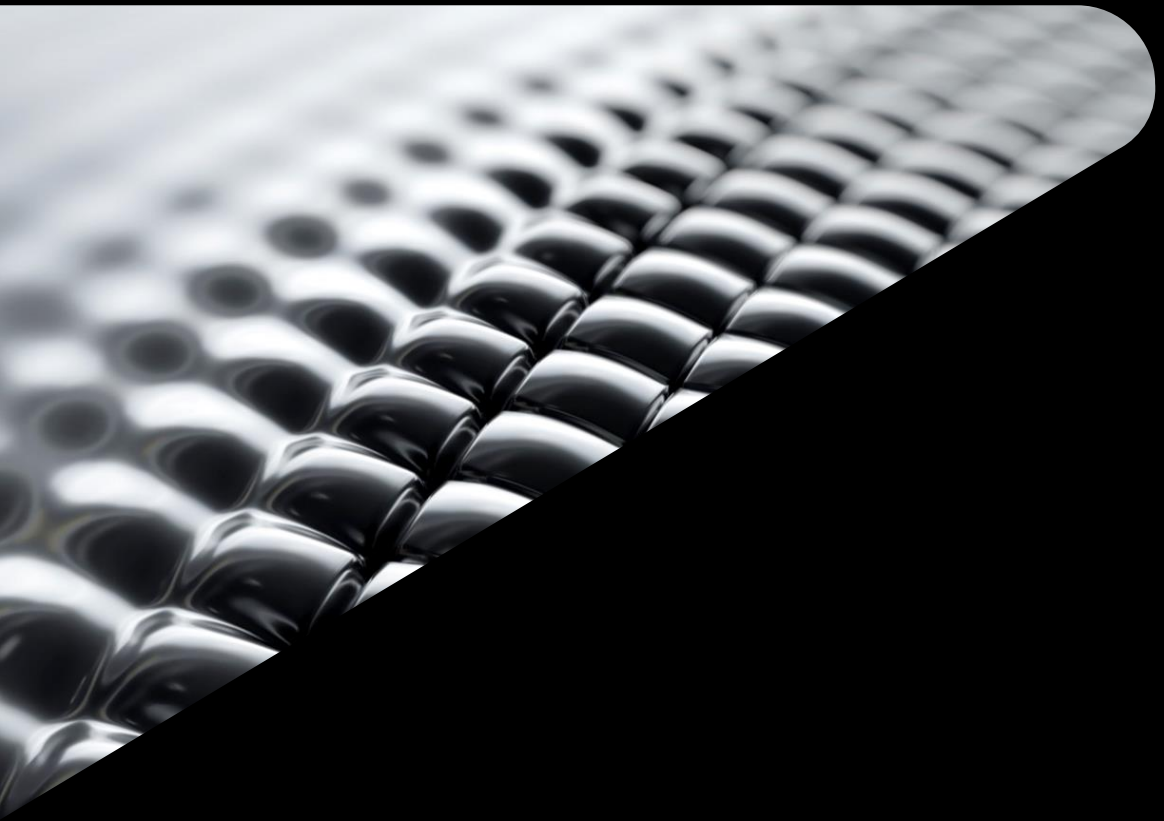
AUTODESK UNIVERSITY

Sustainable Structural Design: Answering the Global Environmental Challenge

BES500782

Deepak Maini

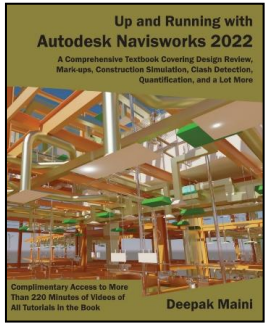
National Technical Manager, Cadgroup Australia
@DeepakMaini24

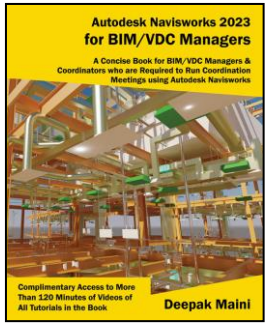


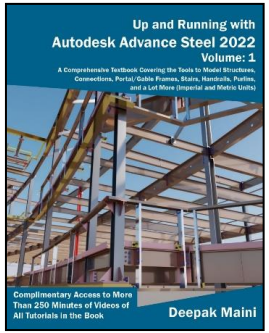
Welcome to AU2022

Introduction

- Qualified Mechanical Engineer
- Over 23 years of experience in the industry
- Certified Consultant and Certified Trainer
- Awarded the “Best Autodesk University Speaker” two years in a row at AU2018 and AU2017 in Las Vegas
- Voted “Top Speaker” at the Bluebeam XCON 2019 in Washington DC
- Author of the Up and Running with Autodesk Navisworks, Autodesk Navisworks for BIM/VDC Managers, Up and Running with Autodesk Advance Steel, and Up and Running with Bluebeam Revu series of books
- Guest lecturer at the University of Technology Sydney (UTS), University of Salford UK, Virginia Tech University, George Brown College





