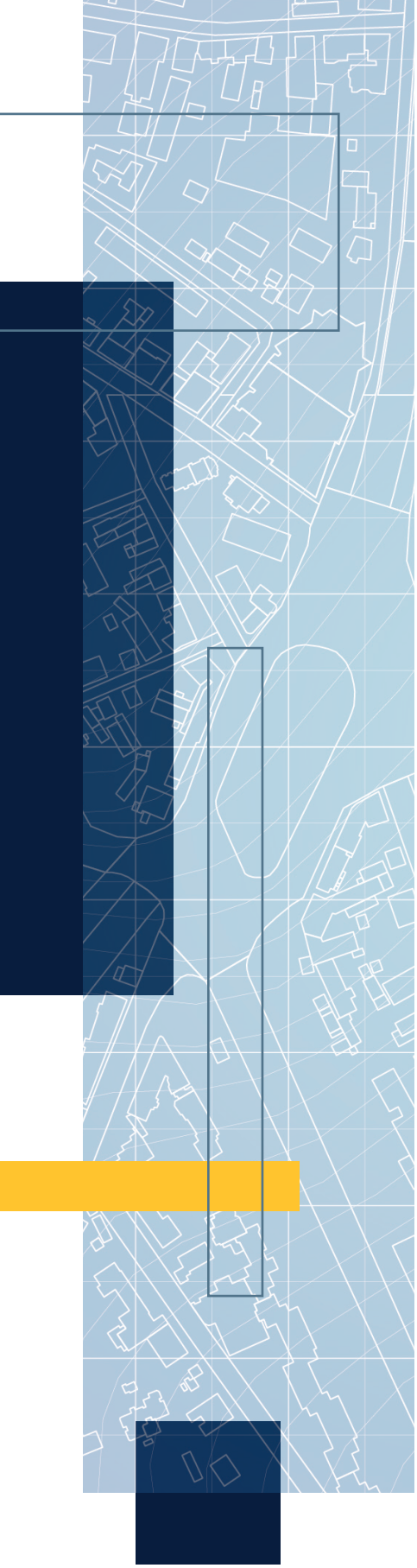

TERNER CENTER FOR HOUSING INNOVATION
UC BERKELEY

A TERNER CENTER REPORT - MARCH 2020

The Hard Costs of Construction: Recent Trends in Labor and Materials Costs for Apartment Buildings in California

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Executive Summary

Against the backdrop of a statewide housing crisis, affordable and market-rate developers have seen increasing development costs, which can hinder the feasibility of new projects and contribute to affordability constraints. The rising cost of building housing is fueled by multiple factors, including land, capital costs, regulations, materials, and labor. In this report, we focus on the subset of these costs that have seen some of the largest escalations in recent years: materials and labor, also referred to as hard construction costs. Hard construction costs comprise more than sixty percent of total development costs. Yet understanding what goes into hard costs is difficult due to the lack of publicly-available, detailed data on specific projects.

To shed light on the drivers of hard construction costs, we compiled and analyzed a unique new dataset of line-item level construction costs for 240 multifamily projects built in California between 2009 and 2018. We find:

- **The per-square-foot hard costs for constructing multifamily housing in California climbed 25 percent over the course of a decade.**

  On average, hard costs per square foot in 2018 were $44 higher compared to 2008-2009, after adjusting for inflation.

- **Cost increases have been most pronounced in the line-item categories for finishes and for wood, plastics, and composites.**

  Detailed data shows that since 2010, wood, plastics, and composites costs rose by 110 percent after accounting for inflation, and finishes costs rose by 65 percent.

- **Trends in both labor and materials have likely contributed to hard cost increases, but do not entirely account for the pace of change.**

  Controlling for key factors, our regression analysis found that projects that began construction between 2016 and 2018 were, on average, $68 more expensive per square foot than projects started between 2009 and 2011.

- **It's more expensive to build in the Bay Area and Los Angeles.**

  Controlling for project characteristics, compared to the rest of the state, average hard costs were $35 more expensive per square foot in the Los Angeles region and $81 more expensive per square foot in the Bay Area. The Bay Area has comparatively higher construction wages than elsewhere in California, which could help to explain the difference in hard costs at the regional level. While we were unable to control for the effects of local regulations, these too could be adding to regional variations in construction costs.

- **Building with concrete and steel costs more.**

  Type I construction (mainly composed of concrete and steel) is significantly more expensive than other construction types. This in turn means that these high-rise buildings are more likely to be financially feasible in markets with high rents.

- **Affordable housing projects cost more on average than market-rate and mixed-affordability projects, but this difference loses significance after controlling for project size.**

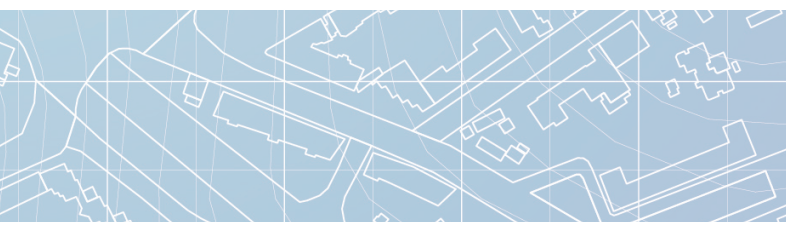
  Controlling for observable cost drivers, affordable projects cost on average $48 more per square foot than market-rate

projects or projects that mix affordable and market-rate units. The significance of this difference disappears when controlling for the size of the project. While more data are needed to tease out the implications of this finding, it suggests that market-rate developers are more likely to realize efficiencies of scale than affordable housing developers because they tend to build larger buildings.

- **Prevailing wage requirements are associated with higher hard costs.**

  Our analysis joins a body of evidence that finds a significant relationship between prevailing wage requirements and higher costs. However, it should be noted that prevailing wage requirements are a policy choice designed to provide public benefit by stabilizing employment and benefits in a high-risk field; those broader benefits would not be captured in an analysis of hard construction data.

Overall, our findings point to the importance of policies that can help to mitigate rising construction costs. Streamlining and bringing more certainty to the permitting and approval processes can mitigate labor and materials cost increases, as well as having the added benefit of bringing down pre-construction and contingency costs. Reviewing regulations and building codes for inefficiencies can also rein in escalating hard costs. Innovative construction techniques that aim to lower costs and increase efficiency—such as industrial and mass timber construction—could benefit from additional state and local support, as could training programs that create a pipeline for talent in the construction industry.



Introduction

The cost of development is often cited as a fundamental obstacle to building more housing in California, especially housing that is affordable to low- and moderate-income households.[1] As the costs to build go up, the rents for those units go up as well. If the costs become too great, rising construction costs can make a project financially infeasible. For example, a multifamily unit that costs $800,000 to build will need to charge approximately $4,000 in monthly rent[2]—a price well over the typical monthly earnings in the state —to cover those costs and meet return on investment requirements for investors.

Many different factors layer together to affect the bottom-line costs of building new housing and whether or not a project will ultimately "pencil": the costs of acquisition (e.g., land and closing costs), hard construction costs (e.g., materials and labor), soft costs (e.g., legal and professional fees, insurance, and development fees), and the costs of conversion once a project is completed (e.g., title fees and the operating deficit reserve). Among these various components of a project's total "cost stack," by far the largest share of a project's total cost comes from materials and labor—or hard costs.

Given the significant role hard costs play in determining the financial feasibility of new housing construction, this analysis focuses on recent trends in materials and labor costs and what might explain them. To better understand these costs components, we collected data from developers, general contractors, and financial institutions for both market and affordable multifamily housing developments that began construction between 2008 and 2018. We created a unique dataset of more than 240 projects throughout the state of California, which includes information on estimated construction costs, final construction costs, construction

This report is part of the Terner Center's The Cost of Building Housing Research Series, which examines the different cost factors that layer together to comprise the total costs to build housing in California. Accompanying this report, we have also released The Costs of Affordable Housing Production: Insights from California's 9% Low-Income Housing Tax Credit Program, which looks specifically at the factors influencing the costs of development for new construction financed through the 9% LIHTC programs. Previous studies include Making It Pencil: The Math Behind Housing Development, in which we outline how land costs, construction costs, local fees, and financing costs all contribute to the total development cost for a housing project. In our work on impact fees and development fees, we found that waning tax revenue and the loss of state and federal funding for infrastructure resulted in rising local exactions on new housing. And in Perspectives: Practitioners Weigh in on Drivers of Rising Housing Construction Costs in San Francisco, we examined the ways in which lengthy permitting processes as well as local regulations and requirements can increase the cost of both market-rate and affordable housing projects.

schedules, and project characteristics (such as size, location, etc.). While other data sources provide insight into broad changes in costs in the form of price indices, or consolidate data to inform cost estimation, our data allow us to review line item costs directly. Our data offer a rare and detailed window into specific factors underlying the hard costs of construction for individual projects. With these data, we are able to trace how hard costs have changed over time, as well as understand which types of costs have seen the steepest increases. The following analysis unpacks these factors and considers state-level approaches to mitigate the rising cost of construction, with the aim of producing more market-rate and affordable housing at lower price points.

