

Bridges, Walkways and Approaches

Structural Welded Wire Reinforcement Proves a Superior Choice in the Transportation Sector

The Opportunity:

- Increased traffic volume increases congestion.
- Labor costs are escalating.
- Work zone safety continues to be a concern.
- More cars sitting in traffic means more pollution for the environment.
- Science has evolved for improved bridge strength.

The Outcome:

- High-quality welded wire reinforcement (WWR) results in a higher strength than traditional reinforcement.
- The higher yield strength of the steel means less weight and less handling -- often resulting in a reduction of as much as 50%.
- Pre-fab elements and just-in-time deliveries translate into fewer site hours and improved work zone safety.
- Public satisfaction and driver safety are increased by minimizing traffic disruption and congestion during construction.
- The uniformity of using the WWR is also an advantage because it is consistently more accurate than hand tying. The cycle time overall is decreased. WWR is laid into a concrete bed as a uniform piece with no time required for tying.



That bridge under construction, leading out from the suburbs into your big city job is really holding up the morning commute. It's a two-cup-of-coffee run, for sure. The bumper-to-bumper traffic jams emit a smog you can almost watch rise in plumes like a morning fog curling over the back garden.

Imagine, instead, if the construction and repair of bridges took days or months instead of years. No backups, less smog, smooth sailing! Those in the bridge-building business are trying to make that a reality. Yet, despite the acceleration of the construction, the quality of the structure must not only be sustained, but improved.

Many say that structural welded wire reinforcement (WWR) is the best-kept, time-saving, high-quality, cost-cutting secret in the concrete reinforcement industry today -- for virtually any application that calls for traditional reinforcement products. A considerable number



of State Department of Transportation (DOT) projects now choose welded wire reinforcement for bridge girders. WWR, along with pre-stressed steel strands, are now frequently used in standard beams and girders.

According to the publication "Building a New Generation of Bridges," developed by PCA, PCI, and others, acting under the National Concrete Bridge Council, "High performance concrete bridges offer cost efficiencies, time savings and twice the lifespan of conventionally built bridges... and a foundation of research, development and 'showcase' bridges has established these findings."

How Does WWR Come Into Play in Concrete Bridges?

WWR is a highly controlled, cold-worked structural product, produced in standard and custom prefabricated sheets, with higher yield strength than Grade 60 reinforcement. High-quality welds and computer-controlled spacing eliminate the time-consuming and less precise job-site layout and tying that is typical of traditional reinforced concrete construction. The higher yield strength of the steel means less weight and less handling -- often resulting in a reduction of as much as 50% in labor costs and less material.

Today, some bridges can be completed in as little as a day. The Federal Highway Administration and state Departments of Transportation (DOTs) are showing increasing interest in accelerating the process. Chuck Prussack, PE, vice president and general manager, Central Pre-Mix Prestress Co., Spokane, WA, said they pour several bridge girders every day using WWR and other reinforcement components. “In 2006, we shipped close to 600 girders, for example,” Prussack said. “If the project is within our geographic area, we can speed up the construction time frame a great deal.”



Idaho DOT works on 87 bridge girders using welded wire reinforcement.

Despite the fact that WWR is more than 100 years old, Prussack has seen a slow but steady migration to the product, particularly at the consulting engineer level. “Part of the buyers’ decision process relates to price and part to the science, safety and metallurgy itself.”

Defining Low Price

It is no secret that it is common practice to award construction contracts based on the lowest construction bid. Yet, when one considers life cycle in these cost analyses, a different story often emerges.

Tech Facts

There are many precast and cast-in-place concrete components for bridges and highways. WWR is designed in foundations, piers and pier caps, and may also be used in bridge girders, decks, approach slabs, median barriers and retaining walls. WWR may also be specified in concrete piling, bridge railing, and deck and highway paving overlays. Corrosion resistant WWR (coated or stainless steel) may be specified when snowmelt chemicals are used.

Welded wire can be epoxy coated to meet the various DOT’s requirements in coastal or snowbelt states. Both AASHTO standard specifications for highway bridges and AASHTO LRFD bridge design specifications approve welded wire reinforcement. For years, many standard cast-in-place or precast/ prestressed components have utilized structural welded wire reinforcement. Consult with WRI members for availability and the ability to furnish reinforcement materials. WRI members can provide the exact area of steel required for those standard highway bridge structures.

Some typical AASHTO standard products are: box beams, deck bulb-tees, I-Beams, double tee beams, bulb-tees, and ASBI standard segments.



“Innovation frequently is the call of the consulting engineer.” Prussack said, “but we have found time and time again that the labor savings and cycle time savings mean a large bottom line benefit. Every single time we conduct this analysis at Central Pre-Mix Prestress Co., we come to the same conclusion: welded wire reinforcement (WWR) saves time and money compared to the conventional tying together of bars.”

