

**ELEMENTS OF ARCHITECTURAL STRUCTURES:  
FORM, BEHAVIOR, AND DESIGN**

**ARCH 614**

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**SPRING 2013**

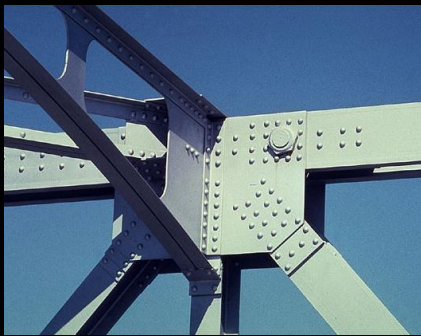
*lecture  
seventeen*

**steel construction:  
trusses, decks & plate girders**



# Iron & Steel Trusses

- *cast iron*
  - 18<sup>th</sup> 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

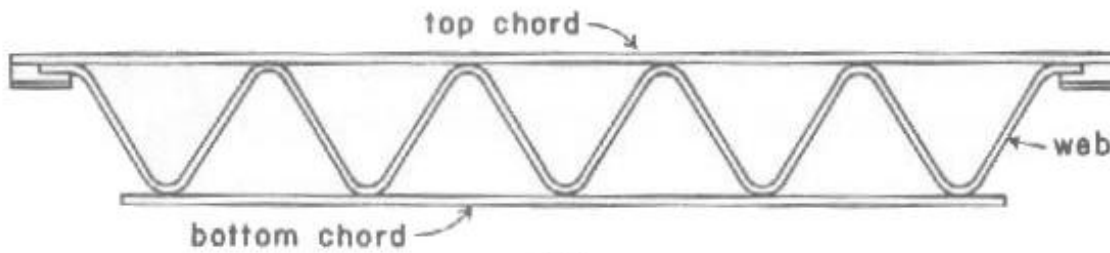
- *require lateral bracing*
- *consider buckling*
- *indeterminate trusses*
  - *extra members*
  - *solvable with statics*
    - *cables can't hold compression*
  - *displacement methods*
    - *elastic elongation*
  - *too few members, unstable*



One Maritime Plaza, SOM 1964

# Manufactured Trusses

- *open web joists*
- *parallel chord*

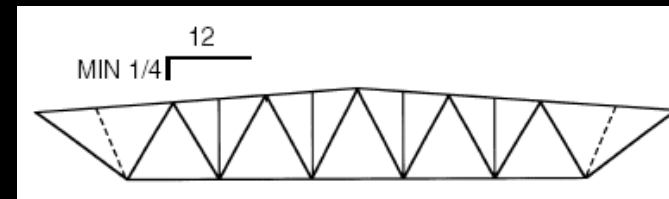
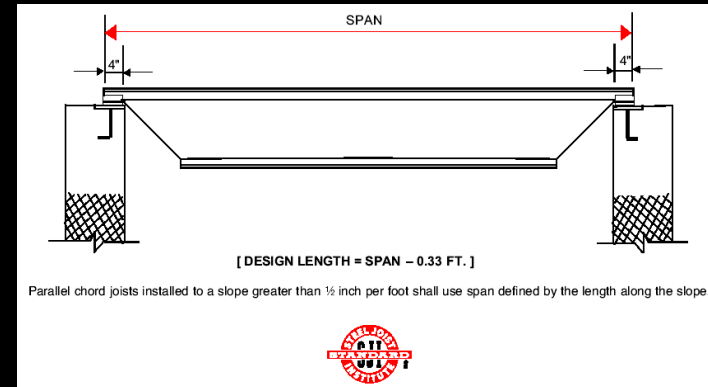


