



Circular Buildings & Materials Workshop

Summary Report

Presented in collaboration with CELC, CSA Group, CERIEC, Light House, and COIL

The potential impact of greater circularity in the construction and built environment sector is immense. But how do we achieve these outcomes? This workshop explored the benefits of circular construction and deconstruction practices, and provided insights on how to expand best practices across the value chain and building life cycle.

Synopsis of Key Take-aways by Topic

Embodied Carbon

- Embodied carbon is difficult to quantify given barriers around EPD and inconsistencies in the data sets; however, there is still a need to take action even without the perfect tools.
- Additional strategies exist beyond improving the sustainability of materials, such as enhancing the longevity of buildings and their adaptability, including behaviour and usage patterns (e.g., intensifying use at night).
- There is a need for more education on the topic.
- Procurement must be designed to factor in embodied carbon considerations.

Materials

- Current information on materials and their sustainability is difficult to use by professional builders.
- Need for building passports to help quantify materials.
- Need for an evaluation of marketplaces to identify the issues, accessibility, and availability of materials.
- Opportunities exist to do more urban mining as a source of resources.
- Can also look at fiscal measures, such as taxes on virgin materials, and channel this toward developing secondary marketplaces.
- Municipalities can become the haulers – can support construction waste separation.
- Material selection and purchasing can also be linked to embodied carbon.

Deconstruction

- There is an important role for policy to support deconstruction efforts (e.g., building codes should get rid of restrictions that don't favour circularity).
- On-site sorting needs to be improved in order to capture higher-value materials.
- An opportunity exists to expand the use of material passports and EPD to capture instructions and information.

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- An opportunity exists to document the operations of companies that do it successfully to learn from these case studies and best practices.
- An opportunity exists to undertake early assessments of buildings to determine if they can be adapted for reuse, even before the final stage of life of the building for planning purposes.
- There is a need for a new certification that has a circularity lens.

Retrofit

- Case for retrofitting: By 2050, 80% of buildings in Canada will be built already (including considerations for both residential and ICI sectors).
- There is a lack of incentives for renovations at the city level.
- In order to be efficient, we need to build capacity. There is a lack of knowledge for contractors around circular strategies.
- Energy retrofits: it is important to have an incentive around heat pumps.
- Issue of heritage homes: lots of uncertainty around renovation and repurposing of the salvaged material (need for regulations and incentives).
- Opportunities: financing, regulation, and secondary marketplace development.

Labour Issues

- There is a need to assess the existing stock (retrofits and deconstruction are fairly labour intensive).
- Need to make trades more attractive to those joining the workforce (how to make construction cool again in high school).
- Need more training for architects and young people that want tech jobs; could fill the labour shortage gaps using solutions such as AI and automation in the construction sector.
- Prefab can evolve into greater application of automation for new buildings with end of life in mind.
- Deconstruction could be a major area for inclusive employment and address labour challenges.
- Will require a combination of industry collaboration and legislation.

Detailed Notes: Embodied Carbon Breakout Table

How is embodied carbon being measured ? And how can you reduce the embodied carbon?

- Tracking materials through passports, but LCA is not required in most projects. Life cycle analysis is a good tool, even though not perfect, better than not doing. New buildings -- we don't know what is their embodied carbon.
- City of Toronto has caps, LEED too.
- Corporations currently focus more on energy.



What can we do without having to develop new tools or measure?

- Build incentives to start tracking. We don't have the perfect tools to measure embodied carbon, but that shouldn't stop us.
- We don't have precise data set, we need to start acting.
- Agility can be improved going forward; what we currently have is good enough.
- Develop an incentive to use low-intensity carbon materials. It is too late for carrots, we need sticks.
- Governments need to be informed so they can translate these initiatives into legislature.
 - i.e. In Massachusetts, it is mandatory to hit these targets.
 - Critical role of procurement if all of the public projects could implement those targets.
- Educate the people who order these buildings. Guidelines are easier to publish than a law. We need to see clear benefits and market them. Carrot and sticks go hand in hand.

What are other strategies we could implement that are not as complex as LCA?

- Pushing companies to make optimal use of their space.
 - i.e. During the pandemic, hotels were used as shelters.
- There is currently a lot of towers being built purely on speculation of there being future demand – this should be grounded in data. We need a culture shift.
- In Quebec, they have been building a lot of factories for batteries, but no LCA was conducted.
- These are decisions that we make as a society; there is a dollars sign attached but no carbon budget (which needs to change).
 - Bring a carbon budget to every department of company. It is the same for accountants.
 - TAS Impact (developer here in Toronto) : piece of carbon accounting
- A lot of it is linked to human behaviour so it is complex. What is the thing that is going to make them do it?
 - For who are we doing this? It is for people. We need to get the human factor in.

