



STEEL ERECTION AND GIRDER INSTALLATION

Plan the Lift. Maintain Stability. Protect Every Connection.

POLICY STANDARD

Structural stability shall be maintained at all times. Bridge girders and steel members shall be erected only under an approved sequence with adequate crane capacity, qualified rigging, temporary/permanent bracing, controlled fall and drop zones, reliable communication and verified connections before release.

PHEIFER BROTHERS CONSTRUCTION CO., INC.

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POLICY RELATIONSHIP

OSHA Subpart R applies to bridge steel erection, including rigging, hoisting, connecting, bracing, bolting, welding, decking and related work. This policy supplements the Crane and Hoisting, Rigging, Fall Protection, Welding/Hot Work, Railroad, Live Traffic and Working Over Water policies.

Primary Regulatory References

- 29 CFR 1926.750-.761 - Steel Erection
- 29 CFR 1926.752 and Subpart R Appendix A - site layout and erection planning
- 29 CFR 1926.753 - hoisting, rigging and working under loads
- 29 CFR 1926.754-.756 - stability, structural assembly and connections
- 29 CFR 1926.759-.761 - falling objects, fall protection and training
- 29 CFR 1926 Subpart CC - cranes and derricks
- Approved contract drawings, erection plans, manufacturer and AASHTO/WisDOT requirements

1. Purpose, Scope, Definitions and Responsibilities

Purpose and Scope

- Prevent collapse, girder rollover, dropped loads, falls, struck-by/caught-between incidents and uncontrolled member movement during bridge steel erection, alteration, repair and dismantling.
- Covers delivery/staging, rigging, hoisting, placement, connecting, bracing, bolting, welding, decking, bridge flooring and related work. More protective engineer, owner, manufacturer or project requirements govern.

Definitions

- Erection plan: qualified-person plan describing sequence, cranes, rigging, stability, connections, temporary works, access, fall protection and coordination.
- Connector: employee who, working with hoisting equipment, places and initially connects structural members and/or components.
- Qualified rigger: rigger meeting qualified-person criteria for the particular load and rigging task.
- Critical lift: lift meeting company/project criteria because of capacity, complexity, multiple cranes, public/rail/traffic exposure, unusual member or consequence.
- Release point: specified connection/bracing condition at which the engineer/plan permits the crane/rigging to be released.

Management / Project Manager

- Obtain approved erection engineering, qualified resources, owner/rail/traffic coordination and sufficient schedule/equipment. Resolve deviations before field work.

Erection Supervisor / Competent Person

- Direct the sequence; verify site, cranes, rigging, stability, connections, fall protection, inspections and weather; stop and correct unsafe conditions.

Qualified Person / Engineer

- Develop/approve the erection sequence, temporary bracing/support, lift analysis, connection/release criteria and changes requiring technical judgment.

Foreman, Operators and Employees

- Foreman briefs and enforces the plan. Operators retain authority over safe crane operation. Employees follow assigned roles, remain outside fall zones and stop work for any deviation or instability.

2. Preconstruction Conference and Erection Plan

Required Planning

- Conduct a preconstruction conference/site inspection with project management, controlling contractor/owner, erector, engineer, crane/rigging personnel, fabricator and affected subcontractors before steel erection.
- Review delivery, staging, crane access/setup, ground/structure capacity, utilities, traffic/rail/water, erection sequence, stability, fall protection, rescue, weather and emergency actions.

Erection Plan

- Prepare a written project-specific plan for bridge girder erection and complex steel work. OSHA requires a qualified-person site-specific erection plan when alternate means/methods are used under 1926.752(e); company practice also requires a plan for major girder erection.
- Identify members/weights/centers, pick points, crane configuration/radius/capacity, rigging, lift path, tag lines, wind limits, connection/bolt sequence, temporary/permanent bracing, release criteria and final verification.
- Include plan sheets/details, member erection marks, bearing orientation, camber/grade, splice sequence, diaphragms/cross-frames and falsework/temporary bent requirements.

Critical / Multiple-Crane Lifts

- Provide calculations, load-sharing method, lift director, communication, synchronized movements, contingency and 1926.1432 compliance for multiple-crane lifts.
- Define company/project critical-lift thresholds and approval. Conduct a documented pre-lift meeting and trial/test movements as appropriate.

Constructibility / Site Readiness

- Verify steel can be erected without unauthorized structural alteration. Resolve fit-up, access, pick-point, bolting and temporary-stability issues with engineer/fabricator before field modification.
- Confirm bearings, anchor rods, substructure elevations, concrete strength and receiving surfaces meet design requirements.

