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Modular Commercial Construction

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Abstract—There has been a significant increase in the use of modular construction methods over the past several years. Modular construction has been described by the Engineering News Record (ENR) as “Creating buildings in modules at an offsite plant and then shipping the (one or more) prefabricated sections to the jobsite.”¹ Commercial modular successes range from relocatable classrooms to permanent dormitories; three to five story hospitality and health care facilities; multifamily (affordable) residential housing; as well as the 32-story, 363-unit Forest City Tower completed in Brooklyn, New York and the more recent 58-story mixed use Rainer Square Tower in Seattle, Washington.

The Modular Building Institute (MBI) suggests that the advantages of modular project delivery method include reduced jobsite disturbance, improved worker safety and more predictable schedule and cost certainty. Additionally, the offsite manufacturing process provides opportunities for better quality management, with less material waste and reduces jobsite congestion.

This paper describes the phases of modular construction and the requirements for successful implementation of the modular project delivery method. Included is a discussion of the project controls (PC) and project production management (PPM) collaboration requirements to support commercial modular construction. This paper is based on virtual conferences, webinars, interviews and literature research of over 60 articles and publications.

¹ Engineering News Record (ENR.com) 3 July 2017

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Introduction

There has been a significant increase in the use of modular construction methods over the past several years. Modular construction has been described by Engineering News Record (ENR) as “Creating buildings in modules at an offsite plant and then shipping the (one or more) prefabricated sections to the jobsite.”² Commercial modular project successes range from relocatable classrooms to permanent dormitories; three to five story hospitality and health care facilities; multifamily (affordable) residential housing; as well as high rise projects such as the 32-story 363-unit Forest City Tower in Brooklyn, New York³ and the more recent 58-story mixed use Rainer Square Tower in Seattle, Washington.⁴

The Modular Building Institute (MBI) suggests that the primary advantage of modular construction is speed which can cut 20 to 30 percent of time from the onsite construction schedule. Other advantages include reduced jobsite disturbance, improved worker safety and more predictable project ‘cost certainty’. The offsite manufacturing process provides opportunities for better quality management, with less material waste and reduces jobsite congestion.

Successful modular construction projects exhibit similar characteristics and performance traits during the various phases of the project. Preconstruction planning and early design decisions are critical for modular to take advantage of the potential schedule improvements resulting from concurrent offsite production. Project controls (PC) must be actively involved and functioning in collaboration with the offsite project production management (PPM) systems during all phases of commercial modular construction.

The future of commercial modular construction has numerous opportunities for growth. The requirement for affordable multifamily residential housing is one of the growth markets in the United States as well as the continued demands for hospitality, education and healthcare facilities throughout North America and internationally. Trends have forecast construction skilled labor shortages with up to 40% of the construction workforce retiring by the year 2031 which could also be a significant factor favoring the future growth of offsite construction projects. The recent market and industry uncertainties suggest that contractors and owners should consider offsite construction alternatives in their project risk mitigation planning.⁵

History of Modular Construction

Modular construction can be traced back more than two centuries. Records show that in the 1800s, hundreds of Henry Manning Portable Cottages were designed and built in London and then the components were shipped to Southern Australia.

² Engineering News Record (ENR.com) 3 July 2017

³ Gregerson, John, “Modular Rising: An Idea Still Grows in Brooklyn”, <https://Builtworlds.com>, 15 March 2016.

⁴ Engineering News Record (ENR.com) 4 March 2020.

⁵ Goodreau, Brian, Arcadis presentation to AACE International New York Metro Section, web meeting, 10/07/2020

In the early 1900s, the Sears Roebuck Company homes were popular in America. Sears offered forty-four (44) styles of home kits ranging in price from seven hundred dollars (\$700) to four thousand dollars (\$4,000). These Sears homes were pre-cut to the plans and specifications, shipped complete with all the components (from nails to paint) to the customer by rail, who were assisted with the initial assembly of the prefabricated parts. Sears reportedly sold over five hundred thousand (500,000) of these well-built homes between 1908 and 1940. ⁶

Other notable uses of modular structures include during the First World War, British Major Peter Norman Nissen designed the Nissen huts (1916), and later during World War II the United States used Quonset huts, named after the original design location Quonset Rhode Island. The 1941 Quonset design was based on the smaller British Nissen hut. The Bellman hangar was designed by N.S. Bellman of the United Kingdom in 1936 and served as temporary hangars for all types of aircraft. All three of those structures were widely used during the World War II period because they were easily transportable and capable of being erected or dismantled by unskilled labor with simple equipment. ⁷

