# Built Environment Survey of the Historical Luten Arch Bridges of Whitman County, Washington

AHA!

AHA! Project 2018-003

November 20, 2018

# Built Environment Survey of the Historical Luten Arch Bridges of Whitman County, Washington

By:

Ann Sharley, M.A., Principal Investigator, and Fran Hamilton, M.A.

Prepared for:

Whitman County Public Works
310 N. Main Street
Colfax, Washington 99111

AHA! Project 2018-003

Architectural History & Archaeology! LLC
109 S. Holiday Road
Spokane Valley, Washington 99016

November 20, 2018

# CULTURAL RESOURCES REPORT COVER SHEET

Authors: Ann Sharley and Fran Hamilton

Title of Report: Built Environment Survey of the Historical Luten Arch Bridges of Whitman County, Washington

Date of Report: November 20, 2018

County: Whitman Acres: 17

| | | | |
|---|---|---|---|
| Section: 29 | Township: 20 North | Range: 42 East | USGS 7.5' Quad: Pine City |
| Section: 24 | Township: 20 North | Range: 45 East | USGS 7.5' Quad: Tekoa |
| Section: 14 | Township: 19 North | Range: 45 East | USGS 7.5' Quad: Tekoa |
| Section: 7 | Township: 16 North | Range: 43 East | USGS 7.5' Quad: Diamond |
| Section: 28 | Township: 14 North | Range: 45 East | USGS 7.5' Quad: Pullman |
| Section: 26 | Township: 13 North | Range: 45 East | USGS 7.5' Quad: Uniontown |
| Section: 34 | Township: 13 North | Range: 45 East | USGS 7.5' Quad: Colton |
| Section: 6 | Township: 18 North | Range: 46 East | USGS 7.5' Quad: Farmington |
| Section: 11 | Township: 16 North | Range: 43 East | USGS 7.5' Quad: Colfax North |
| Section: 29 | Township: 14 North | Range: 45 East | USGS 7.5' Quad: Pullman |
| Section: 4 | Township: 14 North | Range: 45 East | USGS 7.5' Quad: Pullman |
| Section: 31 | Township: 15 North | Range: 46 East | USGS 7.5' Quad: Moscow West |
| Section: 18 | Township: 12 North | Range: 46 East | USGS 7.5' Quad: Uniontown |
| Section: 28 | Township: 19 North | Range: 41 East | USGS 7.5' Quad: Ewan |
| Section: 24 | Township: 19 North | Range: 44 East | USGS 7.5' Quad: Garfield |
| Section: 34 | Township: 16 North | Range: 42 East | USGS 7.5' Quad: Little Penawawa Creek |

PDF of report submitted (REQUIRED) ☒ Yes

Historic Property Inventory Form(s) to be Approved Online? ☒ Yes ☐ No

Archaeological Site(s)/Isolate(s) Found or Amended? ☐ Yes ☐ No ☒ N/A

TCP(s) found? ☐ Yes ☒ No

Replace a draft? ☐ Yes ☒ No

Satisfy a DAHP Archaeological Excavation Permit requirement? ☐ Yes # ☒ No

DAHP Archaeological Site #: N/A

## ABSTRACT

Whitman County Public Works, in compliance with requirements detailed in a May 2017 Memorandum of Agreement (MOA) between the U.S. Army Corps of Engineers and the Washington State Historic Preservation Officer, contracted with Architectural History & Archaeology! LLC (AHA!) for survey and inventory of historical Luten arch bridges in Whitman County; development of a historic context document for earth-filled concrete arch bridges, including Luten arch structures; and support functions during development of a public presentation. The MOA formalizes mitigation for loss of the Edmondson Bridge No. 9060-4.21, a Luten arch bridge near Pullman determined eligible for listing in the National Register of Historic Places. The Edmondson Bridge project was subject to the National Historic Preservation Act of 1966, as amended, (NHPA) because of required U.S. Army Corps of Engineers (USACE) permitting, and due to federal USACE oversight the present phase of the project is also subject to the NHPA. AHA! completed fieldwork and research for the present project in the summer and fall of 2018. Seventeen extant Luten arch bridges were identified in Whitman County, 16 of which were recorded at the intensive survey level. Access to one privately owned bridge was denied, and the structure was recorded at the reconnaissance level from the nearby highway right-of-way. Of the 16 bridges recorded at the intensive level, 12 are recommended individually eligible for listing in the National Register of Historic Places (NRHP) under Criterion A at the state or local level, for their contributions to the development of regional road and highway systems, and under Criterion C at the state level, for their association with Daniel B. Luten's pioneering efforts in reinforced concrete bridge construction and as examples of Luten's distinctive filled spandrel deck arch designs.

***Cover Photograph: Colton Bridge No. 37 (Field Number WCLB-7) in the Town of Colton; view to the southwest (photograph courtesy of Whitman County Public Works).***

## ACKNOWLEDGEMENTS

Architectural History & Archaeology! LLC (AHA!) would like to thank the following individuals and organizations for assistance with this project. Special thanks are due Whitman County Public Works staff members for providing historical information, locational data, and many photographs.

Marc La Vanway, Staff Engineer, Whitman County Public Works
Dan Hall, Right-of-Way Agent, Whitman County Public Works
W. Mark Storey, P.E., Director / County Engineer, Whitman County Public Works
Bob Sevedge, Bridge Supervisor, Whitman County Public Works
Historic Bridge Foundation
City of Colfax
Town of Farmington
Plant Materials Center, Natural Resources Conservation Service
Whitman County Heritage, a project of the Whitman County Rural Library District
Washington State University Manuscripts, Archives, & Special Collections, Libraries Digital Collections
Washington State Historical Society
Northwest Museum of Arts & Culture, Joel E. Ferris Research Archives
Whitman County Assessor
Washington State Department of Transportation Library Digital Collections
National Register of Historic Places
University of Michigan Digital Collections
Purdue University Archives and Special Collections and Libraries E-Archives
Mark Bozanich, Highways of Washington State website
State of Washington Department of Archaeology and Historic Preservation, Olympia
Library of Congress, Chronicling America: Historic American Newspapers
Newspapers.com
HistoricBridges.org
FindAGrave.com
Bridgehunter.com
Douglas H. and Susan Ashburn, private landowners
William and Kristine Foreyt, private landowners
Hozim Ranch, Inc., private landowner
Cathy J. Tucker Living Trust, private landowner

## TABLE OF CONTENTS

## LIST OF FIGURES



## LIST OF TABLES

# INTRODUCTION

Whitman County Public Works, in compliance with federal and state agency directives, contracted with Architectural History & Archaeology! LLC for built environment survey of historical Luten arch bridges in Whitman County. This report provides a summary of the project, including descriptions of the methodology, results, and historic preservation recommendations.

## Project Background and Description

Whitman County Public Works, in compliance with requirements detailed in a May 2017 Memorandum of Agreement (MOA) between the U.S. Army Corps of Engineers and the Washington State Historic Preservation Officer, contracted for (1) survey and inventory of historical Luten arch bridges in Whitman County, (2) development of a historic context document for earth-filled concrete arch bridges, including Luten arch structures, and (3) support functions during development of a public presentation (Figure 1).

This project is being conducted as mitigation for loss of the Edmondson Bridge No. 9060-4.21, a Luten arch bridge near Pullman determined eligible for listing in the National Register of Historic Places. The Edmondson Bridge project was subject to the National Historic Preservation Act of 1966, as amended (NHPA) (36CFR800.1, 36CFR800.16), because of required U.S. Army Corps of Engineers (USACE) permitting.

Due to federal USACE oversight, the present phase of the project is also subject to Section 106 of the National Historic Preservation Act of 1966, as amended. According to the NHPA, historic properties – that is, properties listed in or eligible for listing in the National Register of Historic Places (NRHP) – may include buildings or structures, objects, archaeological sites, or places of traditional cultural value that possess an adequate degree of physical integrity, are generally 50 or more years of age, and meet at least one of four criteria of historical significance (National Park Service 1997:2). These criteria designate as significant those resources:

Criterion A. That are associated with events that have made a significant contribution to the broad patterns of our history; or

Criterion B. That are associated with the lives of persons significant in our past; or

Criterion C. That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

Criterion D. That have yielded, or may be likely to yield, information important in prehistory or history.

In compliance with this legislation and the MOA, Whitman County Public Works contracted with Architectural History & Archaeology! LLC (AHA!) of Spokane Valley for the requested built environment investigations. All project tasks were conducted by the Principal Investigator, Ann Sharley, M.A., AHA! Senior Architectural Historian, with assistance from Fran Hamilton, M.A., AHA! Senior Archaeologist. Ms. Sharley meets and exceeds the Secretary of the Interior's Professional Qualifications Standards for Architectural History as detailed in 36 CFR 61, and both Sharley and Hamilton are AHA! Principals.

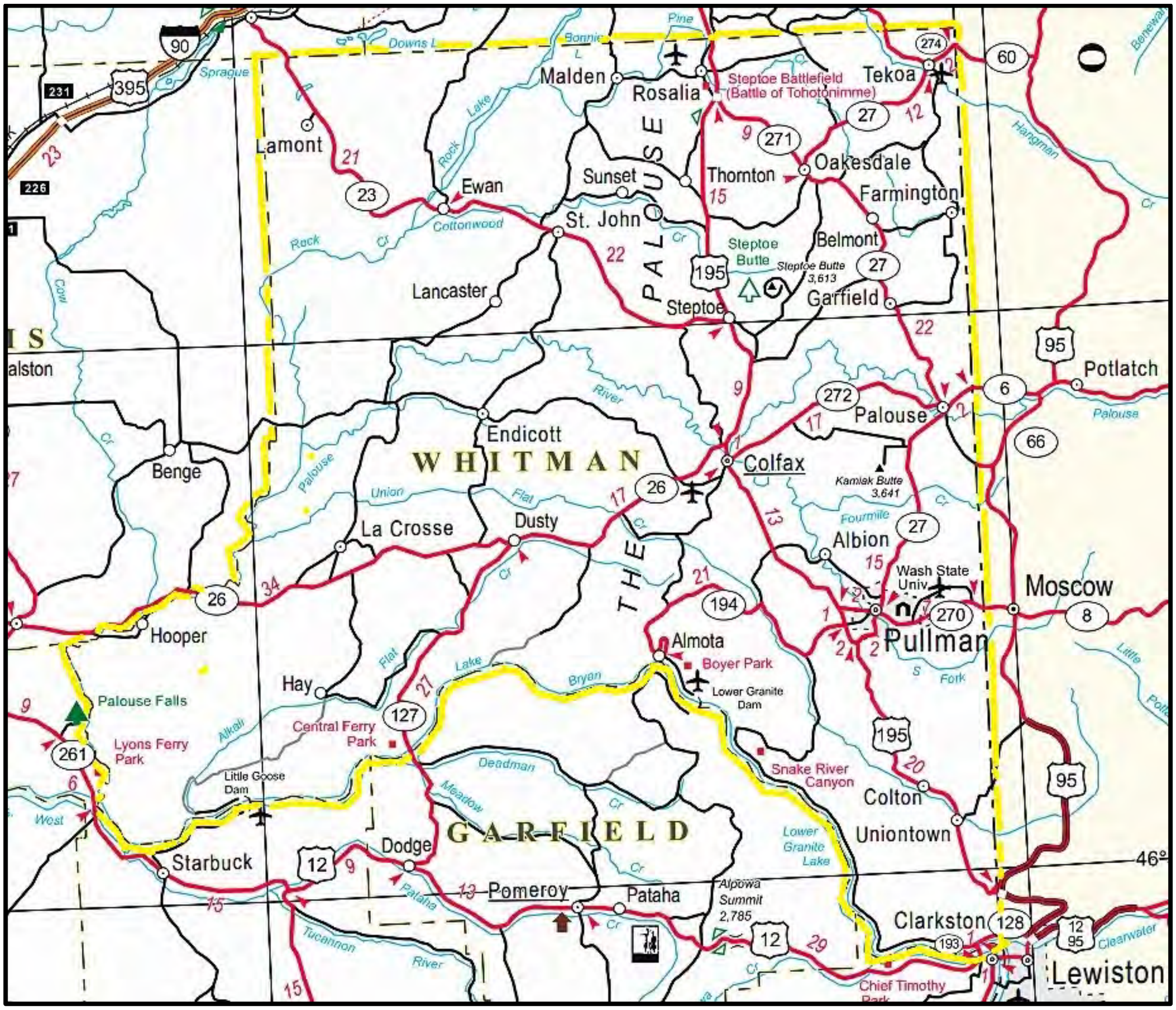



*Figure 1. Whitman County, Washington (adapted from Washington State Department of Transportation [WSDOT] 2014).*

## RESEARCH DESIGN

Standard architectural history methods, adapted to the project objectives and conditions, were utilized in completing this intensive level built environment survey, a level of survey defined in the Washington Department of Archaeology and Historic Preservation's (DAHP's) 2018 "Washington State Standards for Cultural Resource Reporting" (DAHP 2018).

### Objectives

As previously noted, the inventory of Luten arch bridges in Whitman County was conducted at the USACE and DAHP's direction to provide compliance with Section 106 of the NHPA. The intent of the project was to identify all extant Luten arch bridges in Whitman County, provide architectural descriptions of the subject bridges, establish a historic context within which the historical significance of the identified bridges can be assessed, and share the project findings with the public.

***Figure 2. Sanders Bridge (Field Number WCLB-17), north side of west arch; view to the southeast.***

### Methodology

On April 4, 2018, prior to the fieldwork, AHA! Architectural Historian Ann Sharley met with the Whitman County Public Works Director/County Engineer Mark Storey and key Public Works staff members – Marc La Vanway, Staff Engineer; Dan Hall, Right-of-Way Agent; and Bob Sevedge, Bridge Supervisor – to discuss the project. The county provided a list of 17 extant Luten arch bridges – a list believed to be exhaustive – as well as maps of the bridge locations and ownership information. Dan Hall later provided historical maps, available engineering plans, and other information for the 17 bridges, records archived in the Whitman County Public Works vault. Whitman County took photographs of many of the bridges early in the season with a drone-mounted camera and made these photographs available to AHA! personnel.

AHA! subsequently reviewed the DAHP's Washington Information System for Architectural and Archaeological Records Data (WISAARD) database to check for previous built environment surveys of the

17 identified Luten arch bridges, as well as to search for additional bridges of the type in the county. Additional sources were inspected in an attempt to ensure a comprehensive list of extant Luten bridges, including the Washington State Department of Transportation Library Digital Collections, National Register of Historic Places, Historic Bridge Foundation, HistoricBridges.org, and Bridgehunter.com.

Research to locate information about Daniel B. Luten included searches of the Library of Congress Chronicling America Historic American Newspapers database, Google News Archive, Newspapers.com, University of Michigan Digital Collections, the Purdue University Archives and Special Collections and Libraries E-Archives, FindAGrave.com, and general on-line searches.

Owners of private land with known Luten arch bridges were contacted through letters dated July 11 or 12, 2018, to request access permission, while municipal and federal agencies owning or potentially owning Luten bridges – City of Colfax, Town of Farmington, Town of Colton, City of Pullman, and the Natural Resources Conservation Service – were contacted by email on July 26, 2018, to inquire about additional historical information. Ownership of two bridges was subsequently confirmed at the Whitman County Assessor's office.

Searches for historical photographs, maps, and other information included online visits to the Whitman County Library Rural Heritage Collection, Washington State University Libraries Digital Collections, Washington State Historical Society, Northwest Museum of Arts & Culture Joel E. Ferris Research Archives, Washington State Department of Transportation Library Digital Collections, Whitman County Historical Society, Angelfire Highways of Washington website, Washington State University's "Early Washington Maps: A Digital Collection", Historic Map Works collection, and the USGS Store historical map collection, as well as examination of various Whitman County historical references and other online searches.

AHA! Architectural Historian Ann Sharley completed the project fieldwork on April 4, 6, 9, and 10, July 10, 19, 21, 22, 30 and 31, and August 1, 2, and 17. Ms. Sharley recorded the bridges with high resolution digital photographs, GPS coordinates, and detailed field notes. Access to one privately owned property, Rhodes Bridge (Field Number WCLB-15), was refused, and photographs of the property were taken from the State Route 23 right-of-way.

Following the fieldwork, the Architectural Historian completed an intensive level Washington Historic Property Inventory (HPI) form each recorded bridge. These forms, completed in the WISAARD database, included, as available, architectural descriptions, construction dates, map locations, photographs, National Register of Historic Places eligibility recommendations, and other required information. If an HPI form had previously been completed for a property, the form was updated during the present project to the intensive survey level. HPI forms were completed following guidelines in DAHP's "Washington State Standards for Cultural Resource Reporting" (DAHP 2018) and, as appropriate, "Washington's Statewide Historic Property Inventory Guide and Database User Manual" (DAHP 2005). This survey report was also completed, and the required historical context information was researched and added. Following client review and approval, the survey report and HPI forms were submitted electronically to DAHP through the WISAARD database.

### Expectations

Whitman County Public Works provided AHA! with a list of 17 extant Luten arch bridges within Whitman County, a list they believed to be exhaustive; during the project an effort was made to find additional examples of Luten arch bridges within the county. Since Daniel B. Luten was a widely acclaimed bridge engineer, information regarding his life and career was expected to be available.

## HISTORIC CONTEXT

The following sections provide historic background information for this study of Whitman County's earth-filled concrete arch bridges, including the history of Euro-American settlement in the region, the coming of the automobile and the Good Roads Movement, and technological advances related to bridge construction.

## Euro-American Settlement of Whitman County

Initially most Euro-American immigrants to the Pacific Northwest settled south of the Columbia River in present-day Oregon, but by the 1850s nearly all arable land in that area had been claimed. In 1856, in response to new settlers' demands for land, Washington Territorial Governor Isaac Stevens convened a council in Walla Walla for the express purpose of extinguishing Native American title to lands in eastern Washington. Under pressure, Native people in attendance signed the treaties, ceding approximately half of eastern Washington to the federal government in exchange for reservations and other considerations (Hunn 1990:45-46; Hussey 1994:10; Royce 1899:804, 805, Pl. CLXVII; Stevens and Scott 1996:34). A period of unrest followed the signing of the treaties, the Indian Wars of 1855-1858, and a military order left eastern Washington officially closed to further Euro-American settlement (Beckham 1998:155).

When the closure was lifted in 1859, ranchers immediately moved into the bunchgrass rangelands of eastern Washington and farmers sought out fertile valley bottoms. Large numbers of early settlers entered the Walla Walla valley, attracted by the region's rich farmlands, as well as the military protection afforded by Fort Walla Walla, and the town of Walla Walla burgeoned into a regional supply and transportation center (Beckham 1998:155; Gilbert 1882:305; Hussey 1994:65-69, 73).

Within a decade most farmland in the Walla Walla area had been taken and Euro-American settlement expanded northward into the Palouse country, a region of bunchgrass-covered hills, part of which would be designated eastern Whitman County in 1871 (Gilbert 1882:434). In 1869 several families selected farms along Union Flat Creek, becoming the first permanent Euro-American settlers in the area (Gilbert 1882:433; Meinig 1968:243, 245). The following year James A. Perkins arrived at the forks of the Palouse River, the future site of Colfax, where he and various associates built a cabin and established a small sawmill (Figure 3). Availability of lumber attracted more settlers and entrepreneurs to the area and the community of Belleville – probably named for Perkins' hometown of Belle Plains, Illinois – developed near the mill. The new town was platted in 1872 and renamed Colfax in honor of Schuyler Colfax, then vice-president of the United States (Erickson 1981:37, 226; Gilbert 1882:433, 439; LaFollette ca. 1956:2; Meany 1923:52; Swanson 1958:13).

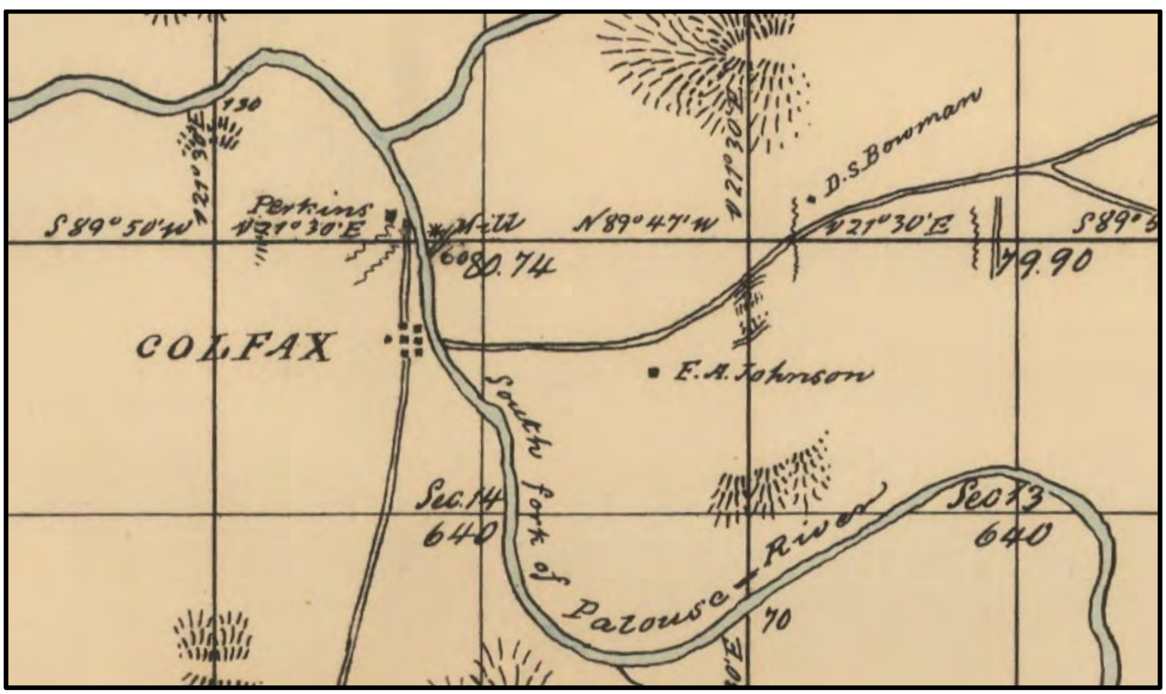



***Figure 3. Colfax vicinity in 1872 as shown on the General Land Office official plat. Note the town of Colfax in the northwest quarter of Section 14, with the Perkins residence and mill just to the north (General Land Office [GLO] 1873).***

The first settlers in the Palouse region selected homes along streams where water and wood were plentiful. These low-lying areas were perceived as good farmland, while the surrounding bunchgrass-covered hills were viewed as rangeland, suitable only for livestock grazing. As the more desirable valley bottoms were claimed, new settlers were forced to take land in the hills. Much to the immigrants' astonishment the hill country proved to be even richer farmland than the valleys and, by the late 1870s, native bunchgrass was accepted as an indicator of rich wheat lands (Figure 4) (Meinig 1968:246, 264, 265; Prevost 1985:8, 11, 12).

***Figure 4. Wheat harvest in the Palouse country, ca. 1906 (post card courtesy of Ann Sharley collection).***

Limited transportation into the region during this period, however, restricted both settlement and commercial enterprise. Roads were essentially nonexistent, forcing residents to follow Indian trails or simply drive across the bunchgrass-covered hills. No railroads had yet been built and the only navigable waterway was the Snake River, running along the southern boundary of the county, a grueling distance from most settlers' homes (Gilbert 1882:432; Lever 1901:117).

The situation improved in the 1870s when the Washington territorial legislature, lobbied by regional promoter Anderson Cox, approved a territorial road from Walla Walla to Colville, via Colfax and Spokane. Although legislative approval was necessary for such an endeavor, no territorial funding was available for construction. The road was surveyed in 1872 and subsequently constructed through the region, entirely financed by county and local sources. County commissioners of the day were authorized to assess road work on men living along the route, residents who were required to either complete the designated number of workdays themselves or pay other men to complete the work (Freeman 1954:128; Gilbert 1882:433; Lever 1901:117; Kingston 1981:253-256; LaFollette ca. 1956:3). Other roads developed in the county during this period and, by 1889 when Washington achieved statehood, a generally unplanned road system connected the various farms and towns (Lever 1901:112, 117).

Railroads arrived in Whitman County during the late nineteenth and early twentieth centuries, connecting towns with national population centers and facilitating large-scale market production of local wheat and other agricultural products. The first railroad, the Columbia and Palouse line, was constructed in 1883 and 1884 by Oregon Railway and Navigation Company interests, connecting the town of Connell with Moscow, Idaho, via Colfax, and Colfax with Farmington (Cheever 1949:117; Lever 1901:111, 116). Additional railroads were built over the next three decades, and by 1910 rail lines owned or operated by the Chicago, Milwaukee and Puget Sound Railway Company; Spokane and Inland Empire [electric] Railroad Company; Washington, Idaho and Montana Railway Company; Oregon Railroad and Navigation Company; Northern Pacific Railway Company; and Camas Prairie Railroad Company crisscrossed the county (Figure 5) (Carter 2009:24-31; Cheever 1949; Railroad Commission of Washington 1910; West 1974).

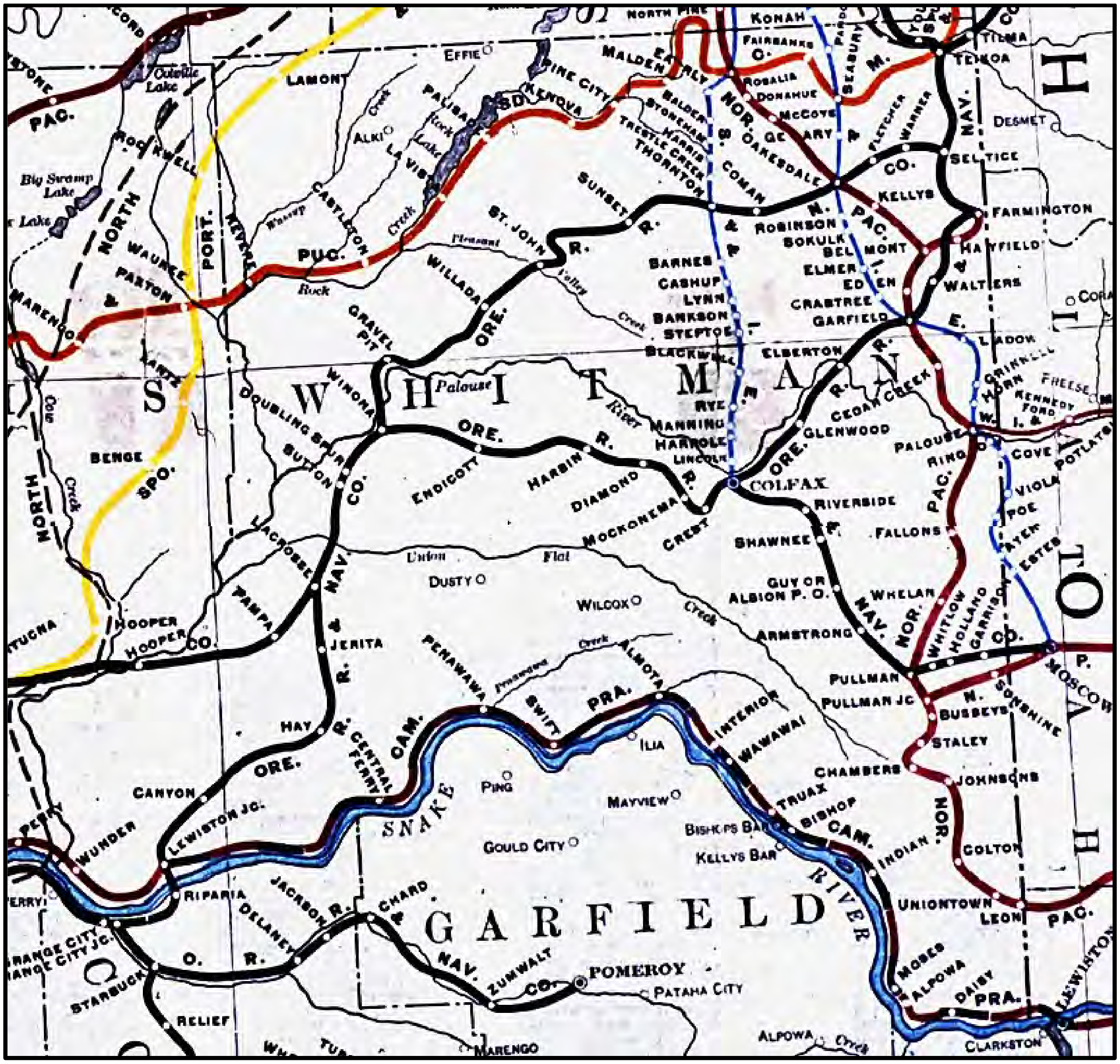



*Figure 5. Whitman County and surrounding areas in 1910 showing rail lines and communities (Railroad Commission of Washington 1910).*

A number of small communities and towns became established throughout the county during the early settlement period, each serving as a commercial center or shipping point for the surrounding farms. Towns predating arrival of the railroad included Colfax, which was officially designated the county seat in 1872; Palouse City (present Palouse), platted in 1875; Farmington, platted in 1877; Almota, a Snake River port platted in 1877; Penawawa, the territorial road's Snake River ferry crossing, platted in 1877; and the smaller communities of Onecho, Lincoln, Clinton, Pullman, Uniontown, Garfield, Texas Ferry, and Wawawa (Gilbert 1882:434-435, 443-447). Later communities, most established as railroad stations or sidings, include

Tekoa, Kenova, Seltice, Mockonema, Staley, Colton, Whitlow, Garrison, St. John, and Oakesdale (Railroad Commission of Washington 1910). While many of these locations were destined to decline or disappear as settlement and transportation patterns changed, award of the state agricultural college to Pullman in 1891 and designation of Colfax as the county seat ensured continued growth and prosperity for those towns (Lever 1901:118-119; Meany 1923:52).

Life in turn-of-the-century Whitman County revolved around the railroads. The appearance, in 1900, of an automobile in Colfax – a wagon-like vehicle capable of 12 mile per hour speeds – presaged a new era, but no one at the time could have comprehended the changes that were coming (Dougherty 2006).

**Automobiles and the Good Roads Movement**

In the 1870s bicycling achieved fad status among wealthy Europeans and Americans, popular as a healthy diversion as well as a mark of status. Subsequent decades saw these influential cyclists bond into groups to lobby for better roads on which to pursue their new sport (Meeks 2000:5, 6; Reid 2015:1-3).

Most American roads of the era were unsurfaced, often resulting in impassable rutted quagmires during the wet seasons and deep choking dust during the dry seasons. Roads paved with cobblestones, bricks, or wood blocks were generally found only in cities, although by 1907 only 40 percent of streets in cities of more than 30,000 people were paved. Suburban roads, if surfaced at all, were generally improved with macadam – randomly placed broken stones covered with crushed rock and compacted with a roller (Meeks 2000:5, 6).

The League of American Wheelmen, founded in 1880 by well-to-do bicycle enthusiasts, began to pressure officials at all levels of government for improved roads and to publicize their cause through magazine and newspaper articles. The group urged states to establish highway departments and to provide funding and oversight for city and county road projects. At the federal level the cyclists lobbied for a National Highway Commission. The average citizen, though, particularly in rural areas, felt little sympathy for these rich cyclists and their seemingly useless sport. Furthermore, rural residents feared they would be conscripted to work on the roads, a common county practice during the era (Meeks 2000:6, 7; Reid 2015:5).

In 1893, based largely on the League of American Wheelmen's efforts, the federal Agricultural Appropriations Act passed with a $10,000 appropriation for research on road construction and maintenance, as well as for dissemination of the research results. This legislation created the federal Office of Road Inquiry (ORI), forerunner of the present U.S. Department of Transportation. Numerous private Good Roads associations were also founded during this period and, by 1900, over 100 existed throughout the United States (Meeks 2000:6, 7).

In the mid-1890s the bicycle craze waned as bicycles became more affordable and began to be seen as a poor man's transportation. As bicycling became commonplace, many wealthy cyclists moved on to the next vehicular innovation, the automobile. The move from recreational bicycling to recreational driving was probably seen as a natural progression, as many of the first automobiles were developed and manufactured in bicycle shops using primarily bicycle parts (Meeks 2000:6; Reid 2015:3, 189-191).

The cyclists-turned-motorists and other new drivers continued to press for improved road conditions through Good Roads associations and other lobbying efforts. "Good Roads Trains" brought on-the-ground road construction demonstrations to all parts of the country, particularly to rural areas, with the support of railway companies that stood to benefit from improved farm to market roads. Automobile ownership increased exponentially as vehicle reliability improved and prices plummeted, and the Good Roads lobby became an even more powerful entity. Rural residents also began to support the movement as they experienced the benefits of Rural Free Delivery (RFD) mail service and observed automobile owners in their own communities (Meeks 2000:8-10).

The Good Roads lobby achieved a major milestone in 1916 with passage of the Federal Aid Road Act, legislation that would have far-reaching effects on the entire nation. This Act, which offered $75 million in matching grants for the 1916 through 1921 period, required each state to have a highway department through which federal funding could be channeled, mandated Secretary of Agriculture approval for federally funded projects, and capped federal expenditures at $10,000 per road mile except where bridges were involved. Although the legislation proved controversial in certain areas, it established an important precedent for federal funding of American roads (Meeks 2000:64).

***Figure 6. Unsurfaced roads in April 1916 between Colfax and Pullman (L99-22.1080, Northwest Museum of Arts & Culture/Eastern Washington State Historical Society, Thomas H. Elsom photographer).***

During World War I, existing railroads were shown incapable of transporting the large volumes of needed war supplies and, when trucks were used to supplement the system, the deplorable condition of the nation's highways became even more evident. Following the war, when the 1916 Act expired, it was replaced with similar legislation, the Federal Highway Act of 1921 (Meeks 2000:65, 67).

In 1896, a diverse group of Washingtonians, including bicyclists, businessmen, and farmers, met in Seattle to launch a state Good Roads movement, intent on lobbying the State of Washington for a state highway department. Three years later, in 1899, the group met in Spokane where they formally chartered the Washington Good Roads Association (Crowley et al. 2005:18, 19).

The first automobiles arrived in Washington – in Seattle, Spokane, and Colfax – in 1900, and motorists were soon added to the Good Roads supporters. By 1906 the number of automobiles registered in the state had grown to 763 and, by 1910, to more than 9,000 (Clarke 2000:33; Crowley et al. 2005:20; Dougherty 2006; Holstine and Hobbs 2005:36).

In 1903 the Washington Good Roads Association successfully lobbied the legislature for passage of a bill creating a state highway board, with funding to hire a state highway commissioner and $100,000 for improvement of ten roads within the state. The governor, however, vetoed the bill, citing lack of available funding. The Good Roads supporters continued their efforts and, two years later, in 1905, the veto was overturned, formally creating the Washington Highway Department and a state highway fund. Both were to be overseen by a state highway board composed of a state highway commissioner, to be appointed by the governor, the state auditor, and the state treasurer. During the first highway board meeting in April 2005, funding was allocated for 12 State Roads, including routes on both sides of the Cascade Mountains (Crowley et al. 2005:20, 21; Washington Department of Highways [WDH] ca. 1946:1).

Despite the availability of funding, little road construction occurred during the Washington Highway Department's first two years, primarily due to resistance from county officials who resented the highway board's involvement in local affairs. Subsequent legislative sessions attempted to rectify this situation by reassigning key parts of the construction contracting process to either the state or the counties (Crowley et al. 2005:22; WDH ca. 1946:2).

The 1907 state legislature approved matching grants for State Aid Roads, to be constructed by counties along major travel routes, and full state funding was again made available for work on the 13 designated State Roads passing through thinly populated or mountainous areas of the state. In 1909 the legislature designated five additional State Roads and, for the first time, earmarked a $10,000 appropriation for maintenance of these routes. The 1911 legislature replaced the State Aid Law with the Permanent Highway Act, legislation which also provided funding for highways along main travel routes. Unlike State Aid Roads, however, Permanent Highways were required to be at least 16 feet wide, surfaced with macadam, stone, gravel or other durable materials, and could not climb at more than a ten percent grade (WDH ca. 1946:2-5).

***Figure 7. Spring road conditions near Wilcox, Whitman County, ca. 1930 (photograph courtesy of the private collection of Cheryl and Tom Kammerzell and the Whitman County Library Rural Heritage collection, WCLRW220-003, http://www.washingtonruralheritage.org/cdm/singleitem/collection/whitman/id/3541/rec/1).***

The 1913 Washington legislature instituted a new system for designating major roads: Primary Roads were identified by name and Secondary Roads were given State Road numbers. The Inland Empire Highway was authorized in this legislation as one of the state's seven Primary Roads, a circuitous route through eastern Washington connecting Virden, northeast of Cle Elum, with Laurier in Ferry County, via Ellensburg, Yakima, Pasco, Walla Walla, Spokane, and Colville. In the Whitman County area the road split into two routes, the main highway passing through Colfax and Steptoe and the eastern segment or Eastern Division accessing Clarkston, Uniontown, Pullman, Palouse, and Oakesdale before rejoining the main highway just south of Rosalia. Construction on the highway, which was cobbled together from existing and new road segments, began immediately and continued for a number of years. In 1923 the state's system for designating state highways again changed and the main route of the Inland Empire Highway became State Road No. 3, while the eastern Whitman County segment remained unnumbered (Bozanich 2018; Kershner 2013; WDH ca. 1946:7).

Less than two months after the 1916 Federal Aid Road Act was signed into law, Washington's state highway commissioner submitted the required applications for the Federal Aid grants. Early the following year, Washington State received its first grant, which it used to pave 3.5 miles of the Pacific Highway near Olympia. Additional Federal Aid grant money, received before the nation's April 1917 entry into World War I slowed domestic road construction efforts, allowed completion of 14 post road projects and several forest roads within the state (Crowley et al. 2005:31; WDH ca. 1946:8).

Following the close of World War I in November 1918, the U.S. government again made federal aid matching funds available to the states for highway construction. Using this funding, the Washington Department of Highways initiated the largest highway construction effort in its history, construction on such a scale that sufficient labor was sometimes unavailable (WDH ca. 1946:10). Many of these routes required bridges and, in 1920, the Washington State Department of Highways created a bridge division to "design all bridges according to the best modern practice" (Holstine and Hobbs 2005:38).

**Bridges in the Late 19th and Early 20$^{th}$ Centuries**

Long-distance transportation in the late nineteenth and early twentieth centuries was by rail, and trains required bridges that could span long distances and withstand heavy loads. Steel, a material strong in both compression and tension, performed admirably, and steel trusses became the structures of choice for most railroad bridges (Holstine and Hobbs 2005:6, 7; Kemp 1989:6, 9; Smith et al. 1989:19-29; Tyrrell 1911:171-194).

Although metal truss highway bridges were also built during this era, such structures came to be seen as aesthetically inferior, particularly in the years following the 1893 World Columbian Exposition in Chicago. This popular exhibition extolled the benefits of urban parks, boulevards, classical architecture, and pleasant views, and the concepts took hold as the nationwide City Beautiful movement (Cooper 1997:3, 17). Arched bridges, with their graceful curves and potential for embellishment, were perceived by City Beautiful advocates as much preferable to the "ugly" metal trusses, an idea that influenced bridge selection and design for several decades (Cooper 1997:17-20).

Stone arch bridges had been built in the United States since the nation's earliest years, but by the late nineteenth century a less labor-intensive method of construction was needed. Engineers of the period began to experiment with concrete, an "artificial stone" construction material first used by the ancient Romans and rediscovered by Europeans and Americans in the eighteenth and nineteenth centuries (Cooper 1997:9; Plowden 1974:297). Although builders initially relied on naturally occurring cement deposits, experiments with concrete construction became widespread following the invention of artificial cement by English inventor Joseph Aspdin in 1824 and by an American, David O. Saylor, in 1871. Both men patented their discoveries, and Saylor proceeded to set up the first commercial cement manufacturing plant in the United States at Copely, Pennsylvania (Plowden 1974:297).

Concrete is a mixture of cement, water, and aggregate, combined in proper proportions, and like stone is strong in compression but weak in tension. The first concrete bridges were unreinforced arch structures and, like stone arch bridges, the arch carried the compressive forces generated by the weight of passing traffic as well as the weight of the bridge itself to the abutments at either end of the bridge, from which the forces passed through the bridge foundations and into the ground (Cooper 1997:12, 13; Kemp 1989:18). Points where such unreinforced masonry bridges are the weakest, known as points of rupture, occur at the haunches of the extrados, that is, the upper surfaces of the two sides of the arch – as compressive forces press down on the top or crown of the arch, the ends or haunches of the arch tend to move outward, potentially breaking the arch and causing bridge failure (Figure 8) (Tyrrell 1911:407).

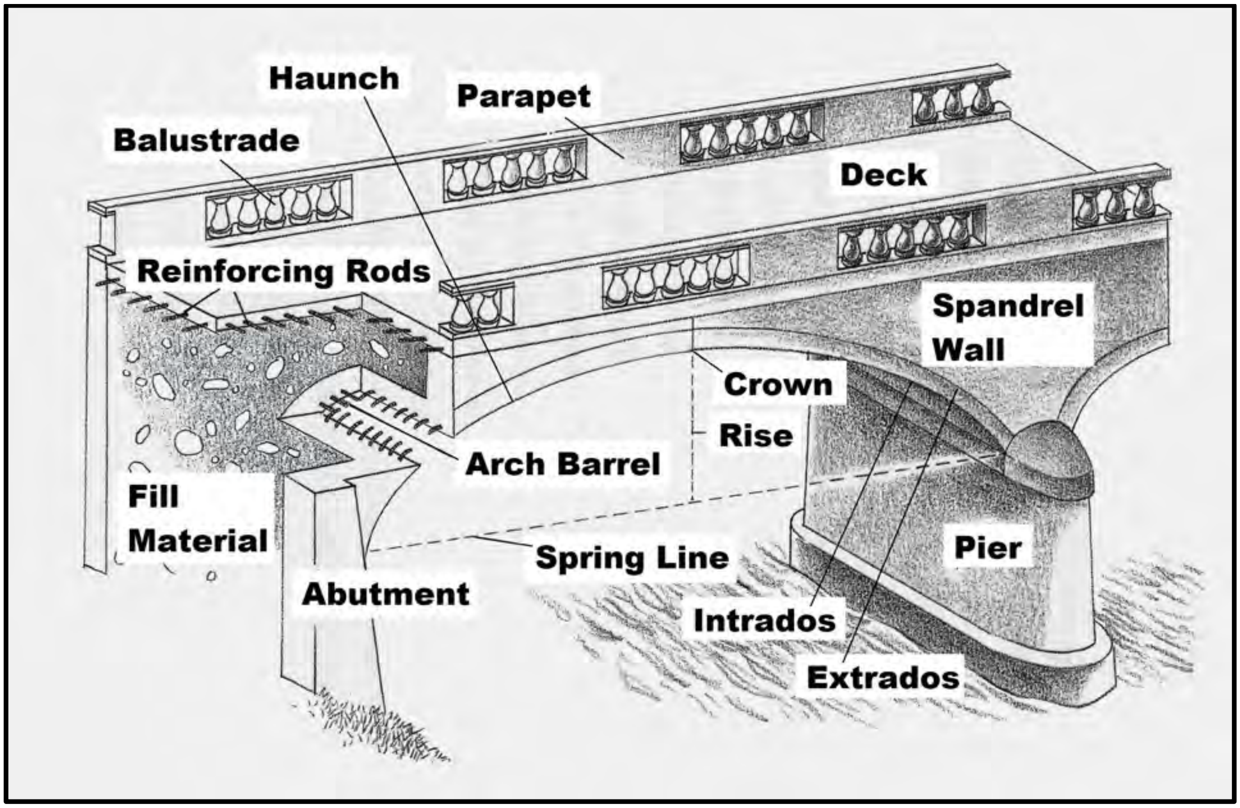



***Figure 8. Typical filled spandrel concrete arch bridge (adapted from California Department of Transportation 1990:74).***

Experiments with concrete construction soon led to a major innovation, the development of reinforced concrete. Applied to arched bridges, reinforcing added metal rods or bands to the arches, extending from the abutments and piers to and beyond the points of rupture, decreasing the chance of failure. The reinforcing rods connect the arch with the piers, abutments, and sometimes other parts of the bridge, creating a massive and stronger structure to deal with the horizontal and vertical forces, rather than requiring each part of the bridge to resist these forces independently (Cooper 1997:12, 13; Tyrrell 1911:407, 408).

