



Historic Bridge Bulletin

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Call For Papers – Society for Industrial Archeology 2022 Conference – Portland, Oregon



The Dey Road Bridge is located over the Tiffin River in Defiance, Ohio. The pin-connected Pratt through truss was built by the Toledo-Massillon Bridge Company of Toledo, Ohio. It has been bypassed and left in place for pedestrian use. *Photo by Nathan Holth.*

Texas Builds Bridges to Engineering History

By Rebekah Dobrasko, TxDOT

Texas emerged from World War II ready to build roads and bridges. During the war, while road construction was on pause due to worker and materials shortages, the Texas Highway Department (THD) saved its roadbuilding funds to upgrade its roads once the war ended. The state's population was on the move, gravitating from the farms to the cities, ready to travel to see the sights across the state, and growing the oil and gas fields in the west. All these changes meant new roads and bridges.

Post-War Pace

In 1945, Texas had more dirt roads than paved roads. As more farmers demanded better ways to get their goods to market and receive mail, THD responded by creating a massive “farm-to-market” and “ranch-to-market” road system, ultimately creating over 36,000 miles of new roads. In the 1950s, THD began planning and constructing its portion of the national Interstate system across the state. All these new roads needed new bridges to cross rivers, streams, railroads, and other roads. Working at an unprecedented pace, THD built an average of two bridges **A DAY** between 1945 and 1965.

This swiftness led to innovations and inventions by THD engineers that allowed for safe, cost-efficient,

and easy-to-build bridges. THD created standard plans for cheaper bridges that allowed for rapid construction, such as the concrete pan-formed girder bridge. The agency also adopted the widespread use of welding, pre-stressed concrete, and neoprene padding in bridge construction. While these innovations are not easily visible to today's travelers or to an untrained eye, the American Association of State Highway and Transportation Officials (AASHTO) ultimately incorporated several of THD's inventions into national bridge standards.

Post-War Pioneers

With a pioneering spirit, THD engineers used new materials and designs to tackle crossings they could not have accomplished in earlier periods. They built bridges where none had been before, and the bridges they designed after the war were longer, higher, and larger than ever before. Increased trade with Mexico meant building international bridges across the Rio Grande. These new bridges solved flooding problems that cut communities off from one another. In east Texas, a new bridge crossed Big Cypress Bayou and its floodplain. This bridge on State Highway (SH) 43 bridge was 3.5 times longer than an average plate girder bridge, and the innovative engineering helped get travelers across this area during flood events (Figure 1). This time period for THD also saw the beginnings of Texas' famous “spaghetti bowl” interchange designs. Some of the earliest 3- and 4-level interchanges opened in Waco and Corpus Christi to accommodate growing cities and their traffic. Overall, THD built more than 15,000 bridges in the 20 years after World War II.

Sharing This Story of Success

In the decades following this period, the current laws governing historic properties required federal agencies to consider how federal projects may impact historic places. Also, during that time THD became the Texas Department of Transportation (TxDOT), which includes a team of cultural resources specialists who help the agency comply with those laws. As the post-war bridges started reaching 50 years old, an initial threshold to considered them historic properties, the TxDOT team needed to understand what might make them significant and to consult with the Texas Historical Commission (THC), the Historic Bridge



Figure 1: The SH 43 Bridge over Big Cypress Bayou at the county line of Marion and Harrison Counties, opened in 1965. Photo by TxDOT.

Foundation, and others with an interest in Texas bridges.

TxDOT conducted in-depth research into THD engineering and design between 1945 and 1965 and identified more than 100 bridges representative of and significant to that time. These bridges are now part of an overall TxDOT historic bridges management plan. TxDOT prioritized approximately 33 of those bridges as highly significant to focus its engineering, environmental, and historic preservation analysis whenever TxDOT needs to work on those bridges (Figure 2).

TxDOT then partnered with the THC and the Historic Bridge Foundation to spread the stories of Texas bridge construction, innovation, and engineering after World War II. These bridges are often not as visible as historic metal truss bridges or concrete arch bridges, so it is challenging to tell their story when many are not as recognizable as even being historic. To that end, TxDOT developed a series of digital products that are shareable and accessible to highlight what makes the bridges important in Texas history (Figure 3).

