Is Wood-Frame Modular the Future of Multi-family Construction?

Modular Wood-Frame for Multi-Family: Design, Details & Why it Makes Sense

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JACKSON | MAIN ARCHITECTURE

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Course Description

Modular construction is touted as an opportunity to combat rising interest rates and construction prices through greater efficiency, address skilled labor shortages, and reduce jobsite waste. However, some architects and engineers are hesitant to embrace the modular approach because they don't want their designs to be compromised, and they don't think it has the flexibility or functionality to execute certain project typologies. Presented by modular design experts from the west coast, this workshop will take a close look at modular wood-frame multi-family projects in particular. First, a Seattle-based architect will examine unique design considerations, detailing and sourcing techniques, and review the advantages and challenges of the design/delivery process. A California-based building enclosure consultant will then offer insights on the building enclosure functions of heat, air, and moisture control in wood-frame buildings, and apply these concepts to the realities of modular construction. Lastly, a structural engineer will focus on unique structural design considerations and constraints associated with modular projects, including load transfer, interfacing with manufacturers, construction sequence coordination, and third-party structural inspections.

Learning Objectives

- Highlight potential benefits associated with the use of modular construction in multi-family buildings.
- Discuss unique design considerations for modular projects including room layouts, spans, fire-resistance and acoustic performance.
- Determine how building enclosure functions, including heat, air and moisture control, differ for modular vs. traditional wood-frame projects.
- Explore the potential for the increased use of modular approaches in wood-frame construction.

Modular Wood-Frame for Multi-family:

Design, Details, Delivery and Why it Makes Sense

Modular Building Basics

- Kit of Parts
- Pre-Approved Boxes
- Pre-Approved Connection Details

Can Modular Save Me Money?

(but)

Where Can Modular Add Value to My Project?

Decrease project schedule

Faster time to dry-in

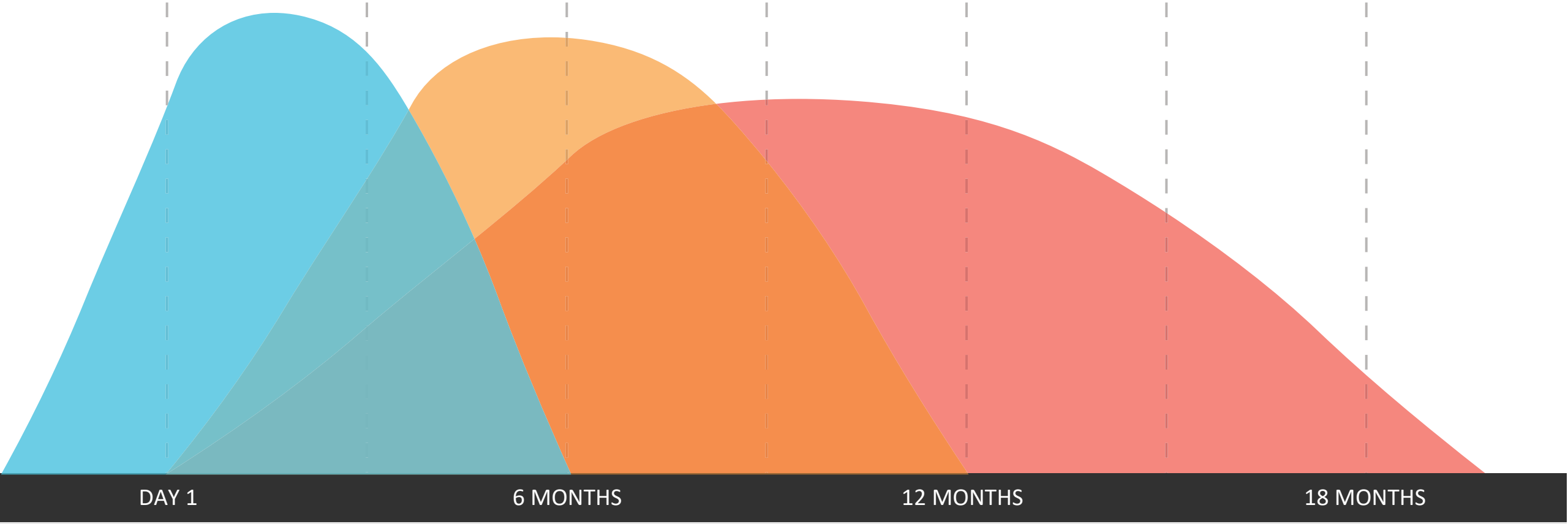
Controlled labor costs

Inherent sustainability

Repeatable quality

Set day is awesome!

