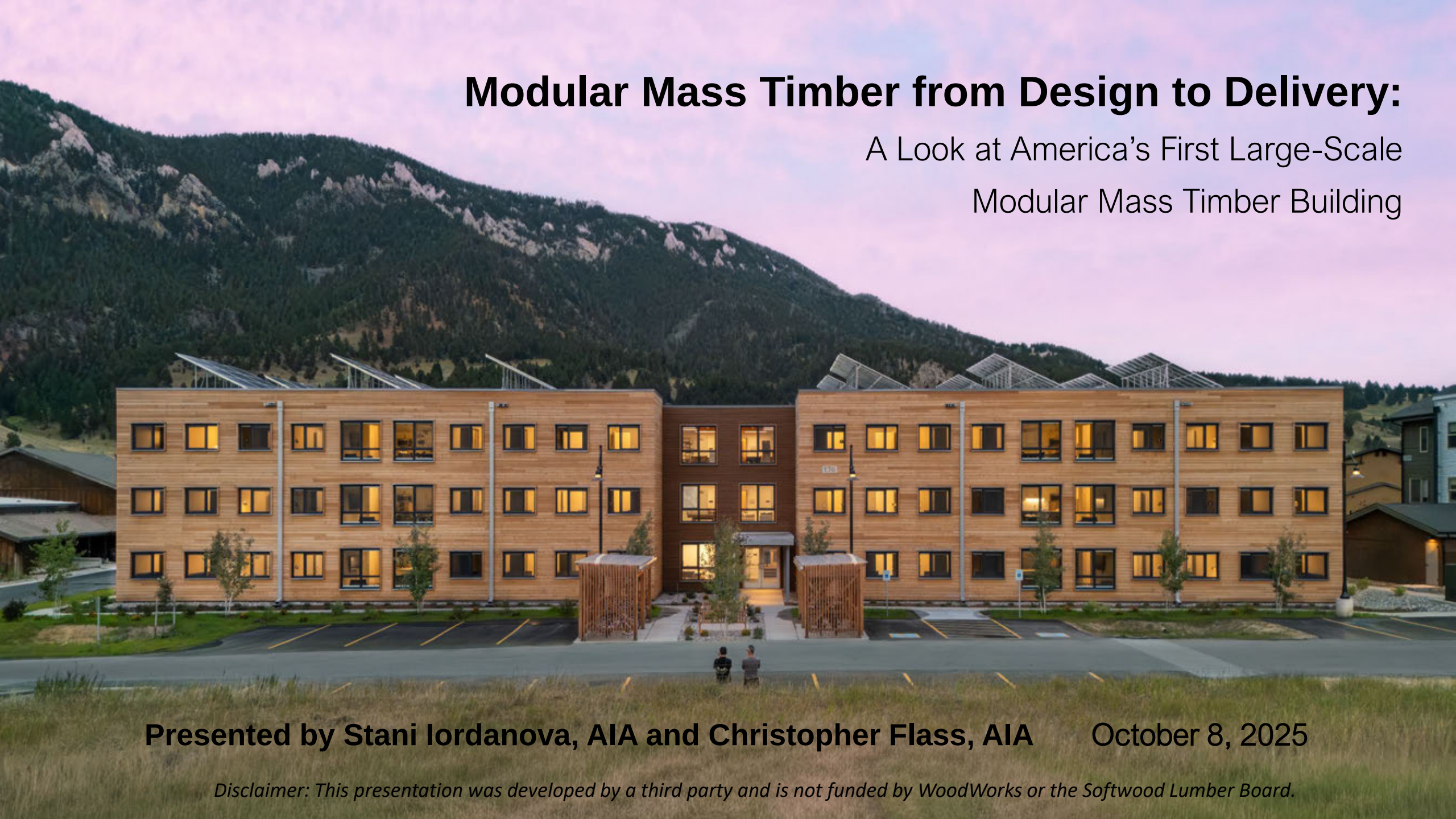


Modular Mass Timber from Design to Delivery:

A Look at America's First Large-Scale
Modular Mass Timber Building



Presented by Stani Iordanova, AIA and Christopher Flass, AIA October 8, 2025

Disclaimer: This presentation was developed by a third party and is not funded by WoodWorks or the Softwood Lumber Board.



INTEGRATED DESIGN CUBED

MODULAR MASS TIMBER

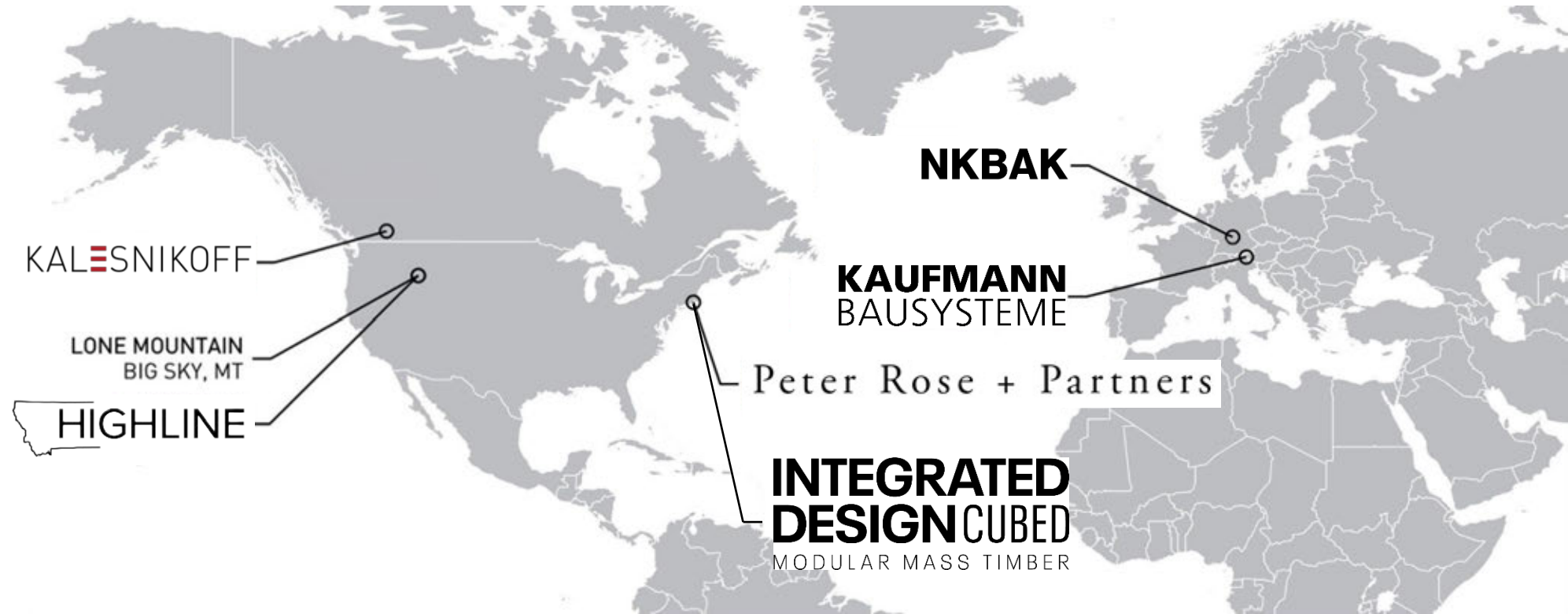
Building Design
Module Design
Timber Component Design
Other Component Design
Supply Chain Management
Module and Building Assembly Process Management





Knight Building

Fabrication Partners



WoodWorks | The Wood Products Council

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Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.



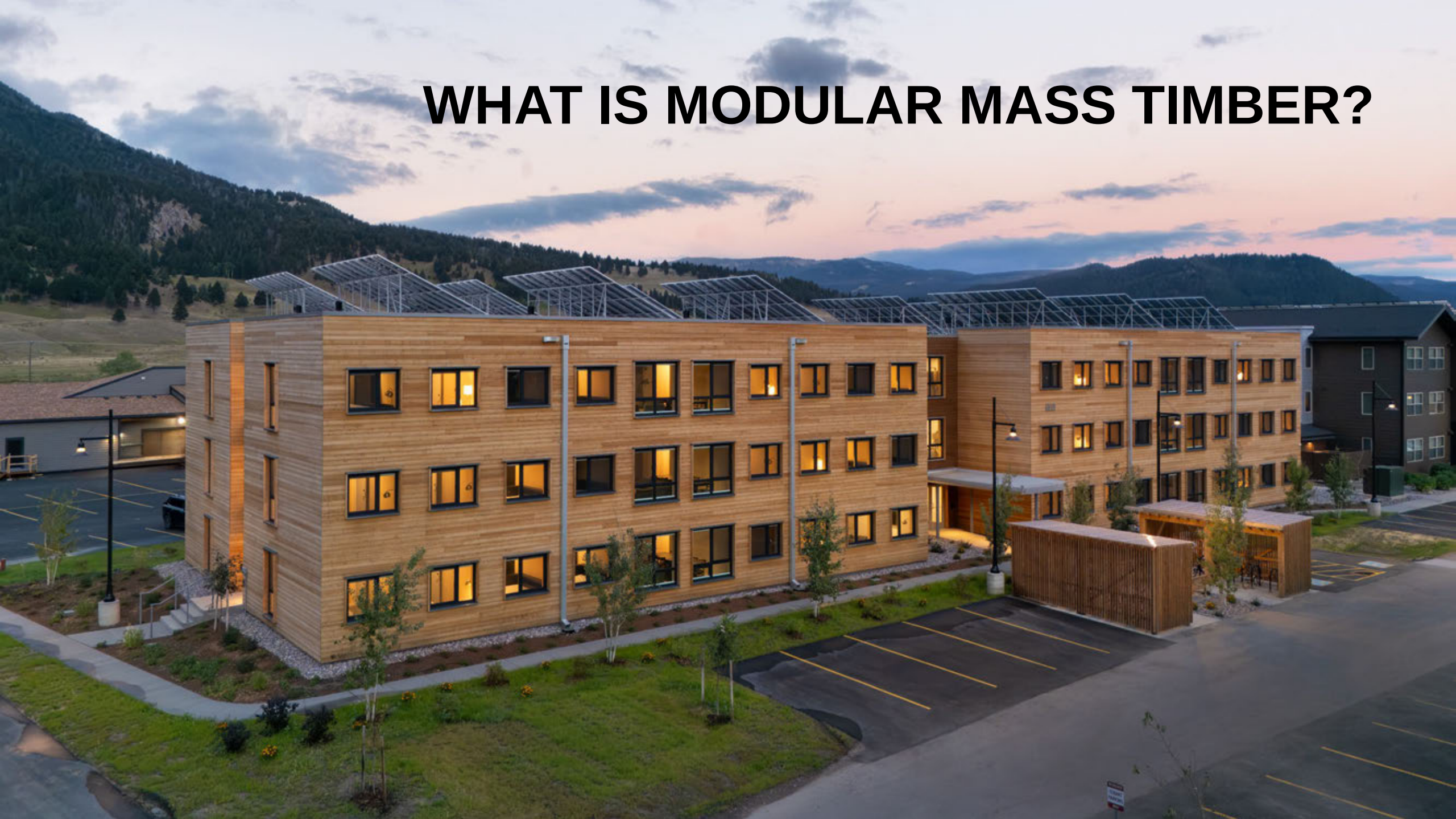
Course Description

This course will explore the use of mass timber modular construction in multi-family and mixed-use building types and showcase the recently completed Knight Building, the first large-scale modular mass timber building in the U.S. With over a decade of experience in mass timber modular construction in Europe, Integrated Design Cubed utilizes Virtual Design and Construction (VDC) and Building Information Modeling (BIM) tools to fully design and plan the finished building systems, including structural, mechanical, electrical, and plumbing systems. Discussion will include defining the roles and responsibilities of the modular facility compared to on-site labor, outlining schedule and cost benefits of modular mass timber, and exploring how Code required inspections can be achieved both in the factory and on-site.

Learning Objectives

1. Understand the role mass timber has within the modular construction sector.
2. Learn how modular mass timber construction can positively impact the cost and schedule of multi-family project types.
3. Understand the benefits of Virtual Design and Construction (VDC) and Building Information Modeling (BIM) on modular construction.
4. Assess the roles and responsibilities of labor within the offsite modular facility as compared to the onsite labor.

WHAT IS MODULAR MASS TIMBER?



