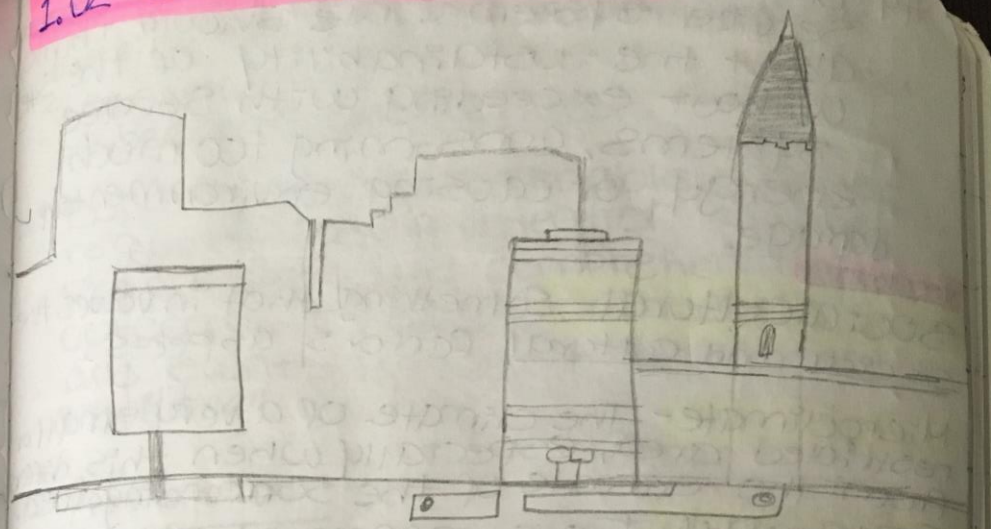
1.02 Building in Context



#1- In order to design a building in a ~~site~~ site, you should study (consider) the background (history) of the site.

#2- The site, planning and design of a building is impacted by the ~~natural~~ microclimate, topography and natural habitat of the site. To measure the path of the sun, the rush of the wind, and the flow of water on a site.

#3- Environmental forces it's not the only thing we should think about, the regulations are the limits of the building, for example: size and shape of the building mass and where it may be located on the site.

#4- Environmental, regulatory factors and Service systems. We should think about the sustainability of the Site Without exceeding with service systems, consuming too much energy, or causing environmental damage.

Vocabulary

Sociocultural- Something that involves the social and cultural factors aspects.

Microclimate- The climate of a very small or restricted area, especially when this differs from the climate of the surrounding area.

Topography- The arrangement of the natural and artificial physical features of an area.

Familiar vocabs.

1) Conceived - considered
2) Erected - Build, setup, establish
3) Constrain - pressure, make
4) Contextual - Relative, Background
5) Enhance - Increase, Improve
6) Indigenous - native, original
7) Landscape - land, site, scene
8) Layout - plan, design, Arrangement
9) Ordinances - laws, roles
10) Regulatory - controlling, supervisory, monitoring
11) Regulations - rules, protocols

1.03 Sustainability

Sustainability is calls for a whole systems sustainability is important in order to become an architect.

"Building in a sustainable manner requires paying attention to the predictable and comprehensive outcomes of decisions, actions, and events throughout the life cycle of a building."

Participation

- Planners
- Architects
- developers
- building owners
- Contractors
- Manufacturers
- Governmental agencies
- NON-governmental agencies

Familiar vocabs.

1) Chaired - overseen, managed, led
2) Scope - Choice, Possibility, Opportunity
3) Holistic - Full, general, Complete, rounded
4) Depletion - Exhaustion, Reduction

Three-dimensional Framework for Sustainable Development

Principles
- Reduce resource consumption
- Reuse resources
- Recycle resources for reuse
- Protect nature
- Eliminate toxics
- Apply life-cycle costing
- Focus on quality

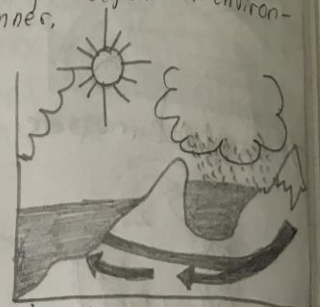
Resources	Phase
-Land	-Planning
-Materials	-Development
-Water	-Design
-Energy	-Construction
-Ecosystems	-Use & Operation
	-Maintenance
	-Modification
	-Deconstruction

1.04 Green Building

"Green building" / "sustainable design"

It describes any building design in an environmentally sensitive manner.

1) Sustainable sites



2) Water Efficiency

LEED = leadership in energy and environmental design.

