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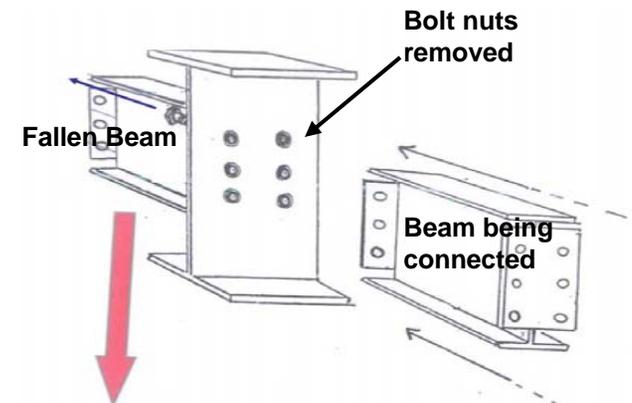
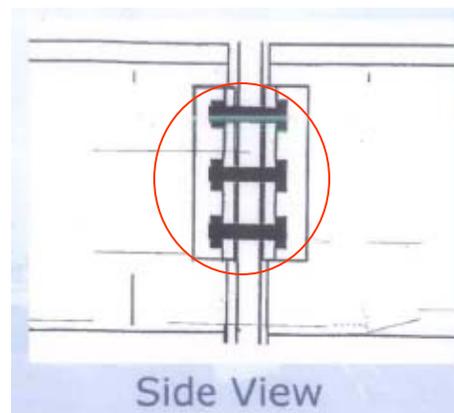
# ***Controlling Risks of Double Connections in Steel Erection***

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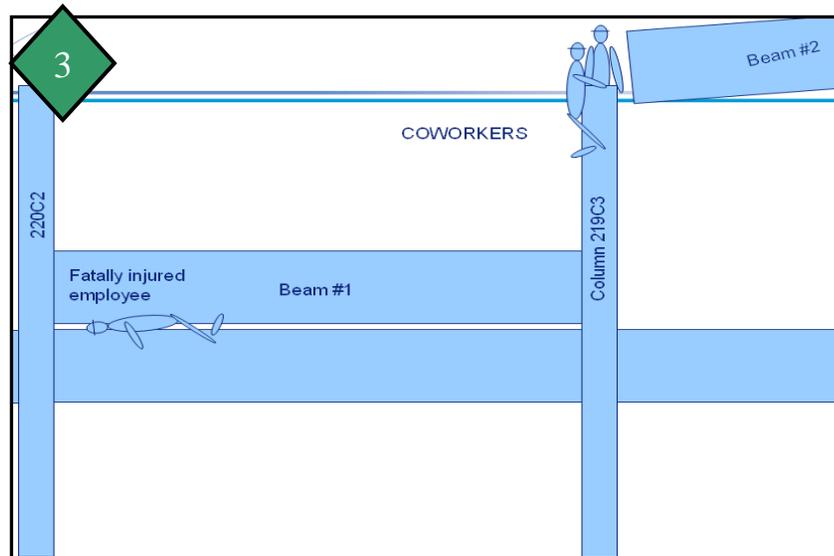
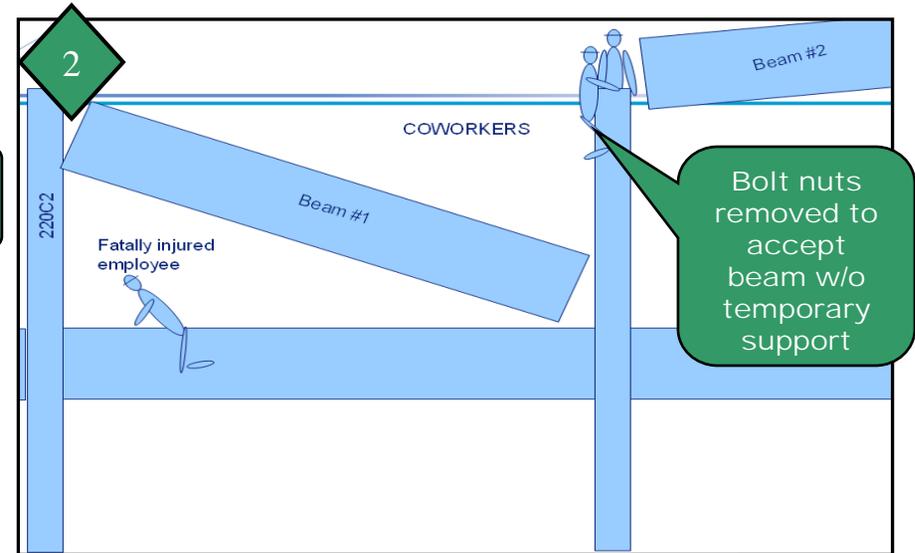
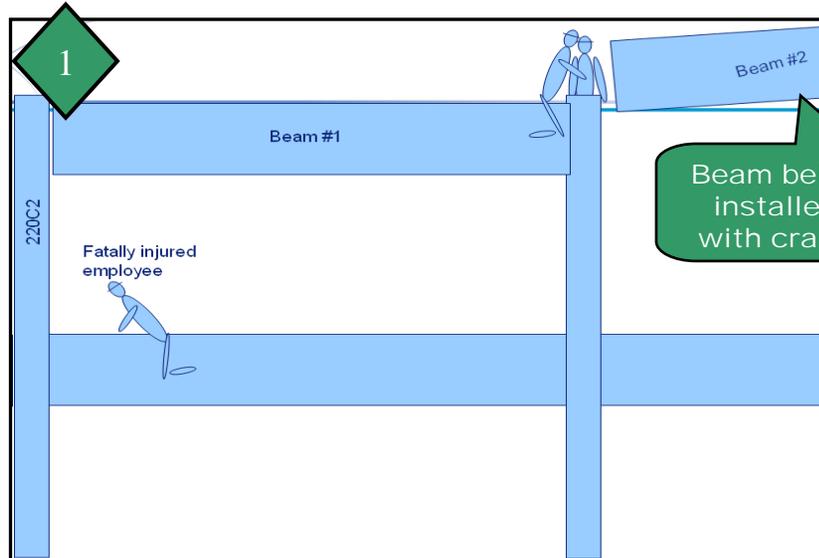
# Double Connection High Hazard Recognition

