Performance of Concrete and Market Share

Photo: Ted Lacey Photography.

John S. Dick, *Executive Editor*

As *ASPIRE*™ concludes its second year of exploring sustainable solutions, this issue's PERSPECTIVE by Clifford L. Freyermuth offers a challenge to the nation's bridge officials. In it, he addresses the growing durability of bridges and suggests that the American Association of State Highway and Transportation Officials (AASHTO) and the Federal Highway Administration (FHWA) begin work to require from 100- to 150-year service lives for highway bridges. Such a goal is noteworthy—and achievable.

Cliff's career has spanned nearly 55 years. His direct involvement in bridges began with the Arizona State Highway Department in 1958. From there on, it was all concrete when, in 1964, he joined the Portland Cement Association. Then, in 1971, he directed post-tensioning activities for the Prestressed Concrete Institute before founding and managing the Post-Tensioning Institute in 1976. In 1989, he helped establish and then managed the American Segmental Bridge Institute through 2008.

He has been instrumental in dealing with many durability and constructability issues that have challenged the prestressed concrete industry since the 1960s. With his unique background, he proposes ways to extend the service life of bridges and advocates the incorporation of minimum service life provisions in the LRFD Specifications. His perspective begins on page 12.

Concrete bridges have an enviable performance record. In the United States, statistics on the condition of bridges are kept in the National Bridge Inventory (NBI) maintained by the FHWA. Generally, high-performance concrete for bridges has been widely adopted over the past two decades. As a result, concrete bridges will perform increasingly well in all likelihood, surpassing expectations. Past performance and suggestions for the future are presented in the Perspective feature mentioned above. Another way to measure performance is through the confidence shown by those designing bridges in the materials they select. The percentage of bridges being built of concrete continues to increase.

Each year, the FHWA compiles data from the NBI (http://www.fhwa.dot.gov/bridge/nbi/matreport2008.cfm). They publish the quantity and deck areas of all bridges built in a given year, by the material of their superstructures. The data are broken down also by federal and non-federal aid highways and are reported by state. Since it takes nearly 2 years for the NBI to receive data for all new bridges built, the latest complete data released this July was for 2006. The data of interest here are for new and replaced bridges. Rehabilitated bridges are not considered.

For the three most recent years, 2004, 2005, and 2006, the percentages of the nation's bridges built using concrete, based on the numbers of projects was 75.8, 76.2, and 75.4, respectively. The balance, of course, is of other materials.

Although the percentage of bridges has remained relatively constant, it appears the size of bridge projects using concrete is growing larger, based on the deck areas of bridges built. For concrete, the percentages for the same years are 67.5, 65.5, and 69.3; a dip then significant growth.

One may also look at the share of bridges built of prestressed concrete. This includes precast, prestressed concrete and all means of prestressing concrete on site such as cast-in-place post-tensioned concrete and all types of segmental concrete construction. The percentages of prestressed concrete bridges built in the past 3 years are by numbers of projects—39.4, 42.5, and 42.9; and by the areas of bridges built—54.8, 55.0, and 60.2. At the same time, in 2006, the number of mildly reinforced concrete bridges exceeded 32% of the total built.

These numbers also likely are understated. A bridge's material in the NBI is determined by the material of the main span. A considerable number of bridges are built with a main span of steel and concrete approach spans. Accounting for these additional areas of concrete construction would most certainly add share for concrete.

Each day, innovative new solutions are being implemented. In this issue, five such projects are featured; each one employs sustainable design concepts. Each project offers ideas to meet a range of challenges. Consider the 24,000 psi compressive strength concrete

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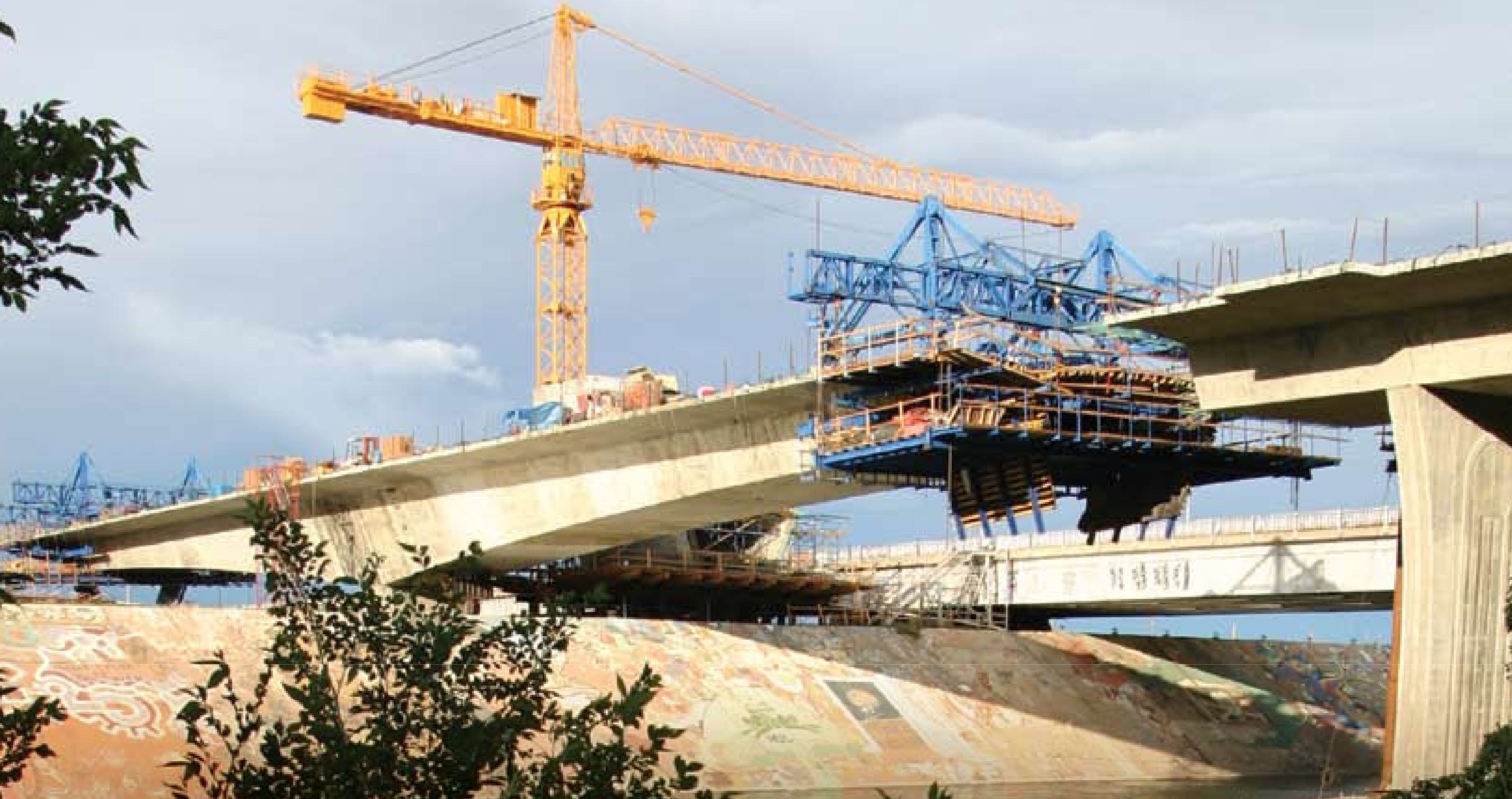