Design Timeline



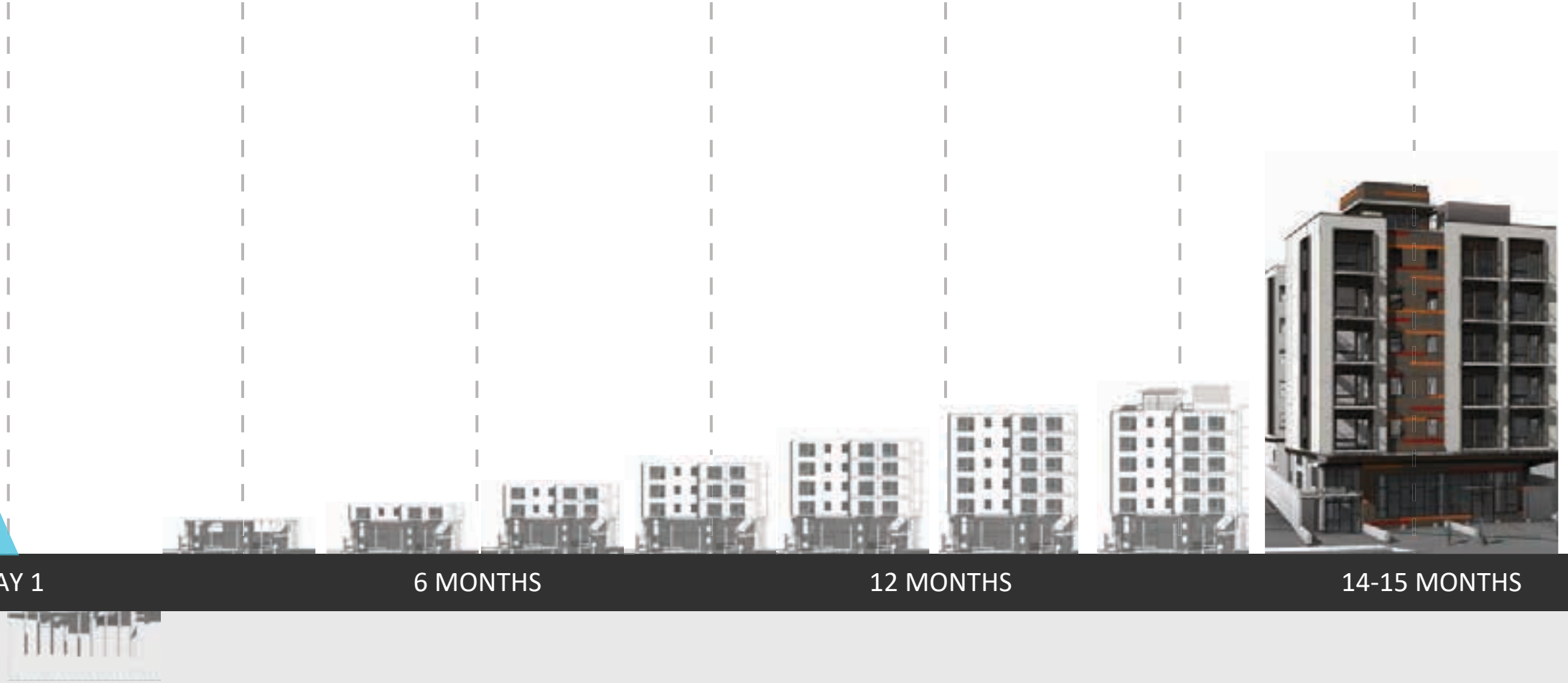
Modular

Integrated Design

Traditional

Standard Construction

Design



DAY 1 | 6 MONTHS | 12 MONTHS | 14-15 MONTHS

Modular Construction

Design

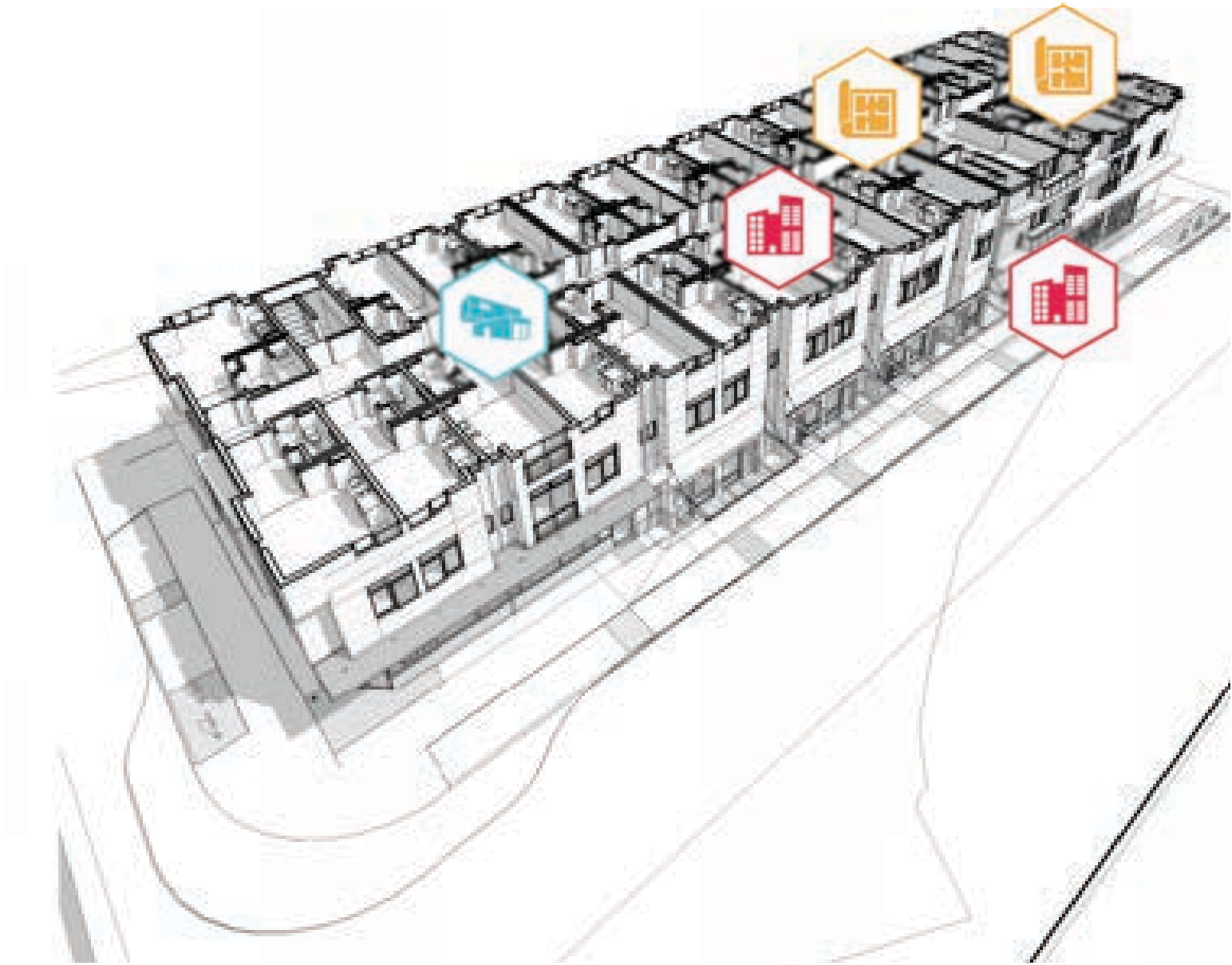
DAY 1 | 6 MONTHS | 12 MONTHS | 14-15 MONTHS

Modular Challenges & Opportunities

Modular Design:

Pain Points & Learning Curve

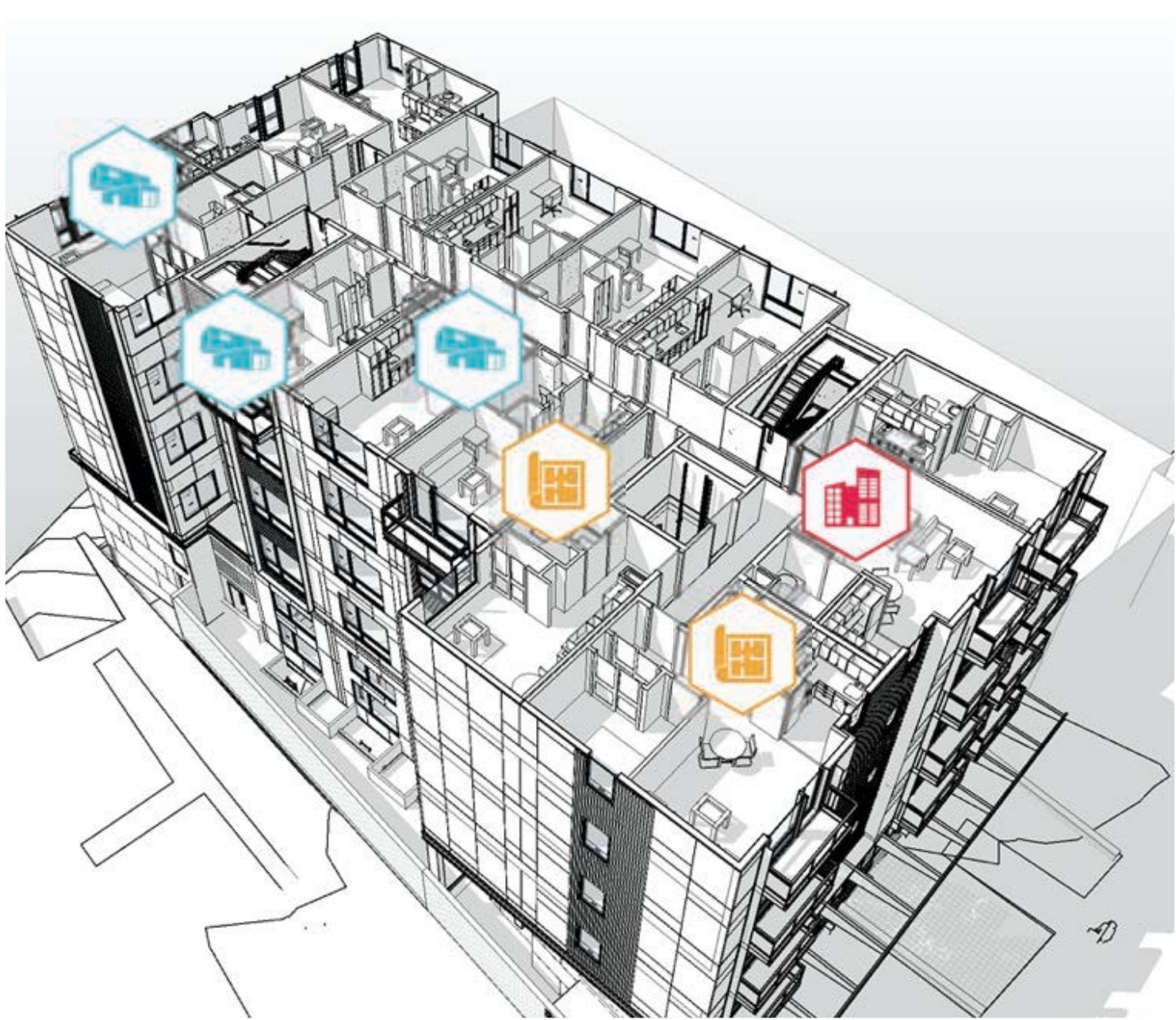
- In-unit matelines
- Connection detail coordination
- Coordinated inspections/reviews
- Multi-story MEP Shafts
- MEP coordination
- Non-jurisdiction permit timelines



Modular Design:

Opportunities & Improvements

- Coordinated reviews
- Eliminate in-unit matelines
- No MEP shafts
- Simple structural system
- Bad weather set
- More factory work
- More off-site construction
- Coordinated inspections



AHJ Coordination

“Who gave you the “ok” to cover?”

Clear delineation of jurisdiction

Special inspections vs. the city

Failed inspections & revisions take time

The inspections that the municipality wants to see may not even be in their system to call for

Construction Coordination

What are the gaps we aren't seeing?

Standard closure details

Inspector education

Municipal Coordination

Contractor scope of work

Sustainability

Is Built in the Factory

Disruptive strategies are needed to meet the 2030 building challenge of 100% net zero buildings

Factory built construction emits 43% less carbon than site built

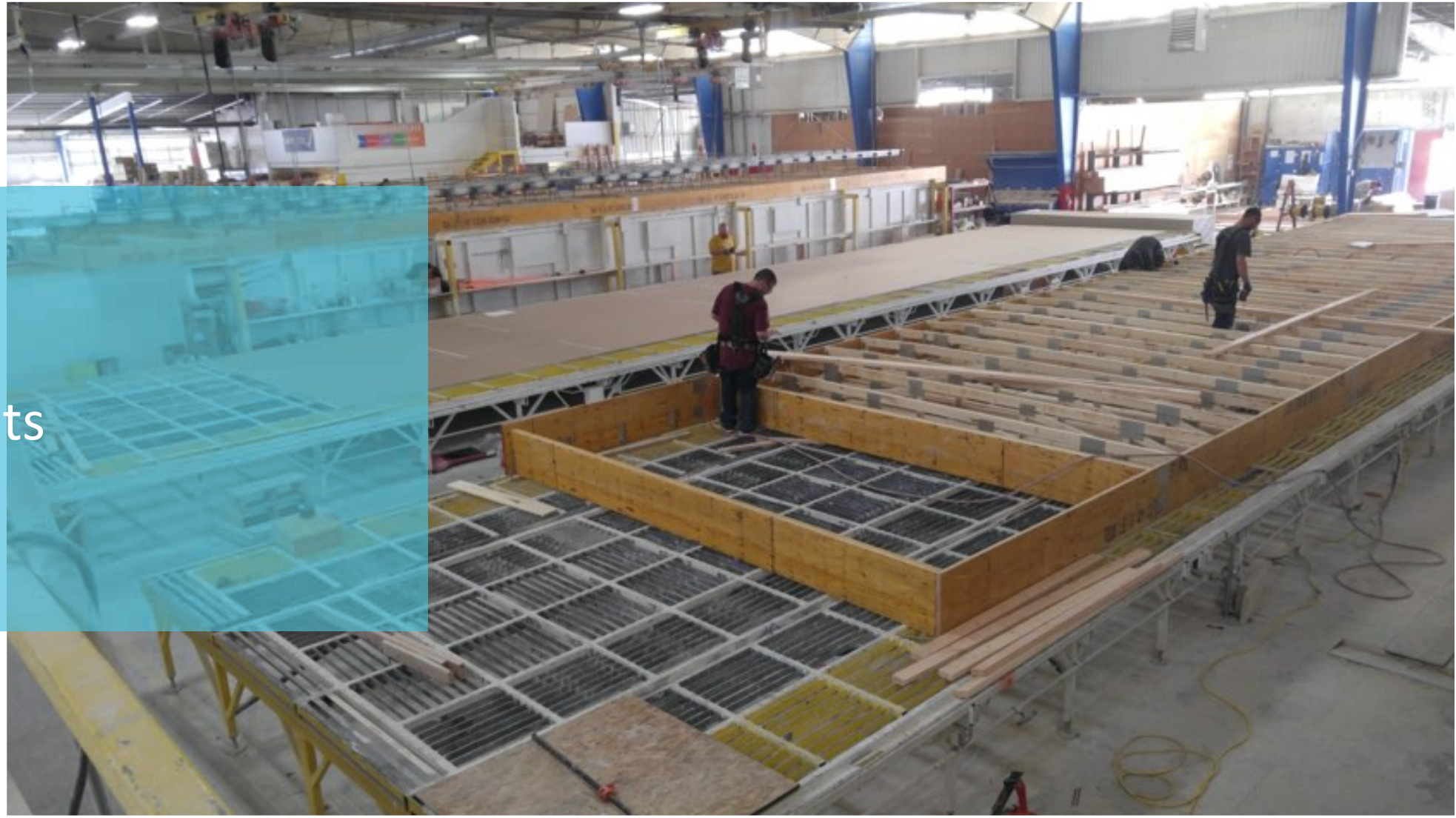
Typically 10% of construction materials can end up waste, modular factories can achieve less than 2%

