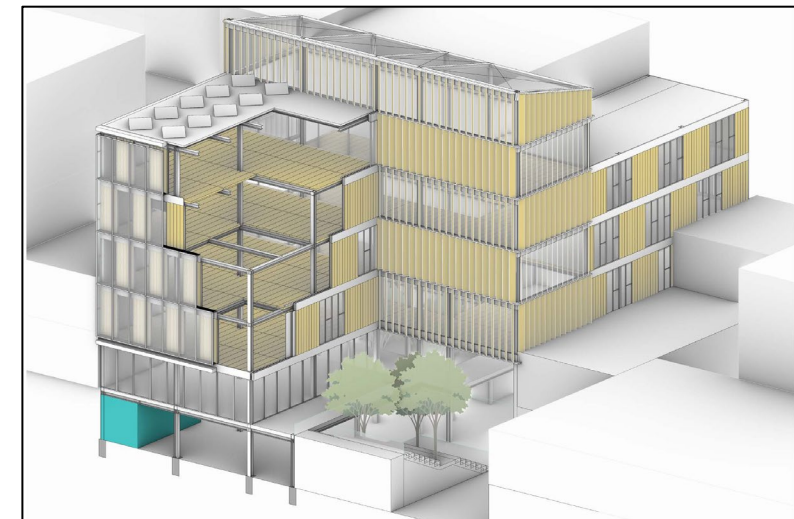
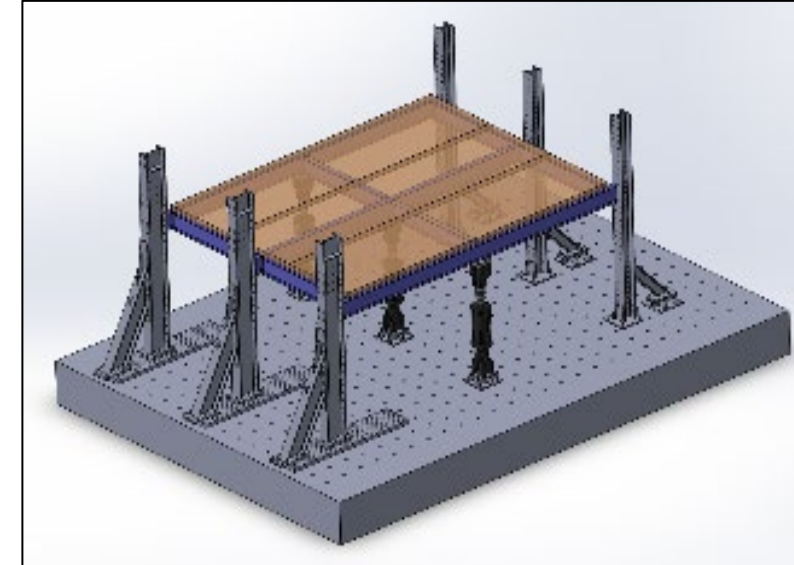


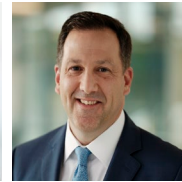
HESTIA Program Review - Sept 21, 2023



**4C2B: Century-scale Carbon-sequestration in
Cross-laminated Timber Composite Bolted-steel Buildings**
Michelle Laboy and Matthew J. Eckelman, Northeastern University
Jerome F. Hajjar, Principal Investigator, Northeastern University