The first experiments with reinforced concrete were conducted in France in the 1860s by a gardener named Joseph Monier, who began to strengthen large flower pots and urns by embedding a single layer of wire mesh in the concrete. During subsequent years Monier and his son Jean expanded this technique to include reinforcement of tanks, bins, arches, and eventually bridges, and the men took out German patents to protect their innovations. In 1880 Gustav A. Wayss purchased the rights to the Monier patents for Germany and Austria. The German Royal Architect, A. Koenen, subsequently developed a method for analyzing stress in the arches, which led to construction of numerous Monier arch bridges, reinforced with a network of thin rods within the arch ring, throughout western Europe. In 1884 the Monier system was introduced to the United States where Americans, inexperienced with concrete construction, generally considered the reinforcing dangerously light (Cooper 1997:14, 15; Tyrrell 1911:408).

Professor Joseph Melan, a prominent Viennese engineer, reviewed the Monier system using then current engineering science and, around 1890, developed a new system for concrete and iron/steel arched bridges in which the metal components – a series of rigid curved iron or steel beams embedded in the bridge's concrete arch – were believed to carry most of the load. Unlike the Monier system in which the concrete and metal bond and work together, the Melan system consisted of metal and concrete elements arranged in parallel and working separately, a system that has been termed concrete-steel, rather than reinforced concrete. Two years later the Austrian Society of Engineers and Architects conducted a test using actual Monier and Melan arches built for the experiment, and loaded them to the point of failure. The test showed that Melan arches could withstand four times the stress Monier arches could before breaking. Armed with this data, Melan took out an American patent for his arch system in 1893 and opened a construction company in New York City (Cooper 1997:15; Gasparini 2002:326, 327).

Austrian engineer, Fritz von Emperger, served as Melan's enthusiastic promoter in the United States during the mid-1890s, and also experimented with a number of new Melan system designs. Edwin Thacher, another Melan system proponent, was also active in concrete arch bridge development during this period, particularly with the elastic method for proportioning arches. Although the Melan system was later shown to be less scientifically advanced than the Monier system, it appealed to the conservative and less scientifically oriented American engineers, and numerous Melan arch bridges were constructed throughout the nation, particularly during the 1894 to 1904 period (Cooper 1997:16; Gasparini 2002:328-332; Tyrrell 1911:409).

Four firms led the effort to develop and promote reinforced concrete arch bridges in the United States during the 1894 to 1904 period: von Emperger, Mueser, and the Melan Arch Construction Company of New York; Keepers and Thacher; Mueser, Thacher, and the Concrete-Steel Engineering Company; and Daniel B. Luten and the National Bridge Company. Of these firms, only Daniel B. Luten – whose firm was founded in 1902 – diverged from the prevalent Melan perspective, taking reinforced concrete arch bridge design in a new direction (Gasparini 2002:328).

In the State of Washington, as in the rest of the nation during the early twentieth century, concrete and steel vied for supremacy as the material of choice for bridge construction. Proponents of one technology over the other debated passionately as to the cost, ease of construction, maintenance needs, and aesthetics of their preferred type. In the end, concrete emerged the more popular material with Washington city, county, and state officials, probably due in part to the ready availability of cement and aggregate in the state and the expense of importing steel from mills in the eastern United States (Clarke 2000:34, 55, 56). Construction of Washington roads and highways increased dramatically during the 1910s through 1920s period as automobile ownership became more common. By this relatively late date, Daniel B. Luten's patented reinforced concrete arch bridges were being constructed throughout the nation by the thousands and the type became well represented on Washington roads.

**Daniel B. Luten and the Reinforced Concrete Luten Arch Bridge**

Daniel B. Luten rose from humble beginnings to become a nationally acclaimed bridge engineer, one of the most prolific designers of reinforced concrete arch bridges in America and a tireless promoter of his product. Due to his penchant for patenting his techniques and prosecuting infringers, Luten held a virtual monopoly over reinforced concrete arch bridge construction in the United States during much of the first two decades of the twentieth century.

Daniel B. Luten was born in Michigan on December 26, 1869, to Dutch immigrants Lambert and Wilhelmina Luten, the second oldest of their five children. The family lived on a farm near Grand Rapids and, as Daniel matured, he was expected to become more active in running the operation. Daniel, however, had other aspirations. In 1890 Luten enrolled in the University of Michigan's engineering program, a career he felt promised a higher standard of living. While a student, Luten must have held paying jobs, as he not only had to cover his own school fees and living expenses, but also the wages of men hired to replace him on the family farm (Cooper 1997:37, 38; Huffman 2015; State of Indiana 1946; United States of America 1897). Luten is described as five feet nine inches tall, blue-eyed with light brown hair, and, at least later in life, displaying a forceful disposition (Indianapolis Star 1930:68; United States of America 1897).

Luten graduated in 1894 with a Bachelor of Science degree in civil engineering and the University of Michigan immediately offered him a position as an Instructor in Civil Engineering and Surveying, assisting Professor Charles E. Greene, then one of the nation's leading authorities on the elastic theory of arch analysis. After a year in this position, Luten resigned to take a job as Instructor of Architectural and Sanitary Engineering at Purdue University in Lafayette, at an initial annual salary of $1,400, a post he held for five years (Cooper 1997:38; Indianapolis News 1895; Luten 1924:46; Purdue University 1895). Having discretionary income apparently suited Luten as, in the summer of 1897, he sailed to Europe for a ten week trip through England, France, Switzerland, and Italy (Journal and Courier 1922, 1947).

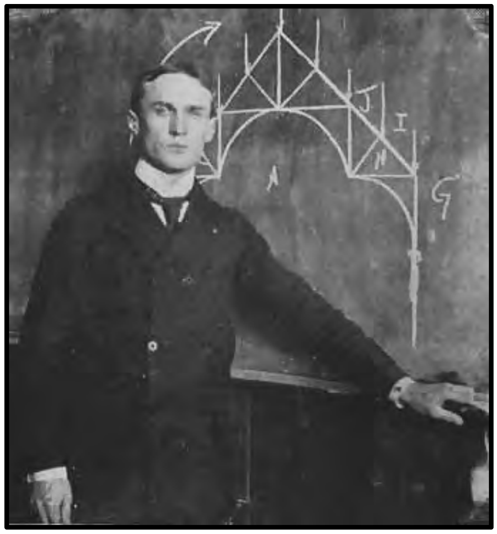


***Figure 9. Daniel B. Luten, Purdue University professor, 1899 (Purdue University 1899:45).***

Although trained in scientific theory, Luten observed that academic engineers lagged behind their peers who practiced applied engineering. To Luten, university professors were so focused on mathematical calculations and theory that they frequently failed to check their conclusions against physical reality, causing them to miss evidence that could have corrected or improved the science behind their conclusions (Cooper 1997:38).

In 1900 Daniel B. Luten, finding the academic life stultifying, resigned to go into private practice. He married Edith Heath Hull, the daughter of a prominent and wealthy Lafayette jeweler, on June 20 of that year, and proceeded to open an office in Lafayette. During his last year at Purdue, the 1899-1900 school year, Luten applied for and received the first of his many patents, for a reinforcing system beneath a streambed to stabilize an arched bridge's abutments or piers. Although the patent noted a number of appropriate materials for this reinforcing system, he chose to use wooden planks due to their longevity when saturated with water. In June 1900 Luten published a catalog for the "Timber-Tie Concrete Arch Company." Although Luten distributed the catalog throughout Indiana, he failed to receive a single inquiry. That summer, however, he was awarded a county contract to build a small timber-tied arch bridge near Lafayette. Since his incipient company had no employees, Luten was forced to do all the manual labor himself, probably a grueling task for a former college professor. Although Luten made a $50 profit on the $400 contract, he needed considerably more work (Cooper 1997:38, 50, 51; Journal and Courier 1928:14; Luten 1924:46; State of Indiana 1900).

In December 1900 Luten moved his "company headquarters" to California where he designed and built three concrete bridges before returning to Lafayette for the summer. In 1901 Luten informally organized his National Bridge Company, which he incorporated the following year with $20,000 in capital, money advanced by his wife and her sister, probably the relatives who served with him as company directors (Cooper 1997:51, 52; Indianapolis Journal 1902:10; Richmond Palladium and Sun-Telegram 1918:12). During the summer of 1901 Luten constructed a number of bridges in the upper Midwest using Purdue engineering graduates as foremen, contracts that allowed Luten to experiment with steel reinforcing in his timber-tied arch design, resulting in an integrated system of reinforcement through the bridge arch, abutments, and under the streambed. By the end of the year, company profits totaled $1,000, although Luten had yet to receive a salary (Cooper 1997:51, 52). While contracts increased in subsequent years – with approximately 500 concrete bridges reportedly erected by 1905 – the company continued to lose money. A new direction was needed and, in 1906, Luten discontinued his bridge construction contracting service to focus solely on bridge design and construction supervision (Cooper 1997:59, 60; Luten 1924:46).

In 1902 the Lutens moved from Lafayette to Indianapolis, where they established an office for the newly-registered National Bridge Company. Luten understood the importance of protecting intellectual property and one of his first tasks after incorporating the firm was to retain the services of a Chicago patent attorney. The attorney assisted him in filing a number of consolidated patents for various aspects of his bridge systems, a common practice among bridge designers of the era. Since Luten was "extremely short of funds" he mailed his sketches to the attorney rather than traveling to Chicago, and requested that as many inventions as possible be combined into one case to save fees. Over the next decade Luten was awarded seven patents from these 1902 applications: one in 1905, one in 1906, three in 1907, one in 1910, and one in 1911. These patents included arch ring reinforcing, a steel-tied arch, a ring-stiffening spandrel, and a concrete "Luten truss" beam bridge. During subsequent years, as Luten perfected his designs and developed new ones, he continued to file patents, most for reinforced concrete bridge improvements that would "reduce the total of material required to produce a given strength" (Appendix A) (Cooper 1997:52).

Luten advertised his bridges as permanent structures that only grew stronger with age. According to Luten, reinforced concrete arch bridges, unlike steel truss or wooden structures, required no painting or repairs; were not affected by floods, freezing temperatures, or fire; and were not subject to rust. The bridges could be widened or improved aesthetically as needed. In addition, since concrete bridges were built in place, local workmen could be used and money would stay in the community. In sum, according to Luten, selection of a reinforced concrete bridge was a shrewd economic choice (Luten 1912a:577, 1912b:631-640, ca. 1915:44, 1924:45; National Bridge Company 1908:142).

In 1905, prior to discontinuing the National Bridge Company's construction service, Luten approached three Indianapolis men – E. H. Lee, J. C. Stuckenberg, and Russell T. MacFall – with a potential opportunity: If the three would found a bridge construction company, Luten would transfer all his contracting business in Indiana to the new firm. The National Concrete Company was organized that same year, with the partners agreeing to promote Luten-designed improvements, transfer $10,000 of its capital stock to the National Bridge Company, and pay a royalty for the use of Luten's designs and reinforcing materials. Within a month the National Concrete Company was awarded the contract for a multi-span concrete Luten arch bridge, for which it paid a 15 percent royalty to the National Bridge Company (Cooper 1997:60).

Luten saw the potential in cooperative agreements with construction firms and pursued similar arrangements, both in Indiana and in other states. He promoted his bridge designs through articles in technical journals, lectures, advertisements, and company catalogs and building contractors began to inquire about use of his plans. The National Bridge Company established a standard policy to regulate these relationships: following the recommendations of the International Patent Conference of 1873, Luten required a license of anyone using his patented designs. He generally charged a royalty of 10 percent of the total bridge contract for the license and, if the contractor also wished to use reinforcing rods supplied by the National Bridge Company, he charged another five percent. By 1907 the National Bridge Company had at least seven construction firms that regularly used and promoted his designs and, by 1913, Luten agents were found in at least 36 states (Cooper 1997:62, 63). Charles G. Huber, an independent Seattle engineer who incorporated the Union Bridge Company in 1919, was known as a specialist in the construction of Luten design bridges in the State of Washington (Contractor 1916:48; Engineering News-Record 1919:992; Pacific Builder and Engineer 1919:19). Not all agents were builders and Luten generally compensated such promoters with half of the royalty he received, or five percent of the contract price. The National Bridge Company also trained foremen to supervise construction of Luten arch bridges and, by 1913, approximately 150 such specialists were available to assist contractors. During this period approximately 500 Luten bridges were constructed annually in the United States (Cooper 1997:62, 63).

As concrete bridges became increasingly popular throughout the country, Luten's business burgeoned. By 1913 he directed a staff of 12 engineers and draftsmen in his downtown Indianapolis office, professionals who assisted in design of bridges for contracts worth nearly $2,000,000 that year alone. Relieved of bridge construction duties, Luten was able to focus on the things that interested him – bridge design, patent applications, and patent infringement issues. Between 1905 and 1913 Luten submitted 74 patent applications – for concrete arches, concrete beams, and bridge construction techniques – nearly half of which resulted in patent awards. By 1915 Luten held 39 U.S. patents for various aspects of concrete bridge construction, more patents than all other American bridge patentees combined. He had designed around 6,000 bridges constructed in the United States, Canada, and Mexico, and had published more than 65 articles in engineering and technical journals. In short, Luten had achieved his dream of becoming a successful "designing and consulting engineer" (Cooper 1997:64, 65).

The National Bridge Company regularly initiated litigation proceedings against competitors who failed to pay the required royalty for any element of concrete bridge construction included in a Luten patent. Since Luten had patented virtually all aspects of concrete arch bridge design, construction of a concrete arch bridge without infringement on a Luten patent was nearly impossible. In 1914 Luten published a booklet titled, "Luten Patents and Litigation," which he distributed to impress on competitors the consequence of using Luten patented construction techniques without paying the royalty (Luten 1914). As noted in the publication, "No suit based on a Luten patent has ever been dismissed. Nor has any claim of any Luten patent ever been held invalid" (Luten 1914:25).

Although for many years Luten successfully prosecuted parties who infringed on his patented designs, the rise of professional engineers into state government was destined to change the way patents were awarded and enforced. In 1904 the State of Iowa appointed the Iowa State College of Agriculture and Mechanic Arts (Iowa A&M) as the state highway commission, with college engineering professors serving as highway commissioners. This scientifically oriented group, while accepting concrete culverts and small concrete slab bridges, questioned the structural adequacy of concrete arch spans. When Luten arch bridges began to be built in Iowa around 1906 the Iowa A&M professor-commissioners objected vehemently. As more bridges designed by Luten were constructed in the state, the commission opened an investigation in an attempt to discredit the empirically oriented engineer. In 1911 the state highway commission summoned Luten to a hearing, in which they demanded he increase both the concrete and steel in his designs, harkening back to the older concrete-steel Melan system. Luten refused, and continued to make his reinforced concrete arch bridge plans available to local cities and counties that resented and resisted the highway commission's oversight (Cooper 1997:91-91).

In 1913 the State of Iowa passed legislation requiring state approval of all bridge plans, effectively ending the construction of Luten-designed bridges in the state. The legislature also authorized the governor to intervene in lawsuits involving bridge or highway patent infringement, and the state immediately joined the defense for Marsh Engineering, an Iowa firm Luten accused of infringement (Cooper 1997:94, 95).

While the State of Iowa was gathering evidence for the Marsh case, the federal District Court in Denver, Colorado, invalidated six of Luten's patents, on grounds that Luten's reinforced concrete "made application of mere mechanical knowledge and skill . . . in no sense a demonstration of inventive genius" (Cooper 1997:94, 95). Adding insult to injury, the respected periodical, *Engineering News-Record*, published the full text of the judgment and excoriated reinforced concrete patentees for using the system to simply garner royalties (Cooper 1997:95).

In 1918 when the Luten v. Marsh case was heard, the judge again ruled against Luten, invalidating more of his patents. Patents could no longer be used to protect techniques that represented knowledge common to any professional engineer (Cooper 1997:95, 96). Rather than a judgment of Luten himself, the decision was more an indictment of the widely used nineteenth and early twentieth century system of employing patents to protect business techniques. Luten's designs, however, were no longer proprietary and his virtual monopoly over reinforced concrete arch bridge construction was essentially over.

After the court decisions Luten continued to practice engineering until his retirement in 1932, remaining a highly respected and renowned engineer (Brown 1982:3; Huntington Press 1925:1; Indianapolis News 1925:32; Indianapolis Star 1925:12, 1926:15; Palladium-Item 1928:15; Star Press 1929:17). During this period Luten and his firm, which he apparently renamed the Luten Engineering Company, continued to charge royalties for use of his bridge plans, sometimes leading to additional lawsuits against his company (Indianapolis News 1922:22, 1925:25, 1926:25, 1929:12; Indianapolis Star 1921:13; Journal and Courier 1923:3; Logansport Pharos-Tribune 1922:1; Richmond Item 1927:4).

Luten remained active in community affairs during his late career, serving on the Indiana State Board for the Registration and Examination of Engineers and Land Surveyors, Indiana State Council of Defense Scientific Research Committee, and committees associated with the Scientech Club, Indianapolis Chapter of the American Association of Engineers, Indiana Engineering Society, American Society of Mechanical Engineers, Rotary Club, Indianapolis Federation of Community Civic Clubs, and Indianapolis Chamber of Commerce. He was in demand as a speaker and regularly lectured on topics such as bridges, roads, economics, and education. He was also an acknowledged chess champion who served as an officer in chess clubs and won many tournaments (numerous Indiana newspaper articles).

After a period of declining health, Daniel B. Luten passed away on July 3, 1946, at age 76 leaving his widow, Edith Hull Luten, and four adult children, Wilhelmina Luten of London, Mary Luten Watson of Indianapolis, Granville H. Luten of Los Angeles, and Daniel B. Luten, Jr. of Berkeley (Indianapolis News 1946:29; Journal and Courier 1946:15). When Edith Luten died on March 8, 1965, her estate was valued at $614,385.00, at least some of which represented her late husband's earnings (Indianapolis Star 1966:10).

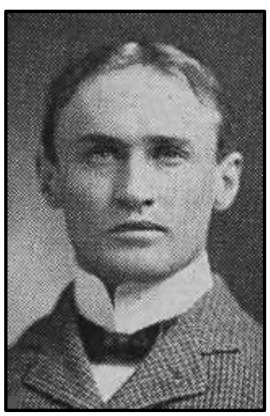


***Figure 10. Daniel B. Luten, 1900 (Purdue University 1900:33).***

***Figure 11. Daniel B. Luten, 1928 (Indianapolis Star 1928).***

Although early in his career Luten designed a small flat-arch "Luten truss" girder bridge and later produced large elegant open spandrel structures, his typical bridge was a simple earth-filled concrete deck arch structure, similar to the "Highway Bridge of Plain Design" shown on page 44 of the National Bridge Company's 1917 catalog (Luten 1917). This symmetrical reinforced concrete bridge type consists of a single semi-elliptical arched span, extending between battered abutments, or two arched spans, extending between battered abutments and a central pier. The arch barrel is cast with a solid soffit, and closed spandrel walls adjoin the arch barrel, creating a space for the bridge's earthen fill. The abutments may be straight or flared and simple incised geometric designs often ornament visible sides of the spandrel walls and abutments. A concrete deck, poured atop the earthen fill and covered with gravel or pavement, forms the roadway. Slightly protruding concrete coping tops the spandrel and abutment walls and creates a low curb at each side of the roadway. A solid parapet, usually embellished on both inner and outer surfaces with simple incised geometric designs, is cast atop the coping at each side of the bridge. The parapet is cast in sections, and sections over the abutments or piers may rise slightly higher than sections over the spandrels. The parapet, or certain sections of the parapet, may be capped with concrete coping. If the abutments flare, parapets above them mimic the curvature. The pattern of the reinforcing rods embedded in the concrete of the bridge may be diagnostic, but these bridge elements are not generally visible.

Numerous examples of this simple bridge type are included in Luten's catalogs, including the bridges shown in Figures 12, 13, and 14, which were constructed in the State of Washington.

***Figure 12. Rock Creek Bridge, Adams County, Washington, built 1915 (Luten 1917:22).***

***Figure 13. Raging River Bridge, King County, Washington, built 1916 (Luten 1917:38)***

***Figure 14. Two-span Peshastin Creek Bridge, Leavenworth, Washington, built 1920 (Luten 1924:33)***

Luten recommended more ornate bridges for monumental structures and for highly visible locations such as urban settings and parks. For smaller bridges, the only difference between a "plain" structure and an "attractive" one was often the substitution of neoclassical balustrades for the solid parapet walls (Luten 1917:44. The following examples are also derived from Luten catalogs (Figures 15 and 16).

***Figure 15. Clover Creek Bridge, Pierce County, Washington, built 1914 (Luten 1917:36)***

***Figure 16. Saskatchewan River Bridge, Saskatoon, Saskatchewan, built 1915 (Luten 1917:4).***

Construction of an earth-filled reinforced concrete Luten arch bridge began with placement of the foundation, perhaps using concrete footings atop wood pilings or, in the case of tied-arch designs, a concrete pavement reinforced with steel rods beneath the streambed. Abutment and pier forms were then erected, reinforcing rods were added in the appropriate configurations, and concrete was poured into these elements. Falsework (temporary wooden forms, also called centering) was then built for the arch, followed by forms for the spandrels. Steel reinforcing rods were arranged within the forms and the concrete arch was poured from abutment to abutment or abutment to pier, usually in concentric layers. The spandrel walls were then poured, followed by the spandrel and abutment coping. Earthen fill was then added and compacted and the concrete roadway was poured on top. When the bridge concrete had set sufficiently, the forms were removed. Parapet (or railing) forms were then erected and concrete poured. After removal of the bridge forms but prior to complete hardening of the concrete, exterior surfaces of the bridge were finished, often by brushing with a wire brush and water and addition of a thin finish coat. Bush-hammering was sometimes used to create decoratively textured areas (Figures 17 to 20) (Luten 1924:45; National Bridge Company 1908:136-141).

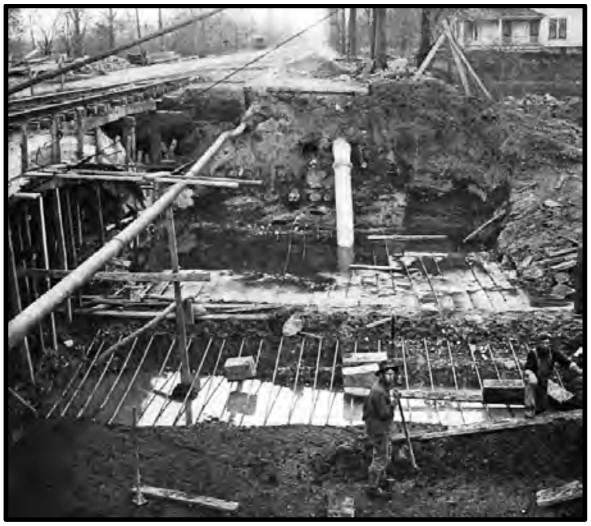


***Figure 17. Laying streambed pavement, East Washington Street Bridge, Indianapolis, before 1909 (National Bridge Company 1908:136).***

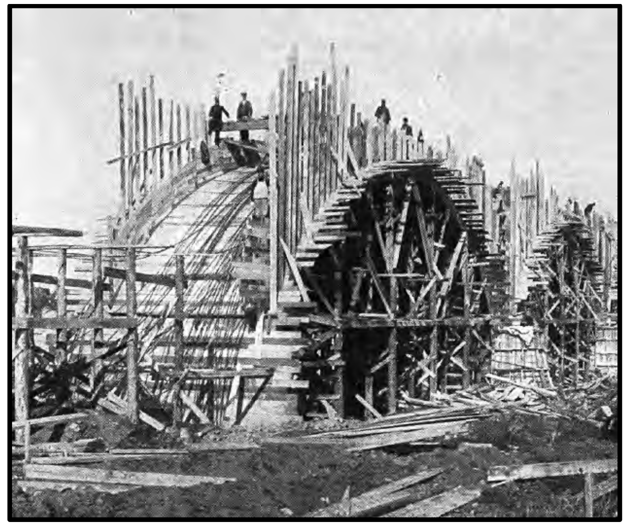


***Figure 18. Erecting centering, Maumee Bridge, Waterville, Ohio, before 1909 (National Bridge Company 1908:137).***

***Figure 19. Steel reinforcing rods in place, Maumee Bridge, Waterville, Ohio, before 1909 (National Bridge Company 1908:138).***

***Figure 20. Pouring arch ring concrete, unidentified bridge, Plymouth, Massachusetts, before 1909 (National Bridge Company 1908:139).***

The publication, *A Context for Common Historic Bridge Types*, prepared in 2005 for the Transportation Research Council, describes Luten arch bridges as:

> *[Reinforced concrete bridges] built during the 1910s and 1920s …. characterized as having either open or closed spandrels, [and] single or multiple rib or barrel arches of short to intermediate span (40 to 150 feet)* (Parsons Brinckerhoff and Engineering and Industrial Heritage 2005:3-59).

The description goes on to note that:

> *…since this describes most arch forms, documentation is needed to establish whether a bridge is a Luten patented or designed example. [Such] documentation includes bridge plaques, city and county records and comparison to known Luten bridges ….* (Parsons Brinckerhoff and Engineering and Industrial Heritage 2005:3-59).

Engineering plans for Luten-designed bridges generally identify Luten as the designing engineer in the title block (Figure 21). Bridges that closely resemble Luten arch bridges but cannot be positively identified as structures designed by Daniel B. Luten, however, are not uncommon. These bridges are generally classified as Luten arch bridges with the caveat that they may or may not be actual Daniel B. Luten designs. Since Daniel B. Luten held a virtual monopoly on reinforced concrete arch bridge construction throughout the nation from about 1910 to at least 1918, and Melan arch structures with which they might be confused generally date to the 1894 to 1904 period, the construction date, if available, is valuable in identification. Although the designer's name was not included on Whitman County bridge plaques observed during the present study, the builder is often identified. If the builder is known to specialize in Luten arch construction, this is further evidence that the bridge is a Luten design.


***Figure 21. Engineering plan title block for Seltice Bridge (Field Number WCLB-3); note identification of Daniel B. Luten as the designing engineer.***

## SURVEY RESULTS AND ANALYSIS

This section summarizes the results of the Whitman County Luten arch bridge built environment survey.

### Summary of Survey Results

During this intensive level survey, AHA!, with the assistance of Whitman County Public Works, identified and recorded 17 reinforced concrete Luten arch bridges within Whitman County, developed historic context statements, and evaluated the subject properties' eligibility for listing in the National Register of Historic Places. The results of these investigations, which correspond closely to the project expectations, follow. In addition to the map, table, and text below, Appendix B contains descriptions, locations, photographs, and National Register of Historic Places eligibility recommendations for each bridge and Appendix C contains copies of the Historic Property Inventory (HPI) forms.

All 17 of the identified Luten arch bridges are reinforced concrete filled spandrel deck arch structures, and all are relatively simple variations of Luten's "Highway Bridge of Plain Design." Although some of the bridges exhibit more ornamental design features than others, none approach the detailing of Luten's "Park Bridge of Attractive Design" (Luten 1917:44).

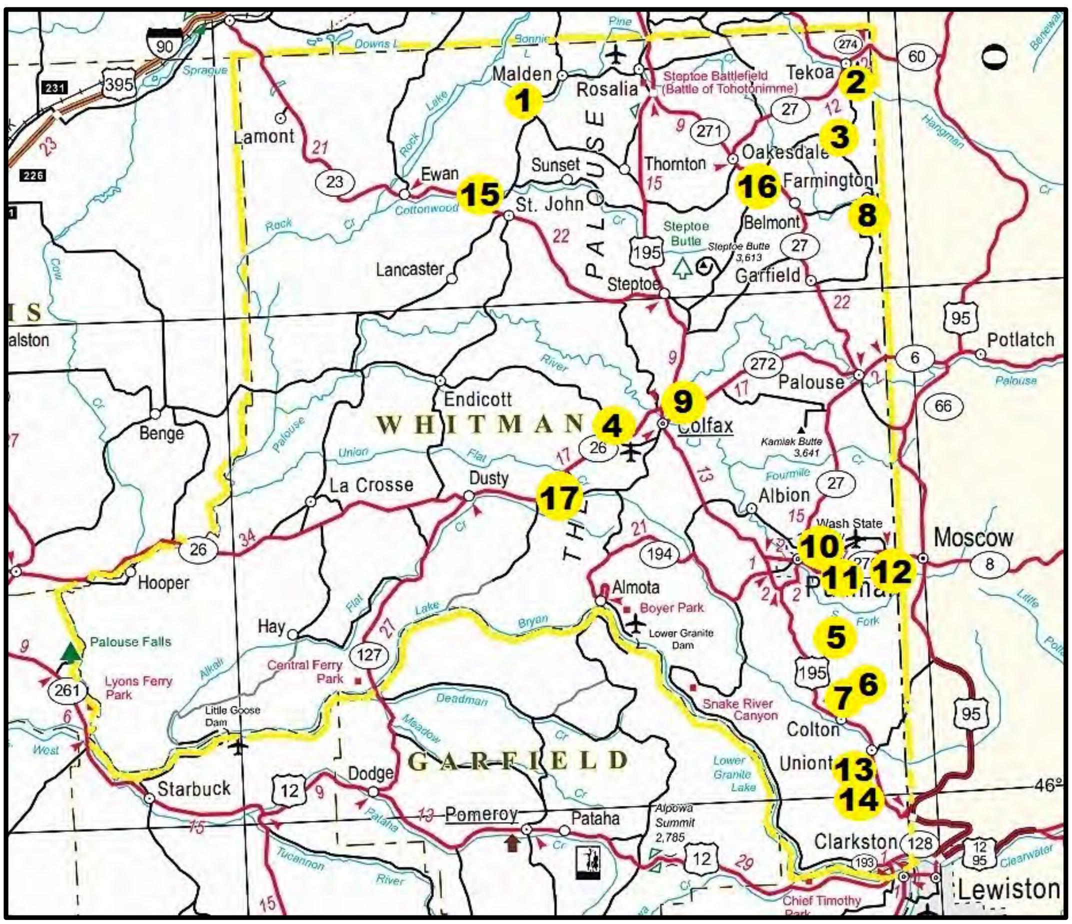



*Figure 22. Locations of extant Luten arch bridges in Whitman County; numbers are project field numbers noted in Table 1 below (adapted from WSDOT 2014).*

*Table 1. Luten Arch Bridges in Whitman County.*

| Project Field Number | Property Name: Historic | Property Name: Modern | Current Owner | Date Built | Builder | Luten design? | Eligible for National Register? |
|---|---|---|---|---|---|---|---|
| WCLB-1 | Kenova Bridge No. 259 | Kenova Bridge, Co. Bridge #3310-02.49 | Whitman County | 1916 | Unknown | Yes | Yes |
| WCLB-2 | McLeod (MacLeod) Bridge No. 100 | McLead Bridge, Co. Bridge #1000-00.68 | Whitman County | 1916 | Charles G. Huber, Seattle | Yes, based on design and Huber construction | No |
| WCLB-3 | Seltice Bridge No. 331 | Lower Seltice Bridge, Co. Bridge #1260-00.03 | Whitman County | 1921 | Unknown | Yes | Yes |
| WCLB-4 | Morley Bridge No. 278 | Morley Bridge, Co. Bridge #4000-27.75 | Whitman County | ca. 1920 | Unknown | Yes, based on design | No |
| WCLB-5 | Staley Bridge No. 360 | Staley No. 2 Bridge, Co. Bridge #9030-01.08 | Whitman County | 1922 | Tom Ristvedt | Yes | Yes |
| WCLB-6 | Unknown | Colton Bridge, Co. Bridge #9050-12.19 | Whitman County | ca. 1910 | Unknown | Yes, based on design | Yes |
| WCLB-7 | Colton Bridge No. 37 | Town of Colton Steptoe St. Bridge | Town of Colton | 1918 | Unknown | Yes | Yes |
| WCLB-8 | First Street Bridge No. 335 | Town of Farmington First Street Bridge | Town of Farmington | 1918 | H. C. Malott, Seattle | Yes, based on design | Yes |
| WCLB-9 | Mill Dam Bridge No. 106 | City of Colfax Sixth Street Bridge | City of Colfax | 1914 | A. C. Biegle & Co., Colfax | Yes | No |
| WCLB-10 | Spring Street Bridge No. 58 | City of Pullman Spring Street Bridge | City of Pullman | 1915 | Charles G. Huber, Seattle | Yes | Yes |
| WCLB-11 | Wood Bridge No. 91 | U.S.A. Bridge | U.S.A. | 1916 | Unknown | Yes | Yes |
| WCLB-12 | Devine Bridge No. 157 | Tucker Living Trust Bridge | Privately owned | 1916 | Unknown | Yes, based on design | Yes |
| WCLB-13 | Bridge No. 317 | Ashburn Bridge North | Privately owned | Probably 1919 | Probably H. C. Malott, Seattle | Yes, based on design | Yes |

| Project Field Number | Property Name: Historic | Property Name: Modern | Current Owner | Date Built | Builder | Luten design? | Eligible for National Register? |
|---|---|---|---|---|---|---|---|
| WCLB-14 | Bridge No. 318 | Ashburn Bridge South | Privately owned | Probably 1919 | Probably H. C. Malott, Seattle | Yes, based on design | Yes |
| WCLB-15 | Rhodes Bridge No. 209 | Logen Bridge | Privately owned | 1918 | Probably H. C. Malott, Seattle | Yes | N/A: access denied |
| WCLB-16 | Kelley Bridge No. 134 | Hozim Ranch Inc. Bridge | Privately owned | 1918 | H. C. Malott, Seattle | Yes, based on design | No |
| WCLB-17 | Sanders Bridge No. 280 | Foreyt Bridge | Privately owned | 1917 | H. C. Malott, Seattle | Yes | Yes |

*Figure 23. Kenova Bridge (Field Number WCLB-1), west side; view to the southeast.*

*Figure 24. Colton Bridge (Field Number WCLB-7), east side; view to southwest (Whitman Co. photo).*

*Figure 25. Bridge No. 318 (Field Number WCLB-14), east side; view to the southwest.*

*Figure 26. Spring St. Bridge (Field Number WCLB-10), south side; view to NE (Whitman Co. photo).*

**Evaluation of Historic Significance**

During the late nineteenth and early twentieth centuries, Daniel B. Luten pioneered the use of reinforced concrete as a bridge construction material, patented his designs and methods, and widely publicized his results. As a result, Luten-designed reinforced concrete bridges were built throughout the nation during the 1910s and 1920s period. Although Luten designed other types of reinforced concrete bridges, his typical design was a filled spandrel deck arch bridge, often with solid parapet railings and incised geometric ornament. Reinforced concrete filled spandrel deck arch bridges of Luten design are therefore a significant bridge type which, if retaining sufficient integrity of location, design, setting, materials, workmanship, feeling, and association, are eligible for listing in the National Register of Historic Places. Such bridges are significant under Criterion C, at the state level, for their association with Daniel B. Luten's pioneering efforts in reinforced concrete bridge construction and as examples of his distinctive Luten-designed filled spandrel deck arch bridge.

Increasing automobile ownership during the early twentieth century led to a growing demand throughout the nation for improved roads, and state and local governments became actively involved in road construction and maintenance. Bridges were important features of these new transportation systems, and such structures, if retaining sufficient integrity of location, design, setting, materials, workmanship, feeling, and association, are eligible for listing on the National Register of Historic Places under Criterion A, at the state or local level, for their contributions to development of regional road and highway networks.

**Development Trends**

Daniel B. Luten, failing to fully understand the properties of reinforced concrete, believed that "a concrete bridge once built, is built for all time" (Luten ca. 1915:44). The passing years, however, have proven him wrong. Today Luten arch bridges in Whitman County exhibit structural deficiencies caused by rusting of the reinforcing rods and cracking and spalling of the concrete. Many are too narrow to accommodate modern vehicles and agricultural equipment, while others have been destabilized by stream flow scouring. Numerous Luten designed bridges in Whitman County have already been removed, and others have been significantly altered in order to remain in service. Additional Luten arch bridges will undoubtedly need to be replaced in the near future.

## CONCLUSIONS AND RECOMMENDATIONS

Numerous reinforced concrete filled spandrel deck arch bridges were constructed in Whitman County during the 1910s and 1920s period, most or all of which were designed by acclaimed engineer Daniel B. Luten (Whitman County ca. 1900s-1970s). Today only 17 of these structures are known to remain extant, four of which have been extensively altered. Of the intact Luten arch bridges, many are now approaching the end of their useful lives. This Luten arch bridge inventory was consequently conducted to identify and document existing Luten arch bridges in Whitman County, the initial step in an effort to explore preservation options.

## REFERENCES CONSULTED


Allen, James
1918 *State of Washington Seventh Biennial Report of the State Highway Commissioner for the Period Oct. 1, 1916 to Sept. 30, 1918*. State Highway Commission, Olympia.

1921 *State of Washington Eighth Biennial Report of the State Highway Commissioner for the Period Oct. 1, 1918 to Sept. 30, 1920*. State Highway Commission, Olympia.

Beckham, Stephen Dow
1998 History Since 1846. In *Plateau*, edited by Deward E. Walker, Jr., pp. 149-173. Handbook of North American Indians, vol. 12, William C. Sturtevant, general editor, Smithsonian Institution, Washington, D.C.

Bozanich, Mark
2018 Highways of Washington State. Electronic document, www.angelfire.com/wa2/hwysofwastate/ index.html, accessed 19 September 2018.

Brown, Lenard E.
1982 *Oconaluftee Bridge, HAER No. NC-40*. Southeast Region, National Park Service, Atlanta.

California Department of Transportation
1990 *Historic Highway Bridges of California*. California Department of Transportation, Caltrans Publication Unit, Sacramento.

Carter, Clive
2009 *Inland Empire Electric Line, Spokane to Coeur d'Alene and the Palouse*. The Museum of North Idaho, Coeur d'Alene.

Cheever, Bruce Bissell
1949 *The Development of Railroads in the State of Washington 1860 to 1948*. Western Washington College of Education, Bellingham.

Clarke, Jonathan
2000 Material Concerns in the Pacific Northwest: Steel versus Reinforced Concrete in Highway Bridge Design in Washington State, 1910-1930. *Construction History* 16:33-61.

Contractor
1916 Bridges, Contracts Let. *The Contractor* 23(18/September 15):48, 49.

Cooper, James L.
1997 *Artistry and Ingenuity in Artificial Stone: Indiana's Concrete Bridges, 1900 – 1942*. James L. Cooper, DePauw University, Greencastle, Indiana.

Crowley, Walt, Kit Oldham, and The HistoryLink Staff
2005 *Moving Washington Timeline: The First Century of the Washington State Department of Transportation, 1905-2005*. University of Washington Press, Seattle.

Department of Archaeology and Historic Preservation (DAHP)
2005 *Washington's Statewide Historic Property Inventory Guide and Database User Manual*. Department of Archaeology and Historic Preservation, Olympia.

Department of Archaeology and Historic Preservation (DAHP)
2018 *Washington State Standards for Cultural Resource Reporting*. Department of Archaeology and Historic Preservation, Olympia.

Dougherty, Phil
2006 Whitman County – Thumbnail History. HistoryLink.org Essay 7882. Electronic document, http://historylink.org/File/7882, accessed October 2, 2018.

Engineering and Contracting
1918 Bids Opened; Contracts Let. *Engineering and Contracting* 49(23):30.

Engineering News-Record
1919 Business Notes. *Engineering News-Record* 82(20/May 15):992.

Erickson, Edith E.
1985 *Whitman County from Abbieville to Zion*. University Printing & Copying, Colfax.

1981 *Colfax 100 Plus*. Edith E. Erickson, Colfax.

Freeman, Otis
1954 Early Wagon Roads in the Inland Empire. *Pacific Northwest Quarterly* 45(4):125-129.

Gasparini, Dario A.
2002 Development of Reinforced Concrete Arch Bridges in the U.S.: 1894-1904. Paper presented at the Fourth National Congress on Civil Engineering, October 2002. Electronic document, https://ascelibrary.org/, accessed May 4, 2018.

General Land Office (GLO)
1873 *Official Survey Plat, T. 16 N., R.* 43 *E., W.M.* Electronic document, http://www.blm.gov/or/landrecords/survey/ySrvy1.php, accessed February 2, 2017.

Gilbert, Frank T.
1882 *Historic Sketches: Walla Walla, Whitman, Columbia and Garfield Counties, Washington Territory*. A. G. Walling Printing, Portland, Oregon.

Hadlow, Robert H.
2002 Elegant Arches, Soaring Spans: C. B. McCullough, Oregon's Master Bridge Builder. *The Journal of the Society for Industrial Archeology* 28(1):85-87.

Hall, Dan
2018 Personal written communication between Dan Hall, Whitman County Public Works Right-of-Way Agent, and Ann Sharley, AHA! Architectural Historian, summer 2018.

Holstine, Craig, and Richard Hobbs
2005 *Spanning Washington: Historic Highway Bridges of the Evergreen State*. Washington State University Press, Pullman.

Huffman, Edythe
2015 Finding Aid – Daniel B. Luten Papers L093: Biographical Note. Indiana State Library, Rare Books and Manuscripts, Indianapolis.

Hunn, Eugene S.
1990 *Nch'i-Wana "The Big River": Mid-Columbia Indians and Their Land.* University of Washington Press, Seattle.

Huntington Press
1925 Lannerd Issues Statement on Cement Bridge. *The Huntington Press* September 12:1.

Hussey, Larry
1994 *Fort Walla Walla, Then and Now*. Larry Hussey, Walla Walla.

Indianapolis Journal
1902 National Bridge Company. *The Indianapolis Journal* April 9:10.

Indianapolis News
1895 The Closing College Year. *The Indianapolis News* June 5:7.

1922 Social Side of Churches. *The Indianapolis News* February 25:22.

1925 T. R. Ratcliff Slated as Head of Engineers. *The Indianapolis News* February 20:25.

1926 Art Wins and Huntingtonians Hope for River Beautification. *The Indianapolis News* March 6:25.

1929 County Bridge Bill Now up to the House. *The Indianapolis News* February 7:12.

1946 Luten, Daniel B. [death notice]. *The Indianapolis News* July 4:29.

Indianapolis Star
1921 Talks to Rotarians. *The Indianapolis Star* June 22:13.

1925 Mead-Balch Company Begins Work on Big Four Cutoff in Ohio. *The Indianapolis Star* July 27:12.

1926 New Bridge is Outstanding in Operations of Mead-Balch. *The Indianapolis Star* June 7:15.

1928 Chamber of Commerce Members Vote Early. *The Indianapolis Star* December 12:13.

1930 When Your Townsman Reads. *The Indianapolis Star* May 11:68.

1966 Mrs. Luten's Estate Valued at $614,385. *The Indianapolis Star* February 25:10.

Journal and Courier
1922 25 Years Ago Today. *Journal and Courier* [Lafayette] May 13:6.

1923 Purdue Men Attend Engineers' Meeting. *Journal and Courier* [Lafayette] January 20:3.

1928 Granville Hull Ranked High in State Masonry, Death of Lafayette Realty Owner Occurs in Ninetieth Year. *Journal and Courier* [Lafayette] February 25:14.

1946 Daniel B. Luten is Dead, Indianapolis. *Journal and Courier* [Lafayette] July 5:15.

1947 50 Years Ago Today. *Journal and Courier* [Lafayette] May 23:6.

Kemp, Emory L.
1989 The Fabric of Historic Bridges. *The Journal of the Society for Industrial Archaeology* 15(2):3-22.

Kershner, Jim
2013 Inland Empire Highway. HistoryLink.org Essay 10644. Electronic document, http://historylink.org/File/10644, accessed October 2, 2018.

Kingston, Ceylon S.
1981 *The Inland Empire in the Pacific Northwest*. Ye Galleon Press, Fairfield.

