

2021 CANADIAN

COMMERCIAL MODULAR CONSTRUCTION REPORT



About the Modular Building Institute – The Voice of Commercial Modular Construction

The Modular Building Institute (MBI) is the international nonprofit trade association serving the commercial modular construction industry for over 35 years.

As the Voice of Commercial Modular Construction™ MBI promotes the advantages of modular construction while advocating for the removal of barriers that limit growth opportunities.

Through its long-standing relationships with member companies, policy makers, developers, architects, and contractors, MBI has become the industry's best resource for information for the commercial modular construction industry.



Cover:
Monarc Condos Sales Office, built by Corner Cast Construction, Inc.
See case study on page 11.

A Message from the Chair of the Modular Building Institute's Canadian Council

The Modular Building Institute's annual report is an essential resource to those involved in modular construction, delivering critical information on the current state and future trajectory of our industry. With increasing demand, a shortage of skilled labour, and many Canadian communities in urgent need of affordable housing and other critical building infrastructure, the value and benefits of modular construction have never been greater. The summaries and case studies presented in this report prove that, with MBI serving as a guiding light for our industry, the future of modular in Canada is tremendously bright.



Kevin Read
CEO, Nomodic

This annual report features images of award-winning buildings from the Modular Building Institute's 2021 Awards of Distinction. Learn more about the Awards and our winners at modular.org.





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of Modular Construction Industry

The modular construction industry is primarily regulated at the state and local levels by building code administrators and authorities having jurisdictions. As with site-built structures, a building constructed using the modular process must meet the local codes where the building will be placed. Unlike federal manufactured housing products, built in accordance with the Housing and Urban Development (HUD) standard, there is no specific “modular building code” or exceptions for a building constructed utilizing the modular construction process. It is simply a more efficient process to construct building components at an offsite facility, and then transport and assemble components of a building at the final building site.

Modular construction can be utilized for a variety of uses including residential, commercial, or industrial applications. The Modular Building Institute (MBI) represents the commercial sector of the industry.

Commercial Modular Buildings are nonresidential factory-built building components and structures designed to

meet all applicable building codes. Commonly, these buildings are constructed in accordance with the International Building Code (IBC) in the United States, the National Building Code (NBC) in Canada, or a local version modeled after these codes. In this context prefabricated, mechanical, electrical, or plumbing (MEP) systems are not included for industry revenue and production figures.

The commercial modular building industry is comprised of two distinct divisions, both represented by MBI.

Relocatable Buildings (RB) – Relocatable buildings, as defined in the International Building Code, are partially or completely assembled buildings constructed and designed to be reused multiple times and transported to different building sites. This segment of the industry maintains fleets of relocatable buildings offered for sale or lease to customers.

Permanent Modular Construction (PMC) – PMC is an innovative, sustainable construction delivery method utilizing off-site, lean manufacturing techniques to prefabricate single or

multi-story whole building solutions in deliverable volumetric module sections. PMC buildings are manufactured in a safe, controlled setting and can be constructed of wood, steel, or concrete. PMC modules can be integrated into site-built projects or stand alone as a turnkey solution, and can be delivered with MEP, fixtures, and interior finishes in less time, with less waste, and higher quality control compared to projects utilizing only traditional site construction.

PMC buildings are subject to the same building codes and requirements as site-built structures, depreciate in much the same manner, and are classified as real property. This segment of the industry provides construction-related services for the successful design, manufacturing, delivery, installation and finish-out of commercial and multi-family buildings.

This report focuses on the Canadian modular construction industry.

Unlike other “prefabrication” reports, which rely almost exclusively on publicly available data and often include a mix of construction methodologies under the



off-site construction umbrella, MBI obtains industry information for this report from multiple sources including:

MBI member surveys – Each year, MBI asks all members for data regarding their annual revenues, sources of revenue, markets served, production, capacity, and total employees.

MBI’s project database – Through the annual Awards of Distinction contest, MBI gathers specific project data to calculate average square footage of buildings by market type, average days to complete by market type, modular project cost, and total project costs.

Construct Connect Insight (formerly Reed Construction Data) – MBI uses this database to determine the baseline for new construction starts in key markets and to measure overall industry market share.

Publicly available data such as news stories, public filings (U.S and Canada), and corporate websites.

Every effort has been made to ensure the accuracy and reliability of this data.

In some cases, MBI’s best estimates and member experience are used. Given that no one, single source for this information exists regarding production, revenue, and market share for the entire commercial modular industry in North America, MBI is confident that this report represents the most comprehensive and accurate information available on the commercial modular construction industry in North America.

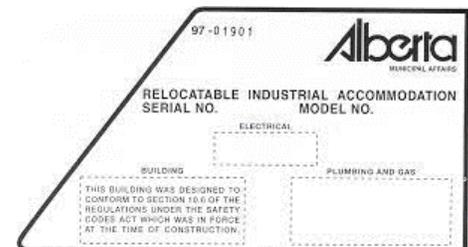
The term “modular” describes a construction method or process where individual modules stand alone or are assembled to make up larger structures. Unlike relocatable buildings, these structures are intended to remain in one location for the duration of their useful life; thus, they are permanent. Permanent modular buildings may be wood-frame, steel, or concrete and can have as many stories as building codes allow.

Industry Standards and Approval Process

The North American modular industry is currently made up of over 250 regional manufacturers building everything from construction site offices to single-family homes and hotels. In the U.S., the industry



Commercial unit label



Canadian label



Commercial relocatable unit

is regulated primarily at the state or local through administrative agencies that implement and enforce the rules for construction.

However, only one Canadian Province (Alberta) has an administrative program. Other provinces either accept the Alberta program or jurisdiction and approval occurs at the local level often by third-party inspection agencies. All modular manufacturers in Canada are required to comply with CSA A277 Procedure for Certification of Prefabricated Buildings, Modules, and Panels. This standard specifies the procedure for certification of prefabricated buildings, and partially or fully enclosed modules and panels for

buildings of any occupancy. It provides requirements for a) certification of the factory quality program; b) certification of the prefabricated product; c) auditing of the factory quality program; and d) in-factory inspection of the prefabricated product. MBI is working with the Canada Standards Agency (CSA) for the development of a new standard for multi-story modular buildings including transportation, installation, and module-to-module connections. Preceding this work, MBI helped CSA with standards research which led to the development of a June 2020 publication titled: *High-Rise Modular Construction: A Review of the Regulatory Landscape and Considerations for Growth*.



Industry DRIVERS

Labor Shortages

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 to prevent costly on-site errors.

To be fair, the industry is not there yet – at least not at scale. While some modular manufacturers incorporate automation and robotics that rival any factory, most are still considered “off-site construction” operations. Even so, the assembly line process requires fewer labor hours to complete a project compared to a typical site-built project.

