

**ARCHITECTURAL STRUCTURES I:
STATICS AND STRENGTH OF MATERIALS**

ENDS 231

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SPRING 2007

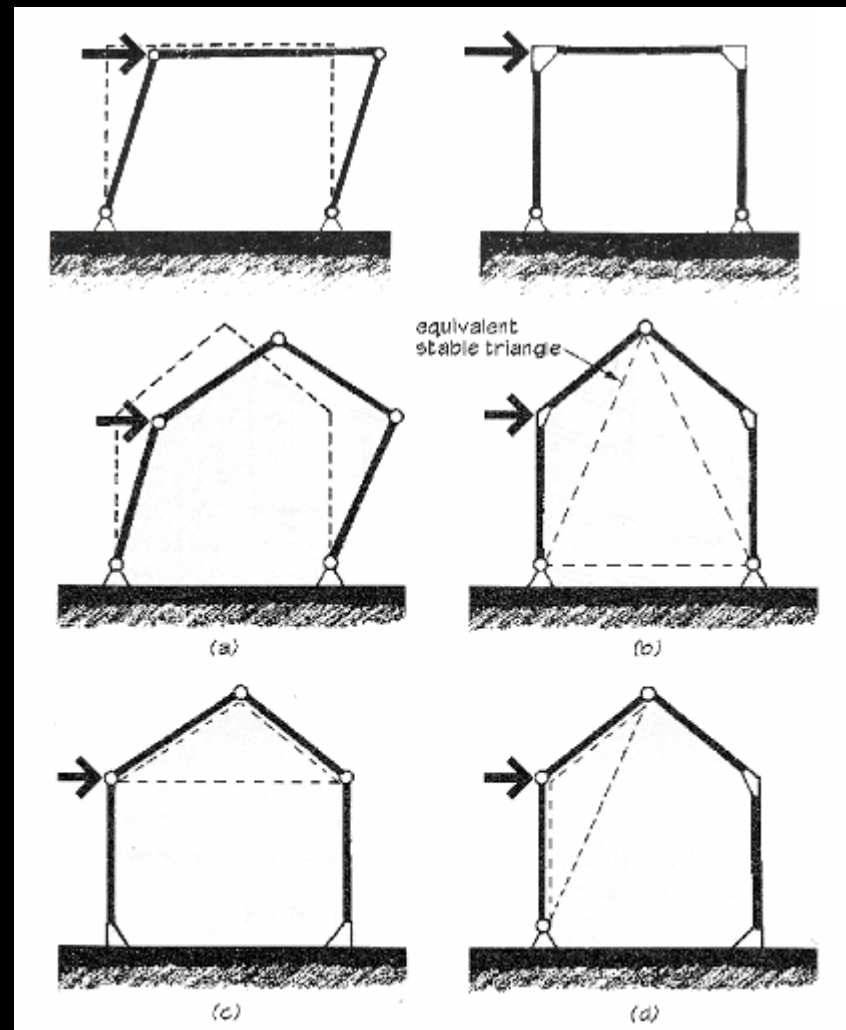
lecture
twenty seven

**frames:
rigid and braced**



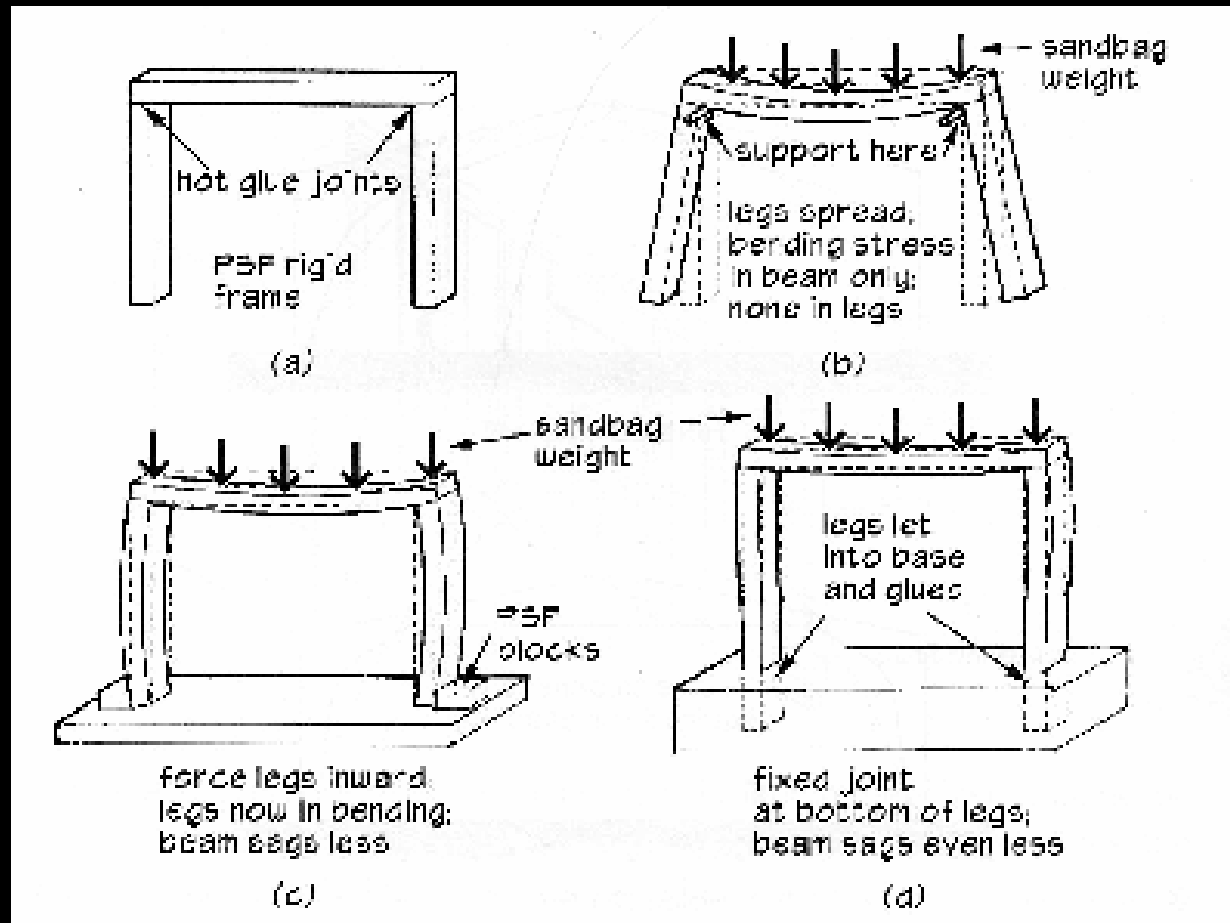
Rigid Frames

- rigid frames have no pins
- frame is all one body
- joints transfer moments and shear
- typically statically indeterminate
- types
 - portal
 - gable



