Mass Timber School Design + Workbench Tour

September 15, 2026

Presented by:

Mark Bartlett, PE
WoodWorks

WOODWORKS WOOD PRODUCTS COUNCIL

Photo: Workbench, WoodWorks

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

AIA Approved Continuing Education

Course Description

Seminar Course Description

This course examines the growing use of mass timber in K-12 school design, with a focus on the key drivers influencing its adoption, including speed of construction, sustainability, cost-efficiency, and code compliance. Attendees will gain insight into the national school construction market, understand how International Building Code (IBC) provisions support the use of mass timber in Types III, IV, and V construction, and compare costs and building configurations across material systems.

Learning Objectives

Seminar Learning Objectives

1. Describe how current IBC code provisions allow for mass timber use in K-12 schools, including allowable building heights, areas, and stories for Types III, IV, and V construction.

2. Identify key market drivers—such as speed of construction, sustainability, and aesthetics—that make mass timber an appealing choice for school design.

3. Compare mass timber to steel and concrete systems in terms of cost, construction schedule, and performance, using real-world case studies and structural strategies.

4. Understand best practices for acoustics, durability, fire resistance, and long-span structural solutions to meet the unique needs of K-12 learning environments.

Course Description

Tour Course Description

This unique educational event offers an in-depth look at Workbench, a four-story, 45,000-square-foot mixed-use development in Austin, Texas, constructed using mass timber, including glulam and cross-laminated timber (CLT) panels.

During the tour, the project team will share the strategies used to design and construct this code-compliant mass timber building, highlighting key decisions that met sustainability and design-intent goals. The interactive tour format encourages questions and discussion, providing attendees with valuable insights into the building's design and execution, as well as the factors that influenced material selection, structural systems, and detailing. Participants will leave with a deeper understanding of the opportunities and practical considerations involved in delivering a successful mass timber project.

Learning Objectives

Tour Learning Objectives

1. Discuss typical construction practices for mass timber projects, including safety best practices, installation efficiency, and coordination with follow-on trades.

2. Highlight a variety of structural and architectural uses of CLT panels and glulam / wood framing through an in-person tour of a completed project, highlighting the biophilic benefits of exposed mass timber and the sustainable benefits of wood construction.

3. Demonstrate connection detailing techniques used in code-compliant mass timber buildings to ensure appropriate structural capacity, fire resistance, and consideration of the project construction type.

4. Explain the diverse methods of project development and approaches used by the design team, including owners, contractors, architects, and engineers, to achieve a successful mass timber project.

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AIA Approved Continuing Education

Market Drivers

Why Choose Mass Timber?

- Aesthetic Value and Biophilia
- Lower Carbon Impact
- Speed of Construction
- Lightweight Structure


Wisner-Pilger Public Schools Addition / BVH Architecture / R.O. Youker Structural Engineering / Photo A.J. Brown

Aesthetic Value & Biophilia

George Fox University – Canyon Commons | Hacker | Photo: Jeremy Bitterman

Lakeridge Middle School / Mahlum Architects / KPFF / Photo Arthur Ross

Carbon Terms

- **Embodied Carbon**: Carbon emissions associated with the entire life cycle of the building including harvesting, mining, manufacturing, transporting, installing, maintaining, decommissioning, and disposing/reuse of a material or product
- **Operational Carbon:** Carbon emissions associated with operating a building including power, heat, and cooling

Image: Boston Society for Architecture

Carbon Benefits of Wood

- **Lower embodied carbon** compared to other common building materials
- **Less fossil fuel consumed** during manufacture
- **Avoid process emissions**
- **Extended carbon storage in products**
- **Carbon sequestration in forests**
- Promotes **forest health**

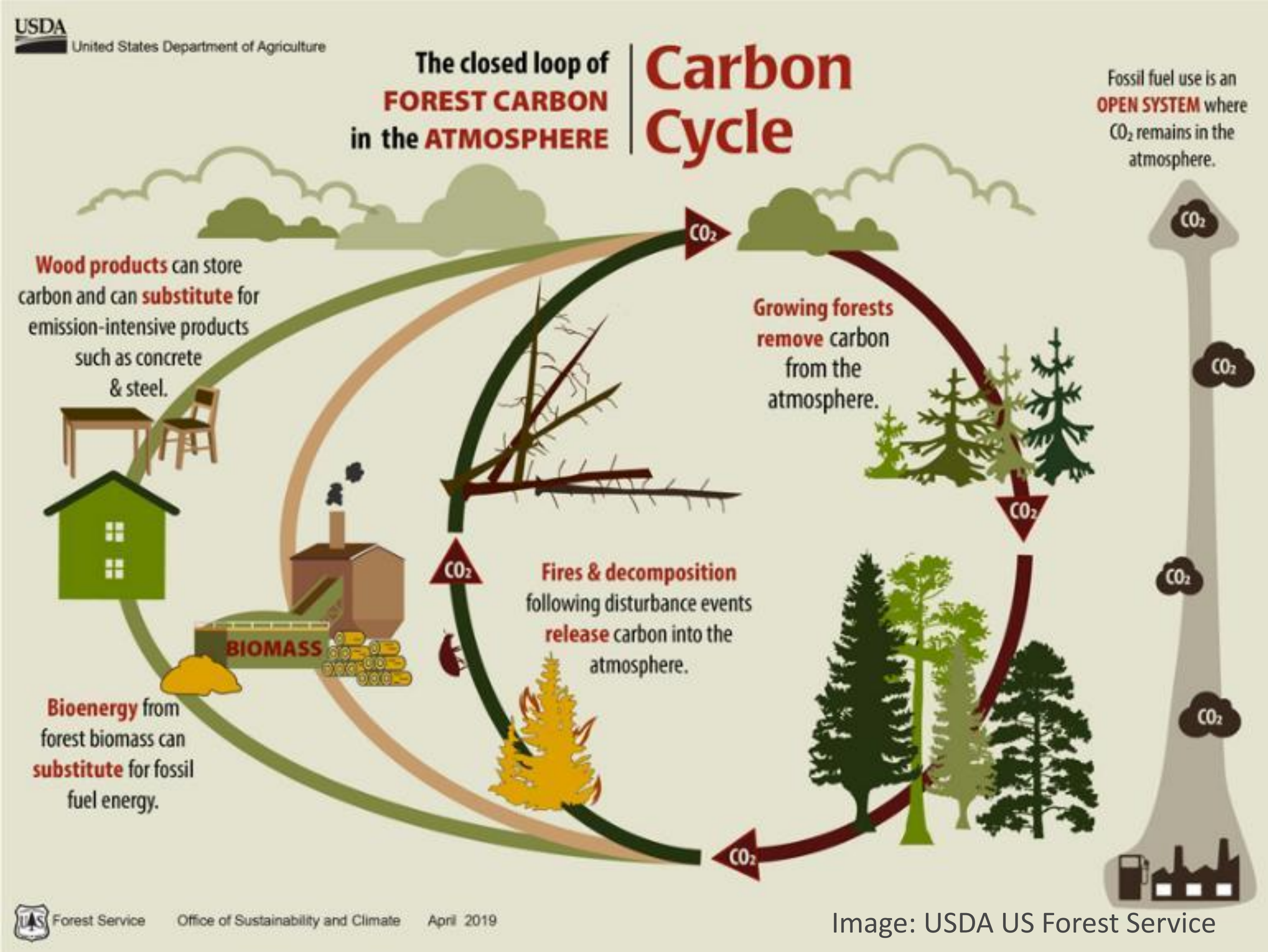


Image: USDA US Forest Service

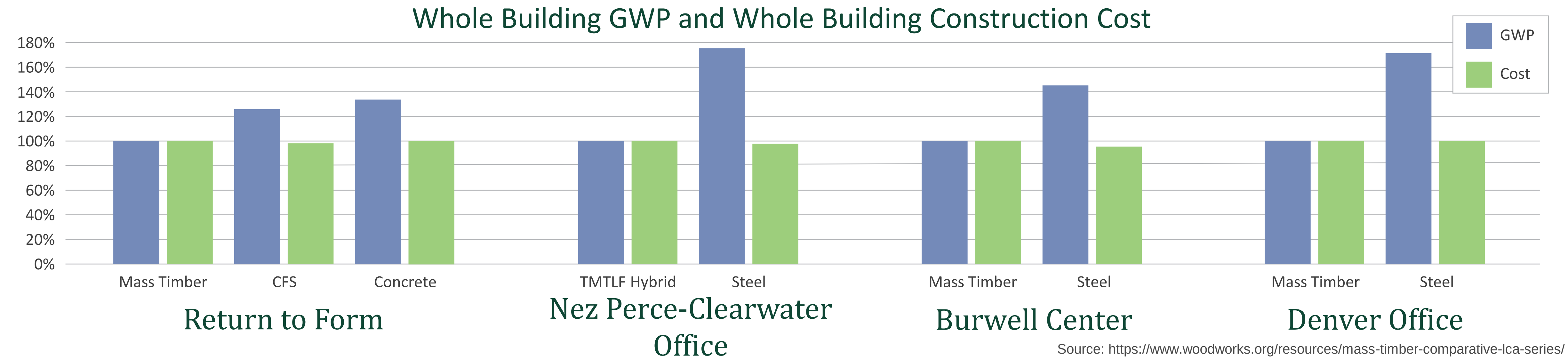
Mass Timber Comparative Life Cycle Assessment Series

Rendering tres birds

Mosaic Architecture / Morrison-Maierle / Photo Heidi Long, Longview Studios

University of Denver Burwell Center for Career Achievement / Lake|Flato Architects / Shears Adkins Rockmore / KL&A Engineers and Builders / Photo © Frank Ooms

Rendering Shears Adkins Rockmore



Source: https://www.woodworks.org/resources/mass-timber-comparative-lca-series/

Frequently Asked Questions:

1. Do building types III, IV, and V allow the height and area that I need for a school?
2. How would I meet fire-resistance requirements with a wood building?
3. How would I ensure that the building has good durability?
4. Can wood members span 50+ ft over the gym or cafeteria?

