

WHITE PAPER

THE U.S. CONSTRUCTION INDUSTRY: **A NATIONAL CRISIS LOOMING**



CHANGING THE WAY THE WORLD BUILDS™

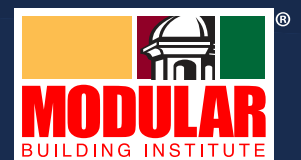


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INTRODUCTION

With the U.S. economy strong again and unemployment rates historically low, one might wonder why anyone would think a crisis is looming. The answer is simple: there are not enough skilled workers to build all the projects that need to be built in the same manner they have been built in the past. The demand (need) for construction in the U.S. is high while the supply of labor is flat and declining relative to demand.

Every aspect of the U.S. construction industry was developed under the assumption that all the work would occur on the final building site — including procurement, design, financing, insurance, contracts, logistics, materials handling, labor laws, safety, and building codes. This assumption is no longer valid; therefore, ALL areas of the construction process must be revisited.

Building on the 2017 McKinsey Global Institute Report “Reinventing Construction,” this paper will make the case for needed changes in thinking at the national, state, and local levels, as well as specific policy recommendations that need addressed and implemented.

THE CHALLENGES

At-Risk Infrastructure

Every four years, the American Society of Civil Engineers' (ASCE) Report Card for America's Infrastructure depicts the condition and performance of American infrastructure in the familiar form of a school report card — assigning letter grades based on the physical condition and needed investments for improvement. The 2017 Infrastructure Report Card reveals that the country has made some incremental progress toward restoring the nation's infrastructure. But it has not been enough. As in 2013, America's cumulative GPA for 2017 is once again a D+.

"Every school day, nearly 50 million K-12 students and six million adults occupy close to 100,000 public school buildings on an estimated two million acres of land. While state and local governments make significant investment in public K-12 school infrastructure and schools play important civic, educational, and public safety roles in communities, the nation continues to under-invest in school facilities, leaving an estimated \$38 billion annual gap. As a result, 24 percent of public-school buildings were rated as being in fair or poor condition."

- ASCE's 2017 Infrastructure Report Card

ASCE estimates that there is currently a two trillion dollar shortfall in funding for infrastructure projects needed by 2025. This does not include other commercial and residential projects such as restaurants and offices, healthcare facilities, nor housing! According to ASCE, failing to close this gap could result in:

\$3.9 trillion in losses to the U.S. GDP by 2025

\$7 trillion in lost business sales by 2025

2.5 million lost American jobs in 2025

ASCE 2017 Grade for U.S. Infrastructure was D+.

The infrastructure is in poor to fair condition and mostly below standard, with many elements approaching the end of their service life. A large portion of the system exhibits significant deterioration. Condition and capacity are of serious concern with strong risk of failure.



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FOR ITS POOREST
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Cost-Burdened Housing

The National Low Income Housing Coalition (NLIHC) reports a shortage of seven million available and affordable rental homes for America's Extremely Low-Income (ELI) renters in its annual report, "The Gap: A Shortage of Affordable Homes 2019," released on March 14, 2019. This shortage leaves only 37 available and affordable homes for every 100 ELI renter households. The Coalition found that no state or major metropolitan area has an adequate supply of rental housing for its poorest renters.

Nevada is experiencing the greatest shortage, with only 19 units for every 100 ELI renter households, while Wyoming has the lowest shortage, with 66 units available per 100 ELI households.

Households are considered housing cost burdened when they spend more than 30 percent of their incomes on rent and utilities. They are considered severely cost-burdened when they spend more than half of their incomes on their housing. More than nine million extremely low-income renters, five million very low-income renters, and four million low-income renters are cost burdened.

The severe shortage of affordable homes for extremely low-income renters is systemic, affecting every state and metropolitan area. Absent public subsidy, the private market is unable to produce new rental housing affordable to these households, because the rents that the lowest-income households can afford to pay typically do not cover the development costs and operating expenses of such housing.

However, one group thinks this is exactly where modular and offsite construction can help. MBI has been working with an organization called the Housing Crisis Solutions Coalition (HCSC). HCSC firmly believes that the federal affordable housing policies, including the low-income housing tax credit (LIHTC) are NOT working. Their belief is that by using a modular solution to get more projects on-line more quickly, the projects will cash flow and perform much better for the developers. With this earlier occupancy and cash flow, more units could be available for lower income renters and perhaps the tax credits would not be needed.

