Embodied Carbon Policy Considerations for Municipalities

Wednesday July 20

TORONTO TAF MANTLE DEVELOPMENTS UNIVERSITY OF TORONTO JOHN H. DANIELS FACULTY OF ARCHITECTURE, LANDSCAPE, AND DESIGN

Today's Speakers

Lisa King

City of Toronto

Senior Planner, Strategic Initiatives, Policy & Analysis

Ryan Zizzo

Mantle Developments

Founder & CEO

Kelly Alvarez Doran

University of Toronto
Ha/f Climate Design
MASS Design Group

Sr. Director of Sustainability and Regenerative Design

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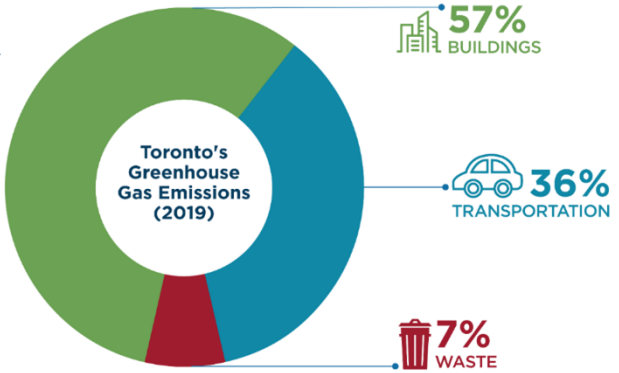
Agenda

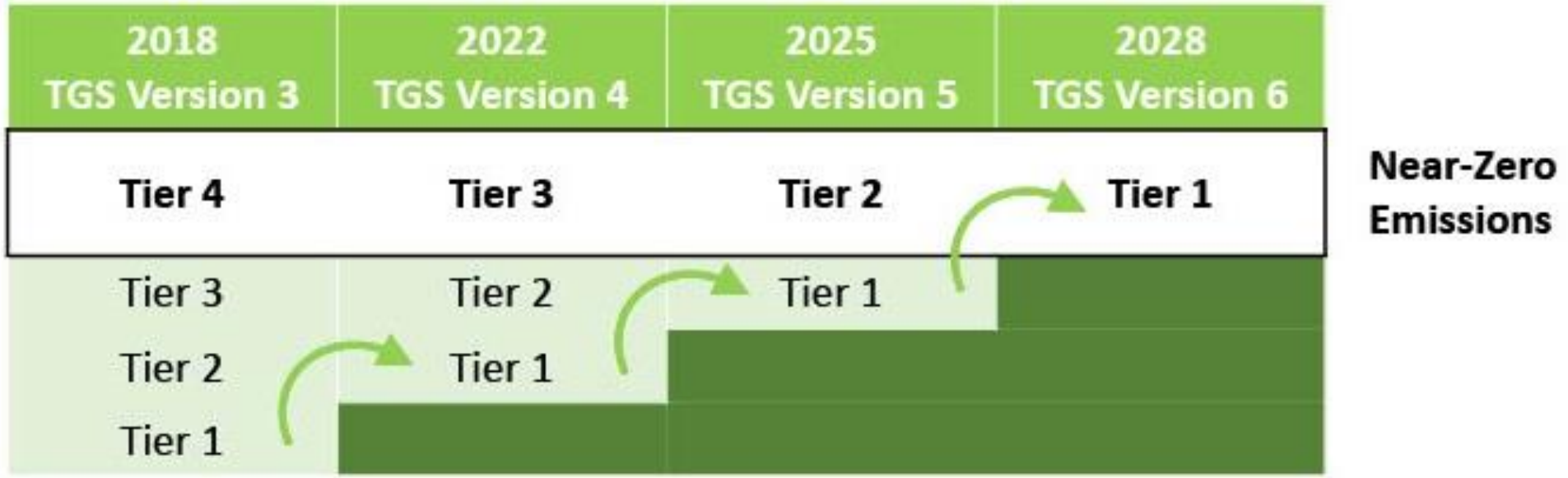
Time	Topic	Speaker
11:00 - 11:05	Introduction and Welcome	Lisa King, City of Toronto
11:05 - 11:25	Embodied Carbon Policy Primer Overview	Ryan Zizzo, Mantle Developments
11:25 - 11:35	Q&A	All
11:35 - 11:55	Breakout Sessions: So what? What Now?	All
11:55 - 12:30	Participants share feedback and experiences	All
12:30	Conclusion	Lisa King

