

# Embodied Carbon Management Toolkit

# Circular Construction

November 19, 2024



Net-zero Carbon and Climate-resilient Developments



# Agenda

- Refresher on embodied carbon and life cycle assessment (LCA)
- Embodied Carbon Management Toolkit
  - Circular Construction Recommendations

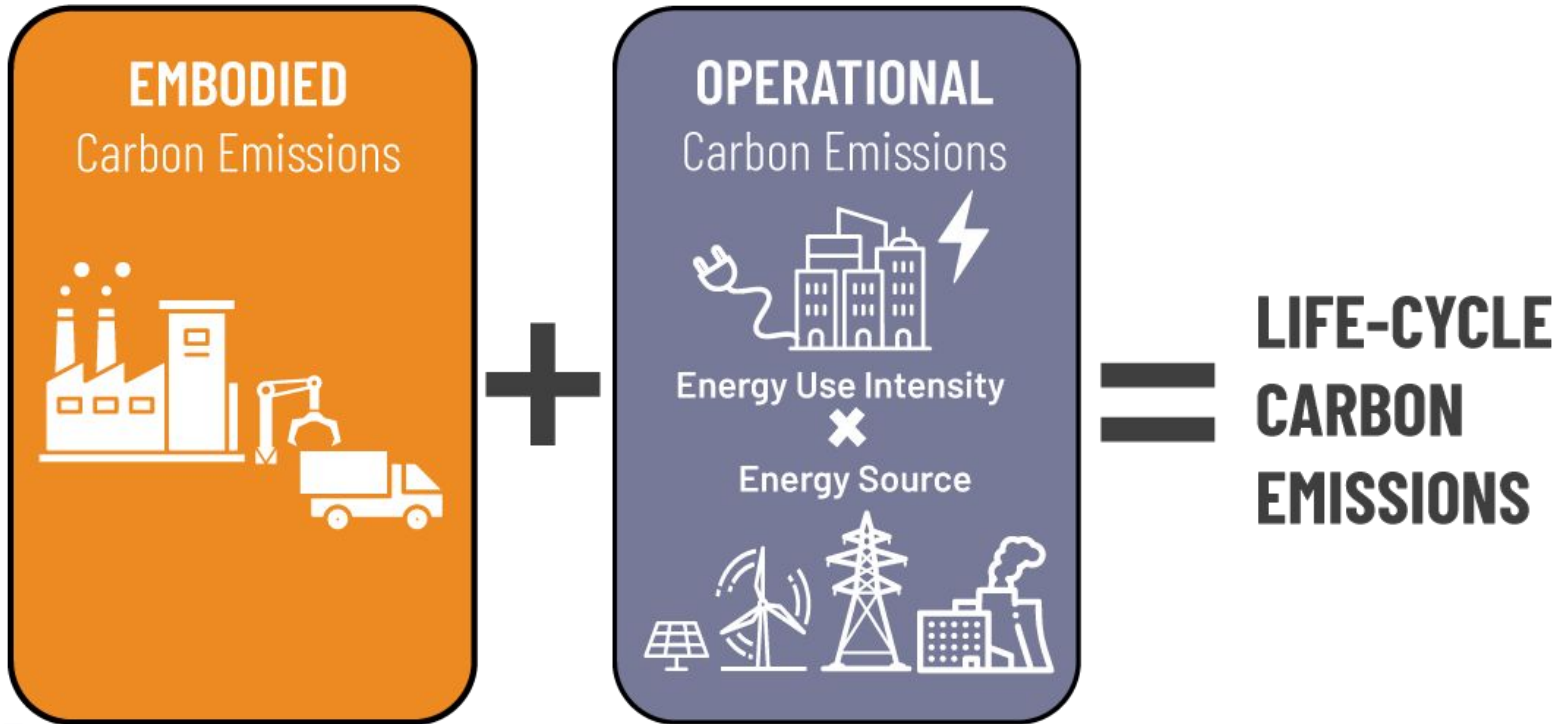
# Ryan Zizzo, CEO & Founder *PEng, MASc, LEED AP ND*