Modular structures of all types have continued to grow in scope and complexity in more recent decades. Previously mentioned were two high-rise projects: the 32-story 363-unit Forest City Tower in Brooklyn, New York ⁸ and the more recent 58-story mixed use Rainer Square Tower in Seattle, Washington. ⁹ Notable as well, is the Apex Towers, in London (UK), rising 29 stories and containing 560 units, with construction completed in just one year from 2016 to 2017. ¹⁰

The Modular Building Institute (MBI) is an international nonprofit trade association formed in 1983 and is the spokesman for both the modular and offsite construction industry. According to their website, currently modular construction accounts for around three to five percent (3 to 5%) of the construction market and continues to grow.

What is Modular Construction?

Engineering News Record (ENR) defined modular as “creating buildings in modules at an offsite plant and then shipping the (one or more) prefabricated sections to a jobsite.” ¹¹

The Modular Building Institute (MBI) describes modular construction in much greater detail: “Modular Construction is a process in which a building is constructed off site, under controlled plant conditions, using the same materials and designing to the same codes and standards as conventionally built facilities – but in about half the time. Buildings are produced in ‘modules’

⁶ Sears Homes 1908 – 1914, www.searsarchives.com.

⁷ Chris Polito, “History modular construction”, <https://bdcnetwork.com>, 14 August 2017.

⁸ Gregerson, John, “Modular Rising: An Idea Still Grows in Brooklyn”, <https://Builtworlds.com>, 15 March 2016.

⁹ Engineering News Record (ENR.com) 4 March 2020.

¹⁰ Aries Building Systems, “What industries are best suited for fast modular building?”, <https://ariesbuilding.com>.

¹¹ Engineering News Record (ENR.com) 3 July 2017

that when put together on site, reflect the identical design intent and specifications of the most sophisticated site-built facility – without compromise.”¹²

MBI suggests that the primary advantage of modular construction is speed which can cut 20 to 30 percent of the onsite construction time from the project schedule. “Modular construction helps the owner and contractors address: quicker client occupancy; craft labor shortages; and (provides) project predictability due to a shorter (onsite) construction schedule, the offsite manufacturing allows for early (up front) materials purchases, and reliable craft labor, modular projects can provide a hedge against construction market uncertainty.”¹³ Other modular construction advantages include reduced jobsite congestion and delays, improved worker safety and predictable “cost certainty”. The offsite manufacturing process provides opportunities for better quality management, with less material waste and reduces jobsite congestion and disruption due to less onsite personnel, equipment and material storage.

Modular Types and Terms

Modular facilities can be either relocatable / temporary buildings or permanent facilities. The key North American 2019 modular markets were: residential (multifamily housing); hospitality (hotels and motels); education (classrooms and campuses); healthcare (emergency rooms, operating rooms, hospital extensions, laboratory, diagnostic center or other medical facilities); offices & administration (from small independent offices to corporate headquarters); retail & commercial (restaurants & diners, banks, convenience stores & gas stations, and golf pro shops); institutional (police & fire stations, prisons & church assembly halls) and the list goes on.¹⁴ A popular and relatively new modular feature are Accessory Dwelling Units (ADUs), which are units that can provide added private spaces to work from home or an additional living space to move family members closer to the home. Think ‘mother-in-law’ cottages and ‘man cave’.

Offsite construction is the assembly work that is performed in a facility or factory away from the construction jobsite: That assembly can be prefabrication of components or subassemblies; precast or prestressed concrete; panelized materials; modules (modular sections) or volumetric (often referred to as three-dimensional or ‘3-D’ units). Volumetric modular construction is the process of assembling fully enclosed, six (6) sided building modules (ceiling, floor, and four walls) in an offsite factory setting, and then joining them together to construct one larger building.¹⁵

There are a variety of terms that are uniquely associated with modular & offsite construction which are only briefly described here. Engineering News Record published a good “Glossary of Offsite Construction / Modular Construction” terms in January 10, 2020, which is available on the internet. [9]

¹² Modular Building Institute, “Why Build Modular?”, MBI Website, 2017.

¹³ Modular Building Institute, “Permanent Modular Construction”, MBI Website, 2019.

