tendons – tendons must be located in the proper position and orientation as specified in the contract documents to ensure intended structural performance. Improper placement may lead to hazards from structural collapse, and unexpected blowout of a tendon through the top, bottom or side of a member.

c) Timing and sequencing of stressing – the Licensed Design Professional establishes when tendons can be stressed and in what order.

d) Required force in tendon - the Licensed Design Professional establishes the required force in each tendon in the contract documents. Installers stress the tendon to this force and the Licensed Design Professional accepts the elongation (the amount the steel stretches when stressed) as being within acceptable tolerance.

e) Anchorage zone reinforcement is critical to the prevention of blowouts during and after stressing. This required reinforcement is detailed by the Licensed Design Professional in the contract documents.

f) Structural stability – the Licensed Design Professional and controlling contractor are responsible for ensuring that the structure is structurally stable during construction. Of particular concern are: shoring and formwork.

6. Are there post-tensioning hazards associated with mixing components from various manufacturers?

Yes, components from different manufacturers may not be compatible with one another and may not perform as expected. Standard codes and specifications require that components be performance tested as a system. Components such as cables, anchors, pocket formers, wedges, should not be used in pours other than what they were designed for without permission from the Engineer of Record (EOR).
7. How can employees be protected from risks or hazards associated with drilling or cutting concrete after post-tensioning operations are complete?

Workers performing drilling or cutting should be properly instructed as to the presence of cables. They can refer to the Post-Tensioning Shop Drawings for actual cable placement as well as consulting with the installer.

   a) Work must be done by competent personnel only.
   b) Tendons must be located by a competent person before drilling or cutting are done.
   c) Drilling and cutting should be approved by the Licensed Design Professional.

8. Are the hazards associated with de-tensioning generally different than the hazards associated with post-tensioning? Please explain.

De-tensioning is the most hazardous of all post-tensioning activities. Specialized equipment is usually required; materials are of unknown strength and quality; the steel may have damage due to corrosion and/or the concrete removal technique(s), and could break prematurely.

A ½ cable is typically stressed to 33 kips which is known as Jack Force. On a typical ram with a piston area of 6 inches, this translates to 5,500 psi gauge pressure. In order to de-tension a cable you must “break” the wedges which occurs at about 35 kips or 5,800 psi. At 41 kips or 6,800 psi the cable will break. So essentially, in order to de-tension a cable you have to take it close to it’s designed breaking strength. This has traditionally been performed using a “stool” or a set of “jack feet”. Which means the extreme force of the ram no longer bears on the anchor, but now on the stool or jack feet. In addition, while the cable is under this pressure someone has to reach INSIDE the anchor cavity to remove the wedges. Another factor to consider is that the de-tensioning is happening due to an issue such as honeycombing which can make the concrete surface unstable and now additional forces are being applied to the unstable concrete.

De-tensioning should only be performed by a properly trained individual. There is also a de-tensioning nose attachment to the ram that makes this process much safer and eliminates the use of jack feet/stools and also removes the hazard of the person who must get close enough to reach in and get the wedges.

What measures are available to reduce these hazards?

   a) Work must be done by qualified personnel only.
   b) Non-essential personnel and other trades must be kept clear of the de-tensioning area.
   c) Proper equipment must be properly calibrated by the supplier and inspected by a qualified person prior to use.

B. Site Conditions and Roads
9. Some contractors perform rebar work, such as building rebar cages, on the ground. At a construction site with multiple contractors, concrete reinforcing workers may not have the authority to alter ground conditions that are muddy, uneven, or contain other hazards. Workers also need to transport rebar and other materials on the site.

Do concrete reinforcing workers experience material-handling hazards, such as tripping, while carrying rebar when site conditions are poor?

Yes, reinforcing ironworkers are required to off-load trucks and hoist rebar much in the same manner as structural Ironworkers off-load beams and columns. There are serious hazards associated with material handling and carrying rebar on job sites with adverse conditions. There is a need for reinforcing Ironworkers to have the same OSHA site access and layout conditions that are provided under the OSHA Subpart R – Steel Erection standard. These reinforcing bars are shipped in bundles and can weight several tons and vary in lengths up to 60 feet long. Reinforcing Ironworkers are required to carry, place, and tie rebar in various shapes and sizes throughout the job site. Following are proposed regulatory text that addresses this hazard that is a reflection of the Subpart R – Steel Erection standard.

Site Access and layout. The controlling contractor shall ensure that the following is provided and maintained:

   a) Adequate access roads into and through the site for the safe delivery and movement of derricks, cranes, trucks, other necessary equipment, and the material to be erected and means and methods for pedestrian and vehicular control. Exception: this requirement does not apply to roads outside of the construction site.

   b) A firm, properly graded, drained area, readily accessible to the work with adequate space for the safe storage of “reinforcing and post-tensioning” materials and the safe operation of the “reinforcing contractors” equipment.

   c) Adequate exterior platform for landing materials on the floors of multi-tiered buildings.

   d) Adequate benching and/or shoring prior to the commencement of reinforcing operations in excavations and/or trenches.

