Lateral resistance was a major element of the foundation designs. Multiple refined soil-structure interaction analysis models were performed for every bent on the bridge, considering pier stiffnesses, vehicle collisions, and various scour depths from no-scour to full-scour conditions. Design of the navigation unit included individual FB-MultiPier software bent models and a global three-dimensional LARSA model of the entire 3550-ft unit with superstructure and substructure. (The design process used for the piers is described in a related Concrete Bridge Technology article in this issue of *ASPIRE*®.)

Superstructure

The superstructure of most of the bridge (the north and south approach spans and the north and south transition spans) consists of a conventionally formed 9-in.-thick CIP sand-lightweight concrete (sand-LWC) deck supported by precast, prestressed concrete FIB girders. Stainless steel reinforcement is used in the deck to enhance corrosion resistance. The deck of the FIB spans was constructed using sand-LWC to reduce dead load on the girders, allowing the girders to span longer distances at the same girder spacing. This reduced both the total number of required spans and, more importantly, the total number of bents and foundations, thereby lowering costs substantially. The sand-LWC deck was not treated differently with regard to durability or corrosion protection; the North Carolina Department of Transportation permitted the use of sand-LWC in the deck without additional corrosion protection provisions.

Most of the bridge has a roadway cross section with two 12-ft-wide lanes and two 8-ft-wide shoulders, with a total out-to-out deck width of 42 ft 7 in. The most common span configuration features a four-girder cross section and a span length of 160 ft 10 in. In the south transition region, a number of spans feature a six-girder cross section and spans up to 182 ft, the longest simple-span prestressed concrete girders in North Carolina. The FIB girders are designed as simple spans for dead load and live load, but they are detailed as continuous for live load and are supported on steel-laminated elastomeric bearing pads with stainless steel sole plates and anchor bolts. In some cases, where designed to allow redistribution of vessel collision loads to adjacent bents, reinforced concrete shear keys are provided.

The use of precast concrete pile bents and vertical cylinder pile foundations minimizes the project's permanent impact on environmentally sensitive seagrass beds in the north approach spans.

To minimize the need for future dredging to accommodate Oregon Inlet's highly dynamic bathymetry, the design provides for a 2400-ft-wide "navigation zone." All spans within this zone provide at least 200 ft of

AESTHETICS COMMENTARY

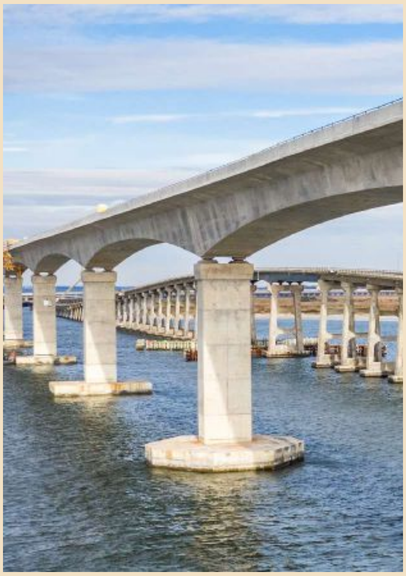
by Frederick Gottemoeller

For observers on the shore, long, relatively low bridges over water have an unfortunate aesthetic impact. Absent the bridge, water-level observers may have 180 degrees or more of seascape to admire, along with sunrises or sunsets and long-distance views of dramatic weather events. However, when a typical short-span causeway is viewed from shore at the usual oblique angles, the pile bents line up one behind the other to form a visual wall, cutting the visible water surface in half and destroying the sweeping, wide-angle exposures otherwise available.

The Marc Basnight Bridge impressively applies modern foundation technologies to the challenging conditions of the Oregon Inlet. Most of the major construction decisions emanated from those conditions, including the decisions to double the spans, raise the bridge height, and use haunched girders over approximately 25% of the bridge's length. A happy consequence of those choices is that the bridge's long spans and high clearances eliminate the most objectionable feature of typical causeway bridges—the way they block views of the water from the shore. With the new structure, long water-level views of the inlet are visible through the bridge.

The haunched girders also engage viewers by providing information about how the bridge works. The girders are thickest over the piers, where the forces are the highest. Finally, the disc bearings and their pedestals raise the girders above the piers just enough to provide a glimpse of sky between the tops of the piers and the bottoms of the girders, so that the girders appear to be floating in midair.

The aesthetic consequences of decisions made for technical reasons will make the Basnight Bridge a



valued improvement to the Oregon Inlet seascape. With this example in front of them, perhaps other transportation agencies will now consider significantly longer spans and higher clearances for other water crossings with high scenic values, even if the technical issues are not as difficult as those faced in the Basnight project.