¹⁴ Modular Building Institute, “Key North American Markets”, MBI Website, 2019

¹⁵ Reference VESTA website, 2020, <https://vestamodular.com>

Why Has Modular Construction Become More Popular?

Modular construction has several advantages over traditional or conventional onsite construction methods. Those advantages include:

- Up to 80% (or more) of the feature is built and inspected at the offsite manufacturing facility.
- Use of fixed cost contracts provide a 'cost certain' project. Therefore, cost contingency can often be excluded from the contractors' bids.
- There is a reduced onsite presence: fewer onsite craft, less congestion of craft and vendors, less onsite material storage and equipment for a safer work site.
- Provides 'schedule certain' delivery of the modules to the job site/ therefore the onsite installation time is reduced. Additionally, the onsite preparation activities are ongoing while the offsite module units are being fabricated, which provides the opportunity to shorten the project completion schedule by as much as 30%.
- Improved quality due to the repetitive offsite unit production operations and reduced waste because of the material controls at the offsite construction facility.
- Fewer labor hours at the offsite construction facility, and likely lower labor costs. Specialty subcontractor requirements may be limited or eliminated.
- 'Repeatability' by consistent quality production in the offsite controlled environment.¹⁶

Project Controls and Project Production Management

Project controls (PC) and project production management (PPM) are two uniquely different processes. Both project controls (PC) systems and project production management (PPM) techniques are required and work in collaboration to support commercial modular construction project success.

Project Controls for Onsite Construction

The project controls (PC) efforts for the modular construction jobsite will focus on planning, scheduling, execution/ coordination, estimating, budgeting and cost management. Traditional / conventional construction project controls systems and techniques will be employed in the management and control of the project onsite construction activities. Those are the core competencies for members of AACE International [12] [13]. The onsite construction planning and CPM scheduling identifies the site work activities; task durations and the logical sequence of activities to manage the onsite work that include the entire scope of the onsite construction project. The important additional requirement is to coordinate and align with the offsite facilities production and delivery schedule in order to achieve the project installation plan and milestone completion dates.

¹⁶ Modular Building Institute, "Permanent Modular Construction", MBI Website www.modular.org 2019.

Project Production Management Terms and Tools

Project production management (PPM) processes and techniques monitor and control the offsite construction (production) facility. The offsite project team includes the production management team, vendors & suppliers, the procurement team (aka materials management), and specialty skill trades that will be working with the offsite facility. Inventory control procedures are established for supply acquisition, storage and accessibility of the production items to ensure adequate quantities of materials are available to meet the offsite production requirements.

The PPM system combines factory capacity, material inventory and assembly time. The material requirements planning (MRP) approach will plan for the delivery of required raw material and schedule the appropriate labor. Capacity requirements planning (CRP) addresses the quantity or volume of modules or units that can be under production in the facility at any given time. These planning capabilities gives the offsite team a head start to purchase materials, hire workers and plan for the equipment necessary for the production project.¹⁷ Supply chain management (SCM) is “the active management of supply chain activities to maximize customer value ... from product development, sourcing, production and logistics in the most effective and efficient manner.”¹⁸

Modular construction will use different manufacturing terminology at the offsite production facility which are generally unfamiliar in traditional construction, including: part numbers and unique catalog numbers; subassemblies for standard components; job shop manufacturing for nonstandard products such as HVAC duct work; a ‘shop order is the offsite equivalent to a traditional construction work package.

Project production scheduling uses the term routings, which is the specific steps inside the factory or shop environment. This includes the sequence of production operations, the work center, and the expected time to perform that production work. Enterprise resource planning (ERP) software products are employed in that process.

A ‘shipping plan’ is used to coordinate the delivery of the units and subassemblies to the construction site, in order to avoid early deliveries that cannot be safely stored onsite or installed. The concept of a just-in-time (JIT) delivery schedule is used “to synchronize the production schedule with the deliveries to the job site so that the transportation timeline corresponds with when the onsite crews and equipment available to install the units.”¹⁹

The bill of materials (BOM) listing the parts or assemblies sent to the jobsite for installation, and output from the ERP software will provide the product cost rollup that is used to account for the labor, machine, and overhead cost of the units or assemblies that have been delivered and put in place on the jobsite.

¹⁷ ENR, “A Glossary of Offsite Construction/ Modular Construction”, 10 January 2020.

¹⁸ Handfield, Robert, “What is Supply Chain Management (SCM)?”, 19 February 2020, <https://scm.ncsu.edu>

¹⁹ Engineering News Record, “A Glossary of Offsite Construction/ Modular Construction”, 10 January 2020.

