AUTODESK UNIVERSITY

BES500782

Sustainable Structural Design: Answering the Global Environmental Challenge

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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.

Deepak Maini

Deepak Maini (Sydney, Australia) is a qualified Mechanical Engineer with more than 23 years of experience in the design industry. He is an Autodesk Certified Instructor and a Certified BIM 360 Consultant and has authored 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. He is currently working as the National Technical Manager - Named Accounts with Cadgroup Australia, an Autodesk Platinum Partner.

Deepak is a regular speaker at various conferences worldwide and was awarded the "**Top Autodesk University Speaker**" two years in a row, in **2018** and **2017,** in the Instructional Demo category. He was also voted as the "**Top Speaker**" at the **Bluebeam XCON 2019** conference in Washington, DC. Deepak is also one of the "Top Rated Speakers" at various BILT conferences in ANZ and Asia.

Outside his full-time work, Deepak is a Guest Lecturer at the University of Technology Sydney (UTS) and the University of New South Wales (UNSW), and has also been invited to speak at the University of Salford, UK, and the Virginia Tech University, USA.

Sustainability Trends

There are several sustainability trends worldwide, but let's be honest, these are all long-term and aspiration goals, as listed below.

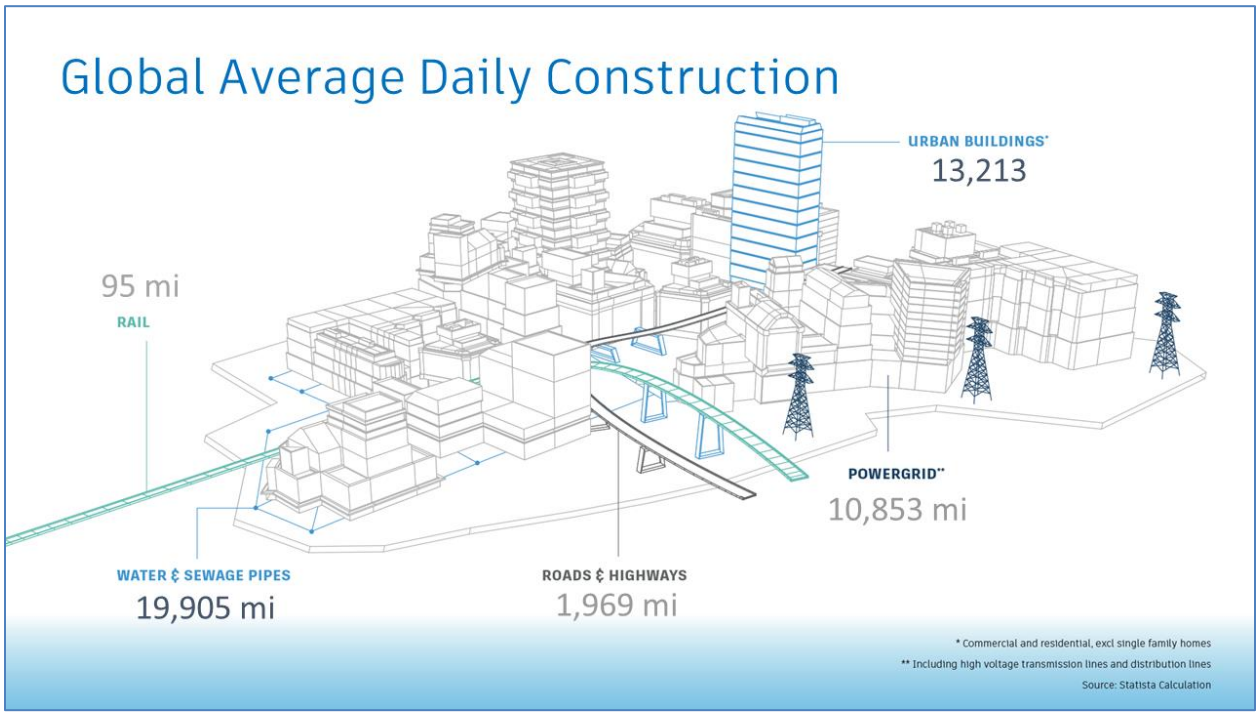
- Net-Zero Energy Building Design
  - Long-term (2050)

- Zero-Waste Construction
  - Aspirational goal for the industry

- Sustainable Cities & Infrastructure
  - How many cities do we know that are working on this?

