

Starting from Scratch

By Susan Olt

What do you do when you have over 35 years of experience in structural engineering, and an idea for a product that would solve some big infrastructure problems? Bill Lockwood, Founder and Chairman of CON/SPAN Bridge Systems, shares the background, concept, challenges and rewards in the process of bringing a new product into the transportation industry.

The product, CON/SPAN Bridge Systems, is a patented, precast modular system for total set-in-place construction of small to medium span bridges, culverts, and underground structures. The technology features a prefabricated approach and a highly automated design that saves both time and money. The three-sided arch box carries heavy loads at low stress levels, sheds water and salts to increase life cycle and provides an economy of materials for a lower initial cost. It is usually installed within hours.

Many civil engineering innovations and developments originate in laboratories of universities and producers/suppliers, or in the field by constructors, or in the facilities of large organizations such as the Corps of Engineers. But, in this case, CON/SPAN Bridge Systems had its roots in an innovative Ohio-based civil and structural engineering firm, Lockwood, Jones & Beals (LJB), founded by Bill Lockwood in 1966.

Lockwood comments, “Consulting engineering firms are a great resource to research, develop or improve building systems. The industry attracts talented, creative, hard-working professionals. There are procedures in the delivery system, however, that create obstacles toward developing new technology.



LTD Commodities, Lake County, IL

Often, there’s little time in the schedule or provision in the budget to explore new methods. Successful research and development need long-range objectives that allow trials and refinements. At LJB, we were fortunate to have an early opportunity to develop a tilt-up building system with a local builder/developer that demonstrated the value of a design-build team working toward long-range goals. This relationship added a new perspective to our approach to problem solving. This legacy and our continuing involvement in bridge design were the roots for CON/SPAN.”

CON/SPAN Bridge Systems was begun by Bill while he was Chairman of LJB. The idea was born out of the recognition of the enormous need for small bridge replacements, and the potential for a building system that utilizes the advantages of new technologies and construction procedures. The inherent advantages of buried structures, together with the durability and economy of precast concrete, focused CON/SPAN’s Research and Development efforts.

Extensive research had been performed by the Federal Highway Administration (FHWA) and the flexible pipe industry on the design and performance of buried structures. Rigorous finite-element analysis programs involving soil-structure interaction had been completed.

In 1983, the CON/SPAN staff began with this technology. They worked with Dr. Mike Katona at Notre Dame, a major contributor on the original FHWA work, and developed an arch-box shape produced from precast concrete. Dr. Andy Bodocsi at the University of Cincinnati’s Civil and Environmental Engineering Department and the University’s Computer Center were invaluable resources during this early stage.

The CON/SPAN shape develops an efficient arch action in the top of the unit by reacting on the adjacent soil mass along both sides. The structural action creates



First 42-foot span installed; Savage Road, Erie County, NY

large load-carrying capabilities with very reduced cross-sections. Every site has its own geometric requirements. The structural design varies with the span, rise, loading, cover, and in some cases, soil type. The system must accommodate a wide range of geometric, structural and functional requirements. It must also be modular to allow an industrial approach to the design, fabrication, delivery and installation.

Patents were applied for and issued for the technology. Introducing new technology and a proprietary product is a slow process. Since there is no Federal Highway approval process, the product approval for state project use had to be state-by-state. Gaining acceptance of a new technology – the soil structure interaction concept – required load testing. Working with a Columbus, Ohio precast producer, the first full-scale load test of a CON/SPAN structure for the



Largest installation to date (9 cell structure crosses 446-feet of the Goose Creek); Coton Bridge, Loudoun County, VA

Ohio Department of Transportation was performed in 1986. The structure passed with flying colors. This made approvals easier in other states.

In 1988, Lockwood and new partner, Tim Beach, spun off CON/SPAN Bridge Systems from LJB as a new and independent company. A turning point in the growth of the program was the addition of precast headwalls and precast



Roadway underpass under airport taxiway.

anchored wingwalls that allowed an entire bridge to be set in hours and backfilled immediately.

With a presence now established, development efforts turned to growing

geographically, to increasing spans and applications, and to developing design, plan preparation and management software to accommodate the growth of the program. As the staff grew, the company was restructured and provisions were put in place to broaden ownership of the firm.

Bridges have grown from small stream crossings to long multi-span structures and railway and airport underpasses and overpasses. Architectural treatments enhance the natural curve of the arch. Other uses include various underground structures for environmental and storage uses.


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product watch

The development and commercialization of new products in our industry is a long process. Concerns for public safety demand absolute certainty of the product's performance. The approval process sometimes seems endless. Projects are slow to develop and the investment is continually building.

However, according to Lockwood, “The rewards are immeasurable. I spend my days with a talented and dedicated staff that is excited about what they do. We share a pride in making some difference in addressing the enormous need for replacing deteriorating bridges in our infrastructure system with solutions that insure durability, economy and speed of installation.

“The journey has been an extraordinary learning experience. It reinforced the significance of the basic principles that are the root of successful enterprises: bring together talented individuals; instill a vision that embeds the significance and potential of the undertaking; engage the most qualified professions for specific needs and to collaborate in mutually beneficial arrangements with other organizations to accomplish goals.

“There are lessons relating specifically to our industry for developing new products. Engineering firms have the talent and understanding to conceive new ideas that have the potential to provide an alternate approach for solutions to infrastructure needs. The conversion of ideas to applications is a long and focused process. Perceptions should be toward programs instead of projects. Significant efforts and expenses should be anticipated. It certainly involves risk. However, the expertise acquired in the development of a specialty can radically change an engineering practice. Clients will recognize your specialty to provide a better solution for their projects. Your focused activities will continue to improve, refine and build your program.”

The satisfaction of moving closer to our goals was the motivation that carried us forward.

Susan L. Olt is Director of Marketing for CON/SPAN Bridge Systems.