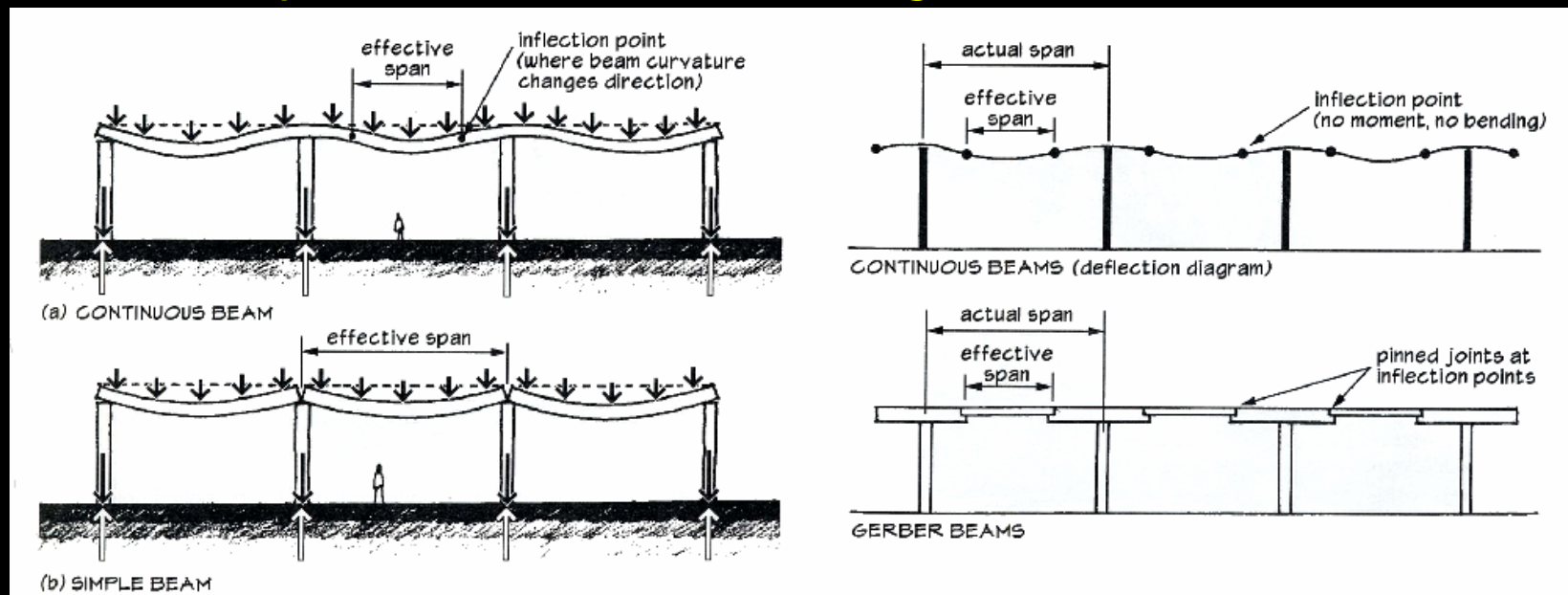
Rigid Frames

- *behavior*



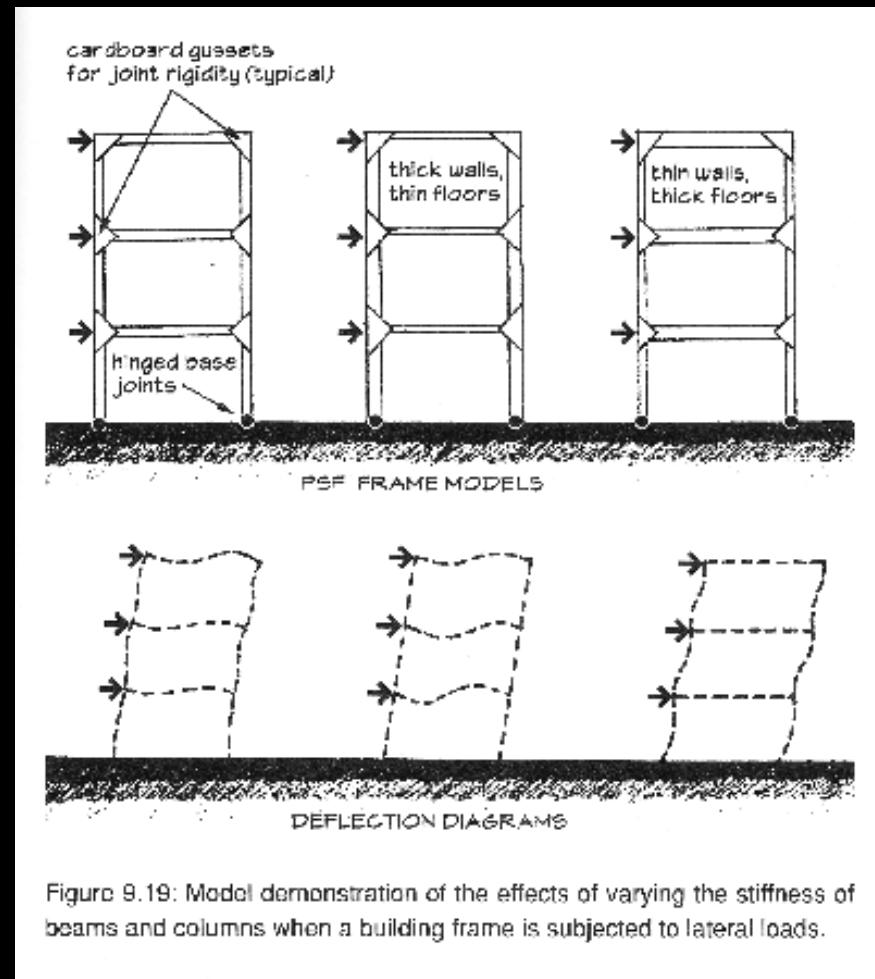
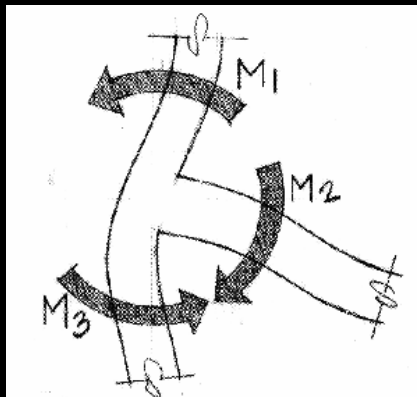
Rigid Frames

- moments get redistributed
- deflections are smaller
- effective column lengths are shorter
- very sensitive to settling