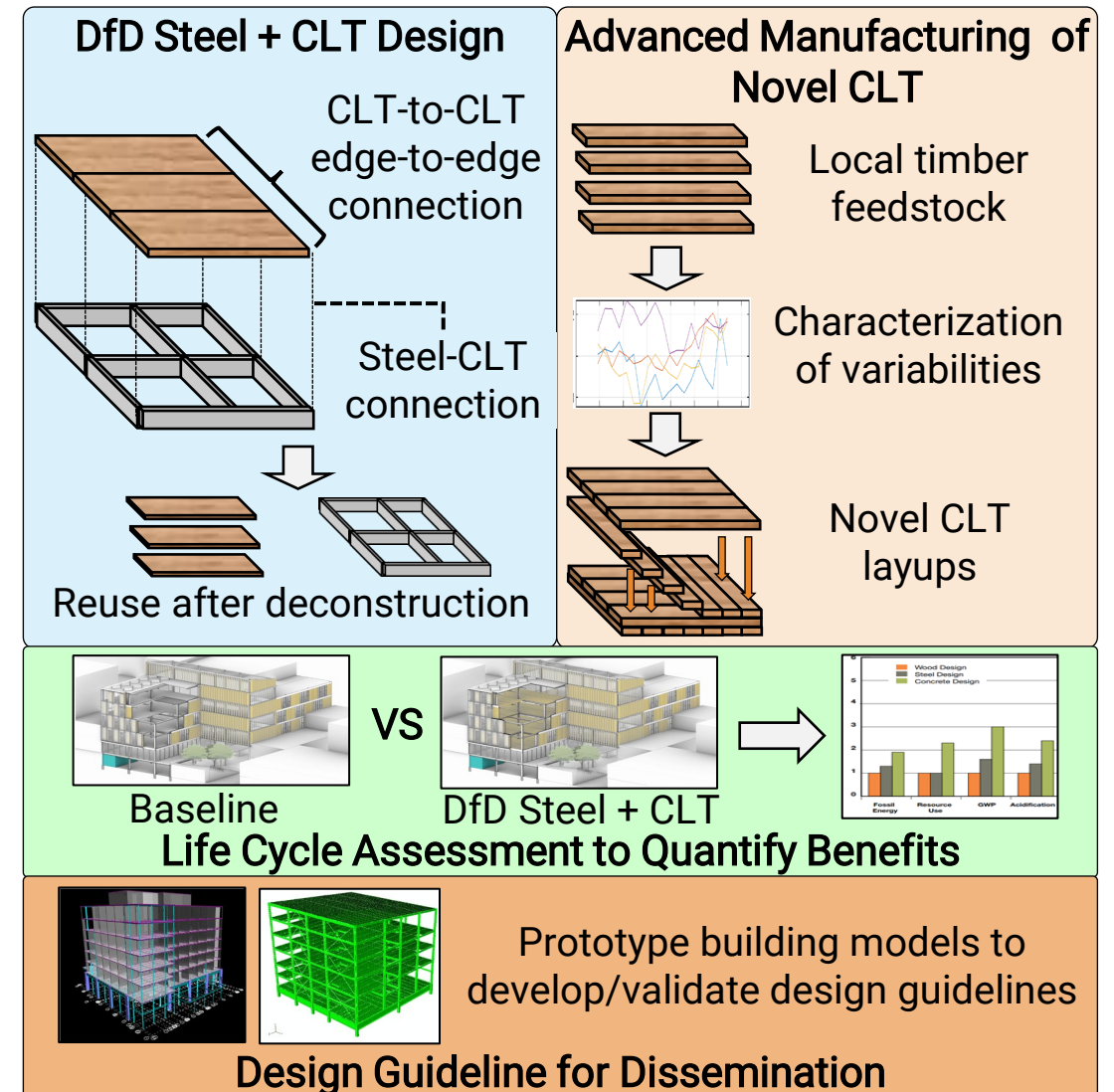
Key Personnel

- ▶ Northeastern University (Lead institution)
 - Jerome F. Hajjar (PI)
 - Michael B. Kane
 - Matthew J. Eckelman
 - John “Jack” Lesko
 - Michelle Laboy
 - Nathan Post
 - SungKu Kang
- ▶ Simpson Gumpertz & Heger Inc.
 - Mark D. Webster
 - Norman F. Perkins
 - Ronald O. Hamburger
 - David J. Jacoby
- ▶ University of Massachusetts Amherst
 - Sanjay R. Arwade
 - Kara D. Peterman
- ▶ Swarthmore College
 - Fiona O'Donnell
- ▶ OPAL
 - Matthew O'Malia
 - Riley Pratt
 - Timothy Lock
 - Addison Godine
 - David Miller



