TESTIMONY TO THE

NATIONAL INSTITUTE OF BUILDING SCIENCES

CONSULTATIVE COUNCIL

"HOUSING AFFORDABILITY HEARING"

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Modern, up-to-date building codes and standards are at the core of building innovation, through the introduction of cross-cutting materials and products, adaptation and resilient design, and innovative construction strategies. The International Code Council (ICC) is a leader in providing such solutions.

The Code Council is a U.S.-based nonprofit organization of roughly 700 employees, driven by the engagement of its more than 60,000 members, that is dedicated to helping communities and the building industry provide safe, resilient, and sustainable construction through the development and use of model codes (I-Codes) and standards used in design, construction, and compliance processes. Most U.S. states and communities, federal agencies, and many global markets choose the I-Codes to set the standards for regulating construction and major renovations, plumbing and sanitation, fire prevention, and energy conservation in the built environment.

We're pleased to provide testimony on approaches to advance innovation, sustainability, and resilience of our nation's housing stock—while increasing affordability and availability. Key industry stakeholders and policymakers alike can help to do so by encouraging greater use of off-site construction, as well as greater consistency through adoption of off-site construction standards, and by supporting greater use of up-to-date building codes.

Advancing Standards in Off-site Construction to Accelerate its Growth

Off-site (modular) construction or pre-fabrication, the design and delivery of housing using an industrialized and manufactured-style approach, has been identified as a core strategy in addressing multiple building industry and societal challenges—including sustainability, access to affordable housing, and rapid delivery of housing availability. With national housing costs rising 52-percent from 2017 to 2022, off-site construction offers an affordable solution, capable of curbing construction timelines and reducing costs.[1] Off-site construction can deliver projects 20- to 50-percent faster than traditional site-built methods, while also providing cost savings of up to 20-percent.[2] In addition to affordability benefits, off-site construction can reduce material waste while enhancing building quality and improving the safety of builders.

[1] S&P/Case-Shiller U.S. National Home Price Index (2017 to 2022), https://fred.stlouisfed.org/series/CSUSHPISA.
[2] McKinsey & Company, *Modular construction: From projects to products* (June 2019); Galante, et. al., *Building Affordability by Building Affordably: Exploring the Benefits, Barriers, and Breakthroughs Needed to Scale Off-Site Multifamily Construction*, Terner Center for Innovative Housing at UC Berkley (Mar. 2017).

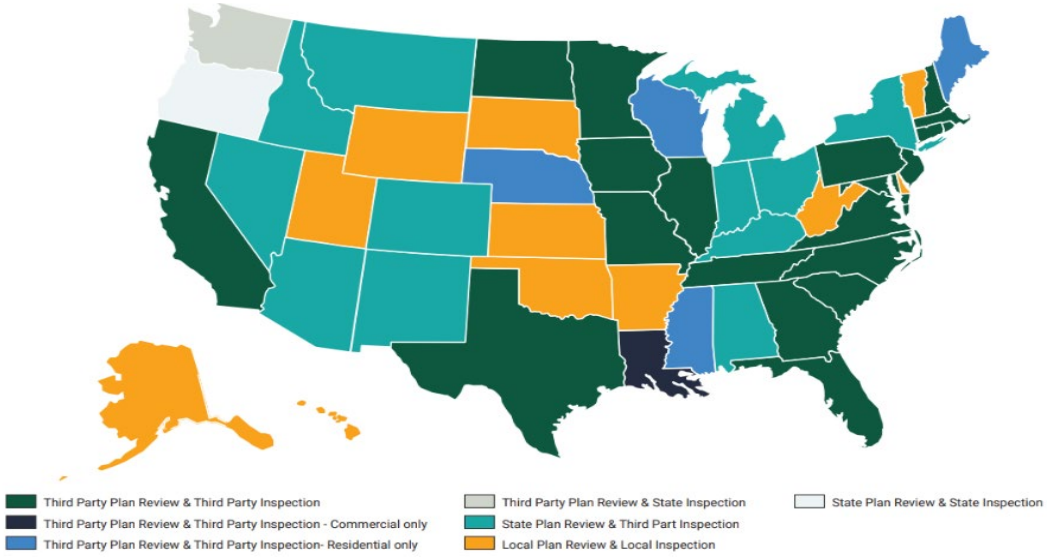
Off-site construction includes a variety of processes including production of volumetric modules (fully enclosed rooms with six sides), wall panels with integrated insulation and building system components, bathroom or kitchen pods, pre-fabricated accessory dwelling units (ADUs), tiny homes, and shipping containers that are constructed in a factory. These processes enable economies of scale, can ensure greater resilience through more consistent construction quality, create safer and less disruptive jobsites, and enhance sustainability through reduced waste and product spoilage.

