

# OSHA Steel Erection Standard



The Current standard consist of the following sections:

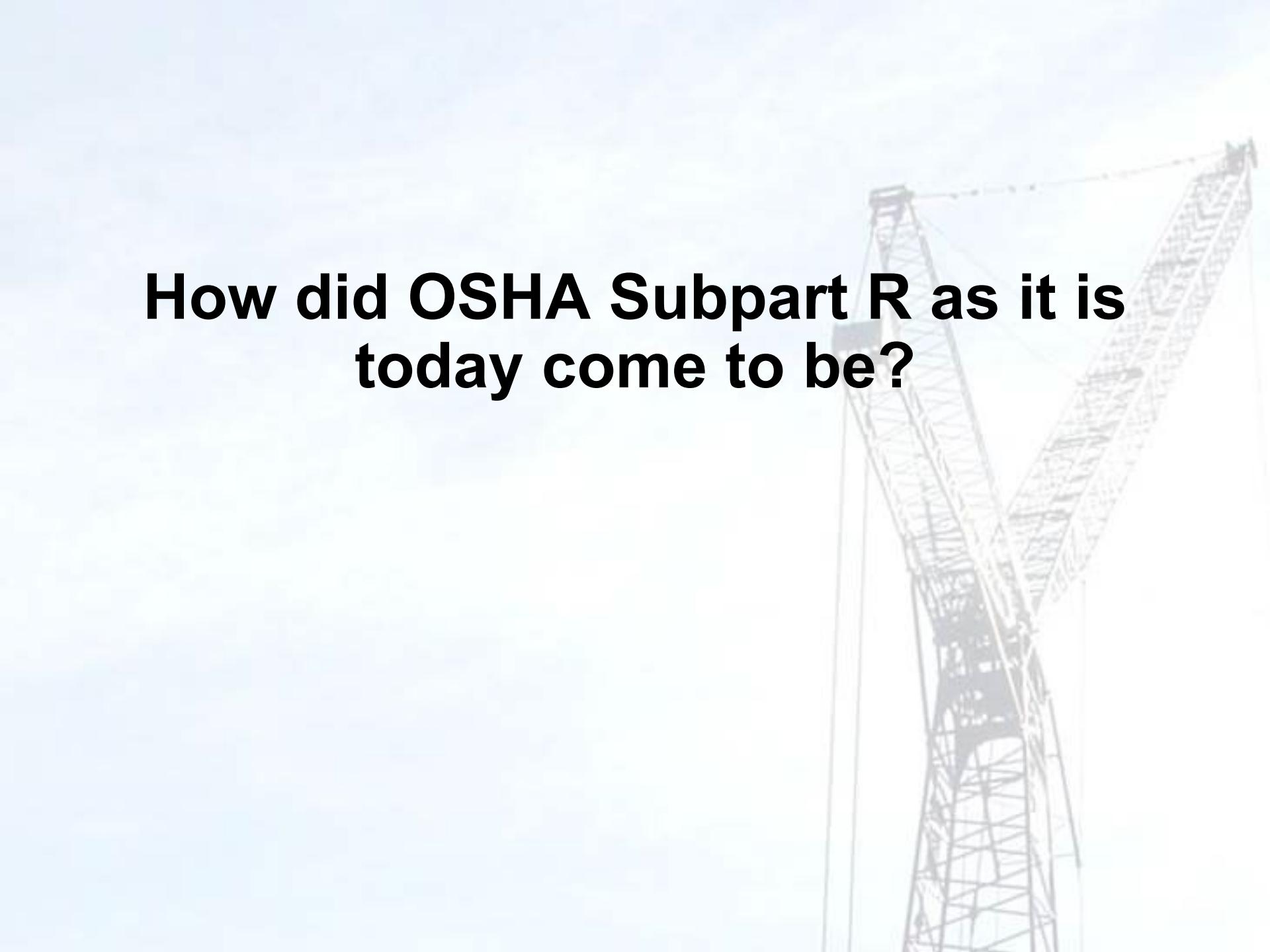
- 1926.750 – Scope
- 1926.751 – Definitions
- 1926.752 -- Site layout, site specific- erection plan & construction sequence
- 1926.753 -- Hoisting & Rigging
- 1926.754 -- Structural Steel Assembly
- 1926.755 – Column Anchorage
- 1926.756- Beams & Columns
- 1926.757- Open Web Steel Joists
- 1926.758- System Engineered Metal Buildings
- 1926.759- Falling Object Protection
- 1926.760- Fall Protection
- 1926.761- Training

# Appendices to the Standard

- **Appendix A** - Guidelines for establishing the components of a site specific erection plan: Non-Mandatory Guidelines for Complying with 1926.752(e)
- **Appendix B** - Acceptable test methods for testing slip-resistance of walking /working surfaces: Non-Mandatory guidelines for complying with 1926.754 © (3)
- **Appendix C** - Illustrations of bridging terminus points: Non-Mandatory guidelines for complying with 1926.757 (a) (10) and 1926.757 © (5)
- **Appendix D** - Illustrations of the use of Controlled Decking Zones (CDZ's): Non-Mandatory guidelines for complying with 1926.760©(3)

# Appendices to the Standard ... Continued

- **Appendix E** - Training: Non-Mandatory Guidelines for complying with 1926.761
- **Appendix F** - Perimeter Columns: Non-Mandatory Guidelines for complying with 1926.756(e) to Protect the Unprotected side or Edge of a Walking/Working Surface
- **Appendix G** - Fall Protection systems criteria and practices from 1926.502:Non-Mandatory Guidelines for complying with 1926.760(d)
- **Appendix H** - Double connections: Illustration of a clipped end connection and a staggered connection: Non-Mandatory Guideline for complying with 1926.756©(1)

A faint, grayscale background image of a construction crane's lattice-boom arm extending diagonally across the frame. The crane is positioned on the right side of the slide.

# How did OSHA Subpart R as it is today come to be?

SENRAC

or

Steel Erection Negotiated  
Rulemaking Committee

# **S**teel **E**rection **N**egotiated **R**ulemaking **A**dvisory **C**Committee

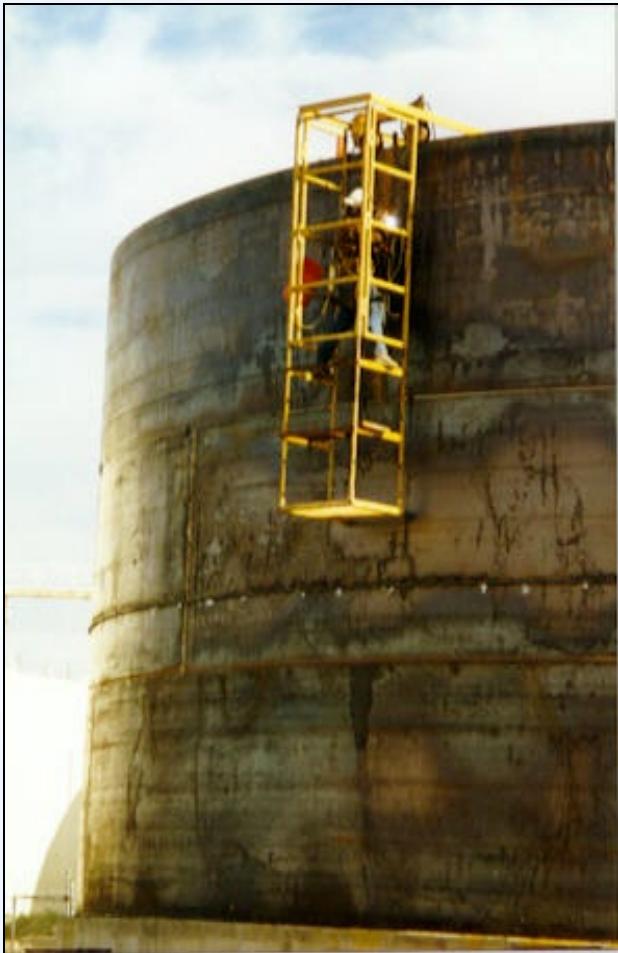
Was the first “negotiated” OSHA Safety Standard since the formation of  
OSHA in 1970

... a brief history of this process

A faint, grayscale background image of a construction crane, showing its lattice boom and counterbalance arm extending upwards and to the right.

