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Architectural and Structural Considerations for Wood Framed Modular Projects

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AIA Approved Continuing Education

Course Description

Off-site construction is an increasingly effective strategy for delivering light-frame wood commercial and multi-family buildings that meet performance, safety, and sustainability goals. This presentation explores the range of off-site approaches—from prefabricated components to fully modular systems—and how their benefits help deliver long-lasting, healthy buildings.

Through case studies and technical discussion, participants will learn about benefits such as improved quality control, jobsite safety, material resource efficiency, and enhanced envelope performance. Key considerations for effectively implementing off-site construction will be addressed, including strategies to ensure effective collaboration, code-compliance, and occupant safety.

Learning Objectives

1. Define off-site wood construction and distinguish the various levels of implementation—from prefabricated panels to fully modular units—while identifying how each approach impacts building performance, safety, and occupant wellbeing.
2. Evaluate the potential cost, schedule, and environmental benefits of off-site wood construction, with emphasis on how reduced construction time, waste, and material handling contribute to sustainable and resilient building practices that support public welfare.
3. Discuss strategies to connect modules together ensuring structural stability while maintaining code required fire-resistance ratings.
4. Explain how early collaboration and coordination among the owner, developer, contractor, and design team improve design accuracy, reduce installation errors, and ensure compliance with life-safety and building code requirements for prefabricated and modular light-frame wood projects.

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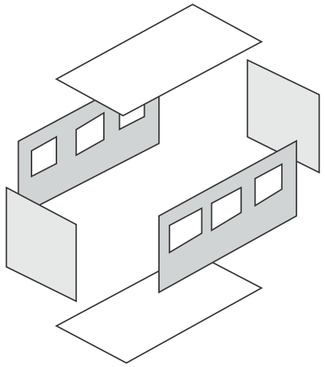
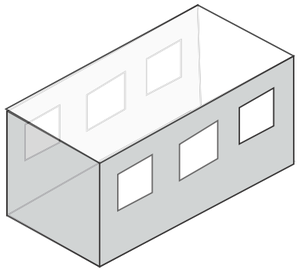
Key Terms in Modular Construction

- site-built vs. factory-built
- panelized vs volumetric modular
- sawboxing: the practice of building 2 or more small modules into one larger module, to be sawed apart in the field



PANELIZED SYSTEMS



VOLUMETRIC SYSTEMS

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benefits of modular

SPEED

COST SAVINGS

EFFICIENCY

COST CONTROL

QUALITY CONTROL

BRAND CONSISTENCY

MINIMAL SITE TIME

SAFETY

SITE CONTROL

LESS WASTE

Modular Building Institute: www.modular.org

Woodwork's Modular Construction: https://www.woodworks.org/learn/off-site-panelized-construction/modular-construction/

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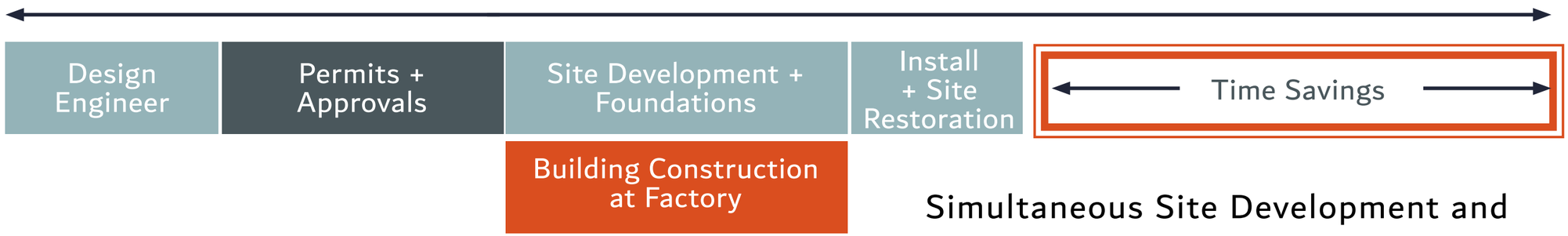
schedule & timeline efficency

SPEED

MODULAR CONSTRUCTION SCHEDULE

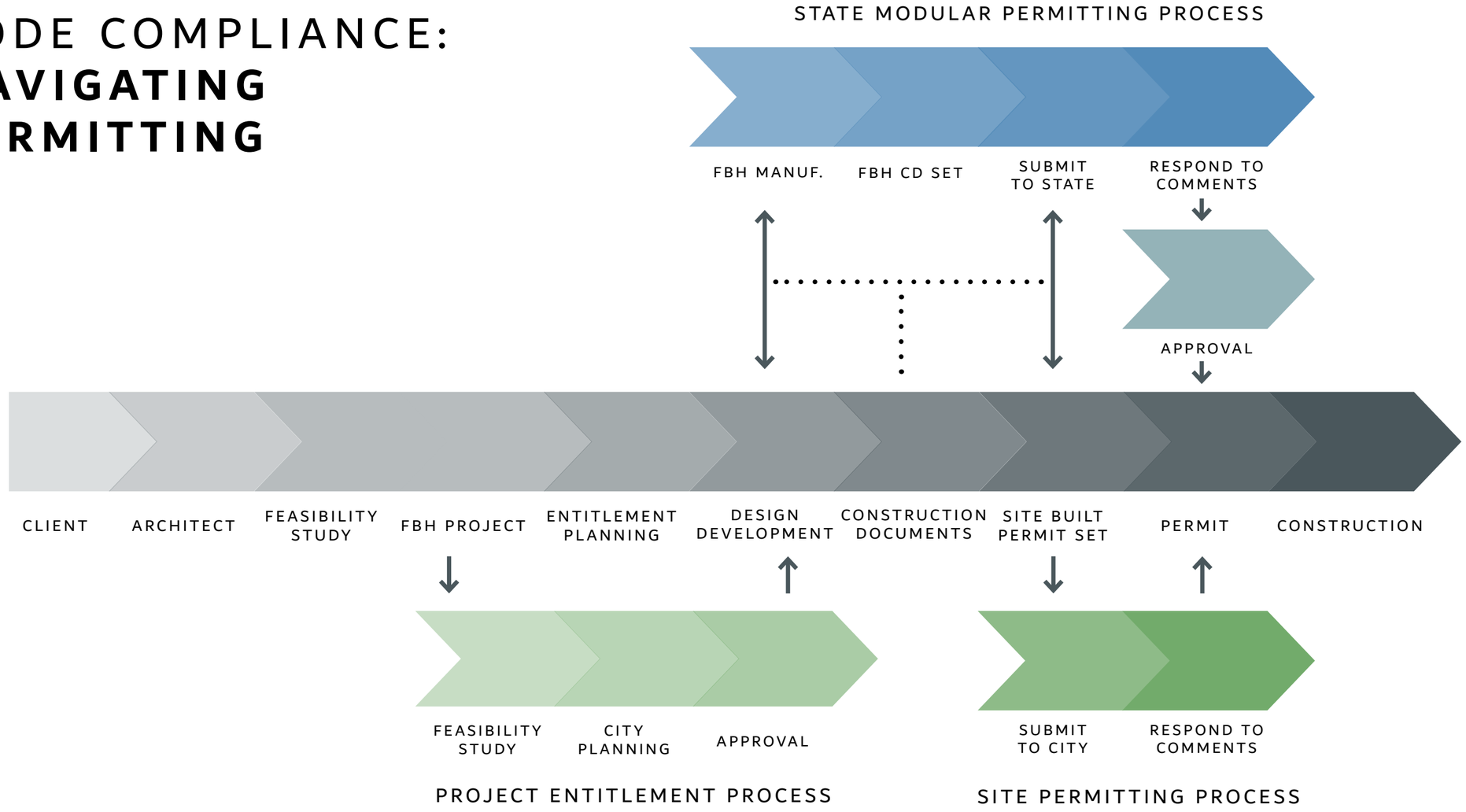


Simultaneous Site Development and Building Construction at the Factory has buildings open 30%-50% sooner!

