

# Transforming the Bay Area Construction Sector: Affordability, Carbon Neutrality and Circularity

## The Need for Construction Industry Innovation

The coalition, led by StopWaste (Alameda County Waste Management Authority) and including San Francisco Department of the Environment (SFE), University of California Berkeley (UCB), Lawrence Berkeley National Laboratory (LBNL), East Bay Economic Development Alliance (EBEDA), Rocky Mountain Institute (RMI), and Build It Green (BIG), proposes a **construction innovation cluster** that aims to relieve economic distress experienced inequitably by disadvantaged residents in the San Francisco Bay Area and surrounding regions. The Bay Area has among the highest income disparities in the nation, with home prices that are up to 15 times per capita income (see Appendix 4: Equity).

This proposal addresses vulnerabilities in the construction industry that are exacerbated by COVID-19 and climate related natural disasters like wildfires. A survey of more than 2,000 contractor firms on pandemic recovery found that the majority were suffering from *worker shortages, supply chain disruptions and rising material costs*.<sup>i</sup> The Bay Area is experiencing these constraints acutely, but they are relevant nationally, and we anticipate that innovations developed by this cluster will have strong spillover effects in other regions of the country.

The coalition proposes to modernize the construction industry in ways that build regional economic resilience and reduce greenhouse gas emissions. It will harness the Bay Area's position as a CleanTech hub and further its potential for onshoring manufacturing.<sup>ii</sup> The construction innovation cluster will:

- **Increase housing production** and affordability through technology driven innovation
- **Create high-road jobs** and fill the middle-wage employment gap
- **Employ circular economy**<sup>iii</sup> strategies to derive greater economic value from existing resources, build resilient regional supply chains, and manufacture high-value products from the region's waste streams

**Comprehensive Economic Development Strategy (CEDS) for the Bay Area** documents the need for greater economic equity and includes specific actions to support housing production and affordability; the Bay Area's innovation and entrepreneurship ecosystems; and the Production, Goods Movement, and Repair Clusters.

## A Vision for Industrialized Construction and Regionalized Supply Chains

The construction industry in the United States has seen minimal to no growth in productivity since 1940 and has even decreased in productivity since 1968<sup>iv</sup>, whereas other nations like China, Japan, and Sweden have modernized and streamlined construction through investments in **Industrial Construction (IC)**<sup>v</sup> and **Advanced Building Construction (ABC)**<sup>vi</sup> to scale these practices to 15-45% of their housing production.<sup>vii</sup>

- **Industrialized construction** produces housing in a more controlled environment with higher precision, increased efficiency, and reduced cost through economies of scale and standardization. Industrializing construction creates new opportunities to adopt new zero net carbon clean energy systems. Modularizing components enables rapid on-site deployment as well as future retrofit and recovery of high-value building components for

a second life, yielding additional cost, resource, and GHG emissions savings. They are also proven to have high standards for quality and strength internationally.

Access to construction materials is also a significant obstacle or enabler to housing production, as demonstrated with COVID-19 supply chain disruptions. The coalition has identified key opportunities to regionalize supply chains to retain or regain manufacturing while reducing embodied greenhouse gas emissions.

- **Cement and concrete** contribute over \$500 million to the Bay Area’s gross regional product (GRP)<sup>viii</sup> but the region’s sources of natural aggregate are depleted, and its cement plants have closed.<sup>ix</sup> The import-to-export ratio of these products has grown by 40% in five years.<sup>x</sup> Emerging regional innovations, including alternative cementitious materials, carbon sequestering and recycled aggregates have the potential to supply up to 20% of the current demand.<sup>xi</sup>
- **Agricultural byproducts** such as the 1-2 million tons of straw<sup>xii</sup> from rice and other crops in California could be recovered for construction materials, creating new revenue streams for distressed agricultural communities, providing opportunities to diversify crops vulnerable to climate change, and restoring soil carbon through climate-beneficial agriculture.<sup>xiii</sup> Straw has the potential to garner up to 30% of targeted product segments, such as medium density fiberboard<sup>xiv</sup> and structural insulative panels. Wood biomass from forest thinning to mitigate wildfires can be used in similar application. These opportunities bridge the rural and urban economies in our state.
- **Urban reuse** derives value directly from materials exiting the existing built environment as waste. Deconstruction creates up to three times as many jobs as demolition, which are also higher skilled. With minimal processing, undervalued outputs can be recirculated as high-value products.

