Historic Inventory Report

Location

Field Site No. DAHP No.

Historic Name: Meridian Street Bridge

Common Name: Puyallup River Bridge 167/20E

Property Address: 0000 N Meridian St N, Puyallup, WA 98424

Comments:

Tax No./Parcel No.

Plat/Block/Lot

Acreage

Supplemental Map(s)

Township/Range/EW	Section	1/4 Sec	1/4 1/4 Sec	County	Quadrangle
T20R04E	21			Pierce	PUYALLUP

Coordinate Reference

Easting: 1194635

Northing: 686851

Projection: Washington State Plane South

Datum: HARN (feet)

Identification

Survey Name: Puyallup River Bridge Date Recorded: 12/30/2011

Field Recorder: Craig Holstine

Owner's Name: Washington State Department of Transportation

Owner Address: 310 Maple Park Blvd.

City: Olympia State: WA Zip: 98504

Classification: Structure

Resource Status: Comments:
Survey/Inventory

Within a District? No

Contributing? No

National Register:

Local District:

National Register District/Thematic Nomination Name:

Eligibility Status: Not Determined - SHPO

Determination Date: 1/1/0001

Determination Comments:

Description

Historic Use: Transportation - Road-Related (vehicular)

Current Use: Transportation - Road-Related (vehicular)

Plan: Unknown

Stories: not applic

Structural System: Steel

Changes to Plan: Slight

Changes to Interior: Not Applicable

Changes to Original Cladding: Not Applicable

Changes to Windows: Not Applicable

Changes to Other: Not Applicable

Other (specify):

Style:	Cladding:	Roof Type:	Roof Material:
Other	None	None	None

Foundation:	Form/Type:
Concrete - Poured	Other

Narrative

Study Unit

Other

Transportation

Date of Construction:

1925 Built Date

1951 Remodel

Builder: Puget Sound Bridge & Dredging Co., Seattle

Engineer: M.M. Caldwell

Architect:

Property appears to meet criteria for the National Register of Historic Places: Yes

Property is located in a potential historic district (National and/or local): No

Property potentially contributes to a historic district (National and/or local): No

Statement of Significance: The Puyallup River/Meridian Street Bridge is currently the longest, simply supported, steel riveted Warren through truss span built prior to 1940 remaining on the Washington State highway system. The popularity of the Warren truss emerged in the late 1930s, and continued through the 1950s. Very few truss bridges were built on State-owned highways after 1960. Although a modest number of Warren trusses still remain on the system, the number has declined. Narrow bridges with restricted vertical clearance, such as through trusses, are routinely replaced by wider concrete bridges.

The Puyallup River/Meridian Street is also significant for its unusual, perhaps unique truss configuration. As a variation from the standard Warren truss' horizontal top chord, the bridge has a parabolic top chord allowing for a longer span length than possible with the standard top chord. The parabolic configuration also avoided the need for heavier, or additional, truss components to reach the entire span length. Its subdivided panels and the addition of longitudinal members at the mid-panel heights in five truss panels achieved both strength and economy of steel. Those highly unusual modifications to the original Warren truss appear strikingly similar to the so-called Turner truss, patented by Claude A.P. Turner in 1923. Turner wrote that "The type of truss is one originated by the writer to eliminate the multiplicity of nominal members" (Turner 1922:180). In his patent description, Turner wrote that one important element of his design were the longitudinal struts connected to diagonal web members "at a point substantially midlength thereof" and that "the framework thus formed by said struts is applied only to alternate panels. The arrangement . . . works out very economically of material in practice. By my invention a truss as provided that uses a minimum of material, it has great stiffness and it eliminates, or greatly reduces, secondary stresses" (Turner 1923). In her Historic American Engineering report for the Liberty Memorial Bridge in North Dakota, Nancy Ross writes: "The primary modification [to the Warren truss] is the reinforcing of alternate panels with a framework of steel struts. Intended to increase the overall rigidity of the truss web, the modification gives the trusses a distinctive appearance that differs considerably from the conventional Warren profile. In spite of the advantages of this novel variant of the Warren truss, the Liberty Memorial Bridge is the only example of the application of this design" (Ross 1991:11).