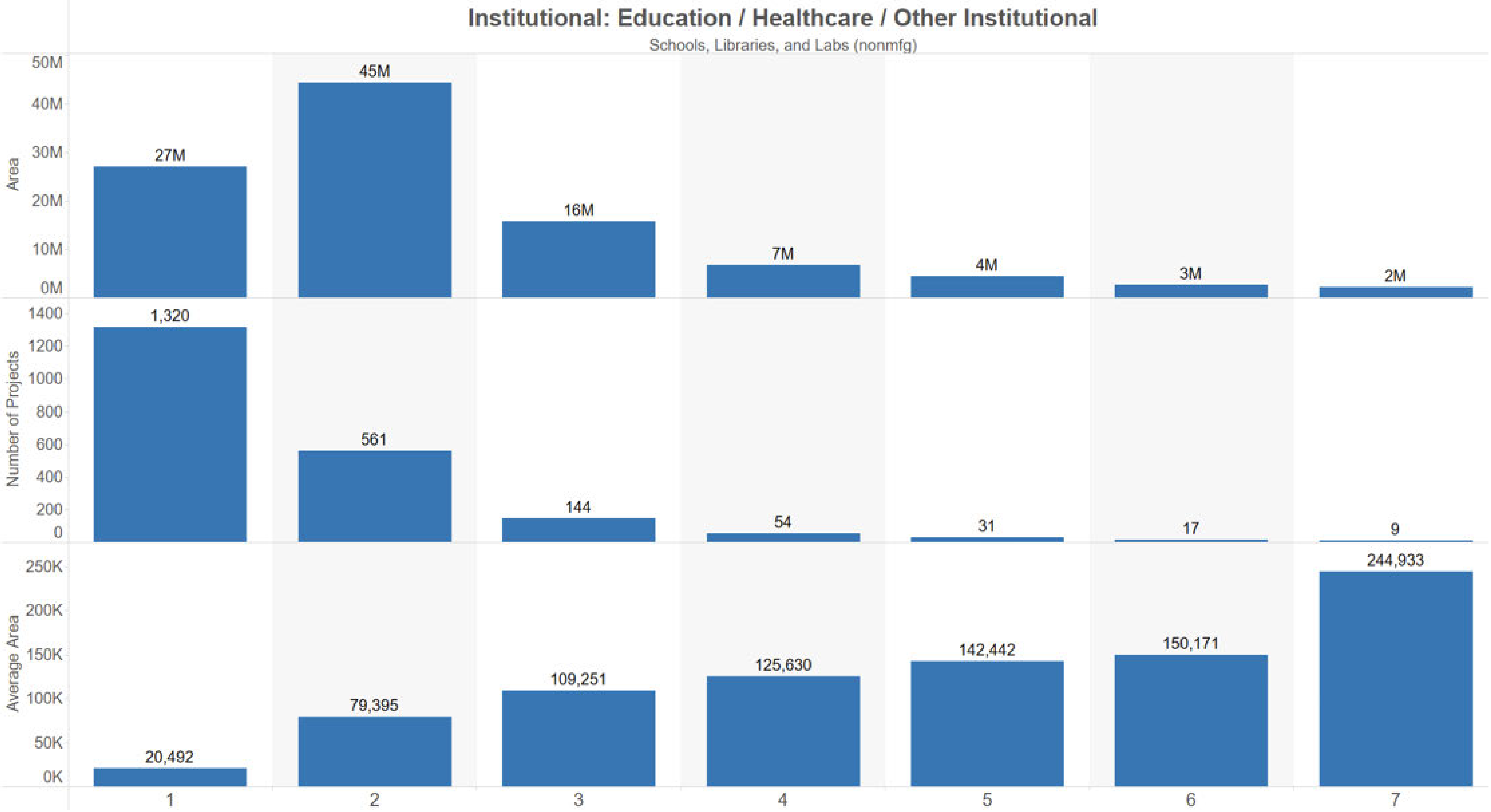
Allowed Building Size
Building Types III, IV & V

ICC Building Valuation Data, **E occupancy**, February 2025

Cost per SF

Construction Type

School Market Size by Story



Source: 2024 Dodge Construction Data

Allowable Building Size

2018 & 2021 IBC Chapter 5

Educational (E) Occupancy with NFPA 13 Sprinkler System

Construction Type / Allowable Limit	IIA	IIB	IIIA	IIIB	VA	VB
Stories	4	3	4	3	2	2
Height (ft)	85	75	85	75	70	60
1 story: Total Bldg Area (ft^2)	125.9k	68.9k	111.6k	68.9k	87.9k	45.1k
2 story: Total Bldg Area (ft^2)	198.8k	108.8k	176.3k	108.8k	138.8k	71.3k
3+ story: Total Bldg Area (ft^2)	298.1k	163.1k	264.4k	163.1k	NP	NP

Assumes full frontage increase

Allowable Building Size

2021 IBC Chapter 5

Educational (E) Occupancy with NFPA 13 Sprinkler System

Construction Type / Allowable Limit	IIA	IIB	IV-C	IV-HT
Stories	4	3	4	4
Height (ft)	85	75	85	85
1 story: Total Bldg Area (ft^2)	125.9k	68.9k	151.4k	121.1k
2 story: Total Bldg Area (ft^2)	198.8k	108.8k	239.1k	191.3k
3+ story: Total Bldg Area (ft^2)	298.1k	163.1k	358.6k	286.9k

Assumes full frontage increase

Construction Types IB, IIA, & IIB

Mass timber is permitted in roof construction of any occupancy group and any construction type other than Type IA where a 1-hour or less fire-resistance rating is required

Image: DeStafano & Chamberlain, Inc, Robert Benson Photography

Image: StructureCraft Builders

Allowable Building Size

2018 & 2021 IBC 507

Lakeridge Middle School / Mahlum Architects / KPFF / Photo Arthur Ross

Unlimited Area Buildings:

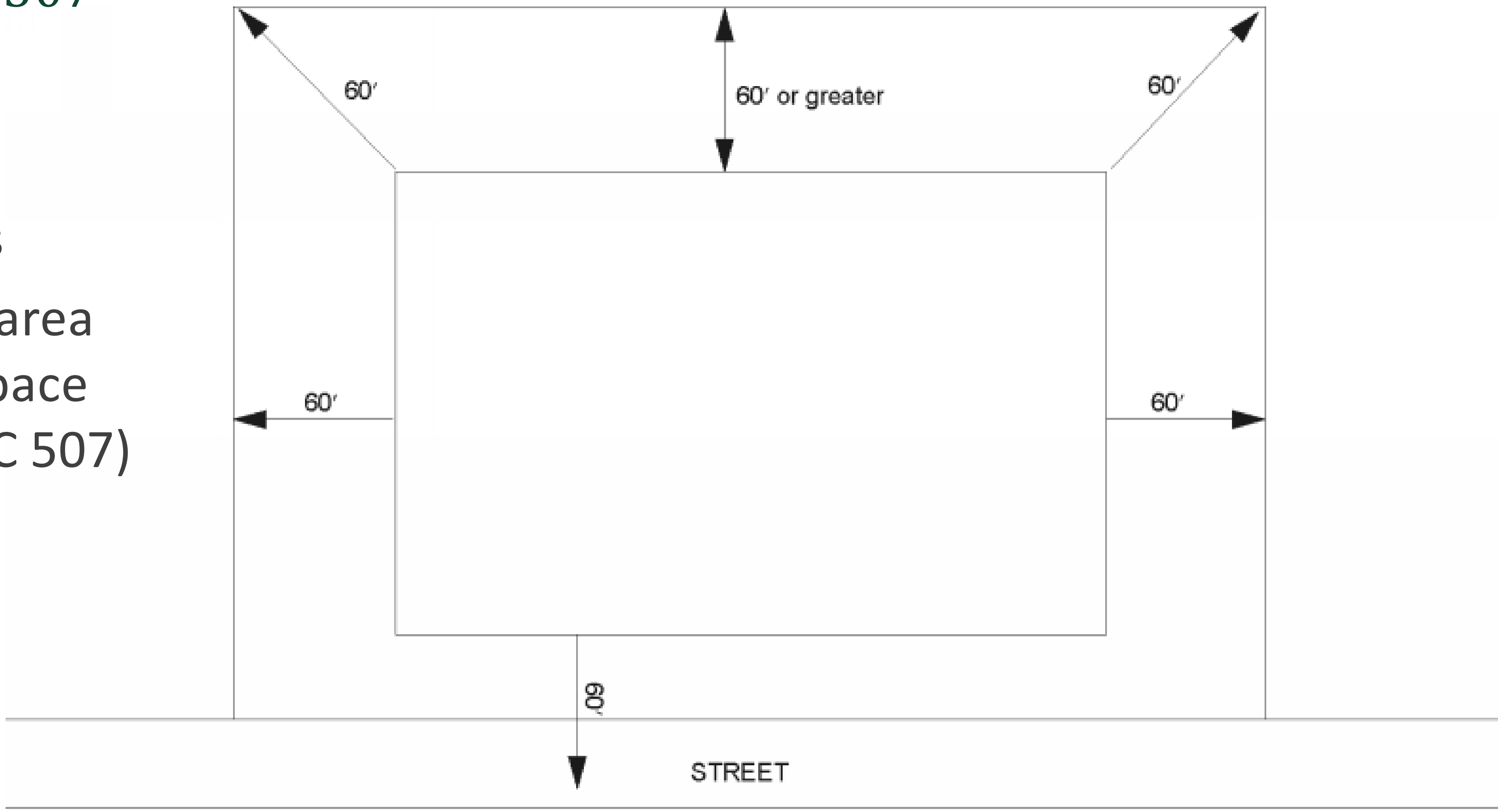
IBC Section 507 gives unlimited area building routes in Type III and IV Construction for:

- Assembly
- Education

Allowable Building Size
IBC 2018 & 2021 Section 507

Unlimited Area Buildings

Provisions for unlimited area buildings rely on open space surrounding building (IBC 507)



= 304.8 mm.

Figure 507.2
REQUIRED SEPARATION FOR UNLIMITED AREA BUILDINGS

Fire Resistance

Fire Resistance Detailing
NDS Chapter 16

Exposed wood fire resistance

Assumptions:

Nominal assumed char rate = 1.5”/hr.

Structurally spanning members: reduced section checked for capacity vs. demand.

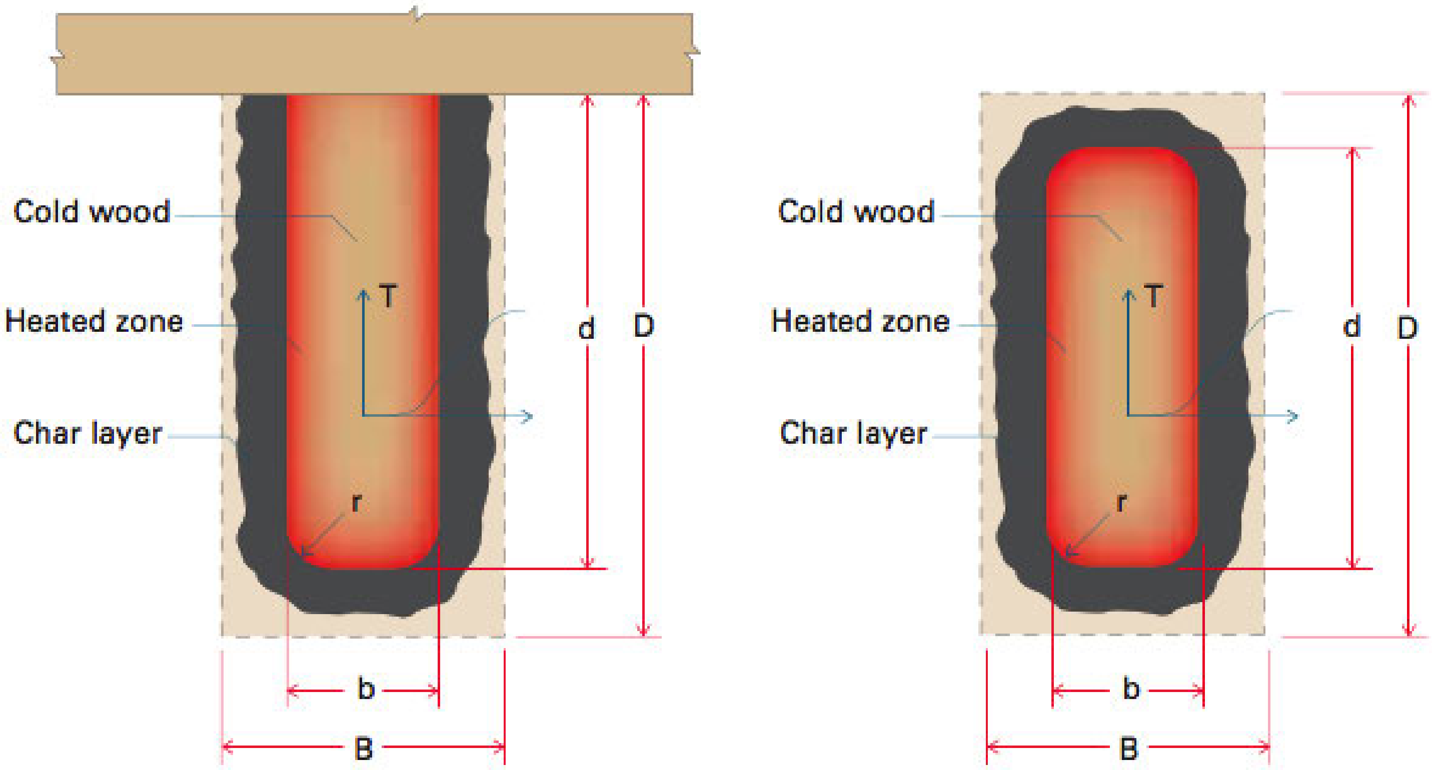


Figure 1-1 Reduction in member breadth and depth over time, t

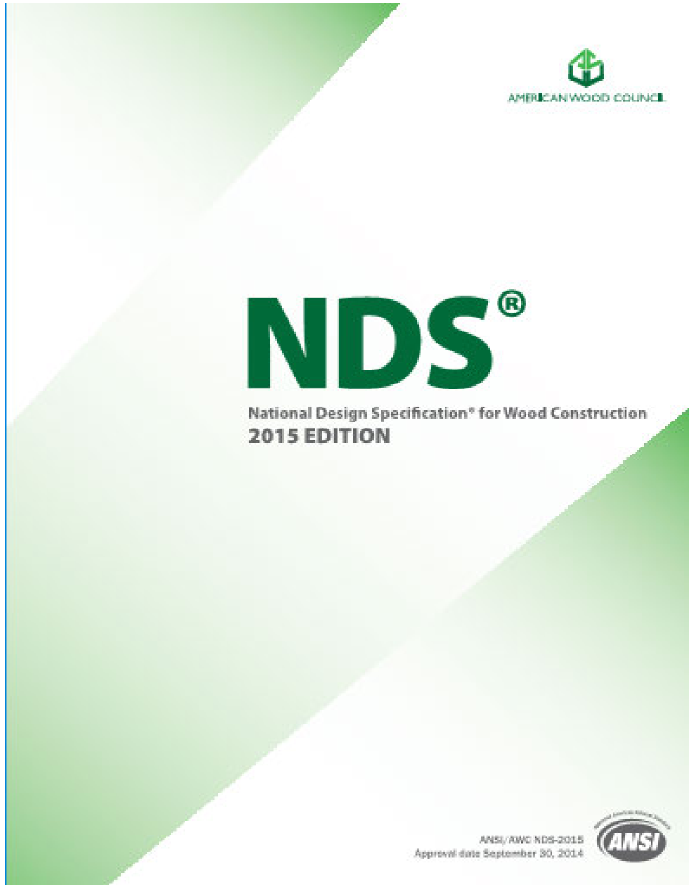
Source: AWC’s TR 10

Fire Resistance Detailing

2018 & 2021 IBC 722

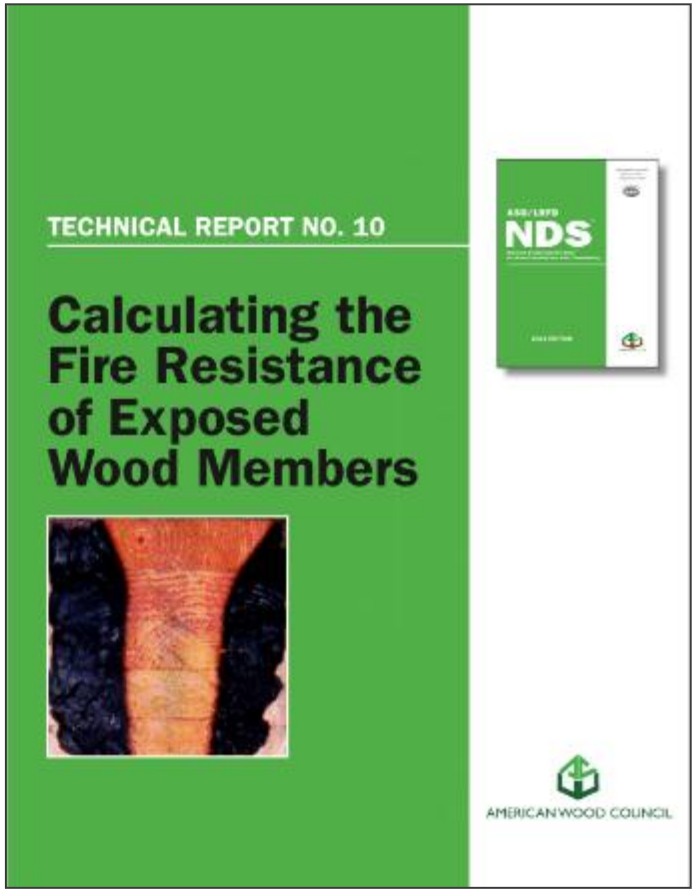
For Exposed Wood Members: IBC 722.1 References AWC's NDS Chapter 16

(AWC's TR 10 is a design aid to NDS Chapter 16.)