TGS Version 4

- TGS V4 applies to all new applications received on or after **May 1, 2022**
- Applies to new rezoning, plan of subdivision or site plan applications
- Final version based on date of **Site Plan** application

Toronto's Accelerated Pathway
New Development





Embodied Carbon: Building Materials

City-owned Required, Tier 2 & 3

- Upfront materials emissions assessment
- Structural and envelope materials
- CAGBC Zero Carbon Building Standard method or BEAM for Low-rise residential
- Low-rise target Emissions Intensity <250 $kgCO2e/m^2$

Tier 3 (Large Buildings)

- Whole building LCA
- Optional target of 20% embodied carbon reduction

Two Benchmark Studies

The Atmospheric Fund (TAF) funded two studies to establish performance benchmarks from real building construction projects in the GTHA.

1. Benchmarking Materials for Low-Rise Housing (published April 2022)
2. Embodied Carbon Benchmarks for Part 3 Buildings (published July 2022)

Draft Primer Contents

Contents

Ontario Benchmarks

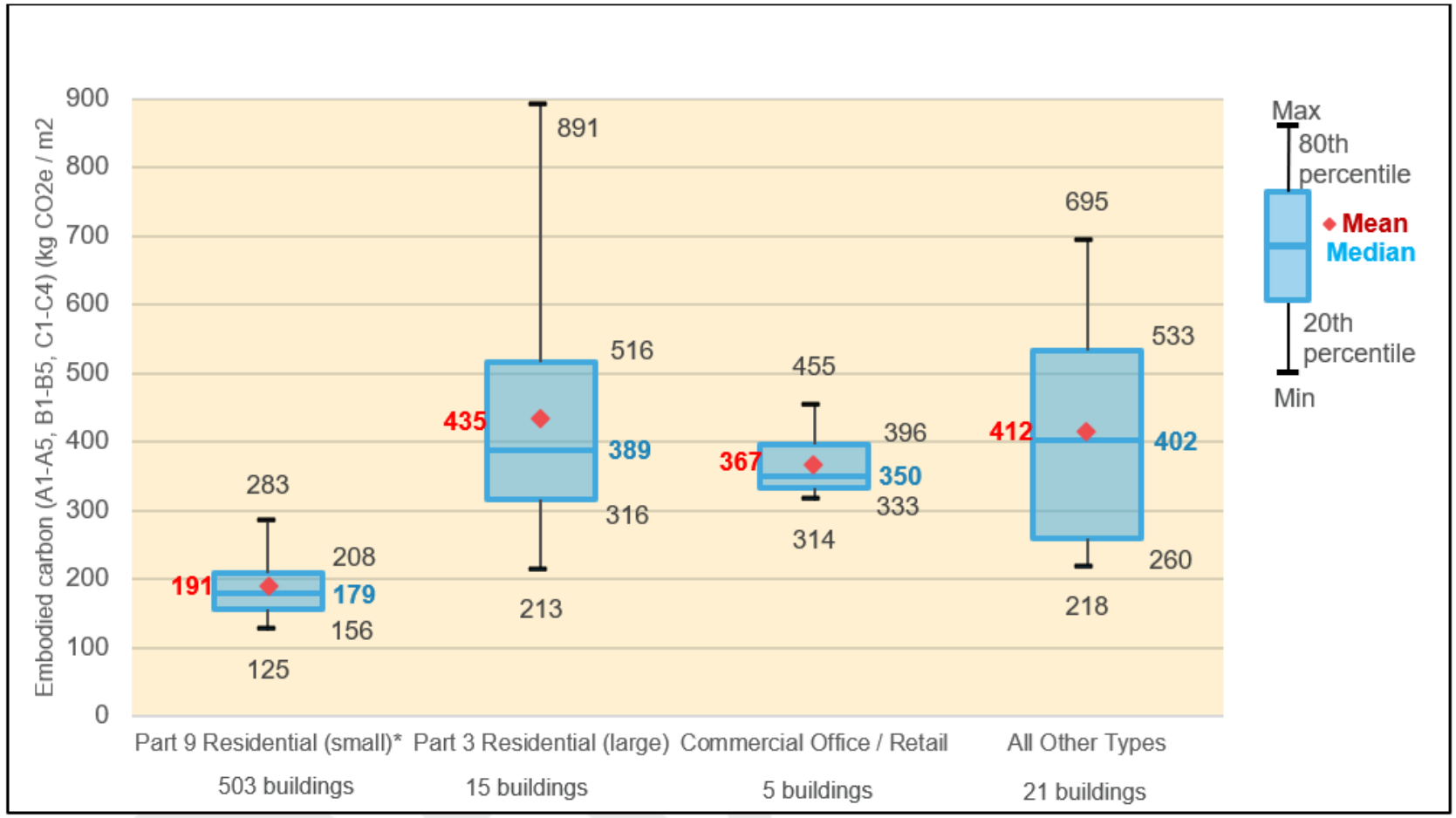


Figure 3: Ontario's first embodied carbon benchmarking; self-reported data from 41 separate large (Part 3) buildings, and results from separate EMBARC study [4] (see page 7) on small (Part 9) buildings.*

