PROJECT PLANNING AND DESIGN

This division will assess objectives related to the preliminary design of sites and buildings. The division will focus on issues related to the generation or evaluation of design alternatives that synthesize environmental, cultural, behavioral, technical and economic issues. Candidates must demonstrate an understanding of and abilities in, design concepts, sustainability/environmental design, universal design, and other forms of governing codes and regulations.

- Preliminary design
- Site information
- Building placement
- Design alternatives
- Environmental design
- Synthesize cultural, environmental, and behavioral concepts
- Schematic Design into Design Development
PROJECT PLANNING AND DESIGN

Table of Contents

• Lecture discussions organized in the order of the 5.0 objectives
• Example projects and goals matrix
• Scenario considerations
• Document samples
• Questions
SITE CONSIDERATIONS

Determining the building location

Noting opportunities (exam 3) vs. final decisions

• Building orientation (i.e. sun path)

• Wind patterns

• Micro climate issues (shadows, actual wind patterns)
SITE CONSIDERATIONS

Determining the building locations

Noting opportunities (exam 3) vs. final decisions

• Soils
• Percolation
• Septic systems
• Topography
• Cut and fill
SITE CONSIDERATIONS

Determining the building locations

Site runoff
  • Retention ponds
  • Detention ponds
  • Bio-swales
  • General drainage
  • Wetlands and regulations
  • Other specialty moments
SITE CONSIDERATIONS

Determining the building locations

Noting options (exam 3) vs. final decisions

• Environmental analysis (P1 & P2)
• Encapsulate (in situ)
• Remove
• RemEDIATE
• Bio-remEDIATE
SITE CONSIDERATIONS

Determining the building locations

Noting options (exam 3) vs. final decisions

- Environmental analysis (P1 & P2)
- Encapsulate (in situ)
- Remove
- RemEDIATE
- Bio-remEDIATE

Consider
While working with a client on transforming an old manufacturing site into a new housing development, you notice that the environmental reports show an unacceptable amount of mercury and other similar toxins in the soils left over from the previous industrial use. You would probably recommend that they do what?
SITE CONSIDERATIONS

Determining the building locations

Noting options (exam 3) vs. final decisions

• Environmental analysis (P1 & P2)
• Encapsulate (in situ)
• Remove
• Remediate
• Bio-remediate

Consider
In the adaptive re-use project for a new charter school, the tests described in the Phase 2 report show the wood window casings have a lot of old lead paint chipping and will need to be dealt with. What would you recommend to the owners?

What if it was a new nursing home?
Sustainable checklist:
• Goal setting
• Active resilient design
• Vulnerability assessment
• Near amenities (walkable)
• Near transit (reduce parking count)
• Alternate transport (bike paths, storage)
• Compact / appropriate density
• Preservation / development of open space
• Create active lifestyle opportunities
• Brownfield site adaptation
• General remediation
• Adaptive reuse building
• Low impact development
• Passive site heating / cooling methods

DETERMINING THE SUSTAINABLE APPROACH

• Stormwater management (run-off issues)
• Native planting
• Water re-use
• Efficient irrigation
• Pourous pavers
• Green roof
• Bio-swales
• Balance cut and fill
• Regional materials
• Low waste
• Heat island effect
• Night sky lighting
• Providing habitat
• Renewable energy
  (green power, solar, wind, geothermal, etc.)
DETERMINING THE SUSTAINABLE APPROACH

Reviewing the analysis

Considering the opportunities (exam 3)

Making the cut

Aspirational vs. logical
SURVEYS

Determining the building locations (also discussed in other exams)
- Plat of survey (min. showing boundaries and “improvements”)
- Metes and bounds
- Benchmark (always relating to a “known” element)
- Types:
  - ALTA
  - Topo
  - Simple
  - Utilities
  - Specialties (trees, etc.)
SURVEYS

Determining the building locations
(also discussed in other exams)

- Covenants

- Easements
  Types:
  Driveways
  Utilities
  Views
  Specialties (trees, etc.)

- What is actually required?
IMPACT OF CONTEXT ON DESIGN

What does the neighborhood tell us when it comes time to design?

• Adaptive re-use

• T.O.D.

• Scale and massing

• Neighborhood continuity

• Streets

• Parking
IMPACT OF CONTEXT ON DESIGN

What does the neighborhood tell us when it comes time to design?

• Acoustics
• Cultural context
• Use type (does “use” fit?)
  Property values
• Materiality
• Micro climates
  Wind patterns
  Shadows
IMPACT OF CONTEXT ON DESIGN

What does the neighborhood tell us when it comes time to design?

