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McGRAW-HILL'S CONSTRUCTION WEEKLY
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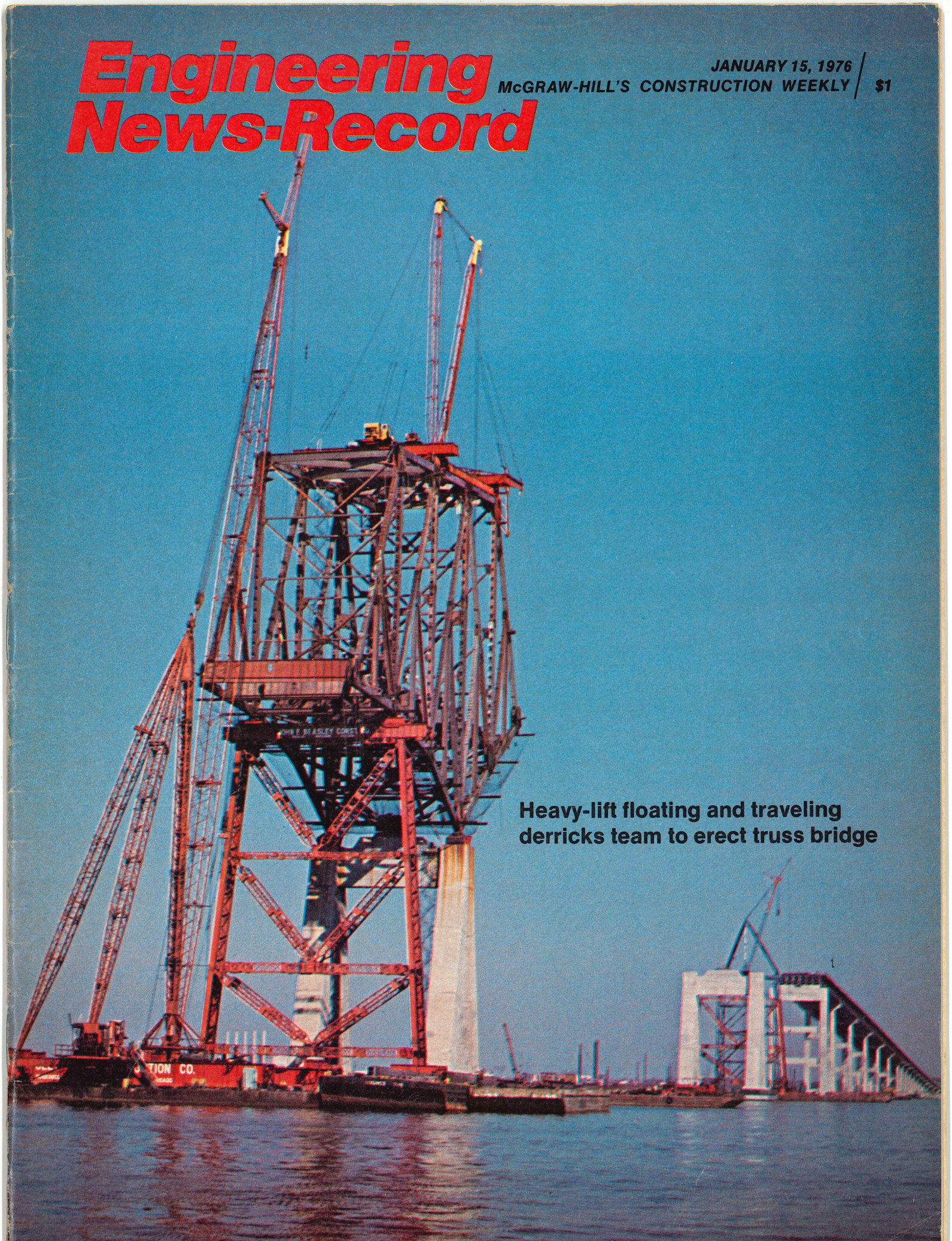
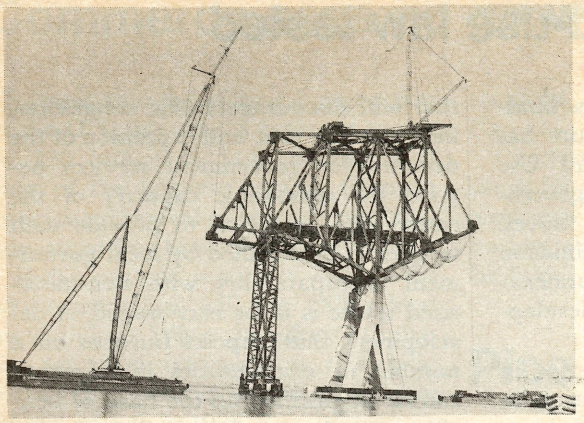
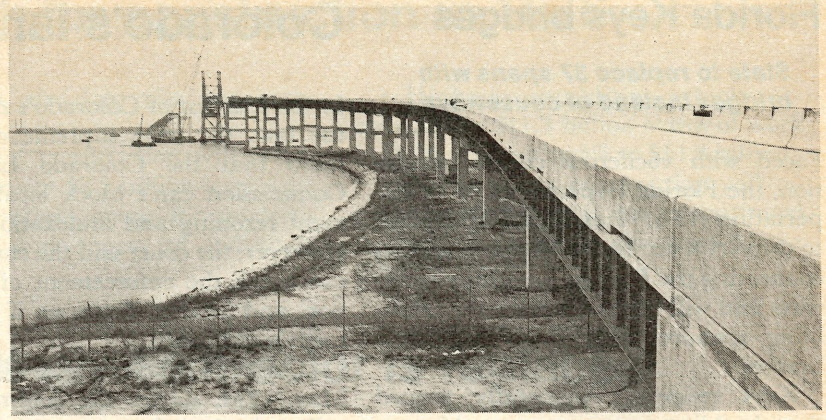