Change Control

- No change to sequence, member orientation, connection, bracing, pick point, crane/rigging, support or release criteria without required qualified/engineer review and written approval.

3. Site, Delivery, Staging and Crane Coordination

Access and Ground Conditions

- Provide and maintain adequate roads for cranes, trucks and deliveries; a firm, graded, drained setup/staging area; and pedestrian/vehicle controls as required by 1926.752(c).
- A qualified/competent evaluation verifies soil, fill, bridge deck, temporary causeway, mats, falsework, barges and foundations support crane reactions, transport and stored steel.

Delivery Planning

- Sequence loads to avoid rehandling and unstable storage. Verify route height/weight, permits, escorts, work-zone/rail restrictions, unloading position and traffic control.
- Assign a spotter and controlled unloading zone. Drivers remain in a designated safe location and follow site PPE/communication rules.

Staging and Storage

- Place girders/members on engineered or adequate dunnage/cribbing that prevents roll, twist, settlement, damage and unauthorized movement.
- Chock/brace curved, tapered, plate, box or eccentric girders. Preserve identification, lifting points, bearings, coatings and connection surfaces.
- Do not stack beyond approved capacity; maintain access for rigging without entering pinch zones or climbing unstable steel.

Crane Coordination

- Follow the Crane and Hoisting Policy. Verify certified/evaluated operator, shift inspection, setup, load chart, counterweight, boom/jib, radius, line pull, rigging weight, wind and power-line controls.
- Pre-plan every steel-erection hoist to minimize employee exposure beneath loads and comply with 1926.753(d). No side pulling or unplanned dragging.

Multiple Equipment / Barges

- Coordinate assist cranes, forklifts, aerial lifts and tugs so forces/movements do not destabilize the member or primary crane.
- For floating cranes/derricks or crane-on-barge work, comply with 1926.1437 and marine stability/securement plans.

4. Erection Sequence, Structural Stability and Temporary Bracing

Stability Is Continuous

- Structural stability shall be maintained at all times. The erected system must be stable at each intermediate stage - not only after final completion.
- Account for lateral-torsional buckling, girder rollover, bearing rotation, unbraced length, curvature, skew, camber, wind, temperature, erection tolerances and construction loads.

Sequence

- Follow member-by-member and connection-by-connection sequence shown in the approved plan. Identify hold points before crane release, next girder, cross-frame removal, splice completion and loading.
- Do not erect an isolated girder unless the plan provides stable support/bracing. Install required diaphragms/cross-frames and lateral bracing promptly in the prescribed order.

Temporary Bracing and Supports

- Temporary bents, towers, falsework, guys, blocking and bracing shall have approved design, foundation, erection inspection, load limits and removal sequence.
- Use positive connections; do not rely on friction, wedges, cranes, come-alongs or partially tightened bolts as permanent stability unless expressly included in the plan.
- Protect bracing from traffic/equipment impact and unauthorized removal. Tag or mark critical temporary members.

Bearings and Seats

- Verify bearing type, orientation, elevation, cleanliness, anchor bolts, sole plates, masonry plates and temporary restraints before landing.
- Control sliding/rotation on bearings. Do not remove temporary bearing restraints until specified connections/bracing are complete.

Construction Loads

- Do not place bundles, deck, equipment, personnel, concrete forms or other loads on incomplete steel unless the engineer/plan confirms capacity and distribution.
- Coordinate deck placement and concrete sequence with stability assumptions. Avoid asymmetric loading not addressed in the plan.

End of Shift / Weather

- Leave the structure in the documented stable configuration. Inspect connections/bracing and secure loose material before shutdown or approaching weather.

5. Hoisting, Rigging, Fall Zones and Load Control

Qualified Rigging

- A qualified rigger inspects rigging before each shift and selects gear for verified weight, center of gravity, pick points, sling angles, edge protection, rotation and environment.
- Use identified, compatible rigging within WLL. Engineered lifting beams, spreaders, clamps and girder lifting points require current design/inspection and proof testing as applicable.

Member Preparation

- Confirm erection mark/orientation, weight, center of gravity, approved pick points and removal of loose items. Protect coating and sling from sharp flange edges.
- Rig to prevent roll, twist, unintentional displacement and sling migration. Use a qualified plan for long, curved, skewed or flexible members.

Test Lift and Travel

- Take slack slowly, verify all legs/points, then lift a few inches and stop to confirm balance, crane control, rigging seating and member behavior.
- Use smooth movements and approved tag lines. Keep tag-line handlers outside fall/swing/pinch zones with clear release paths; never wrap line around the body.