• Acoustics

• Cultural context

• Use type (does “use” fit?)
  Property values

• Materiality

• Micro climates
  Wind patterns
  Shadows

Consider
In the process of designing the facade for a new building in an historic street with many existing well regarded older structures ... what are the contextual factors that you would consider?
IMPACT OF CONTEXT ON DESIGN

Behavioral expectations

- The building and its walkways and driveways should be where people expect them to be
- Clarity of way-finding
- Clear statement of purpose
- Helps the neighborhood, not just the client
- Kevin Lynch terminology

Consider
Imagine the danger posed by making a parking lot that had a confusing driveway, or it was unclear where to park.
IMPACT OF CONTEXT ON DESIGN

Behavioral expectations

• The building and its walkways and driveways should be where people expect them to be

• Clarity of way-finding

• Clear statement of purpose

• Helps the neighborhood, not just the client

• Kevin Lynch terminology

Consider
Imagine your desk at work sits right by a door that opens directly to the sidewalk and looks exactly like the main entry to the building. Think of the number of people that would walk up to the wrong door and bother you while you are trying to work. How annoying. Imagine how annoying it is for the people walking up. The path should be clear.
IMPACT OF CONTEXT ON DESIGN

Working with the existing topography

• Swales for drainage
• Berms for effect
• Cut and fill
• Reasonable slopes for walking and living
• Don’t fight what exists
• Don’t excavate others properties, don’t kill trees, etc.
IMPACT OF CONTEXT ON DESIGN

What does the neighborhood tell us when it comes time to design?

How much should you defer to the local context?

In the real design world, there are many factors, but in NCARB world, you should probably be deferential
QUESTIONS

1. When would a sustainable approach like encouraging convective breezes be a logical choice? Hot humid? Hot arid? Cold? Temperate?

2. You are designing a major retail center that is on the corner of a large “collector” type street and a small “local” street. Which street does the parking lot exit to?

3. The environmental report discusses the water and water vapor contamination in the soil at the site. The Owner decides to encapsulate with a concrete topping. Does this make sense?

4. What would you want to consider when putting an outdoor cafe in a dense, tall, urban landscape?
APPLYING ZONING CODES

Understanding how to apply the zoning codes:

• Use by District

• Scale / density

• Intensity

• Similar feel

• Purposefully mixed

• Overlays

Placement on the site
APPLYING ZONING CODES

Understanding how to apply the zoning codes:

- Placement on the site
  - Setbacks
  - Relative setbacks
  - Relating to neighbors and streets
APPLYING ZONING CODES

Understanding how to apply the zoning codes:

• Using FAR
  Above grade
  About massing
  Allows air and light to penetrate
APPLYING ZONING CODES

Understanding how to apply the zoning codes:

- Parking regulations
  - Size related to use (300sf to 350sf per car)
  - Parking count
  - Drive aisle
  - Site triangles
  - Distance from intersections
  - Landscaping
  - Screening
  - HC spaces
    - Size
    - Signage
    - Direct access to main entry
    - No crossing drive aisle
    - Ease of use
APPLYING ZONING CODES

Understanding how to apply the zoning codes:

• Impact fees
• Overlay zoning
• Covenants
• Easements
APPLYING ENVIRONMENTAL REGULATIONS

- Environmental Impact Reports
- Wetlands, watershed, waterways protection
- Erosion
- Native plantings
- Protection of species and biomes
- Impact fees
APPLYING BUILDING CODES

Understanding how to apply the building code:

• Use / Occupancy
  Vulnerable?
  Scale and density
  What are the specific issues this occupancy will need to be safe?

Where it all starts
APPLYING BUILDING CODES

Understanding how to apply the building code:

- Construction type
  - Trading back and forth
  - Balancing cost and flexibility
  - Robust fire resistance capacity (or not?)
  - Combustible
  - Protected

- This is what kicks off all the restrictions!
  - Allowable area
  - Allowable height
  - Where on the site can it be built
APPLYING BUILDING CODES

Understanding how to apply the building code:

• Construction type
  Trading back and forth
  Balancing cost and flexibility
  Robust fire resistance capacity (or not?)
  Combustible
  Protected

• This is what kicks off all the restrictions!
  Allowable area
  Allowable height
  Where on the site can it be built

Consider
The Allowable Area tables say you can only build a building with 20000 sf per floor given the Use and Construction types that you have chosen, but your client says they need 25000 sf for their program. What should you do?
Understanding how to apply the building code:

Working with both the Use Type and the Construction Type, determine ...

- Fire Protection
  - Bearing walls
  - Beams and columns
  - Demising assemblies
  - Floors and roofs
  - Height of roof
  - UL listing
APPLYING BUILDING CODES

Understanding how to apply the building code:

Working with both the Use Type and the Construction Type, determine ...

- Egress
  - Path
  - Protected (fire ratings)
  - All the way
  - Distances
  - Sprinklers (fire suppression systems)
  - Dead end corridors
  - UL listing
  - Smoke proof towers
  - Smoke evacuation systems
  - Alarms and intercoms
APPLYING BUILDING CODES

Understanding how to apply the building code:

Working with both the Use Type and the Construction Type, determine ...

