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THE WAY THE WORLD
BUILDS

GREENER.
FASTER.
SMARTER.™

PERMANENT MODULAR
CONSTRUCTION
2012 ANNUAL REPORT
COMPANY PROFILE: MODULAR BUILDING INSTITUTE

Founded in 1983, the Modular Building Institute (MBI) is the only international non-profit trade association serving the commercial modular construction industry. Members are manufacturers, dealers and contractors of commercial modular building projects, as well as associates supplying building components, services and financing.

Members are located in 19 countries around the globe and provide all types of building space, from relocatable buildings to complex multi-story permanent construction projects. MBI’s mission is to grow the industry and its capabilities by encouraging innovation, quality and professionalism through communication, education and recognition.

Each year, MBI hosts World of Modular, the largest gathering of professionals in the modular construction industry. The next World of Modular will be held March 24-26, 2012 in Orlando, Florida.

For more information about the industry visit, [www.modular.org](http://www.modular.org).

ABOUT THE INDUSTRY: COMMERCIAL MODULAR CONSTRUCTION

Commercial Modular Buildings are non-residential factory-built structures designed to meet federal, provincial, state and local building codes and in some cases designed to be relocated. The commercial modular building industry is comprised of two distinct divisions:

**Permanent Modular Construction** — PMC is an innovative, sustainable construction delivery method utilizing offsite, 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 turn-key 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.

**Relocatable Buildings** — 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 building sites.

THIS REPORT FOCUSES ON THE PERMANENT MODULAR CONSTRUCTION (PMC) BUILDINGS DIVISION WITH A NORTH AMERICAN FOCUS. SEE PAGE 20 FOR OUR GLOBAL OUTLOOK.
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Countless industries regularly use permanent modular construction, including schools, banks, restaurants, hospitals, medical clinics, day care centers and correctional facilities — just to name a few. The number of industries, as measured by the North American Industry Classification System (NAICS), that utilize our services are numerous, but the most common categories include:

236116  New Multifamily Housing Construction
236210  Industrial Building Construction
236220  Commercial and Institutional Building Construction

The primary benefits of permanent modular construction include:

1. Greener - Reduced environmental impact - less site damage, less material exposure and less waste in landfill.
2. Faster - Streamlined construction process — in many cases occupancy occurs 50 percent faster than with conventional construction
3. Smarter - Resource efficient — less labor and fewer materials wasted

Commercial modular buildings are non-residential structures, 60 percent to 90 percent completed “off-site” in a controlled environment, and transported and assembled at the final building site. This can comprise the entire building or be components or subassemblies of larger structures. In many cases, modular contractors work with traditional general contractors to leverage the resources and advantages of each type of construction.

The term “modular” describes a construction method or process where individual modules stand alone or are assembled together 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, permanent.

An important but subtle difference for this report is that modular construction refers to three-dimensional building “modules” that are prefabricated off site and transported to the site to make up the entire building, rather than prefabricated mechanical systems or wall assemblies.

Permanent modular buildings may be Type V (wood frame, combustible) or Type II (steel, concrete, non combustible) and can have as many stories as building codes allow.

Primarily, four stages make up a modular construction project.

1. Design approval by the end user and any regulating authorities
2. Assembly of module components in a controlled environment
3. Transportation of modules to a final destination
4. Erection of modular units to form a finished building
Modular contractors manufacture buildings (or contract to have buildings manufactured) at off-site locations. Responding to customer requests, they typically operate as general contractors on projects, coordinating the delivery, installation, site work and finish of the building. Construction primarily occurs indoors away from harsh weather conditions preventing damage to building materials and allowing builders to work in comfortable conditions.

Unique to modular construction, site work occurs at the same time or in some cases prior to construction because modules are assembled in a factory. This allows for much earlier building occupancy and contributes to a much shorter overall construction period, reducing labor, financing and supervision costs. Saving even more time and money, nearly all design and engineering disciplines are part of the manufacturing process.