One area where the modular industry can help with labor shortages is when the manufacturer acts in the capacity of a subcontractor, or “super-sub.” In the same manner that a computer scientist is not required to build computers and an auto mechanic is not required on the Toyota assembly line, semi-skilled



workers are utilized on the factory floor at various stations of the building assembly with strict control measures to ensure code compliance and quality. A general contractor can “sub out” a significant portion of a building to one company, rather than tracking down multiple trades.

High Housing Demands

The Canadian Mortgage Housing Corporation (CMHC) recently allocated \$1 billion towards their “rapid housing initiative” requiring all projects to utilize modular construction. The agency was

surprised when over \$4 billion in qualified applications were received and is now evaluating whether to allocate additional funding. In year two, the agency funded the program at \$1.5 billion.

The severe shortage of affordable homes for extremely low-income renters is systemic, affecting every region 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

Shorter Schedules / Quicker Return-on-Investment



afford to pay typically do not cover the development costs and operating expenses of such housing.

Housing authorities can no longer ignore construction processes that help address the chronic housing shortages. Several agencies are starting to reexamine housing policies to include “innovation credits” for completing projects more quickly, an area where modular construction excels.

If you have ever tried to build a custom building in the dead of winter or during hurricane season, you understand that the weather has a huge effect on how long it takes your building to be constructed. Inclement weather can cause site-constructed buildings to take months longer than anticipated.

The ability to construct building modules in a factory while simultaneously preparing the building site work leads to a shortened construction schedule, quicker occupancy, and therefore, quicker return on investment.

Time is money, especially where construction is concerned. If you are creating a business, delays in construction equal delays in revenue. Hotel rooms cannot be rented, hospital equipment cannot be installed, and inventory cannot be stocked until your building is complete.

Modular buildings are significantly faster to build than traditionally crafted buildings. In fact, numerous case studies demonstrate that modular buildings

take 25-50 percent less time to build than traditional buildings.

Environmental Impact

A study conducted by the University of Alberta (North Ridge CO2 Analysis Report, Al-Hussein, et.al.) comparing modular and on-site construction noted even greater advantages for modular construction. The research found that by using modular construction, the overall schedule was shortened by four months on an 11-month project and CO2 emissions were reduced by 43 percent.

According to the Environmental Protection Agency, construction waste and debris is one of the largest contributors to landfills annually. While construction demolition of existing structures represents about



90 percent of this landfill waste, new construction activity accounts for nearly 57 million tons of landfill waste.

Of the 203 architect, engineer, and contractor respondents to the 2020 Dodge Smart Market Report, only one percent indicated that modular construction had no impact on reducing waste, while five percent were unsure. Sixty-five percent said that it had a high or very high impact on reducing waste generated by construction activities. Among the 59 contractor respondents, 97 percent report that modular construction does have a positive impact on reducing construction waste, while three percent were unsure.

Worker Safety

Modular construction has demonstrated the ability to provide a safer environment for the construction workforce. By shifting as much as 80 percent of the building construction to an off-site, factory-controlled setting, workers have a much more predictable and consistent work atmosphere. Additionally, the ability to construct multi-story buildings in modules while remaining on the ground floor of a factory virtually eliminates hazards associated with falls, one of the most common accidents in the construction industry.

The 2020 Dodge Smart Market Report addressed the issue of workplace safety and their research findings support MBI's position. Of the 203 responses received regarding safety, only five percent of architects, engineers, and contractors indicated that the use of modular construction had no demonstrated safety benefits, while 89 percent indicated it did (six percent unsure).

Of the 48 general contractors responding, only eight percent said that modular construction had no impact on improving safety, while 69 percent said it had a high or very high impact. The results are even more dramatic among large contractors with revenues over US\$100 million annually. Among the 18 contractors in that subset, half said that modular construction had a "very high" impact on safety. A full 100 percent of these respondents said that modular construction had a medium (11 percent) high (39 percent), or very high (50 percent) impact on worker safety.

Key MARKETS

and Case Studies

Office and Administrative

Modular buildings serve as corporate headquarters, satellite offices, institutional and administrative buildings, and offices for all business types. Modern single- and multi-story buildings can be configured in several ways to include independent offices, conference rooms, elegant lobbies, kitchens, restrooms, and large open spaces for cubicles or other partition systems.

MBI members have architectural and engineering designs for workspace planning, storm water management, landscaping, parking, and zoned heating and air conditioning. If it is time to capitalize on company growth, modular construction offers a fast, economical approach.

The business and office market historically represents one the largest building sectors for the industry. In 2020, manufacturers reported that 25.8 percent of all production was in the office and administrative market, the highest among all markets reported.

MBI obtained data and analyzed information on an additional thirteen projects completed in 2019 and 2020. The average size of these projects was smaller than the prior averages, at 918 sq. meters consisting of an average of 16 modules each. These projects took on average 202 days to complete from approval to occupancy.



Monarc Condos Sales Office, built by Corner Cast Construction, Inc. (exterior).



CASE STUDY: MONARC CONDOS SALES OFFICE

Company: Corner Cast Construction Inc.

Location: Ville St-Laurent, Quebec

Building Use: Sales office

Gross Size of Project: 960 Square Feet

Days to complete: 42

Architectural Excellence

Corner Cast manufactured & installed this modular complex of 3' x 40' shipping containers in the spring of 2020 in Montreal, Quebec. The complex boasts a high-end architectural finish, branded exterior cladding, gypsum board interior finish with recessed LED lighting, hardwood flooring, universal access & large aluminum & glass facades. The sales office is representative of the overall look and feel of the Monarc housing development which will be one of the largest retail and condo developments in Montreal.

Located among numerous boutiques and restaurants as well as the beautiful Marcel-Laurin Park which is adjacent with its lush and diversified flora, this sales office blends in naturally with the existing landscape and provides a visually attractive retail sales location. The interior design by Andres Escobar is used to showcase the high-end interior finish of the condos which will be built, and to demonstrate the project to potential clients and collaborators.

Technical Innovation & Sustainability

This building was fabricated by recycling 3' x 40' HC used containers and were transported on container trailers to site, and then fully installed & commissioned in two weeks. The interior & exterior finishing eliminate the appearance of modules within the construction, but once the construction of the condo development is complete, the customer can then disassemble the units & re-use them for future

HONORABLE MENTION,
Relocatable Modular Retail,
2021 Awards of Distinction



sales offices. The installation of the complex was done on standard, recycled concrete blocks, making it extremely easy to re-locate once the project is complete. All units were built within the factory in Montreal within four weeks and then transported to site. It was installed in May of 2020 for a total construction time of six weeks.

Cost Effectiveness

Through having the sales office constructed off-site while permitting and civil work was being done, the client was able to have a working sales office immediately when the site was available. This enabled the customer to save time and begin condo sales ahead of schedule, saving the customer money and moving the project forward without delay. High labor rates in downtown Montreal were avoided by using off site construction methods. And the units were completed in six weeks leaving no downtime for the client and fitting within their operational requirements.

