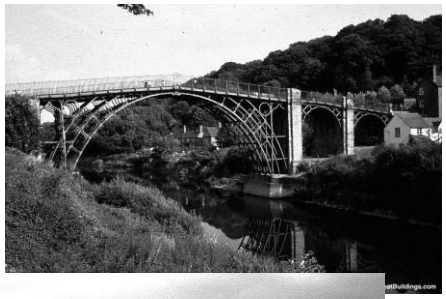
ELEMENTS OF ARCHITECTURAL STRUCTURES:
FORM, BEHAVIOR, AND DESIGN
ARCH 614
DR. ANNE NICHOLS
SPRING 2014

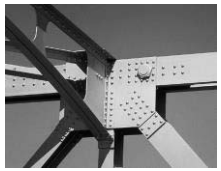
lecture
seventeen

steel construction: trusses, decks & plate girders

Iron & Steel Trusses

- cast iron
  - 18th century
  - chain links
- wrought-iron
- rivets



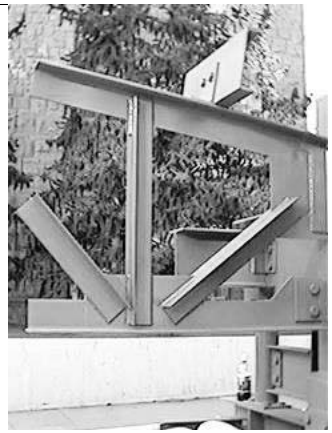


http:// nisee.berkeley.edu/godden

Truss Connections

- gusset plates
- bolts
- welds

(AISC - Steel Structures of the Everyday)



http://courses.civil.ualberta.ca

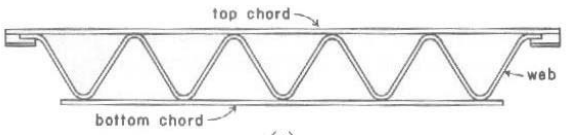
Trusses

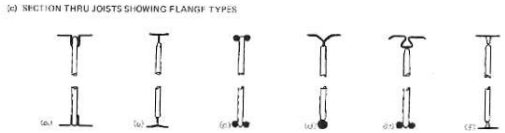
- require lateral bracing
- consider buckling
- indeterminate trusses
  - extra members
  - solvable with statics
    - cables can't hold compression
  - displacement methods
    - elastic elongation
  - too few members, unstable

One Maritime Plaza, SOM 1964

Manufactured Trusses

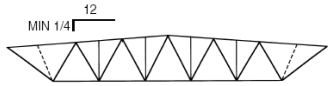
- *open web joists*
- *parallel chord*





Open Web Joists

- *SJI: 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*

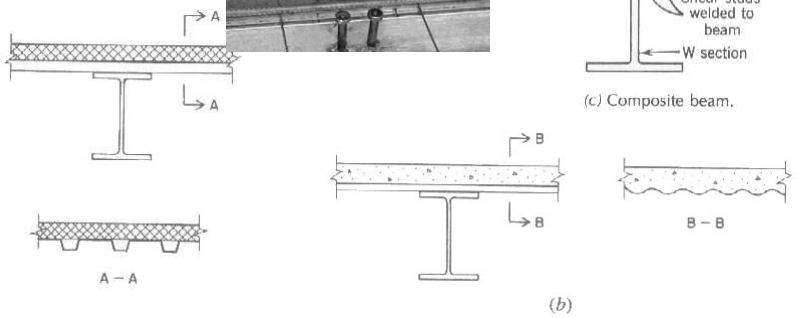
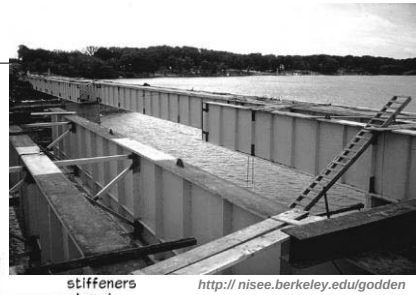


Plate Girders

- *welds*
- *web stiffeners*



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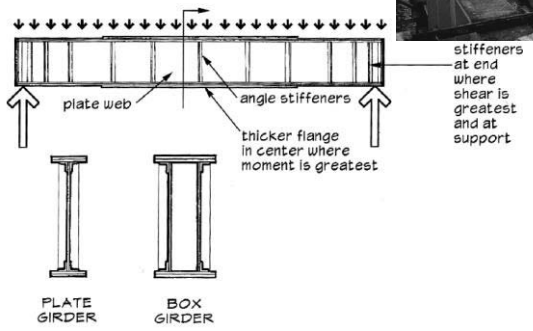
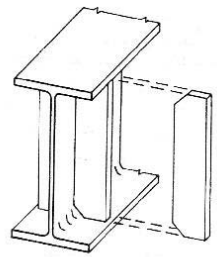