What site conditions make it difficult to transport rebar and other materials on the site?

When adequate access roads are not provided into and through the site for the safe delivery and movement of derricks, cranes, trucks, other necessary equipment, serious injuries have occurred. Excessive mud and standing water on the project make crane set-up and material handling operations dangerous to Ironworkers. When Ironworkers pre-build rebar columns and curtain wall sections on the project every piece of rebar must be carried, placed, and tied into final position. It is necessary to have adequate site conditions to prevent muscular skeletal injuries.

How do these conditions contribute to injuries, if at all? Please explain.

Poor site conditions that have standing water and/or excessive mud create slip and fall hazards that have resulted in serious muscular skeletal injuries. When reinforcing Ironworkers carry heavy bars
on their shoulders through adverse job site conditions, serious injuries to their backs, knees, and other body parts have occurred.

10. Do site conditions pose other significant hazards for reinforcing steel work? If so, how frequently does this occur and when should contractors address site conditions—after excavation, before formwork begins, or at another time?

Yes, reinforcing steel contractors need safe access to position material trailers. We need good communication and coordination of all work including but not limited, to excavation and forming activities. Setting-up cranes (or other equipment) for hoisting materials such as large columns, wall sections, beams, etc. require a level, compacted and properly drained ground conditions.

Poor site conditions affect all trades and workers on the job site who are often working in small-congested areas. For example, other workers such as laborers and carpenters need adequate space and condition to off-load their formwork, bracing, shoring, etc. Inadequate conditions have caused equipment and trucks to slide, and dump materials. Aerial lift equipment is often used on projects and have over-turned due to poor site conditions.

Prior to the commencement of reinforcing operations, the controlling contractor should provide a firm, properly graded, drained area, readily accessible to the work with adequate space for the safe storage of “reinforcing and post-tensioning” materials and the safe operation of the “reinforcing contractors” equipment. The reinforcing contractors and Ironworkers should be provided with the same road conditions that are currently provided to the structural Ironworkers under the Subpart R-Steel Erection standard.

11. Are road conditions a problem for reinforcing concrete contractors, and do they create hazards for employees? What would be an appropriate remedy to address risks to employees?

Yes, road conditions and adequate access into and through the job site is necessary to prevent serious material handling and equipment incidents. Rebar loads can be in excess of 50,000 lbs. in some states and be irregular sizes and top heavy. Given these weights and configurations, they have a tendency to shift during normal transportation to the job. Accessing job sites with adverse roads condition can compound the problem and create hazards when workers begin the off loading process. Without adequate access roads, cranes and trucks cannot safely deliver and off-load reinforcing bars and other materials. The controlling contractor should provide the reinforcing Ironworkers with the same road conditions they provide the structural Ironworkers under the Subpart R-Steel Erection standard. What we can’t have is, “there is the muddy mess, now go deal with it yourself”. We need the controlling contractor to provide leadership and be responsible for coordinated safe access throughout the project. As reinforcing Ironworkers and contractors we have to do our part to keep areas tidy and not land material to block access or work of others but we need help for the other trades involved and once again the leadership of the controlling contractor is key to ensure safe access is addressed on an ongoing daily basis.

Following is the suggested language that was derived from the Subpart R standard.

Site Access and layout. The controlling contractor shall ensure that the following is provided and maintained:
a) Adequate access roads into and through the site for the safe delivery and movement of derricks, cranes, trucks, other necessary equipment, and the material to be erected and means and methods for pedestrian and vehicular control. Exception: this requirement does not apply to roads outside of the construction site.

C. Documentation

12. Welding rebar used for reinforcement that is not safe for welding can make the rebar brittle and may lead to collapse of the structure and injury or death to workers. How can employees be protected from these risks?

Welding of rebar is not a common practice anymore, however it can and is utilized in special circumstances. Mechanical couplers of rebar to rebar connections is standard in most applications. It is important to use only weldable grade A706 rebar when welding rebar to rebar or rebar to other steel structures. Using the correct A706 material when welding rebar will avoid rebar breakage issues and prevent injuries.

13. Are inadequate guardrails a problem for workers performing rebar operations? If so, how frequently does this occur, and what would be an appropriate remedy to address this risk?

Yes, the issue for reinforcing Ironworkers and contractors is that in many cases, we are directed to begin reinforcing operations and access decks, walls, and other platforms before the guardrails have been installed. Current OSHA standards for construction guardrails are appropriate for our type of work. However, we need the controlling contractors to ensure that the guardrails have been installed and not expect us to access these structures until the guardrail systems have been fully installed.

