BUILDING TECH I
MATERIALS, PROPERTIES and STRUCTURAL SYSTEMS: wood | steel | reinforced concrete

ARCH 1231 BUILDING TECH I

PROFESSOR GERNERT

STRUCTURE: COMPONENTS | FORCES

** what type of loads are beams designed to carry?

** what is bending stress?

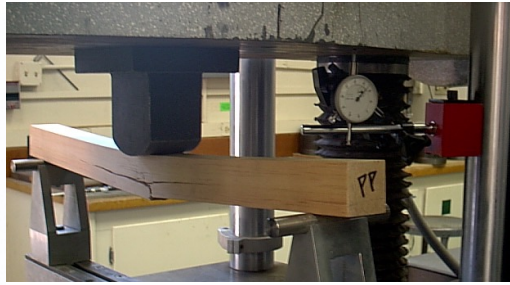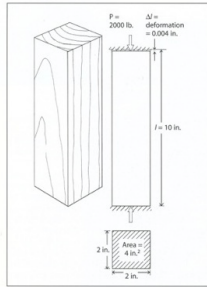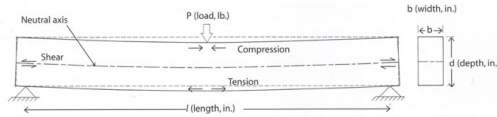** what is the neutral axis of a beam?

** where do the most stresses occur in a beam that's resisting forces?

Source: Ching, Building Constructed Illustrated

1

WOOD structural properties of wood

Allowable Strength:
- The amount of stress you are permitted to apply to the lumber

Wood Strength:
- Wood is stronger parallel to the grain
- Wood is stronger in compression than tension
- Wood strength varies depending on the tree species
- "Allowable strength" varies depending on the species + the lumber grade

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STRUCTURE: COMPONENTS | FORCES
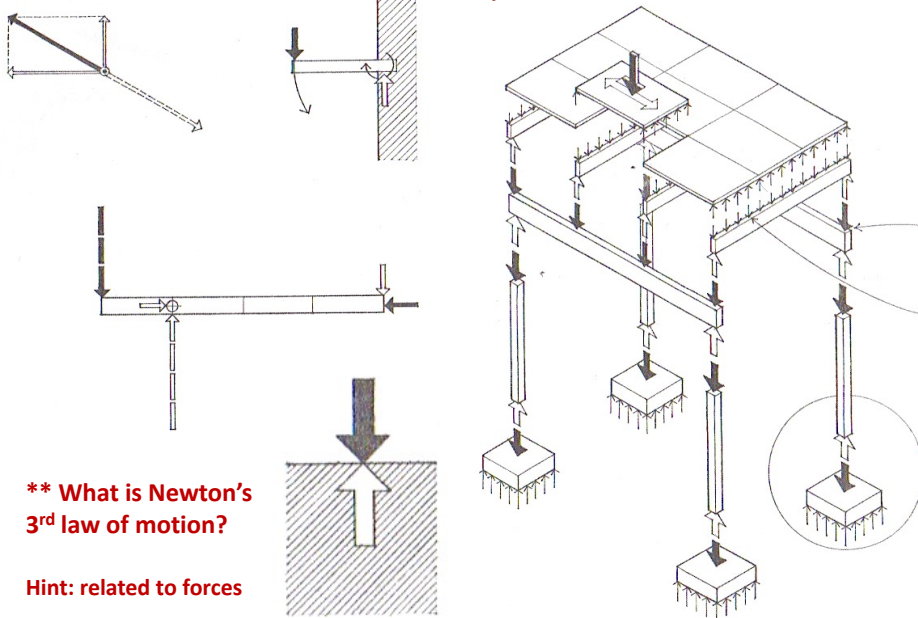
** What is Newton's 3rd law of motion?