Fall Zone

- Plan routes that minimize exposure. No employee is directly beneath a suspended load. Only employees essential and permitted under 1926.753(d) may enter the fall zone for connecting/landing.
- Loads shall be rigged to prevent displacement, by a qualified rigger, with self-closing hook latches/equivalent as required. Bar other work below unless overhead protection is provided.

Signals

- Use a qualified signal person when required, one routine signaler, and tested radio/hand signals. Anyone may give stop/emergency stop.
- Stop immediately after lost communication, person entering fall zone, unexpected movement, snag, wind increase, crane alarm or plan deviation.

Release

- Do not release rigging until specified bolts/connections and temporary/permanent bracing are installed, verified and the member is stable without crane support.

6. Girder Placement, Connections and Diaphragms

Approach and Landing

- Use slow controlled movement over prepared bearings/seats. Keep hands/body out from between girder, bearing, abutment, pier, falsework and adjacent steel.
- Use approved tools, alignment bars, drift pins, jacks or controlled devices. Do not use fingers, feet or unapproved impact to align holes/members.

Initial Connection

- Install the minimum bolts/pins or equivalent connection specified by the erection plan before release. OSHA beam/column provisions generally require at least two bolts per connection, wrench-tight or equivalent unless a documented exception applies; bridge engineering may require more.
- Bolts used for temporary stability shall be correct type/length, fully engaged and positioned as specified. Do not substitute drift pins for required bolts.

Diaphragms / Cross-Frames

- Install in the engineered sequence to control girder stability and geometry. Do not omit, delay, loosen or remove cross-frames without approval.
- Account for fit-up forces. Do not force members into position in a way that overloads girder, bearing, crane, temporary bracing or worker access.

Splices

- Support and align splice segments under the approved crane/falsework sequence. Install required bolts before load transfer or crane release.
- Control pinch/crush zones at web/flange plates. Stage bolts/tools to prevent falling objects and avoid overloading access platforms.

Double Connections / Shared Bolts

- Where connection work removes common bolts or affects an opposite member, use clipped ends, seat/connection devices or sequence meeting 1926.756(c) so one member remains secured.
- Never remove a bolt supporting another member without positive alternate support.

Final Verification

- Inspect bearing contact, alignment, bolt installation, cross-frames/bracing, temporary restraints and member condition before proceeding.
- Record engineer/inspector hold-point acceptance where required. Identify incomplete connections and restrict loading/access.

7. Fall Protection, Access and Rescue

Company Threshold

- Pheifer Brothers requires fall protection at 6 feet or more above a lower level unless a more protective rule applies. This company requirement is stricter than OSHA Subpart R's general 15-foot threshold.
- Guardrails, personal fall arrest, restraint, positioning or nets shall meet the Fall Protection Policy and the erection plan.

Connectors and CDZ

- OSHA allows limited connector and controlled-decking-zone provisions between 15 and 30 feet when all criteria/training are met. Company practice is to provide and require usable fall protection at 6 feet.
- A CDZ is only for initial metal-deck installation under 1926.760(c); it is not a general bridge-girder work zone and may not be used as a substitute for fall protection without written approval and full compliance.

Anchorage / Horizontal Lifelines

- Use engineered/approved bridge anchorage, static lines, beam anchors, SRLs or systems compatible with sharp steel, leading edges and required movement.
- Do not attach to unsecured members, temporary bracing, crane hooks/rigging or guardrails not designed for arrest. Coordinate anchorage loads with erection stability.

Access and Positioning

- Plan aerial lift, scaffold, ladder, stair, temporary walkway, girder access and transitions before erection. Do not walk beams/girders without required protection and training.
- Provide safe access for bolting/welding without climbing rigging, crane components or unstable members. Maintain three-point contact and tool control.

Clearance

- Calculate fall distance, swing, lanyard/SRL performance and lower obstructions including girders, diaphragms, rebar, traffic, water and falsework.
- Use leading-edge-rated equipment where exposed and protect connectors from heat/cutting/abrasion.

Rescue

- Establish prompt site-specific rescue before PFAS use, including access, equipment, trained roles, communication and medical response. Coordinate over-water, rail, traffic and remote pier locations.
- After a fall, call emergency services, perform planned rescue, obtain medical evaluation and remove equipment/affected anchorage from service.

8. Bolting, Welding, Cutting and Tools

Bolting

- Use correct bolt assembly, installation method, sequence and inspection under project specifications. Store fasteners protected and maintain traceability.
- Use proper reaction-arm control on torque/tensioning tools; keep hands clear and brace against sudden rotation. Secure hoses, cords and tools.
- Do not use unverified bolts as tie-off or lifting points. Mark incomplete connections and prevent premature loading/removal.

