Off-Site Construction in Los Angeles County

Unlocking the Benefits of Innovative Approaches to Housing Production

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TERNER CENTER FOR HOUSING INNOVATION
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About the Terner Center

The Terner Center formulates bold strategies to house families from all walks of life in vibrant, sustainable, and affordable homes and communities. Our focus is on generating constructive, practical strategies for public policy makers and innovative tools for private sector partners to achieve better results for families and communities.

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Executive Summary

Efforts to produce affordable housing remain essential, particularly in the face of a global pandemic that has only exacerbated the housing instability of millions of households. In Los Angeles County, rising development costs make these issues particularly acute and challenging. Innovations such as off-site construction could help unlock affordable and supportive housing production at scale. Though adoption of modular and other off-site techniques has been incremental in Los Angeles, stakeholders from various industries and perspectives remain optimistic that these production methods have the potential to lower the cost and time required to develop housing (among other benefits). Yet, several obstacles remain before these advantages can be realized. Los Angeles County has the opportunity to address many of these obstacles through five primary interventions: providing cross-stakeholder education, improving permitting and approval processes in unincorporated areas, procuring funding support, adapting zoning and code requirements in unincorporated areas, and promoting economic development benefits. Off-site construction is not a panacea to all housing production challenges, but intentional leadership and support from Los Angeles County can catalyze off-site methods' growth as an important tool for expanding housing options in Los Angeles and beyond.

Introduction

The need for additional housing supply in Los Angeles County—and specifically more affordable and supportive housing—is broad, acute, and urgent. However, the high costs, complexity, and lengthy development timelines create barriers to meeting supply targets in LA County's 88 cities and in its unincorporated areas (where LA County controls permitting and land use entitlements). While policy change and additional subsidies are critical to expanding housing supply, there is also a need to promote private sector innovation to bring down the costs of development. One emerging innovation, off-site construction, holds the potential to simplify the delivery process by reducing the time and cost required to construct housing units. Off-site approaches—also referred to as industrialized construction—bring a portion of construction to factory facilities to streamline production by optimizing labor use and assembly sequences compared to traditional on-site methods.

This report explores the potential for expanding modular construction in LA County, particularly as it applies to affordable and permanent supportive housing (PSH). The analysis begins by providing an overview of the county's housing needs, the goals set forth for housing production, and the policy environment. It then offers an overview of off-site construction and the capacity of existing infrastructure to deliver on its potential benefits. Then, drawing on interviews with a broad range of stakeholders, the report details interventions that LA County could pursue to remove barriers to the expansion of off-site construction methods to meet the county's housing supply needs.

A Note on Research Methods

The findings and recommendations in this report draw on data gathered through 35 semi-structured interviews with a broad variety of professionals, including off-site manufacturers, architects, general contractors, union trades, real estate lenders and investors, housing developers (both market-rate and affordable/supportive), and public officials at the city, county, and state levels. We included those with and without off-site project experience to understand both the benefits and constraints to using modular construction for affordable housing. Interview questions centered around the most appealing features of off-site methods, the lessons learned from those with project experience, and the extent to which the methods delivered on the purported advantages. Questions also addressed the barriers to fulfilling off-site's potential and suggestions to overcome them.

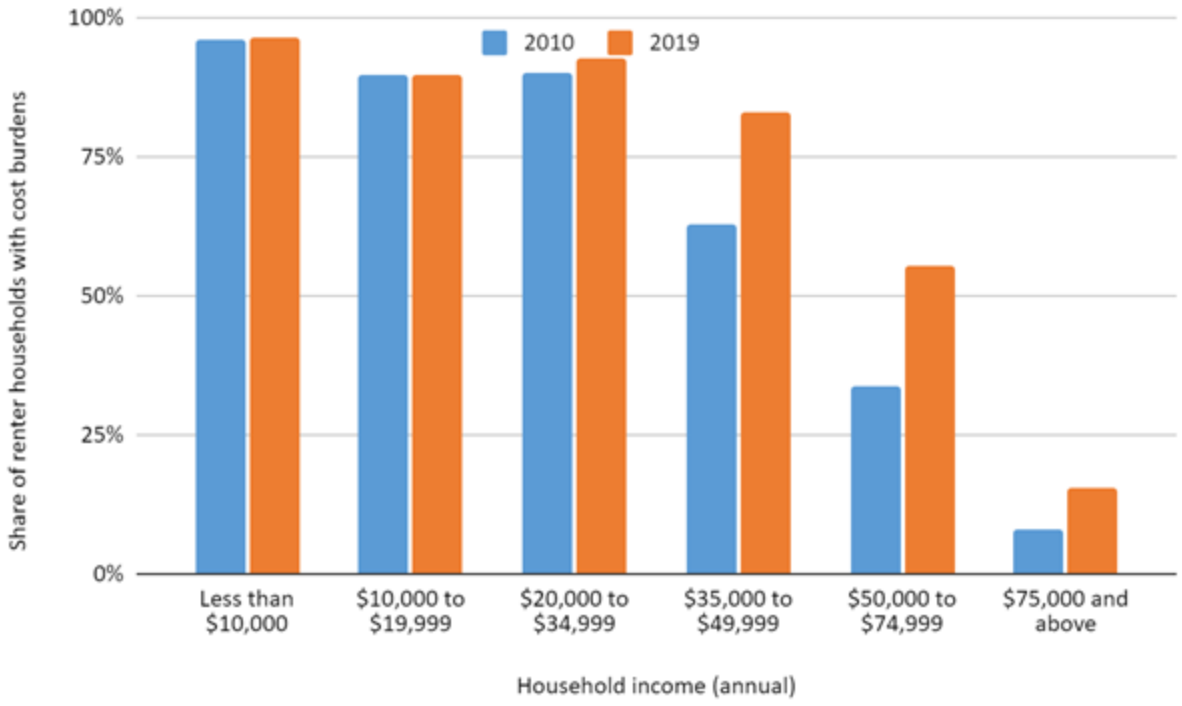
Background

Rising Needs

Los Angeles County's housing market has an ongoing—and growing—need for increased housing supply. The mismatch between supply and demand has led to rising housing cost burdens in the past decade. Increases in typical rental costs have outstripped median household income growth by more than threefold over the past two decades, after adjusting for inflation: LA County's median household income in 2019 was up 16 percent relative to 2000, but median gross rents climbed by more than half (51 percent) over the same period.

As a result, renters in the county are increasingly cost-burdened. Over 75 percent of households with an annual income below $50,000—over 700,000 households in total—spent 30 percent or more of their income on rent in 2019 (Figure 1). Over the past decade, the lack of supply has placed pressure on higher-income households as well. Among households making between $50,000 and $75,000 a year, there was more than a 20-percentage point growth in the share of cost-burdened households between 2000 and 2019.

Figure 1: Proportion of Rent-Burdened Tenants by Income in Los Angeles County, 2010 and 2019



Source: American Community Survey 1-year estimates, Table C25074. Cost burdened is defined as paying more than 30 percent of income towards housing.

