Founders Hall.

University of Washington

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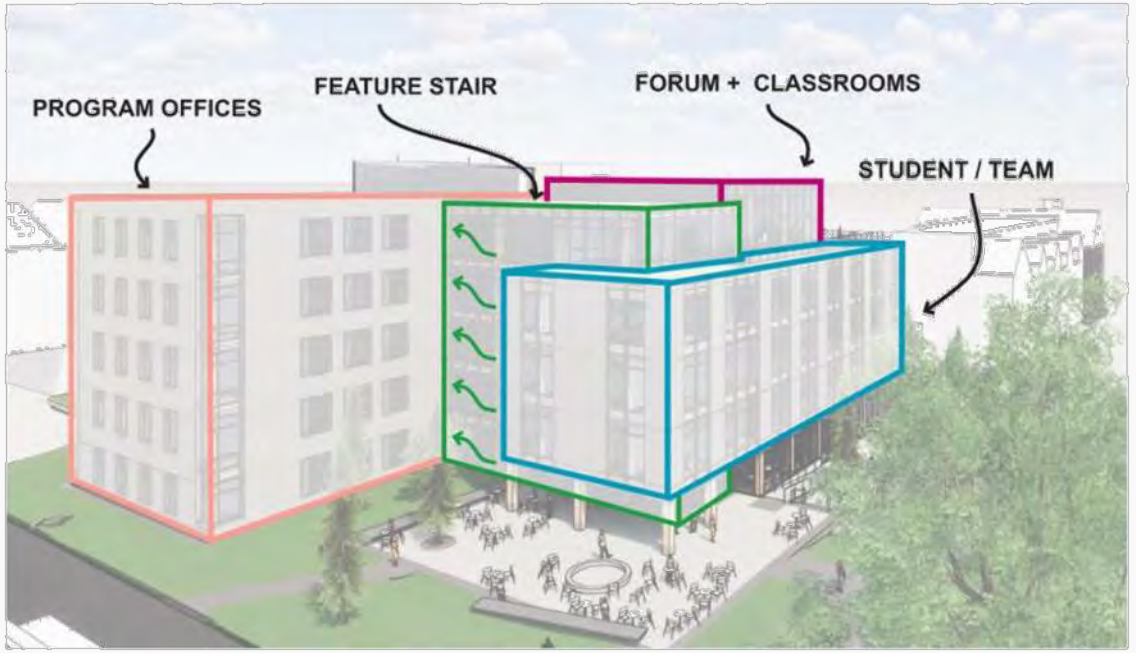
April 26, 2023

HOFFMAN CONSTRUCTION COMPANY

LMN

Project Overview

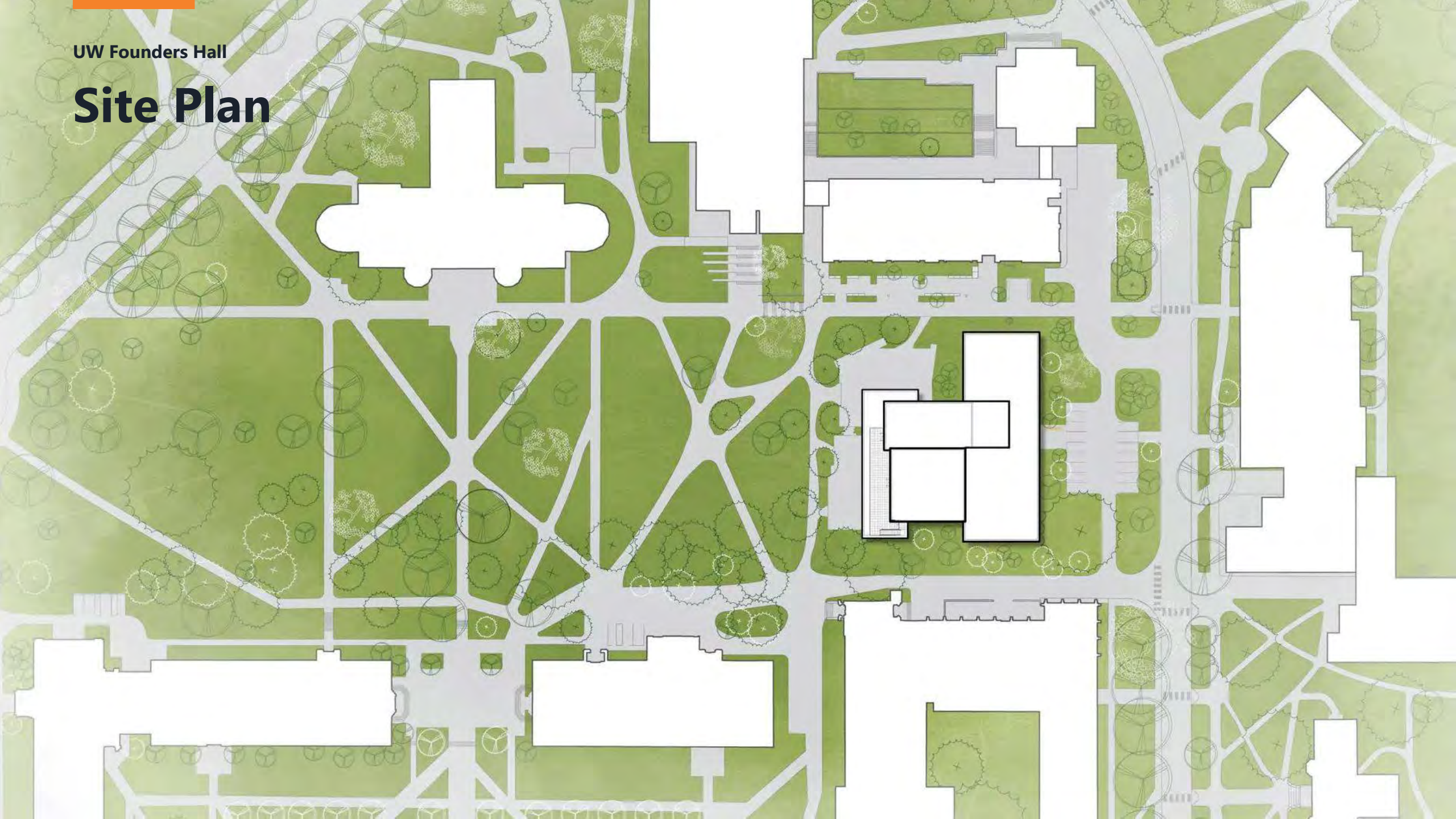
- 85,000 GSF
- 5 stories
- Composite concrete core and wood timber structure
- Offices for administration, faculty, alumni relations & graduate students, 2 large classrooms, commons area and forum/event space
- 5th and final new building on FSB campus
- $75M, project cost
- 100% donor funded




Dempsey Hall (2012)
PACCAR Hall (2010)
Bank of America Executive Conference Center (1997)
Founders Hall (2022)
Master Plan (2002)