The Modular Construction Process

There are essentially four phases for a permanent modular construction project: design, assembly, transportation, and onsite module unit installation.²⁰

The design phase goal is to obtain design approvals from the client (developer or end-user) and any regulating authorities. The identification of all necessary licenses, permits and building code compliance requirements may be the more protracted than normal task. The modular design stage is significantly more detailed than most traditional construction projects.

The assembly phase for the modular units is accomplished in a controlled factory environment. The offsite facility incorporates “Project Production Management” (PPM) operations and shopwork processes and procedures described previously. The mechanical, electrical, and plumbing (MEP) subcontractors are generally familiar with these types of job shop operations. The offsite construction facility will be discussed in more detail later.

The next phase is transportation of the module units to the final jobsite destination: one of the key elements of modular construction is the requirement to obtain all of the necessary transportation licenses, permits and approvals. Crossing state and international borders present additional challenges. There are often regulatory concerns regarding transportation permits and fees. There is no industry standard at present for the transfer (handoff) of module ownership while loading, transport, travel, unloading and erecting.²¹

The installation phase includes the lifting, placing, and securing of the modular units to form a finished building. While the modules are being produced at the offsite facility, the project jobsite has been prepared to receive and possibly temporary staging of the modular units before lifting and final setting. At this stage there will be less construction site congestion: fewer craft laborers, minimal construction equipment, and less required material storage areas. The onsite workforce would include craft labor to operate the material handling equipment and erection cranes that move the modules from the transports to the staging area, or often lifting the module directly from the transport into position and secured.

Modular Design and Planning Phase

Modular construction requires significantly greater upfront planning and design decisions than the traditional construction design phase. These early detailed planning investments during the design phase will ultimately save time, money and labor for the modular project. Early design decisions are needed to take advantage of the concurrent off-site manufacturing advantages.²²

The modular design and planning phase items that require early resolution include the project site evaluation; the scope of work (SOW) and division of responsibilities (DOR); design

²⁰ Modular Building Institute, “Permanent Modular Construction”, page 2, MBI Website www.modular.org 2019.

²¹ Smith, “Offsite and Modular Construction”, page 25, Date TBD

²² MODLOGIQ, “Off-Site Construction checklist for Project Success”, page 11, <https://www.modlogiq.com>

specifications; structural design and building codes, all required inspections and permit requirements; and any green (LEED) building design functional considerations. [2, p.54]

Modular best practices recommend addressing the following factors related to the design and planning phase that require action:

- Bring the entire team together (i.e., “onboard”) early! From a project planning perspective there is a need for all major project participants to be actively involved beginning very early in the project. The project planning participants must include: The owner/ developer / client; architect and engineers, structural design, construction manager and both the onsite construction team and the offsite production team. From the conceptual phase forward to project completion, the entire project team must be “invited to sit at the same table” and the project communication / collaboration must be “horizontal, not vertical”²³
- Scope: “Get it right early and keep things simple!” The entire scope of the project needs to be nailed down in the early stage to avoid change orders which could be very costly if unresolved until a much later time. This is also the best time to assign the division of responsibilities for all phases of the project.
- Evaluate the site factors to include the client preferences for the building style and spacing, the size of the site and the building footprint plus the geologic base of the site to determine the type of building foundation.²⁴
- Permits/ state and local building codes/ responsibility for inspections: for permitting, inspections and quality assurance/ control – the key handoff points must be clarified and responsibilities defined. Currently, 35 states of the 50 United States have modular construction permitting processes in place which helps reduce the potential delays and issues that could otherwise impede the progress of the project.
- Design team & offsite facility team collaboration must be established with solid communications dialogue. The architect and engineering team must be able to interface directly with the offsite team in order to facilitate the production schedule.
- Designers should acknowledge there may be a gap between the design requirements and the production ‘means and methods’ at the factory. The designers should be receptive to embrace the ‘means and methods’ gap for timely response to requests for information (RFIs) and reduce the potential for change orders and improved quality overall.
- Software integration with design: there are a variety of software systems currently available to facilitate and enhance modular successful design integration.
- Building information modeling (BIM) coordination planning needs to prepare the following:
 - BIM Management Plan (the owner defines the requirements/ standards)
 - BIM Design Execution Plan (architect, MEP, structural, civil, others)
 - BIM Construction Execution Plan (contractor & multiple subcontractors)²⁵

²³ MODLOGIQ, “Off-Site Construction checklist for Project Success”, page 6, <https://www.modlogiq.com>

²⁴ VESTA, “Ultimate Guide to Understanding Modular Construction and Modular Buildings”, page 7, <https://vestamodular.com>.

