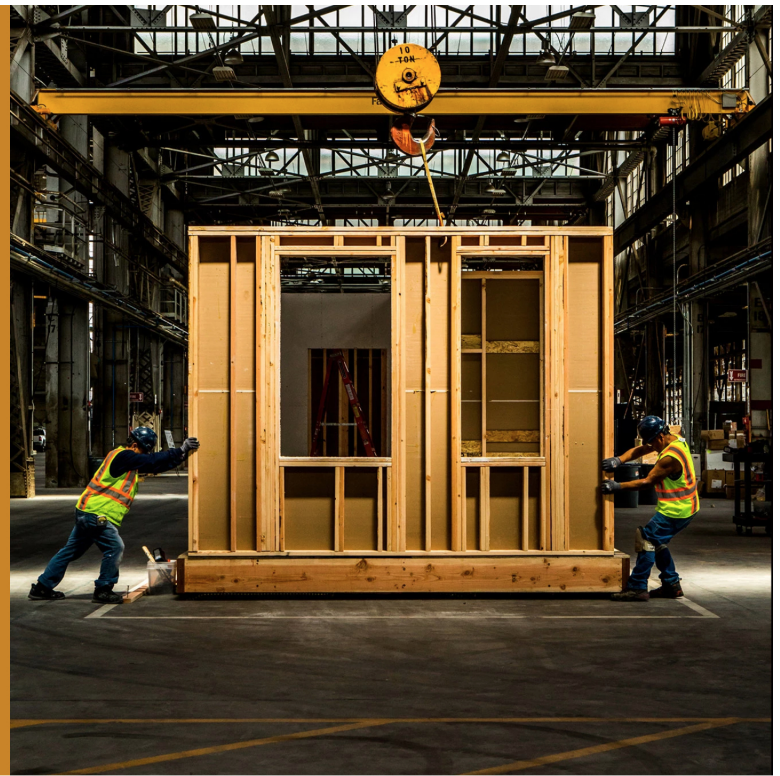


Piece by Piece, a Factory-Made Answer for a Housing Squeeze

Developers are taking on residential building challenges by extending the concept of prefabricated housing to manufacture entire apartment buildings.



At Factory OS in Vallejo, Calif., individual segments of modular homes are built at a series of stations, each devoted to a specific part of the process. Two workers focused on the construction and placement of walls.
Christie Hemm Klok for The New York Times

By **Conor Dougherty**

June 7, 2018



VALEJO, Calif. — California is in the middle of an affordable-housing crisis that cities across the state are struggling to solve. Rick Holliday, a longtime Bay Area real estate developer, thinks one answer lies in an old shipyard in Vallejo, about 40 minutes northeast of San Francisco.

Here, in a football-field-sized warehouse where workers used to make submarines, Mr. Holliday recently opened [Factory OS](#), a factory that manufactures homes. In one end go wood, pipes, tile, sinks and toilets; out another come individual apartments that can be trucked to a construction site and bolted together in months.

“If we don’t build housing differently, then no one can have any housing,” Mr. Holliday said during a recent tour, as he passed assembly-line workstations and stacks of raw materials like windows, pipes and rolls of pink insulation.

Almost a decade after the recession flattened the housing industry, causing waves of contractors to go bankrupt and laid-off construction workers to leave the business for other jobs, builders have yet to regain their previous form. Today the pace of new apartment and housing construction sits at [a little over half the 2006 peak](#).



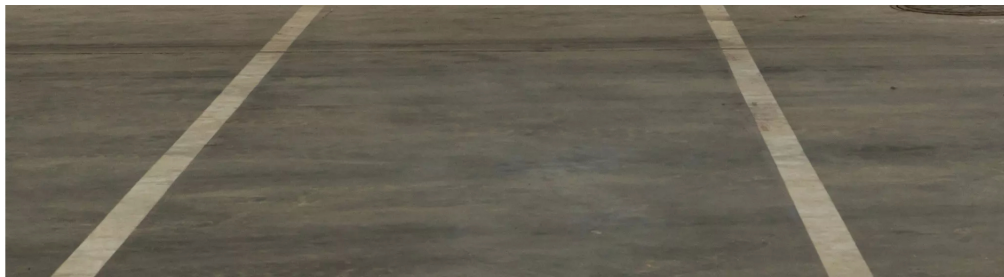


At the first station of the assembly line, flooring is assembled.
Christie Hemm Klok for The New York Times