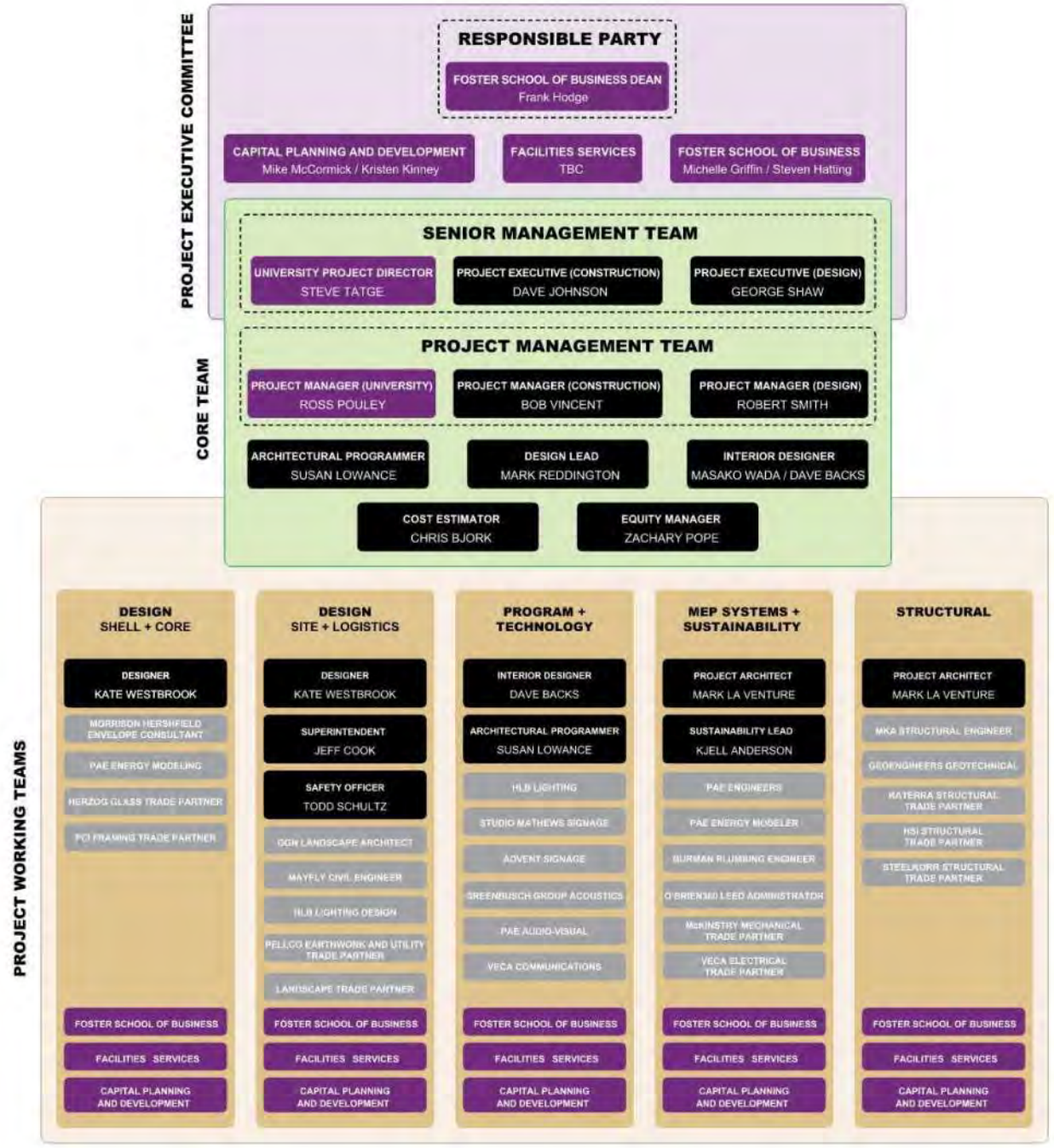
UW Founders Hall

Site Plan

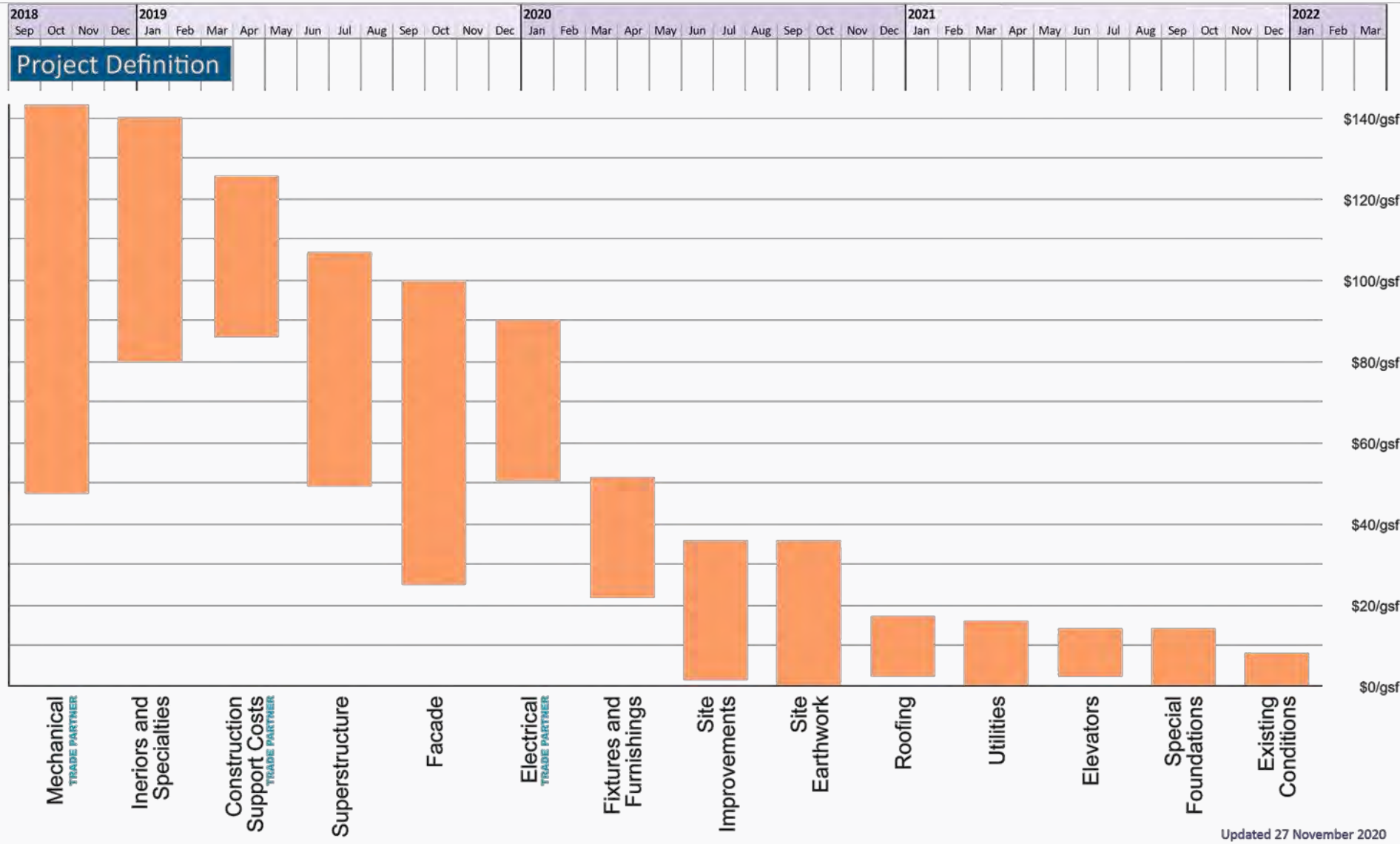


Delivery Model and Structural System Selection

Progressive Design-Build



Target Value Design – Project Definition Comparables

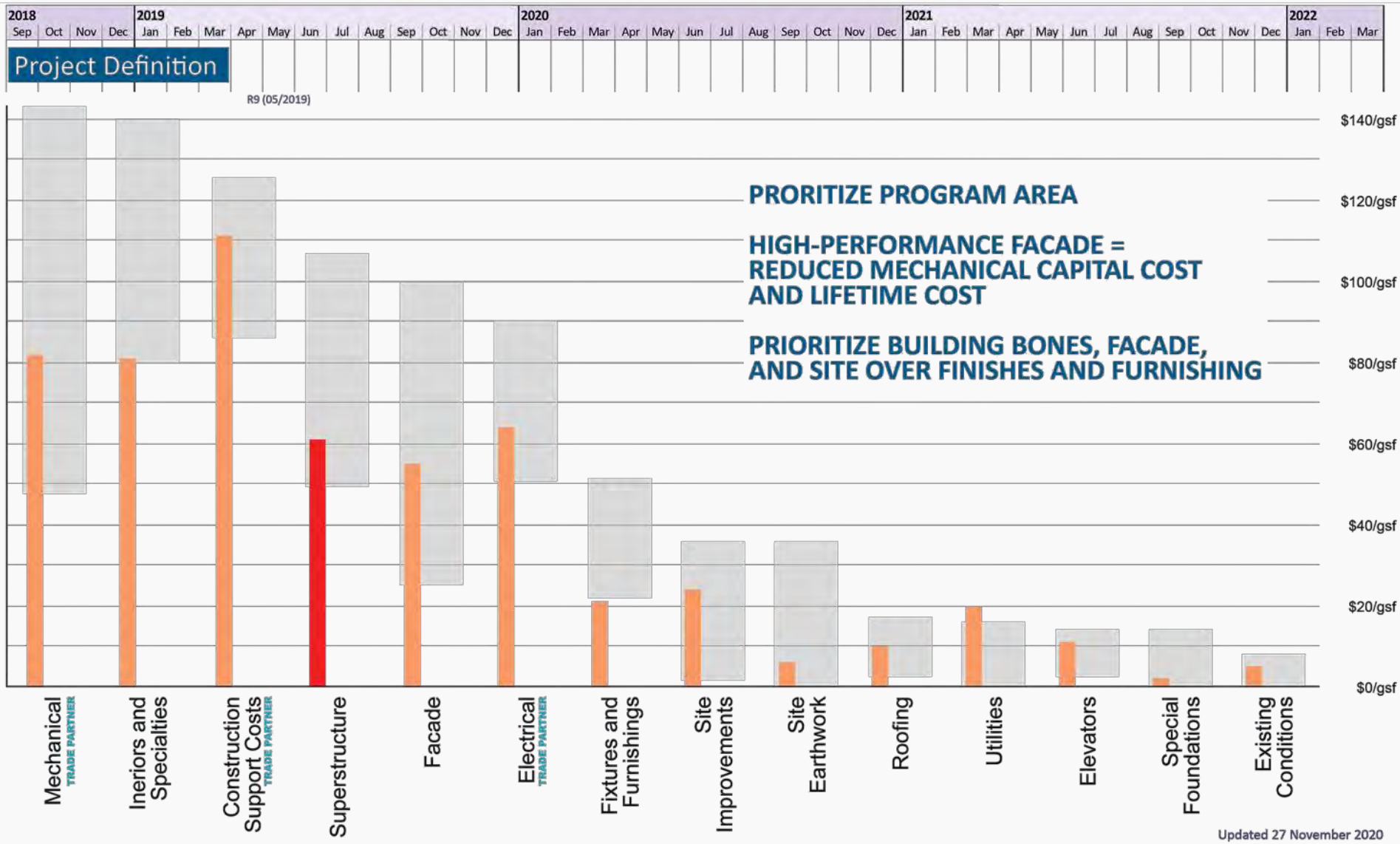


Target Value Design – Structural Systems

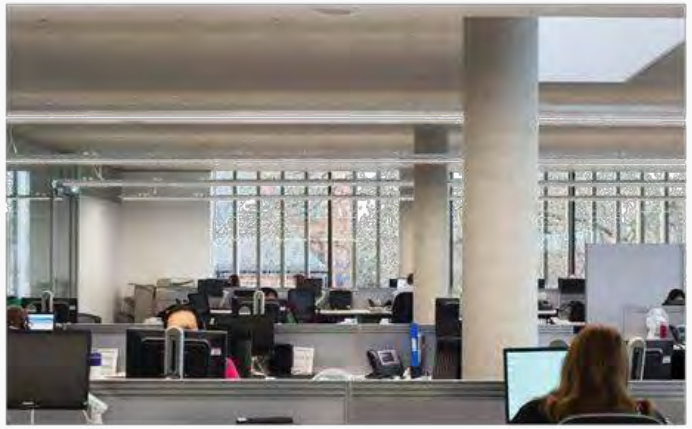
STRUCTURAL DECISION MATRIX

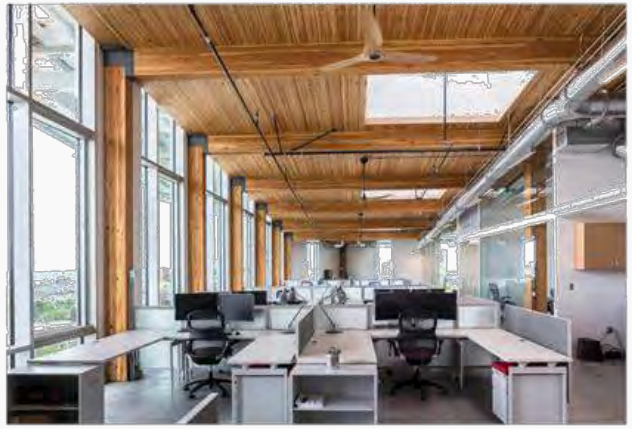
Best = 5 Worst = 1	OPTION 1 STEEL/TIMBER	OPTION 2 PT/PT	OPTION 3 STEEL/PT	OPTION 4 STEEL/STEEL	OPTION 5 STEEL
LEAD TIME RISK	1	3	2	2	2
AESTHETIC	3	2	2	2	1
FIRE PROTECTION COSTS	3	3	1	1	1
SYSTEM DEPTH	1	3	1	1	1
ERECTION TIME	2	1	3	3	3
EMBODIED ENERGY	4	3	2	1	1
Raw Score	14	14	11	10	9
FIRST COST	1	3	4	5	5

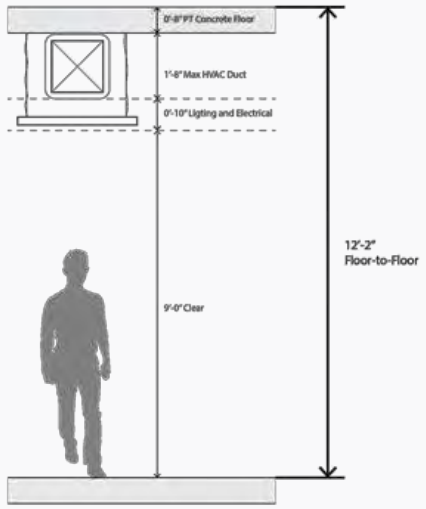
Target Value Design – Project Definition Targets

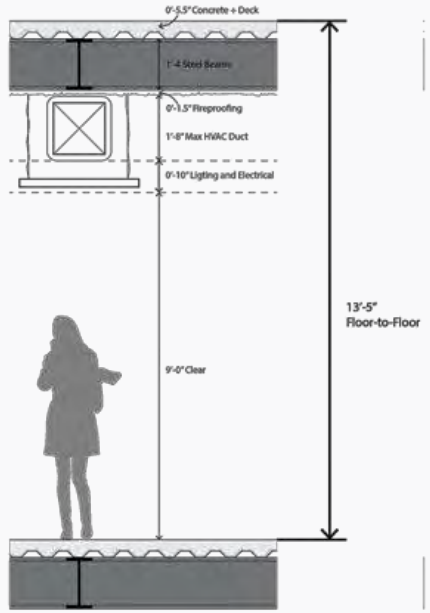


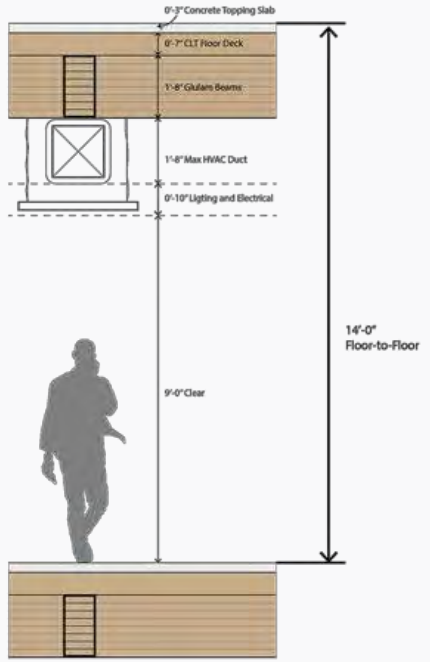
Structural System Recommendations











Structural System Recommendations

RECOMMENDED

	CONCRETE	STEEL	HEAVY TIMBER
First Cost			
Structure (gravity)	$51.50	$34.00	$61.00
Structure (lateral shear wall)	$8.00	$8.00	$11.00