D. Reinforcing Steel Operations

14. What are the hazards associated with using gas-powered abrasive cut-off saws (demo-saws) on rebar? What are appropriate training and safety measures necessary to protect employees?

Flying debris while cutting, excessive noise levels, air borne concrete dust, saw kick-back, and potential fire related hazards are some of the common hazards. This activity and associated hazards are a basic part of equipment training that employers must provide to their employees.

15. Are there safety issues in regard to the wire used for tying rebar (for example, the gauge of wire used for tying rebar)? If there are, what are the safety measures necessary to protect employees?

There are numerous methods and means to secure reinforcing to prevent movement for concreting or to provide stability for support of temporary reinforcing structures or external loads. Communication of the plan for each structure or general task is the key to providing a safe environment for employees. Many different gauges and types of wire and other securing methods are adequate and safe.

16. Rebar columns can collapse when not supported properly, potentially injuring or killing workers. What safety measures are necessary to protect rebar workers from this hazard?
There are significant hazards associated with erecting and stabilizing rebar columns that have resulted in many fatalities and disabling injuries to Ironworkers, and other tradesmen working near columns that have collapsed. Following are proposed text that are submitted to address these hazards.

Structural stability of vertical and horizontal reinforcing steel assemblies shall be maintained at all times.

a) Vertical and horizontal columns, caissons, walls, drilled piers, top mats, and other reinforcing steel assemblies shall be guyed, braced, or supported to prevent structural collapse.
b) Guying, bracing, or supports shall be installed under the direction of a competent person.
c) Guying, bracing, or supports shall be removed only with the approval of a competent person.
d) The controlling contractor shall bar other construction processes below or near the erection of reinforcement assemblies until they are adequately supported and/or secured to prevent structural collapse.
e) Prefabricated walls, caissons, drilled piers, and other modular reinforcing steel assemblies that are free-standing shall be guyed, braced, or supported under the direction of a competent person.
f) Systems for guying, bracing, or supports shall be designed by a qualified person of the controlling contractor, and removed only with the approval of a competent person.

17. Do some types of structures pose more risk to employees performing rebar work? Please explain.

The installation of vertical columns and walls has more risks associated with this type of work. The need for other parties to inspect formwork prior to reinforcing operations is necessary to prevent form collapse and other hazards. Following are proposed written notifications prior to commencement of reinforcing steel activities to address these hazards.

Approval to begin reinforcing steel installation. Before authorizing the commencement of reinforcing steel activities, the controlling contractor shall ensure that the reinforcing steel contractor on the project is provided with the following written notifications.

a) Formwork and falsework have been inspected by a competent person of the controlling contractor prior to, during, and immediately after the installation of reinforcing steel and placement of the concrete.
b) The structural stability of vertical formwork, elevated decks, and other working/walking surfaces are adequately braced, guyed, or supported to allow safe access of reinforcing employees, materials, and equipment.
c) The benching and/or shoring for excavations has been inspected by a competent person of the controlling contractor.

Requirements for Formwork and Falsework Stability
1) The controlling contractor shall ensure that formwork is inspected by a competent person prior to, during, and immediately after the installation of reinforcing steel and placement of the concrete. A competent person performing these inspections shall have been approved, in writing, by an engineer. A written report of the inspections should be required. Reinforcing steel and concrete should not be placed until the report on the erected formwork indicates approval for placement.

2) Prior to the commencement of jacking and grading of bridge decks, the controlling contractor must prohibit employee access to bridge decks during jacking and grading operations.

18. Are there specific safety issues related to the use of reinforcing steel and post-tensioning in residential construction?

Many of the same hazards exist in reinforcing steel and post-tensions operations no matter if it is performed on a commercial or residential project.

19. Workers may form rebar cages on the ground (horizontally) and then raise them to a vertical position. Are there specific rigging hazards related to moving rebar columns? If so, what are they?

Yes, serious incidents have occurred while fabricating and hoisting rebar cages. There is a need to provide internal bracing to the reinforcing columns structure to prevent it from collapsing/racking during fabrication and erection. These structures must be rigged and braced to ensure they remain reasonably flat during erection sequence. (avoid excessive bending to reinforcing structure during erection). Bracing and rigging must be planned and installed under the direction of a qualified rigger (qualified person) and the hoisting directed by a qualified signal person. Following are proposed text to address these hazards.

Requirements for Hoisting and Rigging Reinforcement Assemblies

(1) A qualified rigger (a rigger who is also a qualified person) shall inspect the rigging prior to each shift in accordance with § 1926.251.

(2) Routes for suspended loads shall be pre-planned to ensure that no employee is required to work directly below a suspended load except for:

a) Employees engaged in the placing or initial connection of the reinforcement assemblies; or

b) Employees necessary for the hooking or unhooking of the load.