### Anticipated Outcomes:

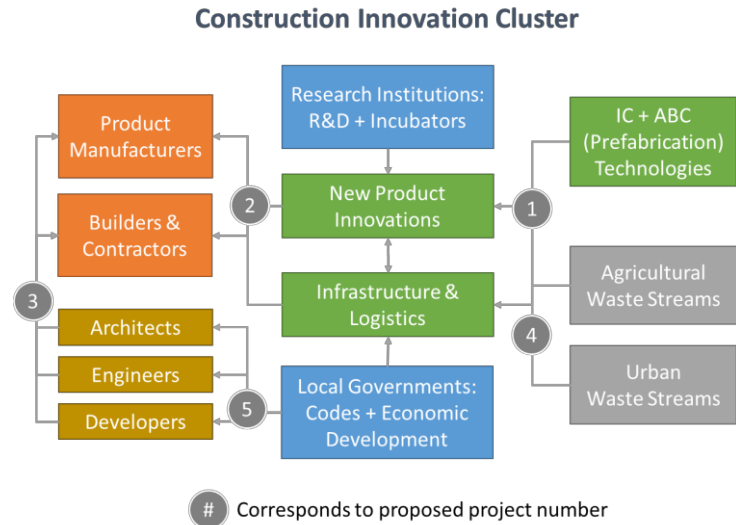
Within 4 years of investment, the construction innovation cluster will generate:

- **Local workforce trained** in innovative construction methods and matched with new high-road jobs opportunities.
- **Innovation ecosystem for entrepreneurs** developing new building materials and regionalizing supply chains.
- **Sustainable markets for new products**, driven by corporate commitments and local government policies.
- **Demonstrated proof of concept** for Industrialized Construction so it can be readily adopted to deliver rapidly constructed affordable housing.

## Proposed Projects

The coalition has developed a cross-sector strategy to address critical points in the industry value chain: material supply, construction methods, and project delivery. The partners we have assembled (see appendices) represent industrial players across the value chain.

We propose a suite of synergistic projects to develop robust regional supply chains and scale industrialized construction to modernize and reduce the cost of new construction. New innovations will be supported through the start-up phase with technology development and testing (Project 1) and brought to market through business incubation (Project 2) and infrastructure investments (Project 4). We will prepare the industry to adopt these innovations through education (Project 3), and pilot projects and aligned policymaking (Project 5).



### Project 1: Research & Development: Innovation Centers (\$30M) Co-led by UCB & LBNL

Establish testbeds to advance manufacturing and material innovation that speeds construction, reduces costs, and creates regional business opportunities.

- **Establish a network of testbeds/innovation centers** to support offsite construction, high-value production from waste feedstock, and technologies to enable zero emission and climate resilient buildings. (LBNL, UCB)
- **Engage local industry** to identify pre-competitive innovations (Coalition)
- **Support testing and product development** and connect to end user/installer feedback. (LBNL and UCB)
- **Host material innovation prototypes** including waste-to-feedstock production and new concrete alternatives development and testing. (SW, SFE, and LBNL)

The testbeds' capabilities will be marketable to the private sector after the grant period, including safety, lifecycle GHG analysis, and resilience (Appendix 3: Sustainability).

**Deliverables:** Creation of testbeds; development and testing of product innovations

**Success Metrics:** Number of product innovations developed

**Potential Match Resources:** Leverage planned upgrades to existing facilities

**Risks & Mitigation:** Construction of a testbed faces potential logistical challenges. LBNL has identified multiple potential sites and has the support of Congressman DeSaulnier's office for a facility in Richmond in his district.

**Timeline:** Testbeds ready to open in 1 year and operate for 3 years with grant funding

### Project 2: Entrepreneurship: Incubator Program (\$16M) Led by UCB

Develop an incubator program for construction industry entrepreneurs, based on successful CleanTech incubators for other business sectors currently operated by UCB and LBNL.

- **Target early-stage technologies** and components, providing support to accelerate tech-to-market with finance and business models, managerial training, access to testbeds, and opportunities to connect with funders.<sup>xv</sup> (RMI, EBEDA)
- **Create a network of stakeholders**, including U.S. Department of Energy (DOE)/California Energy Coalition (CEC), design and construction professionals, developers, researchers, industrial partners, trade association, and CleanTech investors. (LBNL, UCB, RMI, and BIG)
- **Work with architecture**, engineering, contracting, and product manufacturing firms directly to support business models to deploy these innovations at scale, and work with financing entities to establish new project financing mechanisms. (RMI)

Stakeholder feedback will inform innovations going from the lab to the marketplace and identify non-technical gaps that need to be addressed by different parties involved.