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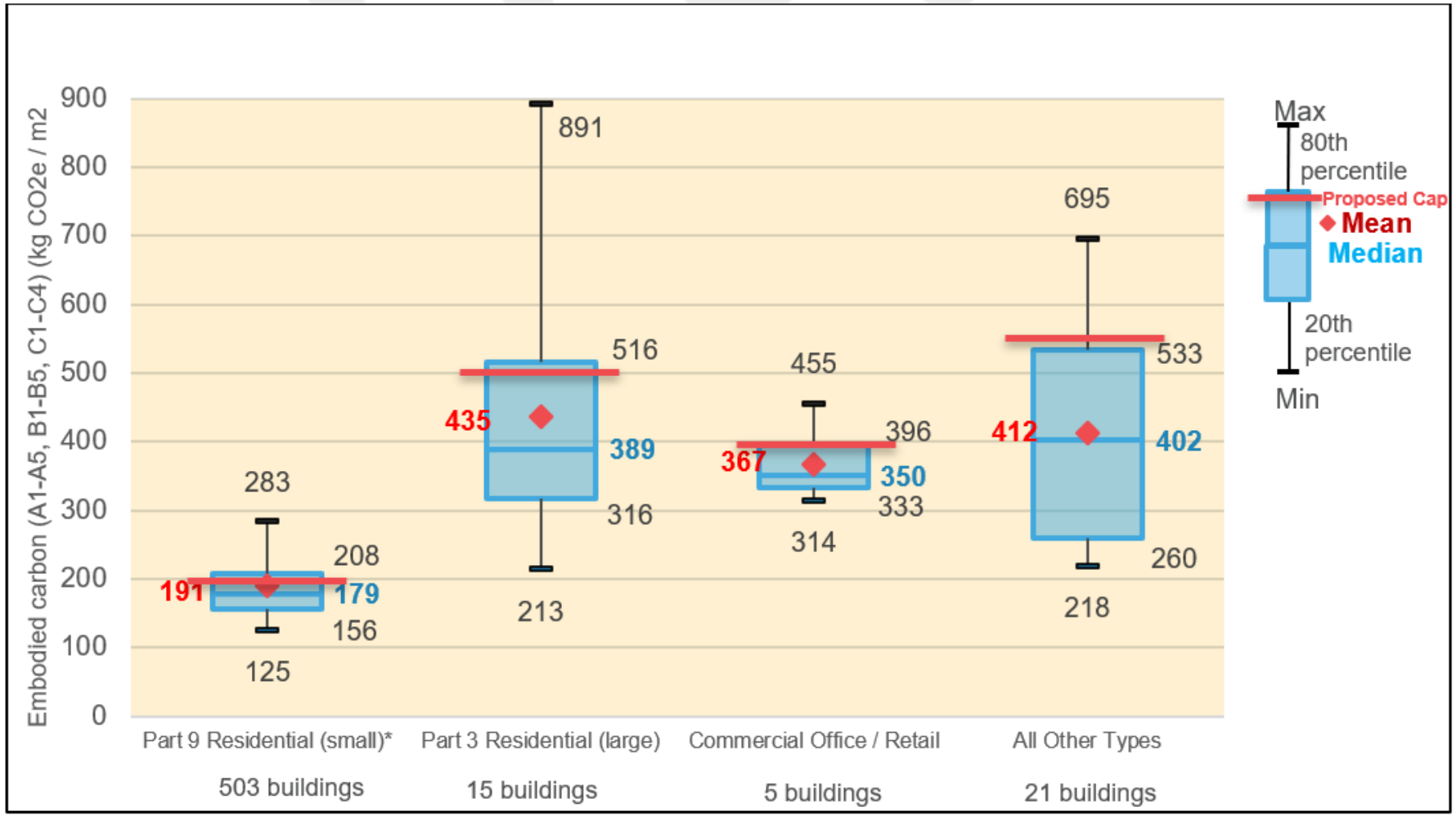