Methodology

Detailed data on hard construction costs—also referred to in this analysis as simply "construction costs"—are not publicly available or easily accessible. We reached out to dozens of market-rate and affordable housing developers, general contractors, and financial institutions to request data on housing projects started between 2008 and 2018, including data on estimated construction costs, final construction costs, construction schedules, and project characteristics (such as size, location, etc.). Responses typically came in the form of original project bids, final cost sheets, and final construction schedules. We also collected additional details on each project through a survey completed by the responding organizations. We then digitized PDFs or scanned documents, cleaned, and standardized responses to create a unique database (the "Terner dataset") of more than 240 multifamily projects constructed throughout the state of California.[3] Given the focus of this analysis, the sample only includes data on hard construction costs, and not on other factors considered elsewhere in the Cost of Building Housing Research Series, such as land, financing, and contingency costs.

Defining Construction Costs

According to the data we collected on total project costs, hard construction costs represented more than 60 percent of the total cost of producing a new residential building in California over the past decade.[4]

This analysis reports on bid costs, or estimated project costs, rather than the final construction costs for projects. While this may underestimate final costs, the data from bid sheets were more complete. These bids are

also what are used to determine the amount of subsidy that is needed for affordable projects. To consider the cost of materials and labor at the time of the bid, our analysis categorizes projects based on the year construction began, rather than the date of completion.

The developers and general contractors that provided data for this project track their line item level costs differently, parsing costs at varying levels of detail. In order to standardize our analysis across a variety of line item categories, we coded each line item according to its Construction Specifications Institute MasterFormat division,[5] a standard commonly used in U.S. construction (also referred to in this analysis as CSI divisions or codes). The line items were coded based on keywords, and any remaining line items were coded by hand before the dataset was reviewed a second time to ensure fidelity to the MasterFormat divisions. In a few cases, project line items were broad enough that they incorporated multiple divisions; in those cases we removed the overly broad costs from the line item level analysis, but included the costs when assessing total hard construction costs.

Key Characteristics of Projects in the Terner Dataset

Among the projects included in the Terner dataset, 79 percent are affordable developments, while market-rate and mixed-affordability projects make up 11 and 10 percent of the dataset, respectively (Figure 2). "Mixed" projects, or projects that contain a mix of affordable and market-rate units, tilt heavily towards market-rate: in the typical mixed project, 14 percent of units are affordable. Most projects in our sample are primarily wood construction—39 percent of the projects are type V (i.e., wood construction), while 11 percent are type V over I (i.e., wood over a concrete podium, which is typically a parking structure). Only 6 percent of the projects are type I, or tower construction (i.e., steel and concrete high-rises). Just over one-third of projects (36 percent) did not include data on the construction type. Almost half of the projects in our sample (49 percent) are non-prevailing wage projects, 42 percent adhere to prevailing wage regulations, and 9 percent did not report their prevailing wage status.

Figure 1: Total Development Costs for Multifamily Projects in California (Completed 2010-2019)

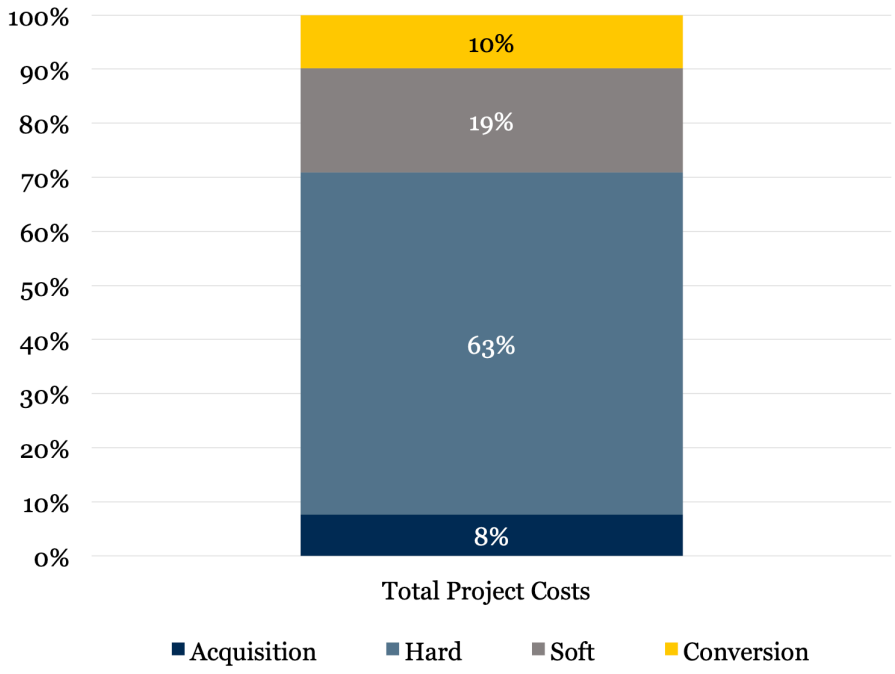


Figure 2: Characteristics of Projects in the Terner Dataset

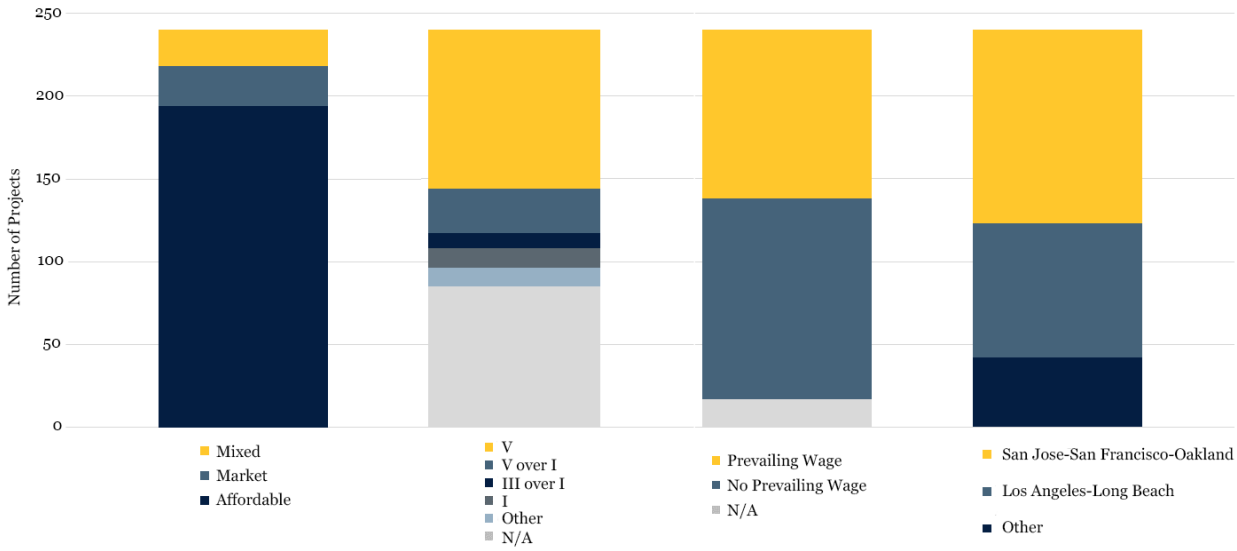


Figure 3: Regions for Cost Analysis

In order to assess regional differences in costs while maintaining the anonymity of respondents, we compared the costs of projects built in the two largest urban centers—the Bay Area and Los Angeles regions—to those built in the rest of the state (Figure 3). Fifty percent of the projects are located within the San Jose-San Francisco-Oakland Combined Statistical Area (CSA), while 33 percent of projects are in the Los Angeles-Long Beach CSA. The remaining 17 percent of the projects are located in the rest of the state.

