# Mass Timber's Growing Foothold in the Northeast

Bowdoin College Mills Hall and Center for Arctic Studies

Presented by Matthew Tonello, P.E.



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

### Learning Objectives

- 1. Planning / Modeling Costs for Mass Timber Projects
- 2. Lessons Learned Procurement, Planning and Construction Phase
- 3. A Perspective on Environmental Impact of a Structural System

### Bowdoin College Center for Arctic Studies & Mills Hall



### Arctic Museum (CAS)

### Mills Hall Classroom & Events

### Center for Arctic Studies



### Mills Hall



### Center for Arctic Studies - Entry



### Center for Arctic Studies Gallery Space



### Mills Hall – Conference / Event Space





### Planning Mass Timber – Early CM Involvement

1. Construction Manager engaged simultaneously with Designer

Designer & CM Involved in Project Goal Setting



### Keys to Success – Cost



### Planning Mass Timber – Compare to Comparable Design

Mass Timber	Structural Steel	Devertation	Takent City	Total Colt/Live:	Total Ammone	Grand Total	
Exposed Timber	AESS Steel	01.0 Structural Steel Framing System 03-30 CONCRETE Concrete trade GC Concrete curing	1 es 13,911 ef	10,273.00 /es 0.43 /ut	10,279 5,982	12,973 7,554	
CLT Shear Walls	CMU Shear Walls	Concrete curing Concrete curing Welded wire mesh material - SOMD - Floor (5x5 W1000000000000000000000000000000000000	5,795 d 2,485 d 11,911 d	0.43 /d 0.43 /d 0.35 /d	2,453 1,068 4,869	3,547 1,545 6,548	
Exposed CLT Walls	Wood Panels	03-30 CONCRETE			92,640	116,984	
Schedule Factors (the tough one):		05-32 STRUCTURAL STEEL Structural steel - Subscatton	230 ton	4,500.00 /tox	1,035,000	1,306,978	
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INCLUDE SCHEDULE IMPACT		Acoustic mut 09-61 FLOOR PREP/MOISTURE MITIGATION 01.0 Structural Steel Framing System	-26,500 sf	6iu /ł	(159,000)	(200,782) (200,782) 21,268	

### **Bowdoin Mills Hall & Center for Arctic Studies**

Schematic Design Mechanical Pricing Options - HVAC, Plumbing, FP & Electrical Support

Anva	, Central steam and Chiller			Opt	fion 1			
Mills Hall - 23,000 sqft	Center for Arctic Study - 14,000 sqft	with 55	CA5 15	AHUs, Centr Ch	al Steam and siller			
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		VRF - J	Air Coole	ed Option			Opt	ion 2
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	and Tata Heat Recovery Wheel.	feat	porotor Eule I N	JUPA and Gal Pho Mon.	01e \$112.000	107.000	19.78	52,090,75

Geothermal AHUs and Central Steam Backup										
Mills Holl - 23,000 sqft	Center for Arctic Study - 14,000 sqft	Mills \$5	CAS SS							
(1) 20.000 CHA Semi Custom Indoor Air funding Unit. Nan Array, Hol Water and Chiled Water Calls, News and Sound Afternation.	(1) 21.000 CMI Cutters Indoor Ale Handling Grif, Ass. Aros, Indi Water and Chilled Water Cos, U/A and Gos. Prose Filters and Sound Afterwaters.	\$149.500	\$342.50							
Per AHU with pressure independent cooling-coll volves.	Per AHG with pressure independent cooling-colivatives	\$12,000	\$10.00							

Opt	on 3			
Geothermo Centrol Ste	al AHUs and am Backup			
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Option 4 VBF - Water Cooled Geo Option								
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a: 4	5,922	DD w/ VE, Distributed DC + Escalation	8P-1 GMP Value 1/30/2020	BP-1 Variance	MEPFP Budget	GMP Budget
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04-20	MASONRY	1,396,994				1,396,994
05-12	STRUCTURAL STEEL	242,552	216,900	(25,652)		216,900
05-50	MISC METALS	433,111				80,200
06-10	ROUGH CARPENTRY	80,206				
06-13	HEAVY TIMBER FRAMING	2,160,070				2,160,070
06-25	FINISH CARPENTRY	482,928				
07-10	WATERPROOFING & JOINT SEALANTS	176,665	183,300	6,635		182.92
07-41	ROOFING	1 274 445				1.274.445

# Planning Mass Timber - Keys to Success - Schedule Bowdoin Arctic Museum and Event Space

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### Procurement – Lessons Learned

- 1. European Glulam Design Parameters
- 2. Building Type Nuances NFPA / IBC Building Type Ratings
- 3. Connection Hardware Clarifications
- 4. Shipping Delivery Where's it Coming From?
- 5. Fabrication Who's fabricating what? Why it matters?
- 6. Connections to Concrete & Where is handoff?