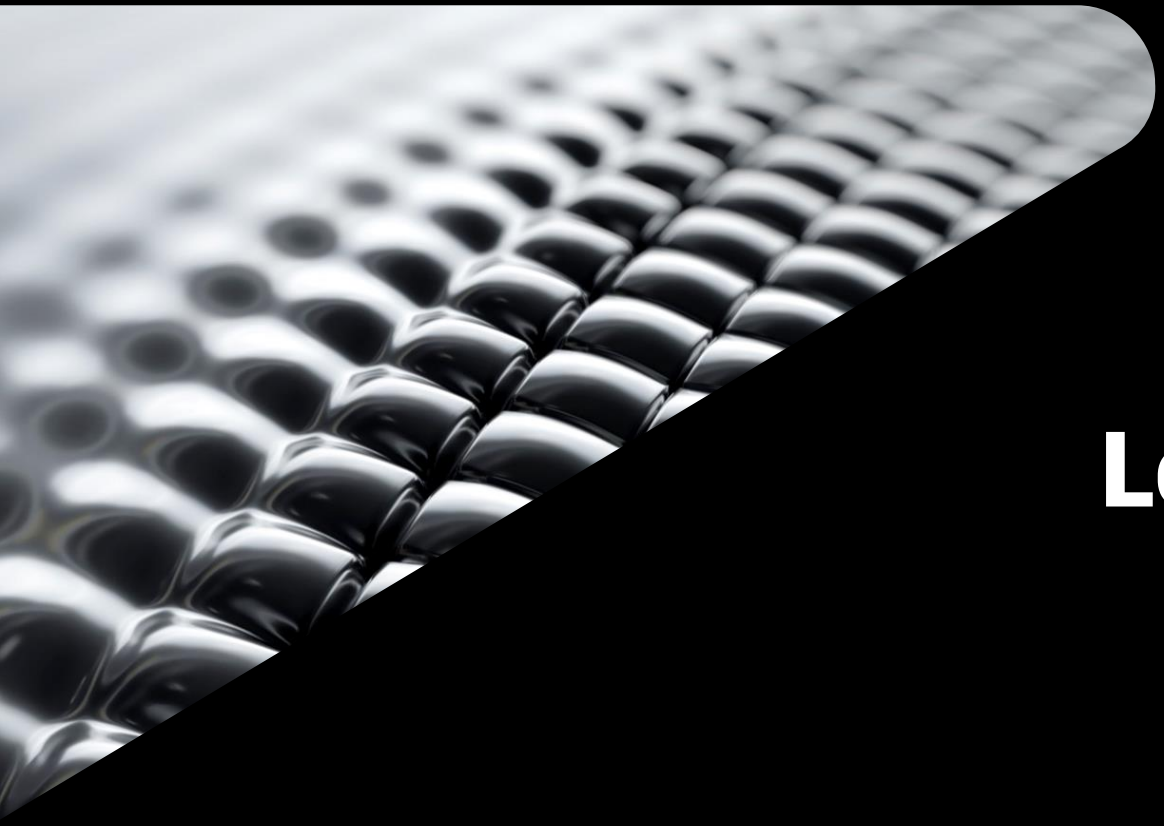


Learning objectives

- Review the technology available today to reduce wastage in structural design and engineering.
- Review collaborative workflows between design and fabrication to improve efficiency without compromising design requirements.
- Learn how to use the embodied carbon in construction calculator to review the environmental impact of structural design.
- Learn about the alternative structural material used in a commercial building in Brisbane to reduce environmental footprint.

Description

Although the structure of any design is its backbone, it is also one of the top areas in construction that adversely impacts the environment. But with the technology available today, we can reduce this environmental impact. Whether it's eliminating wastage or minimizing embodied carbon, we have the means to reduce both short- and long-term environmental impacts and make structural design and engineering sustainable for our planet. This class will focus on the technologies available to structural designers and engineers today to work on connected and collaborative workflows and reduce waste, optimize material use, and make decisions to minimize embodied carbon. This class will also look at one of the top examples of using alternate structural materials in a commercial building, heavily reducing the environmental footprint of production and manufacturing.

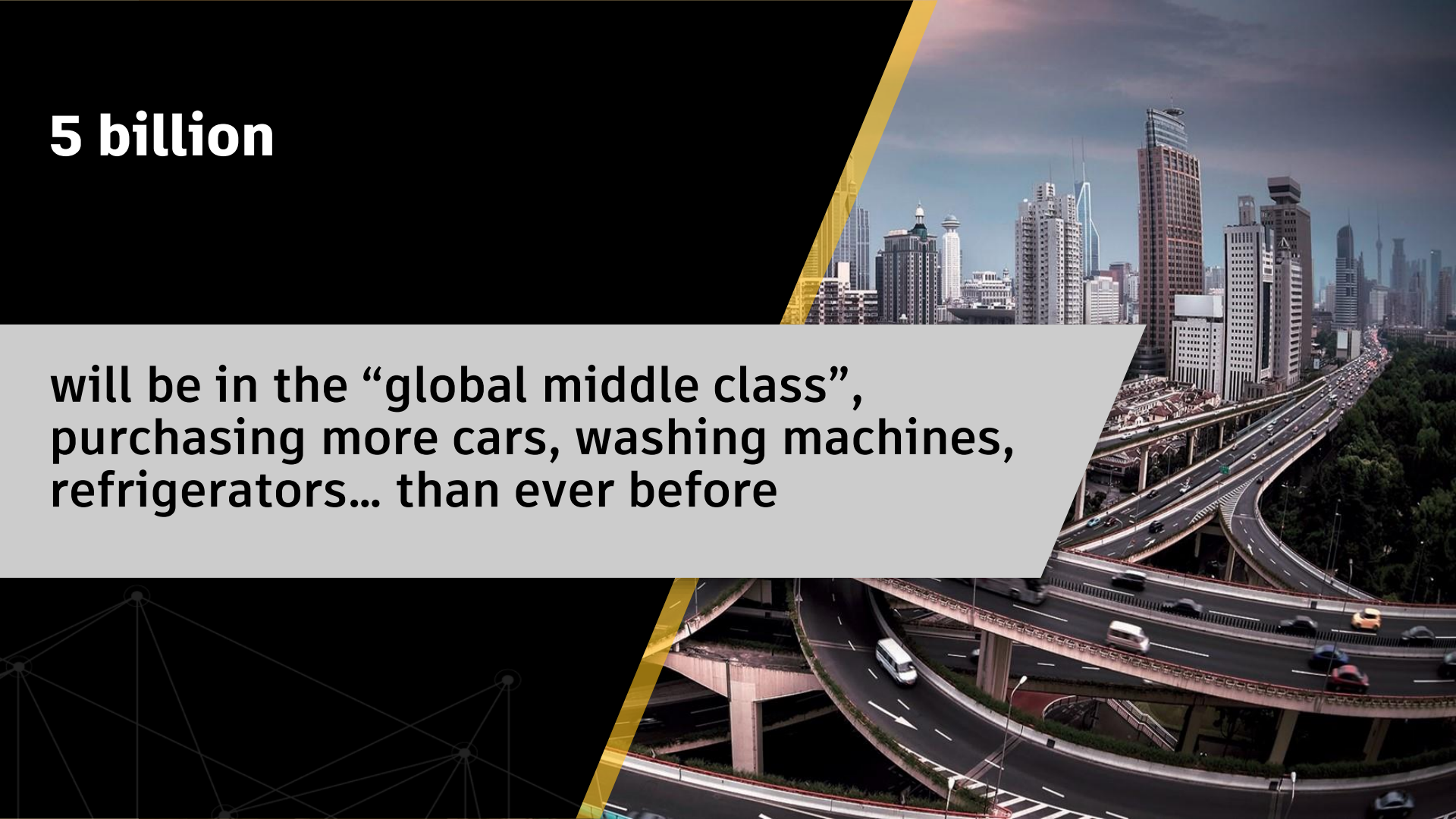


Lets talk some numbers

By 2050

It is expected there will be over
10 Billion people living on planet Earth

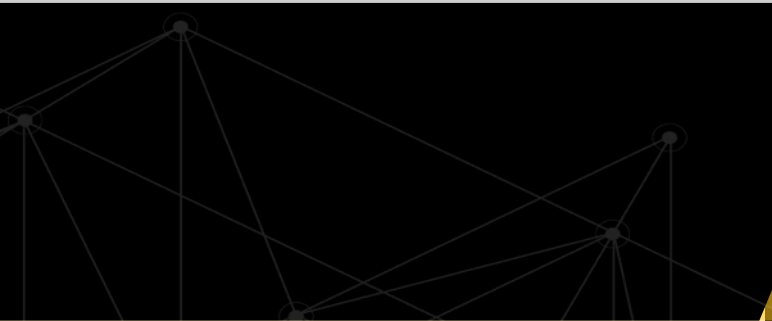
5 billion



will be in the “global middle class”, purchasing more cars, washing machines, refrigerators… than ever before

75% will live in urban areas

(95% of humanity will live within a day's travel of a city); many of which haven't been built yet



2X (double)

Powering these lifestyles will require 2X the amount of world energy currently produced

40%

Of the global energy is consumed by buildings

30%

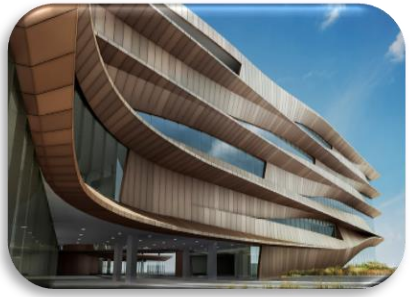
Of operational building energy is wasted

Hold on a sec….