- Egress Stair
  - Grand stair
  - Rise / Run
  - Width
  - Travel path (goes to street, but wait...)
- Handrails
  - Wrap back, start 12" early
- Guardrails
- Area of refuge
- Swing of door in direction of egress
- Locked doors and alarm systems
- Smoke evacuation
APPLYING BUILDING CODES

Understanding how to apply the building code:

Working with both the Use Type and the Construction Type, determine ...

• Fire ratings
• Flame spread
• Smoke generation

Consider
The sad story of the Great White concert at a Rhode Island concert venue.
APPLYING BUILDING CODES

Understanding how to apply the building code:

Working with both the Use Type and the Construction Type, determine ...
• Plumbing counts
• Light and Vent
APPLYING BUILDING CODES

Understanding how to apply the building code:

• Energy code

• Watts per sf

• Energy use for heating and cooling

• ASHRAE comparisons

• Devices
APPLYING BUILDING CODES

Understanding how to apply the building code:

• ADA
• Ramps (1:20 to 1:12)
• Audio / visual
• Telegraphing information
• Way-finding
• Bathrooms
• Kitchens
APPLYING BUILDING CODES

Understanding how to apply the building code:

- ADA
- Ramps (1:20 to 1:12)
- Audio / visual
- Telegraphing information
- Way-finding
- Bathrooms
- Kitchens

Consider
The point of making “accessible” dwelling units is to move handicap people into them, right?
APPLYING BUILDING CODES

Understanding how to apply the building code:

• ADA
• Ramps (1:20 to 1:12)
• Audio / visual
• Telegraphing information
• Way-finding
• Bathrooms
• Kitchens

Consider
Working out the site entry sequence, the entry looks great with some grand steps leading to the front door, but don't worry there is a ramp around the side.
APPLYING BUILDING CODES

Understanding how to apply the building code:

- ADA
- Ramps (1:20 to 1:12)
- Audio / visual
- Telegraphing information
- Way-finding
- Bathrooms
- Kitchens

Consider
Imagine you just designed the coolest stair ever for the new Apple store and it “floats” in the space. How could you warn someone that is blind before they cane right into it and bang their head?
APPLYING BUILDING CODES

Understanding how to apply the building code:

• Clear, continuous paths

• 7/11

• Areas at doors
  Push side
  Pull side
  Door handles
  Pressure to open
  Electronic operation
  Gnarled handles

Figure 1: Turning Space

Figure 2: Maneuvering Clearances at Doors
APPLYING BUILDING CODES

ANSI Examples: Passageways

(a) Front Approach, Pull Side

(b) Front Approach, Push Side

* If both closer and latch are provided

(c) Hinge Approach, Pull Side

(d) Hinge Approach, Push Side

(e) Hinge Approach, Push Side

(f) Latch Approach, Pull Side

(g) Latch Approach, Push Side

*54 min (1370) if closer is provided

* 48 min (1220) if both closer and latch provided

* 22 min (560)

*36 min (915)

* 42 min (1065)

* 24 min (610)

*42 min (1065)

* 24 min (610)

*48 min (1220) if closer is provided
APPLYING BUILDING CODES

ANSI Examples: Passageways
APPLYING BUILDING CODES

ANSI Examples: Transitions

(a)

(b)
APPLYING BUILDING CODES

ANSI Examples: Reach Ranges
APPLYING BUILDING CODES

ANSI Examples: Reach Ranges
APPLYING BUILDING CODES

ANSI Examples: Bathrooms
APPLYING BUILDING CODES

ANSI Examples: Bathrooms
APPLYING BUILDING CODES

ANSI Examples: Kitchens
APPLYING BUILDING CODES

Fire rating examples:

**WALL TYPE 1**
2 HOUR (UL RATING: U419)

- 2 LAYERS - FIRECODE SHEETROCK
- 3½ 20 GA. STEEL STUDS AT 16" OC
- R11 FIBERGLASS SOUND BAT, WHERE NOTED

**STC: 53**

- 3½ 20 GA. STEEL RUNNER ON SILL SEALER
- VINYL BASE, TYP. & FLOOR FINISH
- CONCRETE SLAB
# APPLYING BUILDING CODES

## Project Delivery and Building Codes:

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<th>Design-Build</th>
<th>Fast-Track</th>
<th>Multiple Prime</th>
<th>Integrated Project Delivery</th>
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### APPLYING BUILDING CODES

What is going to drive the design process?

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<th>Thermal &amp; Moisture Protection</th>
<th>Aesthetic</th>
<th>Structure</th>
<th>Cost &amp; Budget (Life-cycle)</th>
<th>Acoustic</th>
<th>Material Sourcing</th>
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QUESTIONS

1. How much area do you need to devote for the vestibule on the preliminary plan for the public library project you are working on?

2. How large is a typical egress stair for an office setting? How about an apartment building?
QUESTIONS

1. For a new construction project, you are trying to determine what construction type you will use. What issues must be established first before you can truly make that decision?

