Steel Trusses 1
Lecture 17

Elements of Architectural Structures:
Form, Behavior, and Design
ARCH 614
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Lecture seventeen

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

• cast iron
  – 18th century
  – chain links

• wrought-iron

• rivets

http://nisee.berkeley.edu/godden
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
  - solvable with statics
    - cables can’t hold compression
  - displacement methods
    - elastic elongation
  - too few members, unstable
Manufactured Trusses

- open web joists
- parallel chord
Open Web Joists

- **SJl**: www.steeljoist.com
- **Vulcraft**: 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
Decks

- sheet steel
- composite
Plate Girders

- welds
- web stiffeners
Web Bearing

- max loads

\[ P_{n\text{(max-end)}} = (N + 2.5k)F_ytw \]

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

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

- connections

- supports

(a) UNISTRUT (System U)

(b) TRIODETIC

(c) MERO (KK-ball)

(a) CORNER SUPPORTS

(b) PERIMETER SUPPORTS

(c) CROSSHEAD BEAMS

(a) COLUMN (POINT) SUPPORT

(b) INVERTED PYRAMID

PLAN (crosshead beam support)
Space Trusses

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Space Trusses

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**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  $\rightarrow \Sigma M = 0$ 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