Colorado's Longest Concrete Bridge Span

4th Street Bridge, Pueblo, Colorado

OWNER: COLORADO DEPARTMENT OF TRANSPORTATION
DESIGNER: FIGG **CONTRACTOR:** FLATIRON

Construction of Colorado's longest concrete highway span at 378' with twin 1,137' long bridges is scheduled for completion in Spring 2011.

This sustainable, environmentally friendly bridge is being built in concrete segmental, balanced cantilever construction over 28 active rail tracks in the Pueblo Rail Yard and the Arkansas River. The canal wall of the Arkansas River is the world's longest painted mural featuring local artistic expression.

Aesthetics were developed through the FIGG Bridge Design Charette™ process with community members selecting features of the bridge. Participants selected bridge features that blend the timeless lines of Contemporary Sculpture with the Natural River Environment and the stylistic aspects of Pueblo Heritage.

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READER RESPONSE

Editor,
I wanted to share with you a comment I received from our client, Bob Friedenwald, senior advisor, The Confluence Project, regarding the article on the Vancouver Land Bridge [see ASPIRE™ Summer 2009, p. 26]: "Excellent article in ASPIRE on the Land Bridge. Congratulations! You provide a very interesting technical insight that clearly shows the uniqueness of this structure."

I especially enjoyed the Aesthetics Commentary on the Vancouver Land Bridge. I am an admirer of the work that Frank Lloyd Wright completed during his lifetime, and being mentioned in the same paragraph as he, even as a passing reference is a great honor!

Tim Shell
KPFF Consulting Engineers
Portland, Ore.

[Editor's Note: We appreciate Tim's note. Also, we extend to him, his colleagues, and client, a heartfelt apology because we printed the wrong headline on the second page of the project profile (p.27). The correct headline should have read, "CAST-IN-PLACE REINFORCED CONCRETE PEDESTRIAN BRIDGE / CITY OF VANCOUVER, OWNER"]

Editor,
[We received] three copies [of the Summer 2009 issue as requested], just to have enough to go around the office. I ask because [three of us] were in picking up plans from the Arizona Department of Transportation and saw your magazine on a table. We were drawn to the advertisement on the lower half of page 21 in reference to the QuikDeck™ Suspended Access System. We were looking for such a system on a recent project we bid for ADOT.

Ryan Withrow
DBA Construction Inc.
Phoenix, Ariz.

Editor,
I received today the Summer 2009 issue of ASPIRE. I immediately glanced through it. Great issue. The quality and value of the magazine is outstanding. You find new ways to improve upon perfection. Congratulations to [the ASPIRE] team.

I enjoyed thoroughly reading several of the articles. Because of my interest in the condition of the nation's bridges, I paid particular attention to the Perspective article by Andrew Herrmann. When I reached the end of the second page I could not find the continuation of the sentence on the next page! What am I missing?

Basile Rabbat
Portland Cement Association
Skokie, Ill.

[Editor's Note: Dr. Rabbat was not the only one to spot our error. During layout, the final four words of the article were hidden under the graphic that follows the last sentence. Those words were "in the long run," so the last sentence provides wise advice and should have read, "However, if we do not invest now, we will end up paying more in the long run." Our sincere apologizes to author Andrew Herrmann!]

(EDITORIAL continued from page 2)

used in longitudinal joints between deck bulb-tee girders on a small bridge in the Village of Lyons in New York State. Within the joints, No. 6 epoxy-coated bars are developed with a 6-in. lap length and No. 4 epoxy-coated bars are developed with a 4-in. lap length. In laboratory tests, this joint sustained 9 million load cycles without water leakage through the joint. The article begins on page 28. How can such technology be used with adjacent box beams or with precast, full-depth bridge deck panels?

Each owner and designer associated with this issue's articles is acknowledged as a leader in the industry, making wise investments on behalf of the public they serve. These projects are but a small slice of those being built throughout the country, and we will endeavor to continue to bring you the best and most innovative in every issue of *ASPIRE*! We hope you enjoy and benefit from their presentation.