USGBC = U.S. Green building council

Familiar vocabs

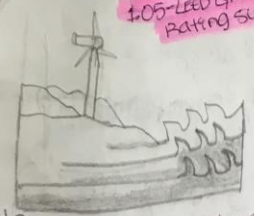
Encompasses - Includes, covers, involves

Consensus - general agreement

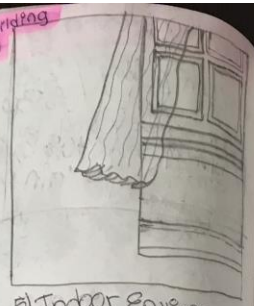
Vocabulary

Ecologically - In a way that concerns the relation of living organisms to one another and to their physical surroundings.

1.05 - LEED Green Building Rating System



3) Energy & Atmosphere



5) Indoor Environmental Quality

4) Materials & Resources

6) Innovation & Design process

LEED major 6 areas of development.

1) Sustainable sites - Reduce pollution.
2) Water efficiency - Reduce wastewater.
3) Energy & Atmosphere - Increase the efficiency in which energy is used materials.
4) Materials & Resources - Seek to maximize the use of materials.
5) Indoor Environmental quality - Improve indoor air quality.
6) Innovation & design process - Rewards the requirements set by the LEED-NC

1.06 - The 2030 Challenge

U.S. Energy Consumption by Sector.

Architecture 2030 - an environmental support group whose mission is "to provide information and innovative solutions in the fields of architecture and planning, in effort to address global climate change.

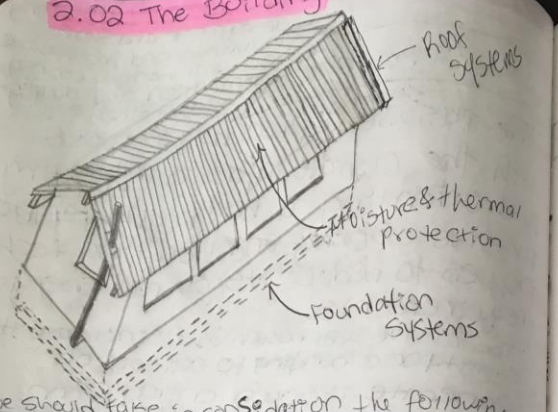
Familiar vocabs

Advocacy - support

Fossil fuel reduction standard for Architecture 2030

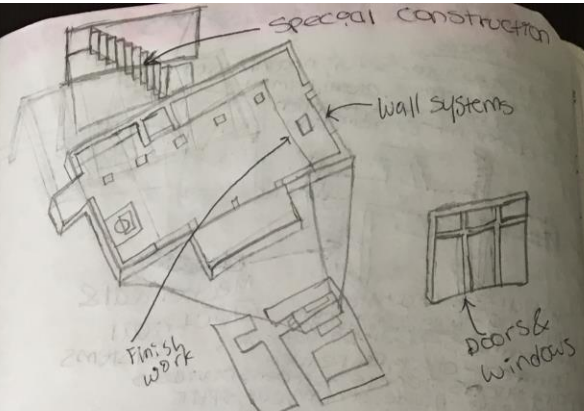
60% in 2010
70% in 2015
80% in 2020
and on 90% in 2025

2.02 The Building



we should take in consideration the following conceptual systems of order in addition to the physical ones of construction:

- The definition, scale, proportion, and organization of the interior space of a building.
- The ordering of human activities by their scale and dimension.
- The functional zoning of the spaces of a building according to purpose and use.
- Access to and the horizontal and vertical paths of movement through the interior of a building.
- The sensible qualities of a building: form, space, light, color, texture, and pattern.

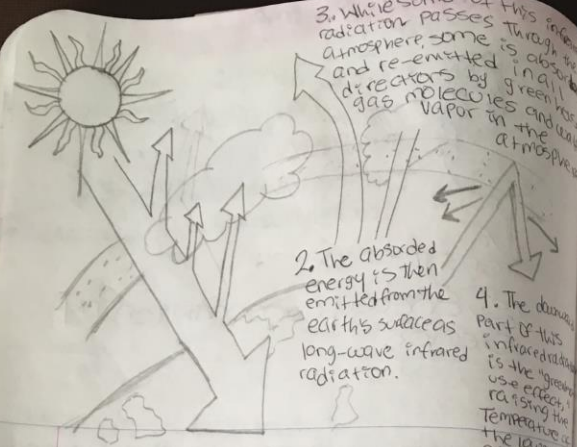


- The building as an integrated component within the natural and built environment.

Of primary interest to us in this book are the physical systems that define, organize, and reinforce the perceptual and conceptual ordering of a building.

Familiar Vocabs

- Assembling - Collecting, Gathering
- Conceptual - Abstract, Concrete (Antonym)
- Interrelated - Unified, Organized, Consistent
- Interdependent - Reliant, Dependent, Codependent
- Embodiment - Personification



1. Some of the incoming solar radiation is reflected by the earth and the atmosphere but most of the radiation is absorbed and warms the earth's surface and atmosphere.