LaFollette, Tabor
ca. 1956 *The History of Colfax* (vol.1). On file, John F. Kennedy Library Special Collections, Eastern Washington University, Cheney.

Lever, W. H.
1901 *An Illustrated History of Whitman County, State of Washington*. W. H. Lever, [place not listed].

Logansport Pharos-Tribune
1922 Luten Admits Getting $8,000 for His Plans. *Logansport Pharos-Tribune* December 28:1.

Luten, Daniel B.
1912a Arch Design; Specialization and Patents. *Journal of the Western Society of Engineers* 17(7/September):577-634.

1912b Concrete Bridges. *Journal Proceedings* 8(3/March):631-640.

1914 *Luten Patents and Litigation*. Daniel B. Luten), Indianapolis.

ca. 1915 *Reinforced Concrete Bridges of Luten Design*. Daniel B. Luten, Indianapolis.

1917 *Reinforced Concrete Bridges of Luten Design*. The Hollenbeck Press, Indianapolis.

1924 *Reinforced Concrete Bridges*. Daniel B. Luten, Indianapolis.

Macartney, Morton
1914 Letter from Morton Macartney, City Engineer, City of Spokane, to John H. Miller, County Engineer, Whitman County, dated Sept. 24, 1914. On file, County Vault, Whitman County Public Works, Colfax.

Meany, Edmond S.
1923 *Origin of Washington Geographic Names*. University of Washington Press, Seattle.

Meeks, Harold A.
2000 *On the Road to Yellowstone: The Yellowstone Trail and American Highways 1900-1930*. Pictorial Histories Publishing Company Inc., Missoula.

Meinig, D. W.
1968 *The Great Columbia Plain, a Historical Geography, 1805-1910*. University of Washington Press, Seattle.

National Bridge Company
1908 *Reinforced Concrete Bridges, Luten Patents*. National Bridge Company, Indianapolis.

National Park Service (NPS)
1997 *How to Apply the National Register Criteria for Evaluation*. National Register Bulletin (formerly Bulletin 15). U.S. Department of the Interior, National Park Service, Washington, D.C.

2018 National Register of Historic Places Database. Electronic document, https://www.nps.gov/nr/research/, accessed 18 August 2018.

Pacific Builder and Engineer
1919 Personal Mention. *Pacific Builder and Engineer* April 25:18, 19.

Palladium-Item
1928 Local Construction Firm is Awarded Ft. Wayne Contract. *Palladium-Item* [Richmond] May 31:15.

Parsons Brinckerhoff and Engineering and Industrial Heritage
2005 *A Context for Common Historic Bridge Types*. NCHRP Project 25-25, Task 15. Prepared for the National Cooperative Highway Research Program, Transportation Research Council, National Research Council. Parsons Brinkerhoff and Engineering and Industrial Heritage, [place not listed].

Plowden, David
1974 *Bridges, the Spans of North America*. W. W. Norton & Company, New York.

Prevost, Nancy M.
1985 *Paradise in the Palouse, the Development of a Farming Empire in Eastern Washington, 1870-1900*. Ye Galleon Press, Fairfield.

Pullman Herald
1918 [Contract]. *Pullman Herald* May 10:6.

Purdue University
1895 Board of Trustees minutes, June 4, 1895. On file, Purdue University Libraries, Archives and Special Collections, Purdue University, Lafayette.

1899 *Debris* [yearbook]. On file, Purdue University Libraries, Archives and Special Collections, Purdue University, Lafayette.

1900 *Debris* [yearbook]. On file, Purdue University Libraries, Archives and Special Collections, Purdue University, Lafayette.

Railroad Commission of Washington
1910 *Railroad Commission Map of Washington 1910* [map]. Rand McNally & Co., Chicago.

Reid, Carlton
2015 *Roads Were Not Built for Cars*. Island Press, Washington, D.C. and London.

Richmond Item
1927 Conference is Opened Here. *The Richmond Item* September 4:4.

Richmond Palladium and Sun-Telegram
1918 National Bridge Company Charged with Coercion. *The Richmond Palladium and Sun-Telegram* December 14:12.

Ristvedt, Tom
1922 Proposal to the Honorable Board of County Commissioners of Whitman County. On file, County Vault, Whitman County Public Works, Colfax.

Rollins, Claudia
2018 Personal email communication between Claudia Rollins, long-time Colfax resident, and Ann Sharley, AHA! Architectural Historian, April 13, 2018.

Royce, Charles C.
1899 *Indian Land Cessions in the United States*. Eighteenth Annual Report of the Bureau of American Ethnology, Part 2. U.S. Government Printing Office, Washington, D.C.

Sego, Mary A.
n.d. *Daniel B. Luten Papers, 1898-1924: Biographical Note.* Purdue University Libraries, Archives & Special Collections. Electronic document, http://www4.lib.purdue.edu/archon/?p=collections/findingaid&id=59&templateset=print&disabletheme=1, accessed March 8, 2018.

Smith, Dwight A., James B. Norman, and Pieter T. Dykman
1989 *Historic Highway Bridges of Oregon*. Oregon Historical Society Press, Portland.

Star Press
1929 Contract is Let for New Bridge. *The Star Press* [Muncie] September 1:17.

State of Indiana
1900 Select Marriages Index, 1748-1993: Daniel B. Luten. On file, Indiana, Marriages, FamilySearch, Salt Lake City.

1946 Death Certificate: Daniel B. Lutin [sic]. Year 1946, Roll 8. On file, Indiana Archives and Records Administration, Indianapolis.

Stevens, Isaac Ingalls, and Darrell Scott
1996 *A True Copy of the Record of the Official Proceedings at the Council in the Walla Walla Valley 1855*. Ye Galleon Press, Fairfield, Washington.

Swanson, Robert Wayne
1958 A History of Logging and Lumbering on the Palouse River, 1870-1905. Master's thesis, Master of Arts in History, State College of Washington, [Pullman].

Tyrrell, Henry Grattan
1911 *History of Bridge Engineering*. The G. B. Williams Co., Chicago.

United States of America
1897 U.S. Passport Applications, 1795-1925: Daniel B. Luten. Roll 491, June 19 to June 30 1897. On file, National Archives and Records Administration, Washington, D.C.

U.S. Army Corps of Engineers
ca. 1956 Palouse River & Tributaries, Washington, Colfax Location - Unit 1, Channel Improvement, Cantilever Walls & 6th St. Bridge. U.S. Army Engineer District, Walla Walla, Washington. Sheet 24, File No. PL-81-1/24. On file, County Vault, Whitman County Public Works, Colfax.

Washington Department of Highways (WDH)
ca. 1946 *40 Years with the Washington Department of Highways*. Washington Department of Highways, Olympia.

Washington State Department of Transportation (WSDOT)
2014 *Washington State Highways 2014-2015* [map]. Washington State Department of Transportation, Olympia.

Washington State Highway Commissioner
1917 *Map of Inland Empire Highway Eastern Division, Whitman County, Garfield to Oakesdale*. Sheet 3 of 5. Office of the State Highway Commissioner, Olympia.

Webber, Bert
1987 *Postmarked Washington, an Encyclopedia of Postal History: Asotin, Spokane, Whitman* (vol. I). Ye Galleon Press, Fairfield.

West, J. B.
1974 The Development of Railroading in Whitman County. *Bunchgrass Historian* 2(2):2-11.

Western Engineering
1918 Bridges and Culverts. *Western Engineering* April:168.

Whitman County
n.d. Bridge Files. On file, Whitman County Public Works, Colfax.

ca. 1900s-1970s Highway Plat Book. On file, County Vault, Whitman County Public Works, Colfax.

1908 Surveyor's Field Notes: W. J. Lawrence Road, dated April 6, 1908, signed by E. C. Murray, County Engineer. On file, County Vault, Whitman County Public Works, Colfax.

1909 Memorandum of Order of the Board of County Commissioners [order to open the newly constructed W. J. Lawrence Road], dated May 17, 1909. On file, County Vault, Whitman County Public Works, Colfax.

ca. 1914 Sketch showing proposed location of Mill Dam Bridge. On file, County Vault, Whitman County Public Works, Colfax.

1914a Mill Dam Reinforced Concrete Bridge over Palouse River, Whitman Co., Wash. [original engineering plans]. On file, County Vault, Whitman County Public Works, Colfax.

1914b Masonry Plan, Mill Dam Bridge over Palouse River at Colfax, Whitman County, Wash. [original engineering plans]. On file, County Vault, Whitman County Public Works, Colfax.

1914c Bids Received on Mill Dam Bridge, Colfax, Wash. On file, County Vault, Whitman County Public Works, Colfax.

1914d General Claim Whitman County, Washington, Debtor to A. C. Biegle & Co. On file, County Vault, Whitman County Public Works, Colfax.

1915 Spring St. Bridge at Pullman, Whitman Co., Wash. [original engineering plans]. On file, County Vault, Whitman County Public Works, Colfax.

1916a Kenova Bridge over Pine Creek, Whitman Co., Wash. 1916 [original engineering plans]. On file, County Vault, Whitman County Public Works, Colfax.

Whitman County
1916b Bridge No. 91 over Paradise Creek, Whitman Co., Wash. [original engineering plans]. On file, County Vault, Whitman County Public Works, Colfax.

ca. 1917 Luten Design of Two 50-Ft. Concrete Arches over Union Flat Creek, Inland Empire Highway, Whitman County, Design No. 2 [original engineering plans]. On file, County Vault, Whitman County Public Works, Colfax.

1917 Inland Empire Highway, Whitman County, Colfax South, Design No. 1, Two 50-Ft. Concrete Arches over Union Flat Creek [original engineering plans]. On file, County Vault, Whitman County Public Works, Colfax.

1918a Reinforced Concrete Bridge over Union Flat Creek at Colton, Whitman County, Wash. [original engineering plans]. On file, County Vault, Whitman County Public Works, Colfax.

1918b Rhodes Bridge, Steptoe - St. John – Ewan Road, Station 986 + 55, Whitman County, Wash. [original engineering plans]. On file, County Vault, Whitman County Public Works, Colfax.

1918c Inland Empire Highway, Whitman County, Oakesdale to Garfield, One – 40 Foot Span Reinforced Concrete Arch Bridge [original engineering plans]. On file, County Vault, Whitman County Public Works, Colfax.

1921 Reinforced Concrete Bridge, Station 1+80, Improved Road No. 7, Whitman County, Wash., 1921 [original engineering plans]. On file, County Vault, Whitman County Public Works, Colfax.

1922a Reinforced Concrete Bridge at Staley Station, Whitman County, Wash. [original engineering plans]. On file, County Vault, Whitman County Public Works, Colfax.

1922b Certificate of Completion. On file, County Vault, Whitman County Public Works, Colfax.

ca. 1969 C.R.P. 100-5 (1-108) & 245-3, Whitman County Bridges, Whitman County Washington, Approved, County Road Engineer [engineering plans]. Handwritten date appears to read “Oct. 69”. On file, County Vault, Whitman County Public Works, Colfax.

Whitman County Library
ca. 2015 Rural Heritage Project online historical photo collection. Hosted by the Washington State Library. Electronic document, http://www.washingtonruralheritage.org/cdm/landingpage/collection/whitman, accessed December 2016 to April 2017.

# APPENDIX A:  SAMPLE LUTEN PATENTS

No. 649,643. Patented May 15, 1900.

D. B. LUTEN.

ARCH BRIDGE.

(Application filed Aug. 2, 1899.)

(No Model.)

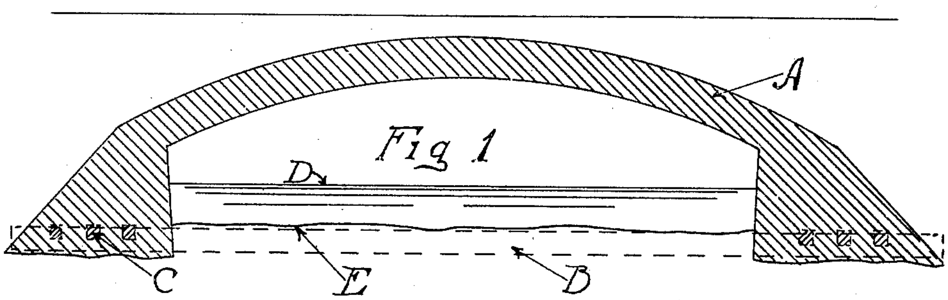



Fig 1

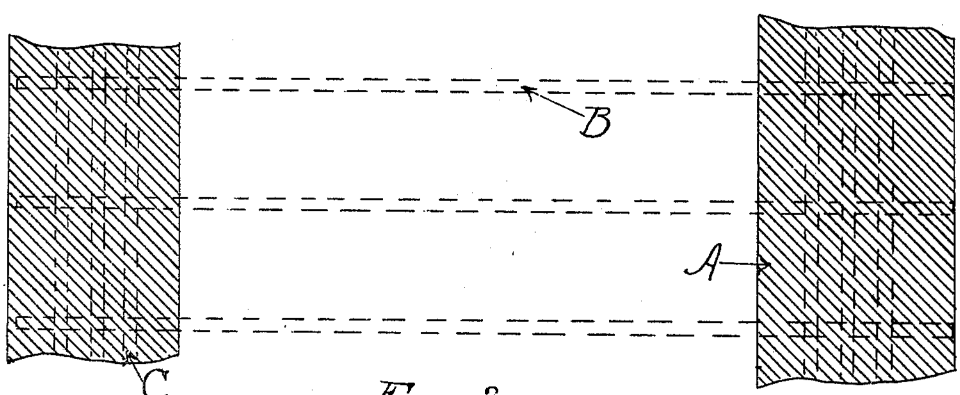



Fig 2

Witnesses.
N. Bertell Luten
Alonzo W. Johnston

Inventor.
Daniel B. Luten

# UNITED STATES PATENT OFFICE.

DANIEL B. LUTEN, OF LAFAYETTE, INDIANA.

## ARCH-BRIDGE.

SPECIFICATION forming part of Letters Patent No. 649,643, dated May 15, 1900.

Application filed August 2, 1899. Serial No. 725,851. (No model.)

*To all whom it may concern:*

Be it known that I, DANIEL B. LUTEN, a citizen of the United States, residing at Lafayette, in the county of Tippecanoe, State of Indiana, have invented an Improvement in Arch-Bridges, of which the following is a specification.

My invention relates to bridges; and it consists in providing means to relieve the abutments thereof of a part of the horizontal thrust of the arch, thus permitting of lighter construction and reducing the cost of building and maintenance, as well as increasing their periods of usefulness.

It consists more particularly in uniting the abutments of an arch-bridge by means of a tie or ties placed beneath the water-line of the structure, which thus relieves the abutments of some horizontal strain and provides a foundation for the bridge, and at the same time the ties are concealed from view, are out of the way of shipping, floating ice, logs, or other objects, are effective in preventing scouring of the bed of the stream, and in case wood or timber is used in their construction they are practically permanent.

The invention is illustrated in the accompanying drawings, in which—

Figure 1 is a vertical cross-section of an arch-bridge provided with timber ties, and Fig. 2 is a foundation-plan of abutments and ties.

Similar letters refer to similar parts in both views.

The arch structure A, of concrete, stone, brick, iron, steel, or other suitable materials, is supported by abutments or piers, of concrete, stone, brick, or other materials, extending below the water-line D of the structure. Extending from abutment to abutment and below the water-line are the ties B, which may be made of any suitable material—as wood, iron, or steel—but in this case are shown as being made of wood or timber, as this is the best material now known to me for the purpose, it being practically everlasting when used under water.

A satisfactory joint between the material of the abutments and the ties is secured by notching the ties and embedding them in the material of the abutments, or by the use of interlocking cross-pieces, as shown at *c*, or by any other usual method of making such connections.

It is an essential part of my invention that all ties shall be placed below the water-line of the structure to insure a good foundation, protection to the bed of the stream, elegance of appearance of the arch, and that the stream is left clear, so that a free passage-way is provided for shipping, floating logs, ice, or debris of any character, and when wood or timber is used there is the further advantage that it is preserved by the water.

I am aware that various forms of tie-rods have long been in use in connection with arched structures. I do not therefore claim such an invention broadly.

What I do claim as my invention, and desire to secure by Letters Patent, is—

1. An arch-bridge of concrete, stone, iron, or steel, having a tie or ties of timber, from abutment to abutment, below the water-line of the structure, substantially as set forth.

2. An arch-bridge of concrete stone, iron, steel, or brick, having a tie or ties from one abutment or pier to the other abutment or pier, below the water-line of the structure, substantially as described.

3. In a bridge, the combination of an arch or vault, with the abutments or piers, and a tie or ties extending from one abutment or pier to the other abutment or pier, beneath the water-line, to relieve the same from strain, substantially as set forth.

4. The combination of an arch or vault with abutments or piers for supporting the same, and a tie or ties of wood or timber extending from one abutment or pier to the other abutment or pier, beneath the water-line, to relieve the same from strain, substantially as described.

DANIEL B. LUTEN.

Witnesses:

A. BERTELL LUTEN,

ALONZO W. JOHNSTON.

No. 802,004. PATENTED OCT. 17, 1905.

D. B. LUTEN.

CENTERING FOR AND METHOD OF CONSTRUCTING ARCHES.

APPLICATION FILED FEB. 25, 1905.

2 SHEETS—SHEET 1.

Fig. 1.

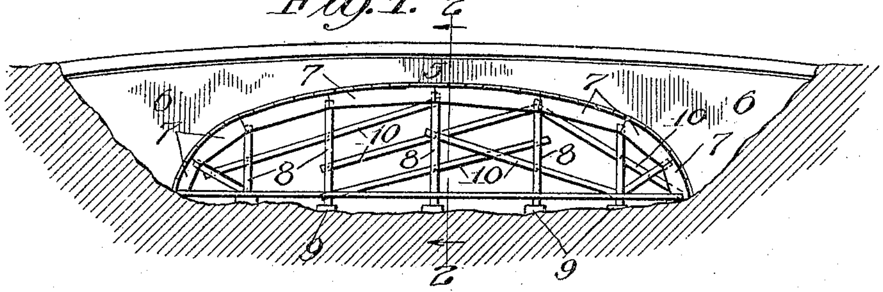



Fig. 2.

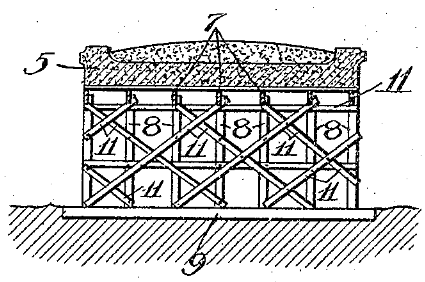
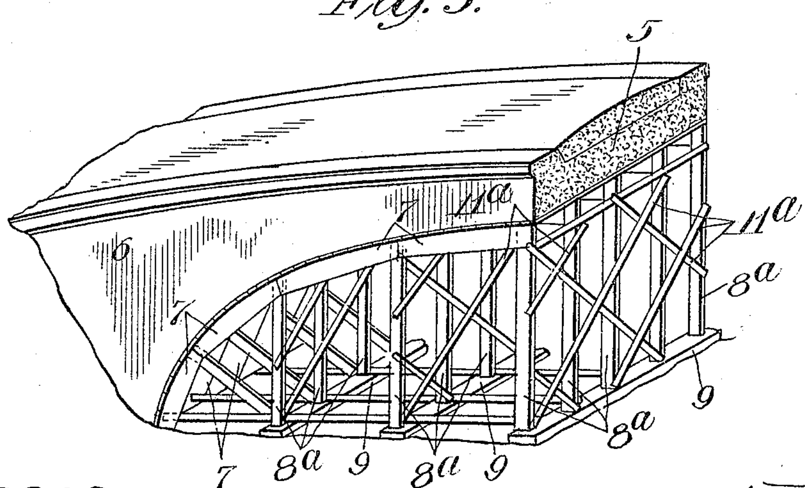



Fig. 3.




Witnesses:
Robert H. Weir
W. Perry Hahn

Inventor:
Daniel B. Luten
By Robert Lewis Ames
Attorney

No. 802,004. PATENTED OCT. 17, 1905.

D. B. LUTEN.

CENTERING FOR AND METHOD OF CONSTRUCTING ARCHES.

APPLICATION FILED FEB. 25, 1905.

2 SHEETS—SHEET 2.

Fig. 4.

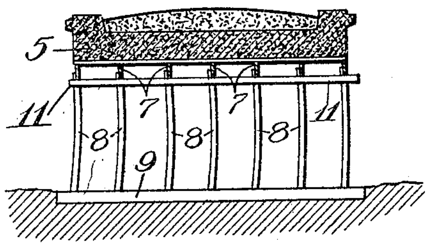



Fig. 5.

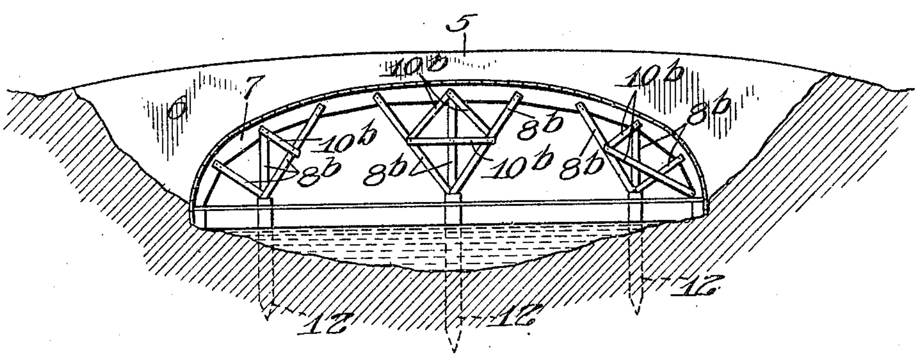
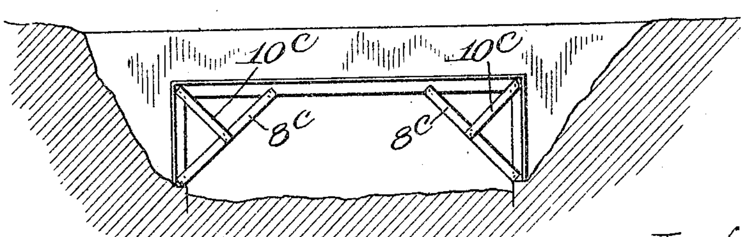



Fig. 6.




Witnesses:
Robert H. Weir
W. Perry Hahn

Inventor
Daniel B. Luten
By Robert Lewis Ames
Attorney.

# UNITED STATES PATENT OFFICE.

DANIEL B. LUTEN, OF INDIANAPOLIS, INDIANA.

## CENTERING FOR AND METHOD OF CONSTRUCTING ARCHES.

No. 802,004. Specification of Letters Patent. Patented Oct. 17, 1905.

Application filed February 25, 1905. Serial No. 247,306.

*To all whom it may concern:*

Be it known that I, DANIEL B. LUTEN, a citizen of the United States, residing at Indianapolis, Indiana, have invented certain new and useful Improvements in Centering for and Methods of Constructing Arches, of which the following is a specification.

My invention relates to the art of masonry arch construction, and pertains more particularly to a new and improved construction of centering or false work for arches, involving also a novel method or process in the construction of the arch itself by reason of the novel character and manner of manipulating the centering or false work. In building arches of considerable span—say seventy-five feet and upward—engineers usually specify that the uprights of the wooden centers on which the arch is supported during construction shall be erected on wedges, which are removed gradually after the arch is completed, so as to let the stresses develop in the arch-ring gradually. Sand-boxes have also been used for this same purpose, the upright-supports resting in boxes of sand confined by means of removable plugs or the like, and when it is desired to lower the centers or "strike the centers," as it is called, the plugs are withdrawn so as to let the sand run out of the boxes and the uprights settle slowly.

My present invention comprises a novel method and construction in arch-centering whereby this same result of an easy and gradual settling of the arch-ring may be attained in a simpler and more economical manner than by the means and methods above described and which at the same time effects an economy in the cost of the centering itself. Generally describing the novel principle and feature of the present invention it may be stated that in the erection of arch-centering the uprights employed have heretofore. so far as I am aware, been required to be of such cross-sectional dimensions in proportion to their length or height as to be capable of sustaining the entire weight of the arch-ring without bending or buckling. I have discovered that much lighter uprights may be safely employed where used in conjunction with sway-bracing, affording the same strength and rigidity of vertical support to the arch-ring during construction as the heavier uprights and dispensing with the necessity of auxilliary devices for facilitating the gradual settlement of the arch-ring, my substitute for the latter residing in the expedient of gradually removing the sway-bracing after the arch-ring has been completed to the point at which the centering may be removed, whereby the light uprights gradually bend or buckle, affording sufficient resistance to support the ring against the sudden imposition of its own weight effect, but at the same time yielding sufficiently to permit the gradual settling to permanent form which every arch-ring undergoes upon the gradual withdrawal of the support afforded by the centering.

The principal of my invention is disclosed in the accompanying drawings, which show an arch-ring supported upon my improved centering and also illustrate the manner in which the stresses are allowed to develop gradually in the arch-ring upon the removal of the centering.

Referring to the drawings, Figure 1 is a side elevational view of an arch supported upon my improved centering. Fig. 2 is a cross-sectional view of the same on the line 2 2 of Fig. 1. Fig. 3 is a perspective fragmentary view in which the uprights are shown as having greater width than thickness with bracing required consequently only in the plane of the lesser dimension. Fig. 4 is a view similar to Fig. 2, illustrating the bending or buckling of the uprights during settling of the arch and upon removal of the bracing. Fig. 5 is an elevational view of another form of centering in which the weight of the arch is transmitted to piling by compression-pieces radiating from the tops of the piling, the aforesaid compression-pieces being designed as the flexible members in my improved form of construction and held to place by the transverse bracing members; and Fig. 6 is a similar elevational view of a flat arch or girder in which still another arrangement of the compression-pieces is shown.

Referring to the drawings, 5 may designate the ring of a concrete or other masonry arch—such, for instance, as occurs in an arch-bridge—6 designating the spandrel-walls thereof.

7 designates the usual centers, supported on uprights 8, resting on sills or other firm supports 9. The uprights 8, which are usually oak or other wooden timbers, are intentionally of such cross-sectional dimensions proportionately to their length as to be incapable of resisting the gravity thrust of the arch-ring without bending or buckling thereunder.

10 designates longitudinal, and 11 transverse, sway-bracing whereby said uprights are supported at various points between their

ends against bending or buckling either longitudinally or transversely of the arch. I have found in practice that in the construction of an arch requiring oak uprights six inches square in cross-section to carry the load unbraced uprights four inches square in cross-section may be safely substituted when used in conjunction with sway-bracing to afford the same rigid support to the arch-ring during construction. When in the building of the arch the work has progressed to the point where the centering is to be removed and the arch-ring allowed to settle, I gradually remove the sway-bracing, the effect of which is to cause the light uprights under the heavy load to slowly bend or buckle a few inches out of true vertical position, as illustrated in Fig. 4. Preferably the bracing is removed gradually from the several uprights or columns, so that the settling of the arch-ring thereupon takes places very gradually, the uprights acting as springs elastically supporting a large part of the weight, while at the same time permitting the arch to gradually assume its full loading. As the uprights bend their resistance to the imposed loading decreases, so that they act as springs supporting the arch, yet with diminishing resistance as the arch settles, thus requiring the arch to assume its full loading as the uprights buckle, a most desirable function. If there be any danger of the collapse of the arch as the support of the centering decreases, it may be guarded against by the previous introduction of auxiliary props to receive the arch in case the centering should suffer complete collapse. After removal of the bracing from the uprights the uprights themselves may be cut out one by one, removing first, preferably, the more unimportant members near the ends of the span.

A desirable modification for some cases is the use of compression members $8^a$, Fig. 3, having a less diameter in one direction transverse to its length than in the other, so that buckling can occur in but one direction. The compression members are then braced against bending in this direction, as by the transverse braces $11^a$, and the bracing in the other direction may be dispensed with.

Fig. 5 shows a form of centering embodying the principle of my invention, wherein the weight of the arch is transmitted to piling 12 by compression members or struts $8^b$, radiating from the tops of the piling, said compression members being designed to be flexible and held against bending during erection of the arch-ring by bracing $10^b$.

While I have described the device as applied particularly to the lowering of an arch, it is apparent that the principle of the invention is applicable to the construction of girders, floors, and other constructions where a superimposed structure is to assume the loading after erection on a temporary false work, as in Fig. 6, wherein $8^c$ represents the main compression-struts braced against buckling by the braces $10^c$.

In view of the fact that the heavy uprights constitute the most expensive part of the centering, while the sway-bracing represents the least expensive part thereof, it is obvious that my invention effects a material economy in the total cost of centering material, aside from the important advantage of dispensing with the necessity for wedges, sand-boxes, and similar devices for effecting the gradual lowering of the uprights from the arch-ring in striking the centers.

I have used the term "uprights" not in the narrow sense of a vertical member, but in the broad sense of a vertical or inclined piece or any compression member or strut.

I claim—

1. The method of constructing an arch which consists in erecting the same on centering having braced uprights too light to carry the arch without bracing, and subsequently removing the bracing, allowing the uprights to bend or buckle as the arch settles and assumes its loading, substantially as described.

2. The method of constructing an arch which consists in erecting the same on centering having laterally-braced uprights too light to carry the arch without bracing, and subsequently gradually removing the bracing from the uprights successively, allowing the latter to bend or buckle as the arch settles and assumes its loading, substantially as described.

3. In arch or analogous constructions, a false work or centering having flexible weight-resisting members held rigidly to place by removable bracing, substantially as described.

4. In arch or analogous constructions, a false work or centering having flexible members adapted to resist endwise compressive strains held rigidly to place by removable lateral bracing, substantially as described.

5. An arch or similar centering comprising uprights or columns too light to alone carry the weight of the arch without bending, and removable sway-bracing for said uprights, substantially as described.

6. An arch or similar centering comprising uprights or columns too light to alone carry the weight of the arch without bending, and removable sway-bracing serving to support said uprights against bending in all directions, substantially as described.

Signed by me at Indianapolis, county of Marion, State of Indiana, in the presence of two witnesses.

DANIEL B. LUTEN.

Witnesses:
A. C. Brown,
J. C. Stuctsenberg.

D. B. LUTEN.

PROCESS OF BUILDING REINFORCED CONCRETE ARCHES.

APPLICATION FILED JULY 27, 1911.

**1,089,488.** Patented Mar. 10, 1914.

Fig. 1.

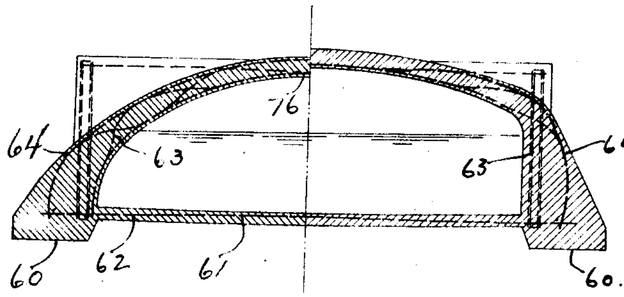



Fig. 2.

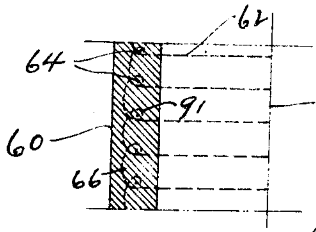
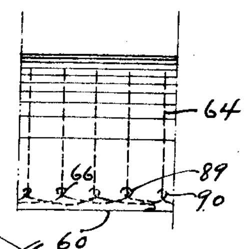



Fig. 3.



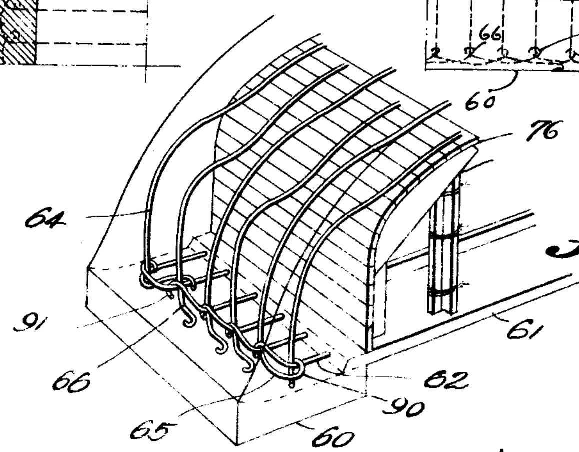




Fig. 4.

WITNESSES:

Paul Klingensmith

B. H. Moore

INVENTOR.

Daniel B. Luten.

# UNITED STATES PATENT OFFICE.

DANIEL B. LUTEN, OF INDIANAPOLIS, INDIANA.

## PROCESS OF BUILDING REINFORCED-CONCRETE ARCHES.

**1,089,488.** Specification of Letters Patent. **Patented Mar. 10, 1914.**

**Original application filed May 17, 1902, Serial No. 107,812. Divided and this application filed July 27, 1911. Serial No. 640,834.**

*To all whom it may concern:*

Be it known that I, Daniel B. Luten, a citizen of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented a new and useful Process of Building Reinforced-Concrete Arches, of which the following is a specification.

My invention relates to a process of building reinforced concrete arches and has for its purpose to provide a method of placing the reinforcing members for arch structures, resulting in greater ease of erection, accuracy of placing and security of anchorage.

The present application constitutes a division of an application filed by me May 17, 1902, Serial No. 107,812.

The invention is illustrated in the accompanying drawings in which the same reference characters describe like parts throughout the several views.

Figure 1 is a longitudinal section of an arch, the two halves being on different section lines, Fig. 2 is a sectional half plan of the footings of the arch, Fig. 3 is a detail section of the connection between members, and Fig. 4 is a phantom perspective of one end of an arch, showing the embedded tension members, the centering, and the different stages in the process of building.

The process consists in erecting a reinforced concrete arch by first laying foundations 60, then placing a concrete pavement 61 with longitudinal reinforcing members 62 embedded therein and projecting beyond the ends of the pavement and lying above the foundations. The ends of these reinforcing members are formed into spirals 66 for anchorage as shown in Figs. 2, 3, and 4, the spirals being tangential to the members and of decreasing radii from the point of tangency. Such a spiral serves to anchor the member securely with minimum extension, it being possible to develop the full strength of the member by such a spiral anchor in concrete with less than one half the length required for a straight extension. Sufficient straight extension cannot usually be secured because of the thinness of the abutment. Reinforcing members 63 and 64 to be later embedded in the arch are then anchored to the projecting spirals 66 of the pavement members 62 by similar spirals 65 passing through the above mentioned spirals 66. The ends of the vertical reinforcing members 63 and 64, as seen in Figs. 3 and 4, are bent around the corresponding horizontal pavement members 62 and the end hooked over one of the adjacent horizontal pavement members. The ends of the members 64 may be hooked around the second distant rod, as shown at 89, or around the adjacent rod, as shown at 90, but of course in either case the principle remains the same and any arrangement in this respect is still within the scope of the invention. Figs. 2 and 4 show the ends 91 of the horizontal pavement members 62 looped about in the same manner, the said ends being hooked about the adjacent vertical members 64; or the rods may be extended at an angle into the concrete and anchored, thus bonding in transverse direction. This arrangement of the ends has the advantage of providing a construction in which the ends of the rods cannot pull out and also furnishes the abutment with a transverse bonding and strengthening member which tends to prevent unequal settlement. The centers on which the arch is to be formed are erected on the pavement 61 and the members 63 and 64 are embedded in the concrete or other material of the bench walls or abutments and the members 64 pass close to the intrados of the arch at the crown 76. The members 64 preferably sag a little so that the least weight upon the arch will produce tension in them. When brought to their proper curvature they may be temporarily attached to the centers at occasional intervals to hold them to place, the anchorage at the end of each member serving to secure it with the assistance of occasional attachment or bracing at infrequent intervals. The pavement on which the centers are erected, serves as a solid foundation for supporting the centers for the arch, as well as increasing the bearing area of the foundations of the structure. The pavement is strengthened by the embedded rods, enabling it to better stand the strains to which it is subjected in sustaining the centers for the arch in the course of its erection.

Finally the concrete of the arch ring is placed on the centers to completely embed all reinforcing members. After allowing sufficient time to elapse to permit the concrete to harden properly the centers are removed.

I claim:—

1. That improvement in the art of building a reinforced concrete arch comprising placing concrete foundations, then placing tension members having spiral ends projecting into the space over said foundations, then erecting the centers for the arch, then placing arch reinforcing members having spiral ends and interlocking such spiral ends with the spiral ends of the first named tension members, then bending the arch reinforcing members so that they are supported by the centers, and then placing the concrete of the arch to embed the arch reinforcing members and the projecting spiral ends.

2. That improvement in the art of building a reinforced concrete arch comprising placing concrete foundations, then placing tension members having bent ends projecting into the space over said foundations, then erecting the centers for the arch, then placing arch reinforcing members having bent ends, then bending the arch reinforcing members so that they are supported by the centers, and then placing the concrete of the arch to embed the arch reinforcing members and the projecting bent ends.

3. That improvement in the art of building a reinforced concrete bridge comprising placing the foundations, then laying between the foundations a pavement having anchor ends projecting from the pavement into the space over the foundations, then erecting on the pavement the centers for the arch, then placing arch reinforcing members and interlocking them with the projecting anchor ends, then bending the arch reinforcing members into position where they are supported at the crown by the centers, and finally embedding the arch reinforcing members and the projecting anchor ends in concrete.

4. That improvement in the art of building a reinforced concrete bridge comprising placing the foundations, then laying between the foundations a pavement having anchor ends projecting from the pavement into the space over the foundations, then erecting on the pavement the centers for the arch, then placing arch reinforcing members and interlocking them with the projecting anchor ends, and finally embedding the arch reinforcing members and the projecting anchor ends in concrete.

5. That improvement in the art of building a reinforced concrete bridge comprising placing the foundations, then laying between the foundations a pavement having anchor ends projecting from the pavement into the space over the foundations, then erecting on the pavement the center for the arch, then placing arch reinforcing members, then bending the arch reinforcing members into position where they are supported at the crown by the centers, and finally embedding the arch reinforcing members and the projecting anchor ends in concrete.

6. That improvement in the art of building a reinforced concrete bridge comprising placing the foundations, then laying between the foundations a pavement having anchor ends projecting from the pavement into the space over the foundations, then erecting on the pavement the centers for the arch, then placing arch reinforcing members, and finally embedding the arch reinforcing members and the projecting anchor ends in concrete.

7. That improvement in the art of building a reinforced concrete bridge comprising placing the foundations, then laying between the foundations a pavement having anchor ends projecting from the pavement into the space over the foundations, then erecting on the pavement the centers for the arch, then placing arch reinforcing members and supporting them on the centers, and finally embedding the arch reinforcing members and the projecting anchor ends in the concrete.

8. That improvement in the art of building a reinforced concrete arch comprising placing concrete foundations and tension members, the latter having bent ends projecting into the space over said foundations, then erecting the centers for the arch, then placing arch reinforcing members having bent ends and interlocking them with the bent ends of the first named tension members, and then placing the concrete of the arch to embed the arch reinforcing members and the projecting bent ends.

9. That improvement in the art of building a reinforced concrete bridge comprising placing the foundations and a pavement between the foundations and embedding in the pavement tension members having anchor ends projecting into the space over the foundations, then erecting on the pavement the centers for the arch, then placing arch reinforcing members and interlocking them with the projecting anchor ends, and finally embedding the arch reinforcing members and the projecting anchor ends in concrete.

10. That improvement in the art of building a reinforced concrete bridge comprising placing the foundations and a pavement between the foundations and embedding in the pavement tension members having an-

chor ends projecting into the space over the foundations, then erecting on the pavement the centers for the arch, then placing arch reinforcing members, and finally embedding the arch reinforcing members and the projecting anchor ends in concrete.

In witness whereof, I have hereunto set my hand and seal at Indianapolis, Indiana, this 24th day of July, A. D. one thousand nine hundred and eleven.

DANIEL B. LUTEN. [L. S.]

Witnesses:

MAY LAYDEN,

FRANK A. FAHLE.

D. B. LUTEN.
ARCH.
APPLICATION FILED MAR. 2, 1908.

**1,186,108.** Patented June 6, 1916.
2 SHEETS—SHEET 1.

Fig. 1.

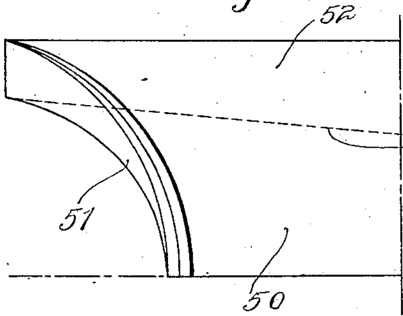



Fig. 2.

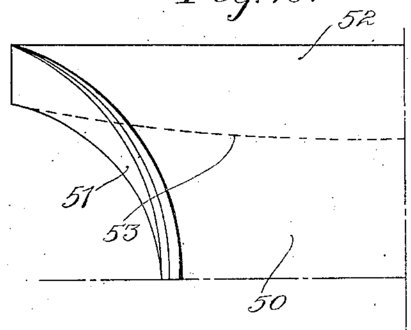



Fig. 3.

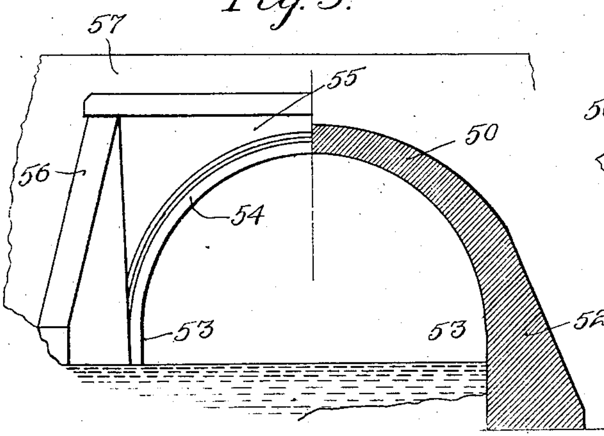



Fig. 4.

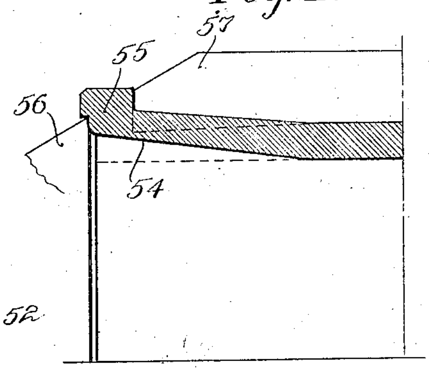



Fig. 5.

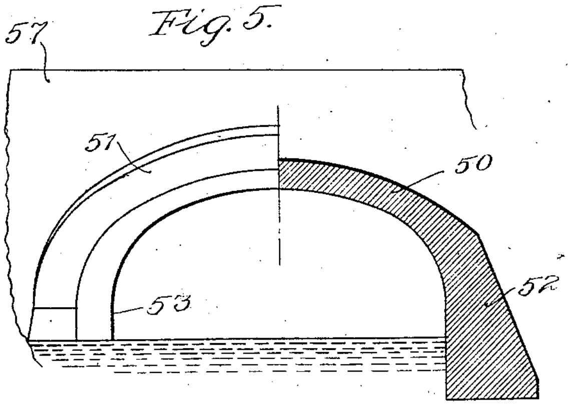
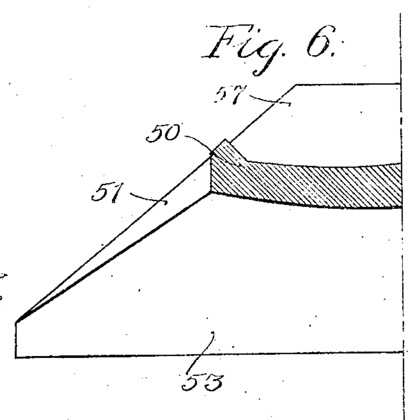



Fig. 6.




Witnesses:
Wm Loeffler
C. L. Hopkins

Inventor
Daniel B. Luten
By Jones, Addington & Ames.
Attorneys.