²⁵ BIM Track’s “Ultimate Guide to BIM Coordination”, e-book, www.bimtrack.co, 2020.

Recognizing the importance of the designer's role in the success of the overall modular construction process the American Institute of Architects (AIA) worked with the Modular Building Institute in 2019, to develop the "Modular and Off-Site Construction Guide" to serve as "a primer on the modular approach for architects explaining the value and opportunities of modular design; pitfalls designers should be wary of; and included case studies that exemplify successes and obstacles." [11]

Pre-Construction Phase

The pre-construction phase includes: contract bid process; construction documents (design drawings & specifications); insurance & bonding; and cost estimating. [2, p. 92].

Because the design phase encourages full project team involvement and detailed planning, there are fewer uncertainties in the contract bidding phase (i.e., fixed cost or cost certainty) which could minimize or eliminate the requirement for cost contingencies in contracts. Fixed cost or cost certain contracts and purchase orders are preferred in modular projects however all contract types and project partnering relationships can work. As an alternative, rather than competitive bidding, the client may decide to negotiate all agreements for the project. [2, p.95]

During the pre-construction phase the entire project team is encouraged to perform a constructability review to maximize efficiency of operations for the construction phase. Constructability factors to consider include: schedule, long lead items, material and labor availability, sequence of work, weather and environmental concerns, site access, operations and maintenance and costs. [2, p.98-99]. The focus in this phase is on team building!

Other pre-construction phase actions include value engineering and risk management actions which are not uniquely different from conventional and traditional construction.

Modular Construction Phase

The construction phase includes the traditional post award project management and administration; jobsite schedule monitoring and progress reporting, supply chain management; quality assurance and quality control. The construction management (CM) team maintains their working relationship with the various project stakeholders and participants: client/owner's representative, design professionals, vendors, manufacturers, general contractor (GC), subcontractors; specialty consultants (surveying, soil and concrete testing, fire sprinklers, HVAC, security systems, system testing and balancing, commissioning, etc.) [2, p. 126-127].

Jobsite (Onsite) Construction

The jobsite construction factors include: Onsite safety programs and standards; personnel protection and fall protection; onsite construction tools, machinery and heavy equipment requirements. The unique factors of the onsite construction phase reflect the reduced congestion/ presence of fewer craft, materials and equipment on the construction jobsite. The onsite construction focuses on site development: primarily civil work, excavation and backfill, site

utilities, drainage and foundations. The sitework is all being performed while the offsite module units are being produced in the factory.

Onsite construction scheduling, estimating, budgeting and cost control are the traditional or conventional construction project controls activities. Planning and CPM scheduling establishes the activities, durations and logical sequence of the onsite work activities. Modular encourages the incorporation of just in time project techniques for delivery and erection of the modular units. The onsite construction team needs to coordinate and maintain the communications interface with the offsite facility management team. Project planning should include the sequencing and scheduling for the onsite modular installations to keep crane time, road closures, and site disruption to a minimum.”²⁶

Offsite Construction Facility

Offsite construction is the assembly work that is performed in a facility or factory away from the construction jobsite: What is the difference from onsite construction? Think manufacturing and production line operations! Expect to find an industrial and shop safety program at the offsite production facility. In the offsite facility there will be: No mud or dust! No jobsite walking or tripping hazards, no loud construction noise, zero pollution/ contaminants; No production delays due to bad weather; Less material waste due to better materials control. ²⁷

Offsite facility requirements will vary with the modular product: from relatively small spaces for prefabricating components or subassemblies to facilities over one hundred thousand square feet (100,000 sq-ft) to produce volumetric modular building units. Material and module handling may also vary from hand tools and standard material handling equipment to specialty production solutions for the large-scale fabrication, assembly, and movement of the modular units. Planning the offsite facility layout requires careful consideration to optimize the utilization of space and production process efficiency. The location of the offsite production facility as related to the jobsite is also a major consideration. As the distance between those two locations increases, so do the transportation costs which could eliminate any planned savings for the project. ²⁸

Challenges of Modular Construction

The identified benefits of cost, schedule and quality control by utilizing modular construction are significant, however there are some challenges and issues that may concern the entire construction industry. By developing an understanding of these challenges, the project developer and the construction industry will be in a better position to succeed. [8, p.18-19]

Some of the unique characteristics of modular construction over traditional EPC construction projects are described below:

²⁶ MODLOGIQ, “Follow the LOGIQ”, page 3 of 4, <https://www.modlogiq.com>

²⁷ East Coast Modular, <https://eastcoastmodulardormers.com>

²⁸ Engineering News Record, “Creating Offsite-Prefab Sites is a Complex Process”, 27 September 2018.