Jeff Anderton, a Factory OS worker, cuts ceiling framing that will be fitted into the modular housing units. Christie Hemm Klok for The New York Times





A group of bathtubs await placement. Christie Hemm Klok for The New York Times



At one set of stations, workers focus on the construction and installation of ceilings for the modular units. Christie Hemm Klok for The New York Times

The United States needs new housing, but its building industry isn't big enough to provide it. The number of residential construction workers is 23 percent lower than in 2006, while higher-skill trades like plumbers, carpenters and electricians are down close to 17 percent. With demand for housing high and the supply of workers short, builders are bidding up prices for the limited number of contractors.

Construction prices nationwide have risen about 5 percent a year for the past three years, according to the [Turner Building Cost Index](#). Costs have gone up even faster in big cities and across California, according to RSMean, a unit of Gordian, which compiles construction data. In the Bay Area, builders say construction prices are up 30 percent over the past three years — so much that even luxury projects [are being stalled](#) by rising costs.

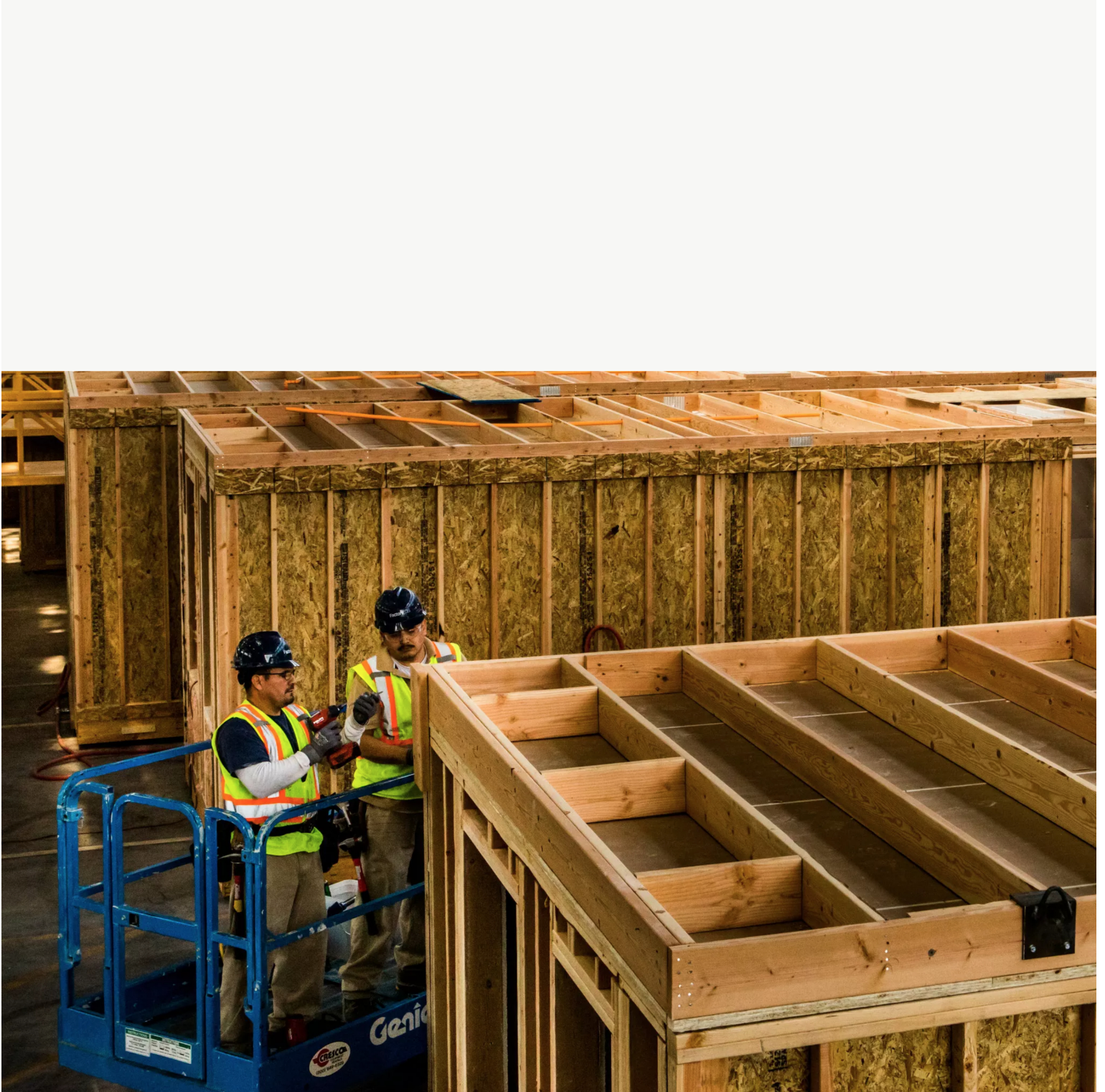
"It's reached the point where you cannot get enough rent or you cannot sell enough units to make it a viable deal," said Lou Vasquez, a founding partner and managing director of Build, a real estate developer in San Francisco.