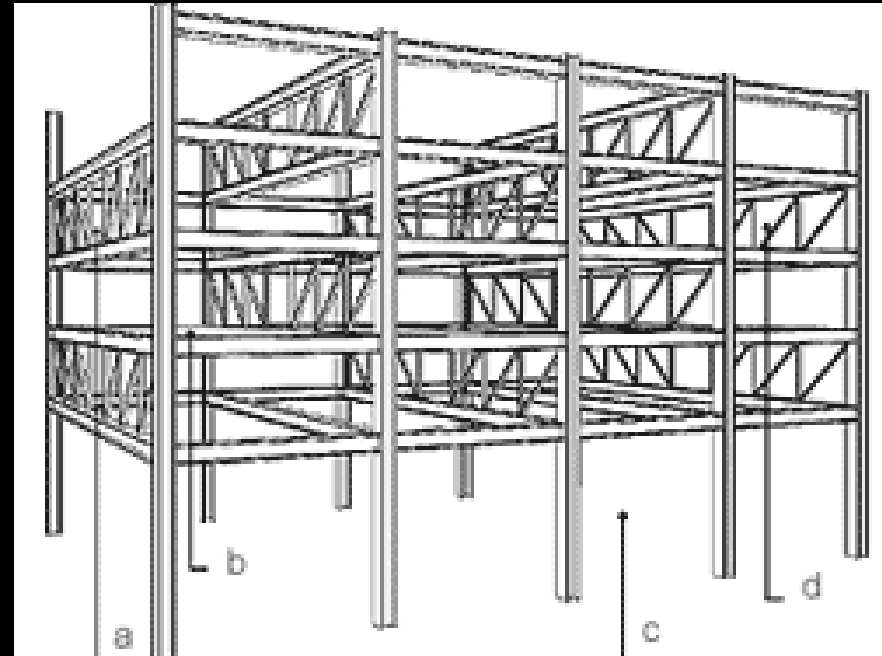
Rigid Frames

- resists lateral loadings
- shape depends on stiffness of beams and columns
- 90° maintained