Ross' conclusion seems to be borne out by the Puyallup River/Meridian Street Bridge in that, although very similar to the design used for the Liberty Memorial Bridge, including longitudinal bracing in alternate panels, it is not a Turner truss. The primary difference between the two designs is that the only vertical struts in the Puyallup/Meridian Bridge are those adjacent to each portal, whereas vertical members connect the longitudinal substruts and diagonals to the bottom chords in every panel on the Liberty Memorial Bridge. In his comparison of the two bridges, retired WSDOT bridge engineer Robert Krier noted: "the absence of vertical members [on the Puyallup/Meridian Bridge] requires the diagonals of the Meridian Truss to act directly, in both compression and tension," whereas in the Liberty Memorial Bridge, the numerous verticals in the truss panels transfer some of the vertical loads indirectly into the diagonals. In addition the panel lengths are significantly different on the two bridges: 26.5 feet on the Puyallup/Meridian Bridge; 17 feet on the Liberty Memorial Bridge. Although not visibly apparent, the resulting structural requirements for the relative floor systems of the two bridges are considerably different. In order to have a more complete understanding of the load distribution of the truss members and thereby perform a structural comparison between the two bridges, it would be necessary to have the details of the sequence of the steel erection, roadway deck construction and release of falsework (Krier 2010).

When comparing the Puyallup River/Meridian Street Bridge with the Liberty Memorial Bridge in North Dakota, structures of similar design, it seems unavoidable to ask: In designing the Puyallup Bridge in 1924, did M.M. Caldwell use or borrow details from Claude A.P. Turner's truss design, patented in 1923? Given that Turner published an article about his design of the Liberty Memorial Bridge in the Engineering News-Record, the most popular nation-wide trade journal of the day, in February 1922, Caldwell probably knew of the design. The article included small drawings of the bridge's elevation and floor system, and a somewhat more detailed drawing of "SUBDIVIDED TRIANGULAR TRUSSES." Those, along with simple drawings and explanations included in the patent, published in January 1923, would have provided ample inspiration for an engineer to adapt the Turner truss details to design any long-span bridge. Turner in fact labeled his patent "LONG-SPAN BRIDGE," perhaps in case the design's applicability was unclear (Turner 1922 and 1923). However, it is questionable whether Caldwell actually would have considered it necessary to incorporate any of Turner's "Long-Span" structural features into the Puyallup Bridge, since its span of 371 feet is 105 feet shorter (22%, a significant structural difference) than Turner's bridge. Further, the subdivided Warren truss (developed in the late 1800s) and the Pennsylvania truss (developed by the Pennsylvania Railroad in 1875 with the polygonal top chord for use in long-span railroad bridges) provided Caldwell with sufficient structural features for utilization in his bridge if he so desired. As no evidence is known to exist that Caldwell either legally used the patent, or perhaps simply borrowed liberally from it without acknowledging the source, further research may reveal Caldwell's awareness of Turner's design. Regardless of his possible knowledge of Turner's truss, Caldwell's design is nevertheless another variation of a subdivided Warren through truss with its own characteristics perhaps unique to this structure.

Although it is not actually a Turner truss, the Puyallup River/Meridian Street Bridge is significant for its design, which is the only one of its kind in Washington, and may very well be unique in the US if not the world, although additional research would be needed to confirm that conclusion. Despite modest alterations over the years, and additions made for safety and structural improvement, the bridge retains integrity of design, materials and workmanship, and is thus eligible for inclusion in the NRHP under Criterion C.