2. You are laying out the seating locations for the theater project, and you realize that the perfect spot to put the accessible (wheelchair) seating is right in the middle, about 1/3 of the way back from the stage, with easy access in and out and good view lines. Are you done?

3. The egress distance allowed for the apartment building you are designing would be dependant on what?

4. How do we know if we need more egress stairs than two?
BUILDING SYSTEMS

Choosing building systems
Heating / Cooling:

• Comfort

• Temperature / humidity

• Climate

• Seasonal expectations

• Cultural expectations
BUILDING SYSTEMS

Choosing building systems
Heating / Cooling:

Moving heat around

• Conduction
• Convection
• Radiation
BUILDING SYSTEMS

Choosing building systems
Heating / Cooling:

• Installation (first costs)
• Energy use
• Maintenance
• Replacement?
BUILDING SYSTEMS

Choosing building systems
Heating / Cooling:

• Room for generation
• General system requirements
• Distribution to the spaces
• Distribution to the people
• Fuel system?
• Waste or flue
BUILDING SYSTEMS

Choosing building systems

Heating / Cooling:

• Passive systems
• Air based systems
• Hydronic systems
• Heat pumps
• IR systems
BUILDING SYSTEMS

Choosing building systems
Heating / Cooling:

- Air based systems
  - Boiler
  - Compressor
  - Coil
  - Distribution supply ducts
  - Return ducts
  - Outside air
  - Filtering
  - Dehumidifying

- Works well for both heating and cooling
Building Systems

Choosing building systems

Heating / Cooling:

- Air based systems
  - Boiler
  - Compressor
  - Coil
  - Distribution supply ducts
  - Return ducts
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- Works well for both heating and cooling

Reminder: How does cooling work
Choosing building systems

Heating / Cooling:

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Typical distribution in a room
BUILDING SYSTEMS

Choosing building systems

Heating / Cooling:

• Air based systems
  Boiler
  Compressor
  Coil
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BUILDING SYSTEMS

Choosing building systems

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  - Return ducts
  - Outside air
  - Filtering
  - Dehumidifying

- Works well for both heating and cooling

Why dropped ceilings:

- Plenums
- Acoustics
- Maintenance
- Damage control
- Costs
- Aesthetic field
BUILDING SYSTEMS

Choosing building systems

Heating / Cooling:

• Air based systems
  Boiler
  Compressor
  Coil
  Distribution supply ducts
  Return ducts
  Outside air
  Filtering
  Dehumidifying

• Works well for both heating and cooling

Impact on the organization / circulation
BUILDING SYSTEMS

Choosing building systems

Heating / Cooling:

• Air based systems
  Boiler
  Compressor
  Coil
  Distribution supply ducts
  Return ducts
  Outside air
  Filtering
  Dehumidifying

• Works well for both heating and cooling

Integrating with residential sections
Choosing building systems

Heating / Cooling:

- Air based systems
  - Boiler
  - Compressor
  - Coil
  - Distribution supply ducts
  - Return ducts
  - Outside air
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  - Dehumidifying

- Works well for both heating and cooling

Integrating with different structural systems
BUILDING SYSTEMS

Choosing building systems

Heating / Cooling:

- Air based systems
  - Boiler
  - Compressor
  - Coil
  - Distribution supply ducts
  - Return ducts
  - Outside air
  - Filtering
  - Dehumidifying

- Works well for both heating and cooling

In floor example
BUILDING SYSTEMS

Choosing building systems

Heating / Cooling:

- Plenum
- AHU
- CAV / VAV
- DX
- Cooling Tower
- Dampers

Impact on the design considerations
BUILDING SYSTEMS

Choosing building systems
Heating / Cooling:

• Hydronic systems
  Boiler
  Distribution
  2 pipe, 3 pipe, 4 pipe
  Radiating
  Loops

• Why not for cooling?
BUILDING SYSTEMS

Choosing building systems

Heating / Cooling:

• Hydronic systems
  Boiler
  Distribution
  2 pipe, 3 pipe, 4 pipe
  Radiating
  Loops

Example: Radiators

• Why not for cooling?
BUILDING SYSTEMS

Choosing building systems

Heating / Cooling:

- Hydronic systems
  - Boiler
  - Distribution
  - 2 pipe, 3 pipe, 4 pipe
  - Radiating
  - Loops

- Why not for cooling?

Example: In floor heating
Choosing building systems

Heating / Cooling:

- Hydronic systems
  - Boiler
  - Distribution
  - 2 pipe, 3 pipe, 4 pipe
  - Radiating
  - Loops

- Why not for cooling?

Example: Combination systems
Choosing building systems

Heating / Cooling:

- Hydronic systems
  - Boiler
  - Distribution
  - 2 pipe, 3 pipe, 4 pipe
  - Radiating
  - Loops

- Why not for cooling?

