NATIONAL STEEL BRIDGE ALLIANCE

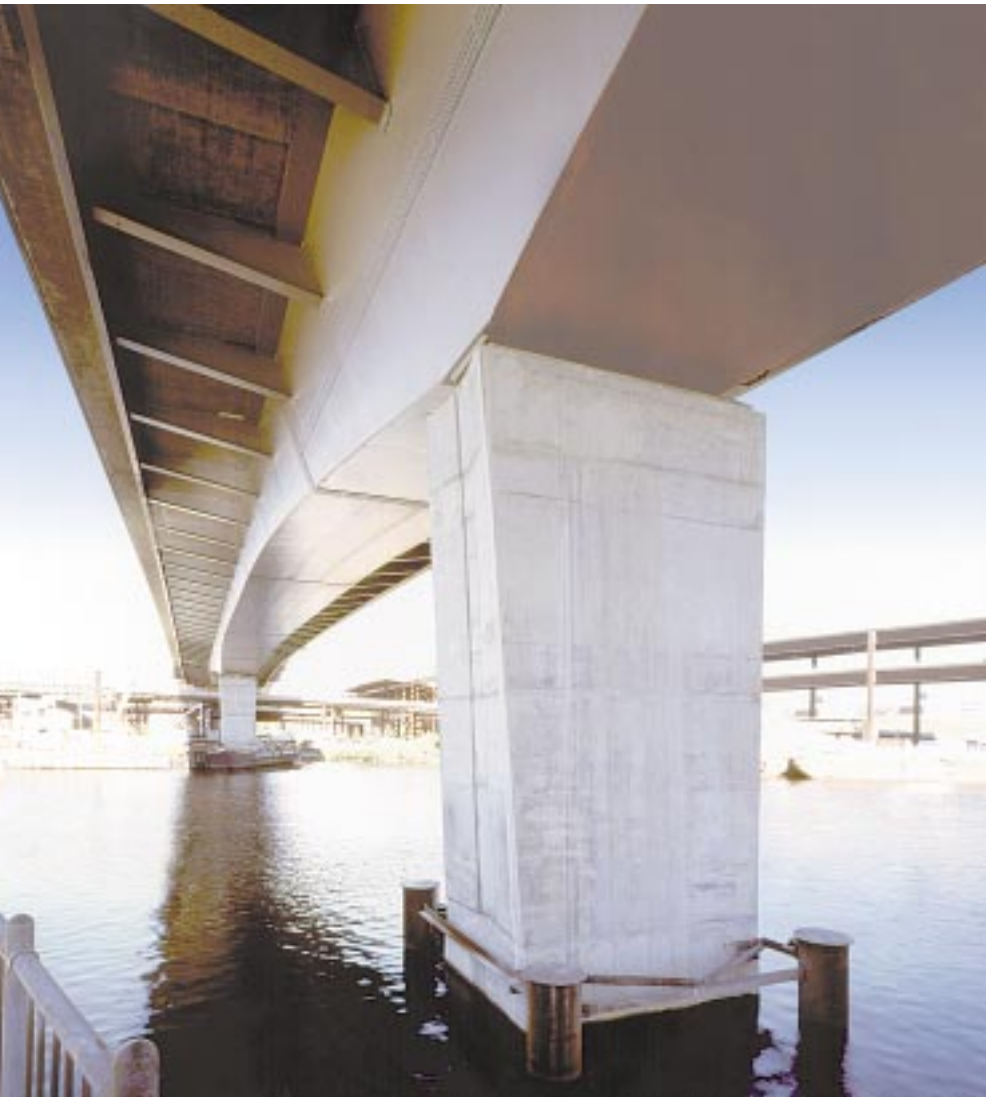
# 2001 Prize Bridge Award

# WINNER:

## MEDIUM LONG SPAN

# Storrow Drive Connector Bridge

Boston, MA



Part of the Central Artery/Tunnel (CA/T) project in Boston, the Storrow Drive Connector Bridge is the largest steel box girder bridge in the United States. The single-cell trapezoidal steel box girder supports a 76-foot wide roadway, which carries four lanes of traffic connecting Boston's Storrow Drive and Leverett Circle with I-93. The steel alternate was selected over a segmental concrete type structure.