**Lets get started reviewing Subpart R**

# Does NOT Apply To ...!



- ELECTRICAL TRANSMISSION TOWERS
- COMMUNICATION AND BROADCAST TOWERS
- TANKS



1926.750 Scope

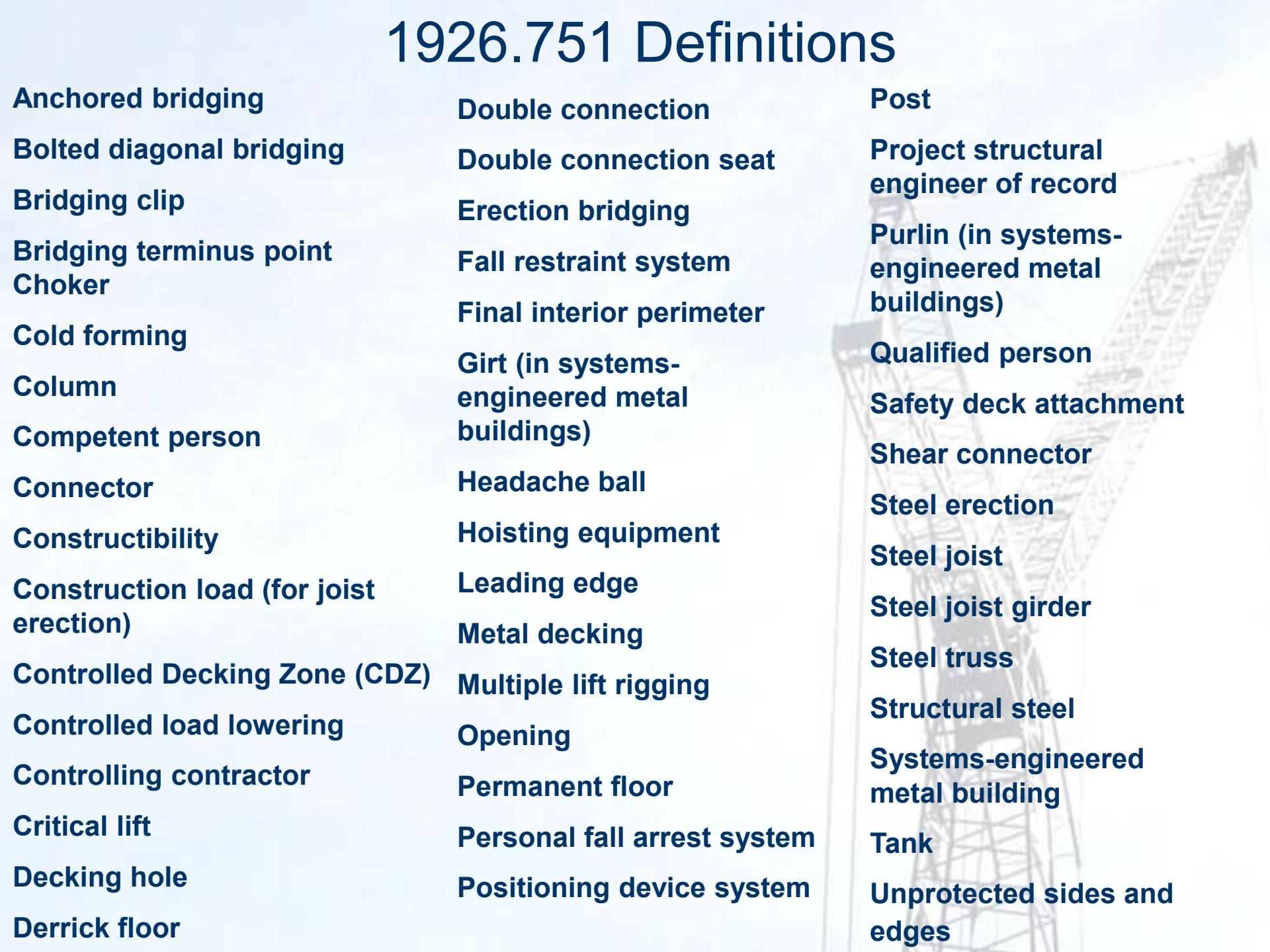
# Precast Concrete Erection is Excluded from Subpart R





**Reinforcing  
Steel  
Installation  
is Excluded  
from  
Subpart R**

# 1926.751 Definitions



|  |  |  |
|--|--|--|
| Anchored bridging                      | Double connection                            | Post   |
| Bolted diagonal bridging               | Double connection seat                       | Project structural engineer of record          |
| Bridging clip                          | Erection bridging                            | Purlin (in systems-engineered metal buildings) |
| Bridging terminus point                | Fall restraint system                        | Qualified person                               |
| Choker                                 | Final interior perimeter                     | Safety deck attachment                         |
| Cold forming                           | Girt (in systems-engineered metal buildings) | Shear connector                                |
| Column                                 | Headache ball                                | Steel erection                                 |
| Competent person                       | Hoisting equipment                           | Steel joist                                    |
| Connector                              | Leading edge                                 | Steel joist girder                             |
| Constructibility                       | Metal decking                                | Steel truss                                    |
| Construction load (for joist erection) | Multiple lift rigging                        | Structural steel                               |
| Controlled Decking Zone (CDZ)          | Opening                                      | Systems-engineered metal building              |
| Controlled load lowering               | Permanent floor                              | Tank   |
| Controlling contractor                 | Personal fall arrest system                  | Unprotected sides and edges                    |
| Critical lift                          | Positioning device system                    |  |
| Decking hole                           |  |  |
| Derrick floor                          |  |  |

## 1926.751 ... a few of the definitions

- **Competent person** (also defined in §1926.32) means one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

## 1926.751 ... a few of the definitions

- Constructibility means the ability to erect structural steel members in accordance with subpart R without having to alter the over-all structural design.
- Controlled Decking Zone (CDZ) means an area in which certain work (for example, initial installation and placement of metal decking) 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.

## 1926.751 ... a few of the definitions

- Controlling contractor means a prime contractor, general contractor, construction manager or any other legal entity which has the overall responsibility for the construction of the project -- its planning, quality and completion.
- Qualified person (also defined in §1926.32)  
....described in detail later

## 1926.751 ... a few of the definitions

- Steel Erection means the construction, alteration or repair of steel buildings, bridges and other structures, including the installation of metal decking and all planking used during the process of erection.

# Important issues for Controlling Contractors to consider when implementing Subpart R

## 1926.752 Site layout, Site Specific Erection Plan and Construction Sequencing.

### (a) Approval to begin Steel Erection:

The Controlling Contractor shall ensure that the Erector is provided with written notification that:

- (1) Concrete or mortar in footings, piers, walls or in masonry piers and walls has attained 75% of minimum design strength or sufficient strength to support the loads imposed during steel erection

## 1926.752 Site layout, Site Specific Erection Plan and Construction Sequence ... continued

- and (2) Any repairs, replacement and /or modification of Anchor bolts were conducted in accordance with 1926.755(b).

### 1926.752(b) Commencement of Steel Erection.

- A Steel Erection Contractor shall not erect steel unless it has received written notification that all concrete and or mortar in footers, piers, walls or masonry piers has reached 75% of design strength to support the loads imposed during steel erection.

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## 1926.752 Site Layout, Site Specific Erection Plan and Construction Sequence, ... continued

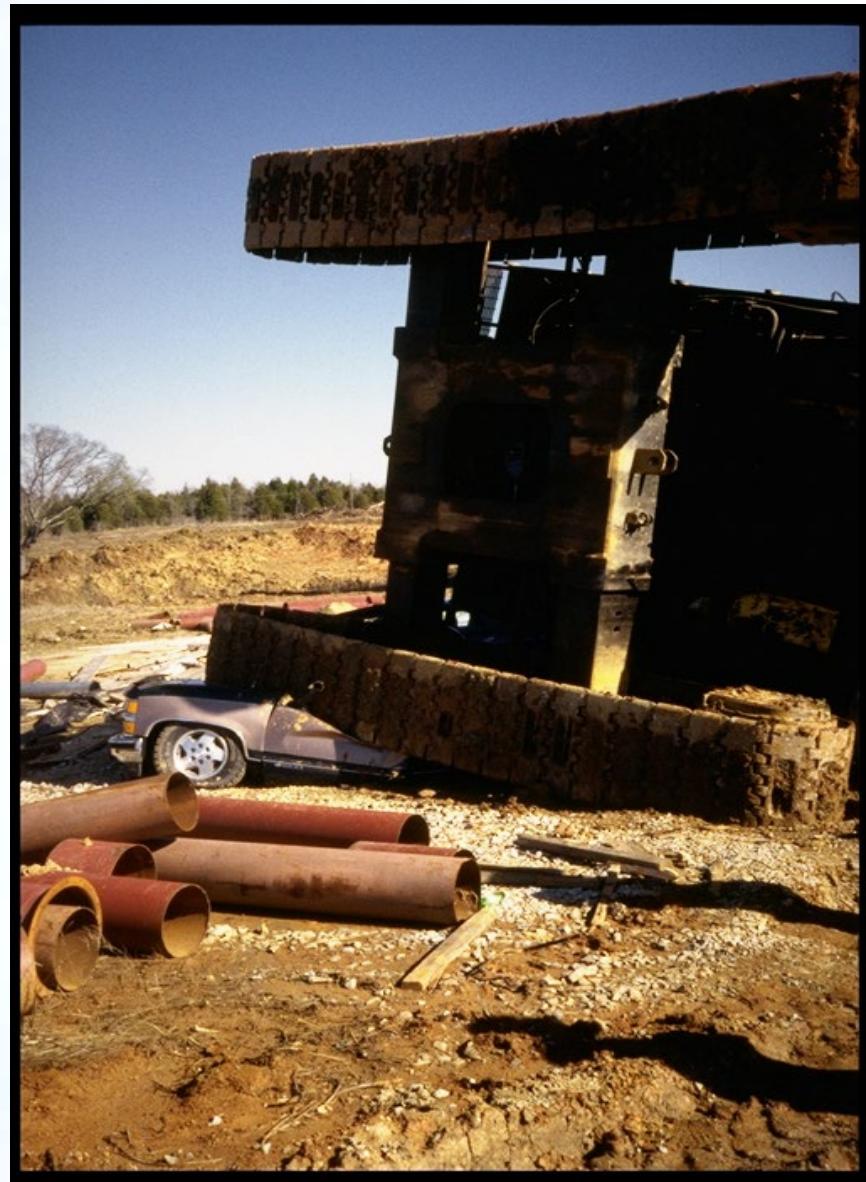
### 1926.752 Site Layout

The Controlling contractor shall ensure that the following is provided and maintained:

## 1926.752 (c) Site Layout ...continued

- Adequate access roads into and through the site for the safe delivery and movement of derricks, cranes, trucks, and the material to be erected and means and methods for pedestrian and vehicular control.

DOES NOT APPLY TO ROADS  
OUTSIDE OF THE SITE



# Site Layout

The controlling contractor shall provide and maintain:

- Adequate access roads





## 1926.752 Site Layout cont.

- (2) A firm, properly graded, drained area, readily accessible to the work with adequate space for the safe storage of materials and the safe operation of the erectors equipment.