20. What health hazards are associated with working with or cutting epoxy-coated rebar or galvanized rebar?

21. What are the hazards involved with using reinforcing steel as guy attachments at deadmen or other anchorage points for scaffolding hooks or stirrups, or as load-bearing members of any lifting device? Does the Bureau of Reclamation's regulation (indicated above) effectively address these hazards?

It is appropriate and safe to tie or secure cables, or other brace members to reinforcing intersections provided the work is planned and completed by a qualified person. However, rebar itself should
never be used as a hook or loop as part of a rigging link. Only engineered products should be used for connecting cables or other bracing members.

22. What are the hazards associated with using rebar mats as a walkway? What safety measures would address these risks?

We strongly oppose this idea for practical and common sense reasons. Accessing and walking on rebar mats during placing of reinforcing bars and post-tensioning cables is necessary for building these structures. The idea of carrying and placing heavy planks or plywood is not only counter-productive, but would create unnecessary ergonomic hazards resulting in back injuries, sprains, strains, etc.

23. What safety measures are needed to address the risk of concrete forms collapsing? Please explain.

This is not in the scope of reinforcing Ironworkers scope of work. The vertical formwork and horizontal deck formwork must be erected and inspected by the party erecting it or overseeing them. They are the responsible parties to prevent formwork collapse. Following are proposed text to address these hazards.

Written Notifications Prior to Commencement of Reinforcing Steel Activities

Approval to begin reinforcing steel installation. Before authorizing the commencement of reinforcing steel activities, the controlling contractor shall ensure that the reinforcing steel contractor on the project is provided with the following written notifications:

1) Formwork and falsework have been inspected by a competent person of the controlling contractor prior to, during, and immediately after the installation of reinforcing steel and placement of the concrete.
2) The structural stability of vertical formwork, elevated decks, and other working/walking surfaces are adequately braced, guyed, or supported to allow safe access of reinforcing employees, materials, and equipment.
3) The benching and/or shoring for excavations has been inspected by a competent person of the controlling contractor.

Requirements for Formwork and Falsework Stability

3) The controlling contractor shall ensure that formwork is inspected by a competent person prior to, during, and immediately after the installation of reinforcing steel and placement of the concrete. A competent person performing these inspections shall have been approved, in writing, by an engineer. A written report of the inspections should be required. Reinforcing steel and concrete should not be placed until the report on the erected formwork indicates approval for placement.
4) Prior to the commencement of jacking and grading of bridge decks, the controlling contractor must prohibit employee access to bridge decks during jacking and grading operations.
E. General Reinforcing Safety

24. 29 CFR 1926.703(d)(2) requires employers to take measures to prevent wire mesh from recoiling. What types of injuries occur when working with wire mesh? Are there additional hazards related to wire mesh that require safety measures to protect workers? What would these additional safety measures be?

Not a significant amount of mesh is placed from rolls anymore. Most mesh is delivered and installed in sheet form now.

25. Are additional protective measures needed to address inhalation of the fibers used in fiber-reinforced concrete?

This work is performed by concrete batch plant operations, not reinforcing contractors or Ironworkers.

26. Is a competent or qualified person necessary to supervise guying, bracing, or shoring formwork?

Yes, it is crucial for contractors who install formwork to have a qualified person supervise and inspect the installation and bracing of formwork. This must be done prior to the commencement of reinforcing steel operations.

The practices related to the requirement questioned above differ from job to job and state to state and company to company. Some of the jobs require the formwork drawings to be stamped by a PE, in that state when others do not. Some states require the horizontal form work be inspected by a PE and others a competent person approved by a PE. Some do not require any inspection. Some companies require an inspection and some do not. Most job specifications state that the formwork shall conform to ACI 346 and this is only a guide to formwork for concrete and is not a code. When it comes to removal of guying of any kind it needs to be removed by those that installed it.

What measures would help avoid collapses of these structures?

The formwork contractor must erect, brace, shore, and inspect the formwork prior to the commencement of reinforcing steel operations to prevent structural collapse hazards. Following are proposed text to address these hazards.

Written Notifications Prior to Commencement of Reinforcing Steel Activities

Approval to begin reinforcing steel installation. Before authorizing the commencement of reinforcing steel activities, the controlling contractor shall ensure that the reinforcing steel contractor on the project is provided with the following written notifications.

1) Formwork and falsework have been inspected by a competent person of the controlling contractor prior to, during, and immediately after the installation of reinforcing steel and placement of the concrete.

2) The structural stability of vertical formwork, elevated decks, and other working/walking surfaces are adequately braced, guyed, or supported to allow safe access of reinforcing employees, materials, and equipment.
3) The benching and/or shoring for excavations has been inspected by a competent person of the controlling contractor.

