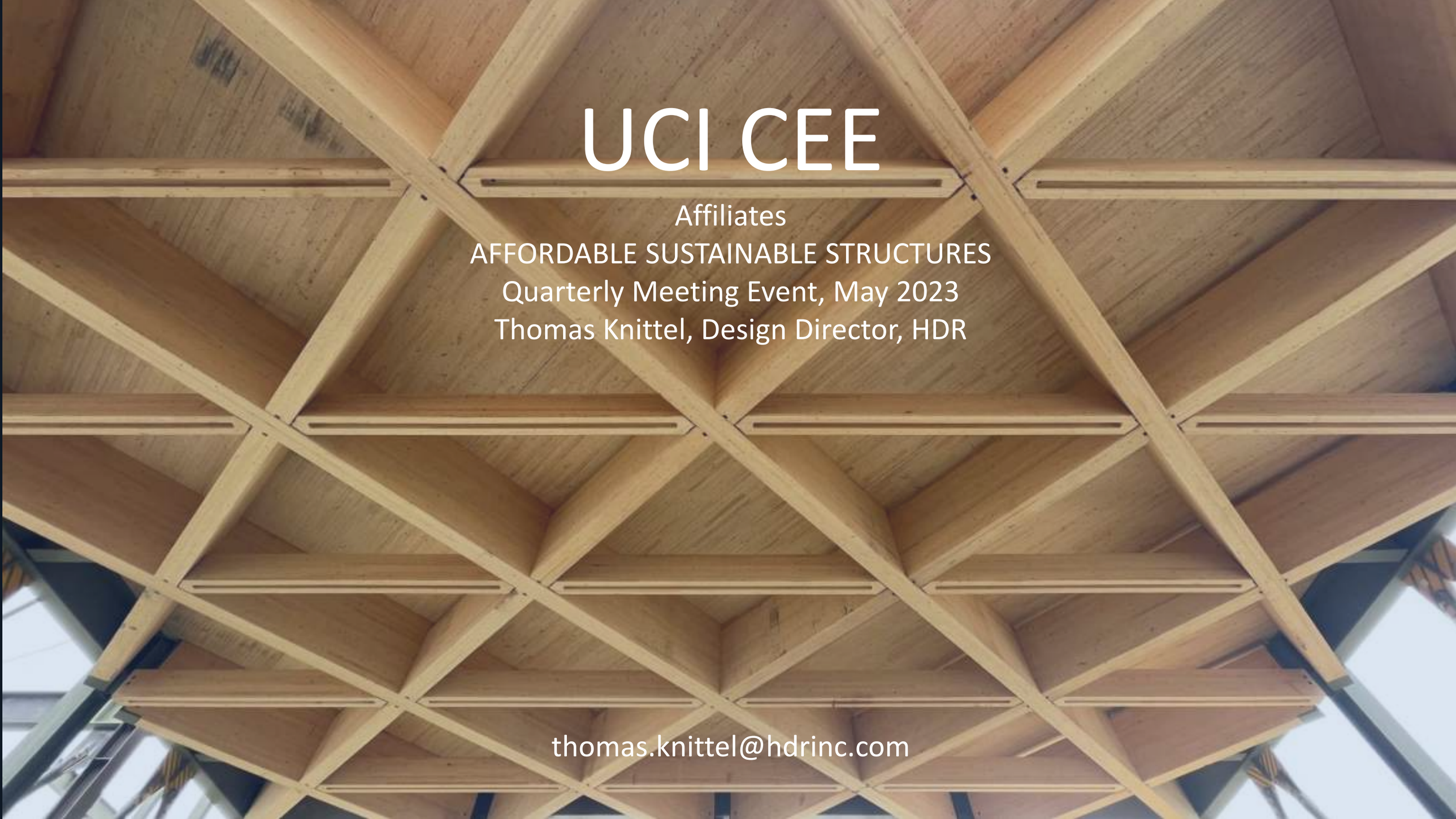


UCI CEE

Affiliates

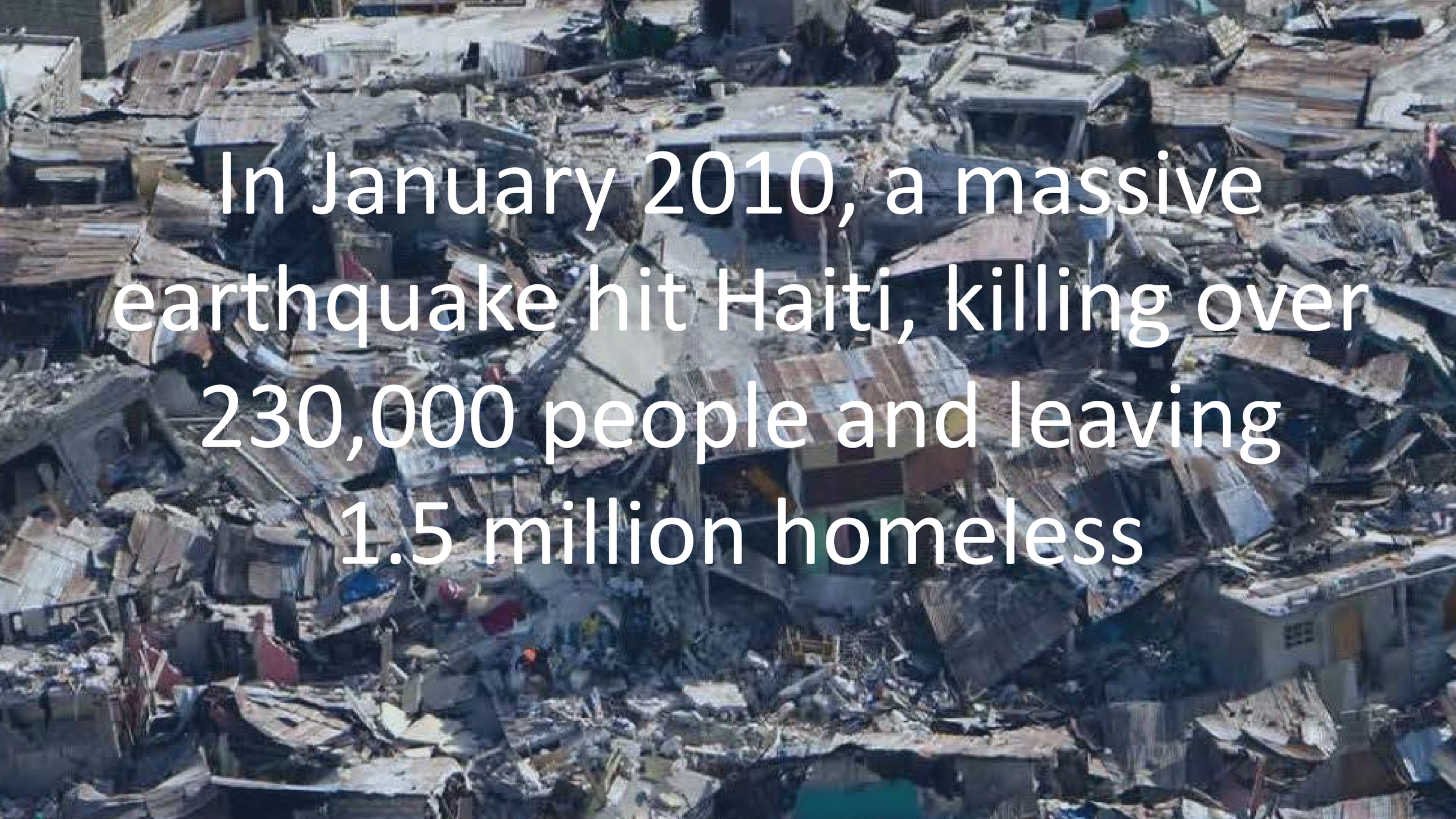
AFFORDABLE SUSTAINABLE STRUCTURES

Quarterly Meeting Event, May 2023

