Continental train platform, Grimshaw 1993

Other beams & pinned frames
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**

![Diagram of Compound Beams]

**Diagram Notes:**
- Internal pin labeled (internal) pin.
- Support reactions labeled: $R_1x$, $R_1y$, $R_2x$, $R_2y$, $R_3$.
- Forces applied: $F_1$, $F_2$.

_not independent_
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

![Diagram of Continuous Beams]

\[ \Delta_{\text{max}} (0.446 \text{ from A or D}) = 0.0069 \frac{w l^4}{EI} \]
Continuous Beams
• unload end span
Continuous Beams

- unload middle span
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