

# Zero Net Carbon Building Zoning

*Embodied Carbon TAG #2  
Presentation - Discussion*

# Zoom Meeting Guidance

**The BPDA will record this meeting** and post it on BPDA's Zero Net Carbon Building Zoning webpage. The recording will include the presentations, discussions and a transcript of Q&A / Chat comments.

It is possible that participants may be recording this meeting as well.

**If you prefer not to be recorded during the meeting, please turn off your microphone and camera.**


# Zoom Meeting Guidance

- Help us ensure that this conversation is a pleasant experience for all.
  - Please mute your mics during the presentation to avoid background noise.
  - It's great to see you! Participant video can be on during the meeting.
  - **Use the Chat** feature for questions and comments during the presentation.
  - Use the Raise Hand feature during the discussion segment.
  - Please be respectful of each other's time.
- As always please feel free to reach out to me directly!  
John Dalzell, AIA, LEED Fellow at [John.Dalzell@Boston.gov](mailto:John.Dalzell@Boston.gov)

# COVID-19 Resources

Stay up-to-date with COVID-19 related announcements, City of Boston reopening plans, and resources for you and your community at:

[boston.gov/coronavirus](https://boston.gov/coronavirus)



The screenshot shows the City of Boston website page for COVID-19 resources. The header includes the City of Boston logo, Mayor Martin J. Walsh's name, and navigation links for 'PAY AND APPLY' and 'PUBLIC NOTICES'. The main heading is 'CORONAVIRUS DISEASE (COVID-19) IN BOSTON'. Below the heading, there is a paragraph of text: 'The state has updated guidance on the Reopening Massachusetts website. We also continue to update City-specific guidance for Boston on our reopening website.' The date 'July 12, 2020' is displayed. A 'PUBLISHED BY: PUBLIC HEALTH COMMISSION' logo is visible. A 'MULTILINGUAL CONTENT' section lists various languages: العربية (Arabic), Kriolu (Cabo Verdean creole), 中文 (Chinese), Français (French), Kreyòl ayisyen (Haitian Creole), Português (Portuguese), and Русский (Russian). At the bottom, there are links for 'TOPICS', 'COVID-19 UPDATES', and 'LATEST PRESS CONFERENCE'. The date 'BOSTON (AS OF FRIDAY, JULY 10)' is shown, followed by the statistics '13,673 CASES | 9,683 RECOVERED'.

# AGENDA

## OPPORTUNITIES FOR POLICY AND AWARENESS

1. Welcome and Introductions (5 min)
2. TAG Meeting #1 Summary - Michelle Lambert (10 min)
3. Policy and Awareness Overviews:
  - Policy - Meghan Lewis, CLF (15 min)
  - Awareness - John Dalzell / (5 min)
4. Facilitated Breakout Discussion (3 pre-assigned rooms)
  - Policy (20 min)
  - Awareness (20 min)
5. Breakout Room Takeaways (10 minutes)
6. Updates and Next Steps - Julie Janiski / John Dalzell (5 min)

# WELCOME & BRIEF INTRODUCTIONS

## WORKING GROUP

Michelle Lambert, CPHC®, LEED BD+C  
Lambert Sustainability / Carbon Leadership Forum

Rachelle Ain, AIA CPHC®, WELL AP, Utile Design  
Carbon Leadership Forum

Julie Janiski, Buro Happold  
Carbon Leadership Forum

Andrea Love, Payette

Olivia Humphrey, Jacobs

Lori Ferriss, Goody Clancy

Jennifer Efron, BSA

Meredith Elbaum, BE+

## CITY STAFF

John Dalzell, AIA, LEED Fellow  
Sr. Architect Sustainable Development, BPDA

Richard McGuinness  
Deputy Director, BPDA

Chris Busch, AICP  
Assist Deputy Director, BPDA

Kathleen Pedersen  
Sr. Land Use Planner / Sustainability Specialist, BPDA

Alison Brizius  
Director of Climate & Environmental Planning, Boston

Kat Eshel  
Carbon Neutrality Program Manager, Boston

# WELCOME & BRIEF INTRODUCTIONS

## TAG MEMBERS

Alison Nash, DiMella Shaffer

Andrea Love, Payette

Anthony Pak, Priopta

Aurora Jensen, Buro Happold

Brad Mahoney, MP Boston

Brenda Pike,

Caroline Shannon, Howeler + Yoon Architecture

Chen Qin, HED (Harley Ellis Devereaux)

Christopher Stanley, Trinity Financial

Ciarán Smyth, BALA Engineers

Courtney Koslow, Beacon Communities

Dan Whittet, AHA consulting Engineers

Daniel Bailey, Takeda Pharmaceuticals

Dennis Carlberg, Boston University

Erin McDade, Architecture 2030

Gunnar Hubbard, Thornton Tomasetti

Ivan Lee, Morrison Hershfield

James Rogers, Turner Construction

Jim Newman, Linnean Solutions, LLC

Kayla Natividad, NSG Pilkington North America

Kevin Maguire, Oxbow Urban LLC

Lori Ferriss, Goody Clancy

Maura Zlody,

Meghan Lewis, Carbon Leadership Forum, University of Washington

Michael Orbank, Commodore Builders

Michael Gryniuk, LeMessurier

Michelle Apigian, ICON Architecture

Nicole Knobloch, Olifant, LLC

Patrick Kenny, Thornton Tomasetti

Paul Richardson, Buro Happold

Peter Sun, BPDA

Steven Burke, Consigli Construction Company, Inc.

Tamar Warburg, Sasaki Associates, Inc.

Tom Chase, New Ecology, Inc.

Turan Karakus, BR+A Consulting Engineers

# **TAG Meeting #1 on May 12 - Summary**

**42 attendees! Thank you!**

**Discussions around-**

- 1. Practice, Structure, Materials, Tools**
- 2. Policy- Precedents and Boston-specific ideas**
- 3. Awareness, Education & Stakeholder Outreach**



# TAG Meeting #1 on May 12 - Summary

## Today's Focus-

1. Practice, Structure, Materials, Tools
2. Policy- Precedents and Boston-specific ideas
3. Awareness, Education & Stakeholder Outreach

# TAG Meeting #1 Discussions

## Policy- Precedents and Boston-specific ideas

- **Incentive Ideas (the carrots)**

- Permitting process speed
- Density bonuses
- MassSave or MassCEC financial incentives
  - Similar to Passive House incentives
- Design challenge (ie: Triple Decker) grants to spark innovation
- Tax credits

# TAG Meeting #1 Discussions

## Policy- Precedents and Boston-specific ideas

- **Requirements & Mandates ideas (the sticks)**
  1. **Disclosure and reporting requirements**
    - 1st step allows for learning curve (on teams and City)
    - Increases embodied carbon literacy
    - Pushes products for EPDs/transparency
    - Pushes CLT market/production

# TAG Meeting #1 Discussions

## Policy- Precedents and Boston-specific ideas

- **Requirements & Mandates ideas (the sticks)**
  2. **Building level carbon budget** (per sf, use type)
    - Need baseline assumptions and reduction targets
    - Tool and materials agnostic (allows for flexibility)
    - Require offsets if needed
    - Or fees for noncompliance (ie: BERDO)

# TAG Meeting #1 Discussions

## Policy- Precedents and Boston-specific ideas

- **Requirements & Mandates ideas (the sticks)**

### **3. Building and Materials Reuse**

- Deconstruction and reuse requirements
- EC study (and offsets?) required for demolition
- Push CW recycling/reuse market
- Revisit old assumptions for tear-downs with climate lens

# TAG Meeting #1 on May 12 - Summary

## Awareness, Education & Stakeholder Outreach

### More Topics to Incorporate-

- Community and worker health impacts (new materials)
- Affordable housing, housing shortage (don't create barriers)
- Smaller projects (cost barriers to doing LCA, less access to tools, resources and consultants)
  - Stick-built multifamily (important type to study)
- Panelization/Modular construction for more control of materials
- Engage stakeholders (Unions for CLT construction, manufacturers for EPDs)

# Policy Examples

*Meghan Lewis*

*Senior Researcher, Carbon Leadership Forum at  
University of Washington*

[meghancl@uw.edu](mailto:meghancl@uw.edu)



# From Strategies to Policy Opportunities

Adaptive reuse

Cement reduction

Use of carbon-storing materials

Material salvage & reuse

Low(er) carbon material selection

Structural optimization  
(lightweighting)