In the meantime, we have this problem about to hit us soon(ish):

And talking about the construction work worldwide, based on **Stastica Calculations**, we have all this being built daily:



Barriers to Delivering Sustainability

Here are the main barriers to delivering sustainability, as per the **NBS Sustainability Report 2022**:

Four things we can do today

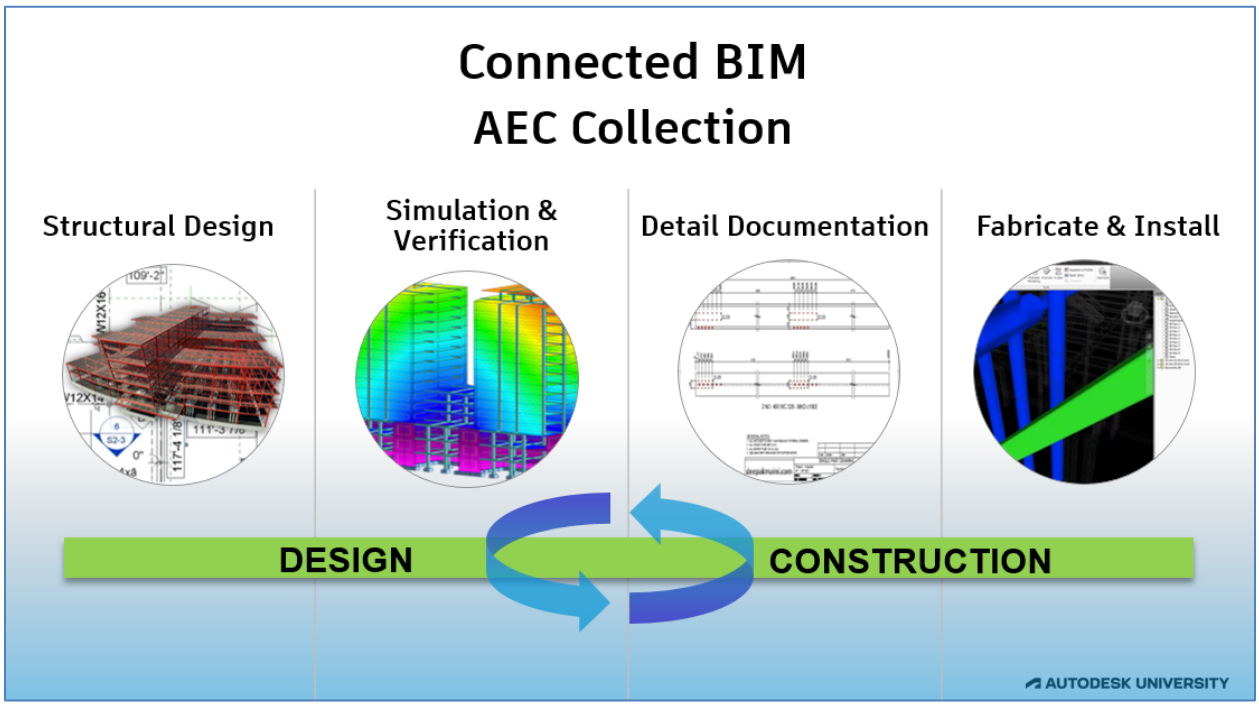
As structural engineers/designers, there are several things we can do today. But the four at the top of my list are discussed here.