D. B. LUTEN.

ARCH.

APPLICATION FILED MAR. 2, 1908.

**1,186,108.**

Patented June 6, 1916.

2 SHEETS—SHEET 2.

*Fig. 7.*

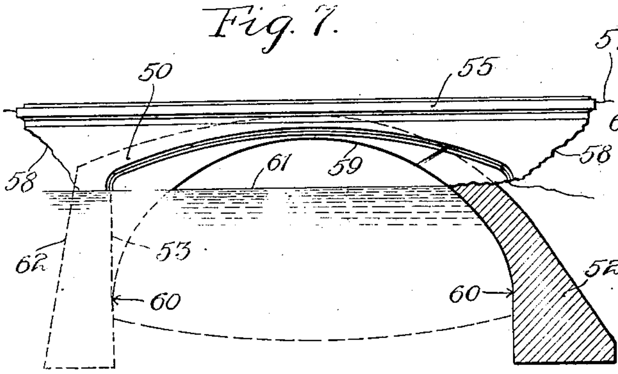



*Fig. 8.*

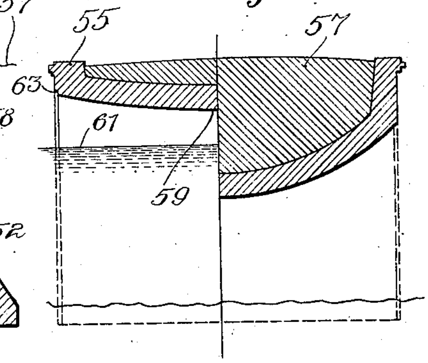
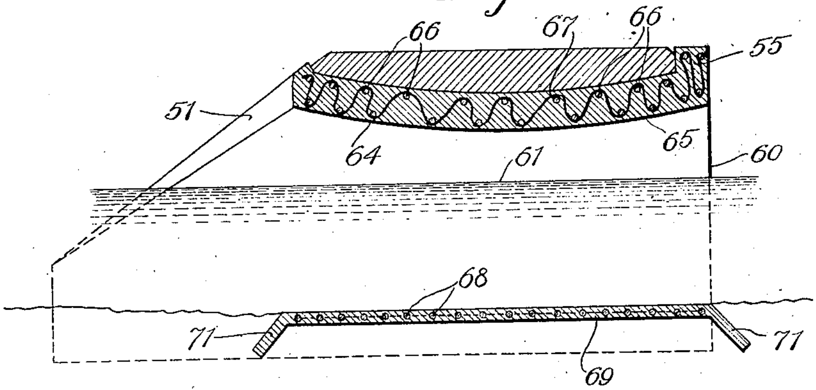



*Fig. 9.*




Witnesses:
Wm Loeffler
C. L. Hopkins

Inventor
Daniel B. Luten
By Jones, Addington & Ames
Attorneys.

# UNITED STATES PATENT OFFICE.

DANIEL B. LUTEN, OF INDIANAPOLIS, INDIANA.

ARCH.

1,186,108. Specification of Letters Patent. Patented June 6, 1916.

Original application filed May 17, 1902, Serial No. 107,812. Divided and this application filed March 2, 1908. Serial No. 418,793.

*To all whom it may concern:*

Be it known that I, DANIEL B. LUTEN, a citizen of the United States, residing at Indianapolis, in the State of Indiana, have invented new and useful Improvements in Arches, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

My invention relates to improvements in concrete construction particularly of arches and especially when reinforced with embedded tension members to reduce the material otherwise required to transmit thrusts and loads from the structures to their foundations.

This application is a division of an application filed by me May 17, 1902, Serial No. 107,812.

This invention is illustrated in the accompanying drawings forming part of this specification, in which the same reference characters designate like parts throughout the several views, and in which;—Figures 1 and 2 are quarter plan views of an arch showing novel arrangements of the footings. Fig. 3 is a half elevation and half longitudinal section of an arch of constricted waterway. Fig. 4 is a transverse section taken on the center line of Fig. 2. Figs. 5 and 6 are views similar to Figs. 3 and 4 for an arch in which the waterway is constricted by a general curving of the inner surface of the arch. Fig. 7 is an elevation and part section of an arch in which the transverse curvature of the inner surface varies with different points in the span. Fig. 8 represents half-sections transverse to Fig. 7 at the center and near the abutment, and illustrating the different curvatures. Fig. 9 is a transverse section of a reinforced concrete arch bonded longitudinally and transversely by embedded tension members and having its thrust resisted by tension members from abutment to abutment across the bed of the stream.

In arches which are to support heavy embankments of earth and which should be designed to secure the maximum discharge of water, economy of material is secured by thickening the arch rib and the abutments toward the middle of the embankment where the load is heaviest. This strengthening has hitherto been accomplished by adding material on the outside, the intrados remaining straight or cylindrical. In my arch however I prefer to add the increased thickness to the inside, which causes the ends to flare outwardly to form a conical or funnel-shaped intrados and by which arrangement is secured both maximum discharge and increased strength.

Figs. 1 and 2 show arches of the horseshoe or warped end type, in which 50 indicates the barrel or rib of the arch, 51 the warped end, 52 the abutment in plan, and 53 the inner bounding line of the abutment, straight in Fig. 1 as part of the conical inner surface, and curved in Fig. 2 as part of a double curved surface composing the intrados. The effect of great discharge is more fully realized in the form of walls or abutments shown in Fig. 2 in which the inner wall 53 may be curved on a true cycloidal curve whereby the barrel of the arch forms a Venturi tube capable of discharging considerably more water than the old form of arch.

Figs. 3 and 4 show an arch of the wing and spandrel type with the inner surface of the funnel or conical form at the ends as shown at 54 whereby from 25 to 50 per cent. greater discharge is secured. The same amount of material is used as in the straight barrel ordinarily used, indicated by dotted lines in Fig. 4, and the arch is of the same strength. 55 is the spandrel and 56 the wing at the end of the arch to retain the embankment or filling 57. The section of the abutment 52 is shown at the right in Fig. 3, the same being taken at the transverse center of the arch.

In Figs. 5 and 6, the arch 50 has the elliptical form, with the warped end 51, the side walls 53, and its inner surface curved at the ends in the form of a cycloid whereby a structure especially adapted for a heavy loading and maximum discharge is secured.

The arch of Figs. 7 and 8 is designed for locations where there is deep water and low banks, such as a deep stream or millrace, and where at the same time a good appearance is desired. For the sake of appearance, an arch should have its springing above the water line; but where the banks are low and the water deep, this would often require an excessively flat arch on high abutments, expensive to erect. By making use of the funnel-shaped intrados, the face of the arch may be made to present the proper appearance by designing it flat with springings above the water line while the main body of the arch which sustains the principal part of the loading may have its springing near the base of the abutment, which accompanied by the considerable rise that results, produces a very strong and economical structure. In such an arch the inner surface may be made straight transversely at the crown, and sagged at the haunches and straight again at the springing, or the conical form may be given in varying degrees to different parts of the inner surface. This funnel-shaped device has the additional function of increasing the discharge capacity of the arch. Thus, it is a well-known fact that a Venturi tube or funnel-shaped discharge pipe will discharge under slight head a much greater quantity of water than a straight tube. In these figures therefore, 57 indicates the roadway filling, and 58 the limits of the embankment. The spandrel walls 55 are straight and the transverse center of the arch as shown by the line 59 has its springing point 60 considerably below the water line 61, the abutment 52 in this portion of the arch, being of the form shown in section at the right of Fig. 7, and being designed for strength and stability. At the ends of the abutment however the abutment is made high with the inner and outer walls 53 and 62 extended about to the water line. The arch ring 50 then springs from the top of this abutment and thus the structure has the appearance of a handsome elliptical arch with springing lines at the water line. In transverse section as shown in Fig. 8, the curve from the center 59 to the edge 63 on the left is gradual and substantially of the Venturi form, but nearer the sides as shown enlarged at the right in the said figure, the flaring is greater, so that the curve for maximum discharge is somewhat departed from. The net result for the whole structure is that an arch is obtained having a neat and handsome external appearance, that is much stronger than one would be if designed on the lines of the external arch ring, if indeed one could be so constructed at all, and one that is capable of greater discharge than the straight-barrel arch of either type.

In Fig. 9, one side of the arch is shown with the usual spandrel end 55 and the other side with the warped end 51. The inner surface is formed to a cycloidal 64 at the up-stream side and to a conical surface 65 at the down-stream side. The springing point 60 is above the water line 61 at the spandrel end, and the springing lines are vertically curved. Longitudinal reinforcing members 66 are embedded in the arch rib and transverse reinforcing members 67 bond the arch transversely, and also act as stirrups to restrain the longitudinal members 66. The abutments are tied together by longitudinal ties 68, embedded in a thin concrete pavement 69, to render the bridge proof against undermining in floods, and this pavement is provided with aprons at up-stream and down-stream sides shown at 71. In a doubly curved arch of this form, and thus reinforced, any distortion of the arch ring would be resisted to a much greater degree than in the straight cylindrical arch for the same reason that a buckle plate is stronger than a flat sheet under transverse forces. The distance of most of the material from the general neutral axis of the structure has been much increased, and the radius of gyration of the section is greater than that of a cylindrical arch.

Thus while the invention has been described specifically with reference to particular details of construction, it is to be understood that it is not so limited, but on the contrary may be embodied in various forms without departing from the scope or principle of the same.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

An arch having an inner surface convex in transverse section, the degree of convexity increasing from the middle of the span toward the end of the span, and the springings of the arch being highest at the faces of the arch.

In witness whereof, I have hereunto subscribed my name in the presence of two witnesses.

DANIEL B. LUTEN.

Witnesses:
J. P. Cook,
C. H. Knight.

**APPENDIX B: BRIDGE DESCRIPTIONS AND SIGNIFICANCE EVALUATIONS**

## Kenova Bridge No. 259 (historic name)
## Kenova Bridge, County Bridge Number 3310-02.49 (modern name)
## Project Field Number WCLB-1

Description:

This single span reinforced concrete bridge – a filled spandrel deck arch type – conveys Kenova Road over Pine Creek near the former community of Kenova, 1.5 miles west of Pine City. Although a county road, Kenova Road is unpaved and lightly used, now serving primarily as a farm access route.

The bridge is symmetrically arranged, approximately 90 feet long and 21.5 feet wide, with a 70-foot long semielliptical arch extending between the battered abutment faces. The sides of the abutments are flat and slightly wider than the adjacent closed spandrel walls. The abutments and spandrel walls were cast separately and impressions of the horizontal 7-inch wide board forms remain visible in both sections. Neither the abutments nor the spandrels are ornamented with geometric designs, although cement stucco was applied to visible portions of these features in an attempt to hide the mold seams. The arched lower edges of the spandrels are beveled, as are visible vertical edges of the abutments. The spandrel and abutment walls are capped with slightly overhanging concrete coping, beveled top and bottom on the outer side and unbeveled, forming a low curb, on the side toward the roadway.

A low solid parapet railing, cast atop the coping of the spandrel and abutment walls, borders the bridge on both sides. Each parapet is cast in seven sections – a narrow central segment, embellished on both inner and outer surfaces with a horizontal incised rectangle; two longer segments on each side of the central section, each embellished on inner and outer surfaces with two incised horizontal rectangles; and a segment of moderate length over the abutment at each end of the parapet, embellished on both inner and outer surfaces with a horizontal rectangle, with a square diamond shape superimposed over the center of the rectangle on each inner surface. A bridge plaque, within the diamond at the northwest corner of the bridge, has been removed. The two abutment segments of each parapet are slightly higher and wider than the five central (spandrel) segments, and are capped with slightly overhanging concrete coping with beveled edges and a faintly rounded upper surface. The coping is highly deteriorated and most is missing from the east parapet abutment segments. The spandrel segments have flat tops with beveled edges, rather than coping. The vertical corners of all parapet segments are beveled. The parapets were cast in horizontal board forms and finished with a light coat of stucco to hide the mold seams.

The arch barrel was cast in four longitudinal sections: a 21-inch wide spandrel wall at each side and two approximately equal 6- or 7-feet wide sections in the center. (In Luten designs, the spandrel wall is generally placed beside rather than on top of the arch ring.) The arch barrel was cast in horizontal 5-inch wide board forms, the boards running perpendicular to the bridge and parallel to the stream. Some deterioration and spalling of concrete can be seen on lower portions of the arch barrel and a round ¾-inch diameter ferrous metal reinforcing rod is visible in a spalled section. A modern corrugated metal bulkhead and concrete and rock riprap have been installed at the northeast corner of the bridge to control erosion.

Although not visible, space within the bridge – over the arch barrel and bounded by the spandrel and abutment walls – is filled with packed earth and rock. A concrete deck was poured atop the fill, now covered with dirt, continuous with that of the unsurfaced Kenova Road. Engineering plans for the bridge depict steel reinforcing rods connecting all parts of the bridge – the abutments, arch barrel, spandrels, and parapets (Whitman County 1916a).

Significance Evaluation:

This bridge, originally called Kenova Bridge No. 259, was built in 1916 on what was then the W. J. Lawrence Road, a road officially established by the county in 1909. The bridge is a Daniel B. Luten reinforced concrete filled spandrel deck arch design, a typical example of Luten's highway bridge structures (Whitman County ca. 1900s-1970s, 1909, 1916a). Today the bridge remains in use as part of the Whitman County road system.

During the late nineteenth and early twentieth centuries, Daniel B. Luten pioneered the use of reinforced concrete as a bridge construction material, patented his designs and methods, and widely publicized his results. As a result, Luten-designed reinforced concrete bridges were built throughout the nation during the 1910s and 1920s period. Although Luten designed other types of reinforced concrete bridges, his typical design was a filled spandrel deck arch bridge, often with solid parapet railings and incised geometric ornament. Reinforced concrete filled spandrel deck arch bridges of Luten design are therefore a significant bridge type which, if retaining sufficient integrity of location, design, setting, materials, workmanship, feeling, and association, are eligible for listing in the National Register of Historic Places. Such bridges are significant under Criterion C, at the state level, for their association with Daniel B. Luten's pioneering efforts in reinforced concrete bridge construction and as examples of Luten's distinctive filled spandrel deck arch designs.

Increasing automobile ownership during the early twentieth century led to a growing demand throughout the nation for improved roads, and state and local governments became actively involved in road construction and maintenance. Bridges were important features of these new transportation systems, and such structures, if retaining sufficient integrity of location, design, setting, materials, workmanship, feeling, and association, are eligible for listing on the National Register of Historic Places under Criterion A, at the state or local level, for their contributions to the development of regional road and highway networks.

Kenova Bridge retains all aspects of integrity to a sufficient degree and is therefore recommended eligible for listing in the National Register of Historic Places under Criterion A at the local level and under Criterion C at the state level.

***Figure A-1. Kenova Bridge (Field Number WCLB-1), west side as viewed from Hole-in-the-Ground Road; view to the northeast.***

*Figure A-2. Kenova Bridge (Field Number WCLB-1), west side; view to the southeast.*

*Figure A-3. Kenova Bridge (Field Number WCLB-1), east side; view to the northwest.*

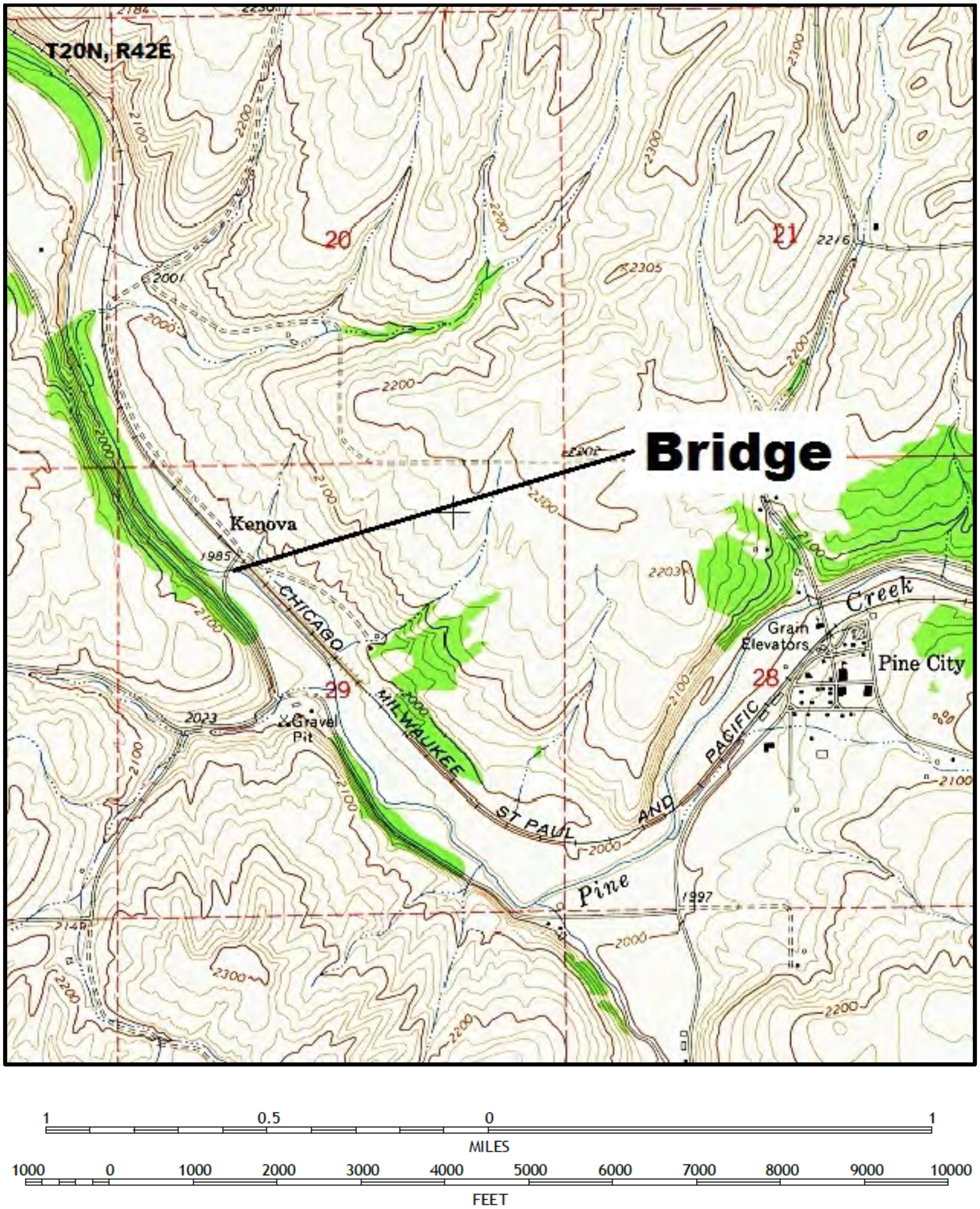



*Figure A-4. Location of Kenova Bridge (Field Number WCLB-1); map adapted from Pine City, Wash., 7.5' quadrangle, U.S. Geological Survey, 1964.*

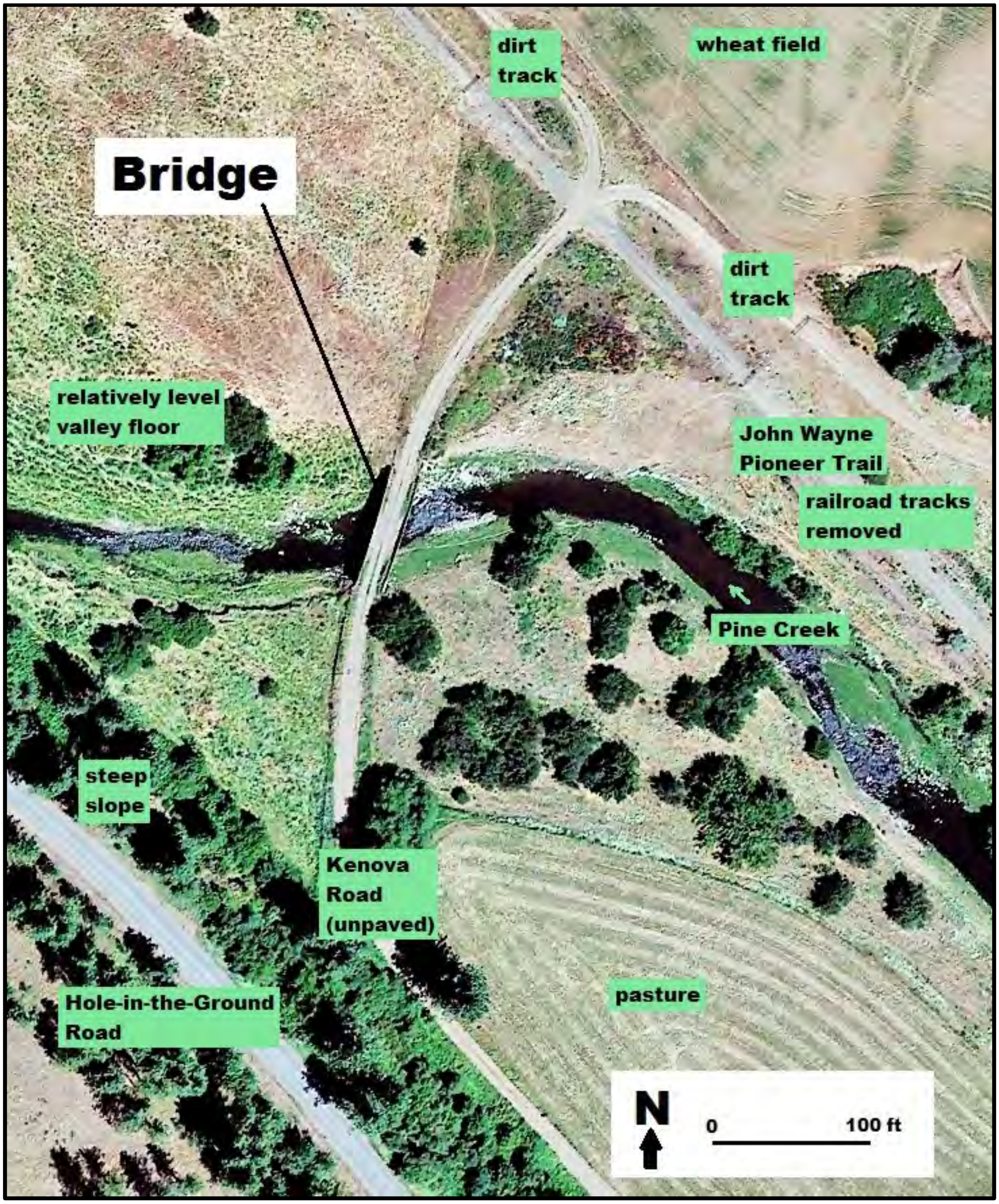



*Figure A-5. Kenova Bridge (Field Number WCLB-1) vicinity; map adapted from Google Earth aerial photograph, 2017.*

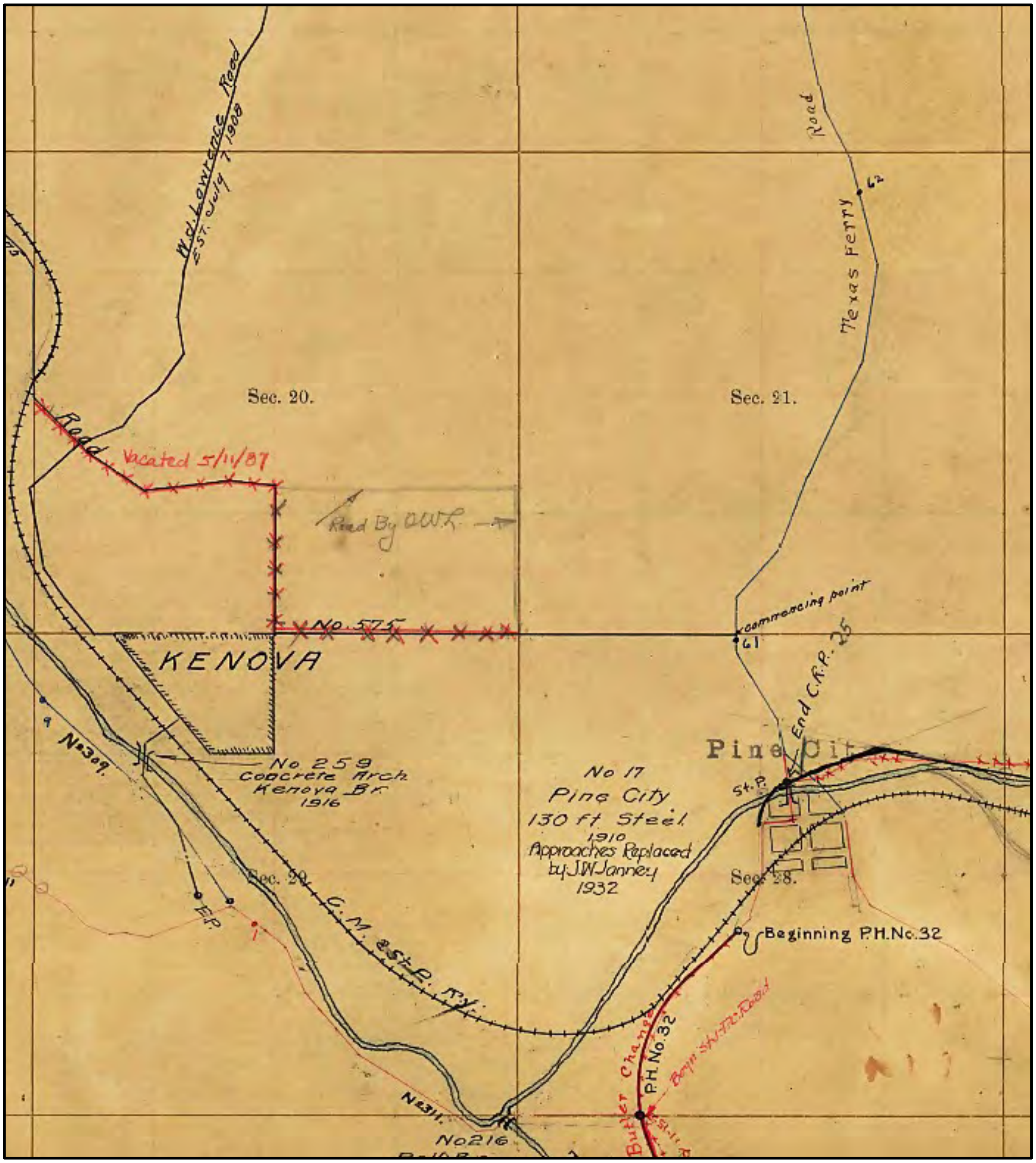



*Figure A-6. Kenova Bridge (Field Number WCLB-1) depicted in the Whitman County Highway Plat Book, just southwest of the community of Kenova on the W. J. Lawrence Road; the bridge is identified as "No. 259 Concrete Arch Kenova Br. 1916" (Whitman County ca. 1900s-1970s).*

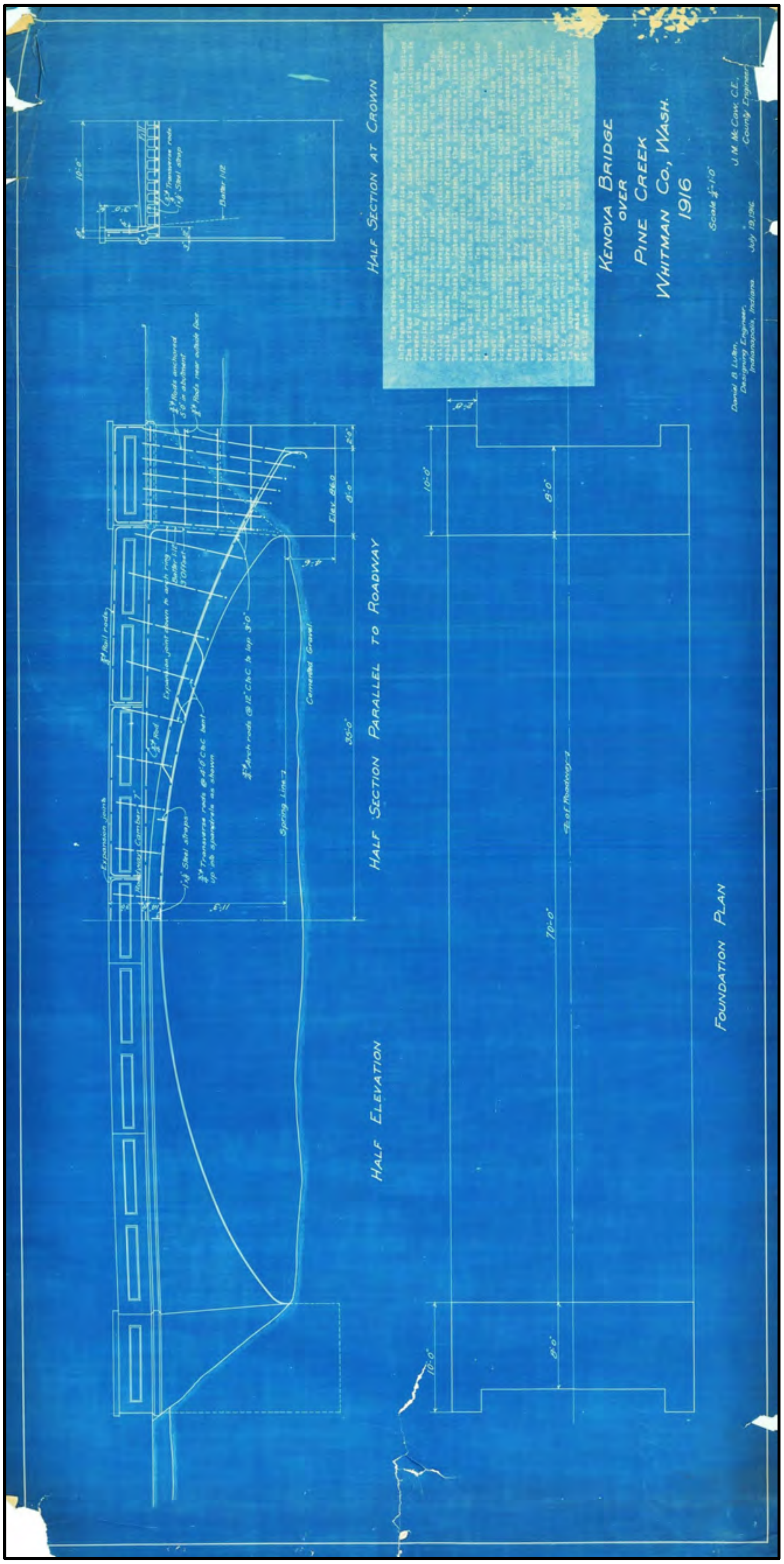
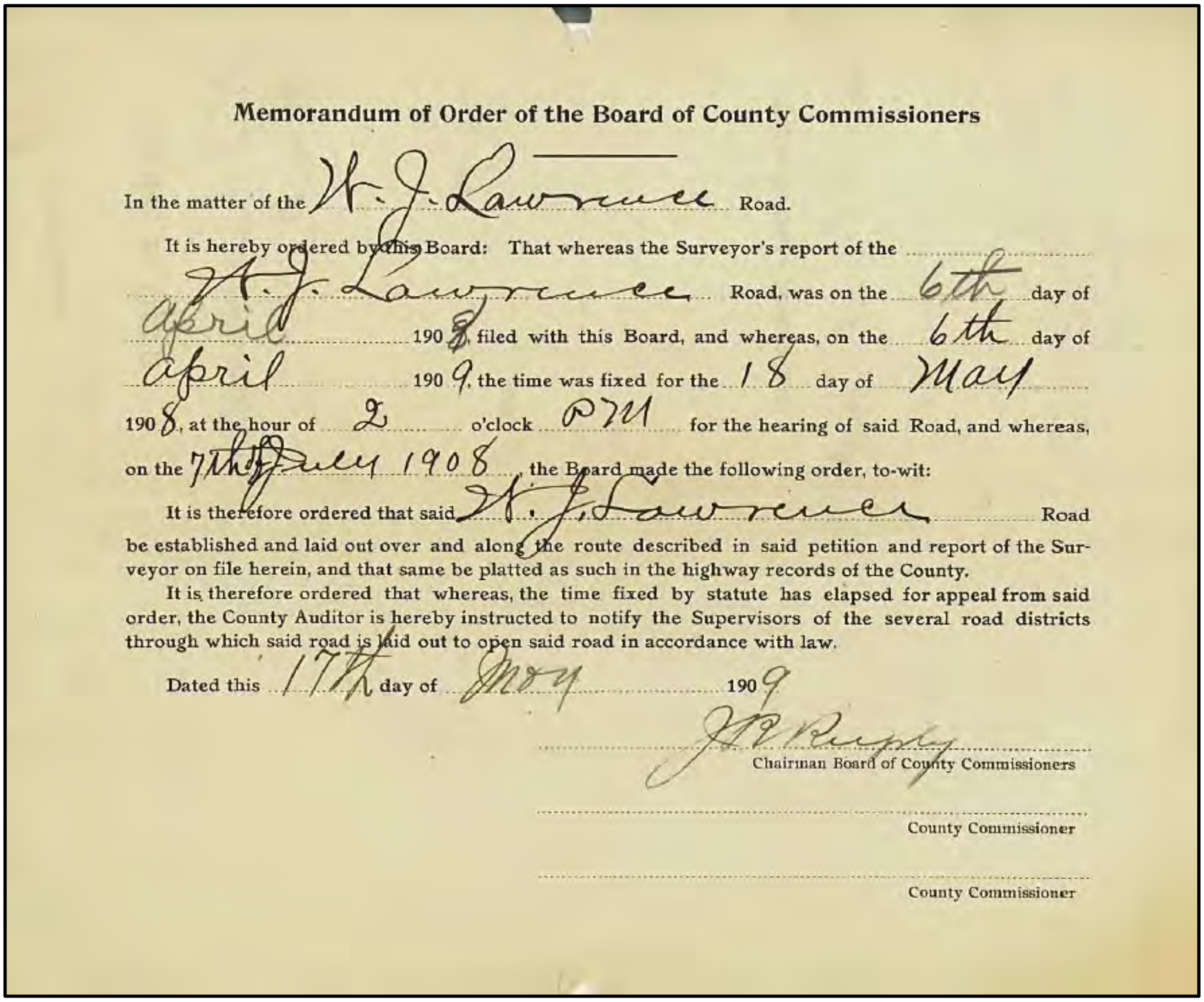



***Figure A-7. Kenova Bridge (Field Number WCLB-1) engineering plans, 1916 (Whitman County 1916a).***



**Memorandum of Order of the Board of County Commissioners**

In the matter of the W. J. Lawrence Road.

It is hereby ordered by this Board: That whereas the Surveyor's report of the W. J. Lawrence Road, was on the 6th day of April 1908, filed with this Board, and whereas, on the 6th day of April 1909, the time was fixed for the 18 day of May 1908, at the hour of 2 o'clock PM for the hearing of said Road, and whereas, on the 7th July 1908, the Board made the following order, to-wit:

It is therefore ordered that said W. J. Lawrence Road be established and laid out over and along the route described in said petition and report of the Surveyor on file herein, and that same be platted as such in the highway records of the County.

It is therefore ordered that whereas, the time fixed by statute has elapsed for appeal from said order, the County Auditor is hereby instructed to notify the Supervisors of the several road districts through which said road is laid out to open said road in accordance with law.

Dated this 17th day of May 1909

J. R. Ripley
Chairman Board of County Commissioners

County Commissioner

County Commissioner

*Figure A-8. Order to open W. J. Lawrence Road (present-day Kenova Road), 1909 (Whitman County 1909).*

**McLeod (MacLeod) Bridge No. 100 (historic name)**
**McLead Bridge, County Bridge Number 1000-00.68 (modern name)**
**Project Field Number WCLB-2**

Description:

This single span reinforced concrete bridge – originally a filled spandrel deck arch structure – conveys Farmington Road, a heavily used two-lane highway, over Hangman Creek just south of the City of Tekoa. The area is rural and the road receives considerable agricultural traffic, which necessitated widening of the bridge in the late 1960s or early 1970s. The bridge is approximately 98.5 feet long and 30 feet wide. Two large concrete girders, resting atop modern reinforced concrete abutments were added on the east side of the bridge ca. 1969, significantly altering the structure's form and appearance.

The bridge's original construction remains visible, virtually unaltered, on the west side of the bridge. Here a 65-foot long semielliptical arch extends between the battered faces of the abutments, while the abutment side walls protrude slightly beyond the face of the adjacent closed spandrel. The spandrel wall and abutments were cast separately and impressions of the horizontal 7-inch wide board forms remain visible in both sections despite application of cement stucco to hide the mold seams. Both the spandrel and abutments are ornamented with incised geometric designs: Two large triangles embellish the spandrel, one on either side of the arch, with each hypotenuse curved to match the curve of the arch ring, and a large rectangle ornaments each abutment, the visible vertical line paralleling the abutment's battered face. The arched lower spandrel edge is beveled, as are visible vertical edges of the abutments. The spandrel and abutment walls are capped with slightly overhanging concrete coping, beveled top and bottom on the outer side and unbeveled, forming a low curb, on the side toward the roadway.

A low solid parapet railing, cast atop the coping of the spandrel and abutment walls, borders the bridge on the west side. This parapet is cast in seven sections – a narrow central segment, embellished on both inner and outer surfaces with a horizontal incised rectangle; two longer segments on each side of the central section, each embellished on inner and outer surfaces with two incised horizontal rectangles; and a segment of moderate length over the abutment at each end of the parapet, embellished on both inner and outer surfaces with a horizontal rectangle. The center of the incised rectangle on the inner north abutment parapet was extended vertically to accommodate a bronze bridge plaque, which reads, "1916 / WHITMAN COUNTY / COMMISSIONERS / W. E. THOMPSON / W.[?] W. WHITLOW / B. T. MANCHESTER / JOHN M. McCAW / COUNTY ENGINEER / CONTRACTOR / CHARLES G. HUBER." The two parapet abutment segments are slightly higher and wider than the five central (spandrel) segments, and are capped with slightly overhanging concrete coping with beveled vertical corners and a faintly rounded upper surface. The spandrel segments have flat tops with beveled edges, rather than coping. The vertical corners of all parapet segments are beveled. The parapets were cast in horizontal board forms and finished with a light coat of stucco to hide the mold seams.

Little historical fabric remains visible on the east side of the bridge. Although the original spandrel wall with its incised triangles remains intact, it is nearly hidden behind the two large modern concrete girders that were added to widen the bridge. The original abutments are no longer visible, obscured by the large modern reinforced concrete abutments supporting the girders. The original parapet has been replaced on this side by a modern W-beam guardrail.

The arch barrel was cast in five longitudinal sections: a 29-inch wide spandrel wall at each side and three approximately equal sections, estimated at 4 feet wide, in the center. (In Luten designs, the spandrel wall is generally placed beside rather than on top of the arch ring.) The arch barrel was cast in horizontal 5-inch wide board forms, the boards running perpendicular to the bridge and parallel to the stream. Today some deterioration and spalling of concrete can be seen on lower portions of the arch barrel.

Although not visible, space within the original bridge – over the arch barrel and bounded by the spandrel and abutment walls – is filled with packed earth and rock. A concrete deck was poured atop the fill, now covered with pavement, continuous with that of Tekoa-Farmington Road. Steel reinforcing rods presumably connect all parts of the original bridge – the abutments, arch barrel, spandrels, and parapets.

<u>Significance Evaluation</u>:

This bridge, originally named McLeod (MacLeod) No. 100, was built in 1916 on a major route that was probably part of either McLeod Road or Improved Road No. 8 (Whitman County ca. 1900s-1970s). Although original engineering plans for the bridge were not located, the bridge appears to be a Daniel B. Luten reinforced concrete filled spandrel deck arch design, one of Luten's typical highway bridge structures. The bridge plaque identifies the builder as Charles G. Huber, a Seattle contractor who specialized in construction of Luten-designed bridges (Pacific Builder and Engineer 1919). Around 1969 large modern girders and abutments were added on the east side of the bridge to widen the structure, and modern guardrails replaced the original east parapet (Whitman County ca. 1969). Today the bridge remains part of the Whitman County highway system.

During the late nineteenth and early twentieth centuries, Daniel B. Luten pioneered the use of reinforced concrete as a bridge construction material, patented his designs and methods, and widely publicized his results. As a result, Luten-designed reinforced concrete bridges were built throughout the nation during the 1910s and 1920s period. Although Luten designed other types of reinforced concrete bridges, his typical design was a filled spandrel deck arch bridge, often with solid parapet railings and incised geometric ornament. Reinforced concrete filled spandrel deck arch bridges of Luten design are therefore a significant bridge type which, if retaining sufficient integrity of location, design, setting, materials, workmanship, feeling, and association, are eligible for listing in the National Register of Historic Places. Such bridges are significant under Criterion C, at the state level, for their association with Daniel B. Luten's pioneering efforts in reinforced concrete bridge construction and as examples of Luten's distinctive filled spandrel deck arch designs.

Increasing automobile ownership during the early twentieth century led to a growing demand throughout the nation for improved roads, and state and local governments became actively involved in road construction and maintenance. Bridges were important features of these new transportation systems, and such structures, if retaining sufficient integrity of location, design, setting, materials, workmanship, feeling, and association, are eligible for listing in the National Register of Historic Places under Criterion A, at the state or local level, for their contributions to the development of regional road and highway networks.