The surge in construction prices is coming at the worst possible time for booming cities like New York, Seattle and San Francisco, already dealing with an affordable-housing crunch that has increased the homeless populations and stoked acrimonious debates about growth and gentrification. City and state legislators have tried to tackle their housing problems with proposals to increase [subsidized affordable housing](#), [reduce building regulations](#) and make it legal to [build taller](#).

But even if every overpriced city suddenly overcame the thicket of zoning rules and [neighborhood opposition](#) that make it difficult to build new housing in the first place — which seems doubtful — today's diminished

building industry would lack the capacity to build at the needed pace. This affects the rich as well as the poor, because it raises the cost of high-end condos and affordable housing alike.

Later this year, California residents will vote on a proposed \$4 billion bond to build more subsidized affordable housing. In San Francisco, where developers say the per-unit construction cost is [edging toward \\$800,000](#), that would buy about 5,000 units, a relative blip. “Costs have risen so much that it is not possible to build homes where people want to live at the prices and rents they can afford,” said John Burns, founder of John Burns Real Estate Consulting.



“If we don’t build housing differently, then no one can have any housing,” Rick Holliday, a longtime Bay Area real estate developer, said during a recent tour of Factory OS. Christie Hemm Klok for The New York Times

All this has prompted developers like Mr. Holliday to go scrambling for

cheaper and less labor-intensive construction methods — and investors to pour money into start-ups that promise to do just that. Kattera, a three-year-old prefabricated building company in the Silicon Valley city of Menlo Park, [has raised](#) \$1.1 billion in venture capital. A number of other building start-ups including Blokable, based in Seattle; Kasita, based in Austin, Tex.; and RAD Urban, based in Oakland, Calif., have all popped up over the past five years.

“The current system can’t meet demand and that’s resulting in a lack of opportunity for some folks and a major hit to the economy,” said Stonly Baptiste, a co-founder of Urban Us, a Brooklyn-based venture capital firm that invested in Blokable. “These aren’t small problems and they aren’t small markets.”

The technologies vary but generally involve simplifying construction through prefabricated panels that can be assembled like Ikea furniture and modular apartments that can be stacked together like Lego bricks. A [recent survey](#) by FMI, a management-consulting and investment banking company focused on the engineering and construction industry, found a third of respondents said they were looking at some form of off-site construction, a steep rise from 2010. The interest extends from housing to [hotels](#) to [medical facilities](#), industrial companies and even [fast-food restaurants](#).

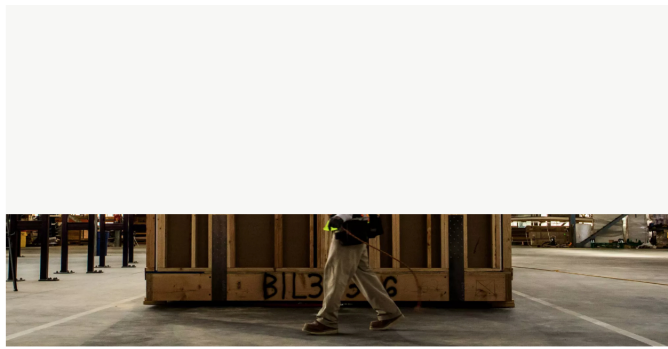
“It’s one of those things that looks like an overnight success but it’s taken 10 years and hundreds of people toiling,” said Chris Giattina, chief executive of BLOX, a Birmingham, Ala., company that builds hospitals with modular components.

