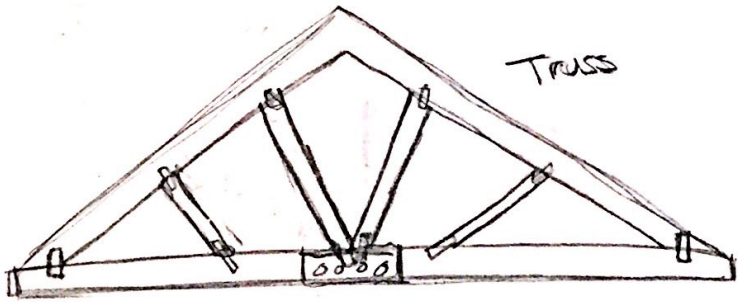
Structure + Envelop

Protects → Sun rain (water)
Snow wind
Heat / Cold

- Insulation
- Layers
- membrane → EPDM
- Passive
- Shelter

Span → structure

ordering system → repeating



- Beams / Joists
- Rafters
- Trusses
- Slabs
- Arches / Vaults
- Space frame

• Pairpit –

• Span range 40' to 150'

(12 to 45m)

• Depth range for sloped trusses

span/2 to span/6

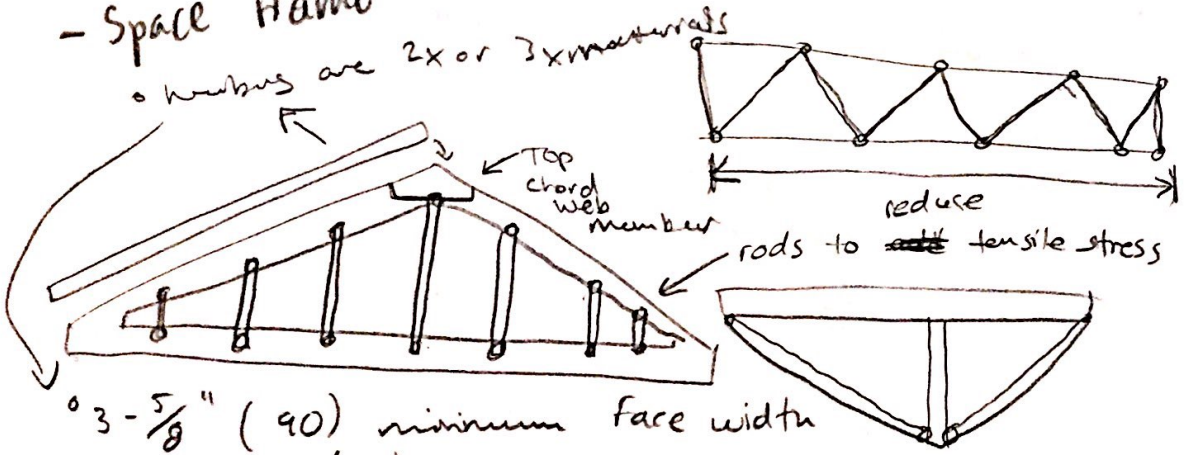
• See 6.09 for a description of truss configurations

• Span range for flat trusses

40' to 110' (12 to 33m)

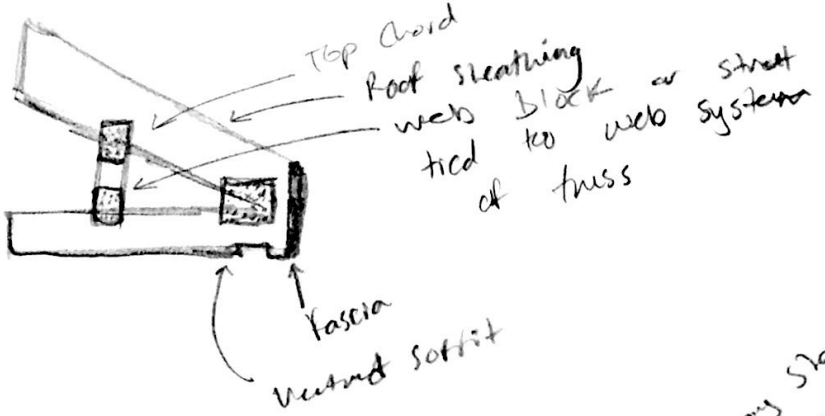
• Depth range for flat trusses span/10 to span/15

• members are 2x or 3x materials

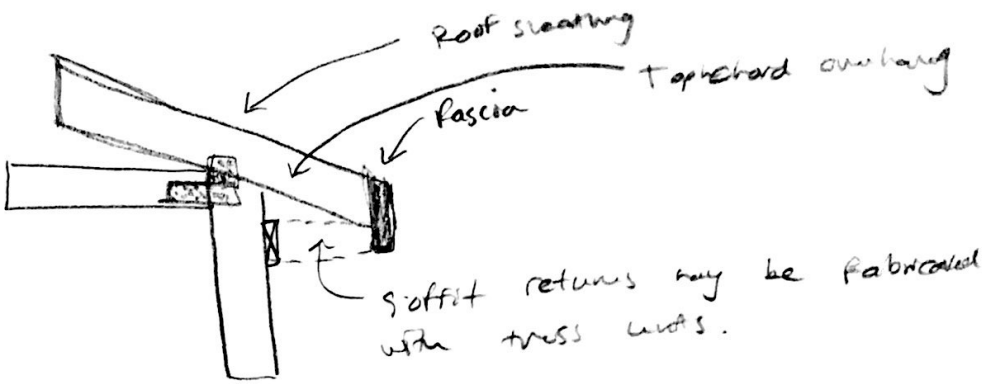


• 3-5/8" (90) minimum face width for 2-1/2 (64) split rings ; 5-1/2" (140) minimum for 4" (100) split rings

