Northwestern Parking Garage

An Introduction to ME 323

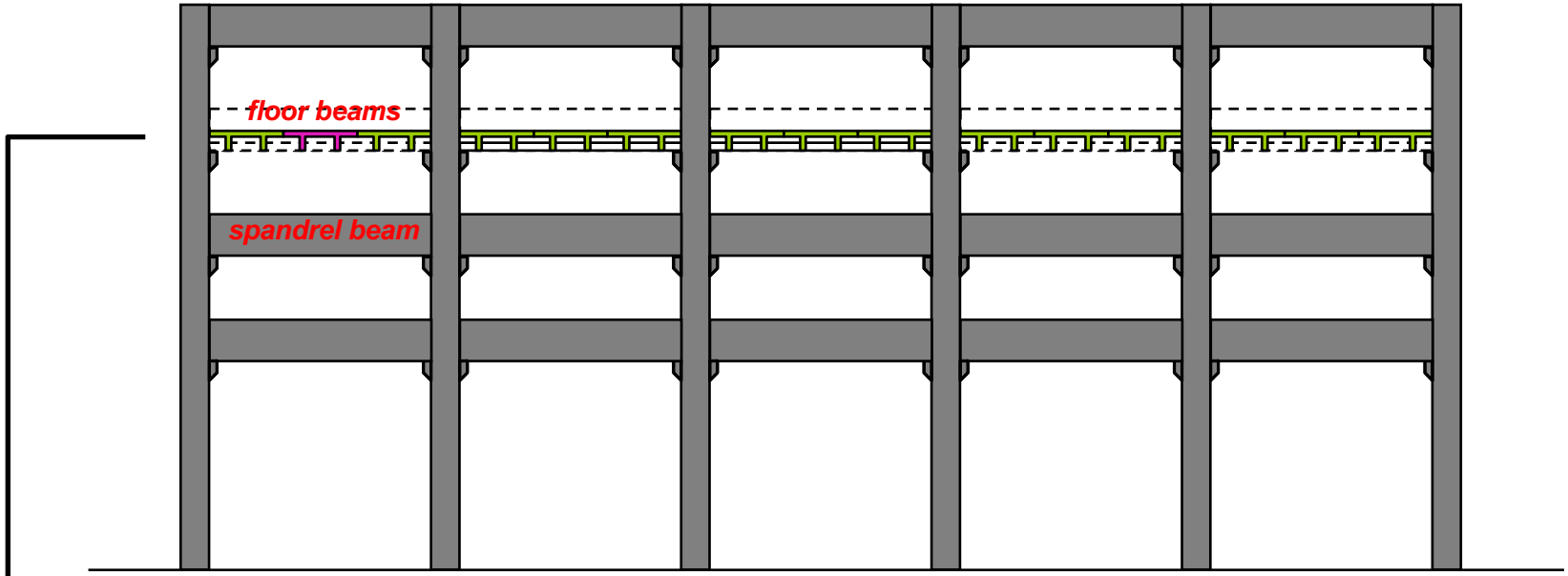
Let's use Purdue's Northwestern parking structure as an application of what you have already seen about stress in ME 270.

Northwestern Parking Garage

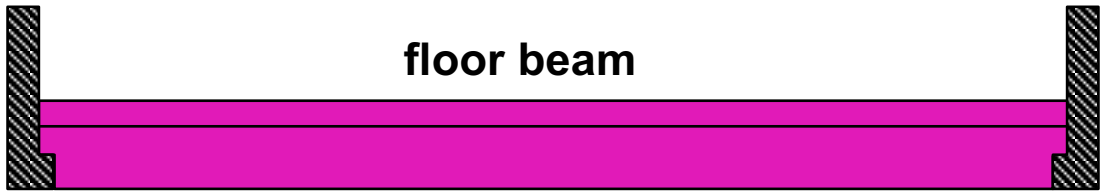
Three critical structural components in the structure: spandrel beams, floor beams and corbels on support columns.