ONTARIO AOYUAN PROPERTIES

Company: NRB Modular Solutions

Location: Toronto, Ontario

Building Use: Sales Presentation Centre

Gross Size of Project: 6324 Square Feet

Days to complete: 214

Architectural Excellence

Ontario Aoyuan was looking for a high-profile, expansive sales office to showcase their first Canadian development project in downtown Toronto. As the site still supported a local grocery store and mini-mall until all permitting and construction was to begin, the necessary time to construct a ‘stick-build’ sales center was not an option. These circumstances presented a perfect fit for modular and an opportunity to showcase its capabilities from a grand perspective. Aoyuan interior designers provided a very expansive open concept floor plan which boasted 16-foot-high ceilings in the presentation room, large two-storey glazing, and open studio space to create ‘walk-through’ model suites.

Technical Innovation & Sustainability

While temporary, the sales office was built using steel post and beam construction with three-inch concrete floor topping, and was installed on piers to below frost level to eliminate any shifting or cracking while in place. The piers were raised to further elevate the structure so that it could boast a large storefront appearance both on Yonge Street and at the main entrance. Exterior wall finishes on the building were installed on site by Aoyuan crews themselves to again showcase materials used on future builds. NRB Modular Solutions pre-installed all electrical rough-ins behind walls, and mechanical systems and ducts prior to shipping, leaving only crossover seams to be completed on site.

FIRST PLACE,
Relocatable Modular Retail,
2021 Awards of Distinction



Cost Effectiveness

With this being a temporary sales office, the premise to construction was centered on appearance, grandeur and speed to market. The large roof hats over 80 percent of the building floor plan posed a number of requirements for innovative methods to evolve and help minimize construction on site, as well as keep cost within budget. The building will be relocated and re-used at another location even with the considerations of the roof hats.



This trend towards smaller projects and a higher percentage of modular costs indicates that this market is less impacted by the “hybrid” construction process with industry companies providing more of a turn-key approach to these projects.

Supportive / Multi-Family Housing

Federal, state, and local governments around the world are struggling with policies to help address the growing housing crisis. Modular construction offers the ability to provide condominiums, apartments, and student dorms in about half the time as traditional, site-built construction methods.

In fact, the multifamily market is now the largest and fastest growing segment of the industry, from seven percent of industry production in 2019 to nearly 21 percent in 2020.

MBI analyzed 26 multifamily projects completed over the past two years in the U.S. and Canada. Twenty of these projects were wood framed while six were steel, including one container-based project.

Most of these projects were three to five stories, with projects consisting of multiple



Recently-constructed Harrison Street supportive housing development in Toronto, built by NRB Modular Solutions.

buildings and an average of 95 total living units per project. On average, each project was 6,234 total sq. meters and consisted of 99 modules. The projects took an average of 385 days to complete from approval to occupancy.

TRETHEWEY AVENUE SUPPORTIVE HOUSING COMPLEX

Company: Nomodic Modular Structures Inc.

Affiliate: Grandeur Housing

Location: Chilliwack, British Columbia

Building Use: Supportive housing

Gross Size of Project: 2272 Square Meters

Days to complete: 299

Architectural Excellence

This permanent modular building is three storeys in height and is comprised of 11 modules per storey for a total of 33 modules. The modules were frameless units of wood structure, ranging in size from 8' x 47' (3 modules) to 12' x 60' (30 modules). It features 46 self-contained suites: 5 designed specifically for people with disabilities, which are approximately 350 ft² and include a bathroom (complete with sink, toilet and shower), kitchenette, and bedroom/living space. The first storey is comprised of office space, tenant support rooms, commercial kitchen with pantry, common dining room, heat treatment room, storage, and laundry facilities. The building was designed with a common corridor down the middle of the module to maximize space and achieve the greatest number of tenant suites within the footprint. The exterior design has a bold, contemporary aesthetic and uses common commercial and residential building materials such as Hardie Panel, Alucobond panels, and HF-12 panels.

Technical Innovation & Sustainability

The complex incorporates a number of innovative features. For example, the mechanical design of the suites was such that all suite HVAC was completed in the factory, which greatly reduced the amount of HVAC work required on site. This was achieved by installing a LifeBreath HRV and an Innova 2.0 heating/cooling



unit in each suite. The Innova 2.0 units were chosen as they offer high performance and do not have an exterior unit, unlike typical PTACs, thereby reducing the amount and size of penetrations which allows a more air-tight building. In addition, the lack of the exterior units means no aesthetic impact to the building. The complex was



HONORABLE MENTION,
Permanent Modular
Multifamily Over 10,000 sq. ft.,
2021 Awards of Distinction



built in accordance with B.C.'s Energy Step Code, achieving specific energy targets set by BC Housing. This included meeting envelope and interior partition air leakage requirements, and exceeding typical building code with energy-efficient building features including LED lighting, energy star rated appliances, and triple-glazed windows.

Cost Effectiveness

Naturally, one of the largest cost-effective methods in modular construction is the ability to reduce onsite construction time and overall construction schedule. Nomadic took advantage of this, completing the excavation, underground utilities, and foundation while the modules were being fabricated. Approximately 80% of the building's electrical, plumbing, sprinklers, HVAC, and

carpentry were completed in the manufacturing facility, where trade labour rates are less than rates in the field. In a further effort to reduce costs, Nomadic engaged a sprinkler contractor who was able to utilize local resources at both the manufacturing facility (Manitoba) and site (B.C.), which also resulted in no scope gaps. In addition, the building's adherence to the B.C. Energy Step Code meant that long-term value has been delivered to the client in the form of energy savings.

Many factors determine the total cost per square meter including location, labor availability and cost, design considerations and finishes, and the construction teams' experience working together.

Education

From single classrooms to complete campuses, modular construction offers public, private, and charter schools what other construction methods cannot: accelerated project timelines, more economical pricing, and less site disruption. Permanent modular schools are indistinguishable from other schools and can be constructed to any architectural and customer specifications. MBI members design and build schools of all types and sizes using traditional building materials such as wood, steel, and concrete.

Virtually any size permanent school can be built, installed, and ready for occupancy in as little as 90 days. Perhaps most importantly, using off-site technology, open construction sites are eliminated while school is in session. Students are safer, and teachers do not have to compete with noises and construction-related disruptions.

UNIVERSITY OF VICTORIA MODULAR KITCHENS

Company: Reliant Asset Management, LLC

Affiliate: Northgate Industries Ltd.

Location: Victoria, British Columbia

Building Use: Main dining facility for students

Gross Size of Project: 26000 Square Feet

Days to complete: 305

Architectural Excellence

Complexed on a paved parking lot of a university campus are 33, 12' x 60' frameless modular kitchen units. These units are secured to a foundation that includes 197 concrete blocks with brackets to mitigate any seismic activity risks that are typical on the West Coast. The complex consists of a retrofitted dining area able to accommodate 500 students at a sitting, two serving lines with point of sale, two cooking lines (one electric one gas), dry and cold storage, prep area and a dishwash area. The complex was originally used as a kitchen for a large camp in Northern Alberta and then redesigned to serve as an institutional kitchen for students at the university while they are building a permanent dining facility and additional student housing.