Also unique to modular construction is the ability to simultaneously construct a building’s floors, walls, ceilings, rafters and roofs. With site-built construction, walls cannot be set until floors are in position, and ceilings and rafters cannot be added until walls are erected. On the other hand, with modern modular methods of construction, walls, floors, ceilings and rafters are all built at the same time and then brought together in the same factory to form a building. This process often allows modular construction times of half that of conventional, stick-built construction.

These practical time and money saving alternatives to site-built structures effectively meet the specialized needs of diverse businesses. Customers served by modular construction include federal, state, provincial and local governments; school boards, corporations, non-profit organizations, retail establishments, healthcare providers, as well as individuals, partnerships and sole proprietorships. Other uses include medical facilities, airport facilities, military installations, restaurants, churches and remote telecommunications stations.
The modular construction process is different than a traditionally constructed building, particularly at the beginning of the process. As such, some owners and contractors have dismissed this efficient process because it isn’t “the way they’ve always done it.”

By the time a project has been designed, scheduled, let out for bid and awarded, it’s often too late to bring in a modular contractor wanting to “streamline the process” and change the schedule. What often results is either avoidance of modular or perhaps worse, forcing a modular solution after the fact.

**Delivery Method**

It is of key importance to bring the modular contractor/manufacturer into the building process as early as possible as part of the team. As such, the “Design-Bid-Build” process is a less than desirable approach. Projects utilizing a “Design Build” approach or “Integrated Project Delivery” (IPD) allow the modular company to bring the industry advantages to the table early in the conversation. IPD is a delivery system that aligns interests, objectives and practices through a team-based approach.

**Critical Path Method (CPM)**

CPM is a project management tool used to schedule a series of activities on a particular project in order to improve communication and minimize scheduling conflicts (basically a flowchart of activities with a timeline). It is a time tested and widely used tool in the construction industry. However, the practice of CPM is flawed and needs revisited as most schedules assume a more linear completion of tasks. With a typical construction project, you cannot start Task B until you complete Task A. Task C cannot begin until Task B is completed, and so on. The modular construction industry literally breaks the model and allows for simultaneous completion of tasks once considered sequential.

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**Lean Construction, BIM, and Green Building**

What is most striking about prefabrication/modularization is its ability to enable all these trends, in addition to being more prominent because of them. It [modular construction] brings all of them together to improve productivity in construction.

*McGraw Hill Construction SmartMarket Report*
Design Considerations

• Three-dimensional modules have widths that are typically nominal 8, 10, 12, 14, and 16 feet with 12 and 14 feet being the most common. Framing dimensions are typically 2 inches less than nominal size.

• Module lengths are up to 70 feet, usually in 2-foot increments.

• Module heights vary from approximately 11 feet, 6 inches to 13 feet, not including the height of the unit’s transport trailer or frame.

• Type V wood frame construction is the most common type of construction; however manufacturers also build with steel and concrete and can meet the requirements for Type I, II and, III construction.

• Multi-story modular buildings can be built up to the maximum stories allowed by code. A majority of modular buildings are 1–4 stories but some have exceeded 10 stories in the U.S.

• Restroom areas should be designed so that a module “marriage line” does not split the space.

• Multiple roof framing styles are available. Some can be completed in the factory, and some may require the installation of site-installed trusses.

• Modular buildings can be configured using modules of various lengths and widths.

McGraw Hill Construction SmartMarket Report:
Prefabrication and Modularization: Increasing Productivity in the Construction Industry

• 66% report that project schedules are decreased - 35% by four weeks or more
• 65% report that project budgets are decreased - 41% by 6% or more
• 77% report that construction site waste is decreased - 44% by 5% or more

"Prefabrication and modular construction processes have been used for years, but today, with the emergence of new technologies and construction practices, we have the ability to utilize these strategies to create innovative and quality buildings, while also improving construction productivity," said Harvey Bernstein, Vice President of Industry Insights and Alliances at McGraw-Hill Construction.
It is now widely accepted that the modular construction process is more resource efficient, not only in terms of labor and money, but also with regard to material usage and waste. The previously cited McGraw-Hill Smart Market Report (on page 6), indicated that 77 percent of architects, engineers and contractors surveyed reported a reduction in site waste. Incredibly, 44 percent reported that site waste was reduced by five percent or greater.