TxDOT's research shows that there is not a lot of information on historic bridges online, and people are not really talking about historic bridges unless one is proposed for replacement. So TxDOT designed its educational materials about these bridges for multiple levels of interest. Some pieces work for those just scrolling through social media. Some will appeal to those wanting to know a bit more by reading a webpage or watching a 3-minute movie. Others offer a deeper dive, with a bibliography and source documentation for those deeply interested in bridge construction techniques or materials development. To view these resources, visit: <https://www.thc.texas.gov/preserve/historic-bridges-texas/post-world-war-ii-bridges/beyond-road-texas-leads-way-after-world>.

Creating New Historic Bridge Enthusiasts

Part of building an appreciation of Texas' engineering and bridge heritage is finding new audiences. As part of continually seeking ways to tell the stories of Texas' historic bridges, TxDOT collaborated with THC's Museum Services group to hold a series of virtual workshops on incorporating STEM activities into history museums. The trainers used Texas bridges and roads as examples of historic narratives that can also translate into STEM-related



Figure 2: As part of this prioritization process, TxDOT examined multiple alternatives to the replacement of the Corpus Christi Harbor Bridge along the coast. Ultimately, the historic 1959 bridge will be removed for one even taller and wider! Photo by TxDOT.

activities for students and teachers. Paving the Way: STEM in History Museums reached hundreds of museum employees, volunteers, and students and introduced TxDOT as a valued partner to share stories and histories around bridges and transportation: <https://www.thc.texas.gov/preserve/projects-and-programs/museum-services/stem-history-museums>.

In addition, TxDOT put together a series of educational activities for teachers, parents, museum or library educators, or anyone looking for activities about bridge building for elementary and middle school students. These short educational activities use the videos, photographs, and webpages created for more general audiences as an entryway for students to learn more. As more and more schools look for multi-disciplinary activities that can cover social studies as well as other disciplines, TxDOT is helping fill that need. The activities are meant for a 3-day lesson but can be broken down or used independently. Each activity is tied to an appropriate science, technology, engineering, or math (STEM) standard for Texas elementary and middle school students. Teachers can review a Teacher's Guide, and students can view PowerPoint slides prior to working on the activities. Feel free to use them for your work, too! <https://www.txdot.gov/inside-txdot/division/environmental/resources-for-educators.html>

Planning for the Future

TxDOT will continue to celebrate the innovations and successes in the state's engineering history as represented in our bridges. We are currently undertaking significant research about the bridges built prior to 1945, as we look at our bridge inventory for those bridges significant to safety, New Deal, and City Beautiful movements across the state. Other initiatives include the creation of an advisory Historic Bridges Working Group, continuing to prioritize the needs of historic bridges in rehabilitation projects, and committing to the preservation of 24 TxDOT-owned historic metal truss bridges. If you have any questions, or would like to learn more about TxDOT's historic bridges, please visit: <https://www.txdot.gov/>



Did you know...

After World War II engineers in Texas used scuba suit material (neoprene) to help stabilize **concrete bridges**.

Find other cool facts on [TxDOT.gov](https://www.txdot.gov/) (keywords: Texas Historic Bridges).

See Interactive bridge maps, videos and more!

Learn about TxDOT's historic preservation process and how you can get involved (keywords: Historic Preservation).

BEYOND THE ROAD
TxDOT

Figure 3: Colorful images that grab the eye help tell the history of our bridges. Graphic by TxDOT.

[inside-txdot/division/environmental/historic-bridge.html](https://www.txdot.gov/division/environmental/historic-bridge.html).