MBI analyzed project data from 17 modular multi-family projects constructed over the past four years. On average, the projects were 33,182 total square feet, with the modular portion constituting 27,261 square feet or 82 percent of the total project. On average, the projects consisted of approximately 50 modules each. Accelerated project timelines are driving greater interest in multi-family markets with the average project completed in just 241 days from approval to occupancy. Earlier occupancy compared to traditional construction methods could mean six to eight months of additional revenue at the beginning of the pro-forma.

Within the last few years, we have seen several new modular manufacturing facilities established with a focus on addressing housing needs. This is a good start, but more capital needs to be invested in existing and new factories to begin to put a dent in the housing gap.

Lack of Labor Participation:

According to a recent report by the Associated General Contractors (AGC), "A severe labor shortage will continue to plague the construction industry through 2019, driving up construction costs further." The report shows that 79 percent of construction companies want to hire more employees this year, but the industry is only estimated to grow its workforce by half a percent annually for the next 10 years. That is hardly enough to make up for the 600,000 jobs lost since the last recession.

For at least the past 20 years, there have been various initiatives and campaigns to try to make the construction industry more appealing to younger people to help fill the labor gap. It's just not working!

According to the Bureau of Labor Statistics (BLS), the overall unemployment rate as of May 2019 was 3.6 percent. However, among people age 18-24, the unemployment rate is a staggering 21.1 percent for men and 16.6 percent among women. It should be noted that the unemployment rate includes those who are actively seeking employment and does not include those not in the labor pool for various reasons. The overall labor participation rate (defined as the section of working population in the age group of 16-64 in the economy currently employed or seeking employment) is at 62.8 percent as of May, lower than the peak of the economic recession.

The U.S. construction industry currently employs approximately 7.5 million people with a 3.2 percent unemployment rate and has nearly 400,000 job openings. With so many people sitting on the sidelines and so many young people unemployed, why can't the construction industry fill its labor needs?

With so many people unemployed; especially 18-24 year olds; why can't the construction industry fill its labor needs?

After the U.S. was attacked at Pearl Harbor and entered World War II, a much smaller labor force was mobilized to build thousands of ships, planes, and tanks for the war effort. The country accomplished this because tens of millions of workers moving from low- to high-productivity jobs in industrial centers, including many female workers.

After the war, the men returned to work and the women returned to their homes. American consumerism (and some say complacency) kicked in. In fact, the often-cited McKinsey Labor Productivity Report shows that while productivity gains were made in some sectors such as manufacturing and agriculture, the construction industry has remained relatively flat for the past several decades.

The reality is that young people, by and large, simply do not want to pursue work in the construction field in sufficient numbers to address construction needs. Most seasoned construction workers are getting older about to enter retirement years. According to BLS, the median age of construction workers in 2018 was 42.5 years. Two-million-four-hundred-thousand of those workers are age 55 or older, while only one million are age 16-24. Simply put, the number exiting the industry is exceeding the number entering by a 2:1 margin.

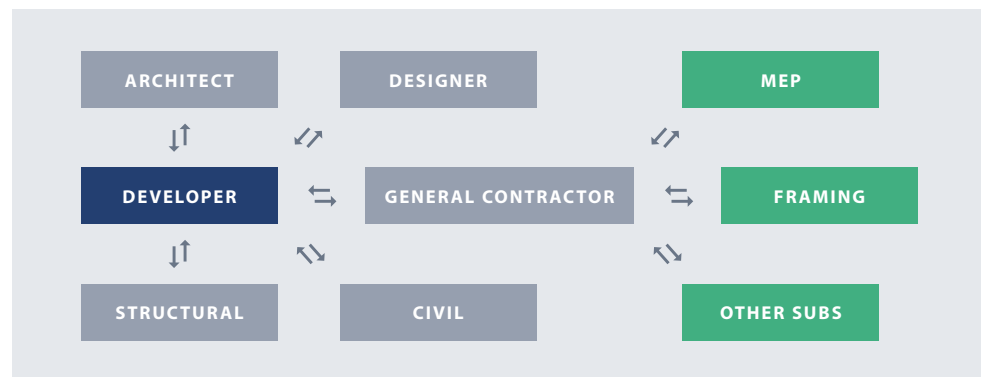
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THE CHALLENGES

