PROJECT DEVELOPMENT AND DOCUMENTATION

This division will assess objectives related to the integration and documentation of building systems, material selection, and material assemblies into a project. The division will focus on issues related to the development of design concepts, the evaluation of materials and technologies, selection of appropriate construction techniques, and appropriate construction documentation. Candidates must demonstrate an understanding of and abilities in, integration of civil, structural, mechanical, electrical, plumbing, and specialty systems into overall project design and documentation.

- Communication / documentation systems
- Assemblies and systems
- Detail design alternatives
- Evaluation of materials
- Selection of appropriate construction techniques
- Integration of systems into designs

PROJECT DEVELOPMENT AND DOCUMENTATION

Table of Contents

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

INTEGRATION OF BUILDING MATERIALS AND SYSTEMS

Analyze the integration of architectural systems
to meet project goals ...

How does the architectural idea translate into
the architectural system

- Shell
- Core
- Partitions and ceilings
- Doors and windows

INTEGRATION OF BUILDING MATERIALS AND SYSTEMS

Analyze the integration of structural systems to meet project goals ...

How does the architectural idea translate into the structural system

- Span
- Shell
- Core
- Framing plan
- Foundations

INTEGRATION OF BUILDING MATERIALS AND SYSTEMS

Analyze the integration of structural systems to meet project goals …

How does the architectural idea translate into the structural system

- Span
- Shell
- Core
- Framing plan
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Individual structural components

Building wide structural systems

INTEGRATION OF BUILDING MATERIALS AND SYSTEMS

Analyze the integration of mechanical systems to meet project goals ...

How does the architectural idea translate into the mechanical system

- Comfort
- Appropriateness
- Efficiency
- Flexibility

INTEGRATION OF BUILDING MATERIALS AND SYSTEMS

Analyze the integration of mechanical systems to meet project goals ...

How does the architectural idea translate into the mechanical system

- Requirements
  - Fresh air
  - Exhaust air
  - Temperature
  - Humidity level
  - Condensation
  - Vapor Barrier
  - Operable ventilation

INTEGRATION OF BUILDING MATERIALS AND SYSTEMS

We can't really discuss mechanical systems without also thinking about the R values of the various exterior assemblies

- Resistance to heat flow
    - Each material has an R value
    - Object vs. thickness
    - Air skins
    - Air gaps
    - Slab edge

    Combination of insulated and non-insulated areas to have an overall R

- U factor (1/r), coefficient of transmission
    - Windows and doors

INTEGRATION OF BUILDING MATERIALS AND SYSTEMS

R value - simple example:

(exterior)

Air film : :
Siding material : :
House wrap : :
Sheathing : :

Insulation / studs : :
Drywall : :
Air film : :

(interior)

DETERMINING THE SCALE OF MECHANICAL SYSTEMS

Basics: Understanding heating transfer

- Convection
- Conduction
- Radiant

DETERMINING THE SCALE OF MECHANICAL SYSTEMS

Basics: Understanding comfort

- Comfort
- (De)Humidification
- Sensible heat
- Latent heat
- Enthalpy
- Psychometric chart
- Sling psychrometer / hygrometer

DETERMINING THE SCALE OF MECHANICAL SYSTEMS

Basics: Understanding charting the needs

- Psychometric chart

DETERMINING THE SCALE OF MECHANICAL SYSTEMS

Mechanical design issues:

- Heating
  - Radiant
  - Convection

- Cooling
  - While it can work, radiant is difficult
  - Convection

- Combinations
  - Most commercial settings will use both

DETERMINING THE SCALE OF MECHANICAL SYSTEMS

Mechanical design issues:

- Heating
  - Radiant
  - Convection
- Cooling
  - While it can work, radiant is difficult
  - Convection
- Combinations
  - Most commercial settings will use both

Consider

My personal favorite heating is from radiant floor. But imagine what would happen if we used the same system for cooling ...

DETERMINING THE SCALE OF MECHANICAL SYSTEMS

Mechanical design issues:

- Determine the heat losses
  - Infiltration
  - R value for wall and roof assemblies
  - R value for doors and windows
  - Slab edges, specialty areas
  - Ventilation

- Adjust to the situation
  - What is the local climate? Design temp.
  - What is the use? Is heat generated?

- Determine the overall BTUh loss
  - Determining the peak “heating load”

DETERMINING THE SCALE OF MECHANICAL SYSTEMS

Mechanical design issues:

- Determine the heat losses
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- Adjust to the situation
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  - Determining the peak “heating load”

Transmission:
= U x A x dT
(Slab Edge: by unit length)

Infiltration:
Crack estimation method
(along doors, windows, etc.)
Air change method
(how many air changes per hour, about 1 typ.)
(assumes a heat capacity of air, in btuh

Ventilation:
(we need fresh air, so we ventilate, but that air comes in without conditioning, usually)

DETERMINING THE SCALE OF MECHANICAL SYSTEMS

Mechanical design issues:

- Heating load calculation
  - Inside design conditions (target), 68? 72?
  - Outside design conditions
    - Depends on the climate, 99% or 99.6%
  - Design temperature difference (dT)
  - Internal heat gain (factor of safety?)
  - What about unheated but indoor spaces?
  - Method of infiltration calculation
  - Know the R-values (and therefore the U)

DETERMINING THE SCALE OF MECHANICAL SYSTEMS

Mechanical design issues:

- Heating load calculation
  - Inside design conditions (target), 68? 72?
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  - Know the R-values (and therefore the U)

1 Determine outside air design temp.
2 Determine inside air design temp.
3 Determine (estimate) temp of unheated areas
4 Calculate the areas of all the assemblies
5 Calculate the R-values of the assemblies
6 Translate the R's to U's
7 Calculate the Transmission losses using the U and the assembly areas
8 Choose method and calculate the infiltration losses
9 If appropriate, determine ventilation losses

Sum the loads

This tells us the load on a bad day (which is what we need to be able to design the system)

DETERMINING THE SCALE OF MECHANICAL SYSTEMS

Mechanical design issues:

- Heating Energy
  - Degree Day Method
  - Bin Method (more complicated)
  - Computer simulation (hour by hour)

- Heating Degree Day
  - 65 degree baseline
  - Average high and low
  - Subtract from 65
  - If above 65, then 0

- Cooling Degree Day
  - Also 65 degrees

DETERMINING THE SCALE OF MECHANICAL SYSTEMS

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  - Bin Method (more complicated)
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- Heating Degree Day
  - 65 degree baseline
  - Average high and low
  - Subtract from 65
  - If above 65, then 0
- Cooling Degree Day
  - Also 65 degrees

To determine the overall heat loss for a typical year, you would substitute the HDD (remember to multiply by 24 hours). This tells us how much heating we will need in a typical year.

Transmission:
= U x A x 24 x HDD

Similar for infiltration and ventilation

From this we can determine likely annual fuel costs.

This would be important for Life Cycle costing

(Degree day is a rough calculation)

DETERMINING THE SCALE OF MECHANICAL SYSTEMS

Mechanical design issues:

- Overall heating load calculation
  Useful but limited

- Room by room heating load calculation
  Typically the best situation is to go by room
  Different rooms may have different needs
  This can then be used for sizing ducts, etc.

DETERMINING THE SCALE OF MECHANICAL SYSTEMS

Mechanical design issues:

- Generation
  - Making the heat or cool
  - Fuel type
  - System type

- Distribution
  - Piping
  - Ductwork

- Termination
  - The device that sends the conditioning out to the people

- Heating target 68, Cooling 75

DETERMINING THE SCALE OF MECHANICAL SYSTEMS

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- Heating target 68, Cooling 75

Hydronic or air based systems

Heating - 600 degrees or more

Heating - 150 to 300 degrees

Heating - 110 degrees or more

DETERMINING THE SCALE OF MECHANICAL SYSTEMS

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Hydronic or air based systems

Heating - 600 degrees or more

Cooling - 45 to 55

Heating - 150 to 300 degrees

Cooling - 55 to 65

Heating - 110 degrees or more

Cooling - 68 to 72

DETERMINING THE SCALE OF MECHANICAL SYSTEMS

Mechanical design issues:

- Heating
  - Hydronic (hot water)
  - Steam
  - Air
  - Other (electric, IR, passive, etc.)

- Distribution
  - Piping
  - Ducts

- Termination
  - Radiators
  - Diffusers

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Consider

Which would you rather live with … air based heating or in floor radiant?

(speed? comfort? efficiency?)

DETERMINING THE SCALE OF MECHANICAL SYSTEMS

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Distribution to the perimeter?

- That is where the problem is
- Condensation buildup
- Buffer

DETERMINING THE SCALE OF MECHANICAL SYSTEMS

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Hydronic systems will be sized on the total heat loss in btuh, with a boiler sized with a modest factor of safety.