Brokers of Risk

The global construction industry is a \$10 trillion behemoth whose structures determine where people live, how they get to work and what cities look like. It is also one of the world’s [least efficient businesses](#). The construction productivity rate — how much building workers do for each hour of labor they put in — has been flat since 1945, according to the McKinsey Global Institute. Over that period, sectors like agriculture, manufacturing and retail saw their productivity rates surge by as much as 1,500 percent. In other words, while the rest of the economy has been supercharged by machines, computers and robots, construction companies are about as efficient as they were in World War II.

To understand this, consider how buildings are actually built. It all starts with the developer, who doesn’t actually build anything but instead secures a piece of land and a loan, and gets the project approved by the government. At that point the money is passed to the general contractor that made a successful bid to build the project, who passes it to subcontractors that won the bidding for things like plumbing and sheet metal work, which often pass it to even more subcontractors.

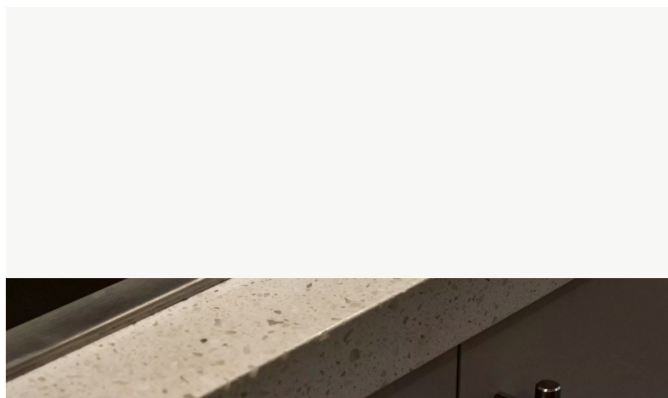
Contractors describe this handoff as “brokering risk.” What they mean is that while everyone in the chain has agreed to build a certain piece of the project for a set amount of money and in a given amount of time, none of them are sure they can do so as cheaply or quickly as they’ve promised. They broker that risk by paying someone else to do it for them, minus a small fee.



The technologies of modular housing vary but generally involve simplifying construction through prefabricated panels that can be assembled like Ikea furniture and apartments that can be stacked together like Lego bricks. Christie Hemm Klok for The New York Times



There are 24 stations in the Factory OS assembly process. By Station 17, where windows are installed, the units begin to resemble the final product. Christie Hemm Klok for The New York Times





A kitchen is nearly finished. Christie Hemm Klok for The New York Times



A completed studio unit, ready to be shipped out. The goal at Factory OS is to churn out about 2,000 apartments a year, to be turned into four- and five-story buildings with 80 to 150 units each. Christie Hemm Klok for The New York Times

“Say you’re a general contractor and your subcontractor agrees to do a job. Once we have a contract I don’t care how many man hours you put into it because that’s your problem now,” said Randy Miller, chief executive of RAD Urban, describing the thinking behind the process.

The goal of prefabricated building companies is to turn this model on its head. Instead of offloading risk, the contractor assumes all of it. Instead of sending jobs to subcontractors, they hire their own factory workers. “The general contractor says, ‘Oh my God, construction is scary, let me broker all that risk,’” Mr. Miller said. “I’m saying, ‘Oh my God, construction is scary, let me plan and control it.”

The basic concept isn’t new. In 1624, Massachusetts settlers built homes out of prefabricated materials shipped from England. The pattern was repeated in Australia, Africa and India as the British Empire shipped colonists and structures wide across the globe, according to “Prefab Architecture,” by Ryan E. Smith, a professor at the University of Utah.

Over the next few centuries, new versions of the idea seemed to pop up anywhere people needed to build lots of homes in a hurry — during the California Gold Rush, after the Chicago fire, and through America’s westward expansion. In the early part of the 20th century, Sears sold tens of thousands of kits for [Sears Modern Homes](#), which consisted of prefabricated parts and panels that buyers assembled.

Along the way, the construction industry absorbed manufacturing concepts such as the assembly-line techniques that were utilized by Levitt & Sons, the pioneer of mass-built subdivisions. But the idea of factory-built housing was never adopted long or widely enough to make an impact, at least in the United States.

