

**1926.750 Subpart R**

**Steel Erection**

## Subpart R – Steel Erection Final Rule

- The Steel Erection Final Rule was published on January 18, 2001
- Effective date:
  - January 18, 2002
  - Painted surfaces provision - 2006

# Subpart R – Steel Erection Final Rule

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- **Metal Buildings**
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- **(Non-Hoist) Overhead Hazards**
  - §1926.759 Falling Object Protection
- **Fall Protection**
  - §1926.760 Fall Protection (for connectors, deckers, and all others)
- **Training**
  - §1926.761 Training (general and specialized)

## §1926.750 Scope

- The standard covers all employers engaged in steel erection activities



## §1926.750 Scope



## §1926.750 Scope

- There are two lists of activities
  - Primary: All activities in .750(b)(1) are covered (connecting, bracing, guying...)
  - Ancillary: All listed in .750(b)(2) are covered “*when they occur during and are a part of steel erection activities*”  
(sealing, caulking, elevator beams...)

## Scope (cont.)

### Does not include:

- Electrical transmission towers,
- communication and broadcast towers,
- Tanks



Ironworker using rope grabs to make tower connection.

# §1926.750 (c) Specific Controlling Contractor Duties

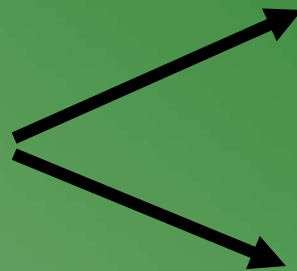
- **Written notification to the steel erector:**
  - Concrete in piers/walls is cured re: ASTM spec
  - Anchor bolt modifications/repairs approved by project engineer (.752(a) and .755(b))



# §1926.750(c) Specific Controlling Contractor Duties

- Adequate on-site access roads [.752(c)]

Before and after photos



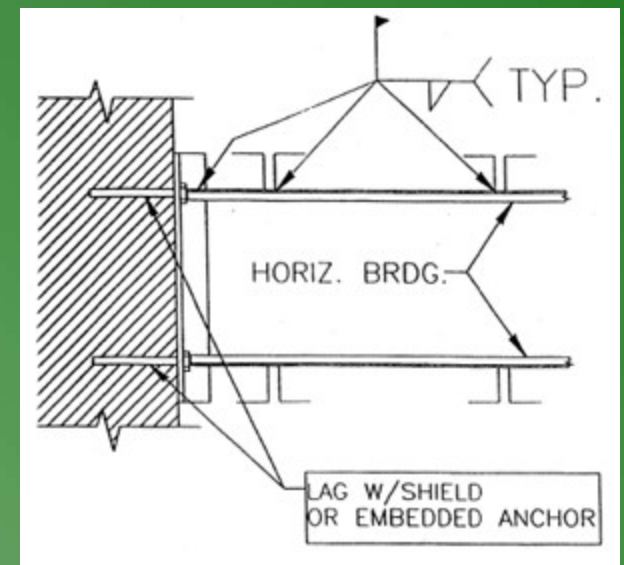
## §1926.750(c) Specific Controlling Contractor Duties

- Preclude work below steel erection unless there is overhead protection [.759(b)]
- Choose whether to accept responsibility for maintaining fall protection equipment left by erector (otherwise it must be removed) [.760(e)]

## Definitions

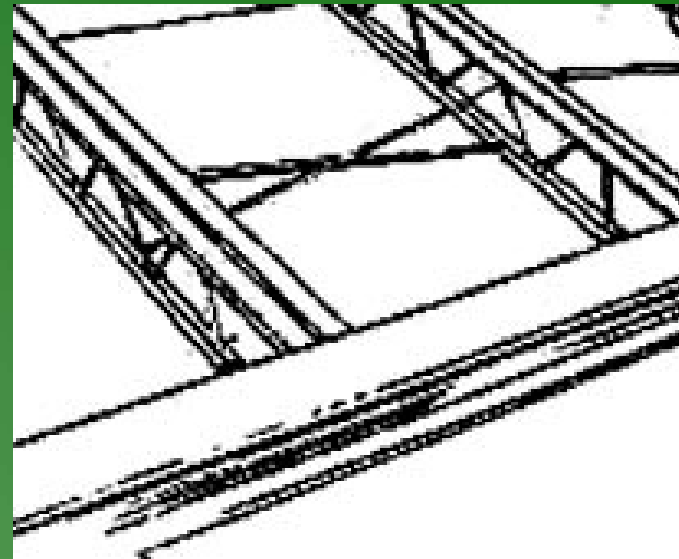
- Anchored bridging means that the steel joist bridging is connected to a bridging terminus point.
- Bridging terminus point means a wall, a beam, tandem joists (with all bridging installed and a horizontal truss in the plane of the top chord) or other element at an end or intermediate point(s) of a line of bridging that provides an anchor point for the steel joist bridging.

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# Definitions

- Bolted diagonal bridging means diagonal bridging that is bolted to a steel joist or joists.