Northwestern Parking Garage

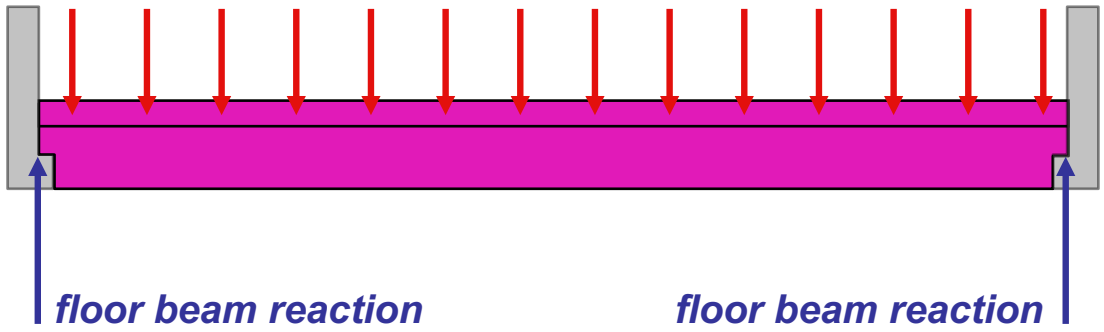
Front view of structure showing FLOOR beams



side view of beam

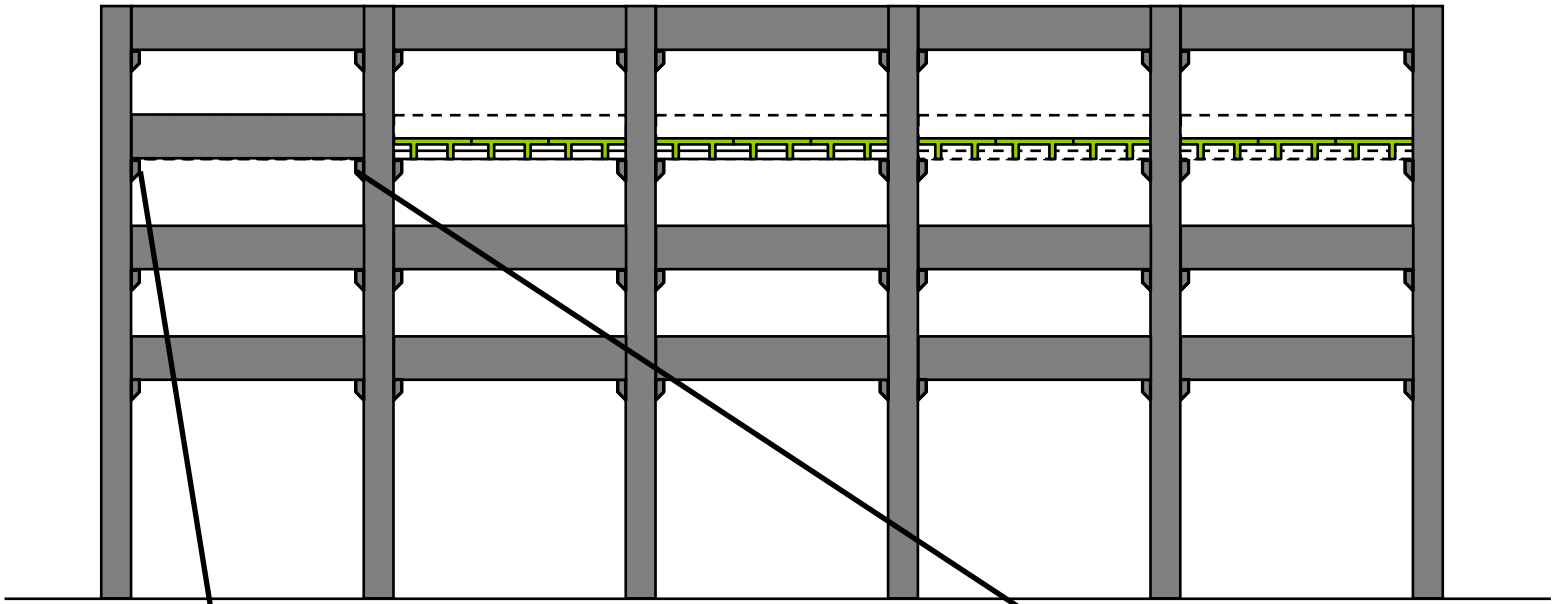