Important

Climate change & global warming

- Greenhouse gases, such as carbon dioxide, methane, and nitrous oxide, are emissions that rise into the atmosphere. CO^2 accounts for the largest share of U.S. greenhouse gas emissions. Fossil fuel combustion is the main source of CO^2 emissions.

- It is necessary to properly design, site, and shape buildings and incorporate natural heating, cooling, ventilation, and daylighting strategies.

Two approaches

- The passive approach is to work with the climate in designing, siting, and orienting a building and employ passive cooling and heating techniques to reduce its overall energy requirements.
- The active approach is to increase the ability of a building to capture or generate it's own energy from renewable sources (solar, wind, geothermal, low impact hydro, biomass and bio-gas) that are available locally and in abundance.

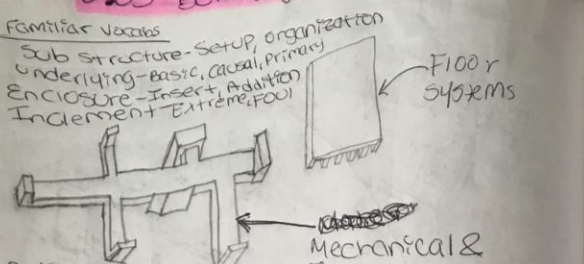
Vocabulary

Geothermal - Relating to or produced by the internal heat of the earth.
Biomass - The total mass of organisms in a given area or volume.
Striking - noticeable, impactful, notable
Irrespective - not taking (something) into account; regardless of.

2.03 Building systems

Familiar Vocabs

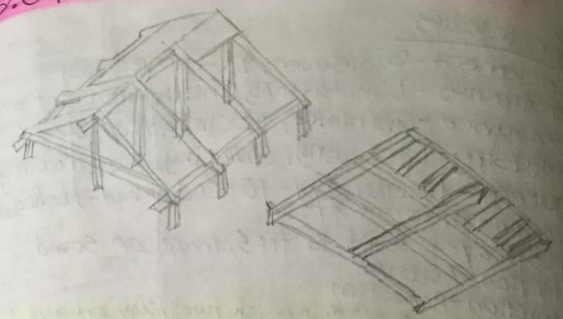
Sub structure - Setup, organization
Underlying - Basic, Causal, Primary
Enclosure - Insert, Adaption
Inclement - Extreme, Foul



Spatial - 3D, longitudinal
Layering - The action or arranging something in layers; meetings, gatherings
Assemblies - Meetings, Gatherings
Dampen - Check, Reduce
Partitions - Panels, Screens, Dividers
Subdivide - Divide, section, cut, split

- Structural System
- Enclosure System
- Mechanical System
  - The water supply system
  - The sewage disposal system
  - Heating, ventilating, and air-conditioning system
  - The electrical system
  - Vertical transportation system
  - Fire-fighting system
  - Waste disposal and recycling system

2.04 Building systems



The manner in which we select, assemble, and integrate the various building systems in construction should take into account the following factors:

- Performance Requirements
- Aesthetic Qualities
- Regulatory constraints
- Economic Considerations
- Environmental Impact
- Construction practices

Occupational Health and Safety Act (OSHA)

They regulates the design of workplaces and sets safety standards under which a building must be constructed.

2.05 Building Codes

Familiar vocabs

- Inclement - Bad, Severe, Extreme, Foul
- Constraints - Limitations, Limits, Restrictions
- Assurance - Guarantee, Declaration, Word
- Comprising - Including, Covering, Embracing
- Adjacent - together, End-to-end, Head-to-head
- Corrosion - Decomposition
- Acoustical - to sound, to the Science of sound
- Deflection - Rebound
- Contraction - Reduction
- Compatibility - a state in which two things are able to exist or occur together without problems or conflict
- Integration - Addition
- Enacted - Passed

- International Building code
- Model codes
- Companion Codes
- Other important codes
- Federal Requirements

- Occupancy or Use } Maximum height
- Type of Construction } & Area

(ASTM) - American Society for Testing and Materials.

- Municipality - city, town, borough
- Substantiate - Validate, Verify
- Stipulating - ordering, specifying

2.06 Types of Construction

Fire-Resistance Rating Requirements (hours)

Construction type	Type I A	Type I B	Type II A	Type II B	Type III A	Type III B	Type IV HT	Type V A	Type V B
Building Element									
Structural frame	3	2	1	0	1	0	2	1	0
Bearing walls									
Exterior	3	2	1	0	2	2	1	1	0
Interior	3	2	1	0	1	0	1/HT	1	0
Nonbearing walls	varies with occupancy, type of construction, location on property line, and distance to adjacent structures								
Floor construction	2	2	1	0	1	0	HT	1	0
Roof construction	1½	1	1	0	1	0	HT	1	0