Numerous government and industry organizations have identified off-site construction as a key housing affordability strategy. President Biden recently recognized this opportunity in the Administration's Housing Supply Action Plan,[3] while the U.S. Department of Housing and Urban Development (HUD) and the U.S. Department of Energy (DOE) are supporting research to help expand its use.[4]

In terms of off-site construction's impact on affordability, 91-percent of all general contractors reported, through a survey undertaken by Dodge Data & Analytics, that modular construction has a favorable impact on project budget performance, with 48-percent indicating that costs decreased by more than 10-percent. More than two-thirds of respondents (68-percent) cited better than a 5-percent positive budget impact. Beyond cost savings, cost predictability is increasingly cited as a benefit of modular/off-site construction. Due to the method's shortened construction schedule and upfront materials purchases, off-site projects provide a hedge against construction market uncertainty.[5]

Despite being identified as a clear solution to the housing crisis, a patchwork of compliance processes and governmental support exists for off-site construction. Currently, as displayed in *Figure 1*, 39 states and Washington, D.C., regulate off-site construction. These programs are responsible for plan review

Figure 1. Off-Site Construction Plan Review and Inspection Requirements by Jurisdiction (ICC NTA)



[3] The White House, *Press Release: President Biden Announces New Actions to Ease the Burden of Housing Costs*, (May 16, 2022).

[4] Department of Energy, Advanced Building Construction Initiative, https://www.energy.gov/eere/buildings/advanced-building-construction-initiative; Department of Housing and Urban Development, The HUD Off-site Construction Research Roadmap, https://www.huduser.gov/portal/pdredge/pdr-edge-trending-072622.html.

[5] Dodge Data & Analytics, *Prefabrication and Modular Construction 2020: Smart Market Report* (January 2020).

and inspection of off-site construction components. However, these programs vary significantly from state to state—some states allow third-party agencies to conduct both plan review and in-factory inspections whereas others only allow state employees to perform these functions.

There is also inconsistency in the types of projects and components covered in each state—some only cover residential construction and others just commercial, and some include closed panels where others only cover volumetric modules. In the remaining eleven states, the off-site construction approvals process is left entirely to local jurisdictions who may have neither the capacity nor capability to effectively approve such projects. Varying requirements increase costs for manufacturers and the resulting variation in construction practices makes code enforcement more difficult.

To incentivize increased use of off-site construction, building regulatory programs must be designed to effectively inspect and approve factory-built components. To address the gap in consistency of current compliance processes, the International Code Council and Modular Building Institute (MBI) have developed the *ICC/MBI Off-site Construction Standard 1200: Planning, Design, Fabrication*[6] ("1200"), and *Assembly* and *ICC/MBI Off-site Construction Standard 1205: Inspection and Regulatory Compliance*[7] ("1205"), which cover the entire off-site construction process and capture best practices to support a consistent approach to verifying compliance. The standards apply to all componentized, panelized, and modularized elements in both commercial and residential buildings, except U.S. HUD-regulated manufactured housing.[8]

Standard 1200 provides requirements for designers, manufacturers, transporters, and assemblers to assure that off-site construction components are produced under a quality assurance/quality control process and that they can demonstrate compliance with building code requirements. Standard 1205 addresses the compliance verification process including permitting, in-plant and on-site final inspections, third-party inspections, as well as the role of Industrialized Building Departments, state modular programs, and localities.