Historical Background

M.M. Caldwell, as he signed his name to drawings and documents, and as his name appears on bronze plaques on the structure, designed the Puyallup River/Meridian Street Bridge. Maury M. Caldwell first appears in Seattle city directories in 1917 as simply "engineer." The next year he is identified as a clerk with the C.G. Huber Company, a Seattle firm then constructing a steel Petit truss bridge on the Cowlitz River in southwest Washington. By 1920 Caldwell had become "Chief Engineer" with the Union Bridge Company (Polks' 1916-1920). In that capacity he oversaw construction in 1921 of the James O'Farrell Bridge over the Carbon River in Pierce County, as well as construction of one mile of highway (presently SR 162) leading to the bridge (Clarke 1993:5; Hall 1994:303; Pierce County Public Works, Fairfax/O'Farrell/Carbon River Bridge file). By 1923 Caldwell was representing the Strauss Bascule Bridge Company of Chicago in promoting a movable bridge in Aberdeen, Washington (Pacific Builder and Engineer 1923:13). The company built the Wishkah River Bridge there the next year under Caldwell's direction (Lawrence 1993:3). By then he had become (in the city directory) a "consulting engineer," apparently no longer affiliated with the Union Bridge Company. Caldwell retained that status until 1942, when his name disappeared from the Seattle City directories (Polks' 1921-1942).

In November 1924 Pierce County applied for federal aid to build what was called a "Steel Highway Bridge Crossing Puyallup River Between Secs. 21 & 22, T20N, R4E." On the drawing submitted with the application, the bridge appears in elevation view to be the design used to build the bridge the next year. M.M. Caldwell's name does not appear on the drawing, however, the only signature being that of C.H. Votaw, the County Engineer. Clifford Votaw eventually supervised construction of the Puyallup River/Meridian Street Bridge, as well as the Hylebos Bridge in Tacoma, among many other Pierce County road and bridge projects (Bonney 1927:491). Undated drawings in the County's Public Works Office do, however, bear the designer's name "M.M. CALDWELL, CONSULTING ENGINEER."

In early February 1925 Pierce County awarded a construction contract for $77,200 to the Puget Sound Bridge & Dredging Company of Seattle. Nine other firms had submitted bids, ranging in cost estimates from $78,989 to $93,905 (Pierce County Public Works, Meridian Street Bridge file). In announcing the award, the Puyallup Valley Tribune noted that "The new road [Meridian Street] will considerably shorten, by the northern route, the distance to Tacoma, and will also bring the big [Puyallup Indian] Reservation district a mile closer to Puyallup" (2/7/1925:1; all following citations in this paragraph are from that newspaper, except where noted). Piling and falsework had been erected across the river by mid May when the same newspaper reported that construction was ahead of schedule on the bridge, but that Meridian Street "is not in condition, nor have any definite steps been taken toward improvement or paving" (5/16/1925:1 & 10). Concrete piers were "virtually" complete when 380 tons of steel from the Virginia Bridge and Iron Company in Roanoke, Virginia, arrived on site the next month (6/13/1925:1; Pierce County Public Works, Meridian Street Bridge file). On July 4th C.J. Flem, superintendent of construction for the Company, reported that riveters had started work on the steel in place across the river, and that the 5 ½ inch-thick concrete deck was "virtually completed" (7/4/1925:1). The bridge was finished in time for the opening of the Western Washington State Fair on 21 September 1925, but Meridian Street remained unpaved, due to refusal by the City Council to fund improvements (9/19/1925:1). Finally County Commissioner Henry Ball had the street "put in shape" for Fair traffic, despite the Council's recalcitrance (9/26/1925:1). In October, work commenced near the bridge on the pyramidal concrete and stone marker with bronze plaque commemorating the first road or Indian trail across the river at the site, the first school in the Puyallup Valley housed in the Indian War blockhouse that stood "Near the north approach," and the first telegraph line to reach the community (7/26/1925:1; 10/17/1925:1).