- Recognized leader in green buildings and climate with 15+ years experience across Canada and Europe
- Supported the development of the City of Toronto's Toronto Green Standard version 4 update, North America's first policy to cap embodied carbon on certain types of new construction
- Supported the development of the Government of Canada's low-carbon concrete policy (Standard on Embodied Carbon in Construction)
- Canada Green Building Council (CAGBC): Embodied Carbon Technical Advisory Group Member, and previous member (4-year term) on Zero Carbon Steering Committee
- Advisory Board Member of the Carbon Leadership Forum (CLF) and founder of the CLF Toronto Hub

# Refresher on embodied carbon and life cycle assessment (LCA)

# We need to build differently



# Embodied Carbon 101



*New buildings are increasingly energy efficient, and energy is increasingly lower-carbon*

# Embodied Carbon is Becoming a Major Priority

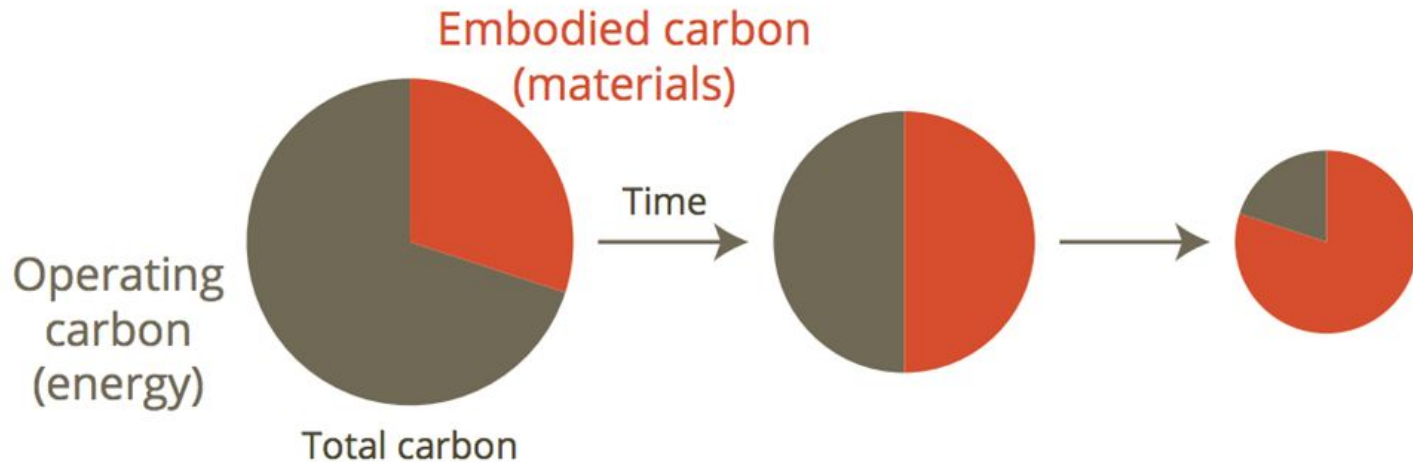


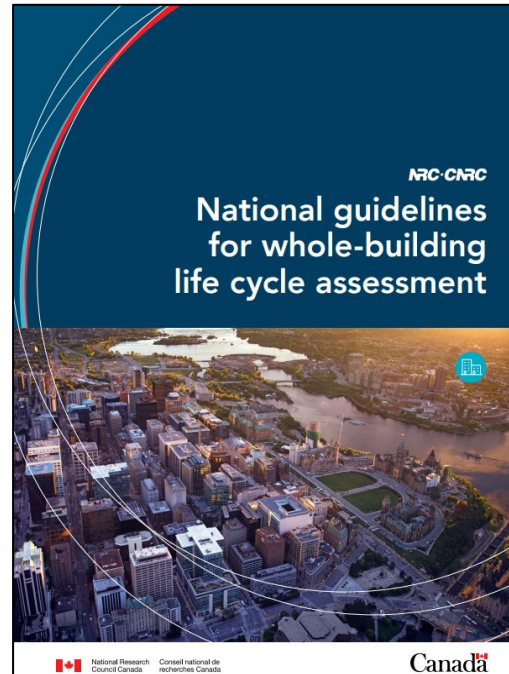
Figure 1. Growing importance of embodied carbon as building operational energy decarbonizes