Then a system for distribution must be decided on ... then each “branch” of the system must be sized for the zone it will serve.

Some examples

- Radiators
- Fin-tube baseboard radiators
- In floor systems

DETERMINING THE SCALE OF MECHANICAL SYSTEMS

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Hydronic example, radiators:

DETERMINING THE SCALE OF MECHANICAL SYSTEMS

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  - Radiators
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Hydronic example, baseboard:

DETERMINING THE SCALE OF MECHANICAL SYSTEMS

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- Heating
  - Hydronic (hot water)
  - Steam
  - Air
  - Other (electric, IR, passive, etc.)

- Distribution
  - Piping
  - Ducts

- Termination
  - Radiators
  - Diffusers

Hydronic example, in floor:

DETERMINING THE SCALE OF MECHANICAL SYSTEMS

Mechanical design issues:

- Cooling
  Typically air based
  Commercial issues

- Ton of cooling
  Relates to a ton of ice melting in 24 hours
  12,000 btuh

- Cubic Feet per Minute (CFM)
  Typically approx. 400 cfm per ton

- Rule of thumb - 200 to 600 sf per ton
  (rough estimate typically 300)

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Mechanical design issues:

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Consider
What are some of the moisture issues that you should be interested in with an air based cooling system?

DETERMINING THE SCALE OF MECHANICAL SYSTEMS

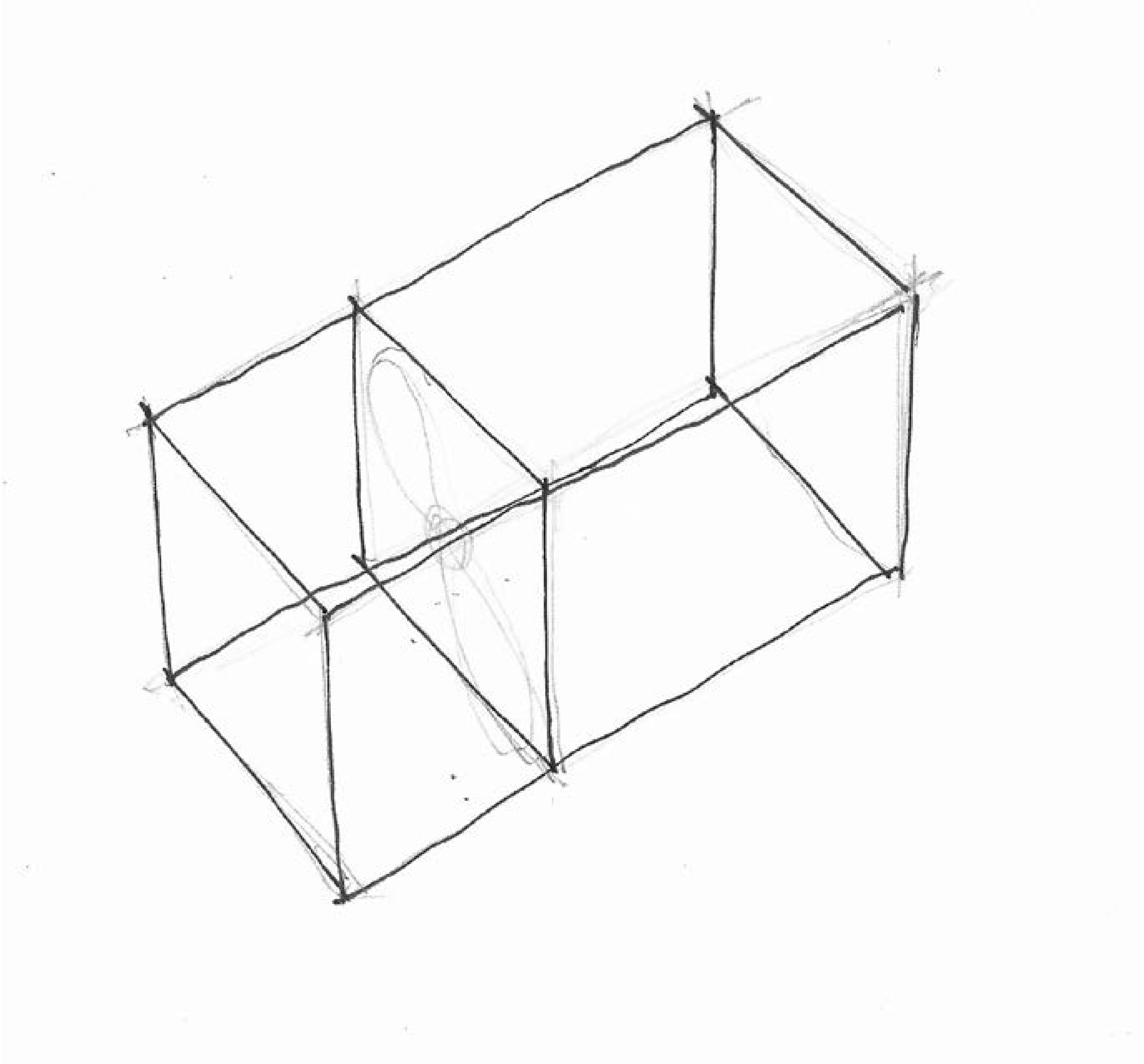
Mechanical design issues:

- Reminder how cooling works

DETERMINING THE SCALE OF MECHANICAL SYSTEMS

Mechanical design issues:

- AHU
- Supply
- Return
- Dehumidification
- Outside air intake
- Combustion air
- Flue



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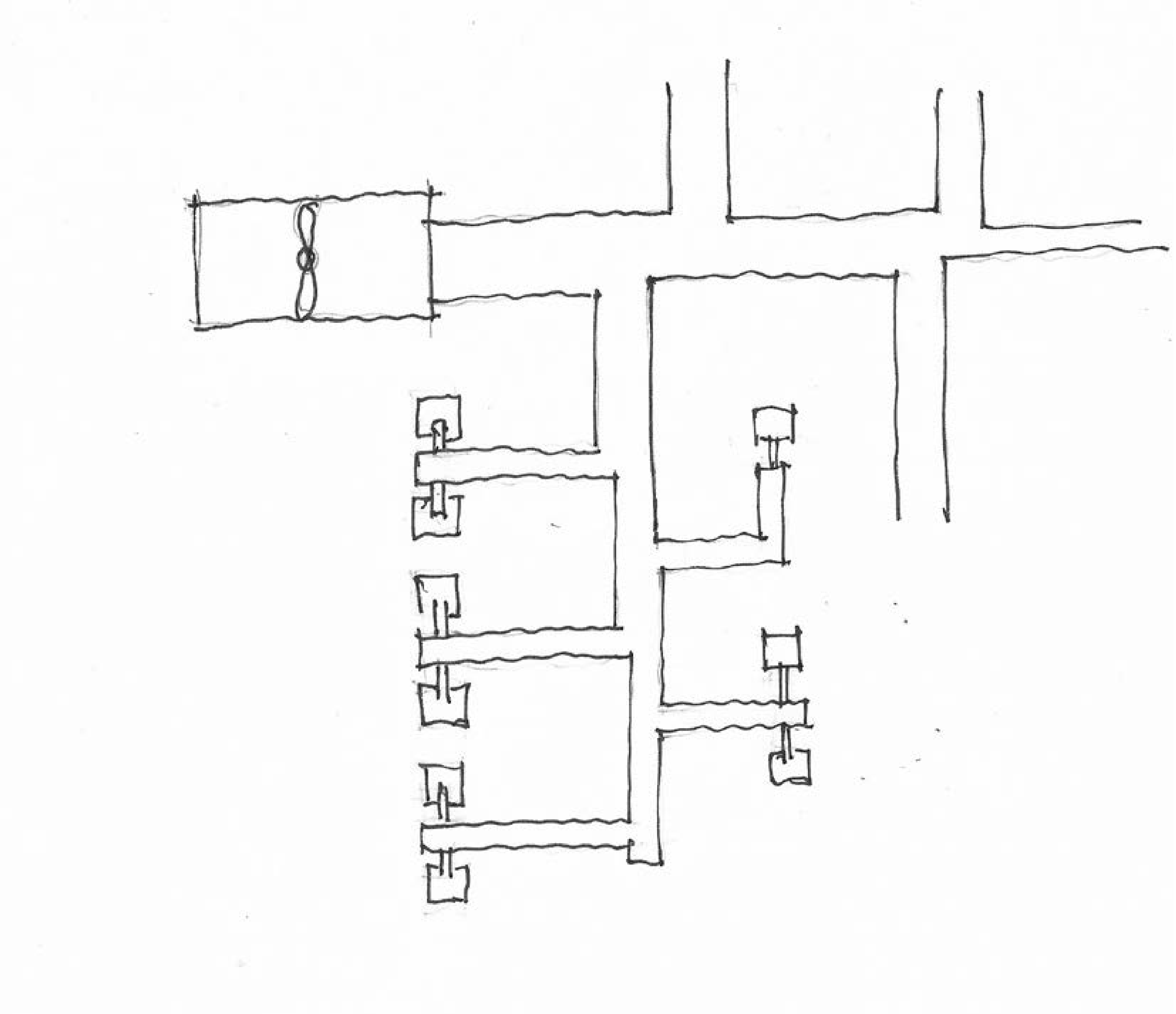