Structure (foundation)	$9.50	$9.50	$10.00
Fire protection (1hr/2hr)	$0	$4.75 - $7.50	$1.00
Painting and column wraps	$0	$2.00	$0
Façade (floor-to-floor height)	$0	$5.00	$2.00*
Partitions (floor-to-floor height)	$0	$1.75	$1.75
TOTAL	**$69.00**	**$67.75**	**$86.75**
Floor to Floor Height	**12’-2”**	**13’-5”**	**14’-0”**
Aesthetic	**Better**	**Mediocre**	**Best**
Indoor Air Quality	**Good**	**Good**	**Best**
LEED / Reduced Embodied Carbon	**Good**	**Better**	**Best**
Schedule	**Better**	**Best**	**Good**
Reliability	**Best**	**Better**	**Untested**

Structural System Recommendations

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Six weeks later…

Structural System Reselection

UNIVERSITY of WASHINGTON
FOSTER Blog

FOSTER SCHOOL WEBSITE | POSTS BY PROGRAMS | POSTS BY CENTERS | NEWS AND EVENTS

Ed Kromer · 27 Jun 2019 · Faculty, Leadership, News · 0

Meet the New Dean: Frank Hodge brings a coaching mentality to the Foster School

On July 1, Frank Hodge officially will become the Orin and Janet Smith Endowed Dean of the UW Foster School of Business.

But you can call him "Coach" if you like. His students all do.