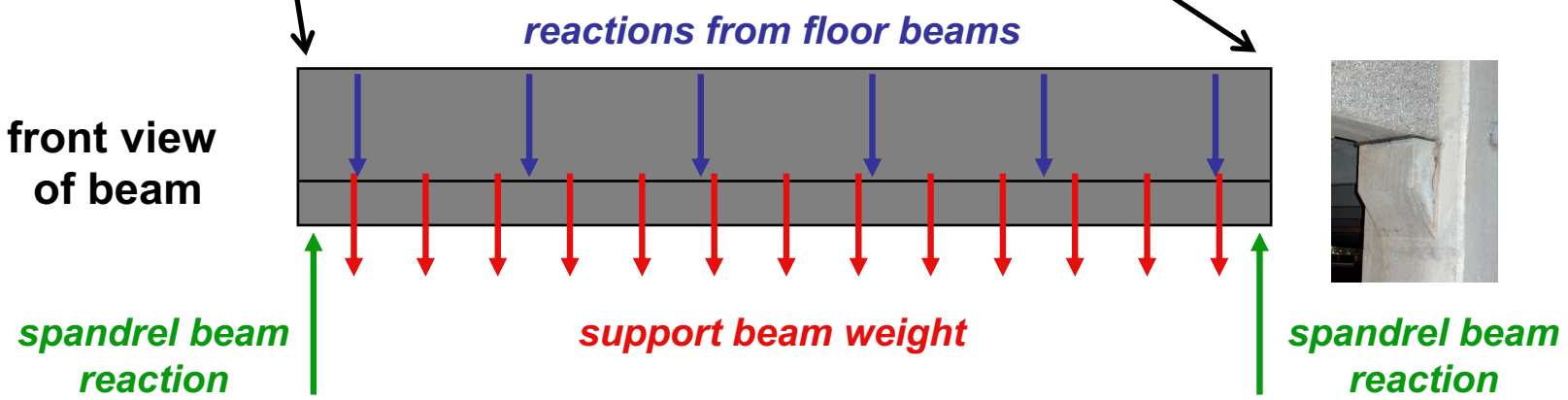
spandrel beam



Northwestern Parking Garage

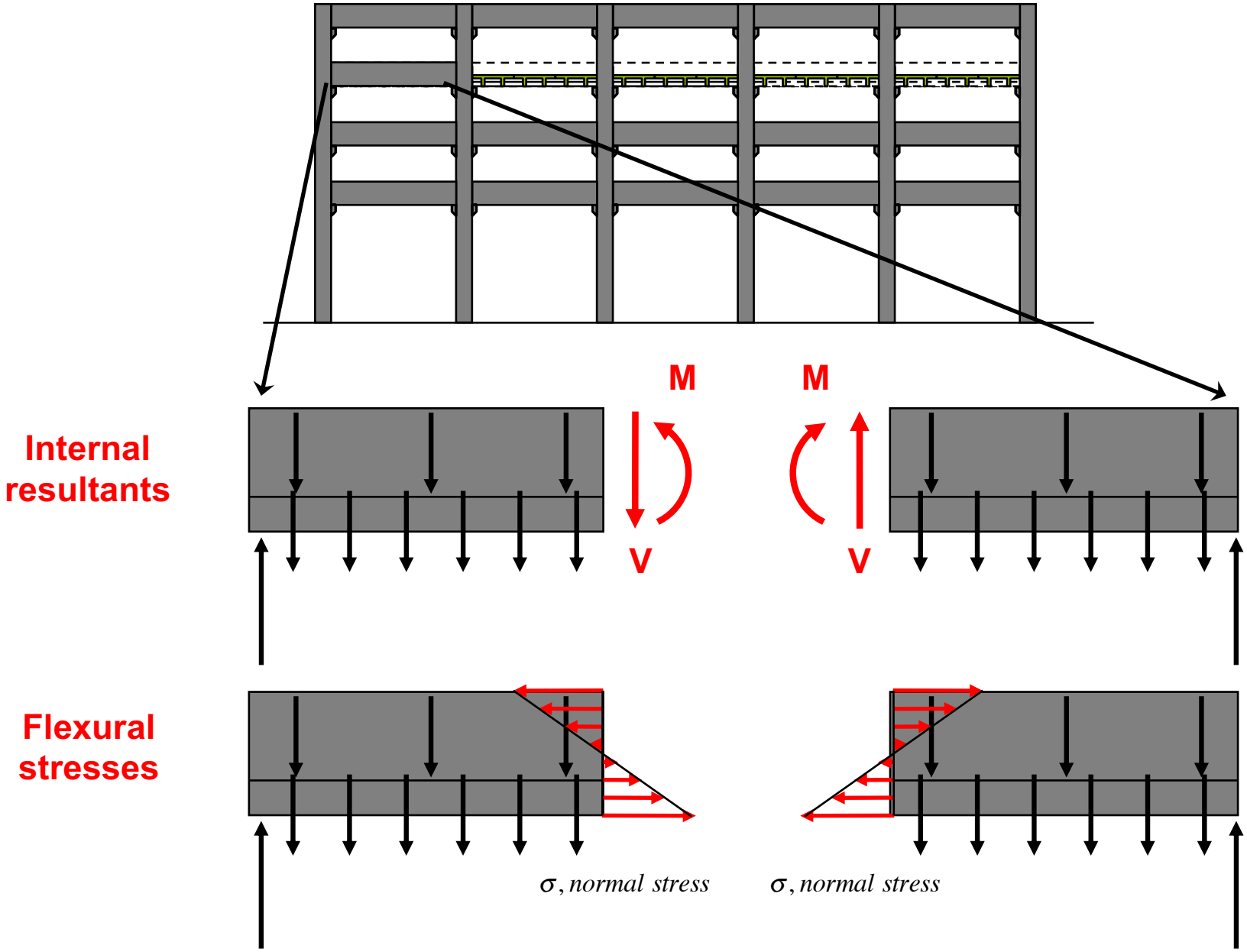