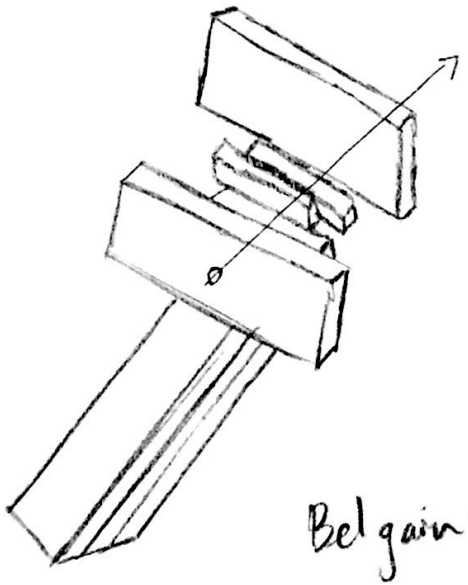
• trusses usually do not exceed 5 members.



Soffited Eave



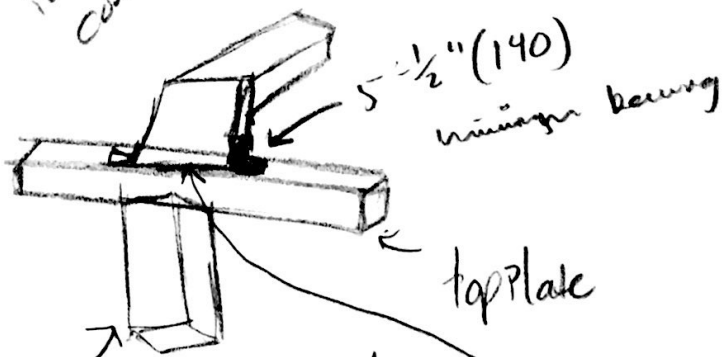
Overhang Eave



Belgain truss

To transmit secondary stress and bending stresses from dead load, the centroidal axes of truss members and the load at a joint should pass through a common node.

• Sizes are buckling while the size of truss members (like rods) is controlled by tensile stresses at connections.



Cement = Sylican, water, alluminia, lime

Concrete = Cement, aguragot, water → Potable

Aguragate = Sand, gravel. → course, fine

properties = strength of material

Compression = → ← = 100% good in Compression

Tension = = almost zero tensile intention

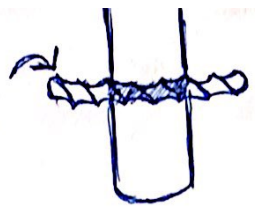
PSI = Pounds per Square Inch

Rebar = made of steel = used for reinforement in concrete

Steel = is recyclable, meltable

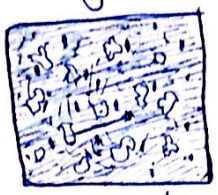
Site Cast = make Concrete on site

Pre-Cast = being made in factories before

Rebar = 

water-cement ratio 45:60%.

Bay Square? Yes, two way ... No, one way.



Concrete mixture similar coinfrecrent to expansion.

Co-Crete = PSI = 0 = Tension

1000-4000 PSI = Compression

Steal = 24K - 36K = PSI Tension

24K - 36K = PSI Compression

---

7 days → first Stage of Strength,

28 days → full Strength

Creep - Sag of Concrete over time.

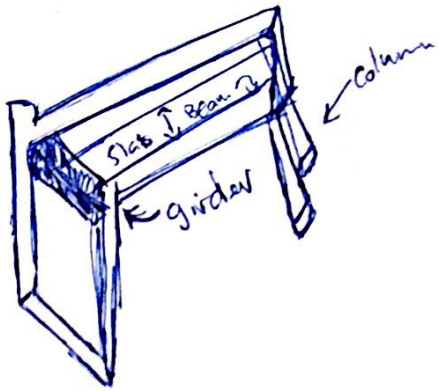
Portland Cement =

Fly ash = add to Concrete to make curing faster

Workability = workable amount of water

Slump test = test Concrete, Cone

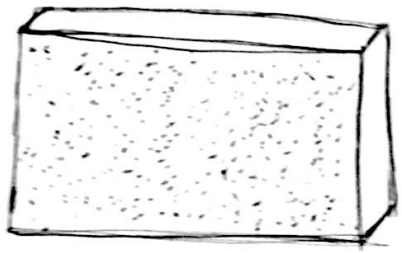
Cylinder test = take Concrete Sample to factory and use hydrolic press



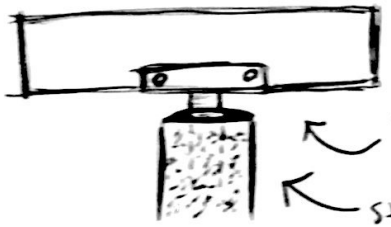
Concrete - Concrete and masonry (Bearing) walls

