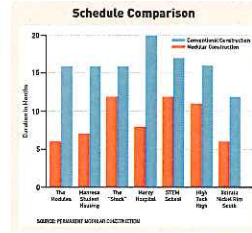
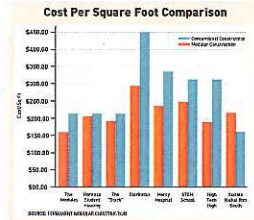


## Study Finds Modular Can Be Faster, Safer and Less Costly



Modular buildings, such as the Millmont Elementary School, can be more than ugly boxes, say sup

Courtesy of NRB Inc.



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A recent study of 17 permanent modular construction projects found that, on average, schedules can be slashed 45% and costs cut 16% over onsite construction. Of the completed projects reviewed, there were on average 0.25 safety incidents.

“These are incredible results,” said Ryan E. Smith, associate dean of research and engagement at the University of Utah and the principal researcher for the study, *Permanent Modular Construction: Process, Practice, Performance*.

The study is a step toward creating a model to collect data on off-site construction, defined by the Off-Site Construction Council of the National Institute of Building Sciences (NIBS) as any component of a building that is assembled away from its final location on a site. Permanent modular construction (PMC), also known as volumetric modular, is a subset of off-site construction. “To date, there is no uniform standard to collect data,” said Smith, at the first Off-Site Construction Expo, Sept. 23-24, in Washington, D.C. Smith is also the chair of the NIBS OSCC.

The study also looked at return on investment, based on comparisons to three conventionally built jobs—a retail project, an office building and a charter school. The developers' data was assessed using a schedule improvement of 25% and 50% faster than the actual schedule. The ROI for a 25% schedule reduction was an average savings of \$5.81 per sq ft; for a 50% schedule reduction, it was \$10.93 per sq ft of savings.

The research, which looked at only volumetric modular projects and compared them to similar conventional construction jobs, had nine sponsors, including the Modular Building Institute (MBI) and NIBS, which together organized the expo. The 17 case studies represent health care, residential, hospitality, retail and office sectors. Three buildings are in Canada, two are in the U.K., one is in Australia, one is in Spain and the rest are in the U.S.

A limit of the quantitative study, said Smith, is the difficulty finding equivalent traditional projects with like-to-like delivery methods. Also, in the best of all worlds, Smith would want 100 samples, not 17. In addition, teams willing to provide data on their projects typically will select their best performers, said Smith.

“Because there are relatively few built permanent modular construction (PMC) cases compared with traditional methods, it is difficult to make statistical arguments or identify trends,” says the study. “Information on costs and labor hours in particular projects is also limited by the willingness of the firms interviewed to share proprietary data.”

Off-site construction has the potential to reduce schedule, and increase safety and quality, chorused the modular construction veterans at the expo, which had more than 600 registrants.

“Teams should be able to get to 35% off-site and prefab with very little heavy lifting,” said Susan S. Klawans, vice president and director of operational excellence & planning for Gilbane Building Co., and the vice chair of the NIBS OSCC.

Still, off-site—and especially PMC—has its challenges, chorused Klawans and others. It changes the sequence of design and construction. “Timing is everything,” she added, with final design and approvals more time sensitive and typically earlier in the process.

Also, PMC can be but is not always less costly up-front than traditional construction, agreed the veterans.

## **BENEFICIAL**

For the Millmont Elementary School in Reading, Pa., PMC was beneficial because there was no laydown area, there were concerns about disrupting the neighborhood and there was time pressure, said Thomas W. Gilbert of Gilbert Architects. The school was designed, publicly bid and completed in 13 months, he added. Eighty percent of the work was executed off site, he said, with 90 modules supplied by NRB Inc., a modular builder located 15 minutes from the site.

“There was no cost differential but the project took less time,” said Gilbert. “There were no code approval problems,” he added, but the work required a new type of coordination of design consultants. “It is like learning a new language,” said Gilbert.

The decision to do a modular project needs to be made early in the planning phase to reap the most benefits of the process, said the veterans. It is critical to have all the stakeholders on board—and on board early—because one naysayer can throw a wrench in the works. Also, “you need the owner to decide on modular early in the development or you lose the possibility of the advantages,” said Artie Spaw, an associate with GBBN Architects Inc.

Modular enthusiasts say building information modeling can make PMC easier, but not all modular building companies are using virtual design and construction tools, which can be a problem. “BIM helps to bring all the stakeholders together,” said R J Reed, Southeast virtual design and construction manager for Whiting-Turner Contracting Co.

To learn more about the use of digital tools, the OSCC is conducting an online survey, through Oct. 9, to learn how companies use software to deliver off-site projects.

“Modular requires a change of mindset and that’s a good thing,” said Reed. A prefab execution plan is important, said Reed. Questions that need to be asked include: What can we build off site? What can we do as modular? What are the constraints, including things like the modular factory’s availability to meet the schedule, transportation, permitting, inspection and labor issues?

Typically, volumetric modular represents an added cost for permits, shipping, added crane time, extra steel in the chassis and protection of the module during transportation and erection. There can also be a scope definition problem. “Who owns the temporary conditions needed, such as protection of the modules?” asked Reed.

A logistics plan is extremely important. “You can’t have 30 modules arrive at the same time,” said Reed. Late design decisions or design changes late in the process “can kill a volumetric modular project,” he added.

## **EDUCATION**

The OSCC says education of design and construction professionals is a concern. A recent survey off off-site construction education by the NIBS OSCC, found that two thirds of architecture schools and 60% of construction schools have never taught or have only sporadically taught off-site construction. “We should engage academia,” said Henry Green, NIBS’ executive director. “I encourage you to connect with programs in your communities.”

One obstacle to engaging architects is the erroneous perception that PMC means poor design, chorused the modular construction experts. PMC is “not limited to boxes,” said Gilbert.

The American Institute of Architects has twice turned down Smith’s proposal for a PMC workshop at the AIA convention, saying, “This might be good for shoeboxes, but we are talking about architecture,” said Smith.

“The greatest barrier [to PMC] is the culture of resistance to change,” he added.

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