Material efficiency



Examples of embodied carbon reduction strategies

**Strategies**

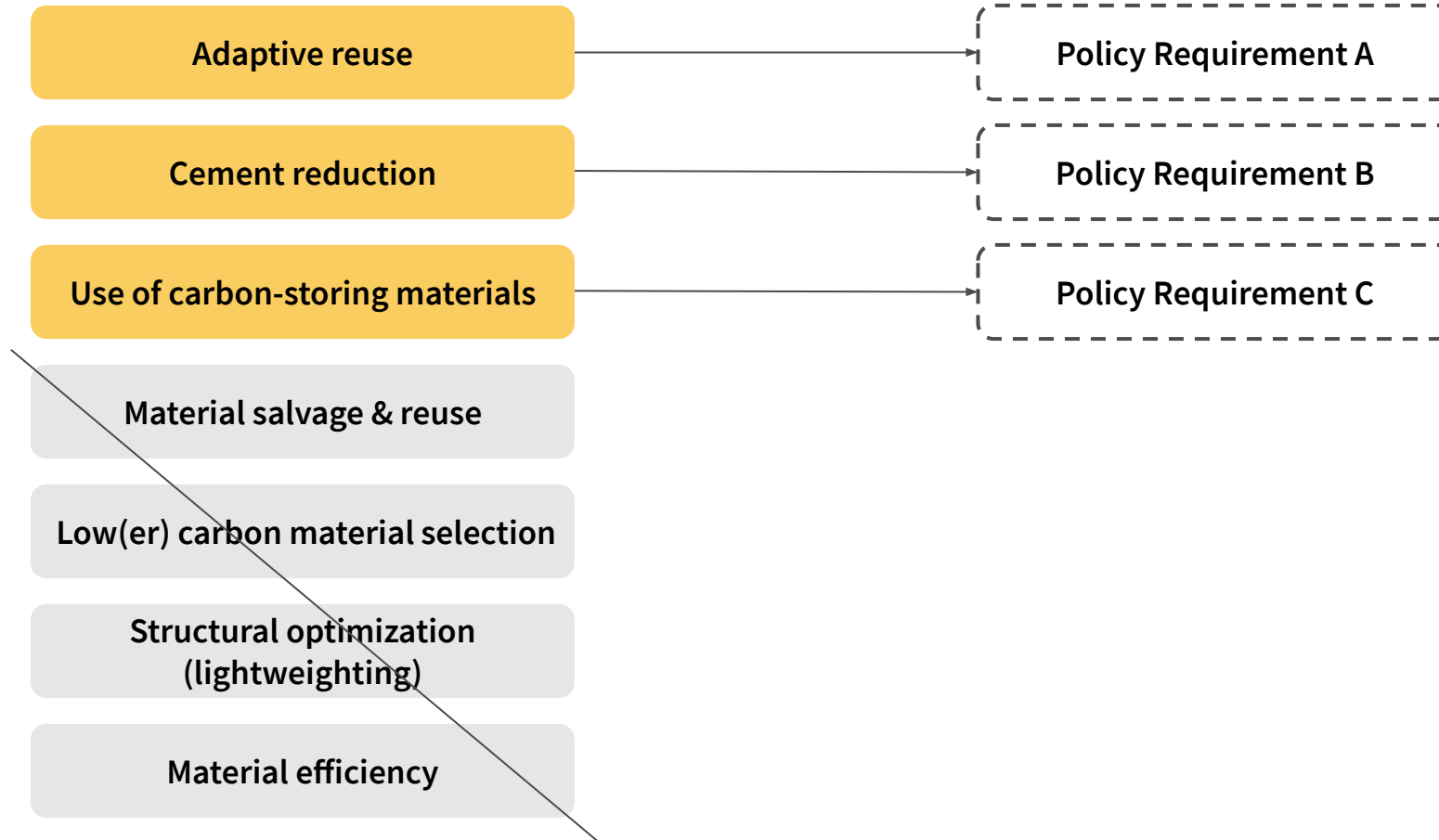


**Policies**

*Identifying strategies is only a part of the puzzle!  
Whether there is an appropriate policy lever to require or incentivize strategies is equally important to impact.*



# From Strategies to Policy Opportunities - Option 1



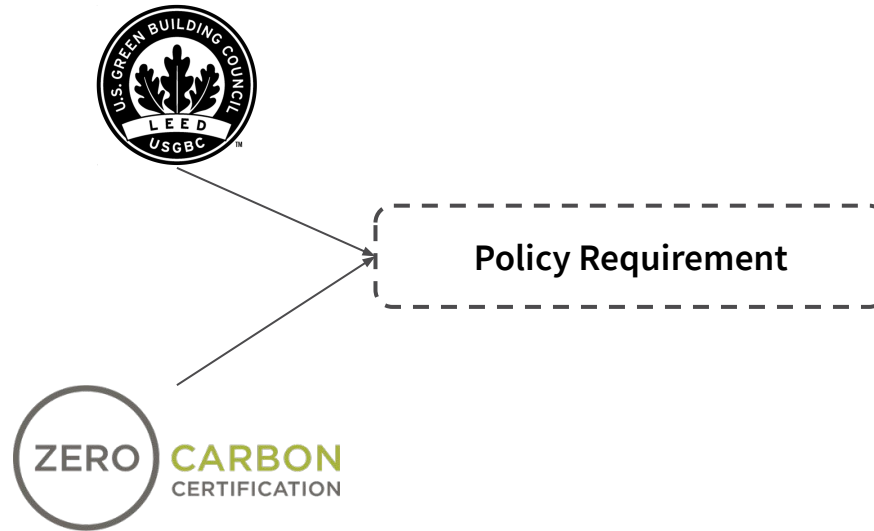
## OPTION 1 (Prescriptive)

*Prescribe specific set of strategies*

1. Identify strategies to reduce embodied carbon
2. Prioritize top strategies
3. Assess available policy levers to require implementation of strategy
4. Develop prescriptive requirements and compliance mechanisms

# From Strategies to Policy Opportunities - Option 2

- Adaptive reuse
- Cement reduction
- Use of carbon-storing materials
- Material salvage & reuse
- Low(er) carbon material selection
- Structural optimization (lightweighting)
- Material efficiency
- Prefabricated/modular construction requirements



## OPTION 2

### *Adopt other green building certification requirements*

1. Identify green building certifications that include embodied carbon
2. Incentivize or require adoption of the green building program

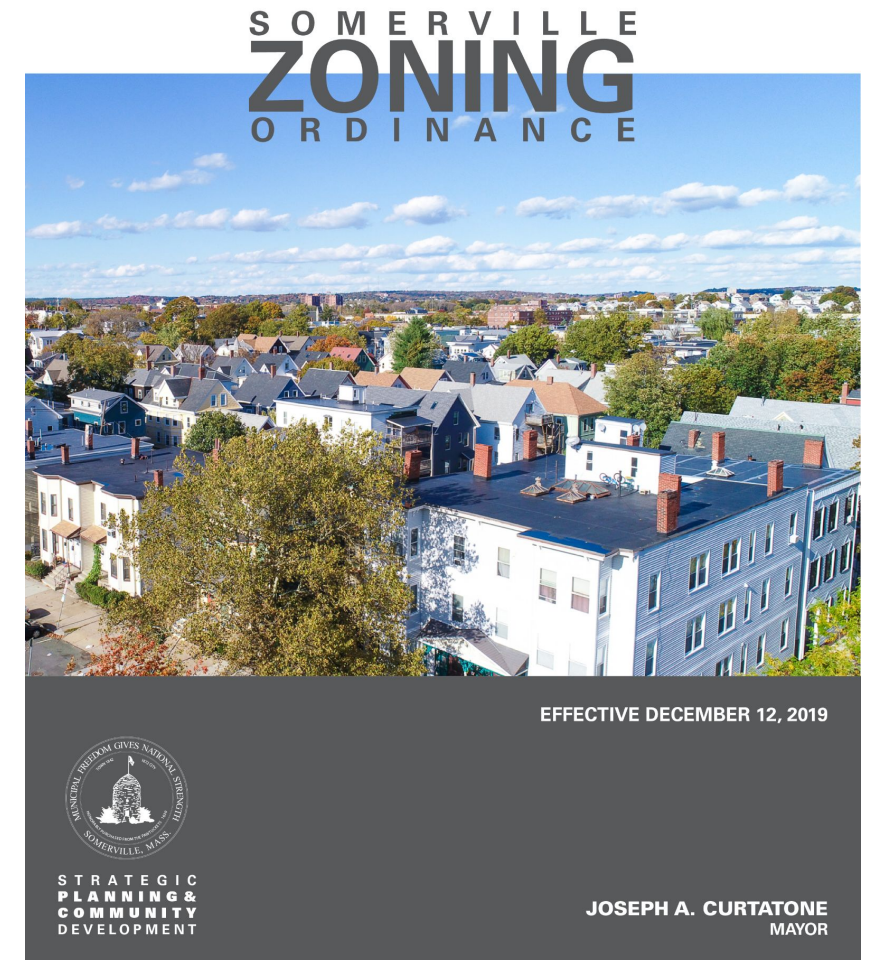
# Case Study **City of Somerville** Zoning Ordinance

Passed in December 2019, updated 2021 with additional pathways to achieve ‘net zero ready building’ status (confirm?)