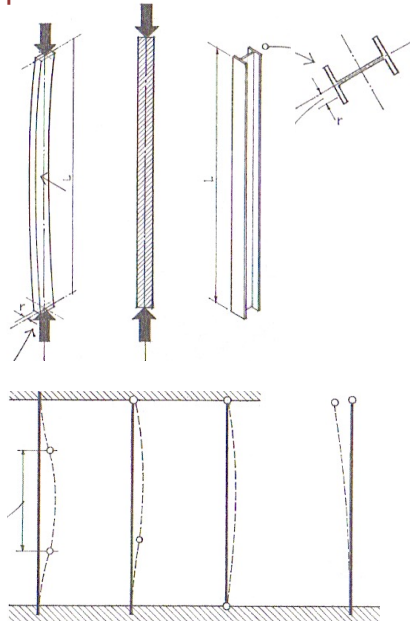**Hint: related to forces**

PROFESSOR MONTGOMERY *Source: Ching, Building Constructed Illustrated* FORCES

4/30/20

STRUCTURE: COMPONENTS | FORCES

** what type of loads do columns mainly support?

**what are 2 causes of the structural failure of columns?

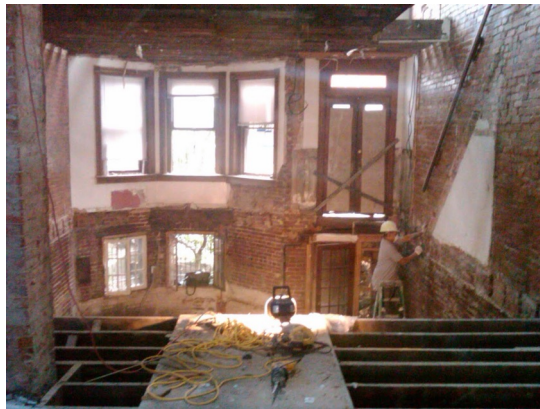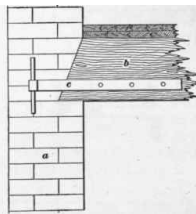*Source: Ching, Building Constructed Illustrated*

COLUMNS

Frank Lloyd Wright
SC Johnson Admin Building, 1937
Interior View

3

STRUCTURE: COMPONENTS | FORCES
spanning systems

MASONRY WALL CONST: spanning systems: wood joist

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MASONRY WALL CONST: spanning systems: heavy timber

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MASONRY WALL CONST: spanning systems: heavy timber

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MASONRY WALL CONST: spanning systems: heavy timber

MASONRY WALL: spanning systems: steel + concrete deck

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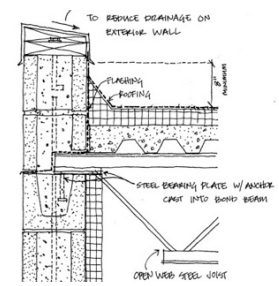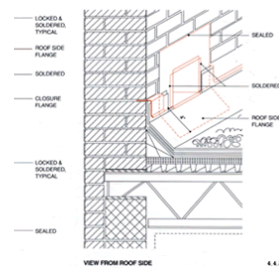
STRUCTURE | MATERIALS | ASSEMBLY

STEEL FRAME – structural grid

RENZO PIANO – RPBW
NYTIMES NYC, US 2000-2007

Structural Design:
Cross Section (Shape)

- Amount of material in the section
- Depth of the section
- Shape of the section
- Cost

WIDE - FLANGE STEEL BEAM
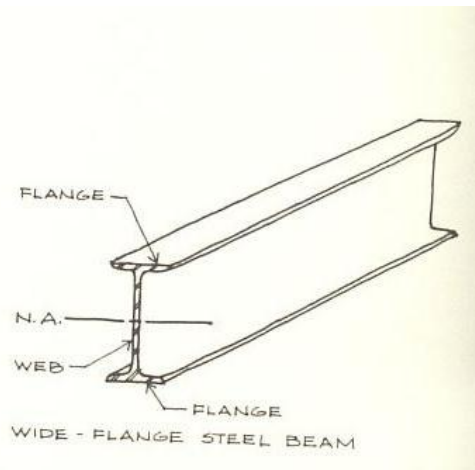
Organizational Structure and Building Façades   week 3