SLB SOFTWOOD LUMBER BOARD

Weyerhaeuser

THINK WOOD™

Budget Development with Katerra

PANEL SCHEDULE

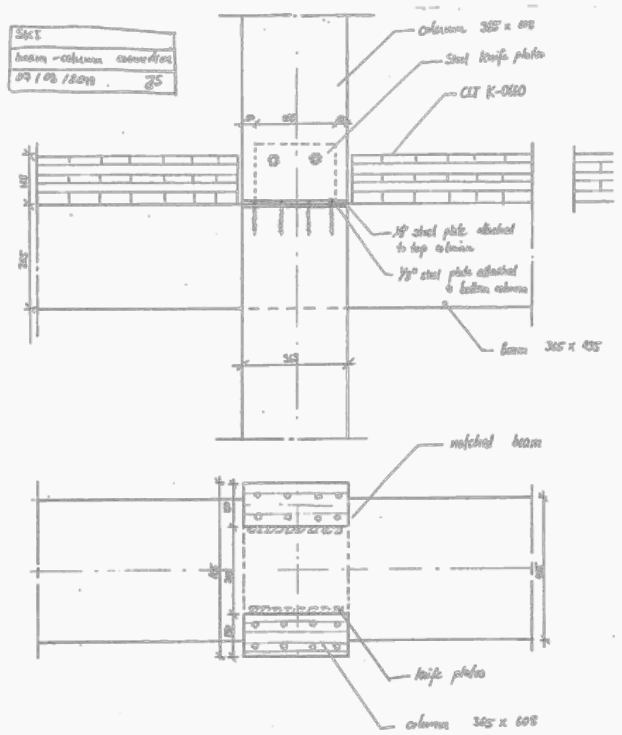
MARK	SIZE	GRADE
P1	2" CONC TOPPING ON KS-0600	V2 / E

BEAM SCHEDULE

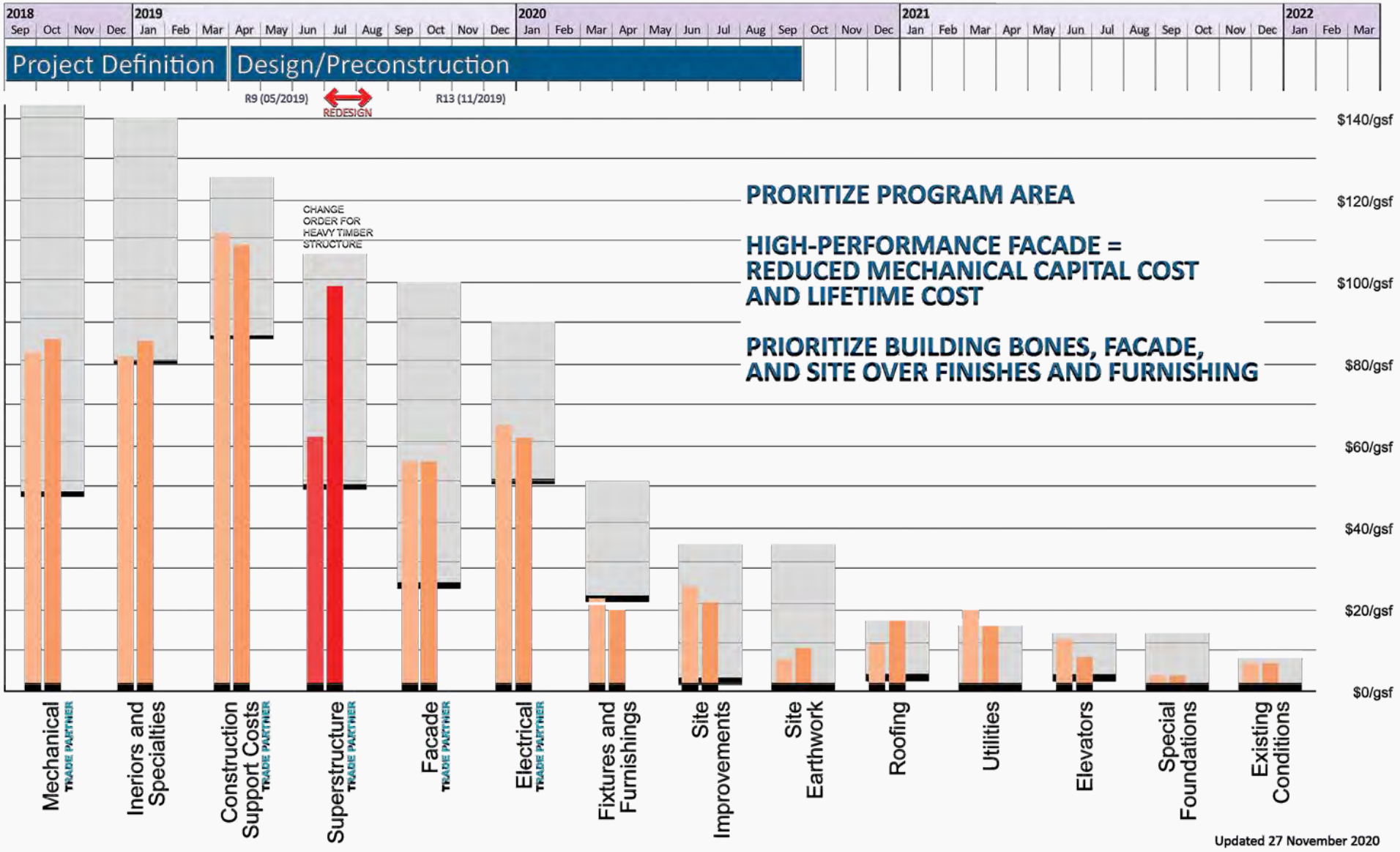
MARK	SIZE	GRADE
B1	14 1/4 x 21	24F-V8 SP/SP

COLUMN SCHEDULE

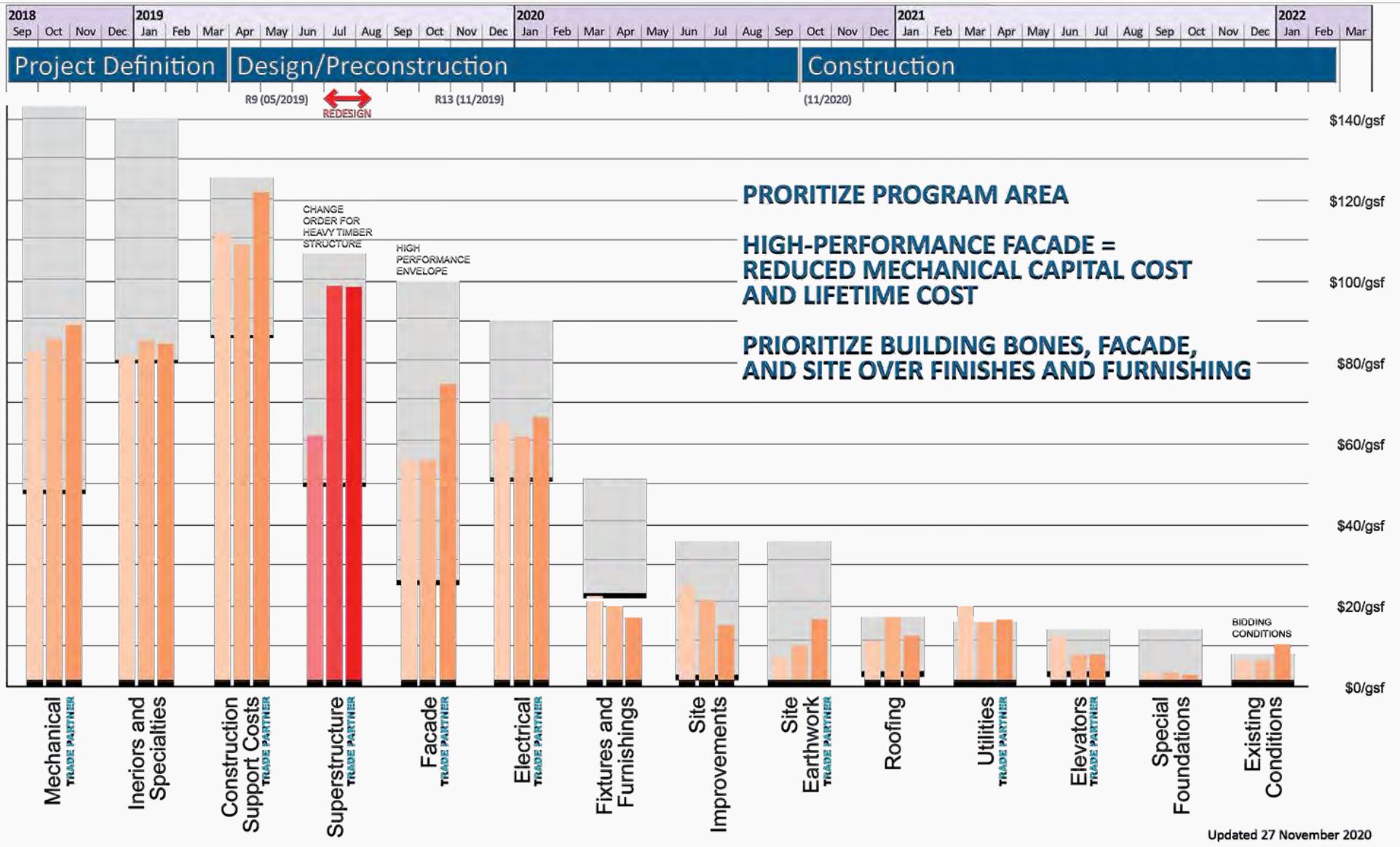
MARK	SIZE	GRADE
C1	14 1/4 x 21	Western Species 2 DF L2



