other beams & pinned frames

Continental train platform, Grimshaw 1993
Pinned Frames

- structures with at least one 3 force body
- connected with pins
- reactions are equal and opposite
  - non-rigid
  - rigid
Rigid Frames

- **rigid frames have no pins**
- **frame is all one body**
- **typically statically indeterminate**
- **types**
  - portal
  - gable
Rigid Frames with PINS

- frame pieces with connecting pins
- not necessarily symmetrical
Internal Pin Connections

- **statically determinant**
  - 3 equations per body
  - 2 reactions per pin + support forces
Arches

• ancient
• traditional shape to span long distances
Arches

- primarily sees compression
- a brick “likes an arch”
Arches

• behavior
  – thrust related to height to width
Three-Hinged Arch

• statically determinant
  – 2 bodies, 6 equilibrium equations
  – 4 support, 2 pin reactions (= 6)
Compound Beams

- **statically determinant when**
  - 3 equilibrium equations per link =>
  - total of support & pin reactions
    (properly constrained)

- **zero moment at pins**
Procedure

• solve for all support forces you can
• draw a FBD of each member
  – pins are integral with member
  – pins with loads should belong to 3+ force bodies
  – pin forces are equal and opposite on connecting bodies
  – identify 2 force bodies vs. 3+ force bodies
  – use all equilibrium equations
Rigid Body Types

- **two force bodies**
  - forces in line, equal and opposite
- **three force bodies**
  - concurrent or parallel forces
Continuous Beams

- statically indeterminate
- reduced moments than simple beam
Continuous Beams

- loading pattern affects
  - moments & deflection

\[ \Delta_{\text{max}} = 0.0069 \frac{w l^4}{EI} \]
Continuous Beams

- **unload end span**
Continuous Beams

- unload middle span

![Diagram of a continuous beam with labeled reactions and shear and moment diagrams. The diagram shows the maximum deflection and shear and moment values at various sections.]

\[
\Delta_{\text{max}} \text{ (from A or D)} = \frac{0.479}{4} \frac{w}{l^4}EI
\]
Analysis Methods

• Approximate Methods
  – location of inflection points

• Force Method
  – forces are unknowns

• Displacement Method
  – displacements are unknowns
Two Span Beams & Charts

- equal spans & symmetrical loading
- middle support as flat slope