Counterproductive Labor Policies

When jurisdictions impose certain labor requirements (such as PLAs, prevailing wages, apprenticeship requirements) on an industrialized process, it often results in limiting or eliminating competition. Traditional labor requirements were not crafted for an industry more reliant on processes rather than a division of trades. For example, image 1 below shows how a traditional build might look, with all the various players, while image 2 shows how an integrated modular manufacturer project might look. *(images courtesy of Rise Modular).*

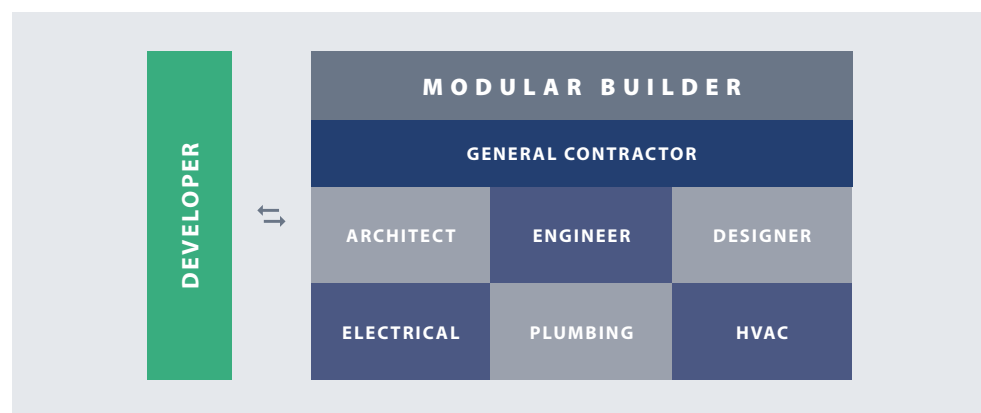
TRADITIONAL BUILD



In other cases, a developer will work with a general contractor, who will utilize the modular manufacturer as a “super sub” performing many of the trades under one roof.

As such, decades old labor policies that limit competition and support a separation of trades simply are impractical for this type of construction. Policies are needed that promote and encourage competition and innovation, or at least provide a neutral playing field between modular/industrialized and traditional construction.

MODULAR BUILD



Too Much Waste!

The amount of waste generated by the construction industry has been written about time and time again, yet little action has been taken. According to the Environmental Protection Agency (EPA), 138 million tons of Construction and demolition (C&D) materials ended up in our landfills in 2015.

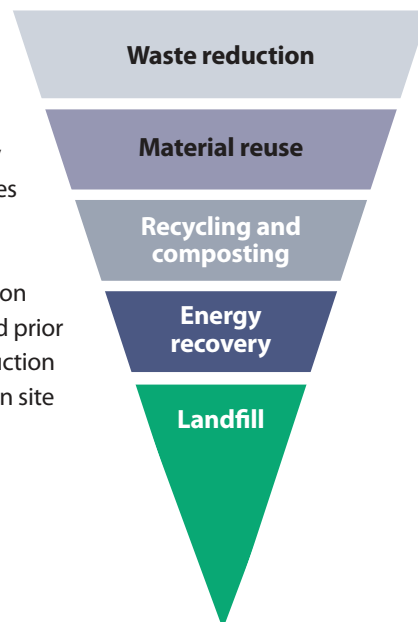
The environmental consequences of construction and demolition waste in the U.S. are staggering. With more than 135 million tons of debris to landfills every year, it's the single largest waste source. Reducing the amount of waste in a project is an important part of sustainable building and begins with the design process. Choosing alternative methods of construction such as prefabrication, modularization, and offsite construction techniques is an effective way to design out waste — reducing the overall construction waste during construction vs. managing and diverting it after the fact.

Green building efforts for site-built construction focus on reuse, recycling or diversion of waste that is generated on site. However, with offsite construction, the materials can be managed prior to leaving the factory, offering a much more efficient process to reduce the amount of waste sent to landfills.

Waste hierarchy showing that the target for any waste reduction strategy is to first design out waste, and then focus on recycling and reusing any remaining waste material. Data courtesy the U.K. Waste & Resources Action Programme (WRAP).

The average new construction project generates about four pounds of waste per square foot of building area. Policies and incentives should be implemented to cut this figure in half.