These rent burdens contribute to rising numbers of individuals and families experiencing homelessness in Los Angeles County. Annual point-in-time counts from 2017 to 2020 have shown a notable uptick in recent years. The 2020 numbers were up more than 13 percent compared to 2019: a change that represents over 7,000 additional homeless individuals in one year, meaning that in 2020, more than 66,000 people in LA County were unhoused at a given point-in-time.[1] Of these, 21,500 individuals are chronically homeless, 7 percent are between the age of 18 and 24, and nearly 10 percent are over the age of 62.[2] Additionally, Black people make up only 8 percent of the total population of LA County while they make up more than a third of the population experiencing homelessness, which highlights deep disparities, rooted in systemic inequities, in who is most impacted by housing affordability challenges.

The pandemic has likely exacerbated these challenges. A Terner Center report published in August 2020 estimated that nearly a third of the California renter households that experienced job loss as a result of the pandemic lived in LA County.[3] In late August, a joint study from UCLA and USC found renters in LA County were experiencing severe financial distress, with more than half (in a survey of over 1,000 households) reporting that they had lost income since mid-March.[4] These findings reflect the fact that renters are more likely to work in the service

industries that have been hardest hit by efforts to slow the spread of the virus. Renters and employees in these industries are also more likely to be people of color, meaning that the current crisis threatens to worsen racial and ethnic disparities. The vulnerability of these workers and households to housing insecurity, eviction, and homelessness is only likely to continue as rent arrears add up and waves of much-needed federal COVID-19 relief takes time to roll out.[5] And because the annual point-in-time count scheduled for 2021 was postponed due to the ongoing pandemic, the full impact of the pandemic remains unclear.

Rising Expectations

Though there are numerous factors contributing to the affordability crisis in LA County, one driving factor is a chronic undersupply of new housing throughout the region. For the past several decades, the county has produced less housing than its targets under the Regional Housing Needs Allocation (RHNA) process.[1] For the 5th RHNA cycle, which spans the 2013 to 2021 planning period, the jurisdictions across LA County were collectively allocated 179,698 units, including over 73,000 units for very low- and low-income households. As of 2019, Los Angeles County as a whole was vastly below the targets set for the three lowest-income housing brackets with the largest numerical gap in the very low-income segment (Table 1). Just six out of the 89 jurisdictions within LA County (less than 7 percent) are on pace to meet their RHNA goals. Unincorporated LA County—which has the second highest RHNA target after the city of Los Angeles—has seen permitting levels largely remain at Great Recession-era lows over the past decade. As a result, unincorporated LA County met less than one-quarter of its 27,000 unit target by 2019.

The next RHNA cycle—the 6th, which is set to start in October 2021—has set even more ambitious goals for the region as a whole and for LA County. LA County will be expected to produce more than 800,000 housing units by October 2029, including more than 200,000 very low-income units,[6] which only increases the urgency and pressure to deliver more housing faster and more affordably.

[1] RHNA is a set of income-bracketed housing production targets set by the state of California in 8-year cycles, quantifies the unit production needed for the state to keep pace with estimated future housing needs. The state apportions targets to regional metropolitan planning organizations (MPOs) that allocate those production goals across jurisdictions within their region. More information available through HCD: https://www.hcd.ca.gov/community-development/housing-element/index.shtml

Table 1: RHNA 5th Cycle Progress in Los Angeles County as of 2019 (Cycle Ending 2021)[7]

Income level	RHNA unit target	Units permitted to date	Percent completed
Very low income (0-50 percent Area Median Income (AMI))	45,626	7,866	17.24 percent
Low income (50-80 percent AMI)	27,440	5,056	18.43 percent
Moderate income (80-120 percent AMI)	30,011	3,617	12.05 percent
Above moderate income (120 percent AMI or more)	76,621	125,751	164.12 percent
Total	179,698	142,290	79.18 percent

Source: California Department of Housing and Community Development

Figure 2: Total Permitted Units in LA County Unincorporated Areas[8]

Source: Construction Industry Research Board, 2000-2018, retrieved from SCAG Local Profiles Report 2019

Meeting these supply targets is particularly difficult given the high costs of development in the Los Angeles region. A recent Terner Center analysis found that the average cost per unit for projects in California using 9 percent Low-Income Housing Tax Credit (LIHTC) funding increased by over 17 percent between 2008 and 2019.[9] Projects in the LA region show a $64,000

per unit cost premium compared to California's inland regions. The main drivers of the increase are hard construction costs, which include labor and materials.

How we expect buildings to perform has changed and expanded over time as well. Especially in California, building codes are regularly updated to meet high standards in areas such as energy efficiency, structural resilience to seismic events and other natural hazards, air filtration, and even quality of life measures like daylighting. These regulations all contribute to the complexity and costs of new development projects.

In addition, despite the fact that affordable housing is targeted to lower-incomes, it can often cost more to build a subsidized unit than a market-rate unit. Previous Terner Center research revealed that, comparing 240 multifamily housing projects built in California between 2009 and 2018, fully affordable projects cost an additional $48 more per square foot than those with only market-rate units or units at mixed affordability.[10] This difference disappeared after controlling for project size, potentially implying that affordable housing developers are not able to capitalize on the efficiencies of scale attained by market-rate developers. Additionally, affordable and supportive housing projects are designed to meet a variety of supplementary policy objectives and can require a project to provide community space and on-site services for permanent supportive housing projects, which serve individuals previously experiencing homelessenss. The balance between achieving multiple goals and adding costs to a project is a question of increasing importance, given that construction costs have been on the rise across the state.[11] The Terner Center analysis of LIHTC construction costs found that sustainable design features increase the upfront per-unit costs by 4 percent on average (though they can save on operational costs during occupancy), and that, overall, PSH projects are the most expensive to build per square foot.[12]

While all of these goals have merit, taken together they not only increase expectations of what these projects must deliver, but they also increase the costs of building. These costs are in tension with the need to meet ambitious housing production targets.

Policy and Funding Context

To address the above demands, policymakers and practitioners at the local, regional, and state level, as well as private sector firms, have been pursuing a number of pathways to accelerate more cost-effective housing production across the state. These include legislative actions to streamline development, new sources of local and state funding for affordable housing, and private sector innovations. The details of the various approaches can interact with the dynamics of off-site production methods in both constructive and prohibitive ways.