## 1926.752 (d) Pre-planning of overhead hoisting operations.

- All hoisting operations in steel erection shall be pre-planned to ensure that the requirements of 1926.753(d) are met.

( ... we'll discuss  
1926.753(d) later ! )



## 1926.752(e) Site-specific erection plan

A Site specific Erection plan is not mandatory unless an employer chooses to use the site specific plan as a vehicle for providing equivalent protection when one of the following erection situations exist

- (1) A safety latch on a hook is intentionally deactivated for the purposes of erecting single joist or purlins

## 1926.752(e) Site-Specific Erection Plans ... continued

- or (2) to document an alternative method of erection that provides equivalent stability for erecting steel joist 60' or longer that are not erected in tandem with all bridging installed as required
  
- or (3) when documenting that a qualified person has determined that a structure or portion of a structure is capable of supporting deck bundles on joist that have not had erection bridging installed.

## When a Site - Specific Erection Plan is used, it should address the following elements:

- The sequence of erection activity including delivery, staging, storage and coordination with other trades.
- Description of erection activities and procedures including any anchor bolt repair, replacement or modifications and the erection or installation of columns, beams, joists and purlins, connections, decking, bracing and guying requirements, erection bridging terminus points and any ornamental or miscellaneous.

# Site-specific erection plan

- A description of fall protection procedures.
- Crane selection and placement procedures including site preparation, paths for overhead loads and critical lift information.
- Falling object protection.
- A description of special procedures for hazardous non-routine tasks.
- Certification of training.
- Listing of qualified and competent persons.
- Rescue procedures.

# 1926.753 Hoisting and Rigging



# 1926.753 Hoisting and Rigging

The standard allows for more liberal use of a crane suspended man-basket for hoisting of personnel in Steel Erection

1926.753(a) All the provisions of subpart CC apply to hoisting and rigging with the exception of 1926.1431(a).

1926.1400 is the New OSHA Crane and Derricks in Construction standards.

## 1926.1431(a)

1926.1431(a) states: The use of equipment to hoist employees is prohibited except where the employer demonstrates that the erection, use, and dismantling of conventional means of reaching the work area, such as a personnel hoist, ladder, stairway, aerial lift, elevating work platform or scaffold, would be more hazardous, or is not possible because of project's structural design or worksite conditions. This paragraph does not apply to work covered by subpart R (Steel Erection) of this part.

# 1926.753 Hoisting and Rigging

- 1926.753 (C) (1) (i) Crane being used in steel erection activities shall be visually inspected prior to each shift by a competent person: the inspection shall include observations for deficiencies during operation.
- 1926.753 (c ) (iv) the operator shall be responsible for those operations under the operator's direct control. Whenever there is any doubt as to safety, the operator shall have the authority to stop and refuse to handle loads until safety has been assured.
- 1926.753 (c ) (2) A qualified rigger (a rigger who is also a qualified person) shall inspect the rigging prior to each shift in accordance with 1926.251.

# 1926.753 Hoisting and Rigging ...continued

1926.753 (c)(5) Safety latches on hooks shall not be made inoperable except:

When a “qualified rigger” has determined that the hoisting and placing of purlins and single joist can be performed more safely by doing so; or

When equivalent protection is provided in a site-specific erection plan.



# 1926.32 (M) Qualified Person

...remember

- **Qualified Person:** One who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated his/her ability to solve problems relating to the subject matter, the work, or the project.

# Working Under Loads

- 1926.753 (d) Routes for suspended loads shall be preplanned to ensure that no employee is required to work directly below a suspended load except for: *Connectors*



# Qualified Riggers



# 1926.753 Hoisting and Rigging... continued

1926.753 (d)(2) When working under suspended loads, the following criteria shall be met:

- Materials being hoisted shall be rigged to prevent unintentional displacement.
- Hooks with self closing latches or their equivalent shall be used to prevent components from slipping out of the hook; and
- All loads shall be rigged by a qualified rigger

## 1926.753 (e) Multiple Lift Rigging Procedure



- Maximum 5 members
- ONLY beams and similar structural members are lifted.
- All employees have been trained
- Rigged at least 7' apart
- Beams shall be set from the bottom up.

## 1926.753 Hoisting and Rigging ... continued

- All employees engaged in the multiple lift have been trained in these procedures in accordance with 1926.761(c)(1).
- No crane is permitted to be used for a multiple lift where such use is contrary to the manufacturer's specifications and limitations.

# 1926.753 Hoisting and Rigging ... continued

## 1926.753 (e) (2)

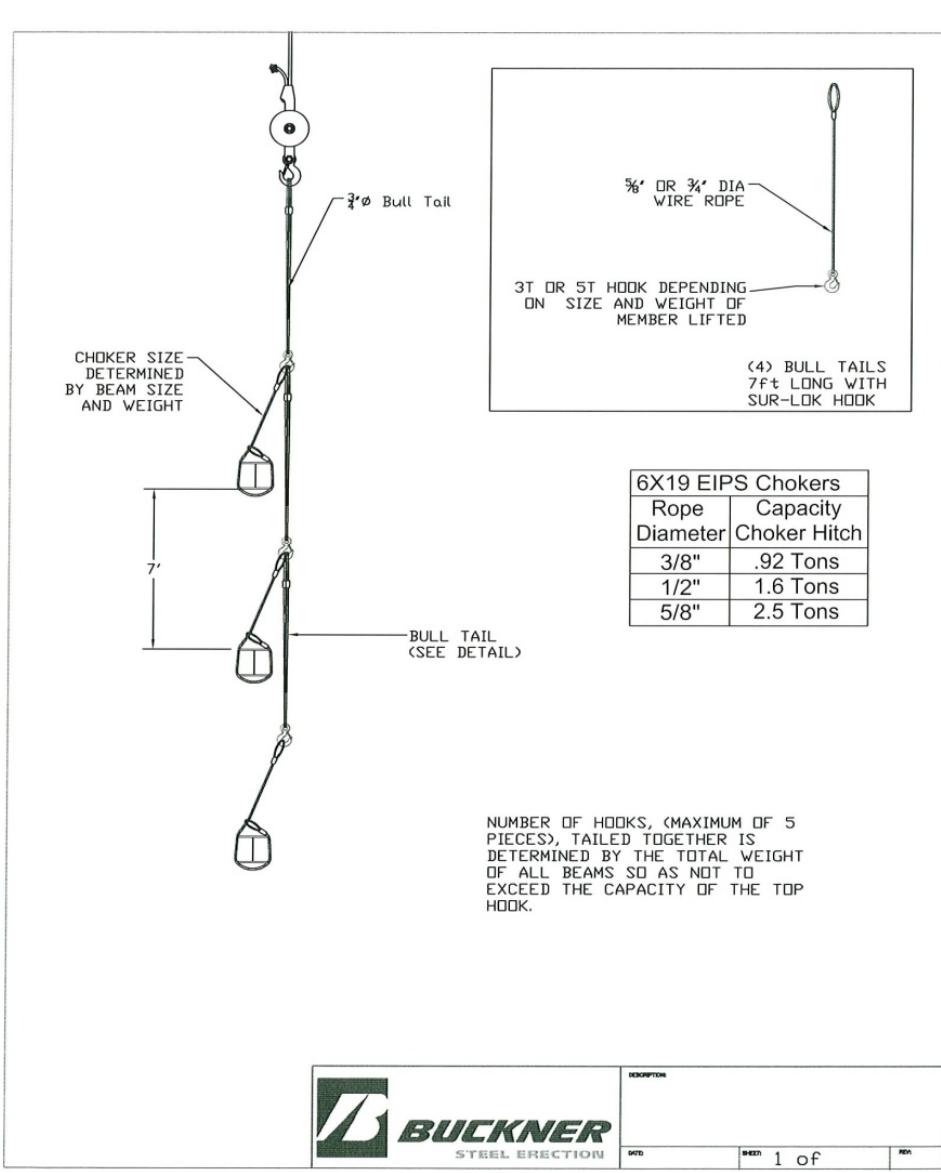
Components of the multiple lift rigging assembly shall be specifically designed and assembled with a maximum capacity for total assembly and for each individual attachment point. This capacity certified by the manufacturer or a qualified rigger, shall be based on manufacturer's specifications with a 5 to 1 safety factor for all components.

# Engineered “Bulls Tails”





# Rigging Diagram



## 1926.754 Structural Steel Assembly

- 1926.754 (a) Structural stability shall be maintained at all times during the erection process.



## 1926.754 Structural Steel Assembly

- 1926.754 (b) (1) no more than 8 floors between the erection floor and the uppermost permanent floor.
- 1926.754 (b) (2) At no time shall there be more than 4 floors or 48 feet of unfinished bolting or welding above the foundation or uppermost permanent secured floor.
- 1926.754 (b) (3) a fully planked or decked floor or nets shall be maintained within 2 stories or 30 feet, whichever is less, directly under any erection work being performed.