Welding and Cutting

- Follow qualified procedures, welder qualifications, drawings and Welding/Hot Work Policy. Obtain permits, fire watch and ventilation/respiratory controls as required.
- Protect fall-protection lines, rigging, coatings, traffic/public and employees below from arc, slag, sparks and hot metal. Do not cut or weld structural/temporary members without engineer approval.

Lead / Coatings

- Assume existing bridge coatings may contain lead or other metals until assessed. Follow Lead and Bridge-Coating, Respiratory and Hazard Communication policies for disturbance.
- Evaluate new coating fumes, galvanizing and stainless steel for hazardous metals. Use local exhaust/respiratory controls based on assessment.

Tools and Energy

- Inspect impact wrenches, magnetic drills, grinders, torches, hoses, leads, GFCIs and guards. Remove defective equipment.
- Secure tools and consumables against drops. Use tethering where it does not create entanglement and is rated/compatible.
- Control stored energy and unexpected movement before drilling, reaming, jacking or correcting fit. Apply LOTO where servicing/equipment hazards require it.

Housekeeping / Fire

- Remove electrodes, bolts, slag and scrap from walk paths; keep openings/access clear. Provide suitable extinguishers and monitor hot material.
- Compressed gas cylinders shall be secured, protected and separated/stored under the cylinder policy.

9. Decking, Falling Objects and Material Storage

Decking Plan

- Plan delivery, hoisting, placement, initial securement, openings, leading edge, wind and bundle loading. Verify steel stability and member capacity before deck bundles are landed.
- Place bundles only at locations shown/approved, secured against movement and within loading limits. Do not overload a bay or uncompleted connection.

Installation

- Control deck sheets against wind and sudden movement; use mechanical handling where feasible. Maintain fall protection and restrict access below.
- Secure each sheet as installation progresses using the specified method. Do not leave loose sheets at breaks or end of shift.

Openings and Shear Connectors

- Cover/guard deck openings and install perimeter protection as work progresses. Mark covers and secure against displacement.
- Do not install shear connectors or similar protrusions where they create tripping/impalement hazards before decking is installed, except as allowed by 1926.754(c). Protect exposed hazards.

Falling Objects

- The controlling contractor shall bar work below steel erection unless effective overhead protection is provided. Establish drop zones and controlled access.
- Use toeboards/screens/canopies, tool/material restraint and good housekeeping. Hard hats do not replace falling-object controls.

Material Storage

- Secure bolts, plates, diaphragms, decking, grating and tools against roll, slide, wind and vibration. Store within verified structural/platform capacity.
- Do not place material near unprotected edges or where it obstructs access, anchorages, fire protection or rescue.

Bridge Deck Forms

- Coordinate stay-in-place forms, overhang brackets, deck pans and temporary walkways with engineered formwork/falsework plans and girder stability assumptions.

10. Traffic, Railroad, Water, Utilities and Weather

Live Traffic

- Use approved closures, positive protection and traffic control so no suspended girder/load passes over unprotected public traffic. Coordinate delivery, crane setup, boom swing and worker escape.
- Plan intrusion response and maintain emergency access. High-visibility apparel does not replace separation.

Railroad

- Obtain railroad authority, right-of-entry, flagging/protective services, track windows, clearances and emergency contacts before fouling or lifting over/near tracks.
- Follow approved erection window and contingency for delayed lift. Never leave track exposed to an unstable member or equipment.

Working Over Water

- Use PFDs and lifesaving equipment where drowning hazard exists; coordinate skiff/rescue, fall-arrest retrieval, barge access and navigation.
- Account for current, water elevation, vessel movement, wind and ice in crane and girder control. Avoid fall-arrest arrangements that create unaddressed drowning/entrapment risk.

Power Lines / Utilities

- Identify and control overhead lines under Subpart CC and Electrical/Utility policies. Use de-energization, clearance planning, encroachment controls and dedicated spotters as required.
- Verify underground utilities before crane mats, anchors, temporary bents or ground disturbance.

Weather

- The erection plan defines wind limits for crane and each member; large girder surface area, curvature and tag-line control may require lower limits than the crane maximum.
- Stop for lightning, ice, poor visibility, flooding, uncontrolled wind or weather affecting stability, footing, access or communication.

Night Work

- Provide task/route lighting without glare or deep shadow, backup communication, fatigue controls and illuminated fall/drop zones. Reinspect after lighting or staging changes.

11. Inspection, Emergency, Training, Records and Review

Required Inspections

- Competent person completes crane pre-shift inspection under applicable crane/steel rules; qualified rigger inspects rigging before each shift; responsible persons inspect fall protection, aerial/scaffold access, temporary works and steel connections as required.
- Inspect after impact, overload, dropped load, weather, ground movement, crane relocation, bracing/sequence change or prolonged shutdown.

