

Zero Net Carbon Building Zoning

*Embodied Carbon TAG Meeting
Presentation*

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

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



The screenshot shows the City of Boston website header with the 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 is a paragraph: '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 shown. A 'PUBLISHED BY: PUBLIC HEALTH COMMISSION' logo is present. 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, it says 'BOSTON (AS OF FRIDAY, JULY 10)' and '13,673 CASES | 9,683 RECOVERED'. A navigation bar includes 'TOPICS', 'COVID-19 UPDATES', and 'LATEST PRESS CONFERENCE'.

ZNC Building Zoning

POLICY FRAMEWORK

- **Low Carbon Building**
Establish attainable reach emission targets
- **On-site Renewable Energy**
Optimize generation within limitations
- **Renewable Energy Procurement**
Establish weighted affordable and meaningful options and standards
- **Embodied Carbon**
Raise awareness, assess standards and action opportunities



PRACTICE & REPORTING

- **Utilize Industry Best Practices**
Work with existing & emerging standards
- **Update Review / Reporting Procedures**
Align ZNC and BERDO standards and coordinate metro area policies

PRINCIPLES & VALUES

- **Leadership** - recognize & reward excellence
- **Feasibility** - we can do good and do well!
- **Balance** - varying success across strategies
- **Equity** - ensuring equal opportunity & benefits
- **Innovation** - encourage new practices
- **Transformation** - accelerate pace and breadth of change throughout the industry

AGENDA

1. Welcome and Introductions (10 min)
2. Public Meeting Recap (15 min)
3. Work Plan & Goal Statement (15 min)
4. Regulatory & Policy Framework (10 min)
5. Action Opportunities (30 min)
 - Practice
 - Standards
 - Awareness
6. Next Steps (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

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Alison Brizius
Director of Climate & Environmental Planning, Boston

Kat Eshel
Carbon Neutrality Program Manager, Boston

WELCOME & BRIEF INTRODUCTIONS

TAG MEMBERS

Caroline Shannon, Howeler + Yoon Architecture
Gunnar Hubbard, Thornton Tomasetti
Dennis Carlberg, Boston University
Anthony Pak, Priopta
Peter Sun, BPDA
Ivan Lee, Morrison Hershfield
Tamar Warburg, Sasaki Associates, Inc.
Michael Orbank, Commodore Builders
Michael Gryniuk, LeMessurier
James Rogers, Turner Construction
Lori Ferriss, Goody Clancy
Alison Nash, DiMella Shaffer
Turan Karakus, BR+A Consulting Engineers
Daniel Bailey, Takeda Pharmaceuticals
Andrea Love, Payette
Steven Burke, Consigli Construction Company, Inc.

Rachelle Ain, Utile Design
Kayla Natividad, NSG Pilkington North America
Meghan Lewis, Carbon Leadership Forum,
University of Washington
Kevin Maguire, Oxbow Urban LLC
Patrick Kenny, Thornton Tomasetti
Courtney Koslow, Beacon Communities
Brad Mahoney, MP Boston
Christopher Stanley, Trinity Financial
Michelle Apigian, ICON Architecture
Ciarán Smyth, BALA Engineers
Jim Newman, Linnean Solutions, LLC
Nicole Knobloch, Olifant, LLC
Tom Chase, New Ecology, Inc.
Dan Whittet, AHA consulting Engineers
Erin McDade, Architecture 2030
Chen Qin, HED (Harley Ellis Devereaux)
Paul Richardson, Buro Happold

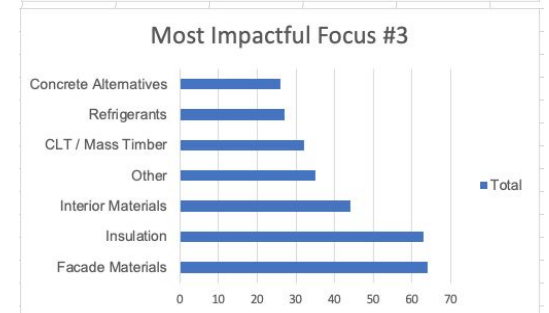
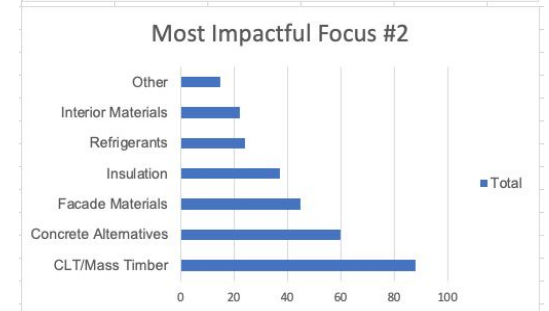
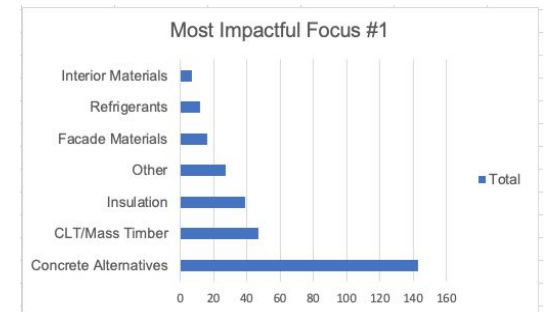
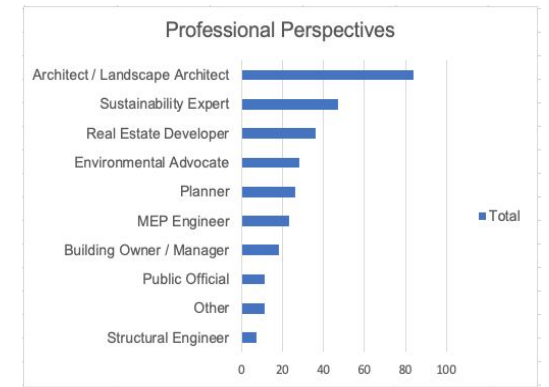
Public Meeting Recap

Participation:

- Great turnout 238 attendees / 311 registration
- Wide range of professional perspectives
- Many experienced in considering embodied carbon in projects - 156!

Most impactful focuses for reducing EC:

- Concrete Alternatives
- CLT / Mass Timber
- Facade Materials / Insulation



Public Meeting Recap

The WHY

“Embodied Carbon in Design & Construction” - Lindsay Rasmussen

- Global construction is projected to grow in the next few decades
- We need to reduce global carbon emissions by 340 GT for a 67% chance of meeting 1.5°C
- We cannot meet our targets without Embodied Carbon

The HOW: Structure and Policy

“Low Carbon Options for Structures” - Mike Gryniuk

- Reducing the Impact of Concrete, & Steel
- Opportunities for Mass Timber
- Raise awareness, measure our impact
- www.se2050.org.