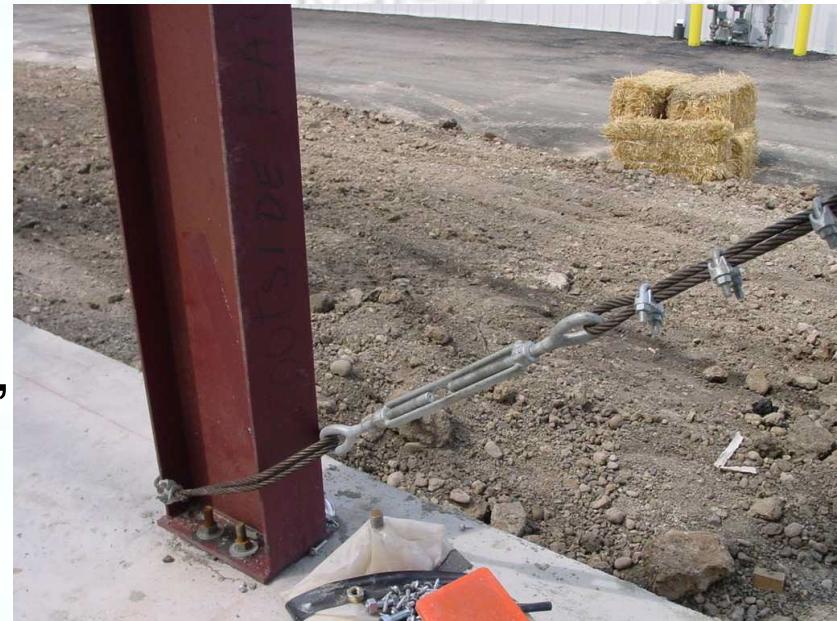
# 1926.754 Structural Steel Assembly

## ➤ Walking / working surfaces

1926.754 (c) Shear connectors, studs, reinforcing bars and other similar anchors shall not be attached to the top flange of beams, joist or beam attachments so they project vertically from or horizontally across the top flange of the member until after metal decking or other walking/working surface has been installed.

## 1926.754(d) Plumbing-Up Equipment

- Installed in conjunction with steel erection process to ensure stability of structure
- In place and properly installed before structure is loaded with construction material
- Be removed only with approval of competent person
- “When deemed necessary”



## 1926.754 Structural Steel Assembly ... continued

### 1926.754 (e) (1) Metal decking

- (i) bundle packing and straps not used for hoisting
- (ii) no loose material on deck bundles being hoisted
- (iii) Deck Bundles landed on joist in accordance with 1926.757 (e) (4)
- (iv) Deck bundles stable and secure on framing members

## 1926.754 Structural Steel Assembly ... continued

- 1926.754 (e) (2) Roof and Floor Holes and openings
- 1926.754 (e) (3) Covering roof and floor openings
- 1926.754 (e) (4) Decking Gaps
- 1926.754 (e) (5) installation of deck
- 1926.754 (e) (6) Derrick floors

# 1926.755 Column anchorage

- 1926.755 (a) 4 anchor bolts minimum



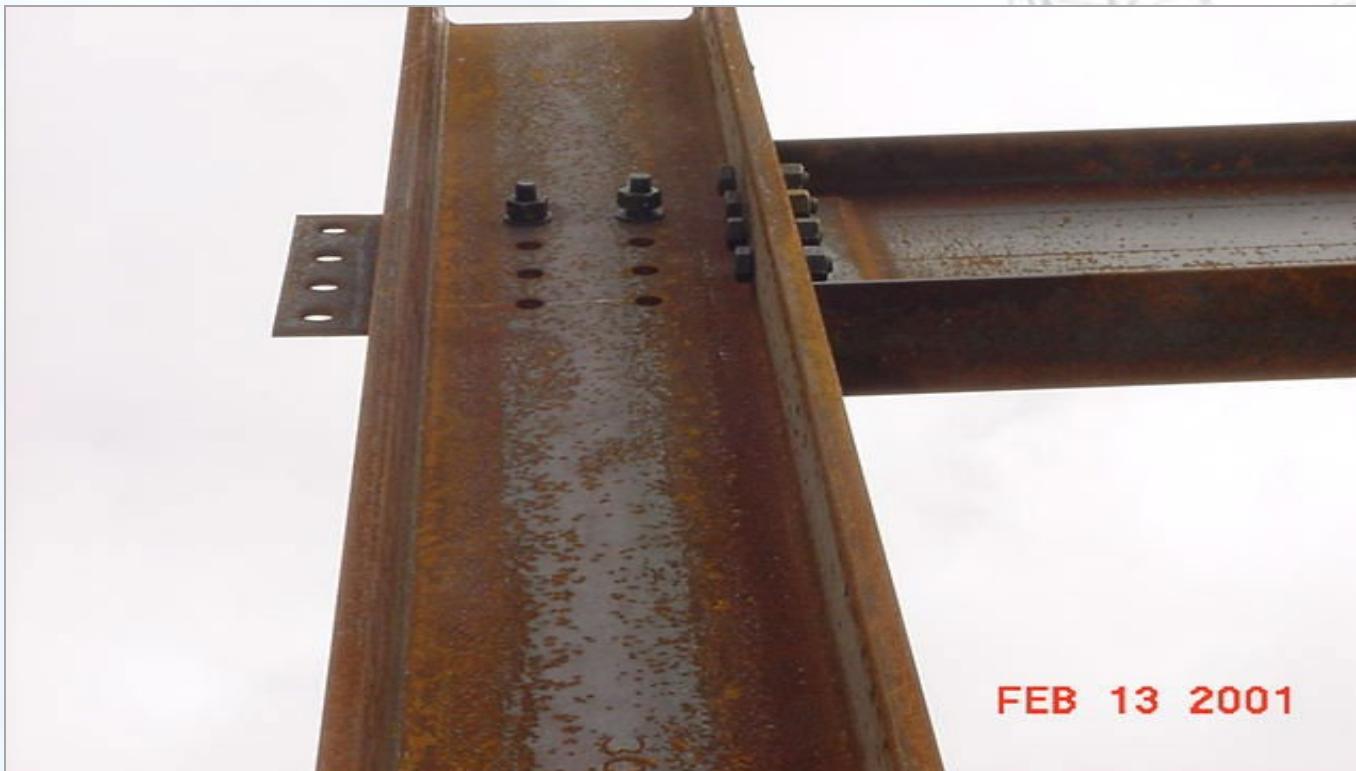
## 1926.755 Column anchorage

- 1926.755 (b) Repair, replacement or field modifications of anchor bolts (shall not be modified or repaired without approval of engineer of record) controlling contractor must provide written notification to erector



# 1926.756 Beams and Columns

- (a) (1) 2 bolts per connection, same size as shown on erection drawings, wrench-tight or equivalent
- (a) (2) Competent person to determine if more than 2 bolts are necessary to ensure stability.
- (b) Diagonal bracing - 1 bolt wrench-tight



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# Double Connections

- 1 bolt with nut shall remain connected to first member unless



## Double Connections ... continued

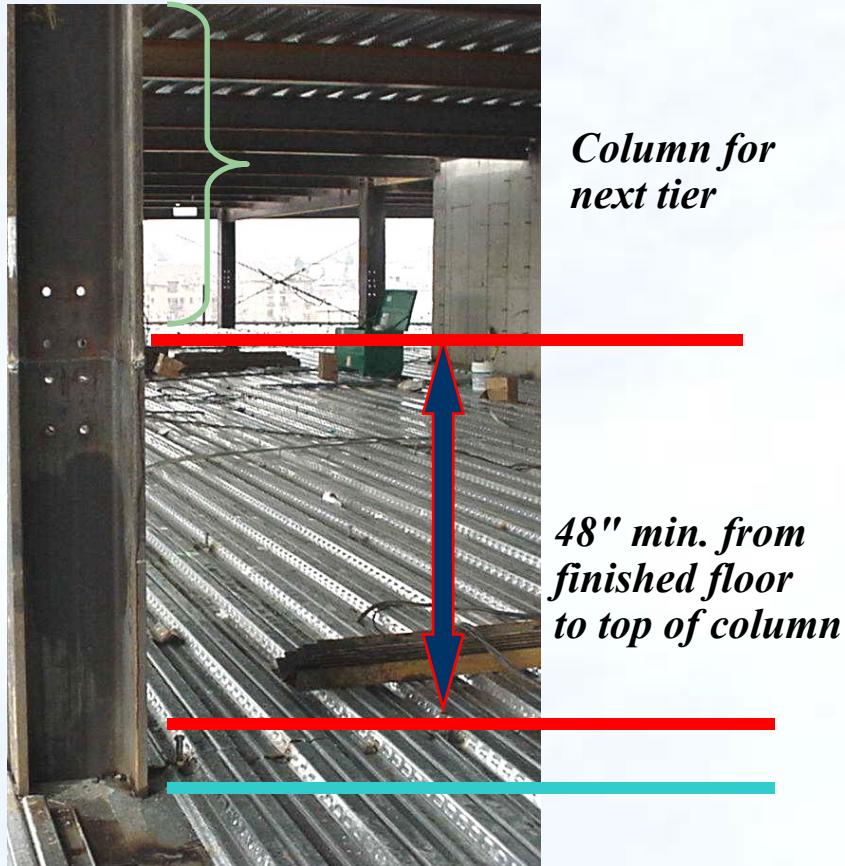
- A shop-attached or field-attached seat or equivalent connection device is supplied with the member



# 1926.756(c)(1) Double Connections



## 1926.756(e)(1) Perimeter Columns



- Perimeter columns must extend a minimum of 48 inches (1.2 m) above the finished floor to permit installation of perimeter safety cables prior to erection of next tier