The standards can integrate with already-adopted building codes and include procedures for plan review and in-factory inspection and approval. The standards were developed by a diverse committee of experts including state program administrators, manufacturers, third-party agencies, and designers. They meet the requirements for private-sector developed standards as outlined in the *National Technology Transfer and Advancement Act* (NTTAA) and OMB Circular A-119. These standards are intended to sit alongside existing building codes and standards to provide the verification process for off-site construction compliance with state or locally adopted building codes and standards. Widespread

[6] *2021 ICC/MBI 1200 Standard for Off-site Construction: Planning, Design, Fabrication and Assembly*, available at ICC Digital Codes (Accessed Sept. 10, 2023).
[7] *ICC/MBI Off-site Construction Standard 1205: Inspection and Regulatory Compliance*, available at ICC Digital Codes (Accessed Sept. 10, 2023).
[8] Manufactured housing is a form of off-site construction, but its design and assembly is regulated by the U.S. Department of Housing and Urban Development (HUD). Local code officials retain responsibility to site work, installation and accessory structures. ICC/MBI 1200 and 1205 do not apply to manufactured housing.

adoption of the standards was recently endorsed by the National Association of Home Builders,[9] with supportive editorials published in *The Seattle Times*[10] and *Governing Magazine*.[11]

President Biden's Housing Supply Action Plan noted that "HUD is also working to assess hurdles to modular and panelized housing posed by inconsistent state and local inspection requirements and standards, which limit economies of scale and potential cost savings," while Congress encouraged HUD's work as well as that advanced by the ICC/MBI 1200 and 1205 standards, stating that recently enacted bipartisan legislation "recognizes that off-site construction, including modular and panelized, can be a promising means of increasing the supply of affordable housing and encourages HUD to support consensus-based off-site construction standards."[12] Last year, at the Code Council's annual conference, HUD Deputy Secretary Adrienne Todman offered the Department's similar support: "We deeply appreciate the Council's efforts to develop model codes for these innovative housing types and look forward to working with you to promote more widespread adoption across the country."[13]

Both off-site and the ICC/MBI standards can also aid in helping house community members post disaster. Disaster events across the country have limited the availability of housing. Off-site construction can provide opportunities for more expedient rebuilding post-disaster. The ICC/MBI standards promote uniform consistency in project approvals processing, which allows for a greater number of manufacturers—familiar with the approvals process—to provide housing resources in times of need.

Integration of Advanced Materials and Construction Methods within the I-Codes

Building codes and standards provide a common language and requirements for the design, construction, and operation of buildings. The International Code Council facilitates the development of model building codes for adoption at the national, state, or local level. The I-Codes are updated every three years and developed through a consensus-based process, bringing together expertise from the public and private sector to capture the latest science and technology. Building codes and standards have long served as the main tool of governments in setting agreed-upon norms and introducing new technologies and innovation across the building stock, often driven by the latest in building sciences or unfortunate lessons learned from tragic events.

In recent years, the I-Codes have incorporated an extensive array of new technologies and best practices that enable and advance construction of tiny homes, reuse of shipping containers, the utilization of cross-laminated timber (CLT), and 3-D printed structures.[14] The Code Council also recently released a standalone publication of the *2021 International Tiny House Provisions: Code, Commentary and*

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[9] NAHB Resolution, *Facilitating Affordability, Sustainability and Regulatory Consistency through Standards for Off-site Construction* (June 10, 2023); A Unique Opportunity to Address the Affordable-Housing Crisis: Off-Site Construction, Governing (Aug. 15, 2023).

[10] Belcher, Matt, *To ease housing crisis, remove barriers to off-site construction (Opinion)*, The Seattle Times (Aug. 23, 2023).

[11] Belcher, Matt, *A Unique Opportunity to Address the Affordable-Housing Crisis: Off-Site Construction (Opinion)*, Governing (Aug. 15, 2023).

[12] U.S. Congress, Explanatory Statement to Accompany H.R. 2617, Consolidated Appropriations Act, 2023, 117th Cong., 2d sess., Pub. Law 117-328 (2022), https://www.congress.gov/117/cprt/HPRT50348/CPRT-117HPRT50348.pdf.

[13] International Code Council, *2022 International Code Council Annual Business Meeting Part 1: Opening Ceremonies*, YouTube (Accessed Sep. 10, 2023).

[14] The I-Codes cover additional non-traditional building materials, including Light Straw-Clay Construction; Strawbale Construction; and Cob Construction.

Standards for Design, Construction and Compliance and has announced development of a standard for tiny homes intended for permanent occupancy. Both CLT and 3-D printing can speed construction and enable new building design options. CLT can also mitigate earthquake hazards for building occupants, while 3-D printing enables impressive precision. Current codes also integrate advancement in building sciences that work to safely enable energy storage.