FIRE DESIGN OF WOOD MEMBERS

16



Acoustics

Acoustical Detailing

IBC 1207

Air-borne sound:

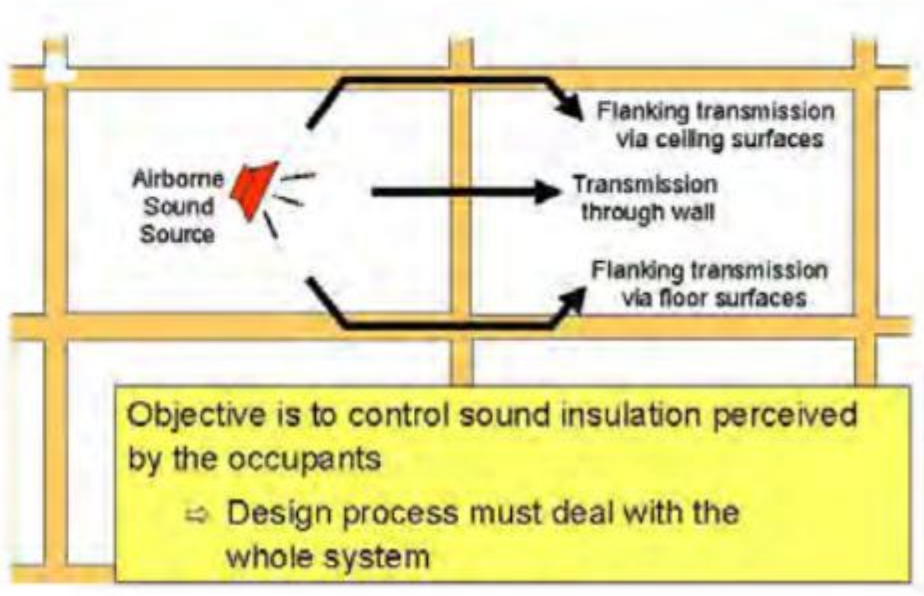
» Sound Transmission Class (STC)

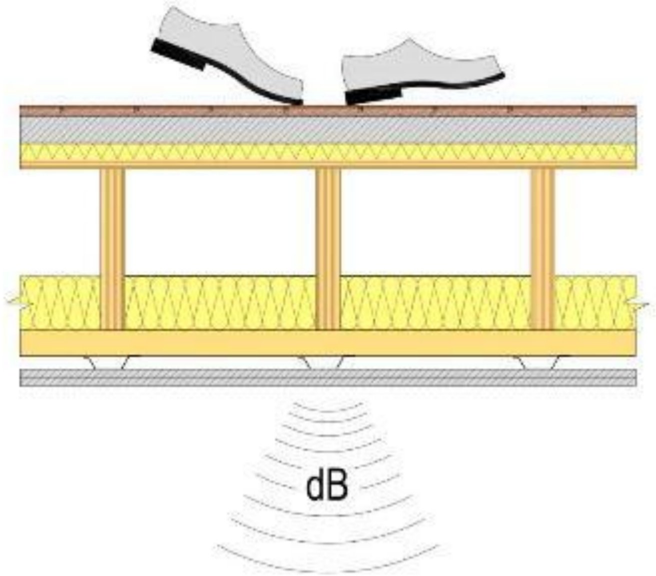
Measures how effectively an assembly isolates air-borne sound and reduces the level that passes from one side to the other.

Structure-borne sound:

» Impact Insulation Class (IIC)

Evaluates how effectively an assembly blocks impact sound from passing through it.





Source: ICC G2 Guideline for Acoustics

Mass Timber Design

Acoustics

Common mass timber floor assembly:

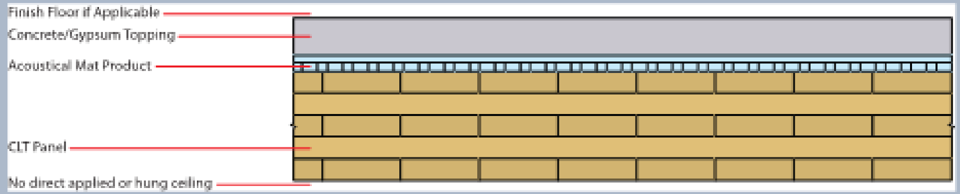
- Finish floor (if applicable)
- Underlayment (if finish floor)
- 1.5” to 3” thick concrete/gypcrete topping
- Acoustical mat
- Mass timber floor panels

Image credit: AcoustiTECH

Mass Timber Design

Acoustics

Table 1: CLT Floor Assemblies with Concrete/Gypsum Topping, Ceiling Side Exposed



CLT Panel	Concrete/Gypsum Topping	Acoustical Mat Product Between CLT and Topping	Finish Floor	STC[1]	IIC[1]	Source
CLT 3-ply (3.5")	3" concrete	Maxxon Acousti-Mat® 3/4	None	53[2] ASTC	45[2] FIIC	72
CLT 3-ply (4.125")	2" concrete	Pliteq GenieMat™ FF25	None	54	44	89
			LVT on GenieMat RST05	53	48	90
			Eng Wood on GenieMat RST05	53	46	91
			Carpet Tile	52	50	92
	3" concrete	Kinetics® RIM-33L-2-24 System with ¾" Plywood	None	57	45	103
			LVT	-	58	104
			2 layers of ¾" USG Fiberock® on Kinetics® Soundmatt	55	55	105
			LVT on 2 layers of ¾" USG Fiberock® on Kinetics® Soundmatt	-	59	106
		Kinetics® Ultra Quiet SR with synthetic roofing felt	None	57	46	107
			LVT	-	55	108
			2 layers of ¾" USG Fiberock® on Kinetics® Soundmatt	57	53	109
			LVT on 2 layers of ¾" USG Fiberock® on Kinetics® Soundmatt	-	50	110
	4" concrete	Kinetics® RIM-33L-2-24 System with ¾" Plywood	None	60	53	111

Acoustics and Mass Timber: Room-to-Room Noise Control

Richard McLain, PE, SE • Senior Technical Director • WoodWorks

https://www.woodworks.org/resources/inventory-of-acoustically-tested-mass-timber-assemblies/

Durability

High Traffic Areas

Durability Detailing

Durability design goals include minimal maintenance and repairs while maintaining safety. Consider high-traffic areas and areas of high moisture. Plan finishes, details accordingly.

- Corridors
- Bathrooms
- Entries
- Labs
- Kitchen
- Building envelope

Sacred Heart School, Atherton / Aedis Architects / Daedalus Structural Engineering / Photo Marco Zecchin

Wood-Framed Schools: Durability, Paper

This paper examines two important durability challenges: areas of high traffic and high moisture.

Free resource at **woodworks.org**

Wood-Frame Schools: Durability Techniques for Interior High Traffic and Moisture Areas

Richard McLain, PE, SE, WoodWorks

Wilkes Elementary School
Bainbridge Island, WA
Mahlum Architects

Photo:
Benjamin Benschneider

Ask any group of design professionals, school facility planners or maintenance personnel to discuss the primary design objectives for school construction, and the topic of durability will arise. Specifically, they point to the challenge of creating structures that last (a common goal is 50 years or more[1]), while minimizing the time and cost associated with maintenance and repairs, and allowing the school to remain open and safe at all times.

Wood-frame schools can be highly durable; around the world, many wood buildings 50 to 100 years old (and much older) are still in service, including school facilities. For example, Lincoln High School in Tacoma, Washington, a wood-frame building with masonry veneer, was built in 1914 and renovated in 2007. Hanover Street Elementary School in Lebanon, New Hampshire, a wood and masonry-frame

Durability of any structural material comes down to the surrounding environment (e.g., moisture, temperature, and relative humidity), ability to dry if it becomes wet, and quality of details and control layers. Designing for a long service life means anticipating potential durability issues and implementing strategies to avoid them.