SITE-BUILT SCHEDULE

code compliance: permitting

CODE COMPLIANCE: **NAVIGATING PERMITTING**



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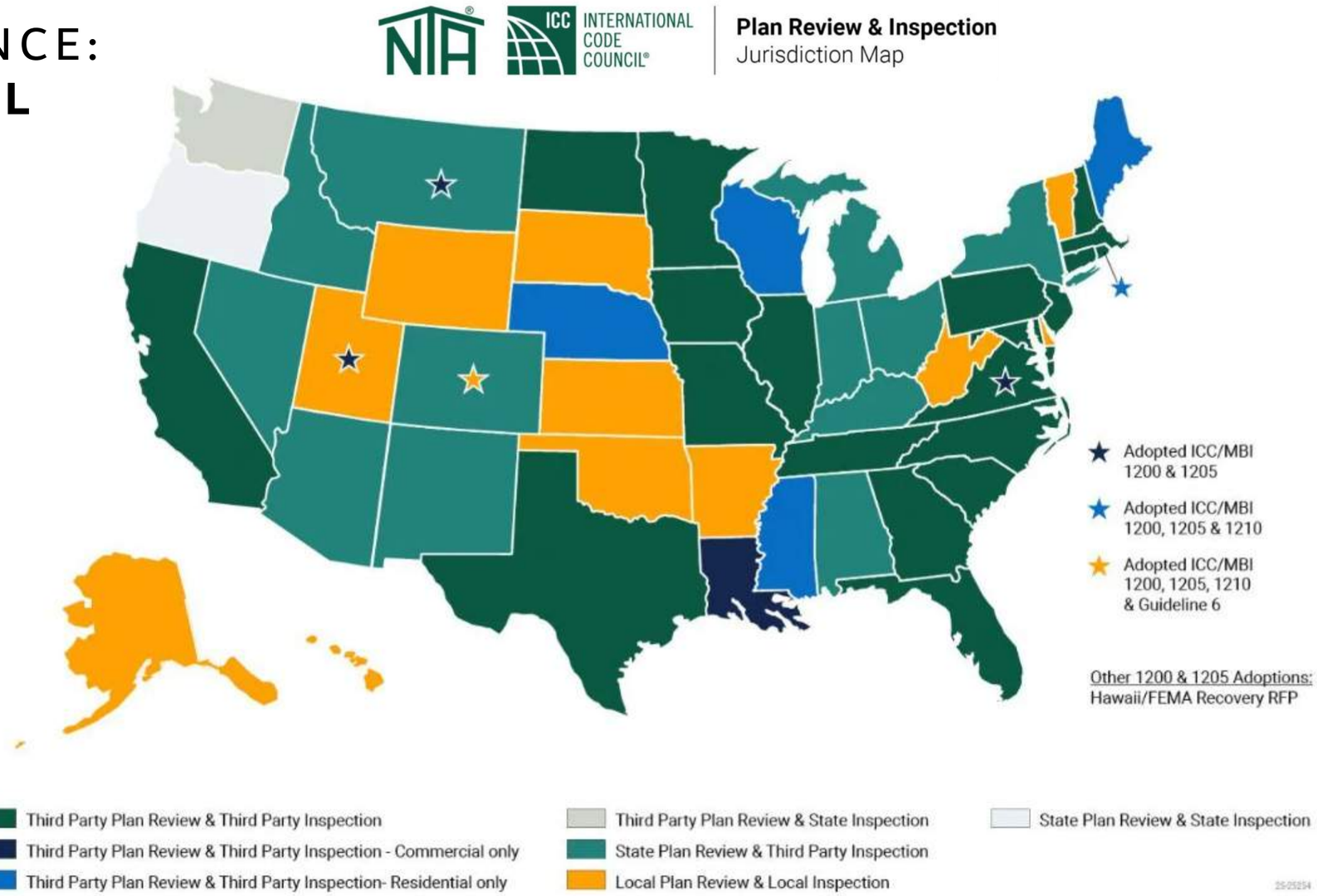
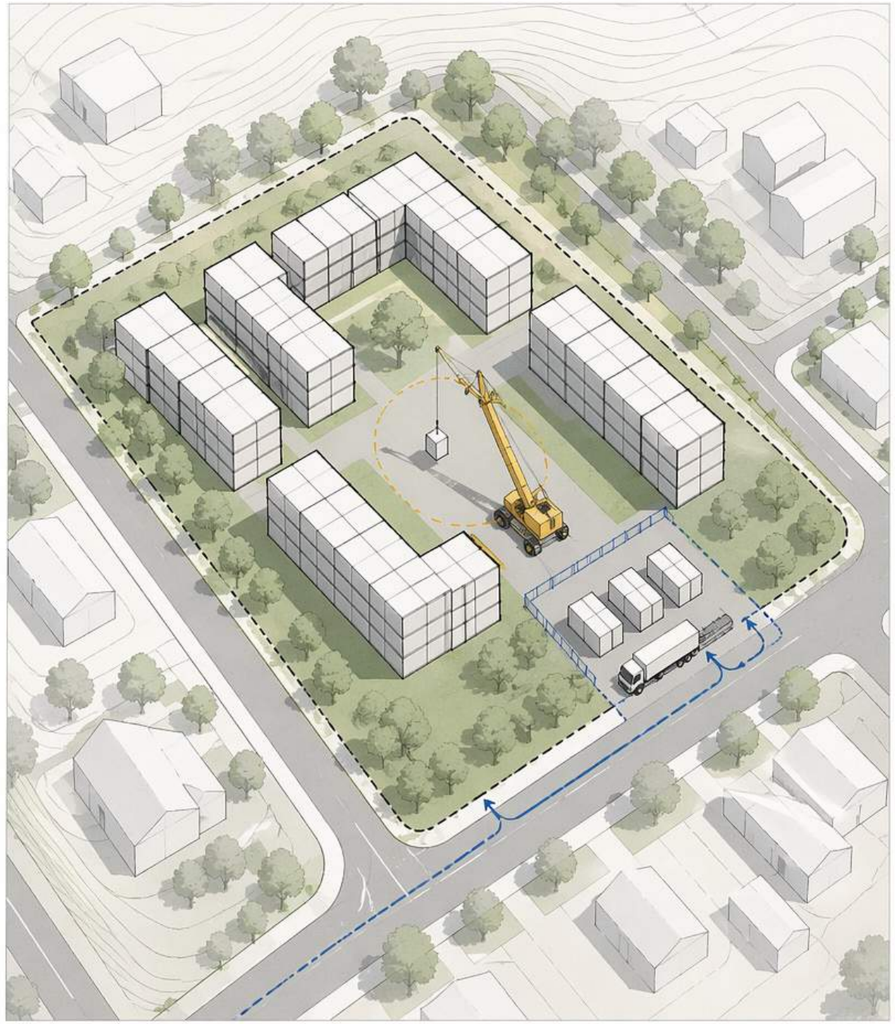
code compliance: jurisdiction

CODE COMPLIANCE: **JURISDICTIONAL CONFUSION**

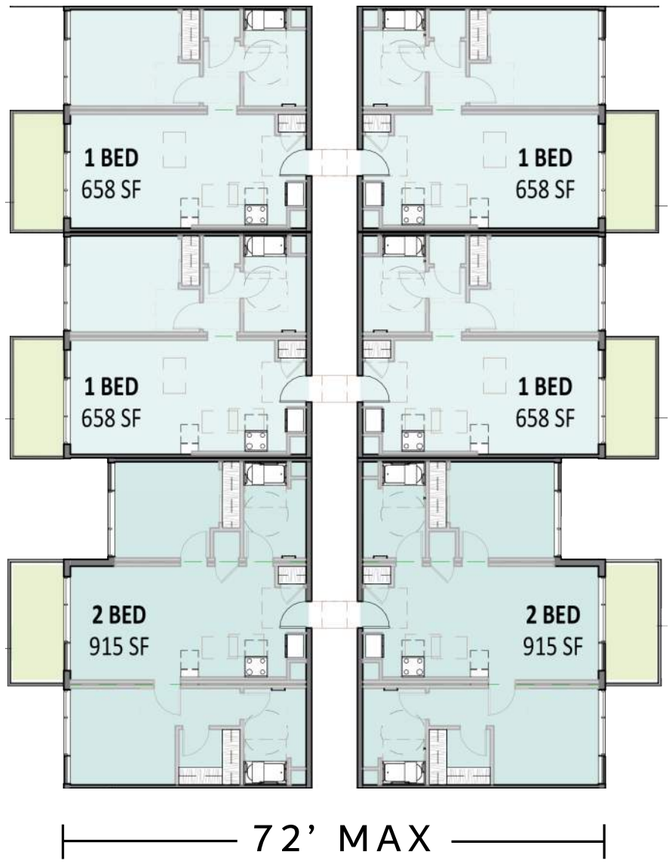


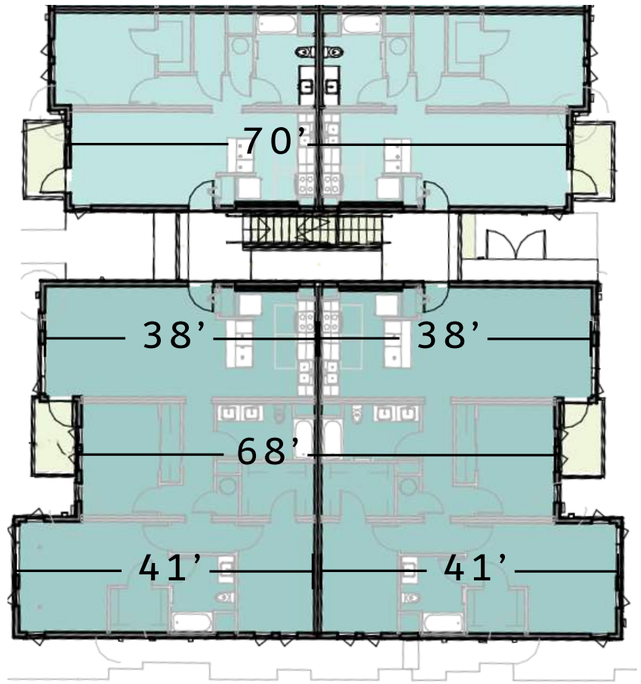
site related considerations:

- GEOMETRIC RESTRICTIONS
  - rectangular sites are ideal.
  - irregular or rounded sites might work, though fewer units fit
  - adequate size to fit modular shipping blocks
- SITE ACCESS
  - aerial obstructions
  - potential local delivery sites and staging area
  - shipping route
- TOPOGRAPHY
  - consider crane location.
  - flat sites work better for modules on grade
  - for sloped sites, consider a podium.



modular sizing and building layout





BEST PRACTICES FOR LAYOUT

- module size: consider shipping restrictions, based on state and shipping route
  - Length: 72’ maximum
  - Height: 14’ maximum
  - Width: varies by state. Aim for 14’ wide maximum, but talk to a shipping company about the route.
- limit variation of box dimensions and unit types
- double loaded corridors
- modules perpendicular to hallway
- design with “building blocks”
- construction types VA, VB, or IIIA
- locate openings in coordination with structural

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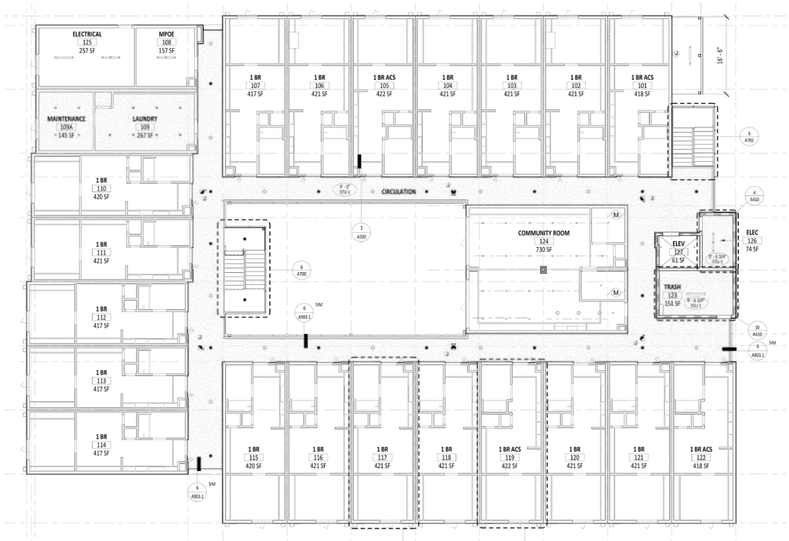
determing responsibilities:

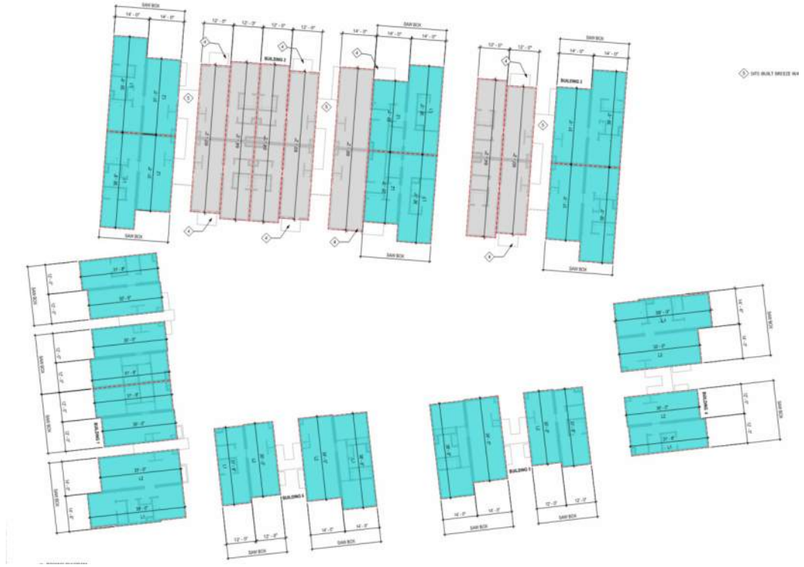
SCOPE OF WORK MATRIX

LOCATION	BUILDING COMPONENT	SITE BUILT (SB)	FACTORY BUILT (FB)
Grade Level	Site Elements	Sidewalks and driveways; landscaping including at grade planting, mulching, trees, bike racks, pedestrian unit paving; irrigation; gates and gate operations equipment; trash enclosures; relocation of solar panels	N/A
	Utilities	Electrical transformer, utility connections	N/A
Residential Buildings	Stairs	Egress balconies, waterproofing, factory-built stair installation, guardrails and handrails	Stair run and treads, ship flat
	Units	Sleepers; MEP and Structural access close-ups and insulation; waterproofing membrane; sheathing close-up between Module connections; exterior finishes	Floor, ceiling, wall assemblies, MEP equipment and fixtures, exhaust fans, ducts, grilles, casework, appliances, finishes, doors and windows, flashing around openings
	Unit Balconies	Install Factory-Built balconies; composite decking over sleepers over waterproofing; guardrail; sidewalls; finishes on exposed wood	Floor assembly, waterproofing
	Signage	All signage, including Unit entry door signage	N/A
	Roof	Roof finish including insulation, roof curbs, installation of parapet walls; parapet support and caps; roof walkpads; stormwater management system: scuppers, leader boxes and rain-water leaders	Roof assembly at top units; partial height parapet to be shipped flat; blocking for parapet installation; blocking for solar systems; coordination with solar layout; "dog-house" roof structures, to be shipped loose
Community Building	Walls, Ceiling, Doors, Windows	Wood stud walls, furring walls, ceiling where occurs, doors, windows, folding glass wall	N/A
	Signage	Exit signage and exterior signage	N/A
	Exterior Finishes	Waterproofing, exterior wall finish assemblies	N/A
	Roof	Pre-fab truss installation, insulation, waterproofing, roof walkpads; stormwater management system: scuppers, leader boxes and rain-water leaders; green roof; finish roofing	N/A
	Interiors	Interior finishes; community kitchen, including appliances and cabinetry; restroom, including fixtures; laundry appliances	N/A

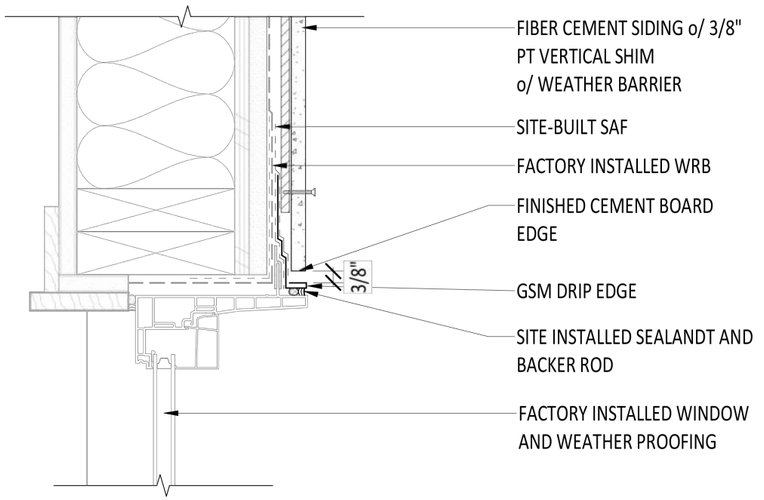
responsibilities matrix



construction plan



modular diagram



detail

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project delivery team

GENERAL CONTRACTOR SELECTION:

- hire the GC early; negotiated BID/GMP contracts work well.
- proven residential modular experience
- dedicated to modular
- factory relationships and integration
- participates in design coordination
- sub-contractor’s modular construction experience
- communication and systems thinking
- staff experience on residential modular

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project delivery team

FACTORY SELECTION:

- ask factories to review the feasibility study
- bring on the modular factory at 50% DD
- financial stability of factory
- deposites & payment schedules
- production availability: backlog syncing with project schedule
- project type experience
- bonds or warranties; insurance
- union or non-union

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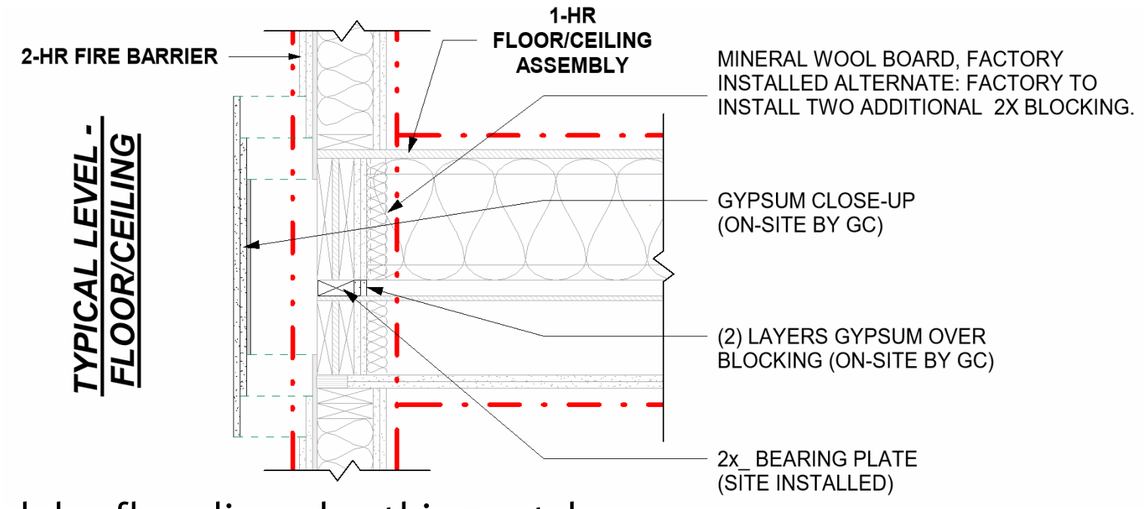
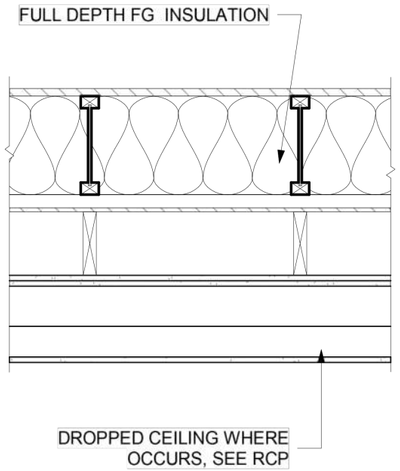
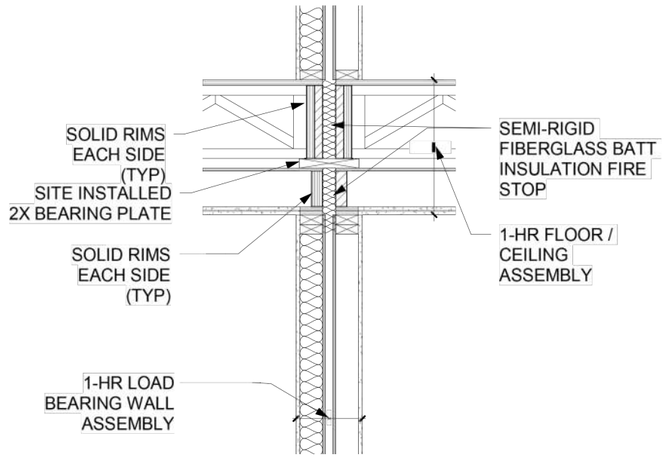
code compliance: construction detailing



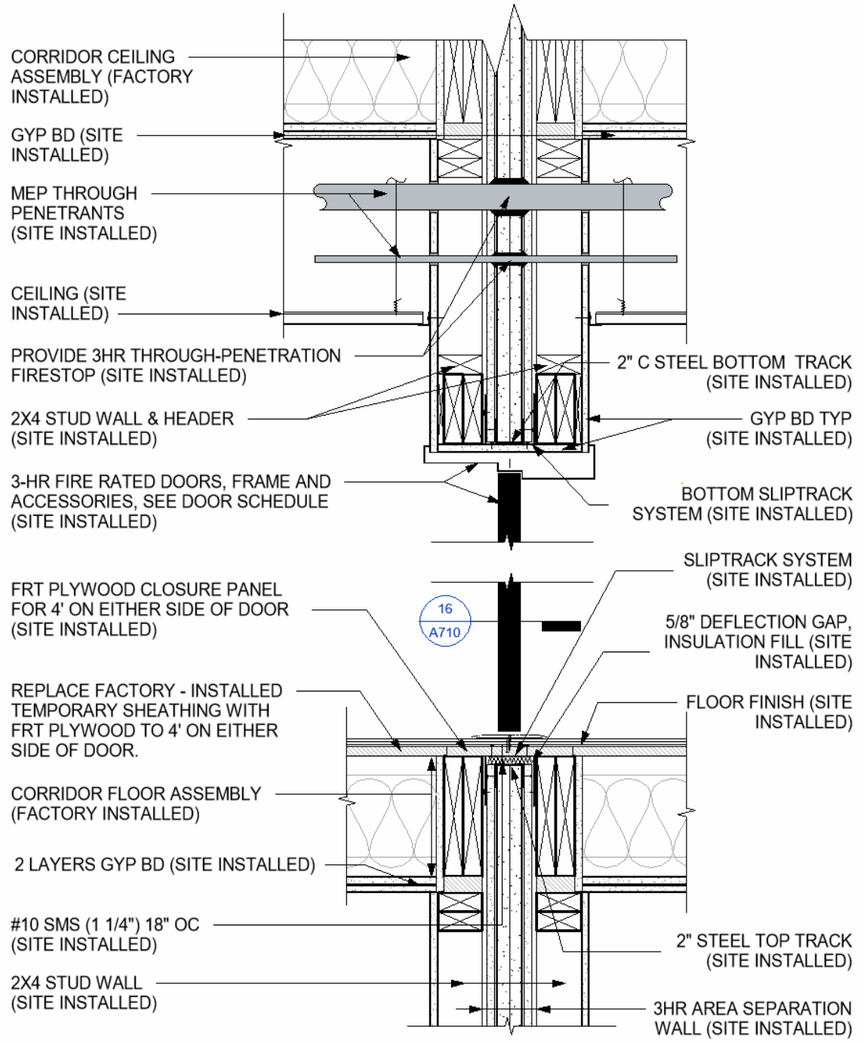
modular floor line: sheathing patch



typical floor-ceiling assembly



mateline: fire rating continuity

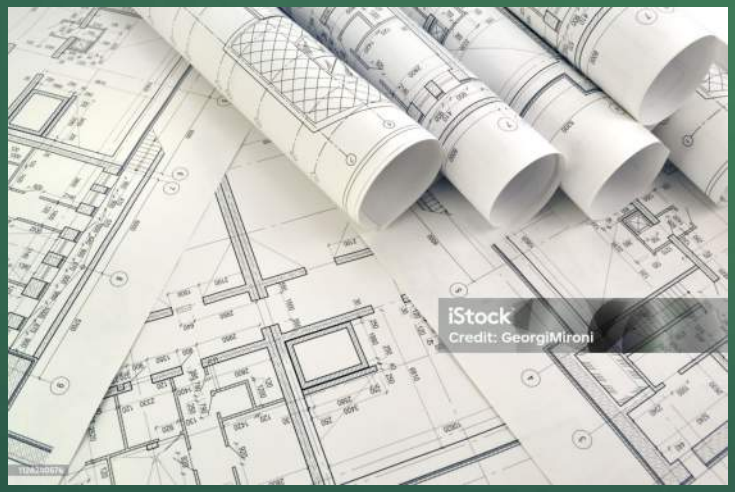


3-hour firewall between modules

PRESENTATION OUTLINE

- Introduction
- Structural notes on Modular
- Engineering Paradigm Shift
- Gravity Load Design
- Lateral Load Design