Front view of structure showing SPANDREL beams





Northwestern Parking Garage

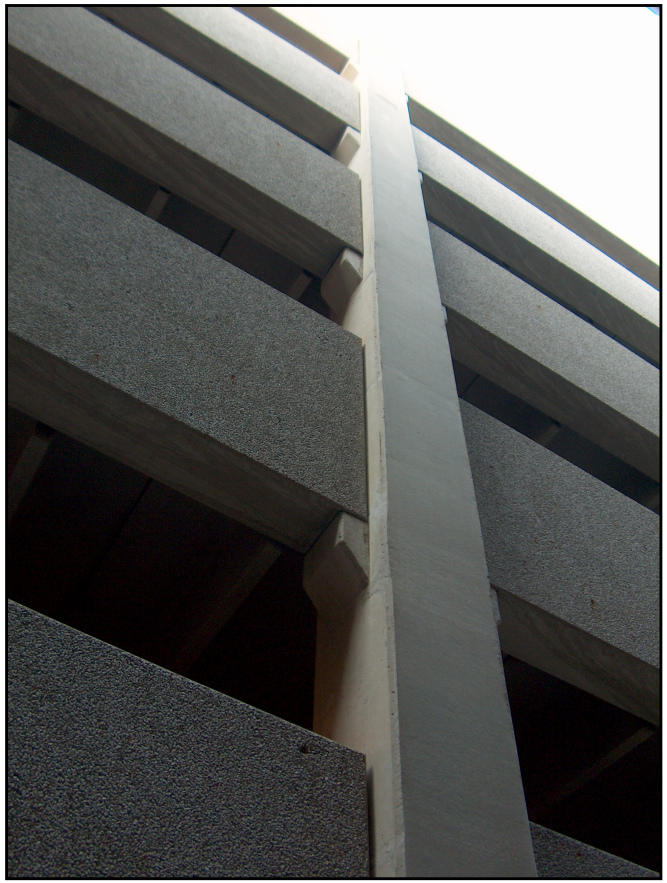
Front view of structure showing SPANDREL beams