This paper will examine two of the most significant durability challenges when designing wood-frame schools: areas of high traffic and high moisture. It also includes a discussion related to the durability of exposed heavy and mass timber elements, which are often used as a design feature to bring wood's natural warmth into the learning environment.

Durability Detailing

Higher durability finishes in high traffic areas:

Hard Tile

Medium Density Fiberboard (MDF)

Impact Resistant Gypsum

Vinyl Wall Coverings

Wood Structural Panel finish or backing to finish

Photo: CADM architecture

Durability Detailing

Higher durability finishes in high traffic areas.

Photos: Jim Hansen

Photo: CADM architecture

Durability Detailing

Stratford Middle School Pleasanton Campus New Classroom Building Photo: Marco Zecchin

Durability Detailing

Washington Latin Public Charter School, Perkins Eastman, Arup, Sarah Mechling

Space Planning

Space Planning

What's in a School?

"Small Spaces"
- Classrooms
- Bathrooms
- Offices

"Medium Spaces"
- Labs
- Music Room
- Kitchen

"Large Spaces"
- Cafeteria
- Gymnasiums
- Library

El Dorado High School / CADM Architecture / Engineering Consultants / Photo Dennis Ivy

Space Planning

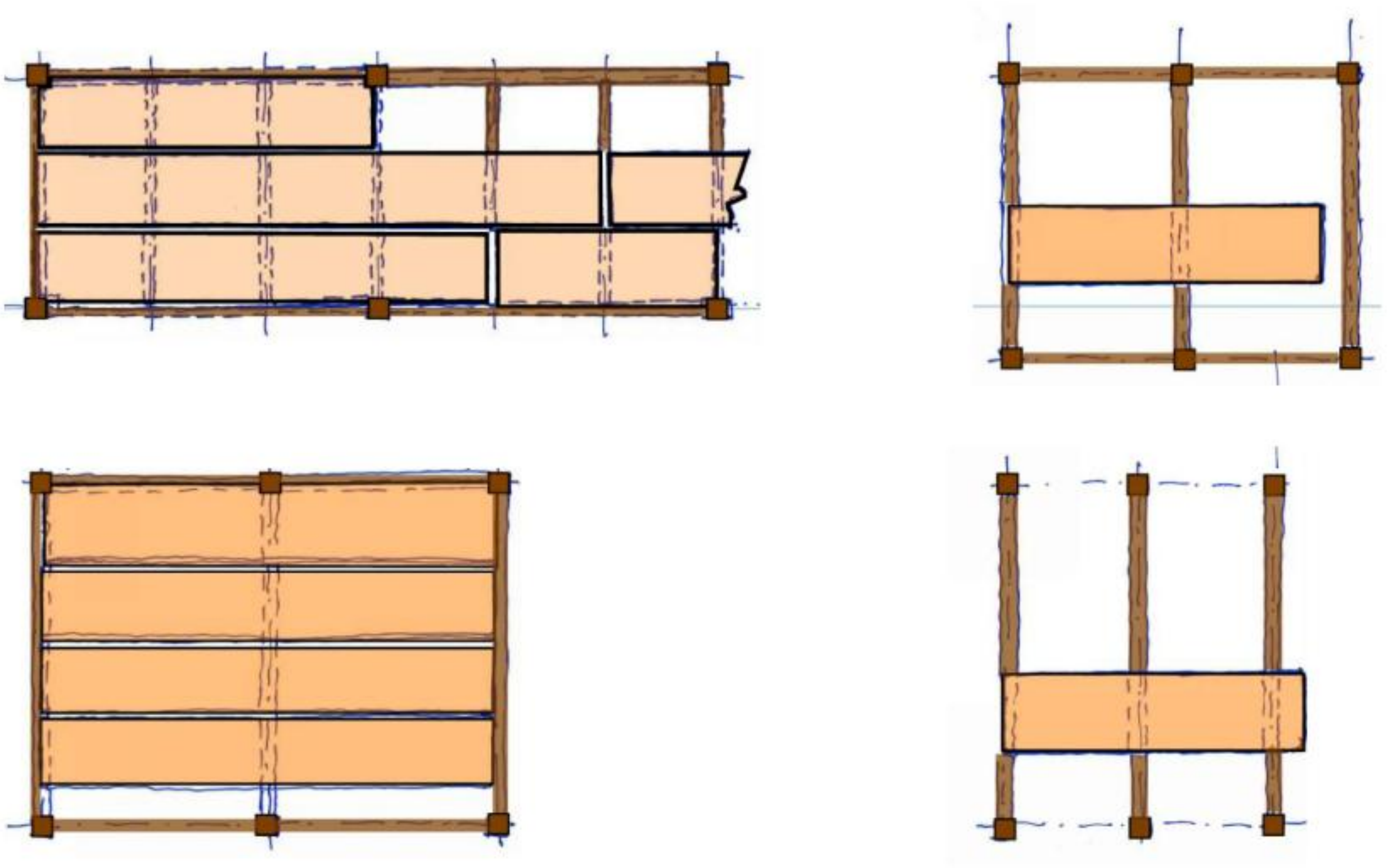
Classroom Wings

- Double-loaded corridor
- Classrooms: 800 sf min; 28-36 sf/student
- Usually square to slightly rect. – length no more than 1.5x width
- Common sizes: 28’x30’, 30’x30’, 30’x32’
- Corridor width: 6-18 ft wide, lockers?
- Min ceiling height: 9 ft. typ flr to flr ~ 13ft

Oregon State University – Cascades-Edward J. Hall, SRG Partnership, catena consulting engineers, Photo SRG Partnership

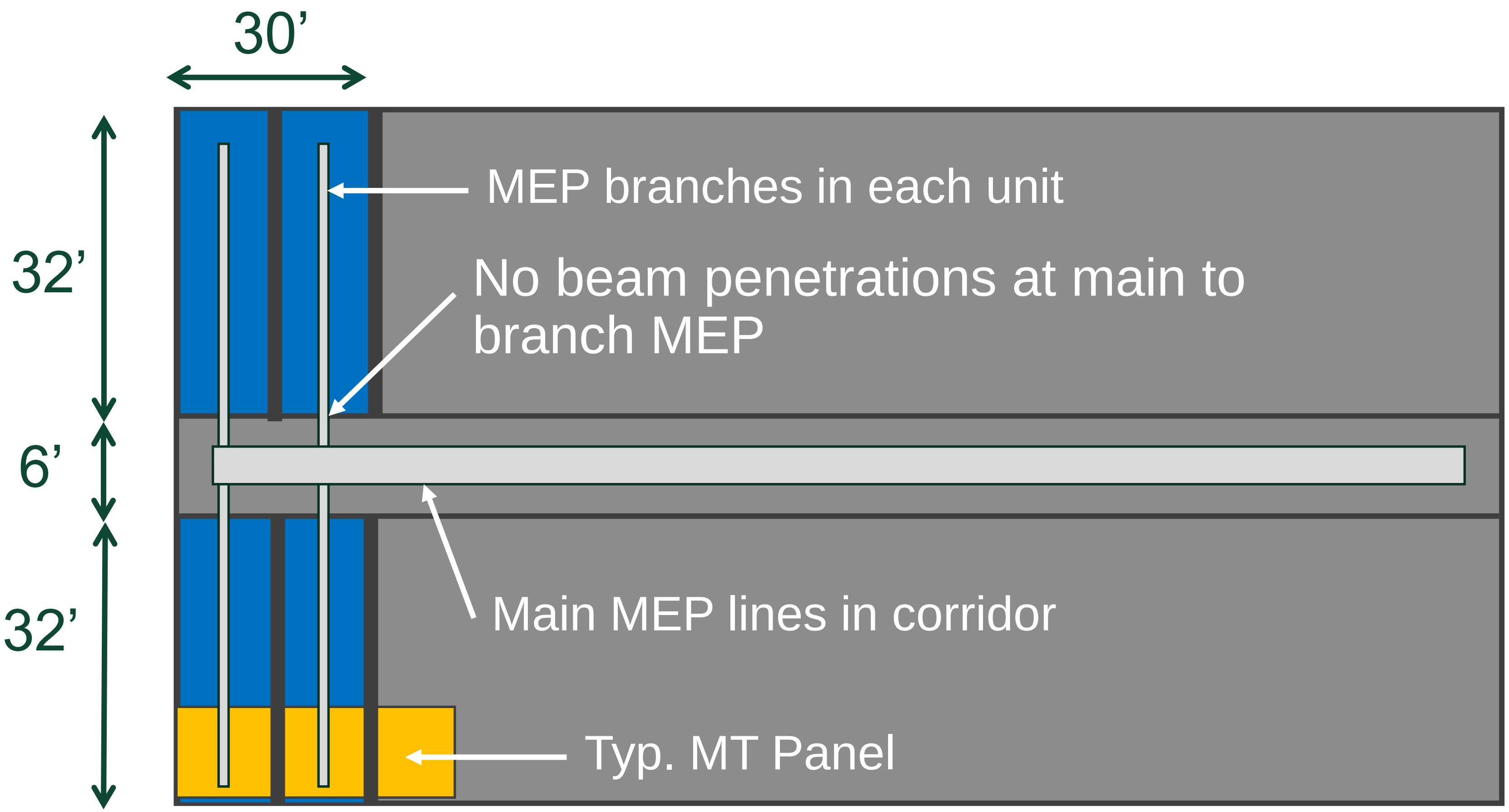
Structural Grid

- Consider Efficient Layouts
- Repetition & Scale
- Manufacturer Panel Sizing
- Transportation