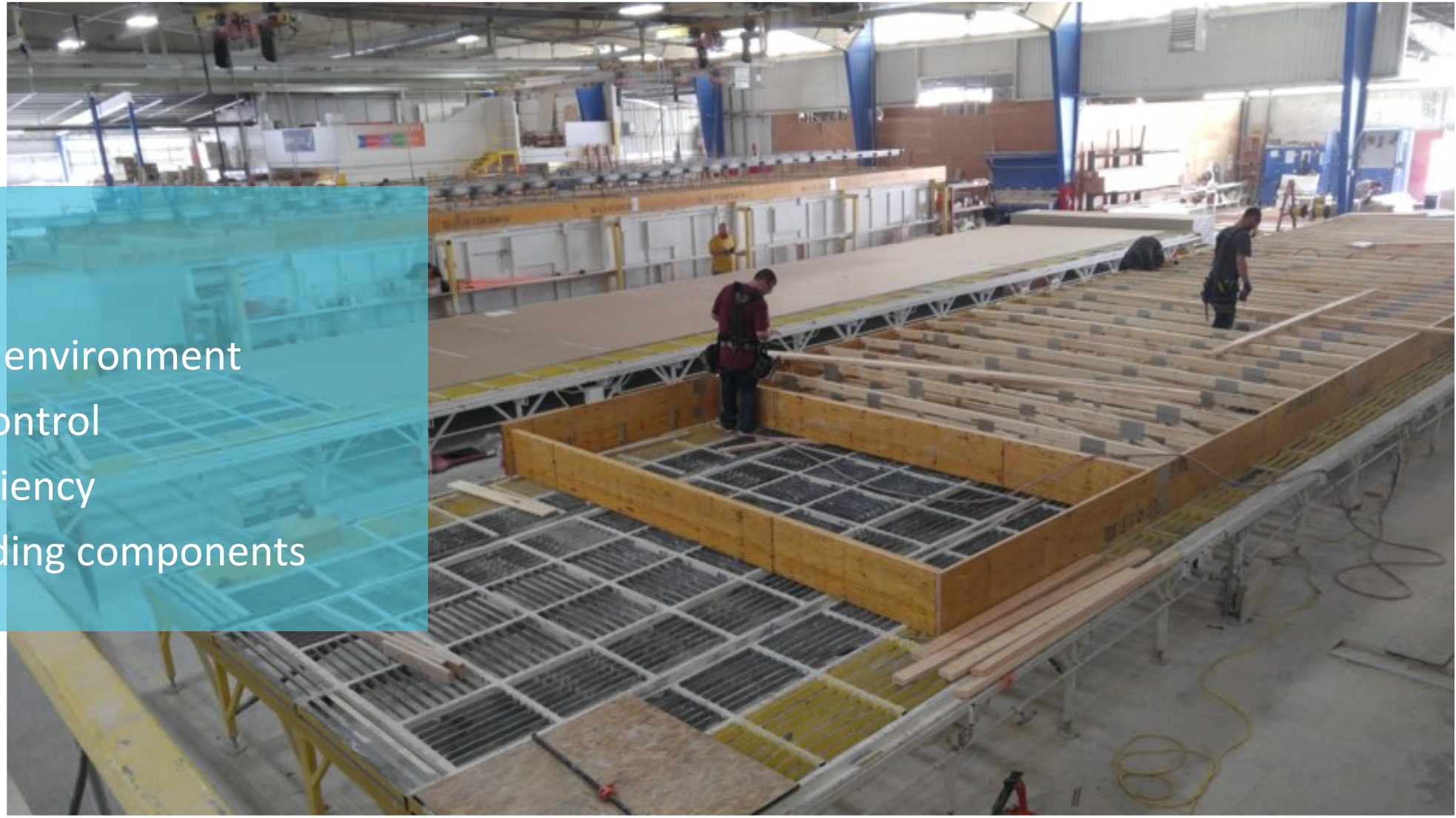
Passive house level envelope for a 4-8% increase

Single source of procurement for specified materials

Skilled labor trades can be cross-trained in many construction fields with experience in manufacturing and even robotics!

Modular Benefits





- Stable Pricing
- Build in controlled environment
- Excellent quality control
- Assembly line efficiency
- Pre-approved building components

Product Design Benefits

- Preset design prices
- More focus on amenities
- Design test redesign
- Unique product repetitive parts

Modular
Builder

COLLABORATION

Jurisdiction

Design Team

Modular Design:

It’s in the Details

Design Concept: Structural

Drag Struts – Collectors – Saw Boxes

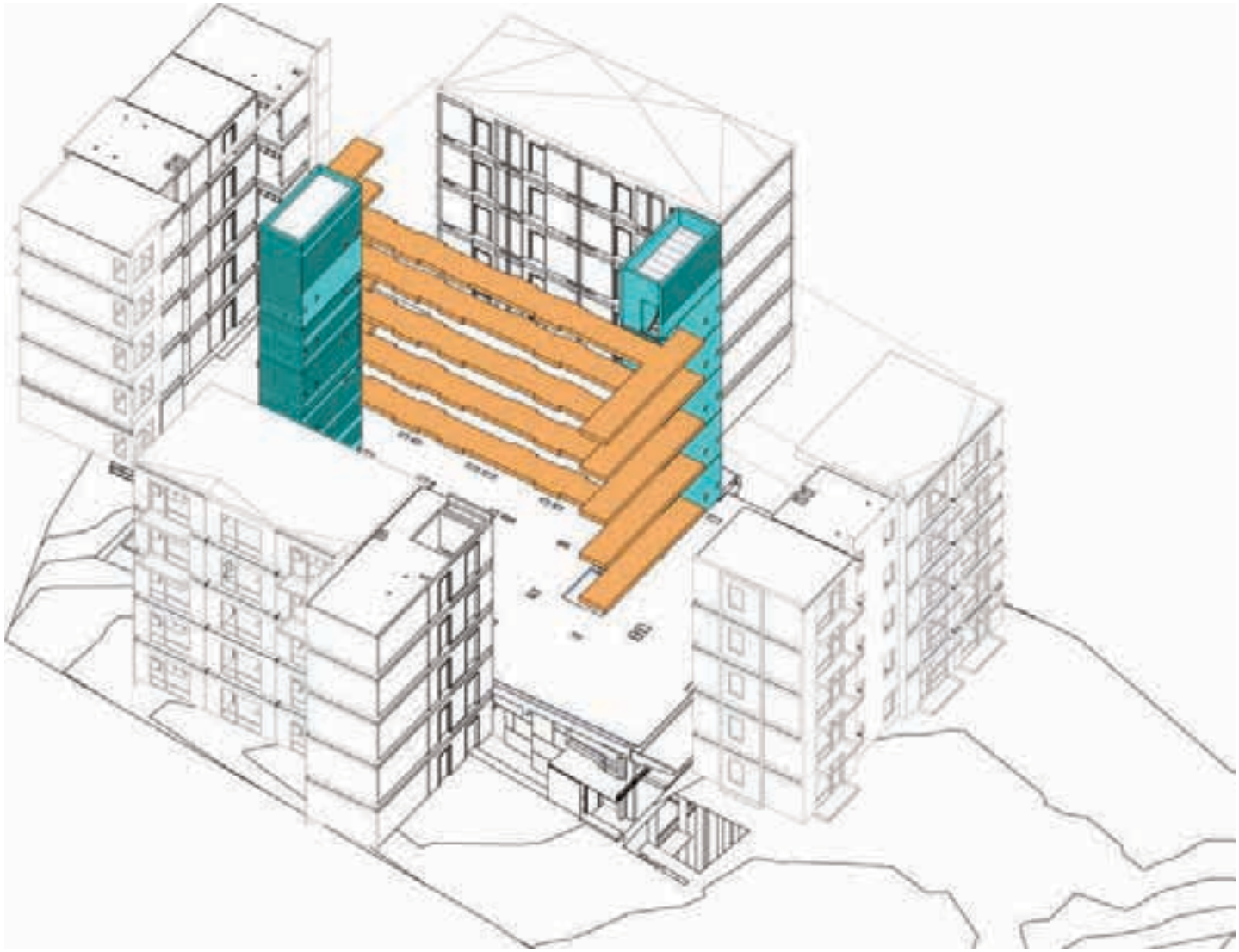
Corridors act as drag struts, precast stair towers as shear columns