Properties

- uncombustible
- Compression / weak in tension
- Height-weight ratio, provisions for lateral Stability = doesn't sway / doesn't need cross-bracing.
- metal wood stud walls

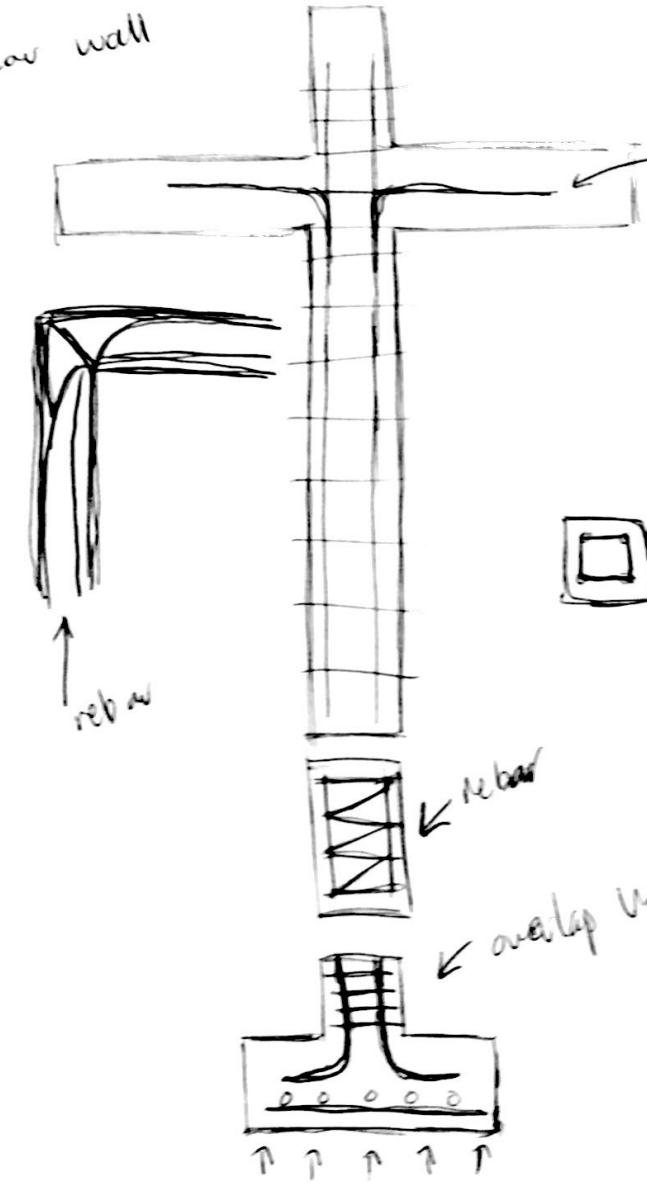


Concrete shear wall



Timber or steel beams.

steel connector.