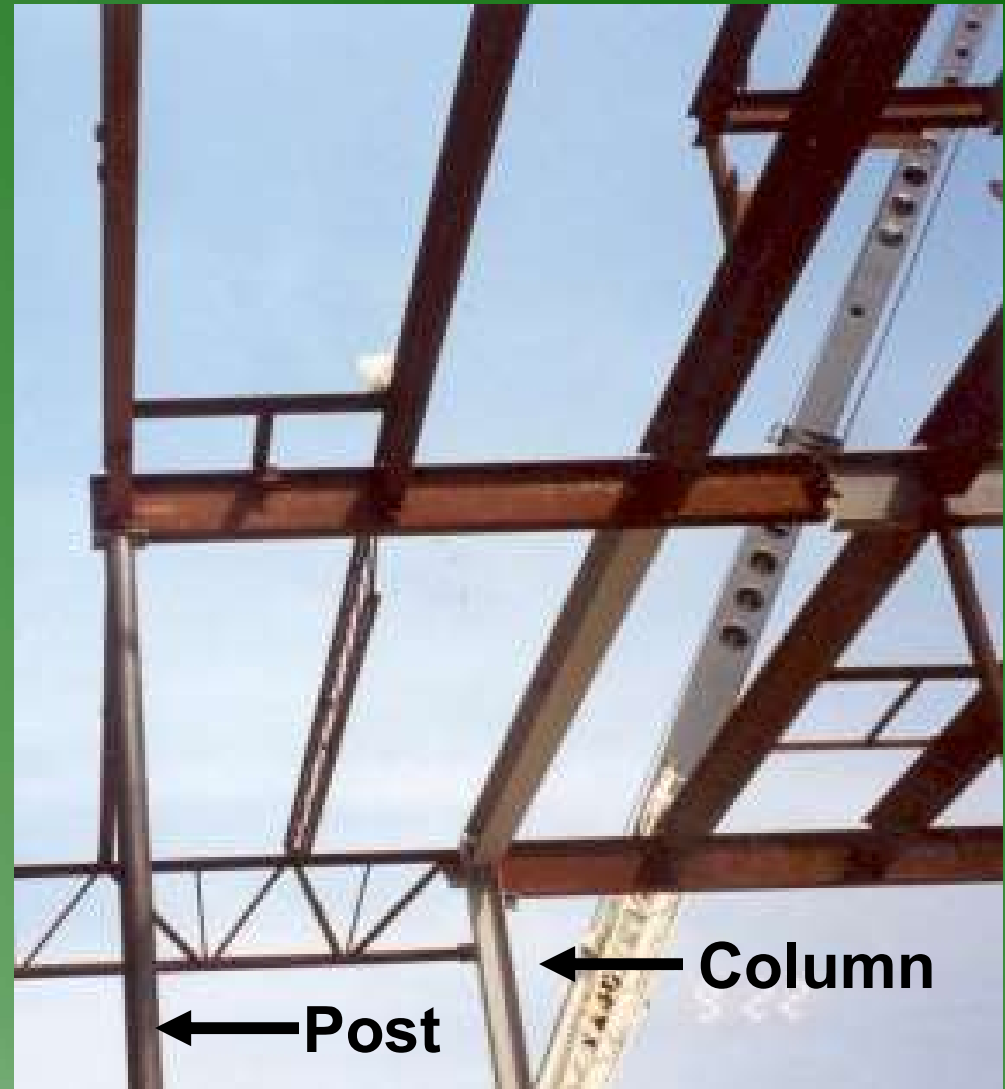
# Definitions

- Choker means a wire rope or synthetic fiber rigging assembly that is used to attach a load to a hoisting device.



# Definitions

- Column means a load-carrying vertical member that is part of the primary skeletal framing system. Columns do not include posts.



# Definitions

- Connector means an employee who, working with hoisting equipment, is placing and connecting structural members and/or components.



## Definitions

- Controlled Decking Zone (CDZ) means an area in which work may take place without the use of guardrail systems, personal fall arrest systems, fall restraint systems, or safety net systems and where access to the zone is controlled.





# §1926.752 Site Layout, Erection Plan and Construction Sequence

- Approval to begin steel erection
- Before steel erection begins, controlling contractor provides steel erector with **written notifications**:
  - Concrete in footings, walls is 75% ASTM cured



# §1926.752 Site Layout, Erection Plan and Construction Sequence

- Steel erection contractor does not begin until he has received notification from the controlling contractor



# §1926.752 Site Layout, Erection Plan and Construction Sequence

- **Site layout.** The controlling contractor shall ensure that the following is provided and maintained:
  - Adequate access roads
  - A firm properly graded area



# §1926.752 Site Layout, Erection Plan and Construction Sequence

- Pre-planning of overhead hoisting operations
- Site-specific erection plan (Appendix A)



# §1926.753 Hoisting and Rigging

- Pre-shift visual inspection of cranes:
  - All controls and drive mechanism
  - Safety devices and pressurized lines



## §1926.753 Hoisting and Rigging

- Hooks & wire ropes
- Electrical
- Tires
- Ground conditions



## §1926.753 Hoisting and Rigging

- Hoisting equipment removed from service until hazards are corrected.
- Crane operator has final call
- “Qualified rigger” inspects rigging prior to each shift
- Cannot ride the ball