Technical Innovation & Sustainability

This kitchen dining complex was originally built in 2011. The project lasted 5 years before it was returned and was placed in storage. In 2018, the University of Victoria approved the build of new student housing which also included the demolition and construction of a new dining hall. The University required a replacement while constructing the dining hall and RAM Modular's 33-unit kitchen was large enough to handle the student capacity and perform day to day operations.

Once identified as a solution, RAM worked with subcontractors to renovate the complex per the specific requirements



of an institutional dining hall. This included converting to natural gas from propane and adding an additional electric cooking line that tied into local services. A catering module was also retrofitted along with the addition of a shipping and receiving dock. After a majority of the retrofit was completed locally, each module was transported by land and barge 1300 kilometers and staged for set up.

Cost Effectiveness

This relocatable modular kitchen that was pre-built and in storage was the most cost effective solution for the main contractor and the University as it was quickly installed over the summer with minimal disruptions to students at the campus. Operations that included catering and student dining were still able to continue as they tore down the old kitchen commons and began construction on the new permanent facility. By using a temporary modular complex, the contractor was able to expedite construction on the permanent facility by several months saving time and money. The complex was redesigned to the Universities requirements and was retrofitted in a controlled environment at the builder's location before being shipped to site 1300 kms west.



FIRST PLACE,
Relocatable Modular Assembly,
2021 Awards of Distinction



MBI also reviewed a total of 14 permanent educational projects completed in 2019 and 2020 for comparison. The average size of these projects was 1,319 sq. meters significantly smaller than the average project completed in prior years. Interestingly, the average number of modules for these projects increased to 25 per project, meaning the average module size for educational projects was smaller. The average completion time for these projects was 159 days, slightly higher than projects completed in prior years. It should be noted that this latter subset of projects included facilities constructed in 2020 with schedules adversely impacted by the pandemic.

Institutional & Assembly

This market includes police and fire stations, prisons, security, facilities for industrial complexes, workforce housing, as well as facilities used for assembly such as churches. Combined, this market accounts for 8.1 percent of all reported manufacturing production in 2020. This analysis does not include relocatable workforce housing projects, common in more remote areas with natural resources extraction. (See MBI's 2021 Relocatable Buildings Report).

MBI obtained data from 12 projects completed in 2019 and 2020, at an average project size of 743 sq. meters consisting of fifteen modules. The modular portion of cost made up 71 percent of total cost.

Healthcare

Many hospitals and healthcare facility contractors are turning to modular, primarily for building components such as bathroom pods and headwalls. However, entire hospitals have been constructed utilizing modular construction techniques. Modular construction offers quiet, safe, and clean applications for medical, surgical, clinical, and dental use.

The insight MBI contractors have from designing and building medical facilities has resulted in satisfied healthcare professionals worldwide. If an organization or community needs a new rehabilitation clinic, emergency room, operating room, hospital extension, laboratory, diagnostic center, or other medical facility, modular construction can be used for custom-built facilities with the tightest budgets while maintaining strict medical and aesthetic specifications. Modular construction also results in much less on-site disturbance during the construction phase.

MBI reviewed six healthcare projects completed in 2019 and 2020. The average size of these projects was 608 sq. meters, smaller than the healthcare projects from prior years. On average these projects took 355 days to complete from approval to occupancy, again factoring in the impact of COVID-19 on schedules.

PCL AGILE BATHROOM PODS

Company: PCL Agile

Location: Vaughan, ON

Building Use: Bathroom pods for hospital suites

Gross Size of Project: 1200000 Square Feet

Days to complete: 424

Architectural Excellence

Ten variations of the pods were built to ensure ease of installation and integration with the hospital layout. With 95 percent of interior construction completed offsite, each pod was delivered with flooring, wall protection, major accessories, M&E rough-ins and millwork. The interior of the pod ensured optimal space in the small area by having both the toilet and grab bars supported by wall posts and G90 sheets. During manufacturing, the exterior of the walls were left exposed to allow for safe and efficient mechanical and electrical inspection. Finishes were selected based on the hospital's interior design specified by the architect of record. The prefabricated pods resulted in the achievement of a level floor transition for patients as well as optimal drain slopes within the washroom wet areas.

Technical Innovation & Sustainability

Each pod weighed approximately 5,000 pounds, so the team had to consider the strength of the concrete base. This led to the use of custom made high-density concrete floor. The strength of the floor was between 120 and 140 megapascal (MPa) and was achieved using ultra high-performance concrete. These floors were 15 mm thick at the drains and could be cast and then stripped and handled in 12 hours. Key to maintaining production rates. Using CNC, PCL created forms which were built in an inverted position to attain the accuracy of a 0.1 percent slope. A custom hoisting cradle made of steel C-channels and HSS tubing was created to facilitate form release. The accurate



dimensions and shape of each concrete slab was achieved by the team's adoption of the Bluco fixturing system. Laser scanning was used to maintain the accuracy of the as-built condition and mockups were tested prior to full scale manufacturing.

Cost Effectiveness

To minimize the high risk of exposure to weather, it was crucial to protect the pod from water to avoid risk of mold formation, as the pods were planned to be delivered before the walls of the hospital were erected. High-grade weatherproof products were used to withstand the weather and prevent any damage in between the time of delivery



FIRST PLACE,
Permanent Modular Bathroom Pods,
2021 Awards of Distinction

and partition wall erection. Preventive measures were taken during the shipping process to minimize water damage and ensure a long lifespan of the pod. Each pod was prepped for delivery by shrink wrapping the entire pod from top to bottom. The shrink-wrapped top was kept on even after delivery and installation on the slab, until the walls of the hospital were erected. The delivery sequence was planned with cost in mind. The pod was delivered to each level dependent on the placement of the concrete. The pods were placed after the reshores were removed, assuring that the concrete slab did not deflect after pod installation causing damage to the pods.



Historically, the healthcare market makes up between five to eight percent of total industry output. For 2020, manufacturers reported that 6.5 percent of their factory output was in the healthcare sector, exclusive of temporary relocatable healthcare facilities.

Commercial & Retail

Simply put, quicker occupancy equals quicker return on investment. Modular construction is accelerated construction. Why is this important to banks, restaurants, convenience stores, childcare centers, and other retail establishments? Because earlier occupancy means a customer generates revenue faster. In fact, it is not uncommon for many modular buildings to be up and running within a week—an important consideration for retailers of all types.

Typical retail applications include restaurants and diners, banks, golf pro shops, convenience stores, gas stations, car washes, and concession stands to name a few. MBI contractors provide a full array of services including site, mechanical, and electrical work. Customers can accommodate their

emerging business with modular buildings customized to their financial needs, space requirements, and deadlines.

Modular projects in this market made up just about one percent of all production again in 2019, with between 150-250 modules produced annually.