Where does sustainability fit into all this?

Industry trends

Net-Zero Energy Building Design



Long term… 2050

Zero-Waste Construction

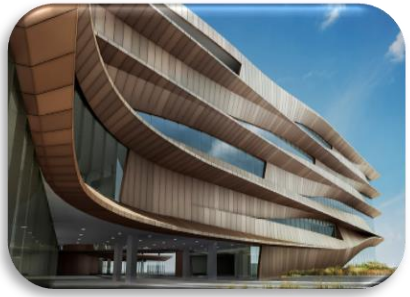
Aspirational goal for industry

Sustainable Cities & Infrastructure

Only a handful cities

Emerging industry trends

Circular & low-carbon construction



Large companies are leading discussions...

High Performance Building Retrofit

Yes, but...

Building Operations

Operational efficiency around energy

Barriers in sustainability

52%

Lack of client demand

51%

Cost of achieving sustainability

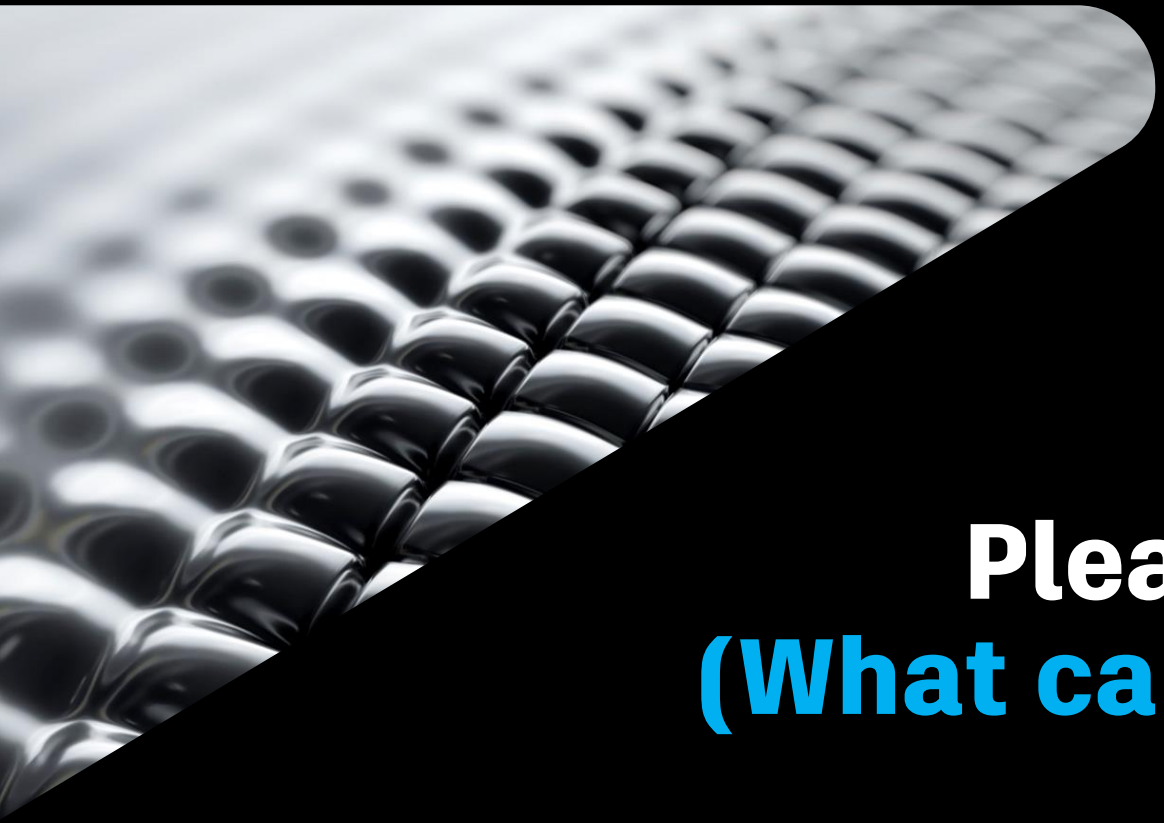
25%

Complexity of sustainability process and calculations

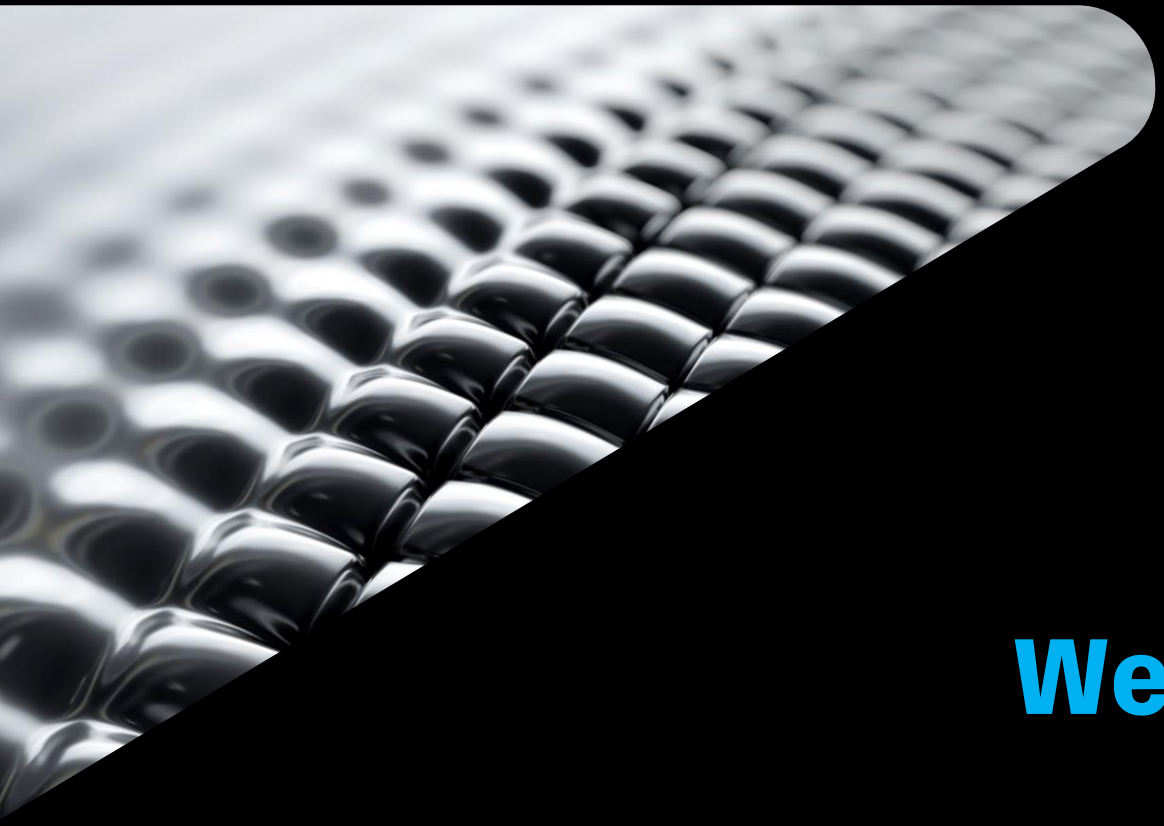
NBS Sustainability Report 2022

Challenges for Structural Design/Engineering

- Increased demands of investigating the use of energy during the planning and design phases
- Yet, the Structural Engineers currently have very limited guidance
- No single methodology to address issues surrounding sustainable structural design