Credit: Tanya Luthi, Entuitive

Early Design Decisions Example – Grid Option



MEP Layout Integration

Dropped below MT framing

- Can simplify coordination (fewer penetrations)
- Bigger impact on head height

Credit: Alex Schreyer

Credit: WoodWorks

MEP Layout Integration

In chases above beams and below panels

- Fewer penetrations
- Bigger impact on head height (overall structure depth is greater)
- FRR impacts: top of beam exposure

Credit: JC Buck

Credit: KL&A Engineers & Builders

MEP Layout Integration

In penetrations through MT framing

- Requires more coordination (penetrations)
- Bigger impact on structural capacity of penetrated members
- Minimal impact on head height


Credit: WoodWorks


Credit: WoodWorks

Floor to Ceiling Glazing Possibilities

Photos: Mark Bitterman

Structural Design

Mass Timber Building Options

Post and Beam **Flat Plate** **Honeycomb**

Mass Timber Building Options

Cirrus, Davis Partnership, photo KL&A Engineers & Builders

Hybrid: Light-frame

Houston Endowment Headquarters / kevin daly Architects with Productura / Arup / Photo Arup

Hybrid: Steel framing

Long-Span Open Areas

Gyms/Arenas:

» **Area:** 7,000 sf+

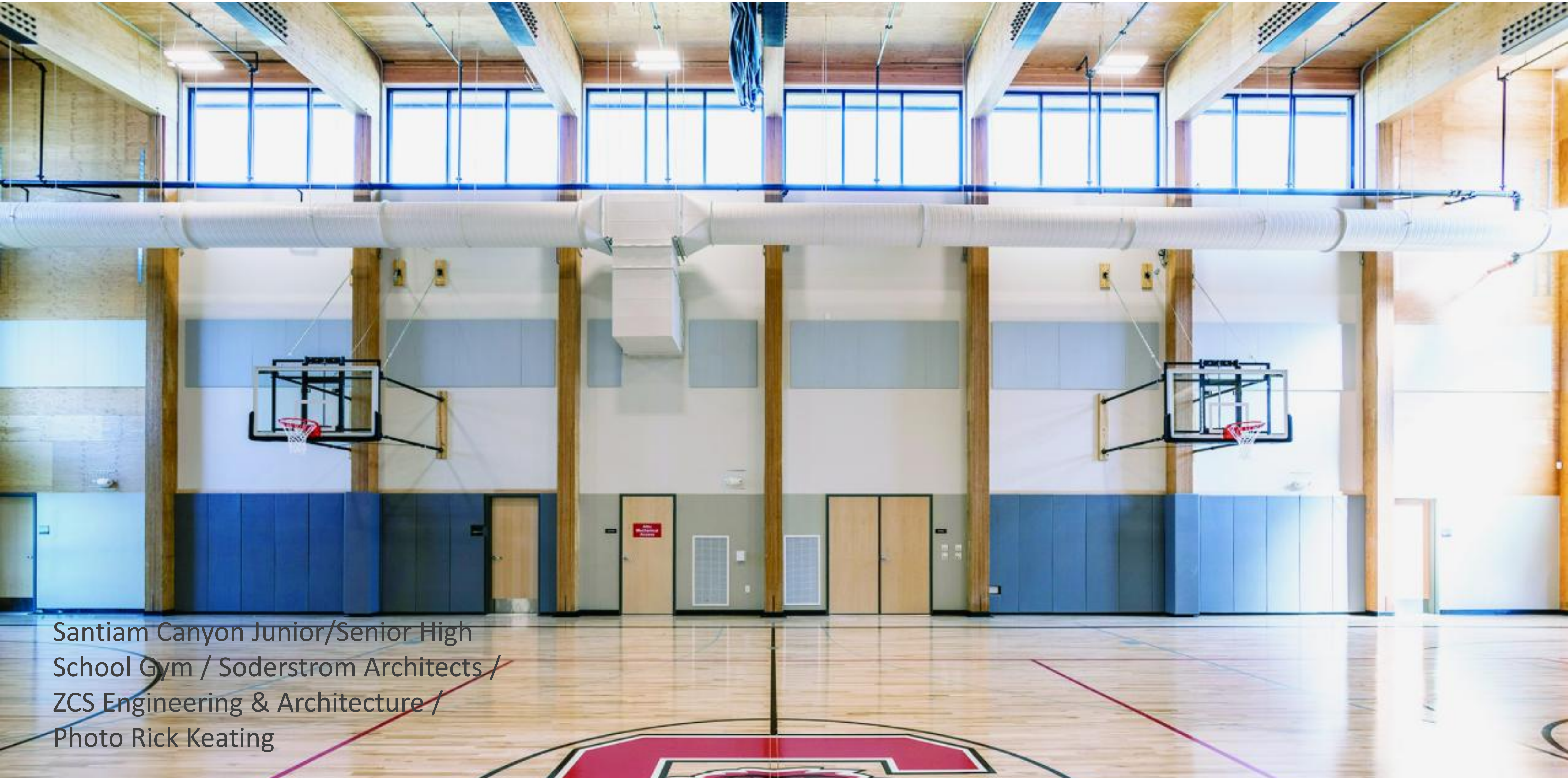
» **Ceiling heights:** 20 ft+

» **Spans:** 60 ft - 300 ft+

Santiam Canyon Junior/Senior High School Gym / Soderstrom Architects / ZCS Engineering & Architecture / Photo Rick Keating

Santiam Canyon High School

Glulam Beams: 72 ft span



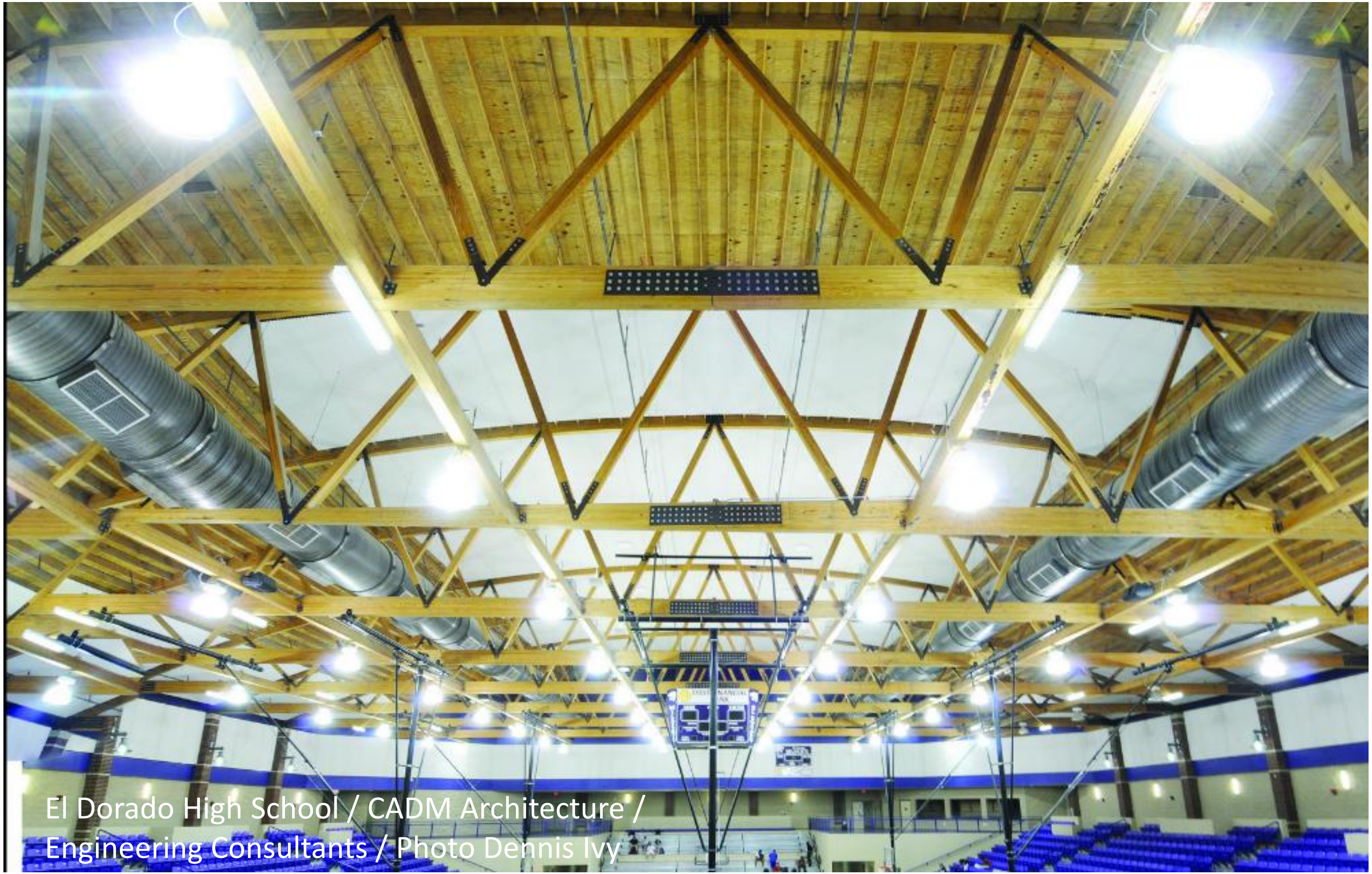
Santiam Canyon Junior/Senior High School Gym / Soderstrom Architects / ZCS Engineering & Architecture / Photo Rick Keating

