

A TALE OF THREE BRIDGES



Washington State
Department of Transportation

TACOMA NARROWS BRIDGE

1940

"Galloping Gertie" The First Narrows Bridge

It's been more than six decades since the first Narrows Bridge opened to traffic and then, four months later, collapsed violently into Puget Sound. Come summer 2005, the bridge that now lies as wreckage on the Narrows seabed will commemorate its 65th anniversary.

When it opened July 1, 1940, the elegant and graceful span stretched like a steel ribbon across Puget Sound. It boasted the distinction of being the world's third largest suspension bridge. Its completion marked a turning point in the history of Peninsula residents by ending decades of isolation and fueling economic growth.

Around the world, people know the tale of Galloping Gertie. It stood for four short months, its deck flexing and rolling before tearing apart in a windstorm.



The Narrows and Lady Gertie. Construction of the first bridge began November 23, 1938. Workers completed the bridge in only 15 months as compared to the 29 months it took to finish the 1950 (existing) bridge.



Caisson in tow. Here, the first section of the lower foundation, the hollow caisson, was towed into place. It was secured to anchors that had previously been placed on the seabed. Creating the lower foundation was a gradual process of repetitively building layers of steel and concrete. Slowly, the pier "grew" upward as it sank downward toward the seabed.



1940 caisson lags in place. The bridge foundations for the first bridge were used to support the towers of the present-day bridge built in 1950.



Dredging the Narrows. As a result of dredging the seabed, the caisson's steel cutting edge met and sank into the earth. The pier was then excavated to the proper depth through its hollow cone (dredge wells).



Standing like sentries in the Narrows. Towers were built on top of each pier pedestal and finished with a steel saddle on its highest point. The saddle of each tower is where the main suspension cable is secured.



Anchorage construction. This anchorage and its twin on the opposite shore of the Narrows supported the bridge and traffic using it. The concept is being used today.



The making of suspension cables. Temporary catwalks were placed from tower to tower, allowing crews to work on the cables. The bridge's two suspension cables were spun from wire spools. The wire was unreeled on site and affixed to an anchorage built on land at each end.



Building the Deck. For the first bridge, the deck was constructed with pre-formed steel sections. This section was carried to the bridge on scows, lifted up and attached to the cables. When all the steel sections were tacked into place, the deck was ready to receive its concrete surface.



Opening day, July 1, 1940. At the opening ceremonies, several bands played a march composed by the Gig Harbor postmaster. The bridge cost \$6.4 million; tolls started at 55 cents and were cut to 50 cents two months later when the bonds were refinanced.



Thursday, November 7, 1940. For bridge engineers, it's a day that forever lives in infamy. Just four months after the span opened to traffic, it tore apart in a 40-mile-per-hour windstorm. At about 10:30 a.m., a center span floor panel dropped into the water 195 feet below. The roadway broke up and chunks of concrete and steel pelted the Narrows. Galloping Gertie's demise may represent the most dramatic failure in the history of bridge engineering. But it's a failure that has contributed significantly to the design and construction of the second, remarkably stable suspension bridge of today.

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About the Images:
Photos on this panel are courtesy of the Gig Harbor Peninsula Historical Society.
About the Content:
Some content in this exhibit has been excerpted and/or paraphrased from the Gig Harbor Museum's exhibit, titled A Tale of Two Bridges.



1950

"Sturdy Gertie" The Second Narrows Bridge

At one mile in length, the existing 1950 bridge is the fifth longest in the United States and represents the best of suspension bridge design, stability and engineering.

Following Gertie's demise, World War II delayed construction of Tacoma Narrows Bridge II for a full eight years. Shortages of steel and wire made such materials valuable commodities. Washington sold bridge steel as surplus, and the remains of the 1940 bridge cables and span were scrapped.

The state financed the second bridge through a \$14,000,000 bond issue. When the bridge opened in 1950, tolls were almost the same as for Gertie. The bridge remained a toll facility until the bonds were retired in May 1965, thirteen years ahead of schedule.



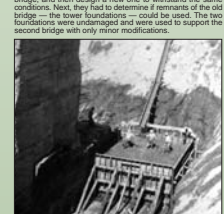
They called it "Sturdy Gertie." Nearly a decade passed between Gertie's collapse in November 1940 and completion in October 1950 of the current bridge. The ten-year gap largely was the result of the redirection of money, materials, and people to fight World War II. In addition, insurance litigation slowed efforts to build a replacement bridge. Promoters gave the new bridge its nickname. Indeed the 1950 bridge proved sturdier than its predecessor. It was wider, heavier and stronger, and carried four lanes of traffic instead of two.



New bridge built on 1940 piers. Engineers faced two major challenges in building the second bridge. First, they had to understand the failure of the 1940 bridge, and then design a new one to withstand the same conditions. Next, they had to determine if remnants of the old bridge — the lower foundations — could be used. The two foundations were undamaged and were used to support the second bridge with only minor modifications.



Raising up the new towers. Crews used a "crawler crane" to build the towers. Laborers worked six months to complete each tower leg. The legs of the 1950 towers are made of hollow steel cells, stacked on top of one another. The cell sections are four columns arranged to form a hollow cone in the center. Each section is 30 feet long and weighs 27 tons. To stabilize the towers during construction, temporary "outriggers" were added until the cables and deck trusses were completed.