Hospitality/Hotels

A shorter construction schedule means quicker occupancy for owners, and that means guests checking in months earlier than with conventional construction methods. It should come as no surprise that companies like Marriott Corporation, Citizen M, and Hilton have made modular construction part of their strategic plan. This market, perhaps more than others, suffered during the pandemic as new projects were delayed or put on hold.

AQSARNIIT HOTEL AND CONFERENCE CENTRE

Company: Stack Modular

Location: Iqaluit, Nunavut

Building Use: Hotel, Conference and Restaurant

Gross Size of Project: 89900 Square Feet

Days to complete: 825

Architectural Excellence

This first-class hotel and conference center is designed with a structural steel podium conference center, lounge, restaurant, commercial kitchen, and staff facilities. Inspired by Inuit culture, the exterior is an asymmetrical structure clad with LED-illuminated glass representative of the Northern Lights, the circular conference space references a drum circle that represents a safe gathering place for participants and dedicated feature space for local artwork is integrated throughout the interior. The four storeys above the traditional base feature modular hotel units including double queen rooms, king rooms and suites that include a spacious residential style kitchen, sitting area, dedicated bedroom, and washroom. Stairwells, electrical rooms, and elevator, mechanical, and electrical shafts, are all incorporated into the design and all FF&E components were fully installed in each modular unit and delivered to site.

Technical Innovation & Sustainability

Given the high energy costs in northern Canada, the client was focused on designing an efficient building to lower energy use. Subsequently, the design used higher effective R-value building envelope systems. With limited site labor and material resources in the remote location, FF&E and M&E systems were finished in the factory, only requiring on-site installation of main service distribution through corridors and shafts. Fan coils in each room allowed



FIRST PLACE,
Permanent Modular Hotel
2021 Awards of Distinction



for a central HVAC system to provide individualized comfort to guest rooms. The isolated location required a creative and complex logistics process. Modules were shipped from Asia with on-board vessel cranes and custom-built trailers

for the modules to be discharged two-at-a-time onto a barge, tugged to shore and trailered directly to site (no lay-down area) and set into place over 9 days. This method avoided double handling and mitigated the high cost to fly-in equipment.

Cost Effectiveness

With the partnership between BIRD Construction & Stack Modular, a turnkey solution leveraging the benefits of both site and modular construction to expedite and reduce the cost of the project. Designed for the long term, the facility includes considerations for expansion including energy upgrades to solar and wind systems to further reduce energy consumption. Dramatic savings were also realized by leveraging Stack's supply chain team to purchase and deliver modules with furniture, fixtures, and equipment (FF&E). As there was no dock to offload the modules, the vessel was deep water anchored where the modules were craned to a barge, tugged to shore then trailered to site at high tide. By delivering the units in this creative turn-key fashion, the high logistics costs and supply cost were avoided while reducing construction time in this location by over a year.

As with the multifamily market, a big incentive for utilizing modular construction in this market is the shorter construction schedule which leads to quicker occupancy and quicker return on investment. Across the board, owners are indicating that the modular process results in their hotels opening four to eight months earlier than if site built.

Data Centers, Bathroom Pods, Equipment Shelters

MBI obtained data on six projects completed in 2019 and 2020 classified as "other" markets. These projects included bathroom pods, small washrooms, and equipment enclosures. In past years, data centers would fall into this category.

MULTI-SERVICE ADMIN COMPLEX

Company: Corner Cast Construction Inc.

Location: Sept-Iles, Quebec

Building Use: Administration and Maintenance

Gross Size of Project: 7040 Square Feet

Days to complete: 184

Architectural Excellence

Corner Cast Inc. designed and built this modern industrial office complex and maintenance facility for the Port of Sept Iles as part of its port expansion. The challenge was to design and build a structure which could seamlessly blend into the maritime environment, without disrupting the daily work processes during installation and also being able to be relocated in the future. The structure is built using 25 modified containers. The roof structure spans above the container foundations and creates an insulated space and maintenance facility in between. The 2-level office complex includes autonomous wash and locker rooms, cafeteria, autonomous potable water distribution systems, and an eco-friendly wastewater treatment facility with UV disinfection and phosphorus removal. The maintenance section recaptures heat from its operations and has welding stations, compressed air systems, oil/sand/dust separator, jib crane, and a CoNo detection system.

Technical Innovation & Sustainability

Ports & Stevedore companies are constantly reorganizing their real estate and landscape. With this building the client is able to combine the port operators' offices and maintenance facilities into one building, while able to relocate the building with zero footprint. This allows the client to extend the buildings life cycle over several projects/tenants. The re-locatability created an additional challenge for the design of the autonomous potable and wastewater treatment. Part of the solution was rather counter intuitive by installing

HONORABLE MENTION,
Relocatable Modular Assembly,
2021 Awards of Distinction



the septic tank of 5000 US Gal on the second floor and using the container structural integrity. The modules are built to withstand the harsh winters of the Canadian north, and the rigors of the salty maritime environment. The containers are optimally used by supporting the roof structure and acting as the foundation. The transportability & design create an efficient and effective space for the client and its users.

Cost Effectiveness

All the 25 containers were modified & outfitted in an indoor production facility to minimize the amount of time on site. Installation time on site was 45 days, drastically reducing on site presence, equipment & manpower circulation. The structure was designed to be re-locatable at the end of the project life cycle, which allows the buyer to spread the cost of the asset over several projects thus reducing capital investment. Centralized control of the heating & cooling systems allowed monitoring & reduced consumption when staff are not present in the building. The maintenance costs of the garage space have been reduced to a minimum by using LED lighting, highly efficient thermal equalizers and minimizing heat loss thanks to its 'living' walls. This, together with the close involvement of the future users in the design process allowed Corner Cast to find a competitive, re-locateable and re-usable solution for the clients needs.



MARKET Outlook

The biggest news for the modular industry in Canada last year was the announcement by the Canadian Mortgage Housing Corporation (CMHC) regarding their “Rapid Housing Initiative.” CMHC committed to \$1 billion in funding for housing utilizing modular methods of construction, primarily due to the reduced construction schedules. The agency received over \$4 billion in qualifying projects for this initiative and is now accessing future funding options.

MBI is also working with the Canada Standards Agency for the development of a new standard for multi-story modular buildings including transportation, installation, and module-to-module connections. Preceding this work, MBI helped CSA with standards research which led to the development of a June 2020 publication titled: *High-Rise Modular Construction A Review of the Regulatory Landscape and Considerations for Growth*.

According to Construct Connect Insights, total construction starts in Canada in the fourth quarter of 2020 declined 43.4 percent year over year, and 22.3 percent in 2020 as a whole. Canadian

construction starts are expected to climb 11.5 percent in 2021, not rising above their pre-pandemic high (in 2018) until 2024.

Overall non-residential construction put in place for key modular markets increased to \$27 billion CAD in 2019, up from approximately \$25 billion in 2018. This figure remained relatively flat in 2020 and forecast to continue to be approximately \$26 billion for 2021.

