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
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
Manufactured Trusses

- open web joists
- parallel chord
Open Web Joists

- **SJL:** [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

### 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)

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<th>Joist Designation</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/ft² / 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

[http://nisee.berkeley.edu/godden](http://nisee.berkeley.edu/godden)
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** 
  \( L/240 \)

### VERTICAL LOADS FOR TYPE 1.5B

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Plate Girders

- welds
- web stiffeners

[Diagram showing plate girders, angle stiffeners, and web stiffeners]

http://nisee.berkeley.edu/godden

stiffeners at end where shear is greatest and at support

thicker flange in center where moment is greatest

PLATE GIRDER  BOX GIRDER

stiffeners to prevent lateral buckling
Web Bearing

- max loads

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

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

• 3D with 2 force bodies and pins
  – pyramid
  – tetrahedron

• “frames” have fixed joints

• layers

• 40’s
Space Trusses

- connections

- supports

(a) UNISTRUT (system 1)  (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

http://nisee.berkeley.edu/godden

www.archdaily.com

Lecture 19

ARCH 331

F2014abn
Space Trusses
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