Due to the factory-controlled process, modular construction is by nature material and resource-efficient. One of the great economies of modular construction is the ability to assemble repetitive units in controlled conditions. Another is to minimize material waste associated with conventional construction due to weather intrusion and construction site theft. Whole modular units – largely finished prior to arriving at the construction site – can significantly limit construction waste generated at the site and contribute directly to construction site waste management.



ACCORDING
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Outdated Procurement Practices

Often, projects are set on a path towards budget and schedule overruns from the onset, simply because of the procurement method used. The design-bid-build (or DBB) is a process widely used project delivery method in which the agency or owner contracts with separate entities for the design and construction of a project. As its name implies, there are three main phases to the design-bid-build method: 1) the design phase; 2) the bidding phase; 3) the construction phase.

By the time the project is designed and bids are received, it is often too late to consider alternative construction methods such as modular or panelized solutions without some degree of redesign. According to the Lean Construction Institute, the DBB procurement method is the most widely used in the U.S. This is primarily for legal reasons on public projects as DBB makes it's easier to compare bids when the agency is required to award the project to the lowest bidder because contractors and subcontractors have the same information. The lowest bidder requirement triggers the preferred use of DBB, which limits competition, communication, and collaboration among the construction team.

New research from FMI shows that the design-build (DB) delivery method, where an owner contracts with a single entity to perform both design and construction, is quickly gaining traction in the industry. According to the June 2018 "Design-Build Utilization" report, DB methods will represent nearly half, or 44 percent, of construction put-in-place spending across many market segments by 2021.

Other procurement practices such as Construction Manager at Risk (CMAR) and Integrated Project Delivery (IPD) are gaining traction in some markets. According to the Design Build Institute of America (DBIA) about half of the states as of 2018 permit design-build for all agencies and for all types of construction. In the other states, DB is limited to subdivisions or specific projects.

At the federal level, "transparency" is a buzz word often used by politicians. As such, the DBB process, where the low bidder is clearly identified, provides some political protection and semblance of prudent spending of taxpayer money. Often lost in this equation is best value, missed projection completion dates, and cost overruns.

The federal government proceeds with large projects based on estimated costs, but once projects get underway officials often revise the costs upward. Cost overruns have plagued the federal government since the beginning. A hospital built in Orlando more than doubled in cost from \$254 million to \$616 million, while one built near Denver quintupled in cost from \$328 million to \$1.7 billion.

The various federal agencies, perhaps through a coordinated effort by the Office of Federal Procurement Policy (OFPP), should examine and measure the effectiveness of the DBB procurement process on recent projects and make recommendations and policies to move towards more efficient procurement practices that emphasis best value, collaboration and communication among the construction team.

NEW THINKING, TRAINING, AND POLICIES NEEDED

The U.S. Construction Industry: A National Crisis Looming

Revisit LIHTC Program

The Low-Income Housing Tax Credit (LIHTC) is the federal government's primary program for encouraging the investment of private equity in the development of affordable rental housing for low-income households. The Program subsidizes the acquisition, construction, and rehabilitation of affordable rental housing for low- and moderate-income tenants. Since its creation in 1986, the LIHTC has helped to finance more than 2.4 million affordable rental-housing units for low-income households (Source: Office of the Comptroller of the Currency).

Many types of rental properties are LIHTC eligible, including apartment buildings, single-family dwellings, townhouses, and duplexes. Owners or developers of projects receiving the LIHTC agree to meet an income test for tenants and a gross rent test. There are three ways to meet the income test:

At least 20 percent of the project's units are occupied by tenants with an income of 50 percent or less of area median income adjusted for family size (AMI).

At least 40 percent of the units are occupied by tenants with an income of 60 percent or less of AMI.

At least 40 percent of the units are occupied by tenants with income averaging no more than 60 percent of AMI, and no units are occupied by tenants with income greater than 80 percent of AMI.

The LIHTC is estimated to cost around nine billion dollars per year. It is by far the largest federal program encouraging the creation of affordable rental housing for low-income households. Supporters see it as an effective program that has substantially increased the affordable housing stock for more than 30 years.