One challenge in understanding differences in construction costs is that different locations, and/or building types, will influence costs. To account for these differences, we present the results of a series of multivariate regression models that allow us to control for these differences. This approach allows us to examine the independent association of different project characteristics—such as construction type, region, or the year construction started—on overall construction costs.

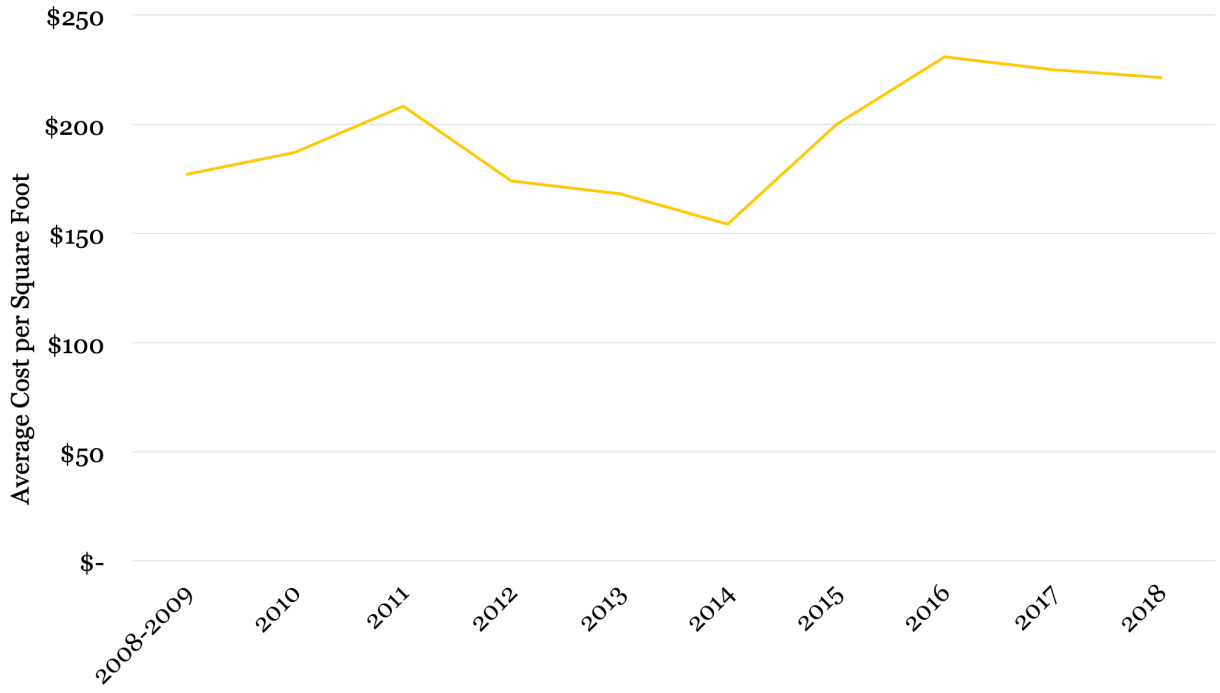
Line Item Data on Rising Construction Costs

The per-square-foot hard costs for constructing multifamily projects in California climbed 25 percent over the course of a decade.

The Terner dataset confirms what construction professionals have reported for years:real construction costs have risen since the recession. A weighted average of hard costs per project square foot, adjusted to 2018 dollars, shows that costs have increased across the state (Figure 4).

In 2008-2009, hard costs averaged $177 per square foot. By 2018 that average had risen to $222 per square foot—a 25 percent increase. While these increases have been felt across the state, costs are highest—and their increases have been most precipitous—in the Bay Area (see Case Study on page 15).

Figure 4: Hard Construction Cost Per Square Foot, California (2018 $)



The cost increases captured in the Terner dataset align with other industry measures of construction costs. The California Construction Cost index, for example, recorded a 24 percent change in costs between 2009 and 2018.[6] Because prices declined following the recession, increases in recent years have registered as much steeper, given that they started from a lower base.[7] Between 2014 and 2018, hard construction costs in California rose almost $80 per square foot, or 44 percent.

Evidence suggests the trend has not abated since 2018. The California Construction Cost Index increased by 3.6 percent in 2019, the highest increase since a 4.4 percent increase in 2016.[8]

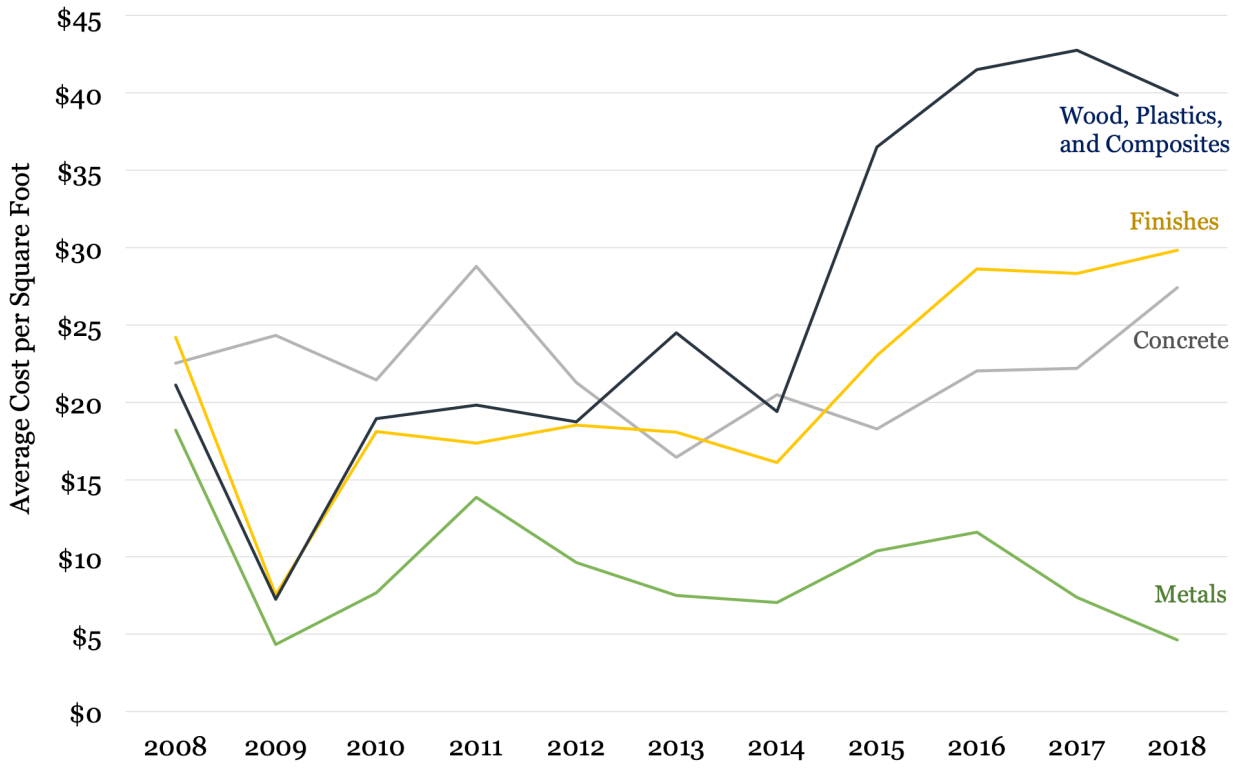
Cost increases have been most pronounced in the line-item categories for wood, plastics, and composites and for finishes.

On any construction project, the largest contributors to hard costs include the following MasterFormat divisions: a) metals, b) concrete, c) finishes, and d) wood, plastics and composites. Metals costs include metal framing, joists, decking, stairs, and railings, among others. Concrete costs cover concrete forming and accessories, concrete reinforcing, cast-in-place concrete, precast concrete, cast decks and underlayment, mass concrete, and concrete cutting and boring. Finishes costs consist of plaster and gypsum board, tiling, ceilings, flooring, wall finishes, painting and coating, among others. Finally, wood, plastics, and composites costs include rough carpentry, finish carpentry, architectural woodwork, structural plastics and composites, and plastic fabrications such as railings and paneling. [9]

Figure 5 documents the trends for each of these line items in the Terner dataset.