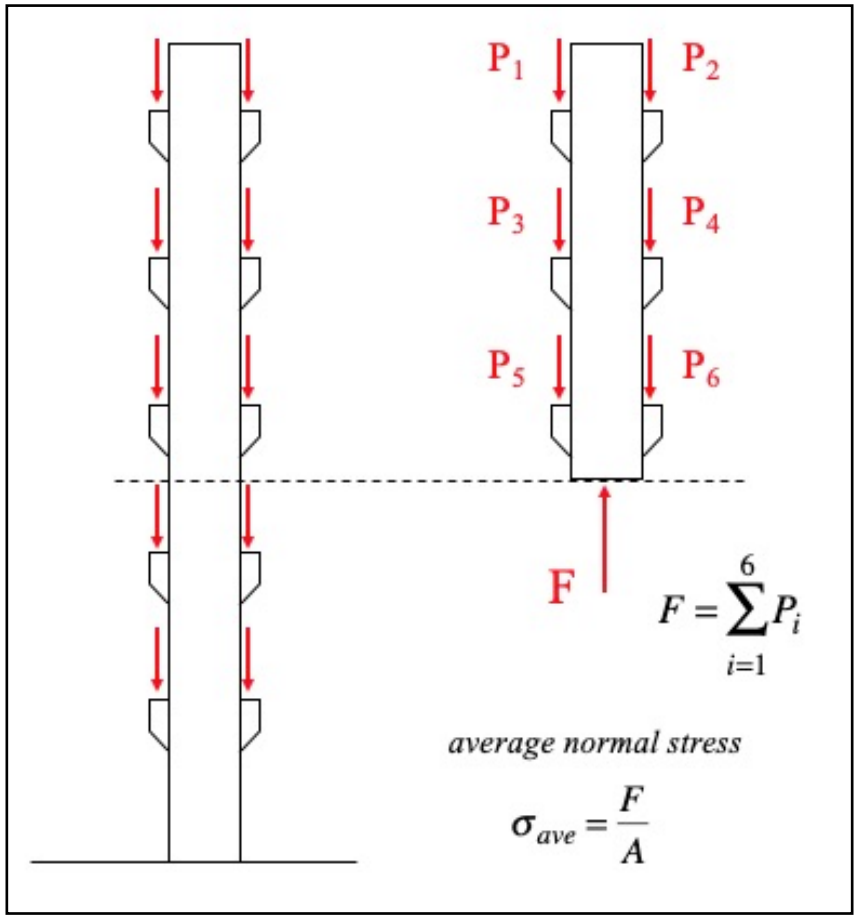


Northwestern Parking Garage

Showing support column

Axial stress in the support columns.