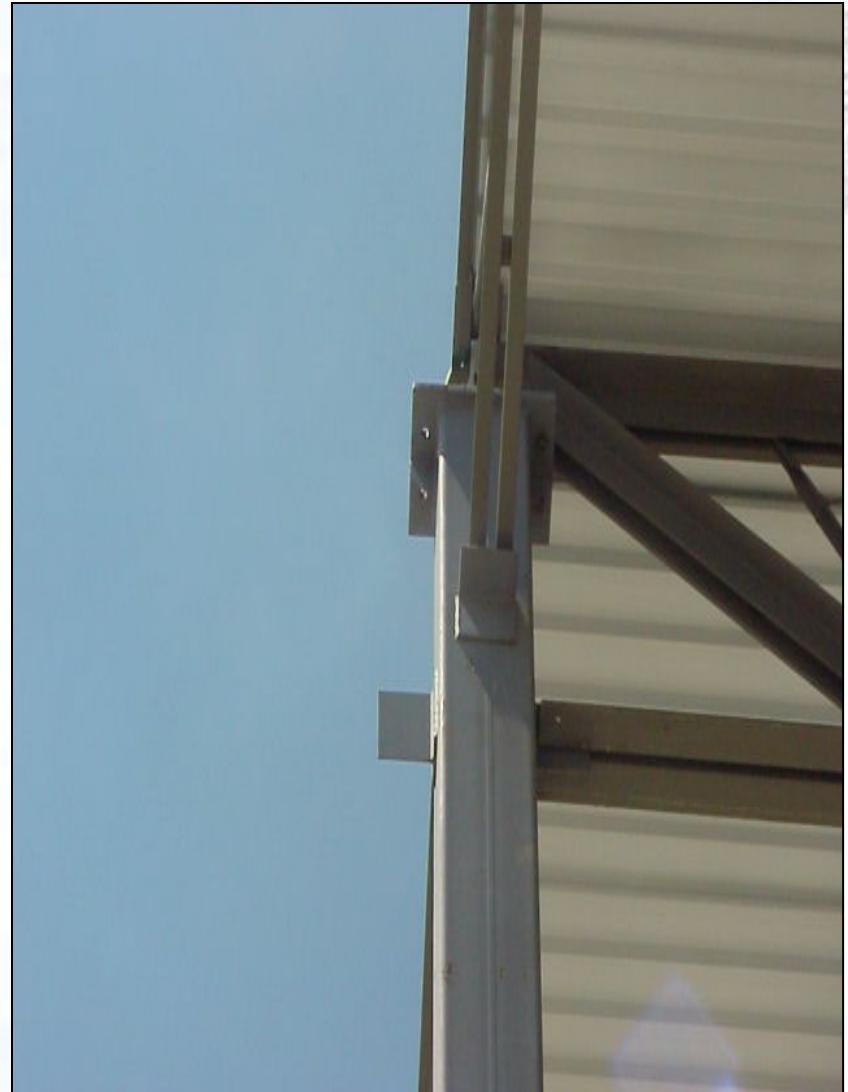
# Perimeter Columns



- 1926.756 (e) Perimeter columns.
- (1) extended a minimum of 48" above the finished floor.
- (2) The perimeter columns are supplied with holes or other devices in or attached to perimeter columns at 42" to 45" above the finished floor.....

# 1926.757 – Open Web Steel Joists

- Where joists are used and columns are not framed in at least two directions with solid web structural members, a joist shall be field-bolted at the column to provide lateral stability during erection
- Columns will have stabilized plate to secure bottom cord of joist during erection with 13/16 hole for attachment of guy/plumb cables



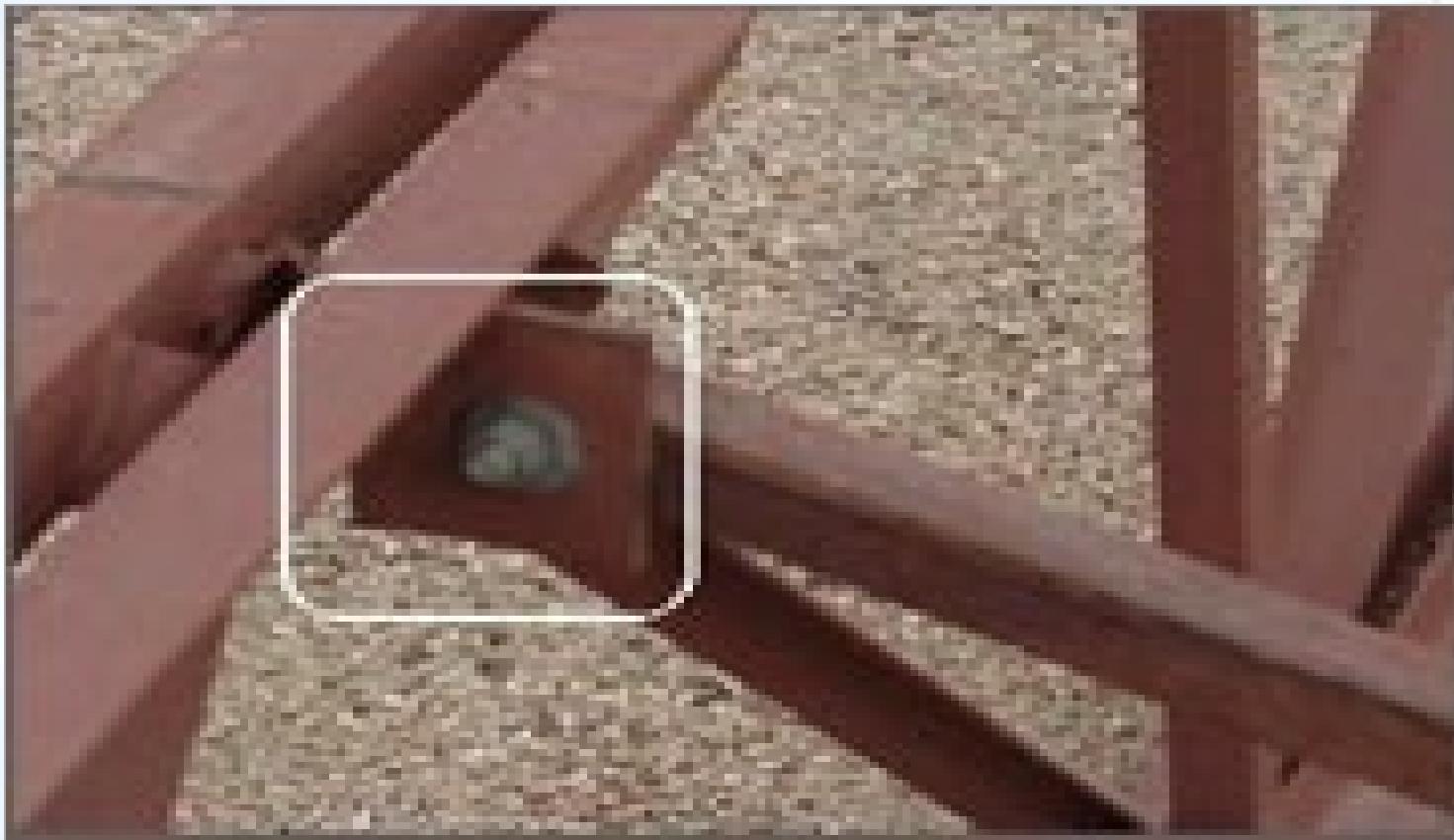
## 1926.757 Open Web Steel Joists ...continued

- Bottom cords of joist at columns must be stabilized to prevent rotation.
- Hoist lines cannot be removed until the seat at each end of the steel joist is field bolted and the joist is stabilized.
- Except for joist that have been pre-assembled into panels connections of individual steel joists to steel structures in bays of 40' or more shall be fabricated to allow for field bolting. **These connections shall be field bolted unless constructability does not allow.**



# 1926.757 Open Web Steel Joists ...continued





## 1926.757 Open Web Steel Joists ...continued

- Joist and joist girders not to be used for fall protection anchorage point unless written approval is obtained from a qualified person.
- Bridging terminus points to be established before bridging is installed.
- Allows for placement of “some” construction loads on joist if certain conditions are met
- Decking bundles not to exceed 4,000 lbs.
- Criteria established for landing deck on un-bridged joist.