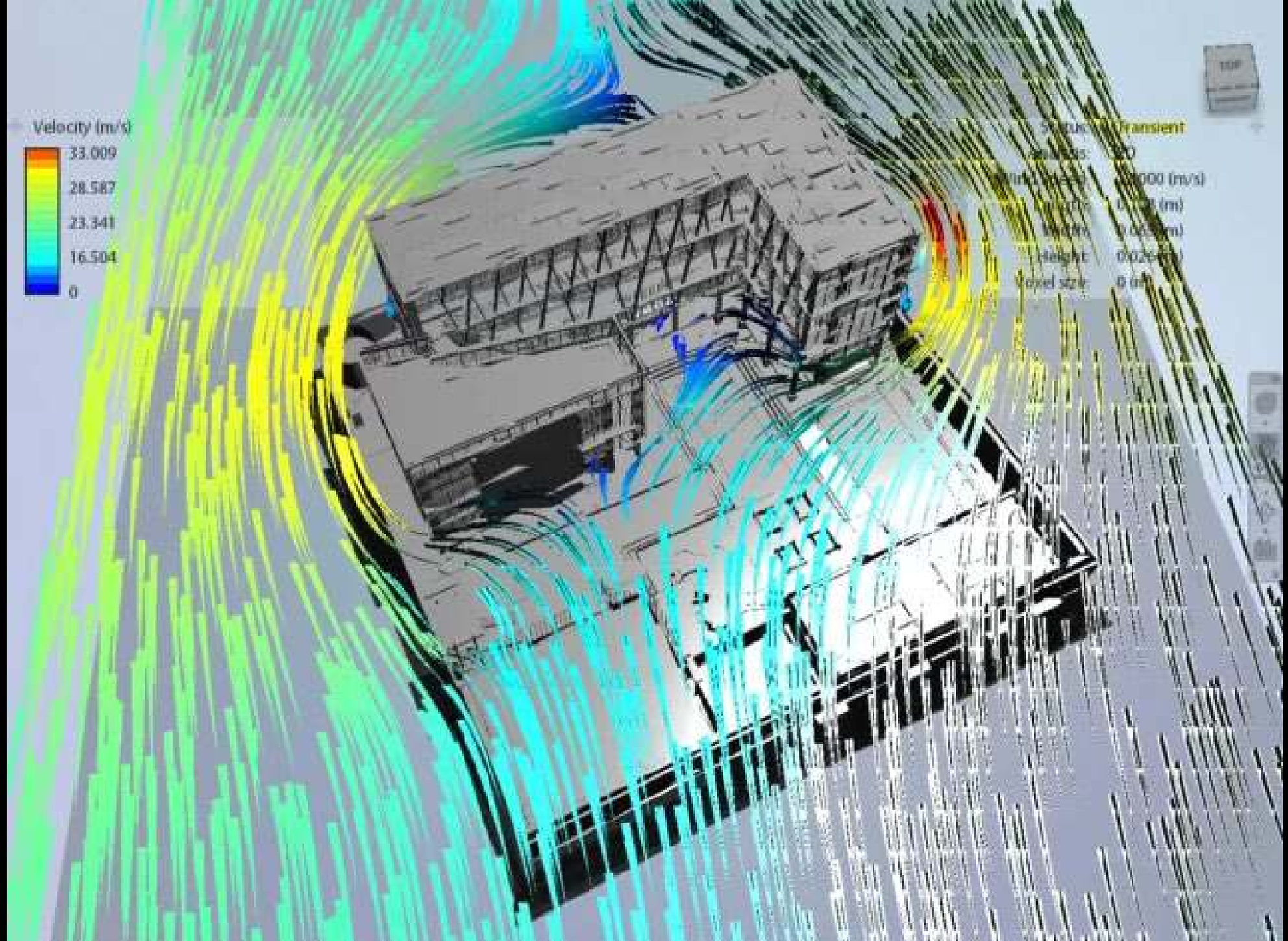
Thomas Knittel, Design Director, HDR

thomas.knittel@hdrinc.com

How can we provide low-cost sustainability with less moving parts?