Critics of the LIHTC argue that the federal subsidy per unit of new construction is higher than it needs to be because of the various intermediaries involved in its financing—organizers, syndicators, general partners, managers, and investors—each of whom are compensated for their efforts. As a result, a significant part of the federal tax subsidy does not go directly into the creation of new rental housing stock. Critics also identify the complexity of the statute and regulations as another potential shortcoming. Another downside is that some state housing finance authorities tend to approve LIHTC projects in ways that concentrate low-income communities where they have historically been segregated and where economic opportunities may be limited. Finally, while the LIHTC may help construct new affordable housing, maintaining that affordability is challenging once the required compliance periods are over.

(Source: Tax Policy Center)

The federal affordable housing policies, including the low-income housing tax credit (or LIHTC) just are not working. We continue to fall further behind in terms of affordable housing inventory and the percent of American's that are cost burdened continues to grow.

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NEW THINKING, TRAINING, AND POLICIES NEEDED

By using a more industrialized approach to construct housing, more housing projects can come on-line, more quickly, and without sacrificing quality

By using a more industrialized approach to construct housing, more housing projects can come on-line, more quickly, and without sacrificing quality. The projects will cash flow and perform much better for developers with earlier occupancy and revenue perhaps changing the overall rate of return, allowing for the possibility of lower rents, even without LIHTC.

According to our most recent data, the multi-family sector is the fastest growing in the modular industry between 2017 and 2018, with more than double the number of multi-family modular units produced (1,136 in 2017 to 2,314 in 2018). This market represents about nine percent of all industry production in 2018 (up from five percent in 2017) but less than one percent of total new multi-family units that were constructed in 2018. With the current industry capacity, and with several recent start-ups focused on this market, we estimate that the industry could quadruple its output of modular housing units to approximate 10,000 per year over the next five years. And while this certainly won't meet the demand, it will help to close the gap.

But what if that same nine billion dollars allocated to the states under the LIHTC program were used by the states as incentives for more modular factories to open? Each state would receive \$180 million to incentivize existing and new manufacturers to invest and expand locally, and hire more people dedicated to building housing to meet local needs.

Another option is for states to supplement the current LIHTC program by offering innovation tax credits, as is currently being done by the State of Virginia. As a separate pool of credits than the low income housing credits, the state offers developers tax credits for innovative construction processes that get more housing inventory online quickly.



New Training Initiatives

The labor would still be needed to fill these factories, but it could come from “non-traditional” sources that the construction industry has not or cannot tap. Imagine a new automated facility in your town, employing men, women, minorities, and the disabled. Swinging hammers would be a thing of the past, replaced with programmers monitoring the automated equipment utilization for wall assemblies.

Imagine a whole new generation learning about 3D modeling and animation on computer screens to simulate actual projects in order to prevent costly on-site errors. Doesn’t this sound much more appealing to young people than what the construction industry is currently selling? This is not a fantasy.

Imagine a whole new army of construction professionals focused on reducing CO₂ emissions and construction debris waste while building more energy efficient buildings in a safe, indoor working environment.

The University of Florida’s Rinker School of Construction recently launched a new program aimed at training for manufactured construction (or TRAMCON). The TRAMCON Consortium was created to fill the growing demand in the Manufactured Construction industry. The consortium is made up of four public Florida colleges; industry associations; CareerSource Florida workforce investment boards; and local employers.



The TRAMCON career pathway includes on-the-job training and nine nationally recognized trade certificates and gives priority consideration to veterans. The TRAMCON program utilizes curriculum developed by the National Center for Construction Education and Research (NCCER) which provides a platform for uniform national-level training and transcripts for the workers. While not all-encompassing, NCCER currently offers two textbooks on manufactured construction that can be supplemented with other construction courses on safety and blueprint reading for example. This program can and should be offered and implemented by vocational schools across the country.

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Standardized Processes

The U.S. modular industry is currently made up of about 200 regional manufacturers building everything from construction site offices to single-family homes to hotels. The industry is regulated primarily at the state level through administrative agencies that implement and enforce the rules for building in that state. However, only 35 states have such a program meaning the remaining states rely on local code officials to determine compliance and safety. Additionally, the state programs lack a great degree of consistency in requirements and even terminology. For example, the program in Massachusetts is referred to as the “manufactured buildings program,” while in other states, the industry is referred to as “industrialized buildings,” or “factory-built housing.”

