

High-Tech Tools for Structural Engineers

By John A. Mercer, Jr., P.E., SECB

Evolution of technologies has continuously engaged the engineering profession over the past several millennia. The wood-covered lead pencil, first mass produced in 1662, must have been revolutionary in its time; quill pens using berry juice ink, chalk, charcoal, and other materials had been used previously for documentation and communication between parties.

Finally!...a device one could carry in the shirt pocket and sharpen with a pen knife to keep its fine point. As you might remember, that eventually led to the invention of plastic "pocket protectors" two or three centuries later, proudly worn, identifying the technical "nerd" of the not-so-distant past. In recent history, India ink, parchment, vellums, and Mylar have cluttered the desks and drafting tables of engineers practicing the art of graphic communication via construction documents. Today, we generally use computer monitors instead.

The cubit was a unit of measure in ancient times that was defined by the length of the forearm of the monarch. As a result, each society had different length cubits, and research indicates that they ranged anywhere from approximately 18 to 20.6 inches in length. Today, we have standardized on "feet" and "meters", no matter who sits on the throne (or in the Oval Office).

Technology development took a long time back then – many lifetimes for sure. Today we have idea development at the speed of light, yielding new devices that have replaced wooden pencils, yardsticks, scale rules, and other such inanimate tools with devices dependent on electric power for operation. Calculators running on solar cells turned into laptop computers. Electronic tapes and total stations now utilize GPS to increase productivity.

Technologies for structural engineers are continuing to emerge at a rapid rate, employing sonic and laser technologies that interface with computers and handheld devices, measuring distances with reasonable accuracy, and even going so far as to scan objects and reproduce them in three-dimensional CAD drawings. What will a structural engineering business look like in the future?

The structural engineer's design services are sure to change. There will be a few more new buildings constructed, but the inventory of existing buildings requiring a structural engineer's review for new uses will continue to grow.

Therein rests one challenge for future structural engineers, to document the existing inventory of structures. In a typical scenario, a building's facility manager can generally resurrect a weathered and worn copy of the mechanical and electrical construction drawings from the boiler room, and sometimes even a copy of the architect's original floor plan. Who would have thought that it would be important to keep a copy of the structural design drawings?

Within our lifetimes, we have witnessed technologies of light and sound advance from a workbench at Bell Labs to handheld devices that will enhance dimensional data collection for structural engineers. Thanks to NASA, the military, and other agencies, as well as high-tech companies, bench-top experiments evolved into application tools that now benefit the structural engineering practice.

Building Information Modeling (BIM) has recently surfaced and is rapidly becoming a driving force in the built environment. The BIM software developer's perspective is that there will be a new department in each design office that manages and operates the BIM model. People with new skills will have to be employed, even replacing some that have been with a firm since the days of the pencil. Exactly how programmers will capture the existing inventory's information is yet to unfold. Fortunately, we do not have to wait for

software developers to provide us with that capability. Tech companies have already stepped into the fray.

New tools are currently available that will allow a partial or complete assessment of a structure's shape, locations, and distances while enhancing productivity. Direct interface with PDA's or computers will allow scanned data to be the feedstock for a CAD/BIM program that will duplicate a building's façade, or capture the framing system. For the moment, it appears that the structural engineer may be left to document framing connections.

The synergies of distance measuring devices, CAD/BIM programs, and data translator interfacing software between graphic and analytical programs will provide the structural engineer with a capability for efficiently evaluating the nation's burgeoning inventory of buildings.

So, where are we going? A database of building information may one day be available online, allowing structural engineers the opportunity to be the managers of the built environment. Will the structural engineering community see the handwriting on the wall and cooperate with each other to populate such a database? What are your thoughts? ■

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