Minimize wastage – include collaborative workflows using Connected BIM

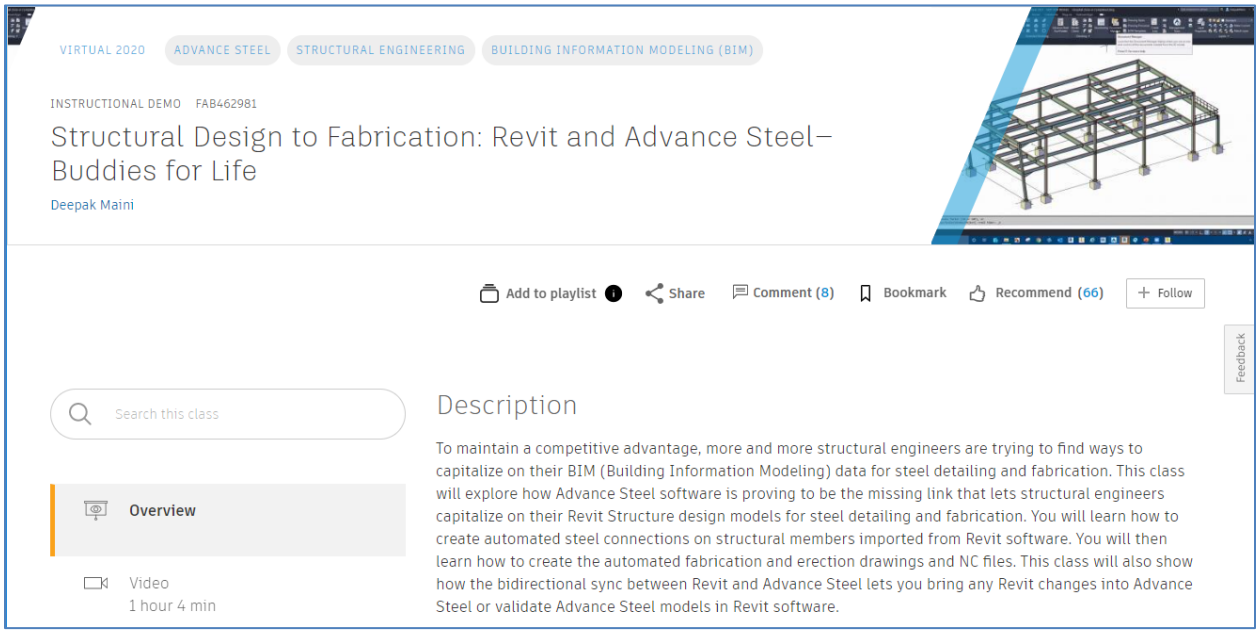
In this workflow, we have a fully synchronized model from design to simulation to documentation to installation and erection. This workflow can be achieved using the AEC Collection, which most of you may already have. Some of the software included in the AEC Collection are:

- Autodesk Revit
- Robot Structural Analysis
- Autodesk Advance Steel
- Autodesk Navisworks
- Autodesk ReCap Pro

Using these software, you can design, simulate, and detail structural designs. You can generate various cutting files, such as NC and DXF files, and generate erection drawings.



To learn the complete Connected BIM workflow in detail, you can watch my AU2020 class, [Structural Design to Fabrication: Revit and Advance Steel—Buddies for Life].