Adjusting for inflation, metal costs have remained relatively stable over time, averaging between $5 and $10 per square foot. Concrete, while significantly higher than in 2014, is only slightly more expensive per square foot than it was in 2008. In contrast, by far the biggest

Figure 5: Line Item Construction Costs (2008-2018)



increases have occurred in line-item costs for wood, plastics, and composites, which roughly doubled between 2014 and 2018. These trends remain the same when the sample is isolated to type V—or primarily wood construction—projects, implying the change in line item costs is not driven by changes in construction type over time. Line-item costs for finishes have also climbed well above 2008-levels. It could be that higher construction costs and a hotter housing market have increased spending on finer floor coverings and other finishes to build out more expensive units and meet the expectations of a higher rental or sale price point.

Trends in both labor and materials have contributed to hard cost increases, but do not entirely account for the pace of change.

While we can see which areas have experienced the greatest increases in overall costs, it is not possible to completely disentangle which of these costs are driven by materials and which are driven by labor. General contractors and developers typically only track bundled labor and materials costs at the line item level; for example, they might record the cost of earthwork, but not the overhead for the earthwork subcontractor, or the cost of labor to dig a foundation.

In order to assess the relative role of labor versus materials costs, we compared the changes in line item costs from the Terner Center dataset to publicly available data on materials cost indices and wage rates at the state level.

Wage and Employment Trends

A review of construction wages in California reveals that, while wages have risen in nominal terms, when adjusted for inflation, wages in key construction occupations (those closely associated with the four MasterFormat divisions reviewed above) are generally close to 2006 levels, at the height of the previous building boom. In nominal terms, wages for all construction and extraction occupations in California rose by 29 percent between 2006 and 2018, and by 13 percent since 2010, below the statewide increase in hard costs of 25 percent. In real terms, however, wages have only risen by just 3.4% since 2006.

These averages, however, hide the tightness in the construction labor market in some areas. Since the recession, there has been a significant mismatch between the number of permitted units—increasing more than 430 percent between 2009 and 2018—and the growth in the construction sector, where the number of workers has only expanded by 32 percent. General contractors noted that anti-immigration rhetoric, as well as a tight labor market overall, has made it hard to find construction workers, let alone workers with more multifamily construction experience and/or those trained in the specific trades.

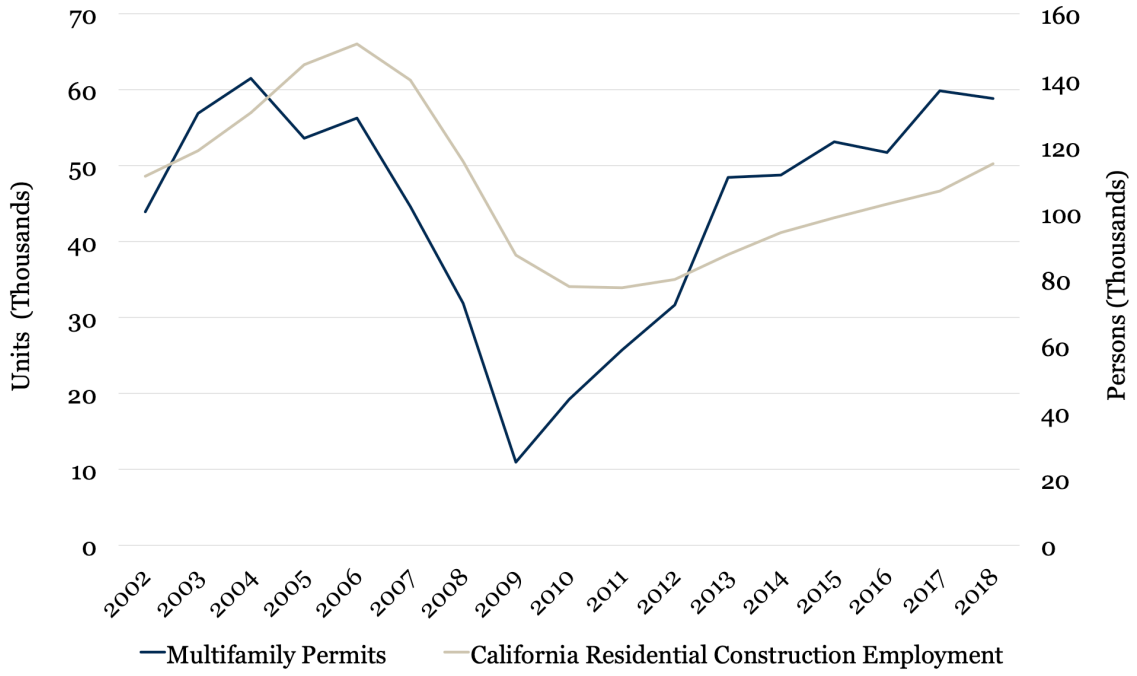
Indeed, surveys of housing developers have consistently listed a shortage of workers as a top concern.[10] For example, in response to a 2019 survey of general contractors in California, more than 60 percent of firms responded that they were "having a hard time filling some or all positions" for craft and salaried workers, reflecting the twin challenge of a constrained labor force at the same time as new development has increased.[11]

Statewide employment data also reveals that certain types of skilled labor are lagging more than others. Employment of carpenters dropped by 30 percent between 2006 and 2018, and reinforcing iron and rebar workers declined by 52 percent over the same period. Similarly, employment of cement masons and concrete finishers decreased by 18 percent and drywall and ceiling tile installers dropped by 23 percent.[12, 13] A survey of California general contractors captured the tightness in the

Table 1: Nominal and Real Hourly Median Wages for Selected California Construction Occupations, and Percent Change in Wages from 2006-2018 and 2010-2018

		California Occupations					
		Construction & Extraction Occupations	Carpenters	Cement Masons & Concrete Finishers	Drywall & Ceiling Tile Installers	Sheet Metal Workers	Structural Iron & Steel Workers
Wages (unadjusted for inflation)	2006	$20.63	$23.50	$19.49	$21.48	$20.93	$25.17
	2010	$23.55	$25.49	$23.10	$23.45	$26.13	$26.47
	2018	$26.56	$27.29	$25.82	$26.78	$25.77	$31.98
	Percent Change, 2006-2018	28.7%	16.1%	32.5%	24.7%	23.1%	27.1%
	Percent Change, 2010-2018	12.8%	7.1%	11.8%	14.2%	-1.4%	20.8%
Wages (adjusted for national inflation)	2006	$25.70	$29.27	$24.28	$26.75	$26.07	$31.35
	2010	$27.12	$29.35	$26.60	$27.00	$30.09	$30.48
	2018	$26.56	$27.29	$25.82	$26.78	$25.77	$31.98
	Percent Change, 2006-2018	3.4%	-6.8%	6.4%	0.1%	-1.1%	2.0%
	Percent Change, 2010-2018	-2.1%	-7.0%	-2.9%	-0.8%	-14.4%	4.9%

Figure 6: Multifamily Permits and Construction Employment in California (2002-2018)



Sources: State of California Department of Finance, Construction Permits, Annual data, from 1975, Residential (units and valuation). Retrieved from: http://www.dof.ca.gov/Forecasting/Economics/Indicators/Construction_Permits/.; Federal Reserve Bank of St. Louis and U.S. Bureau of Labor Statistics, All Employees: Construction: Residential Building Construction in California [SMU06000002023610001A]. Retrieved from: FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/SMU06000002023610001A. January 9, 2020.

labor market across a host of different types of workers: 70 percent or more of respondents noted that it was harder to hire plumbers and pipelayers in 2019 than the year before, and more than 60 percent said the same for roofers, equipment operators-cranes, heavy equipment, drywall installers, sheet metal workers, and cement masons. More than 50 percent of respondents found it harder to hire concrete workers and carpenters, as well as pipefitters/welders, mechanics, and laborers. Perhaps reflecting the increase in iron workers, only 33 percent of respondents noted that the trade was more difficult to hire for than the year previous.[14]

Materials Cost Trends

In order to assess the relationship between materials costs and hard cost line item trends in California, we compared price trends between key materials indices and the Terner dataset (Table 2).