In January 2010, a massive earthquake hit Haiti, killing over 230,000 people and leaving 1.5 million homeless





Velocity (m/s)
33.009
28.587
23.341
16.504
0
TOP

3:56

+ Queue

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Transcript

RESEARCH NEWS

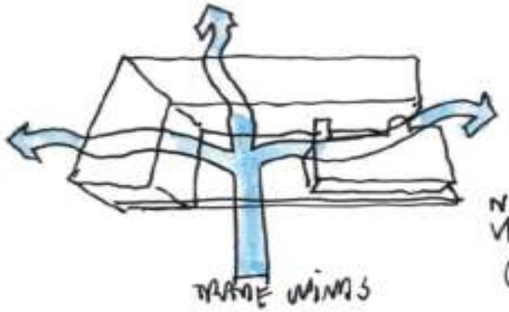
The Wisdom Of Trees (Leonardo Da Vinci Knew It)

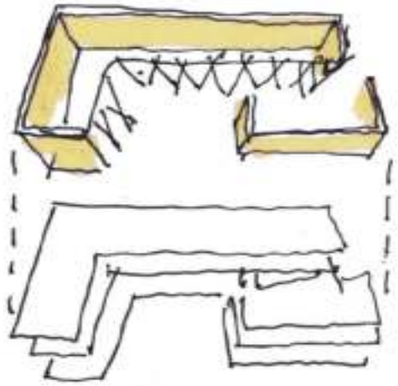
December 26, 2011 · 12:01 AM ET

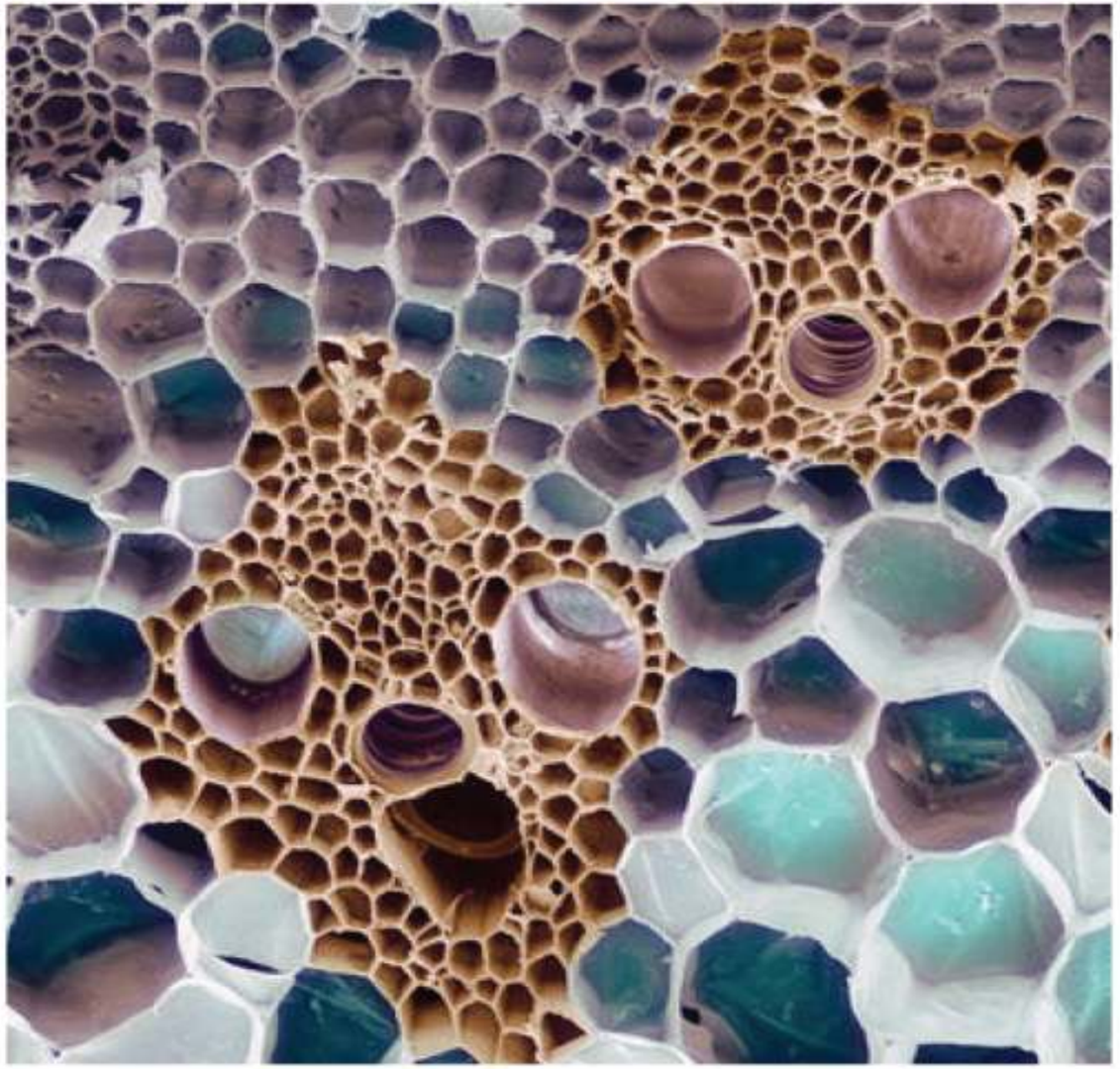
Heard on Morning Edition

JOE PALCA

Leonardo DaVinci noted that when trees branch, smaller branches have a precise, mathematical relationship to the branch they sprang from.