“Policy Examples” - Meghan Lewis

- Policy models for Embodied Carbon
- Embodied Carbon Policy Landscape - Eg, Vancouver B.C.
- Room to grow and evolve: Build capacity and knowledge as we collect data

Chat Questions and Comments from Public Meeting

- Grouped by Topic

Structural Systems Generally

Meeting Discussion Notes

- Low carbon concrete and Mass Timber are showing good low carbon promise. Steel less so – there are only a few mills nationally fabricating steel and limited opportunity to reduce related carbon emissions.

(3 in chat)

- *Keihly Moore*: Our structural engineer has not focused on low-embodied carbon before...are there resources we can point them to?
- *Michelle Oishi*: <https://se2050.org/>
- *Michael Gryniuk*: Please help build the movement and spread the word about SE 2050 to your structural engineer!
www.se2050.org.



Chat Questions and Comments from Public Meeting - Grouped by Topic

Concrete/Cement

Meeting Discussion Notes

Currently replacing about 20% of the Portland cement in concrete with readily available low carbon alternatives. There is still more that can be done including the strength schedule and workability of the concrete. We should focus on what we can do now locally pointing to the need for education.

(7 in chat)

- *Dan Whittet:* Isn't there a shortage of fly ash and slag?
- *Michael Gryniuk:* to Dan Whittet - some regions have more of one or the other. Outside of Boston proper there is a lot of slag - locally in Boston it's barged in from some locations overseas - barging is a relatively low impact shipping technique. Ground glass has a lot of potential and is basically the same as fly ash.
- *Alex Brooks:* What is the lag between concrete mix production and actual project demand?
- *Julie Klump:* Is there a cost premium to using the concrete with reduced Portland?
- *Michael Gryniuk:* to Alex Brooks: costs vary like any global material - there are times when portland cement is more expensive than slag or fly ash and sometimes vice versa. I've seen modest increases on some projects and modest credits on others.
- *Michelle Oishi:* How can concrete plants be brought into the conversation? to achieve more carbon sequestering options around Boston?
- *Lindsey Conlan:* Are there existing best practices surrounding the reuse of aggregate in concrete? By reducing the amount of new aggregate in structural concrete and hardscape we could reduce the environmental impact and carbon footprint of mining for new aggregate.



Chat Questions and Comments from Public Meeting - Grouped by Topic

Steel (0 comments)

Chat Questions and Comments from Public Meeting - Grouped by Topic

Mass Timber/CLT

Meeting Discussion Notes

- CLT is coming to market from Canada and overseas (transit is not a major consideration).
- How do we ensure forestry practices include our sustainability values? The City could play a leadership role starting with material source reporting and promoting more sustainable and beneficial forestry practices.
- Largest barrier to entry for CLT is risk aversion, it is still a new practice. Case studies are a great way to drive awareness.
- Mass Timber has potential to allow 7 to 12 story building construction which in turn could help increase housing opportunities especially surrounding the downtown and near TOD locations.

(13 in chat)

- *Michelle Oishi*: Does the hybrid steel and mass timber structure allow for deconstructability?
- *Michael Gryniuk*: to *Michelle Oishi*: Yes. Most steel frames are bolted together and thus could be unbolted in theory. Same with the CLT connections to the steel framing - could be unscrewed. Of course some modifications of installed connection detailing would have to be modified - but it doesn't seem like an insurmountable barrier for entry.
- *John Bolduc*: Can you discuss supplies of alternate materials, eg, as alternates scale up is there tension between mass timber and deforestation? Thinking of the population and building projections.
- *Sarah Dooling*: For Mass Timber, the key seems to be ramping up sustainable timber harvesting/sustainable forestry practices. Are (national / regional) forestry companies part of the stakeholders that the City is involving?
- *Dan Whittet*: Great question Dan Bailey (on existing building reuse). And to John Bolduc, I am suspicious of the "managed" forest concept. From what I have read, the managed forest may have ecological downstream effects such as reduced habitat, monoculture vulnerability and soil depletion.



Chat Questions and Comments from Public Meeting

- Grouped by Topic

Mass Timber/CL cont.

- *Michael Gryniuk*: Regarding the timber questions and forest management - I couldn't agree more and it requires careful assessment for local impacts. Nationally, it's my understanding, we have a very stable forest stock in terms addressing national deforestation.
- *Lindsay Rasmussen, Architecture 2030 (she/her)*: Seconding the comment from Michael on forestry but adding that there is a lot of regional differences in forest in terms of species, rotation periods, ecological considerations, etc. Forest management is not one-size-fits all. If you're really interested in this topic, I'd encourage you to engage with local forest owners, mills, and CLT manufacturers.
- *Andrew Hazelton*: With regard to structural timber as a "low carbon" alternative for framing buildings, does (or should) the "embodied carbon" calculation take into account the negative carbon effects of cutting down forests? I have heard that deforestation and the ensuing loss of carbon absorption is a major concern on the horizon, and that policy experts such as Bill McKibben no longer advise the use of biomass as a renewable energy source on account of this.
- *Peter Alspach*: how can mass timber be viewed appropriately related to the impacts of sustainable harvesting that can have significant impact on actual embodied carbon of wood? there is also the tension between use of wood for construction and need for forest retention and growth for sequestration. What is the approach to balance these aspects?
- *Peter Alspach*: what fraction of the new building growth do we have plentiful US forest supply to accommodate?
- *Dan Whittet*: The issue is not deforestation, it's the economics of longer growth trees which sequester more carbon, vs rapid growth rapid harvest practices. I'm no expert, but I would like to see more research.
- *Andrew Hazelton*: results of a quick google search: " 'We want to debunk the myth that mass timber is in any way, shape, or form related to some kind of environmental benefit,' said John Talberth, president of the Center for Sustainable Economy, which is based near Portland. 'That's simply not true.'" [from an article in an online Yale forestry program publication "As Mass Timber Takes Off, How Green Is This New Building Material?" BY JIM ROBBINS • APRIL 9, 2019]
- *Meghan Lewis (Carbon Leadership Forum, she/her)*: For anyone looking to dive deep on the issues around wood and carbon @ Andrew, you might want to start with our series last spring: <https://carbonleadershipforum.org/wood-carbon>



Chat Questions and Comments from Public Meeting - Grouped by Topic

Building Reuse

Discussion Notes

- There is a strong synergy with building re-use, embodied carbon reduction, and historic preservation.
- Excellent job growth potential related to building materials salvaging and reuse.

(10 in chat)

- *Dan Bailey*: The lowest of the low hanging fruit for reducing embodied carbon seems to be retaining existing buildings rather than replacing them. As an East Boston resident, I've seen countless buildings in my neighborhood demolished (or functionally demolished) and replaced unnecessarily in recent years. How can we start thinking about Boston's existing buildings as an environmental resource to be conserved and managed? Is the City considering policies to encourage building reuse and/or discourage demolition?
- *Nick Armata (Boston Landmarks Commission)*: The City's current Article 85 Demolition Delay policy does not mention embodied carbon. With an overhaul of the law in the early stages, there will be opportunity to integrate EC policy while encouraging historic preservation. Will this be the case?
- *Nick Armata (Boston Landmarks Commission)*: Is deconstructing existing buildings rather than demolishing structures considered in policy? I've read this is a way of reducing materials that end up in landfills and reusing high quality materials. This is also a way to create new skilled jobs for disadvantaged populations.
- *Jean Carroon*: I'd like to pull attention back to Dan Bailey's comment/questions about policies supporting building reuse and/or discouragement of demolition. Even when speaking about embodied carbon we seem to pivot to new construction. I hope the City is looking at policies in Portland, Oregon and San Antonio, Texas which are also addressing the reduction of construction waste and material reuse.
- *Meghan Lewis (Carbon Leadership Forum, she/her)*: @Nick and Jean great questions/points - I can highlight a few of the policies we're seeing on the reuse side.