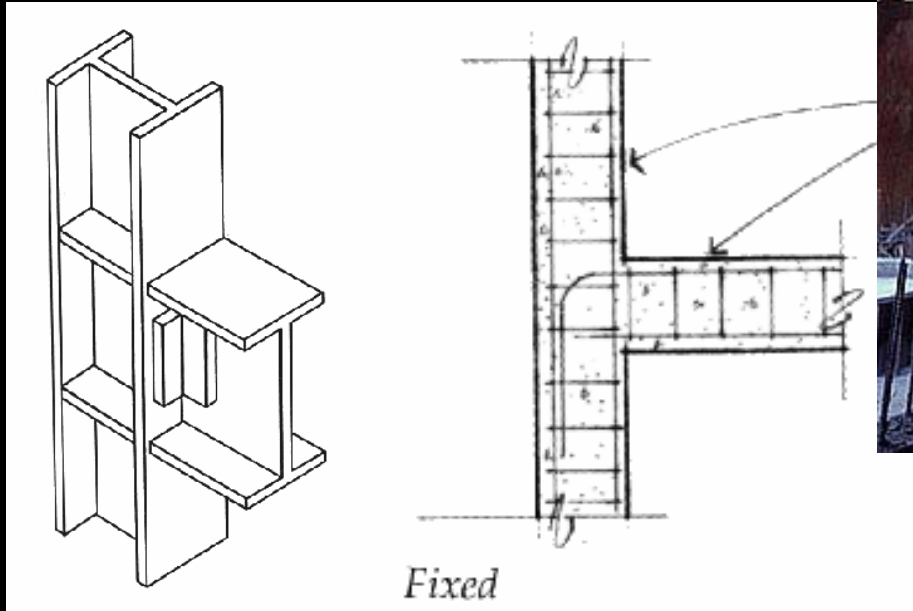
Rigid Frames

- *staggered truss*
 - *rigidity*
 - *clear stories*



Rigid Frames

- *connections*
 - *steel*
 - *concrete*



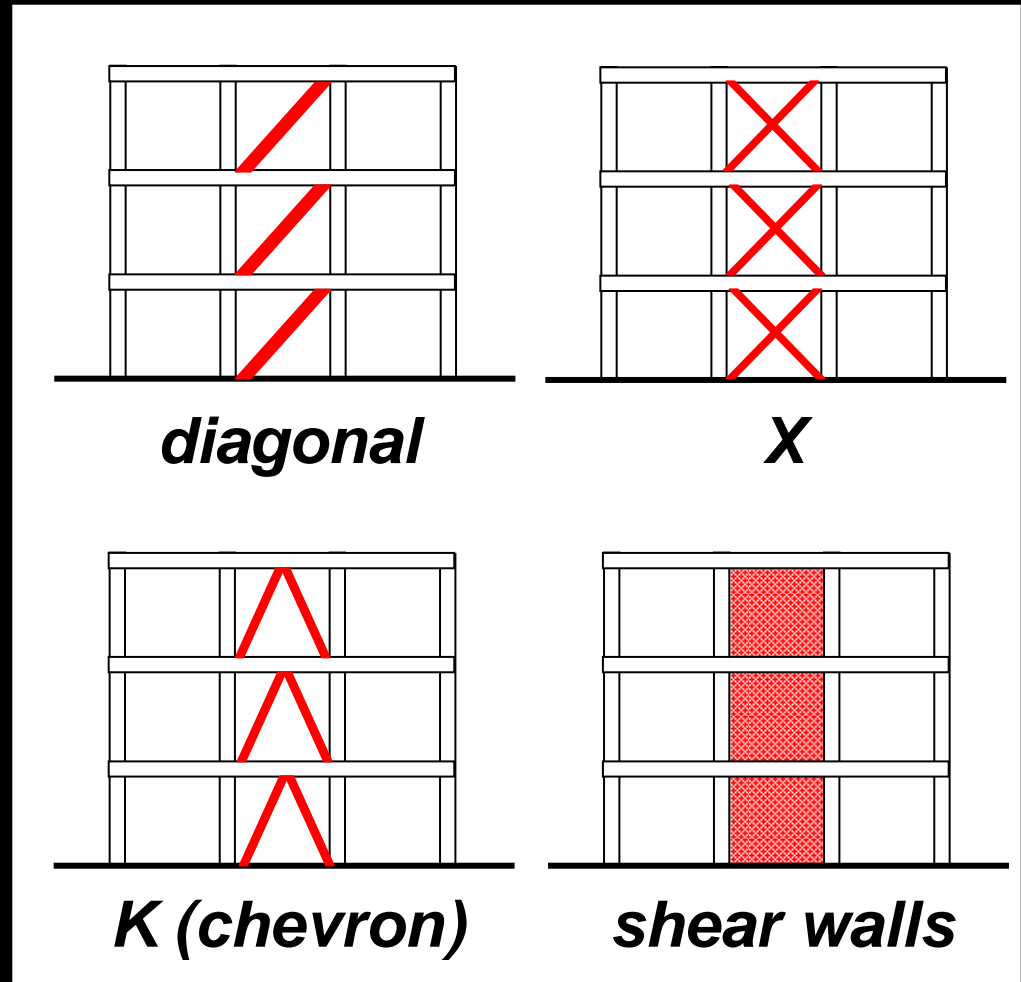
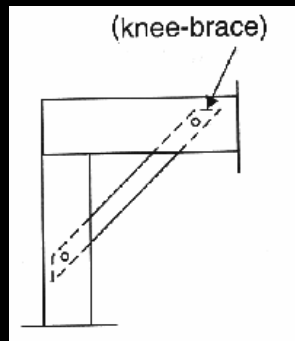