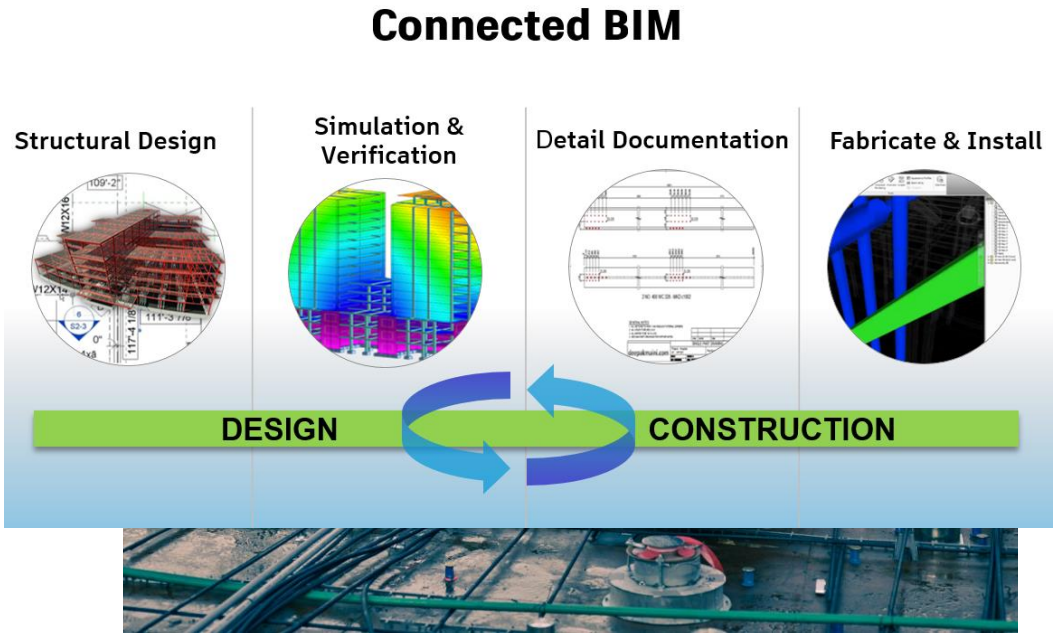
Please simplify it
(What can I do today?)



Four things
We can do today

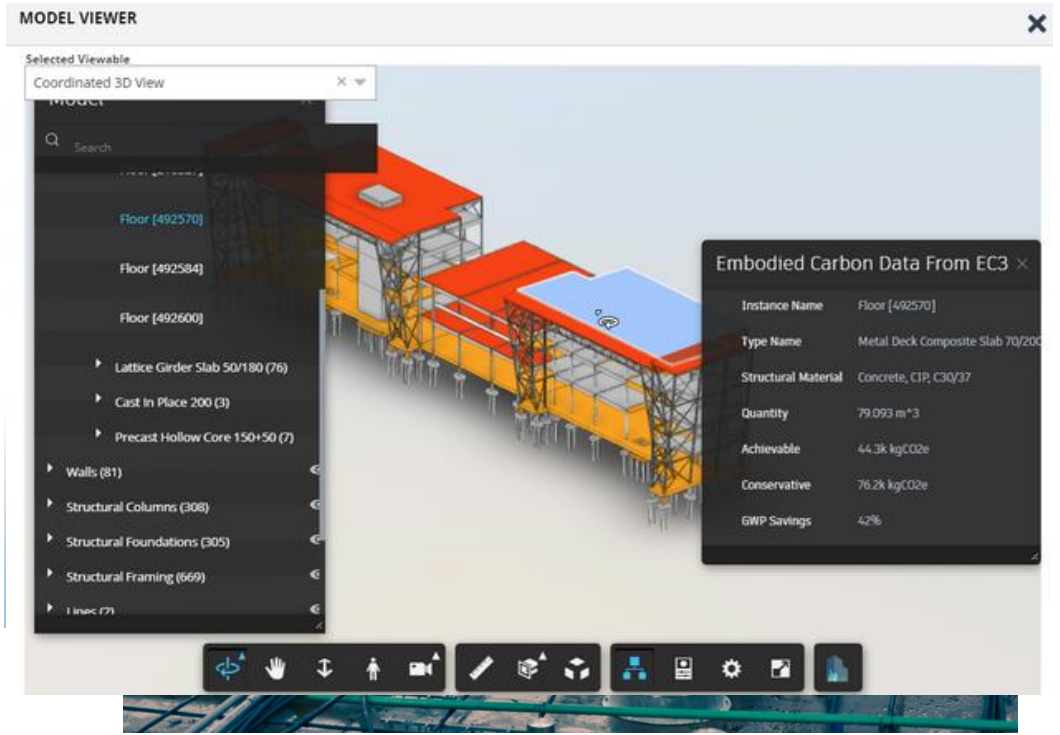
Sustainability in Structural Design/Engineering today

- Minimize wastage – include collaborative workflows



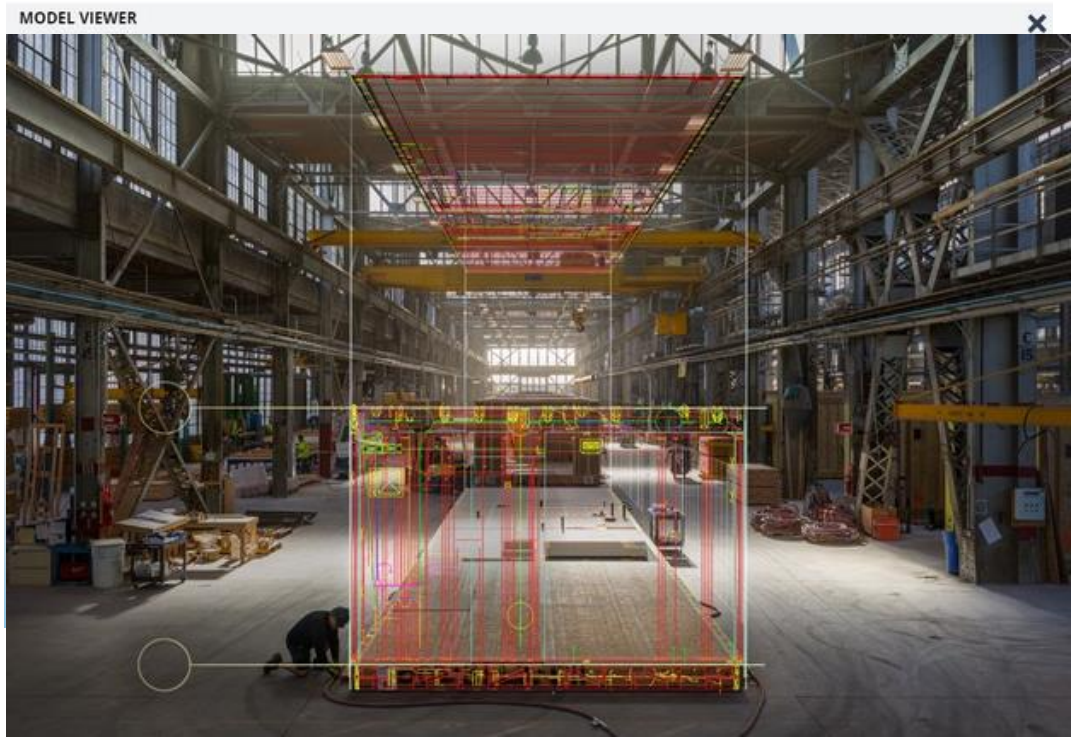
Sustainability in Structural Design/Engineering today