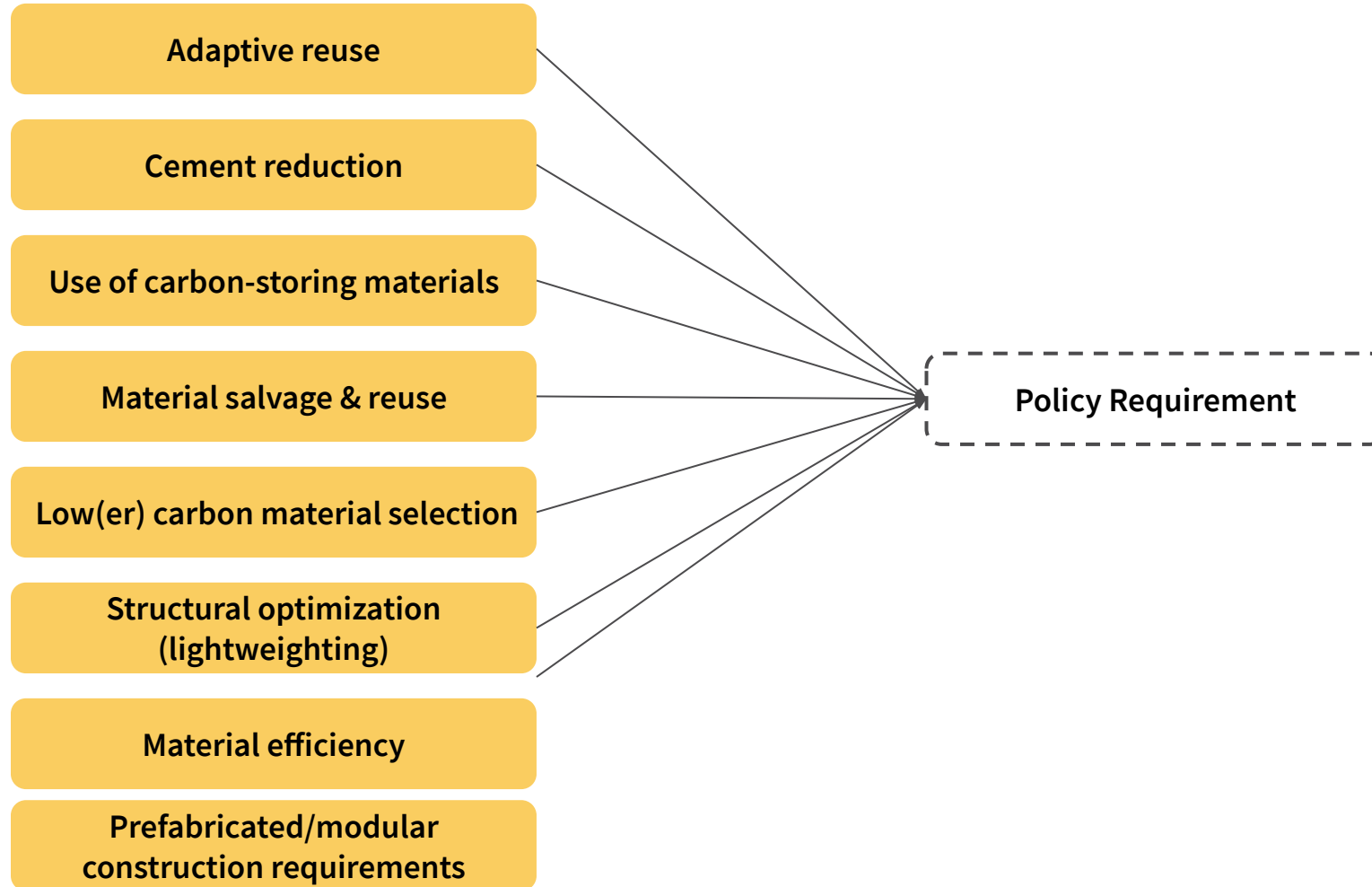
Built off of success with affordable housing density bonuses

Includes:

- Requirements for buildings >25,000 sf to be LEED Gold certifiable and for buildings >50,000 sf to be LEED Platinum certifiable.
- Developers will be allowed to increase the unit count of their buildings if they meet Net Zero Ready requirements, which include a high performing building envelope and no fossil fuel combustion for heating or cooking.
- The **Living Building Zero Carbon certification** (and Passive House certification) are included as pathways to achieving “Net Zero Ready building” status to qualify for density bonuses.



## From Strategies to Policy Opportunities - Option 3



### OPTION 3 (Performance-based)

*Allows for any strategy that can demonstrate its benefit/carbon reduction*

1. Identify calculation requirements for demonstrating carbon reduction
2. (Can be phased in): Set performance target/limit

# Performance-Based Policies for Embodied Carbon

## Building Approach

- Uses Whole Building LCA tools or **early-design estimators** to measure performance

- Incentivizes Designers to collaborate to design a lower carbon building
- Captures strategies like:
  - Building/material reuse
  - Use of bio-based materials
  - Efficient structural design

## Material Approach

- Use Environmental Product Declarations to measure performance

- Incentivizes Manufacturers to invest in clean manufacturing and Contractors to procure low carbon materials
- Captures strategies like:
  - Concrete mix designs
  - Plant efficiency/fuel source

➔ *Most relevant for zoning policies due to when required along project timelines* ➔

# Case Study City of Vancouver Green Buildings Policy for Rezoning



## Disclosure (2017 -)

“All projects shall **report the life-cycle equivalent carbon dioxide emissions** (ie: global warming potential impact, or ‘embodied carbon’) **of each building, in kgCO<sub>2</sub>e/m<sup>2</sup>**, as calculated by a whole-building life-cycle assessment (LCA).”

*In addition to reporting the embodied emissions intensity in kgCO<sub>2</sub>e/m<sup>2</sup>, projects must also report the total lifecycle embodied emissions in kgCO<sub>2</sub>e, and the equivalent annual embodied emissions intensity in kgCO<sub>2</sub>e/m<sup>2</sup>/year.*

Link to [Guidelines](#)



## Targets (2021/22 -)

- Establish standardized baselines to measure reductions for developments and the city
- Require rezoning reduction targets through updates to the “Green Buildings Policy for Rezonings”
- **Learnings from rezoning will be used to update the building code by ~5 year delays** to give the broader industry the time needed to ramp up and become comfortable with these new requirements.



## Inform new policies (2023 -)

- **2021/22:** The first reduction target(s) is introduced in the rezoning plan.
- **2023:** *Possible first embodied carbon requirements are added to the Building By-law.*
- **2025/26:** *The rezoning policy targets are updated & 2021/22 rezoning targets are possibly adopted into the code.*
- **2030:** *2025/26 rezoning targets are adopted into the code & higher targets are set for the rezoning policy to move towards net-zero emissions.*

# City of Vancouver 6.2 Requirements for Calculating Embodied Emissions

There are design team LCA software tools currently available that can greatly streamline the workflow of LCA and that meet the technical requirements below, such as the free Canadian-based Athena Impact Estimator. For consistency in LCA calculations, projects shall use the following standard requirements:

- 1) The LCA must include all envelope and structural elements (including parking structure), including footings and foundations, and complete structural wall assemblies (from cladding to interior finishes, including basement), structural floors and ceilings (not including finishes), roof assemblies, and stairs construction, but exclude excavation and other site development, partitions, building services (electrical, mechanical, fire detection, alarm systems, elevators, etc.), and parking lots; → **Minimum building scope requirement**
- 2) The LCA must assume a building lifetime of 60 years; → **Building service life assumptions**
- 3) The life-cycle boundary must account for cradle-to-grave impacts, including resource extraction, product manufacturing and transportation, building construction, product maintenance and replacement, and building demolition/deconstruction/disposal (EN 15804/15978 modules A1-A5, B2-B4, and C1-C4). Operating energy and water consumption are excluded. → **Life cycle scope requirement**
- 4) The Life-Cycle Inventory (LCI) database used must be ISO 14040, 14044, and 21930 compliant, and regionally-specific, if possible; → **LCI Database requirements**
- 5) The Life-Cycle Impact Assessment (LCIA) method used must be the US EPA's Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI); → **TRACI Impact assessment method requirement**
- 6) If the service life of a product used in initial construction is greater than the building's assumed service life, the impacts associated with the product may not be discounted to reflect its remaining service life.

In addition to reporting the embodied carbon as detailed above, projects shall separately report, where readily available, the impacts and benefits beyond the system boundary (EN 15804/15978 module D). This is a quantification of environmental benefits or loads associated with reuse, recycling and energy recovery from flows exiting the system boundary. Note that these impacts are reported for information only, and are not counted towards the embodied carbon of the building. → **Separate reporting for module D (beyond the system boundary)**

# City of Vancouver 6.2 Requirements for Calculating Embodied Emissions

Projects are also encouraged, but not required, to report:

- |  |   |  |
|--|---|--|
| 1) The lifecycle impacts associated with other building elements that are excluded from the mandatory Embodied Carbon reporting.   | → | <b>OPTIONAL reporting:</b><br><i>Additional building scope</i>                 |
| 2) Other calculated life-cycle indicators and impacts, such as ozone layer depletion, acidification, eutrophication, photochemical ozone creation, primary renewable energy use, fresh water consumption, human toxicity, respiratory inorganics, eco-toxicity, and other impacts;   | → | <i>Additional life-cycle impacts (in addition to global warming potential)</i> |
| 3) A breakdown of impacts by activity (materials/products, transportation, on-site activities, wastage, etc), life-cycle stages (extraction, manufacturing, construction, use/maintenance, end of life), product category (structure, foundation, wall, glazing, etc.), and material type (steel, wood, concrete, plastic, etc). | → | <i>Additional analysis/breakdown for reporting beyond per square foot</i>      |

For projects pursuing LEED v4, calculations created to demonstrate achievement of the Life-cycle Impact Reduction credit, Option 4, and reporting of the proposed building results, are acceptable to meet the intent of this requirement.