Legislation and Ballot Measures

Recent legislative efforts have focused on proposals to incentivize and ease barriers to the production of various forms of affordable and supportive housing. Two prominent policy strategies have the most direct influence on off-site construction methods:

- **Density allowances**: Increases to the zoned density through ordinance in Chapter 22.120 of the LA County Zoning Code, granted to projects with at least five units with affordable housing set-asides of at least 5 percent of total units (pre-density bonus) if made affordable to households at very or extremely low-income levels. The higher the proportion of affordable units and the lower the income level provided for, the higher the resulting density bonus offered; this ranges from a 5 percent bonus for projects with 10 percent of its units dedicated to moderate-income households (120 percent AMI) to 120 percent for projects with all of its units set at extremely low-income levels (30 percent AMI).
- **Streamlined approvals**: The State of California's Ministerial Approval Program, enacted following the 2017 passage of SB 35 introduced by Senator Scott Wiener, requires local governments to streamline affordable housing projects that qualify as urban infill. This allows said projects to forego environmental review under CEQA, eliminates the discretionary approval powers of planning commissions and city councils, and sets a maximum time limit for the local government to respond to the permit application.[13] AB 2162 and AB 101, both enacted in 2019, requires by-right, streamlined review of supportive housing and shelter projects that meet certain criteria in zones that allow multifamily projects.[14] LA County again surpasses the statewide legislative requirements in this regard, and the impending by-right housing ordinance from late 2020 allows for residential development in commercially zoned land and extensions of the by-right review for projects using a density bonus.[15]

In 2020, eight jurisdictions within Los Angeles County, including Santa Monica, Lancaster, and West Hollywood, independently voted on various sales, property, or utility tax measures to partially fund homelessness intervention efforts. Though seven of the eight measures passed, none of the funding is available to actually produce housing for homeless residents—a critical need.[16] The City of LA, on the other hand, passed several ballot measures in the last few years that expand incentives for affordable housing development located near transit (Measure JJJ) and bond funding for 10,000 units of PSH (Measure HHH). More details on these and other funds are provided in the next section.

The housing policies introduced for the 2021-22 legislative session at the state level cover many issues intended to accelerate housing production overall. These include exempted parking requirements for certain projects (AB 1401), ministerial lot splits on single-family parcels (SB 9), and several tools for generating additional funding for housing, including accessory dwelling

units (ADUs) (AB 561).[17] Though not all of these measures are likely to be signed into law, they offer insight into the direction of statewide policy strategies that local jurisdictions may choose to pursue independently.

Public Funding Sources

A multitude of funding programs at all scales of government continue to support affordable and supportive housing. Table 2 below provides a high level breakdown of some of the largest funds available in LA County.

Table 2: Funding Available for Affordable and Supportive Housing

Name	Source	For LA County*	Description
Affordable Housing and Sustainable Communities	State	$223M in 2019-20[18]	For new construction, rehabilitation, or conversion to affordable housing projects within a half mile of a transit stop; maximum per-project loan amount of $30M
Multifamily Housing Program	State	$108M in 2020	For new construction, rehabilitation, and preservation of permanent and transitional affordable housing
Low-Income Housing Tax Credit	Federal	$91M in 2019[19]	Permanent subsidy for the construction, rehabilitation, or preservation of affordable multifamily housing
Affordable Multifamily Rental Housing Fund	LA County	$55.2M for FY 2020-21[20]	For construction and permanent financing for affordable housing projects with at least 20 percent of units reserved for unhoused populations or those with qualifying mental illness or physical disabilities at or below 30 percent AMI; $1M-$5M maximum loan per project
No Place Like Home	LA County	$50M for FY 2020-21	For new construction and permanent financing for affordable housing projects with at least 20 percent of units reserved for formerly homeless populations; $7M maximum subsidy per project
California Housing Tax Credit	State	$48M in 2019**	Supplements the 9 percent federal LIHTC program for preservation and new construction of affordable housing projects. Same eligibility restrictions as LIHTC
Los Angeles City Affordable Housing Fund	City of LA	Varies	Since 2018, sourced partially through the linkage fees whose rates are on the order of $1-$20 per square foot of all new development in the City of LA[21]

**Funding amounts available vary significantly from year to year*

***In 2020, AB 101 provided an additional $500M to the program (separate from the continuous annual allocations), of which $75M was awarded to projects in LA County as of September 16, 2020*[22]

The Affordable Housing and Sustainable Communities fund, based on variable revenue from the state's cap-and-trade program, awarded more to projects in LA County than any other affordable housing program in the 2019-2020 funding cycle, totaling $223 million. This is part of a growing momentum for transit-oriented development (TOD) aimed at incorporating transportation-based goals to reduce automobile dependency through housing projects, though this can be difficult depending on project-specific context. Additionally, federally-allocated LIHTC, combined with the state-supplemented equivalent, are among the most consistently utilized sources of public subsidy for affordable housing, providing combined support for projects in LA County of nearly $140 million in 2019. Other state direct subsidy programs like the Multifamily Housing Program (MHP) offered over $100 million in funding to affordable housing as well, while smaller annual funds like the LA County-led Affordable Housing Trust Fund and No Place Like Home funds will each provide over $50 million in awards for PSH for individuals experiencing homelessness. Several smaller annual funds exist at the state level, including CalHOME, Housing for Healthy California, California Emergency Solutions and Housing (CESH) for homeless housing interventions, and the Veterans' Housing and Homeless Prevention Program, as well as the Golden State Acquisition and Local Housing Trust Fund for affordable housing more generally. LA County Development Authority also administers annual funding through its multifamily bond financing program, which has issued over $650 million in tax-exempt bonds since 1984. LA County receives and administers grants through HUD's HOME program for affordable housing and the Continuum of Care Program for supportive housing, which includes the three McKinney-Vento Homeless Assistance Act of 1987 programs.

In addition to these regular funds, however, several one-time state funding streams have increased the funds available for housing. Project Homekey (a follow-up from the similar but temporary Project Roomkey), which specifically targets vacant buildings like commercial motel buildings to renovate for PSH, has awarded more than $250 million to projects in LA County (as of November 2020).[23] In 2019, AB 101 passed to secure $500 million in state tax credits for affordable housing, another $500 million for the mixed-income housing program (which otherwise has about $40 million in funding per year), and $650 million for homeless housing support.

At the local level, the City of Los Angeles passed Proposition HHH in 2016 to secure $1.2 billion to help meet a goal of producing 10,000 units of PSH in ten years. The measure included a set-aside to promote innovative approaches (which included off-site construction) to reduce costs. However, the ambitious targets set forth by Prop HHH have thus far not been met; as of November 2020, nearly all of the funding was allocated but only five projects (totaling 384 units) were completed. While more than 7,000 additional units are in the pipeline across 106 projects, more than two thirds of these have yet to begin construction and the majority of units are not planned for occupancy until 2023 or beyond.[24] Delays in the timeline for some projects

are partially due to higher costs per unit than expected, with more than three quarters of the units in the pipeline estimated to cost more than $500,000 per unit to deliver and a third projecting unit costs of more than $600,000. The estimate for projects in pre-development increased by over 10 percent between 2019 and 2020, and the full impact of the pandemic may further increase the time and cost required for these projects.[25] Despite the challenges, the City of LA is focused on highlighting early lessons learned and promoting best practices for the remainder of the HHH projects as well as its supportive and non-supportive housing pipeline more broadly.