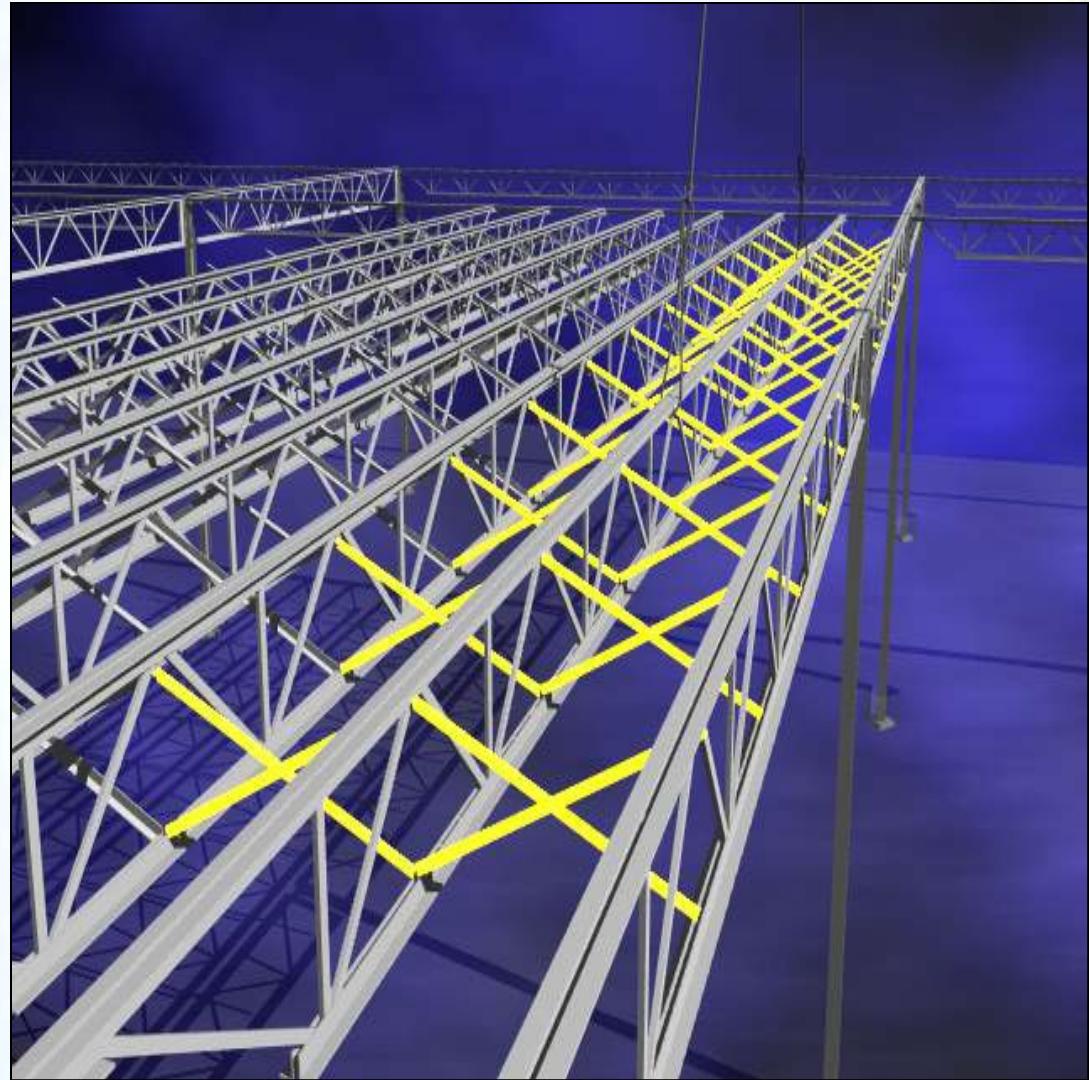
## Open Web Steel Joists ... continued

A Qualified Person must determine and the site specific plan must document that the structure is capable of supporting the load and:

- The load is distributed on a minimum of 3 joist
- The supporting joist are attached on both ends.
- Total weight of bundles not to exceed 4000#
- Placement of bundles shall be within 1 foot of the bearing surface of the joist end.

# Joist Bridging

- References SJI bridging tables
- OSHA tables are much easier to understand than SJI tables



# 1926.758 – Systems-Engineered Metal Buildings

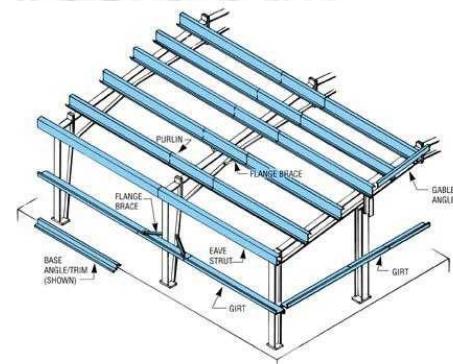
- 1926.755- Column anchorage and 1926.757- Open web steel joists do not apply to metal building erection
- Rigid frames must have 50 percent of the bolts or number specified by manufacturer on both sides of web adjacent to each flange before releasing hoist line
- No construction loads unless safely bolted, welded or otherwise secured

# Systems-Engineered Buildings



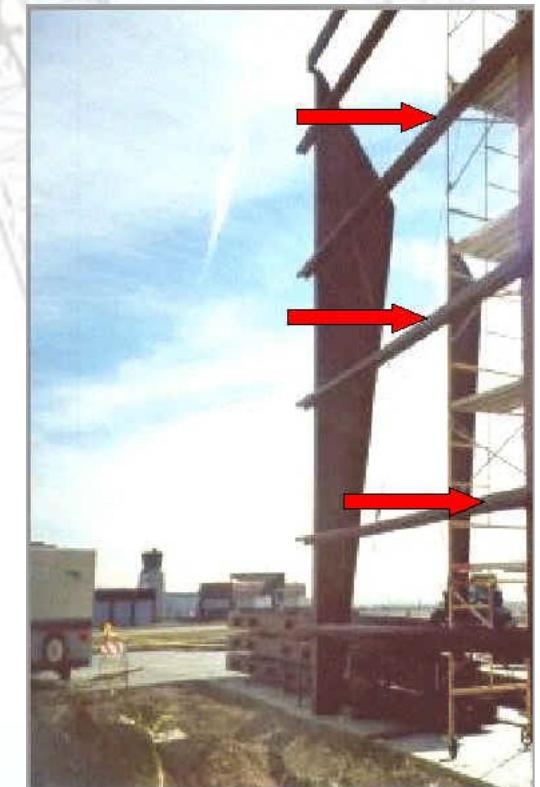
# 1926.758(d)-(e) Systems-Engineered Metal Buildings

- Construction loads not placed on structural steel framework unless secured
- When girts or eave struts share common connection holes:
  - At least one bolt must remain connected to the first member
  - Field-attached seat supplied by the manufacturer may be used in lieu of the bolt



# 1926.758(f)-(g) Systems-Engineered Metal Buildings

- Both ends of steel or cold-formed joists fully bolted or welded before:
  - Releasing cables
  - Allowing employees on the joists
  - Allowing construction loads on the joists
- Purlins and girts not used as anchorage points for a fall arrest system



*Girts*

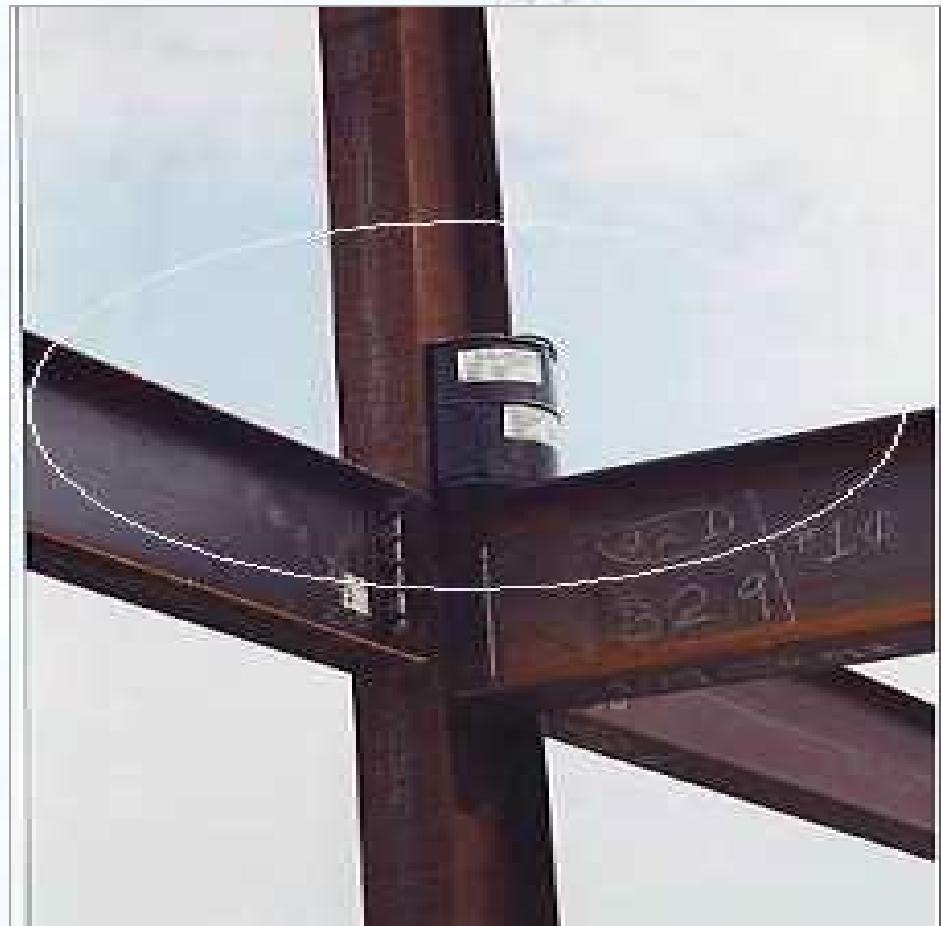
# 1926.758(h)-(i) Systems-Engineered Metal Buildings

- Purlins may be used as a walking/working surface when installing safety systems
  - After installation of permanent bridging, **and**
  - Fall protection provided
  
- Construction loads placed within a zone that is within 8 feet of the center-line of the primary support member



# 1926.759 Falling object protection

- All materials equipment and tools not in use while aloft shall be secured against accidental displacement



