construction
inspection & review

Supervision Practices - IBC

<table>
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<tr>
<th>Verification and Inspection of Steel Construction</th>
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<tr>
<td><strong>Material verification of high-strength bolts, nuts, and washers:</strong></td>
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<tr>
<td>a. Identification markings to conform to ASTM standards specified in approved construction documents.</td>
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<tr>
<td>b. Manufacturer's certificate of compliance requested.</td>
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<td>2. Inspection of high-strength bolts:</td>
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<tr>
<td>a. Bolt-type connections.</td>
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<td>b. Stud-type connections.</td>
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<td>3. Material verification of structural steel:</td>
</tr>
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<td>a. Identification markings to conform to ASTM standards specified in approved construction documents.</td>
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<td>b. Manufacturer's certified test results.</td>
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<td>4. Material verification of weld filler materials:</td>
</tr>
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<td>a. Identification markings to conform to AWS specification in approved construction documents.</td>
</tr>
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</tbody>
</table>

Office Hours

### Supervision Practices - IBC

5. **Inspection of welding:**
   - **Structural steel:**
     1. Complete and partial penetration groove welds. | X |
     2. Continuous fillet welds. | X |
     3. Single-pass fillet welds, 1/8" | X |
     5. Filler and drain welds. | X |
     6. Reinforcing steel:
       1. Verification of weldability of reinforcing steel rebars, shear ASTM A 306. | X |
       2. Reinforcing steel-reinforced structural steel members and beams. | X |
       3. Shear connections. | X |
       4. Other reinforcing steel. | X |
   - **Steel frame joints:**
     1. Inspect steel frame joints for compliance with approved construction drawings. | X |
     a. Details such as bracing and stiffening. | X |
     b. Member locations. | X |
     c. Application of joint details at each connection. | X |

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**Notes:**
- 1 inch = 25.4 mm.
- When applicable, see the Section 1.4.1.1, Structural Inspection for steel connections.
Steel Construction

- proper grade material
  - high strength bolts
- quality welds
- proper bolted conditions (ex. sc)
- fabrication and erection of steel frame connection details

Concrete Construction

- proper placement of all reinforcement
  - welding
  - splices
- mix design
  - slump
  - in-situ strength
  - cast cylinders
  - cylinder cores – if needed

Supervision Practices - IBC

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Construction Supervision

- proper placement of all reinforcement
- prism construction
  - masonry
  - mortar
- hot/cold weather protection
- clear cavity

Wood Construction

- structural members
  - avoid damage
  - must be protected from exposure to weather and water
- connections & bracing

Fire and Life Safety

- for the Design Professional
  - by Carl Wren, P.E.
  - Chief Engineer, Austin Fire Department
  - Nuclear/Radiation Safety Engineering, ~29 years in Fire Protection – Former Commissioner, Texas Commission on Fire Protection, Former Member of Texas Task Force 1 - Firefighter, EMT, & Fire Inspector
  - guest lecture excerpts 2004 & 2008

Fire and Life Safety

- consequences, ex. 2005
  - 3,675 deaths
  - 17,925 injuries
  - $10,672,000,000 in property loss
- behavior & dynamics
  - a rapid (exponential growth), self sustaining oxidation process accompanied by the evolution of heat and light of varying intensities
Fire and Life Safety

• human viability impacts
  – heat, smoke, oxygen deprivation
  – CO produced by combustion
• controlling factors of fire
  – available fuel supply
    • furniture, structure, other contents
  – available oxidizer
    • ventilated or unventilated, chemical oxidizers
  – impact of design, construction, occupancy

Fire and Life Safety

• development – heat transfer
  – conduction, convection, radiation
  – exponential
    • quickly exceed $500^\degree C$ ($932^\degree F$) even > $650^\degree C$
      (1200$^\degree F$) at the ceiling of a confined fire
      within 4 to 5 minutes
    • post flashover (uncontrolled ventilation)
      ~600$^\degree F$ to >1800$^\degree F$ within a matter of seconds

Fire and Life Safety

– fire resistive construction (I-FR, IA)
  • concrete and protected steel
  • may or may not be compartmented
  • typical construction for high-rises
– typical hazards
  • fires are generally content fires
  • not a severe “collapse” hazard
  • spalling of concrete
  • central HVAC as a smoke travel path
    (also floor/ceiling penetrations and voids)
  • hazards may be most obvious on floor above fire floor
  • seek assistance in evaluating severe structural damage

Fire and Life Safety

• high rise fires
  – 1911 Triangle Shirtwaist Company NY, NY
  – 1980 MGM Grand Hotel Las Vegas, NV
  – 1986 Dupont Plaza San Juan, Puerto Rico
  – 1988 1st Interstate Bank Los Angeles, CA
  – 1991 One Meridian Plaza Philadelphia, PA
Fire and Life Safety