Example: cool beams
BUILDING SYSTEMS

Choosing building systems

Heating / Cooling:

- Steam systems
  - Boiler
  - Distribution
  - Self rising
  - Condensate by gravity
  - Loops
  - Radiators
  - Scalding
  - Noisy

Making the steam section work

Large campus style systems
BUILDING SYSTEMS

Choosing building systems

Heating / Cooling:

- Combination Systems
BUILDING SYSTEMS

Choosing building systems
Heating / Cooling:

- Electric heating systems
  Efficient
  But, yet, inefficient
  Remote locations
  No worry about freezing
  Small, can fit anywhere
BUILDING SYSTEMS

Choosing building systems

Heating / Cooling:

- Alternative Systems: Passive
  - Controlling solar gain
  - Trombe walls
  - Greenhouse effect
  - Heat sinks
  - Radiating over time
  - Using solar heat to create convective currents
BUILDING SYSTEMS

Choosing building systems

Heating / Cooling:

• Alternative Systems: Passive
  - Controlling solar gain
  - Trombe walls
  - Greenhouse effect
  - Heat sinks
  - Radiating over time
  - Using solar heat to create convective currents

Passive systems and sections: light shelves
BUILDING SYSTEMS

Choosing building systems

Heating / Cooling:

- Alternative Systems: Passive
  - Controlling solar gain
  - Trombe walls
  - Greenhouse effect
  - Heat sinks
  - Radiating over time
  - Using solar heat to create convective currents

Passive systems and sections: convective pull
BUILDING SYSTEMS

Choosing building systems

Heating / Cooling:

- Alternative Systems: Passive
  - Controlling solar gain
  - Trombe walls
  - Greenhouse effect
  - Heat sinks
  - Radiating over time
  - Using solar heat to create convective currents

Passive systems and sections: Wind scoop
BUILDING SYSTEMS

Choosing building systems

Heating / Cooling:

• Alternative Systems: Geo-thermal
  Heat exchanger
  52 to 55 degrees
  Air based systems
  Hydronic systems
  Pumps
  Horizontal vs. vertical piping
BUILDING SYSTEMS

Choosing building systems

Impact on design thinking

Lighting systems:

• Measuring light
  Footcandles
  Lumens
  Luminance flux (transmit)
  Illuminance (incident on surface)

  Color rendering
  Kelvin
BUILDING SYSTEMS

Choosing building systems
Lighting systems:

• Incandescent

• Fluorescent

• High Intensity Discharge (HID)

• LED

• OLED
BUILDING SYSTEMS

Choosing building systems
Lighting systems:

- Incandescent
  - Filament
  - Hot toaster
  - Fast
  - Low efficacy
  - Dimmable
  - A, G, PAR, C
  - Sizing in eightths
BUILDING SYSTEMS

Choosing building systems

Lighting systems:

- Fluorescent
  - Tube
  - Mercury
  - Electrical arc
  - Phosphors
  - Ballast
  - Dimmable?
  - Straight tube, circleline, U
  - CFLs
  - Efficacy
  - Cold weather
  - Spread of light source
  - Discarding
BUILDING SYSTEMS

Choosing building systems
Lighting systems:

• High Intensity Discharge (HID)
  Mini tube
  Color rendering
  Slow
  High efficacy
  Long lasting
  Point source
BUILDING SYSTEMS

Choosing building systems
Lighting systems:

- LED
  - Many small diodes
  - Color rendering
  - Fast
  - High efficacy
  - Control of voltage
  - Groupings can be spread out or tight
  - Long lasting
  - Heat buildup
BUILDING SYSTEMS

Choosing building systems

Lighting systems:

• OLED
  Similar to LEDs
  Layers
  Potentially flexible and thin
  Currently mostly devices
  Surface light, not point source
BUILDING SYSTEMS

Choosing building systems
Lighting systems:

• Point source / direct
• Indirect
• Task
• Pendant
• Luminaire
• Shade / diffuser
• Shadow / clarity / efficacy
Choosing building systems
Lighting systems:

- Recessed downlight, can light
- Cove light
- Task light
- Pendant
- Lamp
- Uplight
- Stair light
Choosing building systems

Lighting systems:

- Daylighting
- Light sensors
- Movement sensors
- Glare
Choosing building systems

Lighting systems:

• Site lighting

• Night sky lighting

• Self contained or wired

• You can’t light the entire world, so what do you want to light to help people navigate through the site?
BUILDING SYSTEMS

Choosing building systems
Electricity:

- Generation
  - Centralized
  - Decentralized

- Volts, Amps, Watts

- Efficiency for transmission

- Transformers
  - Step up
  - Step down
BUILDING SYSTEMS

Choosing building systems

Electricity:

- Generation
  - Centralized
  - Decentralized

- Volts, Amps, Watts

- Efficiency for transmission

- Transformers
  - Step up
  - Step down

Impact on design thinking
BUILDING SYSTEMS

Choosing building systems

Electricity:

• Load Center (panel)
• Circuits
• Circuit breakers (fuses)
• Busways
• Conduit

Impact on design thinking
BUILDING SYSTEMS

Choosing building systems
Plumbing:

• Supply, Waste, and Vent

• Fixture count

• Locations of fixtures
  Easily accessible for everyone
  Logically located (wet wall)
  Core?
  Efficient

• Location of utilities

• Gravity / pressurized
Choosing building systems
Plumbing:

- Supply piping riser diagram
Choosing building systems

Plumbing:

- Waste & Vent
BUILDING SYSTEMS

Choosing building systems
Plumbing:

- Waste & Vent riser diagram
Choosing building systems

Plumbing:

- Roof drains
Choosing building systems

Plumbing:

- Copper
- Cast iron
- PVC
- Specialty (example: glass)
Choosing structural systems

General issues:
• Appropriate spans
• Relation to the program
• Related loads
• Material choices
• Local market
• Costs
• Specialty requirements
Choosing structural systems
Short spans, simple materials:
• Wood framing vs. heavy timber
• Light gauge metal framing
• Studs, wall sheathing
• Joists, subfloor
• Diaphragms
• Nailers and insulation
• Walls to floors
Choosing structural systems

Short spans, simple materials:
- Wood framing vs. heavy timber
- Light gauge metal framing
- Studs, wall sheathing
- Joists, subfloor
- Diaphragms
- Nailers and insulation
- Walls to floors

Consider
The historical importance of balloon frame and platform frame construction.
Choosing structural systems
Medium spans:
• Post and beam
• Framing plans
• Decking to joists to beams to girder
• Steel
• Concrete
• Engineered wood
• Camber
Choosing structural systems
Medium spans:
• Post and beam
• Framing plans
• Decking to joists to beams to girder
• Steel
• Concrete
• Engineered wood
• Camber

Consider
The extraordinary example of the Monadnock Building shows both the bearing wall and the column / beam frame concepts in one building.
Choosing structural systems
Medium spans:

- Engineered Wood
  - I-joist
  - LVL, LSL beams
  - Paralams
  - Glulams (timbers)
  - Trusses
Choosing structural systems
Medium spans:

- Steel
  - Structural steel
  - Wide flanges
  - Open web joists

- Fire protection
  - Drywall
  - Concrete
  - Spray on fireproofing
  - Height from the floor
  - Water
Choosing structural systems
Medium spans:

• Concrete
  Precast
  Site cast
  Open web joists
  Local skills
  Local economy
  Transportation
  Fire protection
  Formwork
Choosing structural systems
Medium spans:

• Site Cast Concrete
  Walls
  Flat plate
  Flat slab
  Column capital
  Beam and slab
  Joist slab
  Waffle slab

  Two way vs one way
  Formwork
  Layout plans
Choosing structural systems
Medium spans:

- Site Cast Concrete
  - Walls
  - Flat plate
  - Flat slab
  - Column capital
  - Beam and slab
  - Joist slab
  - Waffle slab

  Two way vs one way
  Formwork
Choosing structural systems
Medium spans:

• Pre-cast Concrete
  Flexicore floor slabs
  Beams
  Foundations
  Bearing

  One way
  Topping
  “Framing” plan
Choosing structural systems
Medium spans:

- Pre-cast Concrete
  - Flexicore floor slabs
  - Beams
  - Foundations
  - Bearing

One way
Topping
“Framing” plan

**Consider**
Why do we really need to decide between precast and site cast during planning anyway?
Choosing structural systems

Long spans:

- Trusses
- Steel
- Wood

(castellated beams)
(vierendeel truss)
Choosing structural systems
Long spans:

- Open web steel joists
  - K series
  - LH series
  - DLH series

  Bearing (top vs. bottom)
  Chords
  Webs
  Integration with utilities
  Light weight
  Bouncy
Choosing structural systems

Long spans:

- Precast long span
  - T's
  - Double T's
  - I beams / L beams

- Topping
- Camber / pretensioned
- Rebar / tendons
- Fire safety
- Relation to utilities
- Stiff
- Transportation
Choosing structural systems
Long spans:

- Site cast long span
  - Post tensioned
  - Formwork
  - Camber
  - Rebar / tendons
  - Fire safety
  - Relation to utilities
  - Stiff
Choosing structural systems
Long spans:

- Site cast long span
  - Post tensioned
  - Formwork
  - Camber
  - Rebar / tendons
  - Fire safety
  - Relation to utilities
  - Stiff

Consider
Remember the difference and the implications of pre-tensioned vs. post-tensioned.
Choosing structural systems

Long spans:

- Specialty long spans
  - Air filled (pneumatic)
  - Thin shell
  - Tensile
  - Space frame
  - Lamella
STRUCTURAL SYSTEMS

Choosing structural systems
Long spans:

• Specialty long spans
  Air filled (pneumatic)
  Thin shell
  Tensile
  Space frame
  Lamella

Consider
Some names to review ...
• Candella
• Nervi
• Frei Otto
Choosing building systems