It is important to acknowledge that while the variety of sources reflect and take advantage of the diverse interests and mechanisms for funding affordable and supportive housing, individual projects typically need to weave together multiple disparate sources to make a project feasible. Especially if and when said sources have misaligned incentives, programmatic requirements, and other restrictions which can or cannot be combined, projects can be burdened with layered complexity and administrative overhead that strain the housing development calculus. Furthermore, the collective magnitude of public funding available may still not be enough to fully address the full need for affordable and supportive housing. Many of the funding sources described above require extensive applications for each request but are only able to award a fraction of the requested funds and projects.

Private Sector Innovation

In addition to public sources, private organizations have dedicated substantial funding to accelerate affordable housing development in metropolitan regions most affected by rising housing costs. Venture capital as well as large regional employers (especially tech firms like Amazon, Apple, Google, and Facebook) have promoted startups and other organizations pursuing housing delivery strategies that can scale production in financially, environmentally, and socially sustainable ways. Large philanthropic organizations pursuing similar innovation in parallel and intersectional ways can improve and amplify private efforts. This assortment of funds might also catalyze potential solutions for housing affordable to households between 80 percent and 120 percent of AMI, which does not qualify for public funding support. At present, the variety of strategies and commitments—spanning across many forms of financial, technological, and organizational innovation—are too nascent to fully determine their effectiveness, and one-time infusions of capital carry different implications for financing strategies than ongoing funding streams. But the diversity in sources and interest in tackling these questions mean that new perspectives and ideas to address housing demand are being given increased attention.

Off-Site Construction

"Off-site" or "industrialized" construction are umbrella terms typically used to refer to a broad selection of building techniques in the U.S. that produce parts or all of a housing unit off-site, and then assemble and attach the units to a foundation on the project parcel. Modular construction (sometimes called "volumetric modular") usually refers to a specific strategy that involves building fully formed "boxes" built in a factory setting. These terms are generally used as distinct from "manufactured housing," which uses methods similar to modular applications but exclusively for single-family homes that are not attached to on-site foundations. They thus conform to a fundamentally separate set of building codes defined predominantly at the federal level.

While off-site methods have been a longstanding segment of the construction industry in countries like Sweden and Japan, adoption in the U.S. has accelerated only recently.[26] Even so, expanding venture capital interest and investments have spawned a diversity of approaches in a short amount of time, with notable growth in software innovation. This has enabled streamlined communication and coordination throughout all project phases as well as increased potential for automation in the factory production process.

Although off-site methods vary in their specific techniques and mechanisms, their adoption is often motivated by a handful of perceived benefits. Table 1 below highlights some of these benefits and summarizes the progress to date on the realized advantages, according to the independent insight from industry professionals interviewed for this report.

Table 3: Perceived Benefits of Off-site Construction in the U.S., Potential and Status

Potential Benefit	Description	Status/Progress*
Time savings	Due to labor efficiency in factory settings and simultaneous streams of on- and off-site work	**Realized** Multiple projects have seen measurable improvements in their project schedule, reducing timelines from breaking ground to occupancy by 10 – 30 percent.[2]
Workplace safety	Due to the reduction in on-site labor and the lower risk of in-factory tasks	**Realized, but more evidence needed** Though no formal study has measured the reduction of workplace injuries due to off-site methods, stakeholders reported that their experiences support this perceived benefit.
Cost savings	Due to savings in total project time (reducing interest paid on construction loans and generating revenue sooner) and increased labor productivity	**Inconsistent but promising** While a number of projects *have* seen cost savings, results have been mixed and few detailed comparative analyses have been completed to date.[2] Most respondents estimated that current off-site methods seem to be "as expensive" as site-built practices, with some estimating savings in the range of 10-20 percent compared to traditional construction methods both now and in the future.
Quality improvement	Due to the implementation of stringent QA/QC procedures in a factory setting	**Inconsistent but promising** Several stakeholders reported noticeable quality improvements in elements such as finishes and code compliance for factory-built units. Others reported no noticeable difference, and a few experienced prohibitive quality issues. Most believed that quality would improve in time.
Sustainability	Due to material savings and increased energy efficiency	**Promising** Research suggests off-site methods can reduce material waste and efficiently incorporate sustainable design features,[27] but more long-term studies are needed.[28]
Economic/ workforce development	Due to employment opportunities and potential for skilled labor training in factory facilities	**Promising** Many see this as an important component and advantage of off-site methods' expansion, especially for local production. This belief was held even among manufacturers planning for more automation in their factory.

[2] A Terner Center case analysis of an affordable housing project in San Francisco found that using off-site methods, combined with streamlined approvals and flexible, non-public capital, led to approximately 25 percent reduction in cost and 5-20 percent reduction in construction time.

**Qualitative insight aggregated from stakeholder interviews conducted for this report*

In general, the feedback regarding the state and potential of off-site methods in LA County (and California more broadly) was optimistic. While not all of the above benefits have been consistently achieved, the overwhelming majority of those we interviewed believed it was not a question of "if", but "when" such innovations are reliably successful. California is well-suited to see an expansion of modular construction, partially because such methods tend to favor regions with high demand for both housing and skilled construction labor.[29] The San Francisco Bay Area has seen the largest share of local off-site multifamily producers and projects in the state, with a variety of approaches capitalizing on advanced software and manufacturing automation innovations using both steel and wood building materials.[30] In Los Angeles, by contrast, many of the completed projects that used modular have done so with units imported from outside California; some of the projects both completed and in the pipeline utilize modified or custom-created shipping container-style steel products, including modules imported from manufacturers in China.

Among respondents, there was broad consensus that there is a market for increased modular production. The uptick in interest in the accessory dwelling unit (ADU) market—whose potential was recently unlocked by statewide legislation—as well as the need to replace housing devastated by wildfires has led several modular producers to target single-family home production. However, most industry professionals interviewed both within and external to off-site production believe that multifamily construction holds the most promise for scaled modular solutions. This is largely due to the greater potential for repetition in multifamily projects, which is needed for modular techniques in particular to realize their full advantages.

Why Off-Site Methods Can Be Well-Suited for Permanent Supportive and Subsidized Housing

The risk associated with innovation is typically first adopted by businesses in the private market. However, the off-site construction market has seen a substantial portion of its early projects in the U.S. in publicly-subsidized affordable and supportive housing. There are a few reasons for this. First, off-site methods require a minimum number of units (and minimal amount of unit variety) to be able to realize the benefits of scale that come through repetition. This misaligns with the high degree of customization of finishes, architectural forms, and unit layouts that market-value multifamily properties often feature. Second, because public funding sources have specific timelines and labor wage requirements, affordable housing projects are sensitive to (and desirous of) strategies that can reduce the labor or time required for construction. Supportive housing projects that favor studio apartments also translate well towards the standardization and dimensions of a singular modular unit produced off-site. Lastly, several of the off-site manufacturers entering this space early on have value-driven leadership who are intentionally pursuing the affordable housing segment because of the nature, scale, and consequences of the affordability crisis.

Challenges and Limitations

Despite the benefits of modular construction, interviews also highlighted some major challenges and limitations to bringing industrialized housing production to scale.