Requirements for Formwork and Falsework Stability

4) The controlling contractor shall ensure that formwork is inspected by a competent person prior to, during, and immediately after the installation of reinforcing steel and placement of the concrete. A competent person performing these inspections shall have been approved, in writing, by an engineer. A written report of the inspections should be required. Reinforcing steel and concrete should not be placed until the report on the erected formwork indicates approval for placement.

5) Prior to the commencement of jacking and grading of bridge decks, the controlling contractor must prohibit employee access to bridge decks during jacking and grading operations.

Is using a competent or qualified person for this purpose currently standard practice in the industry?

Not sure who is supervising this work, but responsibility for it must be addressed to prevent structural collapse incidents.

When installation of formwork requires removal of structural-stability guying of an erected cage, is an alternative stability measure used in place of the guys? If so, what are these measures?

This must be answered by the formwork contractors.

27. Are there safety issues associated with guardrails erected by reinforcing concrete contractors remaining onsite after the reinforcing contractors departed from the site?

Reinforcing contractors never install guardrail systems, this work is always done by the controlling contractor or another subcontractor.

Should a controlling contractor be responsible for the guardrails after the reinforcing contractors depart the site to ensure that guardrails remain effective? What is currently the standard practice in the industry?

Yes, the controlling contractor is in the best position to ensure that perimeter and interior guardrail systems are installed prior to allowing access by the reinforcing Ironworkers or other subcontractors. Following is proposed text to address these hazards.

1) Unprotected sides and edges. Employees engaged in reinforcing steel operations shall not be permitted to access elevated decks or walkways until the controlling contractor has installed perimeter and interior guardrails systems, or covers.

28. Does improper sequencing among multiple crafts result in accidents or collapses in reinforcing concrete construction? Would a plan for project sequencing help eliminate the hazards created by multiple crafts working at the same time? Please explain.

Time sensitive concurrent work schedules by all trades is a safety concern for all trades but needs to be handled on a site by site basis. Awareness of this concern by owners and controlling contractors is
required so that appropriate and mutually agreeable project schedules can be developed and followed.

F. Impalement

29 CFR 1926.701(b) requires that "all protruding reinforcing steel, onto which employees could fall, shall be guarded to eliminate the hazard of impalement." Despite this requirement, workers continue to die and experience serious injuries because of impalement incidents. OSHA is looking at ways that it can improve its existing impalement standard to prevent future injuries and deaths.

29. How could the current impalement provision be changed to be more effective or protective? Is it practical or effective to require additional specific forms of impalement protection for specific situations? For example, under what circumstances should a contractor use protective troughs?

Federal OSHA should consider adopting the CAL-OSHA dowel protection standards that allow a variety of methods to protect workers from impalement hazards. The use of wooden or metal troughs is one of the alternatives that is an effective method of covering long rows of exposed dowels. The use of individual protection covers used in combination with troughs can abate impalement hazards in most all situations. The Cal/OSHA standards also address testing requirements and limitation for impalement devices.

30. Subpart R of 29 CFR 1926 contains regulations that explain when a controlling contractor may take possession of fall protection, 29 CFR 1926.760(e). These regulations allow a controlling contractor to take control and responsibility for fall protection installed by a subcontractor. Fall protection stays in place while the responsibility shifts from the subcontractor, who is leaving the area, to the controlling contractor, who remains at the worksite. Similar issues arise when many crafts use rebar caps placed by one contractor. Would procedures similar to the procedures specified for fall protection be useful in ensuring that rebar caps remain installed until no longer needed?

Yes, the example that OSHA described above pertaining to Subpart R and the “custody of Fall protection” has proven effective to address and abate fall hazards. In many cases, the reinforcing contractor will install protective covers while performing their work and leave the area immediately afterwards. These creates the same issue regarding the responsibility for maintaining protective covers after the reinforcing contractor has either completed work in the area, or left the job site completely. Based on our successful results with the OSHA Subpart R standard referenced above, it is our position that the controlling contractor is in the best position to ensure that protective covers remain in place in accordance with the following conditions.

Proposed Requirements for Impalement Protection and Custody of Impalement Covers

(1) Employees shall not be permitted to work above or around unprotected reinforcing bar or other hazardous projections protruding from vertical or horizontal surfaces that create an impalement hazard.

(2) Impalement covers shall include covers, troughs, or other devices that have been engineered by a qualified person to prevent impalement.
(3) When impalement covers are provided by the reinforcing steel contractor, they shall remain in the area where reinforcing activities have been completed to be used by other trades, only if the controlling contractor or its authorized representative:

a) Has directed the reinforcing steel contractor to leave the impalement covers in place; and

b) Has inspected and accepted control and responsibility of the impalement covers prior to authorizing persons other than reinforcing steel employees to work in the area.