# Example language/phrasing

## Disclosure

From January 1, 2022:

All projects shall **report the life-cycle equivalent carbon dioxide emissions** (ie: global warming potential impact, or ‘embodied carbon’) **of each building, in kgCO<sub>2</sub>e/m<sup>2</sup>**, as calculated by a whole-building life-cycle assessment [that meets the City of Boston WBLCA requirements in Appendix X].

**(+ Calculation Guidelines)**

**\*Can include examples of strategies to use to reduce embodied carbon, but don’t have to prescribe which**

WBLCA results disclosed for zoning policies are used (in addition to other relevant research and resources) to **establish Boston building baselines for zoning types**

## Targets

From January 1, 2024/5:

All projects must **reduce their embodied carbon intensity (i.e. kgCO<sub>2</sub>e/m<sup>2</sup>) by X%** as demonstrated by a whole-building LCA [that meets the City of Boston LCA requirements in Appendix X].

**OR**

All projects must **be below the global warming potential limit of X kgCO<sub>2</sub>e/m<sup>2</sup>**, as demonstrated by a whole-building LCA [that meets the City of Boston LCA requirements in Appendix X].

**Targets updated at regular intervals, ideally aligning with City Climate Action Plan targets**

# Additional Case Studies CNCA Framework

## ZONING AND LAND USE POLICIES

POLICY CODE	POLICY NAME	CARBON IMPACT	COST-EFFICIENCY	IMPLEMENTABILITY	ENFORCEABILITY	SUM OF SCORES	EXAMPLES PROVIDED	
Z1	EMBODIED CARBON TARGETS FOR ZONING PROCESS	●●●●●	●●●●○	●●●○○	●●●●○	16	-	<b>Embodied carbon specific</b>
Z2	SET ZONING REQUIREMENTS FOR BIO-BASED MATERIALS	●●●●○	●●●○○	●●●●○	●●●●○	15	Helsinki	
Z3	CARBON-SCORED LAND SALES COMPETITIONS	●●●●○	●●●○○	●●●○○	●●●●○	14	Porvoo, Tampere	
Z4	PARKING REQUIREMENT OPTIMIZATION	●●●○○	●●●●●	●●●●○	●●●●●	17	London, Portland, Helsinki	<b>Prescriptive strategies with large co-benefits</b>
Z5	APARTMENT SIZE AND SPACE EFFICIENCY GUIDELINES	●●●○○	●●●●●	●●●●○	●●●●●	17	NYC	
Z6	PREFABRICATED OR MODULAR CONSTRUCTION PRIORITY	●●●○○	●●●●○	●●●○○	●●●●○	14	-	
Z7	INCREASING DENSITY USING EXISTING INFRASTRUCTURE	●●○○○	●●●●○	●●●●○	●●●●○	14	-	
Z8	USE LOW CARBON BUILDING TYPOLOGIES IN ZONING	●●○○○	●●●○○	●●●●○	●●●●●	14	-	

Source: [CNCA Framework](#)



# Broader Embodied Carbon Policy Landscape



# State / Federal Procurement Policy Landscape

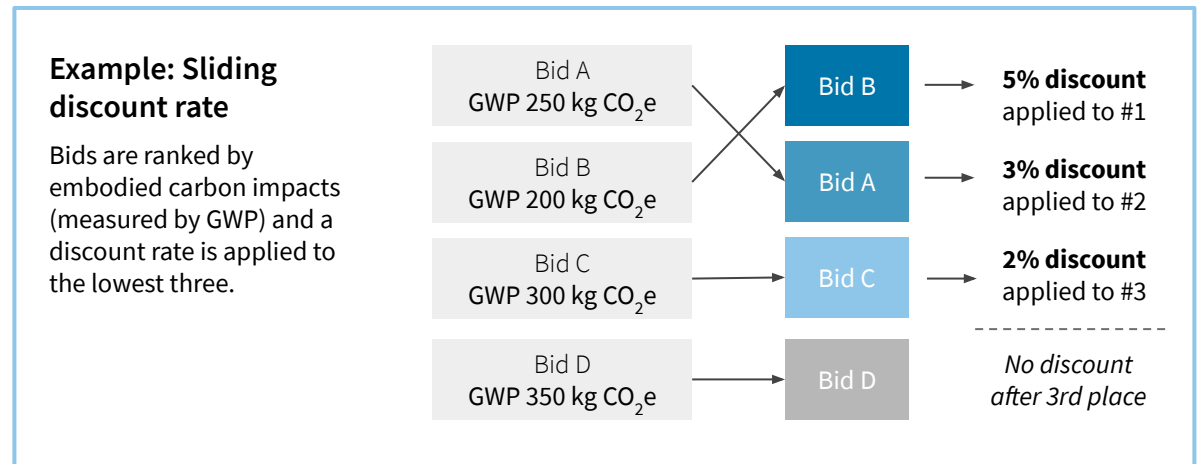
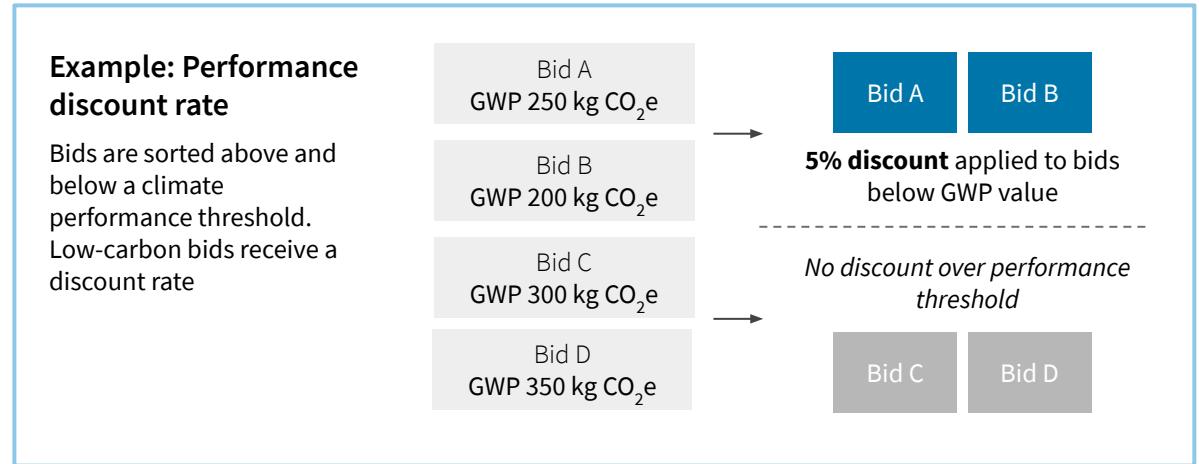
	Active since 2017		State bills introduced in 2021						Federal 2021	
	<a href="#">Buy Clean CA</a>	<a href="#">Minnesota B3</a>	<a href="#">BCBF WA</a>	<a href="#">NY LECCLA</a>	<a href="#">NJ AB 5223</a>	<a href="#">CA AB 1365</a>	<a href="#">CO 1303</a>	<a href="#">OR Pilot</a>	<a href="#">CA AB 1369</a>	<a href="#">CLEAN Future</a>
<b>Materials</b>	Steel, glass, mineral wool	5+ Products	Concrete, steel, wood	Concrete	Concrete	+ Concrete	Asphalt, cement, concrete, glass, steel, wood	Concrete, Asphalt, Steel	+ Gypsum board, insulation, carpet ceiling tiles, and future expansion	(Initial list:) Aluminum, iron, steel, concrete, cement
<b>Includes Buildings</b>	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓
<b>Includes DOT Projects</b>	✓	✗	✗	✓	✓	✓	✓	✓	✓	✓
<b>Requires Disclosure</b>	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
<b>Will set GWP Limits</b>	✓	✗	✗	?	✗	✓	✓	✓	✓	✓
<b>Provides Incentives</b>	✗	✗	✗	✓	✓	✓	✗	✗	✗	✓

# Case Study New York LECCLA (SB542)



Three incentive types in SB542:

- 1. Low embodied carbon concrete discount rate** set by commissioner, applied to 1+ bids based on the GWP from analysis (includes “concrete delivery miles”)
- 2. LECC breakthrough discount rate** also set by commissioner, applied to 1+ bids based on use of breakthrough technologies (CCUS, etc) to be defined by NYSERDA
- 3. EPD Tax Credit:** Manufacturers can receive up to \$3k in support for EPD analysis (*would be valid until 2023*)



# Case Study **Portland Low Carbon Concrete Program**

## Phase 1: Environmental Product Declaration (EPD) Requirements (2020)

- Portland Cement Concrete (including: Commercial Grade Concrete, Plain Concrete Pavement, and High-Performance Concrete/Structural Concrete) for City construction projects
- Product-specific Type III EPD provided for all pre-approved concrete mix designs and concrete mixes for projects over 50 yd<sup>3</sup>

## Phase 2: Data Collection, including Lower Carbon Concrete Pilot Projects (2020)

- Collecting baseline data on concrete mixes in Portland Metro Area (from a variety of sources, including EPDs, historical project usage, and pilot projects)
- Pilot tests of different lower-carbon concrete mixes, such as the [sidewalk pilot](#) with the Portland Bureau of Transportation (PBOT)