- **Summary:**
  - A contractor employee was crushed when a steel I-beam in the process of being connected directly above fell.
  - The beam had recently been secured between two columns. Two other steel erectors were attaching a second beam above to the other side of the column shared by the fallen beam (see sequence diagram on next slide).
  - The attachment (DOUBLE CONNECTION) required the beam in the process of being installed to be secured to the column using the same two bolts that held the beam which fell.
- **Direct Cause:**
  - Crushed under a beam falling after removal of both nuts from the bolts that secured the beam to the column in order to attached a second beam.





# Operation Sequence



## Major Factors:

- Installers training/qualifications.
- Improper procedure to support beam.
- Failure to follow work plan (AHA).
- Adequacy of prime oversight.
- Connections not addressed in Steel Erection Plan.

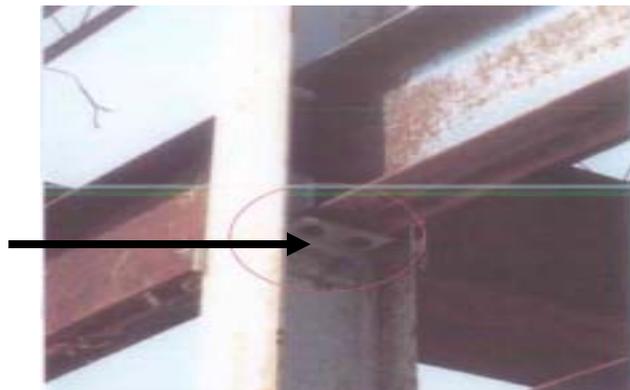


# Root Cause

• The event/condition that, if corrected or eliminated, would prevent reoccurrence of this mishap is:

- Failure to install a required “seat” under beams. Regulations are vague on who is responsible for seat identification but EM 385-1-1 specifically requires a separate steel erection plan to be submitted by the steel erector to address “connections”.
- OSHA and US Army Corps of Engineers (USACE) have established strict requirements on correct attachment procedures for double connections.
- USACE EM-385-1-1 (2003) regulation 27.E.22 and OSHA 29 CFR 1926.756(c) specifically state that where there is not at least one bolt that can remain connected the connection shall include a “seat” installed under the beam specifically to prevent it from falling during the connection process.
- If the required seat had been installed under the beam, the mishap would not have occurred.
- Sequence work to prevent employee positions under operations.

TEMPORARY  
ERECTION SEAT SUPPORT





## *Contributing Factors*

- Only three (3) double connections in the project which were not highlighted in advance of erection phase.
- Excessive deflection of column holding the fallen beam.
- Workers were not using man-lifts identified in the AHA.
- Failure to submit Critical Lift Plan (multiple sling lift).
- Steel erection work began prior to prime NTP letter.
- Failure to properly train workers on connecting techniques -violation of USACE EM-385-1-1, 27.F.12 and OSHA 29 CFR 1926.761(c).

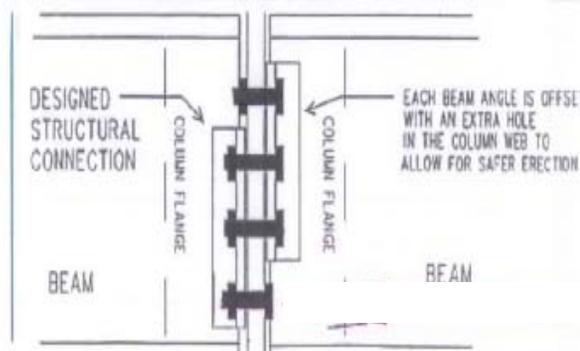
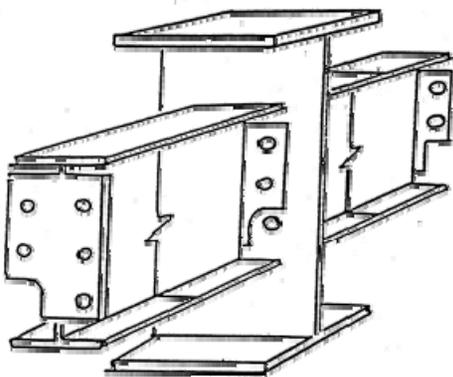


## *Lesson Learned Highlight*

**Contractors/Field Offices - Assure a coordinated (Prime/Sub) Steel Erection Plan submission required by USACE EM 385-1-1 is developed and implemented**

**(See 27.F.01 (a-i)) especially:**

- Connections – identify/address “double connections”
- Erectors training with respect to OSHA reqmts.
- Sequence of work



In addition to a “SEAT” other options contractors may choose to use include - staggered or high/low connection methods and modified clip methods (examples)