Heavy-lift floating and traveling derricks team to erect truss bridge



Stiffleg erects side spans as traveler works on main.



8,636-ft-long bridge is alternative to tunnel crossing for Patapsco River.

Large derricks team to erect bridge truss

What may be the world's tallest stiffleg derrick is being teamed with a 100-ton traveling guy derrick to erect a three-span continuous steel truss 2,644 ft across the Patapsco River as part of Baltimore's $50-million outer harbor crossing.

Standing 425 ft high, the barge-borne, 200-ton-capacity derrick is being used to help erect approach spans and 722-ft anchor arms for the 8,636-ft-long structure that will complete a link along Interstate 695 around Baltimore. Workers will use the traveler to construct the 1,200-ft main span. The bridge's owner and operator, the Maryland Transportation Authority, decided on the 66-ft-wide, four-lane design when the low bid for a 6,200-ft-long, two-lane tunnel came in 55% over estimate (ENR 10/19/72 p. 14).

The floating derrick's long reach enabled the rig's designer and erector on the project, John F. Beasley Construction Co., Dallas, to work from the water to erect some of the east and west approach spans that extend on fingers of land into the river. In erecting other sections of the bridge, the long reach also cut down on the number of times that Beasley had to re-position the derrick.

Beasley began erecting the west approach spans in June, 1974. Falsework placed between the land piers, which are about 150 ft apart, supported the steel girders during construction. For erection of the approach spans over water, Beasley positioned falsework bents atop steel H-piles driven as deep as 135 ft into the soft river bottom.

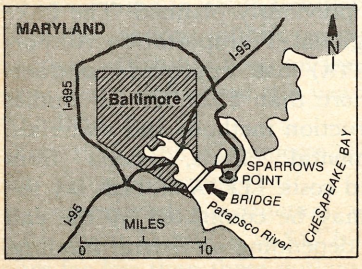
Repetition cuts costs. The three approach spans over water on the west and six on the east side of the truss sections were designed in 300-ft units to cut fabrication costs. Each unit required seven girders from 50 to 128 tons, but because of repetitious design, only four different lengths had to be fabricated. These spans were designed by New York City consultant Singstad, Kehart, November & Hurka. Baltimore Transportation Associates, Inc., Baltimore, designed the 22 approach spans over land.

Pier design for the approach spans also aimed at repetition to economize on formwork. Except for the height, dimensions of all the side span water piers are identical.