31. The state of California has a test to determine whether rebar caps are effective. Does such testing increase worker protection of caps? Please explain.

The testing requirements for impalement covers contained in the California OSHA standards provide many safeguards. These testing requirements help identify any limitation to the protective covers and help to prevent a “false sense of security” for such products. The method of just bending a reinforcing dowel over into a hook or 180 degree candy is not an adequate method of providing dowel protection. Just like respirator filters have different protection factors, so do impalement covers. Impalement products must be designed and tested under the supervision of a qualified person.

32. OSHA issued a memorandum on January 15, 1997, that explains what types of rebar caps adequately protect workers from the hazard of impalement, e.g., mushroom caps are insufficient for this purpose. What should OSHA do to update the clarifications described in this memorandum?

The memorandum makes the distinction and limitations between “mushroom caps” and “impalement covers”. The method of just bending a reinforcing dowel over into a hook or 180 degree candy is not an adequate method of providing dowel protection. The Agency should provide an updated memorandum that recognizes the use of troughs and testing requirements for all devices used to prevent impalement.

33. In addition to rebar, construction sites have other, similar hazards that protrude from concrete, such as pipes. Unlike rebar, no existing OSHA standard covers these hazards. Are these hazards a safety issue, and what would be the most effective measure to use in controlling them?

Yes, many projections can create impalement hazards other than reposed rebar. The California OSHA standard addresses “other projections” in their standard. Other projections include steel stakes used for bracing and shoring formwork, electrical conduit that extends vertically through slabs, and other similar projections. The method of just bending a reinforcing dowel over into a hook or 180 degree candy is not an adequate method of providing dowel protection. Federal OSHA should recognize the California OSHA standard and include “other projections” for a future standard.

G. Training

34. Is specific training needed for work involving reinforcing steel and post-tensioning? If so, what specific types of training are needed for operations involving these activities?
Yes, specific training on hazards associated with reinforcing steel installation and post-tension must be provided to all employees. Following are proposed training requirements.

Proposed training requirements for reinforcing steel and post-tensioning activities.

1) The employer shall ensure that each employee who performs reinforcing steel and post-tensioning activities has been provided training in the following areas:

   a) The nature of the hazards associated with reinforcing steel and post-tensioning activities.
   b) Principles of post-tensioning.
   c) Understanding of post-tensioning materials and components.
   d) Familiarity with materials and related testing.
   e) Installation procedures.
   f) Tendon stressing operations.
   g) Grouting (when applicable).
   h) Reading construction documents.
   i) The proper procedures and equipment to perform reinforcing steel and post-tensioning activities.
   j) Employees involved in reinforcing bar and post-tensioning operations shall be certified by a qualified evaluator (third-party). “Qualified evaluator (third party) means an entity that, due to its independence and expertise, has demonstrated that it is competent in accurately assessing whether individuals meet the training requirements in this subpart. Joint apprenticeship training committees developed by training labor-management that are recognized by the U.S. Department of Labor Apprenticeship Training would qualify as a qualified evaluator third-party to provide certification of training.

35. How does your company/organization evaluate employees to confirm that they understand information provided in the training?

The Iron Workers International Union has established The National Iron Workers and Employers Apprenticeship and Journeyman Upgrading Training Fund to provide training programs in accordance with the United States Department of Labor Approved Apprenticeship Training.

Currently, an apprentice is an employee who learns a skilled trade through planned, supervised work on-the-job, while at the same time receiving related technical classroom instruction. Apprentices are required to sign an indenture agreement with their Joint Apprenticeship Committee/Trade Improvement Committee that spells out the requirements and expectations of an apprentice ironworker. Apprentices are taught the proper use, care, and safe handling of the tools and equipment used in connection with their work and, of course, the important skills necessary to become a successful tradesperson.

36. Should employers rely on hands-on methods and practical demonstration of skills rather than written tests/evaluations?

Yes, Hands-on training, practical demonstration, and written examinations are all necessary.
to produce a qualified person. While working on-the-job and acquiring skills, apprentices are a regular part of the work force on whom contractors and co-workers rely. Apprentices are also required to attend ironworking school and complete the prescribed courses related to the trade in order to complement their on-the-job training. Apprentices will receive an evaluation about every 6 months to determine if they are learning the craft. If the on-the-job or schoolwork is not satisfactory, they may be dropped from the program or sent back to repeat that segment of training.

Most ironworker apprenticeships last 3 or 4 years depending on the local union requirements. An ideal schedule provides equal training in structural, reinforcing, ornamental, welding, and rigging. The actual length of training for each subject may vary depending on the predominant type of work available in the local area. Apprentices are required to receive at least 204 hours of classroom and shop instruction during every year of training. The subjects taken in the shop and classroom complement the hands-on training received in the field.