Although McLeod Bridge is a historical structure, ca. 1969 widening of the bridge resulted in severely compromised integrity of design, materials, workmanship, and feeling. Today the bridge is virtually unrecognizable as a historical structure when viewed from the east. McLeod Bridge is therefore recommended not eligible for listing in the National Register of Historic Places

*Figure A-9. McLeod Bridge (Field Number WCLB-2), west side; view to the east.*

*Figure A-10. McLeod Bridge (Field Number WCLB-2), east side – note girder added to widen bridge; view to the south.*


***Figure A-11. McLeod Bridge (Field Number WCLB-2), plaque on inner west parapet; view to the southwest.***

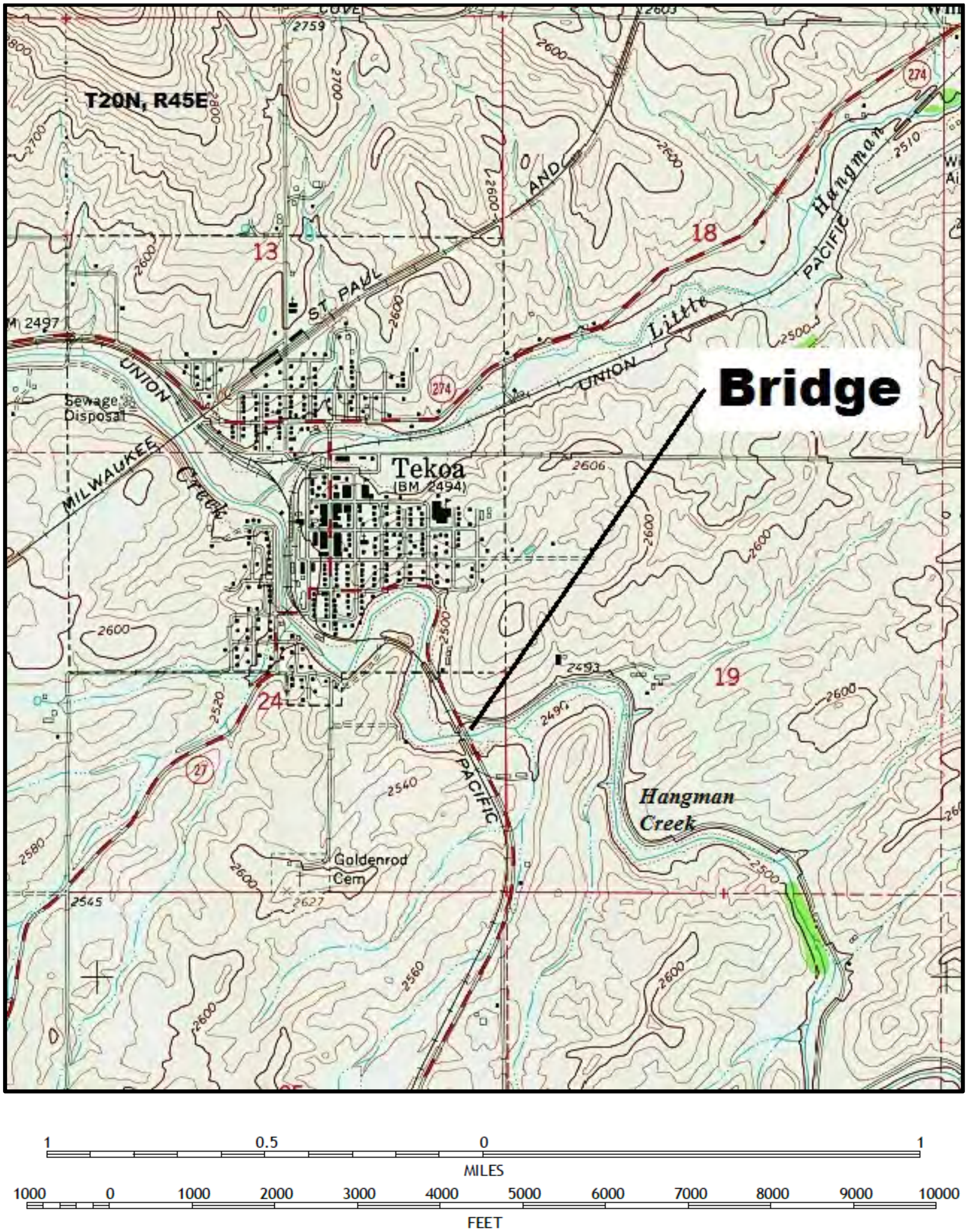



*Figure A-12. Location of McLeod Bridge (Field Number WCLB-2); map adapted from Tekoa, Wash.-Idaho, 7.5' quadrangle, U.S. Geological Survey, 1964.*

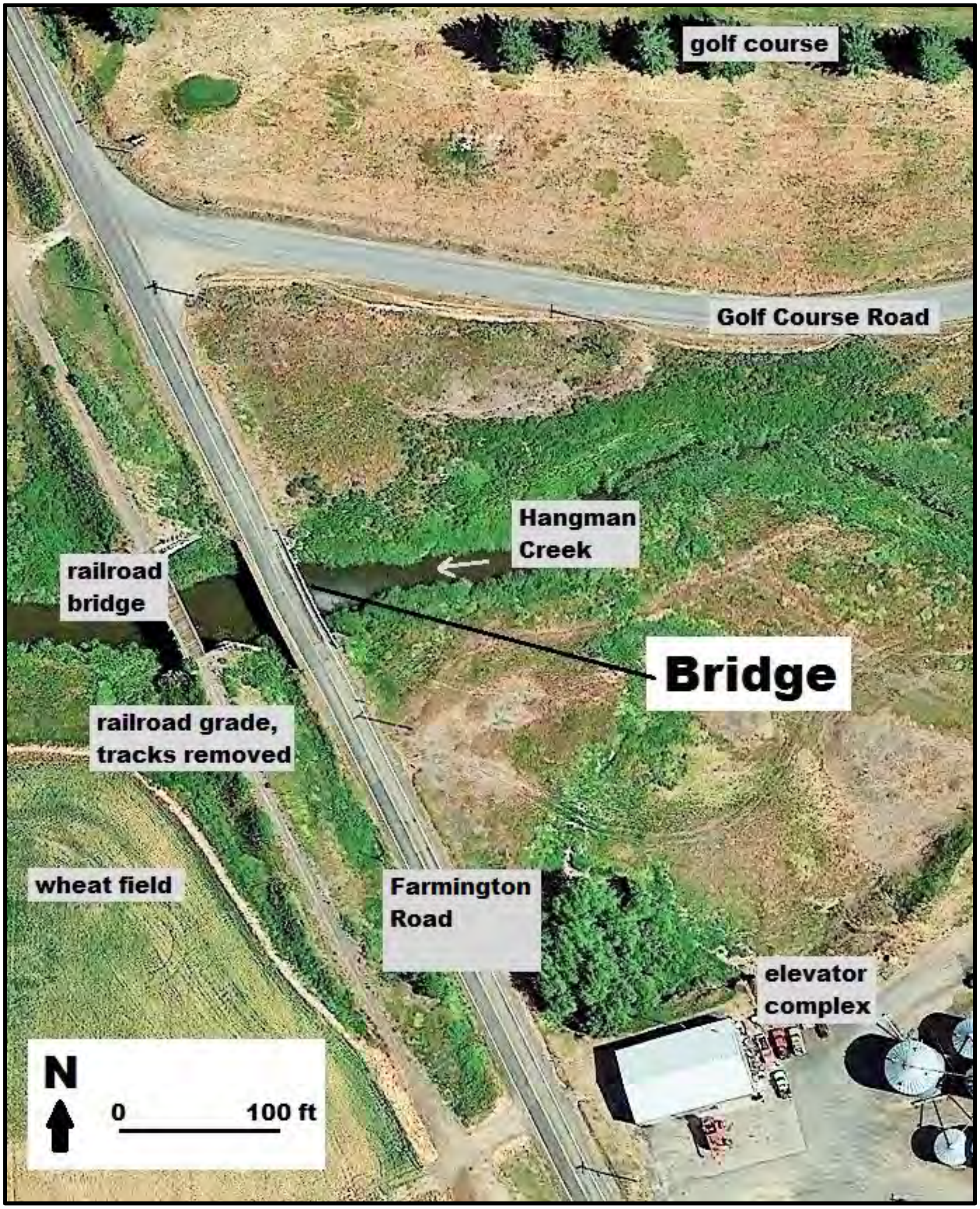



*Figure A-13. McLeod Bridge (Field Number WCLB-2) vicinity; map adapted from Google Earth aerial photograph, 2015.*

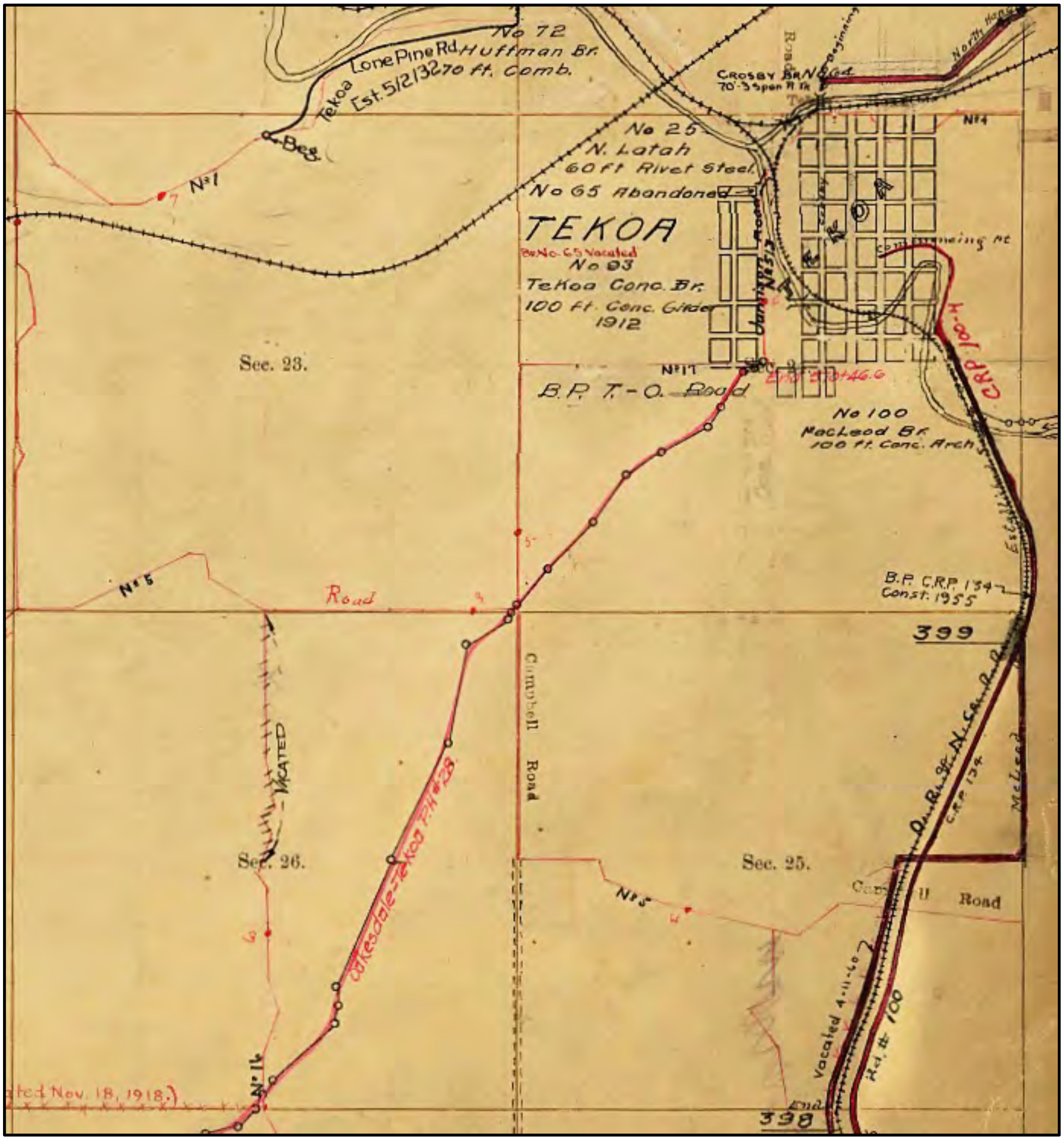



*Figure A-14. McLeod Bridge (Field Number WCLB-2) depicted in the Whitman County Highway Plat Book, just southeast of Tekoa; the bridge is identified as "No. 100 MacLeod Br. 100 ft. Conc. Arch" (Whitman County ca. 1900s-1970s).*

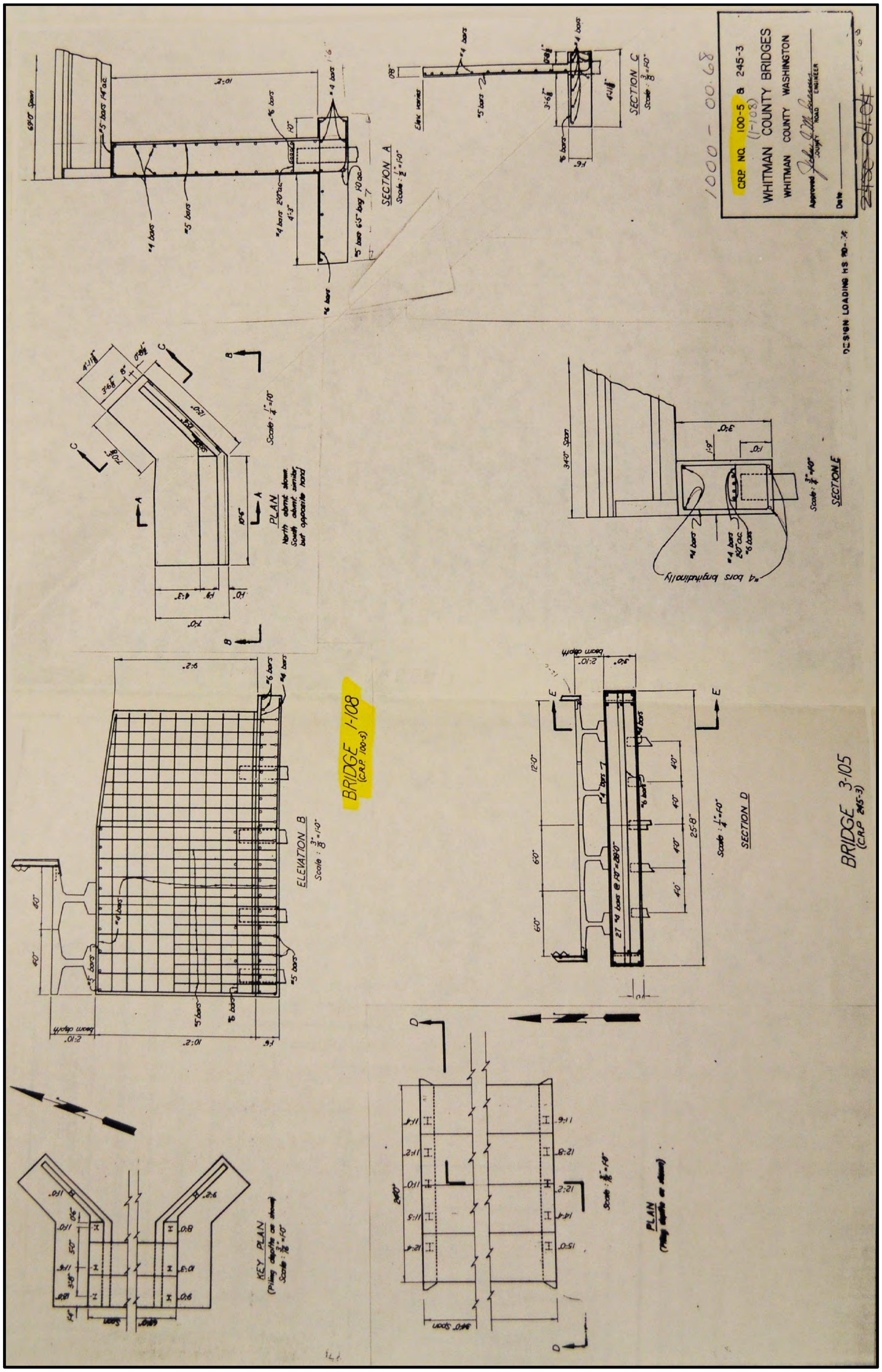



***Figure A-15. McLeod Bridge (Field Number WCLB-2) engineering plans for ca. 1969 widening of bridge (Whitman County ca. 1969). Note that only the upper images, marked "Bridge 1-108" are McLeod Bridge.***

## Seltice Bridge No. 331 (historic name)
## Lower Seltice Bridge, County Bridge Number 1260-00.03 (modern name)
## Project Field Number WCLB-3

Description:

This small single span reinforced concrete bridge – a filled spandrel deck arch type – conveys Seltice Road over Willow Creek near the former community of Seltice, five miles south of Tekoa. Seltice Road is a narrow lightly used rural route, connecting the heavily traveled Farmington Road to the south with Warner Road to the north.

The bridge is symmetrically arranged, approximately 48.5 feet long and 25 feet wide, with a 31-foot long semielliptical arch extending between the battered abutment faces. The sides of the abutments are decoratively curved and slightly wider than the adjacent closed spandrel walls. The abutments and spandrel walls were cast separately and impressions of the horizontal 5-inch wide board forms remain visible in both sections. Neither the abutments nor the spandrels are ornamented with geometric designs and little effort was apparently made to hide the mold seams. The arched lower edges of the spandrels are beveled, as are visible vertical edges of the abutments. The spandrel and abutment walls are capped with slightly overhanging concrete coping, beveled top and bottom on the outer side and unbeveled, forming a low curb, on the side toward the roadway.

A low solid parapet railing, cast atop the coping of the spandrel and abutment walls, borders the bridge on both sides. Each parapet is cast in five sections – a narrow central segment, embellished on both inner and outer surfaces with a horizontal incised rectangle; a longer segment on each side of the central section, each embellished on inner and outer surfaces with two incised horizontal rectangles; and a segment of moderate length at each end of the parapet, curved to match the shape of the abutment below and embellished on both inner and outer surfaces with a horizontal rectangle. The two abutment segments of each parapet are slightly higher and wider than the three central (spandrel) segments, and all parapet segments exhibit beveled vertical edges and slightly overhanging concrete coping with a faintly rounded upper surface. A vertical line is incised into each parapet end.

The arch barrel was cast in four longitudinal sections: a 9-inch wide spandrel wall at each side and two approximately equal 10-foot wide sections in the center. (In Luten designs, the spandrel wall is generally placed beside rather than on top of the arch ring.) The arch barrel was cast in horizontal 5-inch wide board forms, the boards running perpendicular to the bridge and parallel to the stream. Scouring has exposed the south concrete footing on which the abutment rests and minor spalling is visible in portions of the arch barrel.

Although not visible, space within the bridge – over the arch barrel and bounded by the spandrel and abutment walls – is filled with packed earth and rock. A concrete deck was poured atop the fill and pavement has now been added, continuous with that of Seltice Road. Engineering plans for the bridge depict steel reinforcing rods connecting all parts of the bridge – the footings, abutments, arch barrel, spandrels, and parapets (Whitman County 1921).

Significance Evaluation:

This bridge, originally called Seltice Bridge No. 331, was built in 1921 during construction for Improved Road No. 7. The bridge is a Daniel B. Luten reinforced concrete filled spandrel deck arch design, a typical example of Luten's highway bridge structures (Whitman County ca. 1900s-1970s, 1921). Today the bridge remains part of the Whitman County road system.

During the late nineteenth and early twentieth centuries, Daniel B. Luten pioneered the use of reinforced concrete as a bridge construction material, patented his designs and methods, and widely publicized his results. As a result, Luten-designed reinforced concrete bridges were built throughout the nation during the 1910s and 1920s period. Although Luten designed other types of reinforced concrete bridges, his typical design was a filled spandrel deck arch bridge, often with solid parapet railings and incised geometric ornament. Reinforced concrete filled spandrel deck arch bridges of Luten design are therefore a significant bridge type which, if retaining sufficient integrity of location, design, setting, materials, workmanship, feeling, and association, are eligible for listing in the National Register of Historic Places. Such bridges are significant under Criterion C, at the state level, for their association with Daniel B. Luten's pioneering efforts in reinforced concrete bridge construction and as examples of Luten's distinctive filled spandrel deck arch designs.

Increasing automobile ownership during the early twentieth century led to a growing demand throughout the nation for improved roads, and state and local governments became actively involved in road construction and maintenance. Bridges were important features of these new transportation systems, and such structures, if retaining sufficient integrity of location, design, setting, materials, workmanship, feeling, and association, are eligible for listing on the National Register of Historic Places under Criterion A, at the state or local level, for their contributions to the development of regional road and highway networks.

Seltice Bridge retains all aspects of integrity to a sufficient degree and is therefore recommended eligible for listing in the National Register of Historic Places under Criterion A at the local level and under Criterion C at the state level.

***Figure A-16. Seltice Bridge (Field Number WCLB-3), east side; view to the west (photograph courtesy of Whitman County Public Works).***

***Figure A-17. Seltice Bridge (Field Number WCLB-3), west side; view to the east (photograph courtesy of Whitman County Public Works).***

***Figure A-18. Seltice Bridge (Field Number WCLB-3), south part of arch barrel; view to the southeast.***

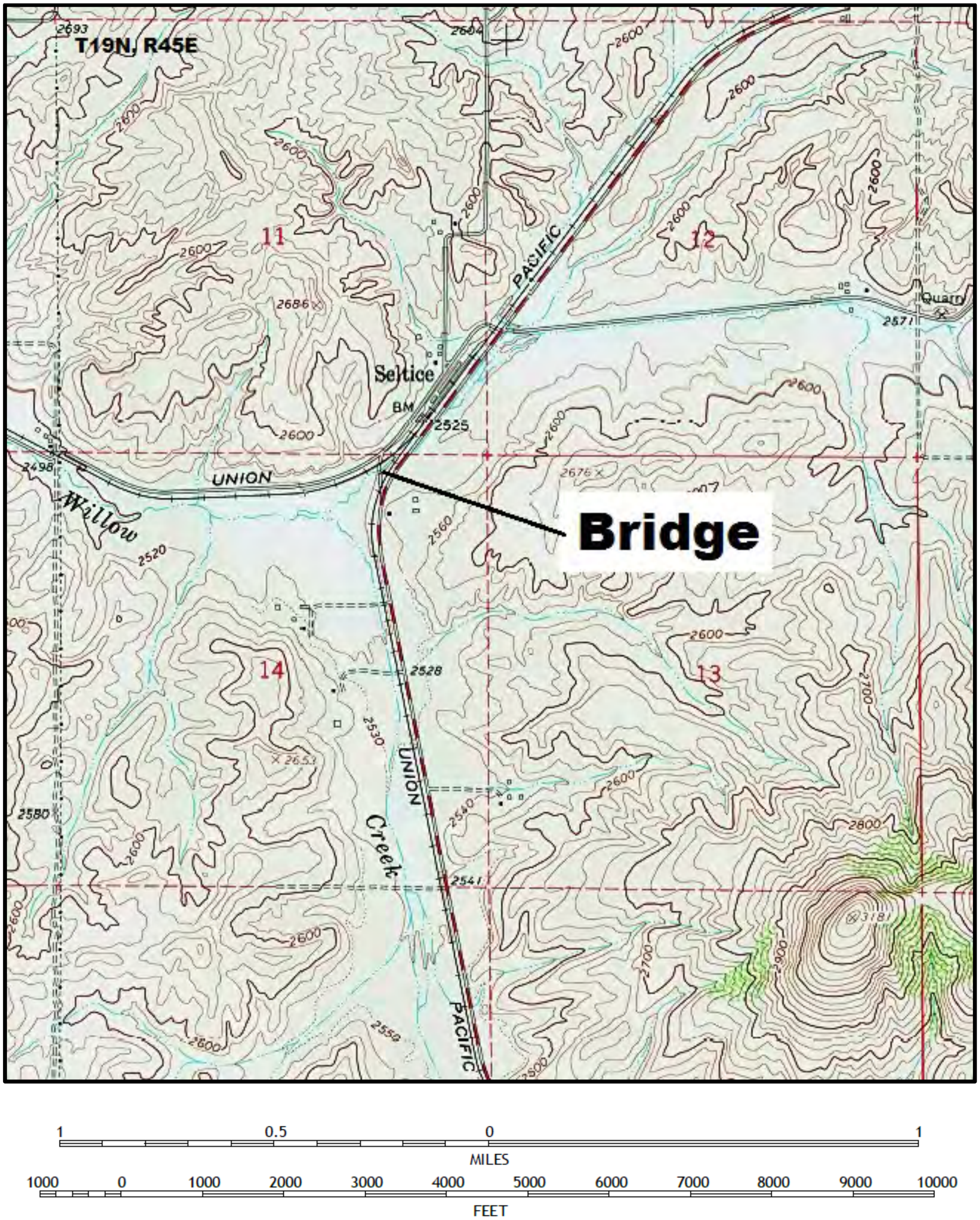



***Figure A-19. Location of Seltice Bridge (Field Number WCLB-3); map adapted from Tekoa, Wash.-Idaho, 7.5' quadrangle, U.S. Geological Survey, 1964.***

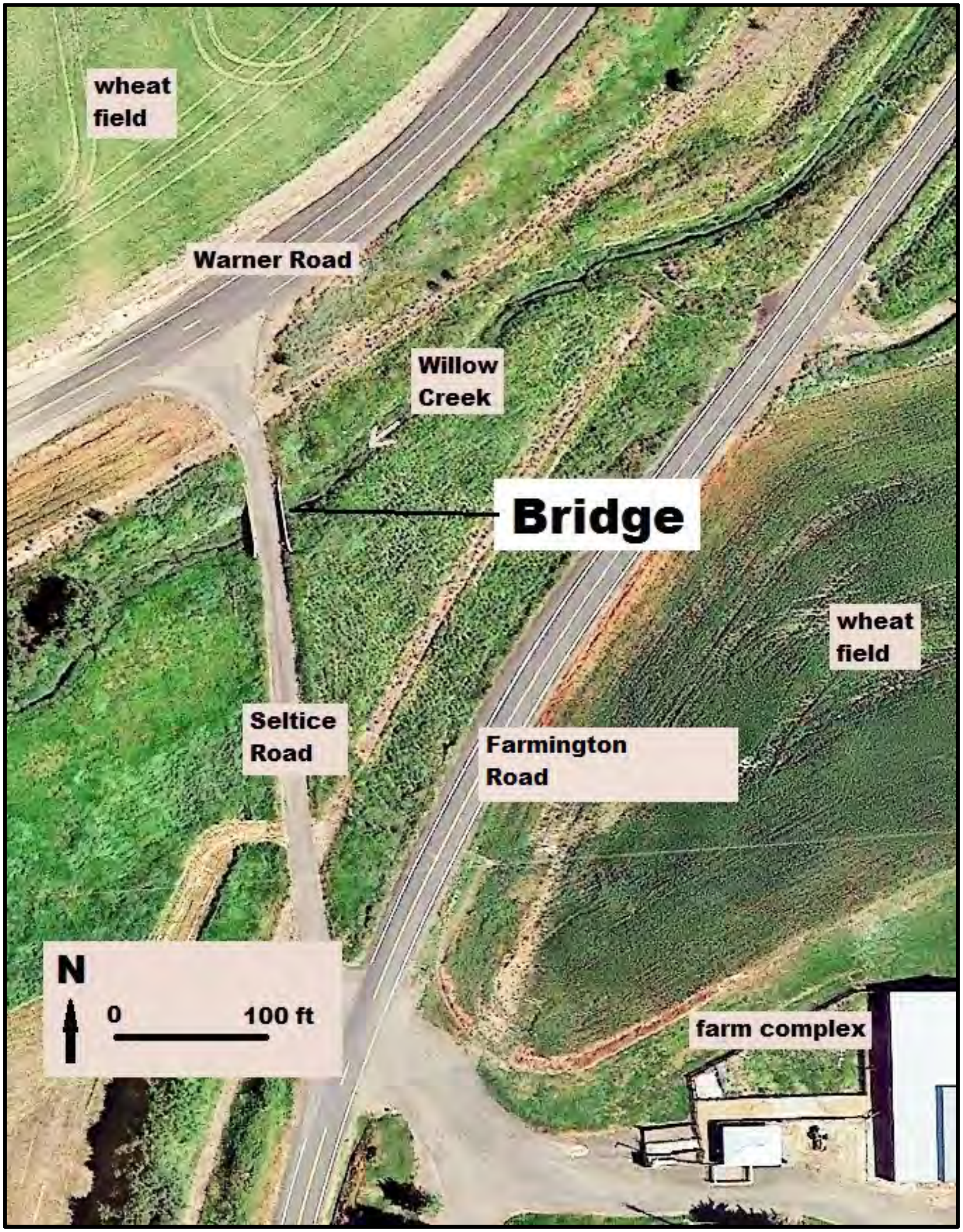



*Figure A-20. Seltice Bridge (Field Number WCLB-3) vicinity; map adapted from Google Earth aerial photograph, 2015.*

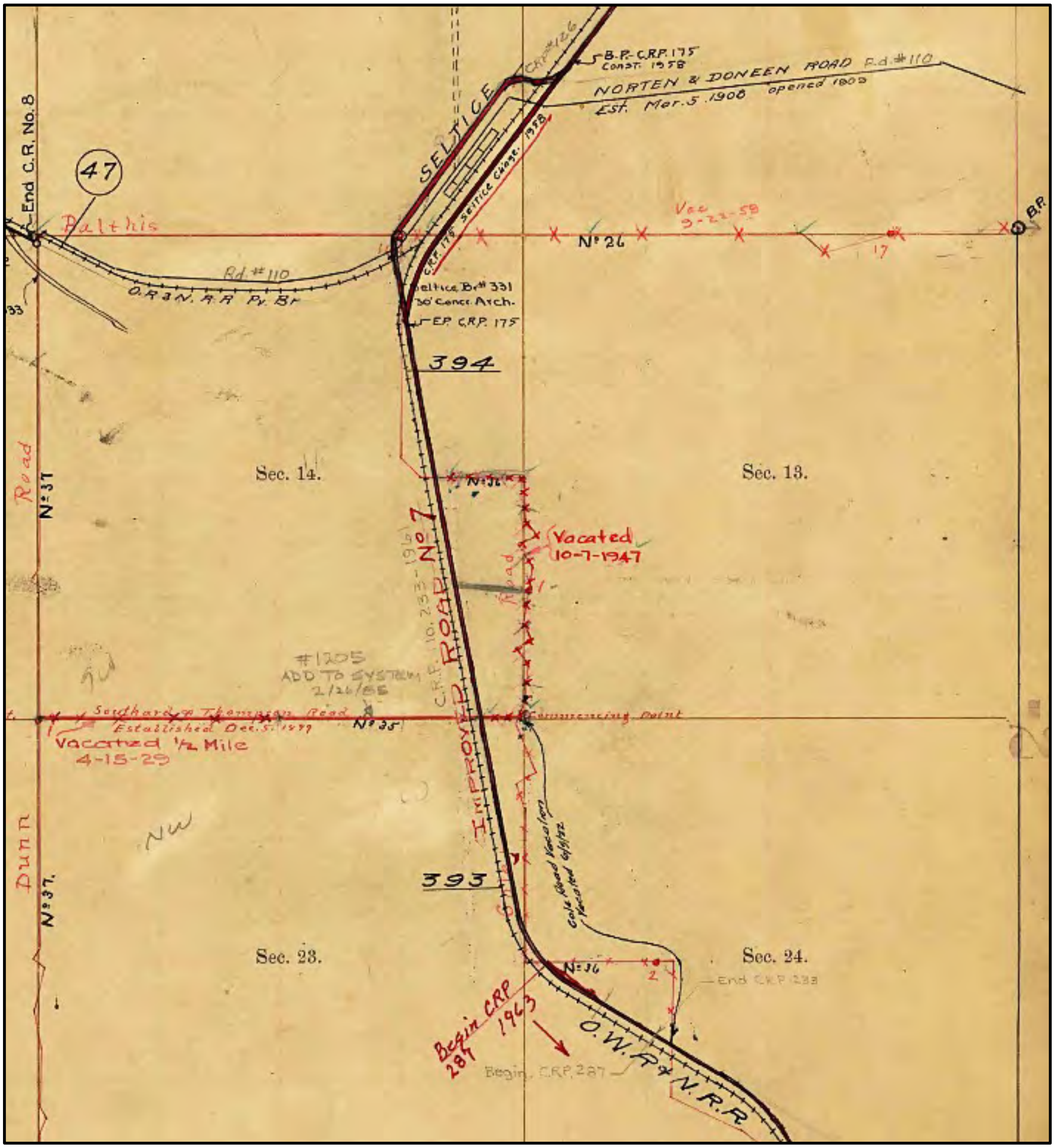


***Figure A-21. Seltice Bridge (Field Number WCLB-3) depicted in the Whitman County Highway Plat Book, just southwest of the community of Seltice on Improved Road No. 7; the bridge is identified as "Seltice Br. #331 30' Concr. Arch" (Whitman County ca. 1900s-1970s).***

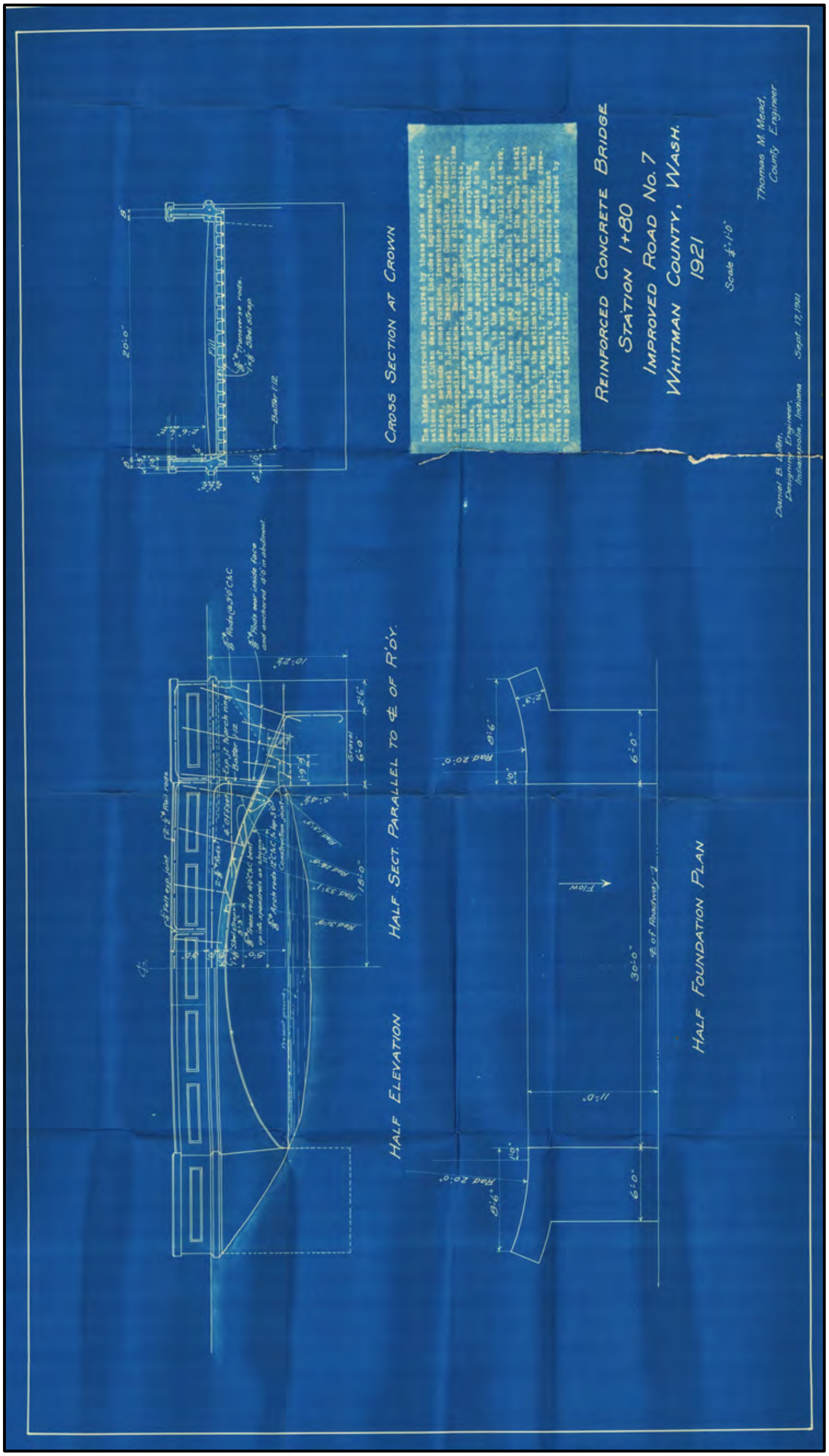



*Figure A-22. Seltice Bridge (Field Number WCLB-3) engineering plans, 1921 (Whitman County 1921).*

## Morley Bridge No. 278 (historic name)
## Morley Bridge, County Bridge Number 4000-27.75
## Project Field Number WCLB-4

Description:

This small single span reinforced concrete bridge – originally a filled spandrel deck arch structure – conveys Endicott Road, a paved two-lane highway, over Rebel Flat Creek one mile north of the historical Mockonema railroad siding. The bridge was widened in 1961 to accommodate the demands of modern traffic, significantly altering the structure's form and appearance. During this reconstruction effort, a large concrete girder was added to each side of the original bridge, the ends supported on modern reinforced concrete abutments.

The bridge is presently approximately 32 feet long and 33 feet wide. Little historical fabric remains visible. Although the original arch barrel and spandrel walls remain intact, they are nearly hidden behind the modern girders. The arch is semielliptical and the spandrel walls are unembellished. The spandrels were cast in horizontal 5-inch wide board forms and finished with a thin coat of cement stucco in an effort to hide the mold seams. The arched lower spandrel edges are beveled. The arch barrel was cast in five longitudinal sections: a 12-inch wide spandrel wall at each side and three approximately equal 5-foot wide sections in the center. (In Luten designs, the spandrel wall is generally placed beside rather than on top of the arch ring.) The arch barrel was cast in horizontal 5-inch wide board forms, the boards running perpendicular to the bridge and parallel to the stream. Some scouring and spalling of the barrel was noted, and aggregate exposed in the concrete is crushed basalt. The original abutments are no longer visible, obscured by the modern reinforced concrete abutments supporting the girders. The original parapet railings have been removed, now replaced by modern W-beam guardrails, and the bridge deck is paved with asphalt.

Significance Evaluation:

This bridge, originally called Morley Bridge No. 278, was built around 1920 during construction of Improved Road No. 4 (Whitman County n.d., ca. 1900s-1970s). Although original engineering plans were not located, the bridge appears to be a Daniel B. Luten reinforced concrete filled spandrel deck arch design, one of Luten's typical highway bridge structures. In 1961 a large modern girder and abutment were added to each side of the bridge to widen it, and modern guardrails replaced the parapet railings (Whitman County n.d.). Today the bridge remains part of the Whitman County highway system.

During the late nineteenth and early twentieth centuries, Daniel B. Luten pioneered the use of reinforced concrete as a bridge construction material, patented his designs and methods, and widely publicized his results. As a result, Luten-designed reinforced concrete bridges were built throughout the nation during the 1910s and 1920s period. Although Luten designed other types of reinforced concrete bridges, his typical design was a filled spandrel deck arch bridge, often with solid parapet railings and incised geometric ornament. Reinforced concrete filled spandrel deck arch bridges of Luten design are therefore a significant bridge type which, if retaining sufficient integrity of location, design, setting, materials, workmanship, feeling, and association, are eligible for listing in the National Register of Historic Places. Such bridges are significant under Criterion C, at the state level, for their association with Daniel B. Luten's pioneering efforts in reinforced concrete bridge construction and as examples of Luten's distinctive filled spandrel deck arch designs.

Increasing automobile ownership during the early twentieth century led to a growing demand throughout the nation for improved roads, and state and local governments became actively involved in road construction and maintenance. Bridges were important features of these new transportation systems, and such structures, if retaining sufficient integrity of location, design, setting, materials, workmanship, feeling, and association, are eligible for listing on the National Register of Historic Places under Criterion

A, at the state or local level, for their contributions to the development of regional road and highway networks.

Although Morley Bridge is a historical structure, 1961 widening of the bridge resulted in severely compromised integrity of design, materials, workmanship, and feeling. Today the bridge is virtually unrecognizable as a historical structure. Morley Bridge is therefore recommended not eligible for listing in the National Register of Historic Places.

***Figure A-23. Morley Bridge (Field Number WCLB-4), east side; view to the west. Note girder added to widen the road.***

***Figure A-24. Morley Bridge (Field Number WCLB-4), west side; view to the southeast. Note girder added to widen the road.***

***Figure A-25. Morley Bridge (Field Number WCLB-4), north end of arch barrel with girder added to widen road; view to the northwest.***

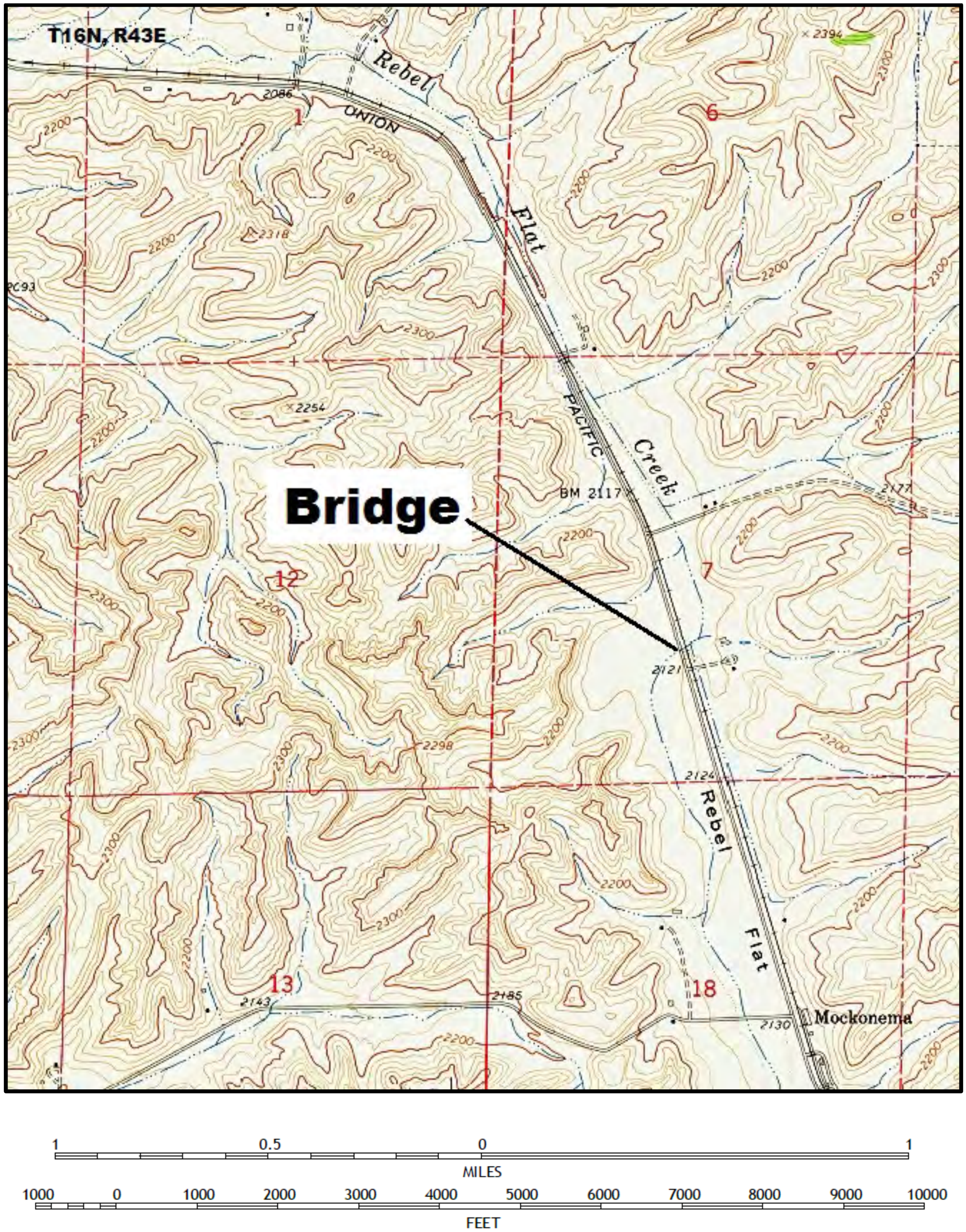



***Figure A-26. Location of Morley Bridge (Field Number WCLB-4); map adapted from Diamond, Wash., 7.5' quadrangle, U.S. Geological Survey, 1964.***


*Figure A-27. Morley Bridge (Field Number WCLB-4) vicinity; map adapted from Google Earth aerial photograph, 2017.*

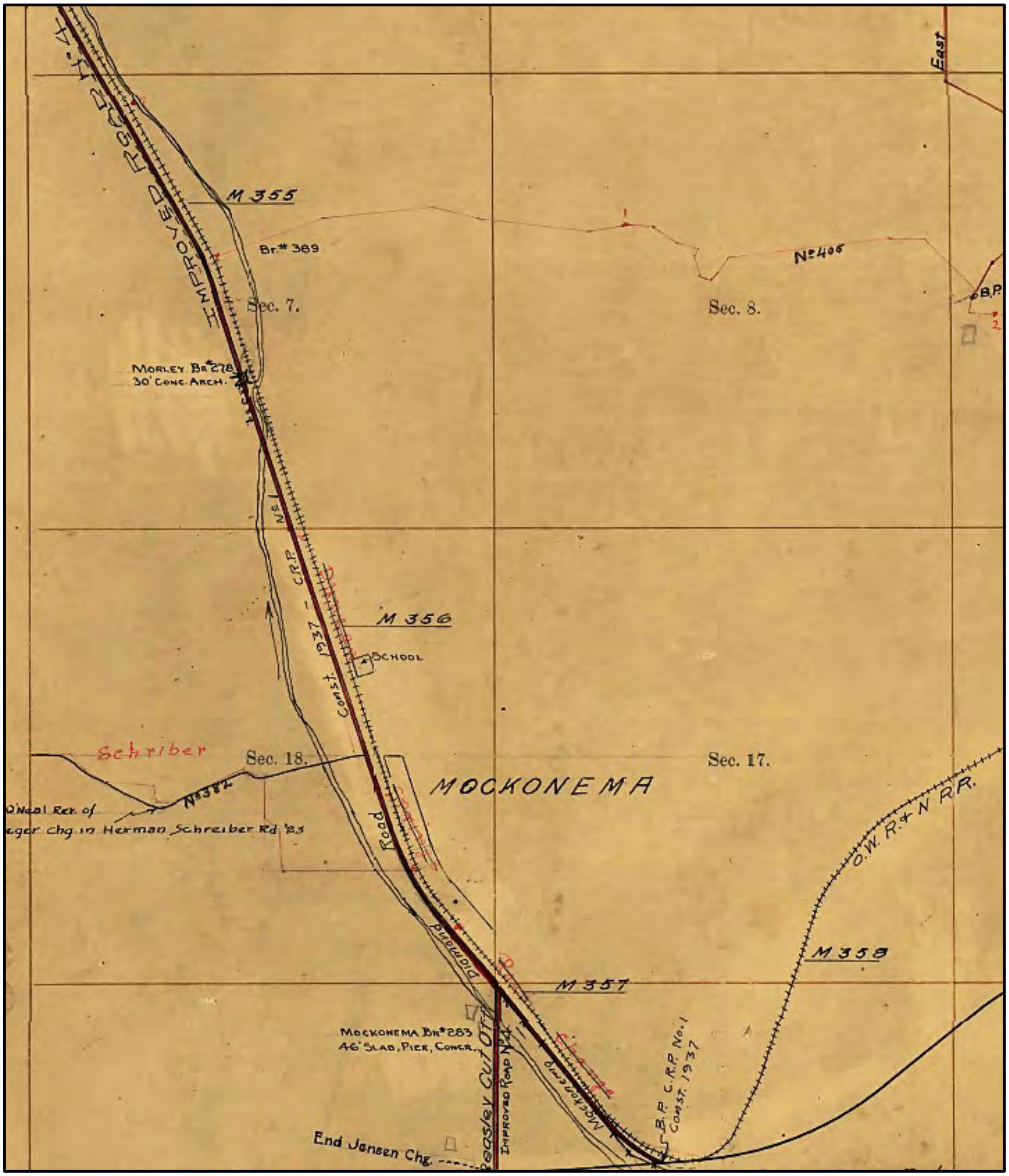



*Figure A-28. Morley Bridge (Field Number WCLB-4) depicted in the Whitman County Highway Plat Book on Improved Road No. 4 in the Mockonema area; the bridge is identified as "Morley Br. No. 278 30' Conc. Arch" (Whitman County ca. 1900s-1970s).*

# Staley Bridge No. 360 (historic name)
# Staley No. 2 Bridge, County Bridge Number 9030-01.08 (modern name)
# Project Field Number WCLB-5

Description:

This small single span reinforced concrete bridge – a filled spandrel deck arch type – conveys Staley Road over Staley Creek within the former community of Staley, three miles south of Pullman. Staley Road is a lightly used rural route with gravel surfacing.