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Notice:

The contact information for the Historic Bridge Foundation is changing. Please note our new address and phone number as follows:

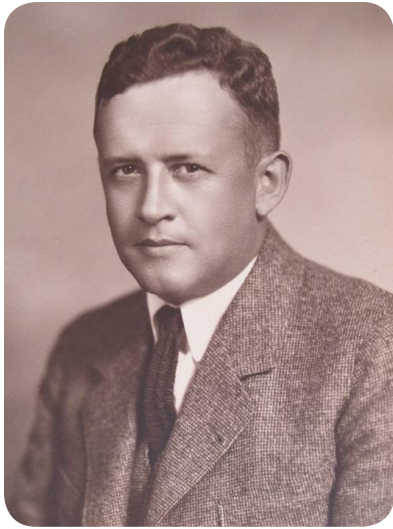
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Scarcely Orthodox: Homer M. Hadley, Washington's Bridge Engineer Extraordinaire

By Craig Holstine

Washington State is home to a surprising number of rare bridges, some of unique design. Many were either inspired or actually designed by an engineer of extraordinary imagination. To characterize Homer M. Hadley as unorthodox would be an understatement.

Homer More Hadley was born in Cincinnati, Ohio, in 1885. He attended school in Toledo before enrolling at the University of Washington in 1908. Over the next eight years, Hadley attended the UW intermittently between railroad surveys in Alaska and Canada. His Alaskan diaries reveal an extraordinarily observant young man with an adventurous spirit driven to explore uncharted territory, as well as a polished writing style that later would appear in over twenty articles and "discussions" he authored in major national engineering journals. He married Margaret



Homer M. Hadley, as he appeared in the 7 July 1928 issue of *Pacific Builder and Engineer*.

Sarah Floyd in Spokane, her hometown, in 1913. For reasons unknown, he failed to graduate from the UW or any other school of higher education. During World War I, Hadley worked for the Emergency Fleet Corporation in Philadelphia, designing concrete ships and barges.

That experience inspired his vision for a concrete pontoon bridge across Lake Washington. The glacially carved lake is deep, averaging 125 feet in depth with up to 100 feet of soft clay and mud at the bottom. It posed an unbridgeable barrier to transportation between Seattle and communities to the east. In 1921 Hadley formally proposed building a first-of-a-kind floating concrete bridge, ridiculed in the local press as “Hadley’s Folly.” It set off a fierce debate that was to last until the bridge was finally built nearly two decades later. The decision to build the bridge came in 1937 when Hadley convinced Lacey V. Murrow, the Washington State Toll Bridge Authority’s Chief Engineer and Department of Highways’ director, that his idea was feasible and affordable with New Deal funding. Due to Hadley’s connection to the concrete industry, he was not allowed to assist with the bridge’s design. That credit was given to Murrow, for whom the bridge was later named. Completed in 1940, the first Lake Washington floating bridge sank in a violent storm in 1990. Its successor is also named for Murrow. In all, four concrete pontoon bridges are now in service in Washington, three on the lake and one across Hood Canal, the fjord separating the Olympic and Kitsap peninsulas. Their designs and construction have made Washington Department of



McMillin Bridge as it appeared on the cover of the 2 January 1936 issue of *Engineering News-Record*. Photo courtesy, Washington Historical Society. Photo courtesy Asahel Curtis, Washington Historical Society.

Transportation engineers the world’s foremost experts in floating bridge technology.

In 1921, Hadley took a job with the Portland Cement Association in Seattle. As regional structural engineer, he spent the next 26 years promoting the use of concrete in structures. In the early 1930s he invented a concrete paving machine, reportedly one of the first in the nation. It was one of six patents the US Patent Office issued to Hadley. By the mid 1930s, Homer Hadley was a well-known bridge engineer whose design suggestions for concrete bridges were being adopted by cities and counties in western Washington. One such design was for the McMillin Bridge, a concrete truss built on the Puyallup River in 1935. With seven-foot-wide parabolic trusses rising to twenty feet above its deck, the 170-foot structure was the longest reinforced concrete span in the US. Although unseen, hollow concrete-box piers support the deck and superstructure, a distinctive feature to be repeated in Hadley designs. Wooden sidewalks pass through 7-foot-high, 3-foot-wide portals in its Pratt trusses on both sides of the roadway, a unique feature in concrete truss bridge design captured in the cover photo of the 2 January 1936 issue of *Engineering News-Record*.