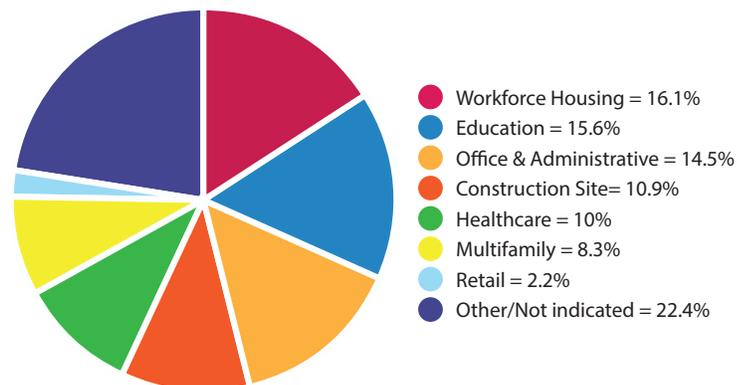
The multi-family sector represents about \$9 billion of the forecasted \$26 billion for 2021, up about 2.2 percent from 2020.

Educational facilities at \$4.7 billion and healthcare at \$3.6 billion are the next largest markets overall.

MBI represents 60 companies (manufacturers, fleet owners, suppliers) based in Canada, including 26 manufacturers of modular structures. In all, MBI estimates that there are about 45 total modular manufacturers in Canada fabricating for a variety of markets including residential, multi-family, commercial, educational, and industrial sectors. MBI directly obtained revenue data from 16 Canadian manufacturers.

Sources of Modular Building Revenue by Market, Canada, 2020

On average, manufacturers in Canada generated approximately \$27,877,778 CAD in revenue in 2020. Top markets for manufacturers in 2020 were:



Historically, one of the key markets for the modular industry in Canada has been the industrial workforce housing sector. The modular industry provided temporary workforce housing solutions in remote regions where the energy sector was active. With the decline in oil prices in recent years, the industry has diversified into some of the above-mentioned markets more aggressively. However, workforce housing still accounted for 16.1 percent of industry revenue generated in 2020.

Western Canada *(British Columbia, Alberta, Saskatchewan)*

Overall construction starts in this region fell significantly to just over \$5 billion, with a huge drop off in multi-family construction in 2020 as the leading cause for the decline. This region is expected to rebound to \$7.4 billion in 2021, according to Construct Connect Insights. That rebound will be driven by the multifamily sector, expected to grow 58 percent from 2020, but still hovering around half of the 2019 value.

The multi-family and educational markets in British Columbia are the largest markets in this region, accounting for

41 percent of all projects in the entire region. The multi-family market was also the largest sector in Alberta in 2020 and forecasted to be the largest in 2021 at \$528 million, less than half its 2019 value of \$1.3 billion. The education and office markets show the most promise for growth in Saskatchewan for 2021.

Eastern Canada *(Atlantic Provinces, Ontario, Quebec, Manitoba)*

Not surprisingly, overall construction activity in the eastern provinces dropped significantly in 2020 to \$16.1 billion, down from \$26.4 billion in 2019 in key modular markets. The multifamily market dropped from \$12 billion in 2019 to \$7 billion in 2020, accounting for half the total decline. This market is forecasted to drop again in 2021 before rebounding in 2022.

The retail and shopping sector also took a big hit in 2020, dropping from \$2 billion in activity in 2019 down to under \$200 million in 2020.

Construction activity is expected to remain steady in 2021, hovering around \$16 billion in new construction starts in key markets. The educational sector

still appears strong in this region, with nearly \$2.9 billion in activity in 2020, down 16 percent from 2019. However, the education market is expected to make a strong comeback for 2021, forecasted at \$3.8 billion, ahead of the 2019 figure. Healthcare, hospitals, and clinics are also expected to remain strong markets, with 2021 forecasted activity just under \$3 billion.



RELOCATABLE Buildings

The Modular Building Institute (MBI) represents 63 companies in Canada including 32 modular manufacturers and contractors and approximately 50 manufacturing locations across Canada. These companies account for approximately 80 percent of the entire modular industry activity in Canada.

The modular construction industry is perhaps better suited than any other industry to help Canada address its facility needs, regardless of market. The industry has thousands of buildings in available inventory that can be quickly deployed and utilized for a variety of needs including housing, office space, and healthcare.

The industry also has the capacity to build and deliver millions of square feet of newly constructed, code compliant buildings for any market. Collectively, the industry factories have the capacity to build 70,000 – 93,000 sq. meters of building space monthly.

In Canada, most of the industry owned RBs are controlled by a handful of large, multi-national corporations with diverse revenue streams. It is not uncommon for a Canadian company to generate revenue from the manufacturing of modular units, from hospitality-related services attributed to workforce housing accommodations (i.e., facility service and catering), and from construction projects such as multifamily housing developments. To the greatest extent possible, MBI separated and did not include revenue from construction projects or facility services for purposes of this report. This data focuses on the leasing and

sales revenue of relocatable buildings and equipment.

The Canadian relocatable building market is different than the U.S. market in many respects. Key Canadian RB market characteristics:

- RB inventory concentrated in a smaller number of multi-national corporations
- Corporations have more diverse revenue streams
- Historically, oil, gas, and mining industries drove demand for RBs
- Industry continues diversifying into new markets



The demand for equipment rentals and workspace solutions largely depends upon the level of industry activity for oil, natural gas, and mineral exploration/development and infrastructure development. The fluctuation in oil prices causes uncertainty in the short-term leading to a reduction in the need for worker accommodations.



PARC RETIREMENT LIVING FAMILY MEETUP CENTRES

Company: Black Diamond Group

Affiliate: Britco

Location: Vancouver, British Columbia

Building Use: Safe visiting space during COVID-19

Gross Size of Project: 800 Square Feet

Days to complete: 14

Architectural Excellence

These temporary Family Meetup Centre buildings look like a regular office trailers from the outside; however, the interior design looks and feels like a customized, comfortable, virus-proof safe visitation space. Our teams retrofitted five of our standard 8' x 20' Bulldog Offices – typically used as secure, theft-proof site offices – for use across British Columbia, with a permanent dividing wall with a tempered glass window and air filters to prevent virus spreading through the units. The units also feature full-unit ventilation to maintain healthy airflow and separate entrances for PARC Retirement Living residents and their guests. The Bulldogs were chosen for a few reasons: their compact size allowed them to be placed in space-constrained parking lots; their ground-level installation allowed a one to be placed under covered parking areas; the ground-level access made it ideal for ease of accessibility; and Britco was able to supply a solution in a very quick turnaround.