- **Developable sites, especially in infill locations, rarely allow for standardized building designs**. More than one practitioner described this as "the Snowflake Problem": every site is different. Partially due to their constrained design flexibility, off-site production methods typically favor sites with more predictable elements. Sites with irregular shapes, limited road access, or uneven ground or other topographic changes can be problematic for modular methods. While hybrid off-site solutions like flat pack or kit-of-parts approaches that do not require large cranes or wide shipping lanes can work to overcome site-specific challenges, the U.S. market currently has limited competitors in these types of solutions.
- **Modular construction is capital intensive, and the timing of capital needs does not align with typical funding models**. Off-site strategies can reduce the total cost required to develop and construct a housing project. However, full volumetric modular products in particular (as compared to more hybrid methods) typically require large capital investments to procure factory production facilities, which could then take

months to output units and even longer to do so at full capacity. Capital constraints can also emerge as a challenge at the project level: the total construction costs might be lower, but developers need to commit a sizable deposit—often in the range of 20 percent of the total modular cost—to secure a "spot in line" in the production pipeline. The payment timing creates a challenge for projects using public subsidy due to restrictions or timing of payment schedules from the funding sources.

- **Modular construction requires a consistent stream of demand and firm commitments for new units, which is at odds with real estate cycles as well as uncertain development timelines**. Modular firms strive to align at least 1 to 2 years of projects to "keep the lights on" in their production facility at all times. For this reason, one modular firm said the goal is to be "like airlines: you always have to be overbooked." Even a temporary closure due to stalled projects could mean that firms have to lay off factory workers. When the facilities reopen, some workers may not return, requiring the off-site producer to find and train a new workforce. Some established producers have come up with creative ways to cope with short-term production pauses, including cross-training of factory labor or diversifying building types so that smaller projects like single-family homes (or ADUs) can fill the gaps when needed. But this can prove challenging depending on the technology or facilities being used, and the lack of consistent business can be catastrophic for newer companies.
- **Real estate development and factory production are not the same**. The mindset and mode of operation of a factory is oriented towards relatively continuous production. Real estate development, by contrast, is mostly project-centric, and the contracts and partnerships function on the basis of fragmented phases of variable length with a high frequency of unpredictable delays. Successful projects both within and outside the U.S. imply that these two processes can coexist, and promising advancements in the software and automation behind off-site construction suggest more holistic flexibility than traditional assembly line processes. But in their current state, the different functions and procedures driving real estate and factory production are not necessarily easy to align.
- **Limited knowledge prevents wider adoption of modular**. Because so few projects using off-site methods have been completed in California, and because it is difficult to compare performance metrics like cost and schedule across projects with different characteristics, there is still a lot to learn about industrialized housing production itself as well as its integration into traditional development processes. The industry needs to invest in continued research and development to refine the potential and expectations of off-site methods.

As off-site production expands and improves, aspects of the above limitations will diminish in importance. At present, industrialized methods can still offer substantive benefits for projects and contexts that minimize the uncertainty of housing development.

Opportunities for Growth in Los Angeles County

To date, only a handful of projects using off-site methods have been completed in Los Angeles County (Table 3). Each of the three projects experienced minor obstacles in coordinating and acclimating the various public and private stakeholders to the nuance of alternative delivery methods. Some intermittent delays due to prolonged entitlement and permitting approvals as well as misaligned production schedules between on- and off-site work limited the potential benefits of modular methods. Despite these challenges, many of the stakeholders involved in those three projects have additional projects in the pipeline that plan to use off-site production.

Table 4: Overview of Three Completed Off-site Projects in LA County

 *(Source: Skid Row Housing Trust)*	**Star Apartments** **Year completed**: 2013 **Stories**: 4 over podium **Unit composition**: 102 studio units **Developer**: Skid Row Housing Trust **Architect**: Michael Maltzan Architecture **Off-site producer**: Guerdon (Idaho)
 *(Source: CRATE Modular)*	**Colden Avenue Apartments** **Year completed**: 2018 **Stories**: 3 **Unit composition**: 8x4-bedroom units **Developer**: Flyaway Homes **Architect**: VTBS Architects **Off-site producer**: CRATE (Los Angeles)
 *(Source: KTGY Architecture)*	**Hope on Alvarado Apartments** **Year completed**: 2020 **Stories**: 5 **Unit composition**: 84 studio and 1-bedroom units **Developer**: 166 Alvarado, LLC **Architect**: KTGY Architecture + Planning **Off-site producer**: Manufacturer in China

Only one of the three completed projects used a local manufacturer—CRATE Modular. Over the last five years, CRATE has been the only producer with facilities in Los Angeles County that has completed project experience in affordable multifamily housing, according to knowledgeable industry respondents. CRATE use recycled shipping containers for all of their projects and began by building schools and other formerly homeless housing around the broader Southern California region. They have the capacity to produce 4,000 square feet of space per week. At least two nearby producers—Plant Prefab with a factory in Rialto and Proto Homes in downtown Los Angeles—are primarily oriented toward single-family home and ADU projects but claim to have the capacity to produce for low- to mid-rise multifamily projects. Because of the recent emergence of off-site production overall, the landscape of firms with local production is likely to change and expand in the coming years. Despite this lack of local production, producers in

Idaho, Colorado, and elsewhere remain cost competitive to site-built methods due to the greater availability of land and labor outside of California. Additionally, the adjacent ports of Los Angeles and Long Beach—two of the busiest ports in the country—allow developers to tap into the international capacity for industrialized construction without severe transportation cost burdens for oversea routes.

Interviews with industry professionals conducted for this report suggest more than a dozen additional projects in LA County are planning to incorporate off-site manufacturing in the coming years. Some of these are already under construction, including several PSH projects supported through Prop HHH funds.

The interest in the use of off-site for publicly-subsidized projects might underscore the points of friction in the housing delivery process at large. Every factor of housing development that introduces uncertainty—be it in the entitlement, permitting, or construction phase—can add costs or create stumbling blocks to production. But such challenges can be problematic for affordable and supportive housing projects (which often have additional time- and performance-based constraints tied to each public funding source), and even more complex for projects utilizing off-site construction methods (which have factory production schedules with multiple projects in the pipeline at any given time). Thus, policies that reduce uncertainty will likely serve to benefit affordable and supportive housing development in addition to the off-site manufacturers that can supply it. Los Angeles County could improve consistency in critical processes, catalyze progress toward greater adoption of these methods, and help realize and expand the various potential benefits of these innovative approaches. The following recommendations highlight key opportunities for the county to advance these goals as part of its broader policy playbook around increasing housing production for its most vulnerable residents.