Most key line items tracked closely with their corresponding materials cost indices; finishes, concrete, and metal costs all rose in parallel with materials costs (Table 2). In contrast, wood, plastics, and composites line item costs climbed at a significantly faster rate than the lumber materials index. While the materials index increased by 39 percent between 2010 and 2018, the wood, plastics, and composites line item costs in California housing projects increased by 110 percent over the same period, with costs remaining high after 2014 (Figure 7). As previously noted, real wages for occupations closely associated with the line items reviewed all either dropped or remained relatively flat, leaving a question as to the central driver of increasing costs for wood, plastics and composites.

Table 2: Percent Change in Terner Line Item Costs and Related Industry Indices for Materials

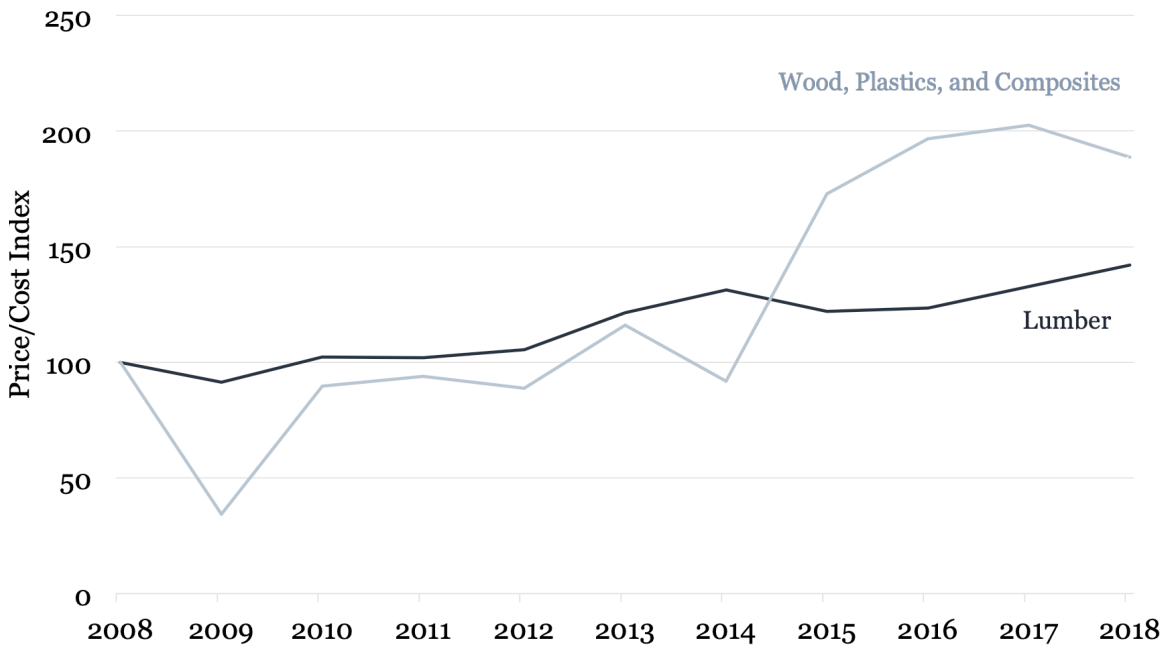
	Percent Change, 2010-2018	
	Terner Data	Industry Index
Concrete	28	25
Finishes/Gypsum	65	66
Metals	-39	8
Wood/Lumber	110	39

Source: Terner Center analysis of U.S. Bureau of Labor Statistics data: U.S. Bureau of Labor Statistics. Producer Price Indexes. Retrieved from: https://www.bls.gov/ppi/.

A number of factors can influence materials costs. Some are macroeconomic forces influenced by global trade patterns and federal policy decisions. For instance, the National Association of Home Builders estimated that the tariffs imposed in 2018 on Chinese imports translated to a $1 billion increase in residential construction costs.[15] Others are shaped by state and local policy decisions—from regulatory requirements to building codes to negotiations around the elements of specific projects—that may dictate the types of materials used in a given project. Although such decisions affect total costs, the impact can be hard to quantify.

Interviews conducted by Terner Center researchers suggested that general contractors and subcontractors are asking for higher levels of overhead, profit, and contingency, in some cases to hedge against risk and costs associated with a restricted workforce, such as losing workers or subcontractors to more profitable projects in the middle of a job. While the structure of the Terner data did not allow us to review profit or contingency separately, San Francisco tied with New York City for the highest contractor's margins in any U.S. city surveyed in the most recent Turner and Townsend survey, at seven percent.[16]

Figure 7: Wood, Plastics, and Composites Line Item Cost Index and Producer Price Index by Commodity for Lumber and Wood Products: Lumber (Base Year 2008)



Source: Terner Center analysis of Terner Center data and U.S. Bureau of Labor Statistics data: U.S. Bureau of Labor Statistics, Producer Price Index by Commodity for Lumber and Wood Products: Lumber [WPU081]. Retrieved from: FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/WPU081, January 9, 2020.

Putting It All Together: The Drivers of Increased Construction Costs

As materials and labor costs have gone up, it is not surprising that overall construction costs have also risen. One possible explanation for the higher costs is that the mix of projects being built has changed over time—for instance, a shift toward more high-rise condominiums that require more expensive construction materials—or that more development is occurring in high-cost markets, where labor costs will be higher.

To understand all the factors that influence construction costs in tandem, we developed a regression model that allows us to assess how each factor influences the bottom-line cost of building. Table 3 presents the results of this analysis, first without controlling for project size (model 1) and then after taking project size into account (model 2).

The key findings are:

- **Hard costs of building housing in California have increased by $68 per square foot, on average.**
  Even accounting for other relevant factors in the model, it is more expensive to build a similarly-sized unit in California compared to a decade ago.

- **It is more expensive to build in the Bay Area and Los Angeles.**
  Controlling for key factors like construction type, prevailing wage requirements, affordability, and year construction started,

Table 3: Model Identifying Factors that Contribute to Per Square Foot Hard Costs, California, 2008-2018

	Per Square Foot	
Variables	**Model 1**	**Model 2**
Project Size (Number of Units)		-0.23***
		(0.09)
Year Construction Began (Compared to Projects Started in 2009-2011)		
Project Started 2007-2008	39.71	59.39
	(42.26)	**(42.36)**
Project Started 2012-2015	9.57	10.00
	(18.16)	**(17.91)**
Project Started 2016-2018	65.46***	67.85***
	(20.18)	**(19.93)**
Type of Construction (Compared to All Other Types)		
Construction Type I	65.06**	70.94***
	(25.69)	**(25.45)**
Region (Compared to Los Angeles)		
San Jose- San Francisco-Oakland	48.94***	46.19***
	(13.18)	**(13.05)**
Other	-30.66*	-35.08**
	(16.80)	**(16.66)**
Project Characteristics		
Project Is Affordable Housing	47.57***	24.27
	(16.97)	**(18.95)**
Project Includes Prevailing Wage	36.41***	30.31**
	(12.95)	**(12.98)**
Constant	127.75***	174.08***
	(23.40)	**(29.06)**
Number of Observations	223	223
R- Squared	0.29	0.31
Adjusted R-Squared	0.26	0.28

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, *p<0.10.

urban areas showed statistically significant cost differences. Compared to projects in other parts of the state, Bay Area projects cost $81 more per square foot to build, and projects in the Los Angeles region cost $35 more per square foot. (See Case Study on page 15 for more on Bay Area costs.)

- **Building with steel and concrete costs more.**
  Type I projects, which are typically over 5-7 stories and constructed with steel and concrete, cost an average of $65 more per square foot than other types of construction, like Type V over I (i.e., wood frame floors over a concrete platform). Type I projects use more expensive components in order to build higher, and are more likely to be found in infill locations, such as San Francisco or Los Angeles, where zoning allows higher density construction. When we also control for the number of units in a project (which reduces costs slightly due to economies of scale), the additional cost of Type 1 projects rises slightly to $71 dollars per square foot.