No vertical wood shear walls

No vertical tie rods

Simple exterior sheathing connection

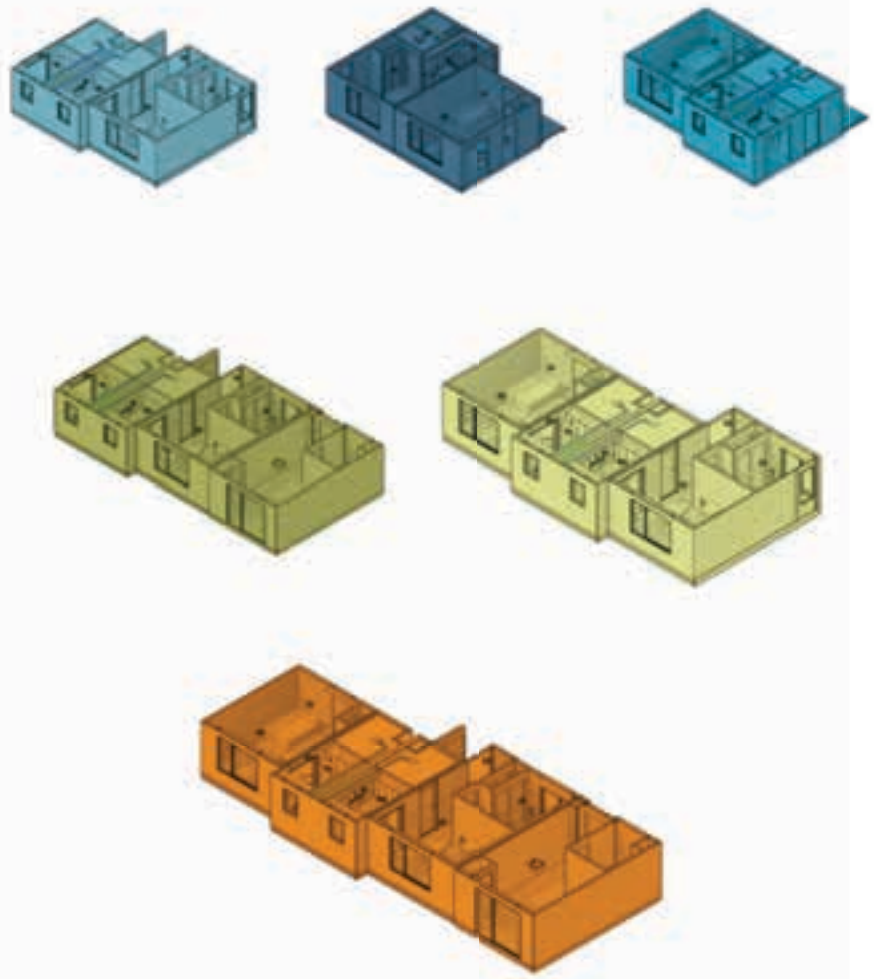
Smaller boxes eliminate need for panelized inside & outside corners

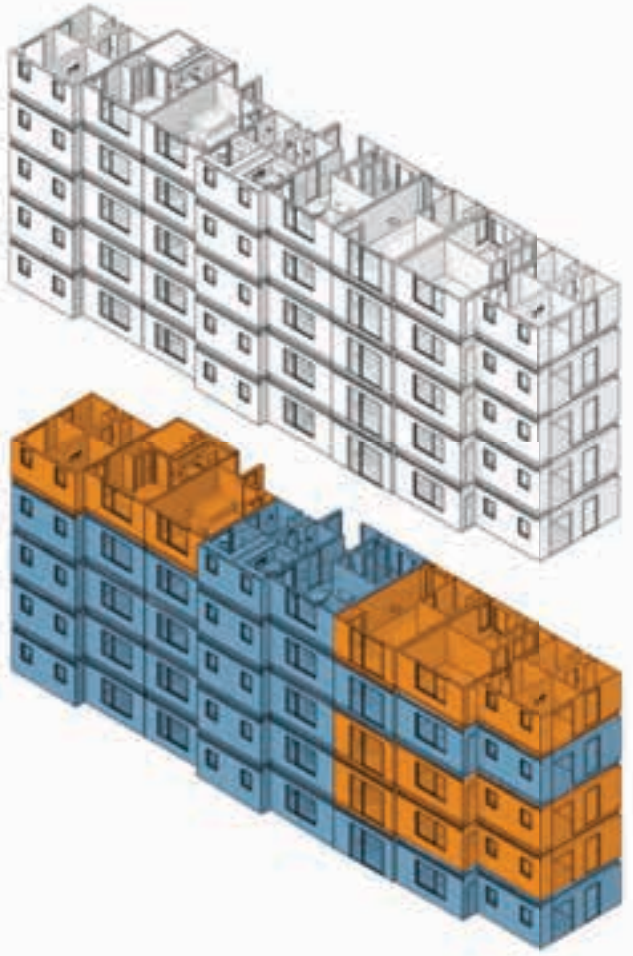


Design Concept: Architectural

Flexible Unit Configurations

- Assembling the kit of parts
- Mixing unit configurations
- Flexibility in design
- Consistency during the set





