Project Background

In 2018, the County of Marin was granted funds from the Bay Area Air Quality Management District (BAAQMD)'s Climate Protection Grant Program to explore opportunities to reduce embodied emissions in buildings through local code amendments. The project aims to create local specifications and model policies for low embodied-carbon concrete, developed through a robust regional stakeholder engagement process. The County of Marin led the project, working in close partnership with StopWaste (Alameda County), Bruce King of the Ecological Building Network, Arup, and the Carbon Leadership Forum. The project proposal submitted to and funded by BAAQMD was supported by the City and County of San Francisco, County of Alameda, City of Berkeley, USGBC, and over 30 building industry companies and organizations that work in the Bay Area.

There are four central outcomes of the project:

1. Model code language for adoption by local governments (led by County of Marin) along with commentary to help interpret the code.
2. Low embodied-carbon concrete specifications for residential and non-residential applications
3. Four pilot projects receiving technical assistance to apply the specifications
4. Formation of a Bay Area Concrete Working Group as an extension of the Embodied Carbon Network

The code language and specifications presented with this letter are drafts ready for public review before being brought to the Marin County Board of Supervisors (and other interested local governments) this fall. The deliverables were developed by the project team with the support of the Bay Area Concrete Working Group, acknowledged below.

Technical assistance for two pilot projects is underway, the outcomes of which will guide the project team in developing resources to help future users navigate the proposed policies. These will be detailed in the final report of this project.

Acknowledgements

This project was made possible by a generous grant from the Bay Area Air Quality Management District BAAQMD)'s Climate Protection Grant Program.[1] The table below recognizes the individuals who contributed to the effort as part of the committee work that took place between November of 2018 and July of 2019 and included six conference calls and two in person meetings.

Academia	Government	Concrete Industry	Engineers & Architects	Developers & Builders	NGO
Kate Simonen*, University of Washington and Carbon Leadership Forum	Miya Kitahara*, StopWaste	Alana Guzzetta & Central Concrete/ US Concrete	Bruce King*, Ecological Building Network	Kimberly Loscher, Skanska	Wes Sullen, US Green Building Council
Mark Aschheim, Santa Clara University	Alice Zanmiller*, County of Marin	Tien Peng, National Ready Mix Concrete Association	Frances Yang*, Arup	Eric Peterson, Webcor	
Guarav Sant, UCLA	Karen Cook, Alameda County	Hernan Jose Perez, Cemex	Anthony Dente, Verdant Structural Engineers	Ryan Bell, University of California Office of the President	
Wil Srubar, Colorado University, Boulder	Bill Kelley, County of Marin		Leo Panian, Tipping Engineers		
	Eden Brukman, City & County of San Francisco		Scott Shell, EHDD Architects		
	Sarah Moore, City of Berkeley				

In addition to those listed above, we are grateful for the early review and comments by other interested stakeholders including those from Central Concrete, Climate Earth, Lehigh NW Cement Company, California-Nevada Cement Association, Sierra Club, Stop Waste and more.

Finally, circumstances compel the project team, with support of the Concrete Working Group, to dedicate this body of work to Professor Mark Aschheim. Mark passed away before this code was completed, but was an active participant early in the project, and made many important contributions to it through his illness. He was widely known in the concrete industry for his contributions to seismic design, and widely

[1] The opinions, findings, conclusions, and recommendations are those of the author and do not necessarily represent the views of the District. The District, its officers, employees, contractors, and subcontractors make no warranty, expressed or implied, and assume no legal liability for the information in this report.

* Indicates a member of the central project team

known more broadly for his many contributions to climate-friendly construction in California, in Haiti, and all over the world. He was a good friend to many of us, and a teacher to many more. We offer our regards to his family, and this dedication to his memory.

Contents

The team developed the following documents:

- Proposed Code
- Proposed Commentary
- Reference Documents: Resources available for those adopting or implementing code.

R1 FAQA Low Carbon Concrete Code by Bruce King
R2 Background White paper by Bruce King
R3 Setting Low Carbon Concrete Limits (analysis of regional data by Frances Yang, Arup)
R3 Model Commercial Specification (led by Frances Yang of Arup)
R4 Model Residential Specification (by Bruce King)

Overview of Options Considered in the Code

There were several options that were discussed by the committee and are appropriate for review and consideration by other jurisdictions considering similar policies including: the percent reduction targets from the baseline and the allowances permitted for applications where increased cement is often required for performance reasons. These options are discussed in the code commentary documentation.

Care should be taken in adapting this document to other regions as the details (most importantly the limits) were developed with careful consideration of current industry practices and capabilities. The cement content and carbon footprint of concrete depends upon many factors including strength, curing time, construction methods, aggregate strength (high regional variability) and available of alternate cementitious materials. See reference R3 for an overview of the process the technical committee used to evaluate and select the limits included in the proposed code.

Next Steps

The above documents will be posted on the Marin County Website. All comments regarding he code should be submitted via the Marin Comment Docket link posted there. Comments received by September 15th will be included in the final project report.