(c) SECTION THRU JOISTS SHOWING FLANGE TYPES



# Open Web Joists

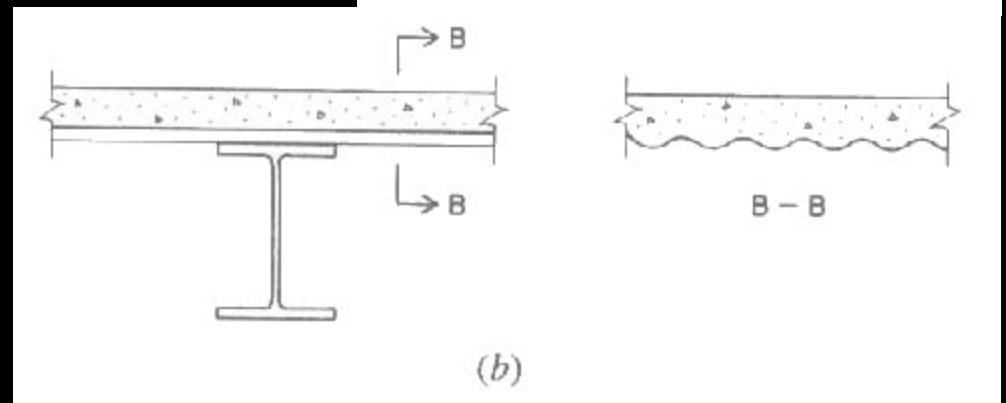
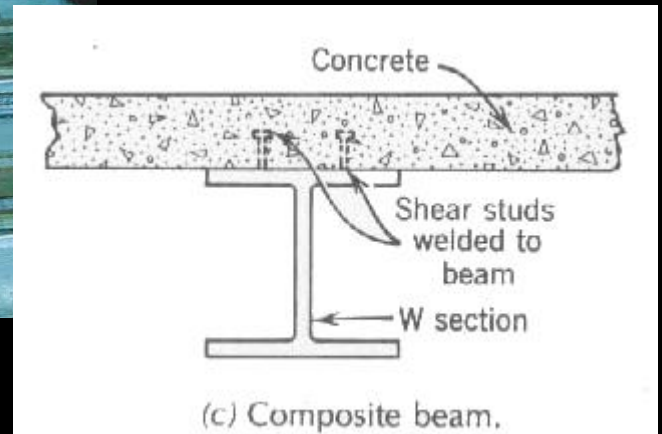
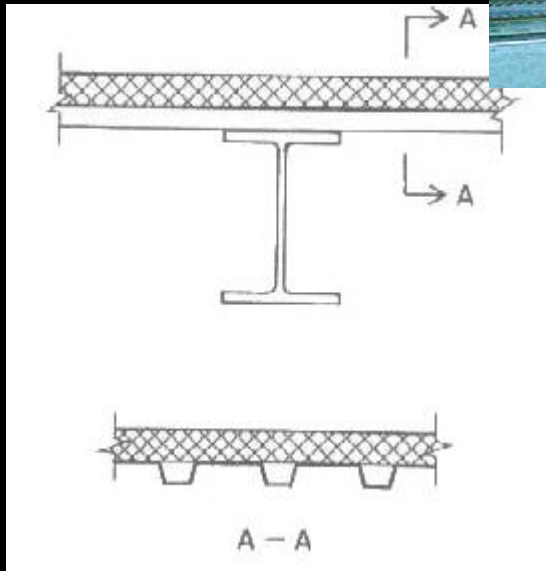
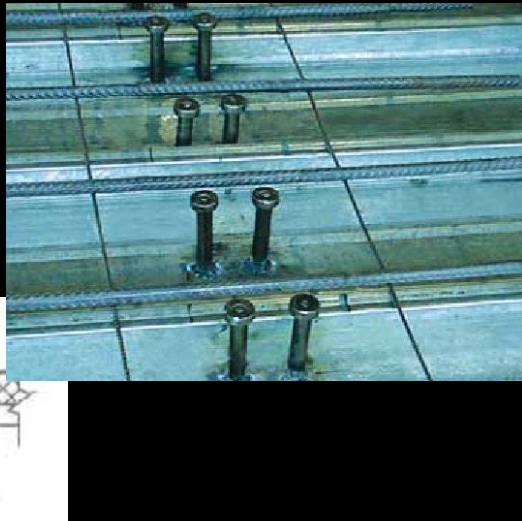
- **SJI:** [www.steeljoist.com](http://www.steeljoist.com)
- **Vulcraft:** [www.vulcraft.com](http://www.vulcraft.com)
  - **K Series (Standard)**
    - 8-30" deep, spans 8-50 ft
  - **LH Series (Long span)**
    - 18-48" deep, spans 25-96 ft
  - **DLH (Deep Long Spans)**
    - 52-72" deep, spans 89-144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