### **Planning Mass Timber - Procurement** CONSIGLI

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### Bowdoin College Center for Arctic Studies and Mills Hall RFP for Mass Timber Design Assist Manufacture,

### Fabrication and Delivery



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### Procurement – Clearly Define Delegated Design

Delegated Design services shall be included for all connections and timber elements that will be supplied by the Timber Vendor. Submission of calculations to the engineer of record for review and approval and will be consistent with requirements of original RFP.

- 1. All loads from Engineer of Record will be provided to Timber engineer for incorporation in calculations for connections and final size verification.
- 2. Loads will be provided for relieving angle connections indicated on S701 once the exterior veneer system is selected. Horizontal and vertical loads will be provided by the Engineer of Record.
- **3.** Other loads required to complete the design of the Delegated Design Services will be available from the Engineer of Record at the request of the timber supplier.

### **Procurement – Fire Ratings**

- 3. All Roof Framing (beams and truss members) will be required to have a one hour rating. (*The currently drawn double members and trusses do NOT meet this requirement, see below for changes anticipated that are requested to be priced / budgeted to establish a baseline GMP value*).
  - a. Roof framing members indicated as (2) 5.125x30 & (2) 5.125x16.5 at the roof of The Center for Arctic Studies will convert to a single solid Glulam as indicated in Sketch attached.
  - b. The Ridge Beam indicated as "Wood / Steel Flitch Beam (2) 5.5"x36" Glulam with 1" x 34.5" [steel plate] will either be converted to one of the following options based on the loads indicated on Sketch "2019-11-20 Ridge Beam Loading...pdf"
    - i. Solid glulam element and upsized to accommodate loads.
    - ii. Remain as a built-up steel and wood member, but will require embedding the steel plate with a wood layer protecting the steel (shop fabricated and delivered as a solid built up member).
    - iii. All beam connections attaching to the ridge beam will be changed to concealed connectors with (1) hour fire protection.

### **Procurement – Fire Ratings**

- 4. All CLT floor panels are required to carry a 1 hour rating (*Note that the current sizing shown in the October* 18, 2019 DD documents meet this requirement)
- For baseline proposal purposes, the current 3-ply roof decks will remain as drawn on the October 18, 2019 drawings. If changes occur under this assumption, revisions to pricing and scope will occur during the Design Assist Process.
- All column splices will be required to maintain a 1 hour rating. Steel splice connections will be eliminated / minimized to the extent possible with recommendations made by Design Assist Timber Vendor. Specifically, connections shown for detail 3 on S800 will be eliminated and columns will be changed to continuous columns.
  - 7. All Beam to Beam, Beam to Column and Column to column connections shall be shop installed and delivered to the job site pre-installed and will be required to maintain a 1 hour rating.
    - a. All Connections shall be supplied with any required fire caulking to achieve the rating

### Coordination – Mass Timber & MEPs



### **Coordination – Shear Wall Penetrations**



### Coordination – CLT Floor Plate Invisible



### Summary of Mass Timber Choice at Bowdoin

**1.** Client has Sustainability Goals for the Project

Carbon is a factor in material choices Forest Sustainability is of Importance

- 2. Timber is a design feature (Exposed Structure is of Importance)
- 3. Timber Structure can do more than one job

Gravity Force Resisting Lateral Force Resisting Finished interior surface Envelope Panel

And COST... Schedule Benefits Are Considered INCLUDE SCHEDULE IMPACT

# **Environmental Perspective**



### **Environmental – Global Warming Potential**



### **Environmental Perspective**

- 1. North America All Vendors Solicited have SFI Certified
- 2. German & Austrian Vendor All offered PEFC Certified
- 3. Premium for FSC certified wood (\$40K on a \$1.5MM Supply)

### **Environmental Perspective**

- 1. North America All Vendors Solicited have SFI Certified
- 2. German & Austrian Vendor All offered PEFC Certified
- 3. Premium for FSC certified wood (\$40K on a \$1.5MM Supply)

# Opinion:

We have the ability to keeping working forests as <u>working forests by</u> <u>sustainably harvesting wood.</u>

### **Environmental Forests vs. U.S. Population**



### **Environmental Forests vs. U.S. Population**



# **Environmental Perspective**