WHAT IS MODULAR MASS TIMBER CLT + GLT



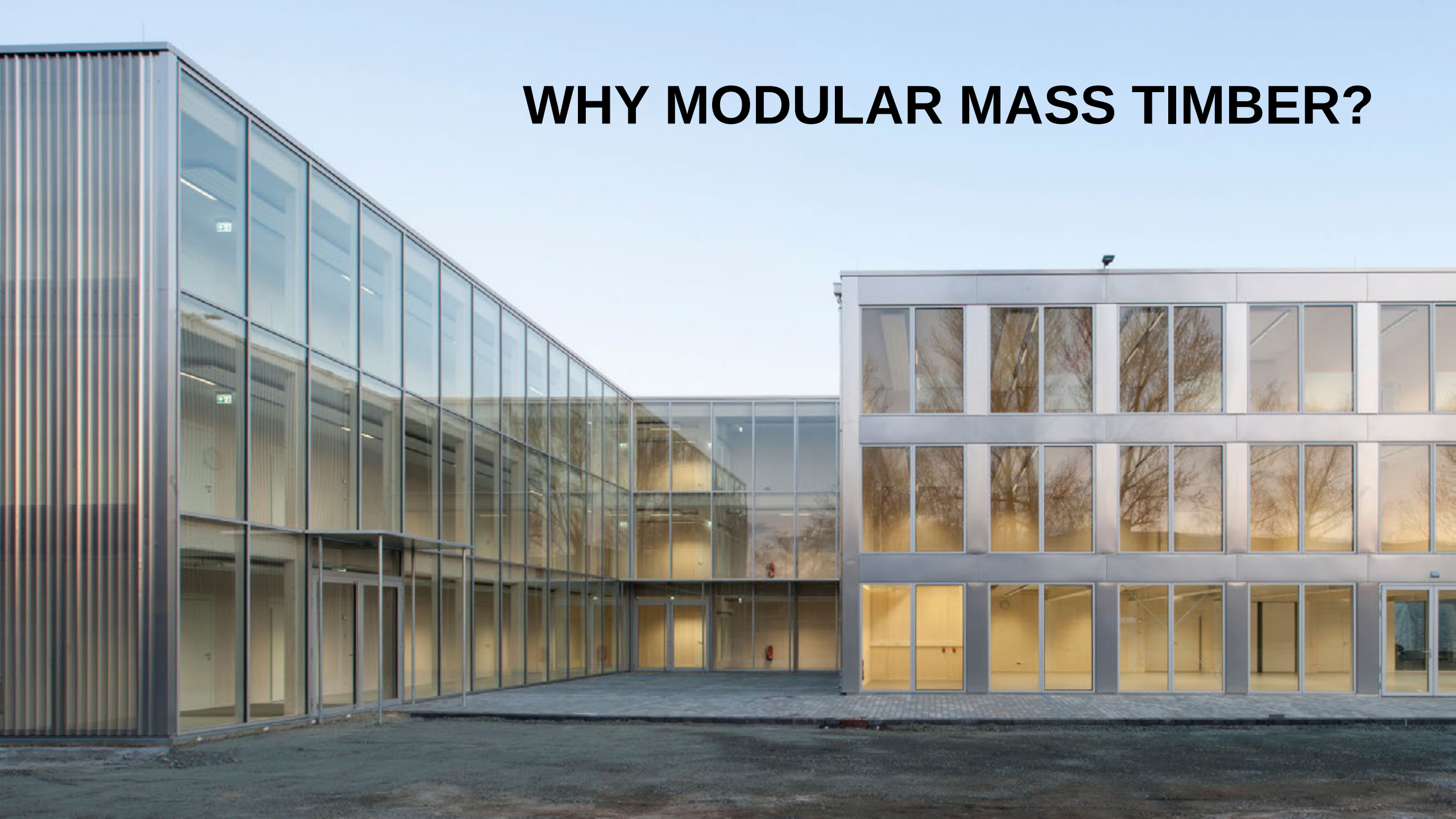
WHAT IS MODULAR MASS TIMBER Volumetric Modules



WHAT IS MODULAR MASS TIMBER Volumetric Modules



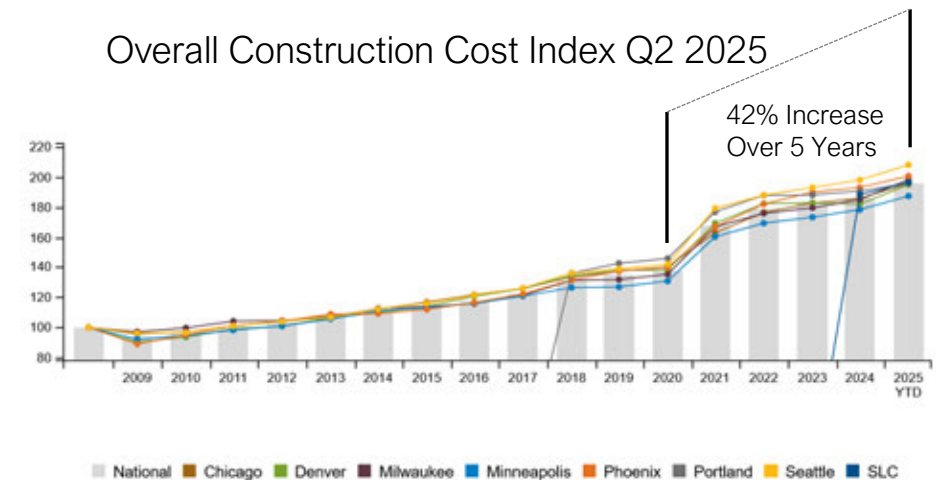
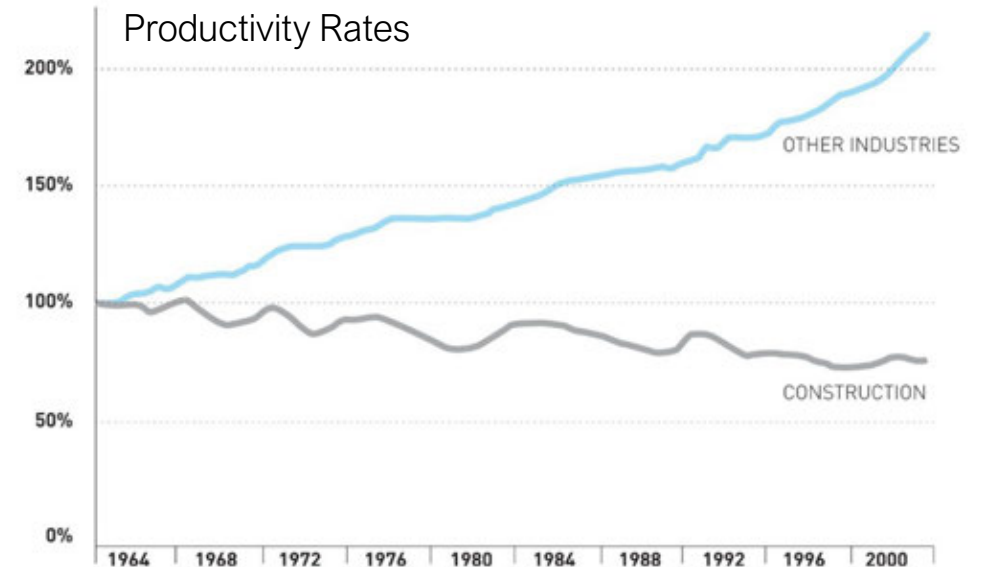
WHY MODULAR MASS TIMBER?



RESEARCH Into The Construction Industry

“The construction productivity rate ... has been flat since 1945... Over that period, sectors like agriculture, manufacturing and retail saw their productivity rates surge by as much as 1,500 percent.”

– New York Times, “Piece by Piece, A Factory-Made Answer for a Housing Squeeze,” 2018



Graph Credit: Mortenson 2025 Q2 Construction Cost Index

RESEARCH Into Other Industries



MATERIAL INNOVATION



PROCESS INNOVATION

WHAT WE LEARNED

1. **AN INTEGRATED TEAM** of designers, engineers, fabricators, and supply chain managers **SIMULTANEOUSLY DESIGNING THE PRODUCT AND THE FABRICATION PROCESS**
2. **INDUSTRIALIZATION** of the fabrication process, via:
 - MATERIAL INNOVATION** [mass timber]
 - PROCESS INNOVATION** [digital tools, robotic fabrication, subassemblies]

MODULAR MASS TIMBER SYSTEM in EUROPE Kaufmann Bausysteme and NKBAK



KAUFMANN
BAUSYSTEME and **NKBAK**



PROJECTS Frankfurt School



By KAUFMANN BAUSYSTEMME & NKBAK

of Modules: 98

Construction time: 7 months



PROJECTS Frankfurt and Berlin Schools



By KAUFMANN BAUSYSTEMME & NKBAK

of Modules: 256

Construction time: 11 months

By KAUFMANN BAUSYSTEMME & NKBAK

of Modules: 90

Construction time: 7 months



PROJECTS Degree of Finish in Assembly Hall



By KAUFMANN BAUSYSTEMME & NKBAK

Percent Complete: 95%



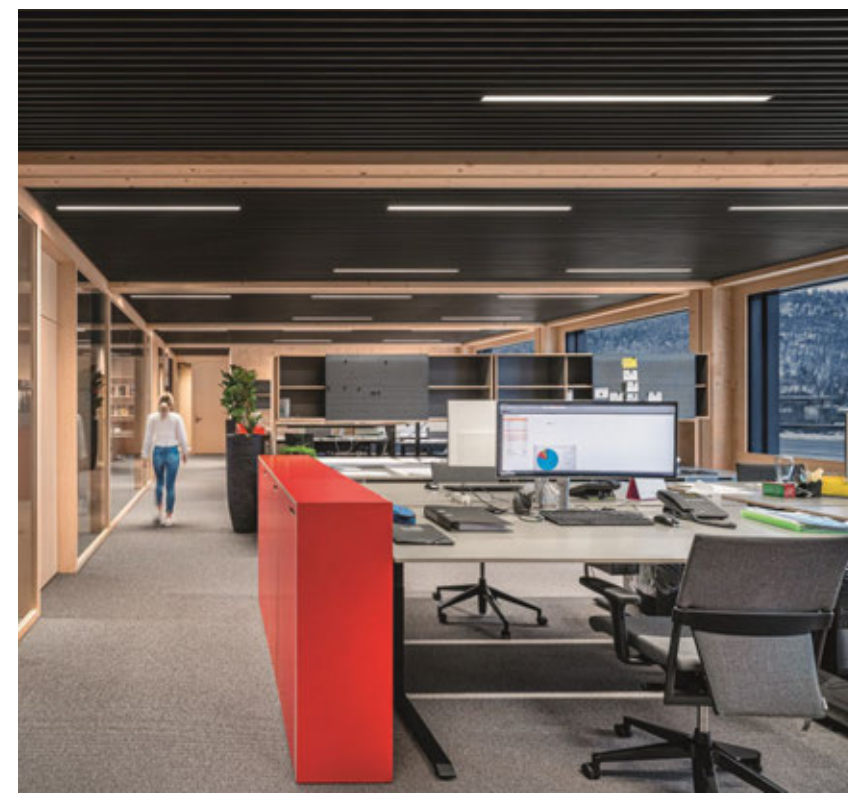
PROJECTS Kaufmann Bausysteme Offices



By KAUFMANN BAUSYSTEMME & Architects ARGE
NKBAK, JK&P, sps

of Modules: 32

Modules Installed in 1 day



PROJECTS Government Offices and Housing/Campus Buildings

**By KAUFMANN BAUSYSTEMME
& SAUERBRUCH HUTTON**

of Modules: 460

Construction Time: 15 months



**By KAUFMANN BAUSYSTEMME
& SAUERBRUCH HUTTON**

of Modules: 1000

PROJECTS Assembly Halls



Image Credit: Kaufmann Bausysteme

PROJECTS Site Installation



Image Credit: Kaufmann Bausysteme

WHY MODULAR MASS TIMBER Fewer, More Precise Parts / Drastically Less Labor/Time



CLT

1 part per wall

minimized labor / reduced complexity

hyper precise

high strength / rigidity

high level of finish

flexible design

WHY MODULAR MASS TIMBER Simple Assembly



WHY MODULAR MASS TIMBER Simple Assembly



WHY MODULAR MASS TIMBER Simple Assembly



WHY MODULAR MASS TIMBER Simple Assembly



WHY MODULAR MASS TIMBER Simple Assembly



WHY MODULAR MASS TIMBER Simple Assembly



WHY MODULAR MASS TIMBER Precision

CNC formatting available from a range of suppliers

Extremely tight and repeatable tolerances

CLT formatting acts as an inherent set of instructions for further work simplifying assembly

Increased precision allows for efficient and seamless onsite assembly.



WHY MODULAR MASS TIMBER Increased Structural Capacity

Greater strength and stiffness

Boxes allow for large areas of diaphragms

Reduce or eliminate the need for other structure

Dimensional stability

Shipping and installation ease and reduced risks



WHY MODULAR MASS TIMBER Increased Design Flexibility



Image Credit: Kaufmann Bausysteme

WHY MODULAR MASS TIMBER Finish

CLT can be a finish material - reduced need for additional finish materials and associated labor and costs

Due to increased structural rigidity, a number of finishes are possible, which may not be in other modular construction types – reduced risk in shipping and module install damage.