In 1936 the Pierce County Engineer F.R. Easterday credited Hadley for inspiration in the design of three hollow concrete box girder bridges. Hadley himself claimed the first such bridge built in the US was the Mashel River Bridge in the southeast corner of the county. The Buckley Bridge over the Northern Pacific Railroad was “characterized by several departures



Mashel River Bridge, reportedly the first hollow concrete box girder bridge built in the US, under construction ca. 1935. Photo courtesy Pierce County Public Works.

from convention design,” the Engineer noted in his *Western Construction News* article. Wide hollow “banana crate” concrete girders allowed for longer spans and “render cross beams unnecessary.” “Major features and layouts” of the bridges were Hadley’s, said Easterday, although the technique of hollow-box construction had been practiced in Europe for some time. On Henderson Bay north of Tacoma, workers completed the Purdy Bridge, whose concrete box girder span of 190 feet was among the “Major features . . . suggested by H.M. Hadley,” according to Easterday. Carl Condit said in his seminal work *American Building Art: The Twentieth Century* that the Purdy Bridge was the “nearest American rival to Freyssinet’s girder spans [in Europe] . . . This structure rates as one of the few box-girder bridges in the United States and has the longest single span among concrete-girder forms.”

“A truism of bridge design is that the greatest economy is achieved by having the cost of the

substructure equal the cost of the superstructure,” Hadley wrote in a 1952 article concerning his design for the Portage Canal Bridge built near Port Townsend the year before. In using steel box girders for 140 feet of its 250-foot main span, instead of concrete box girders throughout, Hadley saved costs in concrete, framing and support falsework. The relatively long span also eliminated the need for additional piers required of shorter spans. It was reportedly only the second bridge of its type built in the US at the time.

The title of a later article captured Hadley’s self-promotional sense: “Tied-Cantilever Bridge – Pioneer Structure in U.S.” Designed in 1955 by Hadley and his son Richard, who had formed a partnership after Homer left the Portland Cement Association in 1947, the Kiona-Benton Bridge proved to be truly “pioneering.” Its use of both steel and concrete box girders was cutting edge, but not an innovation (Homer had used them in earlier in the Portage Canal Bridge). But connecting the deck to towers with diagonal vermiculite concrete-filled steel girders was truly a unique solution to the challenge presented by the crossing of the Yakima River. The towers and inclined stays allowed for a shallow cross section which could then be long enough to remove the piers out of the river channel. The bridge became the prototype for the cable stay, now adopted around the world as signature bridges for long crossings posing otherwise insurmountable challenges.

With a dramatic flair, Hadley opened a 1960 article with “An unusual, even a pioneering, design was chosen for a heavy-duty logging bridge across the Upper Baker River in the Cascade Mountains of



Portage Canal Bridge showing steel box girder center span between cantilevered concrete box girder spans. Photo by Craig Holstine.



The Kiona-Benton Bridge as seen in 2014. Photo by Nathan Holth.



Upper Baker River Bridge under construction showing composite steel and concrete girders. Photo courtesy Mt. Baker-Snoqualmie National Forest.

Northwestern Washington.” What might have been a forgotten one-lane crossing became a distinctive, composite bridge composed of prestressed concrete deck trusses with post-tensioned concrete bottom chords and structural steel webs and top chords. Integration of precast concrete slabs with the steel top chords of the trusses contributed to the “composite action between the several parts,” according to the author, who obviously took every opportunity to display his penchant for unorthodox design. The bridge was reportedly the first of its kind in the nation, according to the *Seattle Post-Intelligencer*. One innovation based on his patented “delta girder” was the Parker Bridge over the Yakima River, awarded the Iron and Steel Institute’s 1962 award for “the most beautiful bridge of its class in the United States.” Like numerous Hadley structures, the bridge has been replaced due to the demands of increasing traffic and heavier live loads.