Unparalleled Precision

The other element regards design and materials. “I have seen many skeptical inspectors look at the welded wire reinforced product,” Prussack said, “and I can’t remember one who didn’t come away saying that the machine-welded product was superior.”

In Washington state, the DOT routinely orders “super girders” in the 160-foot+ length/200,000- pound range, which is the maximum weight that can be legally transported over Washington roads at this time.



Washington State DOT bridge design engineer and concrete specialist, Dr. Bijan Khaleghi noted, “We have occasionally used welded wire reinforcement in our bridges and structures. Use of welded wire reinforcement allows time efficiency and ease of fabrication and inspection.”

For one of Washington State County bridge projects, about 150 miles north of Spokane, the spans are so long that they are splicing together smaller segments to make very large girder pieces.

Another place where Washington State DOT uses welded wire reinforcement is on Washington State Ferry projects. Tom Bertucci, P.E., Bridge Engineer, Terminal Engineering said, "All of our 19 terminals are in highly corrosive marine environments so we use epoxy-coated steel reinforcement in nearly all of our cast-in-place concrete structures. Our precast, prestressed construction has utilized primarily solid and hollow rectangular slabs and for these we also use epoxy-coated rebar."



Pedestrian walkway, Bremerton Ferry Terminal, Washington State Ferries

A few of the terminals have elevated pedestrian walkways. "For these we have used WWR in precast and cast-in-place non-prestressed pedestrian walkway deck slabs in conjunction with composite metal deck and lightweight concrete. We have also used WWR in cast-in-place sidewalks for concrete trestle or higher elevation non-marine applications."

A recently constructed bridge for the Idaho DOT designed by CH2M Hill Inc. of Boise, ID, is now using welded wire reinforcement. Central Pre-Mix Prestress, Inc. is making 87 girders for that project. (See Idaho bridge photos on page 4.)

Prestress Engineering Corp, of Prairie Grove, IL, and their production facility at Blackstone, IL, completed the Des Plaines River Valley Bridge girder project for the Illinois Tollway late in 2007. They used a significant number of concrete girders reinforced with WWR.

The Illinois Tollway serves 1.3 million drivers every day on 286 miles of road. The Des Plaines bridge, part of I-355 in the northeastern section of the state, was a design/build project requiring 600 beams. The largest was 170 feet and the tallest 10 feet. Ten feet high continues to be the tallest concrete bridge beam in the state of Illinois.

Why so many beams? The bridge is 1.3 miles long and spans not only the Des Plaines River, but the Chicago Sanitary and Ship and Michigan Canals, some railway tracks, other roads and a nature preserve.

Prestress Engineering Corp vice president of operations, Terry Muntz, said the job originally called for traditional reinforcement using longitudinal bars. Once the project began, however, they found that WWR would be a better solution. InSteel of North Carolina provided the WWR.

"We've come to realize that the difference in overall cost is pretty much break even," Muntz said. "But the tighter tolerance of WWR and perfect spacing is the advantage."

WWR is also used in other super- and sub-structures such as bridge decks, abutments and rails; for median barriers and sound walls; deck ramps in parking garages; piers, and more. Welded wire can be epoxy-coated to meet special requirements in coastal or snowbelt environments.

Where Do You Find Engineering Education on WWR?



Purdue University is a great place to start.

Bob McCullough Ph.D., P.E., along with Purdue University's School of Engineering in Indiana, has recently led an educational effort around welded wire reinforcement. Funded by a grant from Wire Reinforcement Institute member Ivy Steel & Wire, they have created a Web site exclusively about Welded Wire Reinforcement (WWR). The site contains information resources for designers and construction engineers about WWR's advantages, uses, design resources, and construction procedures. An on-line library is available as well as various design and construction examples, and access to an online professional development class on design basics.

Visit this site at www.wire-reinforcement.com

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Idaho DOT bridges



About the Wire Reinforcement Institute (WRI)

Headquartered in Hartford, CT, WRI is the world's leading association of manufacturers, allied industries and professionals engaged in the production and application of structural welded wire reinforcement (WWR) and related products for concrete reinforcement. The Institute advances the concrete industry by providing technical, outreach and promotional programs and materials on the applications and benefits of structural WWR. WRI works closely with design firms, universities, owners, contractors and government agencies, to ensure adherence to the most accurate, up-to-date codes, standards, specifications and regulatory requirements. Through the WRI Education Foundation, the Institute funds an annual scholarship program for undergraduate and graduate civil and structural engineering students at accredited engineering universities.

Got a question? Get an answer. If you have a question on how to use WWR or where to find more information on WRI or WWR, please visit www.wirereinforcementinstitute.org or call 800-552-4WRI [4974]. Outside the U.S., please call 1-860-808-3000, X356.

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