1. Recommendations for Process

Streamline local review and inspection processes for projects using off-site methods. One of the greatest drivers of uncertainty in the development process relates to entitlement and permit timelines.[31] Any change that increases the predictability of the entitlement, permitting and approval, and inspection process is essential to ensuring high-quality homes can be produced cost-effectively regardless of their construction type and housing segment. For modular projects, there is an added reason to streamline building permit approvals in particular because the California Department of Housing and Community Development (HCD) limits the scope for local plan review. HCD coordinates the inspection of factory-built units in the factory directly, removing related building components—like the insulation of a wall assembly sealed before leaving the factory, for example—from the local jurisdiction's scope for review and comment. This decreased scope might justify a reduction in

the time allowed for local permitting review. And in jurisdictions where plan submission fees are not based directly on the staff time required for review (some are instead based on a project's total floor area), exceptions for projects utilizing off-site methods could reflect the reduced scope for local assessment. LA County could set the standard for these practices in unincorporated territory.

Simplify and standardize the permitting process. Clear and consistent permitting review and enforcement processes would also allow off-site producers to take advantage of their potential to standardize less variable and important features in the city and county-specific plan sets, like accessibility minimums, material requirements unique to a given jurisdiction, or detailed site requirements from the fire department. While many architects already do this to an extent, sophisticated industrialized construction firms are able to embed these features not just into their unit-level plans, but into their assembly operations. This ensures that they are incorporated into every unit and project in design and construction by default. The advantages are then adopted within the procedural standards of the firm rather than just an individual employee's knowledge and habits. To the degree that this is possible, even simple improvements like consistent formatting in project plan submissions can make it easier for government staff (or 3rd party organizations contracted to do plan review) to quickly recognize any issues requiring revision. To encourage and accommodate this mutually beneficial standardization, LA County could pre-approve certain construction and/or installation details attached to building permits to ensure building standards are being met while also increasing predictability and decreasing the time required for permit review. There is precedent for this in LA County's conventional light-frame construction details (the Type V sheet) made available as a building department handout for single story residential construction projects, but the County could consider establishing similarly robust standards for other project types.

Consider establishing a core staff team for off-site construction project review. In addition to the procedural changes above, LA County could develop a core team of staff members in the planning and building departments that are responsible for review and approval of projects using off-site construction methods. In doing so, the County may target training towards a specific subset of staff members to develop this core competency and expertise rather than retraining entire departments. This would establish consistency in communications with developers and other members of a project team while simultaneously maximizing learning opportunities for the local staff in the limited number of early projects utilizing off-site methods. On the other hand, attempting to formally divide internal expertise in this manner might create an additional potential bottleneck if there is a sudden influx of projects using industrialized construction, or if high staff turnover is a persistent problem. LA County should determine a balance that fosters internal expertise for reviewing projects using off-site methods while minimizing risk of complications during the permit approval and inspection processes.

2. Recommendations for Code Requirements

Planning Department

Land use regulations—and particularly zoning codes that influence what is built—are a key barrier to realizing the potential benefits of industrialized construction. Los Angeles County, which sets the land use regulations for its unincorporated area, could support off-site construction for affordable housing by increasing the height and density maximums—or even set broader minimums for the same metrics—in the area under its jurisdiction.

Create an exemption on height variances for modular projects resulting from per floor height regulations. Because modular approaches typically rely on "complete" units that each have their own floor and ceiling, the resulting buildings have "double" floor-ceiling heights as the stacking of the modules results in an increase in material between units. While the additional linear foot of material between floors benefits residents because it improves the thermal and sound insulation between units, it can also result in a total building height that is slightly over the height restriction of local zoning code. This can trigger issues in planning department review. In such cases, a developer either has to use one of their finite development concessions (if the project provides affordable housing) for the height restriction exception, or re-design the project to be one floor shorter (and effectively "lose" all of the additional units that could have been built). The density bonus ordinance allows projects providing affordable units to waive certain development standards as needed, but this can still prohibit projects not using the density bonus that are otherwise limited in the number of available concessions. In the worst case scenario, the height restrictions on what is a minor structural feature of modular projects could determine whether or not a project is deemed financially feasible and ultimately built.

Consider further increases in zoned density allowances and density bonuses. Density maximums can limit project size in a way that makes it more difficult to achieve the scale needed to realize the full advantages of off-site methods.[32] While costs vary significantly depending on many site-specific factors, several off-site manufacturers interviewed reported that a development could require 30-150 repeatable units or modules (with limited variation) to achieve the benefits of scale provided by off-site methods. Expanded density bonuses could incentivize not only a greater number of affordable units, but also make modular and other off-site methods a more attractive and effective option.[33] For some projects, the potential time and cost savings of industrialized methods could expand the number of units an affordable housing developer can build with limited funding sources. This policy shift would also align with LA County's density bonus and zoning concession language, which calls for "identifiable and actual cost reductions" in projects granted density bonuses—a purpose off-site methods can more easily achieve for larger projects. Increases in zoned density often meet with public resistance, however, and projects utilizing density bonuses can be delayed due to pushback from

local residents. This underscores the importance of expanded public education (discussed later) and for LA County leadership to balance existing community preference with urgent housing demand in unincorporated areas.

Review Title 22 (LA County's zoning ordinance) for other potential conflicts. While the above suggestions were specific recommendations that surfaced in our interviews, it is likely that other aspects of the zoning ordinance may require clarification for projects utilizing off-site construction methods. County staff should review the zoning code through this lens to address any areas of confusion or avoidable misalignment.

Building Department

Simplify and align restrictions in building codes. In addition to zoning code, building codes can also limit the adoption of modular construction. While building code requirements are intended to meet accessibility or environmental sustainability goals, the complexity of the building code system makes it harder to standardize modular units. For example, respondents commented on the specificity of some of these standards which can include stipulations around minimum linear feet of closet space, full wheelchair access around three sides of a bed, or a designated minimum amount of space to allow for a couch. This makes it difficult to optimize the unit design while maximizing the unit capacity of projects. Some requirements may be tied to specific funding sources use, but those in the building codes should be revisited to mitigate unnecessary specificity and layered complexity. More flexibility around specific design requirements–while maintaining the underlying objectives—could streamline project development and expand the opportunities for modular construction.

3. Recommendations for Funding

Flexibility

Provide more flexibility to requirements on local funds. The various public subsidies needed for an affordable housing project often have different requirements and restrictions that can add layers of complexity to every phase of the development process.[34] Some of these public funding sources are controlled at the state or federal level, outside the purview of Los Angeles County. But according to industry practitioners, gap funding is frequently provided by city or county governments. Often, it is these local sources of funding that tend to have "the most strings attached" to their use, according to respondents. These additional criteria can include specific design requirements like those mentioned in the previous section that make it difficult to achieve and optimize standard and efficient unit design that can benefit from off-site

production. In addition, the structure and sequence of off-site production does not always align with the layered webs of funding source timelines and requirements.

Structure LA County funds to allow for deposits for off-site production. One of the more common challenges reported by affordable housing developers was that volumetric modular approaches typically require up-front deposits to cover a portion of the cost of materials and to reserve "a spot in line" of the factory pipeline. The deposit is often in the range of 20 percent of the total modular cost, which can be several million dollars depending on the project size. Certain public subsidies, however, may not allow funds to be applied to cover a deposit or be deployable that early on in a project. For affordable housing developers, this means that they have to find even *more* funding sources with the flexibility needed, put their own liquidity at risk (if they have enough), revert to traditional site-built methods, or abandon the project altogether.