Description of Physical Appearance:

The Puyallup River/Meridian Street Bridge's main span is a 371-foot long steel riveted, subdivided Warren through truss. Unlike the standard Warren truss, this bridge has parabolic top chords and alternating diagonal truss members, longitudinal braces between diagonals in alternating panels, and vertical members adjacent to the portals. In 1991 the portal sway braces and interior panel sway bracing was modified to increase vertical clearance for over-sized traffic from 14 feet 7 inches to 18 feet 7 inches. Although the modifications were sensitive to the original truss configuration, retaining as much of the old bracing as possible, the truss appearance has changed somewhat when viewed from the roadway. Among the changes to the deck are the 21 inch-high metal thrie beams attached to the inside (traffic) side of the trusses, reducing the roadway width by 9 inches to 21 feet. The south approach to the truss consists of a 21-foot long precast, prestressed girder span and two 19-foot long timber trestle spans (which replaced earlier timber spans), all added in 1951. The north approach consists of two 19-foot long timber trestle spans, also dating to 1951, bringing the total length of the structure to 468 feet. The truss piers are founded on timber piles, while the approach piers rest on concrete spread footings. A five-foot wide timber sidewalk is attached to the east side of the bridge. A decorative, cross-hatched lattice steel rail is attached to the outer edge of the sidewalk along the full length of the truss span, providing both improved safety for pedestrians and a somewhat aesthetic appearance to the east elevation. The bridge originally carried a lane of traffic in each direction until 1971 when a concrete bridge was built immediately adjacent to the west truss to carry southbound traffic. The modern concrete bridge rises several feet above the roadway of the historic truss bridge, detracting considerably from the aesthetics of the older bridge.

Major Bibliographic References:

Bonney, W.P. History of Pierce County, Washington. Vol. 3. Chicago: Pioneer Historical Publishing Company, 1927.

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George, Oscar R. "Bob." Puyallup River Bridge 167/20E evaluation form. Category 2 Bridges Evaluation Project, WSDOT Environmental Services Office, Tumwater, 2007.

Hall, Nancy Irene. Carbon River Coal Country. Orting: Heritage Quest Press, 1994.

Hufstetler, Mark. Liberty Memorial/Missouri River Bridge 32BL114, North Dakota. National Register of Historic Places nomination. 1996.

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Lawrence, William Michael. Wishkah River Bridge, Aberdeen, Washington, Historic American Engineering Record, HAER No. WA-92. August 1993.

Luttrell, Charles T. Fort Malone Historical Marker historic property inventory form. On file, DAHP, Olympia. 2000.

_____. Puyallup River/Meridian Street Bridge historic property inventory form. On file, DAHP, Olympia. 2000.

Pierce County Public Works. Meridian Street Bridge and Fairfax/O'Farrell/Carbon River Bridge files. Tacoma.

Polks' Seattle City Directories. Chicago. 1916-1942.

Puyallup Valley Tribune, all 1925, all page 1: "Contract for North Meridian Street Bridge Let For $77,200," 2/7; "Work Progresses On New Bridge," 5/16; "Receive Steel For New Bridge," 6/13; "Bridge Will Be Completed Soon," 7/4; "Huge Span at Puyallup Opens Soon," 7/26; "Puyallup Bridge Near Completion," 8/9; "New Bridge To Be Open For Fair," 8/15; "Bridge Finished; Street Unpaved," 9/19; "Ball Continues To Aid In Improving Meridian," 9/26; "Work Commenced On Concrete Marker," 10/17.

Ross, Nancy. Liberty Memorial Bridge, North Dakota. Historic American Engineering Record report, HAER No. ND-7. May 1991

Soderberg, Lisa. Historic American Engineering Record inventory sheet for Category 2 Puyallup River/Meridian Street Bridge. On file, Department of Archaeology and Historic Preservation, Olympia, March 1979.

Turner, Claude A.P. "Open-Well Piers and Subdivided Warren Trusses of Bismarck-Mandan Bridge." Engineering News Record, Vol. 88, No. 5, 2 February 1922:180-83.

_____. Patent 1,441,387. United States Patent Office, Washington, D.C. Applied for 10 July 1913, renewed 21 January 1921, issued 9 January 1923.

WSDOT. Cardex and correspondence files. Bridge and Structures Office, Tumwater.