Evergreen Charter School Glulam Trusses: 48 ft span

Martin Hopp Architect
ODEH Engineers
Rendering: Martin Hopp Architect

El Dorado High School

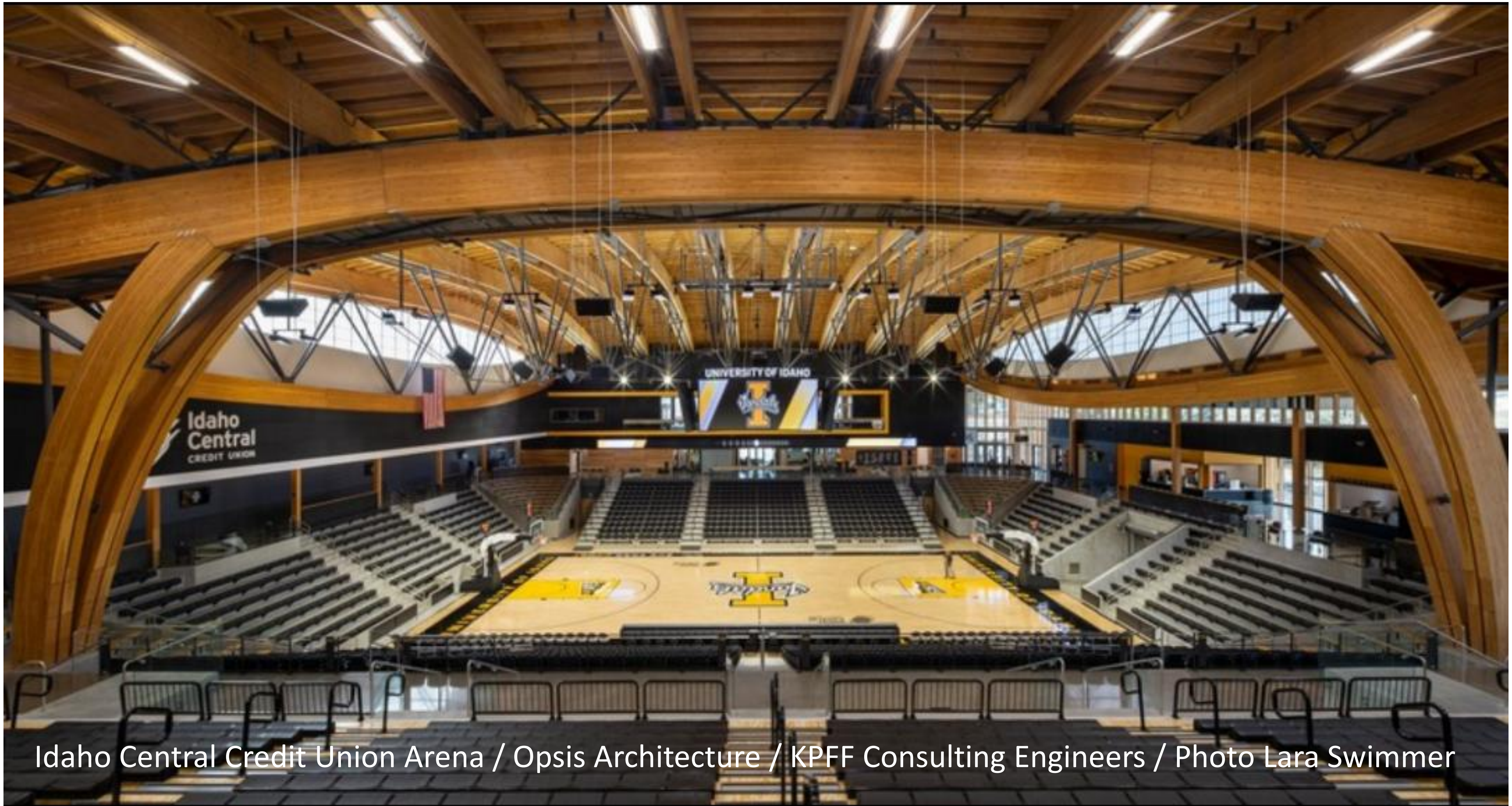
Glulam Trusses: 165 ft span



El Dorado High School / CADM Architecture / Engineering Consultants / Photo Dennis Ivy

University of Idaho Credit Union Arena

Glulam Trusses : 140 ft span



Idaho Central Credit Union Arena / Opsis Architecture / KPFF Consulting Engineers / Photo Lara Swimmer

YMCA Camp Thunderbird Duke Energy Pavilion,
Lake Wylie, SC

70-foot clear span

Engineer: Bulla Smith Design Engineering
Photos: Stanley Capps

Storm Shelters

Storm Shelters

2018 & 2021 IBC 423

IBC 423 requires ICC 500 compliant storm shelters – typically constructed as safe rooms in a larger facility – for group E buildings with tornado wind speed of 250 mph.

Applies to ‘tornado alley.’

Commentary Figure 423.4
SHELTER DESIGN WIND SPEEDS FOR TORNADOES

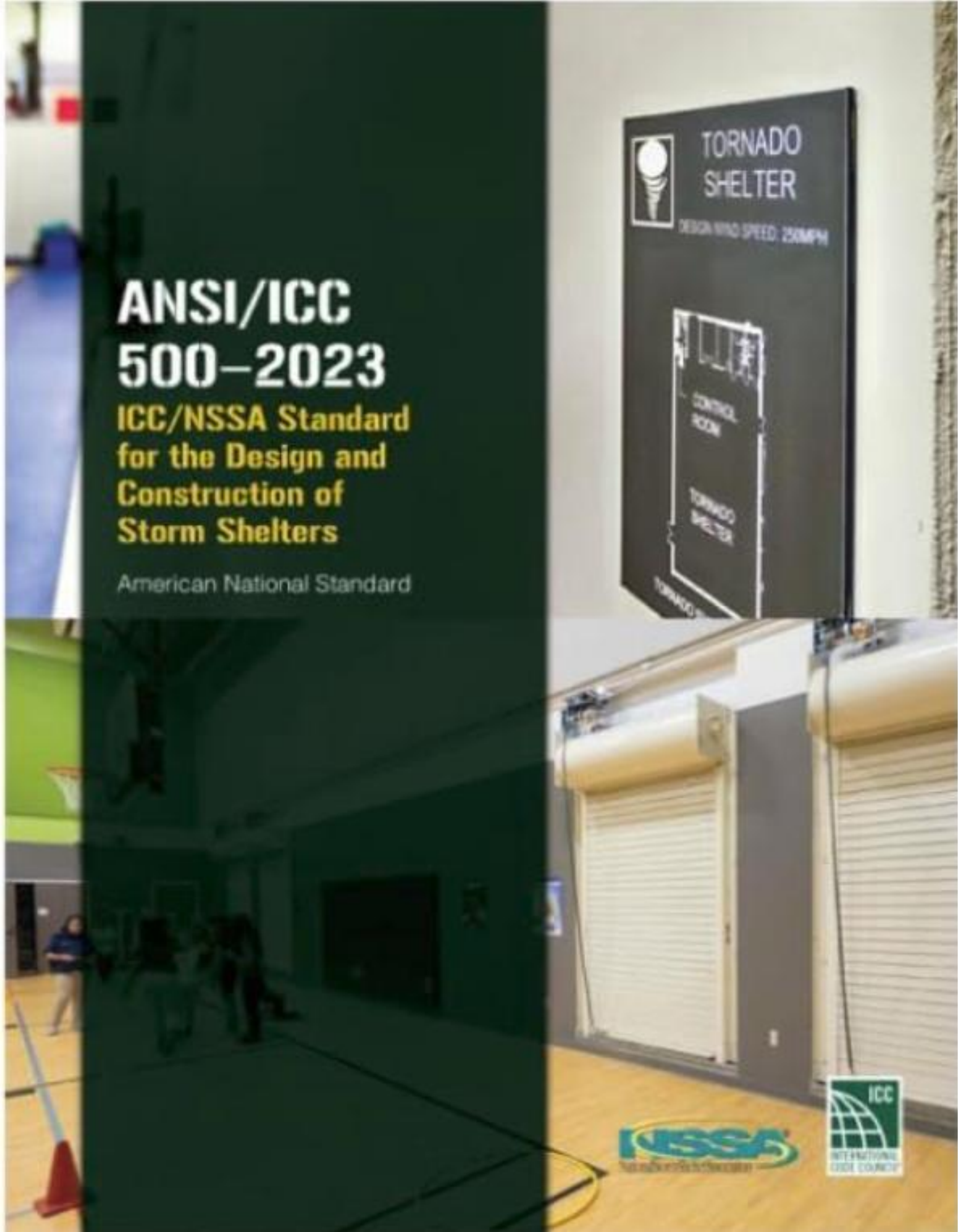
Source: International Code Council[1]

