lecture nineteen

steel construction: trusses, decks & plate girders
Iron & Steel Trusses

- **cast iron**
  - 18th century
  - chain links
- **wrought-iron**
- **rivets**
Truss Connections

- gusset plates
- bolts
- welds

(AISC - Steel Structures of the Everyday)

http://courses.civil.ualberta.ca
Trusses

- require lateral bracing
- consider buckling
- indeterminate trusses
  - extra members
    - diagonal tension counters
  - solvable with statics
    - cables can’t hold compression
  - displacement methods
    - elastic elongation
  - too few members, unstable

http://nisee.berkeley.edu/godden
Manufactured Trusses

- open web joists
- parallel chord
Open Web Joists

- **SJI**: [www.steeljoist.com](http://www.steeljoist.com)
- **Vulcraft**: [www.vulcraft.com](http://www.vulcraft.com)
  - **K Series (Standard)**
    - 8-30” deep, spans 8-50 ft
  - **LH Series (Long span)**
    - 18-48” deep, spans 25-96 ft
  - **DLH (Deep Long Spans)**
    - 52-72” deep, spans 89-144 ft
  - **SLH (Long spans with high strength steel)**
    - pitched top chord
    - 80-120” deep, spans 111-240 ft
### Load Tables - w

#### LRFD

**STANDARD LOAD TABLE FOR OPEN WEB STEEL JOISTS, K-SERIES**

Based On A 50 ksi Maximum Yield Strength - Loads Shown In Pounds Per Linear Foot (plf)

<table>
<thead>
<tr>
<th>Joist Designation</th>
<th>10K1</th>
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<th>12K3</th>
<th>12K5</th>
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**load for live load deflection limit (L/360) in RED total in BLACK**
Decks

- sheet steel
- composite
Light-gage Steel

- **sheet metal**
  - shaped
  - studs, panels, window frames
  - gage
    - based on weight of 41.82 lb/ft$^2$ / inch of thickness
    - 24, 22, 18, 16, i.e.
    - 0.0239, 0.0329, 0.0474, 0.0598 in
    - 0.6, 0.85, 1.0, 1.3, 1.6 mm
Steel Decks

- “Texas” style
  - corrugated
- common
  - 1 – 3 spans
  - can be insulated
  - composite
    - with concrete
Steel Decks

- common fire proofing
  - cementitious spray
  - composite concrete
- non-composite
  - concrete is fill
- lateral bracing
- diaphragm action
Load Tables - w

- live load
deflection limit
L/240
Plate Girders

- welds
- web stiffeners

http://nisee.berkeley.edu/godden

Plate Girder

Box Girder

stiffeners at end where shear is greatest and at support

stiffeners to prevent lateral buckling
Web Bearing

- **max loads**

\[
P_{n(max-end)} = (N + 2.5k)F_{yw}t_w
\]

\[
P_{n(max-interior)} = (N + 5k)F_{yw}t_w
\]
Space Trusses

- 3D with 2 force bodies and pins
  - pyramid
  - tetrahedron
- “frames” have fixed joints
- layers
- 40’s
Space Trusses

• connections

(a) UNISTRUT (System U)
(b) TRIODETIC
(c) MERO (KK-CELL)

(a) CORNER SUPPORTS
(b) PERIMETER SUPPORTS

• supports

(a) COLUMN (POINT) SUPPORT
(b) INVERTED PYRAMID
(c) CROSSHEAD BEAMS

PLAN
(crosshead beam support)
Space Trusses

http://nisee.berkeley.edu/godden

www.archdaily.com

Lecture 19

ARCH 331

S2015abn
Space Trusses

http://nisee.berkeley.edu/godden
Tensegrities

- 3D frame
- discontinuous struts
- continuous cables

Free Ride Home – Kenneth Snelson
Method of Sections

- relies on internal forces being in equilibrium on a section
- cut to expose 3 or less members
- coplanar forces $\rightarrow$ $\sum M = 0$ too
Method of Sections

• **joints on or off the section are good to sum moments**
• **quick for few members**
• **not always obvious where to cut or sum**

![Diagram](image)