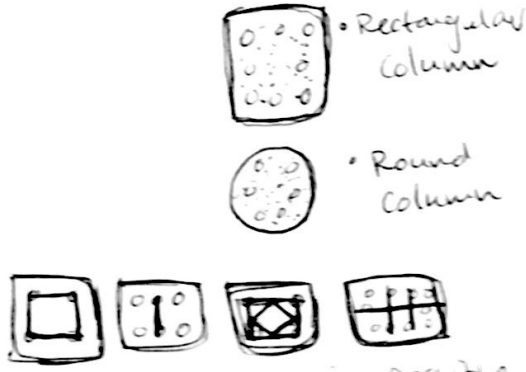


rebar

rebar

rebar

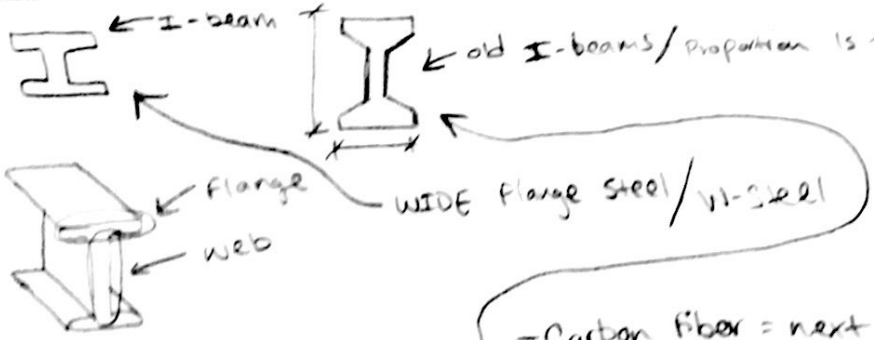
overlap Vertical bars diameters

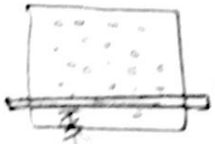


- Rectangular Column
- Round Column
- Layouts of possible steel rebar

material properties - steel - 43,000 psi = Pounds per square inch

3.2. Ching
Chapter 4 Page - 4.14 - 4.22,
Chapter 5 Page 5.35 - 5.38,
Chapter 6 Pg. 6.06 - 6.1





most tension closest to bottom

Density = you are my density

- Carbon fiber = next structural element
= light / strong

S-shape

F = ma

HSS = Hollow Shape Steel

C-shape

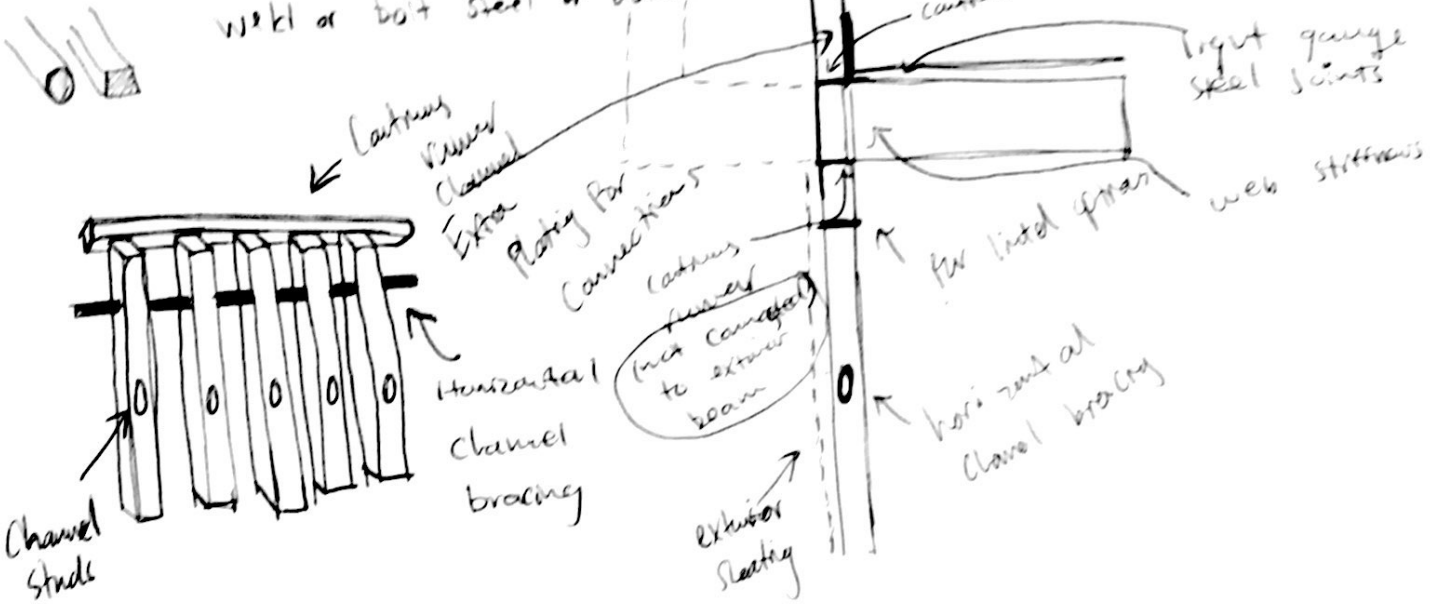
Nominal = approximax

W21 x 83

21 → nominal depth

83 → LBs / FOOT of Length

L4 x 3 x 3/8 → 4 x 3 → Nominal Depth of each leg
3/8 → thickness of the legs



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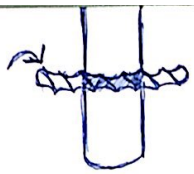
Rebar = 

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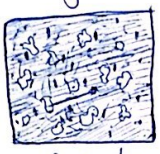

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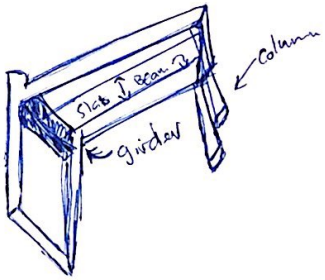
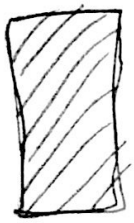


12.08 | Steel -

Steel is used in everyday construction in contanpary architects work as it is strong enough to hold big structures such as skyscrappers.

 ← steel

12.09 | Non ferrar metals 12.09



Alumunum is ductile, malleable, silver-white natic elemt that is used in forming many hard, high alloys.

- gold, platnum
- titanium
- Srlver
- stantess steel
- Brazze
- Cappen
- Brass
- Nickel
- Tin
- Lead
- Cast Iron
- Wrought steel
- Aluminum, 2024-T4
- cadmium
- Aluminum, 1100
- Zinc
- Magnesium

12.02 | Building Materials

Each material has distinct properties of strength, elasticity and stiffness. the most effective structural materials are those that combine elasticity with stiffness.

12.03 | Aquisitran of Raw Materials

↓

Processing, Manufacting, and Packageing

↓

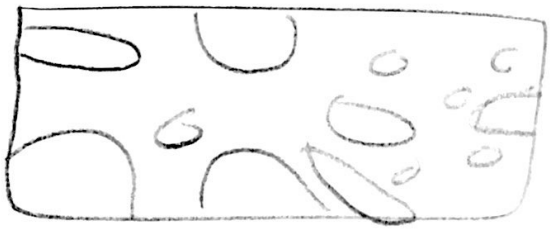
Transportatran and distribution

Construction, Use, and maintenance

↓

Disposal Recycling, and Reuse

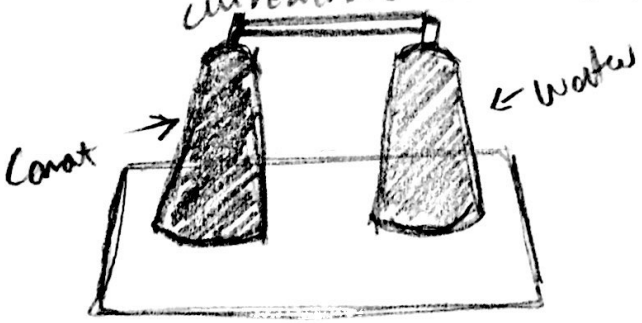
12.04 | Concrete | Cement, Water, Aggregate, Admixtures, Lightweight concrete