Chat Questions and Comments from Public Meeting - Grouped by Topic

Building Reuse cont.

(10 in chat)

- *Olivia Huang*: Another policy angle is deconstruction and building material salvaging! City of Portland, OR requires certain buildings to be deconstructed rather than demolished
- *Dennis Carlberg*: Great point on building reuse!
- *Dan Whittet*: Agreed, Dennis. Most of the buildings that will be around in 2050 are already standing.
- *Tom Chase, New Ecology*: Decon conference coming up in October: <https://www.buildreuse.org/conference>
- *Caitlin Hart*: Tomorrow's Deconstruction Hackathon, in partnership with the Sustainable Building Institute, BuildingEase, and All for Reuse: <https://www.architects.org/events/310587/2021/04/28/decon-hackathon>



Chat Questions and Comments from Public Meeting - Grouped by Topic

Awareness, Education and Advocacy

(7 in chat)

- *Gary Brock*: I think there needs to be common understanding of baselines of embodied carbon to understand relative reductions by project teams.
- *Tom Chase, New Ecology*: Great conference last November hosted by Yale SOE URI jointly with Yale SOA - industrial ecologists, foresters, architects, and engineers presenting on the carbon sequestration and emissions reductions options in this area:
<https://uri.yale.edu/get-involved/events/hixon-center-urban-conference-future-cities-material-flows-implications-design>
- *Dennis Carlberg*: Great session! Building owners and developers need to be asking for lowered embodied carbon to drive the creation of EPDs that help push the industry to simply begin to report the emissions associated with the manufacture of their materials. Thank you to the CLF for developing the EC3 tool!
- *Stefan Poltorzycki*: How can local environmental and community organizations sign onto and help push initiatives proposed in this presentation?
- *Sarah Dooling*: For advocates on the call, you can join Massachusetts Climate Action Network as we mobilize advocates on working with DOER on developing a true net zero stretch code. Check out the MCAN website: <https://www.massclimateaction.org/> Or email me: sarah@massclimateaction.net. (Sarah Dooling, ED)
- *HG Chissell*: Great conversation! Next month we will be leading a Stakeholder Challenge with John Dalzell, Ben Myers, and JC Burton May 19 and 20th. Here is a discount registration link . If you are a nonprofit, please reach out for a no cost ticket.
- *HG Chissell*: - HG Chissell / AEG Boston -
https://www.eventbrite.com/e/aeg-boston-21q2-stakeholder-challenge-buildings-construction-tickets-141876663921?discount=100_Off



Chat Questions and Comments from Public Meeting

- Grouped by Topic

Policy/Permitting/Zoning

(15 in chat)

- *Elliott Laffer:* Is there a plan to put these restrictions in the zoning code, with enforcement by ISD and appeals to the Board of Appeals? How will this mesh with enforcement of the state energy stretch code? (zoning)?
- *John Dalzell: to Elliott:* We are seeking recommendations which could include policy, zoning and practice actions.
- *Jose Sosa:* Will there be incentives for new construction and retrofit if bio materials are used? I.E Wood and Alu-clad wood windows.
- *Kate Hollister:* What can town boards do to encourage or require ZNC in new projects? Ex. my town does not have architectural requirements. What could we legally do using our subdivision rules & regulations and/or zoning bylaws?
- *Peter Alspach:* Arlington County, VA also addresses through zoning bonuses via ILFI Zero Carbon & LEED credits
- *Tamar Warburg:* What is the possible schedule for implementation of ZNC? Will it apply only to projects seeking rezoning / permitting --- or, like BERDO, to all projects over 35,000 SF?
- *John Dalzell: to Tamar:* one recommendation is to lower the Article 37 threshold to 20k sf. The ZNC Bldg Zoning schedule seeks to finalize regulations by the end of 2021.
- *Kate Hollister:* How can we get the suggested performance-based embodied carbon policy that Meghan mentioned?
- *Sarah Dooling:* Stakeholders also includes community advocates who can promote embodied C reduction practices as part of public review processes!



Chat Questions and Comments from Public Meeting - Grouped by Topic

Policy/Permitting/Zoning cont.

(15 in chat)

- *Russel Feldman*: As I understand from the recent Brookline experience limits what localities can do with zoning, and only the state building code can engage in carbon requirements in design or construction. Do other states provide more authority to municipalities?
- *Lisa Cunningham*: The AG did not limit what could be done in zoning, that was a general bylaw. Brookline is in the process of bringing forward two new zoning bylaws to implement the same FFF policy.
- *Lisa Cunningham*: The AG ruled that Brookline's bylaw conflicted with state legacy laws including utility, gas and building code law. Zoning is a viable path in MA although it is not able to capture the broad authority of a general bylaw.
- *Lisa Cunningham*: A group of us is also beginning to look at Building energy reporting and disclosure ordinances - if anyone is interested please let me know.
- *Peter Alspach*: Some approaches aim to knock down the worst offenders, but we don't really have the luxury of time for that tiered compliance approach
- *Meghan Lewis (Carbon Leadership Forum, she/her)*: Also wanted to share this webinar clip (15 min) to hear Vancouver talk about their own long-term strategies from CLF Vancouver: <https://www.youtube.com/watch?v=02c4MCuZhkM&t=2s>

Chat Questions and Comments from Public Meeting - Grouped by Topic

Tools, Reporting and EPD's

(4 in chat)

- *Sayo Okada*: How do you see the CO2e conversion from kwh would be done for reporting? Any conversion factor that would be available through certain tools?
- *Sarah King*: As an owner/developer, Skanska is using the EC3 tool on all of our projects to measure embodied carbon and set reduction targets and explain to suppliers what we're trying to do. We are beginning supplier outreach in the Boston area (particularly focused on concrete, steel, rebar), and if other owners/developers would like to collaborate on outreach, it seems like a "common ask" is helpful and appreciated by material suppliers. And the more developers/owners asking for EPDs, the more likely they are to create them. :) I'm at sarah.king@skanska.com if you want to discuss.
- *Tamar Warburg*: That's great Sarah -- happy to discuss.
- *Meghan Lewis (Carbon Leadership Forum, she/her)*: Building Transparency and the Carbon Leadership Forum will both be launching Owner/Tenant focused toolkits as well related to that @Sarah and Tamar. Looking forward to having those links to share soon!