DETERMINING THE SCALE OF MECHANICAL SYSTEMS

Mechanical design issues:

- AHU
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Try not to cross trunk lines
Try to have as few elbows as possible
Try to balance the length

DETERMINING THE SCALE OF MECHANICAL SYSTEMS

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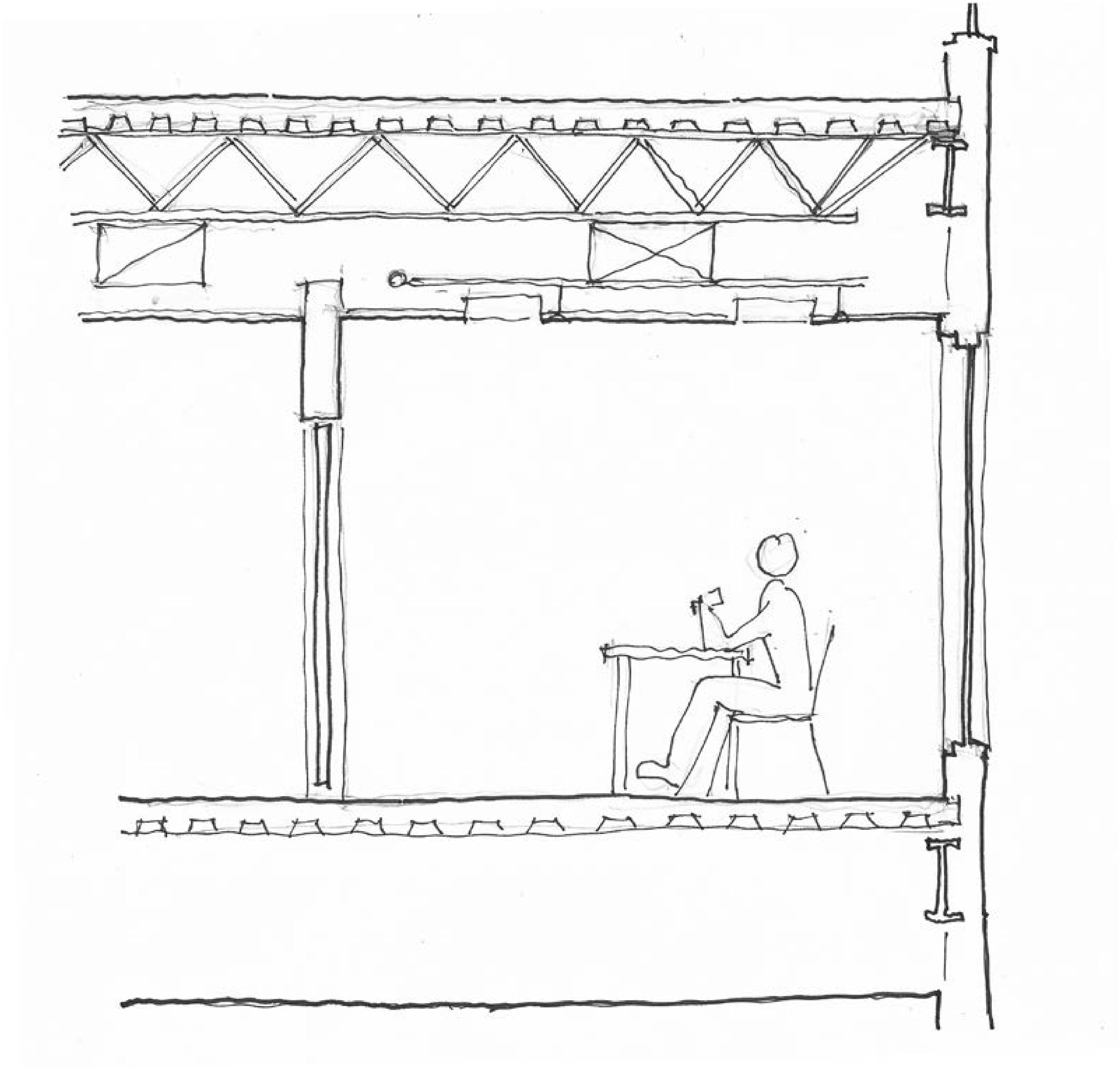

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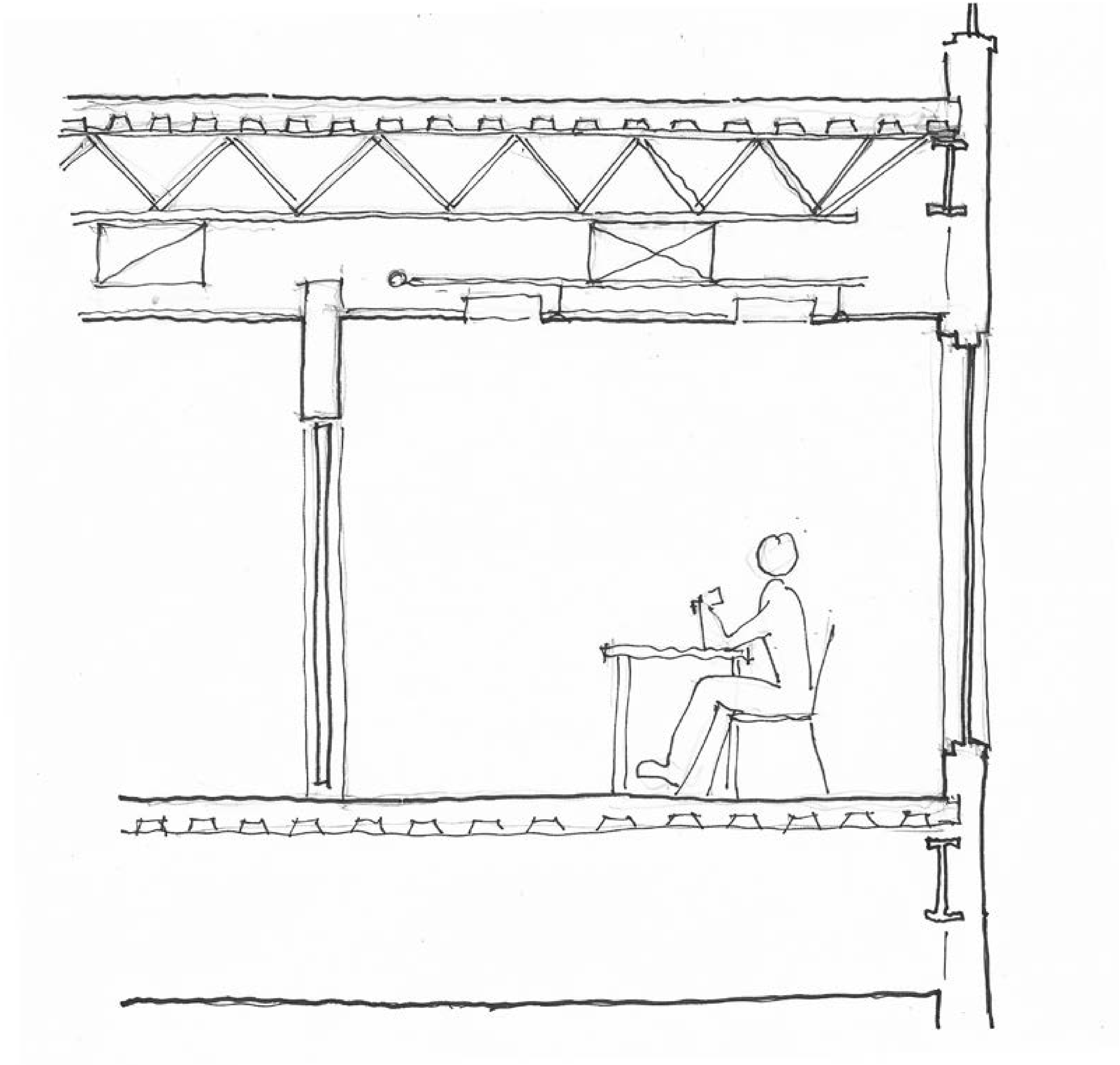