# Decks

- *sheet steel*
- *composite*

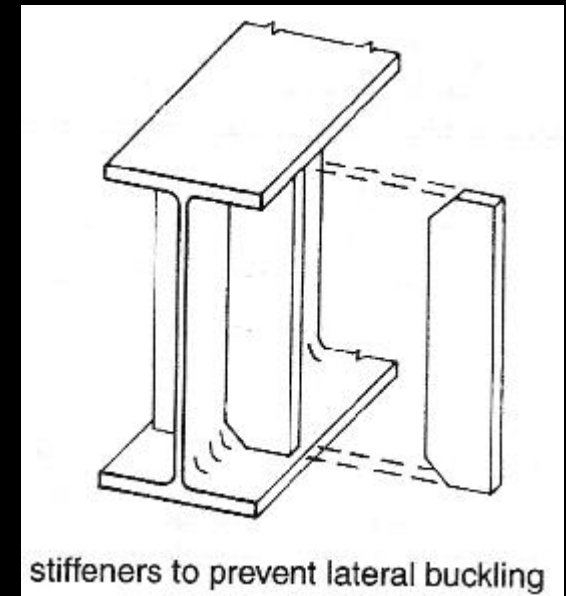
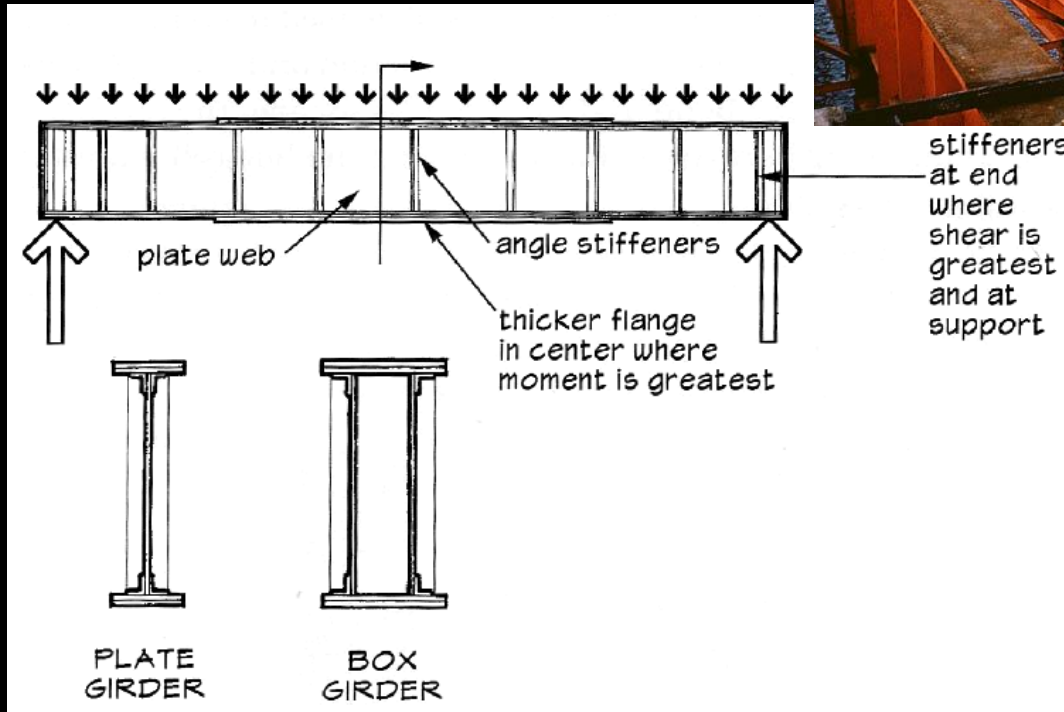