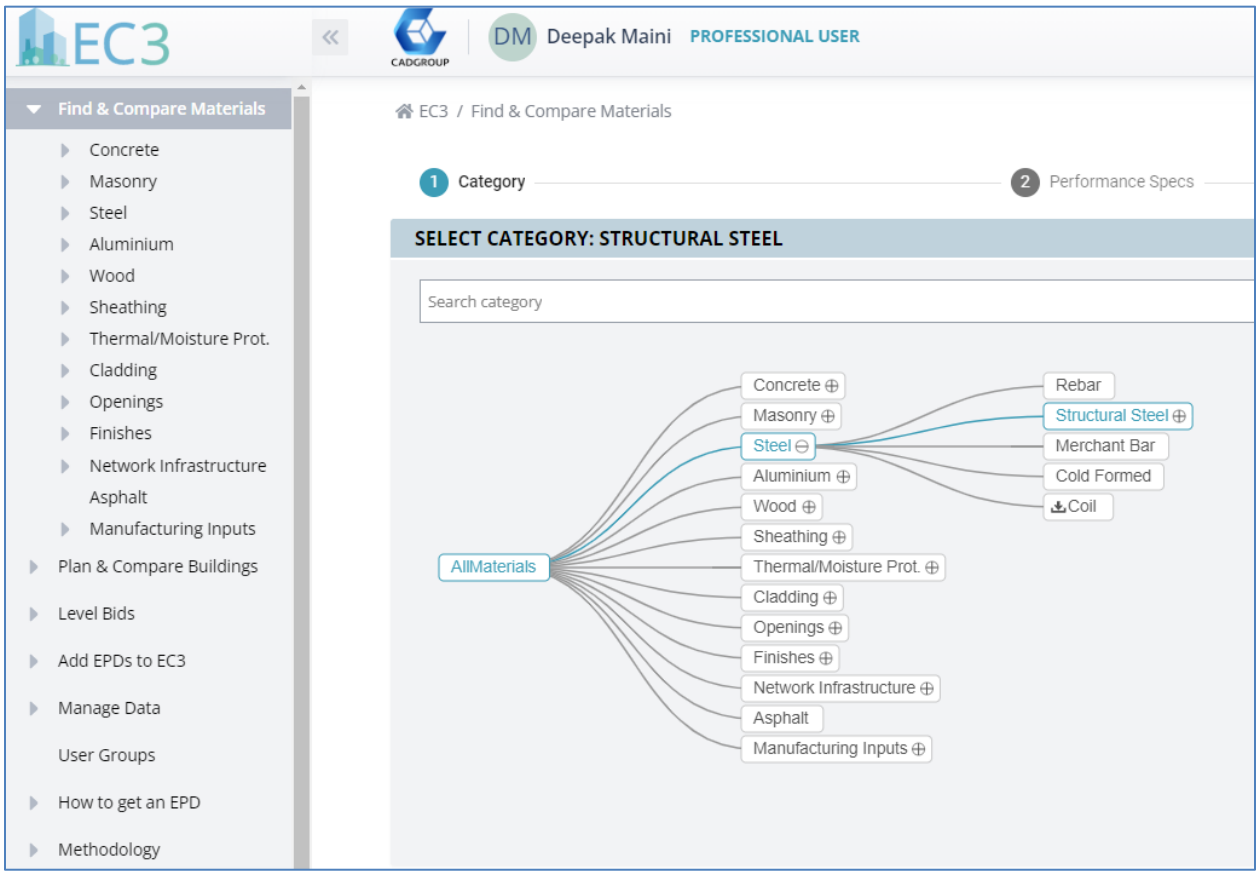


This was an Industrial Demo class where I talked about this workflow of starting design in Revit, taking it to Advance Steel for detail documentation, and BOM and cutting files generation. I then took the Revit design into Robot Structural analysis to perform various wind load and seismic loading simulations, brought the changes into Revit, and then updated the Advance Steel model with those changes, thus showcasing the Connected BIM workflow for Structural Engineers and Designers.