## 1926.759 Falling object protection

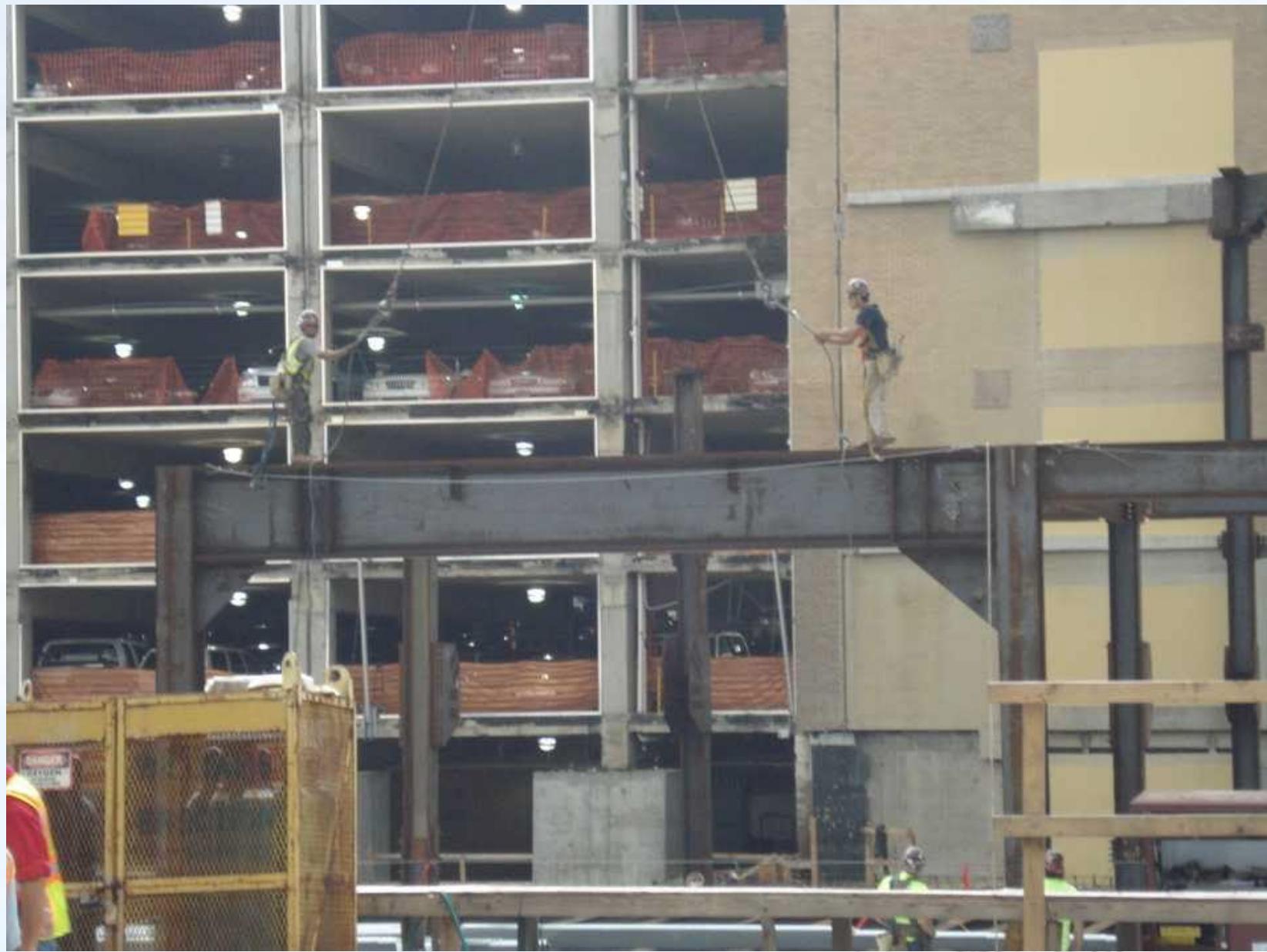
- Controlling contractor shall bar other construction processes below steel erection unless overhead protection for the employees below is provided.

## 1926.760 Fall Protection

- All employees must be protected above 15'
- Except connectors & employees installing metal deck. Protected above 30' but fall protection has to be available.





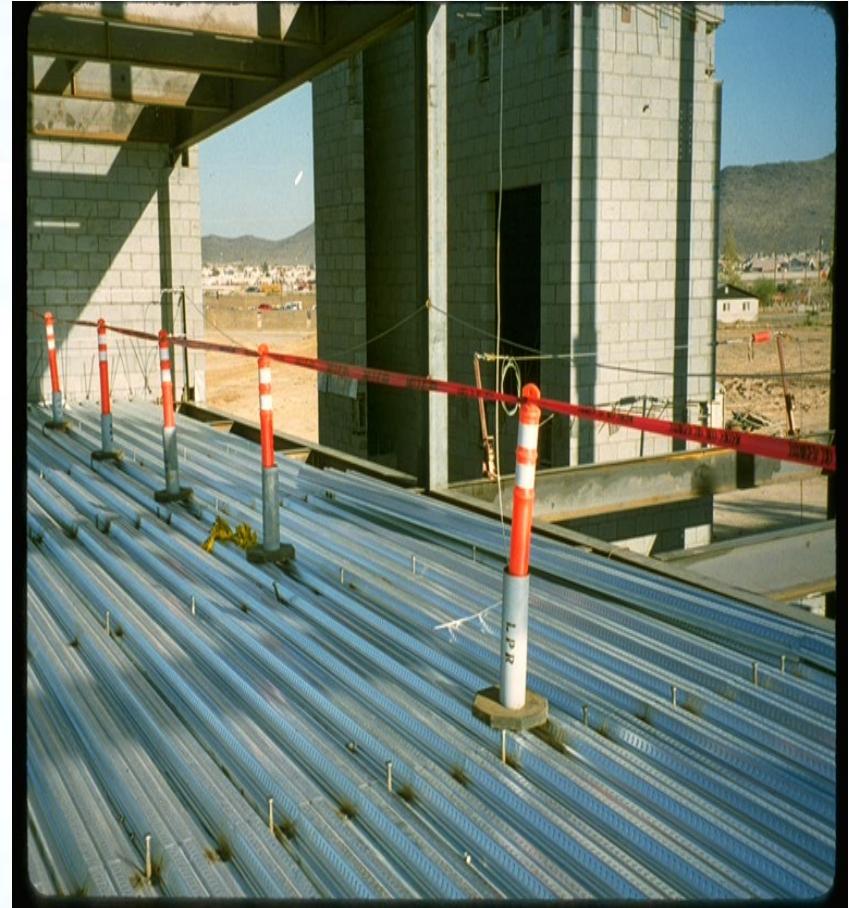


## 1926.760 (4) (e) Custody of fall protection.

- Fall protection of the steel erector shall remain in the area to be used by other trades after the steel erection activity has been completed only if the controlling contractor... has directed the steel erector to leave the fall protection in place; and has inspected and **accepted control**.....

# Controlled Decking Zone (CDZ)

- Controlled Decking Zone may be established where metal deck is initially being installed and the structure is over 15' and not more than 30' and the following shall apply:



## Controlled Decking Zones ... continued.

- Each employee working at the leading edge in a CDZ shall be protected from fall hazards of more than 2 stories or 30' whichever is less.
- Access to a CDZ shall be limited to only those employees engaged in leading edge work.

## Controlled Decking Zones ... continued.

- The boundaries of a CDZ will be designated and clearly marked. The CDZ shall not be more than 90' wide and 90' deep from any leading edge. The CDZ shall be marked by the use of control lines or the equivalent.
- Each employee working in a CDZ shall have completed CDZ training in accordance with 1926.761.

## Controlled Decking Zones ... continued

- Unsecured decking in a CDZ shall not exceed 3000 square feet.
- Safety deck attachments shall be performed in the CDZ from the leading edge back to the control line and shall have at least 2 attachments per sheet of deck.
- Final deck attachment and installation of shear connectors shall not be performed in the CDZ.

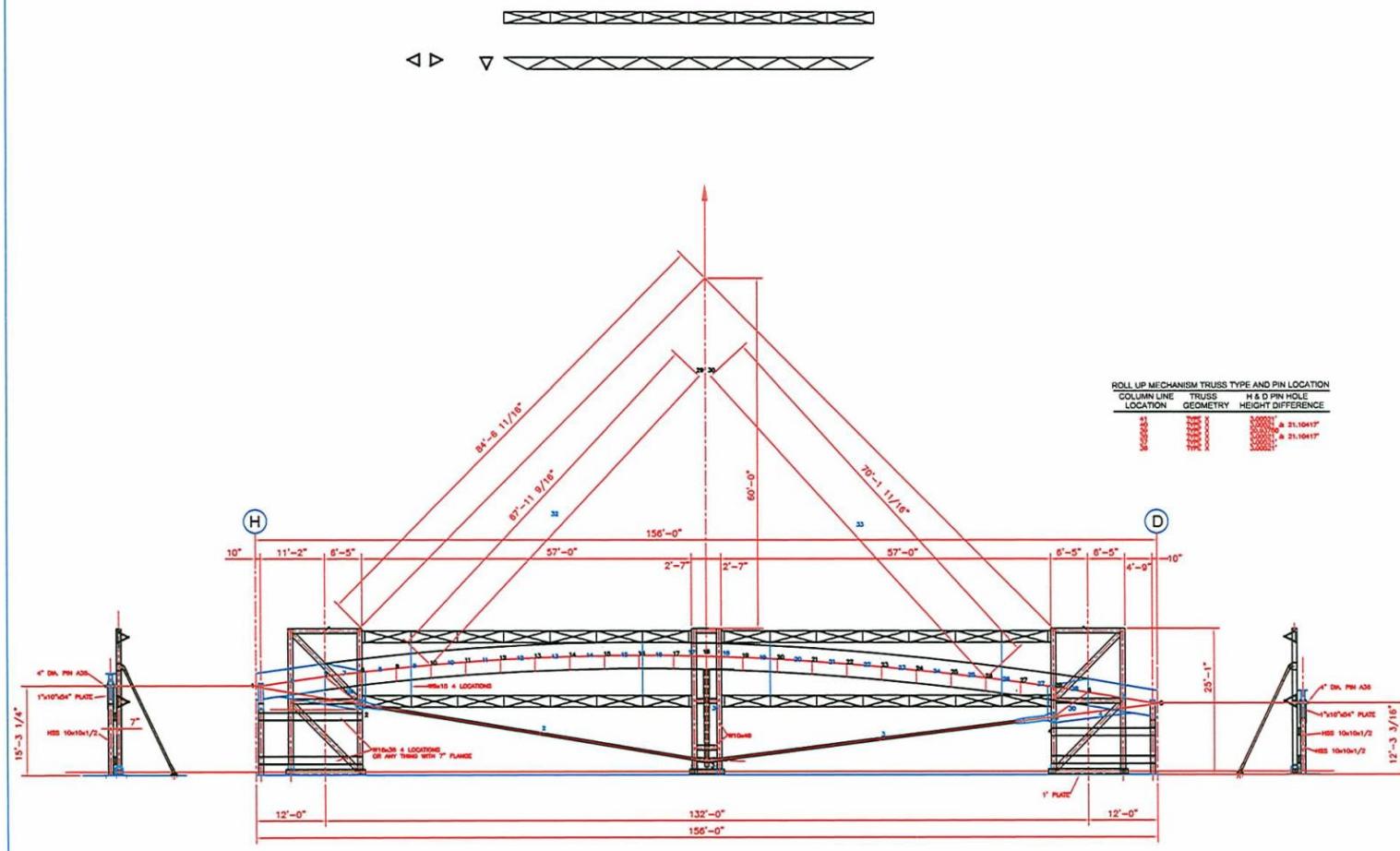
# 1926.761 Training Requirements

- FALL HAZARD TRAINING
- CONNECTOR TRAINING
- MULTIPLE LIFT RIGGING
- CONTROLLED DECK ZONE



# Pre Job Planning Keys to a successful project...

- Steel Detailing...Ensure items are taken care of such as punching perimeter and interior columns for Horizontal lifelines and guardrails, Double connections are compliant with OSHA, all Columns have 4 anchor bolts.
- Early decision on Fabricator/Erector team for planning....