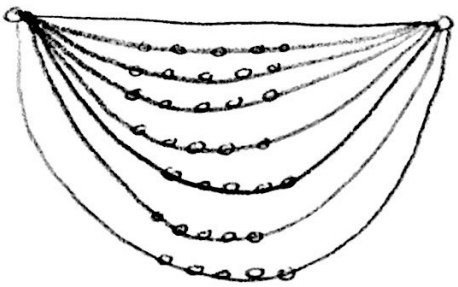
12.05 | Crete

Water - Cement - Ratio = Ratio to water and Cement.

too much of either or could make the Cement unreliable or unsafe.

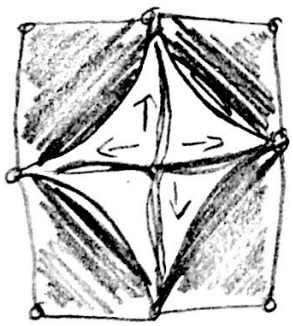


2.28 | Cable Structures



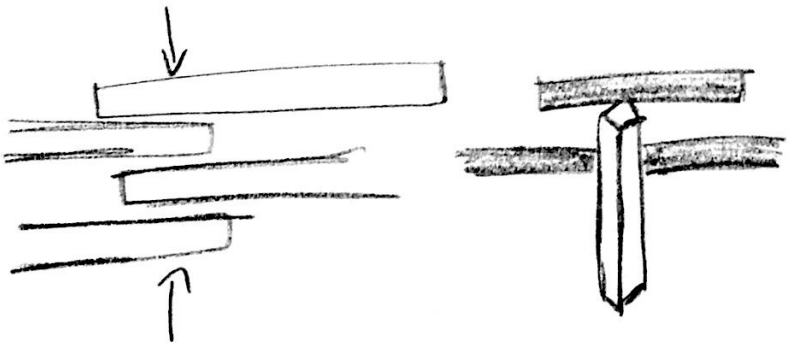
Cable - A Catanary is the curve assumed by a perfectly flexible, uniform cable suspended freely from two points not in the same vertical line.

2.29 | membrane structure



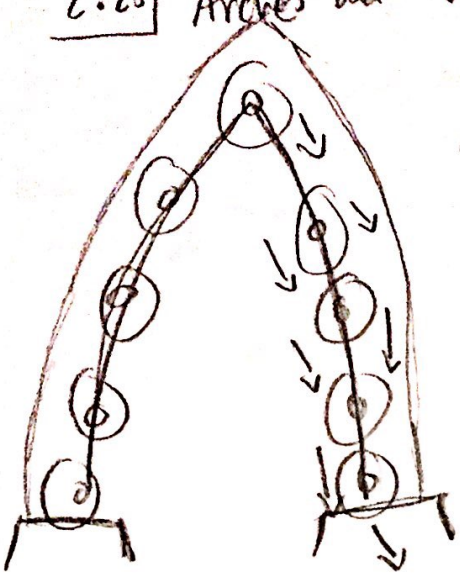
membrane and steel cables transmit external loads to masts and ground anchors by means of tensile forces

2.30 | Joints and Connections



Forces transferred forces from one to the other the joints connected together create tensile strength.

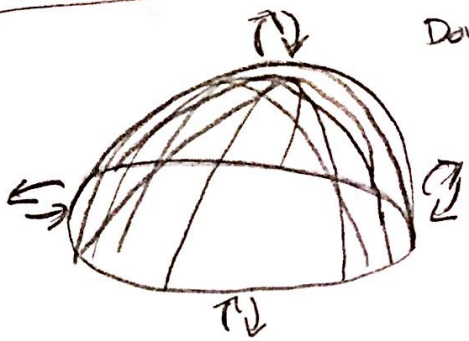
2.25 Arches and Vaults



- Masonary arches are constructed of individual wedge-shaped stone or brick voussoirs