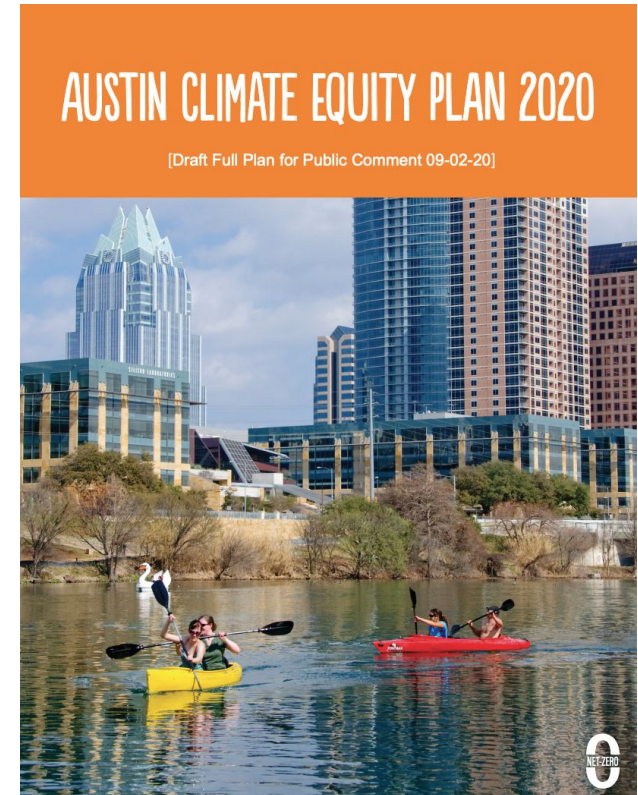
## Phase 3: Establishing Global-Warming Potential (GWP) Thresholds

- City intends to publish maximum global-warming potential (GWP) thresholds for concrete on City construction projects (by type of concrete and strength class)
- Publishing by April/May 2021 with the goal of implementation in 2022 after stakeholder engagement

# Case Study Austin Climate Equity Plan 2020 [Public Comment Draft]

**Goal 3: By 2030, reduce the embodied carbon footprint of building materials used in local construction by 40% from a 2020 baseline.\* \*Target cannot exceed 500 kg CO<sub>2</sub>e/m<sup>2</sup> (~100 lbs CO<sub>2</sub>e/sf).**

- **Strategy 1 Lead by example through design and construction standards:** In partnership with other cities and states, develop **City of Austin design and construction specifications and purchasing agreements** to result in healthy, low-carbon buildings.
  - As an example, encourage lower-carbon building materials, whole-building life cycle analysis, healthy building certifications and building reuse and deconstruction in City funded projects. Purchasing policies should be structured to promote building product transparency and preferred outcomes.
  - Ensure healthy building strategies and certifications are prioritized in community centers, libraries and other community facilities serving low-income communities and communities of color first.
  - Employ circular design strategies to ensure building and building material longevity, such as designing for a building's deconstruction and potential future uses.
- **Strategy 2 Incentivize lower-carbon materials:** Enhance and integrate lower-carbon building materials and deconstruction practices into City incentive programs, like the **expedited permitting process and Austin Energy's Green Building program**, to transition voluntary design guidance into planning and development agreements over time.
  - Develop an embodied carbon baseline to effectively measure success.
  - Consider feasibility and cost to determine the most effective pathways to stimulate voluntary action.
  - Invest in culturally relevant marketing to highlight success cases and drive participation.
- **Strategy 3 Educate stakeholders on materials best practices:** Create a performance framework and **educational programming** for industry professionals and the general public, with a focus on low-income communities and communities of color, to reduce the lifecycle and negative health impacts of building materials and construction practices.
  - Provide resources that address and help mitigate the health impact of materials from the point of extraction to operation, including availability of environmental and health product declarations.
- **Strategy 4 Stimulate decarbonization with local producers:** **Prioritize partnerships within local materials markets to decarbonize high-impact materials, specifically: glass, steel, aluminum, concrete, drywall, insulation and carpet.**
  - Leverage and align with existing local and national efforts to create equitable outcomes in materials decarbonization and look for opportunities for coworking and collaboration among businesses.
  - Encourage the growth of local businesses that can create building materials from current waste streams, including construction, manufacturing and municipal.





# Case Study King County 2020 Climate Action Plan

- **Strategy 4.2.2 Partner with King County cities on C&D recovery and reuse.** King County will work with and support city partners and partnering agencies to implement codes, policies, and incentives resulting in the **maximum recovery and reuse of structural and nonstructural components of existing structures.** King County’s goal is for at least eight cities to have taken one of these steps by 2025.
- **Strategy 5.2.2 Support the transition to a reusable wood market.** The County will dedicate resources to catalyze the movement of wood markets away from combustion and toward higher value uses that are more sustainable for both the environment and people of King County.
- **Strategies GHG 3.3.1/GHG 4.2.1/GHG 4.3.1 [related to Green Building Codes]** Proposed requirements may include ... construction and demolition (C&D material management), **materials with low embodied carbon** and toxicity...
- **Strategy GHG 4.14 Manage King County capital portfolios to maximize GHG emissions reductions in operational and embodied emissions.** They will use the following strategies...**Use the Embodied Carbon in Construction Calculator (EC3) tool to identify low embodied emissions materials** that meet construction specifications, and to inform decisions in materials selections in accordance with King County’s Sustainable Purchasing Guide.
- **Strategy GHG 5.8.1 Specifying low-embodied carbon building materials in King County capital projects.** The mining, manufacturing and transportation of building materials result in significant GHG emissions. To reduce these “embodied” emissions, King County will **develop requirements and specifications for the use of low emission alternatives for concrete, asphalt, wood, and steel** by County project managers and designers in bid solicitations.  
By 2022, the County shall create **standard specifications for concrete and begin requesting environmental product declarations (EPDs)** for this material in construction bids. By 2023, it will require the use of EPDs for concrete and, by 2024, require a maximum global warming potential (GWP) for concrete products, which it will enforce for all construction projects starting in 2025. The Embodied Carbon in Construction Calculator (EC3) tool will be used to help choose the lowest embodied carbon materials per project that meets the specification. Based on lessons learned, the County will expand these specifications to other high embodied emissions materials including asphalt, wood, and steel.



# Case Study Los Angeles

## Green New Deal Sustainable City pLAN 2019

### Industrial Emissions & Air Quality Monitoring

- Target: Reduce industrial emissions by 38% by 2035; and 82% by 2050

### Lead by Example

- Target: Ensure all new municipally owned buildings and major renovations will be all-electric, effective immediately
- 2021 Milestones: Implement GHG performance standards for material procurement for purchasing by City Departments
  - Update the City's Environmentally Preferred Products Purchasing Program to include additional construction materials and a GHG performance standard, such as the Buy Clean California Act
  - Further identify embedded carbon emissions in the City's supply chain through Departmental participation in the Carbon Disclosure Project supply chain reporting program

## C40 Clean Construction Declaration Commitment

3 commitments + 8 supporting actions. Commitments include:

- Reduce embodied emissions by at least 50% for all new buildings and major retrofits by 2030, striving for at least 30% by 2025
- Reduce embodied emissions by at least 50% of all infrastructure projects by 2030, striving for at least 30% by 2025
- Procure and, when possible, use only zero emission construction machinery from 2025 and require zero emission construction sites city-wide by 2030



DECLARATION COMMITMENT	INTENDED ACTION/APPROACH TO MEET COMMITMENT
Reduce embodied emissions by at least 50% for all new buildings and major retrofits by 2030, striving for at least 30% by 2025	<ul style="list-style-type: none"> <li>Select a set of City buildings and calculate the embodied carbon of their design, construction, and operation to pilot as a baseline, by Q4 2021.</li> <li>Collaborate with industry groups to deliver training on the EC3 tool so the industry gains familiarity with low-carbon products and design choices throughout 2021.</li> <li>Launch working groups in 2021 for architecture, engineering, contractors, developers, and tenants to develop a roadmap to 2030.</li> </ul>
Reduce embodied emissions by at least 50% of all infrastructure projects by 2030, striving for at least 30% by 2025	<ul style="list-style-type: none"> <li>Select a set of City infrastructure projects and calculate the embodied carbon of their design, construction, and operation to pilot as a baseline by Q4 2021.</li> <li>Send market signals for low carbon and/or carbon sequestering concrete throughout 2021.</li> <li>Pilot use of above products throughout 2021.</li> <li>Work with Contract Administration, Procurement, and relevant departments to standardize terms for all City infrastructure project contracts by 2022.</li> </ul>
Procure and, when possible, use only zero emission construction machinery from 2025 and require zero emission construction sites city-wide by 2030	<ul style="list-style-type: none"> <li>By Q1 2021, investigate potential to add procurement preference to City contracts for contractors who use zero emission equipment. Implement for Public Works contracts by 2022.</li> <li>Convene focus groups in 2021 for general contractors to discuss how to advance electric equipment use in the region in accordance with the 2025 and 2030 goals.</li> <li>By Q4 2021, develop with South Coast Air Quality Management District a trade-in program for gas equipment to electric equipment.</li> </ul>