# Plate Girders

- welds
- web stiffeners



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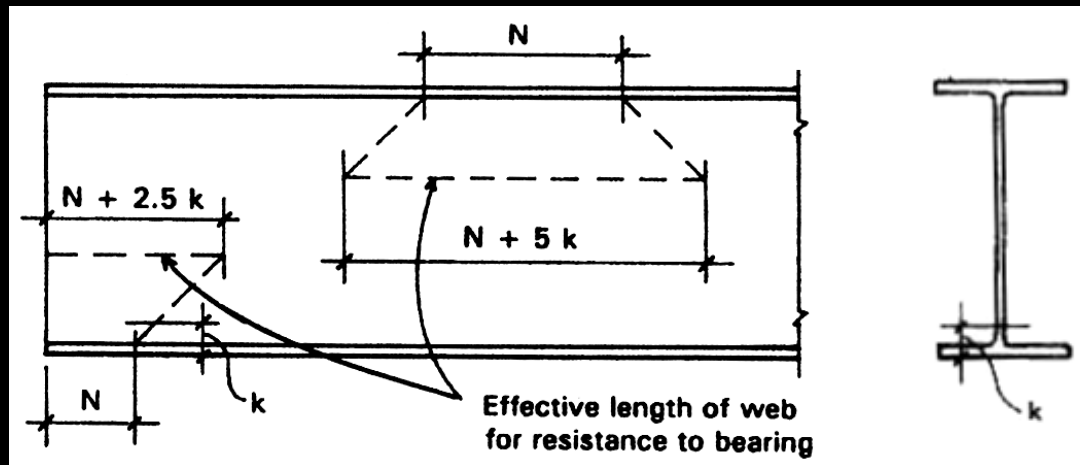


# Web Bearing

- *max loads*

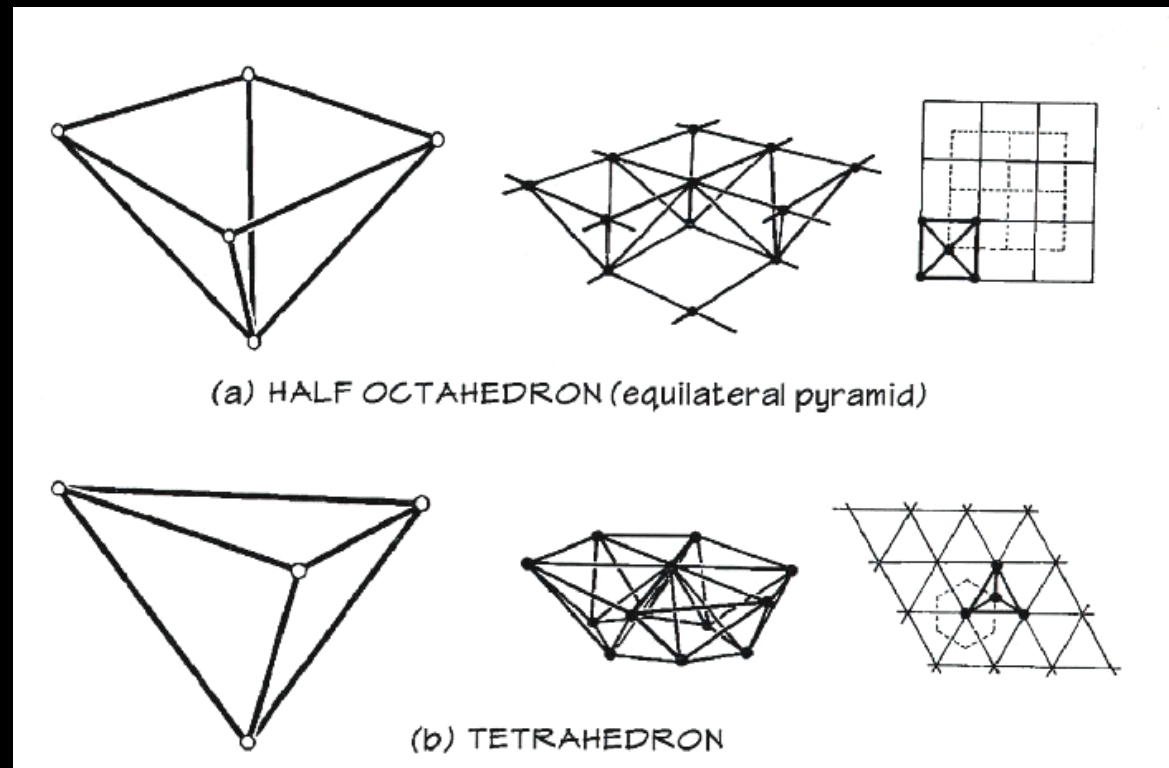
$$P_{n(\text{max-end})} = (N + 2.5k) F_y t_w$$