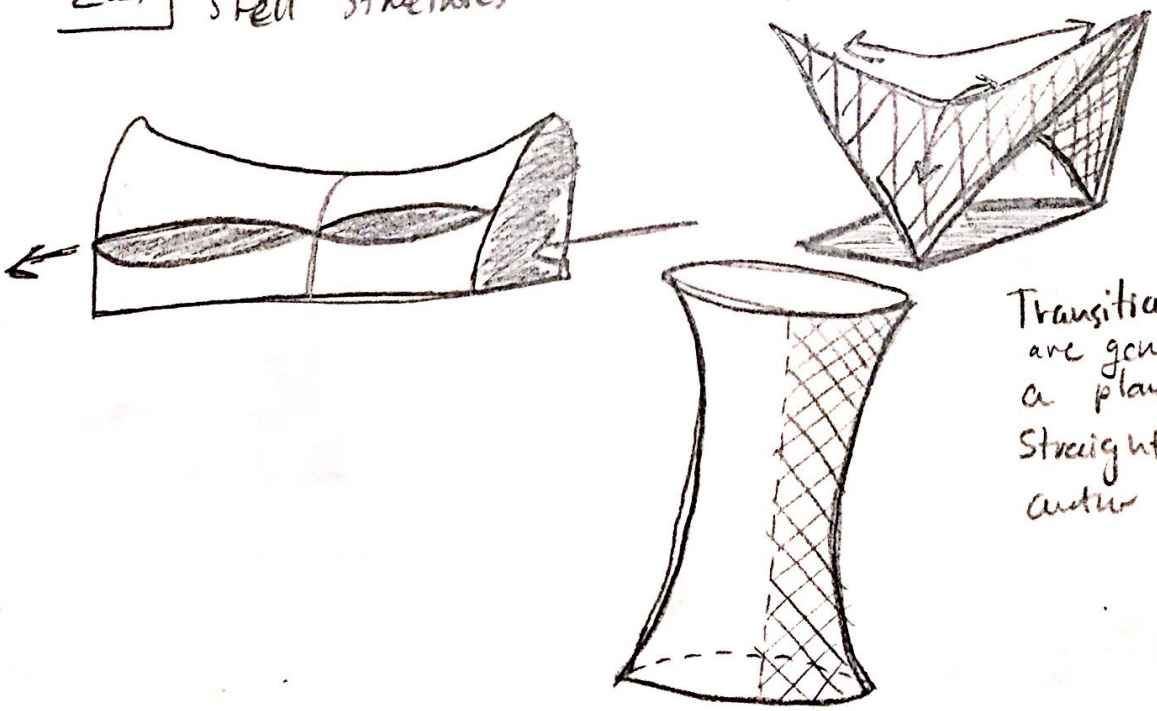
---

Domes (2.26)



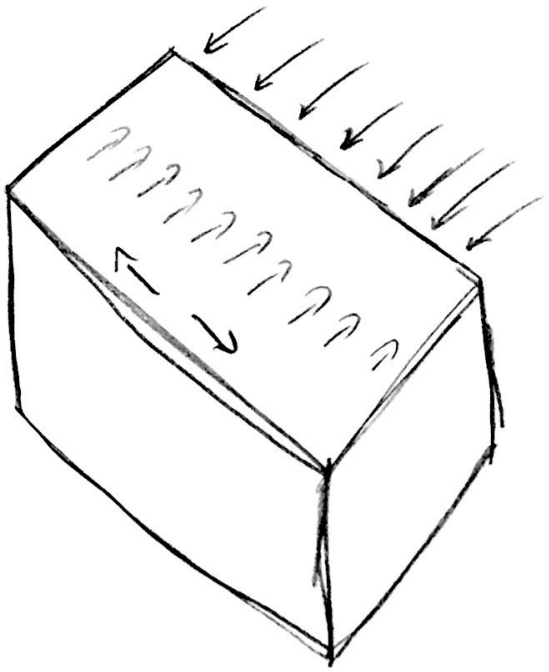
- Sphere constructed of short linear elements
- the transition from compressive forces to tensile hoop forces occurs at an angle of from 45° to 60° from the vertical axis.

2.27 Shell Structures



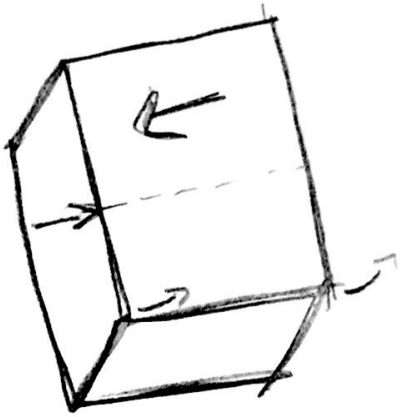
Transitional surfaces are generated by sliding a plane curve along a straight line or over another plane curve.

2.22| Horizontal diaphragms



rigid floor structure acting as a flat, deep beam, transfers lateral loads to vertical shear walls, braced frames, or rigid frames.

2.23| Lateral stability



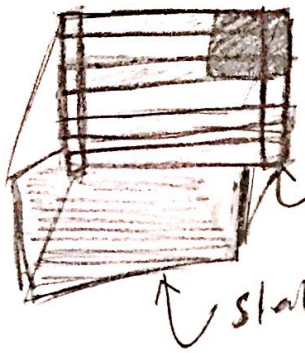
torsional irregularity refers to the asymmetrical layout of mass or lateral force-resisting elements, resulting in noncoincident centers of mass and resistance.

2.24| High rise structures

← frame work
← trusses
← and Cross bracing for wind impact and sway.

2.19 Structural units

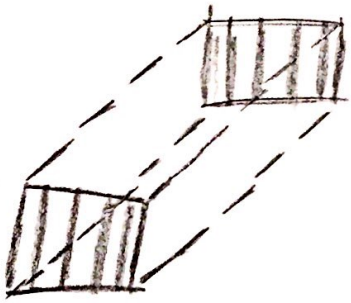
Horizontal spans may be traversed by reinforced concrete slabs or by a layered, hierarchical arrangement of girders, beams, and joists supporting planks or decking.



← Planks or decking joists

Beams or girders

slab or plate structure



← Bearing walls

← Column-and-beam frame.