6 Clean Construction Declaration

ADDITIONAL SUPPORTIVE ACTIONS	INTENDED ACTION/APPROACH TO MEET COMMITMENT
Prioritise the better use, repurposing, and retrofit of existing building stock and infrastructure across the city to ensure their optimal use before new construction projects are considered.	<ul style="list-style-type: none"> <li>LA adopted the Adaptive Reuse Ordinance (ARO) in 1999 which offers regulatory exemptions and project streamlining for developers reusing an old site for a new purpose. 72% of ARO projects are developed within 1/2 mile from Metro rail stations and so have reduced VMT. ARO buoyed development during the last recession and is expected to do so again during this recession.</li> <li>In 2021, revisit the ARO to see what enhancements might be helpful.</li> <li>Encourage adaptive reuse of existing buildings through developing incentives and fast track permitting for qualified projects by Q4 2021.</li> </ul>
Lead by example with municipal procurement by requiring life cycle assessments (LCAs) and the diversion of construction and demolition waste from disposal for all municipal projects. Use municipal purchasing power to procure or demand zero emission construction machinery in municipal projects. Reward resource efficient and circular design, use of low carbon materials and low to zero waste construction sites for all new projects and major retrofit.	<ul style="list-style-type: none"> <li>Since 2010, the City of LA has a policy requiring all mixed C&amp;D waste to be taken to City-certified C&amp;D waste processing facilities. Non-compliance penalties of \$5,000 per load are levied.</li> <li>Launch Zero by Design, a utility program to incentivize design teams to reduce operational and embodied carbon, by Q2 2021.</li> <li>By Q4 2021, investigate how to offer preference points for contractors who utilize zero emission construction equipment on City projects.</li> <li>Work with BOE to implement Buy Clean CA requirements for steel, flat glass, and mineral wool board insulation procurement throughout 2021.</li> <li>Work with BOE to pilot LCA review for City buildings by utilizing the LEED v4.1 pilot credit by Q4 2022.</li> </ul>
Demand transparency and accountability, starting with requiring LCAs in planning permissions and embedding them into planning policies, processes and building codes within a year of endorsing this declaration. Require the public disclosure of this data to facilitate greater transparency and foster accountability to develop robust baselines, standards, certifications and policies.	<ul style="list-style-type: none"> <li>Encourage LCA review and disclosure for projects through developing incentives and fast track permitting for qualified projects by Q4 2024.</li> </ul>

C40 7

# Case Study City of Vancouver Climate Emergency Action Plan

## Lower carbon construction

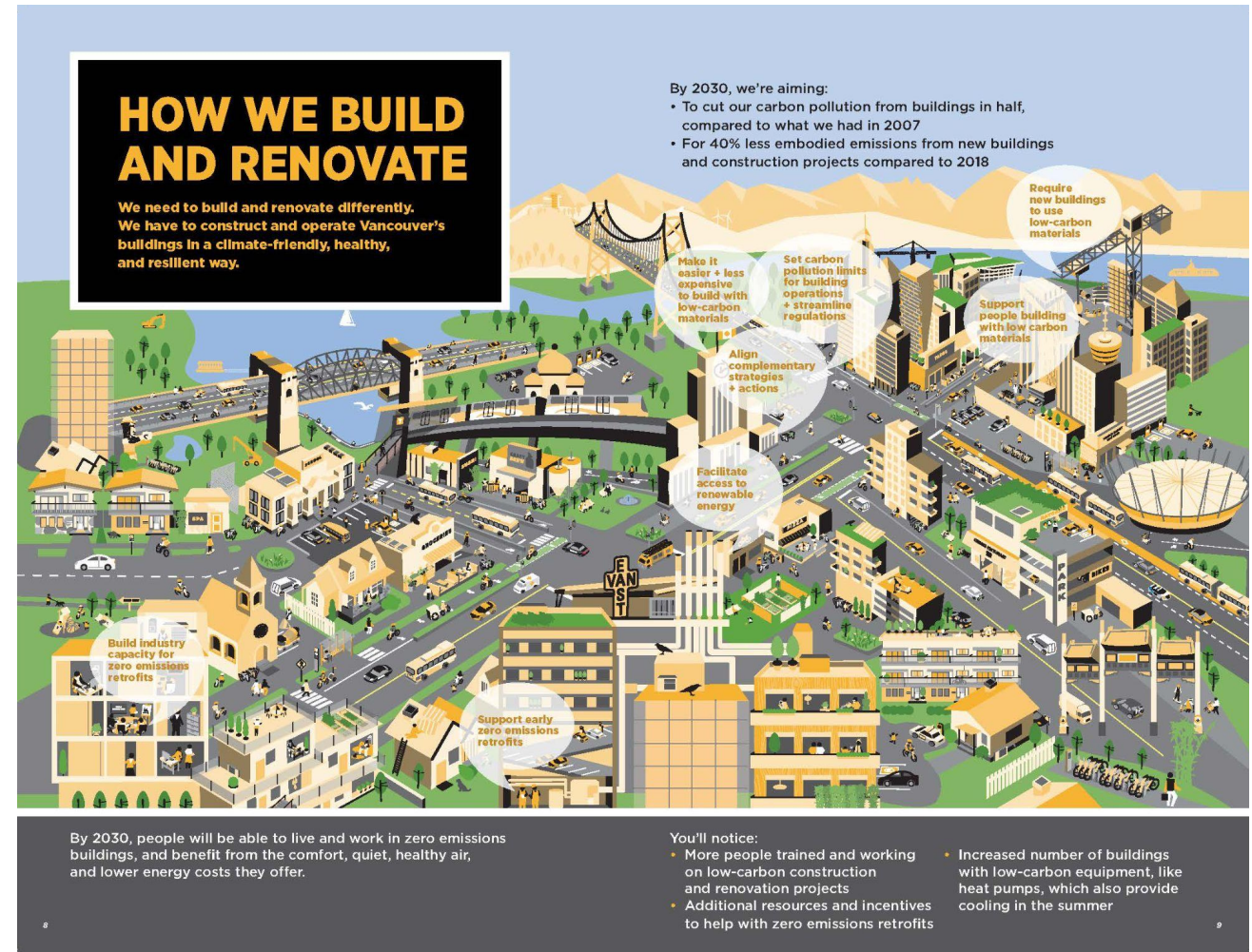
By 2030, we will ensure **40% less embodied emissions** from new buildings and construction projects compared to 2018. Vancouver's Embodied Carbon Strategy sets a vision for a healthy, equitable, circular, and carbon-positive construction economy.

We aim to take responsibility for carbon pollution created while extracting, manufacturing, assembling, replacing and disposing of building materials, such as concrete, metals, insulation. This means:

- Using materials more efficiently
- Reusing existing buildings and materials
- Building more from sustainably sourced wood and mass timber
- Using lower-carbon blends of concrete
- Powering construction sites with renewable energy instead of diesel fuel
- Using low-carbon insulation instead of spray foam, and
- Putting less parking in buildings

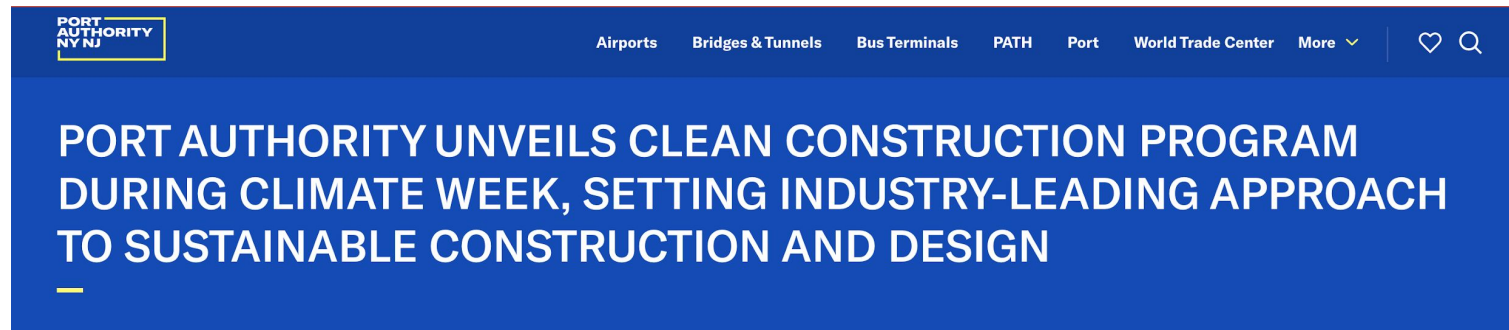
To ensure we meet our target, we'll:

- Set embodied carbon pollution limits for new buildings
- Make it easier and less expensive to use lower carbon materials in new buildings
- Support people using low-carbon materials in new buildings
- Align low carbon planning and strategies



# Case Study **Port Authority of New York and New Jersey**

Port Authority of New York and New Jersey launched their **Clean Construction Program** during Climate Week (September) 2020



Including:

- **Specification for low carbon concrete:** reduces the required cement content in certain concrete mixes by 25%, significantly reducing its carbon intensity and allowing for lower-carbon alternatives
- **Pilot projects to develop low carbon concrete and materials**
- **Requirement for Environmental Product Declaration:** enables systematic collection of environmental data directly from construction contractors to help inform more environmentally focused material selection

# Performance-Based Policies Certification and Commitment Examples



## % Reduction Target

LEED v4 awards points to teams that “conduct a life-cycle assessment of the project’s structure and enclosure that demonstrates a **minimum of 10% reduction, compared with a baseline building.**” ([Credit](#))

## Building GWP Limits

The [Zero Carbon Certification](#) requires that “The total embodied carbon emissions of the project must not exceed 500 kg-CO<sub>2</sub>e/m<sup>2</sup>.”