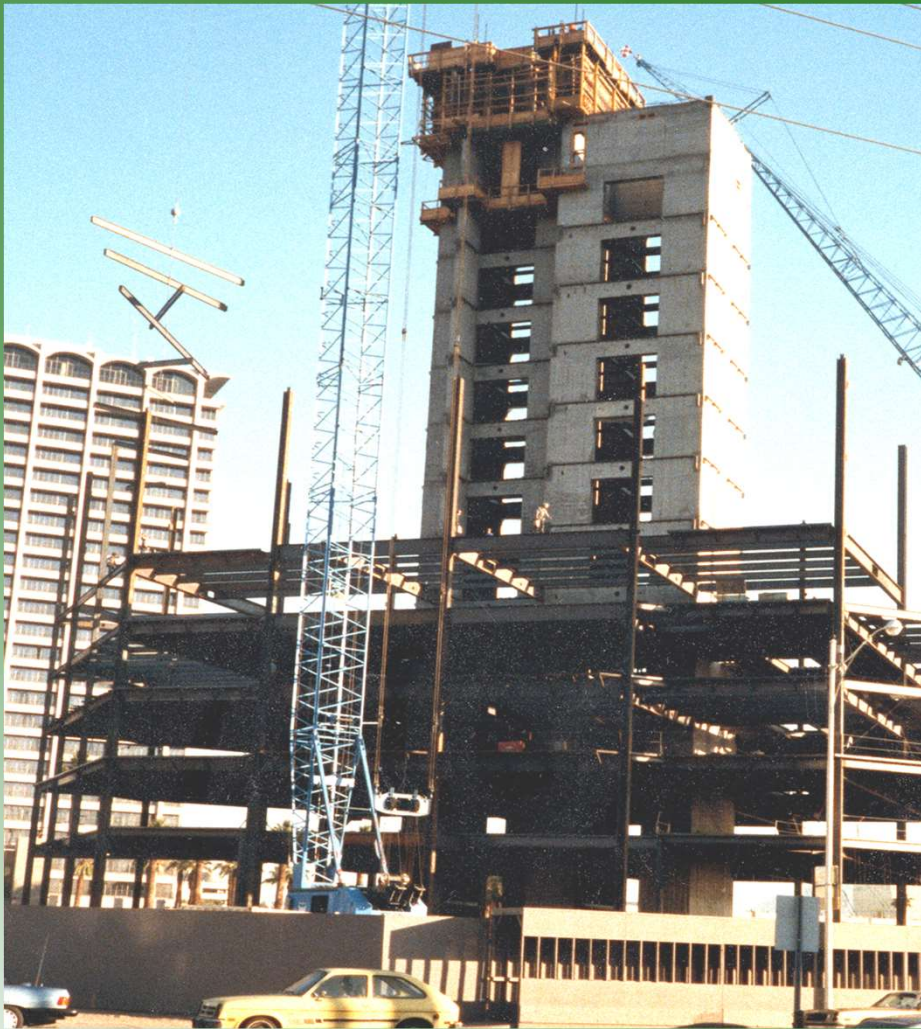
## §1926.753 Hoisting and Rigging

- Only connectors and riggers allowed under loads & loads rigged to prevent unintentional displacement
- All loads rigged by qualified rigger





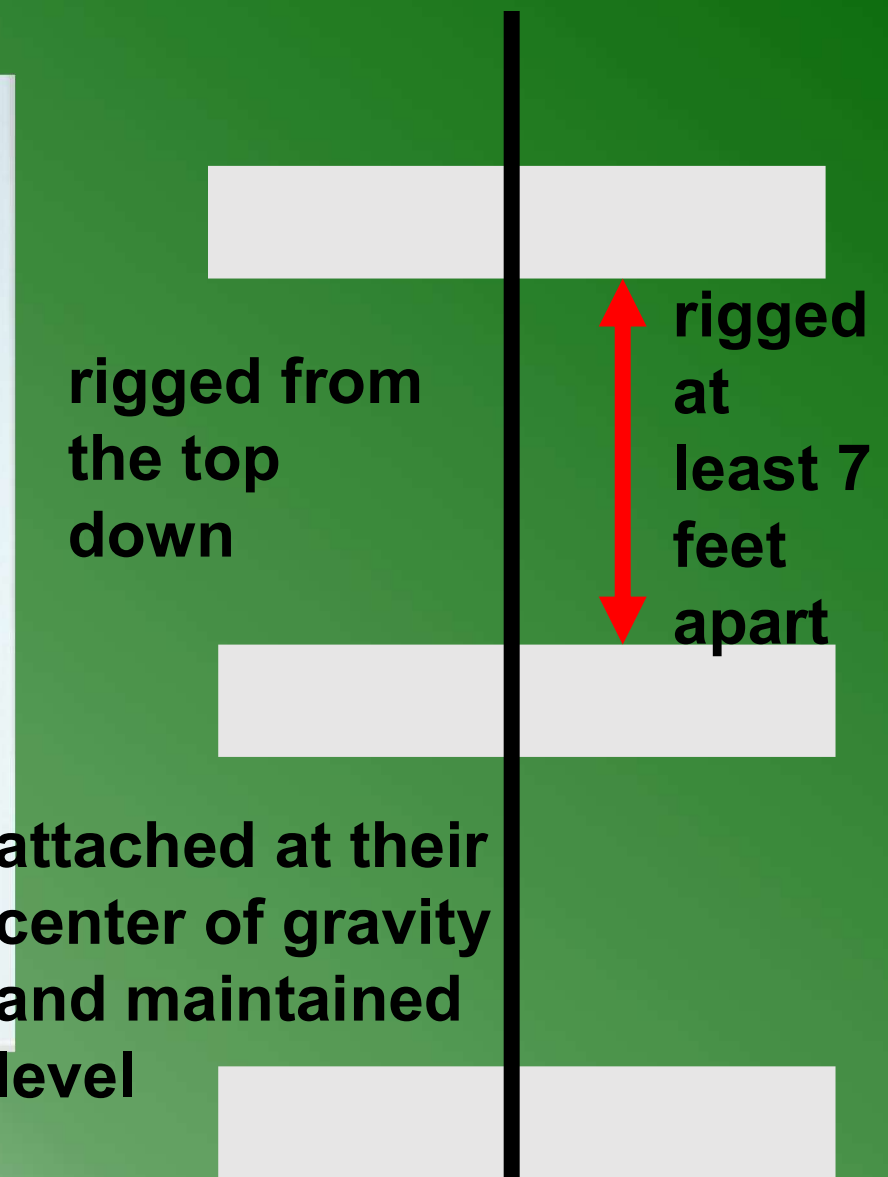
## §1926.753 Hoisting and Rigging



- Prescribes proper procedure for multiple (lifts “christmas-treeing” “multiple lift rigging procedure)
- Maximum of 5 pieces
- Only similar type lifted (no decking bundles)

## §1926.753 Hoisting and Rigging

- Employees trained in procedure
- Multiple lift assembly used is that manufactured by a wire rope rigging supplier
- Crane manufacturer does not prohibit it [1926.760 (e)(1)]



The diagram shows a vertical black line representing a cable or hoist. Three horizontal grey bars represent levels. The top level is connected to the cable. A red double-headed arrow indicates a distance of at least 7 feet between the top and middle levels. The text 'rigged from the top down' is positioned to the left of the top level.