The bridge is symmetrically arranged, approximately 35 feet long and 22 feet wide, with a 25-foot long semielliptical arch extending between the battered 10-foot long wing wall abutments. The wing walls and adjacent closed spandrels were cast separately and impressions of the horizontal 7-inch wide board forms remain visible in both sections. Neither the wing walls nor the spandrels are ornamented with geometric designs, although a thin layer of cement stucco was applied in an effort to hide the mold seams. The arched lower edges of the spandrel walls are beveled. The spandrel walls are capped with slightly overhanging concrete coping, beveled top and bottom on the exterior side of the bridge and apparently covered with gravel on the side toward the roadway.

A low solid parapet railing, cast atop the coping of the spandrel walls, borders the bridge on both sides. Each parapet is cast in five sections – a narrow central segment, embellished on both inner and outer surfaces with a horizontal incised rectangle; a longer segment on each side of the central section, each embellished on inner and outer surfaces with two incised horizontal rectangles; and a very narrow segment at each end of the parapet, embellished on both inner and outer surfaces with an incised square. The two end segments of each parapet are slightly higher and wider than the three central segments, with beveled vertical corners and a vertical line incised into each visible end. All parapet segments are capped with slightly overhanging concrete coping with flat tops and beveled upper edges. The parapet was probably cast in horizontal 5-inch wide board forms, although the cement stucco coating fairly effectively obscures the mold seams. Two holes, one above the other, on the inner surface of the southeast parapet may represent a missing bridge plaque, but no "shadow" can be seen; the holes are also not centered over the incised design, which would be the typical location for a plaque. Some spalling of parapet concrete, particularly of the coping, was noted, in places exposing ½-inch diameter square ferrous metal reinforcing rods. The northwest corner of the bridge appears to have been hit by a vehicle, cracking the concrete.

The arch barrel was cast in five longitudinal sections: a 14-inch wide spandrel wall at each side and three approximately equal 6-foot wide sections in the center. (In Luten designs, the spandrel wall is generally placed beside rather than on top of the arch ring.) The arch barrel was cast in horizontal 3¼-inch wide board forms, the boards running perpendicular to the bridge and parallel to the stream. Some spalling was noted along arch barrel seams and in the lower barrel.

Although not visible, space within the bridge – over the arch barrel and bounded by the spandrel and wing walls – is filled with packed earth and rock. A concrete deck was poured atop the fill and gravel has now been added, continuous with that of Staley Road. Engineering plans for the bridge depict steel reinforcing rods connecting all parts of the bridge – the footings, abutments, arch barrel, spandrels, and parapets (Whitman County 1922a).

Significance Evaluation:

This bridge, originally called Staley Bridge No. 360, was built in 1922 within the platted town of Staley during construction or improvement of Staley Road. The bridge is a Daniel B. Luten reinforced concrete filled spandrel deck arch design, a typical example of Luten's highway bridge structures, and county records identify Tom Ristvedt as the builder (Ristvedt 1922; Whitman County ca. 1900s-1970s, 1922a). Today the bridge and Staley Road remain part of the Whitman County road system.

During the late nineteenth and early twentieth centuries, Daniel B. Luten pioneered the use of reinforced concrete as a bridge construction material, patented his designs and methods, and widely publicized his results. As a result, Luten-designed reinforced concrete bridges were built throughout the nation during the 1910s and 1920s period. Although Luten designed other types of reinforced concrete bridges, his typical design was a filled spandrel deck arch bridge, often with solid parapet railings and incised geometric ornament. Reinforced concrete filled spandrel deck arch bridges of Luten design are therefore a significant bridge type which, if retaining sufficient integrity of location, design, setting, materials, workmanship, feeling, and association, are eligible for listing in the National Register of Historic Places. Such bridges are significant under Criterion C, at the state level, for their association with Daniel B. Luten's pioneering efforts in reinforced concrete bridge construction and as examples of Luten's distinctive filled spandrel deck arch designs.

Increasing automobile ownership during the early twentieth century led to a growing demand throughout the nation for improved roads, and state and local governments became actively involved in road construction and maintenance. Bridges were important features of these new transportation systems, and such structures, if retaining sufficient integrity of location, design, setting, materials, workmanship, feeling, and association, are eligible for listing on the National Register of Historic Places under Criterion A, at the state or local level, for their contributions to the development of regional road and highway networks.

Staley Bridge retains all aspects of integrity to a sufficient degree and is therefore recommended eligible for listing in the National Register of Historic Places under Criterion A at the local level and under Criterion C at the state level.

***Figure A-29. Staley Bridge (Field Number WCLB-5), west side; view to the southeast (photograph courtesy of Whitman County Public Works).***

*Figure A-30. Staley Bridge (Field Number WCLB-5), east side; view to the southwest.*

*Figure A-31. Staley Bridge (Field Number WCLB-5), north approach; view to the south.*

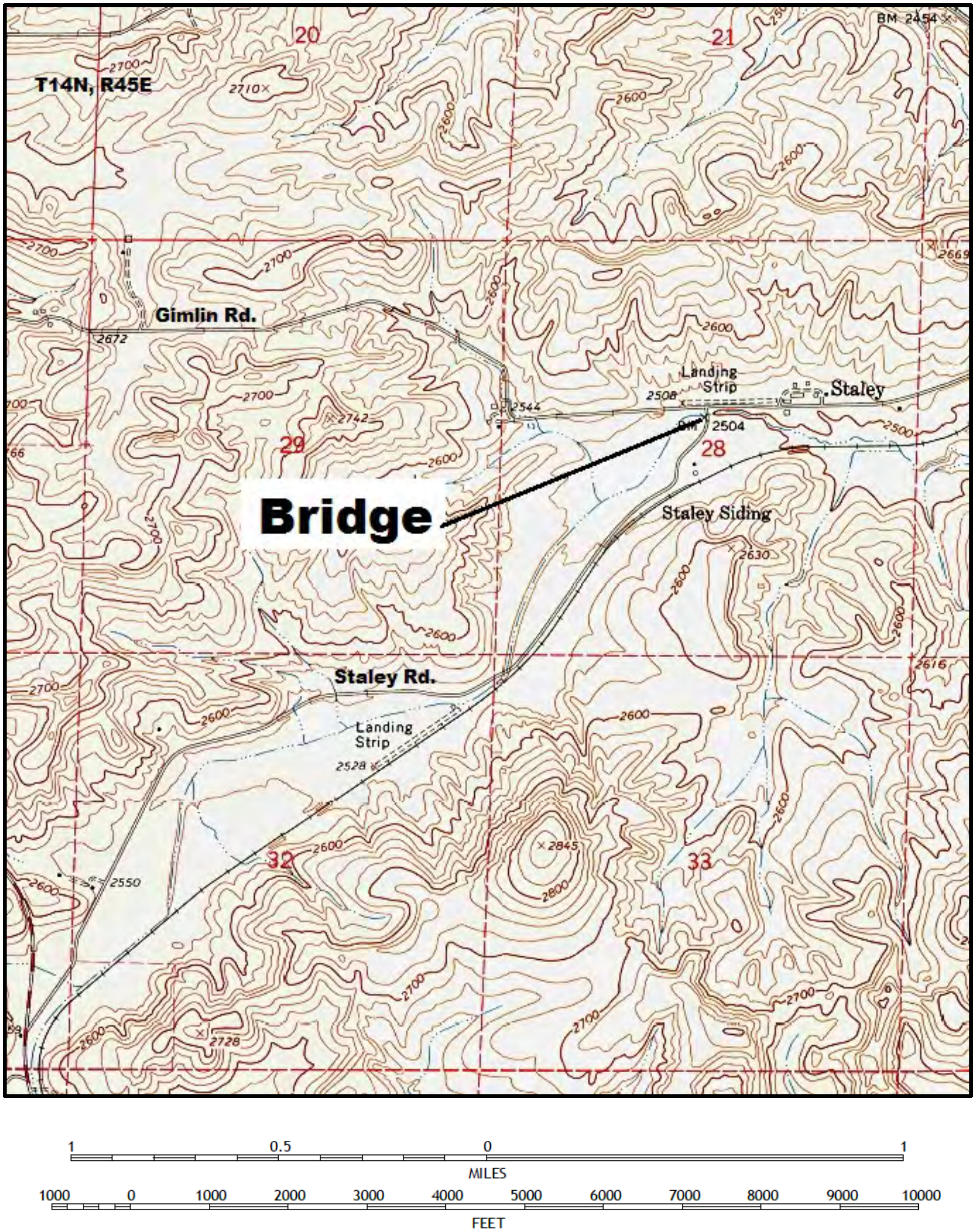



*Figure A-32. Location of Staley Bridge (Field Number WCLB-5); map adapted from Pullman, Wash., 7.5' quadrangle, U.S. Geological Survey, 1964.*

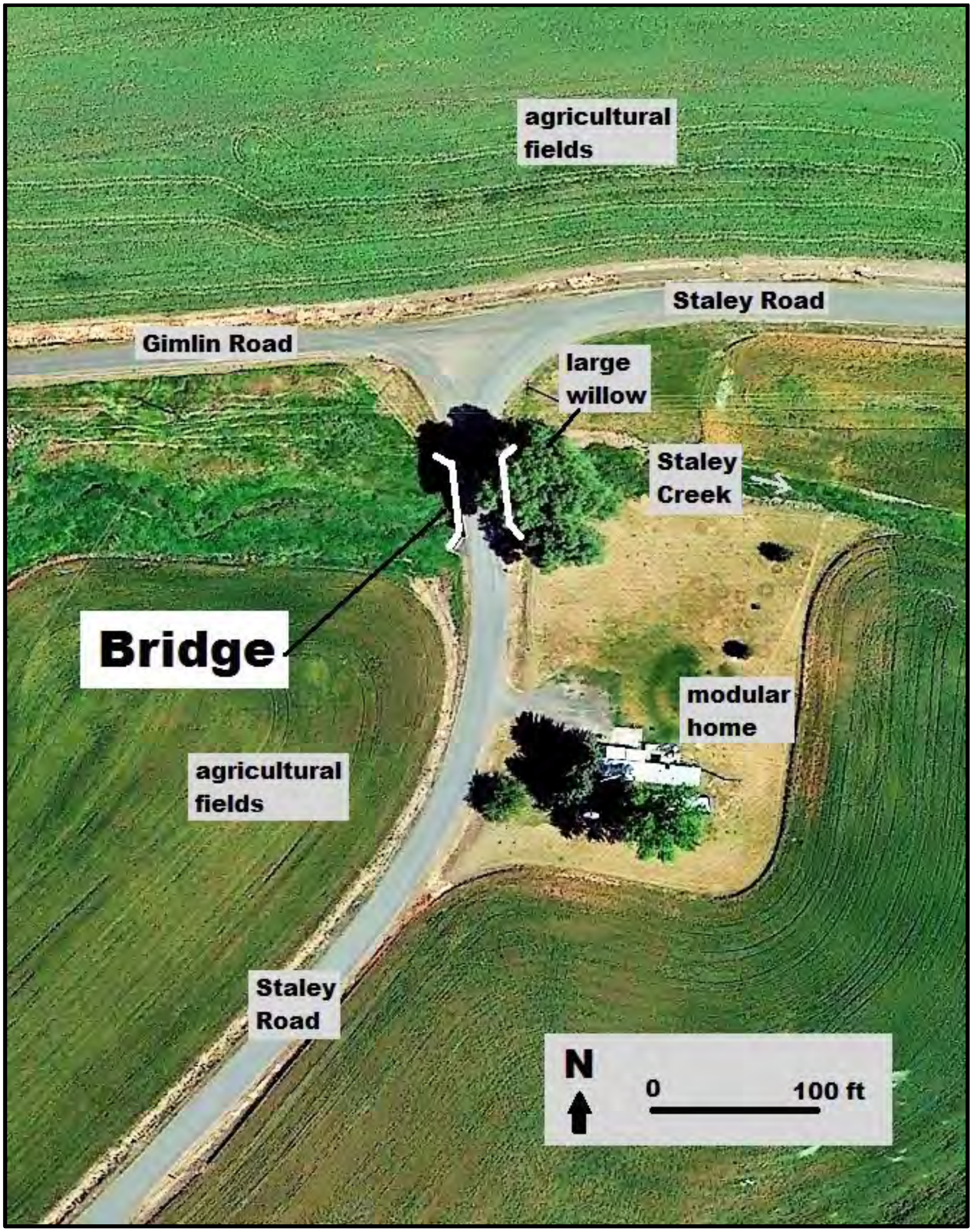



*Figure A-33. Staley Bridge (Field Number WCLB-5) vicinity; map adapted from Google Earth aerial photograph, 2015.*

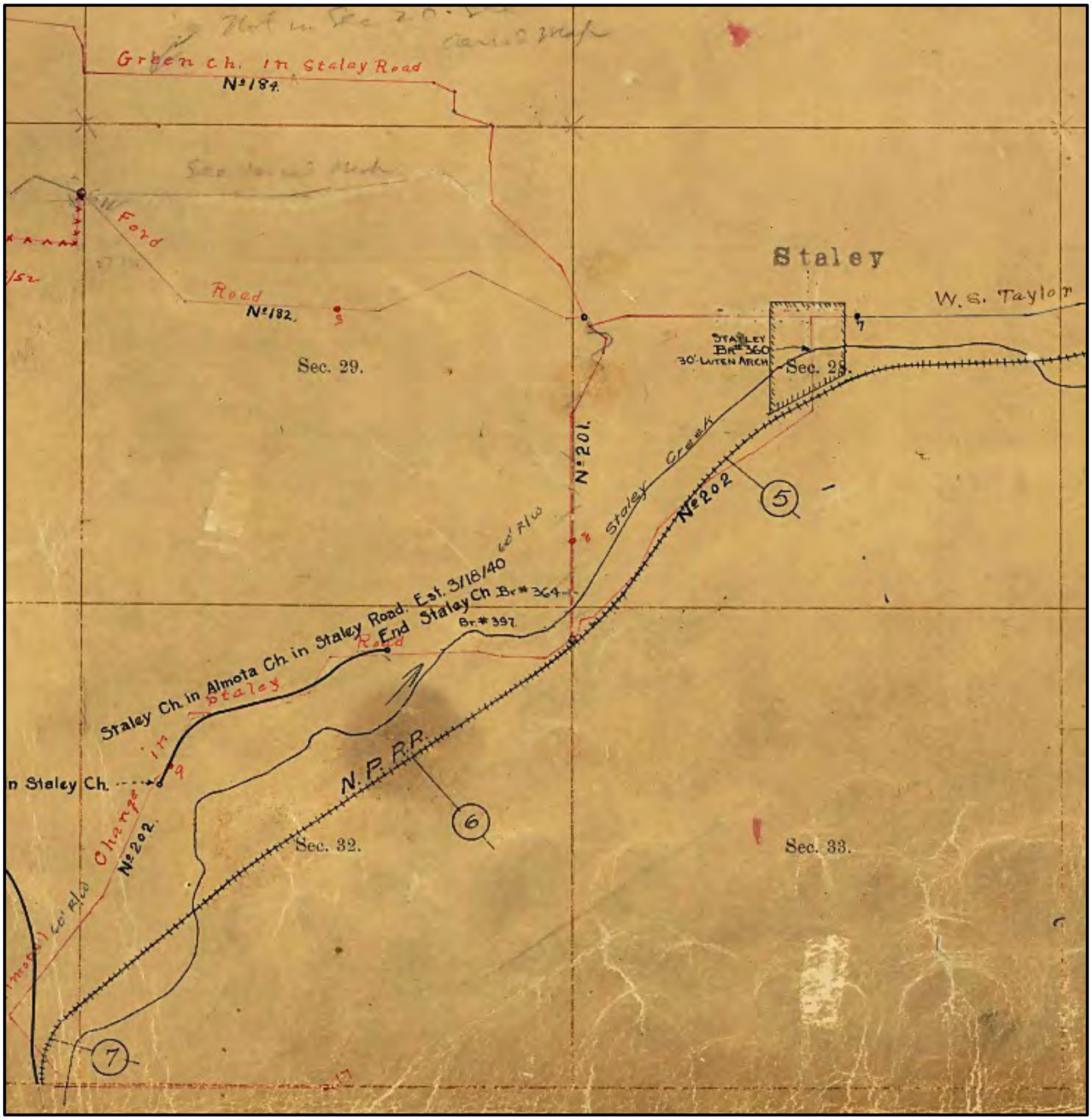



*Figure A-34. Staley Bridge (Field Number WCLB-5) depicted in the Whitman County Highway Plat Book on Staley Road within the platted community of Staley; the bridge is identified as "Staley Br. #360 30' Luten Arch" (Whitman County ca. 1900s-1970s).*

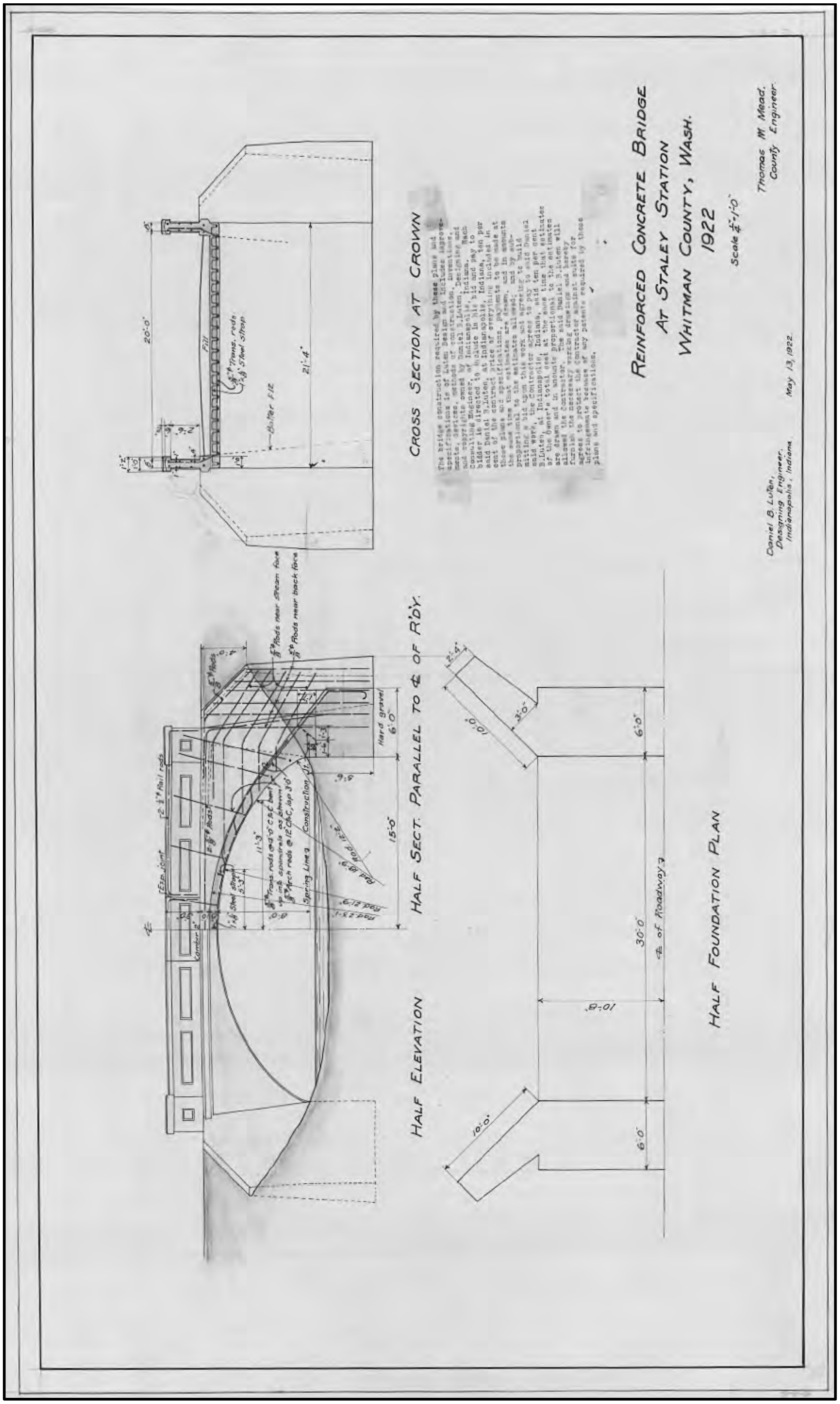



*Figure A-35. Staley Bridge (Field Number WCLB-5) engineering plans, 1922 (Whitman County 1922a).*

P R O P O S A L .

TO THE HONORABLE BOARD OF COUNTY COMMISSIONERS OF WHITMAN COUNTY, WASH.

GENTLEMEN:

The undersigned hereby certifie that I have examined the location of the Staley Bridge across Staley ~~Bridge~~ Creek in Section 28, Township 14, North, Range 45 E. W. M., and ha__ read and examined the Specifications, contract and estimate governing the work in this improvement and the method by which payment will be made for said work and have satisfied myself as to the correctness of the estimate of quantities and local conditions affecting the price of the work, and hereby propose to undertake and complete the work embraced in this improvement, in accordance with said plans, profiles, specifications and contract hereunto annexed and bind myself on the acceptance of this proposal to enter into and execute a contract with the Board of County Commissioners of Whitman County, Washington, for the execution of said work for the lump sum of ________________ ($5452.50) Dollars.

Enclosed is a certified check for 400 Dollars, five 5% ~~ten~~ (~~10~~) per cent of the above bid, which sum is to be forfeited to the Board of County Commissioners of Whitman County, Washington, if the party or parties making the proposal fail to enter into contract with the approved securities within five days after the contract is awarded to said party or parties.

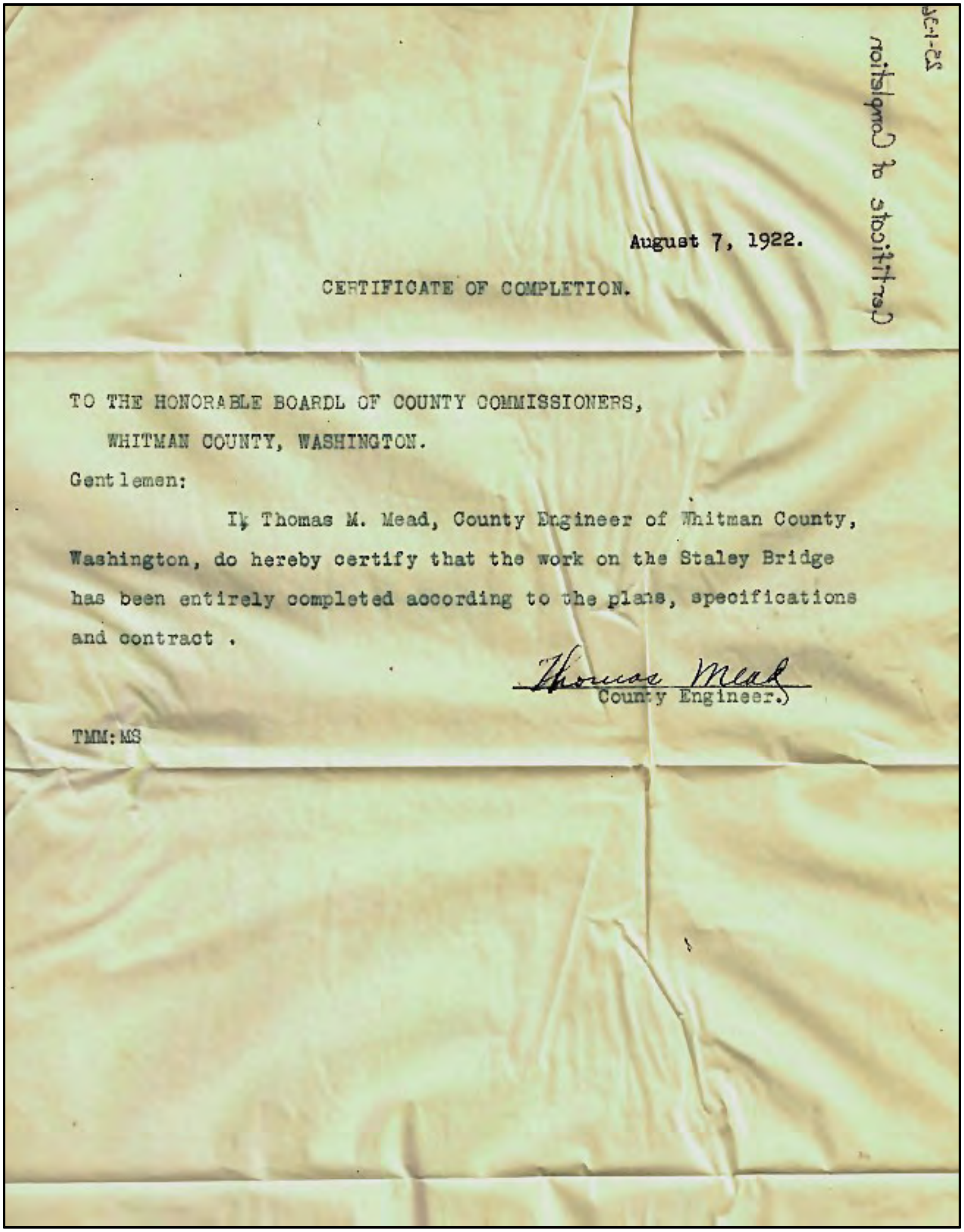
I further agree to perform any extra work and to adjust all changes in quantities as provided for in the general stipulations and detailed specifications at the following prices which include the customary overhead charges and profits:

| | |
|---|---|
| Extra concrete (1:2:4) per cu. yd. in place | 25.00 |
| " " (1:3:5) " " " " " | 24.00 |
| Reinforcing Steel " pound " " | 7 cents |
| Common Labor, per day | 5.00 |
| Foreman " " | 7.00 |
| Teams and Driver per day | 7.00 |
| Carpenter, per day | 7.00 |
| Carpenter foreman, per day | 8.00 |

Respectfully submitted,

Tom Ristvedt

***Figure A-36. Successful contractor's proposal for Staley Bridge (Field Number WCLB-5), 1922 (Ristvedt 1922).***



August 7, 1922.

CERTIFICATE OF COMPLETION.

TO THE HONORABLE BOARDL OF COUNTY COMMISSIONERS,

WHITMAN COUNTY, WASHINGTON.

Gentlemen:

I, Thomas M. Mead, County Engineer of Whitman County, Washington, do hereby certify that the work on the Staley Bridge has been entirely completed according to the plans, specifications and contract .

Thomas Mead
County Engineer.

TMM:MS

*Figure A-37. Staley Bridge (Field Number WCLB-5) Certificate of Completion, 1922 (Whitman County 1922b).*

**Colton Bridge, County Bridge Number 9050-12.19 (modern name)**
**Historic name unknown**
**Project Field NumberWCLB-6:**

Description:

This very small single span reinforced concrete bridge – a filled spandrel deck arch type – conveys the paved Johnson Road over an unnamed tributary of Union Flat Creek, 0.5 mile north of the Town of Colton.

The bridge is symmetrically arranged, approximately 20.5 feet long and 26 feet wide, with a 16.5-foot long semielliptical arch extending between the wing wall abutments. The wing walls are approximately 5 feet long and angle away from the bridge, at 90 degrees at the southeast and northwest corners, and at 120 degrees at the northeast and southwest corners. The wing walls and adjacent closed spandrels were cast separately and impressions of the horizontal 5-inch wide board forms remain visible in both sections. Neither the wing walls nor the spandrels are ornamented with geometric designs, although a thin layer of cement stucco was applied in an effort to hide the mold seams. The arched lower edges of the spandrel walls are beveled. The spandrel walls are capped with slightly overhanging concrete coping, beveled top and bottom on the exterior side of the bridge and unbeveled, forming a low curb, on the side toward the roadway.

A low solid parapet railing, cast atop the coping of the spandrel wall, borders the bridge on both sides. Each parapet is cast in one 20.5-foot long section, embellished on both inner and outer surfaces with two incised horizontal rectangles, and capped with slightly overhanging concrete coping with a faintly rounded top, beveled upper and lower margins, and beveled corners. A vertical line is incised into the end of each parapet. The parapet was cast in horizontal 5-inch wide board forms and a thin coat of cement stucco has been applied in an attempt to hide the mold seams. Some spalling of parapet concrete, particularly of the coping, has occurred, in places exposing 1-inch diameter round ferrous metal reinforcing rods. Both parapets now slope outward, away from the bridge.

The arch barrel was cast in a single longitudinal section, indicating that the spandrel wall was placed on top of the arch ring rather than beside it. (In Luten designs, the spandrel wall is typically placed beside the arch ring.) The arch barrel was cast in horizontal 5-inch wide board forms, the boards running perpendicular to the bridge and parallel to the stream. Some spalling was noted along the lower barrel.

Although not visible, space within the bridge – over the arch barrel and bounded by the spandrel and wing walls – is filled with packed earth and rock. A concrete deck was poured atop the fill and pavement has now been added, continuous with that of Johnson Road. Steel reinforcing rods presumably connect all parts of the bridge – the footings, abutments, arch barrel, spandrels, and parapets.

Significance Evaluation:

According to county bridge files, this bridge was built around 1910 (Whitman County n.d.). No other information was located for the bridge and the feature is not shown on Whitman County's Highway Plat Map, perhaps due to the bridge's diminutive size (Whitman County ca. 1900s-1970s). Although unconfirmed through archival sources, the bridge appears to be a Daniel B. Luten reinforced concrete filled spandrel deck arch design, a very simple example of Luten's highway bridge structures. Today the bridge remains part of the Whitman County highway system.

During the late nineteenth and early twentieth centuries, Daniel B. Luten pioneered the use of reinforced concrete as a bridge construction material, patented his designs and methods, and widely publicized his results. As a result, Luten-designed reinforced concrete bridges were built throughout the nation during the 1910s and 1920s period. Although Luten designed other types of reinforced concrete bridges, his typical design was a filled spandrel deck arch bridge, often with solid parapet railings and incised geometric ornament. Reinforced concrete filled spandrel deck arch bridges of Luten design are therefore a significant bridge type which, if retaining sufficient integrity of location, design, setting, materials, workmanship, feeling, and association, are eligible for listing in the National Register of Historic Places. Such bridges are significant under Criterion C, at the state level, for their association with Daniel B. Luten's pioneering efforts in reinforced concrete bridge construction and as examples of Luten's distinctive filled spandrel deck arch designs.

Increasing automobile ownership during the early twentieth century led to a growing demand throughout the nation for improved roads, and state and local governments became actively involved in road construction and maintenance. Bridges were important features of these new transportation systems, and such structures, if retaining sufficient integrity of location, design, setting, materials, workmanship, feeling, and association, are eligible for listing on the National Register of Historic Places under Criterion A, at the state or local level, for their contributions to the development of regional road and highway networks.

Colton Bridge (Colton County Bridge #9050-12.19) retains all aspects of integrity to a sufficient degree and is therefore recommended eligible for listing in the National Register of Historic Places under Criterion A at the local level and under Criterion C at the state level.

***Figure A-38. Colton Bridge (Field Number WCLB-6), east side; view to the northwest (photograph courtesy of Whitman County Public Works).***

*Figure A-39. Colton Bridge (Field Number WCLB-6), west side; view to the east.*

*Figure A-40. Colton Bridge (Field Number WCLB-6), reinforcing rod exposed at south end of east balustrade; view to the southeast.*

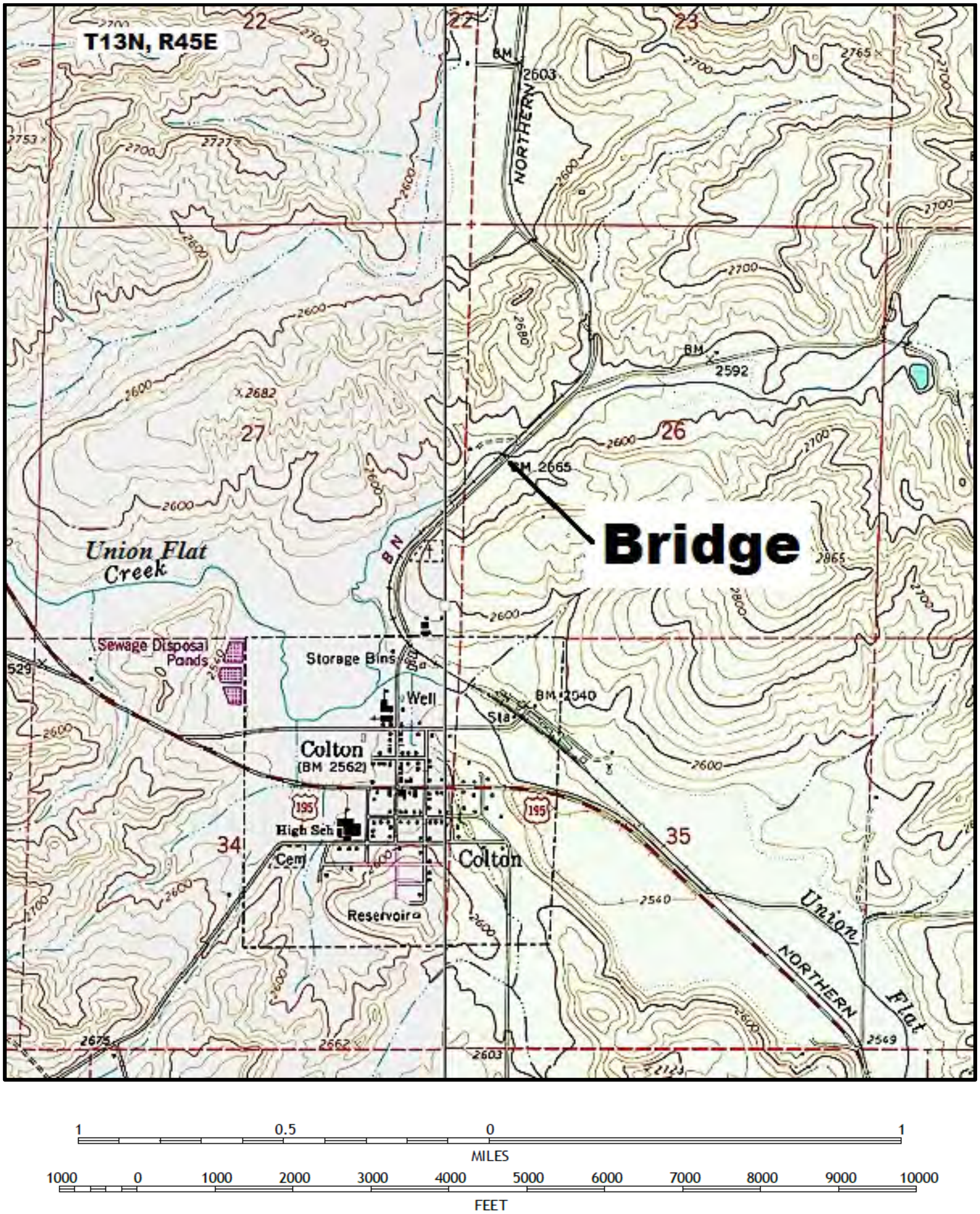



***Figure A-41. Location of Colton Bridge (Field Number WCLB-6); map adapted from Uniontown, Wash.-Idaho, 7.5' quadrangle, U.S. Geological Survey, 1964 (right) and Colton, Wash., 7.5' quadrangle, U.S. Geological Survey, 1975 (left).***

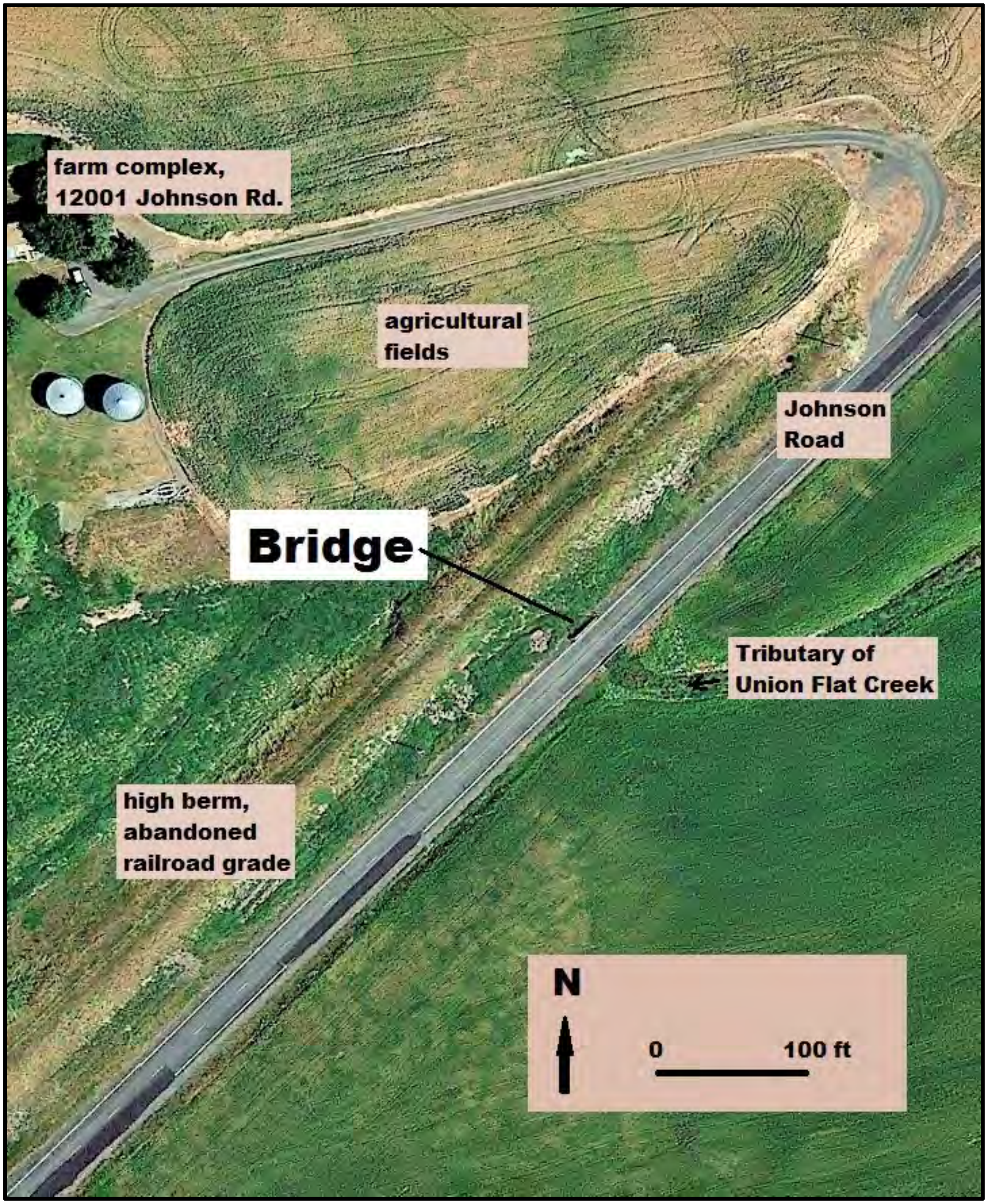



***Figure A-42. Colton Bridge (Field Number WCLB-6), vicinity; map adapted from Google Earth aerial photograph, 2015.***

## Colton Bridge No. 37 (historic name)
## Town of Colton Steptoe Street Bridge (modern name)
## Project Field Number WCLB-7

Description:

This large two-span reinforced concrete bridge – a filled spandrel deck arch type – conveys Steptoe Street, a lightly used paved route, over Union Flat Creek within the Town of Colton. The bridge is located at the northern edge of Colton, where the town grades into the rural area to the north.

The bridge is symmetrically arranged, approximately 107.5 feet long and 26 feet wide, with two 40-foot long semielliptical arches extending between the battered abutment faces and the slender battered central pier. The exterior sides of the abutments and central pier are slightly wider than the adjacent closed spandrel walls. The abutments, pier, and spandrel walls were cast separately and impressions of the horizontal 5-inch wide board forms remain visible in all three sections, although a thin coat of cement stucco was applied to visible portions in an effort to hide the mold seams. Neither the abutments nor the spandrels are ornamented; the pier, however, is embellished with an incised trapezoidal shape, the sides paralleling the battered sides of the pier and the bottom notched to mimic the peak of the projecting wedge-shaped ice-breaker below. The arched lower edges of the spandrels are beveled, as are visible vertical edges of the abutments and pier. The spandrel, pier, and abutment walls are capped with slightly overhanging concrete coping, beveled top and bottom on the exterior side of the bridge and unbeveled, forming a low curb, on the side toward the roadway. Below the arch spring line, the central pier is a large rectangular concrete block, also cast in horizontal board forms. Scouring has now exposed part of the concrete footing beneath the pier.

A low solid parapet railing, cast atop the coping of the spandrel, pier, and abutment walls, borders the bridge on both sides. Each parapet is cast in nine sections – a very narrow central segment atop the central pier, embellished on the outer surface with an incised square diamond and on the inner surface with a nearly square incised horizontal rectangle with truncated corners; a segment of moderate length on each side of the central section, each embellished on inner and outer surfaces with one incised horizontal rectangle; then two long segments on each side, each embellished on the inner and outer surfaces with two incised horizontal rectangles; and one long segment over the abutment at each end of the parapet, embellished on both inner and outer surfaces with one horizontal rectangle. No evidence of a bridge plaque was noted. The abutment and pier segments of each parapet are slightly higher and wider than the six central (spandrel) segments, and are capped with slightly overhanging concrete coping with a flat upper surface and beveled upper and lower edges. The coping is highly deteriorated or missing in places. The spandrel segments have flat tops with beveled edges, rather than coping; tops of some spandrel segments are also highly deteriorated and, in one area, a ferrous metal reinforcing rod is exposed. The vertical edges of most parapet segments are beveled, and a vertical line is incised into the end of each parapet. The parapets were cast in horizontal board forms and finished with a light coat of cement stucco to hide the mold seams.

