Case Study: Tech Campus Plazas

The Project

A technology employer and property owner (unnamed) built new office buildings in San Mateo County and Alameda County to accommodate their expanding workforce. The business parks feature large plazas surfaced with concrete.

The owner has a company goal to reduce greenhouse emissions 75% by 2020 over a 2017 baseline, including both operational and embodied carbon. As an organization the owner has declared a commitment to carbon neutrality by 2030. The company believes in using their partnerships with those up the construction value chain to reduce emissions.

The Concrete

The site in San Mateo County required approximately 6,400 cubic yards of concrete. All concrete was specified to use lower carbon concrete but the construction team found the mix challenging to produce the aesthetic desired by the design team when tested in visible areas of hardscape. In the end the lower carbon concrete mixes were limited to non-visible applications.

The owner had also pursued ground glass pozzolan (GGP), an innovative new alternative cementitious material, but the GGP company could not supply the necessary volume. The owner was still able to incorporate CarbonCure, a carbon-sequestering admixture, which reduced the GWP of the concrete in the footing and foundations by 0.5 lbs/cyd at no added cost. Combined with lowering cement, the mix provided by Central Concrete for the footings and foundations were significantly below the cement and GWP thresholds in the Marin County code.

PROJECT DETAILS	
Volume	6,400 cubic yards, 760 cubic yards of which were low carbon concrete
Concrete Supplier	Central Concrete
Anticipated Cement Savings[1]	247,000 lbs
Estimated GHG Savings[2]	45 MTCO2e

The Process

The owner convened relevant project team members at several project delivery stages, from near the end of design through construction. The owner had been working with multiple technology providers for lower carbon concrete, such as Sioneer and CarbonCure. The owner had hoped to be able to use Sioneer's ground glass pozzolan (GGP) product for this project, as they had already tested a small pour with the GGP in 2017, but Sioneer faced several setbacks and were not ready for the 6400 cyds needed in this project. It was surprising and unfortunate that Sioneer's product is still not available, so the owner and greater Bay Area is not yet able to use it on their projects.

In using CarbonCure, the team learned that while it led to some CO2 sequestration (0.5 lb/cyd) at no added cost, it was not enough to reach the BALCC code limits. Thus, there was still a need to reduce cement and add an accelerating admixture to make up for the slower strength gain, to meet the Marin Code GWP limits and curing schedule.

One of the most critical decision points was when the supplier and concrete subcontractor presented a comparison of the concrete that would normally be supplied according to the specifications before adding the Marin Code limits versus a set of lower carbon concrete mixes that could meet the limits. While the structural concrete could meet the limits, the supplier proposed a lower carbon concrete mix that would further reduce carbon emissions in footings and foundations. In contrast, the standard site concrete mix would not meet the code limits and would require special admixtures to help it set up fast enough, which increased the costs by about $17/cyd.

The owner instructed the construction team to plan to use the alternative concrete mix in both applications, despite the higher costs, because they felt the significant amount of carbon emissions over the code limits (about 240 tons CO2) was not acceptable and also wanted the savings offered in non-visible areas (45 tons CO2). They decided to try the mix first on their project in Alameda County in similar applications and found that the mix was susceptible to cracking at construction joints. As a result, they limited the lower carbon concrete mix to footings and foundations.

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1 Savings is in comparison to NRMCA 2016 national averages, the dataset used by the Bay Area low carbon concrete working group to set code thresholds.

2 GHG savings assumes 0.0.406 kgCO2e per lb of cement reduction. Source: Athena Impact Estimator v5.4, A1-A3 GWP impacts, taking the very rough assumption that the cement is replaced 1:1 with slag, which was found to have higher impact than fly ash.

CONCRETE MIX DETAILS					
Primary Applications	**Volume (cyd)**	**Cement content (lb/cyd)**	**Total cement content (lbs)**	**Marin Code (lb/cyd)**	**Total cement if Marin Code (lbs)**
Footings & Foundations	760	178	135,000	503	382,000

Lessons Learned

- The carbon sequestering CarbonCure admixture can contribute to GHG savings, but alone would most likely not be able to meet the low carbon concrete code thresholds set by Marin County. Cement reduction was still needed.
- Site concrete is a challenging application for low carbon concrete and would need to be included as an application that needs high early strength in order to meet the Marin LCC code.
- New alternatives to cement are coming onto the market but may require assistance to scale.
- For owners of multiple sites, using a project to test concrete for the pour on other sites can be very helpful for the construction team to identify where the mix could deliver acceptable results and make some adjustments before pouring.
- Having a threshold to aim for (such as the Marin Code specifications) even if not a requirement within the jurisdiction allows industry leaders to make decisions that reduce GHG emissions

Special Applications & Aesthetics

The project team tried a new mix on a project in Alameda County with intention to take the lessons learned over to this project in San Mateo County. The project team learned from the test pour that the lower carbon mixes had some issues with chipping at the construction joints and needed to be carefully watered during the curing period to avoid cracking. Thus, for the San Mateo County site, the construction team decided to use the lower carbon mix only in areas where aesthetics would not be a concern.