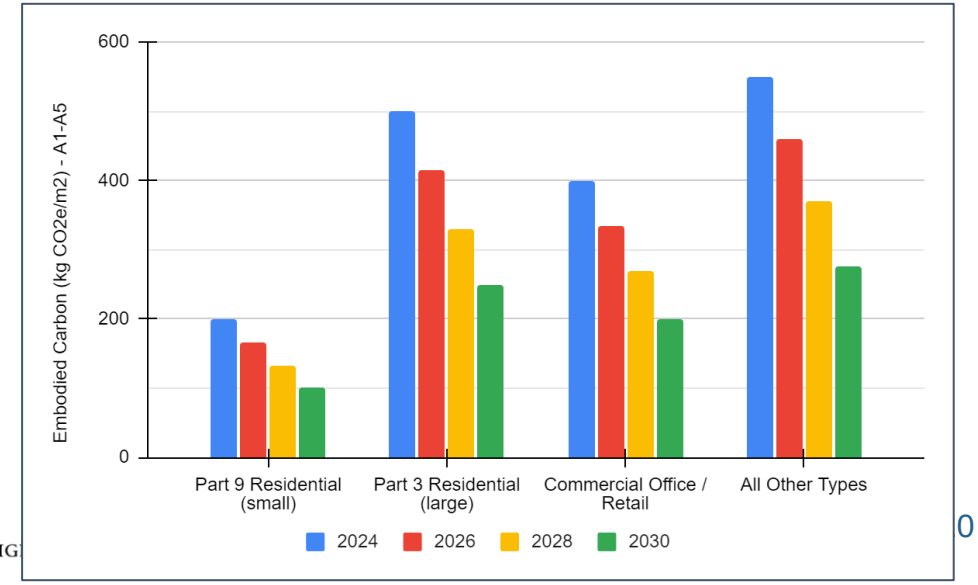
Proposed Caps