Early in the design process a survey was conducted to gather industry capabilities and preferences for fabrication, handling, transport and erection of large box girder sections. This survey formed the basis for evaluating different choices during the type-study and the preliminary design phases.

The main steel box girder of the Storrow Drive Connector Bridge measures 34′-6″ out-to-out of top flanges and is 31′-0″ wide (c/c webs) at the top flange level. It varies in depth from 8 feet at the end piers to 18 feet at the main piers and to 10 feet at the center of the main span. The constant web slope and the variable depth results in a bottom flange width of 18 feet at the main piers to a maximum of 25 feet at the end piers.

To ensure proper fit-up at the site, the 830-foot box girder was shop-assembled in sections from end to end,

including cantilever outriggers and fascia girders, and surveyed to verify the cambered geometry. After the shop fit-up, the sections were disassembled and shipped to Boston.

Field splices were provided to section the 830-foot girder into nine separate field sections. Optional longitudinal splices could be used by the fabricator if required to subdivide these sections for transportation or erection concerns. The 350-ton main pier segments were provided with three longitudinal splices. Two splices were located halfway down on each web and a third at the center of the 18-foot-wide bottom flange, separating it into four sections. For the end sections, the 26-foot-wide bottom flange was provided with two longitudinal splices at third points.

The superstructure required 1,860 tons of structural steel. Over the main piers, the box section consists of 4-inch by 54-inch top flanges, 2-inch-thick bottom flanges and 1¼-inch web plates. Over the negative moment regions near the main piers, the box girder bottom flange was stiffened with WT 16.5 x 100.5 welded in the transverse direction and six lines of WT 10.5 x 36.5 in the longitudinal direction. Longitudinal stiffeners were detailed to pass through web openings of the transverse stiffeners. Over the positive moment areas, the longitudinal stiffeners were changed to ¾-inch by 8-inch plates with MC 6 x 11.5 used in the transverse direction connected to the longitudinal stiffeners at the top with clip angles. The box girder field splices were made with ASTM A325 1″ diameter bolts. All other bolted connections used ⅞-inch diameter bolts, including the optional longitudinal splices.

The 10-inch-thick 4500 psi concrete deck slab was designed to act compositely with not only the main box girder but also with transverse floor beams (including the cantilever out riggers) and the longitudinal fascia girders. The resulting span proportions of the deck slab leads to a fairly high level of two-way action, except for the six-foot cantilever overhang section beyond the fascia girders.

The soil conditions indicated the presence of liquefiable layers at the riverbanks near end piers. As an alternate to soil remediation, the designer

proposed to design the drilled shafts against the forces developed by lateral spreading of the post-liquefied soils. At most locations, the liquefaction considerations did not govern the design of the drilled shafts. At the south end pier where this problem was more significant, a $1^1/_2$-inch-thick permanent steel outer casing and additional reinforcing steel was provided in the drilled shafts.

The exceptional size and weight of the single-cell box girder sections is an innovative demonstration that, with proper planning, steel box girders of these dimensions can be designed to yield an elegant and economical solution for today's marketplace.

**Owner**
Massachusetts Turnpike Authority, Boston, MA

**Structural Engineer**
HNTB Corporation, Boston, MA

**Steel Fabricator**
Tampa Steel Erecting Co., Tampa, FL (AISC member)

**Steel Detailer**
Tensor Engineering Co., Indian Harbor Beach, FL (AISC & NISD members)

**Steel Erector**
Saugus Construction Corp., Georgetown, MA (AISC member)

**General Contractor**
Daniel O'Connell & Sons, Boston, MA

**Software**
GT Strudl and in-house software