Storm Shelters
ICC 500

Includes requirements for:

- Wind, rain, live, flood and hydrostatic loading
- Shielding from host and adjacent buildings
- Resistance to wind-borne and falling debris

Source: International Code Council, ICC 500-2023



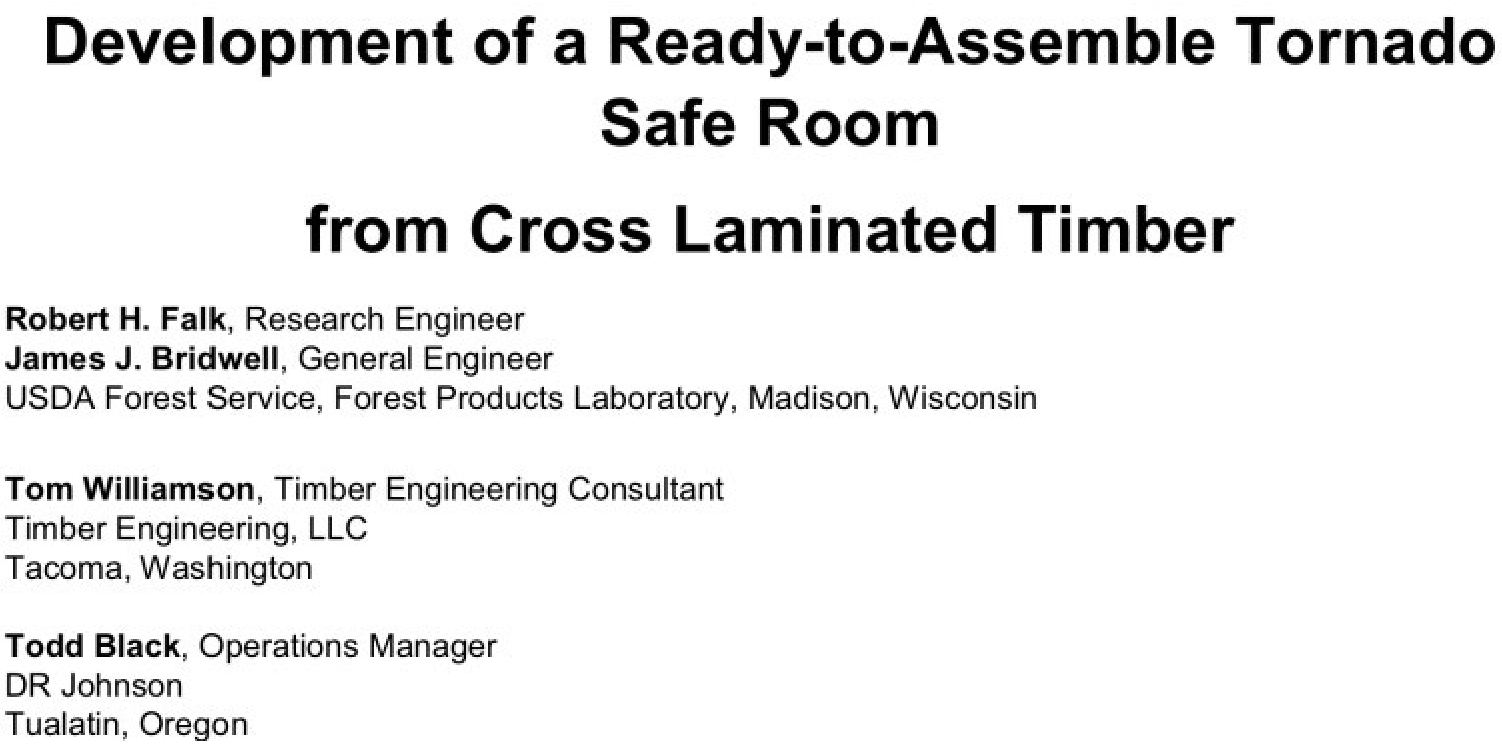
Storm Shelters

2018 & 2021 IBC 423

ICC 500 requires that storm shelters be capable of resisting missile impact, wind loading.

Source: USDA FS FPL wood tornado shelter[2]

Storm Shelters
2018 & 2021 IBC 423



Development of a Ready-to-Assemble Tornado Safe Room from Cross Laminated Timber

Robert H. Falk, Research Engineer
James J. Bridwell, General Engineer
USDA Forest Service, Forest Products Laboratory, Madison, Wisconsin

Tom Williamson, Timber Engineering Consultant
Timber Engineering, LLC
Tacoma, Washington

Todd Black, Operations Manager
DR Johnson
Tualatin, Oregon

Fig 19
Safe room tied down to strong floor

Source: USDA FS FPL CLT tornado shelter[3]

Storm Shelters
2018 & 2021 IBC 423

Benefits of a CLT Storm Shelter

- Strength and Resistance
- Sustainability
- Ease of Construction
- Aesthetics

Fig 19
Safe room tied down to strong floor

Source: USDA FS FPL CLT tornado shelter[3]

Case Studies

Cottonwood Valley Charter School E-Pod

Socorro, NM

Environmental Dynamics, Inc.
Walla Engineering, Ltd.
Photo: Patrick Coulie Photography

Cottonwood Valley Charter School E-Pod

Socorro, NM

6,400 sf, 2 stories

Education

Completed 2011

WOOD DESIGN AWARD WINNER

Environmental Dynamics, Inc.
Walla Engineering, Ltd.
Photo: Patrick Coulie Photography

Duke Lower and Middle Schools

Durham, NC

DTW Architects and Planners
GKC Associates
Photo: Jerry Markatos

Duke Lower and Middle Schools

Durham, NC

79,204 sf, 5 Buildings

Type V-B

Education

Completed 2009

DTW Architects and Planners
GKC Associates
Photo: Jerry Markatos

Evergreen Charter School

Hempstead, NY

Martin Hopp Architect
ODEH Engineers
Rendering: Martin Hopp Architect

Evergreen Charter School

Hempstead, NY

85,000 sf, 5 stories

Type III-A

Educational

Martin Hopp Architect
ODEH Engineers
Rendering: Martin Hopp Architect

Common Ground High School

New Haven, CT

Gray Organschi Architecture
Edward Stanley Engineers
Photo: Gary Sundberg

Common Ground High School

New Haven, CT

» LEED Gold Certified

» Designed to blend into local landscape and farms

» Built with a mission of ecology and sustainability

Photos: Gary Sundberg

Gray Organschi Architecture
Edward Stanley Engineers

Franklin Elementary School

Franklin, WV

MSES Architects
MSES Consultants, Inc.
Photo: Pam Wean, MSES Architects

Franklin Elementary School

Franklin, WV

- First school in the U.S. built with CLT
- CLT selected to fit tight construction schedule
- CLT roof, above-grade floor, and bearing walls. Panels precut for openings and utility chases

Estimated by the Wood Carbon Calculator for Buildings, based on research by Sarthre, R. and J. O'Connor, 2010, A Synthesis of Research on Wood Products and Greenhouse Gas Impacts, FPInnovations. Note: CO_2 on this chart refers to CO_2 equivalent.

Photos: Pam Wean, MSES Architects

MSES Architects
MSES Consultants, Inc.

Santiam Gymnasium

Mill City, OR

Soderstrom Architects
ZCS Engineering
Photo: Rick Keating

Santiam Gymnasium
Mill City, OR

- Slab to structure construction took 2-weeks.
- Uses both CLT and MPP.

Photos: WoodWorks (left) and Rick Keating (right)

Soderstrom Architects
ZCS Engineering

Greenhill School

Addison, TX

Architect: Bohlin Cywinski Jackson
MEP Engineer: DBR Engineering Consultants, Inc.
Photo: WoodWorks

Greenhill School

Addison, TX

53,000 sf, 2 stories

Education

Completed 2023

Architect: Bohlin Cywinski Jackson
MEP Engineer DBR Engineering Consultants, Inc.
Photo: WoodWorks

Greenhill School

Addison, TX

53,000 sf, 2 stories

Education

Completed 2023

Architect: Bohlin Cywinski Jackson
MEP Engineer DBR Engineering Consultants, Inc.
Photo: WoodWorks

Questions? Ask us anything.

Mark Bartlett, PE
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(214) 679-1874
mark.bartlett@woodworks.org

Survey

901 East Sixth, Thoughtbarn-Delineate Studio, Leap!Structures, photo Casey Dunn