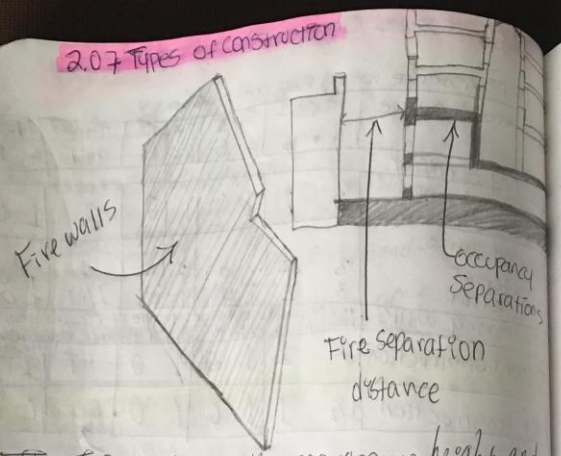
Heavy Timber

The IBC classifies the construction of a building according to the fire resistance of its major elements: structural frame, exterior and interior bearing walls, nonbearing walls and partitions, and floor and roof assemblies.

Familiar Vocabs

Ancillary - Auxiliary
laminated - covered
Proximity - Closeness
resistive - resistance

2.07 Types of construction



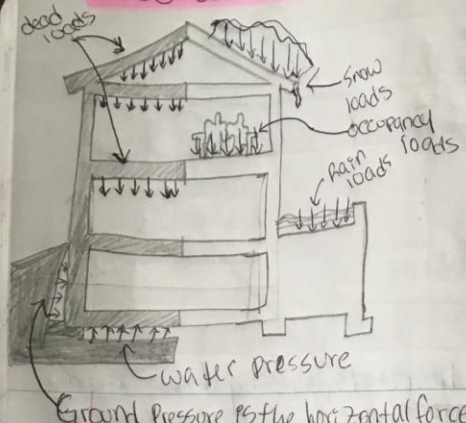
The IBC limits the maximum height and area per floor of a building according to construction type and occupancy group.

The larger a building, the greater the number of occupants

Examples of occupancy Classifications

A Assembly - Auditoriums, theaters, and Stadiums
B Business - Offices, laboratories, and higher education facilities
E Educational - childcare facilities and Schools through the 12th grade facilities
F Factories - Fabricating, assembling or manufacturing facilities
H Hazardous uses - Facilities handling a certain nature and Quantity of hazardous materials.
I Institutional - Facilities for supervised occupants such as hospitals, nursing homes and reformatories.
M Mercantile - Stores for the display and sale of merchandise.
R Residential - homes, apartment buildings, and hotels
S Storage - Warehousing facilities.

2.08 Loads on buildings



- Static loads
- Live loads
- settlement loads

Grand Pressure is the horizontal force a soil mass exerts on a vertical retaining structure

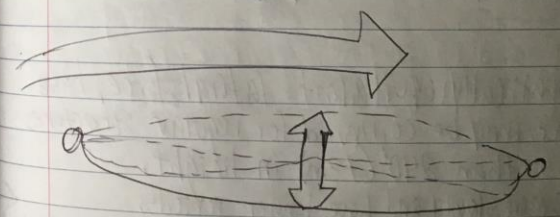
In enclosing space for habitation, the structural system of a building must be able to support two types of loads - static and dynamic.

2.09 Wind loads

negative Pressure
Slope less than 30°

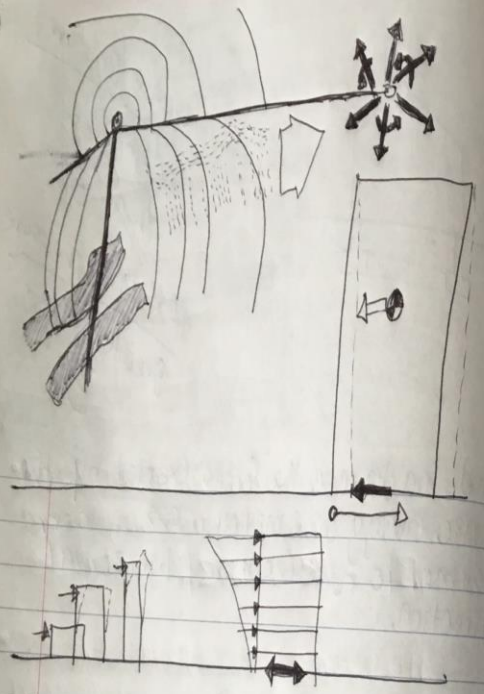
possitive pressure
greater than 30°

wind loads are the forces exerted by the kinetic energy of a moving mass of air, assumed to come from any horizontal direction.