Chat Questions and Comments from Public Meeting - Grouped by Topic

Systemic Change and Action

(3 in chat)

- *Kritika Kharbanda*: Thanks for the informative graphs and the overall framework for tackling the issue, Lindsay! In what sector do you see the most opportunity of making a rapid change?
- *Catalina Pérez-Aguirre*: Do you see any feasible opportunity for not just implementing standards and regulations but also economic incentives such as exploit low prices when high renewable generation to reduce materials production embodied carbon? Do you see any option to make materials production more elastic?
- *Peter Alspach*: Given we have coming up on 8.5 years to hitting our 2030 target, do we have time for the long life cycle of pilot projects to nudge market along?

Chat Questions and Comments from Public Meeting - Ranked by # of Comments

1. **Policy/Permitting/Zoning**
2. **Mass Timber/CLT**
3. **Building Reuse**
4. **Concrete/Cement**
5. **Awareness, Education and Advocacy**
6. **Tools, Reporting and EPD's**
7. **Structural Systems Generally**
8. **Systemic Change and Action**
9. **Steel**

WORK PLAN & GOAL STATEMENT

Work Plan

Develop recommendations for Boston's ZNC Building Zoning Initiative for reducing embodied carbon.

TAG Meeting 1 - Framework & Opportunities

- Practice
- Standards
- Awareness
- Discuss of action opportunities

TAG Meeting 2 - Action Opportunity Specifics

- Details and priorities

TAG Meeting 3 - Summary & Recommendations

- Messaging, practice acceleration, and impact

Goal Statement

- Raise awareness of the impacts of building embodied carbon and low carbon building materials and practices
- Assess standards and policies for reducing building embodied carbon
- Identify action opportunities to reduce building embodied carbon and advance practices and policies

REGULATORY & POLICY FRAMEWORK

Policy Progression

Carbon Free Boston Report provided the basis for the Climate Action Plan Update 2019 specific action recommendations.

Range of Policy Range

Zoning Articles (law), formal, procedural, soft

Programs

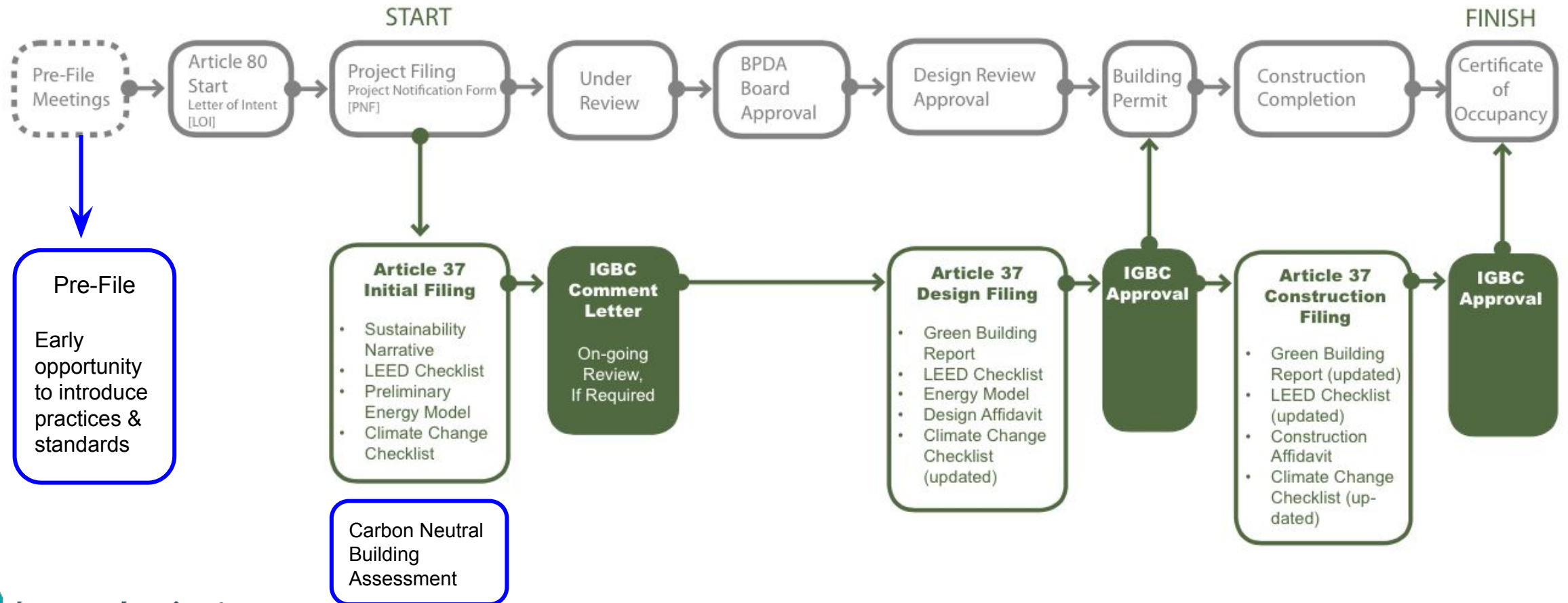
Early adoption and practice feasibility TA and study grants (funding required)

Public Awareness

Case Studies, public presentations, public engagements, competitions, awards, media

REGULATORY & POLICY FRAMEWORK

Boston Zoning Article 80 & 37 Project Review Sequence



ACTION OPPORTUNITIES

Discussion Framework

Practice

- Portland cement alternatives
- Optimized steel design
- Mass Timber / CLT construction
- Building insulation optimization and alternatives
- Building reuse and material reuse

Standards

- Zoning & Policy
- Rating systems and credits
- Practice reporting - primary materials and
- Analysis - EPDs, Building LCAs

Awareness

- Stakeholder, public, professional education
- Social Equity opportunities and burdens
- Advocacy - public (state, federal) and industry

Ranking by # of Comments:

1. Policy/Permitting/Zoning
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Embodied Carbon Reductions of Concrete

- Boston University - Center for Computing & Data Sciences
- Goal of 10% reduction structural and facade system EC (total)
- Focused on concrete
- High portland cement replacement concrete mixes
- About 2,000 T of design CO₂eq savings
- Trial batches / test data
- Achieved 13% reduction (no change to facade)



Embodied Carbon and Mass Timber

- Mass Timber – use of large-scale prefabricated engineered wood products, typically panelized products
- Glue laminated columns and beams
- No longer an ‘emerging’ technology – its here.
- Significant benefits for embodied carbon reduction*
- Applicable for certain building types and structures



Glulam -
Glue laminated timber



CLT - Cross-laminated timber
(NLT - Nail-laminated timber)
(DLT - Dowel-laminated timber)