Technical Innovation & Sustainability

To lessen the risk of spreading COVID-19 between PARC residents and their guests, several precautions had to be implemented. Proper air filtration was required, both within the units and to and from the outdoors, and a barrier was required between residents and guests to establish physical distancing. Our teams installed removable walls with tempered glass windows so residents and guests

FIRST PLACE, Relocatable
Modular Special Application,
2021 Awards of Distinction



could meet face to face and four vent grills with HEPA filters to keep the air clean and to allow the visitors and residents to hear each other's voices. An HVAC unit was installed on the residents' side to ensure the air within the unit remained pure while maintaining the desired temperature. Another important design element was ensuring the unit was accessible to PARC residents who relied on walkers or wheelchairs to get around. The units were placed directly on the ground and were outfitted with low-slope ramps on the resident side for ease of accessibility, and low steps on the visitor side.

Cost Effectiveness

The Meetup Centres were designed using an existing fleet of offices, requiring no new construction and significantly decreased project costs. Since the trailers were placed on PARC Retirement Living's property, property did not have to be rented, which provided significant budget savings. The units are being rented for a pre-determined term, subject to change as the pandemic continues or lessens.



To what code are modular buildings constructed?

It is helpful to think of “modular” as a construction process rather than a building type. A modularly constructed building simply means that the materials were delivered to an off-site location (the modular manufacturing facility), assembled into components or three-dimensional building modules, then transported to the final site for assembly. As such a building constructed in this manner must still meet all the same building codes and requirements as if it were built on-site. This is most commonly a version of the International Building Code (IBC) in the U.S. or the National Building Code (NBC) in Canada.

Do the buildings last as long as site-built? Same quality?

A building constructed using modular methods will last as long, if not longer than, a traditional site-built structure. Again, the building is constructed to the same building codes and must meet the same wind, snow, and seismic conditions. While there is limited research to prove this point, one such study does exist. Following Hurricane Andrew in 1992, FEMA commissioned a study called “Building Performance: Hurricane Andrew in Florida” comparing site-built, modular, and manufactured housing.

In that report, FEMA found “Overall, relatively minimal structural damage was noted in wood-framed modular housing developments. The module-to-module combination of the units appears to have provided an inherently rigid system that performed much better than conventional residential framing.”

Is modular construction cheaper/less expensive?

Generally speaking, yes. There are a lot of variables with a modular project, just as there are with a conventional construction project. The availability and cost of on-site labor is a key factor. In larger urban areas where labor is scarce and/or more expensive, shifting construction to an off-site (often rural) location can yield significant cost savings.

Additionally, the overall efficiency of the process can lead to cost savings. Fewer labor hours are needed to complete a comparable project and waste is significantly reduced. The shortened construction schedule can reduce the time needed for a construction loan and can dramatically advance the occupancy date, critical considerations for revenue-generating businesses such as hotels and fast-food restaurants.

McGraw-Hill published a Smart Market Report titled “Prefabrication and Modularization: Increasing Productivity in the Construction Industry.” Through an internet survey of hundreds of AEC professionals, the report found: “Sixty-five percent report that project budgets were decreased—forty-one percent by six percent or more.”

Perhaps as significant as the cost reduction is the cost certainty with modular projects. Early communication and integration of the entire construction team leads to fewer change orders and a more predictable budget.

Isn't this a new, untested method for construction?

Far from it! A report from 1670 indicates a prefabricated building was shipped by boat from England to the United States. In the 1800s, demand for modular housing increased as the country expanded westward. During the Gold Rush of 1849, more than 500 preassembled homes were shipped from factories in New York to destinations in California.

In the 1920s, Sam Kullman began manufacturing the popular “Kullman Diners” along the northeast coast.

In the 1940s, the industry began to expand into commercial projects with

the founding of industry giants such as ATCO in Alberta. R.D. Southern was just 17 years old when ATCO was originally founded as Alberta Trailer Hire in 1947. With initial revenues of \$1,077 and 15 utility trailers, R.D. Southern and his father, S.D. Southern, set a bold course to service Alberta's booming oil industry. Today the company generates over 20 billion in revenue and employs thousands of workers.

In 1967, Architect Mosha Safdie designed the famous Habitat 67 complex in Montreal. The complex was comprised of 354 identical, prefabricated concrete forms arranged in various combinations, reaching up to 12 stories in height. Together these units created 146 residences of varying sizes and configurations.

In 1969, Zachry Construction utilized modular construction techniques to complete a 21-story modular hotel on the Riverwalk in San Antonio. The hotel, still in operation, was the tallest modular building in North America until the recent completion of the 32-story Pacific Park building in Brooklyn, New York.

Disney Corporation followed with completion of its Contemporary and Polynesian Resorts in 1972, constructed by U.S. Steel. There is a long history of innovative companies successfully utilizing modular construction techniques.

I have heard about “pop-up” or project specific manufacturing plants. Is that the same as a modular factory?

The modular factories detailed in this report are not project specific plants. Rather the companies build for several clients within a given geographic region (typically about a 500-mile radius from the factory). MBI has seen some examples of general contractors renting vacant warehouses near larger project sites and using these “pop-up” factories for some preassembly work and for materials staging and coordination. These are not automated plants and often do not incorporate assembly-line processes or lean manufacturing techniques. Rather these locations are often just an extension of the existing job site.

So, why hasn't it caught on before now? Why the sudden interest?

Until recently, developers and contractors seemed content with the status quo, regardless of the inherent and

understood inefficiencies. Planning and preparing for those inefficiencies seemed easier than learning a different way of building for many.

Today, developers and owners are facing the “perfect storm” in the construction sector, including:

- A widely recognized skilled labor shortage that will not get better anytime soon.
- High housing costs and low housing availability in urban areas, a condition that is worsening.
- A widely documented lack of productivity in construction; and, as previously mentioned,
- The increasing need for shorter construction schedules.

Adding to those factors, the construction industry has more fully embraced innovations and technologies that are leading towards more of an “industrialized construction process.”

More environmentally conscious customers are demanding greater accountability regarding wasted resources and the massive amount of construction debris that ends up in landfills annually. Modular construction is a proven solution to reduce construction waste.

Where is the industry headed? What other trends do you anticipate? Will this interest lead to greater adoption of modular construction?

If history is any indication, we will see a significant shift towards modular and off-site construction techniques over the next five years as greater numbers of the skilled labor force retire. The construction industry will (and must) evolve into a more industrialized and automated process – it is just inevitable. Every major industry has undergone this same transformation. The construction industry is the last holdout while clinging to a lost cause. The companies that build modular now and build it into their strategic plans will be more successful sooner.

In North America, the movement has begun. We are seeing some large general contractors and developers establish their own modular divisions, while others partner with existing modular manufacturers.

How many square feet does the typical manufacturer produce in a year?

This is where the averages can be misleading. The number of modules a particular manufacturer produces each year depends on a few factors such

as the type of project the company is building, the level of customization involved in the project, and the scope of the manufacturer's contract (i.e., whether the customer wanted certain work to be completed on-site). Based on overall data obtained from 76 manufacturers in the U.S. and Canada, the average square footage produced in 2020 was 202,496.

Where can I learn more about modular construction?

The Modular Building Institute's website, www.modular.org is loaded with case studies, research, articles, and links to companies in your area.