One reason the United States has lagged behind Europe, Australia and Asia — which all have well-established companies doing modular and prefabricated building — is that it is a predominantly suburban nation, and the vast supply of open land has kept the cost of single-family-home building relatively low. Another is that the construction industry has slim profit margins and invests little in research and development.

The chances of being burned are high, and each high-profile failure leads to a furlough of the concept. In the mid-2000s housing boom, Pulte Homes, one of the country's largest builders, opened a prefabrication plant that aimed to revolutionize how homes were built. The company [closed it](#) with the onset of the housing bust in 2007.



Prefabricated housing, in one form or another, has been around since at least the early 17th century, when Massachusetts settlers built homes of materials shipped from England. In the 1950s, Hungarian workers lowered a prefab kitchen at a housing construction site. *Sovfoto/UiG, via Getty Images*

Now, instead of single-family homes, companies doing prefab building are focusing on higher-density condominiums and apartments. That's because, while single-family home construction remains well below its level before the recession, multifamily condominium and apartment buildings have rebounded strongly. "Our goal is to be able to do a 40-story tower in 12 months, at half the cost of traditional construction," said Mr. Miller of RAD Urban.

Still, even if builders are able to reduce construction costs, that doesn't necessarily mean they will be successful. Behind each of these companies is a bet that they can build far more efficiently than current methods. That bet has yet to be proven, at least on a large scale.

Efficiency vs. Workers

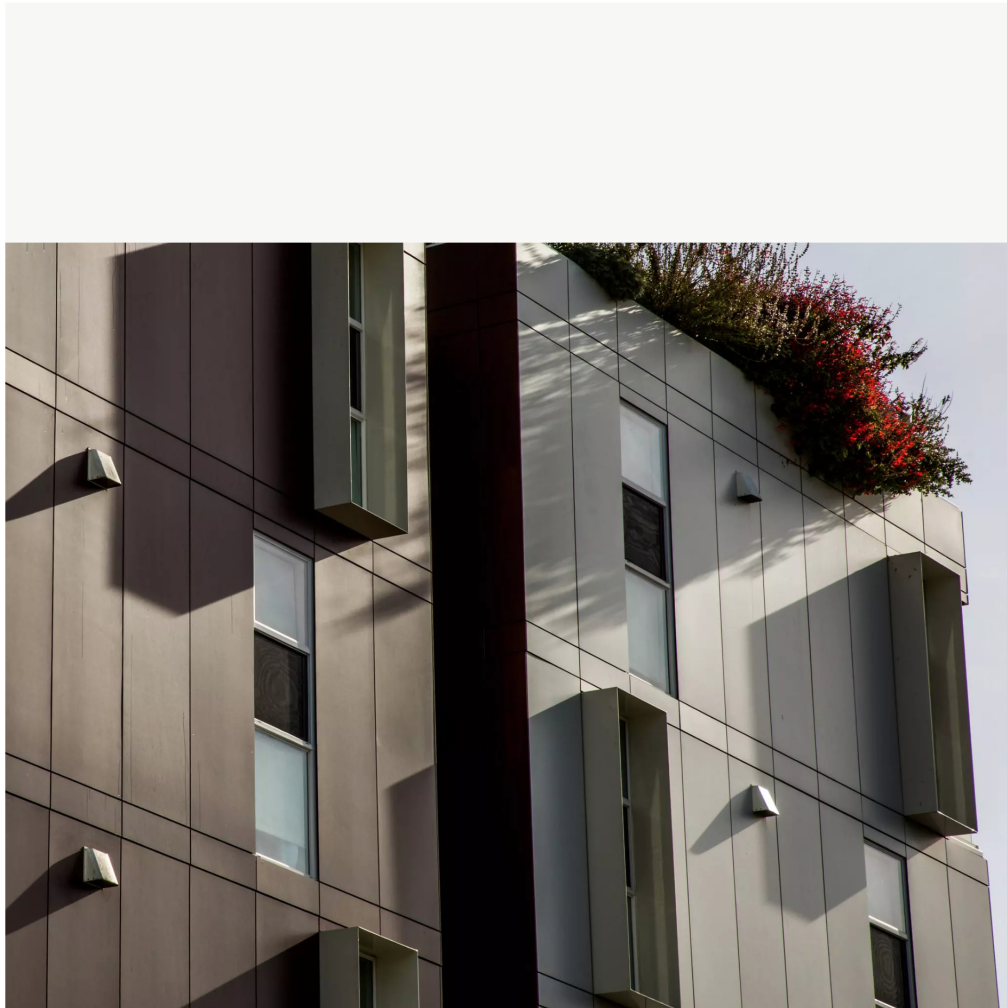
Mr. Holliday of Factory OS started thinking about modular housing about four years ago, when he was struggling to build a project in Truckee, Calif.,