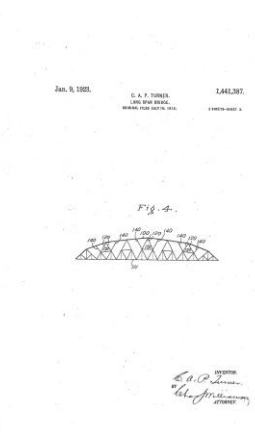
WSDOT. Plan drawings, inspection reports, etc. On line Bridge Engineering Information System (BEISt). Olympia.

Photos

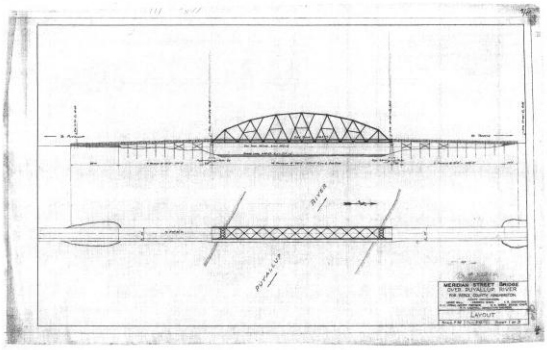
2011

Original portal braces prior to removal and replacement.
1947

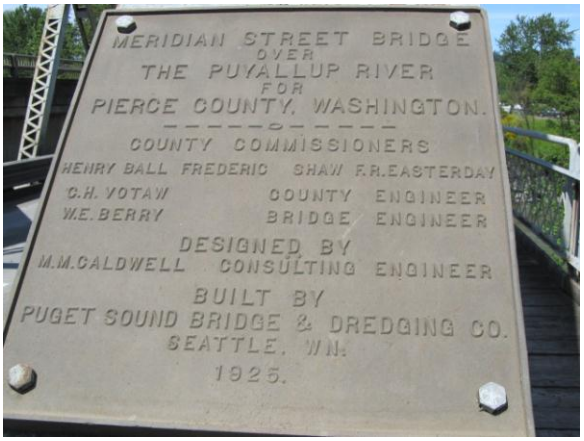
Deck view to north.
2011



C.A.P. Turner's 1923 patent for a "long-span" truss bridge.
1923



Meridian St. Bridge elevation drawing by M.M. Caldwell
2011



Plaque on bridge showing M.M. Caldwell, designer, and Puget Sound Bridge & Dredging Co., Seattle, builder.
2011

Replaced portal brace.
2011

Newer bridge (#167/20W, foreground) and older (1925) bridge to northeast.
2011

Sidewalk on east side.
2011

Subdeck to north.
2011

Jan. 9, 1923.

1,441,387.

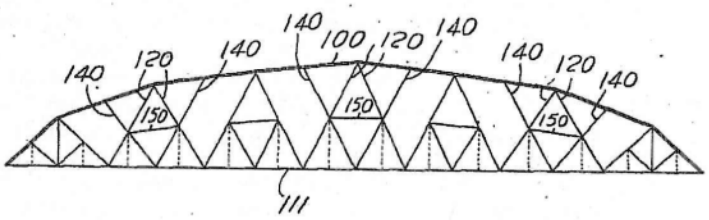
C. A. P. TURNER.

LONG SPAN BRIDGE.

ORIGINAL FILED JULY 10, 1913.

3 SHEETS—SHEET 3.

Fig. 4.