Design Concept: MEP

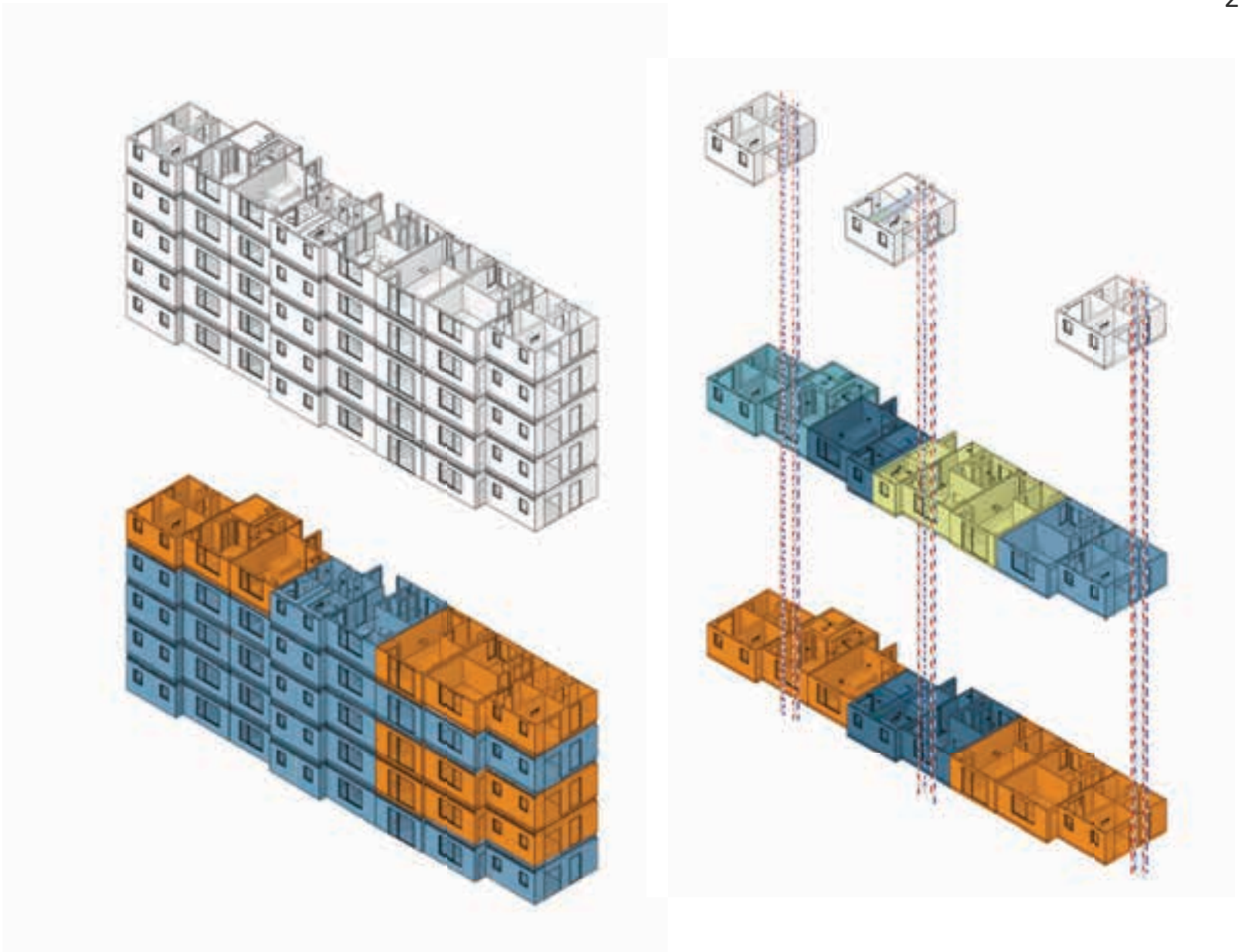
Unstacking the Units

Chases no shafts along hallways

A unit mix that is free from vertical stacking requirements

Align MEP services vertically

And horizontally



Modular Design:

It’s in the Details

How do the site trades coordinate and interact during the set?

Set sequence plan

Draft stop planning

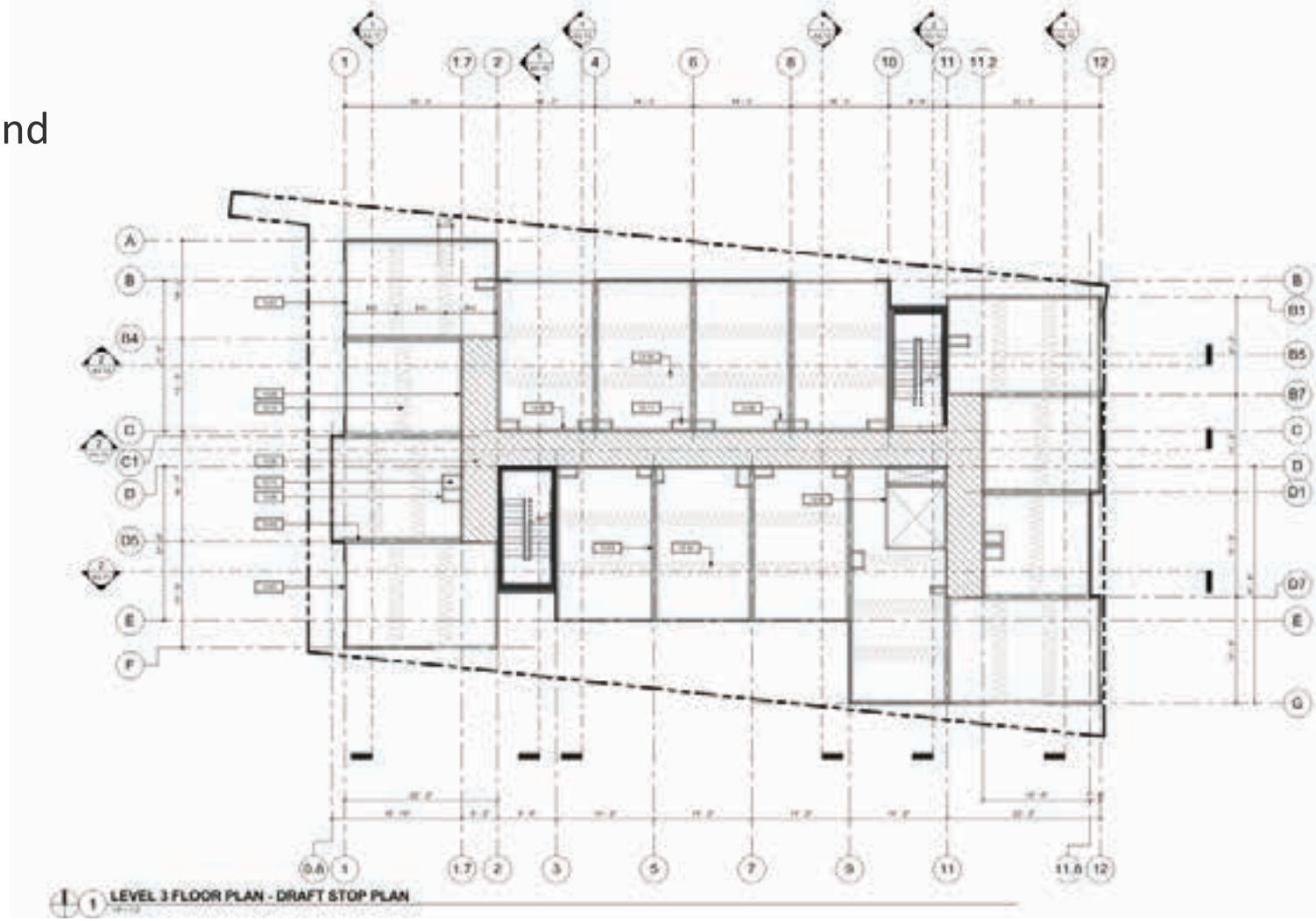
Inspections and AHJ coordination

Detailed set coordination planning

Staging site location

How many crane picks?