MBI adopted the definitions contained in the ICC/ANSI standard 1200 and 1205 for consistency. Sources for other terms not used in the standard include state administrative programs as well as the National Institute for Building Sciences.

Accessory dwelling unit (ADU). A smaller, independent residential dwelling unit located on the same lot as a stand-alone (i.e., detached) single-family home. (source: American Planning Association).

Authority Having Jurisdiction (AHJ). Organization, political subdivision, office, or individual charged with the responsibility of administering and enforcing the provisions of the applicable building code. The authority having jurisdiction shall include a state agency or local building department.

Building Envelope. The physical separator between the interior and the exterior environments of a building. It serves as the outer shell to help maintain the indoor environment (together with the mechanical conditioning systems) and facilitate its climate control. Building envelope design is a specialized area of architectural and engineering practice that draws from all areas of building science and indoor climate control.

Building Site. A lot, the entire tract, subdivision, or parcel of land on which industrialized housing or buildings are sited.

Building System. The design and/or method of assembly of modules or modular components represented in the plans, specifications, and other documentation which may include structural, electrical, mechanical, plumbing, fire protection, and other systems affecting health and safety.

Certification Label. A decal, insignia, or alteration decal.

Closed Construction. A building, component, assembly, subassembly, or system manufactured in such a manner that all portions cannot be readily inspected at the installation site without disassembly or destruction thereof.

Commercial Structure. An industrialized building classified by the building codes for occupancy and use groups other than residential for one or more families.

Compliance (or Quality) Control Program. The manufacturer's system, documentation, and methods of assuring that industrialized housing, buildings, and modular components, including their manufacture, storage, handling, and transportation conform with this chapter.

Compliance Assurance Program. Procedures that state the guiding principles and define the framework for ensuring that construction documents approved by a design review agency, or that modular buildings inspected by a third-party inspection agency, comply with the applicable building codes.

Component. A subassembly, subsystem, or combination of elements for use as a part of a building system or part of a modular component that is not structurally independent, but may be part of structural, plumbing, mechanical, electrical, fire protection, or other systems affecting life safety.

Data Plate. A plate attached by the manufacturer or installer, to a modular building, or modular component that contains identifying information allowing code officials or end users to determine if the structure is suitable for installation in their jurisdiction, location, or project.

Decal. The approved form of certification issued by the authority having jurisdiction, to be permanently attached to the modular building, modular component or panelized system indicating



that it has been constructed to meet or exceed the applicable building code requirements.

Deconstruction. The process of taking a building or structure, or portion thereof, apart with the intent of repurposing, reusing, recycling, or salvaging as many of the materials, products, components, assemblies, or modules as possible.

Design Package. The aggregate of all plans, designs, specifications, and documentation required by these sections to be submitted by the manufacturer to the design review agency or required by the design review agency for compliance review, including the compliance control manual and the on-site construction documentation. Unique or site-specific foundation drawings and special on-site construction details prepared for specific projects are not a part of the design package.

Erection/Installation/Set. The process of blocking, leveling, and anchoring a modular building unit on the building site upon delivery.

Industrialized Building. A commercial structure that is constructed in one or more modules, or constructed using one or more modular components, built at a location other than the commercial site and is designed to be used as a commercial building when the module or modular component is transported to the commercial site and erected or installed.

Industrialized Housing. A residential structure that is designed for the occupancy of one or more families, is constructed in one or more modules, or constructed using one or more modular components, built at a location other than the permanent site and is designed to be used as a permanent residential structure when the module or modular component is transported to the permanent site and erected or installed on a permanent foundation system.

Insignia. The approved form of certification issued by the authority having jurisdiction to the manufacturer to be attached to the modular building, modular component or panelized system indicating that it has been constructed to meet or exceed the applicable building code requirements.

Manufacturer. The entity responsible for the manufacturing of assemblies, panelized systems, modular buildings, or modular components.

Manufacturing Plant. The location other than the building site, at which modular buildings, modular components, modules, panels, or tiny houses are assembled or manufactured prior to transport to the final construction site.

Marriage Wall/Cross Over Connections. The joint between the modules in a complex, commonly called a mate-line or mod-line.

Modular Component. A sub-assembly, subsystem, or combination of elements, including panelized systems, building shells or bathroom pods, for use as a part of a modular building that is not structurally independent, but is a part of structural, plumbing, mechanical, electrical, fire protection, or other systems affecting life safety.

Off-Site Construction. The planning, design, fabrication, and assembly of building elements at a location other than their final installed location to support the rapid and efficient construction of a permanent structure. Such building elements may be prefabricated at a different location and transported to the site or prefabricated on the construction site and then transported to their final location. Off-site construction is characterized by an integrated planning and supply chain optimization strategy (source: National Institute of Building Science).

Off-Site Construction. A modular building, modular component, panelized system, or tiny house which is designed and constructed in compliance with this standard and is wholly or in substantial part fabricated or assembled in manufacturing plants for installation - or assembly and installation - on a separate building site and has been manufactured in such a manner that all parts or processes cannot be inspected at the installation site without disassembly, damage to, or destruction thereof.

Open Construction. A modular building, modular component, panelized system, or tiny house manufactured in such a manner that all portions can be readily inspected at the building site without disassembly, damage, or destruction thereof.

Permanent Modular Construction (PMC). An innovative, sustainable construction delivery method utilizing off-site, lean manufacturing techniques to prefabricate single or multi-story whole building solutions in deliverable module sections. PMC buildings are manufactured in a safe, controlled setting and can be constructed of wood, steel, or concrete. PMC modules can be integrated into site-built projects or stand alone as a turnkey solution, and can be delivered with MEP, fixtures, and interior finishes in less time, with less waste and higher quality control compared to projects utilizing only traditional site construction.

Prefabricated. The manufacture or fabrication of sections of a building at an off-site location which are delivered to and assembled at the building site.

Quality Control. Controls and inspections implemented by the manufacturer, as applicable, to ensure the material provided and work performed meet the requirements of the approved construction documents and referenced standards applicable building codes.

Registered Design Professional. An individual who is registered or licensed to practice their design profession as defined by the statutory requirements of the professional registration laws of the state or jurisdiction in which the project is to be constructed.

Relocatable/Industrialized Building. A partially or completely assembled building that complies with applicable codes and state regulations and is constructed in a building manufacturing facility using a modular construction process. Relocatable modular buildings are designed to be reused or repurposed multiple times and transported to different sites.

Site or Building Site. A lot, the entire tract, subdivision, or parcel of land on which industrialized housing or buildings are sited.

Third-Party Inspector. An approved person determined by applicable statutory requirements to be qualified by reason of experience, demonstrated reliability, and independence of judgment to inspect modular buildings, and portions thereof, for compliance with the construction documents, compliance control program, and applicable building code. A third-party inspector works under the direction of a third-party inspection agency.

Tiny Houses. A dwelling that is designed and constructed in accordance with the IRC with additional requirements as specified in IRC Appendix Q.



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