rigged from the top down

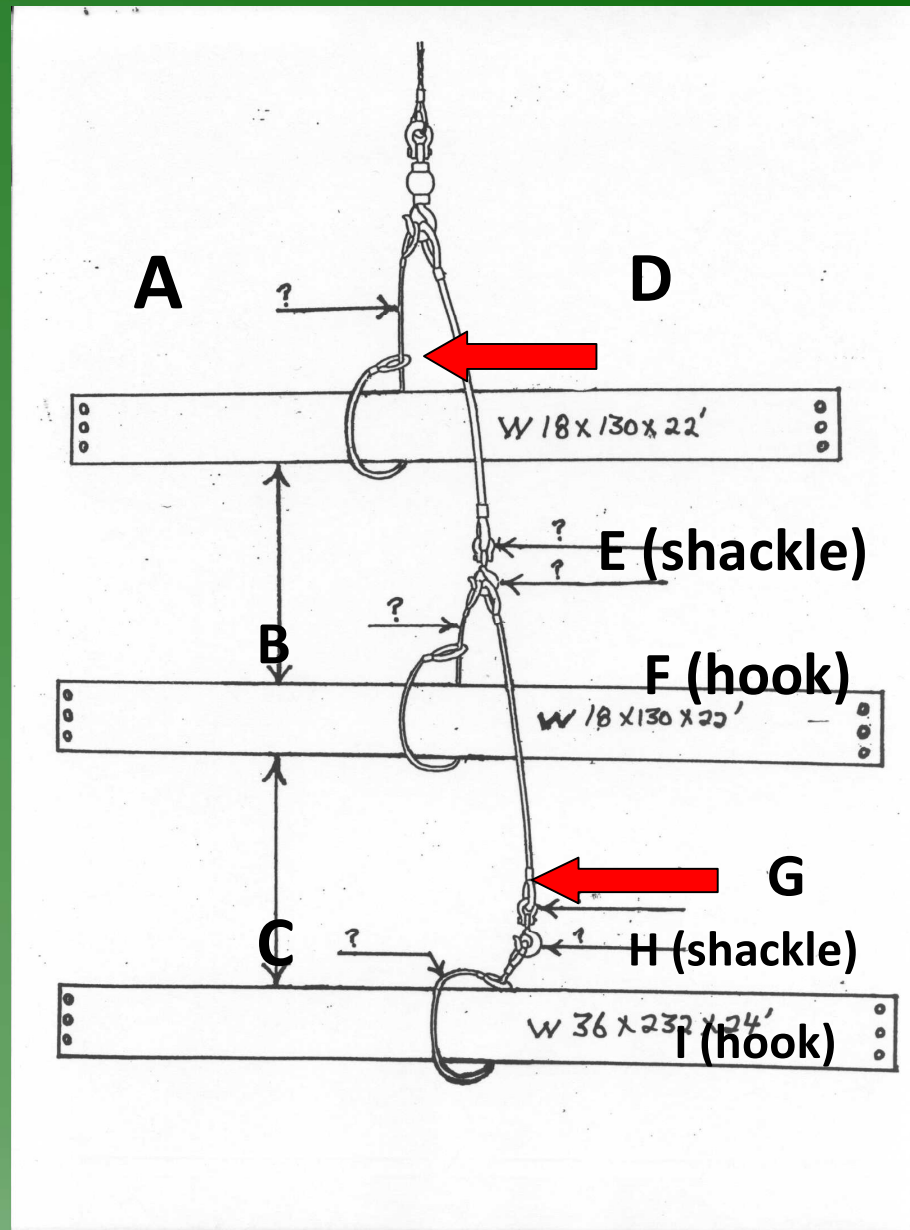
rigged at least 7 feet apart

attached at their center of gravity and maintained level

# Typical Multiple Lift Rigging Assembly

What do you need  
to know?

- How much does each piece weigh?
- What size slings?
- What size and type of hooks?
- What size of shackles?



# §1926.754 Structural Steel Assembly

- 8 Floors max.. between erection floor & uppermost permanent floor.
- Max 4 floors unfinished bolting
- Fully decked or nets within two floors or 30 feet under erection work





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▪ **Structural Stability**

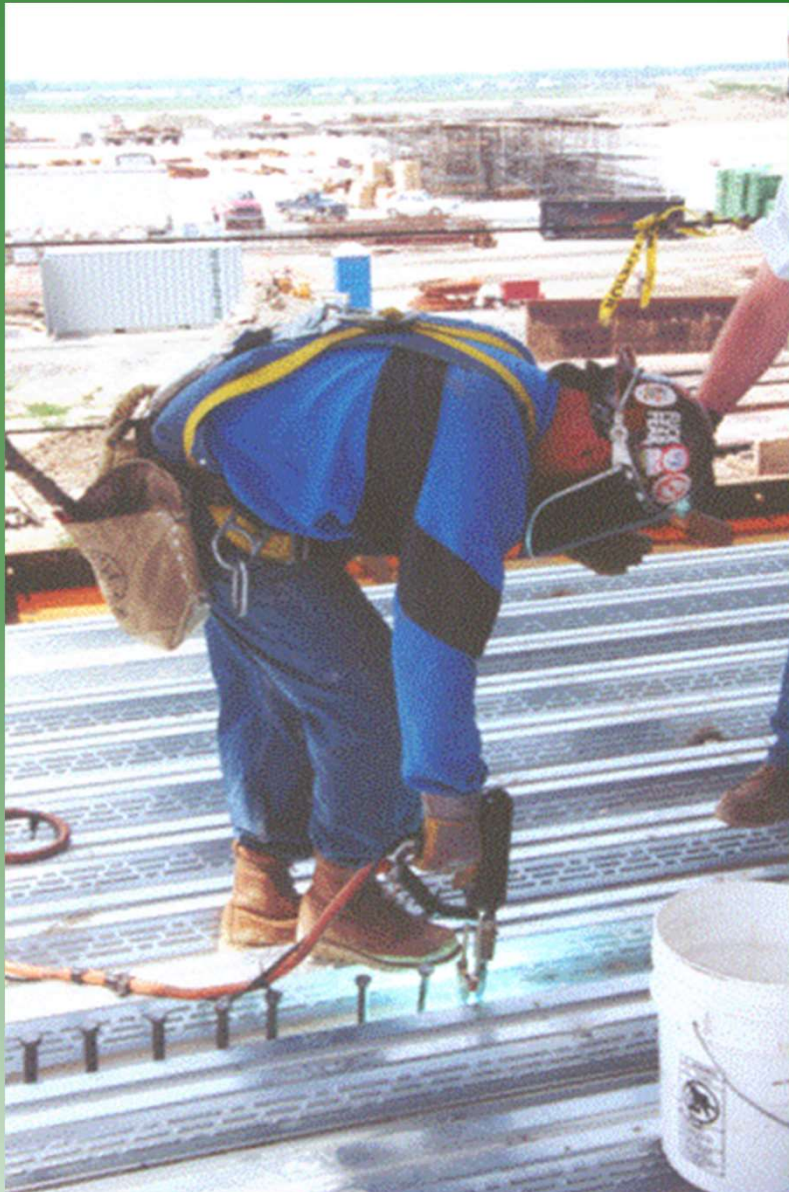
▪ **Criteria for tiered buildings unless structural integrity is maintained as a result of design.**