37. Does your company/organization train employees for operations involving reinforced concrete? If so, what information does it cover? How is training adapted for non-English speaking employees? Please provide copies of training materials, if possible.

Yes, the National Iron Workers and Employers Apprenticeship and Journeyman Upgrading Training Fund provides specific training on reinforcing steel installation and post-tensioning operation. Classroom and hands-on instruction includes hazards associated with columns, walls, mats, post-tensioning and de-tensioning operations. Additional training that is related to these activities includes fall protection, hoisting and rigging, scaffold erection and dismantling, and other courses.

Yes, training materials have been adapted for non-English speaking employees.

38. OSHA would like to receive information on employer experiences with training non-English speaking workers. What percentage of your workforce involved in reinforced concrete operations speaks languages other than English? What training methods have you found to be effective with these workers? Are you aware of any data that estimates the number of non-English speaking workers engaged in operations involving reinforced concrete? If so, please identify the data.

H. Injuries

OSHA currently is looking for information and data on incidents in the reinforcing concrete industry. While the Bureau of Labor Statistics (BLS) keeps data on many types of injuries, the BLS data regarding concrete reinforcing is not specific to the incidents addressed by this RFI. While OSHA has some limited data, including the CPWR and BeSafeBC studies, the Agency needs additional data to determine the types and frequency of these incidents.

39. If you or your company/organization performs work involving reinforcing steel, what kinds of rebar-related injuries, if any, have your employees experienced? How many?
Refer to questions 1 & 2 above. Additionally, the International Association has provided the Agency with data pertaining to fatalities and serious injuries.

40. If you or your company/organization performs post-tensioning operations, what kinds of post-tensioning-related injuries, if any, have your employees experienced? How many?

The International Association has provided the Agency with data pertaining to fatalities and serious injuries.

41. Are you aware of any data used to evaluate the effect of implementing specific safety practices in reinforced concrete operations? If so, please identify the data.

Yes, California OSHA adopted specific standards to address rebar column stability and impalement hazards. The Cal/OSHA 1712 standard was amended to include specific requirements for guyng and bracing of rebar columns. The standard requires such activities to be installed and removed under the direction of a qualified person. This standard has proven effective to help prevent columns incidents.

I. Economic Issues

42. The Agency examined data from the Bureau of Labor Statistics’ (BLS) Occupational Employment Survey (May 2009) to identify which industries employ Reinforcing Iron and Rebar Workers (SOC 472171) (see the table below).\5\ Based on the data in this table, it would appear that most concrete reinforcement activity occurs in NAICS code 238100, with small amounts of activity in other construction sectors.\6\ However, the data may not be accurate because there may be construction workers, including laborers and carpenters, who perform reinforcing concrete operations and who are classified under other SOC codes because reinforcing concrete is not their primary activity. Also, there likely are reinforcing iron and rebar workers employed in non-construction sectors not accounted for in the data presented in this table.

\5\ Standard Occupational Classification (SOC).
\6\ North American Industry Classification System (NAICS).

Reinforcing Iron and Rebar Workers by Industry

<table>
<thead>
<tr>
<th>NAICS code</th>
<th>Industry</th>
<th>SOC</th>
</tr>
</thead>
<tbody>
<tr>
<td>236100</td>
<td>Residential Building Construction</td>
<td>280</td>
</tr>
<tr>
<td>236200</td>
<td>Nonresidential Building Construction</td>
<td>ENR</td>
</tr>
</tbody>
</table>

---

\5\ Standard Occupational Classification (SOC).
\6\ North American Industry Classification System (NAICS).
237000................................. Heavy and Civil Engineering 1,870  Construction.
237100................................. Utility System Construction 360  
237300................................. Highway Street and Bridge 1,870  Construction.
237900................................. Other Heavy and Civil Engineering 100  Construction.
238000................................. Specialty Trade Contractors 16,960  
238100................................. Foundation Structure and Building 16,180  Exterior Contractors.
238200................................. Building Equipment Contractors 150  
238900................................. Other Specialty Trade Contractors 620  
327300................................. Cement and Concrete Product 40  Manufacturing.
423000................................. Merchant Wholesalers Durable Goods 130  
999301................................. Local government including schools 40  and hospitals.

Total...................................... 19,970

ENR = "Estimate Not Released"–due to data suppression, the actual number of rebar workers will be larger than the total based on the available data.

43. Do the data listed in the table provide reasonable estimates of where concrete reinforcement work is done and who is doing it? Are there construction sectors other than those listed in the table above that do concrete reinforcing work? Are there other occupational groups, such as cement masons and concrete finishers, that OSHA should consider in determining the industries in which concrete reinforcement work might take place?