C B BICKNER STEEL ERECTION INC

**GLU-LAM ROOF TRUSS  
BOILIP TABLE AY QLT**

TABLE E-1 1951 TRACES ON GRID LINE 3637-3814741 BETWEEN DANDY

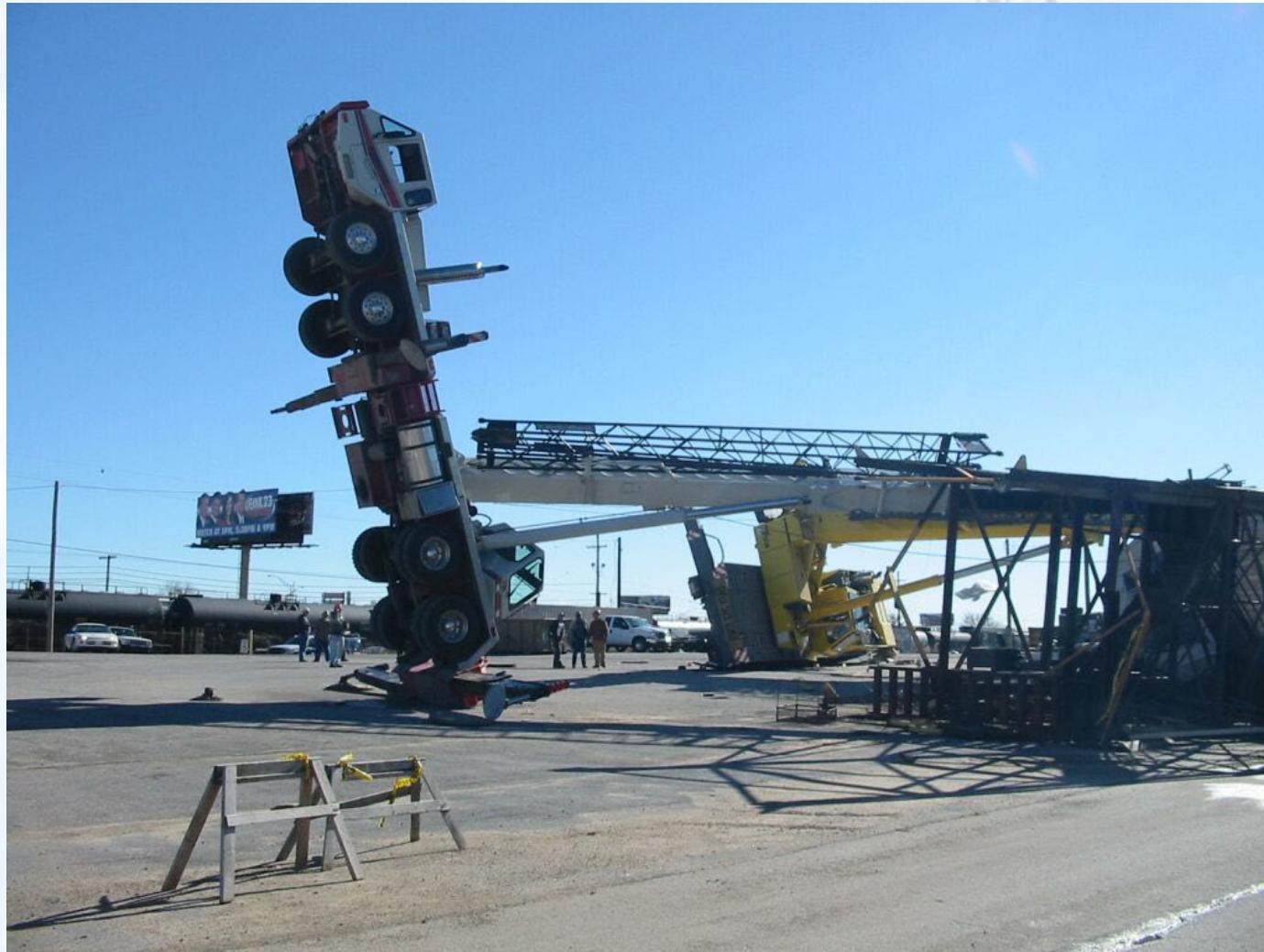
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# Pre Job Planning

- Erector should have direct input in establishing Erection sequences based on their expected equipment size and other experience, site issues, etc.

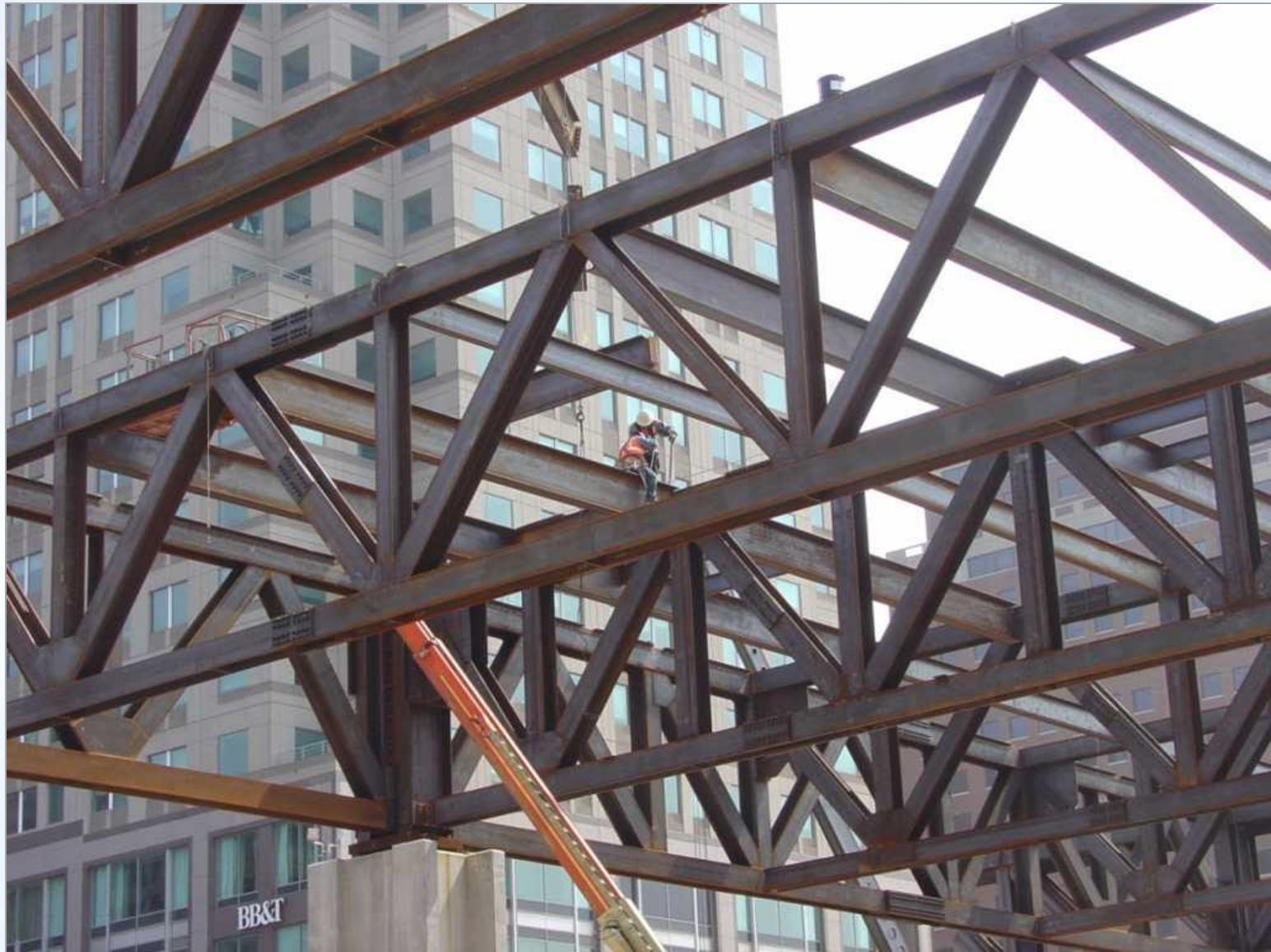


And...finally for those who love Cranes and understand the theory that “you always have to have more Ass behind you than in front of you”, or else....











# Walking/Working Surfaces

## Shear connectors and other similar devices

- Field-installed rather than shop installed
- Installed after the metal decking
- Not attached until after walking/working surface has been installed