Proposed Caps to Half by 2030

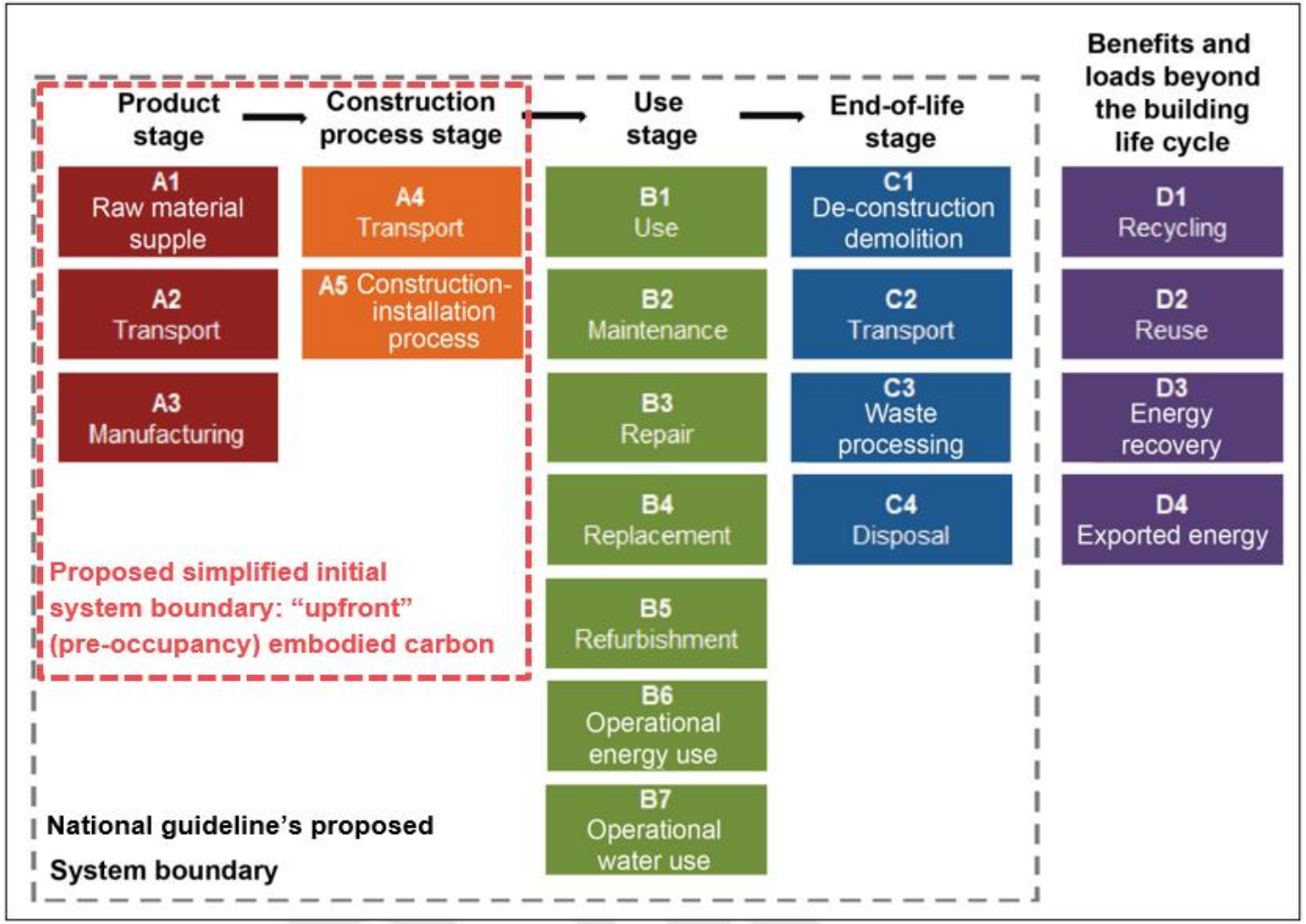
Table 1: Proposed upfront embodied carbon caps for buildings in Ontario in kg CO2e/m2 – Life cycle phases A1-A5