2.20 Structural Spans

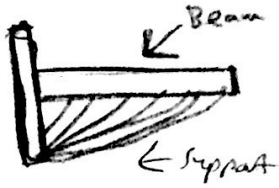
Spanning capability of horizontal elements determines the spacing of their vertical supports.

2.21 Structural Patterns

- grid lines, horizontal beams loadbearing walls.
- basic structural units or bay can be logically extended vertically.

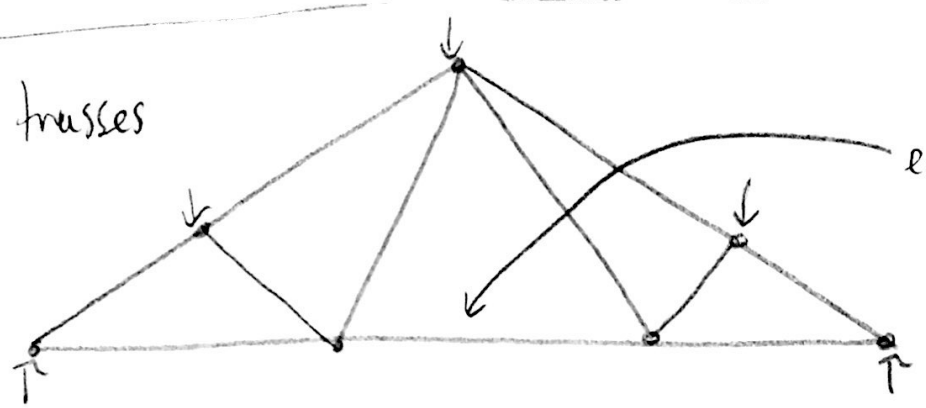
2.15 Beam span

a simple beam rest on supports on both ends to support the weight the beam is supporting.



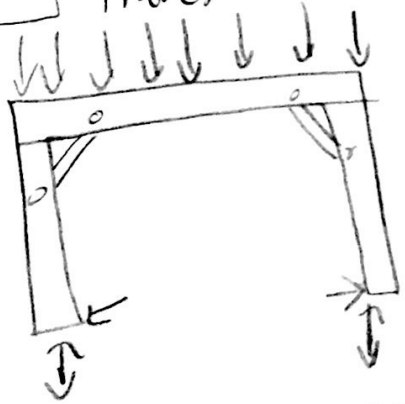
- Cantilevers are created from beam support.

2.16 trusses



trusses in use instead of columns and piers.

2.17 frames and walls



- post and lintel system to distribute weight evenly.

2.18 Plate structures

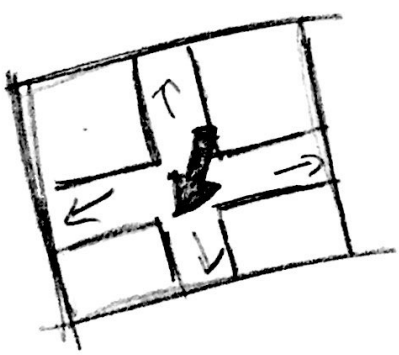


Plate structures are rigid, planar, usually monolithic structures that disperse applied load in multiple directions.

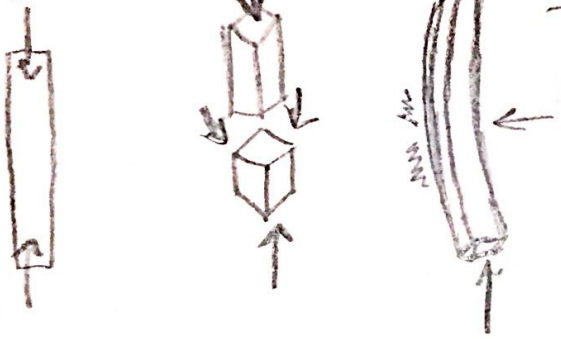
2.12 | Structural Equilibrium

Newtons third law of Motion, the law of action and reaction, States that for every force acting on a body. there's a reaction to the actions.

a Concentrated load acts on a very small area or particular Point of a Supporting Structural element,

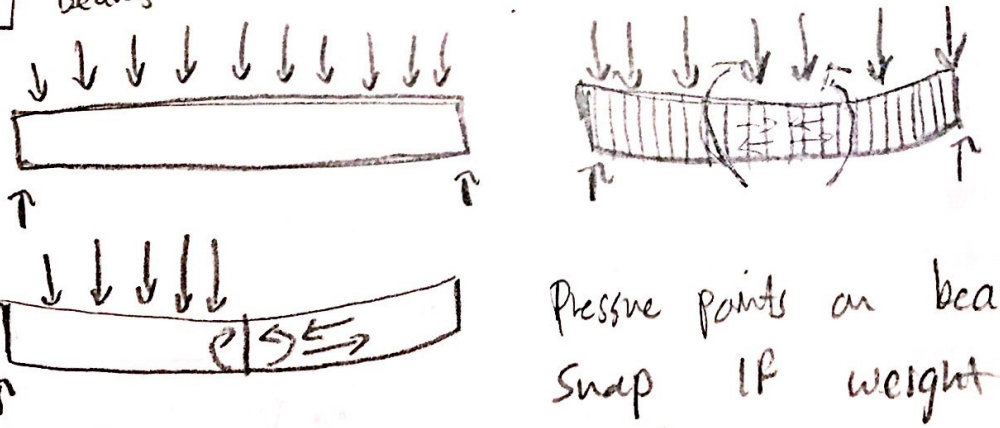
A free-body diagram is a graphic representation of the Complete System of applied and reactive forces acting on a body or an isolated part of a structure.