MORE IS LESS

1m³ timber stores 1 ton CO₂



3,8m³

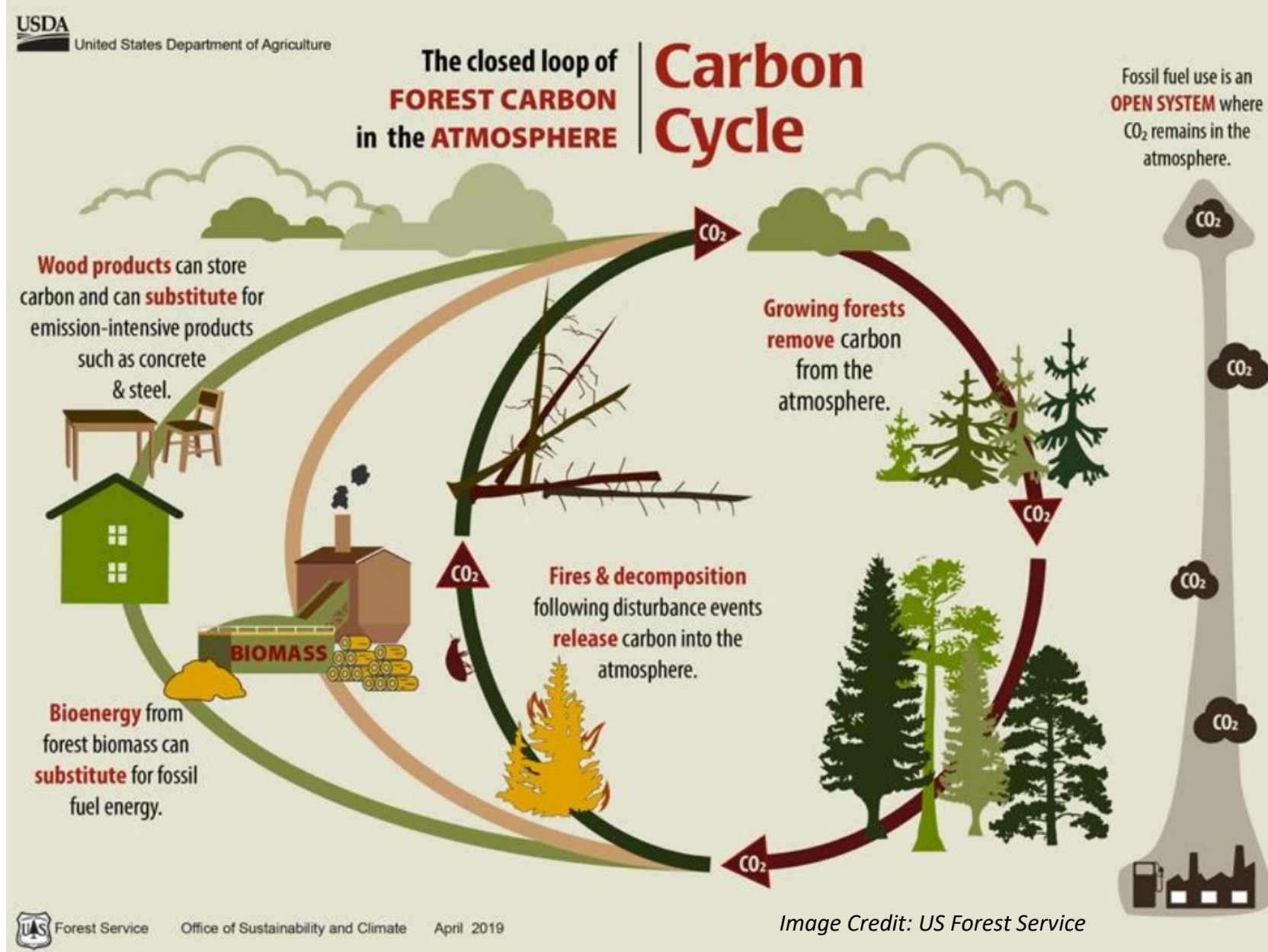
WHY MODULAR MASS TIMBER Climate Impacts

Carbon Storage -
sequestration for life of
building and potential for
re-use

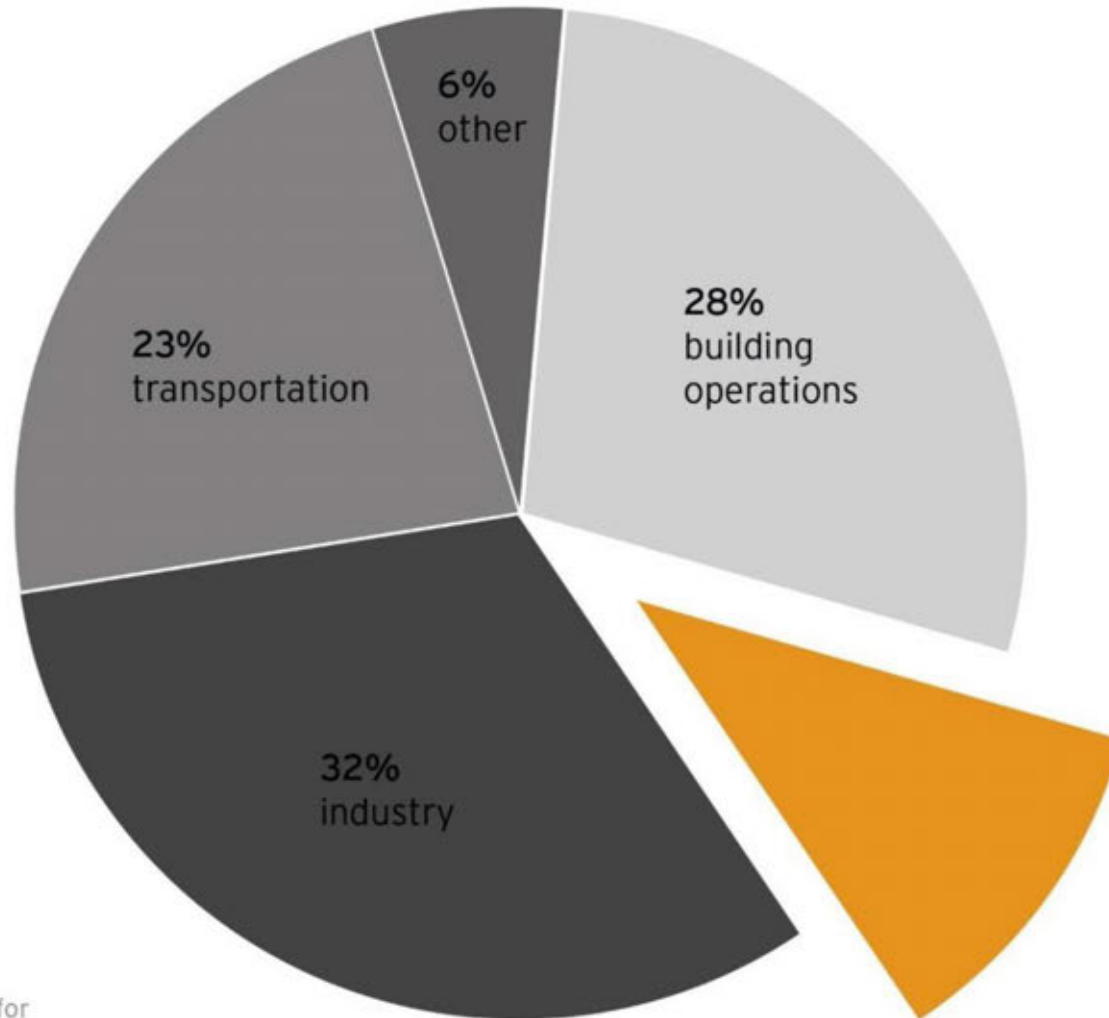
Renewable resource and
efficient use of wood

Modular construction
significantly reduces
waste

High performing building
envelopes



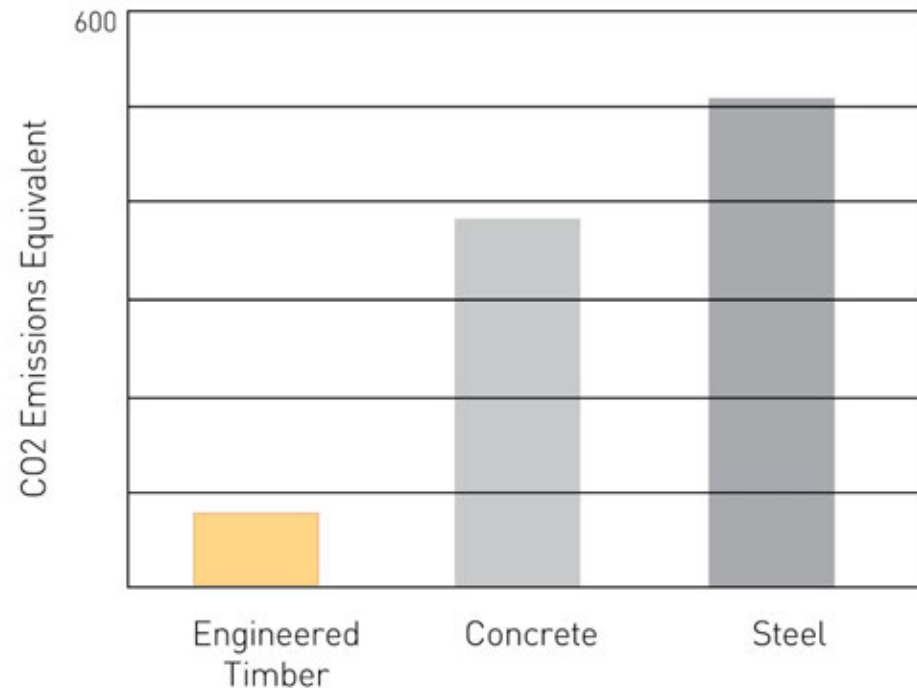
WHY MODULAR MASS TIMBER Climate Impacts



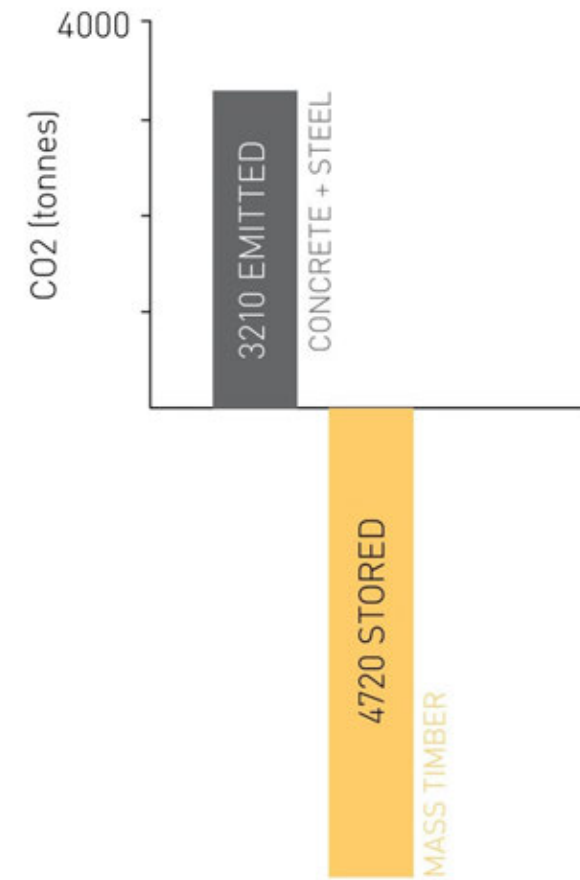
The building industry generates nearly **40%** of annual global GHG emissions.

11%
building materials
& construction
(core and shell)

WHY MODULAR MASS TIMBER Climate Impacts



Source: Passive House



Source: timbercity.org

WHY MODULAR MASS TIMBER Scalable



KAUFMANN BAUSYSTEME,
in 2024:

3,200 modules produced and set
750,000 sf of buildings completed
no factory



Image Credit: Sauerbruch Hutton

MODULAR MASS TIMBER

WHAT IT TAKES



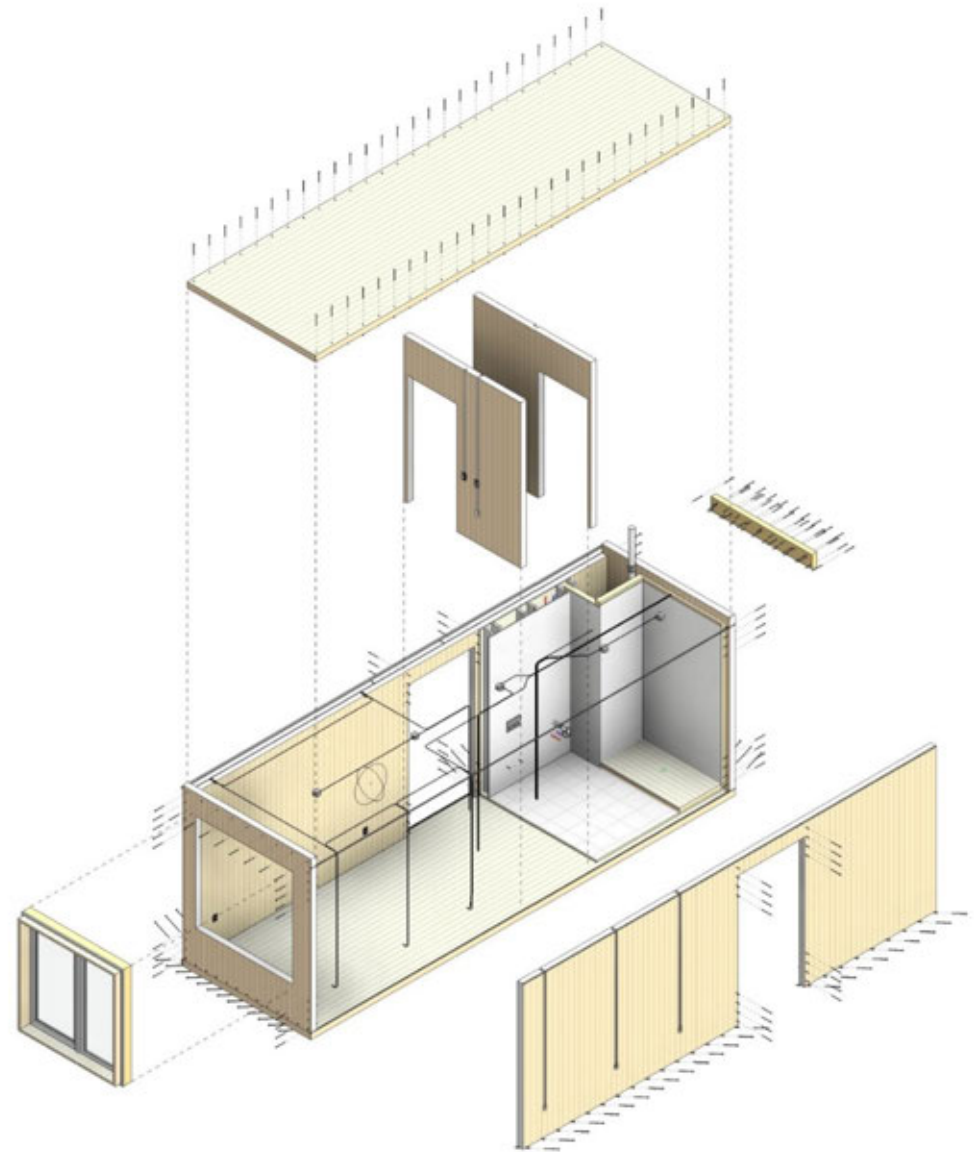
WHAT IT TAKES An Integrated Team and Process

Early Multi-Disciplinary
Coordination

Concurrent Design/Engineering

Alignment of Design, Fabrication,
and Construction from the start

Shared goals



WHAT IT TAKES An Integrated Process

1. DESIGN OF EVERYTHING

Building
Module
Timber Component
Other Component
Supply Chain Management
Assembly Process