Fire Suppression:
- Alarms (tie to sprinklers)
- Sprinkler systems
  - Head
  - Fusible link, ion type, light sensor
  - Wet or dry
  - Preactivation
  - Deluge
  - Foam and chemical
  - Standpipes
  - Typical 12' to 15' diameter (blockages)
- Wall washer
- Fire pump
Choosing building systems

Fire Suppression:
- Water tanks
- Standpipes
- Sprinkler layout
  - Typical 12' to 15' diameter (blockages)
  - Wall washer
- Fire pump room
Choosing building systems

Acoustics:
• Materials / relationships
• Separation (vibration)
• Live vs. dead sound
  • Echo / bounce
  • Direct bounce vs. spread
• Massiveness vs. compartments
• Absorbing
• Lost in the cavity
Choosing building systems

Acoustics:

- **STC**
  Sound Transmission Class

- **NRC**
  Noise Reduction Coefficient

- **IIC**
  Impact Insulation Class
Choosing building systems
Conveying systems:

- Stairs
  - Egress vs. grand

- Elevators
  - Traction, hydraulic, pneumatic
  - Head house, pit, machine room

- Escalators
  - Thickness and the machine room

- Lifts / LULAs / ramps
Choosing building systems
Alarm systems:

• General considerations
• Annunciator panels
• Exit, emergency, alarm lights
• Which buildings get alarm systems
• Design implications
Choosing building systems
Communications systems:

• Intercoms, Speaker systems
• Telephones systems
• Wifi systems
• Cable and broadband
• T1 lines, cell towers, boosters
Choosing Wall and Floor Assemblies

• Wall Assemblies
  Shed water
  Insulate
  Durability
  Acoustic control
  Interior finish
  Fire transmission resistance
  Fenestration
  Tolerance issues
  Structural connection
  Structural stiffness
  Structural bearing
  Utilities
  and, let’s not forget, aesthetic control
CHOOSING ASSEMBLIES

Choosing Wall and Floor Assemblies

• Wall Assemblies
  Shed water
  Insulate
  Durability
  Acoustic control
  Interior finish
  Fire transmission resistance
  Fenestration
  Tolerance issues
  Structural connection
  Structural stiffness
  Structural bearing
  Utilities
  and, lets not forget, aesthetic control

Consider
What are the differences between an exterior wall, a bearing wall, and a partition?
CHOOSING ASSEMBLIES

Choosing Wall and Floor Assemblies

- Floor Assemblies
  - Insulate
  - Durability
  - Acoustic control
  - Interior finish
  - Fire transmission resistance
  - Tolerance issues
  - Structural connection
  - Structural stiffness
  - Structural bearing
  - Utilities
  - Penetrations

  and, let's not forget, aesthetic control

Consider

The building is mostly a masonry bearing wall system with wood joists (ordinary construction) but has a specialty entrance area. You have been working on this special area with a design for a curtain wall system ... what would some of your considerations be?
CHOOSING ASSEMBLIES

Choosing Wall and Floor Assemblies

• Roof Assemblies
• All the same issues with special emphasis on
  Insulation
  Durability / water / sun
  Emissivity / reflections
  Interior finish
  Fire transmission resistance
  Tolerance issues
  Structural connection
  Structural stiffness
  Structural bearing
  Utilities (including supporting them)
  Penetrations !!!
Choosing Wall and Floor Assemblies

- Ceiling Assemblies
  - Insulate
  - Durability / maintenance
  - Acoustic control
  - Interior finish
  - Fire transmission resistance
  - Tolerance issues
  - Structural connection
  - Utilities
  - Penetrations
What is going to drive the design process?

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# CHOOSING ASSEMBLIES

## Project Delivery and Building Codes:

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**CHOOSING ASSEMBLIES**

Phases and choosing assemblies:

<table>
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<th>Pre-Design</th>
<th>SD</th>
<th>DD</th>
<th>CD</th>
<th>B</th>
<th>CA</th>
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QUESTIONS

1. You are trying to design a new large conference room for the board of directors. What acoustic issues would you most likely be considering?

2. The fire-fighters arrive at the emergency at your building. What are their first 4 actions?

3. You just designed a beautiful long span concrete structure for the professional scrabble stadium with a stunning 210' open span. What kind of concrete structure is it? Is it precast or site-cast? Is it pre-stressed or post-tensioned?