a mountain town of about 15,000 people near Lake Tahoe. The idea was to build a cluster of 800 to 1,000 high-density apartments and condominiums, but “the numbers wouldn’t work,” he said. “You couldn’t get the construction costs down enough.”

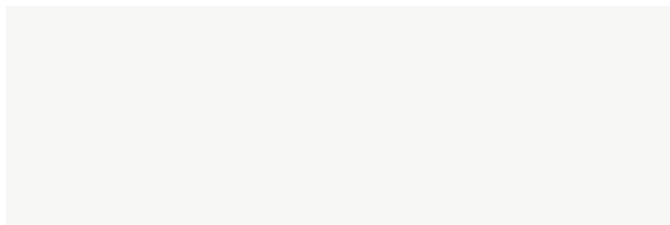
Mr. Holliday floated the idea of modular building to his longtime contractor, Larry Pace, from Cannon Constructors, who over the past four decades has built various projects from one-off homes to high-rise condo and office towers. “I said ‘modular jobs have been a fiasco — we don’t need that in our lives,’” Mr. Pace recalled, adding an expletive for emphasis.

But Mr. Holliday persisted, and he and Mr. Pace used modular technology from two manufacturers to build four projects in the Bay Area. They are planning to do the same with the original Truckee development. Mr. Pace became so comfortable with modular that he suggested that they find some investors and build a factory of their own.

On a recent afternoon, Mr. Pace laid out the factory’s process. At the first station, just past the door, four workers toiled above and below a raised platform to build what would eventually become the floor. The two men up top laid down flooring while a man and woman stood below simultaneously installing pipes.



A completed project: an apartment complex in Berkeley, Calif., made of prefabricated units that have been fastened together. Christie Hemm Klok for The New York Times

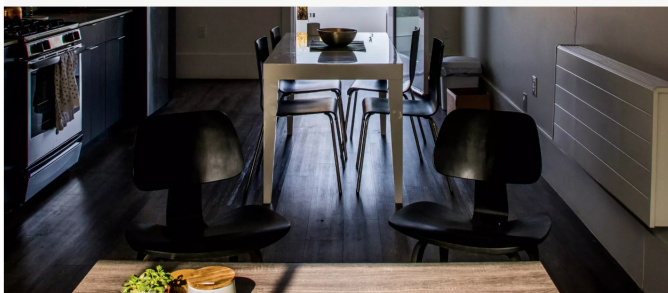
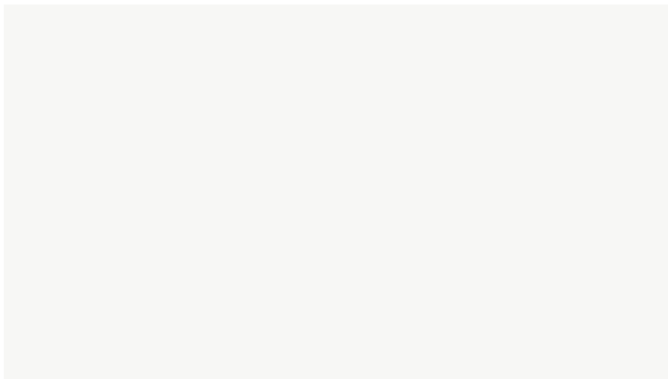




The apartment has been designed and built to maximize interior space.
Christie Hemm Klok for The New York Times



A telling detail that this is a prefabricated unit: the small strips in the door frames, designed to hide the connection between modules. Christie Hemm Klok for The New York Times



Transom windows are used in the dormers to promote ventilation since the units in Parkview are not

From there the unit would move steadily down the line, and, over 21 additional stations, would acquire toilets, indoor walls, outdoor walls, a roof, electric outlets, windows, sinks, countertops and tiling. It takes about a week to finish a unit, Mr. Pace said. The goal is to churn out about 2,000 apartments a year, which would be turned into four- and five-story buildings with 80 to 150 units each.