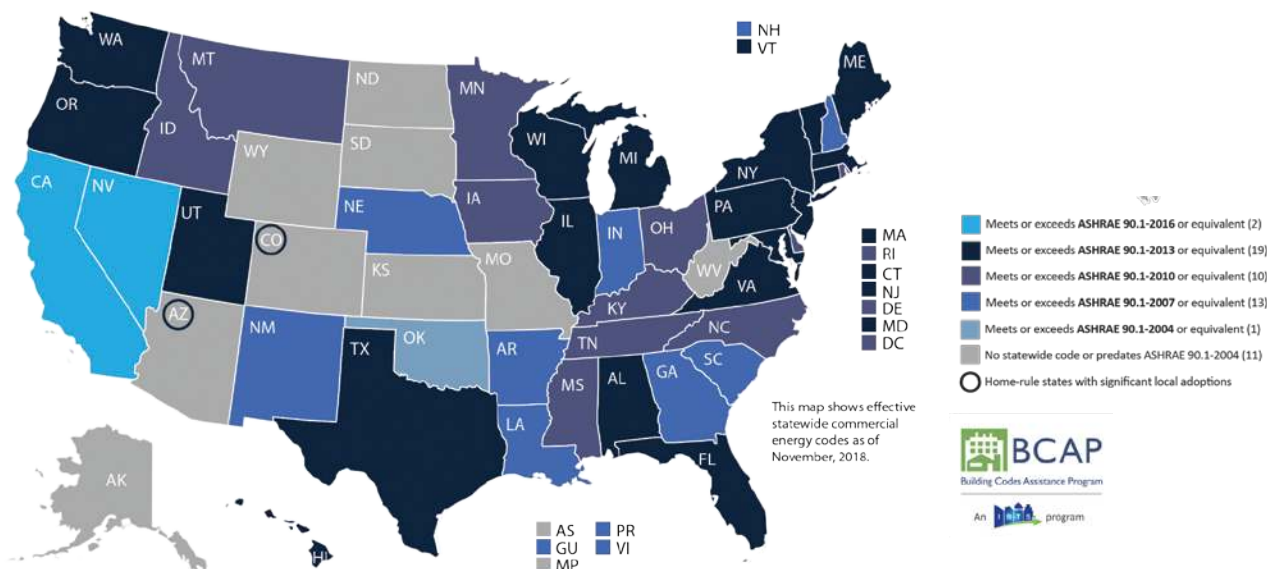
MBI is currently working with the International Code Council to help develop industry standards for various aspects of modular and offsite construction including terminology. Once developed, these ANSI standards

will address HOW modular buildings get approved among other aspects of construction. Currently, these various state program requirements make it extremely challenging and costly for regional manufacturers shipping into multiple states. Helping to develop and implement more consistent administrative rules will improve efficiency and lower costs.

The building codes themselves, while developed on a national model, can also vary from state to state. This is largely due to the differing code adoption cycles at the state level as well as local amendments added to the base model code. For example, some states such as Maryland have adopted the most current version of the International Building Code (2018), while nearby states are still on the 2015 or even 2012 version. To further complicate matters, the energy code adoptions have become somewhat political and polarizing.

The map below shows the various energy code adoptions nationwide.

COMMERCIAL ENERGY CODE ADOPTION



If you are a Texas-based manufacturer, you are likely building product for at least five different states with three or four different energy code requirements. Consistency, standardization, and interstate reciprocity on a regional basis are generally helpful.

Removal of Transportation Barriers

Similar to administrative and building code requirements, the transportation requirements often vary from state to state. This can create a logistical nightmare when trying to transport modules from a factory to the final site several states away, particularly in the Northeastern United States. State transportation departments create their own policies for days and hours of transport, oversize loads, divisible loads, fees, and height, width, and length limits. Take all these variables and multiple by fifty states and you can imagine the added time and cost associated with just transporting building modules.

While there have been some efforts to “harmonize” state transportation requirements, those efforts have largely gone cold. Some states, such as Connecticut, seem to be complete outliers regarding their requirements relative to neighboring states. We would encourage state DOT and policy makers to revisit the harmonization of regulations at least on a regional basis. This is not only good for the modular industry, but commerce in general.