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



# Space Trusses

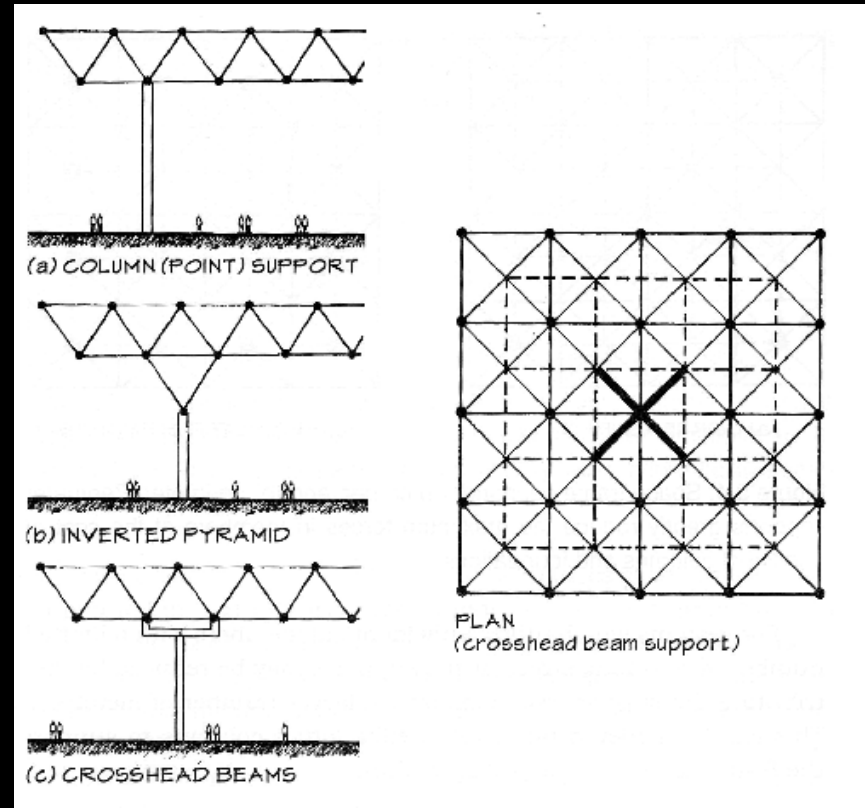
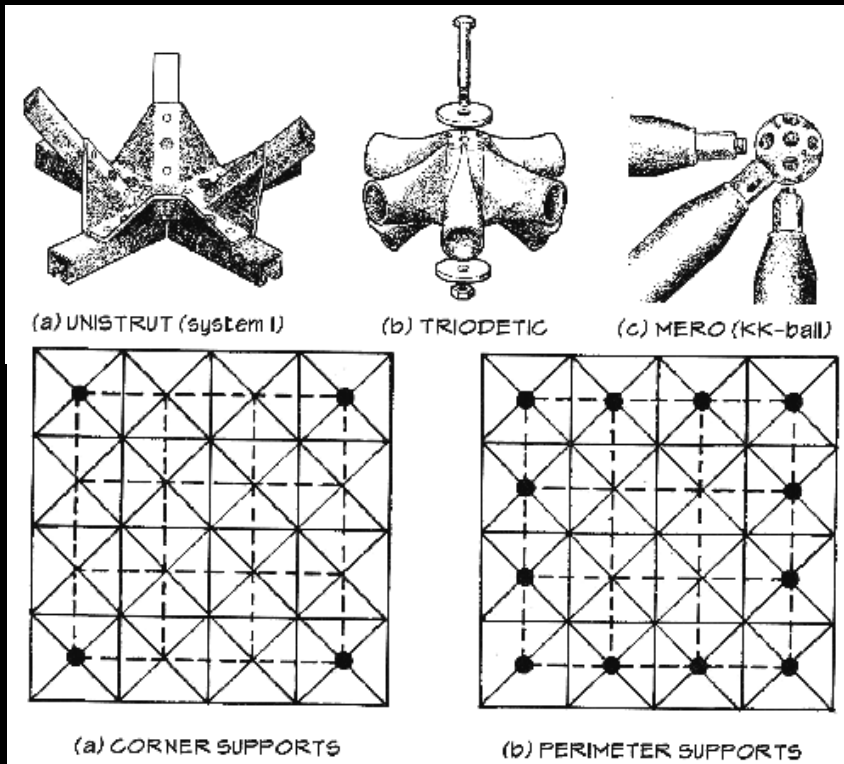
- *3D with 2 force bodies and pins*
  - *pyramid*
  - *tetrahedron*
- *“frames” have fixed joints*
- *layers*
- *40’s*