<b>Erection Floor</b>	<b>8th</b>
	<b>7th</b>
<b>Fully Planked or Netted</b>	<b>6th</b>
	<b>5th</b>
<b>Fully bolted and Welded</b>	<b>4st</b>
	<b>3d</b>
	<b>2d</b>
<b>Permanent Floor/Concrete</b>	<b>1st</b>

## §1926.754 Structural Steel Assembly

- Metal deck openings turned down
- Holes cut immediately prior to filling
- No shear connectors on beams until walking surface installed



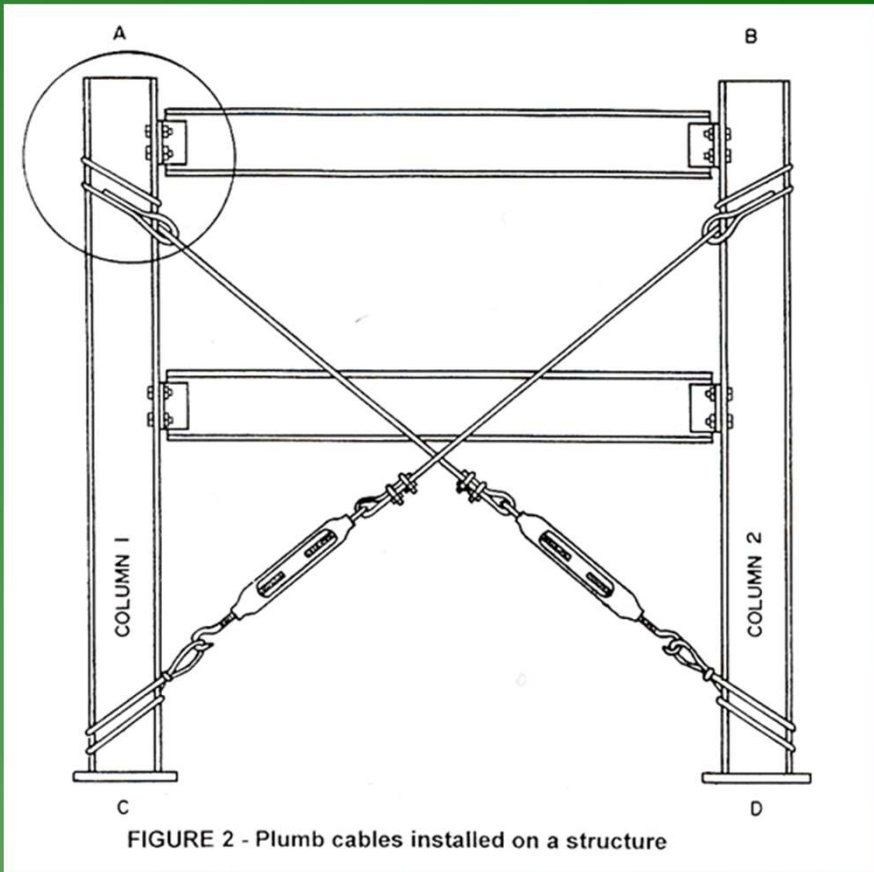


Shear connectors installed **after** decking has been installed



# §1926.754 Structural Steel Assembly

- Plumbing up to ensure stability of structure
- Installed **before** constructions are placed on structure
- Removed only with approval of competent person



## §1926.754 Structural Steel Assembly

- No hoisting using bundle straps or bands
- Loose items secured
- Land decking joists according to 757(e)(4)
- Secure at end of shift if necessary



## §1926.754 Structural Steel Assembly

- Holes covered
- Covers secured
- Twice anticipated load
- Marked 'Cover' or 'Hole'



**No secured, nor marked to indicate the opening.**

## §1926.754 Structural Steel Assembly

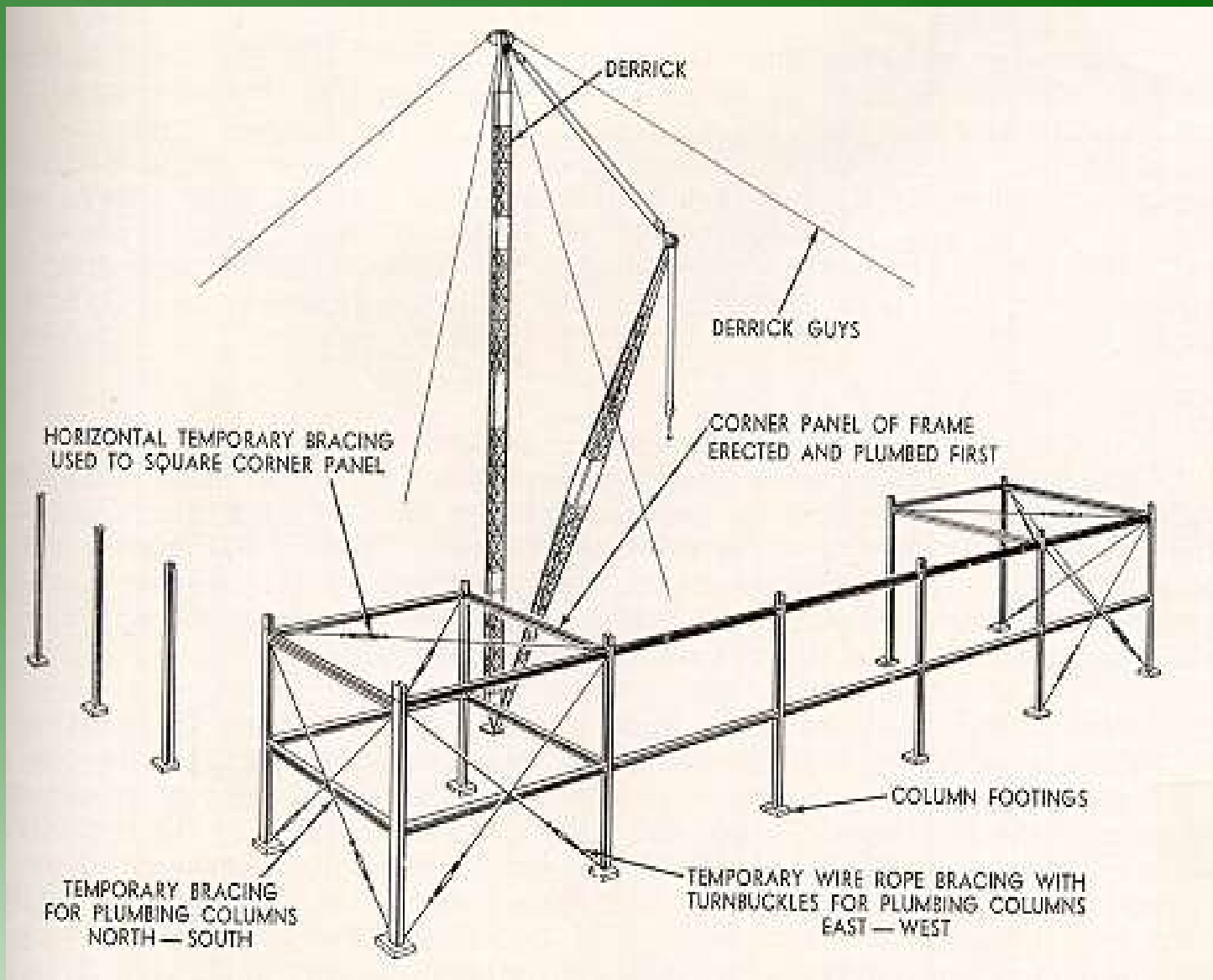
- Smoke dome or skylight fixtures that have been installed, are not considered covers unless they meet the strength requirements
- Decking holes around columns protected



