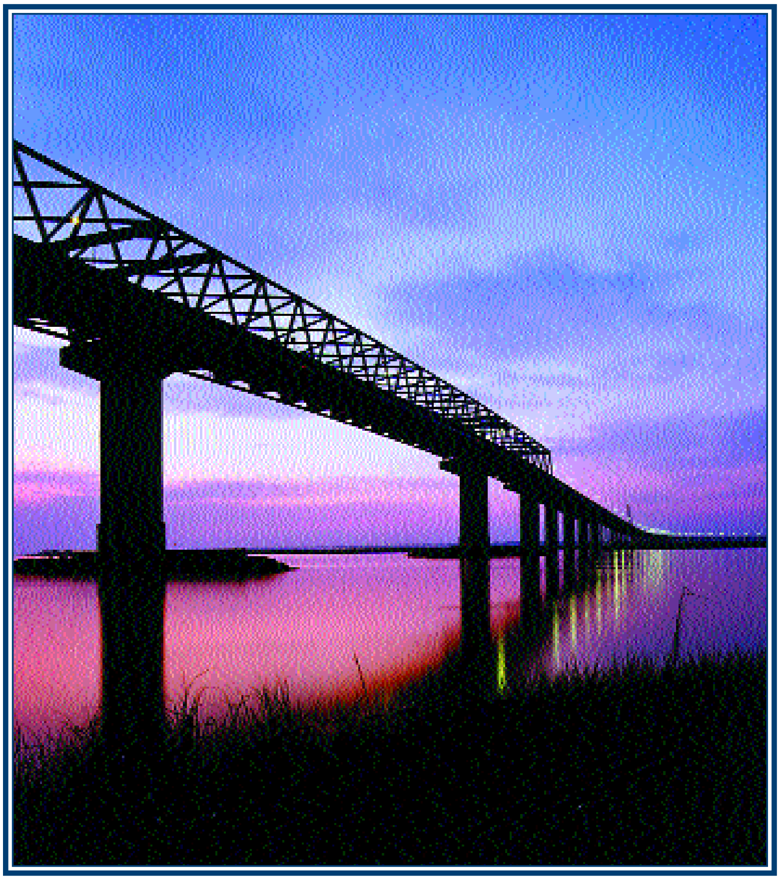
1996 Merit Bridge Award: Long Span
I-526 Bridge over the Cooper River



Judges Comments:

"A highly innovative structure with excellent details"

"Well proportioned with very clean lines"

Planning, design and construction of the Cooper River Bridge took more than 10 years, but when it opened in 1992 it immediately helped to alleviate congestion on Charleston's crowded bridges and highways. Design began in 1982, shortly after the HNTB Corporation was selected to prepare the steel alternate for the Cooper River crossing. After several alternatives were evaluated, HNTB developed a parallel chord truss design—an option that proved to be $17 million less expensive than the concrete alternative.

The bridge opened as a two-way, four-lane roadway with the capacity to expand to six lanes. It has a navigational clearance of 1555' over the main channel of the Cooper River. Additionally, the bridge crosses two islands, several local streets, an arterial highway and two railroads. This portion of the Mark Clark Expressway also includes more than two miles of ramp structure.

Innovative Truss Spans

The most distinctive feature of the bridge is the main channel span. The steel superstructure is a three-span continuous parallel chord Warren truss with a main span of 800' and side spans of 400'. To create a more attractive facility from a driver's viewpoint, the truss was designed with a constant depth and without vertical and sway bracing, which resulted in an open appearance.

The members of the truss are either box (compression members) or H sections (tension members). The box sections were closed off to eliminate the need for interior painting, an important cost savings when considering future maintenance needs. The designers detailed the through truss to be truly parallel—with a constant 55' between the upper and lower chords—by varying the yield strength of the steel from A36 (36 ksi) to A572 (50 ksi) to A514 (100 ksi) instead of varying the depth of the

Project Data

Steel wt./sq. ft. of deck: 84 lbs. (truss)

Cost: $98 million

Steel tonnage: 6,250

truss. Fillet welds are used for all connections between plate elements of these truss members. Approximately 30% of the truss is A36, 55% is A572 and 15% is A514.