- Codes
- SE Role
- Construction Documents



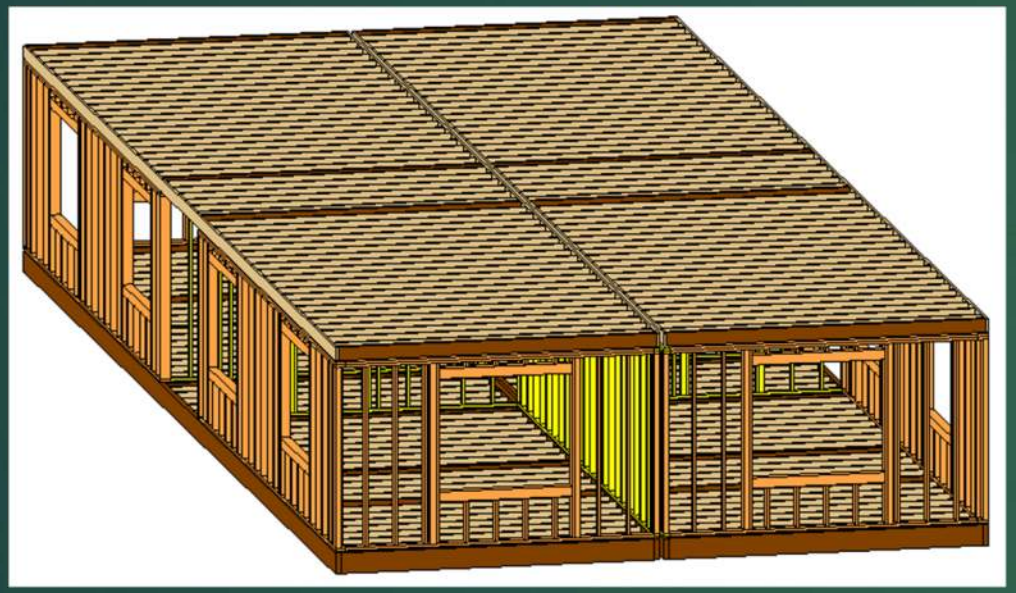
ENGINEERING PARADIGM SHIFT

- Means and Methods
- Design for Manufacturing and Assembly (DfMA)
- Shipping
- Setting