# §1926.754 Structural Steel Assembly

- Decking laid tight and immediately secured
- Placed for full structural support
- Derrick floors fully planked & bolted





# §1926.755 Column Anchorage

- 4 anchor bolts per column
- Withstand 300 lb. eccentric gravity load from 18 inches at column top



## §1926.755 Column Anchorage



- Columns set on floors, plates, or packs adequate to transfer construction loads
- Evaluated by CP to determine if bracing is needed





## §1926.755 Column Anchorage

- Structural engineer of record must approve any repair or modifications to anchor rods
- Written notification from CC prior to column erection for any repair or modification



## §1926.756 Beams and Columns

- Two bolts per connection prior to releasing hoisting line
- Solid web members for diagonal bracing one bolt wrench tight min



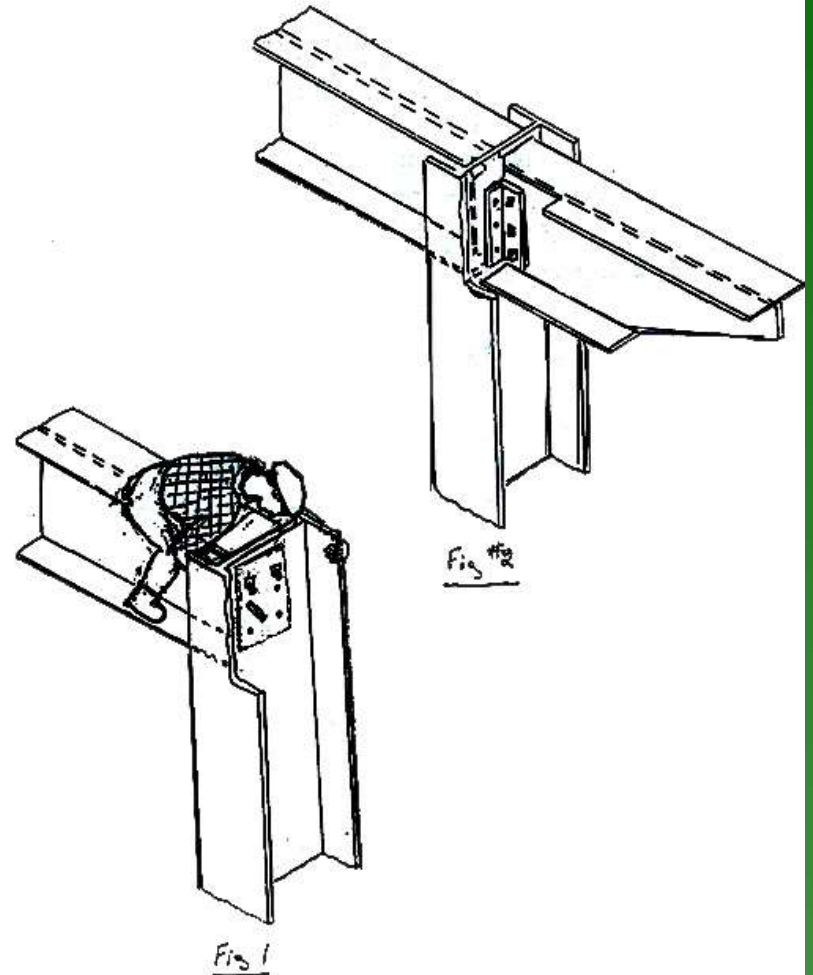
## §1926.756 Beams and Columns

- Requires one bolt to remain connected for double connections unless seat or equivalent used
- Seats for double connections shall be designed for the load during the double connection process