For workers, factory building seems to mean lower wages but steadier work. Factory OS pays about \$30 an hour with medical insurance and two weeks of vacation. That's about half what workers can make on a construction site, but the work is more regular and, for many, requires less commuting.

Tony Vandewark, a 51-year-old foreman at Factory OS, is OK with the trade-off. Mr. Vandewark lives a few minutes from the factory in Vallejo, where homes cost less than half what they do closer to San Francisco. Contrast that with a job he once had in the Silicon Valley city of Sunnyvale. Mr. Vandewark drove two hours to work and three hours home before deciding to rent a room so he could stay closer to work on weekdays.

"On a job site, you can go do piece work and make really big money, but then the job is gone," he said.

In addition to not being rained on, one of the key differences between a construction site and Factory OS is that any worker can be trained to do any job. And for old-school trade unions, that is a declaration of war. "The business model is 'Hooray for me,'" without regard for anyone else, said Larry Mazzola Jr., business manager of UA Local 38, a San Francisco plumbers' union with about 2,500 members across Northern California.

Factory OS is not anti-union: It has a contract with the Northern California Carpenters Regional Council, which has organized other modular factories and is banking on the technology's continued growth. The issue is that builders are laid out like a Detroit auto factory, where one union represents all of the workers, and workers can be trained to do any job within the company walls.

That is a huge departure from construction sites, where unions representing plumbers, electricians, carpenters and various other trades each control their piece of the building process. Last year Mr. Mazzola wrote a letter to San Francisco's mayor, Ed Lee, a month before he died, urging him to deny any city business — such as contracts for subsidized housing — to Factory OS.

"Any decision to use Factory OS shows a blatant disregard for the other craft unions," he wrote. He asked the mayor to refrain from contracting with the company unless it allowed craft unions to do their pieces of the work. "We realize modular is coming and we want to be part of it, but not at the expense of our workers, which is what's happening right now," Mr. Mazzola said in an interview.

Jay Bradshaw, director of organizing for the carpenters' council representing Factory OS workers, said that would be impractical. Think back to that first station, where four people worked above and below the floor. In Mr. Mazzola's world, a plumbers' union would represent the workers installing pipes, while other unions would represent the workers up top.

"It would never work to have upward of 10 or 15 labor organizations at a single employer in a factory setting," Mr. Bradshaw said.

For Mr. Bradshaw, the real fight isn't defending job titles but making sure construction workers remain part of a union at all. A short drive from Factory OS, at a carpenters' training center, the union is developing a program to train housing-factory workers — something that, it hopes, will prepare more people for an industry that it has come to see as inevitable.

"It sure blows the hell out of building in China," he said.

72 Comments

The Times needs your voice. We welcome your on-topic commentary, criticism and expertise.



Related Coverage

- March 20, 2018 **California Housing Problems Are Spilling Across Its Borders**
- April 12, 2018 **Rent Control Campaign in California Is Taken to the Streets**
- May 12, 2018 **These 95 Apartments Promised Affordable Rent in San Francisco. Then 6,580 People Applied.**
- Dec. 1, 2017 **The Great American Single-Family Home Problem**

Fast Forward

Examining technological, economic, social and cultural shifts that happen as businesses evolve.

This Factory Was Ready to Expand. Then Came the Trump Trade Wars.

June 1



Jeans, Made in the ... U.K.?

May 29



Manufacturing Flip-Flops for the Greater Good

May 28

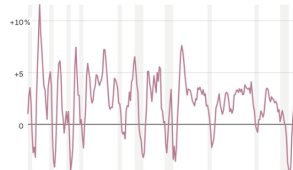


More in Economy

E-Commerce Might Help Solve the Mystery of Low Inflation

When it's easier to comparison shop online, businesses are less likely to raise prices — but you wouldn't know that by looking at official inflation data.

4h ago



Trending

Live Updates: Trump and Kim Jong-un Hold Meetings in Singapore

Trump, Opening Talks With Kim, Welcomes 'Terrific Relationship'

Lasik's Risks Are Coming Into Sharper Focus

ICE Came for a Tennessee Town's Immigrants. The Town Fought Back.

Save 50% for one year. One day only.

SUBSCRIBE NOW >