2. MODULE ASSEMBLY

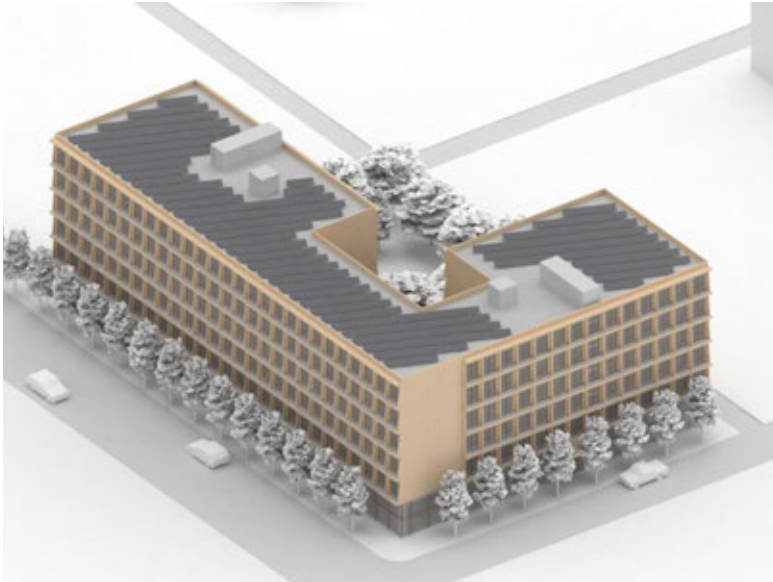
Assembly line production
Quality assurance
Just in time delivery

3. BUILDING ASSEMBLY

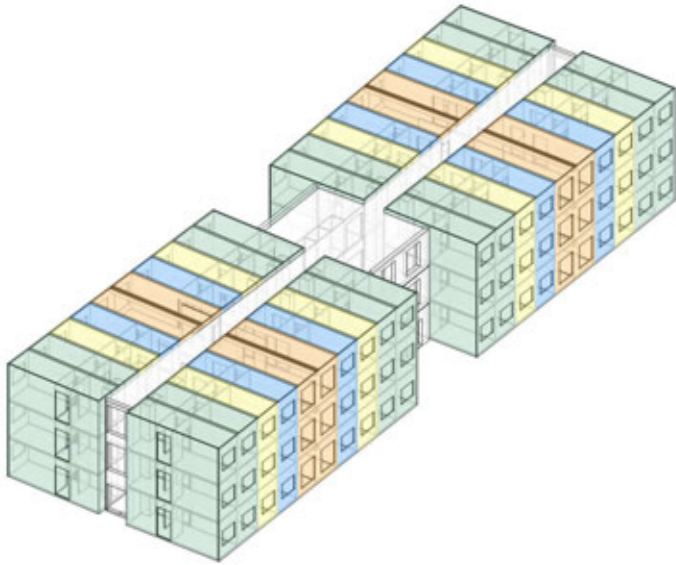
High quality
Shorter on-site construction time
Earlier ROI



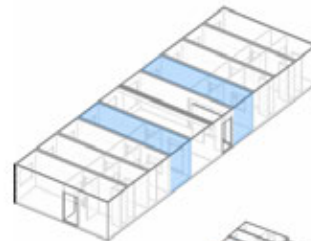
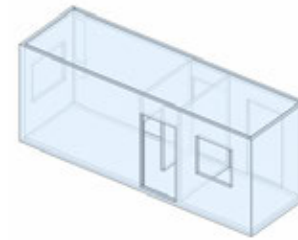
WHAT IT TAKES An Integrated Process: Building Design



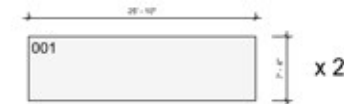
WHAT IT TAKES An Integrated Process: Module Design



MODULE C : Bedroom + Pantry/Mudroom



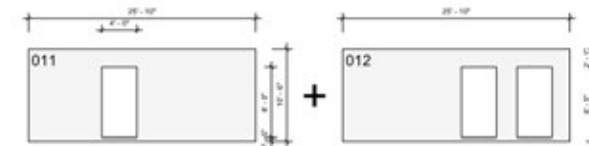
**FLOOR/
CEILING**
3 lam / 0.3" thick



m³

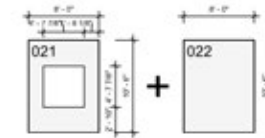
3.2

**LONG
WALLS**
3 lam / 0.3" thick



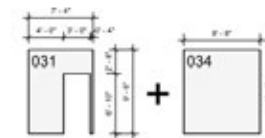
4.6

**END
WALLS**
4 lam / 0.4" thick



1.9

**INTERIOR
WALLS**
3 lam / 0.3" thick

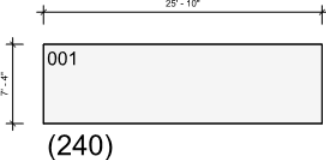
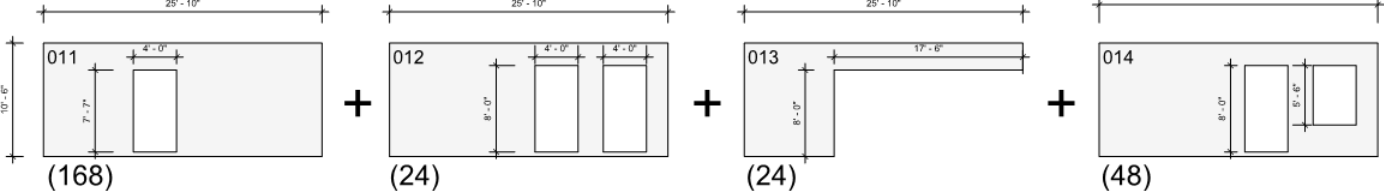
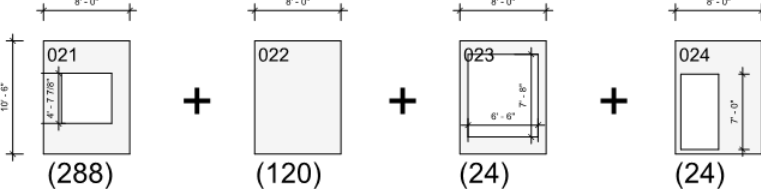
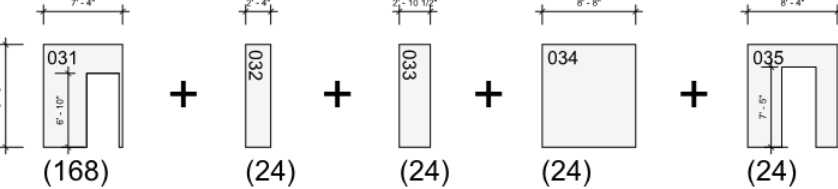


1.29

total 11.02 m³

WHAT IT TAKES An Integrated Process: Timber Component Design

Incorporates the shop drawing and coordination process across multiple trades

		qty.
FLOOR/ CEILING 3 lam / 0.3" thick		240
LONG WALLS 3 lam / 0.3" thick		216
END WALLS 4 lam / 0.4" thick		432
INTERIOR WALLS 3 lam / 0.3" thick		240
total components		1,128
total component types		14

WHAT IT TAKES An Integrated Process: Other Component Design

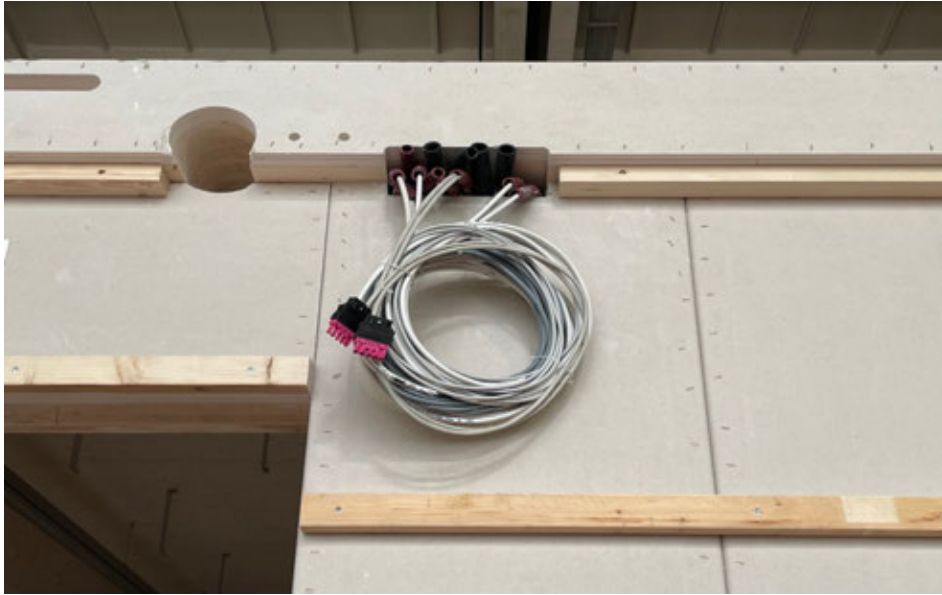
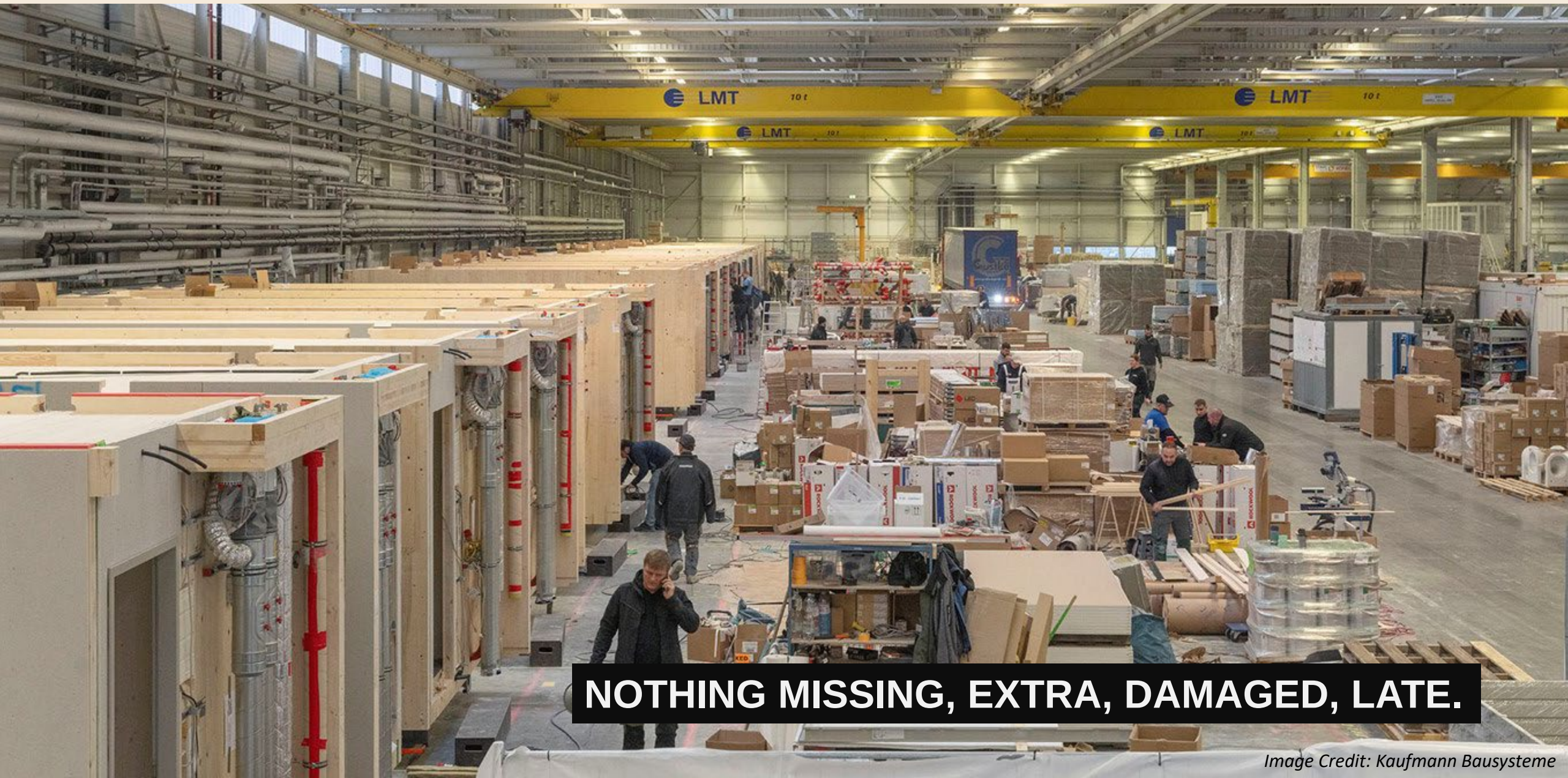


Image Credit: Kaufmann Bausysteme

WHAT IT TAKES An Integrated Process: Supply Chain Management



NOTHING MISSING, EXTRA, DAMAGED, LATE.