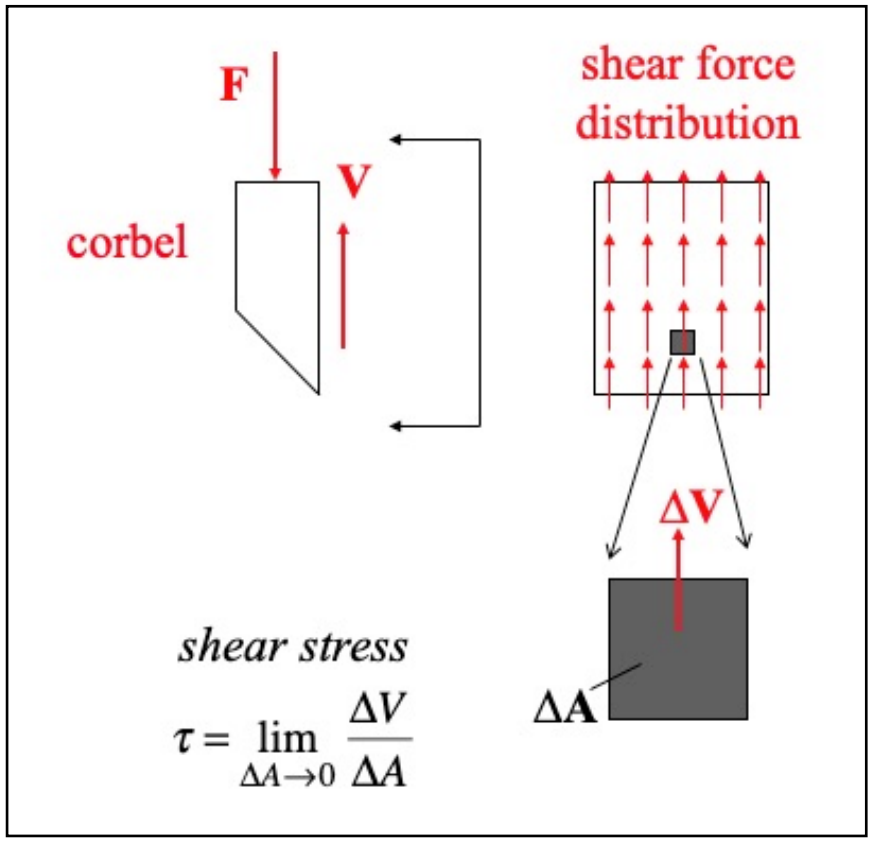


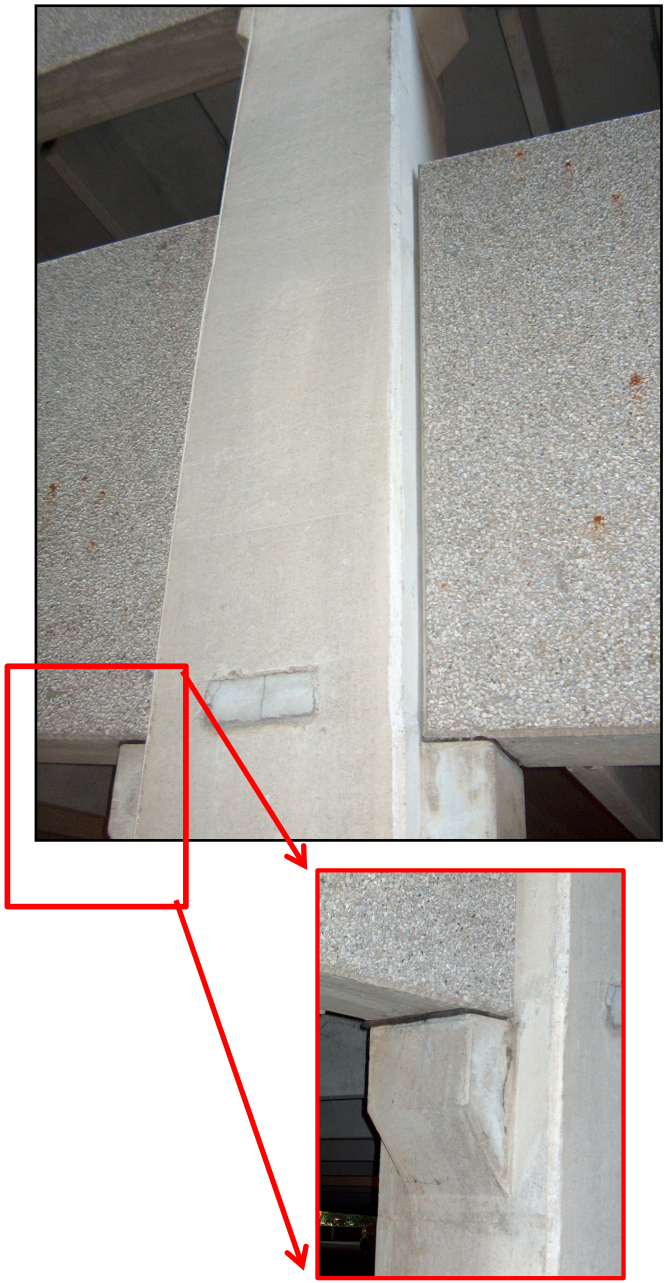


Northwestern Parking Garage

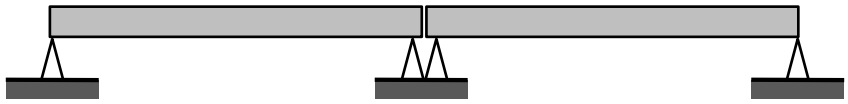
Corbel support in the support beams

Shear stress in corbel supports.





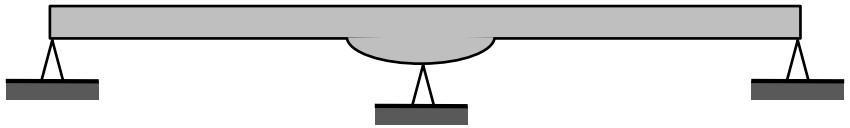
Railroad Overpass on Sagamore Parkway



A set of <u>two</u> simply-supported beams:
"Easy" to solve for stresses, right?

Highway Overpass on I-65