The arch barrels were cast in four longitudinal sections: a 15-inch wide spandrel wall at each side and two approximately equal 12-foot wide sections in the center. (In Luten designs, the spandrel wall is generally placed beside rather than on top of the arch ring.) The arch barrels were cast in horizontal 5-inch wide board forms, the boards running perpendicular to the bridge and parallel to the stream. Some deterioration and spalling of concrete can be seen on lower portions of the arch barrels and along seams, exposing ferrous metal reinforcing rods in places.

Although not visible, space within the bridge – over the arch barrels and bounded by the spandrel and abutment walls – is filled with packed earth and rock. A concrete deck was poured atop the fill, now covered with pavement continuous with that of Steptoe Street. Engineering plans for the bridge depict steel reinforcing rods connecting all parts of the bridge – the footings, abutments, pier, arch barrels, spandrels, and parapets (Whitman County 1918a).

Significance Evaluation:

This bridge, originally called Colton Bridge No. 37, was built in 1918 on Steptoe Street within the Town of Colton. Since Steptoe Street is a continuation of the Inland Empire Highway, the bridge was probably built during construction of that route. The bridge is a Daniel B. Luten reinforced concrete filled spandrel deck arch design, a typical example of Luten's highway bridge structures (Whitman County ca. 1900s-1970s, 1918a). Today the bridge is owned and maintained by the Town of Colton.

During the late nineteenth and early twentieth centuries, Daniel B. Luten pioneered the use of reinforced concrete as a bridge construction material, patented his designs and methods, and widely publicized his results. As a result, Luten-designed reinforced concrete bridges were built throughout the nation during the 1910s and 1920s period. Although Luten designed other types of reinforced concrete bridges, his typical design was a filled spandrel deck arch bridge, often with solid parapet railings and incised geometric ornament. Reinforced concrete filled spandrel deck arch bridges of Luten design are therefore a significant bridge type which, if retaining sufficient integrity of location, design, setting, materials, workmanship, feeling, and association, are eligible for listing in the National Register of Historic Places. Such bridges are significant under Criterion C, at the state level, for their association with Daniel B. Luten's pioneering efforts in reinforced concrete bridge construction and as examples of Luten's distinctive filled spandrel deck arch designs.

Increasing automobile ownership during the early twentieth century led to a growing demand throughout the nation for improved roads, and state and local governments became actively involved in road construction and maintenance. Bridges were important features of these new transportation systems, and such structures, if retaining sufficient integrity of location, design, setting, materials, workmanship, feeling, and association, are eligible for listing on the National Register of Historic Places under Criterion A, at the state or local level, for their contributions to the development of regional road and highway networks.

Colton Bridge retains all aspects of integrity to a sufficient degree and is therefore recommended eligible for listing in the National Register of Historic Places under Criteria A and C at the state level.

***Figure A-43. Colton Bridge No. 37 (Field Number WCLB-7), east side; view to the southwest (photograph courtesy of Whitman County Public Works).***

***Figure A-44. Colton Bridge No. 37 (Field Number WCLB-7, west side; view to the southeast.***

***Figure A-45. Colton Bridge No. 37 (Field Number WCLB-7), detail of east side and central pier; view to the southwest.***

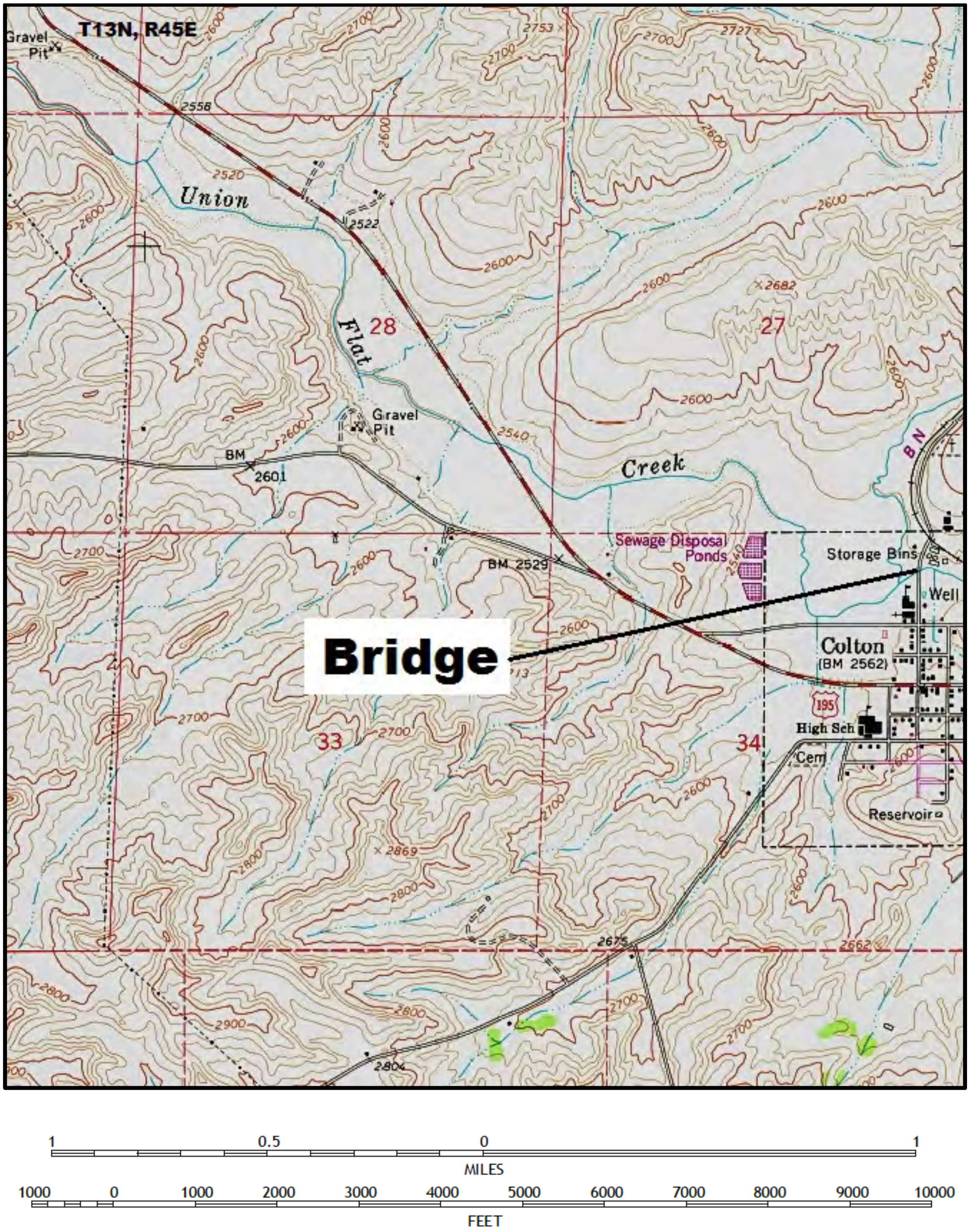



***Figure A-46. Location of Colton Bridge No. 37 (Field Number WCLB-7); map adapted from Colton, Wash., 7.5' quadrangle, U.S. Geological Survey, 1964, photorevised 1975.***

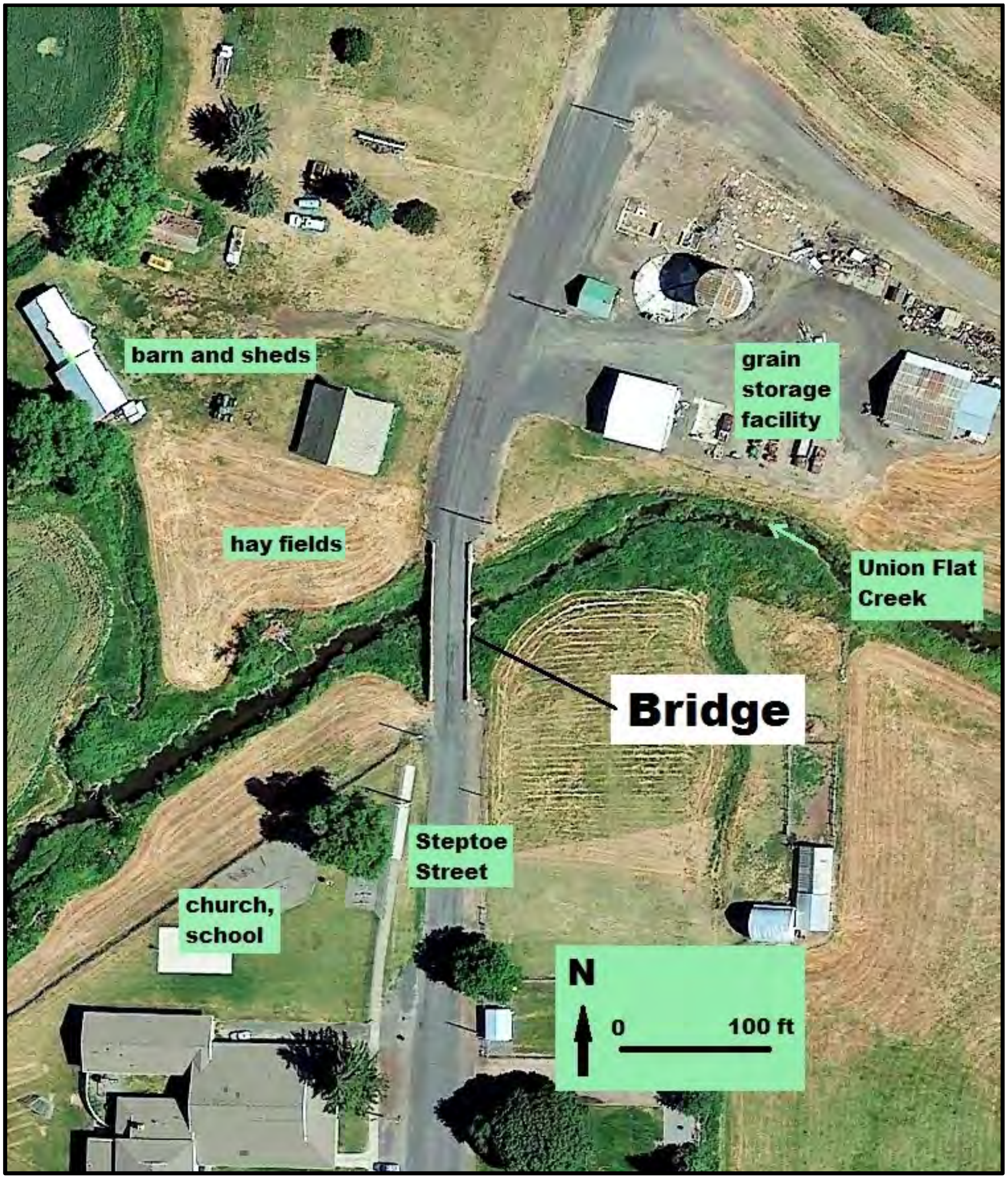



*Figure A-47. Colton Bridge No. 37 (Field Number WCLB-7) vicinity; map adapted from Google Earth aerial photograph, 2015.*

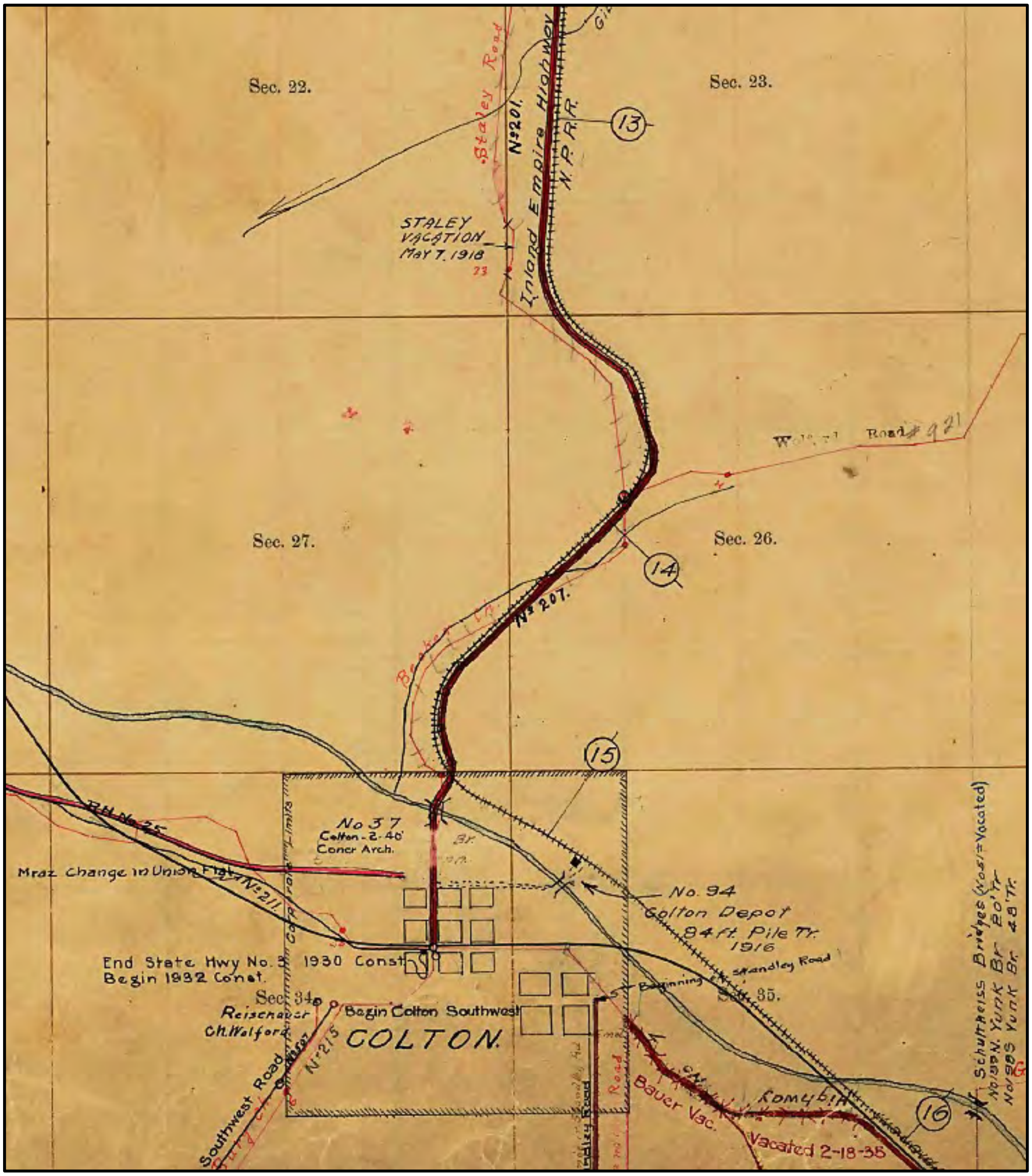



*Figure A-48. Colton Bridge No. 37 (Field Number WCLB-7) depicted in the Whitman County Highway Plat Book, on the road at the north edge of Colton that becomes the Inland Empire Highway; the bridge is identified as "No. 37 Colton 2-40' Concr. Arch" (Whitman County ca. 1900s-1970s).*

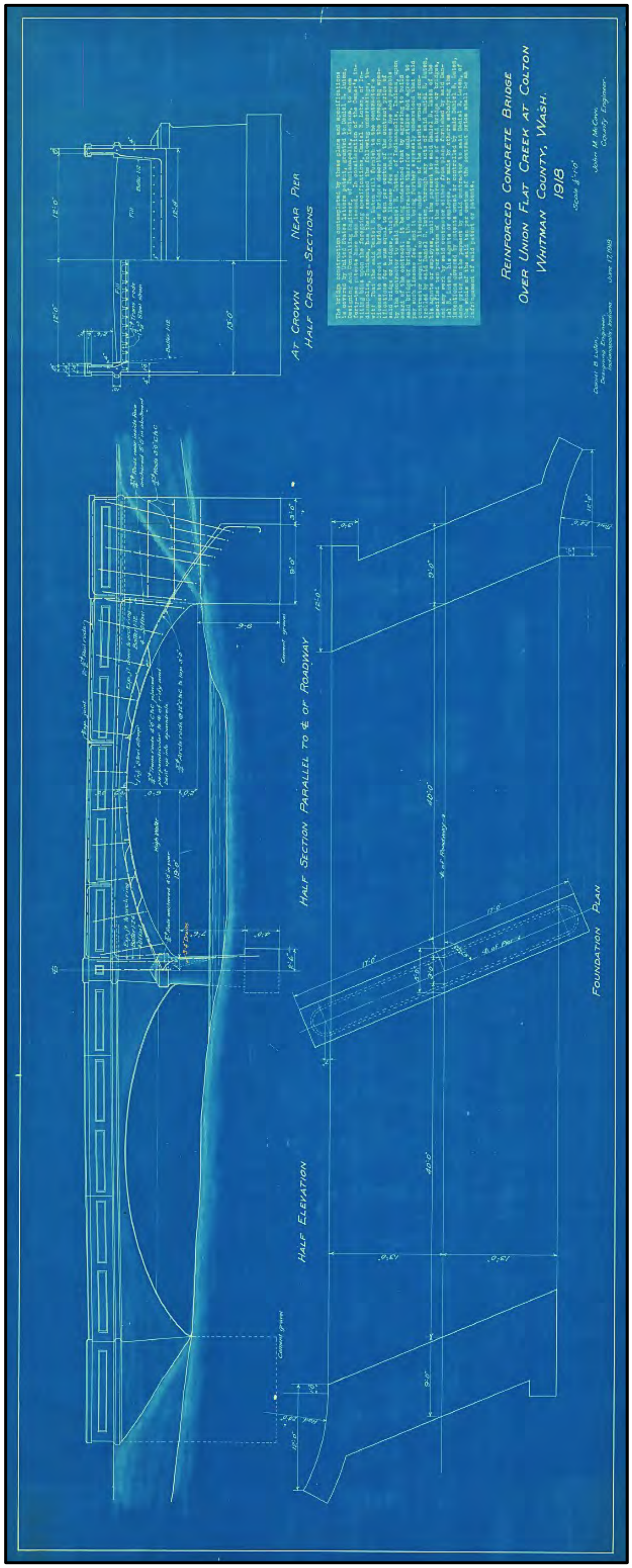



***Figure A-49. Colton Bridge No. 37 (Field Number WCLB-7) engineering plans, 1918 (Whitman County 1918a).***

## First Street Bridge No. 335 (historic name)
## Town of Farmington First Street Bridge (modern name)
## Project Field Number WCLB-8

Description:

This single span reinforced concrete bridge – a filled spandrel deck arch type – conveys First Street, a lightly used paved route, over South Fork Pine Creek within the Town of Farmington. The bridge is located at the south edge of Farmington, where the town grades into the rural area to the south. A modern metal footbridge has been installed about 50 feet west of the bridge.

The bridge is symmetrically arranged, approximately 46 feet long and 26.5 feet wide, with a 27-foot long semielliptical arch extending between the battered abutment faces. The sides of the abutments are flat and slightly wider than the adjacent closed spandrel walls. The abutments and spandrel walls were cast separately and impressions of the horizontal 7-inch wide board forms remain visible in both sections despite application of a thin coat of cement stucco to hide the mold seams. Both the spandrels and abutments are ornamented with incised geometric designs: Two large triangles embellish the spandrel, one on either side of the arch with each hypotenuse curved to match the curve of the arch ring, and a large rectangle ornaments each abutment, the visible vertical line paralleling the abutment's battered face. The arched lower spandrel edge is beveled, as are visible vertical edges of the abutments. The spandrel and abutment walls are capped with slightly overhanging concrete coping, beveled top and bottom on the exterior side of the bridge and unbeveled, forming a low curb, on the side toward the roadway.

A low solid parapet railing, cast atop the coping of the spandrel and abutment walls, borders the bridge on both sides. Each parapet is cast in five sections – three segments of moderate length in the center, each ornamented on both inner and outer surfaces with a horizontal incised rectangle, and a slightly shorter segment over the abutment at each end of the parapet, also embellished on both inner and outer surfaces with a horizontal rectangle. The two parapet abutment segments are slightly higher and wider than the three central (spandrel) segments, and are capped with slightly overhanging concrete coping with beveled lower edges and corners and a faintly rounded upper surface. A section of coping is presently missing from the southwest abutment segment and a large section of coping on the northeast abutment segment has recently been replaced with concrete cast in a slightly different shape. The spandrel parapet segments have flat tops with beveled edges, rather than coping. The vertical corners of all parapet segments are beveled and a vertical line is incised into the end of each parapet. The parapets were cast in horizontal board forms and finished with a light coat of cement stucco to hide the mold seams. A cast bronze bridge plaque is affixed to the exterior of the bridge, centered within the incised rectangle of the central western parapet segment. The plaque reads, "1918 / WHITMAN COUNTY / COMMISSIONERS / B. E. MANCHESTER / J. B. SANBORN / W. E. THOMPSON / J. W. McCAW / COUNTY ENGINEER / CONTRACTOR / H. C. MALOTT".

The arch barrel was cast in four longitudinal sections: a 14-inch wide spandrel wall at each side and two approximately equal 12-feet wide sections in the center. (In Luten designs, the spandrel wall is generally placed beside rather than on top of the arch ring.) The arch barrel was cast in horizontal 5-inch wide board forms, the boards running perpendicular to the bridge and parallel to the stream. Some deterioration and spalling of concrete can be seen on lower portions and seams of the arch barrel.

Although not visible, space within the bridge – over the arch barrel and bounded by the spandrel and abutment walls – is filled with packed earth and rock. A concrete deck was poured atop the fill, now covered with pavement, continuous with that of First Street. Steel reinforcing rods presumably connect all parts of the bridge – the footings, abutments, arch barrel, spandrels, and parapets.

Significance Evaluation:

This bridge, originally called First Street Bridge No. 335, was built in 1918 within the Town of Farmington, apparently a municipal project (Whitman County ca. 1900s-1970s). The bridge plaque identifies the builder as H. C. Malott, a Seattle bridge contractor. Although engineering plans were not located, the bridge appears to be a Daniel B. Luten reinforced concrete filled spandrel deck arch design, a typical example of Luten's highway bridge structures. Today the bridge remains in use, owned and maintained by the Town of Farmington.

During the late nineteenth and early twentieth centuries, Daniel B. Luten pioneered the use of reinforced concrete as a bridge construction material, patented his designs and methods, and widely publicized his results. As a result, Luten-designed reinforced concrete bridges were built throughout the nation during the 1910s and 1920s period. Although Luten designed other types of reinforced concrete bridges, his typical design was a filled spandrel deck arch bridge, often with solid parapet railings and incised geometric ornament. Reinforced concrete filled spandrel deck arch bridges of Luten design are therefore a significant bridge type which, if retaining sufficient integrity of location, design, setting, materials, workmanship, feeling, and association, are eligible for listing in the National Register of Historic Places. Such bridges are significant under Criterion C, at the state level, for their association with Daniel B. Luten's pioneering efforts in reinforced concrete bridge construction and as examples of Luten's distinctive filled spandrel deck arch designs.

Increasing automobile ownership during the early twentieth century led to a growing demand throughout the nation for improved roads, and state and local governments became actively involved in road construction and maintenance. Bridges were important features of these new transportation systems, and such structures, if retaining sufficient integrity of location, design, setting, materials, workmanship, feeling, and association, are eligible for listing on the National Register of Historic Places under Criterion A, at the state or local level, for their contributions to the development of regional road and highway networks.

First Street Bridge retains all aspects of integrity to a sufficient degree and is therefore recommended eligible for listing in the National Register of Historic Places under Criterion A at the local level and under Criterion C at the state level.

*Figure A-50. First Street Bridge (Field Number WCLB-8), east side; view to the northwest.*

*Figure A-51. First Street Bridge (Field Number WCLB-8), west side; view to the northeast.*


***Figure A-52. First Street Bridge (Field Number WCLB-8), plaque on exterior side of west parapet; view to the east.***

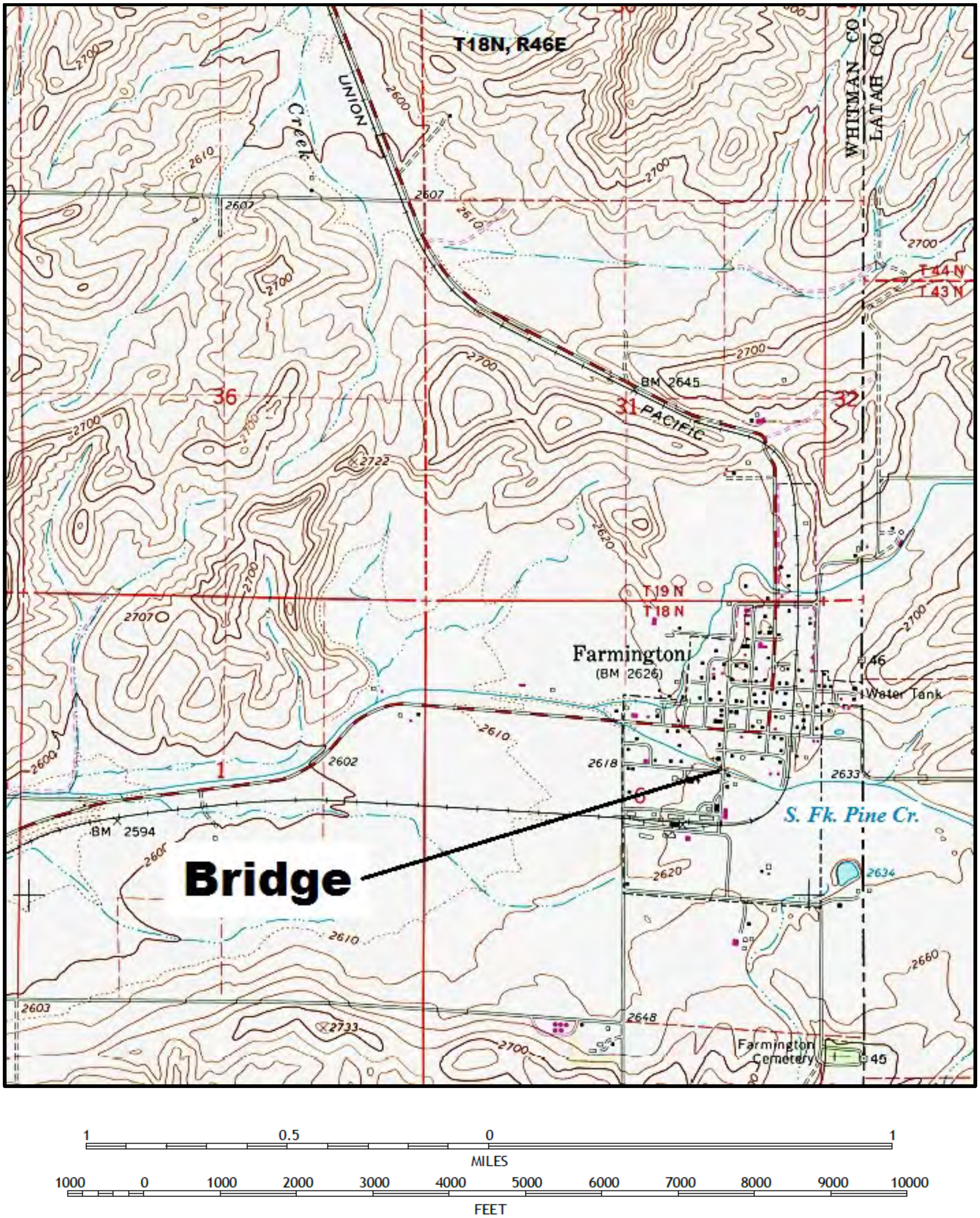



*Figure A-53. Location of First Street Bridge (Field Number WCLB-8); map adapted from Farmington, Wash-Idaho., 7.5' quadrangle, U.S. Geological Survey, 1964, photorevised 1984.*


***Figure A-54. First Street Bridge (Field Number WCLB-8) vicinity; map adapted from Google Earth aerial photograph, 2015.***

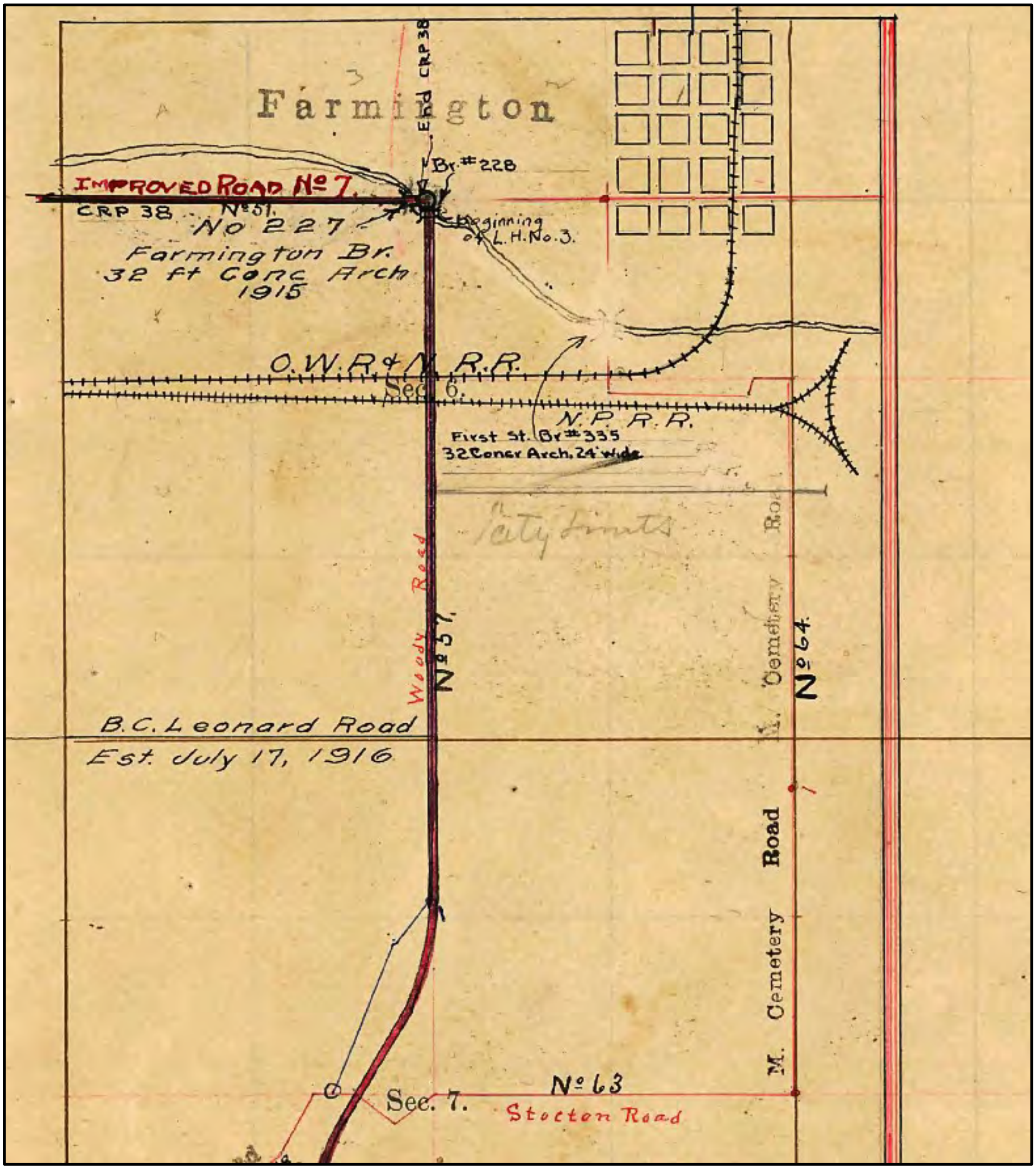



*Figure A-55. First Street Bridge (Field Number WCLB-8) depicted in the Whitman County Highway Plat Book on First Street in southern Farmington; the bridge is identified as "First St. Br #335 32 Concr Arch, 24' wide" (Whitman County ca. 1900s-1970s).*

**Mill Dam Bridge No. 106 (historic name)**
**City of Colfax Sixth Street Bridge (modern name)**
**Project Field Number WCLB-9**

Description:

This reinforced concrete bridge – a filled spandrel deck arch type – was built as a large two-span structure, conveying Sixth Street over the Palouse River at the northern edge of Colfax. The bridge was subsequently modified: During channelization of the Palouse River in the 1960s, fill was added around the northern arch leaving only the southern span visible. Portions of the original parapet remain along both northern and southern portions of the bridge, although some segments have been altered or removed.

The present bridge, including visible portions of the northern section, is approximately 183 feet long and 23 feet wide. Only the southern half of the structure, however, continues to function as a bridge, its 77.5-feet long semielliptical arch extending between the slender battered central pier on the north and the battered abutment face on the south. The exterior sides of the abutment and central pier are slightly wider than the adjacent closed spandrel walls. The abutment, pier, and spandrel walls were cast separately and impressions of the horizontal 7-inch wide board forms remain visible in all three sections; little effort appears to have been made to hide the mold seams in this area. None of these three features – the abutment, pier, or spandrels – is ornamented, although the arched lower edges of the spandrels are beveled. The spandrel, pier, and abutment walls are capped with thick slightly overhanging concrete coping, beveled top and bottom on the exterior side of the bridge and unbeveled, forming a curb, on the side toward the roadway. The northern arch apparently remains intact under the fill, as local residents report seeing the top of the arch when grass clippings have not been dumped along the western spandrel margin.

Portions of the original low solid parapet railings, cast atop the coping of the spandrel, pier, and abutment walls, border the bridge on both sides. The western parapet is more intact than the eastern parapet, extending along nearly the entire length of the original bridge. The western parapet appears to be cast in five sections – a very narrow central segment atop the central pier, embellished on both inner and outer surfaces with an incised horizontal rectangle; a very long segment on each side of the central section, each embellished on inner and outer surfaces with eight incised horizontal rectangles; and a segment of moderate length over the abutment at each end of the parapet, the northern abutment segment embellished with one horizontal rectangle, and the southern abutment segment – which is lighter colored and curved, apparently a modern replacement – embellished with two horizontal rectangles. Additional segments appear to have been removed from the northern end of the west parapet. The eastern parapet now consists only of the very long segment over the southern arch, embellished on inner and outer surfaces with eight incised horizontal rectangles, and a segment of moderate length over the south abutment, embellished on inner and outer surfaces with one horizontal rectangle. Additional parapet segments have been removed from the north end, and probably the south end, of this feature, and modern W-beam guardrails have been installed at the northern end. The abutment and pier parapet segments are slightly higher and wider than the central (spandrel) segments. All parapet segments are capped with slightly overhanging concrete coping with beveled lower margins and a peaked upper surface. Vertical edges of parapet segments are not beveled and no vertical lines are incised into the ends of the parapets. The parapets were cast in horizontal board forms and finished with a light coat of cement stucco to hide the mold seams. No evidence of a bridge plaque was noted. A modern metal girder has been added to the east side of the bridge, adjacent to the parapet, supporting a pedestrian walkway.

The arch barrels were cast in four longitudinal sections: an approximately 2-feet wide spandrel wall at each side and two equal 9-feet wide (estimated) sections in the center. (In Luten designs, the spandrel wall is generally placed beside rather than on top of the arch ring.) The arch barrels were cast in horizontal 7-inch wide (estimated) board forms, with the boards running perpendicular to the bridge and parallel to the stream. Slight deterioration and spalling of concrete can be seen along some arch barrel seams.

Although not visible, space within the bridge – over the arch barrels and bounded by the spandrel and abutment walls – is filled with packed earth and rock. A concrete deck was poured atop the fill, now covered with concrete slab or asphalt pavement. Engineering plans for the bridge depict steel reinforcing rods connecting all parts of the bridge – the footings, abutments, pier, arch barrels, spandrels, and parapets (Whitman County 1914a).

<u>Significance Evaluation</u>:

This bridge, originally called Mill Dam Bridge No. 106, was built in 1914 on Sixth Street at the northern edge of Colfax and named for a nearby mill pond. A preliminary drawing for Mill Dam Bridge shows the county road, accessing Colfax from the north, crossing Sixth Street on an existing bridge – probably a metal truss structure – at the site of the proposed bridge. Long-time Colfax resident Claudia Rollins (personal communication 2018) notes that the Sixth Street crossing was formerly the principal route into town. The bridge is a Daniel B. Luten reinforced concrete filled spandrel deck arch design, a typical example of Luten's highway bridge structures, and county records identify the builder as A. C. Biegle & Co. of Colfax (Macartney 1914; Whitman County ca. 1900s-1970s, ca. 1914, 1914a, 1914b, 1914c, 1914d). Today the bridge is owned and maintained by the City of Colfax.

During the late nineteenth and early twentieth centuries, Daniel B. Luten pioneered the use of reinforced concrete as a bridge construction material, patented his designs and methods, and widely publicized his results. As a result, Luten-designed reinforced concrete bridges were built throughout the nation during the 1910s and 1920s period. Although Luten designed other types of reinforced concrete bridges, his typical design was a filled spandrel deck arch bridge, often with solid parapet railings and incised geometric ornament. Reinforced concrete filled spandrel deck arch bridges of Luten design are therefore a significant bridge type which, if retaining sufficient integrity of location, design, setting, materials, workmanship, feeling, and association, are eligible for listing in the National Register of Historic Places. Such bridges are significant under Criterion C, at the state level, for their association with Daniel B. Luten's pioneering efforts in reinforced concrete bridge construction and as examples of Luten's distinctive filled spandrel deck arch designs.

Increasing automobile ownership during the early twentieth century led to a growing demand throughout the nation for improved roads, and state and local governments became actively involved in road construction and maintenance. Bridges were important features of these new transportation systems, and such structures, if retaining sufficient integrity of location, design, setting, materials, workmanship, feeling, and association, are eligible for listing on the National Register of Historic Places under Criterion A, at the state or local level, for their contributions to the development of regional road and highway networks.

Although Mill Dam Bridge is a historical structure, extensive modification during 1960s channelization of the river – including burying the north span beneath fill and removal of much of the parapet railing – has severely compromised the bridge's integrity of design, setting, materials, workmanship, and feeling. Today the bridge scarcely resembles the original structure. Mill Dam Bridge is therefore recommended not eligible for listing in the National Register of Historic Places.