Heavier cables mean bigger anchorages. The new bridge had a much bigger cable load, increased from the original 28 million pounds to 36 million pounds for both suspension cables. As a result, the anchorages of the 1940 bridge were modified. The space between the old pair of suspension cables (28 feet) was expanded to 60 feet to accommodate the extra load, and the original anchorages were increased in mass to 54,000 tons.



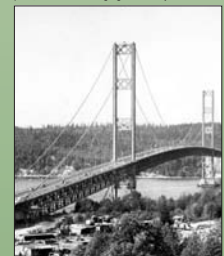
Cables & Spinning. Once the towers and cable saddles had been built, the main suspension cables. Spaced 60 feet apart, each cable contained 19 strands of 458 No. 6 gauge wires.



Raising a deck. The deck of the second bridge was built quite differently than the deck of the first. Crews raised steel beams singly or in sections. Assembling the deck, piece by piece, was like assembling a giant triceratops.



Bracing against the elements. The 33-foot deep Warren truss system was assembled at the bridge site from shop-fabricated components. Four rolling derricks (2 per tower) moved each way from the towers. Two nesting cranes and traveler operators worked from the lower piers to the center of the main span, while two other crews worked from



A second round of celebrations. On October 14, 1950, opening day celebrations capped the long process to build Galloping Gertie's replacement. The price tag for construction was one-third more than the \$11.2 million estimated by the Toll Bridge Authority. The final construction cost estimate, made just prior to the bond issue, reached \$13.738,000.

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2007

The New Tacoma Narrows Bridge

NEW PARALLEL BRIDGE COMPLETED BY: EARLY 2007
1950 BRIDGE (RETROFIT) COMPLETED BY: EARLY 2008

In September 2002, the Washington State Department of Transportation began constructing Tacoma Narrows Bridge III. Two years later, the project was nearly half complete.

By September 2004, bridge builder Tacoma Narrows Constructors had finished the two bridge caissons, or tower foundations, in the water. On land, they were paving new roadways, building the east and west anchorages and numerous retaining walls, and installing drainage facilities. They had completed two half-diamond interchanges and a highway underpass, and had started building the toll facility. Along the way, the project remained right on schedule.

Tacoma Narrows Bridge III is the largest suspension bridge built in the United States since 1964. Its foundations stand a mere 60 feet south of the current bridge's foundations. This \$849 million project will also improve 2.4 miles of State Route 16, and will renovate the existing bridge with seismic upgrades and a new deck.



From shipyard to port. Massive barge gently coasts a gentle part of a caisson from the Port of Tacoma to its final resting place just south of the existing bridge. Above the water line can be seen corrugated steel panels, which are the caisson's "steel skin," providing a watertight environment for placing concrete in the dry. Favorable tides, knowledgeable mariners and a tremendous amount of planning contributed to a smooth and successful voyage. Summer 2003



Getting to "Pier Top City." Convenient access to the caisson construction site is provided by this temporary 21-story stairway. Supported by the existing bridge's tower, it descends to "Pier Top City," the nickname for temporary offices placed on the existing bridge caisson. Spring 2003



Night fall, crews kept on. Lights illuminating the caisson at night allowed crews to keep up an aggressive construction schedule almost around the clock. Summer 2003



A man-made canyon. The eastern (Tacoma) anchorage was built into a site excavated almost 65 feet deep. The main standing at the top right of the photo is shored by the hole that was filled with reinforced concrete shortly thereafter. Summer 2003



Serenity image belies rapid progress. Whether working in rain or shine, crews forged ahead to complete construction on both caissons by summer 2004. Derrick barges provided work platforms for crews, equipment and supplies. Fall 2003



A bird's eye view. Only birds and airplane pilots enjoy this view of the Narrows Bridge, new caisson and work barges. Around the clock support from the marine and land side was necessary to build the caissons that reached the seabed floor in December 2003 (Gig Harbor) and January 2004 (Tacoma). Fall 2003



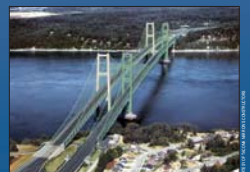
Working on water. The white structures, or "brackets," sitting on each Gig Harbor tower leg house the concrete forms that crews use to place concrete as the towers rise. Jutting from the top of the forms is steel rebar that reinforces the lower concrete. A refractable walkway (lower left) provides construction access to the towers from the existing bridge. Summer 2004



Bridge-building in swift currents. The apparent whitewater rapids shown here are actually water churning from tidal currents in the Narrows channel. During the construction of the caissons, the currents reached 20 to 24 knots, creating unique marine challenges to the designers and builders. Spring 2003



Birth of a tower. With the 1950 bridge's towers in the background, a female worker focuses on the task at hand — pouring the first concrete of the new towers. Reinforced with layers of precast steel rebar, the concrete towers will rise 510 feet into the sky to stand tall and ready to their more massive bridge companions. Summer 2004



Giant rebar. Before a concrete bridge pier can rise from the 1950 span, in 2007 it will be ready. This computer-aided view of the new bridge is a preview of the bridge to come. Workweeks, only a handful of pieces can hoist parallel suspension bridges. Summer 2004

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About the Images:
The majority of photos featured on this panel are the work of staff of the Tacoma Narrows Bridge Project. Other images of the new bridge (2007) are courtesy of Tacoma Narrows Constructors.