**Deliverables:** Incubation program services established and entrepreneurs served

**Success Metrics:** Number of entrepreneurs served and their jobs and gross product potential; dollars of private capital invested

**Potential Match Resources:** Leveraging resources from existing incubators at UCB

**Risks & Mitigation:** Incubators face funding challenges after initial investment. The UCB team has demonstrated a viable corporate membership model for ongoing sustainability.

**Timeline:** Incubator to launch in 9 months and operate for 4 years with grant funding

### Project 3: Workforce Development: Industry Education (\$9M) Led by BIG

Deliver education and assistance through higher education, industry, labor and community organizations. Work with Construction Trades Workforce Initiative (CTWI) on labor.

- Design & Construction education and technical assistance hub as part of higher education partner networks (UCB and Stanford)
- **Technical assistance** on low emission design, data and analysis. (LBNL)
- **Connect workforce development** opportunities with network of trade unions and educational offerings in **community colleges**. (with cluster partner CTWI)
- **Offer manufacturer and industry partner education**, including design and engineering specification practices, leveraging existing networks such as the regional chapters of the American Institute of Architects. (SW and BIG)
- **Workforce training for deconstruction** and product/material rescue (SFE)
- **Support community-based organization** partners (see Appendix 4) to deliver workforce development, and **industry partners** to deliver on-the-job training.<sup>xvi</sup>

Education will be geared towards developers, design professionals, government planning and permitting staff, and the construction workforce and supply chain on how to integrate construction innovations into their practices.

**Deliverables:** Courses delivered, educational materials, technical assistance provided

**Success Metrics:** Number of people educated through each channel, job placements and wage growth, including representation by disadvantaged populations; projects receiving technical assistance their contribution to GRP

**Potential Match Resources:** Leverage existing workforce development and continuing education programs through partner network

**Risks & Mitigation:** The prefabrication sector is not well connected with unions. Our partner CTWI will connect employers with local unions. Training will be available to all, including union trades that wish to retool for new methods of construction delivery.

**Timeline:** Programs developed in 1 year and delivered for 3 years with grant funding

#### **Project 4: Infrastructure: Secondary Materials Marketplace (\$5M) Led by SFE**

The current reuse market is constrained by lack of physical space for the inventory, storage, and transfer of construction materials. Establish a warehousing and exchange site for a secondary market of salvaged and surplus construction products.

- **Install nonpermanent storage elements** (e.g., watertight repositories, rack shelving), security measures, a small office to house the operations staff, technology, and utilities.
- **Prioritize distribution** to climate refugees, small businesses, and communities in need.

With minimal site improvements, this additional regional asset can service a high volume of secondary material flows, SFE has longstanding partnerships with local facility operators and has identified several market-based mechanisms to transition operations to a self-sustaining business model (see Appendix 3: Sustainability).

**Deliverables:** Reuse facilities built and operational with self-sustaining business model

**Success Metrics:** Number of jobs created in secondary market and wages; gross product throughput and dollars of new value generated from previous demolition waste stream

**Potential Match Resources:** Leverage an online materials exchange platform funded by a grant from the Carbon Neutral Cities Alliance to SFE

**Risks & Mitigation:** A permanent location is difficult to secure in a dense urban area. SFE will design site elements to be mobile and has identified potential sites for relocation.

**Timeline:** Complete site installations in 1 year and operate for 3 years with grant funding

#### **Project 5: Market Development: Project Pipeline & Policy (\$5M) Led by SW**

Establish a pipeline of projects committed to using the methods and materials developed and support the adoption of aligned policies:

- **Identify projects** through industry and government partners and from programs such as Project Homekey, BUILD program, corporate housing developments, DOE's ABC program, and CEC network support. (SW, RMI, UCB TC, LBNL)
- **Align local, state and federal policies** to remove zoning and permitting barriers and support market adoption of construction innovations.<sup>xvii</sup> (SW, UCB, LBNL)

These activities will ensure sustained demand for products and businesses in the region.

**Deliverables:** Pipeline of potential projects, case studies, and adopted policy recommendations, communication strategy

**Success Metrics:** Number of projects in the pipeline, their increased contribution to GRP, jobs, and wages; estimated economic impacts of policies adopted

**Potential Match Resources:** Construction costs for pilot projects covered by private investment and state programs for affordable housing and building decarbonization

**Risks & Mitigation:** Fragmentation of building codes/permitting is a major barrier. Members will address multiple levels of government and leverage existing networks.

**Timeline:** Activities to begin immediately, and continue for 3 years