Year	Part 9 Residential (small)	Part 3 Residential (large)	Commercial Office / Retail	All Other Types
2024	200	500	400	550
2026	166	415	335	460
2028	133	330	270	370
2030	100	250	200	275



Life Cycle Phases

Image from the NRC's National Guidelines for whole building LCA



Object of Assessment

Simplified (must be included)	Expanded (can be added in separate model)
All new materials that are part of: • Structural systems including footings and foundations, basements, floors (slabs), walls, columns, beams, and stairs • Envelope systems including exterior glazing and frames, cladding, framing, insulation, roofing • Interior vertical finishes (gypsum and/or other) on structural elements • Parking structures (above or below grade)	**All new materials that are part of:** • Site works, excavation, and shoring • Mechanical, electrical, plumbing • Fire detection and alarm systems • Elevators and transportation systems • Interior horizontal finishes (flooring and ceiling) like carpets, ceiling tiles, etc • Interior vertical finishes (gypsum and/or other) on non-structural elements • Surface parking lots • Interior (non-structural) partitions, doors, glazing

Class D to A LCA Reports

	Costing	LCA	Embodied Carbon Decisions using LCA
Class D	Conceptual design. +/- 20% to 30%	Conceptual / schematic design	Amount of underground parking; main structural material type: concrete vs steel vs timber; reuse existing structures; massing and foundation types; setbacks.
Class C	33% design development. +/- 15% to 20%	Design development	Cladding materials and window-to-wall ratio; insulation type; floor plan; interior partitions; concrete types and strength classes
Class B	66% design development. +/- 10% to 15%	Tender documents, "for construction"	Local and low-carbon suppliers; transportation distances and electric vehicles; material properties including recycled content, concrete mix specifics and curing time requirements, steel supplier, certified wood
Class A	100% tender documents. +/- 5% to 10%	Construction completed, "as-built"	Maximize salvaged materials; low-carbon concrete mixes; minimize transportation distances (use local suppliers); low-carbon construction equipment.

Potential to link to building approvals

City of Toronto Requirements:
Official Plan Policies supporting embodied emissions reductions and sustainable building materials
Rezoning Application: Preliminary LCA submitted with the Energy Strategy Report
Tier 2 verification Report (Occupancy) – Full LCA report with recommendations
Proposal to add requirement as part of Site Plan Approvals

Table 6: Vancouver's embodied carbon requirements linked to approvals stages (Vancouver Green Buildings Policy for Rezoning – Appendix A)

Approvals Stage	Embodied Carbon Requirement
Rezoning Application	Preliminary embodied emissions calculation
Building Permit	Calculations of embodied emissions
Occupancy Permit	Final calculations of embodied emissions

Proposed Reporting Template

1. GENERAL INFORMATION

Please provide the following general information about the project.	
Project Name	
Embodied Carbon Assessor's Name	
Embodied Carbon Assessor Firm	
Date of Assessment Completion	
Software & Version Number	
Above grade storeys (#) & gross floor area (m^2)	
Below grade storeys (#) & gross floor area (m^2)	
Total storeys (#) & gross floor area (m^2)	
Parking levels (#) & gross parking floor area (m^2)	
Project Life	☐ 60 year
Assessment Timing (check all that apply)	☐ Schematic Design (Class D) ☐ Design Development (Class C) ☐ Tender / Construction Documents (Class B) ☐ Post Construction Documents (Class A)
Please confirm that the analysis includes all structural and envelope components ("mandatory materials") by checking the applicable boxes to the right.	☐ Footings and foundations ☐ Complete structural wall assemblies (cladding to finish) ☐ Structural floors and ceilings (no finishes) ☐ Slab on grade ☐ Roof assemblies ☐ Stairs ☐ Parking structure (not including surface parking)
Please list any additional materials that are included at the applicant's discretion (in optional 'expanded scope').	
How were the material quantities obtained?	☐ From itemized cost estimates showing material quantities ☐ From BIM / 3D models ☐ From designers (architect, structural engineer, envelope designer) ☐ Manual take-offs from drawings
Note where proxies or generic EPDs were used instead of facility-specific EPDs from actual product manufacturers.	
Optional: provide any alternative intensity values here, for example residential projects might want to report kg CO_2e/unit or /bedroom. Offices may use kg CO_2e/desk. Etc.	