Braced Frames

- *pin connections*
- *bracing to prevent lateral movements*



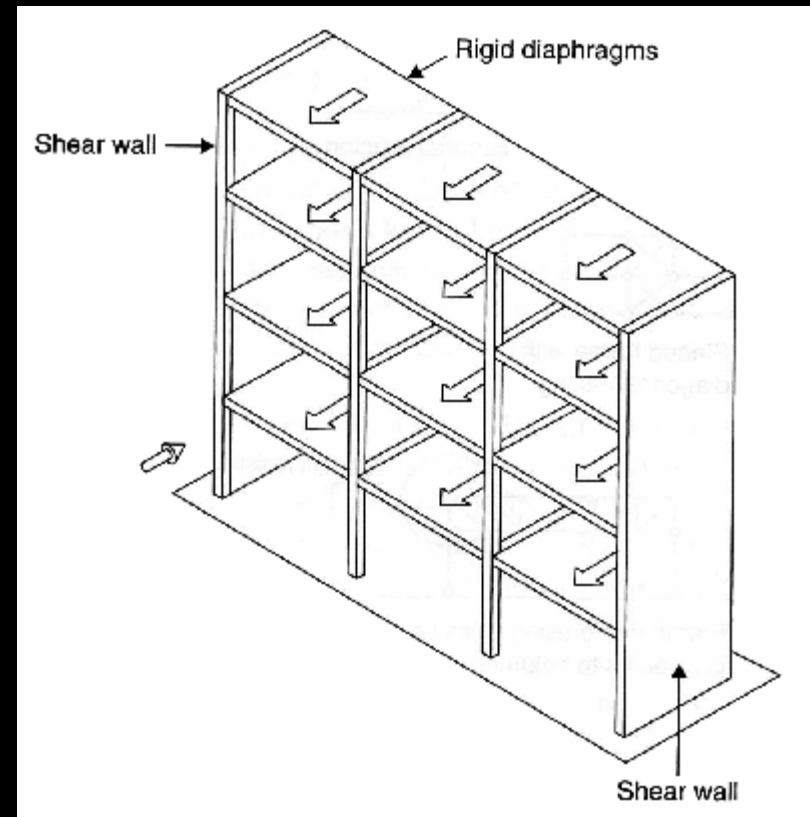
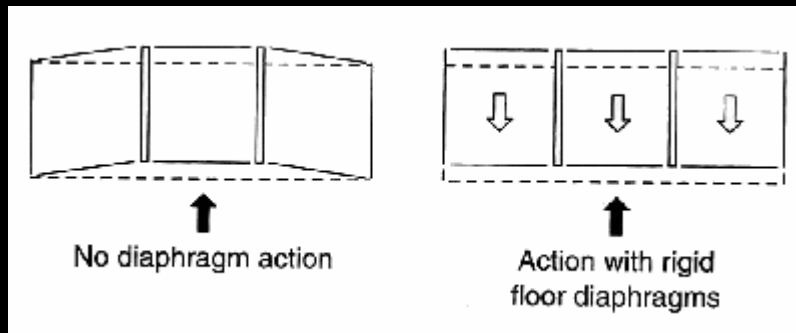
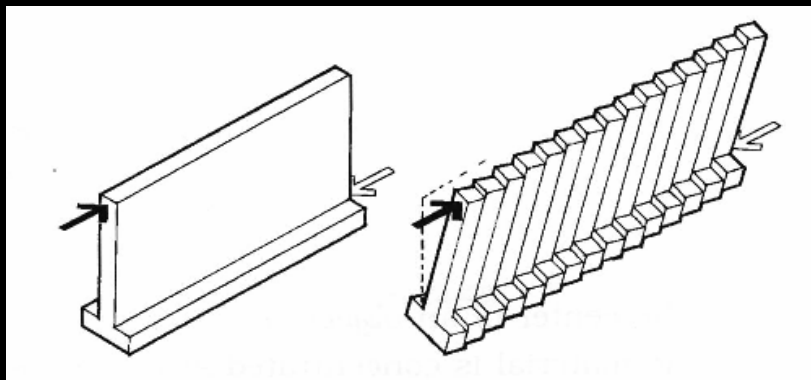
Braced Frames