- **Affordable housing projects cost more on average than market-rate and mixed-affordability projects, but this difference loses significance after controlling for project size.**
  Controlling for year, region, construction type, and prevailing wage requirements, affordable projects cost, on average, $48 more per square foot compared to market-rate projects and projects that mixed affordable and market-rate units. In a companion study, The Costs of Affordable Housing Production: Insights from California's 9% Low-Income Housing Tax Credit Program, we examine the drivers of costs for affordable projects in more detail, and find that funding complexity, including the associated prevailing wage and other local hire requirements, is associated with higher development costs, especially if multiple projects subject to labor requirements move forward simultaneously in a constrained labor market. In order to secure local approvals, affordable housing projects are also often subject to increased design requirements. In some cases, purely aesthetic changes required by a locality can increase the cost of construction, and even result in a reduction in the number of units produced.[17]

  However, once we control for project size, we find that affordable projects are not statistically more expensive than market-rate. This may be in part due to the small sample, but it may also be due to the fact that affordable projects tend to be smaller given that the way affordable units are entitled and financed constrain project size.[18]

- **Prevailing wage requirements are associated with higher hard costs.**
  Both market-rate and affordable projects may be subject to prevailing wage requirements or project labor agreements for their construction contracting. Market-rate projects may adhere to requirements as part of a developer agreement with a locality, for example. Funding sources for affordable projects may trigger state or federal Davis-Bacon prevailing wage requirements, which differ from state level prevailing wage requirements in terms of oversight regulations as well as wage rates.[19]

  Our model found that projects with prevailing wage requirements cost an average of $30 more per square foot than those without wage requirements, after controlling for whether or not a project was affordable, as well as project size, region, construction type, and the year construction started.[20]

  Prevailing wages may increase the cost of construction for a number of reasons.

Case Study: The Bay Area has the highest construction costs in the state.

Hard construction costs have climbed statewide, but they are the most expensive and have risen most dramatically in the San Francisco Bay Area. While normalized statewide costs increased 25 percent between 2008-2009 and 2018, costs for projects in the Bay Area rose 119 percent over the same period, reaching more than $380 per square foot in 2018 (Figure 8).

Figure 8: Construction Costs Per Square Foot, Statewide and Bay Area Weighted Averages (2008-2018)

A number of factors are likely contributing to the rapid escalation of construction costs in the Bay Area. For one, wages are higher in the region, reflecting higher costs of living.[23] In 2018, the San Francisco and San Jose Metropolitan Statistical Areas had the two highest hourly median wages in the state, which could contribute to comparatively higher construction costs overall.[24] However, when adjusted for inflation using the local consumer price index (which takes into account the cost of living in the Bay Area by accounting for changes in gas, shelter, food, energy and other consumer goods), wages in the region have actually fallen in real terms (Table 3). The failure of wages to keep pace with local price increases may contribute to the challenges and delays in attracting labor reported by developers and builders.

Table 3: Percent Change in Median Hourly Wages for Construction and Extraction Occupations in the Bay Area (2009-2018)

Metropolitan Statistical Area	Percent Change in Hourly Wages	
	Unadjusted for Local Inflation	Adjusted for Local Inflation
San Francisco-Oakland-Hayward, CA	7%	-16%
San Jose-Sunnyvale-Santa Clara, CA	15%	-10%

Additional local regulations and lengthy review processes specific to the Bay Area may also add to the cost of construction. For instance, while raw materials costs are relatively similar across the state (notwithstanding variation in transportation costs), local regulations that require certain materials or building components can contribute to the costs of materials.[25] Moreover, workforce procurement rules—such as San Francisco's Small Business Enterprise, Local Business Enterprise, and local hire requirements—reflect worthy policy goals; they may also result in restricting the labor pool for projects, particularly in a region where living costs are so high that few construction workers can afford to live locally.[26] In addition, a recent study found that the average San Francisco project takes 3.8 years to be permitted.[27] While delays in permitting and approval may not affect hard construction costs directly, our previous research found that subcontractor concerns about project timelines and risk can make them hesitant to work in San Francisco, pushing up bids.

Besides setting higher wage rates, prevailing wage triggers requirements such as payroll certification that can add to costs. The same measures may also deter illegal labor practices that would lower costs, such as wage theft and worker misclassifications—construction consistently ranks as an industry with some of the highest number of cases on the U.S. Department of Labor's list of "Low Wage, High Violation Industries," although it is unclear what proportion of those cases represent residential projects.[26, 27] Interviews highlighted that because of the increased demand for labor, it can also be harder to find contractors willing to do prevailing wage jobs. Conversely, labor economists argue that better paying projects are able to attract more productive workers, which can mitigate the cost impacts of prevailing wage requirements.[28]

Ultimately, prevailing wage requirements are a policy choice designed to provide public benefit by stabilizing employment and benefits in a high risk field; those benefits have values not captured in an analysis of hard construction data.

Policy Implications

This report provides a unique look at the role of different line item costs in driving hard construction costs. While state and local policymakers do not control broader labor market trends or the cost of materials, there are a number of levers at their disposal that could help mitigate rising costs, including the following:

Shortening permitting and approval timelines can mitigate costs associated with uncertainties and delays.

Local agencies should consider ways to shorten review and approval timelines, reducing risk for projects. As previously noted, these timelines can be extensive.[29] The process is sufficiently onerous that developers often hire private expeditors to move projects through review in a timely manner.[30] Affordable projects often face more extensive review by more local departments, resulting in longer and more circuitous paths to final permitting and approval.[31] Slowing any project in the pre-construction phase can increase the cost of carrying capital and imperil key funding deadlines, endangering the viability of projects. Increased risk and uncertainty in the approvals process may also convince general contractors and subcontractors to add escalation clauses or to increase contingency costs in their contracts, in order to ensure they can cover future hikes in wages and materials costs if a project is delayed.[32] And, of course, the longer a project takes to move into construction, the higher the likelihood that costs associated with labor and materials have also increased.

Reviewing code for inefficiencies can also mitigate rising construction costs.

Jurisdictions should consider the ways in which overlapping regulations can add to construction costs, and review ways to maintain environmental and safety standards while easing the cost impact for new housing. For example, in our report on construction costs in San Francisco, focus group members suggested that the city could require more advanced air quality ventilators only for lower floors affected by pollution, rather than throughout a building.[33] Small changes can have an outsize impact as jurisdictions aim to meet goals for housing development while continuing to rigorously protect the health and sustainability of their community. Further research is needed on state building codes to determine if there are opportunities to consolidate or improve the efficiency of regulation while achieving the same policy goals.

Increasing support for labor training programs, such as apprenticeships and programs at community colleges, can assist in building and skilling up the construction workforce.

California needs a more robust labor pool to meet the demand for building in the state, especially as the state steps up goals for production. Unions are playing an increasing role in training the construction workforce; empirical studies have found a positive relationship between union coverage and construction worker training.[34] In a 2019 survey by the Associated General Contractors of America (AGC), 47 percent of California contractors reported that they had added or increased their use of unions to provide workers in the past year, the top response.[35]

Vocational training programs also provide an important pipeline for talent; the second most prevalent response to the AGC survey question was "[engaging] with [a] career-building program."[36] These programs, which include classes and academies within high schools and pre-apprenticeship programs, provide students with the skills they need to enter the workforce. The state could consider increasing support for labor training programs, such as those at community colleges that prepare students for apprenticeship exams.

Supporting innovative construction methods and materials could ultimately lead to lower construction costs.

Industrialized construction (IC) has the potential to lower costs and speed construction schedules. A broad category that encompasses firms that produce units, elements, or parts of a building offsite, industrialized construction has garnered attention from venture capitalists, developers, and researchers as a way to improve an industry that has seen productivity decline for decades.[37] California leads the nation in industrialized construction, with at least 31 different companies founded in the state over the last two decades.[38] Our research found that off-site construction can save as much as 20 percent on the cost of building a three or four story wood-frame multifamily development, and shorten the construction timeline by between 40 and 50 percent.[39]

Yet, industrialized construction also faces challenges. As developers and architects begin to work with new construction technology, they are experiencing a learning curve in terms of siting and designing projects to optimize potential efficiencies. General contractors have to adapt to new workflows and scopes of work, which requires coordination and education between developers, contractors, and IC firms. Government actors also have a role to play in smoothing the way for new technology. Currently, the state inspects offsite components while local buildings officials review the completed building for local code compliance, which can cause confusion. The state and local governments can work with firms to bring local inspectors up to speed on the unique approach to building review.