The EPA reports that the average amount of construction and demolition waste generated for a non residential project is 4.34 lbs/sq ft. For a 10,000-square-foot facility, this amounts to 43,400 pounds of waste, or more than 21 tons! If owners are able to reduce this amount by just five percent using modular construction techniques, that translates into 2,170 pounds of waste, or more than a ton of waste per project diverted from the landfill.

Projects utilizing modular construction also have the ability to reduce waste in another manner. Due to the fact that these buildings are designed and constructed to be assembled on site, they are also therefore “designed for disassembly” or “design for deconstruction (DfD).” In short, it is much more practical to disassemble a modular project and salvage or reuse significant components of the building compared to a similar site built facility.

The increasing use of BIM technology as well as the general public’s growing disdain to pay for wasteful practices are two key reasons why modular construction techniques will continue to gain in popularity.

Research + Upcycle | The R+U project consisted of renovating two 24x40 retired, open DSA classrooms into the Architectural, Building & Development Firm’s office and their residence. The project illustrates economical, energy efficient “upcycling” of modules and materials. The buildings, remodel and site work was done under $140K ($73/sf). The modules were placed on a temporary site built foundation and the residence and office are also connected by a wood walkway constructed of recycled pallet boards.

All pictures on these two pages are winners of our annual Awards of Distinction for 2012 under the category Renovated Reuse.
RENOVATED REUSE (After)
Bowen Island Golf Club: Cup Cutter Clubhouse
Days to Complete: 21

RENOVATED REUSE (After)
Olympic Legacy Affordable Housing
Days to complete: 952
33,961 total sq. ft.
MARKET SIZE

In 2011, 126 modular construction companies indicated that permanent modular construction accounted for an average of 54 percent of their total revenue (leasing and sales of relocatable buildings account for the remainder). This equates to about $2.7 billion of the estimated $5 billion industry in North America.

For 2011, manufacturers indicated that their top markets were:

Education, Healthcare, Multifamily/Student Housing, Government (barracks, administrative offices), Retail/ Hospitality

Permanent modular buildings are considered real property, built to the same building codes and requirements as site-built structures, and are depreciated in a similar manner. As such, the markets for permanent modular construction are similar to the markets for site-built contractors, with few exceptions.

K-12 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 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 face less disruption.

HIGHER EDUCATION STUDENT HOUSING

From single dormitories to complete campuses, permanent modular construction offers public, private and charter schools what other construction methods cannot: accelerated project timelines, more economical pricing and less disruption. Permanent, modular student housing is indistinguishable from other school buildings and can be constructed to any architectural and customer specifications. MBI members design and build student dorms of all types and sizes using traditional building materials like wood, steel and concrete. Virtually any size permanent student housing facility can be built, installed and ready for occupancy, some in as little as 90 days.

OFFICE & ADMINISTRATIVE SPACE

Permanent modular buildings serve as corporate headquarters, satellite bureaus, institutional and administrative buildings, and offices for all business types. Modern single- and multi-story buildings can be configured in a number of 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.
K-12 EDUCATION
West Reading Elementary Center
Days to complete: 208

STUDENT HOUSING
Appalachian State University
Days to complete: 273

MULTI-BUSINESS OFFICE COMPLEX
Victoria Shipyards
Days to complete: 121
RETAIL & HOSPITALITY

Simply put, quicker occupancy equals quicker return on investment. Modular construction is accelerated construction. Why is this so important to banks, restaurants, convenience stores, child care centers and other retail establishments? Because earlier occupancy means a customer generates revenue faster. In fact, it’s not uncommon for many modular buildings to be up and running in as little as 24 hours—an important consideration for retailers of all types. Typical retail applications include hotels and motels, restaurants and diners, banks, golf pro shops, convenience stores, gas stations, car washes, college bookstores, 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.