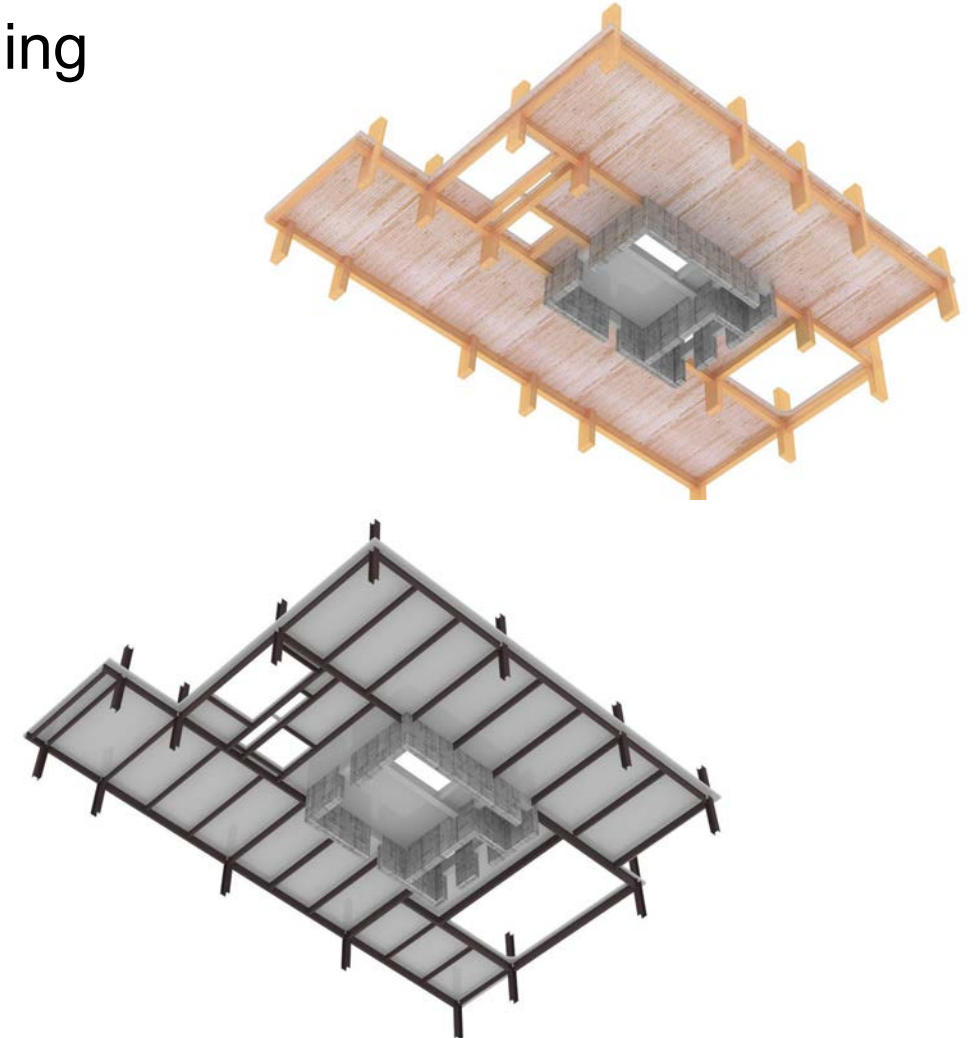
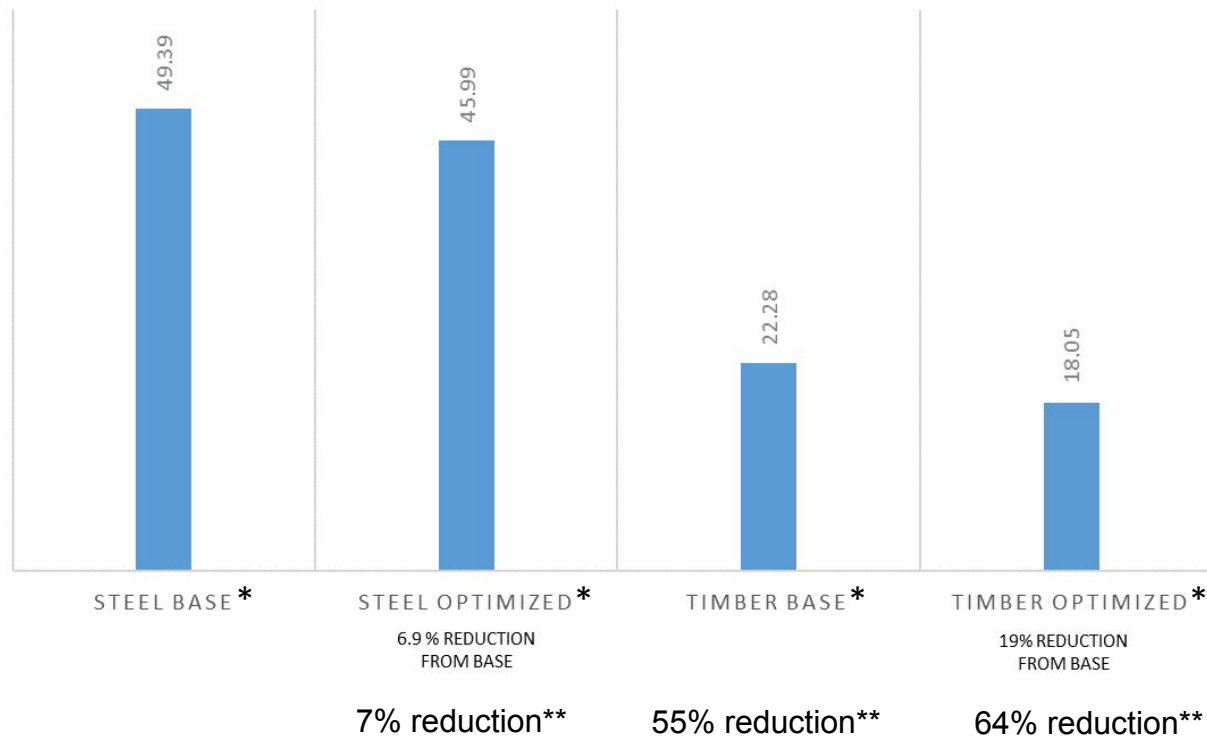


*Provided the timber is from a sustainably harvested forest

Embodied Carbon and Structural Systems

- Early system choices are critical for determining final embodied carbon impacts

LBCO2-EQ/FT2 FOR EACH OPTION



*Slice of building at mid height not including impacts of the complete structure **From steel base

ACTION OPPORTUNITIES - Discussion Notes:

- **Practice** - Promising and impactful practices and materials?
- **Standards** - Available tools and emerging embodied carbon standards?
- **Awareness** - Stakeholders, equity, education and market opportunities?