Stacking order, boom lock?



Modular Design:

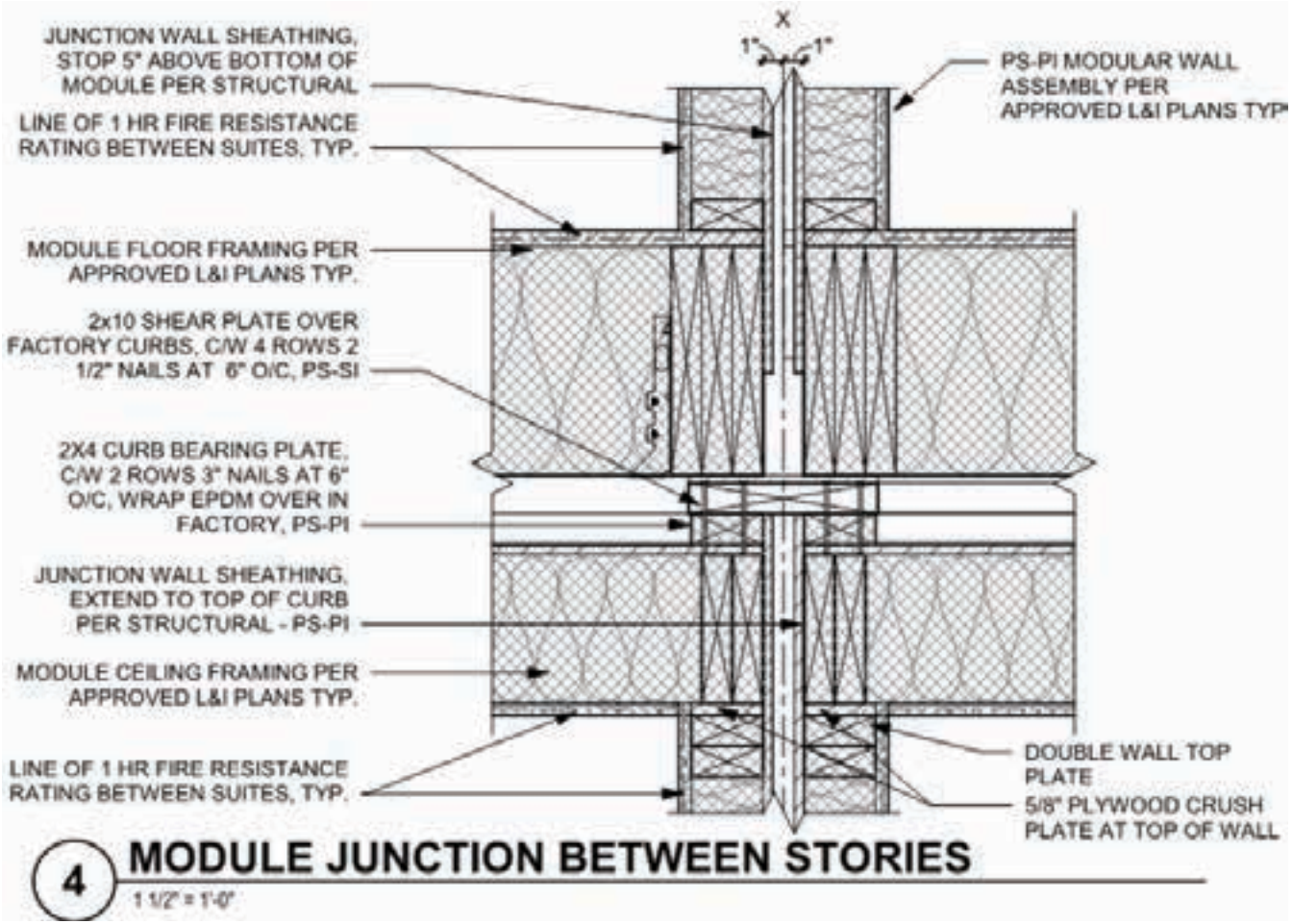
It’s in the Details

Adding the element of time to your details

Defining the scope of work for each component

Any inspections required, by who and when?

PS-PI	PLANT SUPPLIED - PLANT INSTALLED
PS-SI	PLANT SUPPLIED - SITE INSTALLED
SS-PI	SITE SUPPLIED - PLANT INSTALLED
SS-SI	SITE SUPPLIED - SITE INSTALLED
CS-SI	CLIENT SUPPLIED - SITE INSTALLED
CS-PI	CLIENT SUPPLIED - PLANT INSTALLED
CS-CI	CLIENT SUPPLIED - CLIENT INSTALLED
PLANT =	METRIC MODULAR
SITE =	GENERAL CONTRACTOR
CLIENT =	NEXGEN HOUSING