The structure, components, and cladding of a building must be designed to resist wind-induced sliding, uplift, or overturning

2.10 Earthquake Loads



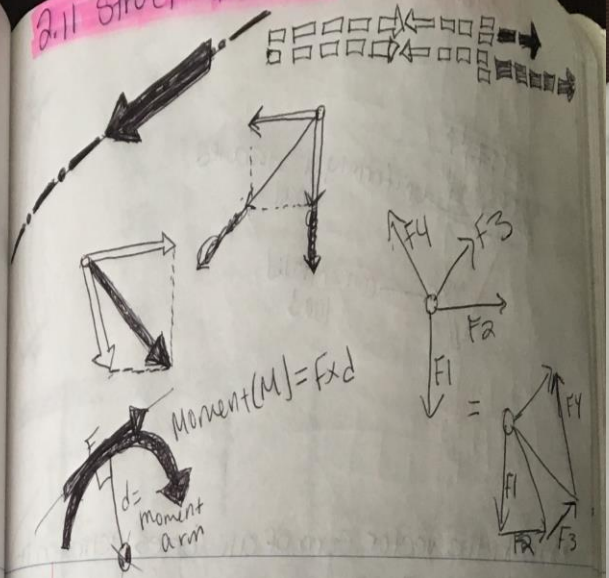
A statically equivalent lateral force, base shear, may be computed for regular structures less than 240' (73m) in height.

Oscillate more slowly and have longer periods.

The natural period of a structure varies according to its height above the base and its dimension parallel to the direction of the applied forces.

Relatively stiff structures oscillate rapidly and have short periods while more flexible structures

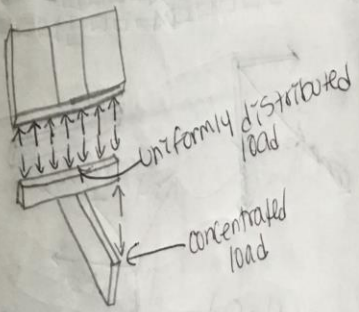
2.11 Structural Forces



A force is any influence that produces a change in the shape or movement of a body

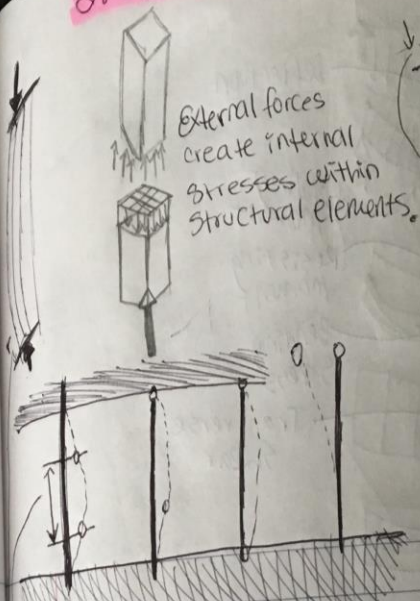
Two or more forces may be related in the following ways:
- collinear forces
- concurrent forces

2.12 Structural Equilibrium



- First, the vector sum of all forces acting on it must equal zero, ensuring translational equilibrium: $\Sigma F_x = 0$, $\Sigma F_y = 0$, $\Sigma F_z = 0$.
- Second, the algebraic sum of all moments of the forces about any point or line must equal zero, ensuring rotational equilibrium: $\Sigma M = 0$

2.13 Columns



External forces create internal stresses within structural elements.

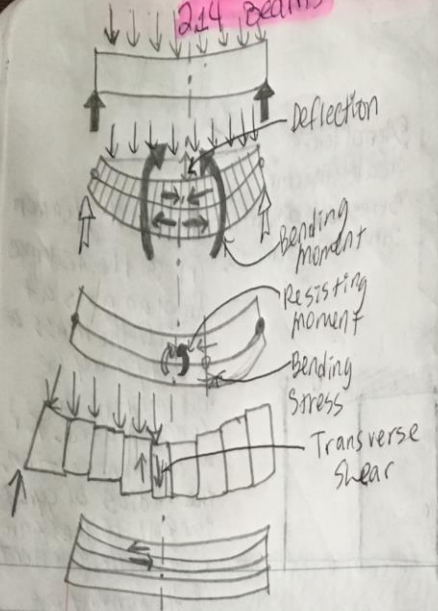
Radius of gyration (r) is the distance from an axis at which the mass of a body may be assumed to be concentrated. For a column section, the radius of gyration is equal to the square root of the quotient of the moment of inertia and the area.

Both ends fixed; K=0.5 | One end pinned; K=0.7 | Both ends pinned; K=1.0 | One end fixed, one free; K=2.0

Effective length is the distance between inflection points in a column subject to buckling. When this portion of a column buckles, the entire column fails.

