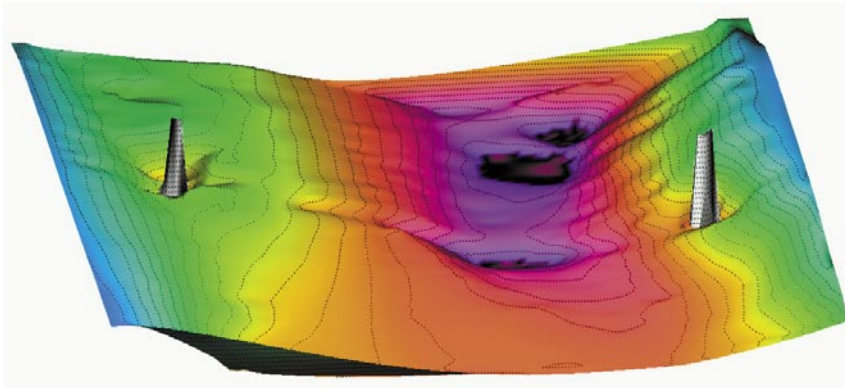


Caisson Anchoring Systems Tacoma Narrows Bridge, Tacoma, WA



View of the bathymetry of the Tacoma River at the site of the new bridge caissons.

Ben C. Gerwick, Inc. was retained by Tacoma Narrows Constructors to develop and evaluate seven alternative anchor systems for the installation of caissons for the new Tacoma Narrows Bridge.

Each of the two caissons to be installed requires 16 anchors placed at 600' radius and another 16 anchors placed at 240' radius from the center of each caisson. The water depth at the two caisson sites is nominally 130' at the northwest caisson site and 144' at the southeast caisson site, with the anchor sites varying from 40' at the shallowest to 196' at the deepest.

In addition to local variations in the riverbed bathymetry, several hydrodynamic and geotechnical factors affect installation of the anchoring systems, caissons and other marine work at the site.

Year of Completion: 2002

Construction Cost: \$3M

Client:

Tacoma Narrows Constructors

The anchor alternatives included gravity-, friction-, and drag-anchors, ballasted with quarried rock, tremie concrete or iron ingots. The evaluated anchor systems included:

1. Bathtub Anchor
2. Open Grill Anchor
3. Valdez Anchor
4. Pancake Anchor
5. Patent Anchor
6. Pile Anchor
7. Hybrid Anchor

The Bathtub Anchor consists of a steel tub on top of a horizontal steel platform, ballasted with either rock or tremie concrete. The Open Grill is a similar ballasted anchor using a steel grillage without a containment tub. The Valdez and Hybrid anchors both consist of box-type structures placed in a dredged hole and covered with sufficient ballast to establish the necessary frictional and passive resistance. The Pancake Anchor consists of a stack of interlocking precast concrete panels or steel slabs. The Patent Anchors represent commercial fluke drag-anchors used in the offshore oil industry, whereas the pile anchor consists of grouped, steel pipe piles driven

through a template and fitted with a steel cap.

The evaluation of the seven alternatives focused on four criteria:

- Safety, including the placing method, weight, and the need for divers.
- Cost, including the variability and availability of materials.
- Reliability, including scouring, previous application, load paths and quality control during installation and testing.
- Schedule, including environmental constraints, product availability, lead time, fabrication time, and reliability of completion dates.

Ben C. Gerwick, Inc. completed the detailed design of the 32-anchor spread mooring system for each of the two caissons utilizing pile-driven plate anchors, which proved to be the most feasible anchoring system in relation to safety, cost, reliability, and schedule.

Services Performed:

- **Conceptual Design of seven Anchor System Alternatives**
- **Design of Anchor-Caisson Attachment System**
- **Design of Method for Load-Testing of Anchors**
- **Assessment of Hydrodynamic and Geotechnical Site Conditions**
- **Evaluation of Installation Methods and Load Testing**
- **Evaluation of Existing Features of the Riverbed Bathymetry**
- **Site Inspection**
- **Estimation of Quantities and Costs**