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

- **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

#### Load for Live Load Deflection Limit (L/360) in **RED**

**Total in **BLACK**

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<tr>
<th>Joist Designation</th>
<th>10K1</th>
<th>12K1</th>
<th>12K3</th>
<th>12K5</th>
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*Steel Trusses 7*  
*Lecture 16*  
*Architectural Structures*  
*ARCH 331*  
*SU2013abn*
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

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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

<table>
<thead>
<tr>
<th>No. of Span</th>
<th>Deck Type</th>
<th>Max. SDI Const.</th>
<th>Span (ft-in.)</th>
<th>Allowable Total (Dead + Live) Uniform Load (PSF)</th>
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<td>B 21</td>
<td>7'-4</td>
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Plate Girders

- welds
- web stiffeners

Plate Girder

Box Girder

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Web Bearing

- max loads

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

\[ P_{n(max-interior)} = (N + 5k)F_{yw}t_w \]
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 I)
(b) TRIODETIC
(c) MERC (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

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