# Life Cycle Assessment (LCA)

This standardized approach is governed by international standards including

- ISO 14040 - Environmental management, Life cycle assessment, Principles & framework
- ISO 14044 - Environmental management, Life cycle assessment, Requirements & guidelines

*Canadian guidance is available from the National Research Council (NRC).*



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National Whole-Building Life Cycle  
Assessment Practitioner's Guide  
Guidance for Compliance Reporting of Embodied  
Carbon in Canadian Building Construction



# Guidance on material reuse and impact on carbon

- Published May 2024
- Reused / salvaged materials count as zero carbon in a new project
- Salvaged material can be major solution to achieving low embodied carbon targets
- Such targets are being introduced federally, in Toronto, Vancouver, Mississauga, etc

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## National Whole-Building Life Cycle Assessment Practitioner's Guide Guidance for Compliance Reporting of Embodied Carbon in Canadian Building Construction

### (v) Waste Management at the End-of-Life (Module C)

Where the tool allows it, default scenarios for waste management at the end of building life can be updated to better reflect a product that may have been specified, the proposed design, or regional waste management practices.

For instance, the default transportation distances specified in Module C2 may be modified to reflect the current waste and recovery facility locations in the project jurisdiction.

### (vi) Salvaging and Reusing (Modules A to C)

If in the proposed design a portion or components of the existing building on site are reused or if a salvaged component from another site is reused, the quantity of reused materials and components shall be excluded from all the life cycle stages (A to C) in the embodied carbon assessment. When calculating the floor area of the building for calculating the embodied carbon intensity, the reused portion should be included in the floor area except for the area of attached garages where the project authority has set absolute intensity limits based on GFA.

The embodied carbon from the demolition of the portion of the existing building that is removed from the site shall not be included in the embodied carbon calculation.

### (vii) Design for Disassembly (Modules C to D)

Design for Disassembly (DFD) enables future reuse and recycling and thus reduces emissions from Modules C and D. However, currently there is no quantitative approach to measure how DFD solutions may reduce embodied carbon.

### (viii) Modules Beyond A1 to A3 (Modules A4 and A5, B, and C)

Where the software tool scope is missing data for any of the life cycle stages beyond product stage (i.e., beyond Modules A1 to A3), the following methodology may be applied to all building elements of the required scope (as described in Section 3.3(a)) as an interim