44. OSHA is interested in the experience of employers in complying with existing standards regarding concrete reinforcement, in terms of costs and benefits; specifically, the experience of employers in states with supplemental mandatory requirements related to concrete reinforcement, such as California and Washington.

   a. Have there been additional expenses in complying with these rules and what are these expenses?

      We are not aware of any additional expenses for complying with safety standards that prevent serious incidents and costly job site delays.

   b. Have these standards had any affect on the industry structure? Has there been a noticeable
improvement in safety? Are there any data sources on injuries related to reinforced concrete operations at local or regional levels?

Yes, there have been significant improvement in safety performance when California OSHA adopted revisions to the 1712 standard to address column stability and fall protection requirements. Incidents trends pertaining to column collapse and falls have been dramatically reduced since these standards were revised.

c. What is the industry's experience, in terms of costs and benefits, in complying with various consensus standards, such as the ANSI standards?

The ANSI A10.9 standards pertaining to reinforcing steel and post-tensioning activities are currently under revision to address many of the same safety issues contained in OSHA’s RFI. Some of the ANSI standards do not reflect current work practices or safety concerns in the reinforcing steel industry.

d. Have the Bureau of Reclamation or Army Corps of Engineers requirements imposed additional expenses, affected industry structure, or resulted in safety improvements?

e. Is there any reason to believe that, if OSHA adopted the requirements of these various standards, the resulting costs, benefits, and affects on industry structure would differ from current experience?

Yes, it is our position that many incident trends stemming from poor site conditions, rebar column and formwork collapse, exposed rebar impalement, post-tensioning, improper hoisting and rigging, and lack guardrails systems would be dramatically reduced.

Since the Subpart R – Steel Erection was revised with the expertise of industry stakeholders and promulgated by OSHA as a Final Rule in 2001, there has been a significant reduction in the following incident trends.

a) Reduction in material handling injuries due to site access and condition requirements.
b) Reduction in anchor bolt failure due to controlling contractor requirements for written notifications of anchor bolt modifications.
c) Reduction in anchor bolt failure due to controlling contractor requirements for written notifications of concrete strength prior to erection.
d) Reduction in column collapse due to fabrication requirements for double connections.
e) Reduction in exterior falls due to fabrication requirements for exterior columns.
f) Reduction in perimeter falls due to controlling contractor requirements pertaining to the “custody of fall protection”.
g) Reduction of falling object incidents due to a controlling contractor requirement to bar all activities below the steel erection process.

Based in these successful results and standards developed by industry stakeholders utilizing the negotiated rulemaking process, we can expect much improvement in reducing fatalities and incident trends for reinforcing Ironworkers.

e. Are current state standards sufficiently flexible and/or performance-oriented to adapt to changing technology in the construction sector over time?
Yes, every industry continues to make changes to adapt to new technologies, practices, and industry regulations.

45. Subpart R requires the controlling contractor to properly grade and drain the work area (29 CFR 1926.752(c)(2)). Reinforcing concrete work may be done before structural steel work begins. Currently, there is no requirement to grade and drain the site prior to commencing reinforcing concrete work. If controlling contractors must drain and grade the site prior to reinforcing concrete work, would this increase the cost of draining and grading the site, or would it merely shift the timing of the cost? Please explain.

In many cases, any costs associated with draining and grading the project would shift the timing of the costs. The job site must be drained and graded sooner or later, and providing it sooner will enhance safety performance and productivity of the subcontractors.

46. How many, and what kind of, small entities (small businesses, small organizations, and small governmental jurisdictions) perform reinforcing steel and post-tensioning operations? What percentage of the industry do they comprise? Are there important differences between entities of various sizes within the affected industries?

47. OSHA requests that members of the small business community and others familiar with small business concerns address any special circumstances small entities may encounter in controlling hazards and reducing injuries and fatalities associated with reinforcing steel and post-tensioning operations.

a. How, and to what extent, would publication of new regulatory provisions that address hazards in reinforcing steel and post-tensioning operations affect small entities in the industry?

New regulatory provisions would reduce the incidence of injuries and fatalities which, in turn, would reduce insurance cost and workman compensation claims.

b. Are there special circumstances that make the control of hazards in reinforcing steel and post-tensioning operations more difficult or more costly for small entities? Please describe these circumstances, and explain any alternatives that may serve to minimize these impacts, such as extended compliance dates, use of performance standards, simplified compliance options, different requirements, and partial exemptions for affected small firms.

The control of hazards in reinforcing steel installation and post-tensioning operations is equivalent for and readily achievable by both large and small companies. The size of the crew(s) that normally accomplishes this type of work would be similar whether they are employed by a large or small firm.

48. Are there reasons why the benefits of new provisions to control the hazards of reinforcing steel and post-tensioning operations may be different for small entities than for larger establishments? Please explain.

No, the new provisions would be equally beneficial to all entities in protecting construction personnel and the public from hazards.