DETERMINING THE SCALE OF MECHANICAL SYSTEMS

Mechanical design issues:

- Heat rejection loop
- Refrigerant loop
- Chilled water loop
- Airside loop

DETERMINING THE SCALE OF MECHANICAL SYSTEMS

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- Heat rejection loop
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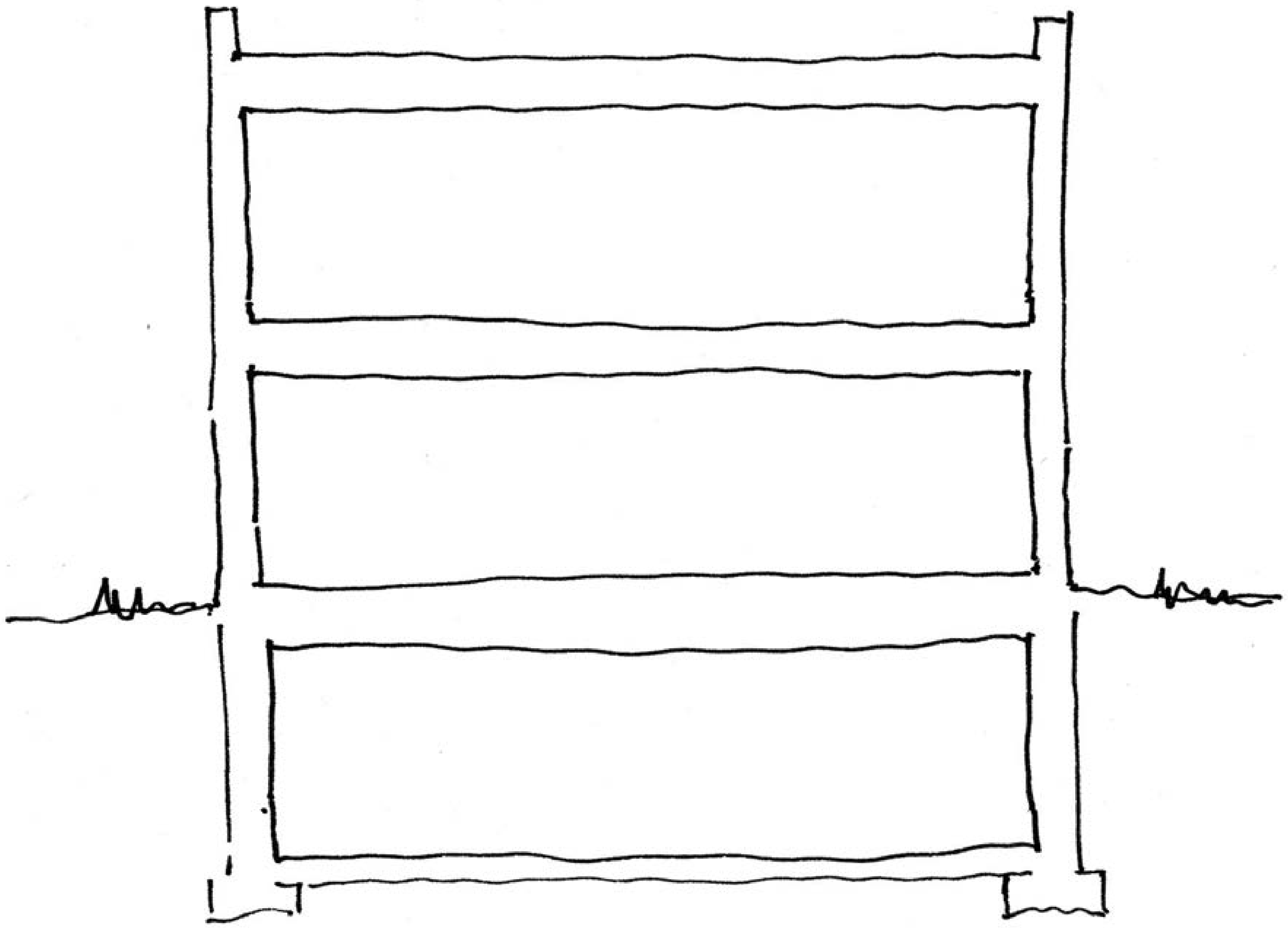
Location of systems example, chiller:



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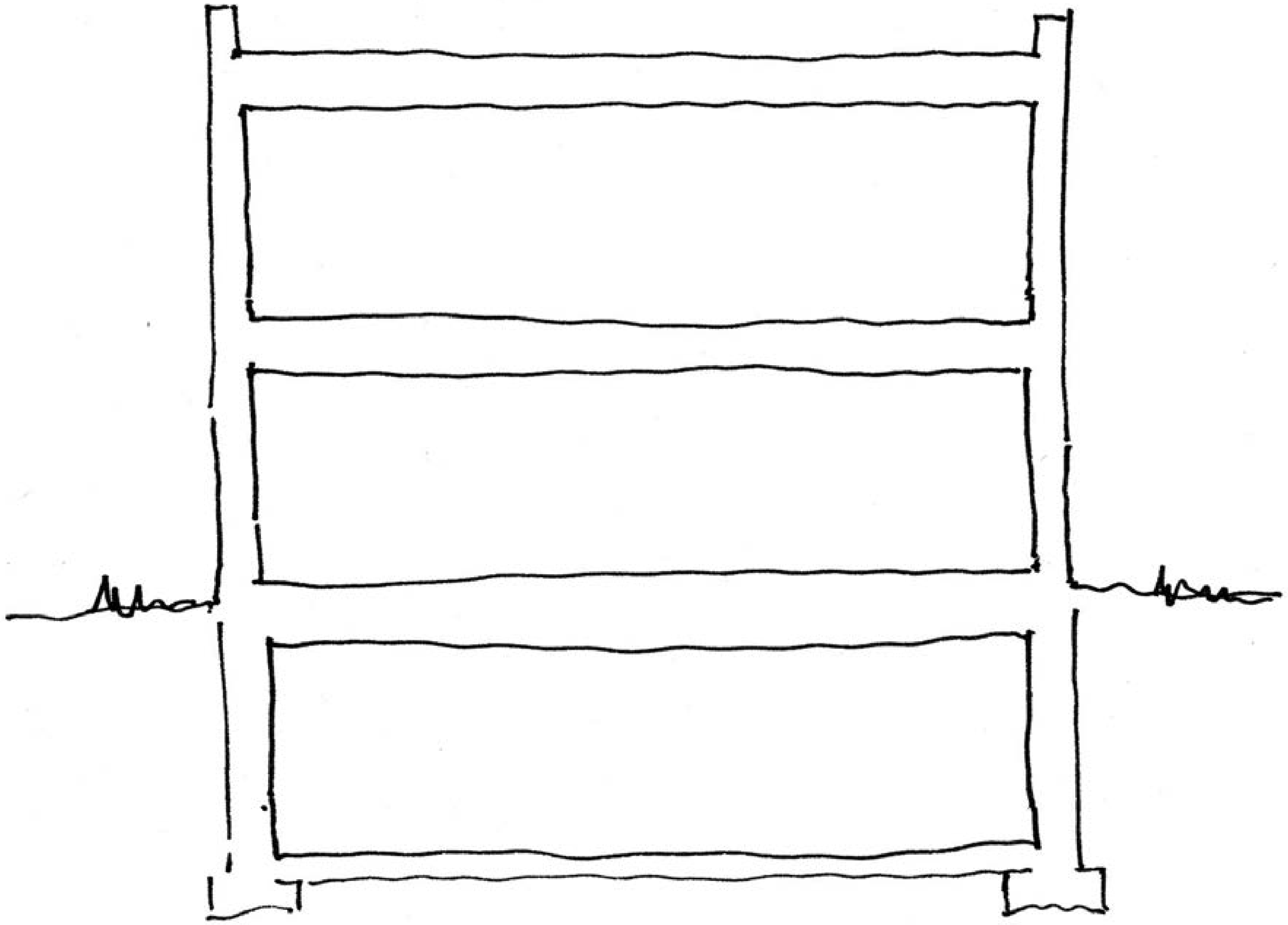
Location of systems example, fan coil:



DETERMINING THE SCALE OF MECHANICAL SYSTEMS

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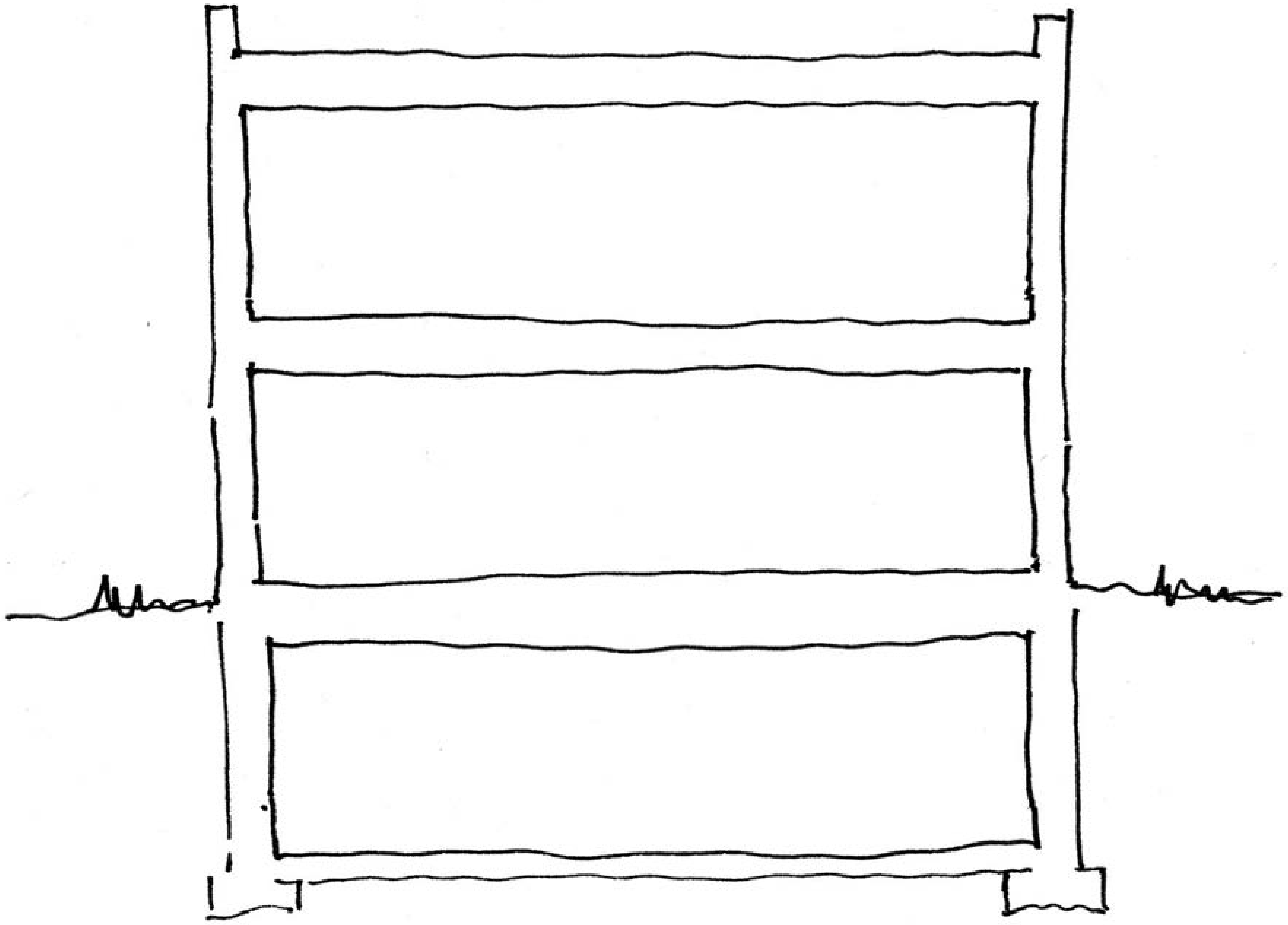
- Airside loop

Location of systems example, DX in unit:



DETERMINING THE SCALE OF MECHANICAL SYSTEMS

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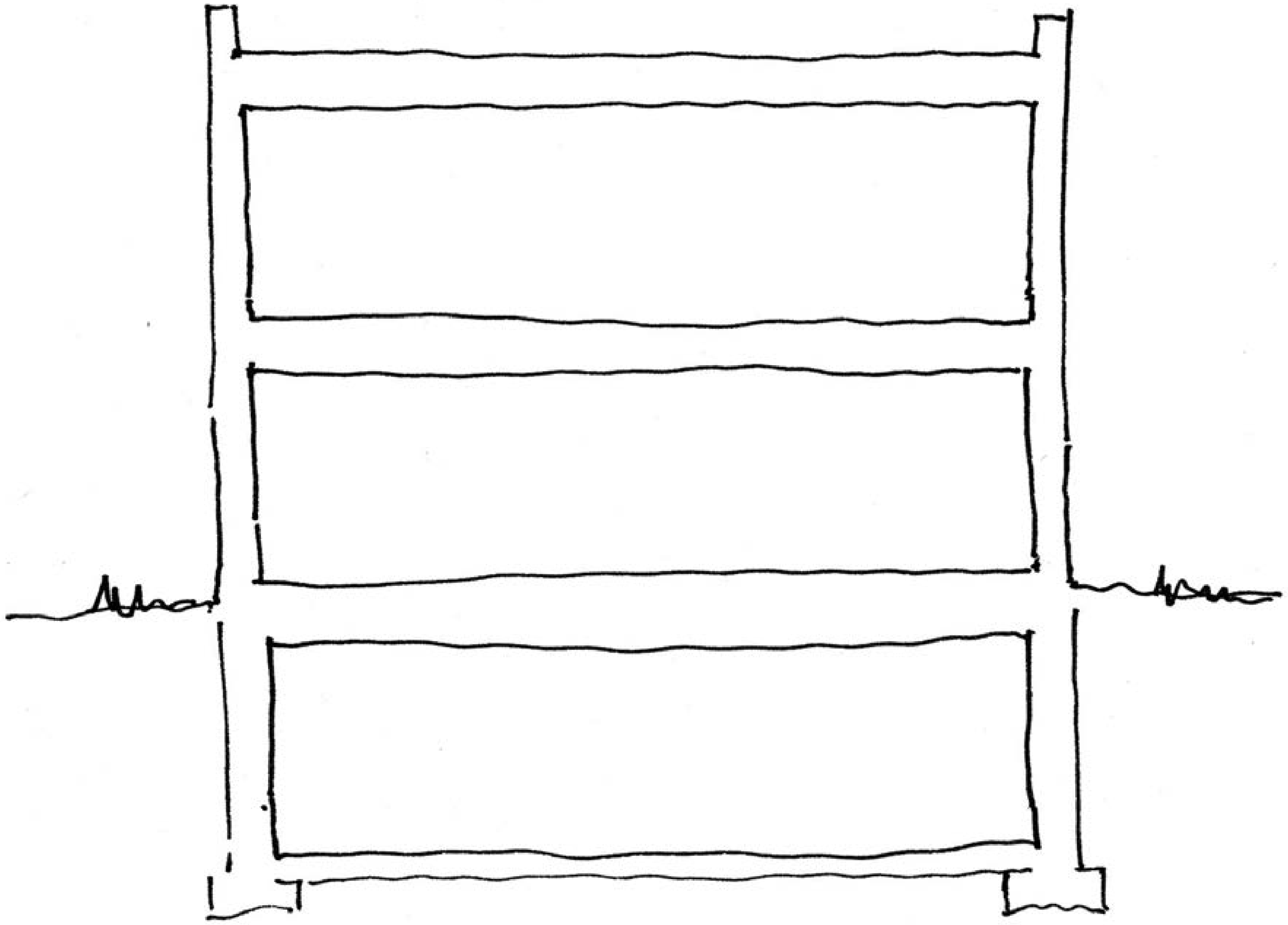
Location of systems example, DX RTU:



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- Flue

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DX RTU, close up:

DETERMINING THE SCALE OF MECHANICAL SYSTEMS

Mechanical design issues:

- Designing the duct
- Round vs. rectangular
- Static pressure
- 1 cfm per sf?
- Determine the heat loss of the SPACE
- Determine the CFM needed
- Make an estimate to the duct size
- Use a ductulator or online calculator to determine to check your estimate by determining what the pressure level for that size duct would be with that much CFM
- Is there too much pressure?
- Build it up through the branch to the trunk

DETERMINING THE SCALE OF MECHANICAL SYSTEMS

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Like a hose filled with water, pressure, flow, effort, are all related

DETERMINING THE SCALE OF MECHANICAL SYSTEMS

Mechanical design issues:

- Re-heats
- CAV
- VAV
- Booster fans
- Multi-pipe systems

DETERMINING THE SCALE OF PLUMBING SYSTEMS

Plumbing design issues:

- First, what is the use?
- Second, how large a space is it?
- Third, how many people per square feet?
- Fourth, look up the required number of fixtures
- Adjust appropriately
- Occasionally, the number is just not reasonable, so you need to propose a new one