- *types of bracing*
 - *knee-bracing*
 - *diagonal*
 - *X*
 - *K or chevron*
 - *shear walls*



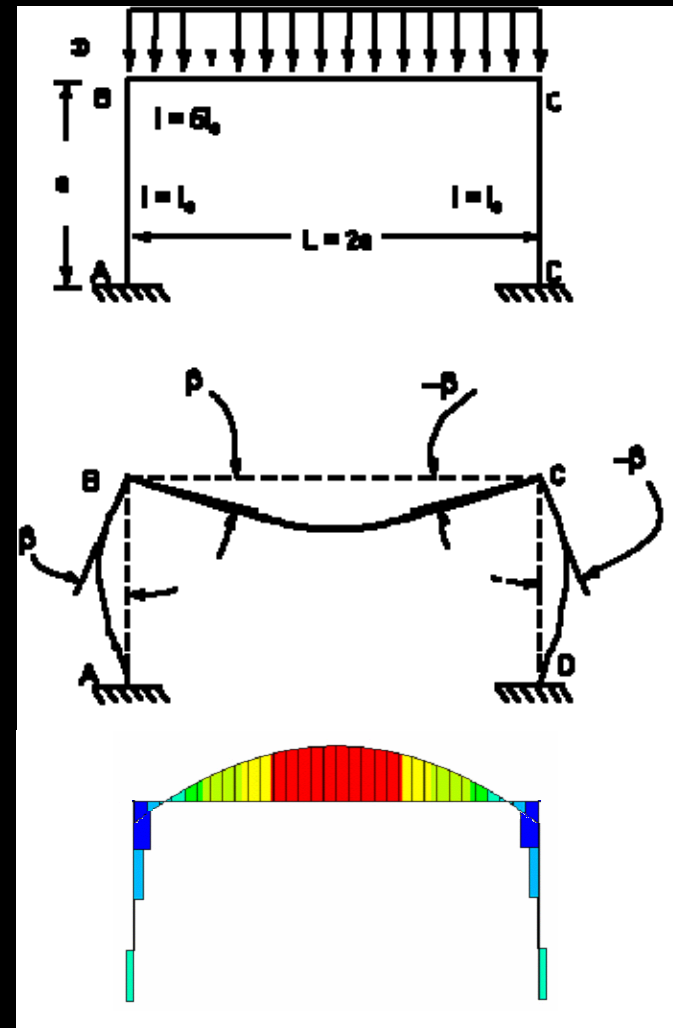
Shear Walls

- *resist lateral load in plane with wall*



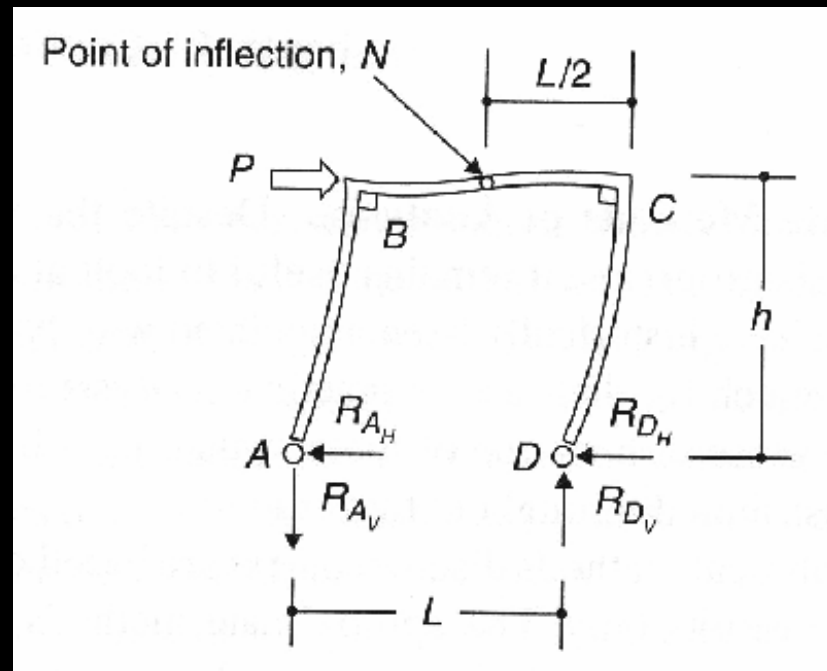
Rigid Frame Analysis

- *members see*
 - *shear*
 - *axial force*
