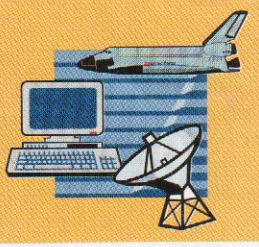
Technology Today



Alan J. Pierce

An "Ace Bandage" for Bridges

A major part of the infrastructure of our bridges and overpasses consists of reinforced concrete columns and beams. These structural elements are designed to support normal dynamic and static loads, as well as the occasional extraordinary load of a storm or earthquake.

Over time, corrosion of the reinforcing bars (rebar) in the concrete can adversely affect the structural integrity of these elements. It is the concrete's rebar that actually handles tension forces. These reinforced concrete elements could also fail due to a natural event that surpasses the structure's safety factors.

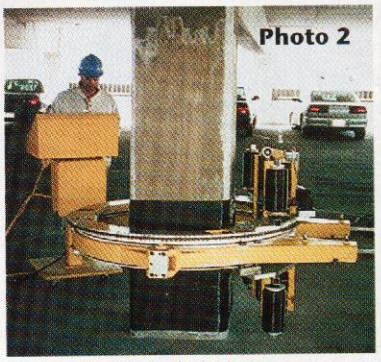


Photo 2

Courtesy XXsys Technologies Inc.

During the Loma Prieta earthquake in October 1989, the Nimitz Freeway in San Francisco failed, the upper deck of the highway collapsing onto the lower roadway. In this case, the fault line of this very powerful earthquake ran directly under the center of the highway. The new California earthquake code reflects the belief that if the concrete structural elements of this road had been stronger, the freeway infrastructure wouldn't have failed in the earthquake.

New technologies have made it possible to engineer systems that can decrease the chance of cataclysmic structure failure due to an earthquake. (See "Technology Today," January 1997.) This month we'll explore a new technology being used to retrofit existing bridge columns and beams so they can meet new highway earthquake standards. This same technology is also being used to rebuild and reinforce corrosion-laden columns and beams that in the past would have been totally replaced.

Photo 1

Courtesy XXsys Technologies Inc.

California's new highway earthquake standard calls for the retrofit of many existing bridge and overpass infrastructures to increase their ability to withstand larger seismic activities. In the past, this has been accomplished by adding more hoop steel around supporting columns. In that case, steel jackets are welded or bolted in place around the column. To the casual observer, it would look like the columns were wearing belts to hold up imaginary pants. Although these jackets have a negative effect on the aesthetics of a structure, they do help prevent loss of stability of the column during an earthquake.

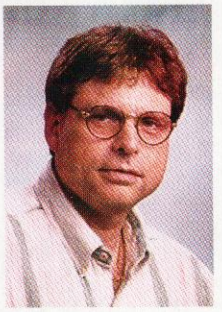
A new system has just been developed that raps a thin shell of high-strength carbon composites around each column and beam. The Robo-Wrapper II applies this 0.02"-thick fiber at 400' per minute. The Robo-Wrapper applies fiber as if it were an Ace bandage. A special oven cures the fiber, creating a non-corrosive, seamless jacket that increases the strength of the column by a factor of two or three. This means that the column can withstand a much greater seismic load. Photo 1 shows a Robo-Wrapper in action on a bridge column. If you look carefully, you can see a radiant oven in the background that is curing fiber already applied to another column.

This use for high strength carbon fiber was developed by Gloria Ma, now CEO of Xxsys Technologies, Inc. of San Diego, CA. The robotic wrapping equipment was designed by Larry Cercone, now Xxsys vice president of engineering. Cercone's Robo-Wrapper II invention was a finalist in the 1997 *Discover* Magazine Innovative Technologies Awards. Xxsys Systems has just won a retrofit contract for the historic Arroyo Seco Arch Bridge in Pasadena, CA. The company's retrofit technology system is quickly gaining popularity around the country and was used to retrofit two parking structures of the Latter Day Saints Hospital in Salt Lake City, UT. Photo 2 shows Robo-Jr. in action on that job.

You can learn more about this innovative process and this new company by visiting the Xxsys web site at www.xxsys.com.

Recalling the Facts

1. How can water adversely affect the strength of concrete columns and beams?
2. How would a steel or high carbon fiber jacket increase a column's strength?
3. Name the two causes of structural failure that this process is designed to prevent.
4. Describe and compare the old and new methods of reinforcing bridge columns and beams. TD



Alan J. Pierce is professor, Department of Technology, Elizabeth City State University, Elizabeth City, NC 27909.

RETCO

SINCE 1934

YOUR DEPENDABLE
Source of Supply
FOR OVER 60 YEARS

Large Inventory for FAST Service!

Steel / Copper / Brass
Aluminum / Plastics

- Tool Box Kits
- Estes Rockets
- Lego Dacta
- Robotics
- Power Tools
- Machinery
- Band Saw Blades
- Safety Equipment
- Acrylic Sheets
- Machinable Wax
- Machinable Plastic Rod
- Foundry Supplies

Call For FREE Catalog!

RETCO ALLOY COMPANY
880 Estes Ave • ELK GROVE VILLAGE, IL 60007

1-800-722-3307

Circle No.13