- Minimize wastage – include collaborative workflows
- Use Embodied Carbon in Construction Calculator (EC3) tool



Sustainability in Structural Design/Engineering today

- Minimize wastage – include collaborative workflows
- Use Embodied Carbon in Construction Calculator (EC3) tool
- Look into modular construction



Sustainability in Structural Design/Engineering today

- Minimize wastage – include collaborative workflows
- Use Embodied Carbon in Construction Calculator (EC3) tool
- Look into modular construction
- Try low-impact building materials

Minimize wastage???

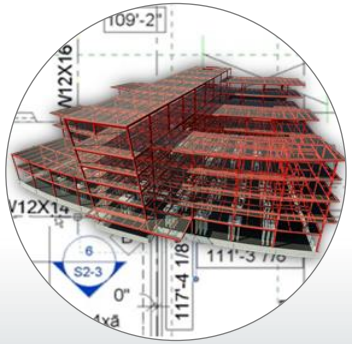
But the leftover steel pays for the Beers and BBQ on Fridays...

Minimize wastage – include collaborative workflows using Connected BIM

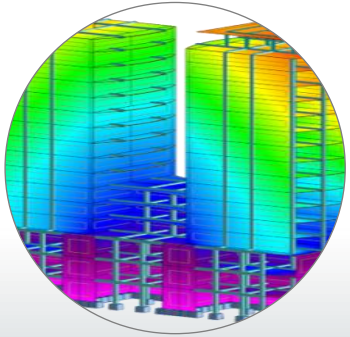
- Fundamental to the Lean Construction workflows
- A workflow in which we have a fully synchronized model from design to simulation to documentation to installation and erection
- Help reduce project complexity
- Interoperability to avoid errors and redundancies
- Result in improved productivity
- Better project coordination