 - *bending*
- *V & M diagrams*
 - *plot on “outside”*



Rigid Frame Analysis

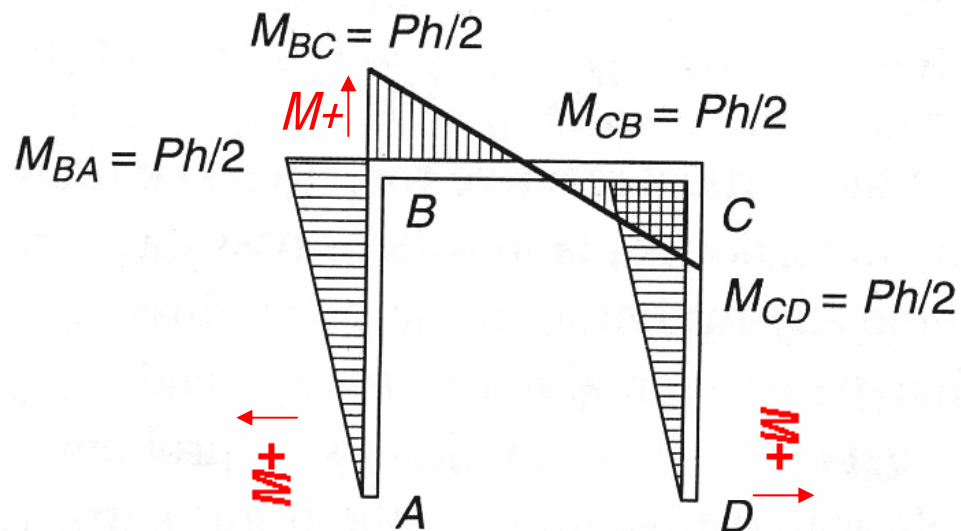
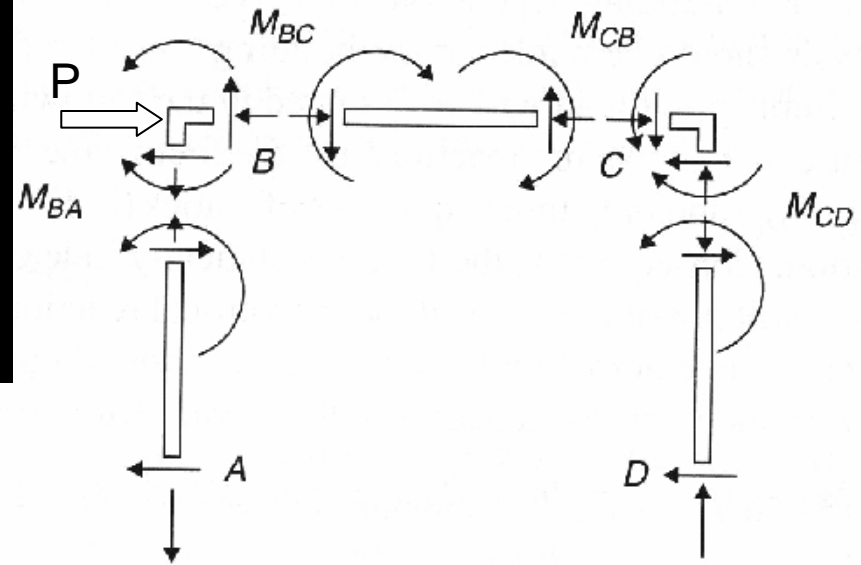
- need support reactions
- free body diagram each member
- end reactions are equal and opposite on next member
- “turn” member like beam
- draw V & M