Forever in character on the engineering stage, Homer Hadley fueled an ongoing controversy when, in 1950, he proposed a crossing of Puget Sound with a floating bridge. To accommodate marine traffic, the concrete pontoon spans would be accessed by submerged tunnels atop concrete piers at each end. His vision of but another unique, miles-long structure

has yet to materialize. Late in his life, Homer Hadley was interviewed by a reporter for the *Seattle Post-Intelligencer*. “You could say bridges are my first love.” The reporter asked why. “Maybe it’s because the spans are longer than in buildings . . . I do work on buildings, too. But bridges are much more fun.” He pursued his enjoyment in designing bridges until the end of his life. An avid swimmer, Homer Hadley drowned in Soap Lake, Washington, on 5 July 1967 at the age of 81.

“It may be observed that the number of studs per slab is scarcely orthodox,” Hadley wrote in an article concerning one of his bridge innovations. Scarcely subtle, he reminded readers that the designer was as unorthodox as the designs he produced. Perhaps choosing to disregard his self-promotional tendencies, his widow, Margaret Hadley, wrote: “Recognition didn’t matter to Homer, (though it has to his family), nothing mattered, just so long as his cherished concept was utilized and put into practice.” Seven decades after he had proposed the idea of a floating



Craig Holstine, the Homer Hadley Bridge and plaque, and the Lacey V. Murrow Bridge, Seattle. Photo by Marsha Reilly.

bridge, Homer Hadley's family and friends joined the University of Washington's Mortar Board in calling for public recognition of his contributions to the innovative solution to crossing Lake Washington. In July 1993 the state's Transportation Commission formally named the new Interstate 90 floating bridge in Hadley's honor, firmly establishing his prominent position in the history of bridge engineering in the state. Aside from the high-profile commemoration, his legacy lives on in countless modest, unheralded bridges throughout Washington.

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Craig Holstine holds an M.A. in history from Washington State University. He is a retired historian with the Washington State Department of Transportation and is the co-author with Richard Hobbs of Spanning Washington: Historic Highway Bridges of the Evergreen State. Craig currently serves on the Board of Directors of the Historic Bridge Foundation.



Purdy Bridge, a reinforced concrete box girder bridge in Pierce County, Washington conceived by Homer Hadley and built in 1936. It broke national records for span length when completed. Photo by Nathan Holth.

Call For Papers – Society for Industrial Archeology

2022 Conference – Portland, Oregon

The Society for Industrial Archeology invites proposals for presentations and poster displays at the 50th Annual Conference in Portland, Oregon, June 9-12, 2022. The presentation sessions will be held at the conference hotel on Saturday June 11, 2022. As usual, numerous tours will be available on the other days, and as you will know, Portland is a bridge city, so expect some good ones on that topic.

We invite presentations or poster displays on all topics related to industrial archeology, industrial heritage, history of technology, social change related to industry, and historic industrial structures and bridges. Papers about structures industries in Oregon and the Pacific Northwest and timbering history are particularly encouraged, as is participation by graduate students. All presentations and poster displays should offer both interpretation and synthesis of data, and can be on works in progress or finished projects. A themed discussion panel may also be proposed.

We are particularly hoping to gather the session(s) on historic bridges into a theme issue of *IA: The Journal of the Society for Industrial Archeology*, and the editor will be in touch with presenters for a full paper submission after the conference but certainly before Labor Day 2022. Even if you are unable to be in Portland for the conference, please send a note to the presentations chair to be contacted on this prospect.

THE DEADLINE FOR PROPOSALS IS JANUARY 31, 2022.

Visit <https://www.sia-web.org/50th-annual-conference-portland-oregon/> for further information and to submit your proposal. There you will enter your presentation title, ~300-word abstract, contact details, and brief biographical statement, as well as any special requirements you might need for your presentation.

For questions and further information please contact Steven Walton, SIA Presentations Chair, at sawalton@mtu.edu.



Above left: The Steel Bridge in Portland, Oregon. Built in 1912 to the design of Waddell and Harrington, this double deck vertical lift bridge features a rare telescoping lower railroad deck that can be raised without lifting the upper highway deck to allow smaller craft under the bridge. The highway deck can also be lifted for taller boats. Above right: The St. Johns Bridge in Portland, Oregon. Built in 1931 to the design of Robinson and Steinman, this is a suspension bridge designed by famous engineer David Steinman. It is noted for its aesthetics and beauty. *Photos by Nathan Holth.*