DETERMINING THE SCALE OF PLUMBING SYSTEMS

Plumbing design issues:

- Riser diagram to determine how many fixtures are on each line
- Supply
- Waste & Vent

clean outs
shut-offs
branches to FP, etc.
enlargers
mixers
traps
gravity
axo vs. elevation
frost proof silcocks / hose bibs

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- Riser diagram to determine how many fixtures are on each line
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  clean outs
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  branches to FP, etc.
  enlargers
  mixers
  traps
  gravity
  axo vs. elevation
  frost proof silcocks / hose bibs

DETERMINING THE SCALE OF PLUMBING SYSTEMS

Plumbing design issues:

- Fixture Units
- Enlarge quickly for first few
- Then very slowly
  (unlikely for everyone to
  flush at once)
- Then look up table to see the relation between fixture units and pipe diameter
- Then label each pipe on the riser diagram

DETERMINING THE SCALE OF LIGHTING SYSTEMS

Lighting design issues:

- Zonal Cavity Method
  - Work-plane
  - Texture
  - Color
  - Volume
  - Dimension
  - Height
  - Pendant
  - light direction %
  - Maintenance
  - Re-ordering process
  - Efficacy

  Relationship to natural light

DETERMINING THE SCALE OF LIGHTING SYSTEMS

Lighting design issues:

- Light types
    - Task
    - Cove
    - Indirect
    - Can, downlight
    - Recessed
    - Pendant
    - Uplight
    - Vanity
    - Decorative
    - Surface

DETERMINING THE SCALE OF LIGHTING SYSTEMS

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  - Dimension
  - Height
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  - Maintenance
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  - Efficacy

  Relationship to natural light

1. Establish work plane and desired footcandles
2. Gather all the information
3. Start with a guess
4. Go through the calculation
5. Re-evaluate your guess
6. Go through the calculation again
7. Check to make sure that luminaire is actually available

DETERMINING THE SCALE OF LIGHTING SYSTEMS

Lighting design issues:

*** look at example ***

- Zonal Cavity Method
  - Work-plane
  - Texture
  - Color
  - Volume
  - Dimension
  - Height
  - Pendant
  - light direction %
  - Maintenance
  - Re-ordering process
  - Efficacy

  Relationship to natural light

DETERMINING THE SCALE OF FP SYSTEMS

Fire Protection design issues:

- Spacing
- Wall washers
- Extra egress distances
- Careful about blockages
- Ties into alarm system
- Specialty
  - kitchen
  - computer
  - pre-action
  - etc.

DETERMINING THE SCALE OF FP SYSTEMS

Fire Protection design issues:

- Spacing
- Wall washers
- Extra egress distances
- Careful about blockages
- Ties into alarm system
- Specialty
  kitchen
  computer
  pre-action
  etc.

Consider

How could you design a system that helps fire fighters locate the fire?

DETERMINING THE SCALE OF FP SYSTEMS

Fire Protection design issues:

- Standpipes
- Multi connections
- Sprinkler system booster
- Direct fire-fighting
- Ties into alarm system
- Fire extinguishers
  - kitchen
  - computer
  - general distribution
  - fire hoses

DETERMINING THE SCALE OF ELECTRICAL SYSTEMS

Electrical design issues:

- From power plant to outlet
- Meters and disconnects
- Load centers (panels)
- Circuits
- GFCI, and Arc fault
- Insulation, protection, raceways
- Sizing
  - 120, 120 / 240, 120 / 208, 277 / 480
  - Lag

DETERMINING THE SCALE OF STRUCTURAL SYSTEMS

Design issues:

- Span
- Bounce
- Deflection
- Buckling
- Bridging / bracing
- Shear walls
- Connections

DETERMINING THE SCALE OF STRUCTURAL SYSTEMS

Design issues:

- Material
  - Modulus of elasticity

- Shape
  - Moment of Inertia
  - Radius of Gyration

- Bracing

DETERMINING THE SCALE OF STRUCTURAL SYSTEMS

Design issues:

- Material
  - Modulus of elasticity
- Shape
  - Moment of Inertia
  - Radius of Gyration
- Bracing

Consider

The initially crazy looking formula for deflection in a uniformly loaded simple beam…

$$\frac{5\,w\,L^4}{384\,E\,I}$$

DETERMINING THE SCALE OF STRUCTURAL SYSTEMS

Design issues:

- One way

- Two way

- Continuous

- Framing plan

DETERMINING THE SCALE OF STRUCTURAL SYSTEMS

Design issues:

- One way

- Two way

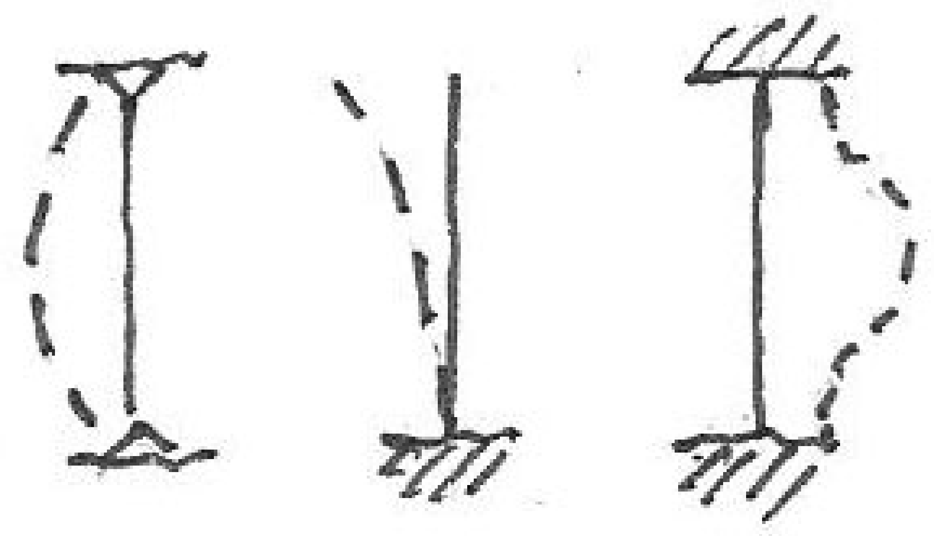
- Continuous

- Framing plan
  - Decking
  - Joist
  - Beam
  - Girder
  - Column
  - Bearing wall

DETERMINING THE SCALE OF STRUCTURAL SYSTEMS

Design issues:

- Moment connections
- Pinned connections
- Diaphragms
- Friction



DETERMINING THE SCALE OF STRUCTURAL SYSTEMS

Design issues:

- Steel

- Concrete

- Wood

- Masonry

DETERMINING THE SCALE OF STRUCTURAL SYSTEMS

Design issues:

- Tension
- Compression
- Camber
- Neutral axis

DETERMINING THE SCALE OF STRUCTURAL SYSTEMS

Typical steel design issues:

DETERMINING THE SCALE OF STRUCTURAL SYSTEMS

Typical steel design issues:

DETERMINING THE SCALE OF STRUCTURAL SYSTEMS

Typical steel light gauge design issues:

DETERMINING THE SCALE OF STRUCTURAL SYSTEMS

Typical concrete design issues:

DETERMINING THE SCALE OF STRUCTURAL SYSTEMS

Typical concrete design issues:

DETERMINING THE SCALE OF STRUCTURAL SYSTEMS

Typical masonry design issues:

DETERMINING THE SCALE OF STRUCTURAL SYSTEMS

Typical masonry design issues:

DETERMINING THE SCALE OF STRUCTURAL SYSTEMS

Typical wood light frame design issues:

DETERMINING THE SCALE OF STRUCTURAL SYSTEMS

Typical wood light frame design issues:

DETERMINING THE SCALE OF STRUCTURAL SYSTEMS

Typical wood timber frame design issues:

DETERMINING THE SCALE OF STRUCTURAL SYSTEMS

Typical wood timber frame design issues:

DETERMINING THE SCALE OF STRUCTURAL SYSTEMS

Other systems:

DETERMINING SPECIALTY SYSTEMS

Acoustic issues:

- STC ratings and wall design
  (typical range from 45 to about 70)

DETERMINING SPECIALTY SYSTEMS

Acoustic issues:

- STC ratings and wall design
  (resilient channels)

DETERMINING SPECIALTY SYSTEMS

Acoustic issues:

- NRC ratings and finish materials
- NRC btwn 0 and 1

DETERMINING SPECIALTY SYSTEMS

Emergency and alarm issues:

- Emergency lights
- Exit lights
  (and related signs like “stair”)
- Alarm sound / strobe
- Pull stations
- Fire extinguishers
- Intercoms and emergency communication

DETERMINING SPECIALTY SYSTEMS

Emergency and alarm issues:

- Areas of refuge
- Communication systems

DETERMINING SPECIALTY SYSTEMS

Conveying system issues - elevators:

- Car size
- System type
  (pit?, head house?, space for tracks or
  cables? elevator machine room location?)
- Button locations
- Call systems
- Relation to structure
- Relation to fire ratings
- Relation to ADA issues

DETERMINING SPECIALTY SYSTEMS

Conveying system issues - Lifts:

- LULA
- Lift
  (does it need a shaft? how many stops?
  what travel length? etc.)
- Is it for general use, or is it operated?
- Button locations
- Call systems
- Relation to structure
- Relation to fire ratings
- Relation to ADA issues

DETERMINING SPECIALTY SYSTEMS

Conveying system issues - Escalators:

- They are big!
- They are thick!