Connected BIM
You already have the tools

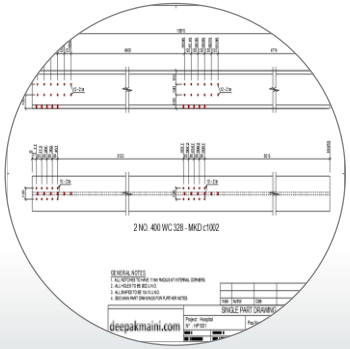
Structural Design



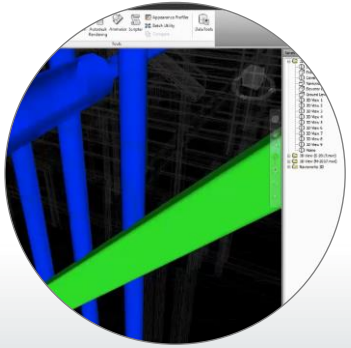
Simulation & Verification



Detail Documentation



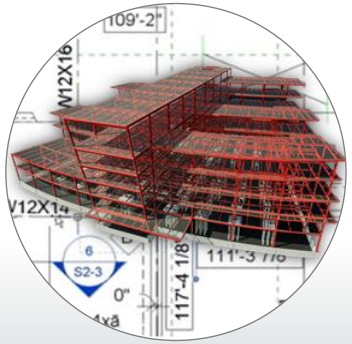
Fabricate & Install



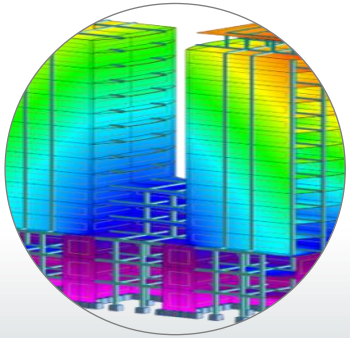
DESIGN **CONSTRUCTION**

Connected BIM
AEC Collection

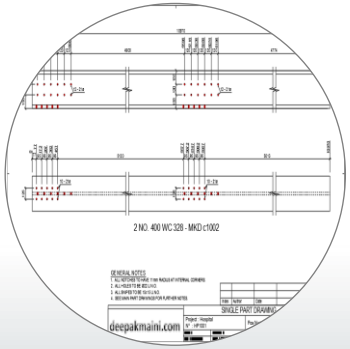
Structural Design



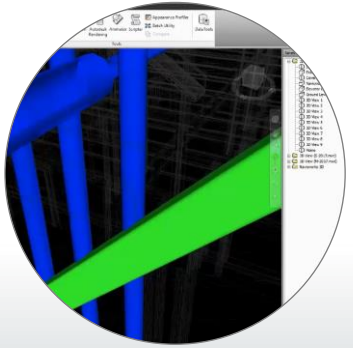
Simulation & Verification



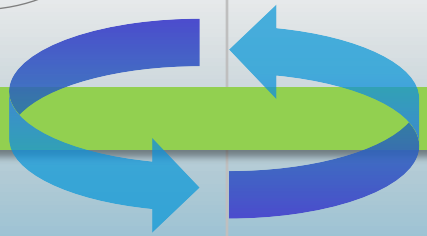
Detail Documentation



Fabricate & Install



DESIGN



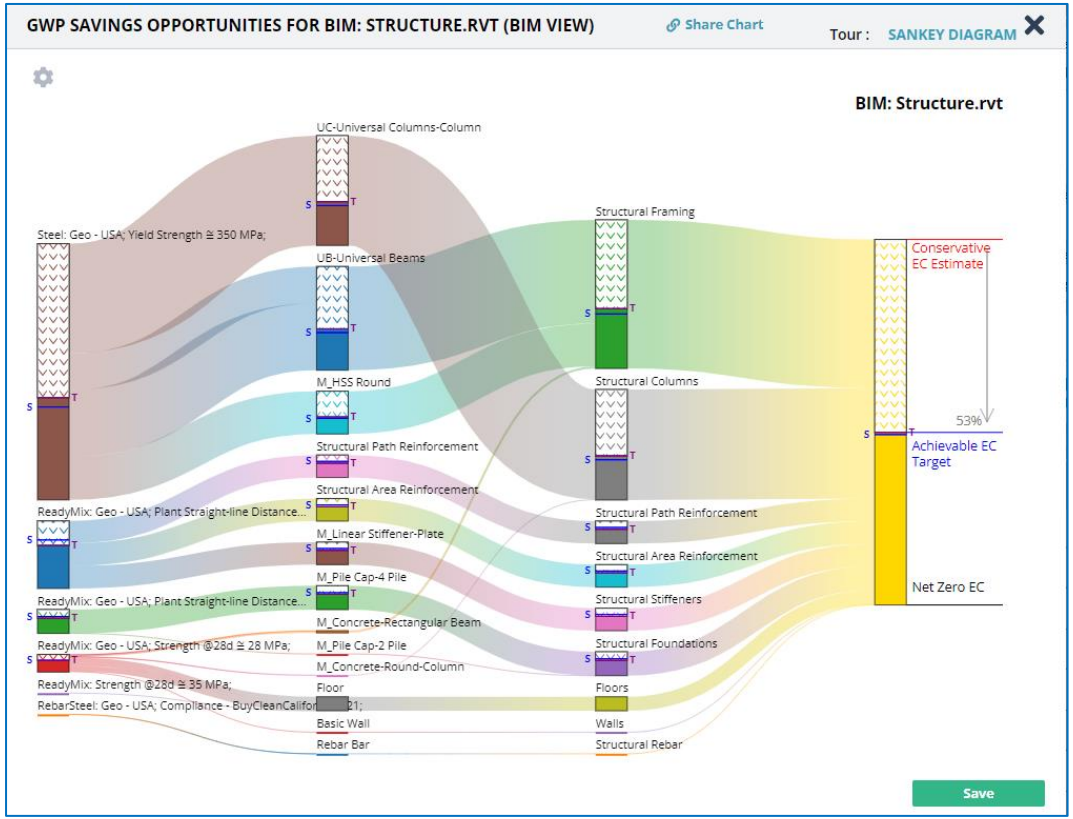
CONSTRUCTION

One of the Most Disconnected Industries

Use Embodied Carbon in Construction Calculator (EC3) Tool

- A sustainability software service by C-Change Labs and a program of Building Transparency
- A tool to specify, procure, and incentivize low carbon construction materials
- Search product categories with their Environmental Product Declarations (EPDs)
- Import BIM data directly from BIM360 and have its content categorized

Plot a Global Warming Potential (GWP) savings chart



EC3

buildingtransparency.org/ec3

EC3 | CADGROUP | DM Deepak Maini PROFESSIONAL USER | Measurement Units: USA

- Find & Compare Materials
- Plan & Compare Buildings
- Level Bids
- Add EPDs to EC3
- Manage Data
- User Groups
- How to get an EPD
- Methodology

Our partners

SKANSKA

The EC3 tool is a sustainability service in Public Beta Test. We take the confidentiality of your data seriously but we accept no liability for damage caused by disclosure of information entered on this site.

EC3

Tour : OVERVIEW

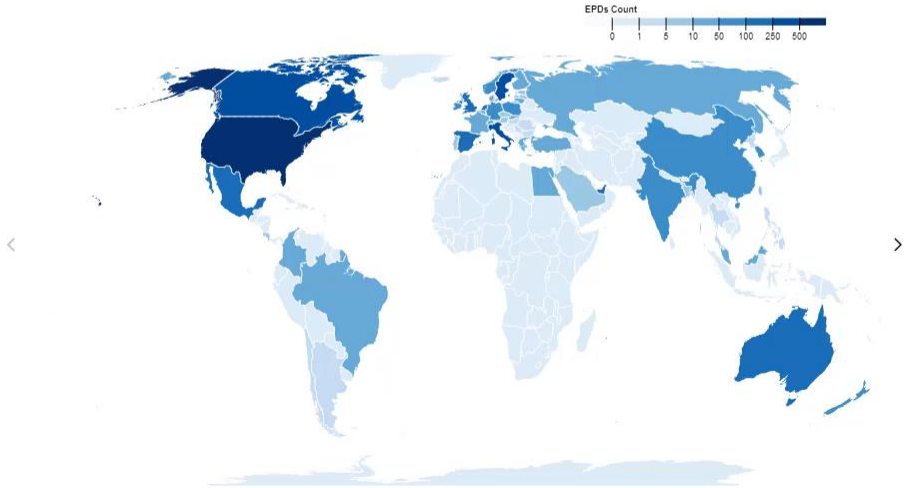
Welcome to the Embodied Carbon in Construction Calculator (EC3) Tool

You are logged into the North American servers of buildingtransparency.org as deepak of Cadgroup.
The EC3 tool version v-110.0.0_b-1875 is in Public Beta.

The Carbon Query Database is **Online** and contains:

Digitized EPDs in EC3, by Country

Concretes | non-Concretes



DOWNLOAD AS CSV

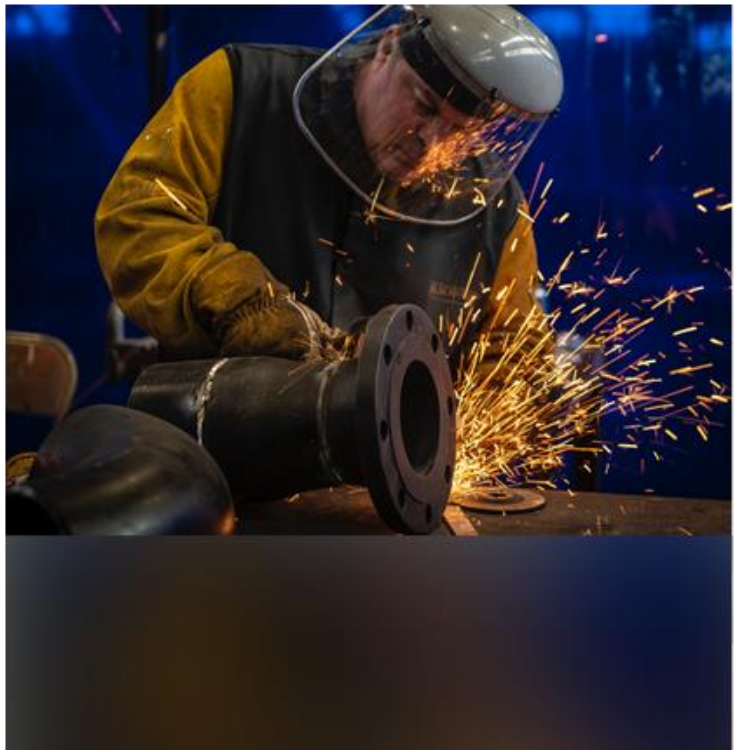
Report Bugs & Feedback

Modular construction: *bringing industrial thinking into construction*

- Consistent quality

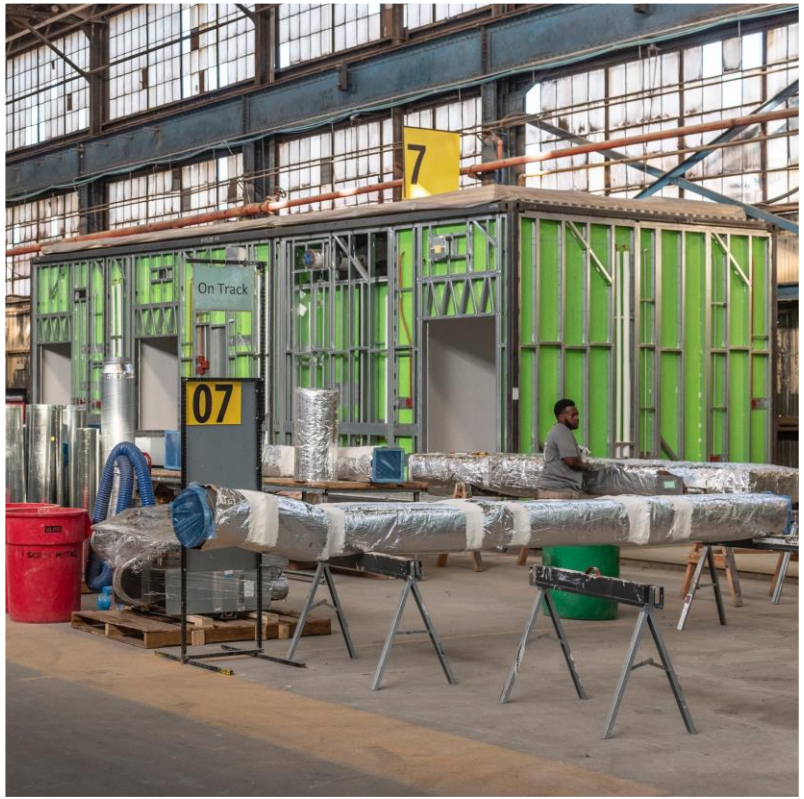
Modular construction: *bringing industrial thinking into construction*