Stop-Work Triggers

- Plan deviation; unverified weight/capacity; damaged rigging/member; missing bolt/bracing; bearing movement; unexpected girder roll/twist/deflection; people in fall zone; lost signal; failed fall protection; traffic/rail incursion or weather limit.
- Anyone may give stop/emergency stop. Safely suspend/land the load and protect the area.

Emergency / Recovery

- For instability, dropped/shifted member, crane alarm/contact, fall, fire or electrical event: call 911 as needed, evacuate/barricade and use the project emergency/rescue plan.
- Do not enter under unstable steel or improvise recovery. A qualified person/engineer develops stabilization and recovery before movement; notify owner/rail/traffic authorities as required.

Training

- Qualified persons provide Subpart R fall-hazard training and special connector, multiple-lift or CDZ training when applicable. Train riggers, signal persons, operators, bolters/welders and aerial/scaffold users to their standards.
- Review the project erection plan and task JHA before work; retrain after change, incident or observed deficiency.

Records

- Maintain erection plans/calculations/revisions, engineering approvals, crane/rigging inspections, qualifications, lift plans, fall/rescue plan, temporary-work inspections, connection/bolt/weld records, briefings, incidents and corrective actions.

Review / Enforcement

- Review before each erection phase and after change/incident. Printed copies are uncontrolled unless formally issued.
- Unauthorized sequence/connection/bracing changes, entering fall zones, releasing unstable members or bypassing fall protection is subject to corrective action.

12. Field Erection Checklist

VERIFY	EXPECTATION
Plan / people	Current erection plan; supervisor, qualified person, operator, rigger and signal person assigned
Member	Erection mark, orientation, verified weight/CG, pick points and condition confirmed
Site / crane	Access, setup, ground/structure, load chart, radius, utilities and inspection acceptable
Rigging	Tagged/inspected, capacity/angles/edge protection compatible; test lift planned
Stability	Sequence, bearings, temporary supports, bracing and release criteria verified
Connections	Required bolts/pins, splice sequence, diaphragms/cross-frames and hold points clear
Fall protection	6-foot company rule; anchorage, leading-edge rating, clearance, access and rescue ready
Drop zone	Load path, fall zone, work below, traffic/rail/public and signals controlled
Environment	Wind/member limit, lightning, visibility, water/current and night lighting acceptable
Hot work / tools	Permit/fire watch, coating assessment, PPE, inspected tools and drop controls ready
Emergency	911/access, fall/water rescue, instability/recovery and authority contacts reviewed
Change / closeout	No unapproved deviation; end-of-shift stable configuration and records complete

PROJECT / LOCATION:	DATE / SHIFT:
MEMBER / ERECTION MARK:	WEIGHT / PICK / CRANE:
ERECTION SUPERVISOR:	RIGGER / SIGNAL PERSON:
CONNECTION / BRACING / RELEASE:	FALL PROTECTION / RESCUE:
CHANGES / STOP CONDITIONS:	APPROVAL / FOLLOW-UP:

13. Test Your Knowledge

Circle the best answer. Review missed questions with your foreman.

1. What must be maintained throughout erection? A. Maximum production speed B. Structural stability C. One open traffic lane	2. When may the crane release a girder? A. After required connections/bracing are installed and verified B. When the girder touches the bearing C. When tag lines are removed
3. What is Pheifer Brothers' fall-protection threshold? A. 15 feet B. 30 feet C. 6 feet	4. Who may change an engineered erection sequence? A. Any connector B. Only through required qualified/engineer approval C. The truck driver
5. What should occur a few inches into a lift? A. Stop and verify balance, rigging and control B. Increase swing speed C. Remove the tag lines	6. Who may be directly under a suspended girder? A. The rigger B. Anyone wearing a hard hat C. No one
7. What controls girder rollover during erection? A. A verbal warning B. The approved sequence, connections and bracing C. Paint markings	8. What is required after signal communication is lost? A. Stop until communication is restored B. Continue slowly C. Sound the horn and swing
9. What should happen if wind exceeds the member/plan limit? A. Add workers to tag lines B. Lower the crane alarm C. Stop and place the load/structure in a safe condition	10. Who may give an emergency stop signal? A. Only the project manager B. Anyone recognizing danger C. Only the crane operator

EMPLOYEE: _____

DATE: _____

ANSWER KEY: 1-B | 2-A | 3-C | 4-B | 5-A | 6-C | 7-B | 8-A | 9-C | 10-B