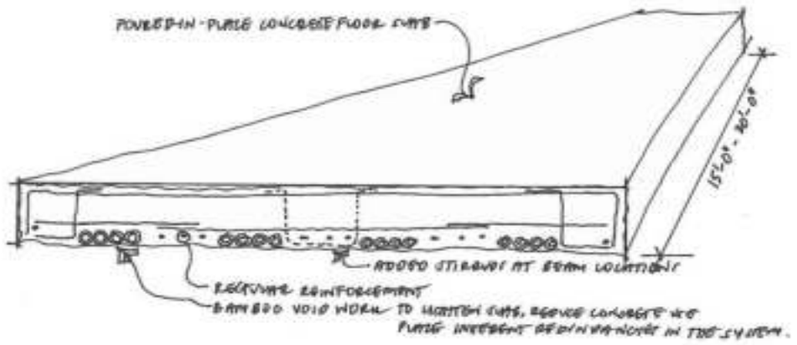




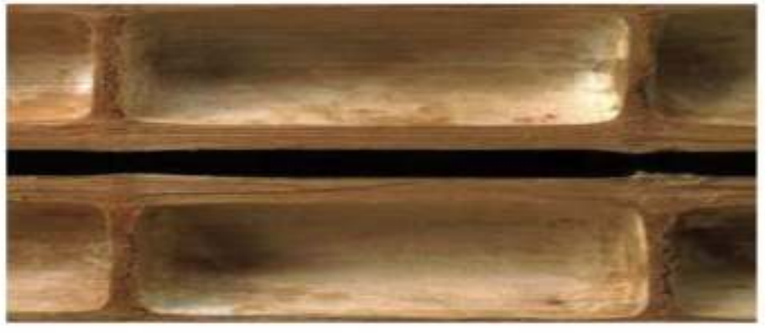
Building Cladding System

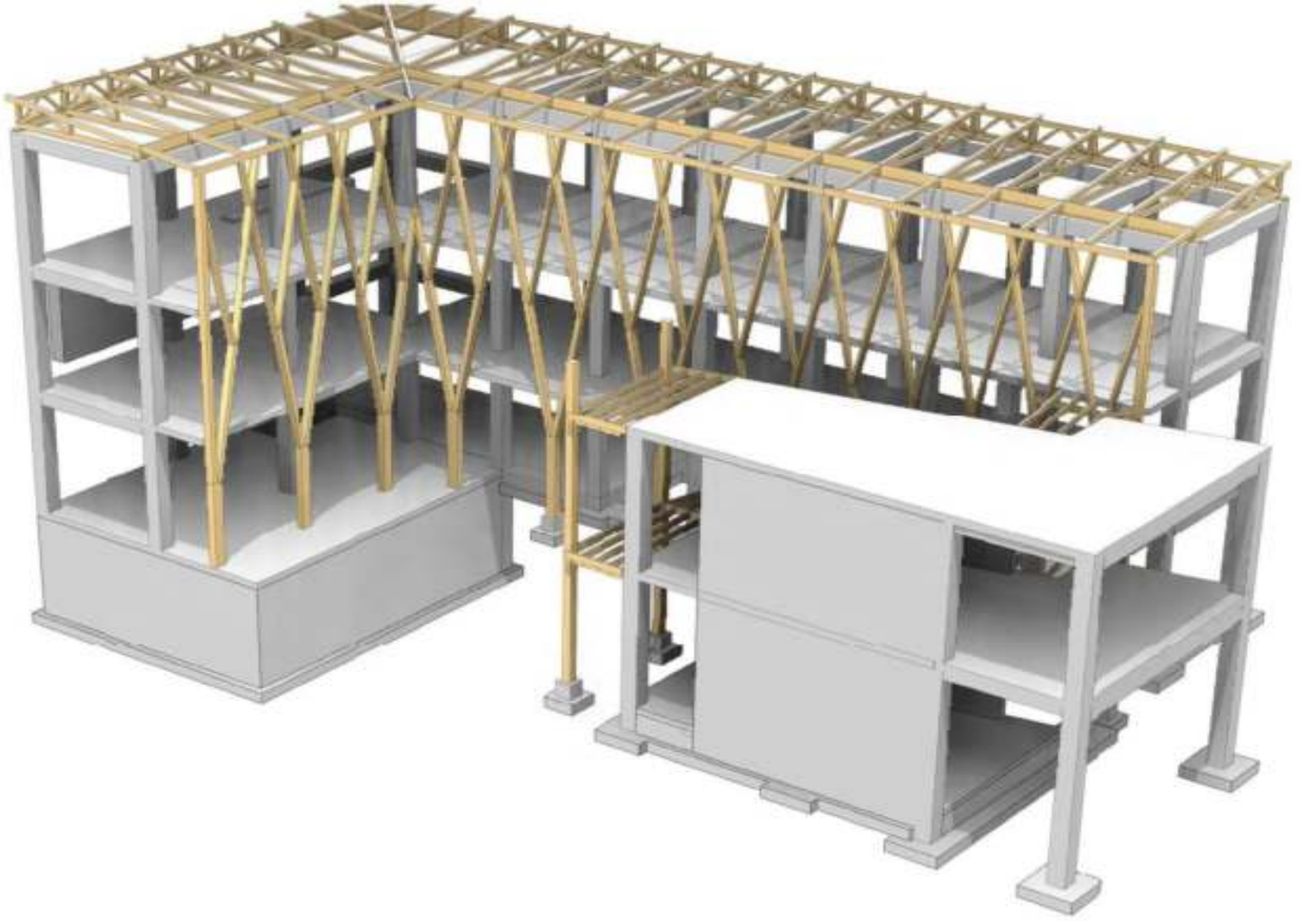
The second skin keeps the heat off the concrete core while admitting natural ventilation. High surface area, low emissivity, porous surfaces are used in nature to manipulate boundary layers as a survival strategy.