INTEGRATING MULTIPLE SYSTEMS

Floors to walls:

- Structure vs veneer
- Water repellent
- Insulation
- Movement
- Acoustic control
- Sealant and backer rod
- Capillary break

INTEGRATING MULTIPLE SYSTEMS

Floors to walls:

- Structure vs veneer
- Water repellent
- Insulation
- Movement
- Acoustic control
- Sealant and backer rod
- Capillary break

INTEGRATING MULTIPLE SYSTEMS

Mechanical shafts:

- Fire rating
- One sided build
- Chimney
- Movement
- Firestopping

INTEGRATING MULTIPLE SYSTEMS

Ceilings to walls:

- Structure vs veneer
- Water repellent
- Insulation
- Movement
- Acoustic control
- Sealant and backer rod
- Capillary break

INTEGRATING MULTIPLE SYSTEMS

Integrating different mechanical systems:

- Coordination
- RCP
- Section
- Meetings
- 3d models
- Have a system
- Relate the small to the big idea

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QUESTIONS

1. The condo association is getting lots of complaints about sounds traveling from one unit to another. What are a couple of ways that this multi-family residential building could alter the building to make this issue better?

2. What questions should the architect be asking the client when trying to determine the lighting system?

3. What are two advantages of a plenum return system? What about disadvantages?

4. In order to size the heating system for ski chalet, what would the architect need to determine first?

DOCUMENTING THE BUILDING DESIGN

Keeping track of design concepts:

- Archiving designs
- Dating system
- Coordination with meeting minutes

- Opportunity for input
- Seek multiple stakeholders

- Clarity of the process
- Clarity of the drawing set's place in that process

- Know what is expected
- Manage other's expectations

DOCUMENTING THE BUILDING DESIGN

Keeping track of design concepts:

- Design Drawings
  vs.
- Construction Drawings
  (Contract docs)

DOCUMENTING THE BUILDING DESIGN

Keeping track of design concepts:

- Design Drawings
  vs.
- Construction Drawings
  (Contract docs)

Consider
What to do with BIM models … they tend to lack the controlled legal narrative specificity of contract documents but they are also way more detailed and explicit than design drawings.

Imagine litigation 4 years later …

DOCUMENTING THE BUILDING DESIGN

Keeping track of design concepts:

- Who needs to know what?
- Multiple packages
  - % complete
  - for code officials
  - for GC
  - for funders
  - for different project delivery methods
  - different disciplines

DOCUMENTING THE BUILDING DESIGN

Contract documents:

- “A” Title sheet
- Civil
- Landscaping
- (Demo)
- Architecture
- Structural
- Mechanical
- Plumbing
- Electrical
- Fire Protection

- Everyone else
  Lighting, conveyance systems, kitchens
  acoustic, specialty equipment, etc.

DOCUMENTING THE BUILDING DESIGN

Contract documents:

- “A” Title sheet
- General notes, code compliance, etc.
- Site plans
- Floor plans, roof plans
- RCPs
- Elevations
- Sections
- Wall sections
- Interior elevations / detail elevations
- Specific elements
- Exterior details
- Interior details
- Schedules

DOCUMENTING THE BUILDING DESIGN

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Consider

Scale of the project makes a big difference. Hard to imagine that on a small project a contractor will rummage through an entire set of drawings to find a door schedule before they just make an assumption.

DOCUMENTING THE BUILDING DESIGN

Contract documents:

- Sheets and labels

DOCUMENTING THE BUILDING DESIGN

Contract documents:

- Size of drawings
  - Plans - 1/4, 1/8, (key plans)
  - Site plans - 1/8, 1/16, 1/32, 40 - 100
  - Elevations - 1/4, 1/8 (key plans)
  - Sections - 1/4, 1/8
  - Wall sections - 3/4, 1/2
  - Detail elevations - 1/2, 3/8
  - Details general - 3, 1 1/2, 1
  - Details millwork - full, 6, 3

- Key Plans

DOCUMENTING THE BUILDING DESIGN

Contract document tools:

- Column lines
- Key Plans
- Tags
- Schedules
- Main point - have a system
  (ONLY ONE PLACE)

DOCUMENTING THE BUILDING DESIGN

Contract document tools:

- Dimensions

DOCUMENTING THE BUILDING DESIGN

Contract document tools:

- Schedules

DOCUMENTING THE BUILDING DESIGN

Stages of drawings:

- Dimensions
- Poche
- Notes
- Tags and connections to other drawings

DOCUMENTING THE BUILDING DESIGN

Project Delivery and Building Codes:

	Design-Bid-Build	Design-Build	Fast-Track	Multiple Prime	Integrated Project Delivery

DOCUMENTING THE BUILDING DESIGN

Role of the Project Manual:

- Bidding and Addenda
- Contracts
- Specifications
- Tagging
- CSI
- Essentially the written information for a project

DOCUMENTING THE BUILDING DESIGN

Role of the Project Manual:

- Part 1 - General

- Part 2 - Products

- Part 3 - Execution

DOCUMENTING THE BUILDING DESIGN

Role of the Project Manual:

- Proprietary

  vs.

- Performance

DOCUMENTING THE SITE DESIGN

Site design process:

- Civil

  vs.
- Landscaping

  vs.
- Site Plan

DOCUMENTING THE SITE DESIGN

Site design process:

- Context
- Legal
- Stormwater
- Textures
- Landscaping
- Parking
- Drive / walks / loading

DOCUMENTING THE SITE DESIGN

Site design process:

- Electrical
- Water connection
- Fire prevention
  - Fire trucks and access
  - Standpipe access
  - Hydrants
  - Whatever the fire marshal wants
- Other mechanical

DOCUMENTING THE SITE DESIGN

Site design process:

- Topography
- Accessibility
- In relation to the building components
- In terms of controlling the water flow

DOCUMENTING THE DETAILS

What should be detailed?

Two basic categories -

- Emblematic (if you draw this, then many other details would be well understood as well)

- Very specific (so no one would be able to know if you didn't draw it out)

- Try not to include it twice (should not just be a clip out of another drawing

DOCUMENTING THE DETAILS

What should be detailed?

- Exterior
    - Materials
    - Joints
    - Flashing
    - Movement accommodation
    - Relation to structure
    - Relation to insulated box

DOCUMENTING THE DETAILS

What should be detailed?

- Interior
  - Materials
  - Finish
  - Joints
  - Movement accommodation
  - Relation to structure
  - Relation to acoustics
  - Relation to fire ratings

DOCUMENTING THE DETAILS

What should be detailed?

- Windows / doors
  - Jamb
  - Head
  - Sill
  - Other
  - Materials
  - Finish
  - Movement accommodation
  - Relation to structure

DOCUMENTING THE DETAILS

What should be detailed?

- Stairs and railings
  - Code dimensions
  - Materials
  - Finish
  - Relation to structure
  - ADA info

DOCUMENTING THE DETAILS

What should be detailed?

- Millwork
- Roofing
- Others

- Structural
- Mechanical
- Plumbing

- Civil
- Landscaping

- Combination
- Special

APPLYING DRAWING STANDARDS

What standard?

- Office standards
- Project systems
- Regional concepts
- Client needs
- Funder requirements
- Specific code requirements

APPLYING DRAWING STANDARDS

Readable drawings

- Clarity of information

  vs.
- Legal control of information

APPLYING DRAWING STANDARDS

Quality control process

- Internal process (who does what)
- Phase control points
- Outside reviewers
- Use your documents
  - Program
  - Code review
  - Meeting minutes
  - Design control documents

DOCUMENTING THE PROCESS - CHANGES

What to do when changes are made:

- Review with team
- Manage expectations with clients
- Clarify impact of changes with code officials
- Update drawings
- Clarify updates

DOCUMENTING THE PROCESS - CHANGES

What to do when changes are made:

- Update drawings
  - Have a system
  - Review by sheet?
  - Review by topic?
  - Review by type of issue (tagging, schedules, drawings, notes, etc.)