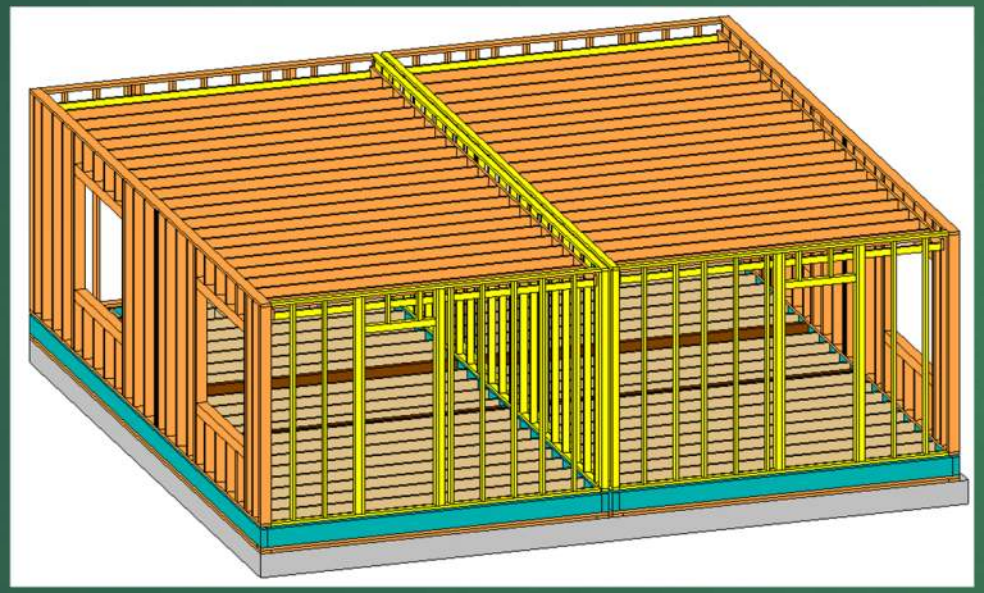
MODULAR CONFIGURATIONS AND TERMS

- Short Box
- Double-Loaded
- Side Wall
- Mate Wall
- End Wall
- Corridor Wall

CEILING OPTIONS



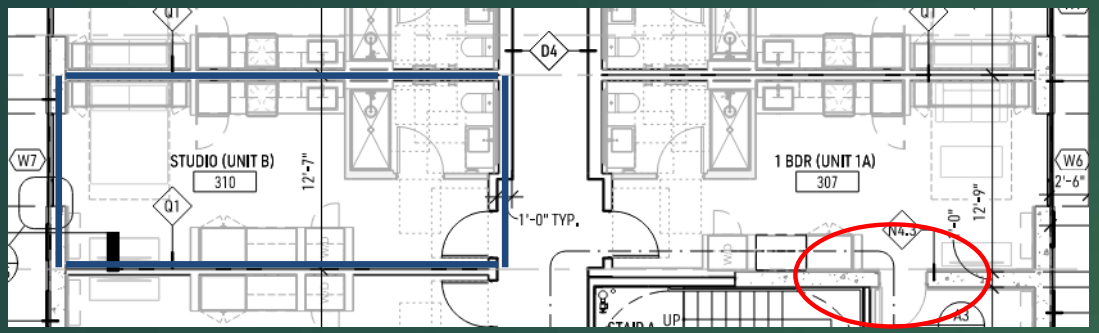
Platform Framing

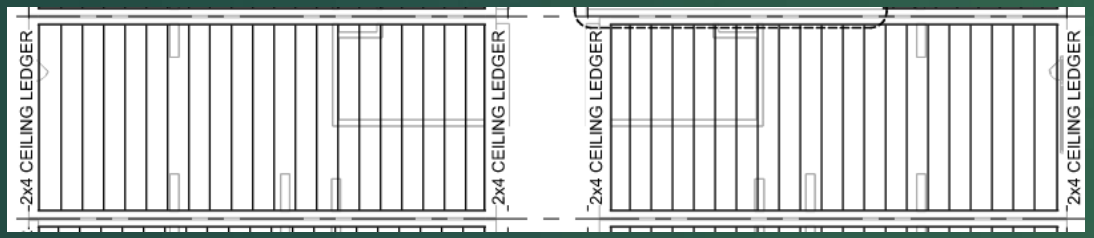


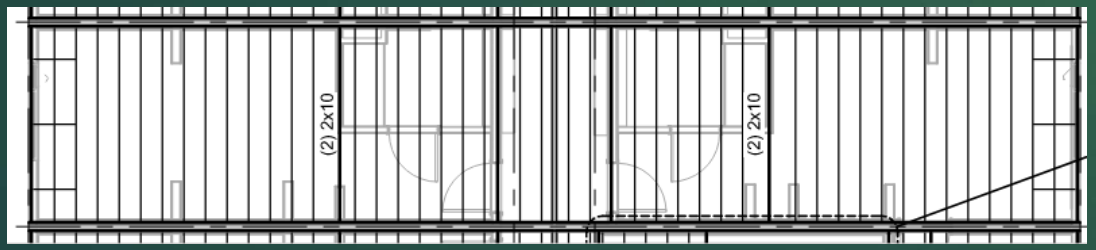
Balloon Framing

Title

GRAVITY LOAD PATH

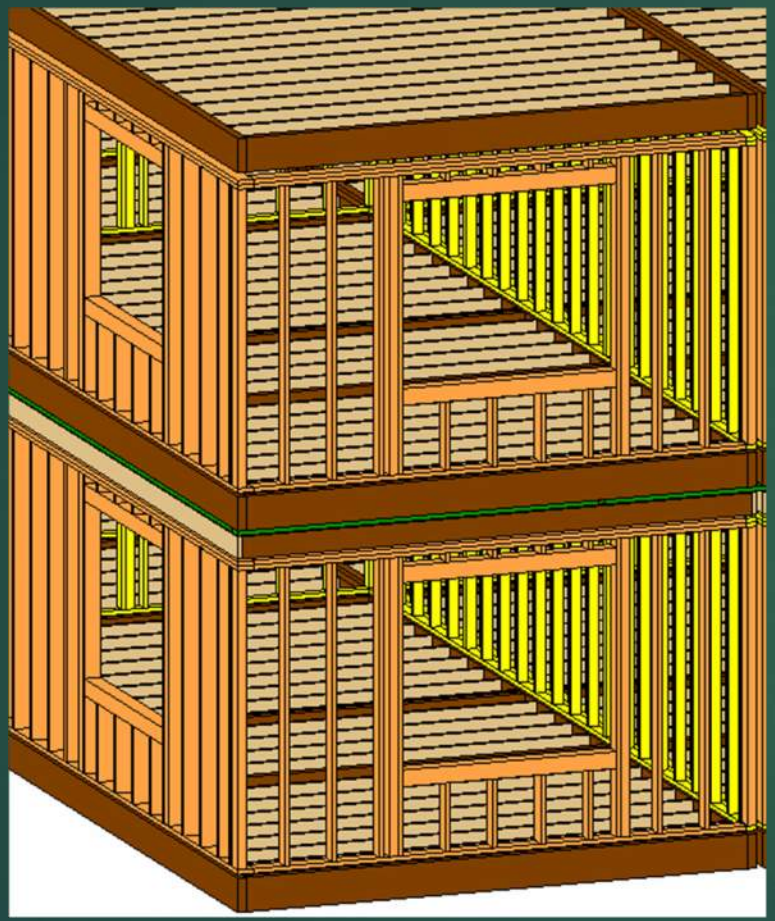