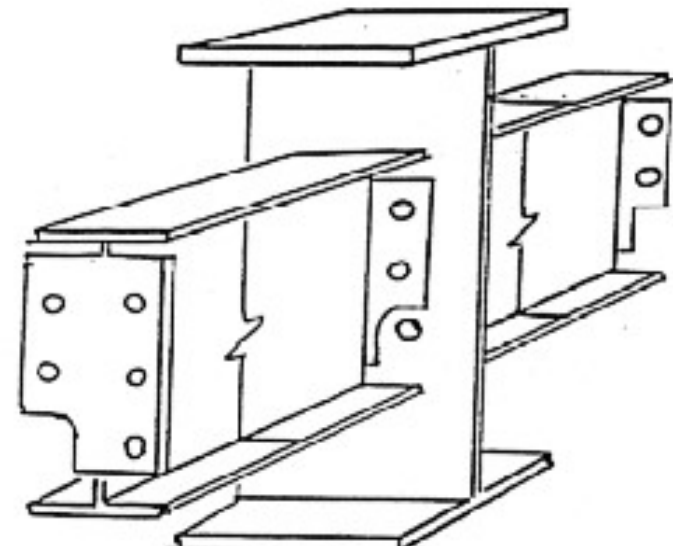
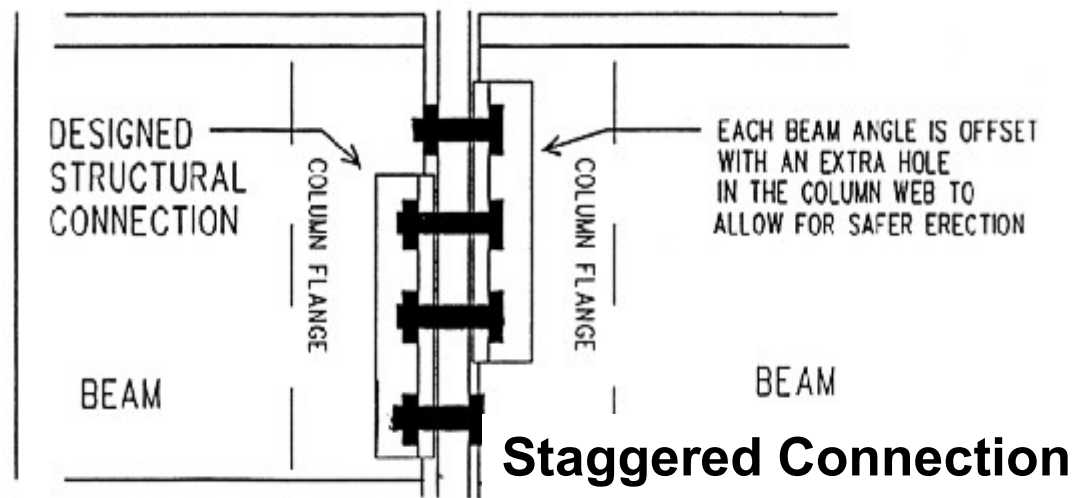
## §1926.756 Beams and Columns

- In order to make the “double connection”:
- The connector has to back out the bolts
- hold the beam in place with a spud wrench (fig. 1)
- When second beam arrives, align and hold it with a spud wrench
- Push bolts back through first beam into second beam and secure in place.



## §1926.756 Beams and Columns

- Double connections at columns and/or at beam webs over a column: At least one bolt or similar connection device must be present (e.g., a beam seat, etc..)



**Clipped Connection**

## §1926.756 Beams and Columns

- Requirements to facilitate quick installation of perimeter safety cables:
  - Perimeter columns extend 48 inches
  - Have holes at 42 to 45 for perimeter cable installation



Column  
splices to  
withstand  
300 lb.  
force from  
18 inches



## §1926.757 Open Web Steel Joists

- Joists field bolted at columns unless columns framed in at least two directions
- Vertical stabilizer plate provided on each column for joists





## §1926.757 Open Web Steel Joists

- Hoisting cables not be released until joist is field bolted.
- A vertical stabilizer plate required for each column for steel joists.



- Joist placement not at a column:
  - Alternate means used to stabilize joists on both sides of the column
  - Erection procedures designed by qualified person
  - Provides for joist stability
  - Shop installed connections
  - On erection drawings
  - Hoisting cables not released until both ends bolted and joist is stabilized





Steel joists at or near columns, span 60 feet or less, joist designed with sufficient strength to allow one employee to release the hoisting cable without the need for erection bridging.



Steel joists at or near columns span more than 60 feet joists set in tandem with all bridging installed

A steel joist or steel joist girder shall not be placed on any support structure unless such structure is stabilized.

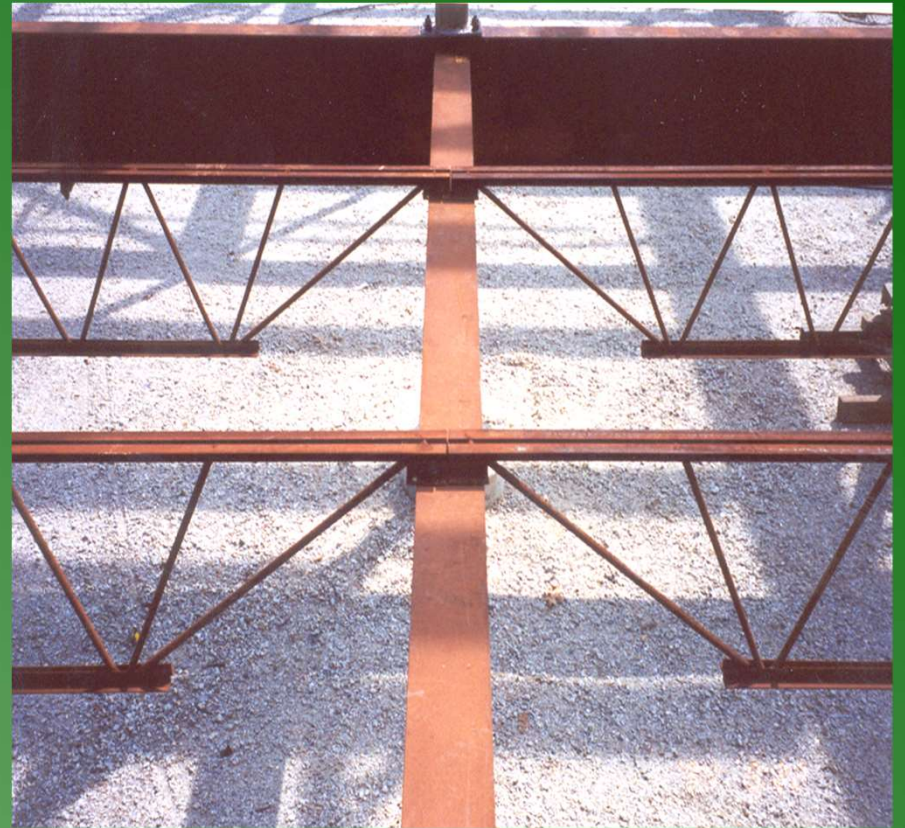


## §1926.757 Open Web Steel Joists

- Except for steel joists that have been assembled into panels, connections of individual steel joists to steel structures in bays 40 feet or more shall be fabricated to allow for field bolting during erection.