## Targets

The [2030 Challenge for Embodied Carbon](#) asks the global architecture and building community to commit to:

“[E]mbodied carbon emissions...shall immediately meet a maximum global warming potential (GWP) of **40% below the industry average today**, increasing to:

- 45% or better in 2025
- 65% or better in 2030
- Zero GWP by 2040.”

## Targets

Signatories to the [Clean Construction Declaration](#) from C40 Cities pledge to:

“Reduce embodied emissions by at least 50% for all new buildings and major retrofits by 2030, striving for at least 30% by 2025.”

# Cambridge Embodied Carbon Proposal

## 2.5 Embodied Carbon (New Action)

### Overview

Structural materials are responsible for over 10% of global carbon dioxide emissions, with particular impact in the short-term. The purpose of this action is to reduce GHG emissions of construction in Cambridge through the calculation and analysis of and potential standards for embodied carbon used in the construction and renovation of new and existing buildings.

### Contribution to Net Zero Objective

Net Zero projects should consider the impact of both embodied carbon and operational carbon. Including Embodied carbon neutrality in the NZAP is an important step in the pathway to achieve a net zero carbon future.

### Projected GHG Reductions

Additional investigation is needed to quantify the impact of embodied carbon on the Net Zero pathways

### Key Actions:

#### Short Term (1-2 Years)

- Require an embodied carbon narrative for all new construction projects and adaptive reuse study for existing buildings.
- Develop a policy that requires developers to prioritize the re-use of existing structures in their developments
- Create education materials and toolkit for implementation of embodied carbon calculations
- Perform a technical assessment on carbon impacts of using biogenic carbon materials.
- Participate in peer learning sessions with the City of Boston and others exploring this issue

#### Medium Term (3-5 Years)

- Require a whole building Life Cycle Analysis of the primary structural materials demonstrating a **20% reduction** of embodied carbon

#### Long Term (5+ Years)

- Require a Life Cycle Analysis of the primary structural materials demonstrating a **50% reduction** of embodied carbon
- Investigate the use of a Zero Carbon certification mandate for new construction projects.

### Equitable Design

Track implementation and provide publicly available updates to facilitate transparency and accountability.

### Ensuring Equity

When considering embodied carbon, also consider the cost implications, including how and that incremental costs are unfairly passed onto may be distributed across tenants and small business owners.

### Cross-cutting Issues

**Climate Change Preparedness / Resilience** n/a

**Electric Transport** - n/a

**Capacity / Local Carbon Fund** - Limited

# Newton Embodied Carbon Policy

## Sustainable Development Requirements, Adopted December 2019-

Applies to any proposed development in any zoning district that includes the construction or substantial reconstruction of one or more buildings totaling **20,000 sf or more** of gross floor area **that also requires issuance of a special permit** under any provision of this Zoning Ordinance.

- Requires LEED Silver for 20,000 sf, LEED Gold for 50,000 sf or Passive House or Enterprise Green Communities
- AND “The Petitioner’s design teams will utilize the best available information to **assess embodied carbon** in building materials and **incorporate that information** into the design process so that low embodied carbon materials can be incorporated when cost, availability and performance is feasible.”



**Thank You!**  
**Questions?**



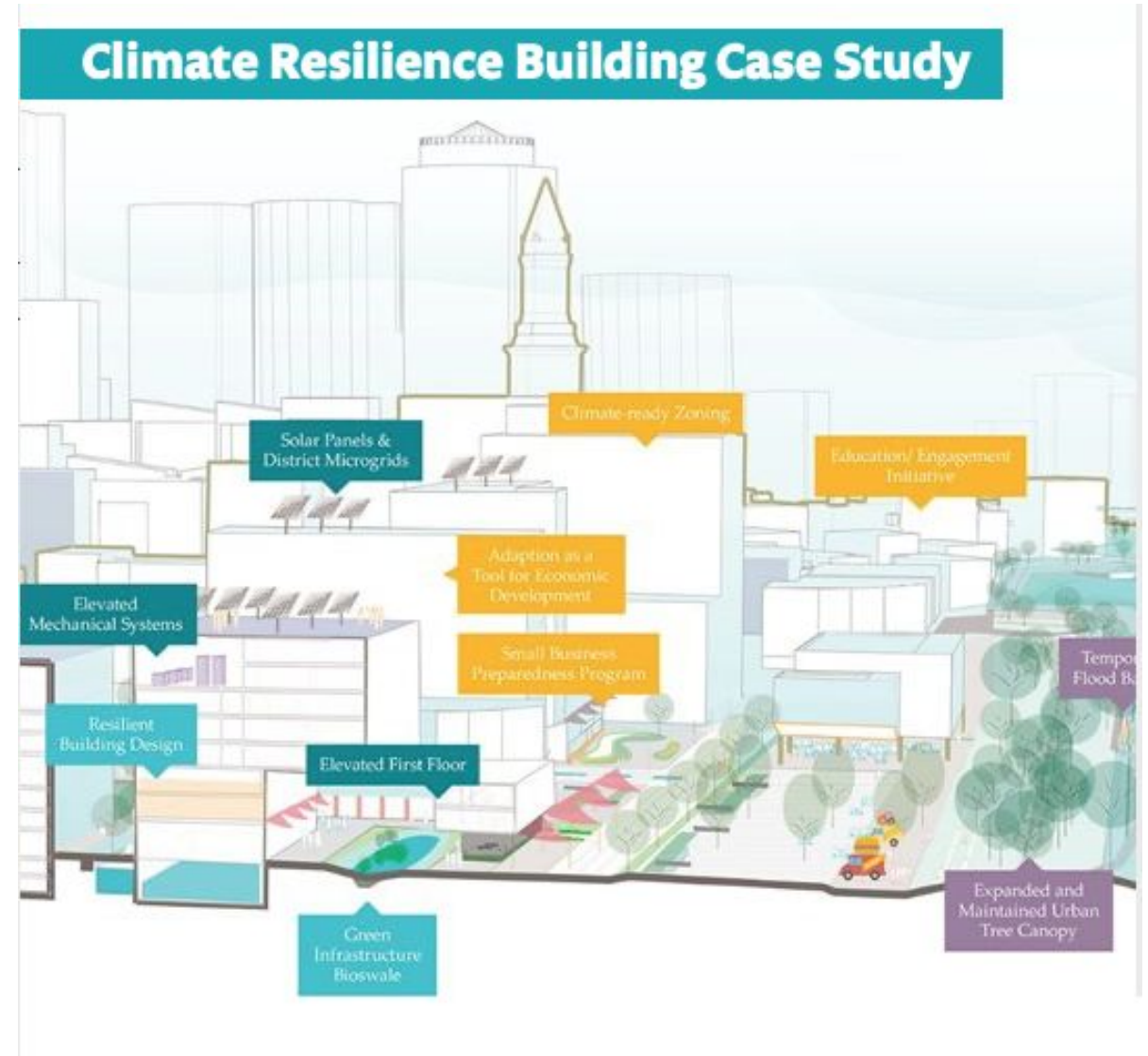
# Awareness Opportunities

## Education

- Case Studies and Research
- Partnerships - CLF Boston Hub, BSA, BE+, others
- Participation - Municipal Summit, professional development

## Recognition

- Awards, Certifications



# Awareness Opportunities

## Program and Initiatives

- Competitions - Boston Living with Water, E+ Green Buildings
- Community Engagement - Greenovate Boston, and Climate Corps
- Programs & Incentives - technical assistance, feasibility studies



# Facilitated Breakout Discussion

## LOGISTICS

- Three Breakout Room each with a facilitator and note-taker
- Participants are pre-assigned to distribute perspectives
- ID a Spokesperson to briefly report
- We will reconvene and wrap up at the end

## Policy (20 min)

- Policies aspects that seem most impactful / feasible to implement near-term?
- Steps and hurdles to effective implementation?

## Awareness (20 min)

- Primary audiences, their needs, and most impactful / feasible actions?
- Tools / resources for effective implementation? City and City partners roles?

# Facilitated Breakout Discussion - Policy

**Policy Opportunities** (10 min. discussion + 10 min. assessing / summarizing)

- Which aspects of the example policies seem most impactful and most feasible to implement in Boston in the near-term?
- What are the steps and hurdles to effectively implementing EC policy in Boston?