Notes:

- Keep focused on the enduring environ quality and the health of people- look at holistically
- What are the health impacts on the replacement of cement? (cement-ad mixtures)
- Building reuse!
- Tally tool- did a lot of research- SEM fully encapsulated into the concrete- not rereleased in a harmful way from a health pov
- Still need more data on this area though
- Community health and **supply chains**- think more broadly – there are solutions for storing
- Communities adjacent to manufacturing facilities and the impacts to those communities
- Many comments in the chat about mass timber/steel structure as a good alternative
- Structural design itself is a really good lever- could be good to try to incentivize this (also maybe challenging)
- Design and material both important to track
- There is great promise with mass timber but in the next 10 years most buildings will be steel and concrete so we need solutions for those materials too

Discussion Notes - continued

- Is it % reduction target or benchmarks that the building should fall below
- How do we define baseline selections?
- Getting more granular around baseline helps
- Vancouver is thinking through these issues ^ in their current work
- What development and types of buildings? There is a tremendous need for affordable housing and renovating existing housing in Boston- this does not use steel unless it is a larger building
- Existing buildings will need insulation
- How can policy and design practice take these opportunities?
- Can we partner to develop materials in Mass?
- Larger building projects -the LCA is better understood
- There are biogenic supply chains in Maine and places like Mass need to send signals that this is valuable
- Is the city thinking about setting standards right away and would that impose costs or are there incentives? (John says yes to both)
- There is a diff between renewable and nonrenewable material and the types of carbon
- Could Tax Credits be used to incentives practices?
- It is not that easy right now to access Mass Timber
- There is a height gap- doesn't pencil out to build taller affordable buildings- can CLT help address this?
- From a public funding standpoint- awarding in 40-50 unit increment- at a smaller scale you could do pilot buildings

Discussion Notes - continued

- Can we reframe this about how we can be regenerative and get back to nature, justice issues, permaculture, etc.
- With the new version of BERDO getting ready to launch and EC coming up later in the convo, how is the City thinking about incentivizing EC considerations? How do we combine the efforts to move forward in a positive way?
- Could you have an EC allowance and if exceeded than how do you off-set?

- Should the City address systems beyond structure?
- MEP hard to standardize and regulate at this point- city could raise awareness rather than try to regulate in this instance
- Germany has a good system- can use to perform LCA on mechanical systems
- System selection matters
- Hard to get info/declaration when a system is made of so many different parts

- Beacon Properties has a project in Albany that is a good example

- Need the carrots and the sticks
- In the Netherlands they have an EC budget by sq ft that you need to hit (by building type)- this might be happening in France as well. Incentives offered for doing better too
- EZ Code would require calculating your carbon footprint

- TM65 methodology helps with calculating for MEP
- Emerging MEP 2040 EC initiative underway

- Could the City require projects to disclosed their EC in all projects? This is a needed first step

- Reduce underground parking and you can reduce EC as well (in addition to reducing cars on the road)
- Need to connect all of the different parts- design, engineering, etc. to make sure that one reduction method doesn't have unintended consequence for another part



Discussion Notes - continued

- Gather data on Boston as a whole on where the EC is coming from?
- It is important to think about which projects we are targeting
- Is there a sense of this?
- As you get smaller in scale it might be more difficult to have the resources for reporting

Next Steps

- **Next TAG Meeting - 2pm, Wednesday, June 2nd** (calendar invite to follow)
- ZNC Embodied Carbon - TAG Meeting #1
 - Today's presentation and discussion notes will be posted by Friday
- ZNC Building Zoning Initiative
 - Public engagement opportunities (ongoing)
 - Public Meeting #2 - Late spring / *summer (TBD)*
 - Report on Recommendations would follow
 - Regulatory zoning process would follow

Introductions - from Chat

Julie Janiski, Partner, Buro Happold; working with our practice on embodied carbon for the past ~7 years

Patrick Kenny - Thornton Tomasetti - Structural Engineer, I head up TT's efforts to develop low EC specs and to develop strategies for low EC structural design

Kevin Maguire founder/managing member of Oxbow Urban. Oxbow is a boutique Boston based developer that is working to be on the leading edge of community redevelopment at a neighborhood scale with a focus on ownership, wealth creation as well as leading edge physical structures.

Dennis Carlberg, AIA Associate VP for Sustainability at Boston University. Working with Mike Gryniuk on the Center for Computing and Data Sciences to reduce embodied carbon for the project. My particular interest here is to provide an owner's perspective and support to this effort.

Alison Nash, DiMella Shaffer, Sustainability Practice Leader. Embodied carbon analysis & policy for New Construction & Reno Multifamily/ Residential typologies. User of most LCA tools for design from BEES to Tally

Mike Gryniuk - practicing structural engineer - Associate at LeMessurier and Chair, SE 2050 (www.se2050.org)

Ciarán Smyth, MEP Engineer/PM at Bala Engineers. Chair of our EC group particularly looking at more EC info for MEP systems.

Tom Chase, New Ecology - focused on operating and embodied emissions in affordably multifamily new construction and renovations, previously studied carbon impacts of building demolition, most excited about the potential for timber as a substitute for other structural materials.

Ivan Lee - Building Science Consultant at Morrison Hershfield. Working on low carbon buildings, including building an EC parametric tool for the Athena Institute and the City of Vancouver

Jacob Knowles - Director of Sustainable Design at BR+A Consulting Engineers, studied EC in MEP systems.

Michael Orbank - Commodore Builders (Boston) - Sustainability Manager - Working to analyze commercial construction impacts on embodied carbon and working with project teams to actively reduce these impacts. Would love to give a CM perspective to this discussion

Gunnar Hubbard | TT Sustainability: Here to play second fiddle to Patrick Kenny who will be the primary participant from TT. I come to this effort with the scale of a 1500 person firm with offices around the world - including Boston. We have been tracking our EC for 10 years as a firm, and we continue to advance our work and impact, through tools and opportunities on all scale projects.

Courtney Koslow, Beacon Communities. Beacon is a large mission-driven, for-profit affordable housing developer, manager and owner. I am working on a two projects with a low embodied carbon focus

Introductions - from Chat

Chen Qin, Sustainable Design Leader at HED Boston office. We are a national firm with 8 offices and practices across different sectors ranging from housing, education, healthcare to automotive and data center. Interested in carbon sequestration and the use of mass timber.

Paul Richardson - Structural Engineer/Principal @ Buro Happold. Working on Low Embodied Carbon Buildings and keen to encourage the use of better structural materials in buildings.

Nicole St. Clair Knobloch, principal Olifant market development. Focus on getting mass timber/ CLT incentivized to more quickly scale up its use, partly within the context of Boston and MA climate action plans; consider whether/ how City or Commonwealth can capture those emissions savings. My group is also working to quantify the full carbon implications of timber, including forest harvest and regrowth.

Meghan Lewis, Senior Policy Researcher at the Carbon Leadership Forum. I lead our embodied carbon policy research out of UW, I previously worked as an architect (doing many WBLCAs) and on the owner/tenant side managing a real estate supply chain sustainability program

Anthony Pak - Principal at Priopta, Founder of CLF Vancouver, CLF Regional Hub Director. Focused on LCA consulting for new construction and provided input/research to inform the City of Vancouver's embodied carbon policies.

Turan Karakus - BR+A Consulting Engineers - Energy Engineer, working in Sustainability department, interested in Embodied Carbon in MEP Systems

Dan Whittet AHA Consulting Engineers member of the ASHRAE 189.1 High Performance Buildings standard Materials working group.