Be locally attuned and responsive: *use readily available materials and energy, cultivate cooperative relationships, leverage cyclical processes, use feedback loops*



Wood is precious and no longer availble locally for construction. Bamboo is an emerging resource with great potential: it will be used as leave-in place formwork for slabs, and as a low-emissivity second skin on facades.

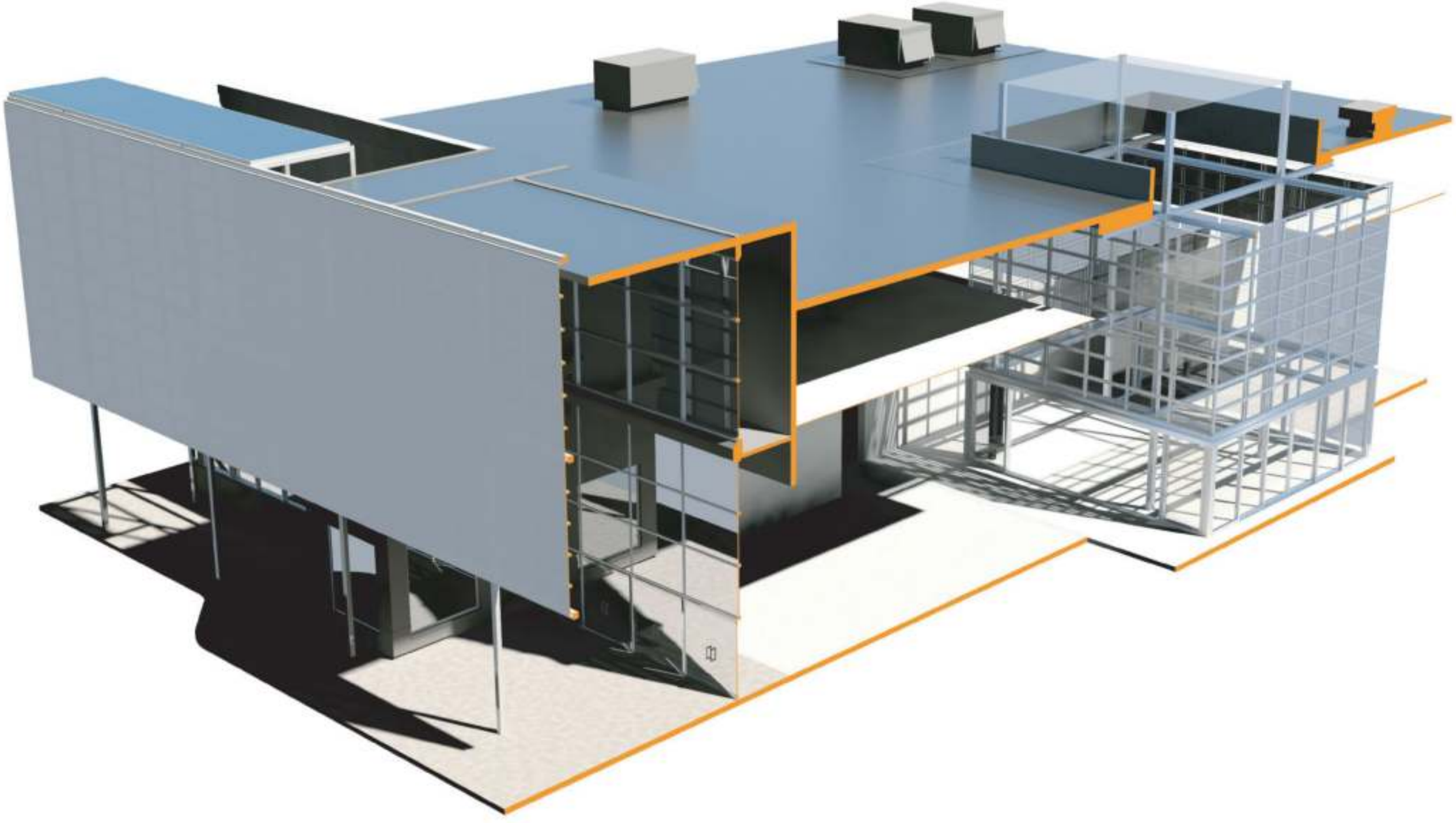


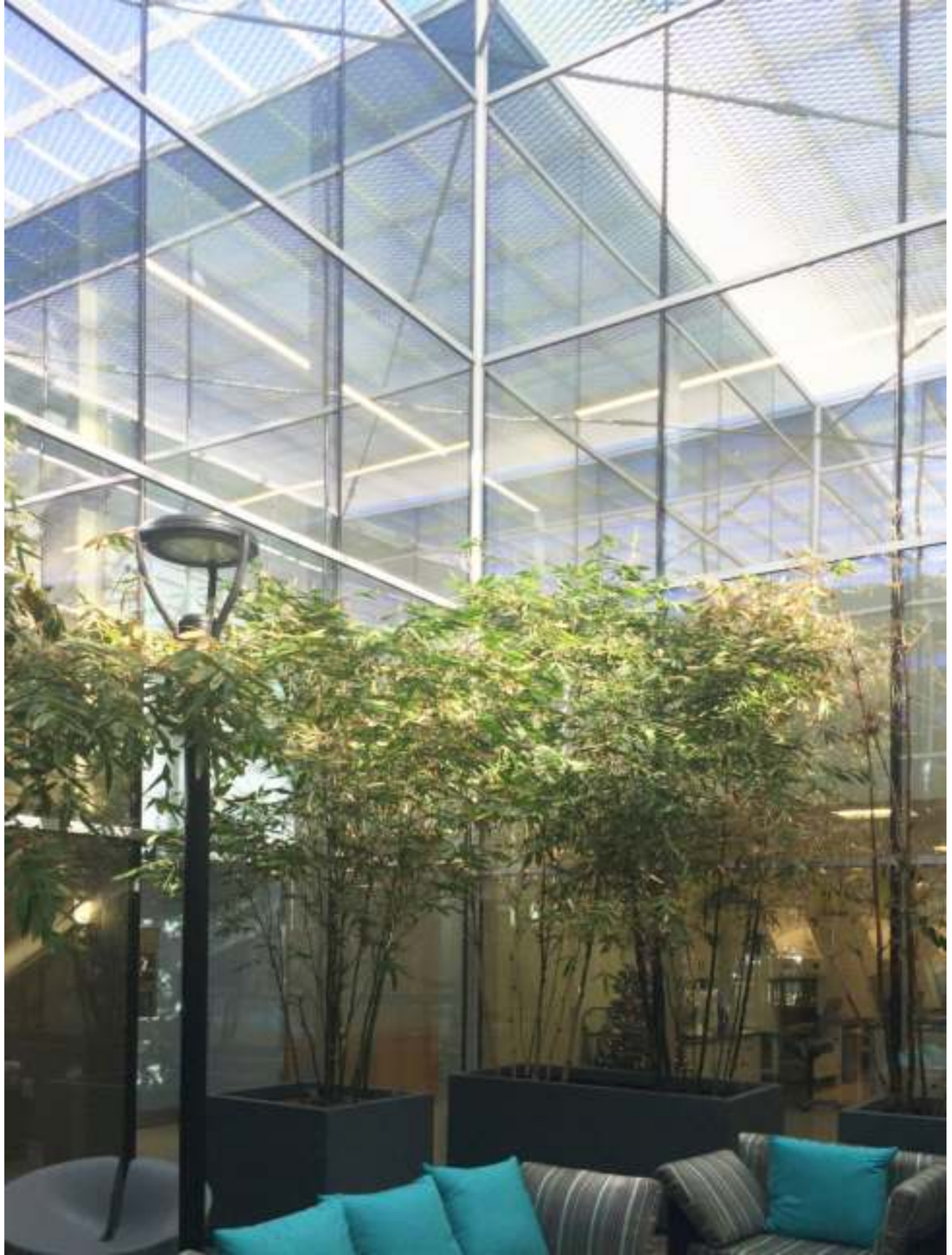


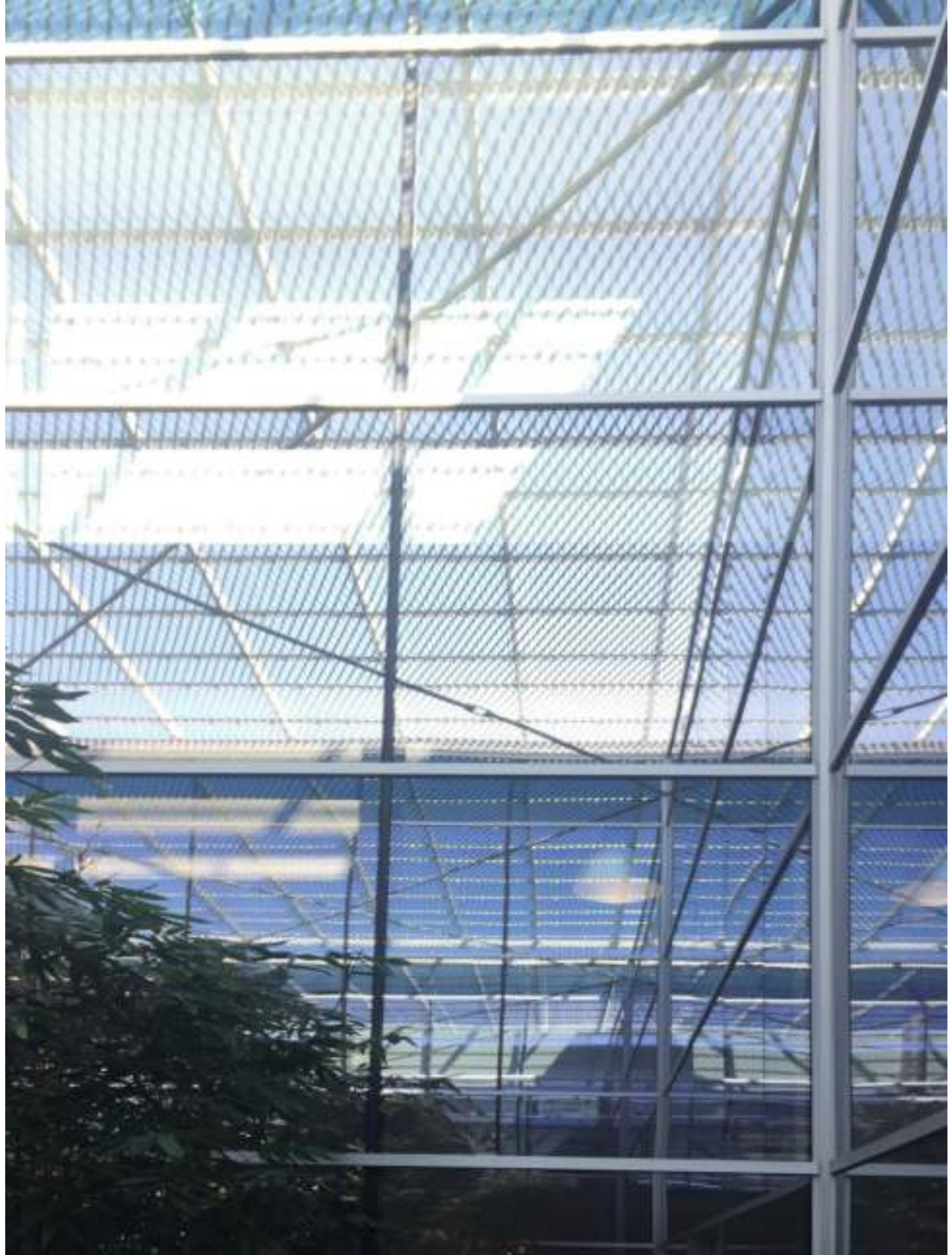
The project leverages local materials in a redundant concrete structural frame designed to IBC 2009 Standards, and repetitive details promote quality and labor up-skilling.

