

Case Study: Berkeley Way

The Project

Berkeley Way Apartments, on the east side, provides affordable housing for families (89 studios, one and two bedroom apartments) with community spaces, a common laundry room, and administrative offices. The Berkeley Food and Housing Project (BFHP) Hope Center, on the west side, includes a veterans transitional housing dormitory, 53 permanent supportive apartments for formerly unhoused people, and temporary sleeping accommodations. The ground floor offers a variety of services including a commercial kitchen, multipurpose room with multiple meal services and supportive programs, 24-hour reception, as well as supportive services, management, and administrative functions. The estimated cost of the entire development is approximately \$70M. The project broke ground in July 2020 and construction is anticipated to be complete in May 2022.



The Concrete

Berkeley Way is 4 stories of wood construction over two levels of prestressed concrete podium and a mat slab foundation. The total amount of concrete on the project is approximately 4,000 cubic yards. From the start of the project, the team opted to specify cement content limits and sought to push for the lowest cement content possible. The mixes provided by Central and approved by TSE to date contain 55% less cement than national average concrete for the same strength. As a result, 614 metric tons CO2 equivalent of greenhouse gas emissions throughout the supply chain of the concrete will be avoided compared to a national average.

The Process

Key to the project success was initiating discussion with the concrete contractor early on to find mixes that achieved lower cement content without cost increase or time delay. During Construction Documents the team held meetings with the General Contractor, the concrete supplier, the structural engineer and Arup to analyze concrete mixes. They aimed for mixes with high cement replacements that would work structurally without adding significant time or cost. Having the team approach this together before the GMP process was helpful and got the team on the same page about goals.

During construction, there were multiple, last minute substitution requests. Some were due to seasonal fly ash shortages whereas others were to make the concrete pours simpler for the contractor. The former was dealt with by using mixes with slag only to replace cement instead of mixes with both fly ash and slag, which can have even lower cement. The latter was discussed by the design and construction teams before coming to an agreement on allowances that gave the contractor flexibility while still achieving high overall cement reduction targets. Throughout the submittal and substitution request process, the team needed to review the changes quickly, so the detailed tracking of the different mixes being used throughout different elements in the building, that Arup kept up to date, was essential

PROJECT DETAILS

Developer/owner	BRIDGE Housing
Architect	Leddy Maytum Stacy
Structural engineer	Tipping Structural Engineers
Builder	Nibbi Brothers General Contractors
Concrete supplier	Central Concrete, although Cemex provided notable pre-con support
Project status	In construction

CEMENT DETAILS

Volume	About 4,000 cubic yards
Path	Cement content limits
Anticipated Cement Savings ¹	1,678,000 lbs
Estimated GHG Savings ²	680 MTCO ₂ e

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 0.0406 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)	Strength (psi)	Cement content (lb/cyd)	Total cement content (lbs)	NRMCA average (lb/cyd)	Total cement if NRMCA avg (lbs)
Foundation, Slab on Grade	2,140	6,000	370	791,700	759	1,624,200
Walls	270	8,000	375	101,200	938	253,300
Post-Tension Slabs	1,570	6,000	530	832,100	759	1,191,600
Total	3,980			1,725,000		3,069,200

NOTE: The project is currently under construction and not all concrete has been poured. Values are based on mixes and volumes poured to date plus approved mixes and the estimated remaining volumes. These will be updated at end of construction.

Keys to Success

- Ongoing communication among the team, beginning early in the process (e.g. during construction documents before concrete specifications are finalized.
- Tracking of approved mixes and substitutions through the construction process.
- Bringing all team members on board with low carbon goals, and a bonus to have architects and structural engineers experienced with sustainable building design.

City of Berkeley Code Amendment

In December 2019, the City of Berkeley amended their building code to require concrete to include at least 25% substitute cementitious materials (SCMs) as a way to reduce carbon intensity. The Berkeley Way project was ahead of the curve and exceeded the code amendment before it came into effect, reaching 50-70% SCM content.