WHAT IT TAKES An Integrated Process: Assembly Process Management



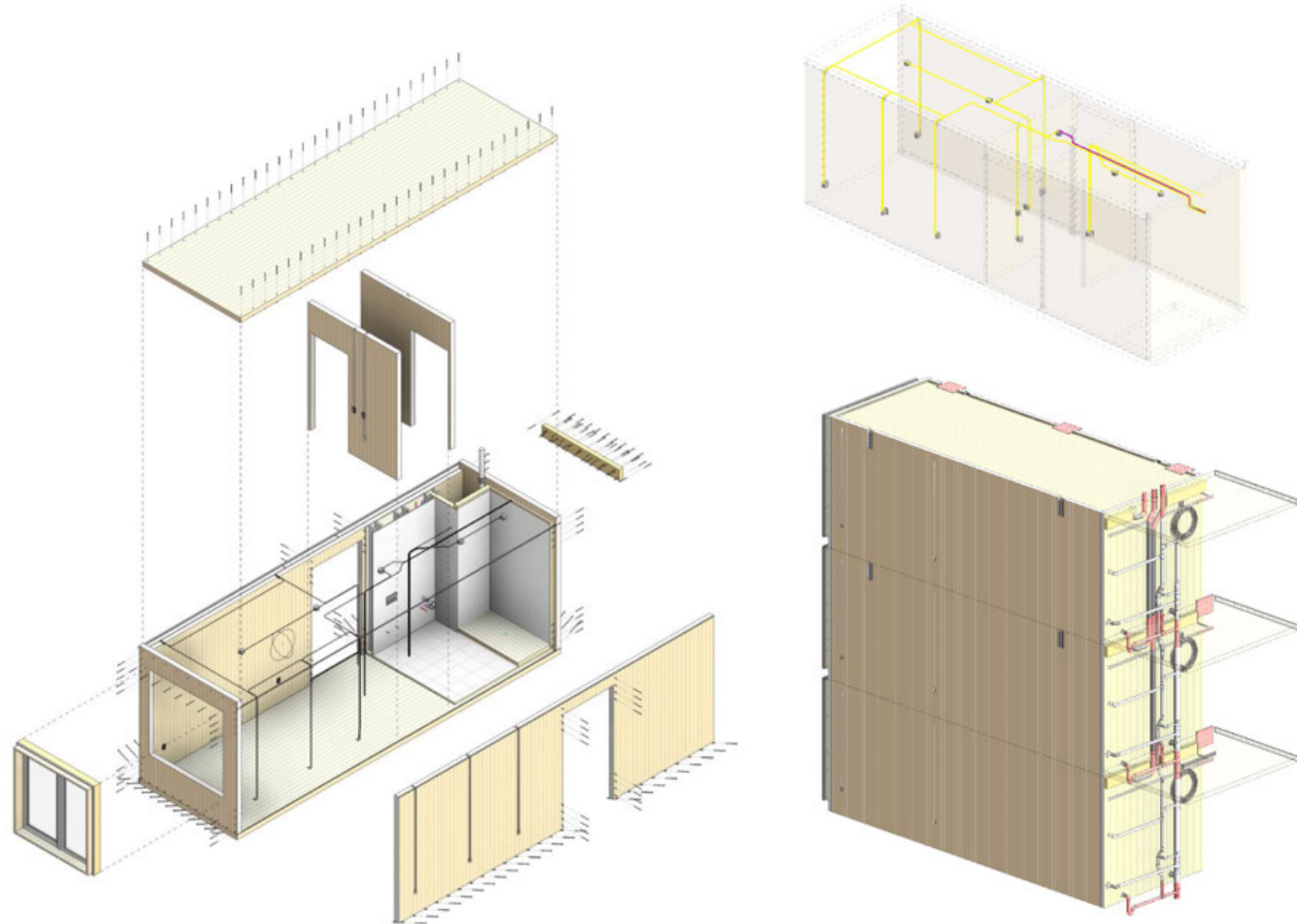
**SOFTWARE
PLATFORM**

WHAT IT TAKES Digital Twin – VDC/BIM Tools

A live working tool as a shared reference for all team members

Basis to assembly hall workflow and supply chain management

Ensures seamless interface between modules and systems on site



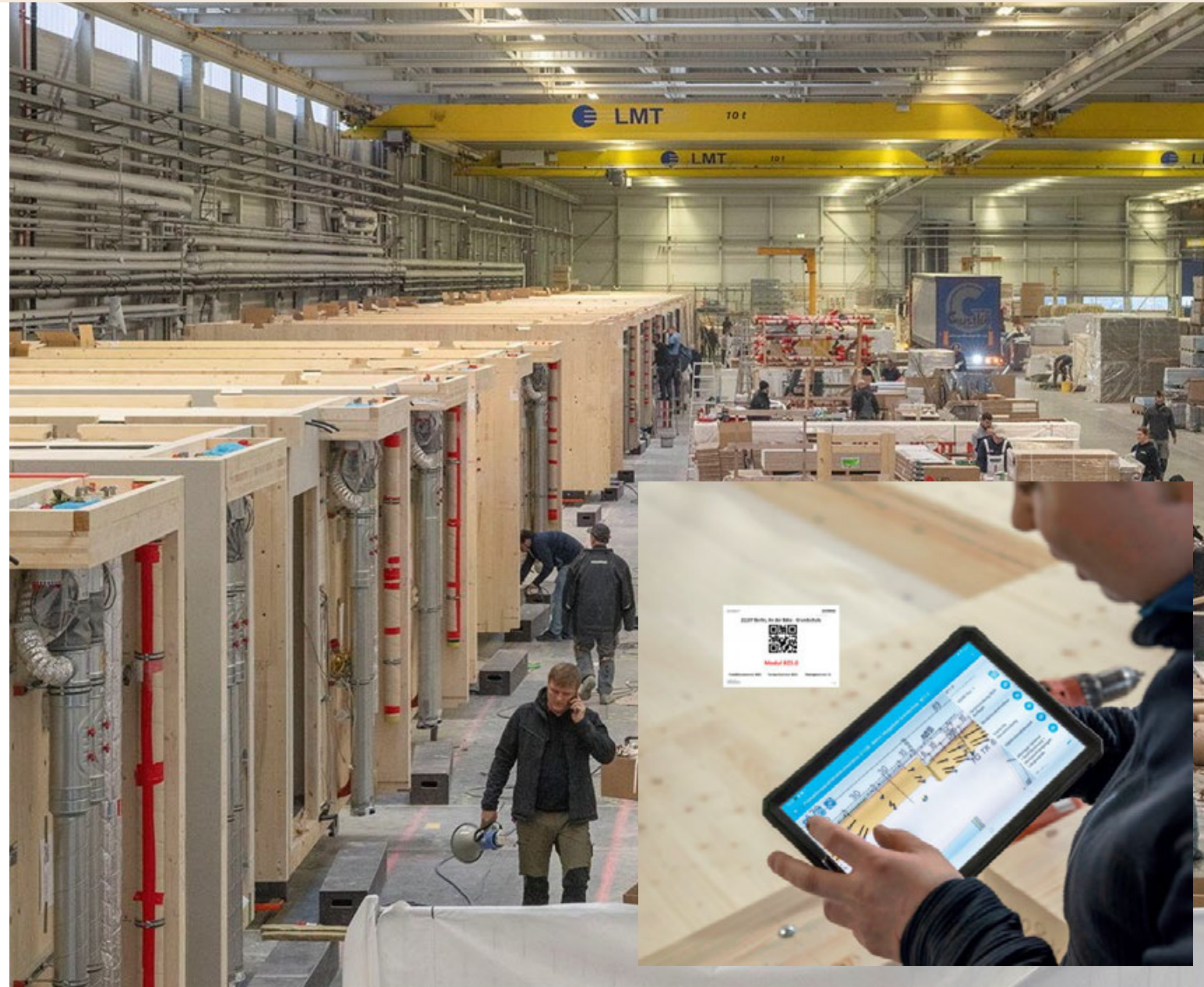
WHAT IT TAKES Digital Twin – VDC/BIM Tools

Digital twin is used as the base in construction management software that runs the assembly process.