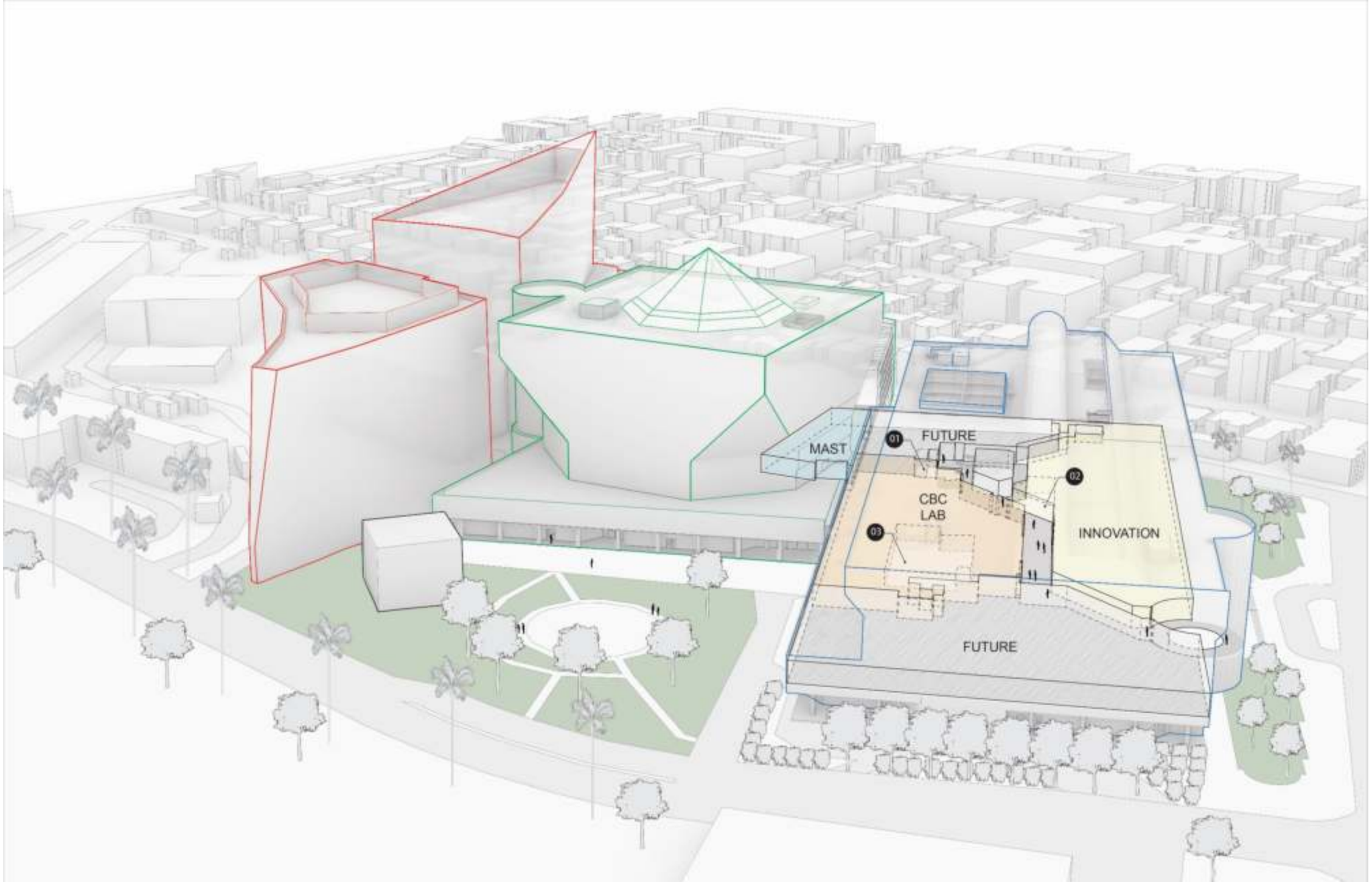

Is the most sustainable, cost effective strategy to not build at all?


BEFORE: Great Outdoors Big Box

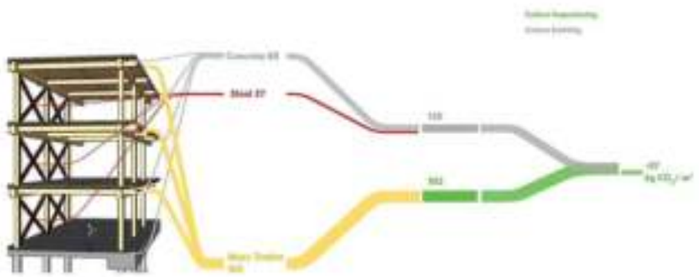







MAST
01
FUTURE
02
CBC
LAB
03
INNOVATION
FUTURE


Can cost effective, low embodied carbon approaches …also heal us?