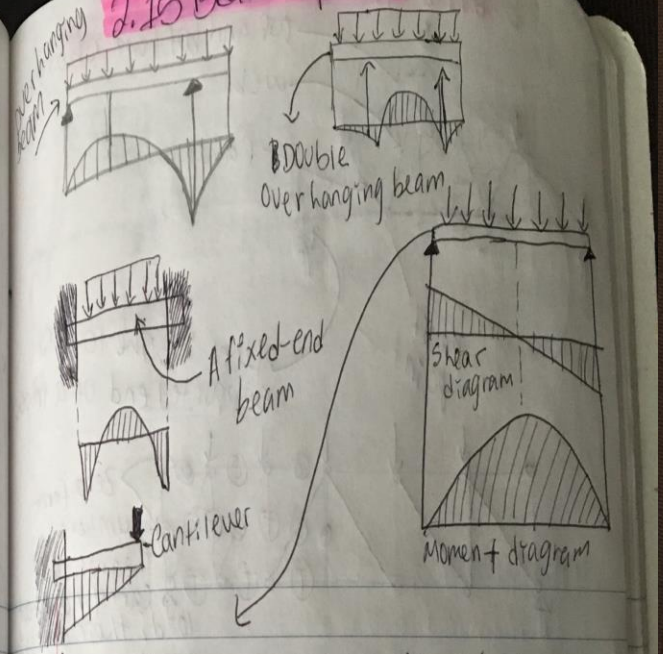
The slenderness ratio of a column.

2.14 Beams



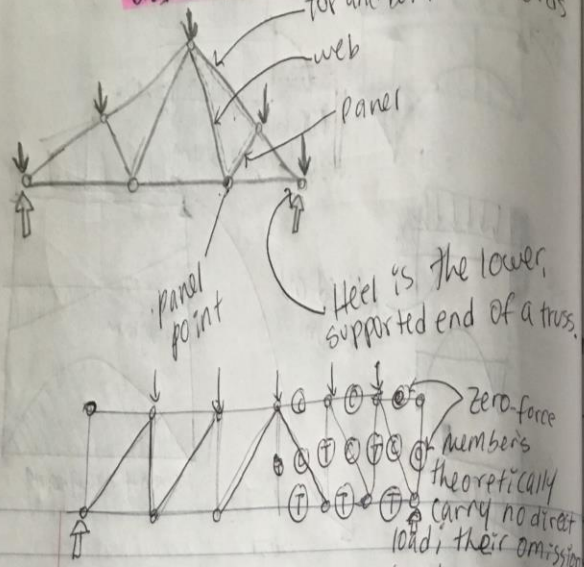
The efficiency of a beam is increased by configuring the cross section to provide the required moment of inertia or section modulus with the smallest possible area.

2.15 Beam Spans



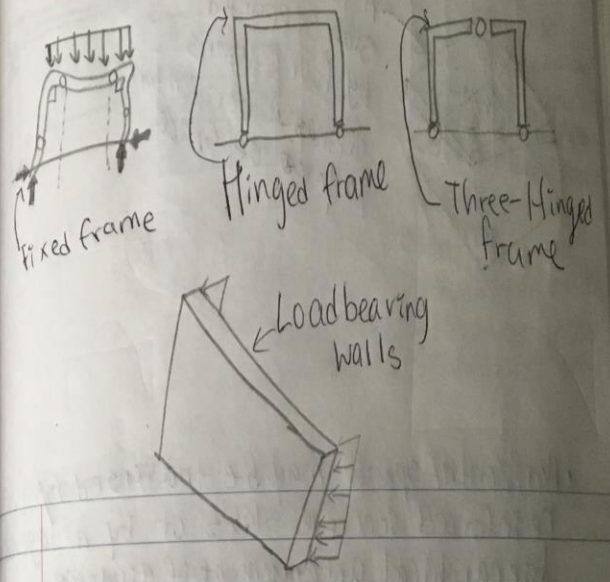
A simple beam rests on supports at both ends, with the ends free to rotate and having no moment resistance. As with any statically determine structure, the values of all reactions, shears, and moments for a simple beam are independent of its cross-sectional shape and material.

2.16 Trusses

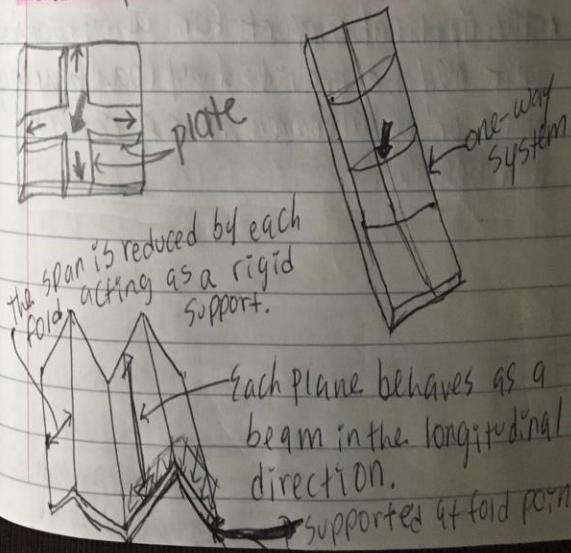


A truss is a structural frame based on the geometric rigidity of the triangle and composed of linear members subject only to axial tension or compression.

