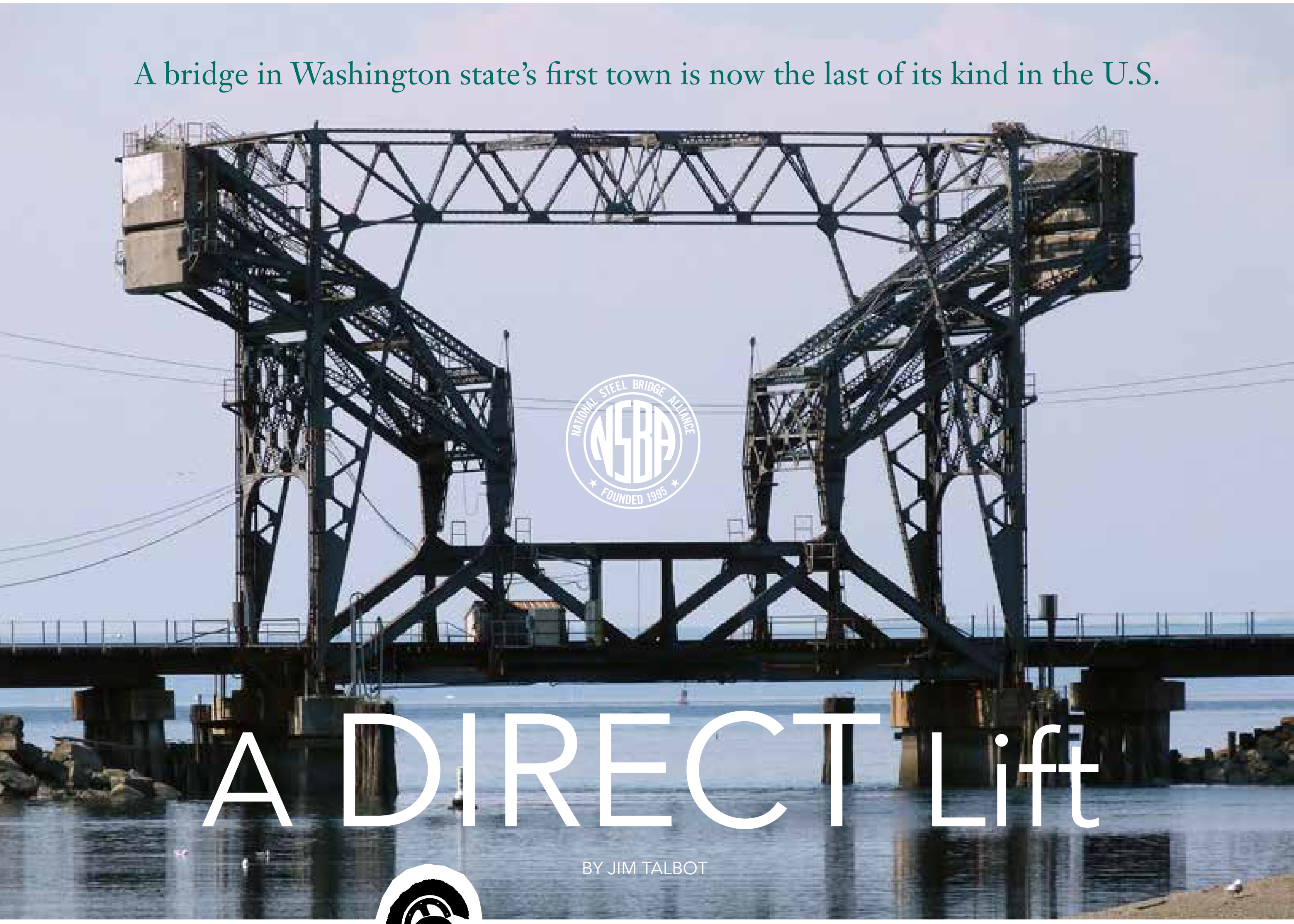
A bridge in Washington state's first town is now the last of its kind in the U.S.

A DIRECT Lift

BY JIM TALBOT



STEEL CENTURIONS
SPANNING 100 YEARS

Our nation's rich past was built on immovable determination and innovation that found a highly visible expression in the construction of steel bridges. The Steel Centurions series offers a testament to notable accomplishments of prior generations and celebrates the durability and strength of steel by showcasing bridges more than 100 years old that are still in service today.