- Consistent quality
- Reduced disruptions on site



Modular construction: *bringing industrial thinking into construction*

- Consistent quality
- Reduced disruptions on site
- Improved safety

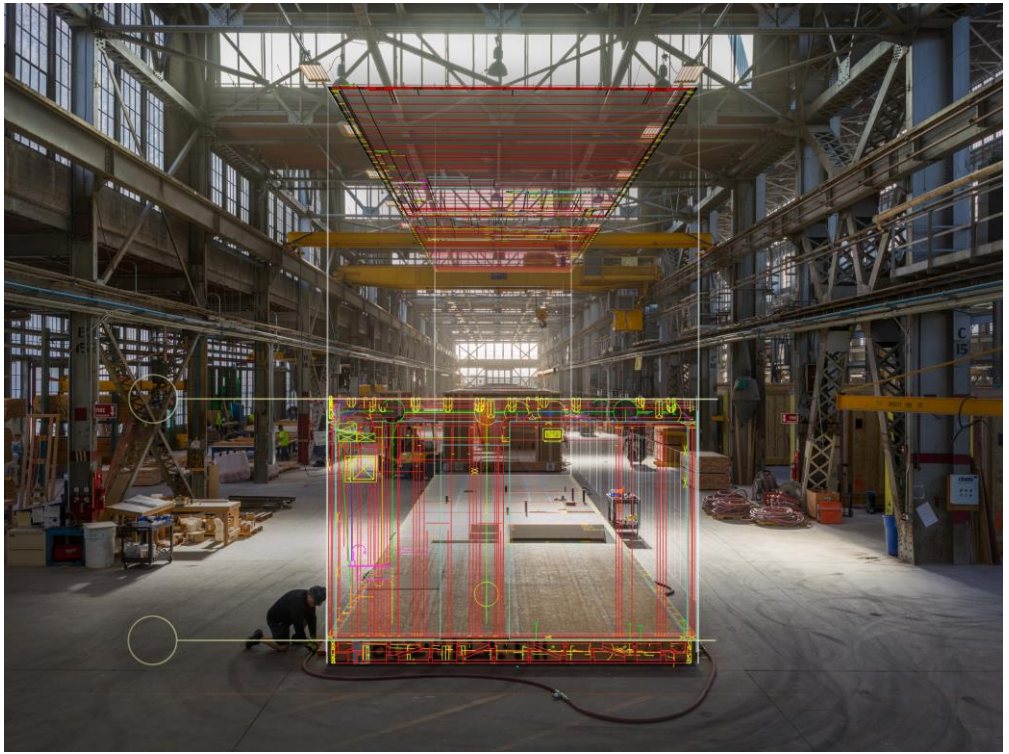


Modular construction: *bringing industrial thinking into construction*

- Consistent quality
- Reduced disruptions on site
- Improved safety
- Cost effective

Modular construction: *bringing industrial thinking into construction*

- Consistent quality
- Reduced disruptions on site
- Improved safety
- Cost effective
- Flexible



Success story
Collins House, Melbourne
A Hickory Project
Thanks George Abraham

Collins House, Melbourne

- Winner of the 2020 CTBUH Construction Award
- Slimmest tower project in Australia, 204m/670FT tall
- Building cantilevers 4.5m over adjoining building at L14
- Program reduced by up to 30% using fast-track Hickory structural, façade, and fit out delivery

Collins House, Melbourne

- Small site footprint with single point of access
- HBS construction method allowed the project to be serviced by a single tower crane
- Façade and precast floors fabricated off-site & assembled onsite

COLLINS HOUSE

MELBOURNE

Low impact building material

- These aren’t new

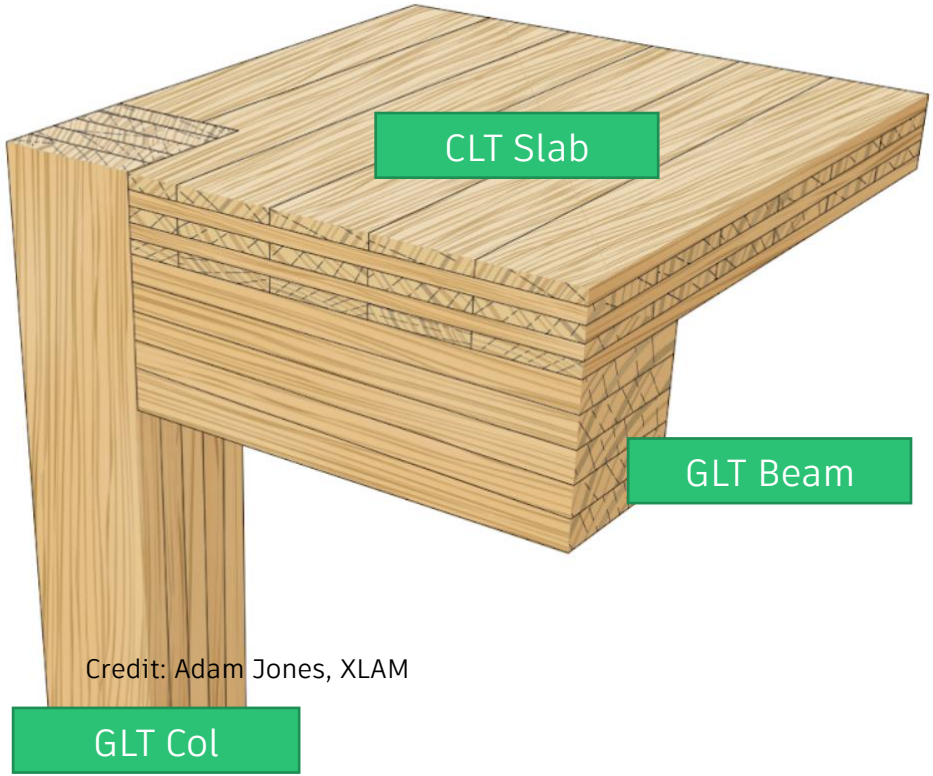
Low impact building material

- These aren’t new
- Dimensional lumber

Image courtesy Lampert Lumber

Low impact building material

- These aren't new
- Dimensional lumber
- Engineered timber, such as Cross laminated timber (CLT) and Glue laminated timber (GLT)

