Case Study: San Francisco Wurster Remodel & Addition

The Project

The project is a significant renovation of a historic single-family home in San Francisco's Presidio Heights neighborhood. It was built in 1959 and designed by William Wurster, the former dean of the UC Berkeley architecture department who designed Berkeley's Stern Hall. It is a 5,650 sq. ft. ranch-style home containing 4 bedrooms and 4.5 bathrooms. Because of the historical significance of the architecture, minor additions were made to the visible structure above grade. The existing retaining wall was starting to fail and needed to be replaced to stabilize the building. In the effort to improve the building's foundation, the project team took advantage of the opportunity to excavate further and capture a large basement underneath the footprint of the building, requiring a significant amount of concrete. This strategy led to the design team's interest in low carbon concrete.

PROJECT DETAILS	
Developer/owner	Private Homeowner
Architect	Walker Warner Architects
Structural engineer	Holmes Structures
Builder	Thompson Suskind, L.P. General Contractors
Concrete supplier	Central Concrete
Project status	In construction

CEMENT DETAILS	
Volume	500 cubic yards
Path	Cement content limits were used to show compliance although both cement content limits and GWP limits were included in the concrete specification
Anticipated Cement Savings[1]	109,400 lbs
Estimated GHG Savings[2]	44 metric tons CO2e

The Concrete

The project contained three applications of concrete: approximately 200 cyd each for the foundation/mat slab and retaining walls, and an additional 60 cyd for concrete over a metal deck. In all of these cases, the final submittals came in with lower cement content than the thresholds set by the Bay Area low carbon concrete working group that developed the County of Marin code. The greatest savings were gained in the foundation, which contained about half as much cement as national averages. The retaining wall shotcrete mix had less of a cement reduction because it needed faster curing times, though it still contained about 25% less cement than the national average.

The Process

The goal to lower the carbon footprint of the project, where cost allowed, was shared by the homeowner, architect, structural engineer and builder. As there was little impact to concrete cost, this effort was seen as a great value-add. Choosing low-carbon concrete did not significantly impact the project team's process. The architect discussed the benefits with the owner early in the design, and discussed strategies with the contractor in the pre-construction phase. Over the course of these early discussions, the team was able to strategically identify conditions where the use of low-carbon concrete would not negatively impact the design, cost, or project schedule.

The project team found that using low-carbon concrete did not directly add cost or extend the construction schedule. The challenge was managing the longer curing times that low-carbon concrete typically requires. The team found ways around this constraint through design and construction sequencing – by targeting specific conditions that could accommodate a longer curing time without impacting the design or extending the project schedule. The contractor and structural engineer played a key role in balancing goals to minimize cement content while making sure the curing times would not adversely affect the project schedule in the field. The general contractor was also able to rely on the technical assistance provided by Arup, who was responsible for reviewing and ensuring the mixes provided by Central Concrete worked within the pilot program's goals.

---

[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)	Strength (psi)	Cement content (lb/cyd)	Total cement content (lbs)	NRMCA average (lb/cyd)	Total cement if NRMCA avg (lbs)
Foundation/Mat Slab	240	4000	282	67,680	570	136,800
Retaining Walls	200	4000	425	85,000	570	114,000
Concrete over Metal Deck	60	3000	267	16,020	455	27,300
Total	**500**			**168,700**		**278,100**

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

- Early discussions with the homeowner and project team.
- Identifying specific applications that can tolerate longer curing times without extending the project schedule.
- Project team agreement on goals to reduce the project's carbon footprint where cost feasible.

> *"This experience has given us confidence that we can promote low-carbon concrete on future projects as a successful way to lower the carbon footprint on a project without adding cost or extending the construction schedule."*
>
> - Matthew Shanks, Walker Warner Architects