HEALTHCARE

Perhaps a customer’s interest is in serving patients as quickly as possible in the most safe and aesthetically-pleasing environment available. If so, modular construction offers quiet, safe and clean applications for medical, surgical, clinical and dental use. The insight MBI contractors have from designing and building thousands of medical facilities has resulted in satisfied healthcare professionals the world over. If an organization or community needs a new rehabilitation clinic, emergency room, operating room, hospital extension, laboratory, diagnostic center, or other medical facility, remember that modular construction can be used for custom-built facilities with the tightest budgets while maintaining strict medical and aesthetic specifications.

PUBLICLY FUNDED FACILITIES

Governmental users consist of federal, state and local public sector agencies and organizations, public education entities, and military housing and administrative projects. The industry has enjoyed success in focused niches such as prisons and jails, courthouses, military installations, and national and border security buildings.

MARKET SHARE

The U.S. Census Bureau reports monthly the value of construction put in place for residential and commercial, and for public and private projects. Year-end data for 2011 indicated that the total U.S. construction put in place was about $787 billion annualized — $244 billion in residential and $543 billion in non-residential.

The non-residential category can be further delineated into “buildings” and “non-building” categories such as power, highway and street, and water supply. Building categories that align with industry key markets are: lodging, office, commercial, healthcare, educational and religious. These categories totaled $183 billion for year-end 2011. The $2.7 billion PMC building market, therefore, is roughly 1.5 percent of this total.
Franchise owners of convenience stores, fast food restaurants and coffee shops have all turned to modular construction because of one simple equation: faster occupancy = faster cash flow. Because of the accelerated construction timeline with modular construction, franchisees are discovering that occupancy can occur months earlier than with conventional construction.

**Here are three big advantages to using modular construction:**

1. **Faster Installation**

Modular buildings can be delivered and installed as soon as a site is prepared by a general contractor. In some cases, this allows a franchisee to open 60-90 days sooner than with traditional construction. In one case, a popular coffee shop was built, installed and opened two months more quickly using modular construction compared to traditional site built construction. With an average daily sales volume of around $2,000, this earlier occupancy translated into nearly $120,000 in additional revenue. With a net profit margin hovering around 10 percent, this decision put an additional $12,000 in the owner’s pocket.

2. **Faster Store Replacement**

In another example, a franchisee wanted to demolish an existing store and replace it with a new one. With speed to re-opening as a primary consideration to protect market share and minimize lost sales, modular construction was chosen for its expedited timeline. A 3,000 square foot chicken franchise was delivered and opened within a five-week window, including demolition of the old store.

As crews were taking down the old restaurant, work on prefab custom modules for the new building was underway at a nearby production facility. The new restaurant featured exterior brick, and all interior finishes are identical to those used in their conventionally built stores. All cabinets, counters and planters, plus solid oak window frames and trim, were installed at the plant.

3. **Consistent Labor Pool**

The average franchisee owns and operates multiple stores in multiple locations. Finding reputable contractors and navigating local construction issues within these various locations can often be challenging. Modular manufacturers typically can build and deliver competitively within 500 mile radius of their factory. By partnering with a modular contractor, a franchisee can be assured of consistent quality and a steady labor pool knowledgeable of all the various code requirements. This relationship can reduce time and resources spent on multiple GCs in multiple regions.

These projects are excellent examples of how a client can receive quality equal to or better than conventional construction, while benefiting from accelerated construction schedules, with no compromise in aesthetics.
When High Tech High needed to develop a sustainable learning campus in a short time in Chula Vista, California, their general contractor advised them to turn to modular construction. Modular building would not only keep the project within the necessary environmental requirements and five-month deadline, but also allow it to stay within its strict budget.

The design and construction of the school had to accommodate a range of LEED®, CHPS (“Collaborative for High Performance Schools”), and ENERGY STAR requirements, including site design, indoor environmental quality, energy efficiencies and renewable building materials. Both onsite and offsite construction needed to be limited to certain areas to keep air and noise pollution and habitat destruction to a minimum.