- **“Increased team coordination required** - modular projects require increased coordination among the design team, the modular manufacturer, and the on-site construction management team, particularly in the early stages of the project.
- **Greater upfront draw percentage** – modular projects require earlier capital investment than traditional construction. Manufacturers require upfront capital in order to procure all materials and begin production. Unlike traditional construction, modular construction does not easily allow lenders to assess financial draws based on work completed.
- **Regulatory overlap** – modular projects are built to the same local building code as traditional construction. However, some code agencies may require additional reviews for different project stages. State and local governments may also require additional fees and different requirements for transportation of modular units.
- **Technical limitations** – some notable disadvantages to modular or off-site construction include: Structural bulkiness related to heights and wall thickness; Transportation restrictions limit module unit size; design configurations and spans are somewhat restricted; and flexibility and changeability of structure may be difficult for future renovations. Additionally, for newcomers to the modular and offsite process, there is a lack of transparency related to the costs: overhead, profit margin, transport, setting (cranes) and associated increased design fees.”²⁹

What is the Future of Modular Construction?

Modular construction has a promising future in many markets, particularly as the economy returns to normal (e.g., education, health care, hospitality, commercial/ retail, etc.). There is a particularly strong demand for affordable multifamily housing in the United States. With this potential for cost savings and shorter construction timelines, modular multifamily construction could be part of the strategy to address the affordable housing supply crisis currently taking place in the United States. “The U.S. Federal National Mortgage Association (FNMA, commonly known as Fannie Mae) and the National Institute of Building Sciences (NIBS) developed the “Multifamily Modular Construction Toolkit” [8] for lenders and other stakeholders in the multifamily industry with the goal to equip stakeholders with information and resources on the advantages and opportunities of modular construction, so they can appropriately assess their risk and be prepared to finance high quality properties.”³⁰ The requirement for affordable multifamily residential housing is just one of the growth markets and there are continued demands for hospitality, education and healthcare facilities throughout North America and Internationally.

Various sources have forecast 40% construction skilled labor retiring from the construction workforce by the year 2031 which could also be a significant factor favoring the future of offsite construction projects. The recent market and industry uncertainties plus those arising from the 2020 pandemic suggest that contractors and owners consider offsite construction alternatives in their project risk mitigation planning.³¹

²⁹ Fannie May and NIBS, “Multifamily Modular Construction Toolkit”, August 2020, pages 18-19.

³⁰ Ms. Libby O’Neal, “Modular Multifamily Housing as an Affordable Supply Strategy”, webinar presentation, August 2020.

³¹ Goodreau, Brian, Arcadis presentation to AACE International New York Metro Section, web meeting, 10/07/2020

Conclusion

There has been a significant increase in the use of modular construction project delivery methods over the past several years. The primary advantages of modular construction are speed which can cut 20 to 30 percent of time off the onsite construction schedule and a more predictable project 'cost certainty'. Other advantages include reduced jobsite congestion and improved worker safety. Offsite manufacturing provides opportunities for better quality management, with less material waste and reduces jobsite congestion.

With reports forecasting up to a 40% construction skilled labor shortage by the year 2031, as workers retire from the construction workforce that could be a significant factor favoring the future growth of modular and offsite construction projects. These market and industry labor uncertainties and those arising from the 2020 pandemic suggest that contractors and owners consider offsite construction alternatives in their project risk mitigation planning.

The future of commercial modular construction has numerous opportunities for growth. The requirement for affordable multifamily residential housing in the United States is one of the growth markets as well as the continued demands for hospitality, education and healthcare facilities in both North American and International markets.

Commercial modular construction utilizes both traditional project controls (PC) systems and processes and project production management (PPM) operations successfully. Professionals should consider the potential for career growth and professional satisfaction in the modular construction market. Modular construction project delivery has both challenges and opportunities.

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