# Room 1 Notes- Policy

## What resonated from the presentation? What is relevant to Boston?

- Focus on the design before the material consideration since this is part of zoning and you can intervene earlier in the process
- Boston is a really high cost place so any ways to incentivize to build in Boston
  - Maybe tax credits?
  - Newton example probably will have the effect of increasing cost b/c it's another permitting hurdle and could negatively impact development (permit required for net zero qualifications)
- Expedited permitting and density bonuses would be great!
  - Cambridge is looking at expedited permitting
- Measuring EC is more realistic for larger projects but much harder for small projects
  - How can we help/support smaller projects or help to simplify it?
  - smaller projects could have prescriptive rather than performative- this can also be good for adaptive reuse
  - There is a tool for smaller project construction (BEAM)
  - In Canada they provided funding as well
- 40B has helped with expedited and density bonus- when using in friendly way it helps with the timeline
  - Could 40B align with Net Zero goals? Could net zero goals mimic 40B- this is a state regulation but it is based in zoning so could have local applicability



# Room 1 Notes- Policy - continued

- More holistic look at demolition impacts (rather than just historic significance review which is the current consideration)
- A full LCA can help you determine whether it is better to demo or keep the building
  - Remember that operational carbon happens over time but that embodied carbon all happens as you are building (right now)
- want to make sure that the building can handle the systems and mechanics that are being replaced too

# Room 2 Notes - Policy

- **Disclosure for new construction over a certain threshold**
- **Easy tool for smaller buildings and early decision making in concept phase**
  - ideal not to have to hire a consultant
  - Guidelines must be clear
  - BH developing tool - can we have 1 tool? collaborate w/ CLF? evolution of ecosystem of tools.
  - could prepopulate for particular city/regional data
  - how to compare across products
  - unclear guidelines
  - ease of access, ease of review
  - hard to find info.
  - 2030 EC disclosure as model?
- **EPD/disclosure by manuf to have the local data**
  - mechanism to incentivize?
  - concrete mix info pleeeeeeeeeeeeease!
- **Setting specific targets/thresholds**
  - gradual over time (like Boston Emissions Std forthcoming, NY LL97, etc)?
- **Deconstruction regulations**
- **Collab re racial/social justice on policy development (eg Pittsburgh)**
- **Reuse/Renovation**
  - re showing study for why it can't be kept?
  - grants/incentives? (eg Austin)



# Room 3 Notes - Policy

Vancouver Planning / Schematic Stage

Software tools - how to account for the variations among them

Vancouver going with Percentage reduction approach

What if the marketplace helps put this together? Design challenge or grants or lowest embodied carbon - data generated for the registry?

Roadmap that started with narrative + WBLCA; then reporting is part of BERDO to develop standards and baselines; then percent reduction; then a fixed carbon budget





# Room 3 Notes - Policy - continued

- Importance of defining long-term targets: people care early b/c they know what's coming, what will be regulated later
- Reporting wrapped into BERDO
- Bringing a lot of people along in this process
- Does focus on baselines and benchmarks cause more harm than good?
  - They have to be set artificially high
  - EPD's - prohibitive cost of new epd's
  - Importance of balancing depth of data requirements vs. making actual progress
- Percentage reduction approach better than absolute value targets?
  - How to define the baselines - Vancouver providing building archetypes to establish what those baselines are - eg - SCM content, typ. Insulation
  - Where are the reductions are coming from?
- Total EC reduction targets or EC to 0 right away w/ offsets allowed?
  - The amount of offsets allowed ramps down as we get to 2040.

# Room 3 Notes - Policy - continued

- Registry to record emissions “what gets measured gets managed”
  - Get hung up on data type. Agree on a margin of error/generalize - order of magnitude
  - Metric that people can understand. Not too complicated. What metric could be made universal?
    - This could be the embodied carbon / sf (corollary to EUI)
  - How do we get people used to LCA (not see this a prohibitive or too time consuming)
  - + for Vancouver’s approach - how do you differentiate metrics per different phases of design? (SD, DD, etc.)
  - Regulation vs. incentives- in Vancouver, re-zoning set the roadmap. What does it take to get to 40%?
- Procurement/grants based on EC reductions (not one specific material)
- **Roadmap:** narrative, WBLCA → codified/standards w/baselines (model on Buy Green)--> % reduction. Eventually, fixed carbon budget.
- What would be the simple baseline?
  - Concern for focus to be on baseline/benchmark - have to be set arbitrarily high. This sends the wrong message.
  - Is this project a potential for mass timber? Y/N Huge savings (for structural).
  - EDPs can be cause for concern. Advanced concrete mix, manuf. Didn’t have EDP to confirm reduction. Based on 28 day strength (vs. 56). Need first steps on ths structural side.
  - Baseline for functionality equivalent building. Guidance for baseline assumptions - ie. concrete, typ. Insulation, etc. - then what are the intentional design decisions
- Net Zero Carbon target - start with zero net carbon as the baseline. Allow for a % that you can offset.

# Room 3 Notes - Policy - continued

- WGBC proposed offset approach - Useful to have 2030 as a strategy / model, 2030 Challenge points to the building code as baseline
  - Aimed to educating architects; shifted to including code officials and contractors
- Awareness: Local Hubs as a good initial step as baseline; webinars - there's a lot of content out there; targeted content specific discipline; address training gaps on how to navigate and grown LCA literacy
- We learn the most in the context of real projects - City of Boston, measure embodied Carbon and develop real life case studies to address real problem solving issues - tie this into grants, competition - would be good to include Mass Timber
- Ask the question why Mass Timber isn't being considered?
- Opportunities to optimize and reduce through reducing structural factor of safety? We do need it given how buildings are built and it's a sensitive subject.

# Facilitated Breakout Discussion - Awareness

**Awareness Opportunities** (10 min. discussion + 10 min. assessing / summarizing)

- Who are the primary audiences, what are their needs? Consider who is missing and why.
- What would be the most impactful and feasible actions?
- What tools and resources are critical for effective implementation? Consider both City and City partners roles.

# Room 1 Notes- Awareness

What can we recommend the City start taking? Where is it most important to raise awareness (audience)?

- The policies will also increase the awareness just by introducing them
- Cambridge is raising awareness by requiring projects to consider it
- Developers and those that fund them (DND)
- If the City requires it that also gets the developers' attention
- The cost is also a big issue! This is a good awareness area for developers (BE+ study)
  - Modeling/LCA
  - Construction cost is a concern with developers
  - *But...consider the initial response to LEED was also negative and now it's just practice*
- Consider how this work benefits the larger community too
- City could provide case studies and understanding about the cost and whether there is a premium and how projects are developing this
- Market EC like LEED

# Room 2 Notes- Awareness

- city reaching out to vendors/manufacturers on what's possible
- city hire consultant to study what materials are at the top of the list that need more focus
- who needs to be in the room to tackle building reuse question?
  - demolition delay permit - could this process include reuse metrics? perhaps for buildings larger than X?
  - expedited permitting for deconstruction / reuse?
- how does the general public gain more awareness?
- professional awareness re holistic carbon analysis (operational v embodied re building reuse/renovation)
- awareness to building owners re benefits of reuse/renovation
  - can the City incentivize adequately as part of the 'benefits'
- what can happen in the market re retrofit for envelope improvements?
  - competition to imagine how to upgrade existing building with cost-competitive solutions?
  - vendors/manuf invited in to Boston and supported by the City with pitches to the AEC community?
- WGBC - whole building carbon pathway - launch June 26: net zero ops + embodied by 2030
  - deferring to local GBC re: reduction + offset
  - will publish guidelines

# Room 2: some resources

<http://allforreuse.org/index.html>

<https://www.arup.com/perspectives/publications/research/section/circular-economy-in-the-built-environment>

<https://www.arup.com/perspectives/publications/research/section/realising-the-value-of-circular-economy-in-real-estate>

<https://www.arup.com/perspectives/publications/research/section/circular-business-models-for-the-built-environment>

# Room 3 Notes - Awareness

- Awareness two-way street. Who needs to know this? What do we need to know about them?
- We need targeted outreach for each discipline:
  - Developers
  - Designers
  - Policymakers
  - Other...
- City of Boston to incentivize owners to pilot - “real life case study”
- Struct. engineer has to explain why or why not mass timber could work (for example)
-



# June Events!

## CLF Boston Hub Working Groups







- Advocacy & Policy
- Case Studies
- Design: Project Timeline
- Reuse Group
- Roadmap - SE2050
- Education Series

## Connect with Us!

Email [CLF.Boston@gmail.com](mailto:CLF.Boston@gmail.com) if you are interested in being part of the community!



## JUNE 2021: EMBODIED CARBON EVENTS

Monday	Tuesday	Wednesday	Thursday	Friday
7  <b>Impact: Preservation and Reuse (3-4p)</b>	8	9	10  <b>Impact: Carbon in the Landscape (4-5p)</b>	11  <b>Zero Carbon Buildings Municipal Summit (8a-10:30a)</b> 
14	15  <b>Impact: Embodied Carbon &amp; Interiors (3-4p)</b>	16  <b>Impact x2: Highly Controlled Spaces: Healthcare, Science &amp; Tech (10-11a)</b>  <b>Commercial &amp; Multi-family Projects (3-4p)</b>	17 <b>METROPOLIS FORUMS</b> <b>Getting Interiors to Net Zero (11a-12p)</b>	18
21	22  <b>Impact: Substitutions Not Accepted: Public Bid Process (3-4p)</b>	23	24  <b>Impact: Home Sweet Home (4-5p)</b>	25
28	29	30 <b>Architectural Record</b>  <b>Concrete Innovations: Sustainability and the Role of Concrete in Net Zero Design (2-3p)</b>	31	



Impact Series are CLF Boston Hub / BSA; refer to the BSA website

# Next Steps

Today's Presentation and Discussion notes will be posted by Friday

We will follow up with a calendar invite for our next TAG Meeting - TBD

## ZNC Building Zoning Initiative

- Public engagement opportunities (ongoing)
- Public Meeting #2 - Late summer / early (TBD)
- Recommendations Report will follow
- Regulatory zoning process will follow