As new and innovative products come to market, manufacturers can demonstrate code compliance through the ICC-Evaluation Service's (ICC-ES) product evaluation process. Through this process, manufacturers, designers, contractors, and those charged with enforcement gain confidence in the safety of innovative construction products. Where the model codes do not yet address properties for such a product, ICC-ES can develop Acceptance Criteria (ACs), which help ensure project safety. Similar to the code development process, ACs and changes to such criteria are vetted via a public input process and are approved by an Evaluation Panel made up of code officials.

The federal government has increasingly moved towards incentivizing the adoption and implementation of current codes due to their hazard resistance measures. This approach was advanced during the Trump Administration within the federal government's National Mitigation Investment Strategy—developed by the Mitigation Federal Leadership Group (MitFLG)—and continued by the Biden Administration through the National Initiative to Advance Building Codes (NIABC).[15, 16] The White House, in support of the NIABC, just released the National Climate Resilience Framework, which further highlights the role of model building codes and standards in advancing hazard risk reduction and calls for the expanded adoption of the latest consensus-based building and energy codes.[17]

Building Codes Protect Life Safety Without Impacting Affordability

Contemporary research continues to find that modern model building codes have no appreciable implications for housing affordability—in fact, no peer-reviewed research has found otherwise. Any potential impact from codes would primarily affect construction costs. However, one study considering the role of government regulation on home prices found that construction costs, including labor and materials, were flat from 1980 to 2013.[18] The International Code Council was formed in 1994, the I-Codes were adopted across the country in the early 2000s, and several significant advancements to better mitigate structures against natural hazards were integrated into these codes during the period studied. None of these code activities meaningfully impacted construction costs.

Several additional contemporary analyses reached similar conclusions. After Moore, Oklahoma experienced its third violent tornado in 14 years, the city significantly strengthened its building codes. The Moore Association of Home Builders estimated a \$1-\$2/ft^2 resulting increase in the cost of construction. Yet, researchers found that the change to a stronger building code had no effect on the price per square foot or home sales.[19] The most detailed benefit-cost analysis of seismic code adoption

[15] Mitigation Framework Leadership Group, *National Mitigation Investment Strategy* (Aug. 2019).
[16] The White House, *Press Release*, *FACT SHEET: Biden-Harris Administration Launches Initiative to Modernize Building Codes,* Improve Climate Resilience, and Reduce Energy Costs (June 1, 2022).
[17] The White House, National Climate Resilience Framework (September 2023).
[18] Gyourko, J. & Molloy, R., *Regulation and Housing Supply*, Handbook of Regional and Urban Economics, Volume 5B Chapter 19 (2015).
[19] Simmons, K. & Kovacs, P., *Real Estate Market Response to Enhanced Building Codes in Moore, OK*, Investigative Journal of Risk Reduction (Mar. 2018).

to date modeled six buildings in Memphis, Tennessee and compared the costs of adhering to the seismic provisions of the 2012 edition of model building codes as opposed to late 1990s-era codes. The study found that adopting the 2012 codes, for the apartment building studied, would add less than 1-percent to the construction cost (and less to the purchase price, since construction cost typically amounts to between one-third and two-thirds of purchase price), reducing annualized loss—in terms of repair cost, collapse probability, and fatalities—by approximately 50-percent.[20]

The National Institute of Building Sciences (NIBS) in its Mitigation Saves study found that the regular adoption of building codes saves $11 for every $1 invested and that savings accrue to every stakeholder including developers, tenants and lenders.[21] The principal investigator for the NIBS report found that improvements to model building codes' resilience over the nearly 30-year period studied only increased a home's purchase price by around a half a percentage point in earthquake country or in an area affected by riverine flood.[22]

In addition to having no appreciable impact on housing cost, up-to-date codes provide considerable benefits to homeowners. According to the Association of State Floodplain Managers (ASFPM), the insurance savings from meeting current codes' flood mitigation requirements can reduce homeowners' net monthly mortgage and flood insurance costs by at least five-percent.[23] Codes also reduce the risk of damage or full loss of housing in the face of hazards, helping maintain the availability of housing units.