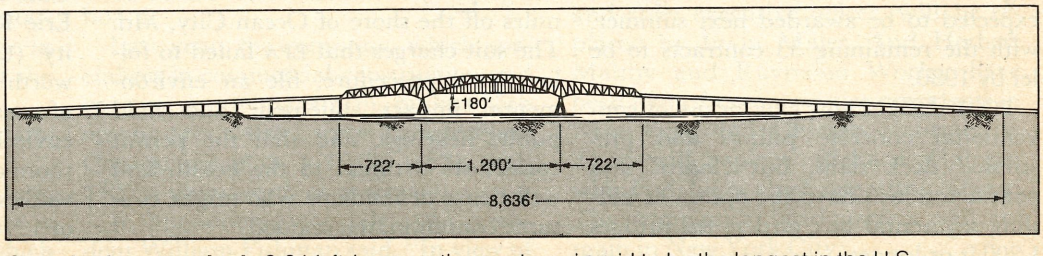
To speed substructure construction, which accounted for $20 million of the total, joint venture contractors The Balf Co. and Savin Brothers, Inc., both of Bloomfield, Conn., and Whaling City Dredge and Dock Corp., Groton, Conn., constructed a temporary accessway along the pier line of both approaches by tieing together a string of barges that were set up with a roadway atop the deck. A two-month labor strike, however, sank any chance of expediting the pier work and contributed to overall construction being about a year behind schedule, now slated for late 1976.

More problems. There have been other problems also. One mishap occurred as Beasley cantilevered two 12-ft-deep girders across falsework from a water pier on an east approach span. With the girders cantilevered about 120 ft past the temporary bent, high winds started the members vibrating, according to William J. Gigl, Beasley's project manager. As the vibrations increased, the girders toppled onto their sides and bent over top of the falsework. "We feel it was a structural failure caused by wind," says Gigl. He says it used the same erection method before without incident. On members erected after the accident, Gigl says, "we watched the wind more and added more bracing between the girders."

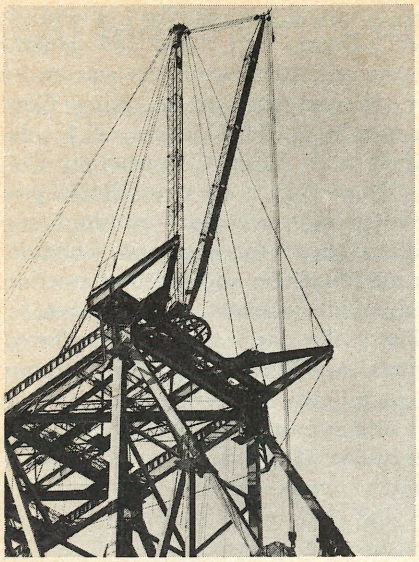
"It was a matter of timing," says Earl Turner, who heads the overall field inspection team for Singstad and Balti-



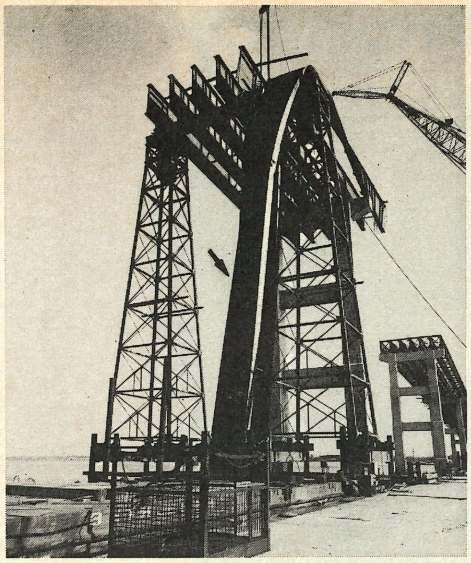
Bridge is major I-695 link.



Outer harbor crossing's 2,644-ft-long continuous truss is said to be the longest in the U.S.



Guy traveler is a modified jumping rig.



Girders (arrow) failed in high winds.

more Transportation Associates. He says it was a combination of winds and the fact that all of the bracing wasn't in place when Beasley lifted the two girders. The collapse "was probably caused by the lack of diaphragms and absence of lateral bracing to sustain loads encountered during erection," according to Turner's report. He says that only 40% of the diaphragms were in place at the time.