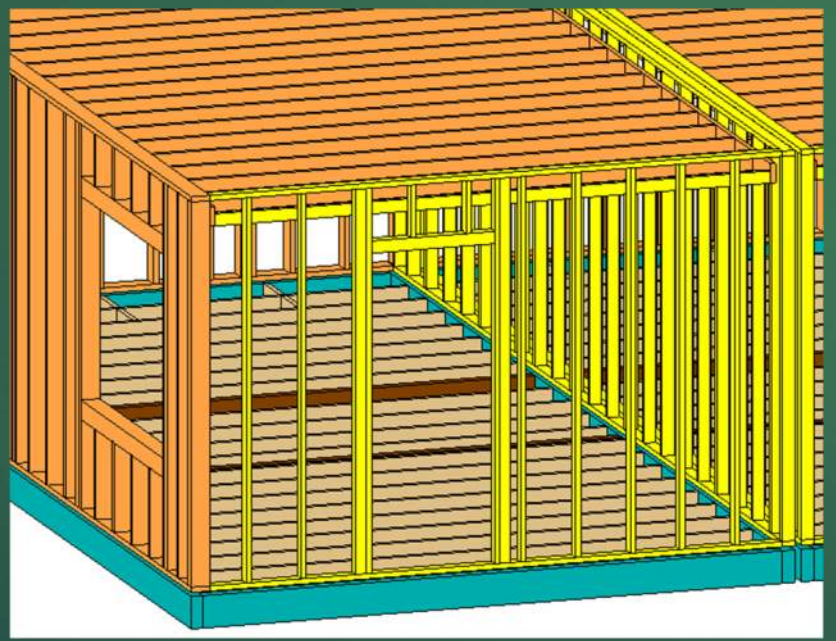




GRAVITY LOAD PATH

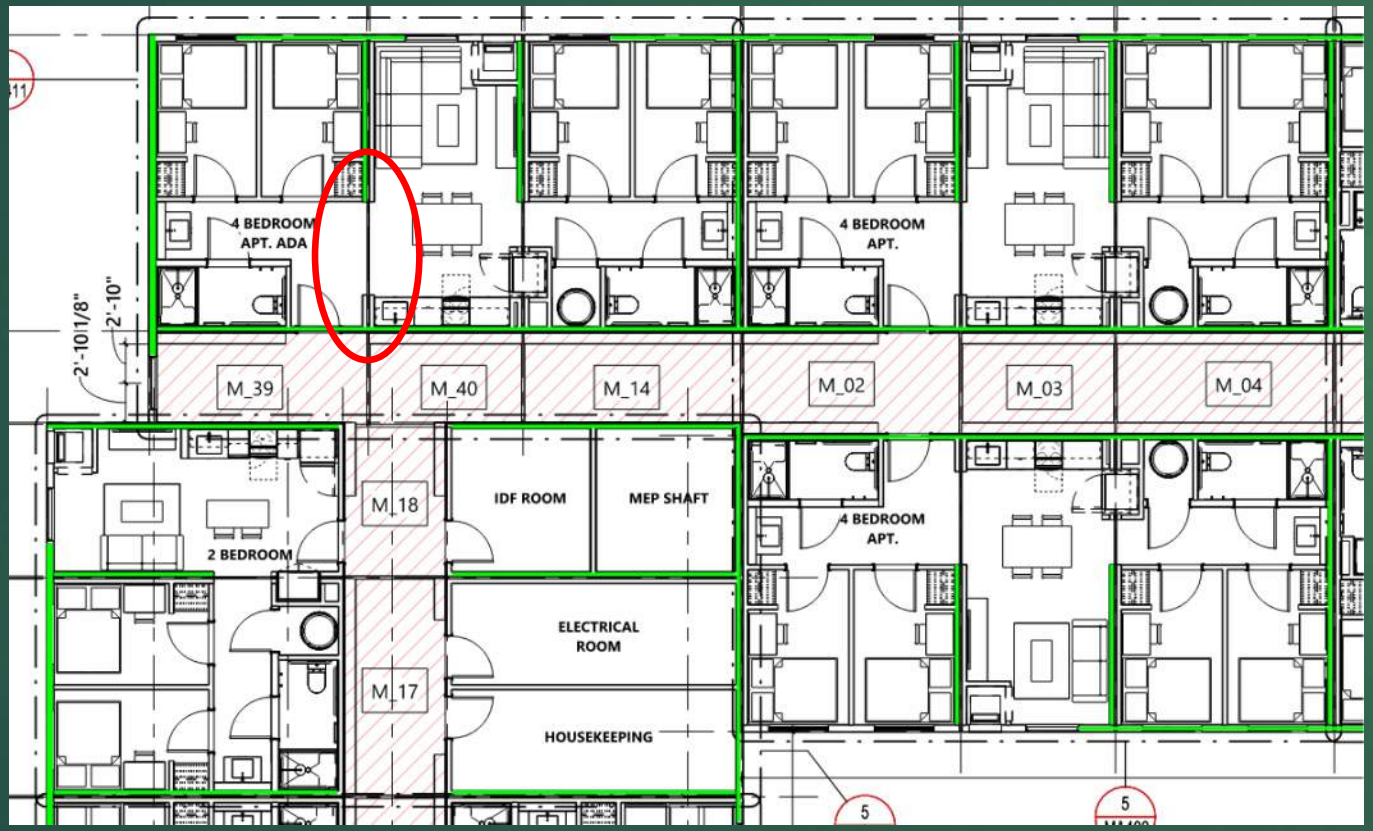
Headers



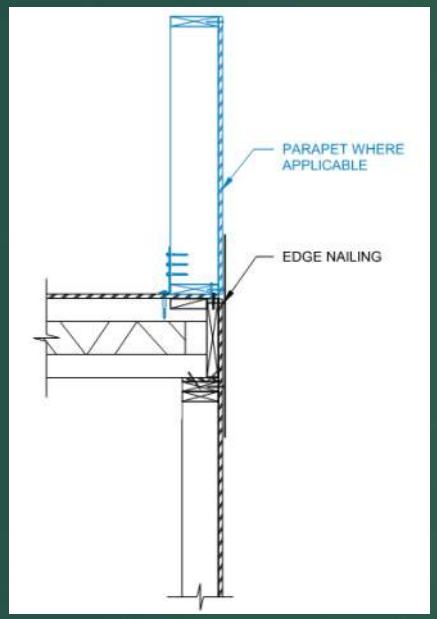


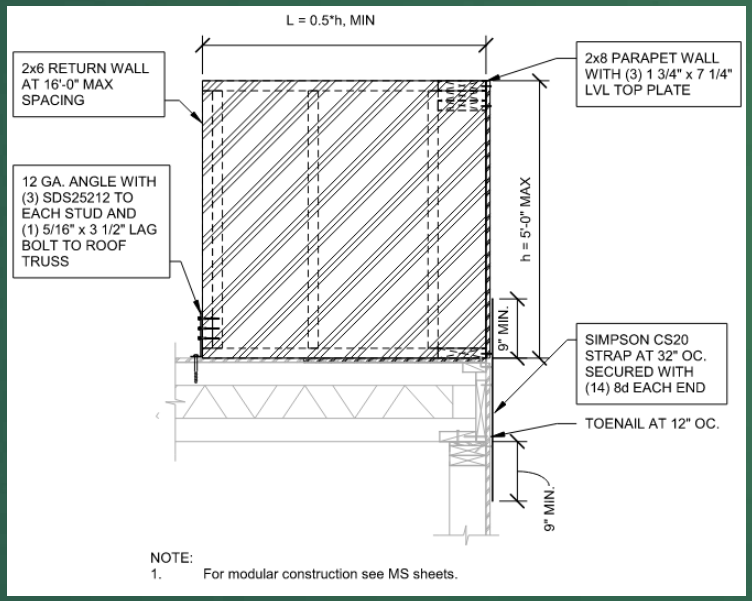
GRAVITY LOAD PATH
Ceiling Headers

- Headers



GRAVITY LOAD PATH
Parapet Connections



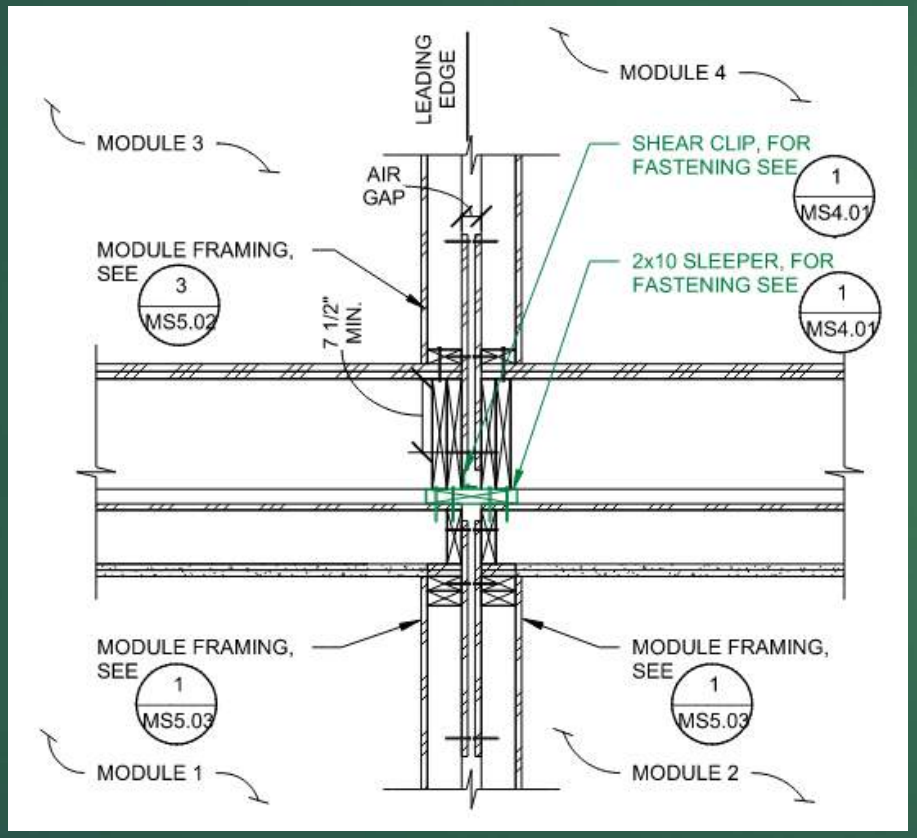


LATERAL LOAD PATH

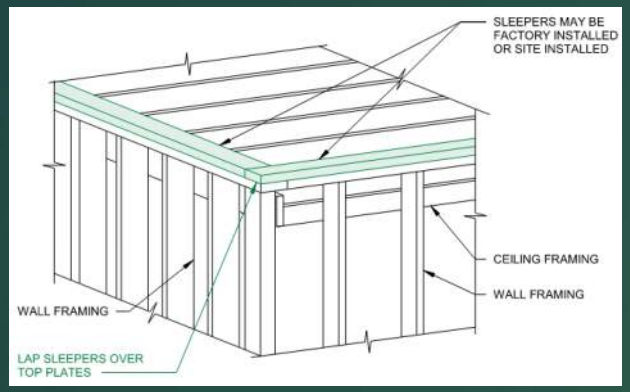
- Diaphragms
- Sub-diaphragms
- Chords / Sleepers

