

ANGLE and LINE

A Quarterly Newsletter by COWAN ASSOCIATES, INC.

Engineers • Designers • Surveyors
Serving Business, Municipalities, and Industry since 1958



GOING MODULAR

by Scott P. McMackin, P.E.

The use of modular buildings or building components is presently being taken to a new and larger scale. The use of prefabricated buildings has a long history in the USA; it gained popularity in the 20th Century with Sears and Roebuck selling over half a million prefabricated houses prior to World War II.

After World War II, returning GI's wanting to start a family needed economical houses, creating such a large market that conventional home building could not satisfy. The modular building process, already proven to be a cost-effective alternative, took off and many of these early houses built in the 1950's are now sought after by down-scaling and retiring baby boomers.

In recent years, the construction industry experienced volatile markets and supply shortages in many basic construction materials, often delaying construction projects and thus increasing costs. On the other hand, in the last 20 years the modular building industry has become more sophisticated and greatly increased with the pioneering work of assembling not only houses but modular commercial, institutional, and industrial facilities. Overhead cranes now built for 100 ton lifting capacities allow much larger modules to be constructed and shipped cross-country. The only limitation is the size of each individual module due to the width of roads from the factory to the construction site.

Modular building companies often have in-house engineering capabilities to provide structural, mechanical and elec-

trical design, or they partner with engineering consulting firms like CAI.

In today's building environment, flexibility of materials is

important for code and market considerations. Modular units can be fabricated with wood or steel framing; precast concrete components such as load bearing wall sections and partitions; or fiberglass modules used for clean rooms, ATM and



toll booths, and kiosks.

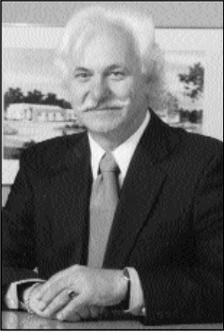
There simply is no other type of construction that gives you so many opportunities to start and finish a project so quickly. These compressed schedules are available because the building construction and the site work are done simultaneously or, in many cases, the building construction will actually precede the site development.

Because modular construction takes place at the fabricator's site and not the construction site, daily operations which will have to continue uninterrupted are minimally disturbed, an important advantage for institutional construction like school and life care facilities.

Modular builders have quality assurance programs in place to guarantee that production standards, methods and materials have code and specification compliance. Third-party inspection agencies like CAI make inspections on both the modular builder's plant and the building under construction. A few examples of just how well accepted modular units have become are McDonald's and Checkers Restaurants, First Bank

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PRESIDENT'S CORNER



Happy 50th Anniversary to staff and management of Cowan Associates! We are celebrating 50 years of service commitment, stability and growth. Steeped in tradition of a strong work ethic, we at Cowan Associates continue in the footsteps of our founder, Richard S. Cowan, and by the guiding practice principles of the leaders that followed – first, James R. Leister and then, William D. Kee.

Richard S. Cowan, who established the firm in 1958, focused on providing core services such as surveying, and providing civil and structural engineering services for the private and public sector. Since then, our assignments have become extremely varied, ranging from commercial to residential land development and industrial facilities design, to major public works projects including bridges and sewage treatment and water filtration plants. Our staff is trained and experienced in all basic disciplines and is licensed in Connecticut, Delaware, Maine, Maryland, Massachusetts, New Jersey, New York, North Carolina, Pennsylvania, South Carolina, and Virginia. In addition, we are experienced in partnering with local firms when logistics require.

Our clients come from many industries, companies, and businesses such as property syndicators, retailers, office and institutional property managers, residential developers, manufacturers, utilities, law firms, insurance adjusters, architects, contractors, government agencies, and school districts.

However, business is business, and it does not matter whether we go back 50 years or catapult ourselves 50 years into the future. What is important, especially today, is that we must constantly reformulate our practices and methods.

I learned quite a lot from Fred, my late uncle-in-law. He was a canny Dutchman with a softer accent than mine and a great sense of purpose for his business. He also happened to be a dedicated family man, civil leader, philanthropist and accomplished tenor. But when he was not busy raising funds for a hospital addition or library, or singing in his church, he was a fur merchant adding value between the tannery and the furrier.