Manage Supply Chains

Manage Quality Assurance Process

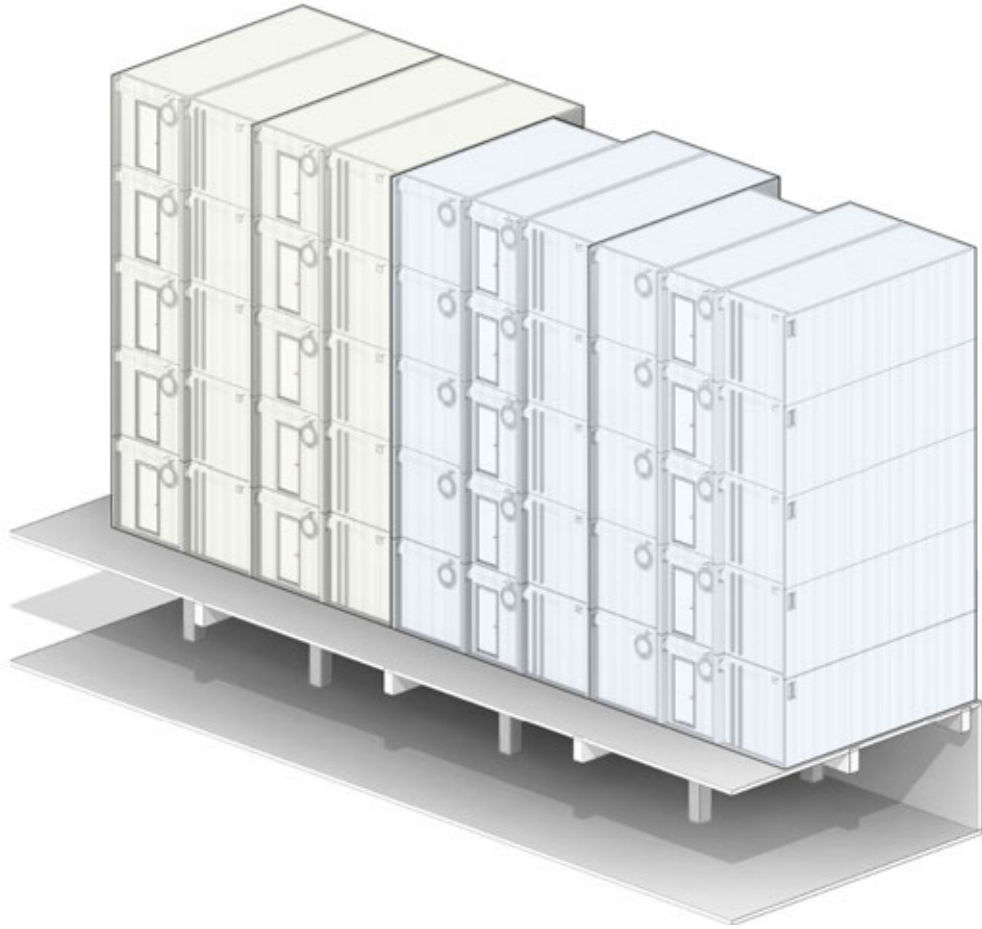
Monitor Progress and Schedules



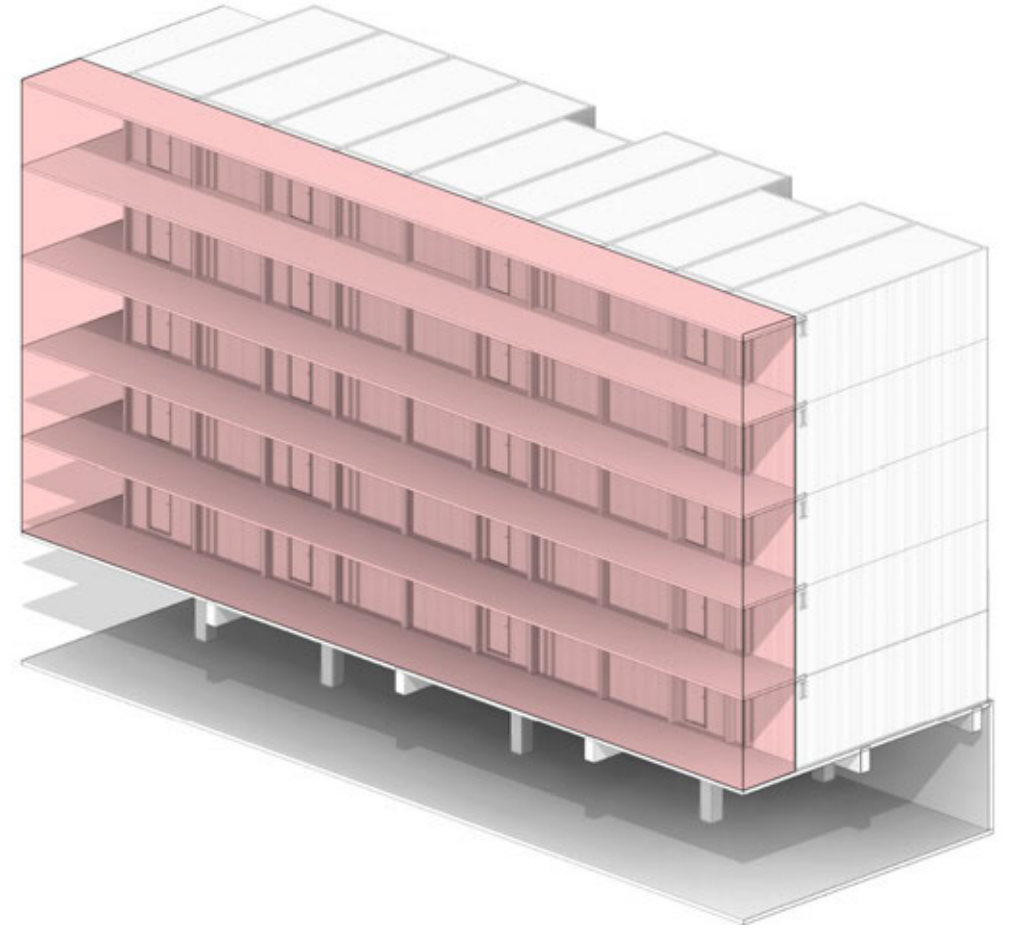
WHAT IT TAKES Off-site vs On-site Labor



WHAT IT TAKES Off-site vs On-site Labor



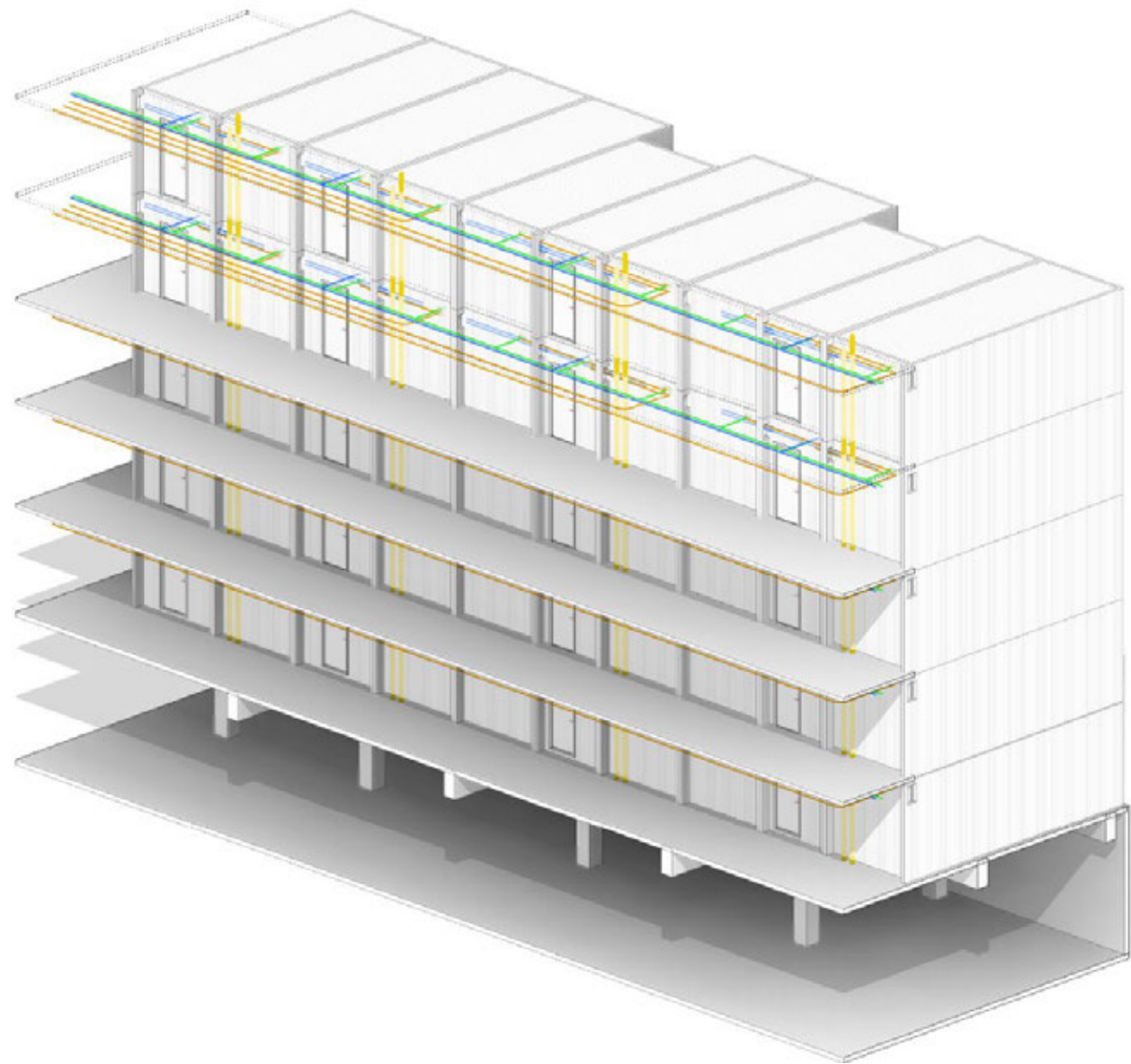
Modules – delivered and set on site



Corridors – built on site

WHAT IT TAKES Off-site vs On-site Labor

All systems infrastructure connections are made on site in corridors

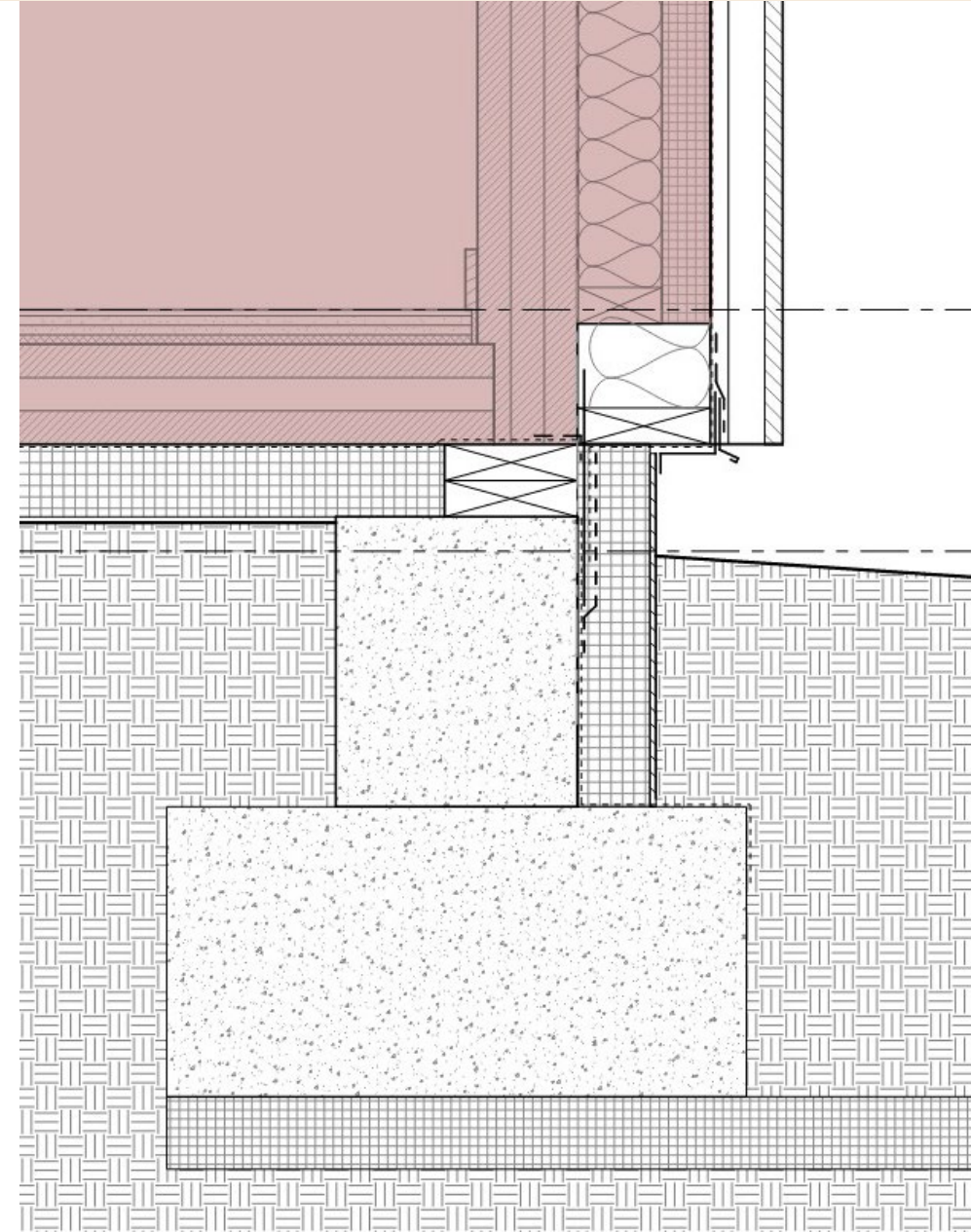


WHAT IT TAKES Off-site vs On-site Labor

Flexibility in contractual delivery but a fully integrated team as early as possible is key

Relatively local assembly hall if possible

Clear delineation of work/scope from the beginning of project



WHAT IT TAKES Off-site vs On-site Labor

Use same subs for off-site and on-site labor, if possible

Ultimately on-site team is responsible for building turnover but off-site team needs contractual responsibility for on-site follow up, if needed.





MODULAR MASS TIMBER

COSTS and SCHEDULE

CONSIDERATIONS

COST and SCHEDULE IMPACTS Improved Timelines

Time = Money Schedule reductions of 30% - 50%

Early integrated planning

Modular fabrication overlaps with site work

Highly controlled and monitored assembly halls – improves quality control and efficiency

Meticulous supply chain and logistics management with integrated software planning, logistics, and monitoring

Significant waste reduction

Reduced total labor – both on-site and in assembly hall

Scalability and associated economies of scale for large repetitive projects

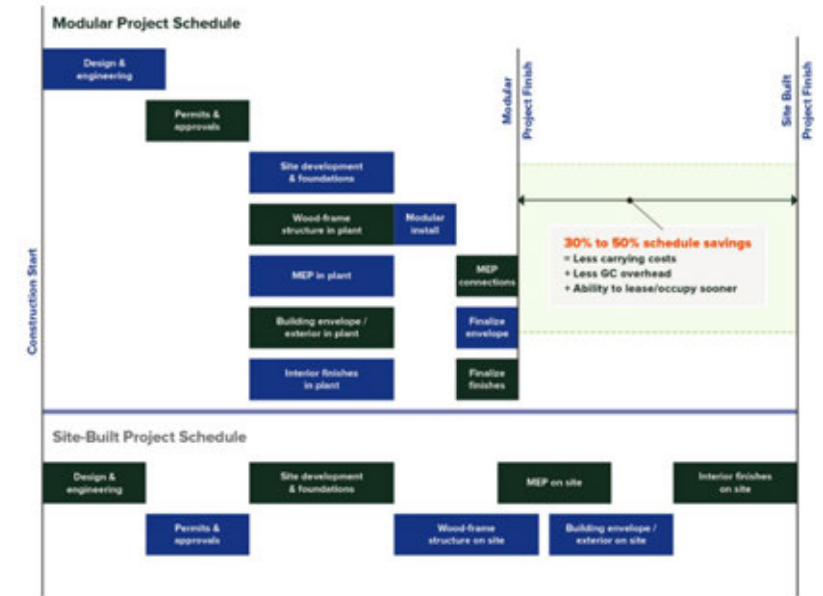
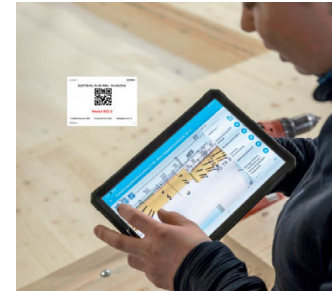


Image Credit: WoodWorks



In construction risks always carry a price

Integrated team is key in alleviating risk premiums

Reduce or remove risk premiums in bids

Provide comfortable and safe working conditions

Plan regulatory compliance early

Reduced environmental risks (weather and climate impacts)

COST and SCHEDULE IMPACTS Long-term Cost Benefits of High-Quality Buildings

Direct financial savings to owners

Reduced Change orders
Reduced Schedule overruns
Reduced Litigation

Operation and Life Cycle Savings

Decreased maintenance
Decreased water and energy use
Longer-term building life cycles

Human and business impacts

Increased occupant productivity and health
Better brand and reputational image
Increased market values

Environmental and social impacts

Reduced carbon footprint
Significant waste reductions
Positive community impacts

COST and SCHEDULE IMPACTS Project Specific Considerations



Short construction windows due to climate

Remote locations

Reduced local labor availability

Constrained sites

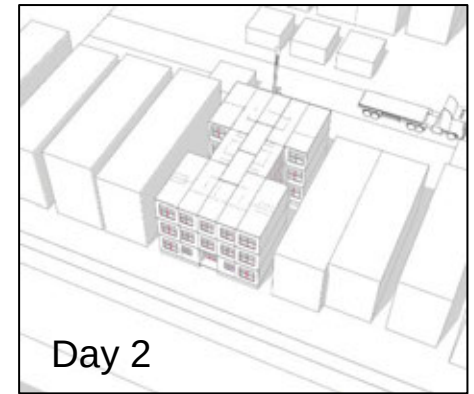


COST and SCHEDULE IMPACTS Long-term Cost Benefits of High-Quality Buildings

Changing the Narrative **Quality, Cost, and Schedule**



Projects Chicago and Detroit



Day 2



KNIGHT BUILDING

Big Sky, MT

**First modular mass timber building
in the United States**

Affordable, workforce housing for 96
employees

31,000 GSF

Delivered **on time**

11 months on-site construction

Under budget

Sustainable, all electric, solar array

Stores 1,200 tons of carbon

KNIGHT BUILDING Big Sky, MT



TEAM

Modular Mass Timber Design and Project Delivery: IDCUBED

Architects: Peter Rose + Partners & NKBAK

Strategic Partner: Kaufmann Bausysteme

Module Assembly: Kalesnikoff

Site Assembly/Contractor: Highline Partners

Structural Engineer: RSE Associates, Inc.