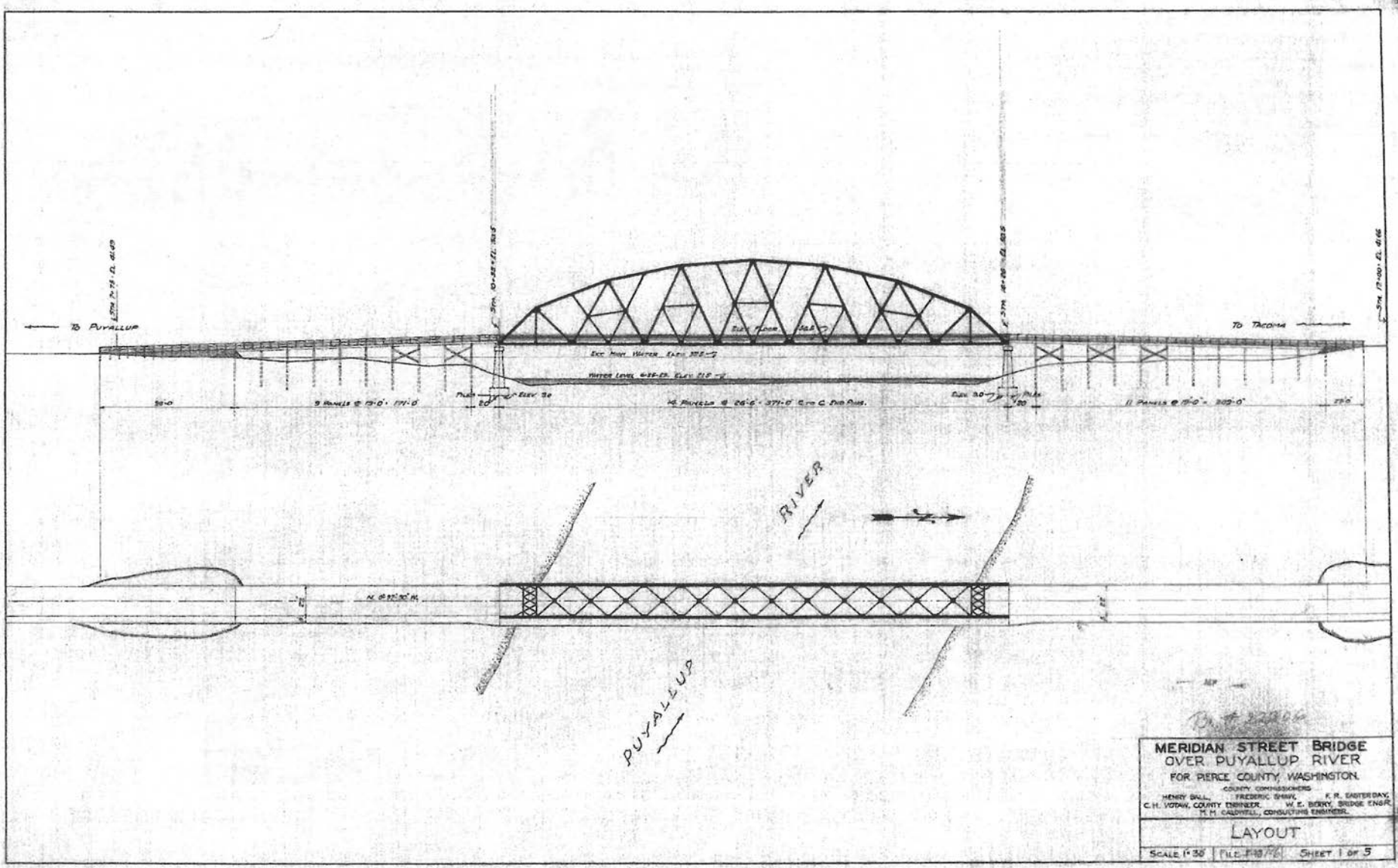


INVENTOR.

C. A. P. Turner.

BY Edward J. Williamson

ATTORNEY.



MERIDIAN STREET BRIDGE
OVER PUYALLUP RIVER
FOR PIERCE COUNTY, WASHINGTON.

COUNTY COMMISSIONERS
HENRY BALL, FREDERIC SHAW, F. R. EASTERDAY.
C. H. VOTAW, COUNTY ENGINEER. W. E. BERRY, BRIDGE ENGR.
H. M. CALDWELL, CONSULTING ENGINEER.

LAYOUT

SCALE 1"=30' | FILE F-18/16 | SHEET 1 OF 5