And therein lies a lesson; while he could add value by constantly improving processing and expanding his customers from furriers in New York City to Los Angeles, he and many others flourished. The pelts coming from his relatively small operation in the Poconos were lapped up by furriers as far away as China. However, with time came change, and many tanneries were faced with two options – reinvent your service or seek new business opportunities. Fred managed to do both, and his business enterprises outlived the tannery.

If you do not reinvent, the market always finds you out!

Nowadays, changes in technology, especially information technology, are so dramatic that they affect the fundamental ways we are doing business, including ours.

Although technology is a tremendous enabler, it is not the be-all and end-all. Nothing can replace direct contact with a

client or the trust that materializes out of such relationships. If you trust your engineering consulting partner, you will be willing to accept how new technology and a new range of services you may not have even thought of needing can benefit you and your community. With ever-improving technology that brings engineer and client together, the question is raised – what is the future role of the consulting engineer? Maybe like the fur merchant, he will survive only if he can add value that outweighs his costs, and evolves to stay abreast of changing times.

Our basic engineering challenge will never change; the old cliché of engineers turning ideas into reality is true. To quote our most famous engineer, President Herbert Hoover: "It's a great profession. There is the fascination of watching a figment of the imagination emerge . . . to a plan on paper. Then it moves to realization in stone or metal or energy. Then it brings jobs and homes . . . Then it elevates the standard of living and adds to the comforts of life. That is the engineer's high privilege."

It is the engineer businessman's mandate to stay relevant by not only finding new and better ways to serve our clients and adding value to our services, but by influencing public policy and private sector decision-making.

GOING MODULAR

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Corp, Bank of America, fuel buildings like Sheetz, and car wash facilities like "Care."

Currently, Cowan Associates is involved in two projects where modular construction was chosen due to project constraints. Siegfried (formerly Wolf) Elementary School in the Northampton Area School District is presently under construction utilizing modular building for a three-story classroom addition, part of a 56,000 square foot expansion project. Due to timing constraints, modular construction gave the ability to construct the addition in time for the upcoming school year. MKSD, LLC of Orefield, PA is the project architect, and NRB (USA), Inc. of Ephrata is the modular building contractor. A second project under construction at Pine Run Retirement Community proposes a new three story modular building to replace an existing aging building in the complex. The decision to utilize modular construction was in effort to promote future replacement of existing and aging building units. Modular units have enabled Pine Run Community to address two critical issues at once, the first being minimizing the time frame needed for the construction of future replacement buildings on a fully occupied site, and the need to replicate a uniform appearance, a template if you will, for all new residential buildings.

While the modular building approach is not appropriate for all situations, there are advantages to this type of construction and one an owner should at least consider when proposing a building project.

QUITTING TIME

One of our engineers learned shortly before quitting time that he had to attend a meeting. He tried unsuccessfully to locate his car-pool members to let them know that he would not be leaving with them. Hastily he scribbled a message to one fellow and left it on his desk: "Last-minute meeting. Leave without me. Ted." At 6:30 p.m., the engineer stopped at his desk and found this note: "Meet us at the bar and grill across the street. You drove."

LARGE BLOCK SEGMENTAL RETAINING WALLS

by Charles R. Tomko, P.E.

Large block segmental retaining walls have recently gained popularity. These walls are constructed of precast concrete units which are interlocked with an integral shear key. They are most economical when used as a gravity wall but can also be built with the addition of geogrid reinforcement for higher walls. The block sizes vary among manufacturers but are generally in the range of 16 to 18 inches high by 48 inches wide. Depth of pieces varies from 24 to 45 inches. Wall heights without geogrid reinforcement up to 10 feet are often attainable as a gravity wall depending on soil types, backslope, and surcharge (highway or other superimposed loads near wall).

Unlike cast-in-place concrete retaining walls where you can have guiderail or fencing posts right up to the wall, in segmental walls they must be kept a minimum of 3 feet from the edge of the wall. If geogrid reinforcing is used, the geogrid must be hand cut or sonotubes pre-placed in the reinforced zone by cutting the geogrid around the tube. Fence or guardrail posts are then set in the sonotubes and backfilled with stone. It is important to try to not drive posts through the geogrid as this will often displace the geogrid, which can lead to localized failure of the wall.

As with all segmental block retaining walls, the installation of a drainage layer of clean stone behind the wall and weep holes or a collector drain pipe is important to reduce hydrostatic pressure behind the wall. A geogrid layer between the clean stone and soil backfill is recommended. Additionally, proper compaction of the fill is important for the wall to work properly. This is particularly important for walls with geogrid reinforcement as those walls, unlike gravity walls, are largely reinforced earth structures which count on the composite soil reinforcing grid action behind the face block for structural support.