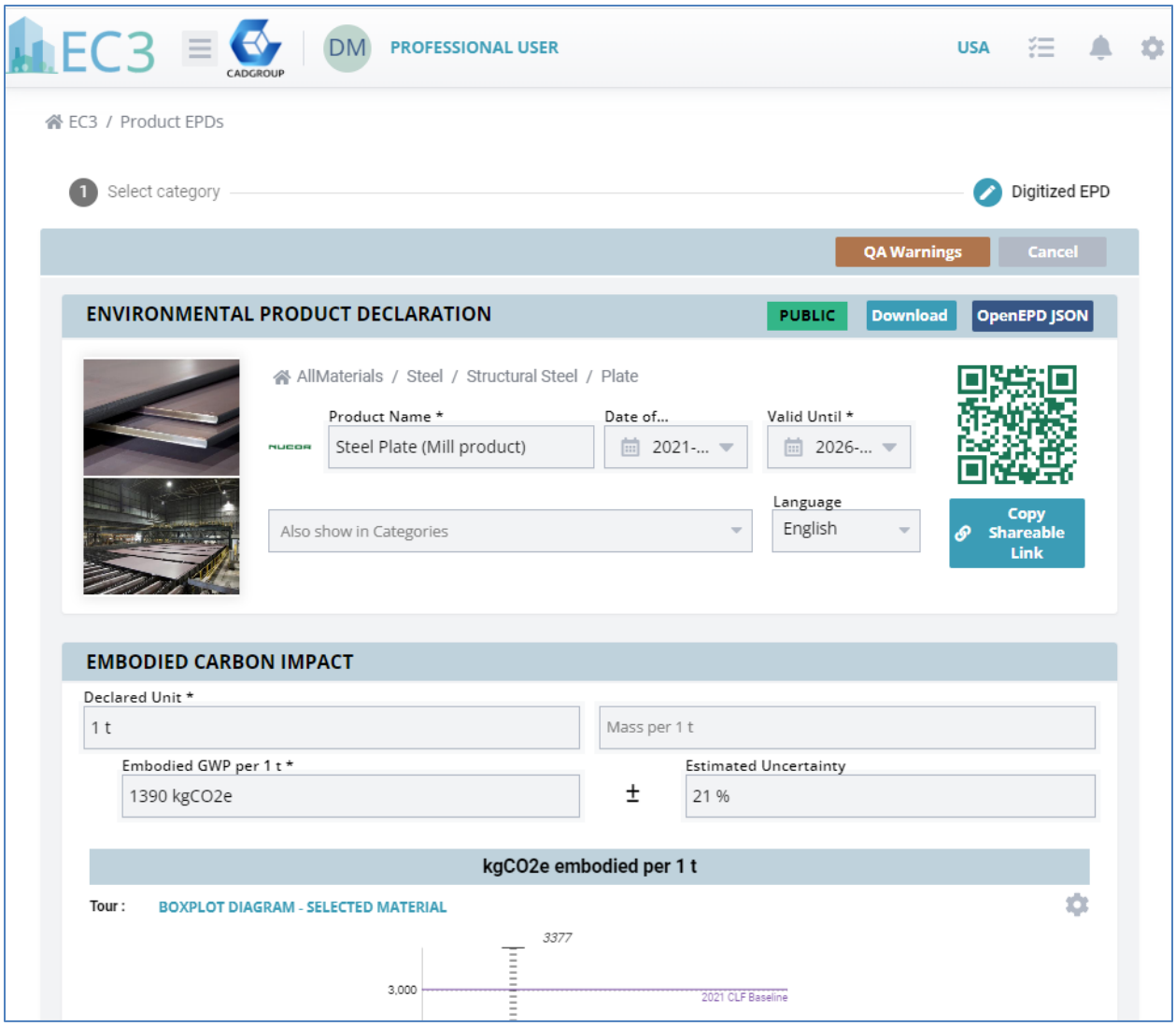
Use Embodied Carbon in Construction Calculator (EC3) Tool

The Embodied Carbon in Construction Calculator, or as we call it EC3, is a sustainability software service by C-Change Labs and a program of Building Transparency, a Washington State 501c(3) public charity. It is a tool for Owners, Architects, Engineers, Contractors, and Materials Manufactures to specify, procure, and incentivize low carbon construction materials.