Affordable housing projects face additional financial barriers to adapting IC, because factories require a large deposit prior to construction in order to cover ordering of materials, before or at the time of finalizing a construction loan, even though no work has been delivered to the site. While private developers may be able to access more flexible forms of capital, affordable housing developers draw from fewer and more regulated sources of capital, limiting their ability to spend earlier in order to save later. The state or local governments could address this concern by running a pilot program to create supplemental revolving construction loans for affordable housing developers that make use of offsite technology, in effect seeding the industry to lower costs for subsidized development.

Other technological advances, like mass timber (MT), may also lower costs, but MT has yet to be fully integrated into statewide building codes. MT has drawn attention for its ability to shorten construction timelines (by 15-20 percent, by some estimations),[40] and lower costs. Some have argued that the need for MT is heightened in the face of increased seismic requirements for the 2020 building code, which MT can mitigate by lightening the load of the building.[41]

While states like Oregon have allowed for mass timber to be used in taller residential structures, only one high-rise (eight story) residential building has been built in that state[42] and California has yet to adopt similar code. MT remains cutting-edge in residential construction, but continues to gain traction in the field—the International Code Council adopted changes to the 2021 International Building Code that allow for MT construction up to 18 stories.[43]

Following this determination, California State Assemblymember Frank Biglow introduced Assembly Concurrent Resolution 102 in 2019, which would have "urged the Office of the State Fire Marshal to adopt rules for the use of mass timber products for residential and commercial building construction," but the resolution stalled in the assembly.[44] MT construction could help to lower building costs across the state while providing additional benefits in terms of seismic requirements, and the state should continue to weigh responsible ways to incorporate the material more explicitly in the building code.

Streamlining affordable housing entitlements and funding could help to lower construction costs.

The finding that, on average, affordable units cost more per square foot than market-rate units indicates the need to further examine how affordable housing is permitted and funded. As The Costs of Affordable Housing Production: Insights from California's 9% Low-Income Housing Tax Credit Program shows, while some of the factors influencing the cost of affordable housing are no different from market-rate construction, there are aspects of costs that are unique to affordable projects. Key among these is the fragmented regulatory and funding structure for financing affordable units. Resolving this fragmentation won't be easy, but a valuable first step would be for the state to consider emulating the Minnesota Housing Finance Agency in creating a consolidated Request for Proposals (RFP) for several funding sources, including LIHTC.[45]

National policy changes are also key to reining in hard construction costs.

At a national level, more can be done to lower the cost of materials and expand the construction workforce. As previously noted, some have traced part of the increase in materials costs to increased tariffs; lowering tariffs and promoting the international trade of building materials could mitigate rising material expenses. On the labor side, national immigration policy has direct effects on the construction workforce. According to a recent report by the Pew Research Center, unauthorized immigrants make up 15% of the national construction occupation,[46] and the current administration's actions on immigration have raised concerns about the loss of experienced construction workers.[47] While outside of the purview of state and local policymakers, national level policies represent fundamental tools to lower the cost of hard construction.

Conclusion

California's rising construction costs undercut housing affordability goals and threaten the viability of new housing projects overall. The data confirm that, controlling for key factors, hard construction costs have significantly increased, and certain line items are driving those costs. In a state battling to overcome years of undersupply of housing, policymakers are rightfully invested in tamping down escalating development costs.

While there is no "silver bullet" to lower costs, state and local policymakers have a host of tools at their disposal to mitigate expensive construction. Building regulations and codes, as well as permitting and approval processes, could be reviewed with an eye towards streamlining and lowering the cost of building. Policymakers could consider ways to responsibly support new construction techniques with the potential to increase the sector's efficiency. Supporting the expansion of training and apprenticeship programs could increase the pipeline for much-needed talent. Finally, policymakers could review the way in which affordable housing projects are financed to promote more cost efficient construction. By reining in construction costs, policymakers can build more housing more affordably, broaden the impact of public subsidies for affordable homes, and move forward in alleviating the state's housing crisis.

1. Garcia, D. (2019). “Making It Pencil: The Math Behind Housing Development.” Terner Center for Housing Innovation at UC Berkeley. Retrieved from: https://ternercenter.berkeley.edu/making-it-pencil.

2. According to the U.S. Bureau of Labor Statistics’ Occupational Employment Statistics, in 2018, the median hourly wage for all occupations in the state was $20.40. Assuming an employee earning that wage works 8 hours a day for 20 days in a month, their monthly earnings would be $3,264.

3. We requested data from both single-family and multifamily developers and builders but did not receive any responses from the single-family industry. Single-family cost trends remain an area in need of further research.

4. The majority of the projects for which we were able to collect total project cost data were affordable projects, with a smaller number of mixed-affordable and market-rate projects. No data on total costs was available for solely market-rate projects. Figure 1 displays four project cost categories: 1) acquisition costs, which include land and closing costs, 2) hard construction costs, 3) soft costs, such as legal fees, insurance, professional fees, and development fees, and 4) conversion costs including the conversion fee, the operating deficit reserve, and title fees. This figure includes acquisition costs that were as low as $100 or $0, presumably because land was donated to the project. When those low figures are extracted from the averages acquisition costs rise by 1% to 9% of total project costs, and hard costs drop by the same amount to 62% of total costs.

5. Construction Specifications Institute MasterFormat. Retrieved from: https://www.csiresources.org/home.

6. California Department of General Services. DGS California Construction Cost Index CCCI. Retrieved from:https://www.dgs.ca.gov/RESD/Resources/Page-Content/Real-Estate-Services-Division-Resources-List-Folder/DGS-California-Construction-Cost-Index-CCCI.

7. These data align with those presented in the GAO report on Low-Income Housing Tax Credit (LIHTC) development costs. See United States Government Accountability Office. (2018). Low-Income Housing Tax Credit: Improved Data and Oversight Would Strengthen Cost Assessment and Fraud Risk Management. 16-18. Retrieved from: https://www.gao.gov/assets/700/694541.pdf.

8. California Department of General Services. DGS California Construction Cost Index CCCI. Retrieved from: https://www.dgs.ca.gov/RESD/Resources/Page-Content/Real-Estate-Services-Division-Resources-List-Folder/DGS-California-Construction-Cost-Index-CCCI.

9. See https://www.edmca.com/media/35207/masterformat-2016.pdf for a detailed list of CSI MasterFormat Divisions.

10. National Association of Home Builders. (2019). Builder Confidence Holds Firm in November. Retrieved from: http://eyeonhousing.org/2019/11/builder-confidence-holds-firm-in-november-2/.

11. Associated General Contractors of America and Autodesk. (2019). 2019 Workforce Survey Results: California Results. Retrieved from: https://www.agc.org/sites/default/files/WorkforceDevelopment_2019_California_0.pdf.

12. Terner Center analysis of U.S. Bureau of Labor Statistics data: U.S. Bureau of Labor Statistics. Occupational Employment Statistics Data. Retrieved from: https://www.bls.gov/oes/tables.htm.

13. It is unclear why California saw such an increase in structural iron and steel employment while reinforcing iron and steel employment declined. Staff from the U.S. Bureau of Labor Statistics confirmed that the occupational definitions for these groups did not change between 2006 and 2018.

14. Associated General Contractors of America and Autodesk. (2019). 2019 Workforce Survey Results: California Results. Retrieved from:https://www.agc.org/sites/default/files/WorkforceDevelopment_2019_California_0.pdf.

15. National Association of Home Builders. (2019). Housing Takes a Hit on Higher China Tariffs. Retrieved from:http://nahbnow.com/2019/05/scheduled-chinese-tariff-hike-on-may-10-will-harm-housing-affordability/.

16. Turner and Townsend. (2019). International Construction Market Survey 2019. Retrieved from:https://www.turnerandtownsend.com/en/perspectives/international-construction-market-survey-2019/the-most-expensive-market-to-build/.

17. Reid, C. & Raetz, H. (2018). “Perspectives: Practitioners Weigh in on Drivers of Rising Housing Construction Costs in San Francisco.” Terner Center for Housing Innovation at UC Berkeley. Retrieved from:https://ternercenter.berkeley.edu/uploads/San_Francisco_Construction_Cost_Brief_-_Terner_Center_January_2018.pdf.