2.13 | Columns



- Columns need equal amount of weight and could only withstand so much.
- thickness of column comes into consideration.

2.14 | Beams



Pressure points on beams could cause a snap if weight isn't distributed equally.

2.07

Fire walls resistance ratings are to prevent spread of fire from one part of a building to another.

- Opening in fire walls
- Vertical or Horizontal Construction to prevent spread to adjacent occupancy in building.

A - Assembly
B - Business
E - Educational
F - factories
H - Hazardous uses
I - Institutional
M - Mercantile
R - Residential
S - Storage

2.08

- Static load; assumed to be applied slowly to a structure until it reaches its peak value without into magnitude or position.
- Occupancy loads, are loads by occupant in the building
- Live loads, moving weight around the structure.

2.09 wind loads

- the direction the wind is blowing puts pressure on buildings, and could tilt it if it doesn't have cross-Bracing

2.10

earthquake loads, are loads of weigh distributed beg earthquakes and they could impact the structure negatively if not prepared for.

2.11 structural forces - Collinear forces occur along a straight line, the vector sum of which is the magnitudes of the forces.

Building types, typologies

- Readloads, buildings have mass
- weight and objects that don't move
- dynamic loads, occupancy in building

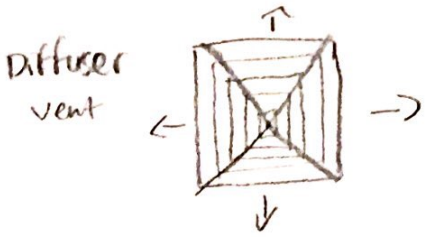
force = mass + acceleration

equilibrium = equal and opposite reaction

geo-technical = study of earths soils.

lateral forces = wind, earthquake

System egress = Pathway to escape



- Envelope
- Structure
- Point load / Wall/linear load

Vocabulary: Vertical:

Point load → Column
Pier
Post

Linear load → Wall

Lateral Support → Cross Bracing
Shear wall
Sheating

Spanning Structural Elevents

Beam
Joist
Girder
Decking
subfloor
Slab
Rafter

Truss
Space frame
Arch
Vault

Dome
Shell
Cable
membrane

Slab → oneway → one-way slab + beams
→ one-way Joist

Slab → two-way → Two way slab + beam
→ Two-way waffle
→ two-way flat plate
→ two-way flat slab

Construction illustrated notes:

Chapter 1:

1.02

- Microclimate
- topography
- natural habitat
- Conserve energy
- material resources
- Human Contact

- These are just a few things you must take into consideration when choosing a location and Commencing in Construction of a Structure.

"building in Context"

- Contextual forces such as transportation systems, utilities, and other services. The site should have substantial capacity of servce systems, causing enough energy, or environmental damage.

"Substainabilty"

1.03 Framework for Substainable Development

Principles:
- Reduce resource Consumption
- Reuse resources
- Recycle resources for reuse
- Protect nature
- Eliminate toxics
- Apply life-cycle costing
- focus on quality

Resources:
- Land
- Materials
- water
- Energy
- Ecosystems

Phase:
- planning
- Development
- Design
- Construction
- Use & Operation
- Maintenance
- Modification
- Deconstruction

1.04 Green building

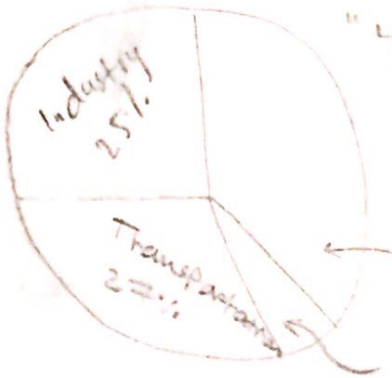
1. Sustainable Sites
2. Water Efficiency

Green Buildings seek to provide healthy environments in a resource-efficient manner using ecologically based principals.

1.05 LEED Green building rating system,

3. Energy and atmosphere
4. Materials and resources
5. Indoor environmental Quality
6. Innovation and design process

1.06 "The 2030 challenge"



"48% Buildings"

40% Building operations and maintenance

8% building materials & Construction

U.S. Energy Consumption by sector

1. Solar radiation reflected by earth and atmosphere, most radiation is absorbed and warms earth.

2. absorbed energy is emitted from surface as long-wave infrared radiation.

3. Some of the radiation is then re-emitted in different directions by greenhouse gas molecules and water vapor in the atmosphere.

4. Downward part of the infrared radiation is the "greenhouse effect," temperature increases in the lower atmosphere and earth's surface.

Chapter 2:

2. - The building -
- definition, scale, proportion, and organization.
- a system of assembly to build are big project.

3. - Building Systems -
- Moisture and Thermal Protection
- enclosure / envelope, exterior walls and roofs also dampen noise and provide security.

4. - Building systems
- fire resistance
- structural compatability
- Noise reduction
- Resistance to wear.
- Control Heat and air flow.

5. - Building Codes -
- NFPA-70, the National Electric Code, ensures safty and safeguarding building - NFPA-101

NFPA-13

6. - types of Construction -
- Concrete, masonry, steel focus on fire resistance
- Type I-V building Construction Protocols.