Another problem involved the fit-up of some of the box members of the west anchor arm, which Beasley is currently erecting. Where the alignment problems occurred, bolt holes of adjacent members failed to align properly. The American Bridge Division (Ambridge) of U.S. Steel Corp., Pittsburgh, fabricated both anchor arms while superstructure general contractor Pittsburgh-Des Moines Steel Corp., Pittsburgh, fabricated the main truss.

An Ambridge spokesman says a combination of shop and material tolerances, in part, resulted in a ¼-in. overrun on the webs of some box girders that prevented a girder from fitting properly between the inside splice plate and outside gusset plate of a contiguous member. He says that according to American Society for Testing and Materials tolerance standards, "For plates of this width and size (48 in. deep, 31 in. wide, with webs 3 to 4 in. thick), it's permissible to have that much overrun."

The fit-up problems occurred where the design called for heavy members at points of maximum stress, the spokesman says, and adds that the overrun was probably a result of a combination of unusual circumstances that probably wouldn't happen again for years.

There were problems also with gaps at some milled-to-bear joints. Gigl says two were about ⅛ in. wide. Stainless steel shims were used to achieve the proper fit.

Modified jumping derrick. While the stiffleg derrick is erecting the west anchor arm, Beasley uses a traveling guy derrick for the main span. The contractor decided to use the traveler because of the 360-ft height of the top of the main truss and because of the heavy river traffic to and from Chesapeake Bay.

Beasley designed the derrick originally as a jumping derrick for use on a Dallas building. For work on the bridge, the contractor modified the rig and mounted it on a sliding frame. As the main span cantilevers out from the pier, the traveler is winched out on rails. When the main span reaches its midpoint, the traveler will be dismantled and reassembled atop the east anchor arm, a job requiring about a month. This is the first bridge project on which the traveler has been used. Its capacity is twice that of most conventional travelers, says Gigl.

The roadway crosses the navigation channel at a height of 180 ft. It passes through the anchor arms but is suspended from the main truss. After the main span is completed, the suspended deck will be erected from the water using the stiffleg derrick.

Sidney Sherman, project engineer for Greiner Engineering Sciences, Inc., Baltimore, which designed the main truss and is chief consultant to the state for the project, says it studied using a suspension bridge but rejected it because of high anchorage costs. He says the structure is the longest continuous truss bridge in the U.S.

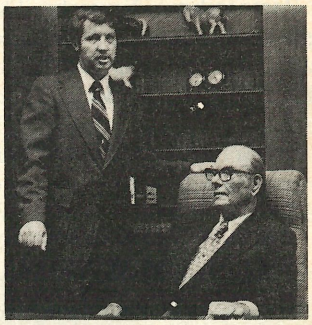
Beasley keeps focus on big rigs as founder steps down

Special equipment designed to handle large steel erection jobs like the Patapsco River Bridge is a hallmark of John F. Beasley Construction Co., which began developing rigs for extremely high and heavy lifts 25 years ago.

The Baltimore project, the largest bridge job ever undertaken by the company, is the last major project begun under the supervision of 74-year-old John F. Beasley, who on Jan. 1 sold his majority interest in the company he founded 44 years ago to three long-time employees.

The company is one of the largest independent steel erectors in the country and one of the most diversified, says its new president B.L. Landfair. Its three major areas are large bridges, multistory buildings and powerplants, but it also has erected more than 600 communications towers. Beasley maintains about $25 million to $30 million in contracts on the books, about half of which is bridge construction. Its work force generally is 300 to 500 persons.

One of the special pieces of equipment Beasley is using on the Baltimore bridge is the stiffleg derrick. "At 425 ft, instead of the usual 120 to 130 ft of boom for a stiffleg mounted on a barge or tower, this probably has the longest reach of any derrick in the world," says Landfair. "With its capacity of more than 200 tons, compared to a capacity of less than 85 tons for cranes with booms up to 400 ft, we feel this is a unique piece of equipment."



Landfair (left) and Beasley.

Beasley owns about $7 million worth of heavy equipment, including 22 derricks of 20 to 200-ton capacity, 22 cranes, 34 hoists and a variety of tractors. Assembling a fleet like this in today's market would be almost prohibitive, says Landfair, a 42-year-old civil engineer. "But it allows us to be very competitive on erection of major river crossings. When we bid a job, we try to have a specific piece of equipment in mind for certain heavy or very high lifts or lifts at a very large radius."