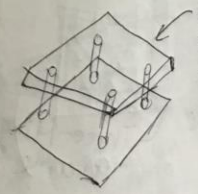
2.17 Frames & Walls



2.18 Plate Structures



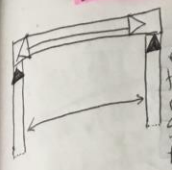
2.19 Structural units



A two-way slab supported by four columns defines a horizontal layer of space.

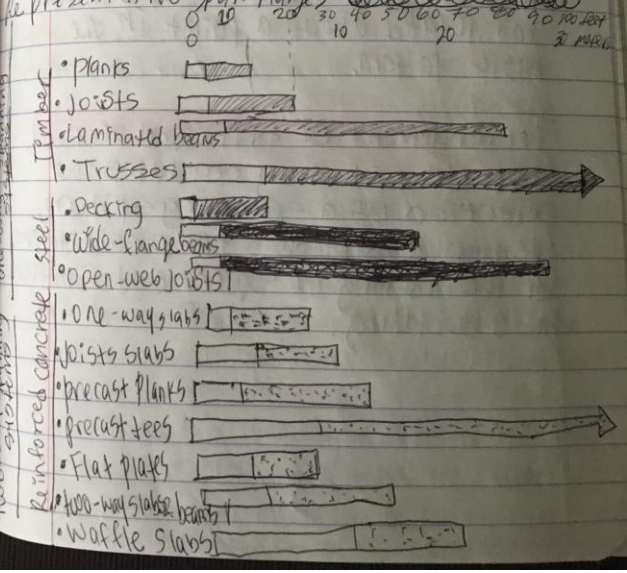
- Horizontal spans may be traversed by reinforced concrete slabs or by a layered, hierarchical arrangement of girders, beams, and joists supporting planks or decking.
- The vertical support for a structural unit may be provided by loadbearing walls or by a framework of columns and beams.

2.20 Structural spans

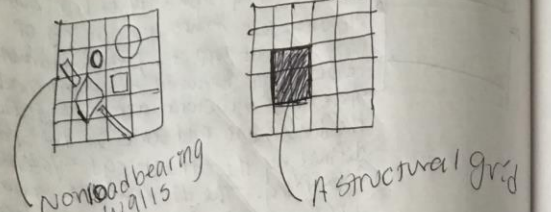


The spanning capability of horizontal elements determines the spacing of their vertical supports. This fundamental relationship between the span and spacing of structural elements influences the dimensions and scale of the spaces defined by the structural system of a building. The dimensions and proportions of structural bays, in turn, should be related to the programmatic requirements of spaces.

Representative span ranges



2.21 Structural patterns



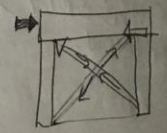
A portion of the grid can be dislocated and rotated about a point in the basic pattern.

The arrangement of principal vertical supports not only regulates the selection of a spanning system, it also establishes the possibilities for the ordering of spaces and functions in a building.

2.22 Lateral stability

Horizontal diaphragm

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

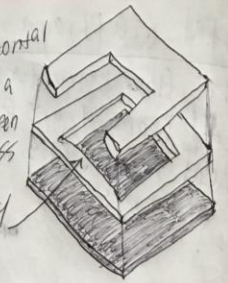


- Rigid frame
- Shear wall
- Braced Frame

2.23 Lateral stability

- A soft or weak story has lateral stiffness or strength significantly less than that of the stories above.
- A discontinuous shear wall has a large offset or a significant change in horizontal dimension.
- Torsional irregularity refers to the asymmetrical layout of mass or lateral force-resisting elements, resulting in noncoincident centers of mass and resistance

A discontinuous diaphragm is a horizontal diaphragm having a large cutout or open area, or a stiffness significantly less than of the story above or below.



The center of resistance is the centroid of the vertical elements of a lateral force-resisting system, through which the shear reaction to lateral forces acts.

2.24 High-rise Structures

- A framed tube
- perforated shell tube
- A braced tube
- A trussed tube
- A latticed truss
- Bundled tubes
- A tube-in-tube
- A tuned mass damper } Damping mechanisms
- Base isolation

2.25 Arches & vaults

- Barrel vaults have semicircular cross sections

- Groin or cross vaults are compound vaults formed by the perpendicular intersection of two vaults, forming arched diagonal arrises called groins.