Some modular manufacturers have tried alternatives to highway transportation such as by rail or even ship. One challenge when transporting by ship (east coast to west coast) is Section 27 of the Merchant Marine Act of 1920, known as the Jones Act. Among other purposes, the law regulates maritime commerce in U.S. waters and between U.S. ports. The Jones Act requires that all goods transported by water between U.S. ports be carried on U.S.-flag ships, constructed in the United States, owned by U.S. citizens, and crewed by U.S. citizens and U.S. permanent residents.

Practically speaking, this means that ships entering East Coast ports carrying consumer goods made overseas, leave the port with empty shipping containers. One East Coast modular manufacturer estimates that if he could utilize that ship to transport modules from the East Coast where his factory is located, to the West Coast where housing demand is high, it would cut the cost of transporting the modules by two-thirds! This would dramatically expand the service area of many factories.



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MODULAR TIPPING POINT REACHED

What happens if the U.S. construction industry essentially does nothing and tries to continue building the way we always have?



Twenty-story Citizen M Hotel in NYC with room modules fabricated in Poland.



Remember what happened to the U.S. auto industry when the Big Three (GM, Chrysler and Ford) did not innovate and invest in new technologies, designs, and processes? While U.S. automakers continued to build big, inefficient cars, Japan innovated the industry by building smaller fuel-efficient vehicles. Their factories were built on lean manufacturing principles and just in time inventories. This was not a problem until gas prices soared, making gas guzzling cars less desirable. In 1979, the Shah of Iran was overthrown, the Ayatollah Khomeini came into power, cutting Iran's oil production, and reducing shipments of crude oil to the United States. That led to soaring gasoline prices as the American economy plunged into a recession.

In 1961, GM, Chrysler, and Ford held a combined 85 percent of the U.S. auto market share. Today those same companies account for about 44 percent of the market-share with Toyota and Honda accounting for about 24 percent. But those are cars and that can't happen with the construction industry can it? Before you answer, consider that two twenty-story hotels recently built in New York City are utilizing room modules fabricated in Poland.

Many Asian and European modular companies, with the support of pro-modular government policies and housing initiatives, have made great strides in addressing housing and labor shortages in their own countries and are now eyeing exports to the U.S.

General contractors, recognizing the advantages of the "super sub" model, will be reluctant to return to the scheduling and communication challenges of coordinating multiple subs.

Developers, now sold on the advantages of modular, will not go back to less-efficient site-built methods. They will seek and find modular partners, even if it means importing from other countries. Cashflow is king and modular means quicker occupancy and quicker ROI.

TIME TO PIVOT: POLICY RECOMMENDATIONS

In many countries such as Japan and Germany, the prefab/offsite construction industry grew out of their manufacturing sector, making it much more of an industrialized and automated process. Whereas in the U.S., our offsite industry grew out of the construction industry, making it much more labor dependent and regionalized.

Modular construction currently accounts for only about four percent of all new construction starts in the U.S., driving about nine billion dollars in construction activity. Greater market share has been limited by the factors cited in this paper and by long held misconceptions about modular construction and an incredible lack of willingness to build differently.

The results of our past actions speak for themselves. According to a McKinsey research paper in 2016, cost and schedule overruns are now the norm in the construction sector. Large projects across asset classes typically take 20 percent longer to finish than scheduled and are up to 80 percent over budget. Construction productivity has declined in some markets since the 1990s; and financial returns for contractors are often relatively low and volatile.

Rather than continuing to cling to outdated policies and practices that have yielded no gains in efficiency, we must advance towards industrialized construction to a much greater degree.

Summary of policy recommendations:

1. Greater emphasis and investment at the federal, state, and local levels on closing the two billion dollar infrastructure funding gap identified by ASCE.
2. Revisit the LIHTC program and reallocate resources in a more productive manner.
3. States to expand housing tax credit program to favor innovative approaches that address needs.
4. Standardize the state-level approval process for modular and offsite construction processes.
5. Encourage regional state reciprocity agreements for construction related policies.
6. Revisit efforts to harmonize state transportation requirements.
7. Revisit the Jones Act with an eye towards repeal/amending.
8. Limit/prohibit use of union-only project labor agreements and mandatory apprenticeship requirements.
9. Expand the use of NCCER manufactured construction curriculum nationwide.
10. Implement policies and incentives to reduce average construction waste to two pounds per sq ft of building space.
11. Revisit federal procurement policies in favor of methods that promote collaboration and communication among construction team such as design-build and integrated project delivery.

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