Key Opportunities:

- We need a standard at the federal level for embodied carbon of concrete; additionally, we need to roll out this process to the whole building structure.
 - It is important to include this type of approach in design and LCA to quantify.
- Perhaps combining a carbon cost approach with a bidding approach could result in an effective system.

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- Having the tools to take an informed decision for decision-makers is crucial. We also need to be able to quantify the impact of these decisions.
 - Barrier: There is a lack of information in EPD, and no third party certification, so it is hard to compare different products.
- A lot of the conversation is on the inconsistencies of the EPD; solving this is the first step to more accurate quantification.
- We need to understand (in)consistencies between data sets. Where there are needs, where there are gaps?
- We need to set caps on embodied carbon of new buildings.
 - What are companies using? EPD and oneClick LCA.
 - Can refer to Canada green building standards so you don't have to reinvent the wheel every time.
 - City of Toronto standard: You can count it as zero if you reuse materials.
- It is important to find incentives to stop demolition of buildings, not build new buildings.
- We need to address the quality concern of reused materials. Merge quality and satisfied standard.
- We need to require deconstruction in new design, municipalities should add this to their bid.
- A life cycle approach needs to be at the core of all decisions – considerations such as increasing the life span of buildings to decrease carbon.

Key Barriers / Challenges:

- Architects don't have enough knowledge to address materiality considerations; they need to be educated that sustainability it is not only about water and energy.
- We currently don't integrate strategies or longevity or adaptability in the way we quantify intensity per square meter. We are missing this piece of the conversation when we are only focusing on new materials.
 - UBC is doing a study to understand the support of policies to redefine liabilities and performances around those reused materials.
- Bylaw in Richmond for deconstruction of single homes, but there is no market for the deconstructed materials because of loss of performance of the material.
- *Resources* Richmond: Toolkit to recover asphalt pavement.



Detailed Notes: Materials Breakout Table

Overall Take-aways

1. Evaluate current materials in system, sort and get them out
2. Explore uses for the materials and find secondary markets.
3. Need for greater embodied carbon considerations
4. Need for greater deconstruction considerations.

Key Barriers / Challenges:

- Lack of ppl/labour
- Lack of awareness and concern / allergic to innovation
- Space issues for source separation
- Budget is an issue – time and resources cost more than the perceived benefits (need for a culture shift)
- That waste happens only at the end of life is the typical viewpoint; waste is waste at all stages if not properly considered
- LEED Certification is an issue / there exists knowledge gap regarding sustainability standards
- Lack of on-site efficiency – limited knowledge in circular strategies and practices
- Market barriers – availability of some materials is slow

Key Opportunities:

- We need to set key structures in place at the beginning of the design and production processes
- Different wastes are generated at different times during the construction process – there is an opportunity to align bins phase and type of waste which will save on space and cost
- We need a reconceptualizing construction as layers when looking towards deconstruction
- Proper planning is needed – need for materials passport and other resources
- Need a database of what already exists as well as the building's lifespan, era and correlating materials used at the point in time when structure was constructed.
- *Resource: MEIA Manitoba* – sponsored a study on construction phases and waste generation

Detailed Notes: Deconstruction Breakout Table

Key Barriers / Challenges:

- Policy needs to be context-specific (regional)
 - Decisions have to be made for each project in the context of the regional parameters
- Deterioration of practices that prioritize longevity and quality materials in new homes – harder and less financial imperative to deconstruct
- Lack of end markets for used materials
 - We won't have markets without policy drivers
- Cultural barriers around reuse
- Challenges of matching new retrofit design elements with the design parameters of the existing structure

Key Opportunities:

- Deconstruction Policy v2.0 needed to build on existing deconstruction bylaws
- Emphasize the importance of design that plays in deconstruction
- Design products that provide the method for deconstruction
- Add deconstruction methodology to EPD
- Tracking of materials (GS1) – material passport
 - Updating a building passport through a building's life is required because majority of building components are replaced over the life of a building
- Best practices for deconstruction
 - Should deconstruction of certain buildings be mandatory?
 - Need to consider the storage of materials from deconstruction
 - Using BIM as the material inventory
- Need for earlier decision-making on assessing end fate for the building (reno v removal)
- Planning should inform building design so it isn't considered on an individual structure basis
- Need for bringing together all actors to develop solutions
- Need for a new circularity certification or circularity criteria (EPDs provide a circularity score)
- What are the factors of Unbuilders success?
 - Received money from a building innovation fund targeting SMEs (government role)
 - Incorporated processing
 - Offering tax credits
- Need for greater regulation of deconstruction; i.e. early deconstruction permitting upon provision of a deconstruction plan
- Need for more policy drivers
- Need for knowledge sharing -- Learn more about how operations like Tomlinson work
- Support of specific companies and end markets for specific materials (e.g. dimensional lumber)
- Reform building codes
- Identify non-structural applications for reused materials