18. Reid, C. (2020). “The Costs of Affordable Housing Production: Insights from California’s 9% Low-Income Housing Tax Credit Program.” Terner Center for Housing Innovation at UC Berkeley. Retrieved from: http://ternercenter.berkeley.edu/development-costs-LIHTC-9-percent-california.

19. California Tax Credit Allocation Committee, California Debt Limit Allocation Committee, Department of Housing and Community Development, California Housing Finance Agency, Newman, M., Shawn, B., & Woodward, S. (2014). Affordable Housing Cost Study. Retrieved from: https://www.treasurer.ca.gov/ctcac/affordable_housing.pdf.

20. This is consistent with what previous research has found, see, for example, Duncan, K. & Ormiston, R. (2019). What Does the Research Tell Us About Prevailing Wage Laws? Labor Studies Journal. 44(2) 139-160. Retrieved from: https://doi.org/10.1177/0160449X18766398.

21. Romem, I. (2018). What's Up With Construction Costs. BuildZoom. Retrieved from: https://www.buildzoom.com/blog/whats-up-with-construction-costs.

22. U.S. Bureau of Labor Statistics. May 2018 Metropolitan and Nonmetropolitan Area Occupational and Wage Estimates. Retrieved from: https://www.bls.gov/oes/current/oes_41860.htm.

23. Romem, Issi. (2018). What's Up With Construction Costs. Buildzoom. Retrieved from: https://www.buildzoom.com/blog/whats-up-with-construction-costs.

24. Reid, C. & Raetz, H. (2018). "Perspectives: Practitioners Weigh in on Drivers of Rising Housing Construction Costs in San Francisco." Terner Center for Housing Innovation at UC Berkeley. Retrieved from:https://ternercenter.berkeley.edu/uploads/San_Francisco_Construction_Cost_Brief_-_Terner_Center_January_2018.pdf.

25. Goggin, B. (2018). Measuring the Length of the Housing Development Process in San Francisco. Retrieved from: http://ternercenter.berkeley.edu/student-projects.

26. U.S. Department of Labor. Low Wage, High Violation Industries. Retrieved from: https://www.dol.gov/agencies/whd/data/charts/low-wage-high-violation-industries.

27. Duncan, K. & Ormiston, R. (2019). What Does the Research Tell Us about Prevailing Wage Laws?. Labor Studies Journal. 44(2) 139-160. Retrieved from: https://doi.org/10.1177/0160449X18766398.

28. Ibid.

29. Ibid.

30. Reid, C. & Raetz, H. (2018). "Perspectives: Practitioners Weigh in on Drivers of Rising Housing Construction Costs in San Francisco." Berkeley, CA: Terner Center for Housing Innovation at UC Berkeley. Retrieved from: https://ternercenter.berkeley.edu/uploads/San_Francisco_Construction_Cost_Brief_-_Terner_Center_January_2018.pdf.

31. See: Reid, C. (2020). "The Costs of Affordable Housing Production: Insights from California's 9% Low-Income Housing Tax Credit Program." Terner Center for Housing Innovation at UC Berkeley. Retrieved from: http://ternercenter.berkeley.edu/development-costs-LIHTC-9-percent-california.

32. Reid, C. & Raetz, H. (2018). “Perspectives: Practitioners Weigh in on Drivers of Rising Housing Construction Costs in San Francisco.” Berkeley, CA: Terner Center for Housing Innovation at UC Berkeley. Retrieved from: https://ternercenter.berkeley.edu/uploads/San_Francisco_Construction_Cost_Brief_-_Terner_Center_January_2018.pdf.

33. Ibid.

34. Waddoups, C. J. (2014). “Union Coverage and Work-Related Training in the Construction Industry.” ILR Review 67, no. 2 (April 2014): 532–55. https://doi.org/10.1177/001979391406700210.

35. Associated General Contractors of America and Autodesk. (2019). 2019 Workforce Survey Results: California Results. Retrieved from:https://www.agc.org/sites/default/files/WorkforceDevelopment_2019_California_0.pdf.

36. Associated General Contractors of America and Autodesk. (2019). 2019 Workforce Survey Results: California Results. Retrieved from:https://www.agc.org/sites/default/files/WorkforceDevelopment_2019_California_0.pdf.

37. Woetzel, J., Sangeeth, R., Mischke, J., Garemo, N., & Sankhe, S. (2014). A blueprint for addressing the global affordable housing challenge. McKinsey Global Institute. Retrieved from:https://www.mckinsey.com/~/media/McKinsey/Featured%20Insights/Urbanization/Tackling%20the%20worlds%20affordable%20housing%20challenge/MGI_Affordable_housing_Full%20Report_October%202014.ashx.

38. Pullen, T., Hall, D. M., & Lessing, J. (2019). “A Preliminary Overview of Emerging Trends for Industrialized Construction in the United States”(White Paper). Zurich, Switzerland: ETH Zurich Research Collection. https://doi.org/10.3929/ethz-b-000331901.

39. Galante, C., Draper-Zivetz, S., & Stein, A. (2017). Building Affordability by Building Affordably. Terner Center for Housing Innovation at UC Berkeley. Retrieved from: http://ternercenter.berkeley.edu/uploads/offsite_construction.pdf.

40. Pacheco, A. (2018). Can mass timber help California build its way out of the housing crisis? The Architect’s Newspaper. Retrieved from: https://archpaper.com/2018/03/can-mass-timber-help-california-build-way-housing-crisis.

41. Boerner, D. (2019). Is Mass Timber An Answer To Codes And Costs In The Bay Area? Bisnow. Retrieved from: https://www.bisnow.com/san-francisco/news/construction-development/is-mass-timber-an-answer-to-new-code-demands-and-soaring-costs-in-the-bay-area-101803.

42. Libby, Brian. (2018). Mass Timber Tower Carbon12 Rises Over Code and Financing Hurdles. Architect Magazine. Retrieved from:https://www.architectmagazine.com/practice/mass-timber-tower-carbon12-rises-over-code-and-financing-hurdles_o.

43. ACR 102, (2019). file:///C:/Users/hayley_raetz/Downloads/201920200ACR102_Assembly%20Floor%20Analysis_.pdf.

44. Dayton. Mike. (2019). Assembly Floor Analysis: Assembly Third Reading, ACR 102 (Bigelow), As Introduced June 6, 2019. Majority Vote. Retrieved from: https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201920200ACR102.

45. Minnesota Housing Finance Agency. Multifamily Application Instructions: Consolidated RFP and HTC Rounds 1 and 2. Retrieved from: http://www.mnhousing.gov/sites/multifamily/applicationresources.

46. Passel, Jeffrey S., & Cohn, D'vera. (2018). "U.S. Unauthorized Immigrant Total Dips to Lowest Level in a Decade". Pew Research Center. Retrieved from: https://www.pewresearch.org/hispanic/wp-content/uploads/sites/5/2019/03/Pew-Research-Center_2018-11-27_U-S-Unauthorized-Immigrants-Total-Dips_Updated-2019-06-25.pdf.

47. Buckley, B., Rubin, D. K., Long, J. T., Poirier, L., Overman, S., & Powers, M. B. (2018). DREAMS AND NIGHTMARES: Muddled immigration rules now threaten at least 1.5 million undocumented construction workers and how their employers operate. ENR: Engineering News-Record, 16. Retrieved from: https://search-ebscohost-com.libproxy.berkeley.edu/login.aspx?direct=true&db=f5h&AN=128845484&site=eds-live.

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Acknowledgments

This report was made possible thanks to support from the Chan Zuckerberg Initiative, and specifically their support for the intensive data collection and cleaning that it took to do this analysis. We would especially like to acknowledge Libby Nachman, Steven Doctors, and Ryan Kelley-Cahill for their assistance on this project.

We would like to thank all the developers and contractors who took the time to work with us on this project. We are grateful to Minh Nguyen and Ben Gluckstern at Citi Community Capital for the data and insights they provided.

We appreciate the contributions of the Terner Center's team, especially Carol Galante, David Garcia, Ben Metcalf, and Cora Johnson-Grau, for their thoughtful feedback and contributions to the report.