- For bending to be eliminated throughout an arch, the line of thrust must coincide with the arch axis.
- The thrust of an arched structure on its abutments is proportional to the total load and span, and inversely proportional to the rise.

2.26 Domes

- Schwedler domes
- Lattice domes
- Geodesic domes

- Meridional forces
- Hoop forces
- tension ring

The transition from compressive hoop forces to tensile hoop forces occurs at an angle of from 45° to 60° from the vertical axis.

2.27 Shell Structures

- Translational surfaces
- ruled surfaces
- Rotational surfaces
- Saddle surfaces
- one-sheet hyperboloid
- hyperbolic paraboloid
- barrel shells

Shells are thin, curved plate structures typically constructed of reinforced concrete.

2.28 Cable Structures

funicular shape

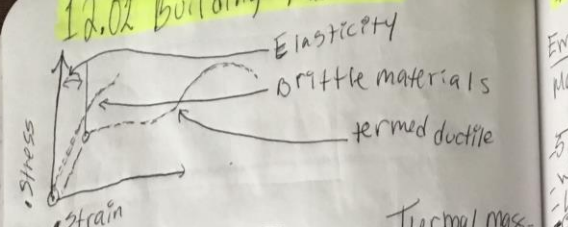
- catenary
- single-curvature
- Double-cable structures
- Double-curvature structures
- Cable-stayed structures
  - The mast
  - Guy cables

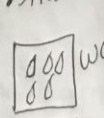
2.29 Membrane Structures

- Membrane and stell cables
- Reinforcing edge cables
- Air-supported structures } pneumatic structures
- Air-inflated structures

- The membrane may be tied to the mast supports by a reinforcing cable loop or be stretched over a distribution cap.
- The masts are designed to resist buckling under compressive loading.

12.02 Building Materials




water


air

Thermal mass- To control the hot/cold weather in the desert.


Temperature


Fire

Each material has distinct properties of strength, elasticity, and stiffness

The best materials are those that have elasticity and stiffness.

The color, texture, and scale of a material are obvious considerations.

Primary forces= Compression and Tension

↓

The reduction in volume

12.03 Building Materials

Embodied Energy in Building Materials

Material	Energy content BTU/LB*
Sand & gravel	18
wood	185
-Lightweight concrete	940
-Gypsum board	1830
-Brickwork	2200
-Cement	4100
-Glass	11,100
-Plastic	18,500
-Steel	19,200
-lead	25,900
-copper	29,600
-Aluminum	103,500

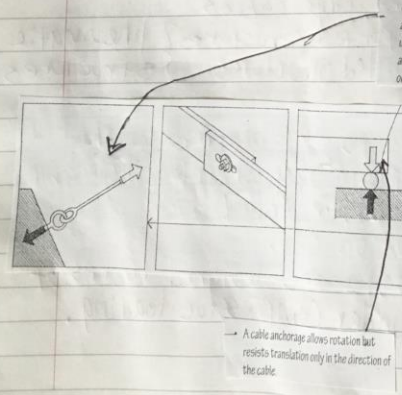
*1 BTU/lb= 2.326kJ/kg

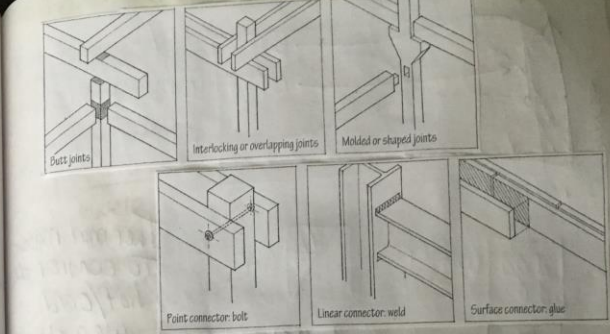
This assessment process consists of three components

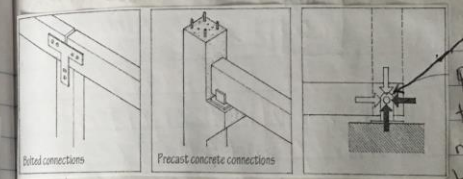
- Inputs: Raw materials, energy, water
- life-cycle inventory
- Outputs

Some air-supported structures use a net of cables placed in tension by the inflating force to restrain the membrane from developing its natural inflated profile

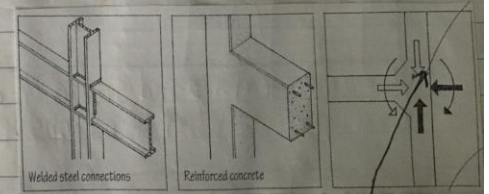
2.30







Pinned Joints theoretically allow rotation but resist translation in any direction.



Rigid or fixed joints maintain the angular relationship between the joined elements, restrain rotation and translation in any direction, and provide both force and moment resistance.