(Indiana)



A <u>single</u> beam with three supports:
Can you solve for the stresses in this beam?
Also, why the "bulge" in the beam?

Bridge designs

What do these bridge designs have in common (from a structural standpoint) and are different from a highway overpass bridge?

Kennedy Bridge
(truss structure)

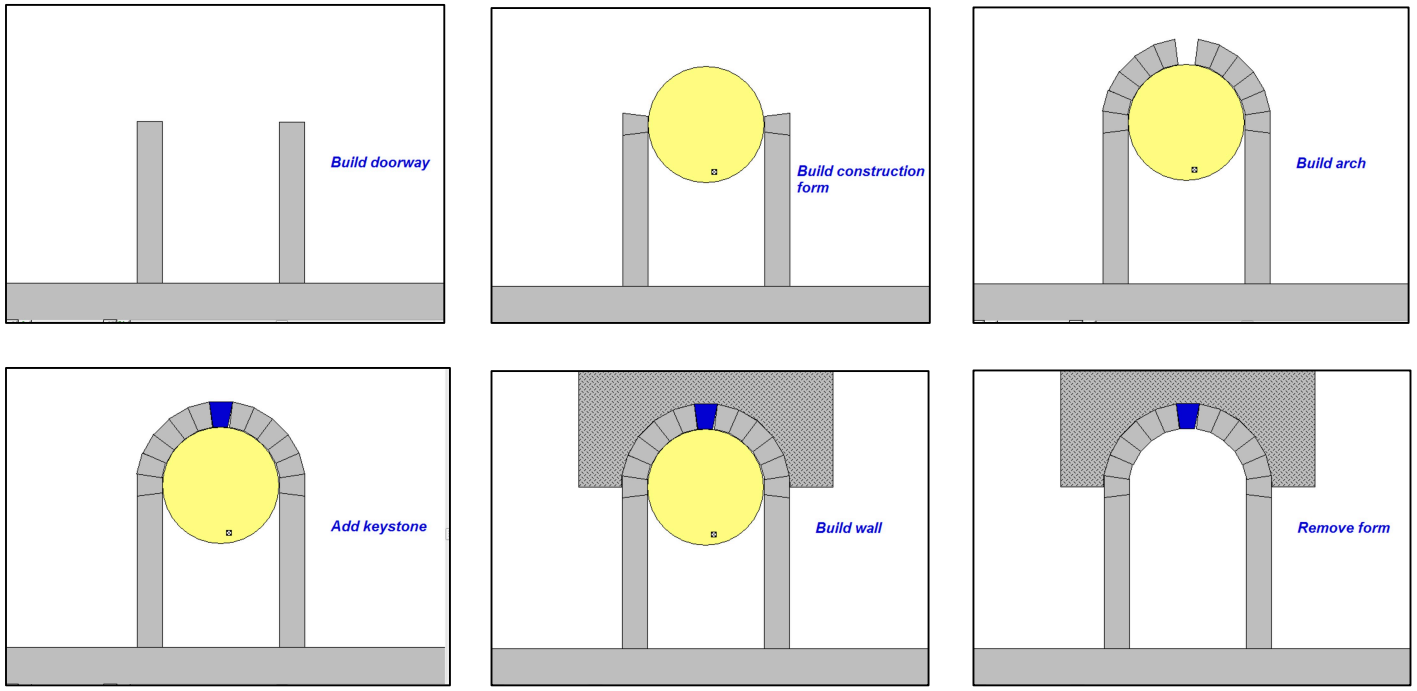
Sherman Minton Bridge
(truss-cable structure)