Brad Mahoney - Director Sustainable Development at MP Boston. Developing Winthrop Center, 1.6 million sf development under construction. 800k sf of Passive House Office so interested in how we collectively transform the industry from design to construction and development

Dan Bailey -- my background is a bit different than most on the call. I'm a process chemist at Takeda Pharmaceuticals and lead Takeda's Green Chemistry Team, where we focus on reducing carbon emissions and environmental impact of pharmaceutical manufacturing using a life cycle approach. I have a personal interest in building sustainability, and expertise in the unique challenges presented by petrochemical derived building materials. I'm also an active East Boston resident with a strong interest in building reuse and preservation.

Erin McDade, Architecture 2030: Senior Program Director at Architecture 2030. 2030 has been supporting Boston in decarb policy efforts for the last few years and has been leading the renewable procurement TAG. I've been heavily involved in 2030's embodied initiatives for the last 7+ years, including most recently co-developing the City Policy Framework for Reducing Embodied Carbon, led by CNCA and Bionova

Chat Notes

Michael Orbank | Commodore Builders: One possible small change would be changing "Building Reuse" to "Building and Material Reuse". Including both building and building material reuse helps to promote a wealth of other progressive embodied carbon policies, such as deconstruction, increased waste diversion, and spurring growth of companies that look to contribute towards a circular economy.

Tom Chase | New Ecology | he/him: ^I would second that comment, Michael

Michelle Lambert: Great suggestion Michael, I totally agree.

Meghan Lewis: Agreed

Nicole Knobloch: Me, too.

Paul Richardson (BH): A hybrid mass timber/steel structure is a great alternative and we're seeing some significant carbon savings with this and seems to be more palatable solution for clients

Kevin Maguire: Is there a completed development which could serve as a case study for Building and Material Reuse??

Patrick Kenny: Great info Mike! As another structural engineer I very much agree that steel is our friend and has the potential to be a true circular economy material. The design of the structural system has huge potential for EC reduction.

Dennis Carlberg, BU: Great discussion on the health issue. Thank you.

Kevin Maguire: Related to Building and Material Reuse, it would be interesting from the development/feasibility perspective to understand how foundation design is addressed for a range of building types/scales. For example: the reuse of a 25k sf footprint for a one story strip shopping center or a one story masonry storage/auto/distribution use in an urban setting

Kevin Maguire: Helpful and useful to articulate feasibility thresholds for size and height of CLT.

Chen Qin | HED: To the structural engineers: besides concrete mix specifications, do you widely use carbon mineralization? Our data center clients are committed to the CarbonCure technology. I'm wondering if you have some experience specifying this technology on other types of buildings?

Lori Ferriss: Great points, Anthony! Appreciate the point about percent reduction allowing for a range of tools.

Meghan Lewis: @Anthony You basically just quoted my presentation from last week! Great minds. A Building approach is more appropriate for zoning, in my opinion.

Chat Notes - continued

Kevin Maguire: What are the potential funding sources that will allow for the 'living R&D process' of designing/constructing/learning so that the production process can evolve. Is it carbon reduction credits v. state/city funds v other?

Michael Orbank | Commodore Builders: From a construction perspective, projects with mass timber or a combination of mass timber and steel help to reduce typical construction schedules and provide a safer workspace for subcontractors. Working in Boston it seems that the unions are also becoming more palatable with the idea of these structures. Really exciting to know that not only it can help reduce embodied carbon of a structure but also provide many more additional benefits for the workers.

Ivan Lee: One critical point to the percentage reduction approach is the nail down on the baseline assumptions. We've seen on some LEED projects in people would 'game' the baseline building to make their current design look better

Tom Chase | New Ecology | he/him: Great points on stick-built multifamily and rehabs, Alison. Where we're starting to see friction in other jurisdictions on insulation especially is in a desire for carbon sequestering insulation and a lack of that insulation type in NFPA 285 compliant assemblies.

Julie Janiski, Buro Happold: On funding/incentives: I wonder if Mass Save has already started to incorporate embodied carbon as part of the process for various incentives.

Dan Bailey: To Alison's point, access to good information, tools, and resources is critical to making good choices during design and construction. While large developers and architecture firms may have access to the necessary information, homeowners, small landlords, and small scale developers likely do not. It seems there's an active role for the city to play here in developing public resources, guides, rules of thumb etc. for the most common renovation and construction projects.

Julie Janiski, Buro Happold: Second: John D - Would the City of Boston entertain a Renewable Energy Investment Fund (REIF) type Fund whereby embodied carbon offsets paid by new construction could support incentives/funding?

Michelle Lambert: Julie- MassCEC is actively working on the idea of an embodied carbon incentive. Not sure if the funding is there yet, but the program development has been underway.

Julie Janiski, Buro Happold: Thanks, Michelle - I forgot about that one.

Mike Gryniuk (LeM): to Chen Qui - great question. I am likely speaking for all SEs when I say we've all been asked if we can specify some form of carbon mineralization. There is certainly a need to do more than just replace portland cement and that is one additional option. From a purely embodied carbon standpoint the current cm technology provide relatively modest improvements. I have heard some evidence about pumpability issues with CC but I don't have specific data. I think most SEs would be open to exploring its use here in Boston with test data to ensure the required concrete properties are achieved.

Chat Notes - continued

Alison Nash | DiMella Shaffer: @Julie Janiski - MassSave is using the results of the Triple Decker Challenge to inform future incentive structures.

Alison Nash | DiMella Shaffer: I'd like to see HERS software include a plug-in for Embodied Carbon.

Mike Gryniuk (LeM): good point, Michael, on the speed of construction and work place safety.

Anthony Pak, Priopta & CLF Vancouver: Thanks @Meghan, great to hear you're also advocating for building level approaches too. @Ivan, I agree it's very important to nail down baseline assumptions. CLF Vancouver will be planning an event to discuss Baseline definition/assumptions, which is tentatively scheduled for March 20th, although we are still finalizing details. We may potentially need to delay the event for a week or two.

Julie Janiski, Buro Happold: Can a Zero Zoning policy require a one-time embodied carbon offset for new construction that generates funds for Boston homeowners/ R&D / etc rather than green-e certified purchase from who-knows-where?

Nicole Knobloch: Yes! Definitely on encouraging MT at the mid-rise. Maybe this can be a "soft" encouragement at the point of permitting?

Nicole Knobloch: This is also a question for MAPC. They may have thoughts on that.

Mike Gryniuk (LeM): Would be very advantageous to have building grids related to what typical panel sizes the CLT manufacturer produces to cut down waste, etc.

Meghan Lewis: Returning to Anthony's earlier comment, we can get away from focusing on whether mass timber or whether concrete or steel are strategies by instead setting building reduction targets or limits, which are technology-agnostic

Mike Gryniuk (LeM): Meghan: great point and its very important we don't pit one structural material against the other. I think a entire building carbon budget would be useful here.

Kevin Maguire: I don't know the specifics of the legislation that results in the funding of the MassSavings program, but it occurred to me that there is not an obvious 'carbon' industry where \$\$ can be negotiated for this type of purpose as it can be for 'energy reduction' that fits clearly into the utilities mandate. I don't know the answer but the ability to access state level thinkers who could provide a reality check on how to get say \$10M for incentivizing carbon reduction.