Images: Nathan Holth/HistoricBridges.org

IN 1854, STEILACOOM BECAME the first incorporated town in what is now Washington state.

At the turn of the century, with the approach of the Northern Pacific Railway, the town leaders hoped Steilacoom would become its western terminus. But the railroad just wanted a water-level route along Puget Sound on its way south past Tacoma, so it bought up rights through Steilacoom and continued south toward Olympia. In doing so, it had to cross Chamber's Creek, which emptied into Puget Sound in northern Steilacoom.

The U.S. Corps of Army Engineers considered the creek a navigable waterway, which dictated a movable bridge. The railroad contacted the Strauss Bascule Bridge Co. in Chicago, engineers and designers of trunnion, bascule and lift bridges. Joseph B. Strauss, America's premier bridge designer at the time, proposed and patented a radical new structure type—what has become known as the Strauss vertical direct-lift bridge.

The bridge depends not on tall towers and cables to lift the 97-ft movable bridge section, but rather on a direct rack-and-pinion arrangement. (Apparently Strauss wanted to avoid the inevitable stretching of cables under load, which would require adjustment and rail traffic interruptions.)

Two other vertical direct-lift bridges of similar design (though not Strauss') have been built in the U.S.—one across the Illinois River in Illinois and the other across the Ohio River in Kentucky. But the bridge across Chamber's Creek, built in 1914, is currently the only such bridge remaining in the U.S. (A Strauss direct-lift rail bridge, also built in 1914, crosses the Fraser River in British Columbia, Canada.)

◄ ▼ The Chamber's Bay Bridge is the last of its kind still standing in the U.S.

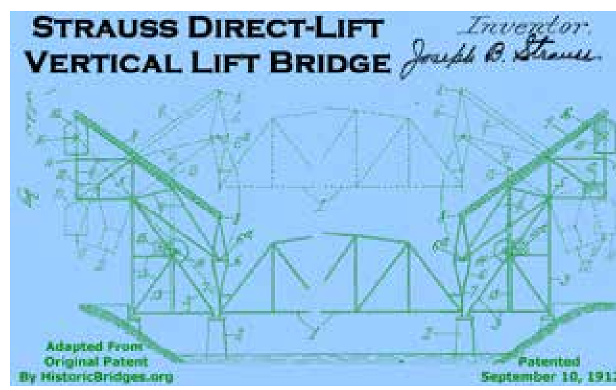
▲ Steel trusses mounted on the tower posts on either side of the movable span support concrete counterweights.

▼ A diagram of the Strauss vertical direct-lift bridge.

According to the Historic American Engineering Record (HAER) for this bridge (which goes by several names, including the Chamber's Bay Bridge, Bridge 14 and the West Tacoma Bridge) steel trusses mounted on the tower posts on either side of the movable span support concrete counterweights. A system of counterweights, trusses, hangers and links forms a jointed frame in the shape of a parallelogram. Reportedly, the parallelogram has proportions so as to be in perfect equilibrium in all positions. The lift span, a pony truss, carries two rail tracks.

The HAER record states that each tower post contains a vertical rack that engages corresponding spur gears on the lift span. At each end of the bridge, 25-hp motors connect to the pinions in such a way that the four span corners always move together. The operator resides in a cabin mounted on the lift span and in case of a power failure, he can manually lift the span. The maximum vertical lift of the bridge is 43.5 ft, and the bridge mechanism was designed to lift a weight of 15 tons.

Information in an early *Engineering News-Record* article about the Strauss design noted that direct-lift bridges with double-balance levers are practicable and economical only for small lifts. Today, the structure is designated Bridge 14 of the BNSF Railway, which represents the result of more than 390 merged railroad lines. According to a BNSF publication, the average weight of a rail car was 40 tons and the average length of a train 50 cars in 1914. Now the average car weighs 142 tons with an average train length of 100 cars.



Years of increased tonnage from rail traffic eventually caused the bridge's seats to founder. In 2004, BNSF refurbished the bridge, replacing its seats, saddles, cover plates, some steel work and the rail tracks. During reconstruction, trains crossing the bridge span had to travel at 10 mph or less and several closures were necessary. The reconstruction project has allowed the BNSF railway's historic bridge to continue to operate for many years to come. ■

Jim Talbot is a freelance technical writer living in Ambler, Pa. You can reach him at **james.e.talbot@gmail.com**.