Lincoln Bridge
(cable-stayed
structure)

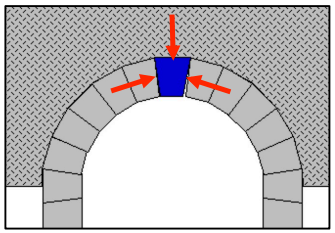
stone archway
bridge

highway overpass
bridge

Building a stone arched-doorway



Pisa Cathedral



Archway stones are held in place by compressive normal forces… no tensile flexural stress components

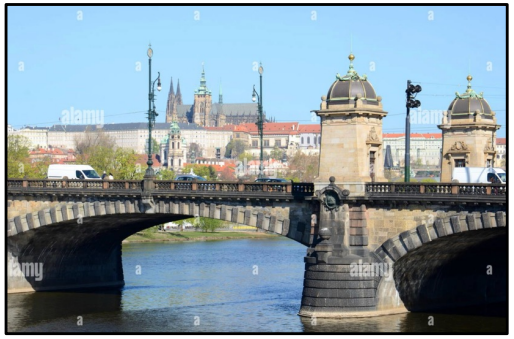
Some bridges of Prague

A common theme

Charles Bridge, 1357
(arch structure)

Jirasek Bridge, 1929
(arch-column)

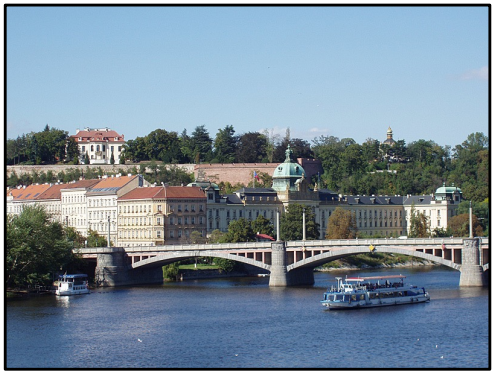
Legion Bridge, 1899
(arch structure)



Chechuv Bridge, 1905
(truss substructure)

Palecky Bridge, 1875
(arch structure)

Manes Bridge, 1911
(arch-column)



Sun Kinks in Railway Rails

What caused this?

Some questions for this semester in ME 323

Concepts

- How big is a *Pascal*? A *PSI*? Which is larger?
- Do *material properties* affect stresses?
- How do you solve an *indeterminate* problem?
- More important: *shear stress* or *normal stress*?
- S*tress without strain*? S*train without stress*?
- How do materials *fail*?
- Why are automotive drive shafts *hollow*?
- What role does the *second area moment of a beam* play in finding stress in beams?
- Why do we care about *shear force/bending moment diagrams* in beams?