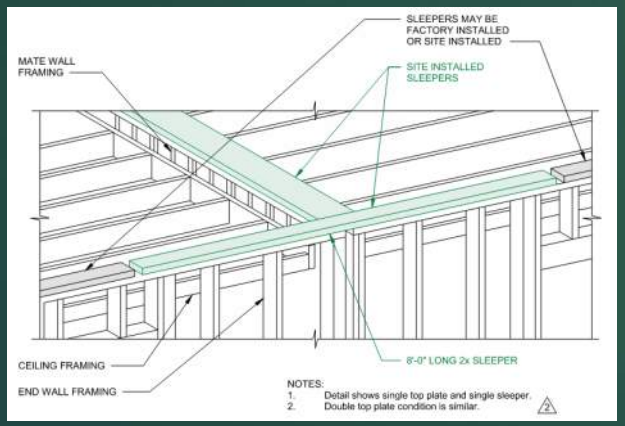
LATERAL LOAD PATH

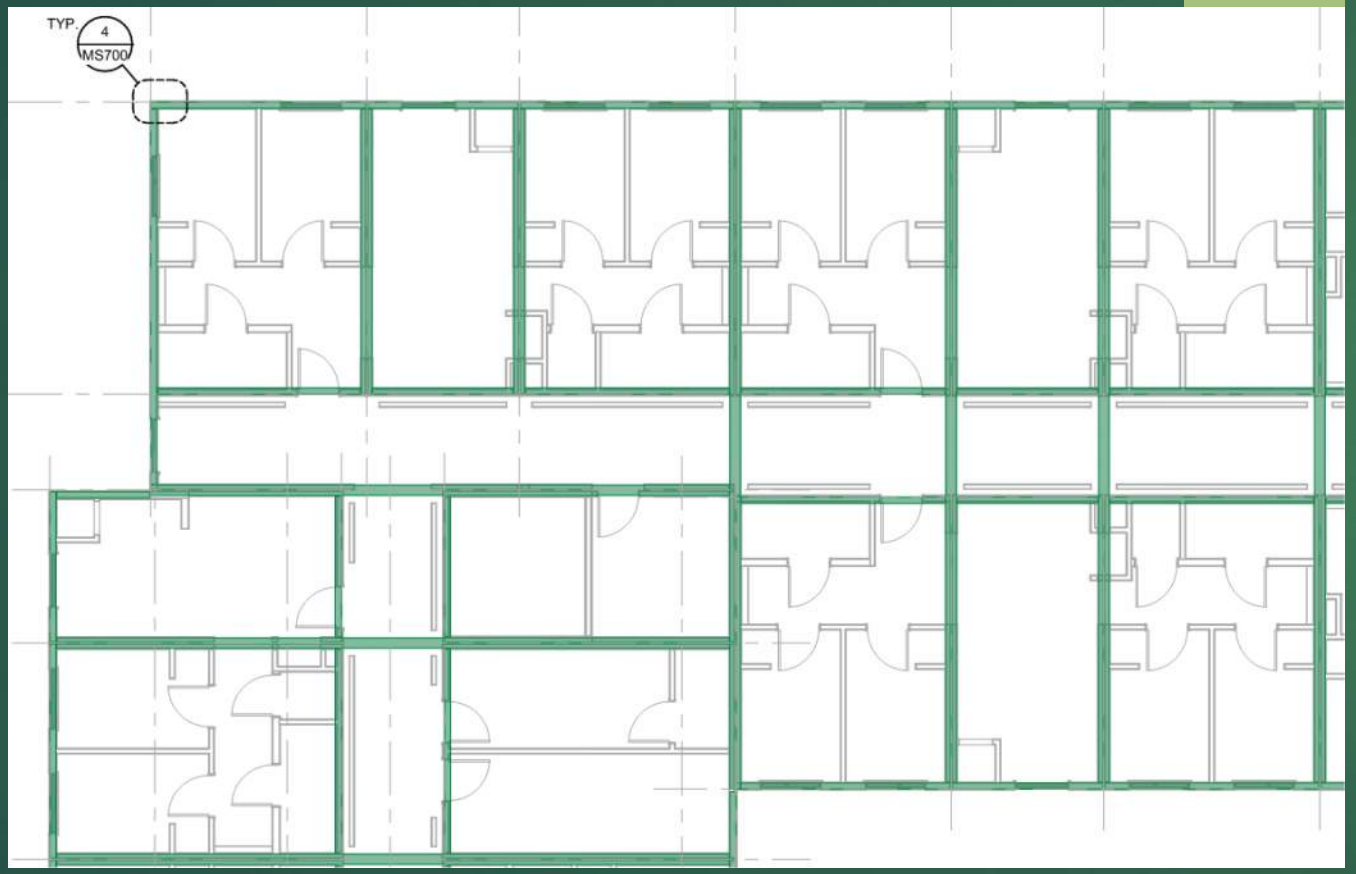
- Sleepers / Bearing Plates



SLEEPER LAYOUT

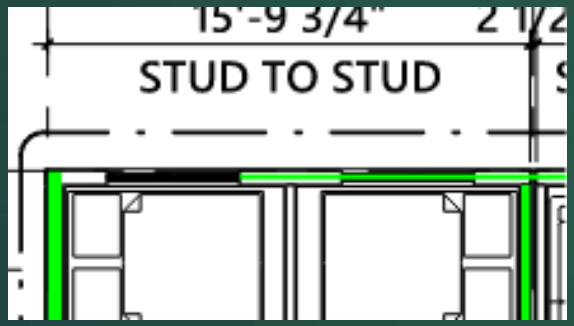


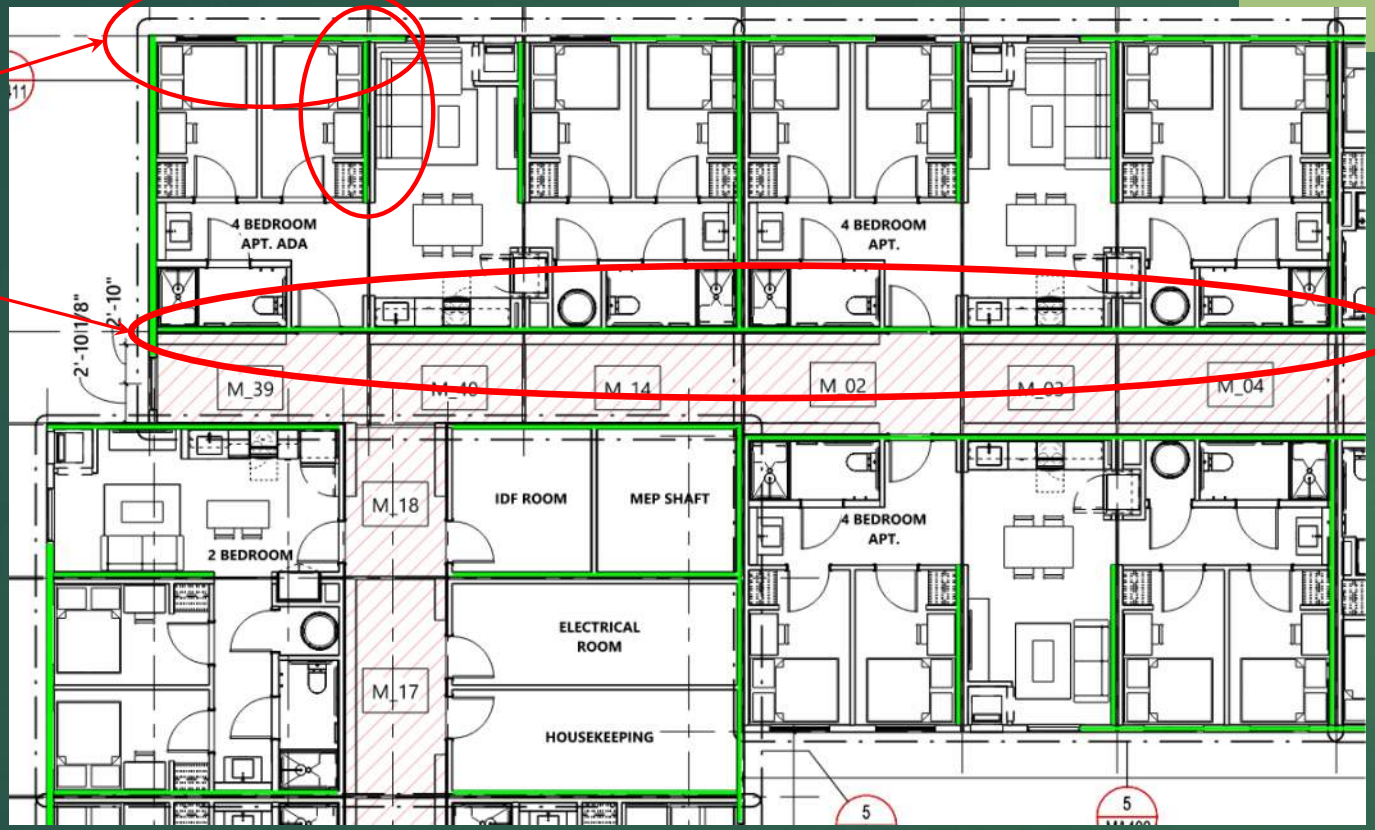




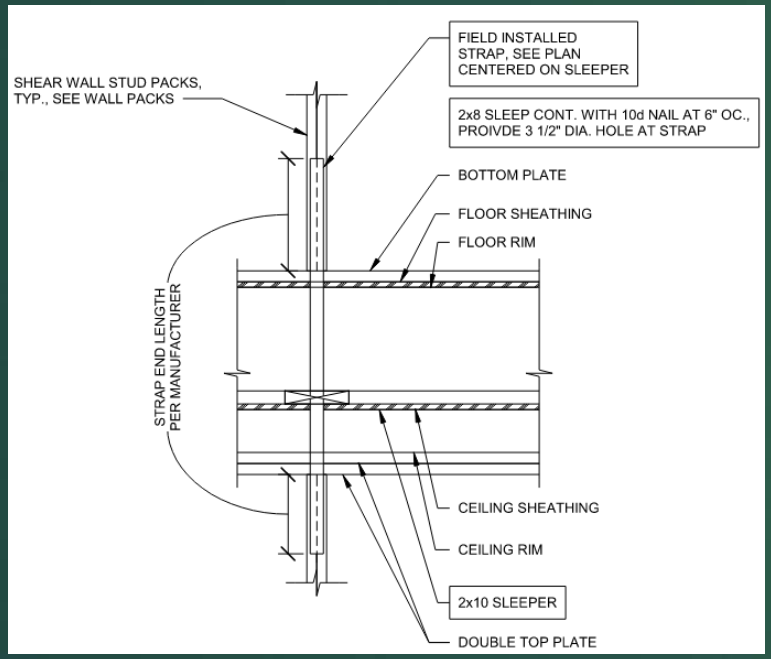
SHEAR WALLS

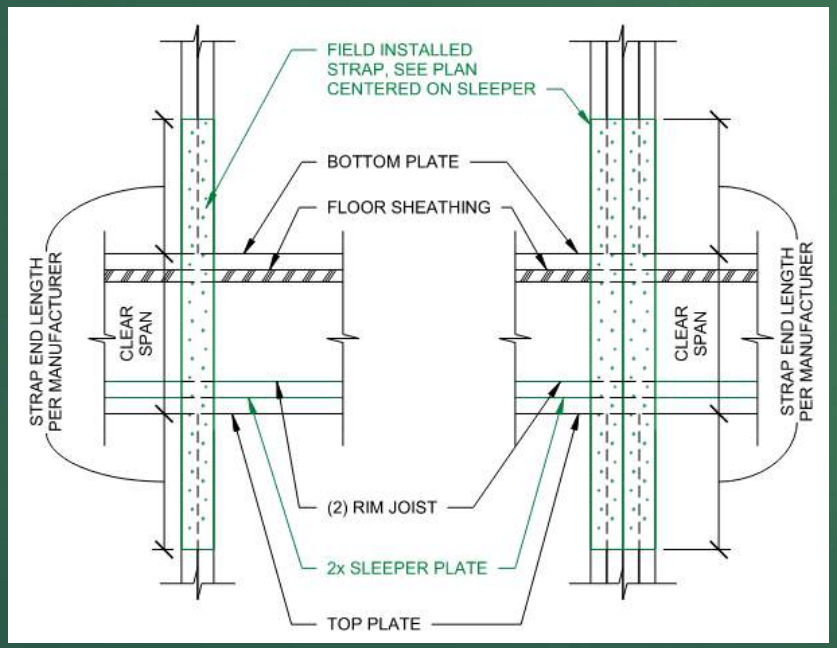
- Segmented
- Perforated





LATERAL LOAD PATH
Hold-down Connections





Hold-down

Module Set

This concludes The American Institute of Architects
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