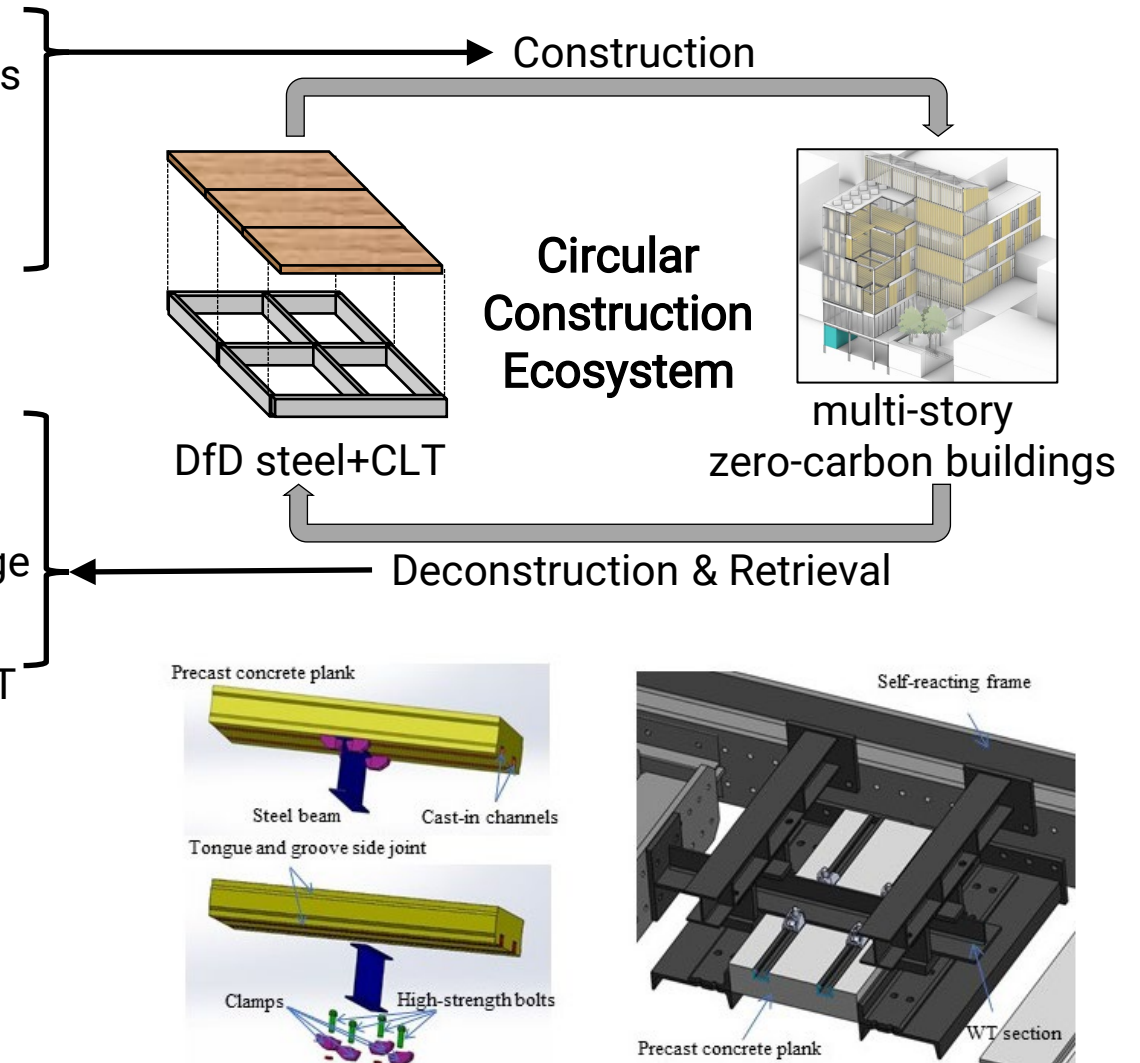
Project Overview

- ▶ Project Overview
 - Develop and test steel+CLT hybrid building designs to store biogenic carbon
 - Leverage current AEC ecosystem for rapid market penetration
- ▶ Innovations
 - Design for deconstruction (DfD) and CLT reuse via novel connectors to reach century-scale carbon storage
 - Novel CLT layups minimizing carbon footprint and utilizing regional biomass resources
 - Use of short-cycle agricultural products into assemblies
- ▶ Deliverables
 - LCA results showing the value of the proposed works
 - Standards-based design guidelines of DfD Steel+CLT