2. CARBON EMISSIONS FOR EACH LIFE-CYCLE STAGE

Provide the following breakdown by life-cycle stage. If the software used does not provide values for every stage, leave the missing ones blank. If results are grouped (ie: A1-A3), merge those cells.

Life-cycle Stage				Embodied carbon from simplified scope		OPTIONAL: Embodied carbon from expanded scope	
				Absolute (kg CO_2e)	Intensity (kg CO_2e/m^2)	Absolute (kg CO_2e)	Intensity (kg CO_2e/m^2)
Upfront	Product	A1	Raw Material Supply				
		A2	Transport (to factory)				
		A3	Manufacturing				
	Construction	A4	Transport (to site)				
		A5	Construction & Installation				
		Upfront Carbon					

Only the value in the red box needs to be below the relevant embodied carbon cap shown in Table 1.

Biogenic Carbon (stored in bio-based materials): *This value should not be subtracted from the embodied carbon values reported in other rows.*							

Optional other phases to be reported if desired, below:

Life-cycle Stage			Embodied carbon from simplified scope only		OPTIONAL: Embodied carbon including expanded scope	
			Absolute (kg CO_2e)	Intensity (kg CO_2e/m^2)	Absolute (kg CO_2e)	Intensity (kg CO_2e/m^2)
Use	B1	Use				
	B2	Maintenance				
	B3	Repair				
	B4	Replacement				
	B5	Refurbishment				
	Use Embodied Carbon					
End of Life	C1	Demolition				
	C2	Transport (to disposal)				
	C3	Waste Processing				
	C4	Disposal				
	End of Life Carbon					
Cradle to grave embodied carbon *(sum of above three main sections)*						
Beyond the Life-cycle	D	Reuse				
	D	Recycling				
	D	Energy Recovery				
	Beyond Carbon					
Biogenic Carbon						

3. CONTRIBUTION ANALYSIS

Please provide a contribution analysis, broken out to the best of your ability by either material type or building assembly type. The list must include the top 5 contributing items at a minimum (concrete can only count as one, although multiple mix types can be listed separately).

Material or Building Assembly *(add additional rows if desired)*	Absolute Embodied Carbon (kg CO_2e)	Embodied Carbon Intensity (kg CO_2e/m^2)
1.		
2.		
3.		
2.		
3.		

4. REDUCTION MEASURES CONSIDERED

Please provide a list of embodied carbon reduction measures considered, as well as the associated embodied carbon reduction potential of each if known.

Description of Embodied Carbon Reduction Measure	Absolute Reduction Potential (kg CO_2e)	Intensity Reduction Potential (kg CO_2e/m^2)
1.		
2.		
3.		
4.		
5.		

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Breakout Session

So What?