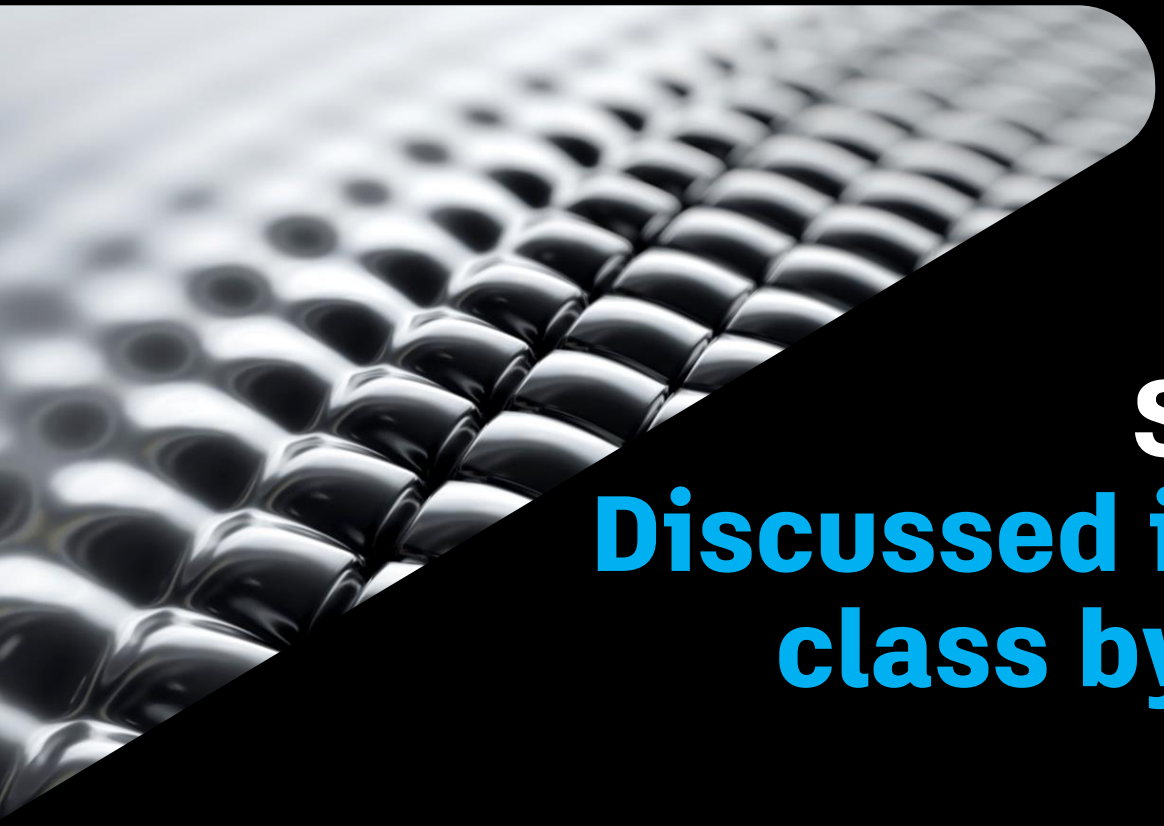


Credit: Adam Jones, XLAM

Low impact building material

- These aren’t new
- Dimensional lumber
- Engineered timber, such as Cross laminated timber (CLT) and Glue laminated timber (GLT)
- Green concrete (eco-friendly concrete)

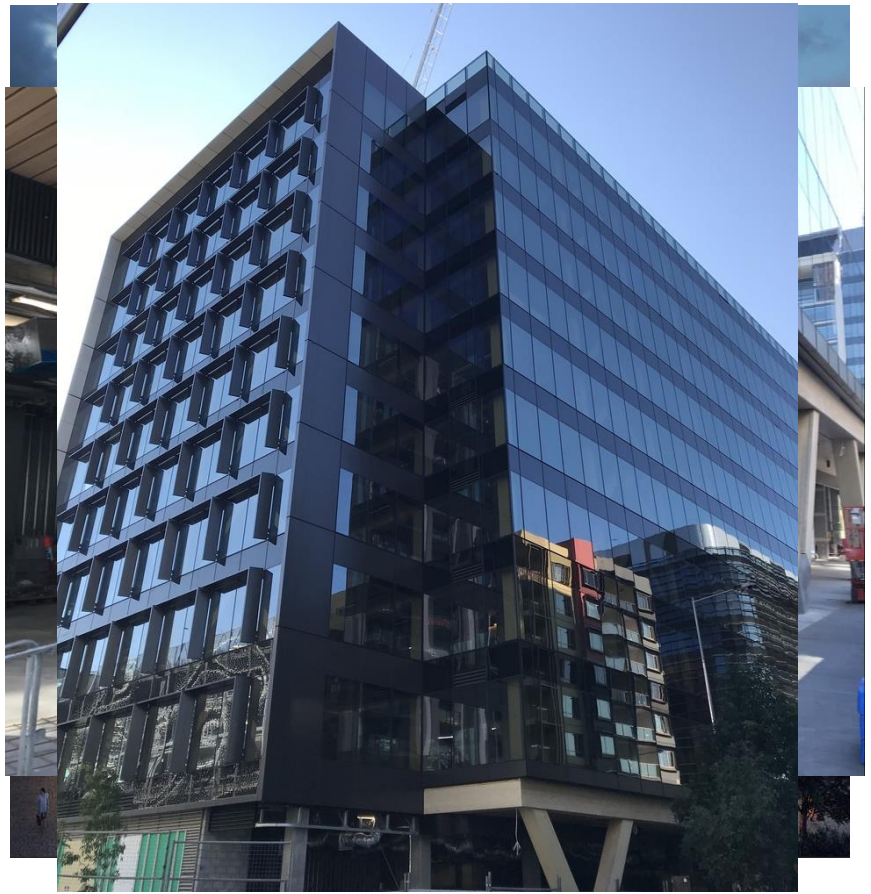
Credit: Professor Ali Abbas, The University of Sydney



Success story
Discussed in the AU2018 class by Aaron Coats Bates Smart

25 King, Brisbane

- Client + Structural Engineer: Aurecon, Builder: Lendlease, Architect: Bates Smart
- 9 storey plus ground superstructure of CLT and GLT
- On-floor workers reduced from 60 to 12
- Entire levels built in as little as eight days
- The building constructed in 15 months (69 fewer days of impact)
- Representing a reduction of 20% construction time compared to comparable steel/concrete buildings



25 King, Brisbane

- Achieved the following sustainability ratings
  - 6 Design and As Built v1.1 Green Star rating
  - Carbon Neutrality by Climate Active
  - 6 Star NABERS Energy Rating
  - 4.5 Star NABERS Water
  - 3.0 Star NABERS Waste
- Saves 74% embodied carbon compared to equivalent concrete buildings
- Achieved 46% reduction in energy and 29% reduction in potable water consumption


SITE
25 King, Brisbane

Four key takeaways

- Connected BIM is a possibility today
  - Most of you already have the tools for that
- EC3 tool can help you select materials based on their embodied carbon informatoin
- Prefab/Modular construction is here already
- Alternate materials is the way forward
  - Green concrete
  - CLT and GLT
  - Dimensional lumber

Questions??