Rigid Frame Analysis

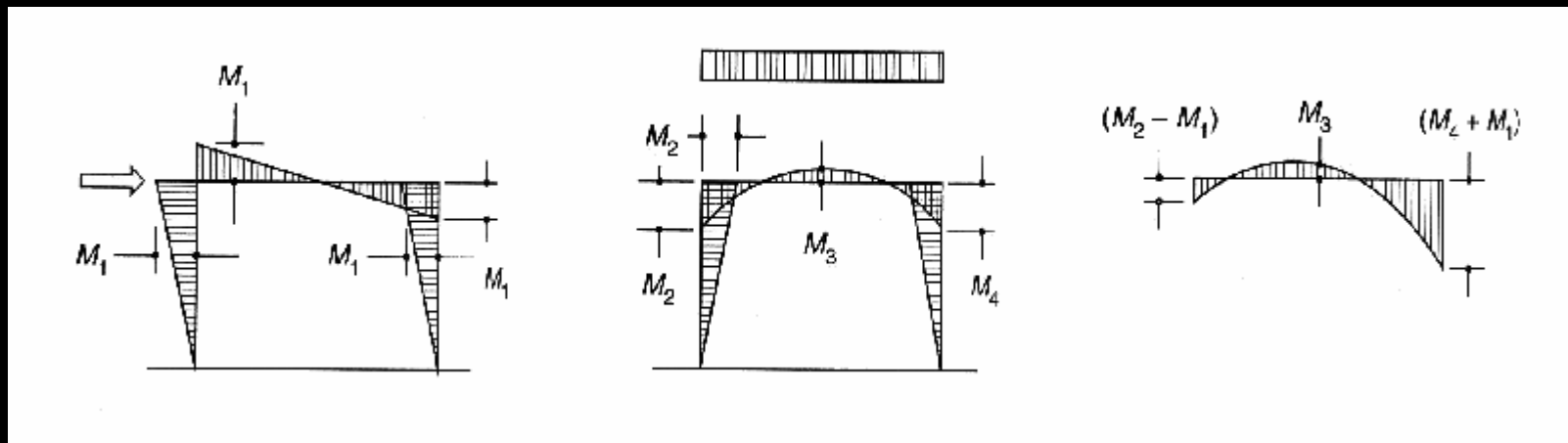
– FBD & M

- opposite end reactions at joints



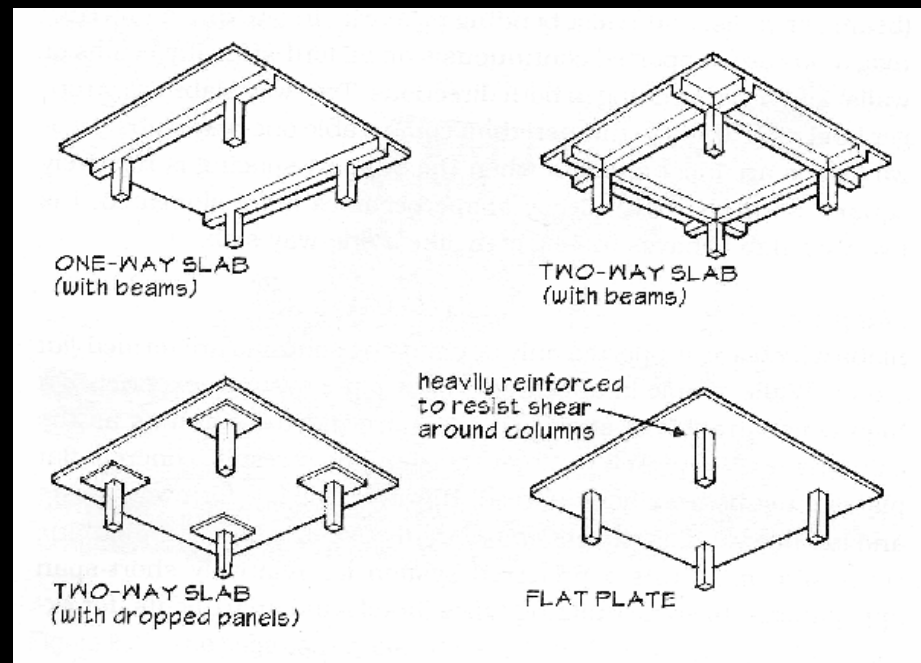
Rigid Frame Design

- *loads and combinations*
 - *usually uniformly distributed gravity loads*
 - *worst case for largest moments...*
 - *wind direction can increase moments*



Rigid Frame Design

- frames & floors
 - rigid frame can have slab floors or slab with connecting beams
- other
 - slabs or plates on columns



Rigid Frame Design

- floors – plates & slabs
 - one-way behavior
 - side ratio > 1.5
 - “strip” beam
 - two-way behavior
 - more complex