The finished building, which is LEED for Schools Gold-certified, offers classrooms, seminar rooms, studios, teacher offices and multiple courtyards. With student health paramount, low-toxicity materials – which also boast durability and minimal maintenance – were used: polished concrete floors, steel framing, steel roof and floor decking, and fiber-cement siding.

The project’s San Diego-based GC, BYCOR, subcontracted Baltimore’s Williams Scotsman, a modular building supplier, to coordinate the integration of modular building construction with conventional methods as well as accommodate the sustainability requirements of the project.

The subcontractor provided 59 modules totaling 32,807 square feet. To stay within LEED design requirements, the company coordinated with their local manufacturer and the project team to ensure the modular units incorporated a variety of unique materials to enhance classroom acoustics, day lighting, and energy and environmental efficiencies. All of these improvements helped reduce life cycle costs.

To decrease pollution and land affected by construction, Williams Scotsman worked closely with the building and fire officials on permitted delivery times for modular units and site construction areas. A sequential crane set-up process enabled them to install variable sized modules, minimize the impact to the ongoing tasks of the general contractor and complete the project in a timely fashion.

With outstanding practicality, aesthetics and environmental features, the project received a prestigious Modular Building Institute Award of Distinction for Green Building Design in 2010.
Data for this report was compiled from previously conducted surveys with contractors and manufacturing companies (both members and non-members of MBI). In addition, MBI obtained data from a variety of sources, including public statistics and information, state and provincial modular regulatory agencies, and direct communication with company leaders.

In all, MBI collected data from 22 modular building manufacturers with a total of 45 plant locations and 12 modular contractors.
PRODUCTION AND PRODUCTIVITY

Modular manufacturers are located throughout North America, with larger “clusters” of manufacturers in Pennsylvania, Georgia, Texas, Indiana, California, and Alberta, Canada. Most manufacturers in North America are single-location operations and can competitively transport units within a 500-mile radius of their plant. Peak employee size varied significantly, impacted by market and geography as well as the physical size of the plant. While not necessarily and indication of actual activity, the average manufacturer is approved to build in 20 states.

In general, manufacturers averaged 171 workers during their peak production. Larger companies with multiple locations employed as many as 4,000 workers while smaller plants employ between 60-70.

The typical modular manufacturer produced 146,387 square feet in 2011, producing an average of 290 “floors” or “modules.” This production is about 7 percent less than reported in 2010. The average-sized module produced was about 500 square feet. Transportation regulations are commonly the limiting factor in module size.

Depending on the level of customization required by the owner and architect, most modules leave the factory 60-90 percent complete, with wiring, plumbing, structural and mechanical systems inspected and approved before arriving at the site.

According to survey results, 71 percent of the buildings manufactured in 2011 were wood framed construction and 93 percent were one or two story structures. Survey respondents built a total of 16 LEED-rated buildings in 2011.

MARKET INDICATORS

The Architectural Billings Index (ABI) is a leading economic indicator of construction activity and shows an approximate nine to 12 month lag time between architectural billings and construction spending, with a score above “50” indicating an increase in billings. The ABI for December 2011 was 52.0.

School Population Increase in K-12 — Public elementary enrollment is projected to continue a pattern of annual increases through 2016. Public secondary enrollment is projected to decrease two percent between 2007 and 2011, and then begin increasing again through 2016. Public secondary school enrollment in 2016 is expected to be about two percent higher than in 2007.
2011 SUMMARY

The Modular Building Institute continues to advance construction industry competitiveness through a network of research and educational partners. MBI has two affiliated foundations – the Modular Building Institute Educational Foundation (MBIEF), a U.S. based 501(c)3 entity, and the Modular Building Institute Canadian Foundation (MBICF).

Through these entities, MBI hosts student design competitions, awards scholarships and underwrites whitepapers and other industry research. MBI also supports and partners with university-based programs in architecture, engineering and construction management through our “Partners in Education” program.

The interest in modular construction from the architect, engineer, contractor and owner community is at an all-time high, due largely to the efficiencies gained through this process.

The modular construction industry is changing the way the world builds – greener, faster, smarter.
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