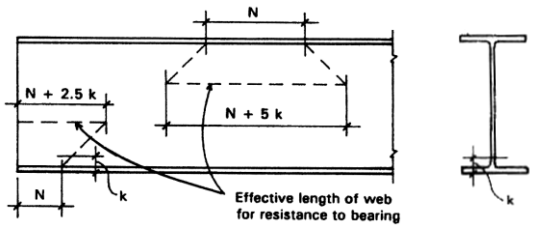
stiffeners to prevent lateral buckling

Web Bearing

- *max loads*

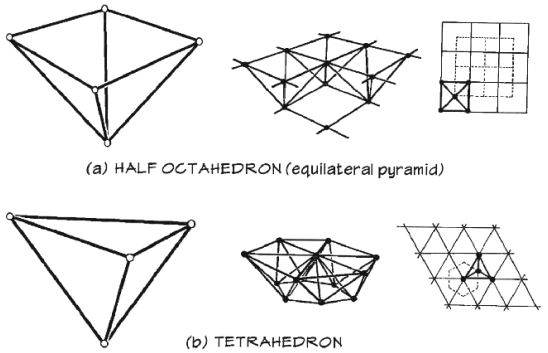
$$P_{n(\max-\text{end})} = (N + 2.5k)F_y t_w$$

$$P_{n(\max-\text{interior})} = (N + 5k)F_{yw} t_w$$



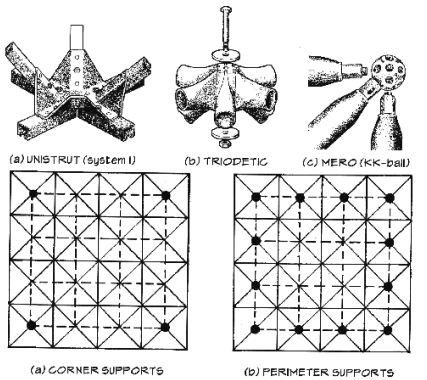
Space Trusses

- *3D with 2 force bodies and pins*
  - *pyramid*
  - *tetrahedron*
- *"frames" have fixed joints*
- *layers*
- *40's*

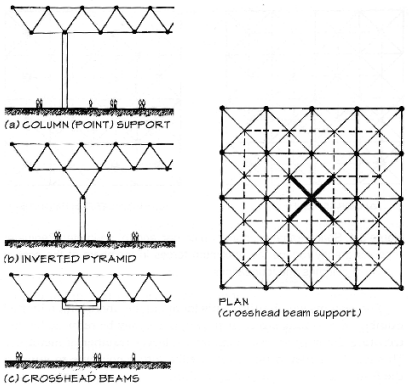


Space Trusses

- *connections*



- *supports*



Space Trusses

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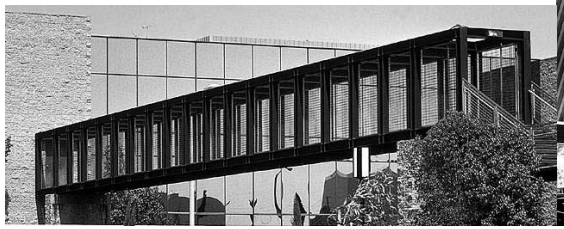

Space Trusses

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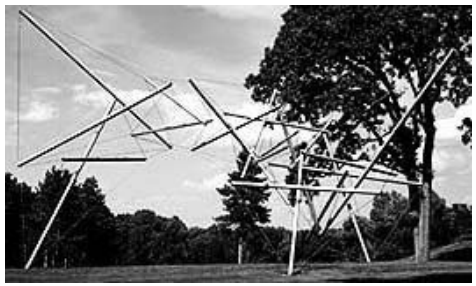
Tensegrities

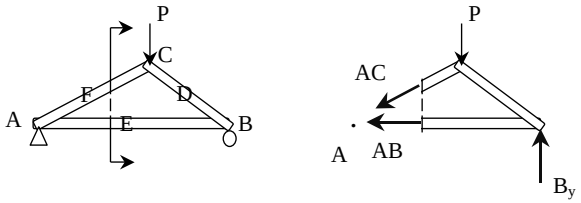
- *3D frame*
- *discontinuous struts*
- *continuous cables*



Free Ride Home – Kenneth Snelson

Method of Sections

- *relies on internal forces being in equilibrium on a section*
- *cut to expose <u>3 or less</u> 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*