# Embodied Carbon Management Toolkit

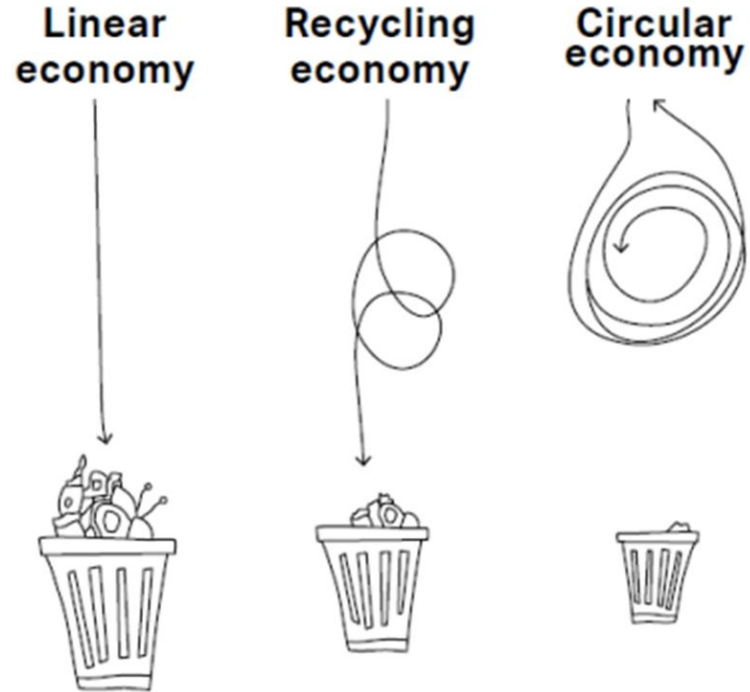
# Embodied Carbon Management Toolkit

Key Goal = develop an “EC Management Toolkit” to help ON municipalities identify major drivers of EC and optimize for low carbon buildings through actionable changes, including possible updates to standards and guidelines

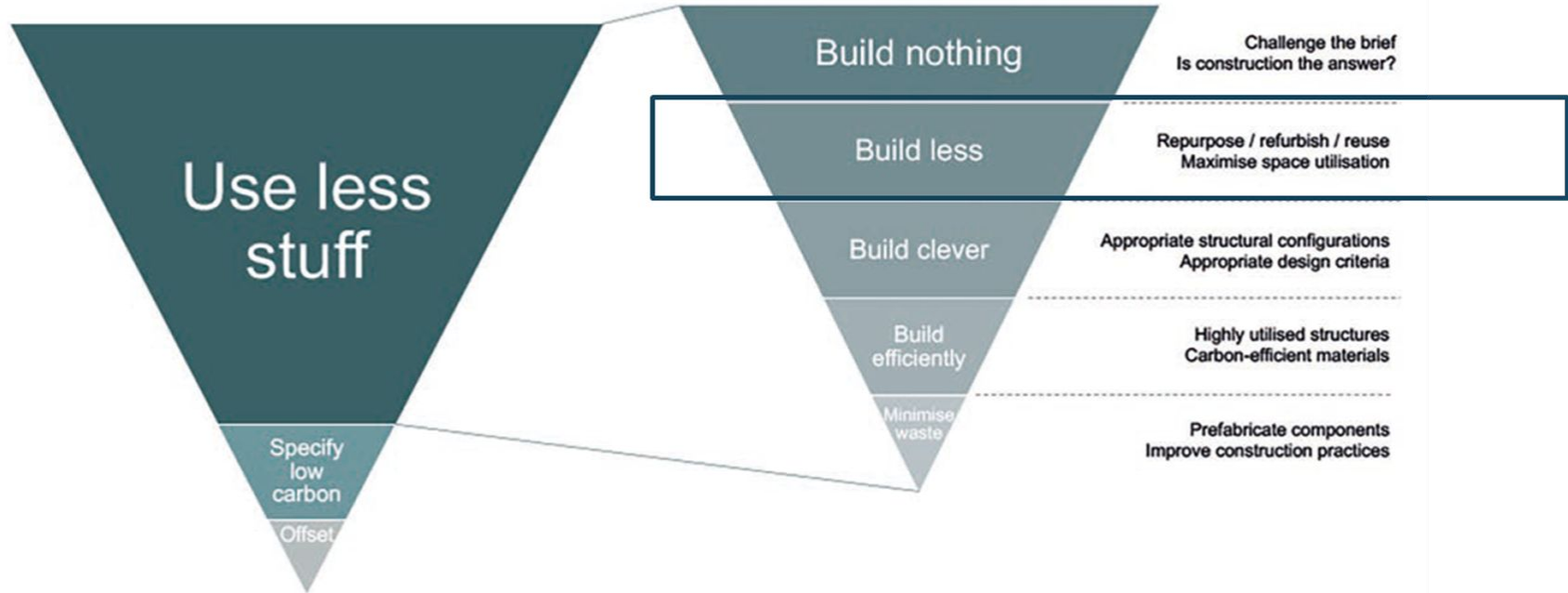
Three main topics of analysis:

1. Urban Design Guidelines
2. Procurement of low carbon materials
3. Circularity
  - Included a review of current City of Toronto practices / policies and a jurisdictional scan into international best practice
  - Workshops and interviews with City staff (various departments including Heritage, Planning, etc) and industry experts

# Construction Circularity



# Hierarchy for net-zero structural design



↑FIGURE 1: Hierarchy for net-zero structural design (inspired by PAS 2080)

# Facadism: Good for heritage. What about carbon?



# Circularity Can be a 6X “Win”

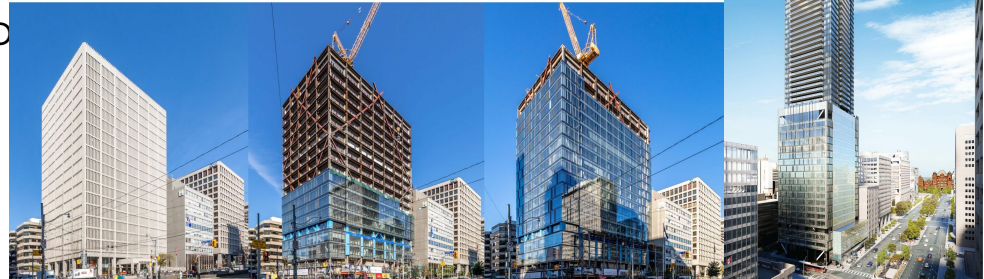
- ✓ 1. Supports local jobs
- ✓ 2. Improved heritage / culture
- ✓ 3. Lower carbon
- ✓ 4. Less waste
- 5. Less resource extraction



# Adaptive Reuse Support Building Adaptation

## Make it easier to implement a circular approach than a new building approach

- Create a streamlined zoning approach to allow appropriate conversions of underused buildings (especially to residential)
- Waive or reduce certain requirements, such as overshadowing
- Provide financial incentives for



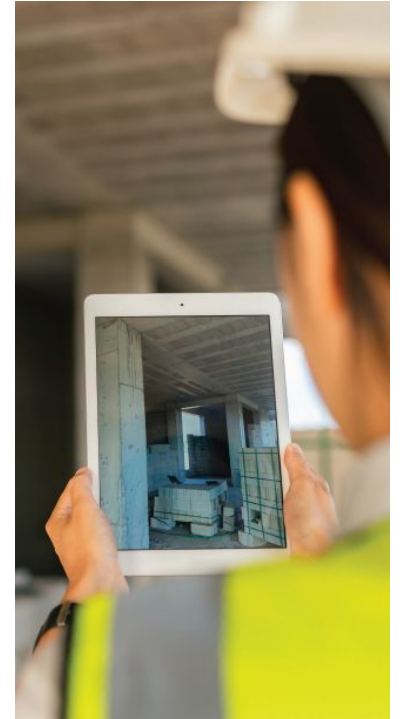


# Adaptive Reuse Require Pre-Development and Pre-Demolition Audits

Also called “Circularity Audits”

- Before demolition permit can be granted: require an audit to assess degree to which existing buildings, infrastructure, and materials can be repurposed (both into the new development and more broadly into the circular economy)

*Note: existing O. Reg 102/94 actually does require some of this, but is not typically being followed.*