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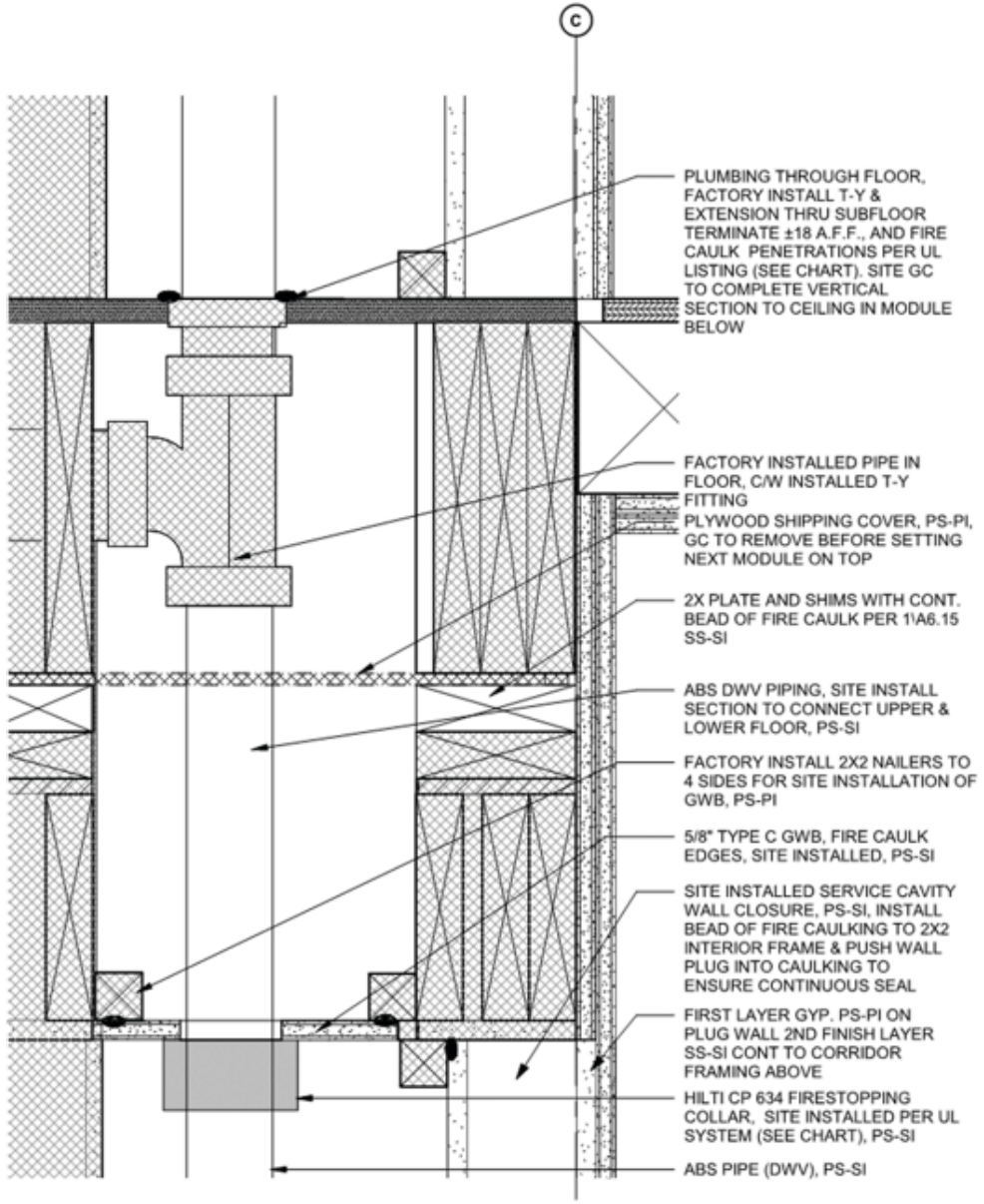

11 **RATED UTILITY CONNECTON BTWN FLOORS**

3" = 1'-0"

Modular Design:

It’s in the Details

- Corridors do all the hard work
- MEP coordination has to be done to BIM 400 level
- Balance factory work vs. site work
- Pay attention to fire membrane continuity
- Make your details <u>inspectable</u>

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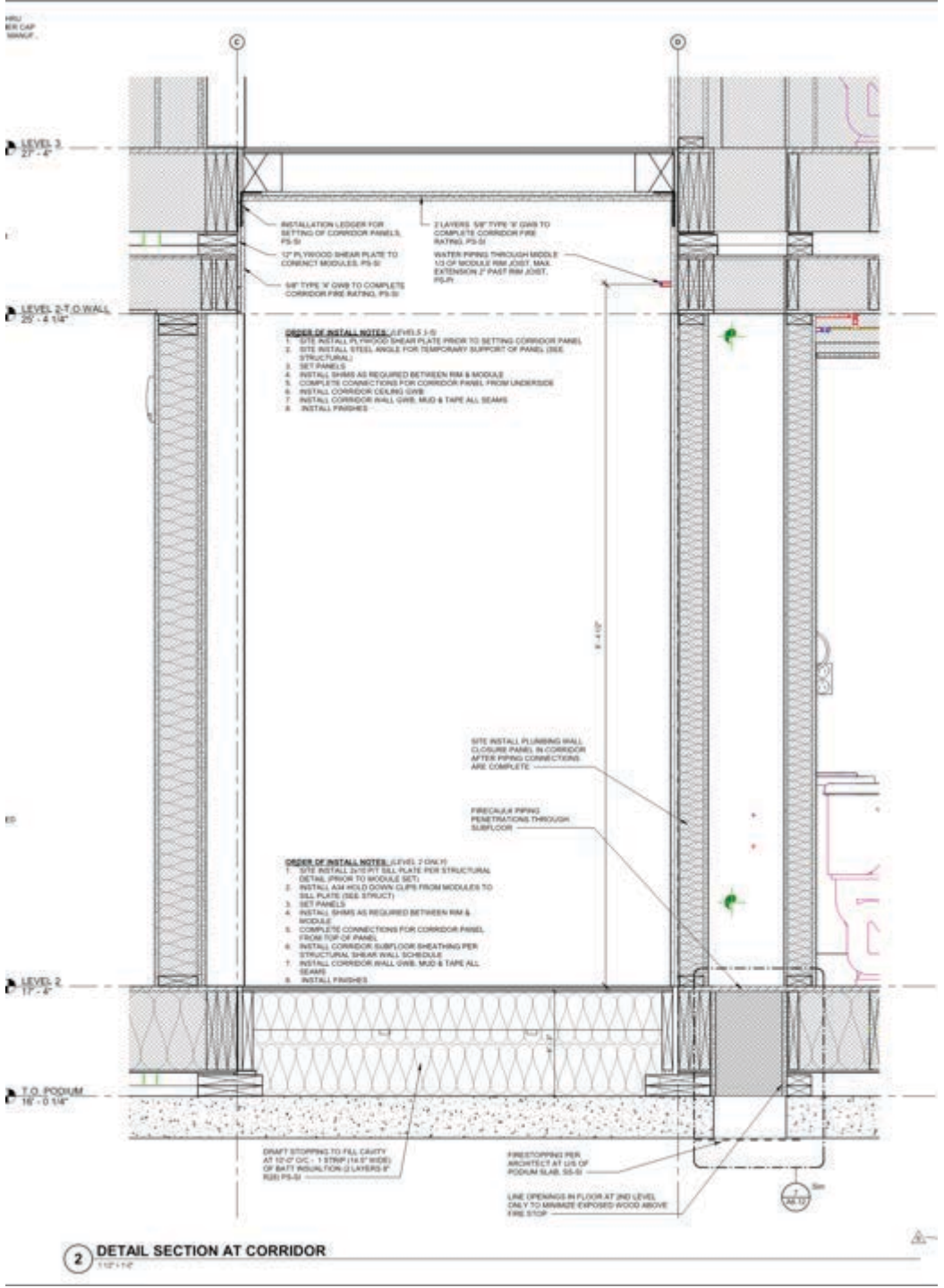

What's Next?

Creating the Recipe Book For Modular Construction

Future Proof

Climate change will have the largest
Impact on the built environment
In the next decade

Architecture 2030 Challenge and
Net zero buildings

Municipal coordination and outreach

Building inspector training

Skilled labor training in factory setting

Policy advocacy

Partnering

For the Future

Continued investment into product

Validation of concept through apartment development projects

Iterative improvement through ROI data

Future opportunities via licensing arrangements

Sharing the Knowledge of Investment

Open Source for the Design Community

“It’s not what you know that matters, it’s what You do when you don’t know.” -Unknown

Industry knowledge shared for Architects, Engineers & Owners

Diagrams, details and instructions for designing modular

Made available for everyone to help ensure success

Advocating for the use of modular

> Questions?

This concludes The American Institute of Architects
Continuing Education Systems Course

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