Coloring of the blocks is possible by color staining after installation. The blocks generally come without color added, allowing the manufacturer to keep standard shapes in stock which significantly reduces delivery time.

Local manufacturers of these blocks include Modern Concrete located in Forks Township, PA, which manufactures Recon Blocks; and Bethlehem Precast, Inc. of Bethlehem, PA, which manufactures London Blocks.

Cowan Associates has recently been involved in the design and construction inspection for several projects using the large segmental block design. One such project is located along the entrance road to the Jim Thorpe Wastewater Treatment Plant. The wall was constructed next to an existing loose-laid stone wall. The bank between the road and the wall was cut down to reduce the wall height to a maximum of about nine (9) feet. This allowed the use of a gravity wall design without geogrid.



This allowed the use of a gravity wall design without geogrid.

As a result, the entrance road to the plant, which is the only access,



could remain open by allowing the existing wall to remain and installing the new large block gravity wall in front of the old wall. This significantly reduced the amount of excavation required.

Block widths varied from 45 inches wide at the base to 24 inches at the cap. Clean stone fill was used between the new and old walls due to limitations of compaction because of the tight space and to provide a drainage layer. A perforated PVC drainage pipe which was out-



letted beyond the wall was utilized at the base of the drainage layer.



The wall was completed within three weeks, largely due to the availability of the blocks and the simplicity of construction. Finish grading and entrance road paving was completed within

60 days.

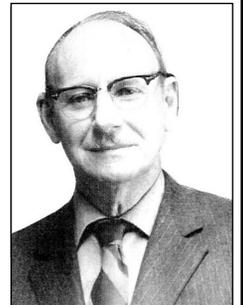
Cowan Associates, Inc. can help you with your retaining wall projects from field survey through design and construction inspection.

RICHARD S. COWAN, P.E.

Founded Cowan Associates, Inc. 1958

VISION: Full Service Civil Engineering Service

QUOTE: We Are A Service Business, It Takes 6 Months To Get A Client and 6 Seconds To Lose One



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MASONRY BLOCK TESTING

by Michael R. Smith, P.E.

In our continuing effort to provide our clients with a broad scope of professional services, Cowan Associates, Inc. is proud to announce the procurement of a testing machine for masonry block construction. The equipment, manufactured by Test Mark Industries, is a high capacity compression-testing machine with a maximum capacity of 500,000 pounds. This machine, in addition to our current 250,000 pound capacity compression testing machine, will enable CAI to provide quality control testing services for any concrete and masonry construction project, as well as quality assurance testing for design professionals, material suppliers, and building owners. The new compression machine will permit the testing of full size masonry block prisms up to twelve (12) inches wide.

A masonry prism is an assembly of two layers of concrete block mortared together, and may have the hollow cores grouted to represent the construction materials and methods used during the wall construction. The final compression-testing sample will nominally be sixteen (16) inches in height and length, with the width being equal to the constructed wall width. These prisms, after being fabricated by the mason during the wall construction, will be transported to our laboratory along with the grout and mortar samples prepared by CAI's inspector during our on-site inspection. The samples are processed in our laboratory, and properly cured

and tested following the procedures detailed in the applicable ASTM (American Society for Testing and Materials) standard test method. During the compression test, the sample is subjected to increased loading in the hydraulic testing machine until sample failure occurs. The maximum load at failure, which may be as high as 400,000 pounds, is recorded; this data, as well as other pertinent information, is reported to the client and compared to the project specifications for conformance. Masonry compression testing may also be utilized for investigation of existing structures to determine structural adequacy for the design and construction of alterations and additions, or to investigate structure failures.

The 2006 International Building Code, Chapter 17, "Structural Tests and Special Inspections," specifies the required scope and frequency for inspection and testing of masonry construction as well as concrete construction, steel construction, soils and foundations, and spray fireproofing. Cowan Associates, Inc. has the experienced staff, certifications and testing equipment to perform any of these required special inspections during the construction of your project. If you would like to obtain additional information on special inspections, discuss testing for your project, or just want to visit our laboratory, please contact our office.

ANGLE and LINE is published quarterly by Cowan Associates, Inc. For additional information on articles contained within contact:
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