4. During the planning charrette, the engineers are all arguing over who gets precedent. Who is right? Who gets to place their work first, HVAC, Electrical, Plumbing, Fire Protection, or Lighting?
FINALIZING THE PLAN

Sorting through the options and information to make a final determination of the plan:

• Organize the plan
  Bubble diagram to plan
  Check plan against egress
  Check plan against program
  Check plan against zoning
  Check plan against cost controls

• Organize the section
  Bubble diagram to section
  Check section against egress
  Check plan against program / zoning
  Check plan against building code
    (fire and smoke separations)
Sorting through the options and information to make a final determination of the plan:

- **Organize the plan**
  - Bubble diagram to plan
  - Check plan against egress
  - Check plan against program
  - Check plan against zoning
  - Check plan against cost controls

- **Organize the section**
  - Bubble diagram to section
  - Check section against egress
  - Check plan against program / zoning
  - Check plan against building code
  - (fire and smoke separations)

---

**Consider**

The building program for the corporate client includes a strong and persuasive note about a clear demonstration of egalitarianism and the desire to clearly demonstrate that the employees are all in together. It is determined that a large multi-floor atrium space that all the different departments open onto is just the ticket to demonstrate all the togetherness. What should your next thought be? (hint: what would a code official think about all this togetherness?)
FINALIZING THE PLAN

Sorting through the options and information to make a final determination of the plan:

- Organize the plan regarding Universal Design
  - Ramps
  - Lifts
  - Strobes
  - Space at doors
  - Signage
  - Way-finding
  - Full paths

- Accessible
- Adaptable
- Visitable
FINALIZING THE PLAN

Sorting through the options and information to make a final determination of the plan:

• Organize the plan regarding Universal Design
  Ramps
  Lifts
  Strobes
  Space at doors
  Signage
  Way-finding
  Full paths

Accessible
Adaptable
Visitable

Consider
Imagine for a moment trying to get around a city before curb cuts were at most corners. This is not ancient history, this happened in your lifetime.
FINALIZING THE PLAN

Sorting through the options and information to make a final determination of the plan:

• Organize the roof and the elevations
  Slopes?
  Parapets?
  Drainage?
  Green roof?
  What about rooftop equipment?
  Heat island effect?
Consider
Clearly, making holes in your roof is a bad idea. So why don't all roof systems shed water instead of taking the water down a roof drain into the building?

FINALIZING THE PLAN

Sorting through the options and information to make a final determination of the plan:

• Organize the roof and the elevations
  Slopes?
  Parapets?
  Drainage?
  Green roof?
  What about rooftop equipment?
  Heat island effect?
FINALIZING THE PLAN

Sorting through the options and information to make a final determination of the plan:

- Impact of the systems on design
  - Ceilings?
  - Soffits?
  - Space for lighting?
  - Roof drains?
  - Plumbing walls (“wet walls”)?
  - Plumbing stacking?
  - Vertical shafts?
FINALIZING THE PLAN

Sorting through the options and information to make a final determination of the plan:

- Impact of the systems on design
  - Ceilings?
  - Soffits?
  - Space for lighting?
  - Roof drains?
  - Plumbing walls ("wet walls")?
  - Plumbing stacking?
  - Vertical shafts?

Consider
You decide that the multifamily apartment building should be built with passive principles. How would this likely impact your planning process?
FINALIZING THE PLAN

Sorting through the options and information to make a final determination of the plan:

• Impact of the specialty program requirements into the plan
FINALIZING THE PLAN

Sorting through the options and information to make a final determination of the plan:

• Impact of the environment on the final plan
  - Environmental engagement
  - Sustainability issues
    - Orientation
    - Wall sections
    - Ceiling sections and air flow
    - Etc.

• Impact of the context on the final plan
  - Local buildings
  - Noise
  - Pollution
  - Safety
QUESTIONS

1. You have decided to design a combination of air based heating and cooling along with a supplemental radiant system along the perimeter. What sectional issues would become important to consider given this design?

2. The team decides on a DX rooftop system for the three story tenant office space. You are designing the first floor tenant space. What must you consider regarding the other floors?

3. As I run out of the 2 hour protected stairwell in the fire emergency, what do we know about what I am running into?
How to make budgeting decisions:

• First Cost
  What is the initial material cost
  What is the initial labor install cost

• Life Cycle Cost
  First cost
  Maintenance cost
  Replacement cost
  Energy use
  Timeline considerations

• Best for comparisons
EVALUATING BUDGET CHOICES

“Cost evaluations”:

• Efficiencies
  Are the material choices reasonable
  Are there opportunities to double up
  Need vs. want

• Analysis
  Does it meet the program needs
  Is the response appropriate

• Value engineering
  Space
  Materials
  Comparisons
EVALUATING BUDGET CHOICES

“Cost evaluations”:

• Take offs vs. guesstimates

• Rules of thumb

• Previous experience

• Means (and other proprietary systems)
  Types
  Assemblies

• Outside providers
  Sales reps
  Third party estimators
## EVALUATING BUDGET CHOICES

### Project Delivery and Building Codes:

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**EVALUATING BUDGET CHOICES**

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QUESTIONS

1. You are designing the new classroom building at the local university, and, during a team meeting with the consultants, the mechanical engineer offers two approaches, the first a chiller system in a basement mechanical room with air handling units on each floor and the second a series of 5 rooftop DX units. What would be a logical way to evaluate your choice?

2. While trying to determine a reasonable cost estimate for a high school design for San Jose, California, you realize that it is very similar in size and scope to a recent project the team did in a small town in Louisana. Can you just use that cost estimate?

3. When is the best time to consider “value engineering”? 