# Space Trusses

- connections

- supports





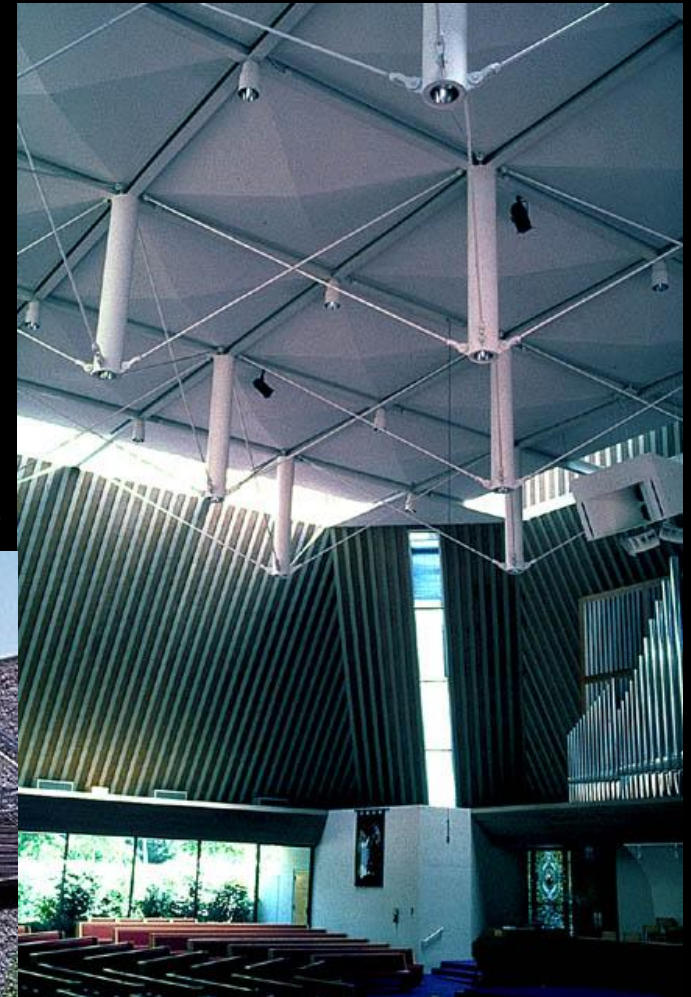
# Space Trusses



<http://nisee.berkeley.edu/godden>



Steel Trusses 12  
Lecture 17



Elements of Architectural Structures  
ARCH 614

S2013abn



# Space Trusses

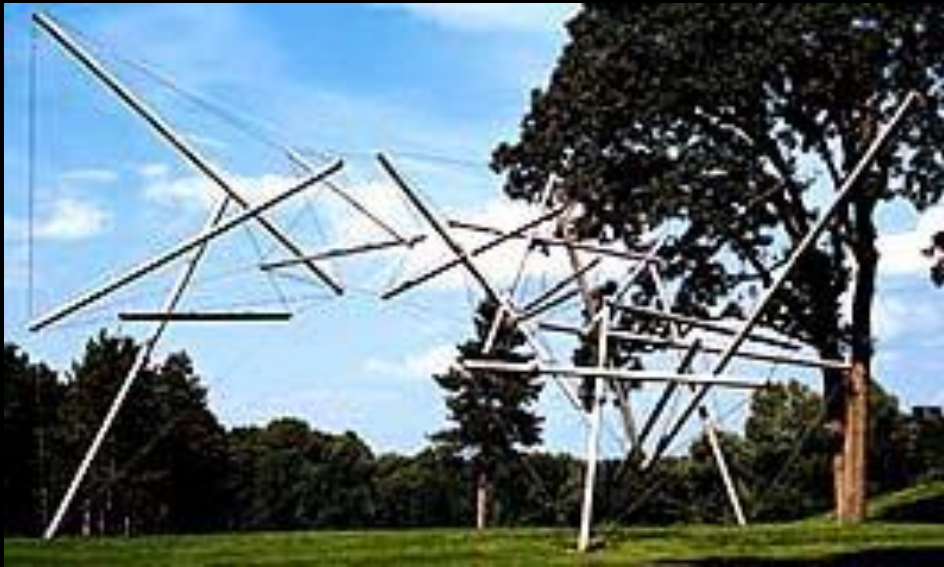