# Adaptive Reuse

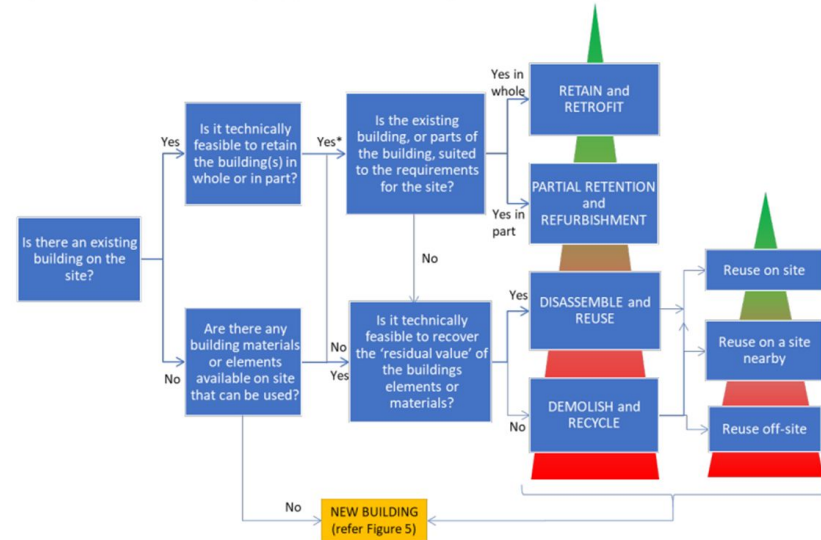
## Use a Circularity Decision Tree

- Develop and require the use of a decision tree to help decide if building has high embodied carbon and/or heritage value
- Penalize high (carbon) value demolition with high fees or block entirely

### What's happening in London? Circular Economy Statements

Excerpt from City of London Circular Economy Statement Guidance 2022 [circular\\_economy\\_statements\\_lpr\\_0.pdf](#) (london.gov.uk)

Figure 4: Decision tree for design approaches for existing structures/buildings



\* With exceptions, refer to paragraph 2.4.4 below.

# Deconstruction and Salvage Ban (or disincentivize) “demolition”

- Require deconstruction (no longer allow ‘demolition’)
- Potential updates to Building Permit Fee schedule
  - Increase the fee for demolition (or remove the option completely)
  - Create a reduced fee for deconstruction and material salvage - pre-deconstruction audit could serve as evidence / input
- Toronto Municipal Code Chapter 363, Building Construction and Demolition
  - Revise demolition to deconstruction or add deconstruction option with lower fee
  - Require submission of compliance documents for O.Reg. 102/94 and 103/94



# Deconstruction and Salvage

## Support a secondary materials market

- Support creation of secondary market for deconstruction and salvaged materials
  - Marketplace to link designers and purchasers
  - Could start with one material (brick?) and require it be sent to marketplace



# Deconstruction and Salvage

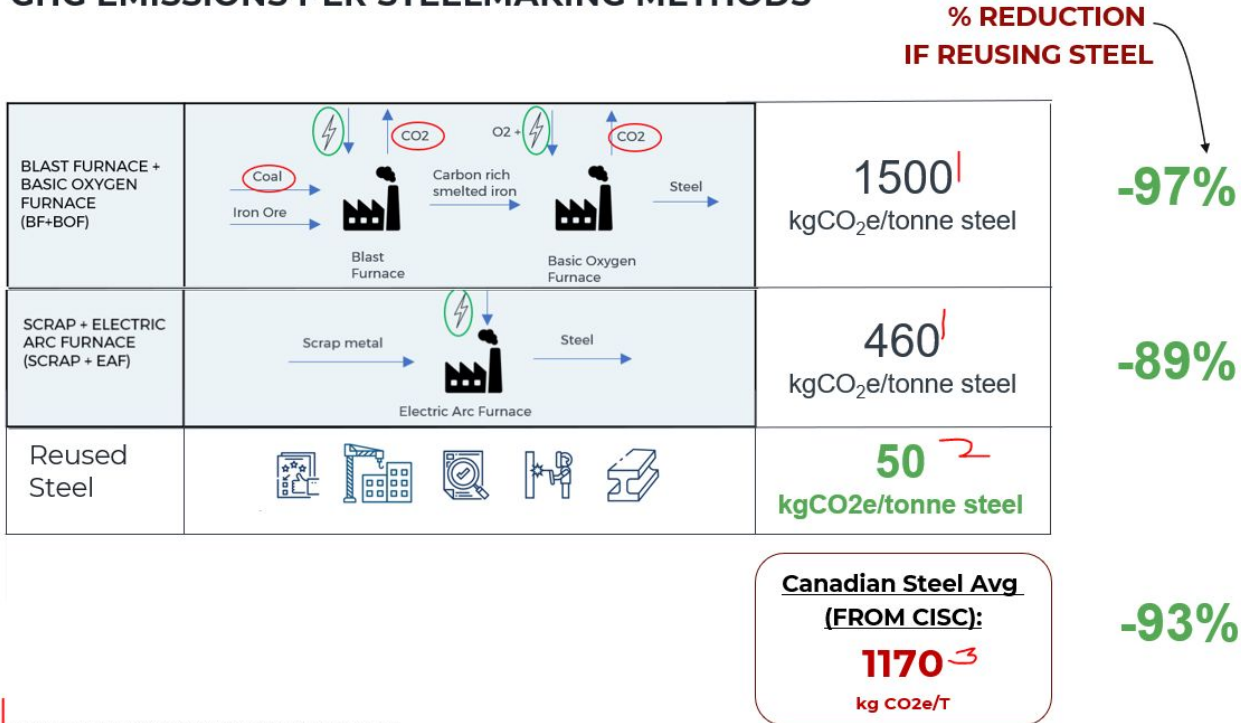
## Minimum circularity requirements in new buildings