The constant depth of 55’ was established as the optimum for the 400’/800’/400’ continuous truss span configuration. This shallow and constant depth was beneficial at the site due to the hurricane force winds in this location. Load factor design was used for an efficient truss design and the typical verticals in the Warren truss were removed to provide a more open appearance to the structure. The typical cluttered appearance of the sway frames and portal frames in the truss were eliminated by using stiff upper and lower lateral bracing systems and full moment connections at the floor beam diagonal connection. These changes from typical simple connections produced a three dimensional “torsion box” that is very efficient in sharing load between the vertical trusses.

Continuous Joints

The bridge deck is an 8”-thick, 93’-3”-wide reinforced concrete slab. To reduce dead load effects, lightweight concrete was used in the center span and normal weight concrete in the end spans. The slab is supported by 10 lines of rolled A572 beam stringers space 9’-8” o.c. W30x24 members are used in panel L0-L1 and W30x99 members are used in all other panels. The stringers act compositely with the slab and span the 57’-2” floor beam spacing.

Project Team

Designer:
HNTB Corporation
Fairfield, NJ

General Contractor:
Cooper River Constructors
South San Francisco, CA

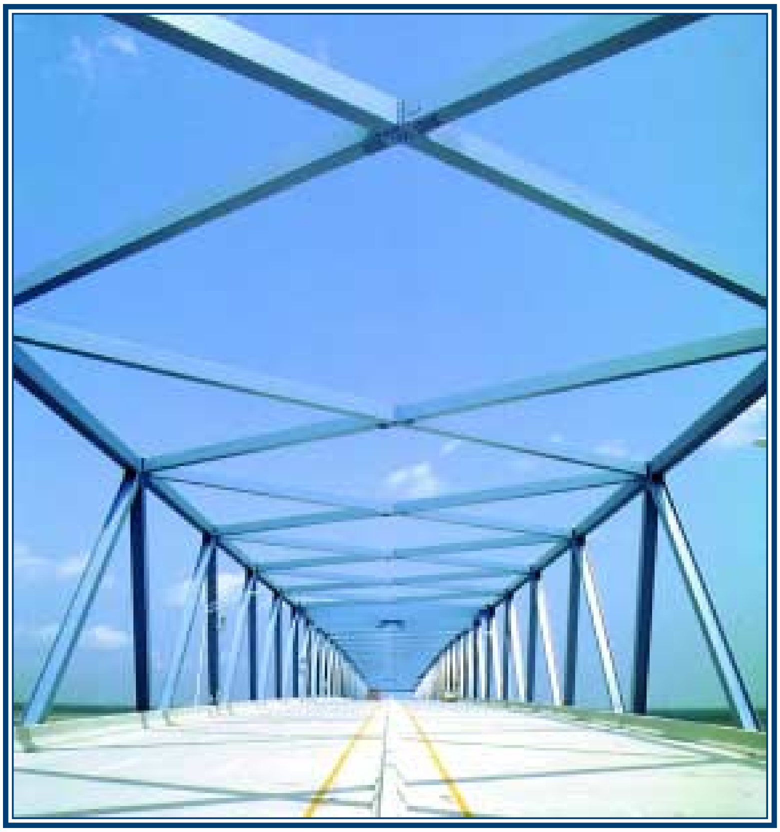
Fabricator (MO & IL):
PDM Bridge (formerly Hartwig Mfg. Co.)
Wausau, WI *

Fabricator:
Pitt-Des Moines, Inc.
Des Moines *

Erector:
John F. Beasley Construction Co.
Dallas

Owner:
South Carolina Department of Highways & Public Transportation

Please note that red text denotes an AISC member



The most common form of deck system for truss bridges in the U.S. has been the use of a concrete slab spanning tranversely over steel stringers, which in turn span longitudinally over floor beams, a system that typically utilizes stress relief joints. This naturally constitutes a waste of material as well as a maintenance headache.

However, these stress relief joints can be eliminated through proper detailing and calculation of the stresses resulting from their elimination. In this bridge, the roadway deck is fully continuous from end-to-end for 1,600'. The middle stringers are connected to the floorbeam to provide stability to the top compression flanges and the remaining stringers are supported on Teflon bearings in order to allow movement.

The box members were coated prior to fabrication with an inorganic zinc primer and shop conenctios were welded and tested. The welds of the boxes are only at the four outside corners, except at the end where there is a return weld approximately 3' to the diaphragm.