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# Tensegrities

- 3D frame
- discontinuous struts
- continuous cables



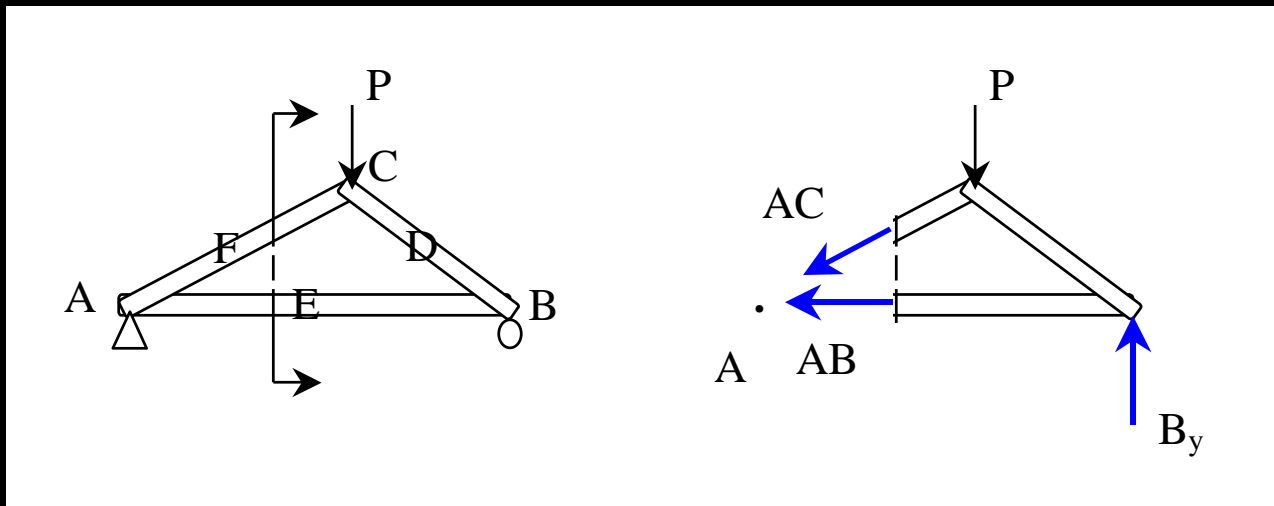
*Free Ride Home – Kenneth Snelson*





# Method of Sections

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