[1926.757(8)(i)]

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## §1926.757 Open Web Steel Joists



On steel joists that do not require erection bridging under Tables A and B, only one employee shall be allowed on the joist until all bridging is installed and anchored.



Steel joists and steel joist girders shall not be used as anchorage points for a fall arrest system unless written approval to do so is obtained from a qualified person.



## §1926.758 Systems-Engineered Metal Buildings

Rigid frames shall have 50% of their bolts or the number specified by manufacturer installed and tightened on both sides of the web adjacent to each flange before hoisting equipment is released.



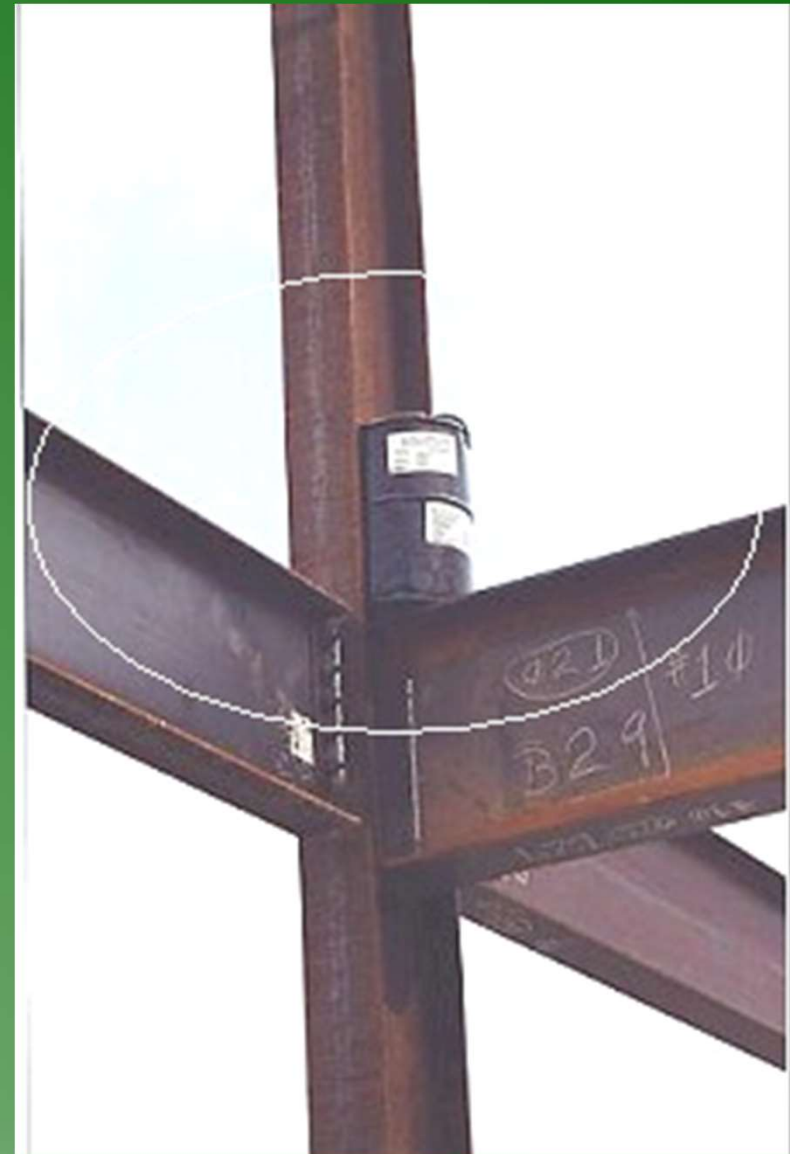
## §1926.758 Systems-Engineered Metal Buildings

- Construction loads shall not be placed on any structural steel framework unless such framework is safely bolted, welded or otherwise adequately secured.



## §1926.759 Falling Object Protection

- Secure loose items aloft
- Controlling contractor to bar operations below steel erection unless falling object protection provided (***from objects other than hoisted materials***)



## §1926.760 Fall Protection

- All must be protected at heights greater than 2 stories or 30 feet, including connectors and deckers.



## §1926.760 Fall Protection (cont.)

- Perimeter cables required as soon as decking is installed



## §1926.760 Fall Protection (cont.)

- Between 15 and 30 feet:  
Fall protection required for all with exceptions for:
  - Deckers in controlled decking zone (CDZ) and
  - Connectors
  - Connectors must be provided and wear equipment necessary to be able to be tied-off, or to be provided with other means of fall protection



## §1926.760 Fall Protection (cont.)

- Controlled Decking Zone (CDZ). A controlled decking zone may be established in that area of the structure over 15 and up to 30 feet above a lower level



## §1926.760 Fall Protection (cont.)

CDZ shall not be more than 90 feet wide and 90 feet deep from any leading edge.

CDZ marked by the use of control lines



Unsecured decking in a CDZ 3,000 square feet max..





## §1926.760 Fall Protection (cont.)

- Guardrail systems and safety net systems must meet 1926.502 criteria.



Guardrails and nets used at opening in back.

Note: ladder not long enough

# §1926.760 Fall Protection (cont.)

## Custody of Fall Protection Equipment

- Controlling contractor must choose to either:
- Accept responsibility for maintaining all protection equipment left by erector,
- OR ensure that it is removed [.760(e)]



## §1926.761 Training

- Qualified person to train workers in use & operation of fall protection equipment
- Qualified person to train workers engaged in specific activities:
  - “christmas-treeing”
  - connecting
  - CDZ procedures



## OSHA's Web Site

- The complete standard can be obtained from the web site at [www.osha.gov](http://www.osha.gov).