Kevin Maguire: As it relates to QAP, this is an important process but Passive House was really driven forward by MassSaves vs. DHCD QAP.

Anthony Pak, Priopta & CLF Vancouver: Building on Meghan's point, a building level approach also addresses some of the embodied carbon impacts of certain scopes that are not directly addressed when we focus on specific materials. For example, Buy Clean California focuses on certain types of insulation, but doesn't address XPS and Spray Foam insulation with HFC blowing agents, which can be 10X higher embodied carbon than other types of insulation. Also, a building-level approach can expand to include scopes in the future that we currently don't always address, like interior finishes and Mechanical, Electrical, and Plumbing systems.

Chat Notes - continued

Nicole Knobloch: Kevin, It is very true that the agencies and programs have been set up to address energy/ operational and not embodied.

Christopher Stanley: To Rachelle's point- A CLT building at 8-15 stories should be a default structural system for housing. The market in this area, seems oriented toward a stick over podium height,, but the norm obviously needs to change.

Nicole Knobloch: Transferable tax credits can be commodified.

Michael Orbank: During a CLF Boston Reuse Group Discussion, other municipalities on the west coast found success in incentivizing construction projects that reduce embodied carbon by creating a time incentive in the permitting process for different building types. Knowing that the permit process in Boston can sometimes take a while, maybe this is something to look into? Knowing every owner wants to speed up the project, this would be a great incentive.

Kevin Maguire: Mike Gryniuk - really like the idea of building grids as an example of a threshold that can be communicated. When looking to purchase land, there is a lot of education needed to communicate to potential 'sustainable developers' what parcel size or existing building footprint could be feasible for a CLT or carbon zero construction. In Boston/metro Boston, almost all development opportunities are the result of repurposing existing land uses

Alison Nash | DiMella Shaffer: There is market pressure and people needing housing-pressure to speed up new construction, which for housing leads to panelization in either wood or cold form steel. Also, I see an increase in use of modular/ off-site construction practices for bathrooms, etc. Embodied carbon can be reduced, optimized in these factory-built systems. A demonstration project is a great idea to show how to do this at scale and grow biogenic supply chains.

Meghan Lewis: The "budget" idea is the building limit/sf that Anthony mentioned as an alternative to a % reduction. It is the approach currently used in ILFI Zero Carbon Certification

Meghan Lewis: (As well as in many European countries, as Michelle mentioned)

Anthony Pak, Priopta & CLF Vancouver: CIBSE TM65 is a great resources for estimating embodied carbon of MEP systems. Given the lack of data and EPDs available, perhaps having a coordinated approach to gather data from MEP manufacturers using the TM65 manufacturers form would be a great idea.

<https://www.cibse.org/knowledge/knowledge-items/detail?id=a0q3Y00000IPZOhQAP>

Lori Ferriss: +1 Jacob's recommendation of requiring embodied carbon disclosure. This helps build literacy and data without necessitating a reduction or cap to begin with.

Mike Gryniuk (LeM): Jacob - I think a lot of positive intended consequences would come out of require projects just to attempt the calculation - naturally education would be greatly accelerated which would, hopefully, make it more obvious the need to make improvements. Could you imagine if every building had to submit a pEUI/operational carbon and embodied carbon value for each project? Even if the first few years were 'not the most accurate' at least we'd be doing something.

Chat Notes - continued

Julie Janiski, Buro Happold: +1 on embodied carbon reporting AND offset for neutrality

Alison Nash | DiMella Shaffer: +1 on embodied carbon disclosure- Boston could look to Canada's BEAM tool for a spreadsheet based-tool that could capture a lot of the middle & smaller scale new construction & major renovation projects. Or the City could work with a partner to create a MA specific tool for use in permitting.

Nicole Knobloch: Totally agree about the disclosure comment. That can be included with “soft” ways to encourage more sustainable building, including thinking about materials, grid spacing and height to encourage CLT (and more housing for key markets), and also to set up a registry for reduced emissions to be used against the Net Zero and 50 by 2030 planning.

Tom Chase | New Ecology | he/him: Agreed with the embodied carbon disclosure recommendation (we can't manage what we don't measure), but I would caution that there is a large process burden on cost-constrained smaller and affordable housing projects in meeting reporting requirements without explicit guidance on assumptions and methodologies for those studies, or broad forgiveness around the initial lack of consistency that will result. BEAM is a great example for those projects.

Julie Janiski, Buro Happold: Alison - agreed, a simple Excel-based tool to capture key items (steel, concrete, insulation, etc) so requiring disclosure doesn't require a full LCA would go a long way; and contractors all have the qty info.

Nicole Knobloch: I like that so it doesn't become unwieldy.

Mike Gryniuk (LeM): to Julie and Alison - <https://se2050.org/ecom-tool/> just sayin'. :) But yes something simple and basic would be great.

Michael Orbank | Commodore Builders: Agree with Patrick 100%

Meredith Elbaum | Built Environment Plus: Speaking of awareness, here are links to the 2 events we have coming up. One is a 4-hour embodied carbon course. The second is a Municipal Summit on Building Carbon.

Buildings and Carbon | Green Building Training Program

June 8 @ 1:00 pm - 5:00 pm

<https://builtenvironmentplus.org/event/buildings-and-carbon-green-building-training-program/>

Zero Carbon Buildings – Municipal Summit

June 11 @ 8:00 am - 10:30 am

<https://builtenvironmentplus.org/event/zero-carbon-buildings-municipal-summit/>

Chat Notes - continued

Rachelle Ain: What about civil scale & infrastructure projects?

Alison Nash | DiMella Shaffer: An adapted version of the BEAM tool was used for the MA CEC Triple Decker Challenge. So, in a way, the spreadsheet tool almost exists and could be further refined for Boston.

Julie Janiski, Buro Happold: Civil & Infra will be included in the MEP2040 effort

Mike Gryniuk (LeM): Julie, fine, SE 2050 is now SE 2049.

Alison Nash | DiMella Shaffer: MEP and Structure the 2030 Challenge is ahead of all of you. :)

Julie Janiski, Buro Happold: ha! It's definitely not a competition :) I can't take any credit for the 2040 date, will loop you in at some point so we can collaborate and cross-support the disciplines

Mike Gryniuk (LeM): We are now officially SE 2022.

Michelle Lambert: Hold- Next TAG Meeting on Wed June 2 at 2pm

Kevin Maguire: Is it possible to get a contact list of participants?

Dan Whittet: Thanks to everyone who has been working on this. Progress is being made.

Nicole Knobloch: What is the webpage to find the comments from this meeting? Thanks!

Julie Janiski, Buro Happold: <http://www.bostonplans.org/planning/planning-initiatives/zero-net-carbon-building-zoning-initiative>

Dennis Carlberg, BU: Thanks

Nicole Knobloch: Great - great discussion.

Meghan Lewis: Thanks!

Meredith Elbaum | Built Environment Plus: This was a really great discussion.

Dennis Carlberg, BU: Great discussion!

END