Supervision Practices - IBC

TABLE 1704.3
REQUIRED VERIFICATION AND INSPECTION OF STEEL CONSTRUCTION

<table>
<thead>
<tr>
<th>VERIFICATION AND INSPECTION</th>
<th>CONTINUOUS</th>
<th>PERIODIC</th>
<th>REFERENCED STANDARD</th>
<th>RE REQU.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Material verification of high-strength bolts, nuts and washers:</td>
<td>X</td>
<td></td>
<td>Applicable ASTM material specifications; ASC 335, Section A-10.1, Section A-3.3</td>
<td></td>
</tr>
<tr>
<td>a. Identification markings to conform to ASTM standards specified in the approved construction documents.</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Manufacturer’s certificate of compliance required.</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Inspection of high-strength bolting:</td>
<td>X</td>
<td></td>
<td>ASC LRFD Section M2.5</td>
<td>1708.33</td>
</tr>
<tr>
<td>a. Bearing-type connections.</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Slip-critical connections.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Material verification of structural steel:</td>
<td>X</td>
<td></td>
<td>ASTM A 6 or ASTM A 568</td>
<td>1708.4</td>
</tr>
<tr>
<td>a. Identification markings to conform to ASTM standards specified in the approved construction documents.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Manufacturer’s certified mill test reports.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Material verification of weld filler materials:</td>
<td>X</td>
<td></td>
<td>ASC A 6 or ASTM A 568</td>
<td>1708.4</td>
</tr>
<tr>
<td>a. Identification markings to conform to AWS specification in the approved construction documents.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Manufacturer’s certificate of compliance required.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. Inspection of welding:
   a. Structural steel:
      1) Complete and partial penetration groove welds. | X |
      2) Multiple fillet welds. | X |
      3) Single-pass fillet welds > \( \frac{1}{8} " \) | X |
      4) Single-pass fillet welds \( \leq \frac{1}{8} " \) | X |
      5) Floor and deck welds. | X |
   b. Reinforcing steel:
      1) Verification of weldability of reinforcing steel other than ASTM A 706. | X |
      2) Reinforcing steel resisting flexural and axial forces in intermediate and special moment frames, and boundary elements of special reinforced concrete shear walls and shear reinforcement. | X |
      3) Shear reinforcement. | X |
      4) Other reinforcing steel. | X |
6. Inspection of steel frame joint details for compliance with approved construction documents:
   a. Details such as bracing and stiffening. | X |
   b. Member location. | X |
   c. Application of joint details at each connection. | X |

For SI: 1 inch = 25.4 mm

Professor: Anne Nichols (845.654.05)

Office Hours

http://faculty.arch.tamu.edu/anichols/schedule/
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

<table>
<thead>
<tr>
<th>TABLE 1710.1</th>
<th>REQUIRED VERIFICATION AND INSPECTION OF CONCRETE CONSTRUCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VERIFICATION AND INSPECTION</strong></td>
<td><strong>CONTINUOUS</strong></td>
</tr>
<tr>
<td>1. Inspection of reinforcing steel, including protection, spacing, and placement.</td>
<td>—</td>
</tr>
<tr>
<td>2. Inspection of reinforcing steel welding in accordance with Table 1710.1, Item 5.</td>
<td>—</td>
</tr>
<tr>
<td>3. Inspection of steel reinforcement splices</td>
<td>—</td>
</tr>
<tr>
<td>4. Inspection of concrete and concrete placement in accordance with F2007abn.</td>
<td>X</td>
</tr>
<tr>
<td>5. Inspection of prestressed concrete</td>
<td>—</td>
</tr>
</tbody>
</table>

Steel Construction

- proper grade material
  - high strength bolts
- quality welds
- proper bolted conditions (ex. sc)
- fabrication and erection of steel frame connection details
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 Commission, 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 $500^\circ C$ ($932^\circ F$) even > $650^\circ C$ ($1200^\circ F$) at the ceiling of a confined fire within 4 to 5 minutes
    • post flashover (uncontrolled ventilation)
      ~$600^\circ F$ to > $1800^\circ F$ 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

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

- push for the durability of fire resistive coatings to be re-evaluated and improved

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

- 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

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

Fire and Life Safety

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

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)

- ANSI A-17.1 & A-17.3 Elevators

Fire and Life Safety

- NFPA 72, Fire Detection and Alarm

- NFPA 101, chapter 5
  - 2003 ICC Performance for Buildings and Facilities
  - NFPA 5000, chapter 5

- performance based codes
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.esbnyc.com
**Structural “History”**

- by building system and relevance

**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

**Final Exam Material**

- my list (cont’d):
  - code and design requirements
    - methodologies by materials
    - construction supervision
  - system selection
    - wood, steel, concrete, masonry
    - component types
    - connections
    - foundations