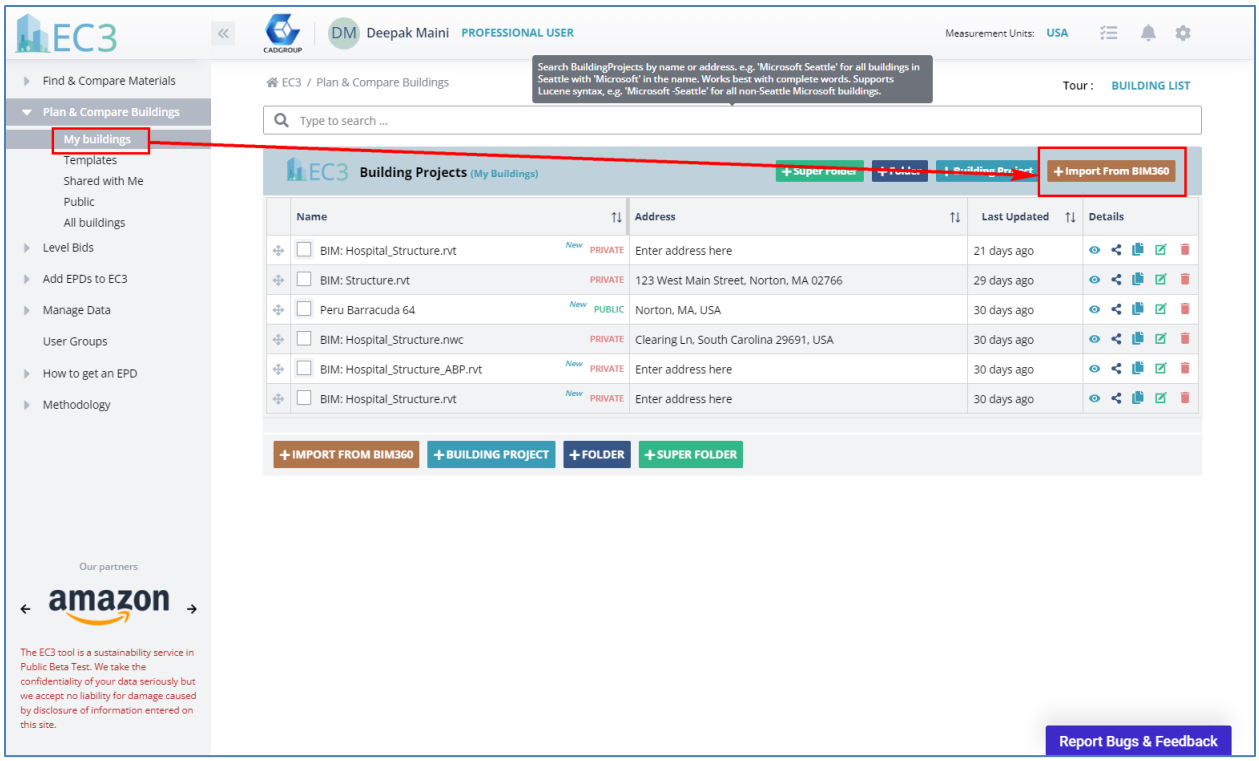
It allows you to find and compare materials based on their Environmental Product Declarations (EPDs).



You can download EPDs of the preferred material and attach them to your projects.



And if your project is hosted on BIM 360, you can directly open the model from there to assign materials to the elements in your model.


EC3
Deepak Maini
PROFESSIONAL USER
Measurement Units: USA
Find & Compare Materials
Plan & Compare Buildings
My buildings
Templates
Shared with Me
Public
All buildings
Level Bids
Add EPDs to EC3
Manage Data
User Groups
How to get an EPD
Methodology
EC3 / Plan & Compare Buildings
Search BuildingProjects by name or address. e.g. 'Microsoft Seattle' for all buildings in Seattle with 'Microsoft' in the name. Works best with complete words. Supports Lucene syntax, e.g. 'Microsoft -Seattle' for all non-Seattle Microsoft buildings.
Tour : BUILDING LIST
Type to search ...
Building Projects (My Buildings)
+ Import From BIM360
Name
Address
Last Updated
Details
BIM: Hospital_Structure.rvt
Enter address here
21 days ago
BIM: Structure.rvt
123 West Main Street, Norton, MA 02766
29 days ago
Peru Barracuda 64
Norton, MA, USA
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BIM: Hospital_Structure.nwc
Clearing Ln, South Carolina 29691, USA
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Enter address here
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+ IMPORT FROM BIM360
+ BUILDING PROJECT
+ FOLDER
+ SUPER FOLDER
Our partners
amazon
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.
Report Bugs & Feedback