- City could set minimum procurement requirement for use of circular materials that increases over time
  - 1% of materials (by value) from salvaged / reused sources in 2025
  - 2% in 2026
  - 3% in 2027, etc



# Reuse of Structural Steel

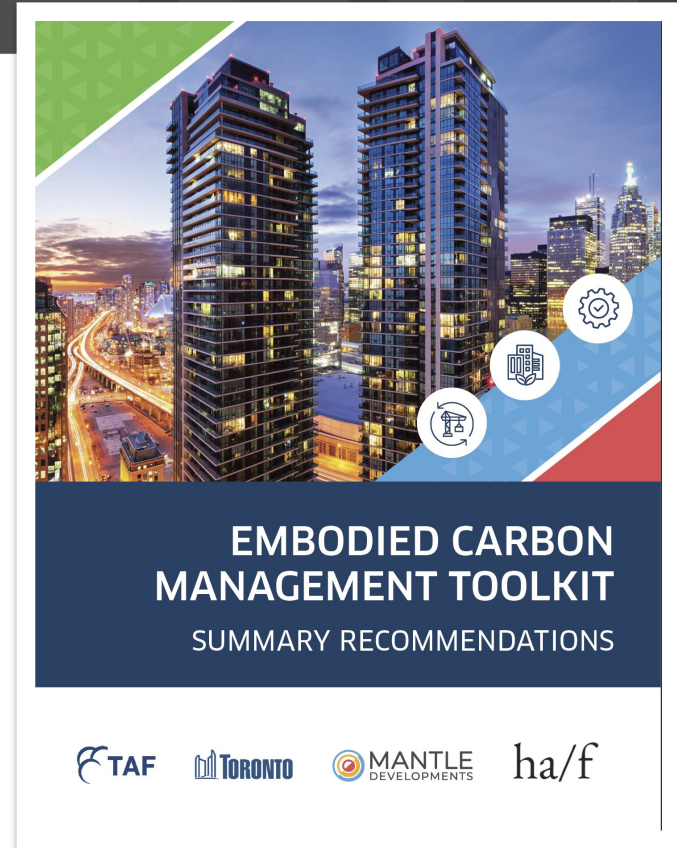
## GHG EMISSIONS PER STEELMAKING METHODS



<https://aciercanadien.ca/files/resources/HowCleanisTheU.S.SteelIndustry.pdf>

# Toolkit available online (any day)

- [www.mantledev.com/publications](http://www.mantledev.com/publications)
- [Toolkit](#)



# Let's chat. Thank you!

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