MODULES | BAYS | RHYTHMS -- SURFACES | EDGES | CORNERS

MIES VAN DER ROHE
CROWN HALL - IIT
Chicago US 1956

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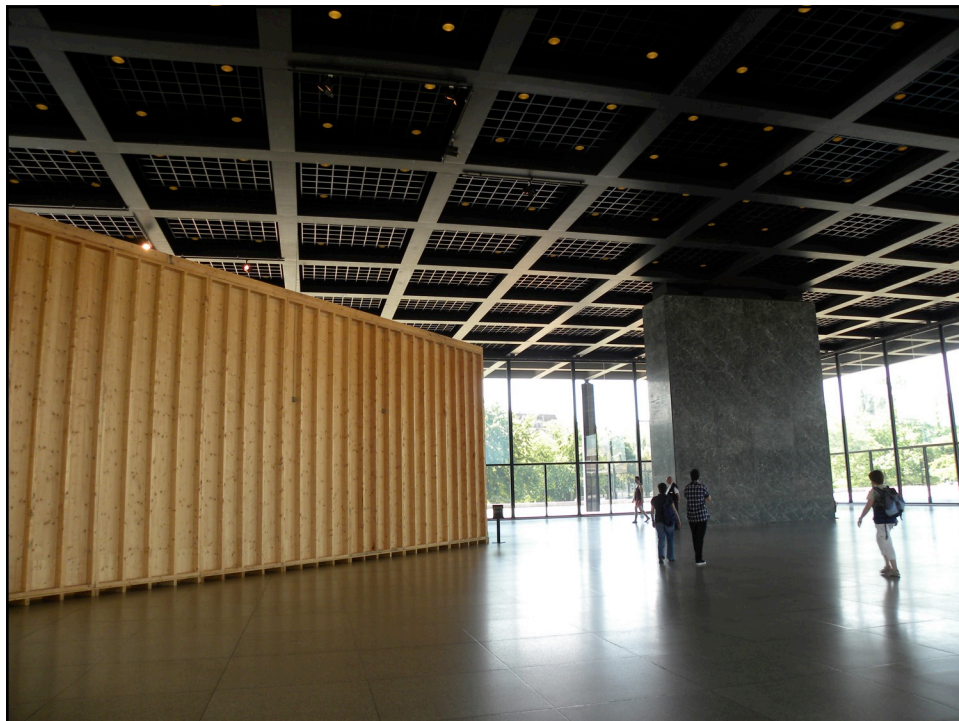
STRUCTURE | MATERIALS | ASSEMBLY   week 10

STEEL FRAME
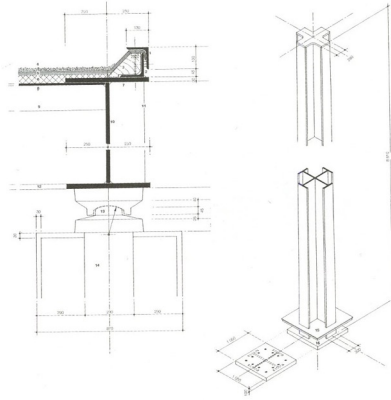
16. Details of column and pin-joint.

MIES VAN DER ROHE
NEUE NATIONAL GALLERY
Berlin Germany   1965-68

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STRUCTURE | MATERIALS | ASSEMBLY   week 10

REINFORCED CONCRETE

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REINFORCED CONCRETE — principles of reinforcing

Steel position in concrete columns:

- Steel is used in columns to resist some compressive stresses
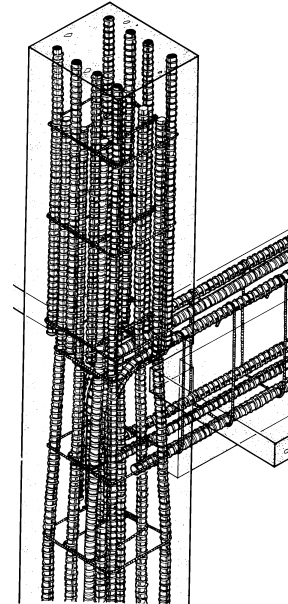
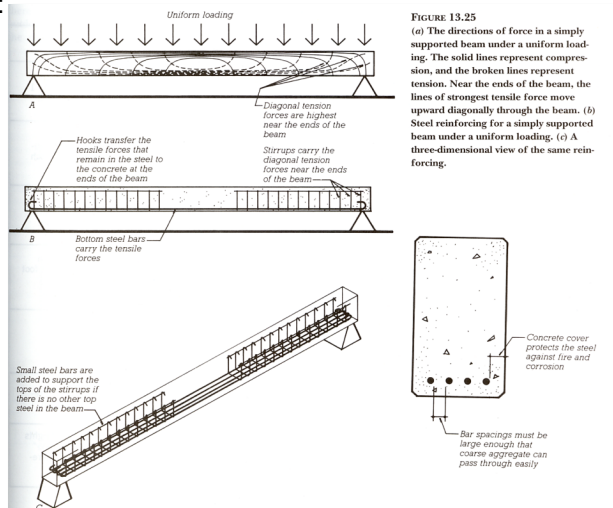ARCH 1100 + 1140   BUILDING TECHNOLOGY

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REINFORCED CONCRETE — designing the structural section

Steel reinforcing reflects the structural system

The engineer calculates:

- How much "cross-section" of steel is required to resist the tensile forces that remain in the steel to the concrete at the ends of the beam

- Depth of coverage required

- Clear spacing between the bars

- Size + # of bars

FIGURE 13.25
(a) The directions of force in a simply supported beam under a uniform loading. The solid lines represent compression, and the broken lines represent tension. Near the ends of the beam, the lines of strongest tensile force move upward diagonally through the beam. (b) Steel reinforcing for a simply supported beam under a uniform loading. (c) A three-dimensional view of the same reinforcing.

Uniform loading

Diagonal tension forces are highest near the ends of the beam

Hooks transfer the tensile forces that remain in the steel to the concrete at the ends of the beam

Stirrups carry the diagonal tension forces near the ends of the beam

Bottom steel bars carry the tensile forces

Small steel bars are added to support the tops of the stirrups if there is no other top steel in the beam

Concrete cover protects the steel against fire and corrosion

Bar spacings must be large enough that coarse aggregate can pass through easily

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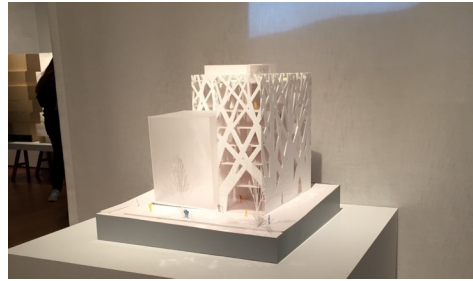# STRUCTURE | MATERIALS | ASSEMBLY week 10

REINFORCED CONCRETE

"Most modern architecture is composed of Euclidean geometry, although there is no perpendicular grid in the natural world.

Branched trees display angles of varying degrees, for example, but no branch intersects precisely at a perpendicular. Trees merely repeat a simple rule of branching, and yet they are able to produce complicated forms that fit comfortably within the natural environment.

Today we are able to create architecture based on the rules in the natural world by using computer technologies.

However, we should use these rules not to make forms that imitate nature but instead to create architecture that breathes and is congruous with the environment."

- - Toyo Ito, 2016

ARCH 1101   INTRODUCTION TO ARCHITECTURE

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STRUCTURE | MATERIALS | ASSEMBLY week 10

TOYO ITO
TOD'S OMOTESANDO BUILDING
TOKYO JAPAN 2002-04