Target Value Design – Design Targets with Heavy Timber

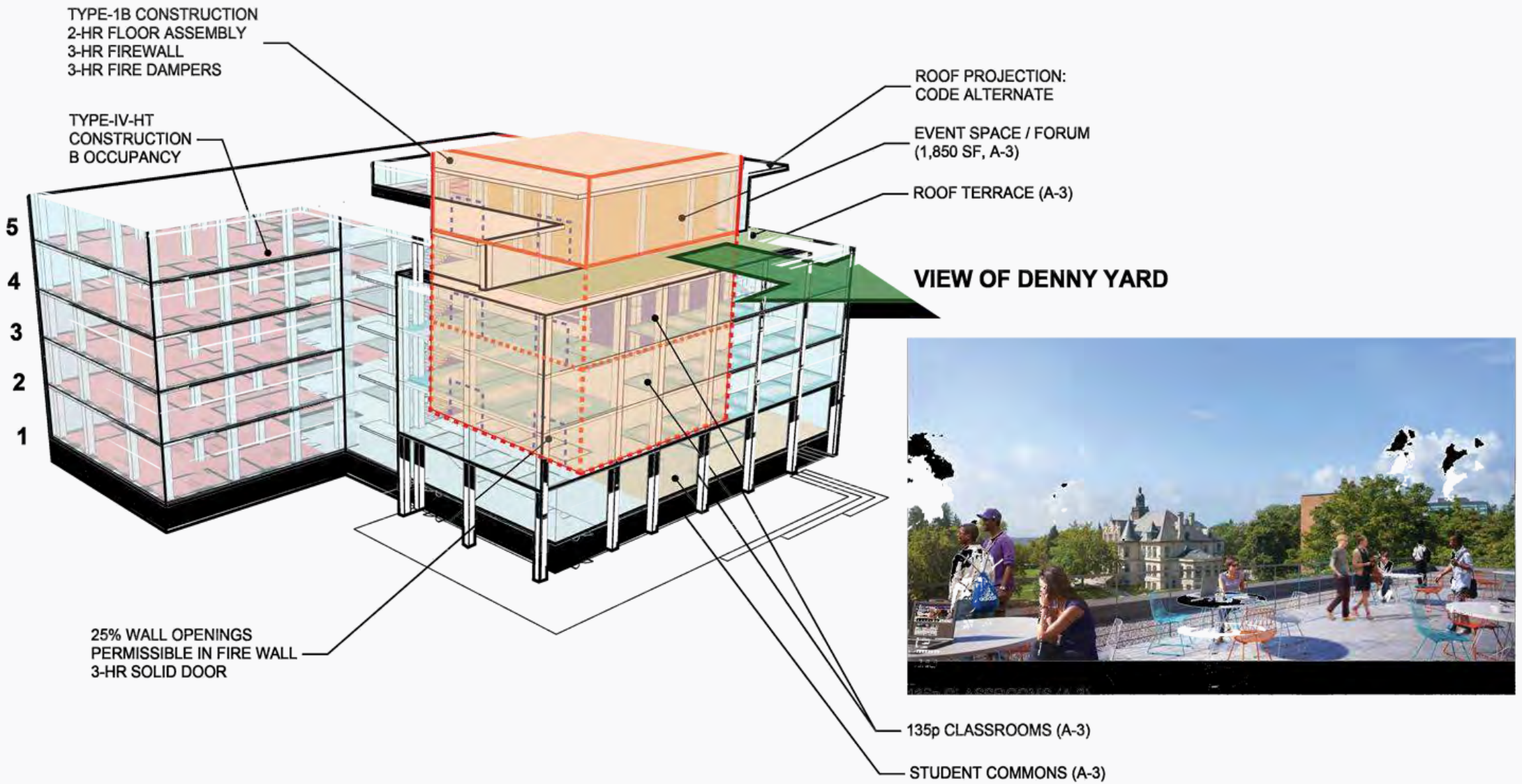


Target Value Design



Code Strategy

Mixed Construction Type IV-HT / IB



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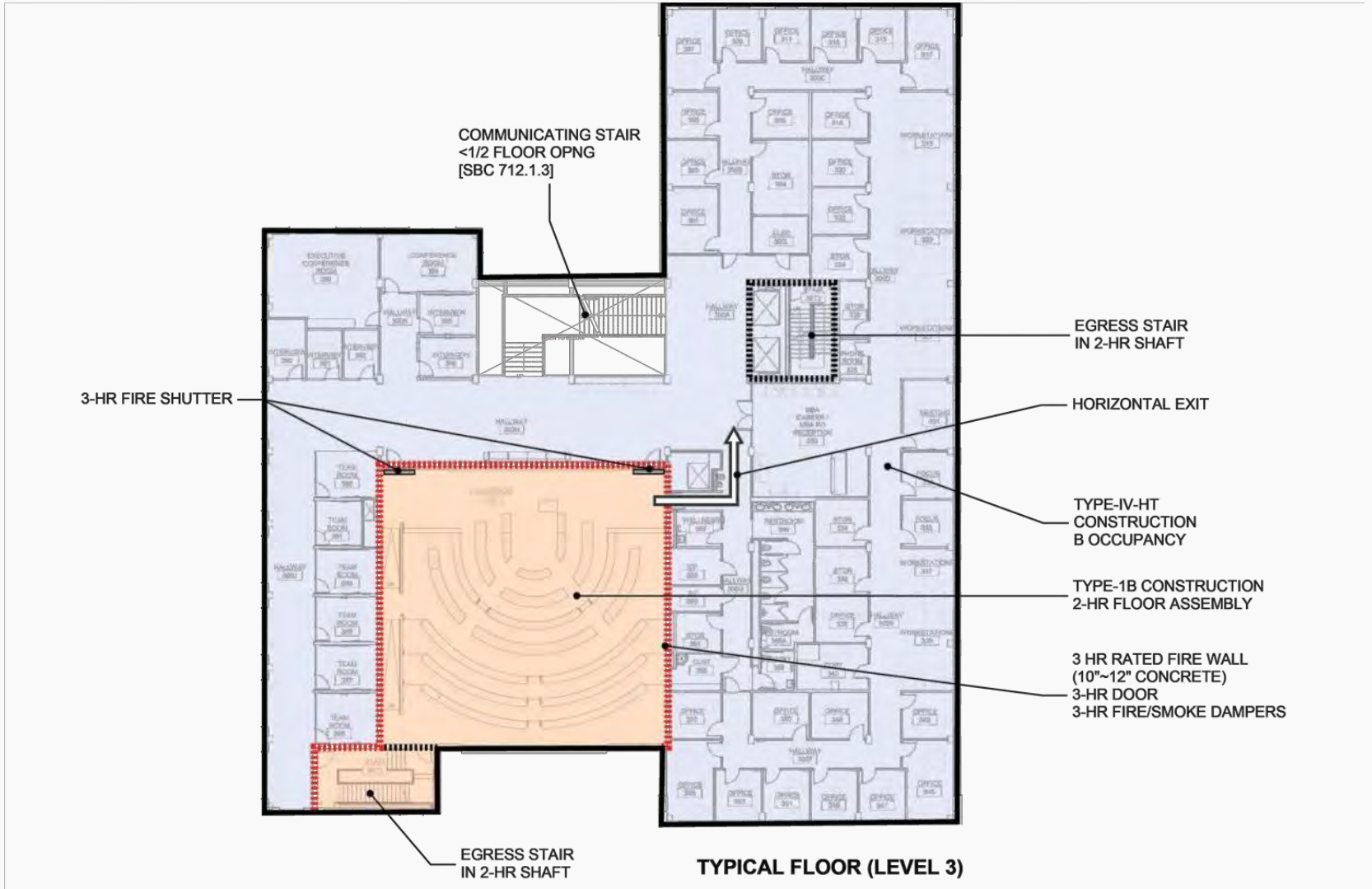