The cost effectiveness of modern codes is due in no small part to the active participation in the code development process of stakeholders representing development and property management interests. Building owners and managers, home builders, architects, design professionals, building trades, the fire service, plumbing and sanitation professionals, manufacturers, and others representing the housing industry devote considerable time and effort towards ensuring code updates are practical and cost effective.

In addition to examining upfront or first costs, it is important to examine the long-term impacts of building codes on the ability of residents to remain in their homes. As discussed in the following sections, the total cost of ownership or total cost of rental and the protection against destruction in the face of hazards is critical. It is also important to separate building code requirements from other local policies or regulatory activities like zoning or aesthetic requirements (e.g., all housing must have brick exteriors or a garage) that can drive up costs or limit housing production.

Modern Building Codes Enhance Resilience and Reduce Homeowner Vulnerability

Modern model building codes are among the most effective and systemic measures to reduce the risk to buildings and their occupants from natural and manmade hazards. There are years of disaster recovery and billions of dollars in taxpayer resources that could have been avoided with more consistent and frequent consideration of the I-Codes. The International Residential Code (IRC) and International

[20] NEHRP Consultants Joint Venture, *Cost Analyses and Benefit Studies for Earthquake-Resistant Construction in Memphis, Tennessee*, NIST GCR 14-917-26 (2013).
[21] Natural Hazard Mitigation Saves: 2019 Report. www.nibs.org/mitigationsaves.
[22] Porter, K., *Resilience-related building-code changes don't affect affordability*, SPA Risk LLC Working Paper Series 2019-01 (2019).
[23] ASFPM's Comments in Response to FR-6187-N-01, White House Council on Eliminating Barriers to Affordable Housing Request for Information (Docket HUD-2019-0092).

Building Code (IBC), per the Federal Emergency Management Agency (FEMA), provided more than $27 billion in cumulative mitigation benefits against flood, hurricane wind, and earthquake hazards from 2000 to 2016.[24] These benefits could have been doubled if all post-2000 construction adhered to the I-Codes. FEMA projects that if all future construction adhered to current codes, the nation would avoid more than $600 billion in cumulative losses from natural hazards by 2060.[25]

Requiring current hazard-resistant codes could prevent roughly $14,000 in losses per building in areas where codes have not been updated in the past two decades. Ensuring that future construction within these jurisdictions is resilient and energy efficient provides corresponding loss avoidance benefits equivalent to preserving 15,000 new homes, and avoiding 1.5 million metric tons of CO_2 emissions, per year.[26] The loss avoidance benefit of constructing buildings to wildfire resistant codes has the equivalent value of preserving about 4,800 new homes, and avoiding 500,000 metric tons of CO_2 emissions, per year.[27]

According to a recent study by CoreLogic and the Insurance Institute for Business and Home Safety, modern building codes can reduce the likelihood of mortgage default following a disaster.[28] The study explored the impact of landfalling hurricanes on mortgage delinquency rates and how more resilient modern building codes and their adoption impact local housing markets. According to the study, modern building codes decreased the expected spike in post-hurricane mortgage delinquency rates in Florida by about 50 percent.

Mortgage defaults do not simply affect homeowners, as we saw during the Great Recession. The Journal of Housing Research reported increases in mortgage delinquency rates following extreme weather, illustrating that disasters contribute to financial risk in the mortgage market at large.[29]

Researchers have confirmed the link between property damage and mortgage delinquency after Hurricane Harvey (2017) and Hurricane Ida (2021).[30] CoreLogic has also shown a pattern of sharp increases in mortgage delinquencies following climate disasters such as hurricanes, flooding and wildfire.[31]

Building Energy Codes Reduce Energy Burdens and Deliver Resilience

Modern building energy codes are an impactful tool to increase energy efficiency and reduce the GHG emissions directly associated with new buildings. In addition, modern energy codes are a mechanism to deliver energy bill savings for consumers and enhance community resilience in the face of growing natural hazards like extreme heat and cold events. Modern energy codes, like the International Energy Conservation Code (IECC), have been identified as tool to curb soaring energy costs and reduce energy burdens for residents across the nation.