To address this, LA County could structure some of its funding to seed a revolving loan fund that could provide short-term assistance for projects that require up-front deposits. The loans could be replaced by more permanent sources once the project is further along (and possibly before completion). This would allow for a continual stream of capital that could be put toward modular projects and elicit cost savings over time.

Revise per project maximum cost levels to increase the scale of affordable projects. Many affordable housing programs have maximum per project spending caps. This ensures that housing funds can be distributed across many projects, but in practice, this tends to limit the number of units an affordable housing developer can build.[35] A consequence of this limitation on project size is that it becomes more difficult to achieve the scale of unit production to make off-site methods feasible. For example, one respondent claimed that, in LA County, based on the scale and complexity of aligning multiple public subsidies, projects with roughly 50-80 units seems to be the "sweet spot" for affordable housing projects to be feasible. However, this could be at the low end of what many off-site producers see as a *minimum* unit threshold for industrialized methods to reliably achieve substantial cost and time savings, with ideal project sizes of 100 or more units. Some developers in Los Angeles have overcome this challenge by establishing multiple-project partnerships with an off-site producer to ensure that enough repeatable unit designs are included to produce substantive cost and time savings. But exceptions to funding caps (or removal of per project maximums altogether) for LA County funding sources could help affordable and supportive housing projects reach their maximum unit potential and make it more feasible for industrialized housing producers to meet the demand.

Ease or adjust LA County funds' stakeholder requirements. Some funding sources include requirements on stakeholders that can complicate and sometimes unnecessarily push

out the timeline to complete affordable housing projects. For example, some require the major project partners (developers, namely, but potentially architects as well) to have previous experience working on affordable housing projects. If a developer hires a firm without sufficient experience according to the program terms, they may have to bring on additional consultants or other stakeholders to fill in the gap, adding further complexity to the map of project partners and more costs to a developer's administrative overhead. While this requirement may help ensure completion, it does disincentivize developers from seeking new project partnerships, such as those that include off-site producers as principal partners. The extended map of project stakeholders could further discourage industrialized construction firms from seeking out affordable and supportive housing projects despite the high demand.

Other requirements from public subsidies might stipulate that a developer choose partners based on "best value," particularly in regard to general contractor bids. Projects designed for off-site production are particularly vulnerable to pressure to move forward with a contractor (and other subcontractors) who submits a low bid compared to others as a reflection of their lack of experience with alternative construction types. Different off-site producers may also have different operating standards regarding who is responsible for transportation, on-site assembly, or providing in-unit furniture for modular units. As a result, general contractors might assume different scopes of work from each other, making direct comparisons impossible. The situation represents a potentially difficult but important choice between a partner's experience with affordable projects, their experience with off-site production, and many other qualitative project dynamics. However, one public funding source might have language that dictates a developer's decision in choosing between bids without considering these tradeoffs. This can put affordable housing developers and projects using innovative methods at additional risk by incentivizing low cost contractor bids without properly balancing other considerations.

Coordinating and Aligning Public Funding Sources

Align the terms and approvals for funding across development phases. LA County should seek to coordinate the terms and processes of disparate funding sources to be complementary and not conflicting. This is true for capital subsidies (discussed above) as well as for funds meant to cover operating costs of affordable and supportive housing projects. For example, a project that receives an award of upfront capital to develop their project can be rejected for more long-term funding through Section 8 project-based vouchers; these are administered through LA County Development Authority (LACDA) as well as the Housing Authority of the City of Los Angeles (HACLA), depending on jurisdiction. When this happens, the projects in question are effectively put on hold until further notice and the project stakeholders are left stranded. LA County should work with HACLA to better align approvals for capital subsidies with long-term programmatic subsidies so that the critical efforts made to

accelerate project development upfront are not undermined by challenges to secure crucial project services during occupancy.

Public Land

Evaluate LA County-owned land for affordable housing projects using off-site methods. Because the global pandemic and resulting economic stress will continue to strain the resources of city and county governments, other forms of financial support might be more feasible in the near term. One critical avenue already being explored by LA County is the use of public land for affordable and supportive housing. In fast-moving housing markets, land acquisition can be an especially challenging obstacle for affordable housing developers attempting to align multiple funding sources to complete a deal. While housing development in general—and off-site production methods in particular—are not appropriate for every site, making more public land available for housing could still meaningfully support housing without putting too much additional strain on the limited government resources. Additional means of supporting off-site construction could come in the form of explicit calls for industrialized construction in any RFPs for housing on public land. A high level assessment of which parcels are well-suited for off-site methods—such as being relatively flat or having similar sizes and shapes—could further encourage and take advantage of the potential benefits of scale for industrialized housing construction.

Bonding Requirements

Allow alternative liability protections for projects using LA County funding. A construction bond is a specific surety bond type that protects against financial loss or disruption to investors due to a contractor's failure to meet certain specifications as defined in a project agreement. Many public sources of affordable housing funds have bonding requirements that are difficult for off-site manufacturers—particularly those without a long project history—to incorporate. This is partially because they might not have the liquidity to cover the full scope of off-site work, which often comprises a third or more of the total project cost (more than any single subcontractor in a traditional site-built project). Combined with a general unfamiliarity with the nuance of off-site construction methods, these conditions make many financial institutions unwilling to offer products or bonding terms that align well with off-site methods. To overcome this barrier, some off-site producers incorporate insurance packages directly into their services that imitate the liability protection of a bonding agreement. But many do not, and even the alternative approach may or may not fulfill the rigid requirements tied to a public funding source. LA County should evaluate any such requirements in their available funds and allow for alternative means of risk protections without putting unnecessary burden on off-site manufacturers attempting to address affordable housing needs.

Catalyzing Private Support

Cultivate privately funded innovations. LA County should engage private and philanthropic organizations where possible to support innovative approaches to housing delivery. Public funds like Prop HHH can leverage private capital to unlock innovative housing delivery strategies and time and cost savings. By including explicit encouragement of off-site construction and other cost-reducing methods in housing project RFPs, the County will help to generate the demand that can bring private capital into the modular space and generate interest in investing in new modular production facilities. This and other symbolic support would signal the presence of strong pipelines of new projects. Privately-funded efforts may prove especially critical for the provision of moderate-income housing—a segment with similarly high demands for lowering construction costs while maximizing production, but without the benefit of public subsidy for development.

4. Recommendations for Workforce Development

A number of off-site construction companies in dense metropolitan areas are focusing on their factories' potential to stimulate local employment growth by creating embedded partnerships and training programs with local trade unions (particularly the carpenters union), organizations coordinating fair chance hiring of formerly incarcerated people, and other initiatives. Particularly in regions with high housing demand like in Los Angeles, nearby production facilities could help spur quality job creation in jurisdictions outside of the urban core. This aligns well with a growing need for skilled on-site labor familiar with industrialized methods because both hybrid and full modular approaches require a degree of trained labor to assemble units on-site. This creates opportunities for smaller firms—many of which are minority-owned Disadvantaged Business Enterprises—closer to the construction site to meaningfully participate even in larger housing projects (where larger subcontractors with more labor capacity would otherwise have the advantage). Several of the industry professionals interviewed identified strong potential for small subcontractors to train and become invaluable in on-site assembly practices of different off-site methods as these approaches become more popular.