- Clarify updates

DOCUMENTING THE PROCESS - CHANGES

What to do when changes are made:
Documenting change is different for each phase of the design process

- Revision clouds
- Addendums
- Change orders
- Bulletins
- Memos and general communications
- Written record, design log, meeting minutes, etc.

DOCUMENTING THE PROCESS - CHANGES

What to do when changes are made:
Documenting change is different for each phase of the design process

- Revision clouds
- Addendums
- Change orders
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- Memos and general communications
- Written record, design log, meeting minutes, etc.

Consider

Communicating a design change with clarity and in a timely manner is not just a good thing to do - It is contractually necessary. Imagine you are a subcontractor who has bid a project and you find out just as the construction is starting that the architects have made a change that impacts your bid costs. What would you do? Stop the project before it starts? Start the project but then try to negotiate during or after the work?

DOCUMENTING THE PROCESS - CHANGES

What to do when changes are made:
Documenting change is different for each phase of the design process

- Construction Change Directives

  vs.

- Change orders

- Addendums

DOCUMENTING THE PROCESS - CHANGES

What to do when changes are made:

Documenting change during the Bidding phase

- Alternates
- Substitutions
- Allowances
- Unit prices
- Add alts, deduct alts

DOCUMENTING THE PROCESS - CHANGES

What to do when changes are made:

Documenting change during the Bidding phase

- Alternates
- Substitutions
- Allowances
- Unit prices
- Add alts, deduct alts

QUESTIONS

1. Where should the size of the door be shown?

2. You are nervous that the bids are going to come back too high. What are three ways that you could hedge your bets to manage the process without having the overall bid numbers be beyond what the client can handle?

3. What are three ways to make sure that a stakeholder knows there has been a change in the design?

4. The design change from the client mandates an extensive change to the drawings. What would you call the communication of these changes to the contractors?

DOCUMENTING THE BUILDING DESIGN - PROJECT MANUAL

Identifying the components required for the Project Manual:

- PM or PA or spec writer
- What makes it in?
- What is the type of project?
- Is there an expectation of a specification?
- Is there a need for a “full” spec.?
- Would a “outline specification” suffice?

DOCUMENTING THE BUILDING DESIGN - PROJECT MANUAL

Identifying the components required for the Project Manual:

- Prioritization

DOCUMENTING THE BUILDING DESIGN - PROJECT MANUAL

Identifying the components required for the Project Manual:

- Revisions
    - Bubbles (revision clouds)
    - Addenda notes
    - Dated notes on table of contents
    - Separate memos

QUESTIONS

1. What type of specification should be used if price is the most important issue?

2. Where would you find metal studs in the specification?

3. Within the specification section, where would I find the information regarding the product warranty? How about what sort of protection is required for the installed material?

4. When would you start writing the specification?

5. What is the first thing I would find in the Project Manual?

DOCUMENTING CODE ADHERENCE

Determine the code related issues that should be documented on the CD sets in order to satisfy the local code officials

- Fire and emergency safety
- Scale and construction types / capacity
- General safety
- ADA issues
- General health & mechanical codes
- Zoning regulations

DOCUMENTING CODE ADHERENCE

Determine the code related issues that should be documented on the CD sets in order to satisfy the local code officials

- Codes
  vs.
- Standards
  UL
  OSHA
  ASHRAE
  ANSI

  ADA
  FAA
  Earthquake or Hurricane regulations

DOCUMENTING CODE ADHERENCE

Determine the code related issues that should be documented on the CD sets in order to satisfy the local code officials

- Fire and emergency safety
  Wall assemblies
  Floor assemblies
  Ability to get out of a building
  Egress path
  Egress path distances
  Relation to sprinklers
  Scale of structure / type of structure
  Smoke clearance

DOCUMENTING CODE ADHERENCE

Determine the code related issues that should be documented on the CD sets in order to satisfy the local code officials

- Scale and construction types
  Vulnerable people
  Vulnerable occupancy
  Vulnerable structural system

  Ability to get out of a building

DOCUMENTING CODE ADHERENCE

Determine the code related issues that should be documented on the CD sets in order to satisfy the local code officials

- Construction capacity

DOCUMENTING CODE ADHERENCE

Determine the code related issues that should be documented on the CD sets in order to satisfy the local code officials

- General safety
  - Width of egress
  - Stair dimensions
  - OSHA issues

  Essentially, how to make building components that people expect and therefore will interact with safely

DOCUMENTING CODE ADHERENCE

Determine the code related issues that should be documented on the CD sets in order to satisfy the local code officials

- ADA issues
  Dimensions of movement
  Reach ranges
  Responses to types of disability
  Moving people through
  Maintaining and signage

  Does the project meet Fair Housing Act?
  Does it meet the ADA?
  Is it a public amenity?

DOCUMENTING CODE ADHERENCE

Determine the code related issues that should be documented on the CD sets in order to satisfy the local code officials

- General health & mechanical codes
  - Maintaining the light and vent
  - Maintaining a reasonable temperature
  - Is plumbing system adequate?
  - Is plumbing system safe?
  - Electrical safety in sizing
  - Electrical safety in relation to people
  - Does the fire protection system work?
  - Relationship between the fire protection egress system
  - Etc. etc. etc.

DOCUMENTING CODE ADHERENCE

Determine the code related issues that should be documented on the CD sets in order to satisfy the local code officials

- Zoning regulations
  Site dimensions
  Allowed / permitted
  Scale / massing
  Open spaces
  Parking / loading
  Street types

  Covenants / Easements

  Does the project help the City from a health, safety, and welfare standpoint

DOCUMENTING CODE ADHERENCE

Determine the code related issues that should be documented on the CD sets in order to satisfy the local code officials

- Fire and emergency safety
- Scale and construction types
- General safety
- ADA issues
- General health & mechanical codes
- Zoning regulations

Consider
You have received a permit! Thank god you got the project through the system, now we don't have to worry about it.

Right?

QUESTIONS

1. What is the minimum height of an electrical outlet in an ADA housing unit?

2. If I was a code official, where would I look to find the ability of the project to withstand the spread of fire from one apartment unit to another?

3. How many egress stairwells are there in the office building?

4. You want to build a building larger than what is allowed by code … what are your options?

5. How do code officials regulate uses and occupancies in a given location?

ANALYZING CONSTRUCTION COST ESTIMATES

Cost estimating through the project:

- Pre contract
- Programming
- SD
- DD
- CD
- Bidding
- Comparing to original expectations

ANALYZING CONSTRUCTION COST ESTIMATES

Cost estimating through the project:

• Pre contract	Comparables
• Programming	Square foot
• SD	Unit
• DD	Assemblies (by square foot and linear foot)
• CD	Full breakouts
• Bidding	Apples to apples
• CA	Check and gut check

ANALYZING CONSTRUCTION COST ESTIMATES

Bidding process:

- Description letter (Bid letter)
- Bid Form
- Add alternates
- Deduct alternates
- Unit pricing
- Performance specs (vs proprietary specs)
- The point is to have enough information that you can meet the owner's needs

ANALYZING CONSTRUCTION COST ESTIMATES

Comparing estimates:

- Different breakdowns
- Following the requirements
- Have enough information that you can make reasonable decisions
- Ask for more information, if necessary
- Re-bid, if necessary
- Re-draw, if necessary
- Re-design, if necessary

ANALYZING CONSTRUCTION COST ESTIMATES

Comparing estimates:

- Different breakdowns
- Following the requirements
- Have enough information that you can make reasonable decisions
- Ask for more information, if necessary
- Re-bid, if necessary
- Re-draw, if necessary
- Re-design, if necessary

Consider
You are nervous about the pricing, so as a precaution you get “unit pricing” on 42 different line items.

ANALYZING CONSTRUCTION COST ESTIMATES

Estimate situations:

- Design Bid Build
- Design Build
- Construction Manager
- Multiple Prime
- Negotiated Bid
- Sealed Bid

ANALYZING CONSTRUCTION COST ESTIMATES

Comparing estimates:

- Regional differences
- Project type differences
- Funder differences
- Bidding climate
- Local rates
- Specific materials

QUESTIONS

1. When you receive a bid, what will it be compared to?

2. You are designing a complicated office building for a local developer and they want to know if the contractor they have been working with is giving them a good deal. What are your choices?

3. What is the advantage of going with Design Bid Build project delivery when it comes to pricing and estimates?

4. Regarding pricing and estimates, what is the advantage of going with a CM (construction manager project delivery)?

5. What is the rule of thumb about choosing between add-alts and deduct-alts for bid forms?