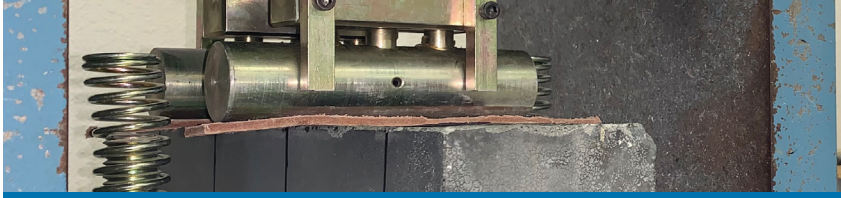
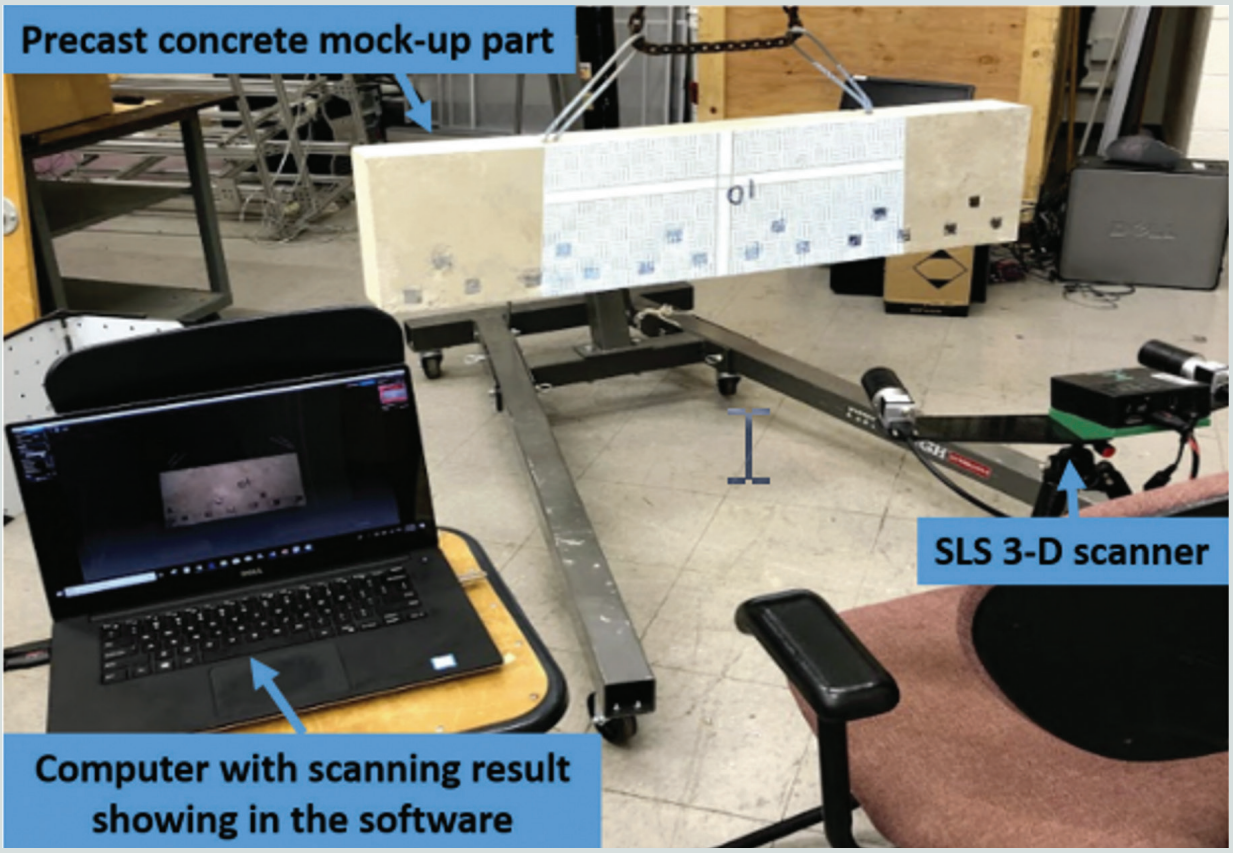


Research leads to innovation

Isaac Perkins and Andrew Osborn

Innovation comes in many forms. From design through erection, there have been many improvements throughout our industry over the past few years. We have seen a shift from solid cladding walls to thin cladding sections supported by steel frames. Buildings are constructed with new flooring systems. The northeast extreme tee beam (NEXT) beam has allowed for quicker construction of bridges. Producers have begun integrating other trades under the scope of the precast concrete producer. Think of the windows and glazing that are now installed in panels before products are delivered to the jobsite. These innovations have allowed our industry to grow in ways that many did not see



Three-dimensional scanning setup in Wang et al.

coming years ago. Often the ideas from PCI members drive the path toward innovation, and the dues members pay contribute directly to this research.

Several of the Daniel P. Jenny Fellowships over the past few years have embraced innovative methods to move the industry forward. The use of virtual reality technology was thought to provide an option for early career training in the industry. A group from Mississippi State University researched opportunities to use this technology and eventually landed on creating a basic safety training program for new employees.[1] The virtual reality program placed the user in a precasting plant. After donning the appropriate personal protective equipment, the user can "walk" through the plant and encounter hazards similar to what are seen on a day-to-day basis.

Another fellowship that showed promise recently was research around three-dimensional (3-D) scanning of products by a group from Virginia Tech.[2] The group proposed and validated the ability of a selective laser sintering (SLS) 3-D scanner to capture images of the product. These images were then converted into a point cloud and compared with the design, allowing the computer to access the differences in design and production of the member. Although not part of the original proposal, during the process the group of researchers realized that they could also quantify the consistency of the surface finish with the same data that had already been captured. As is sometimes the case, research funded by PCI on an innovation may lead to further research before adaptation to the industry. This is the case here, with further development of the idea being performed by Louisiana State University.

Research pertaining to concrete often requires measuring strain to see how stresses are flowing through the test specimen. In particular, testing to determine the transfer length of prestressing steel in concrete members has been a topic of interest over the past 50 years. Measurement of transfer length is usually accomplished by casting prisms of prestressed concrete, attaching small metal disks on the sides of the prism, and measuring the space between the disks to an accuracy of 1/10,000 in. (0.1 mil) using a handheld device called a Whittemore gauge. The measurements are made first before transfer of prestress then second after release of prestress. The measurement effort is slow and tedious to perform and requires writing down a lot of numbers that later have to be transcribed into a spreadsheet and analyzed. Recently, within a PCI funded research project, a

Laser speckle device used to measure concrete strains.

laser scanning device was created by researchers at Kansas State University to automatically measure transfer length, an innovative idea with many potential applications to actual products like railroad ties.[3]

One of the key areas that producers have discussed in recent years is the shortage of skilled labor. This continues to hinder the ability to get products delivered on time. Last year a professor at McGill University suggested a project to build a vision-guided robotic arm system used to assemble reinforcing bar cages. The research is ongoing, but early results are promising and the research team continues to develop a solution that may be beneficial in the future.

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