MEP: Energy-1

Fire Protection: Coffman Engineers

Landscape: Brightview

Mass Timber Supplier: Kalesnikoff

Owner: Lone Mountain Land Company

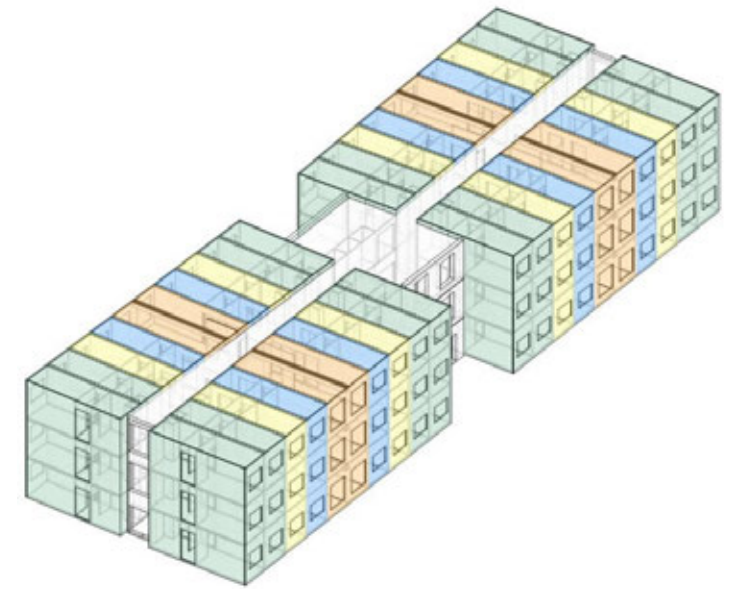
Photography: Chuck Choi

KNIGHT BUILDING Big Sky, MT



Image Credit: Kalesnikoff

KNIGHT BUILDING Big Sky, MT

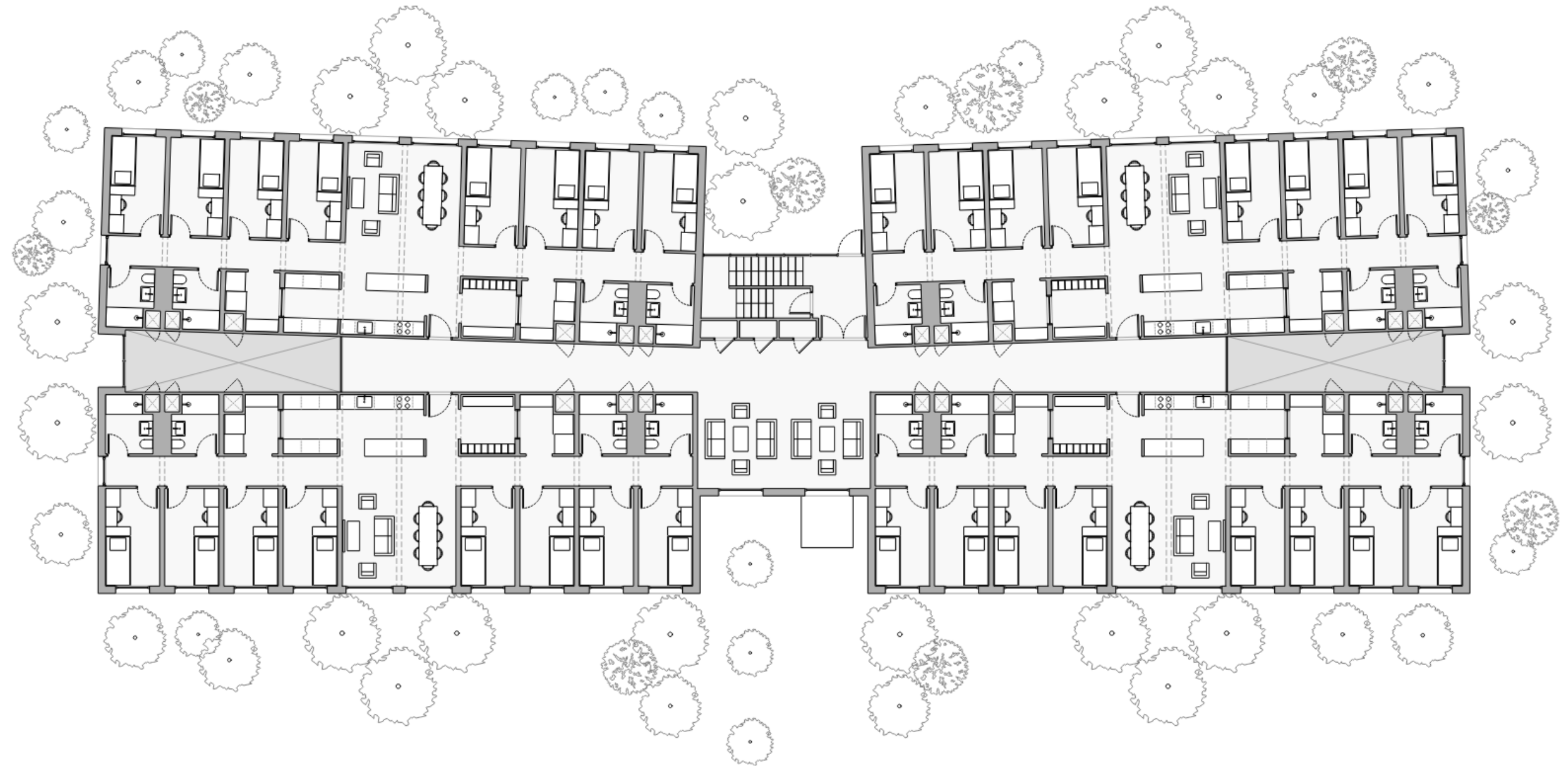


12 units / 96 occupants
(8 bedrooms per unit)

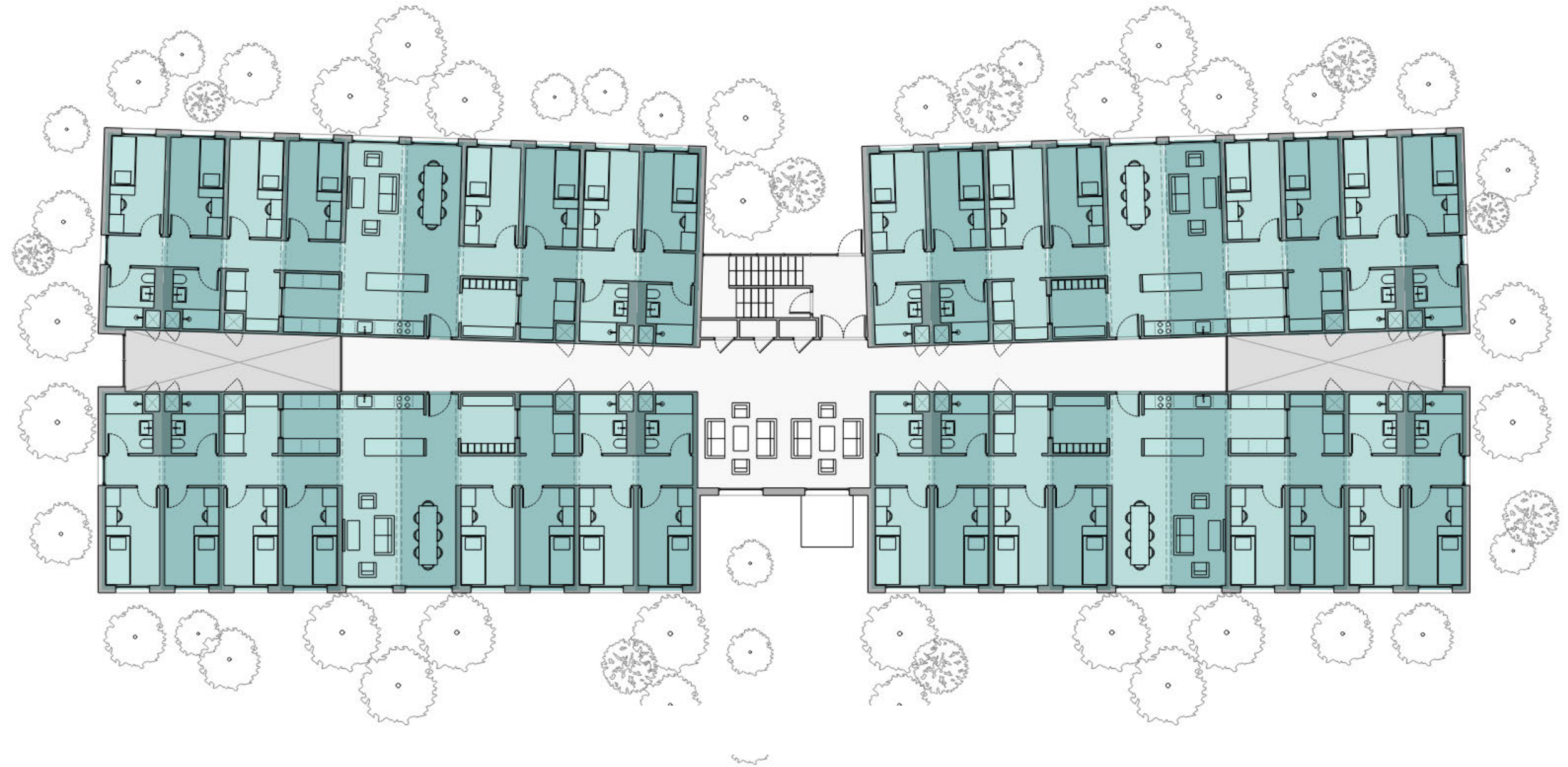
120 modules

Set at a max rate of 20/day

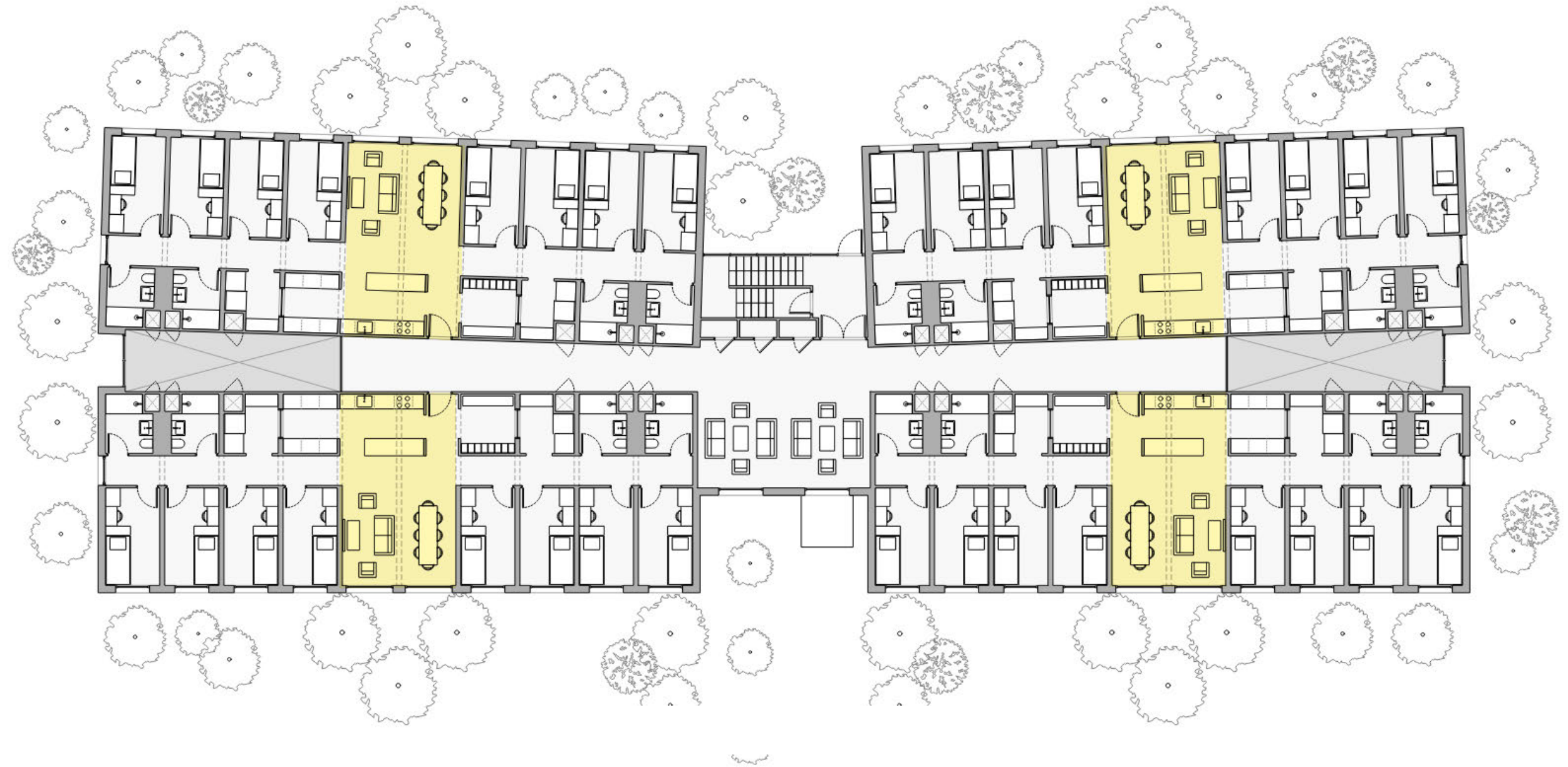
KNIGHT BUILDING Big Sky, MT



KNIGHT BUILDING Big Sky, MT – Building Modules



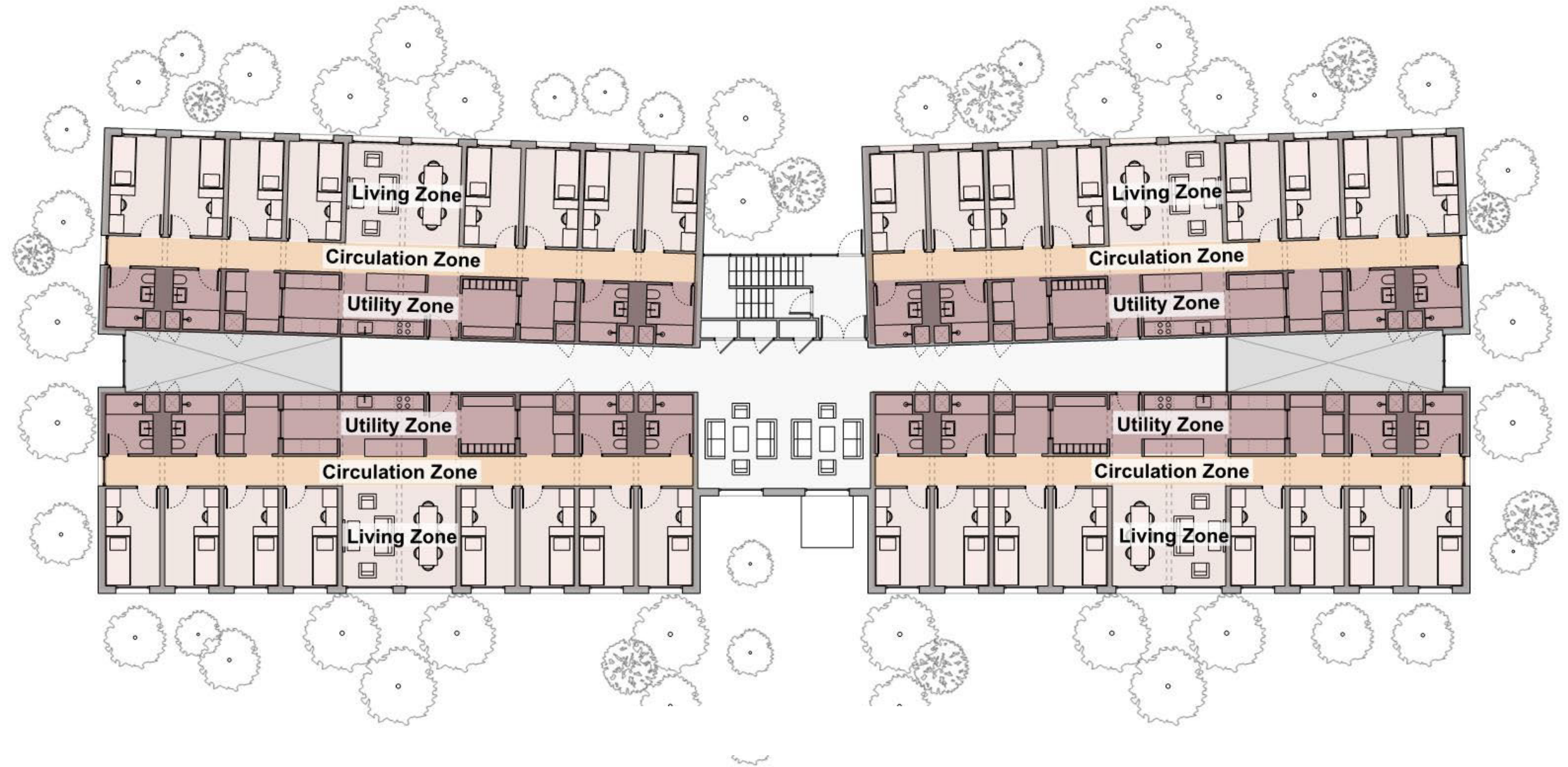
KNIGHT BUILDING Big Sky, MT – Open-Sided Modules