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[24] FEMA, Protecting Communities and Saving Money: The Case for Adopting Building Codes (Nov. 2020).
[25] FEMA, Building Codes Save: A Nationwide Study (Nov. 2020).
[26] Porter, K. Do Disaster-Resistant Buildings Deliver Climate Benefits? SPA Risk LLC (2021).
[27] *Id.*
[28] Corelogic, *Can Modern Building Codes Impact Mortgage Delinquency After Hurricanes?* (Aug. 2023).
[29] Kousky, C., M. Palim, and Y. Pan. Flood Damage and Mortgage Credit Risk: A Case Study of Hurricane Harvey, *Journal of Housing Research v.* 29 (Nov. 2020).
[30] Corelogic, What Are the Effects of Natural Hazards on Mortgage Delinquencies? (Nov. 2021).
[31] *Id.*

Energy insecurity, fuel poverty or high energy burdens impact the social resilience of low- and moderate-income populations.[32] Energy insecurity intersects with other hardships, compounding the severity of the others and contributing to detrimental health consequences. In the U.S., low-income households face energy burdens two to three times that of median households. Of all U.S. households, 25 percent (30.6 million) face a high energy burden (i.e., pay more than 6 percent of income on energy bills) and 13 percent (15.9 million) of U.S. households face a severe energy burden (i.e., pay more than 10 percent of income on energy).[33] Building energy codes provide important mechanisms for reducing energy burdens. Importantly, such efforts can improve quality of life and health outcomes while providing economic stimulus and job creation.[34]

The DOE has observed that energy efficiency is a low-cost resource across the country that can reduce household energy costs regardless of a given state's climate, heating fuel and energy price factors. The International Code Council facilitates the development of the IECC on a 3-year cycle, which provides consensus-based code language to achieve energy conservation and GHG emissions reduction in new buildings and major renovations. The 2021 IECC represents a roughly 40 percent improvement in energy efficiency for buildings compared to the 2006 edition, along with corresponding improvements in building, mechanical and material science and technology.

The Pacific Northwest National Laboratory's (PNNL) final determination on the 2021 IECC found a 9.4 percent site energy savings improvement and an 8.7 percent reduction in carbon emissions for residential buildings relative to the 2018 edition, saving homeowners an average of $2,320 over the life of a typical mortgage.[35] The U.S. Department of Housing and Urban Development (HUD) estimates that hard-working families will save over 35% on energy costs by building homes using the latest energy codes.[36]

As hazard mitigation becomes a priority, energy codes are also being recognized for their contributions to resilience. DOE has also found that modern building energy codes play an important role in community resilience, both in grid resilience as well as passive survivability of structures built to the latest editions of the IECC.[37] A recent report by DOE and three national labs[38] found that the 2021 IECC can reduce deaths during a disaster-induced power outage coupled with extreme heat by 80% and extreme cold by 30%. Benefit-cost ratios for these resilience benefits ranged from 2 to 6 to 1. These benefits are additive to the energy bill savings the IECC provides. Reduced energy demand to achieve comfortable indoor temperatures through increased building efficiency can also enhance resilience of the energy grid.[39] Given the trend that extreme weather events are growing in severity and frequency, the resilience benefits associated with current energy codes represent a meaningful piece of our national resilience to hazard events.

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[32] Energy insecurity, fuel poverty or high energy burdens refer to inability to access energy sources or the cost of using such sources is significant compared to monthly income.
[33] Drehobl, A., Ross, L., and Ayala, R. How High are Household Energy Burdens? Washington, DC: American Council for an Energy-Efficient Economy (September 2020).
[34] *Id.*
[35] DOE, EERE, *Determinations*, https://www.energycodes.gov/determinations.
[36] U.S. HUD, Office of Community Planning and Development, Minimum Energy Standards.
[37] DOE, EERE, *Energy Resilience*, https://www.energycodes.gov/energy-resilience.
[38] https://www.energycodes.gov/sites/default/files/2023-07/Efficiency_for_Building_Resilience_PNNL-32727_Rev1.pdf.
[39] International Code Council, The Important Role of Energy Codes in Achieving Resilience (2019).

Conclusion

Modern building codes and off-site construction standards are mechanisms to drive innovation across the building and construction sector and are core solutions to the housing affordability and availability crisis. The International Code Council encourages industry stakeholders, government agencies and policymakers to incorporate modern building codes and offsite construction standards into program requirements and best practices to promote innovation, resilience, sustainability, and affordability across the housing stock.