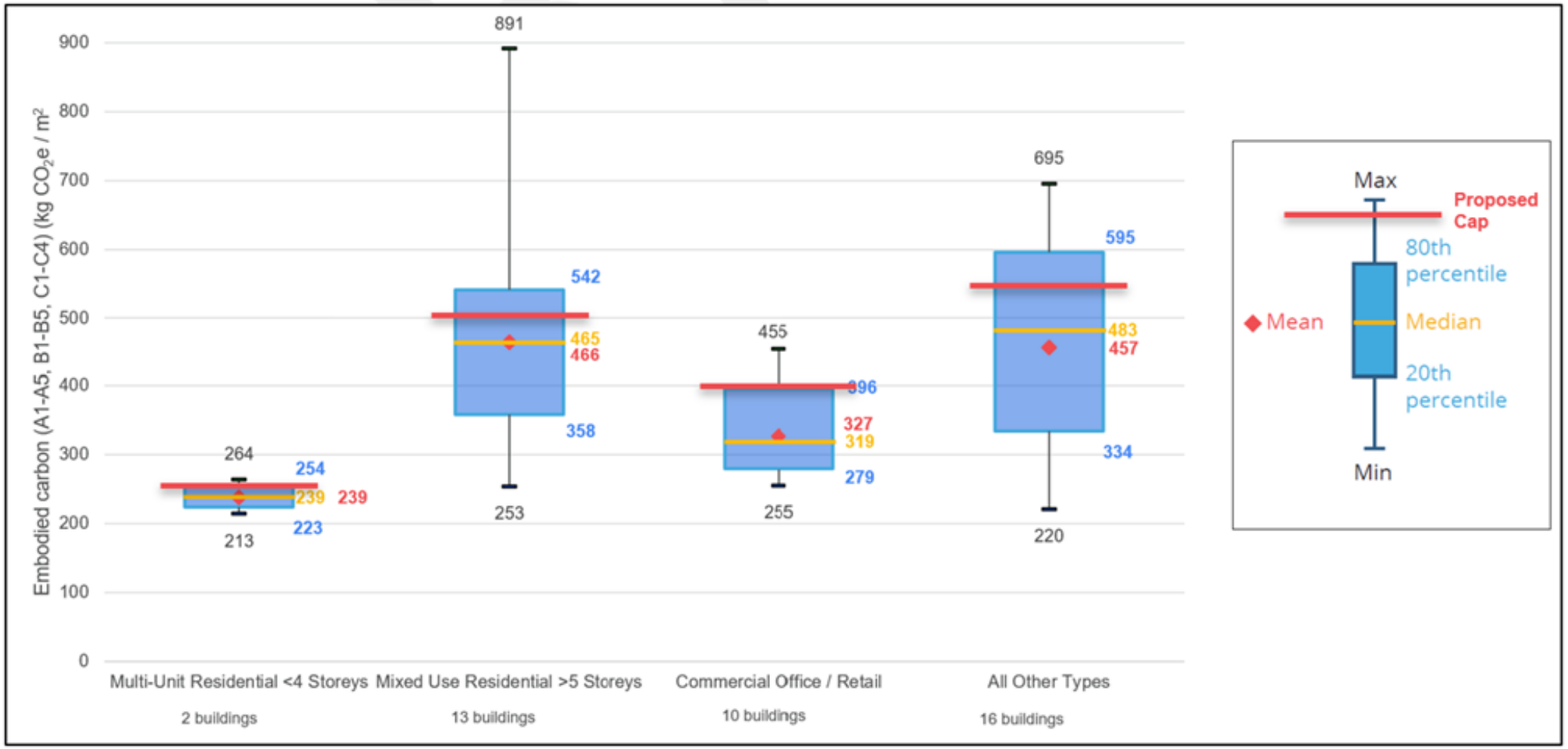
What Now?

1. Any additional comments on the primer contents presented?
2. How can municipalities apply the findings from the study?
3. What supports/strategies are needed to effectively implement embodied carbon reductions?

Discussion

Please share your feedback and experiences

Thank You!


Embodied carbon (A1-A5, B1-B5, C1-C4) (kg CO_2e / m^2)
900
800
700
600
500
400
300
200
100
0
264
254
239
239
223
213
891
542
465
466
358
253
455
396
327
319
279
255
695
595
483
457
334
220
Multi-Unit Residential <4 Storeys
2 buildings
Mixed Use Residential >5 Storeys
13 buildings
Commercial Office / Retail
10 buildings
All Other Types
16 buildings
Max
Proposed Cap
80th percentile
Mean
Median
20th percentile
Min