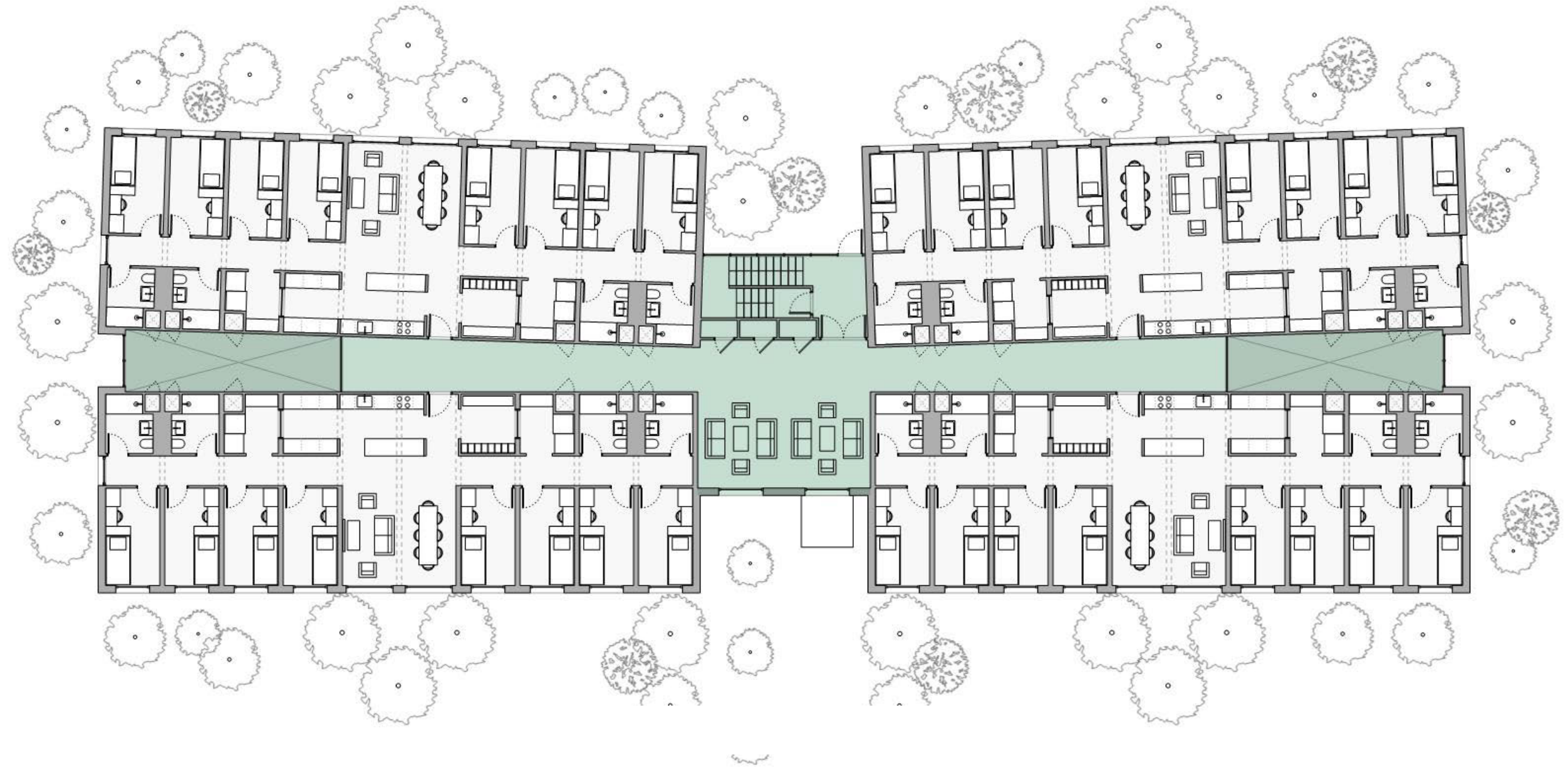
KNIGHT BUILDING Big Sky, MT – Open-Sided Modules



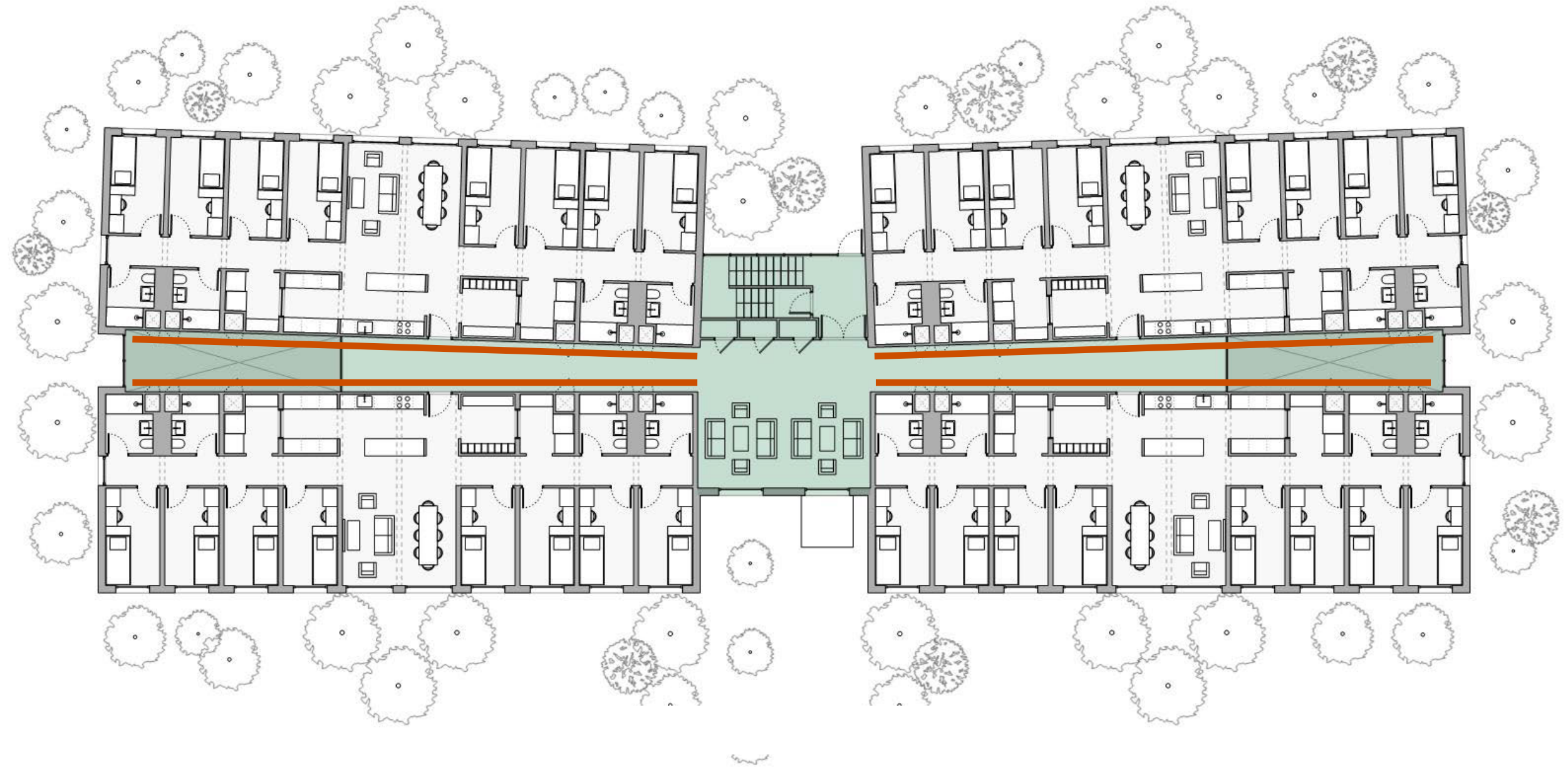
KNIGHT BUILDING Big Sky, MT - Module Design Strategy



KNIGHT BUILDING Big Sky, MT – Site-Built Area



KNIGHT BUILDING Big Sky, MT – Connections



KNIGHT BUILDING Big Sky, MT



KNIGHT BUILDING Big Sky, MT



Biophilic Materials

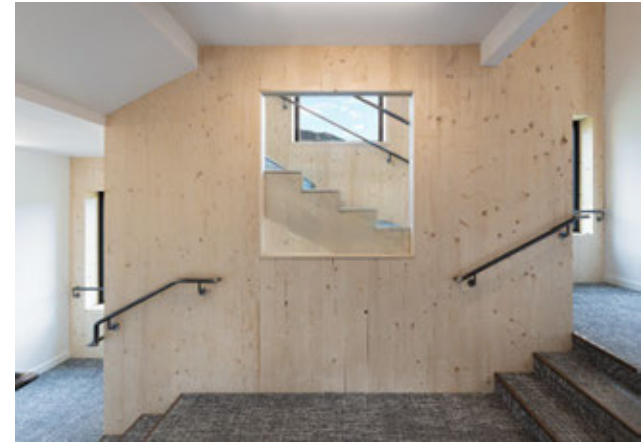
Exposed wood surfaces support biophilic design, enhancing wellness and reducing stress while also minimizing the need for finish materials, further lowering embodied carbon.

Daylight-Driven Design

Generous natural lighting, thoughtful orientation, and high-performance windows reduce the need for artificial lighting and lower energy demand.



KNIGHT BUILDING Big Sky, MT



Durability is Inherent in the System

The structure is designed for longevity, with durable materials and robust detailing intended to extend the building's life far beyond conventional construction.

Sustainably-Harvested Timber

Mass timber elements are sourced from responsibly managed forests.

KNIGHT BUILDING Big Sky, MT



Optimizing Solar Power | All-electric utilities

A 70 kW rooftop solar array generates clean, renewable electricity on-site. The building operates with 100% electric utilities, eliminating on-site combustion and significantly reducing greenhouse gas emissions.

High-Performance Envelope

The building envelope is airtight and thermally efficient, reducing heating and cooling loads while increasing occupant comfort.

KNIGHT BUILDING Big Sky, MT



Lessons Learned / Keys to Success

An engaged and educated client

Healthy team dynamic with clear and open communication and support for overall project goals

All design work and decisions must be made prior to starting detail module design and construction

Robust strategies for temporary weather protection

MODULAR MASS TIMBER Summary of Process

1. AN INTEGRATED TEAM

2. MASS TIMBER MODULES

3. ASSEMBLY HALL MANAGEMENT

MODULAR MASS TIMBER Summary of Benefits

Up to 50% shorter building times. Dramatically reduced labor.

Modules finished up to 95% in assembly hall.

High quality.

Competitive cost.

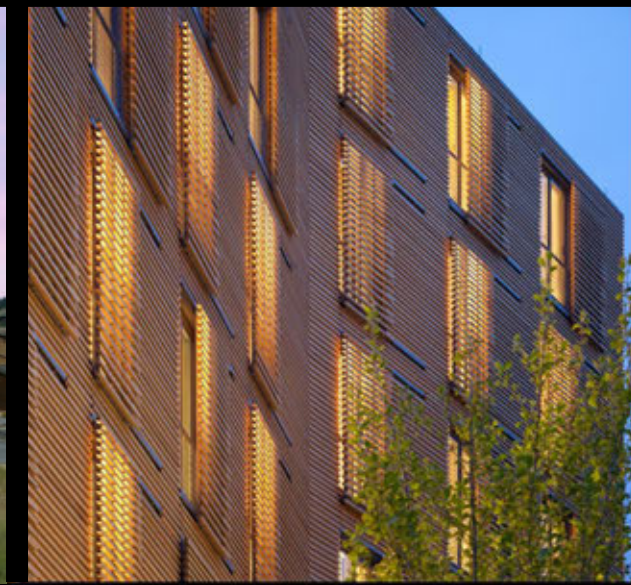
Climate positive.

Agility of design. Buildings and spaces of many sizes and shapes for multiple programs.

Scalable. 1200 to 3500 modules from one year to the next for KBS.

Works almost anywhere.

Predictable.



**INTEGRATED
DESIGN CUBED**
MODULAR MASS TIMBER

QUESTIONS?

This concludes The American
Institute of Architects Continuing
Education Systems Course



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Principal

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Christopher Flass, AIA

Principal

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