Modular construction: bringing industrial thinking into construction

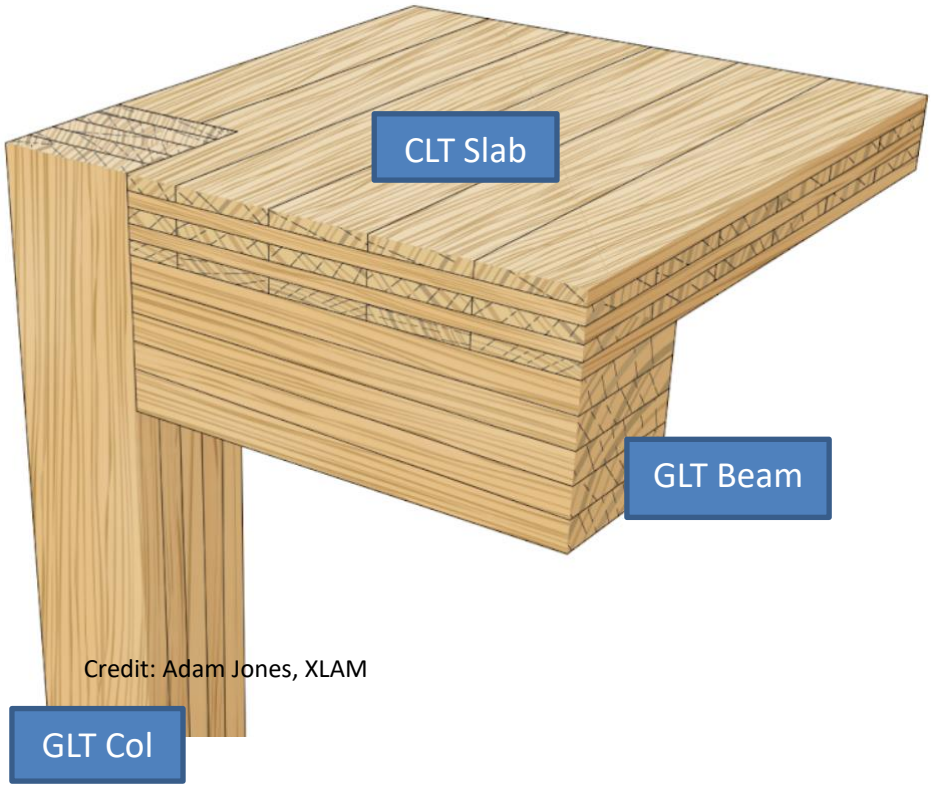
Due to a controlled manufacturing environment in a factory, modular construction makes it a lot easier to maintain consistency. Imagine a car manufacturing plant now building pods or sections of each level. Since many components of a building are completed in the factory, there is significantly less traffic and equipment movement around the construction site. Less hazard means improved safety on site. Controlled manufacturing environments supported by checks and balances ensure minimal wastage and improved cost savings. Modular construction helps design flexibility as the assembly lines can be configured easily to compensate for innovation.

Low impact building material

Some of these are materials we have used in the past, such as timber. A good example is Dimensional Lumber, which is manufactured in a controlled environment with stricter standards.

Image courtesy Lampert Lumber

Other examples include Cross Laminated Timber (CLT), where the pieces of timber are glued at a 90-degree angle to the layer above, giving the product strength in both directions. This gives CLT similar characteristics to concrete used for floors and lift shafts. Similarly, Glue Laminated Timber (GLT) is where pieces of laminated structural timber are layered and glued on each other in the same direction. This gives GLT increased strength, and so it is used primarily on structural beams or columns.



Credit: Adam Jones, XLAM

Several types of eco or green concrete materials are being tested worldwide to reduce the carbon footprint of buildings and infrastructure. For example, the one below is a mix of fly ash, and waste materials, including ground glass and gaseous carbon dioxide


Credit: Professor Ali Abbas, The University of Sydney