Create and adapt local skilled labor for off-site methods. As use of industrialized methods expand, LA County could take advantage of existing funding and programs for workforce development to catalyze growth in the off-site building industry. This includes funds like the Community Development Block Grant (CDBG) provided annually from the federal government; LA County is one of the largest recipient counties of CDBG funding in the country, with over $13.6M allotted for use in the 2020-2021 fiscal year.[36] Most of the most recent

allocation is specified for COVID-19 relief, but in general, CDBG funds can be used for a variety of purposes including workforce training and youth and homelessness services.

Existing organizational infrastructure for workforce development is coordinated through the Los Angeles County Economic Development Corporation. The program established partnerships with the City of LA and other jurisdictions, local community colleges, and several nonprofit and for-profit enterprises in the region to create reliable pathways for stable employment. The Los Angeles Regional Initiative for Social Enterprise (LA:RISE) extends these services in a program that specifically targets formerly incarcerated and formerly unhoused individuals.[37] Outside of LA County, the carpenters union established a state-of-the-art training facility in Las Vegas to prepare their members for work in off-site production facilities. LA County can expand its existing workforce development programming and partnerships to incorporate and take advantage of the new and emerging employment opportunities offered by off-site construction.

Encouraging and catalyzing local production facilities through workforce development projects would also allow LA County housing projects to reduce transportation costs during construction while enabling all stakeholders (including city and county staff) to more easily visit and learn about innovative construction methods. Local factories would also create a positive feedback loop and multiplier effect of centralizing the commercial activity (and respective tax revenue) of housing production activities kept within the region. The opportunities provided by proximity for further housing cost reduction as well as more wide-reaching education efforts (as will be expanded on in the next section) could prove invaluable, especially in the recovery from the pandemic and its economic impacts.

5. Recommendations for Education and Shared Experience

Increased familiarity with off-site construction methods is both an input and an output for improving the outcomes offered by such methods. One interviewee quoted Albert Einstein to that effect, saying, “The only source of knowledge is experience.” While early applications of industrialized construction methods were not unanimously successful, nearly every professional interviewed noted the numerous lessons they—and their project partners—learned in the process. The more this knowledge can be developed, amplified, and shared throughout the industry, the more repeated pitfalls can be avoided and the more quickly high-quality housing production can scale.

Understand and enforce the reduced scope for local review on off-site construction projects. Los Angeles County is uniquely positioned to take a leadership role as a trusted focal point for shared knowledge and programming around off-site methods. Internally, this could

take the form of a dissemination point for critical knowledge to support planning and building department staff at the county level to increase familiarity with the scope of work required for off-site projects. This does not need to be created from scratch: HCD organizes the inspection of factory-built housing facilities and reviews plans for the in-factory production scope of industrialized methods. Because of this, HCD has developed robust guidelines on the division of scopes for plan review and inspection between state and local officials. This includes explicit limitations on the jurisdiction of County and City staff on the state-reviewed portions of projects using off-site manufacturing. However, communicating those guidelines to local staff has proved difficult, especially in jurisdictions with high staff turnover (which might be even more severe after pandemic-related budget cuts). LA County should take advantage of HCD's expertise and embed its resources into the training of its planning and building department staff. This will help increase familiarity with these methods among planners as well as industry professionals trying to take advantage of innovative construction methods and get their projects approved. Then, the County should work to ensure that staff *follow* these streamlined local review procedures and, to the extent that it can, encourage local city staff to do the same.

Provide transparent guidelines for developers utilizing off-site construction. Externally, County leadership in this area could provide more clarity and consistency around the procedures for developers, architects, and contractors. The county should reinforce the streamlined local approval process unique to projects using off-site construction with transparent guidelines that strictly follow the reduced scope for local plan review as set forth by HCD. This could take the form of a process diagram detailing the two different sets of building plans for state versus local planners, isolating the relevant information for each. Project stakeholders could then take advantage of (and reinforce) the bifurcated review procedure set forth by HCD and simplify the process for local staff.

Promote research for further learning about off-site methods. More extensive efforts could include targeted research projects that seek detailed comparative case analyses among the shortlist of off-site projects already completed in Los Angeles. Deeper insight as to where cost savings originate in those projects, and how much they truly deliver on the purported benefits, would be critical in directing further efforts for advancement in cost reduction and process streamlining opportunities. LA County could engage local research institutions to promote collaboration on the topic without expending vital County resources and staff time.

Improve public education around affordable housing and off-site construction. Finally, a crucial component of education needed around off-site methods is public perception of new construction methods and of affordable housing at large. Affordable and supportive housing projects can be especially vulnerable to local resistance, particularly if they utilize density bonus ordinance in order to produce more units. Gentrification and displacement pressures endemic to low-income and other neighborhoods can exacerbate these concerns and related resistance to

development (in addition to traditional "NIMBYism"). Because the benefits of off-site methods are derived from scale and speed, the rapid construction of sizeable buildings can inadvertently serve to highlight the specter of accelerated neighborhood change, especially if the modules were produced in facilities far outside the community. Off-site methods may thus only aggravate resistance to new supply if proper steps are not taken to educate the public about the decision-making behind housing development and the use of off-site production.

Additionally, factory-built housing methods are still perceived by many to only produce generic building forms and designs. Though standardization does help off-site construction methods achieve scale and repetition, modular methods can produce creatively designed buildings indistinguishable from traditional site-built construction, as evidenced by the Star Apartments project pictured earlier. LA County should show crucial leadership in this regard by ensuring the public in unincorporated areas is kept informed of housing developments and the broad potential benefits of alternative construction methods both during and after the construction phase. The reduction of on-site construction times similarly reduces the extent of noise and traffic disruption felt by nearby residents, while early perception of improved quality for modular projects may translate to buildings that are more easily maintained, for longer. This information and still-evolving knowledge stream can be integrated into ongoing community engagement and outreach as part of Housing Element programming throughout LA County.

Conclusion

Ensuring that Los Angeles County has sufficient affordable housing for its residents is an urgent challenge. Off-site construction serves as one promising tool to reduce costs and increase supply, but one whose full potential cannot be realized or optimized without thoughtful and intentional changes in the policy, process, and programs that support affordable housing in LA County. Across all stakeholder groups, we found a shared desire and passion to address the monumental housing shortage, as well as a collective understanding of the collaboration needed to make modular one part of the solution. As one interviewee put it: "Everyone wants everyone else to succeed." While modular may not be a panacea, nor the only innovation needed, LA County should take advantage of this opportunity to catalyze innovation in off-site construction methods and remove unnecessary barriers to its adoption.

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