Interior Resolution

Mass Timber Interiors

Objective

- Celebrate inherent characteristics of the mass timber structure

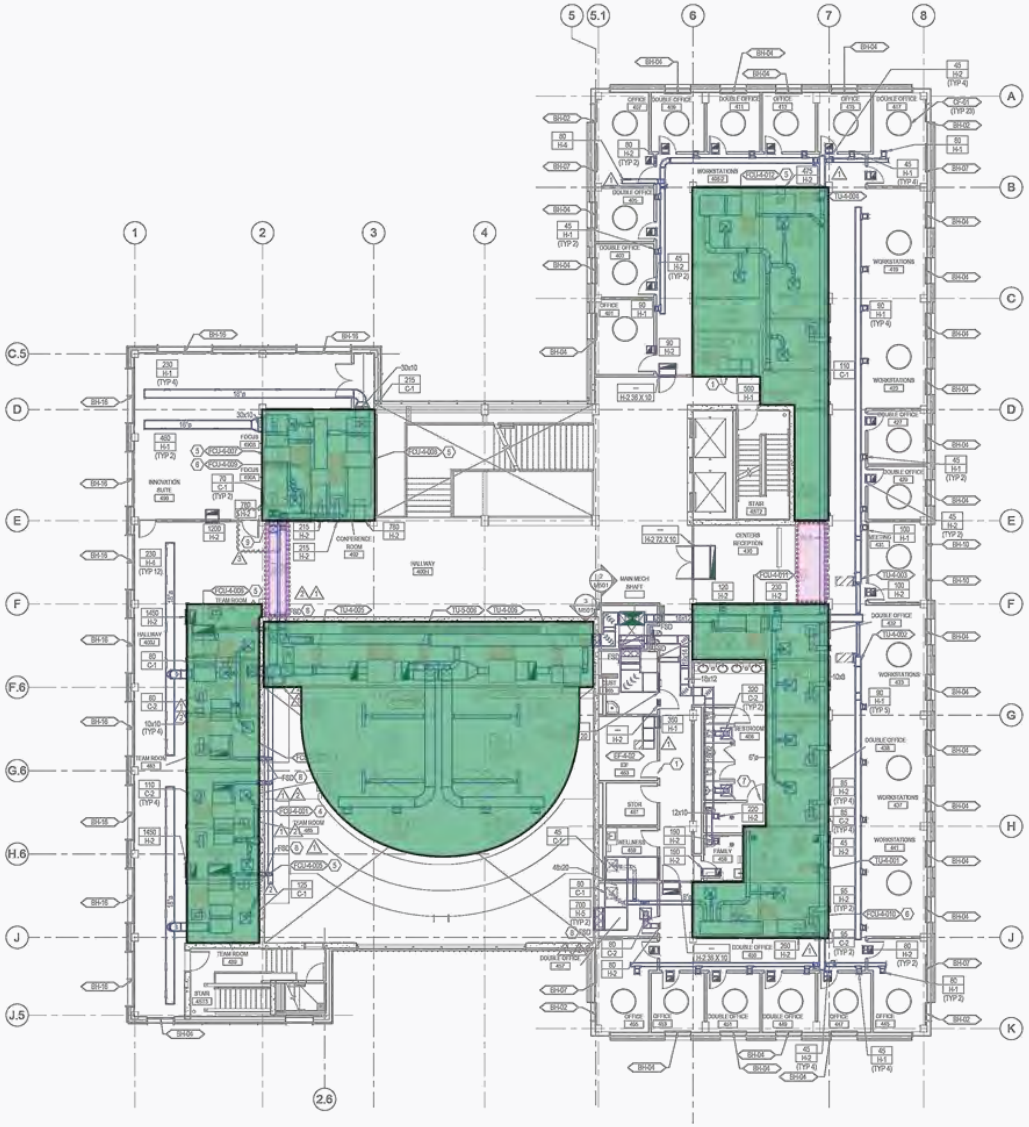
Solutions

- Expose the timber structural elements to the greatest extent possible
- Design elements which complement and do not compete with the timber structure

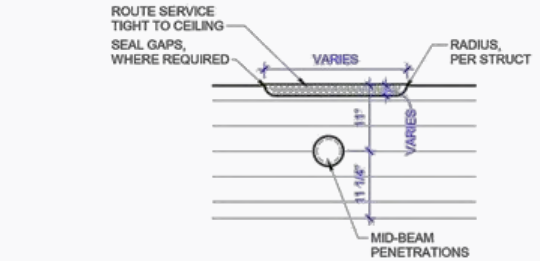
Issues

- Exposing the CLT deck requires omitting ceilings
- Spaces without ceilings leave building systems open to view
- Some amount of acoustic absorption is required at overhead plane
- Setting client expectations is critical

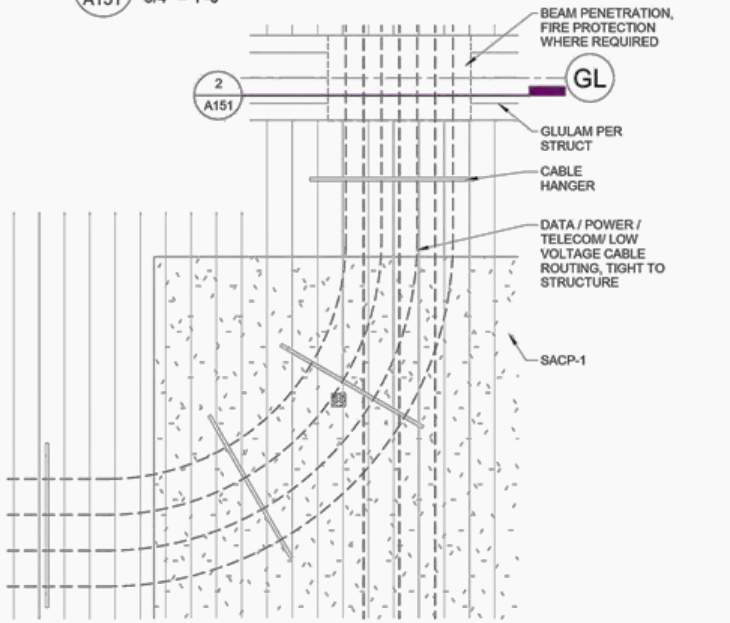
Building Systems Organization



Building Systems Organization



2 A151 BEAM PENETRATION DIAGRAM
3/4" = 1'-0"



3 A151 RCP SERVICE ROUTING (L1-L5 TYP)
3/4" = 1'-0"

Acoustic Solution

Acoustic Requirements

- ~40% of floor area to achieve 1.5 seconds reverberation time (similar to PACCAR atrium)
  - 2,000 sqft public area
  - 800 sqft treatment
- Both wall and ceiling required to prevent reverberation
- Acoustic treatment in circulation zone serves public stair

Mass Timber Interiors – Setting Expectations with Renderings

Building Systems – Setting Expectations with Renderings

Mass Timber Interiors – Setting Expectations with Images

Construction Challenges

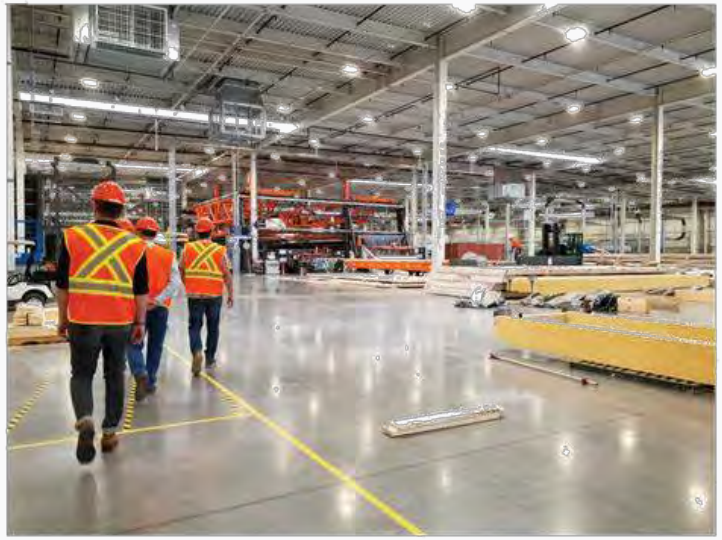
5/03/2021

5/12/2021

5/21/2021

5/27/2021

Katerra



Posted on: June 03, 2021

BUSINESS

AEC Startup Katerra Will Close

Founded in 2015, the Menlo Park, Calif.–based company will lay off more than 2,000 employees without severance, according to several news reports.

