US 181 HARBOR BRIDGE PROJECT

Monthly Status Report

Texas Department of Transportation

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April - May 2024

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HARBOR BRIDGE
Corpus Christi, Texas

Harbor Bridge Project: Cable-Stayed Bridge Construction 101

Cable-Stayed Bridge Defined: One or more towers from which steel cables support the bridge deck. The structure comprises of three main components: a tower, a deck (driving surface), and support cables. Each tower is like an A-Frame supporting bridges with spans ranging from 600 to 2,800 feet. CSB construction is efficient and safe to build because each section is self-supporting as it is constructed.

History of Cable-Stayed Bridges: In the mid-19th century, design engineers combined features of suspension and cable-stayed bridges, providing a safe alternative to steel truss arch bridges such as the existing Harbor Bridge. CSBs were modernized in the 20th century with the combination of new materials, larger construction machinery, and the need to replace older bridges with longer spans.

New Harbor Bridge: The new HB is a cable-stayed precast concrete segmental bridge designed to withstand hurricane-force winds and has materials meant to last up to 170 years.

- Dimensions: Approximately 540-foot land-based towers, 3,285-foot total deck length, 1,661-foot deck span over the Corpus Christi Ship Channel, 205 feet of vertical clearance, and 514 feet of horizontal clearance.
- Bridge Deck: Three northbound and three southbound mainlanes, a 10-foot-wide shared-use path with pedestrian fencing, and a traffic barrier next to 10-foot-wide shoulders (x's 4).
- Primary Elements: 698 precast concrete segments (match cast side-by-side and transported individually from the precast yard in Robstown), 84 delta frames (DF's anchor the stay cables at the bridge deck), and 19 sets of cable that attach from the upper tower(s) to the 3,285-foot-long deck.
- Aesthetics: LED non-corrosive, programable lighting, integrated pedestrian lighting along the walkway, and a widened lookout with bench seating at the middle of the bridge.

FAQ: The growing main/back spans appear to be magically suspended. What holds them in place, and how are segments added?

Answer: The 'magic' in engineering terms is known as 'balanced cantilever construction' (holding your arm straight out creates a cantilevered plane). Cable-stayed bridge construction does not require scaffolding or support beneath. It's built symmetrically by constructing adjacent cycles on each tower in tandem to balance the main/back span cantilevered planes. Here's how it works:

- Segment Placement: Segments are lifted onto the deck and placed with derrick cranes one segment at a time. Each piece is joined together with steel cables using a method called post - tensioning. The same is done on the opposite side of the tower to maintain balance.
- Adding the Median Slab: Once segments in a section are connected, a concrete median slab is poured down the center of the deck to 'join' the northbound and southbound lanes.
- Installing the Stays: White pipes are lifted with the tall tower crane from the center of the bridge deck to the upper towers, creating a set of stays on both sides of each tower. Epoxy-coated steel cables are fed one at a time and anchored from the bridge deck to the tower to provide permanent support. The stays are pulled tightly (stressed) to create the necessary support for the bridge deck.
- Meeting in the Middle: During construction, geometry control procedures ensure that each side of the new bridge aligns precisely when joined over the ship channel.
- New Harbor Bridge Joint Venture Contractor: Flatiron and Dragados have collectively built 32 CSBs worldwide, ten in the United States -completing three together.

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