HYBRID STRUCTURAL SYSTEM:
MASS TIMBER WITH EXPRESSED STEEL BRACE FRAMES

Winner of the CA Mass Timber Building Competition
Recognized as a demonstration project and awarded a grant to source mass-timber wood products from within CA.

A MASS TIMBER SOLUTION

Volume of wood products used:
480 m3 (16,836 ft3)

U.S. and Canadian forests grow this much wood in: 1 minute

CO_2 Carbon stored in the wood:
360 metric tons of CO2

CO_2 Avoided GHG emissions:
770 metric tons of carbon dioxide

Total potential carbon benefit:
1140 metric tons of carbon dioxide

Offset:
217 vehicles

Offset:
97 homes

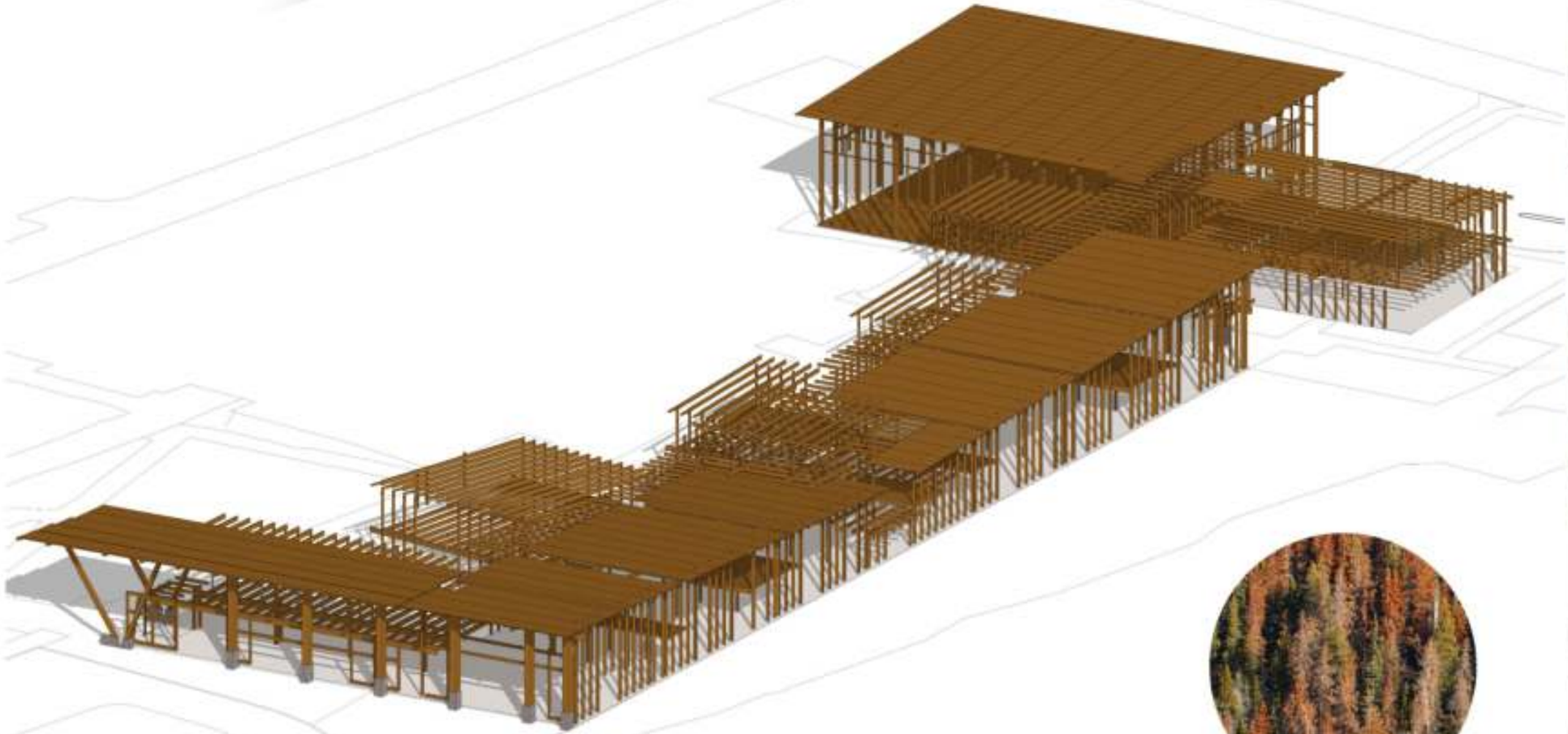
STRUCTURAL SYSTEM COST COMPARISON – BUSINESS HUB

Item	Mass Timber Structure	Steel Structure
Structural Costs	$2.9M	$2.9M
Foundation Changes (additional piles)	+$125K	
Foundation Changes (Weight difference of structure)		+$125K
concrete slab topping	+175K	+$310K
Pour stop + membrane	+80K	
Intumescent paint + fire proofing		+130K
Drywall column wraps		+200K
Ceilings and Bulkheads		+350K
Temporary protective measures	+85K	
Schedule Impact		+225K
TOTAL	**$3.36M**	**$3.84M**

Largest IPD project Canada: 2021




DEMOUNTABLE HEAVY TIMBER CONSTRUCTION



Jim Pattison Centre of Excellence for Sustainable Building Technologies and Renewable Energy Conservation