By MADELEINE D'ANGELO

courtesy Katerra

Supplier	Grade	Fb (psi)	E (10^6 psi)	Ft (psi)	Fc (psi)	Fv (psi)	Fs (psi)
Katerra	CE1	2,100	1.8	1,575	1,875	160	50
Structurlam	E1M5	2,100	1.8	1,575	1,875	160	50

Table 1. Lumber Lamination ASD Design Values

Supplier	Layup	Thickness (in)	FbSeff,0 (lbf-ft/ft)	Eleff,0 (10^6 lbf-in2/ft)	GAeff,0 (10^6 lbf/ft)	Vs,0 (lbf/ft)
Katerra	K5-0690	6.90	11,275	471	0.93	2,480
Structurlam	175E	6.90	11,250	469	1.10	2,480

Table 2. CLT Panel ASD Design Values

6/04/2021

6/10/2021

6/18/2021

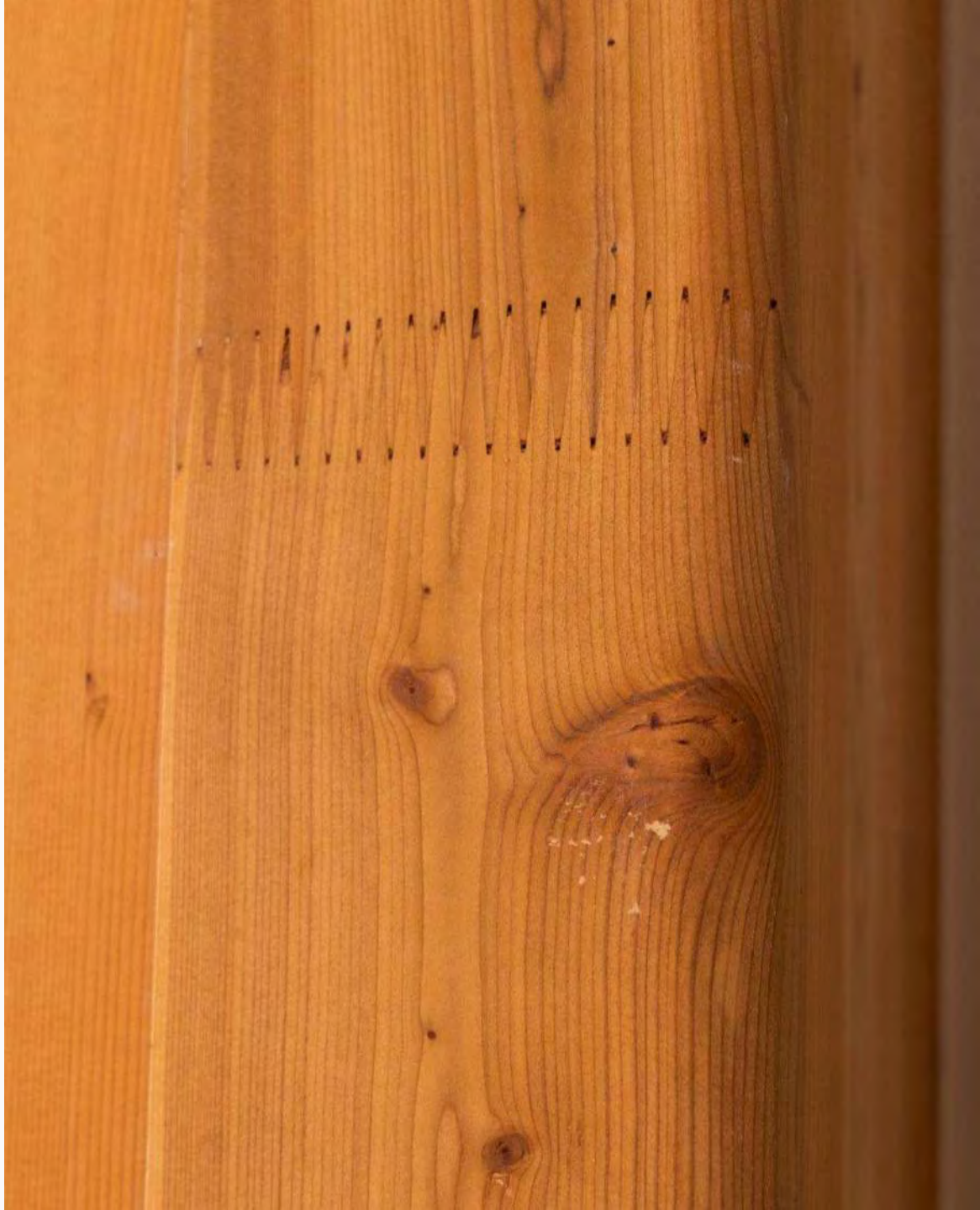
6/27/2021

8/16/2021

10/04/2021

Successes & Lessons Learned

- **Early Material Procurement**
- **Optimal Details and Modeling**
- **Temporary Weather Protection**



Early Material Procurement

- Select trade partners/manufacturer
- Get into manufacturers production schedule
- Keep design process linear / optimize design for the manufacturer
- Increased prefabrication
- Design out complexity
- Mitigate commodity pricing volatility risk

Optimize Details and Modeling

- **Practicality and Cost**
- **Mockups**
  - Connections
  - Fire protections
  - Sealers/Finish
- **Test Fits**
- **Tolerances**

Moisture Management What We Do Control

Prudent measures to limit staining and timber saturation:

- **Setting expectations of your crews for working with wood**
- **Prudent shop prep**
- **Protection of critical details**
- **No raw steel on the timber decks**
- **No steel cutting on the timber decks**
- **No on-site wrapping of timber**
- **All galvanized or well primed connectors**
- **Fluid tight deck seals**
- **Contain concrete deck slurry**

Moisture Management – Shop Prep

Goal is to limit short term water penetration

- **Factory sealer ALL CLT ends and edges**
- **Topside factory sealer CLT floor decks**
- **Ideally … factory install permeable vapor barrier at roof panels**
- **UV - stain ‘limiting’ sealer at all GL beams & columns**
- **Best practice – schedule erection in dry weather**
- **Expedite exterior closure**

Moisture Management What We Don’t Control

- **Rain!**

Moisture Management Careful Dry Out

Post Enclosure

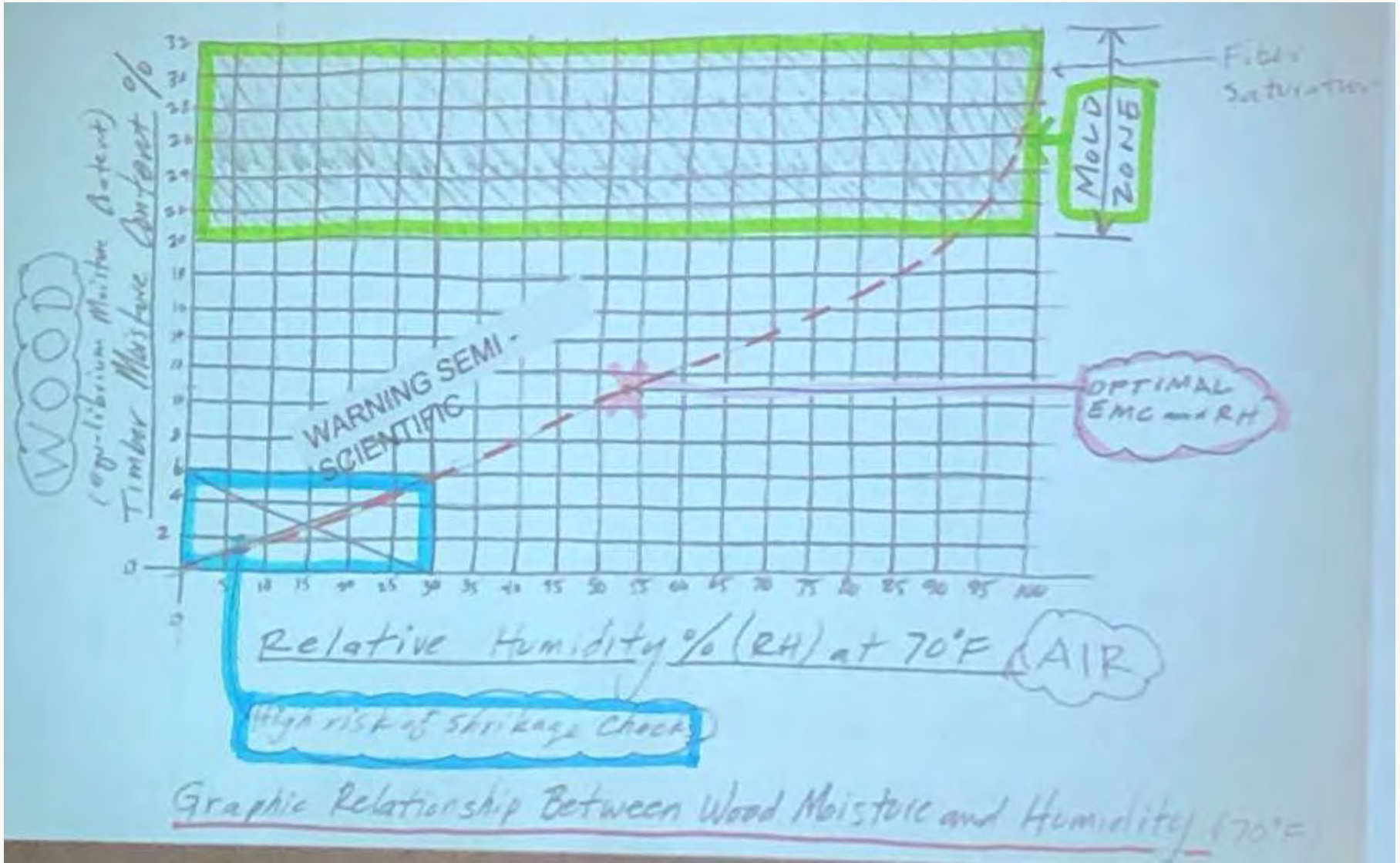
- Large volume air movement, WITHOUT heat
- Gradual heating WITH added humidity
- NO cover on timber with moisture higher than 14%