Project Impact

- ▶ Rapid Transformation Strategy
 - Can be designed and constructed with existing foundations
 - Standards-based design guidelines for practitioners
 - Light-weighted and faster construction compared to conventional concrete floors
- ▶ Technology Impact
 - 70% reduced carbon emission from steel structure via DfD
 - Multi-story zero-carbon buildings with century-scale storage
 - Efficient assessment of the residual life of materials
 - New market opportunity involving the reused steel and CLT



Recent Successes

- ▶ Extensive testing of novel CLT species



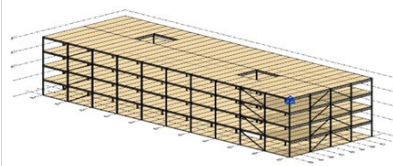
- ▶ Database of bio-based non-structural materials



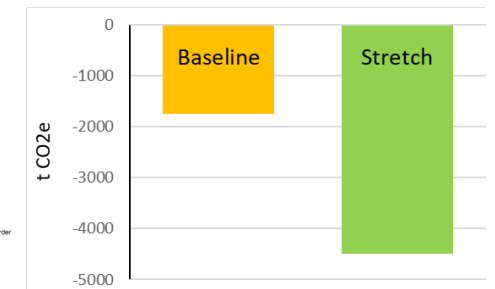
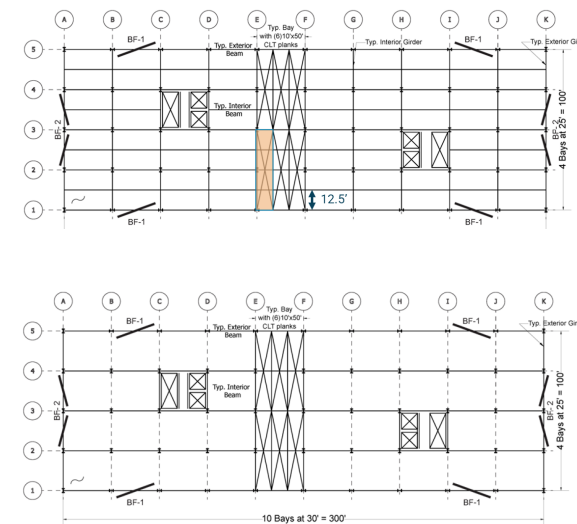
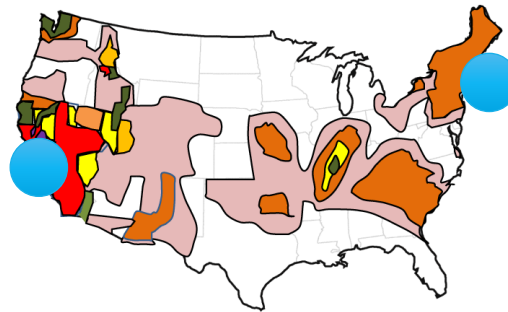
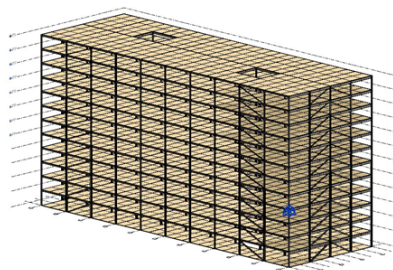
- ▶ Development of prototype building designs for local conditions

- ▶ LCA trade-offs of structural patterns

LOW RISE
4-STORIES
TYPE V



HIGH RISE
12-STORIES
TYPE IV B



Tech to Market Plan

- ▶ DfD Steel+CLT design guidelines
 - Codification via standards organizations (e.g., AISC)
 - Targeting design provisions
- ▶ Standardization of the proposed technologies
 - Connector designs for DfD Steel+CLT
 - Advanced manufacturing technology for novel CLT layups
- ▶ Enabling new markets without disrupting the industry
 - Testing and certification of reused Steel+CLT
 - DfD stockpiling and planning for the reuse