– non-combustible or limited combustible construction (II-H, II-A)
  • metal, masonry, or concrete wall construction with metal roof
– typical hazards
  • unprotected lightweight steel roof joist & W's
  • roofs typically flat with combustible weather covering
  • ignition of built-up roofing may be above ceilings ABOVE fire sprinklers
  • concentrated roof loading by HVAC units, etc.
  • steel expands and loses 40% capacity after ~10 min at 593°C (1100°F)

Fire and Life Safety

– ordinary construction (III)
  • freestanding masonry or brick walls
  • solid wood joist flooring and roofing (typical within older buildings)
  • wood truss assemblies (typical in newer buildings)
– typical hazards
  • combustible concealed spaces
  • peaked roof concealed spaces
  • lack of or damaged draft or fire stopping
  • decorative parapet walls
  • “fire cut” beams

Fire and Life Safety

– heavy timber construction
  • wood frame or large cross section (8 in. min vertical members and 6 in. min horizontal members)
– typical hazards
  • high fuel load exclusive of contents
  • masonry wall collapse (similar to ordinary construction)
  • may survive long exposure, but control in advanced stages may be very difficult
  • radiant heat exposures may be extreme

Fire and Life Safety

– wood frame construction
  • light weight wood members typically consisting of wood 2 x’s
– typical hazards
  • entire frame is part of fuel package
  • small dimension timber can be compromised more quickly than heavy timber
  • Braced Frame (mortised connections), Platform (sectional framing & multi-story), and Balloon Framing (fire & smoke travel paths)
  • failure of wood frame bearing walls may trigger simultaneous collapse of floors and/or roof
Fire and Life Safety (from DHS training program)

- type V wood frame truss construction

Figure 4 — Metal tooth plate connectors like those shown are used extensively in lightweight parallel and pitch chord trusses. The multi-tooth plates are embedded in the firewood filler, using high temperature clamps.

Fire and Life Safety

- what can I do?
  
  – break up the fuel continuity during construction and in the completed project:
    - fire barriers
    - open spaces
    - fire resistive and noncombustible construction
  
  – even the use of simple gypsum wallboard partitions and closed doors can help

Fire and Life Safety

- what can I do?
  
  – utilize wood carefully, install attic draft stops, early and correctly

Fire and Life Safety

- what can I do?
  
  – utilize fire detection and suppression systems wisely
Fire and Life Safety

- what can I do?
  - consider your occupants and realistic opportunities for people to escape

Fire and Life Safety

- what can I do?
  - push for the durability of fire resistive coatings to be re-evaluated and improved

Fire and Life Safety

- what can I do?
  - consider the abilities and resources of firefighting and rescue personnel near your projects
    - be realistic
    - how they can reach the scene of the emergency

Fire and Life Safety

- what can I do?
  - use the rule of thumb of the emergency services - risk vs. benefit
    - risk (invest) a lot for a life (maybe even another life)
    - risk little for little gain
  - but again be realistic
    - we cannot and will not eliminate all risk
Fire and Life Safety

- know the applicable codes
- understand the code and standards development processes
  - International Code Council (a consortium of ICBO, BOCA and SBCCI)
  - meant to create a single consistent series of codes for the USA (world?)
  - National Fire Protection Association (NFPA)

Fire and Life Safety

- International Code Series – e.g.
  - International Building Code (IBC)
  - International Fire Code (IFC)

Fire and Life Safety

- NFPA 1, Fire Prevention Code (New UFC)
- NFPA 70, National Electrical Code
- NFPA 5000, Building Code (vs. IBC)

Fire and Life Safety

- many other standards and codes
  - NFPA 14, Standpipes (Hose Systems)
  - NFPA 13, Fire Sprinkler Standard
Fire and Life Safety

- NFPA 70, National Electrical Code (NEC)

Fire and Life Safety

- NFPA 72, Fire Detection and Alarm

Fire and Life Safety

- ANSI A-17.1 & A-17.3 Elevators

Fire and Life Safety

- performance based codes
  - NFPA 101, chapter 5
  - 2003 ICC Performance for Buildings and Facilities
  - NFPA 5000, chapter 5
Fire and Life Safety

• references

5. FIRE LOSS IN THE UNITED STATES DURING 2003, by Michael J. Karter Jr., National Fire Protection Association, Fire Analysis & Research Division, Quincy, MA, September 2004

Structural “History”

• by building system and relevance

www.en.wikipedia

www.esbny.com
**Final Exam Material**

**my list:**

- systems focus
  - general behavior, resistance to lateral loading (shear walls, etc.)
  - hazard considerations
  - behavior of elements
    - beams & columns (statics)
    - continuous beams, cables, arches, rigid frames, plates, grids, membranes, shells, nets

- code and design requirements
  - methodologies by materials
  - construction supervision

- system selection
  - wood, steel, concrete, masonry
  - component types
  - connections
  - foundations