Striving to avoid mold and checking

Constant monitoring of:

- Wood moisture content
- Interior temperature
- Interior relative humidity

Moisture Management - Wood Moisture and Humidity (RH)



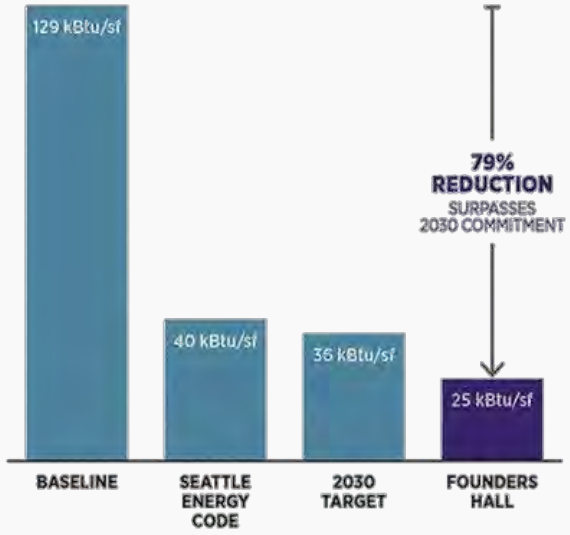
Moisture Management Principles (floors/roof)

(collaboration of contractors, architects, envelope consultant and manufacturers)

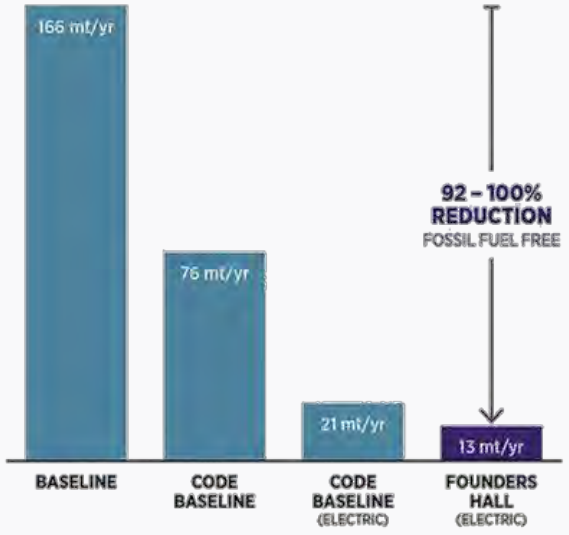
- **Protection of wood as early as possible!**
  - best: factory installation of water-resistive permeable membrane
  - second choice: staging or field installation
- **Detailing floors as if floor is a roof – which it is**
- **Removal of water from the floor surfaces**
- **Drying moist wood through proper ventilation and passively through proper permeable material selection**

Building Performance

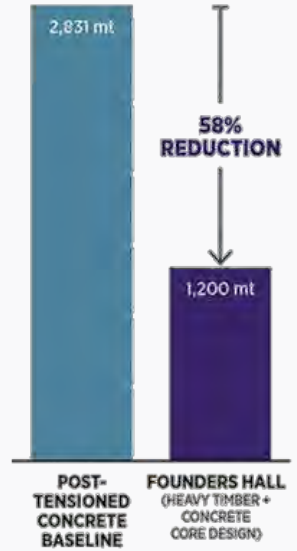
Energy Use Intensity



Operational Carbon CO_2e



Embodied Carbon CO_2e



Water Use

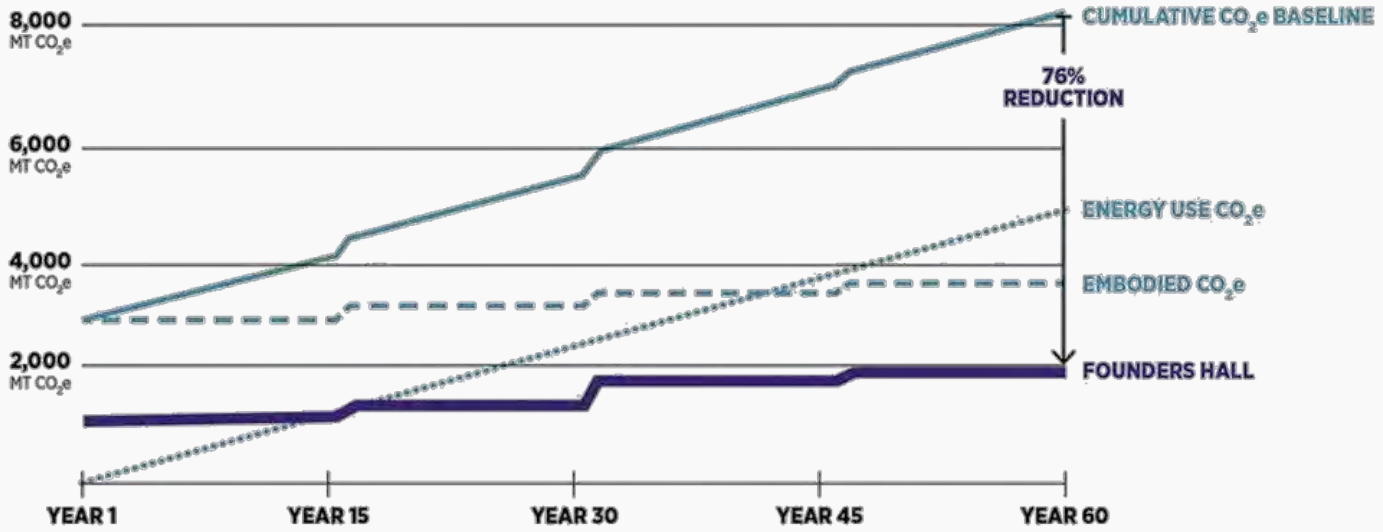
Sustainability Goals

2030 Challenge

UW Green Building Standards

- 50% water use reduction below code
- 15% energy use reduction below code
- LEED NC v4 Gold

Cumulative Carbon 60 years, CO_2e



Naturally Ventilated Offices

- Operable Windows + Ceiling Fans
- Automated Night Flush

High-Performance Building Envelope

- Low Air Infiltration
- Highly Insulated Envelope

Optimized Daylight and Views

Maximized Connectivity to Outdoor Landscapes

LEED NC v4.1 Gold

79% Energy Use Reduction

- DOAS (Dedicated Outdoor Air System) with 90% Efficient Heat Recovery Ventilation (HRV)
- Fossil Fuel Free Operations
- Target Performance Energy Use Monitoring
- Solar Ready Roof
- Disconnected from Campus Steam

58% Embodied Carbon Reduction

- Mass Timber Structure
- Reduced Embodied Carbon Materials

53% Water Use Reduction

- Native and Drought-Resistant Planting
- Stormwater Collection to Bioretention Swales
- Low-Flow Plumbing Fixtures

Bike Commuting Racks and Showers

© Tim Griffith

© Tim Griffith

Thank you to all of those whose hard work contributed to the success of this project!

Thank you to the University of Washington, the Foster School of Business and our Design-Build partner LMN Architects for the collaboration on this successful project!

Our key consultants and trade partners included MKA, PAE, McKinstry, VECA Electric, Herzog Glass, Hoffman Structures Inc., Pellco Construction, Performance Contracting, and Steelkorr.

Wood Timber partners:
Katerra, Structurlam, Western Archrib and Northwest Steel Fab.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