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- Better sorting at construction sites – where are there opportunities to do more onsite sorting
- Provide incentives to promote innovation in automation (e.g. Urban Machine)
- Establish guidelines for reuse (i.e. in Germany?)

Key Questions:

1. What can be set at a national (standards, values, decision matrix), provincial, local level (implementation)?
2. How are we building typologies? What best practices are we following? What priorities are guiding this process?

Detailed Notes: Retrofit Breakout Table

Overall Take-aways

- 80% of the whole building stock in 2050 will be composed of buildings available already today.
- Explore examples of ecosystems and replicate (e.g., Unbuilders in BC)
- Energy retrofits vs renovations (incl. embodied carbon)
- Map enabling factors and actors to renovate/retrofit
- Provide framework: standards, certification and education
- CSA group's research reports specific to commercial real estate buildings: [Exploring Circular Strategies to Extend the Life of Existing Buildings](#) and [Opportunities to Apply Circular Strategies to Existing Office Buildings](#)

Key Barriers / Challenges:

- 'Chicken and the egg' dilemma: where to start in the absence of an ecosystem
- Labour shortage, lack of experience and skills at contractors' levels
- Limited knowledge, lack of awareness and concern
- Uncertainty around quality of materials – are they meeting the building codes? More certainty needed around standards and codes
- Lack of incentives at city level to reuse/repurpose
- Subsidies for energy retrofits are good but need to tackle capacity issues as regards permits and audits and fasten up the process



Key Opportunities:

- Create platforms on social media to build up a secondary materials/products marketplace on social media. Municipalities could be enablers.
- Building permits for renovation activities at commercial scale should include incentives to reuse materials by giving money back.
- Transparency/data: extend mandatory reporting of key data to waste, in addition to energy and water. Develop national databases on EPDs, benchmarks for operational energy savings, and secondary materials and products
- Create and replicate ecosystems. Example: practices like Unbuilders: residential, able to recover higher value materials. Have market for resale. High level of achievement in deconstruction due to value of materials and tax credits through 'Habitat for Humanity'. Tax credits and value of materials will enable the ecosystem.
 - Regulations spur innovation – replication in other jurisdictions will enable transition.
 - This model allows building premier products, and creating new businesses, new business models and additional markets.
 - Sources of investment can foster entrepreneurship: private (e.g., Desjardin) or public – e.g., BC Building Innovation Fund).

Detailed Notes: Labour Shortage Breakout Table

Key Barriers / Challenges:

- Hurdles to technology introduction in construction: skill gaps, process changes.
- Need more investment in white-branded factories – there is currently on't have enough to build factories right now because the pipeline is short-to-mid-term. Often responding to contracts.
- Architects lack competencies when it comes to modularity.
 - Architects/engineers should work on the ground for x years before practicing (help labour shortage issues)
- Making the transition will be labour intensive (human challenge is significant)
 - Brand as 'New circular' = more automated and different skills; making it appealing and sexy
 - Invest in factories for prefabs - white brand
 - Then supply from them and build
 - Lots of training gaps
- Need for traceability of materials

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Key Opportunities:

- Leveraging modularity - taking advantage of industrial history (i.e. Model T example process line, lego)
- Change mindsets/culture/language: "No longer building a house... manufacturing it."
 - Thinking about a home as a product and how it will eventually be deconstructed
- Build a framework for traceability.
- Develop a Material Carbon Estimator (cradle to gate). Laborers world right now. They are so in demand that they don't want to sort waste.
- Need to market trades more, in high school (+integrate tech, CAD, programming, to make it attractive)+ need to bring in foreign workers; embedding purpose in trades
- Integrate Indigenous communities
- Leveraging technology to lighten the labour load as well as appeal to a younger generation
- Need for incentives
- Need to quantify embodied carbon
- Education and mindset change of upcoming construction workers by the old guard
- Deconstruction can be a major area for inclusive employment; don't drain from skilled labour needed elsewhere
- Implement carbon and plastic credits (i.e. PLAEX, LDPE)