***Figure A-56. Mill Dam Bridge (Field Number WCLB-9), west side; view to the northeast. The bridge's north arch is buried under the fill to the left of the channelized river.***

***Figure A-57. Mill Dam Bridge (Field Number WCLB-9), east side; view to the southwest. The bridge's north arch is buried under the fill to the right of the channelized river (photograph courtesy of Whitman County Public Works).***

*Figure A-58. Mill Dam Bridge (Field Number WCLB-9), west side; view to the southeast. The north arch is buried beneath the fill in the foreground.*

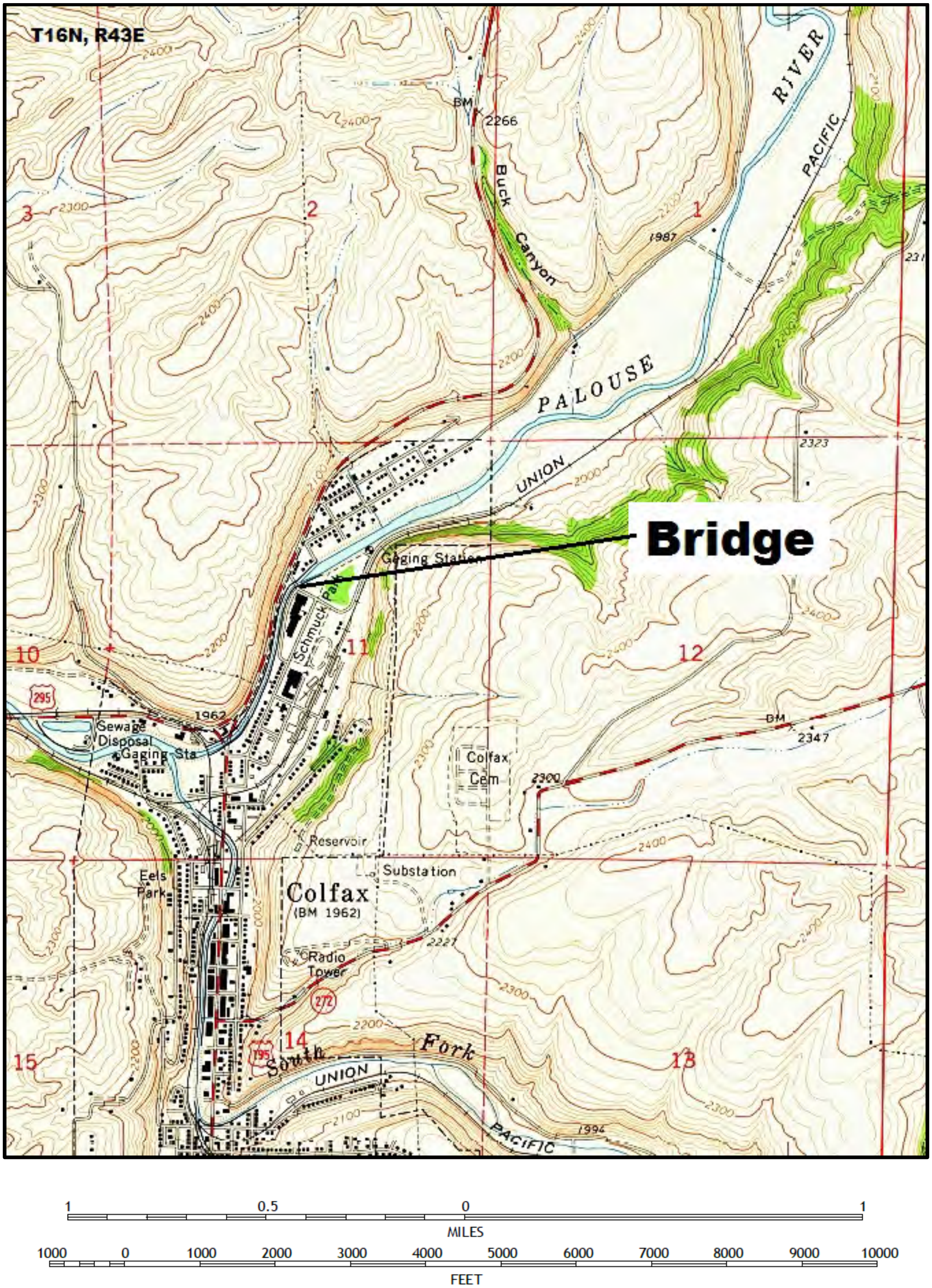



*Figure A-59. Location of Mill Dam Bridge (Field Number WCLB-9); map adapted from Colfax North, Wash., 7.5' quadrangle, U.S. Geological Survey, 1964.*

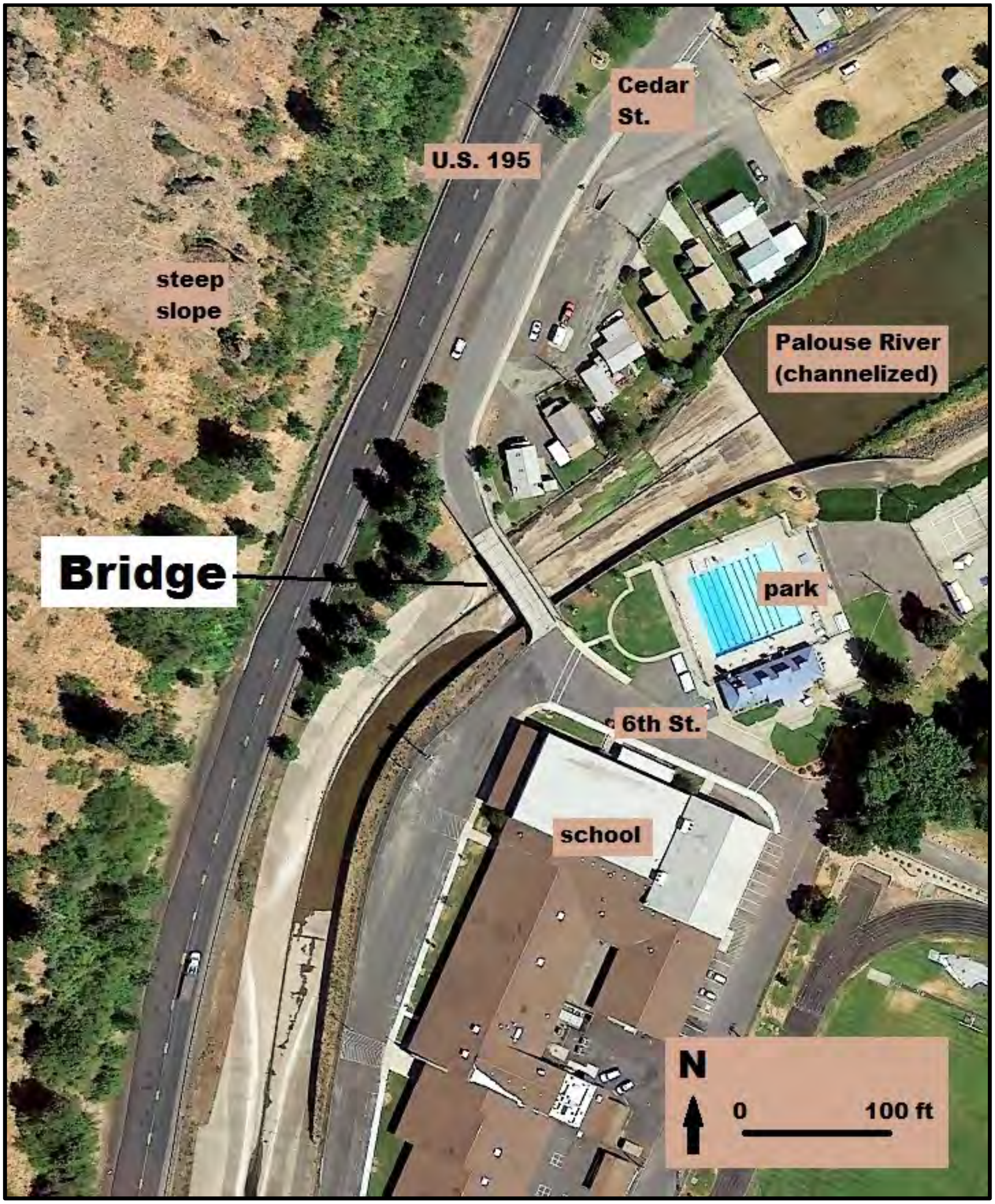



*Figure A-60. Mill Dam Bridge (Field Number WCLB-9) vicinity; map adapted from Google Earth aerial photograph, 2015.*

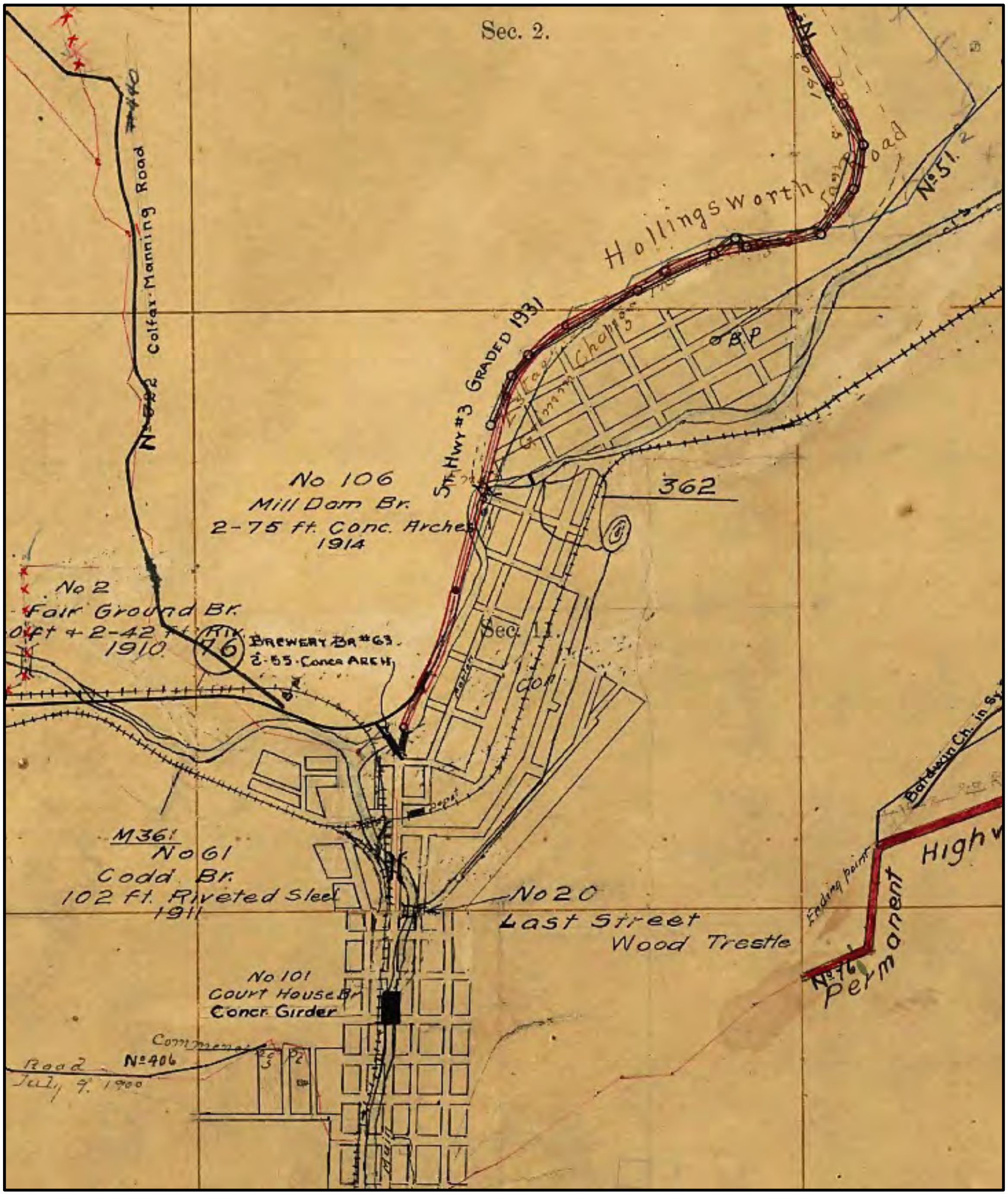



*Figure A-61. Mill Dam Bridge (Field Number WCLB-9) depicted in the Whitman County Highway Plat Book just north of downtown Colfax; the bridge is identified as "No 106 Mill Dam Br. 2 - 75 ft. Conc. Arches" (Whitman County ca. 1900s-1970s).*

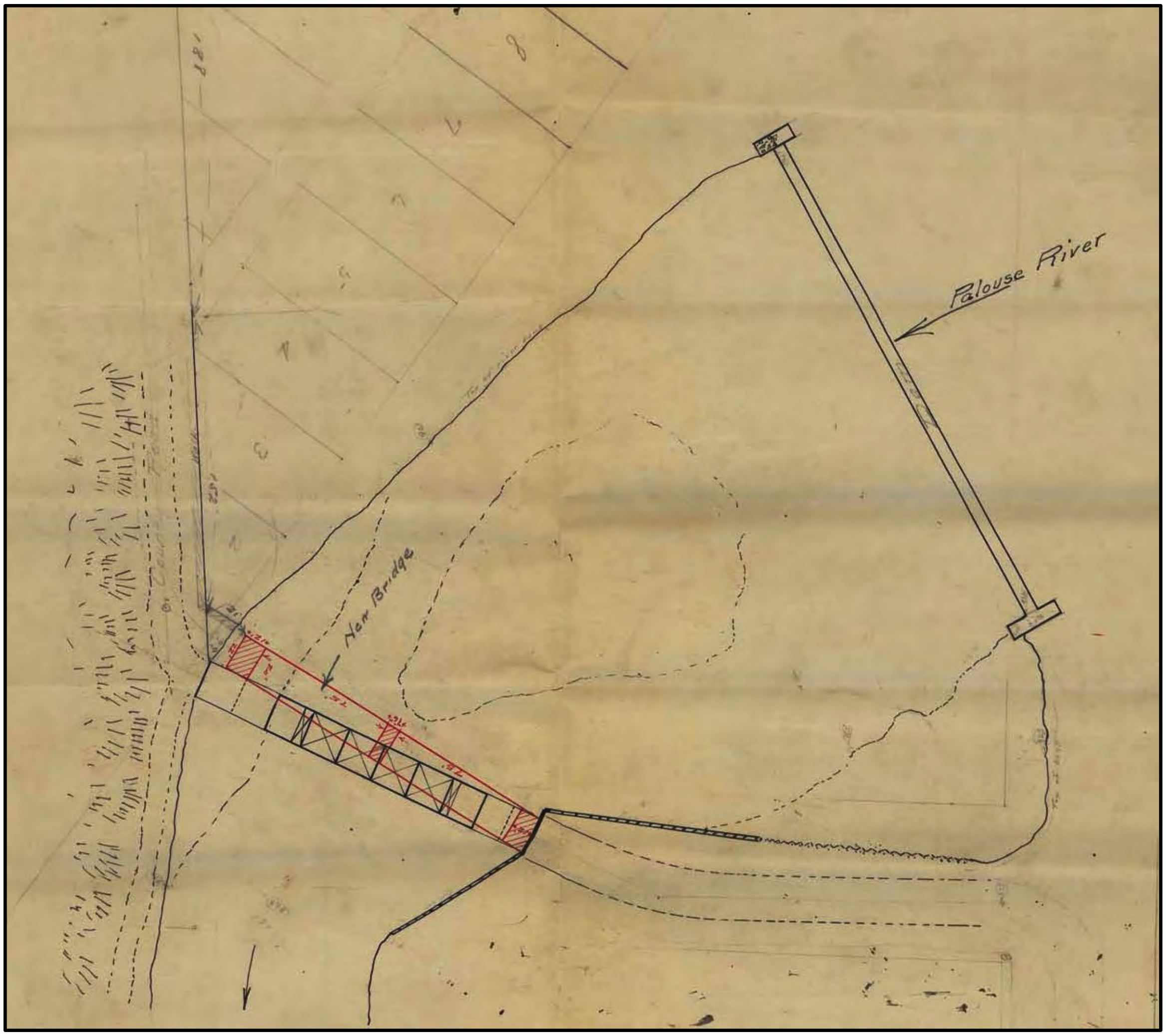



***Figure A-62. Sketch showing proposed location of Mill Dam Bridge (Field Number WCLB-9) ca. 1914 (Whitman County ca. 1914). Note the existing bridge, shown in black.***

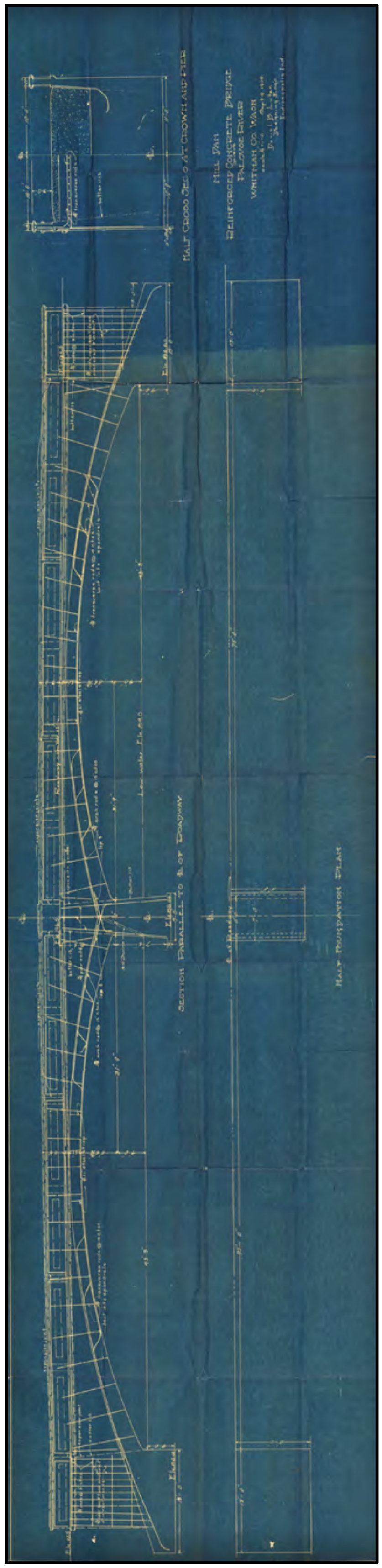


***Figure A-63. Mill Dam Bridge (Field Number WCLB-9) engineering plans, 1914 (Whitman County 1914a).***

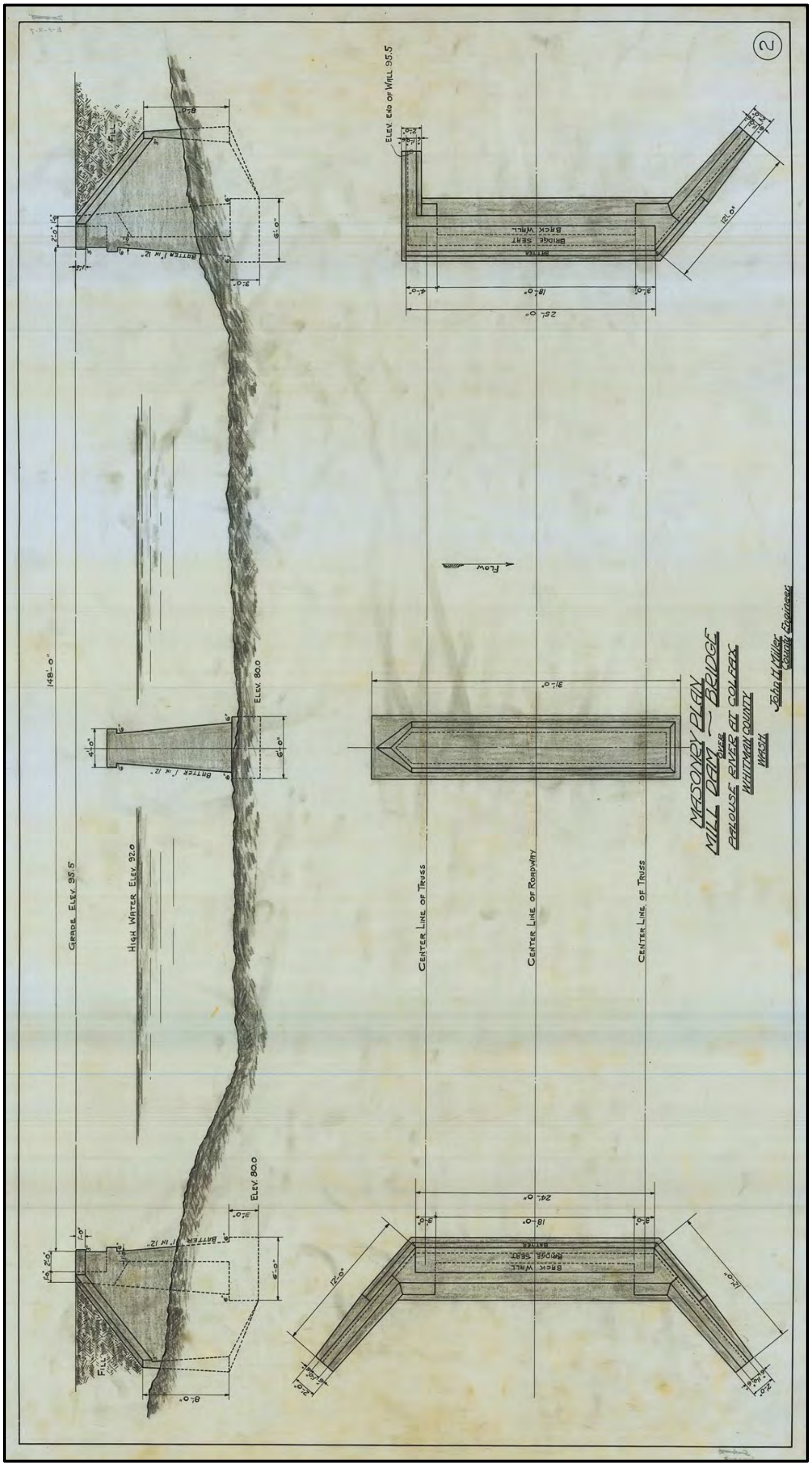
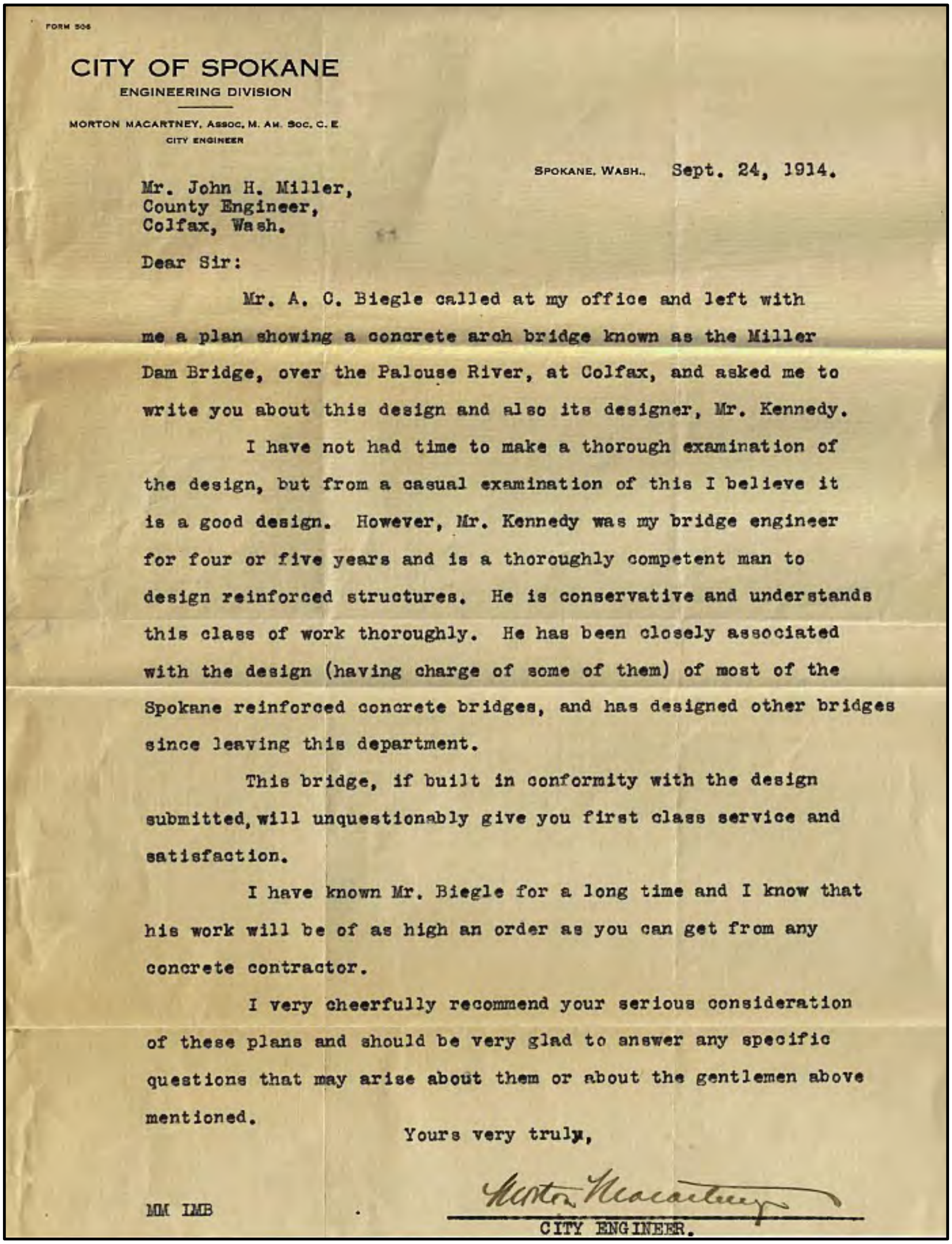



*Figure A-64. Mill Dam Bridge (Field Number WCLB-9 engineering plans, 1914 (Whitman County 1914b).*



FORM 506

CITY OF SPOKANE
ENGINEERING DIVISION

MORTON MACARTNEY, Assoc. M. Am. Soc. C. E.
CITY ENGINEER

SPOKANE, WASH., Sept. 24, 1914.

Mr. John H. Miller,
County Engineer,
Colfax, Wash.

Dear Sir:

Mr. A. C. Biegle called at my office and left with me a plan showing a concrete arch bridge known as the Miller Dam Bridge, over the Palouse River, at Colfax, and asked me to write you about this design and also its designer, Mr. Kennedy.

I have not had time to make a thorough examination of the design, but from a casual examination of this I believe it is a good design. However, Mr. Kennedy was my bridge engineer for four or five years and is a thoroughly competent man to design reinforced structures. He is conservative and understands this class of work thoroughly. He has been closely associated with the design (having charge of some of them) of most of the Spokane reinforced concrete bridges, and has designed other bridges since leaving this department.

This bridge, if built in conformity with the design submitted, will unquestionably give you first class service and satisfaction.

I have known Mr. Biegle for a long time and I know that his work will be of as high an order as you can get from any concrete contractor.

I very cheerfully recommend your serious consideration of these plans and should be very glad to answer any specific questions that may arise about them or about the gentlemen above mentioned.

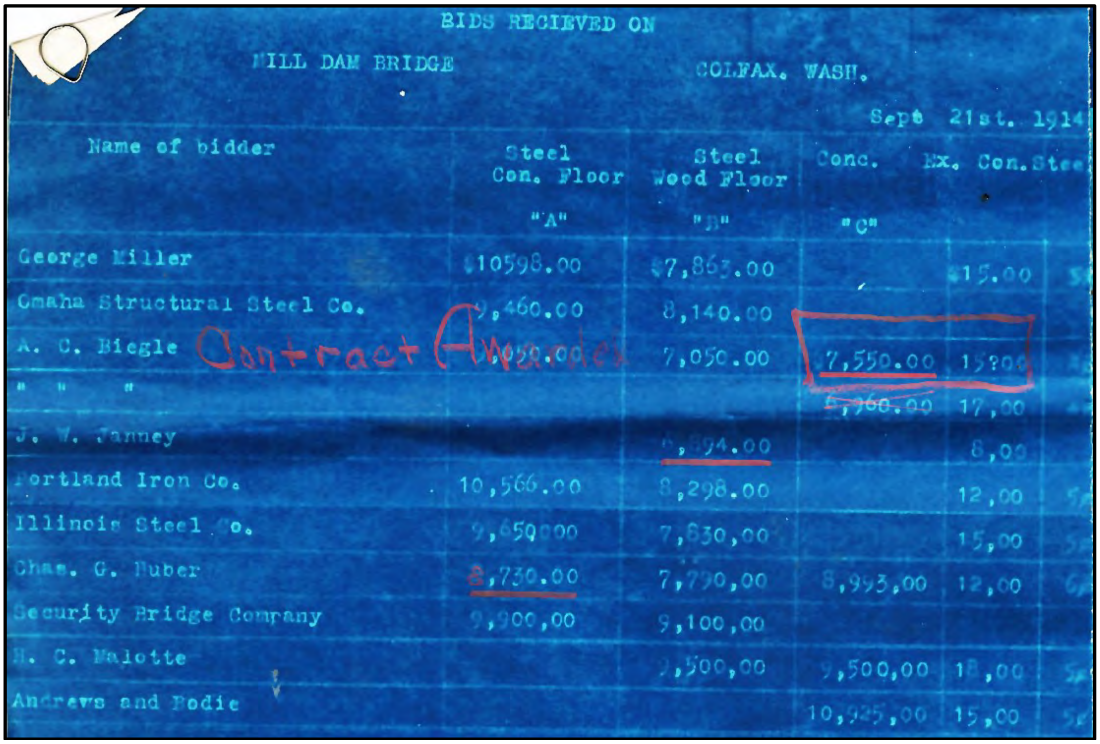
Yours very truly,

Morton Macartney

MM IMB

CITY ENGINEER.

*Figure A-65. Letter recommending A. C. Biegle's proposal for the Mill Dam Bridge (Field Number WCLB-9) (Macartney 1914).*



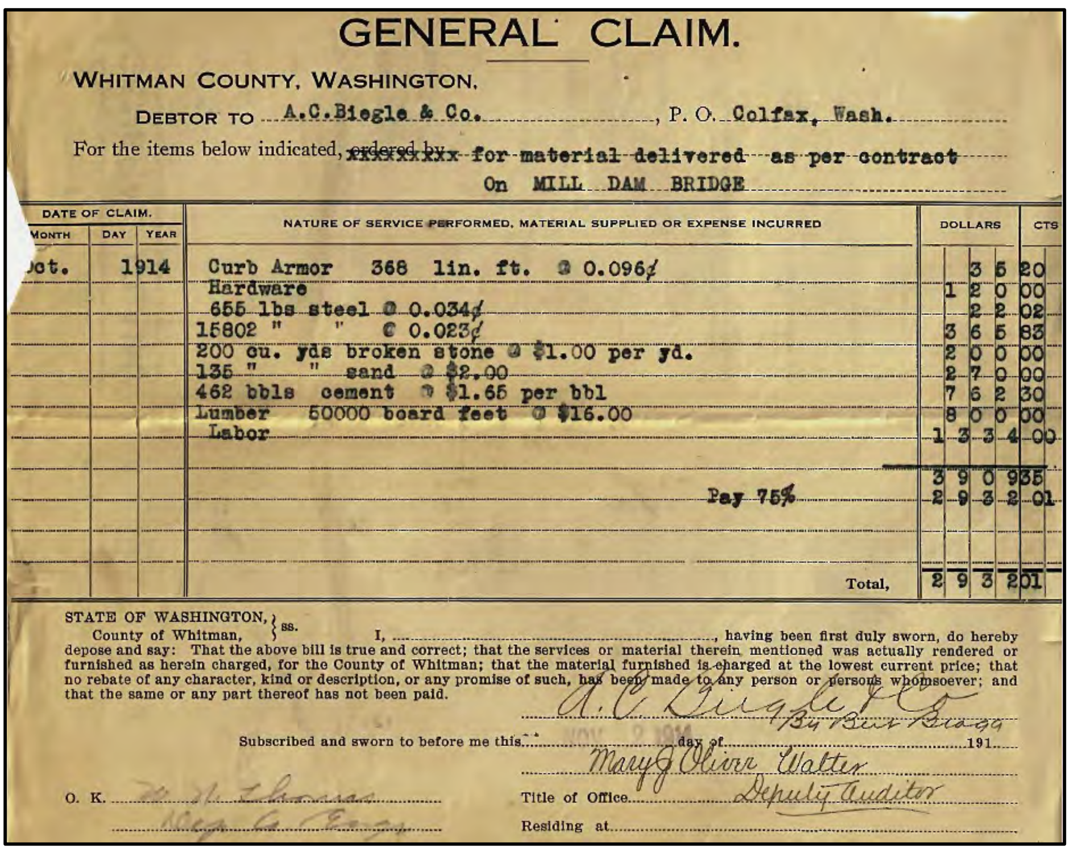
BIDS RECIEVED ON

MILL DAM BRIDGE COLFAX, WASH.

Sept 21st. 1914

| Name of bidder | Steel Con. Floor "A" | Steel Wood Floor "B" | Conc. "C" | Ex. Con. Steel |
|---|---|---|---|---|
| George Miller | $10598.00 | $7,863.00 | | $15.00 |
| Omaha Structural Steel Co. | 9,460.00 | 8,140.00 | | |
| A. C. Biegle Contract Awarded | [illegible] | 7,050.00 | 7,550.00 | 15.00 |
| " " " | | | [illegible],760.00 | 17,00 |
| J. W. Janney | | [illegible],894.00 | | 8,00 |
| Portland Iron Co. | 10,566.00 | 8,298.00 | | 12,00 |
| Illinois Steel Co. | 9,650.00 | 7,830,00 | | 15,00 |
| Chas. G. Huber | 8,730.00 | 7,790,00 | 8,993,00 | 12,00 |
| Security Bridge Company | 9,900,00 | 9,100,00 | | |
| H. C. Malotte | | 9,500,00 | 9,500,00 | 1[illegible],00 |
| Andrews and Rodie | | | 10,925,00 | 15,00 |

*Figure A-66. Bids, options, and contract award for Mill Dam Bridge (Field Number WCLB-9) (Whitman County 1914c).*



GENERAL CLAIM.

WHITMAN COUNTY, WASHINGTON.

DEBTOR TO A.C.Biegle & Co., P. O. Colfax, Wash.

For the items below indicated, ~~ordered by~~ for material delivered as per contract On MILL DAM BRIDGE

| DATE OF CLAIM. Month | Day | Year | NATURE OF SERVICE PERFORMED, MATERIAL SUPPLIED OR EXPENSE INCURRED | DOLLARS | CTS |
|---|---|---|---|---|---|
| Oct. | | 1914 | Curb Armor 368 lin. ft. @ 0.096¢ | 35 | 20 |
| | | | Hardware | 120 | 00 |
| | | | 655 lbs steel @ 0.034¢ | 22 | 02 |
| | | | 15802 " " @ 0.023¢ | 365 | 83 |
| | | | 200 cu. yds broken stone @ $1.00 per yd. | 200 | 00 |
| | | | 135 " " sand @ $2.00 | 270 | 00 |
| | | | 462 bbls cement @ $1.65 per bbl | 762 | 30 |
| | | | Lumber 50000 board feet @ $16.00 | 800 | 00 |
| | | | Labor | 1334 | 00 |
| | | | | 3909 | 35 |
| | | | Pay 75% | 2932 | 01 |
| | | | Total, | 2932 | 01 |

STATE OF WASHINGTON, County of Whitman, } ss. I, ..., having been first duly sworn, do hereby depose and say: That the above bill is true and correct; that the services or material therein mentioned was actually rendered or furnished as herein charged, for the County of Whitman; that the material furnished is charged at the lowest current price; that no rebate of any character, kind or description, or any promise of such, has been made to any person or persons whomsoever; and that the same or any part thereof has not been paid.

A. C. Biegle & Co
By Bert Biegle

Subscribed and sworn to before me this ... day of ... 191...

Mary J. Oliver Walter

O. K. [illegible]

Title of Office Deputy Auditor

Residing at

*Figure A-67. Contractor's invoice for Mill Dam Bridge (Field Number WCLB-9) materials (Whitman County 1914d).*

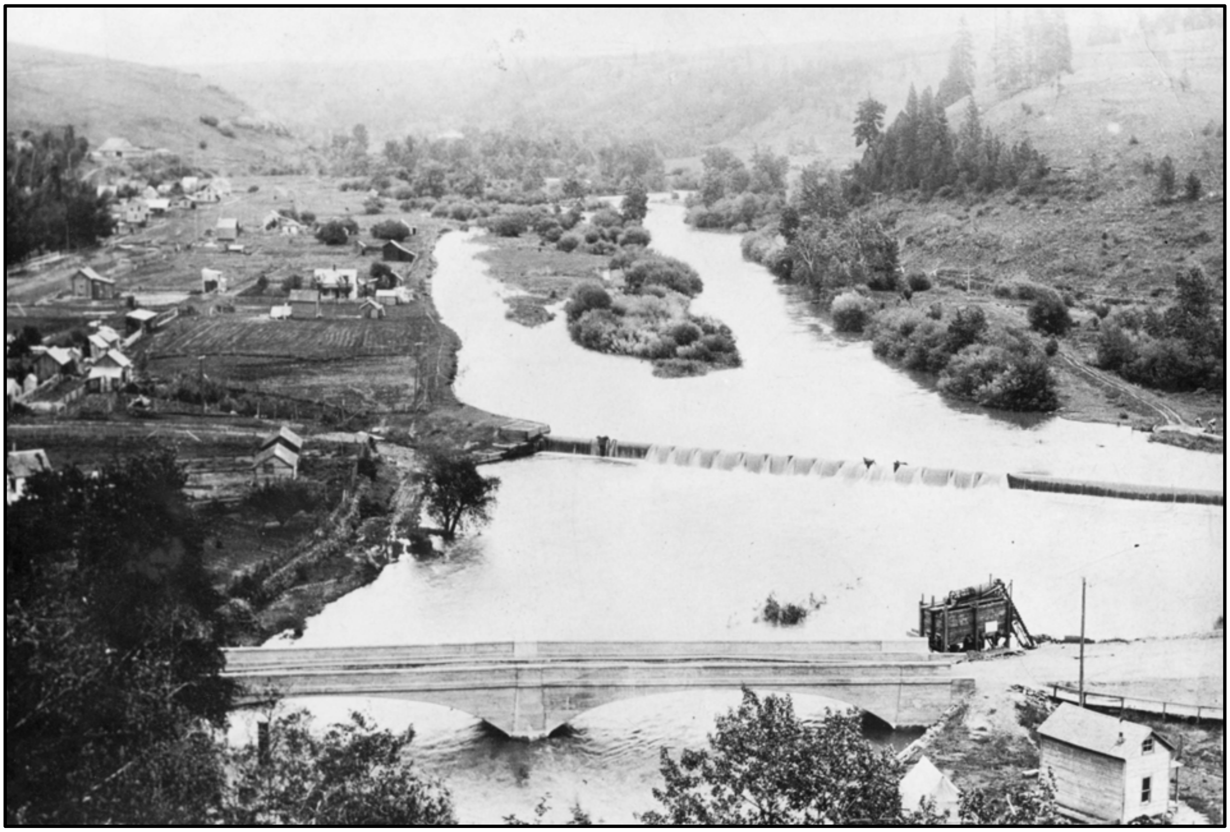


***Figure A-68. Mill Dam Bridge (Field Number WCLB-9) soon after its completion (photograph courtesy of the City of Colfax and the Whitman County Library Rural Heritage collection, WCLCF365, http://www.washingtonruralheritage.org/cdm/singleitem/collection/whitman/id/3541/rec/1). Note the left span, which was buried beneath fill during 1960s channelization of the Palouse River.***

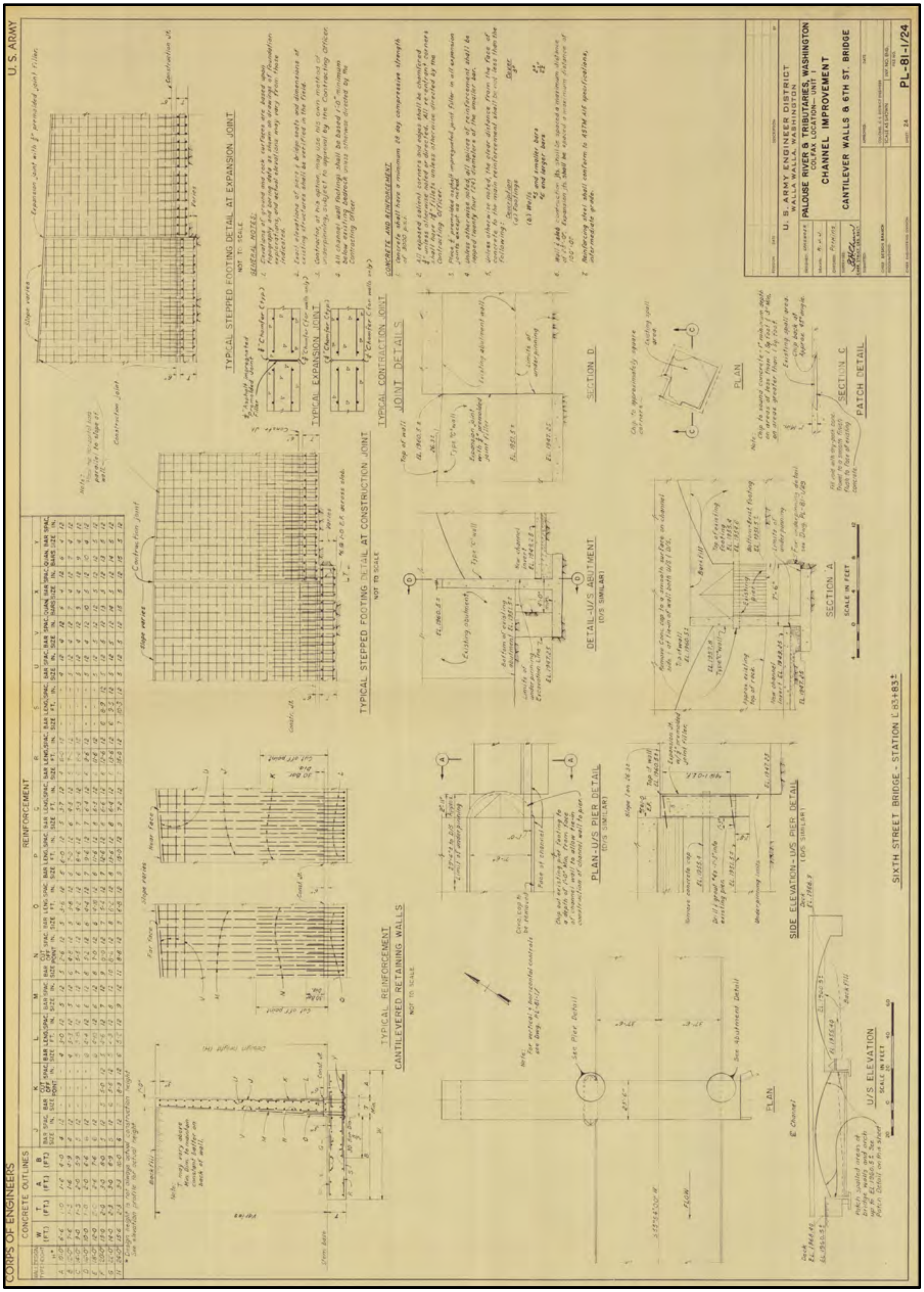



***Figure A-69. Mill Dam Bridge (Field Number WCLB-9) – Sixth Street Bridge – addressed in engineering plans for channelization of the Palouse River (U.S. Army Corps of Engineers ca. 1956).***

## Spring Street Bridge No. 58 (historic name)
## City of Pullman Spring Street Bridge (modern name)
## Project Field Number WCLB-10

Description:

This single span reinforced concrete bridge – a filled spandrel deck arch type – conveys Spring Street over the South Fork Palouse River in Pullman, just west of Washington State University (WSU). Today Spring Street, a paved road, is a primary access route for Reaney Park and WSU.

The bridge is symmetrically arranged, approximately 80 feet long and 30 feet wide, with a 62-foot long semielliptical arch extending between the battered abutment faces. The sides of the abutments are flat and slightly wider than the adjacent closed spandrel walls. The abutments and spandrel walls were cast separately and impressions of the horizontal 5-inch wide board forms remain visible in both sections despite application of a thin coat of cement stucco to hide the mold seams. Neither the abutments nor the spandrels are ornamented, although the arched lower edges of the spandrels are beveled. The spandrel and abutment walls are capped with slightly overhanging concrete coping, beveled top and bottom on the exterior side of the bridge and unbeveled, forming a low curb where visible, on the side toward the roadway.

A low solid slightly arched parapet railing, cast atop the coping of the spandrel and abutment walls, borders the bridge on both sides. Each parapet appears to be cast in five sections – a long central segment, embellished on both inner and outer surfaces with two horizontal incised rectangles, with a slightly protruding vertical band between them and another band on each side; a long segment on each side of the central section, each embellished on inner and outer surfaces with two incised horizontal rectangles, with a slightly protruding vertical band between them; and a segment of moderate length over the abutment at each end of the parapet, embellished on both inner and outer surfaces with one horizontal rectangle. All of the incised rectangles have been bush-hammered to create a decorative texture. The centers of the inner incised rectangles at the northeast and southwest corners of the bridge have been expanded to accommodate a bridge plaque. Both plaques are identical cast bronze plates, reading, "1915 / WHITMAN COUNTY / COMMISSIONERS / W. E. THOMPSON / M. W. WHITLOW / B. T. MANCHESTER / JOHN M. McCAW / COUNTY ENGINEER / CONTRACTOR / CHARLES G. HUBER, SEATTLE / 1915". The central (spandrel) parapet segments are capped with slightly overhanging concrete coping with rectangular edges, a rounded border beneath the lower margin, and a faintly rounded upper surface. The abutment parapet segments are slightly higher and wider than the spandrel segments, and are capped with overhanging concrete coping with beveled edges and a decoratively raised rectangular area on the upper surface. A vertical line is incised into the end of each parapet and the adjacent vertical corners are chamfered. The parapets were cast in horizontal board forms and finished with a light coat of cement stucco to hide the mold seams. Modern W-beam guardrails have been added at the northwest, southwest, and southeast corners of the bridge.

The arch barrel was cast in six longitudinal sections: an 18-inch wide spandrel wall at each side and four nearly equal 6- to 7-feet wide sections in the center. (In Luten designs, the spandrel wall is generally placed beside rather than on top of the arch ring.) The arch barrel was cast in horizontal 5-inch wide board forms, the boards running perpendicular to the bridge and parallel to the stream. Slight scouring and spalling were noted on lower portions of the arch barrel and along some barrel seams.

Although not visible, space within the bridge – over the arch barrel and bounded by the spandrel and abutment walls – is filled with packed earth and rock. A concrete deck was poured atop the fill, now covered with pavement, continuous with that of Spring Street, and a modern sidewalk along the north side of the bridge. Engineering plans for the bridge depict steel reinforcing rods connecting all parts of the bridge – the abutments, arch barrel, spandrels, and parapets (Whitman County 1915).

Significance Evaluation:

This bridge, originally called Spring Street Bridge No. 58, was built in 1915 as part of construction for the Inland Empire Highway. The bridge is a Daniel B. Luten reinforced concrete filled spandrel deck arch design, a typical example of Luten's highway bridge structures (Whitman County ca. 1900s-1970s, 1915). The bridge plaque identifies the builder as Charles G. Huber, a Seattle contractor who specialized in construction of Luten designed bridges (Pacific Builder and Engineer 1919:19). Today the bridge remains in use, owned and maintained by the City of Pullman.

During the late nineteenth and early twentieth centuries, Daniel B. Luten pioneered the use of reinforced concrete as a bridge construction material, patented his designs and methods, and widely publicized his results. As a result, Luten-designed reinforced concrete bridges were built throughout the nation during the 1910s and 1920s period. Although Luten designed other types of reinforced concrete bridges, his typical design was a filled spandrel deck arch bridge, often with solid parapet railings and incised geometric ornament. Reinforced concrete filled spandrel deck arch bridges of Luten design are therefore a significant bridge type which, if retaining sufficient integrity of location, design, setting, materials, workmanship, feeling, and association, are eligible for listing in the National Register of Historic Places. Such bridges are significant under Criterion C, at the state level, for their association with Daniel B. Luten's pioneering efforts in reinforced concrete bridge construction and as examples of Luten's distinctive filled spandrel deck arch designs.

Increasing automobile ownership during the early twentieth century led to a growing demand throughout the nation for improved roads, and state and local governments became actively involved in road construction and maintenance. Bridges were important features of these new transportation systems, and such structures, if retaining sufficient integrity of location, design, setting, materials, workmanship, feeling, and association, are eligible for listing on the National Register of Historic Places under Criterion A, at the state or local level, for their contributions to the development of regional road and highway networks.

Spring Street Bridge retains all aspects of integrity to a sufficient degree and is therefore recommended eligible for listing in the National Register of Historic Places under Criteria A and C at the state level.

***Figure A-70. Spring Street Bridge (Field Number WCLB-10), south side; view to the northeast (photograph courtesy of Whitman County Public Works).***

***Figure A-71. Spring Street Bridge (Field Number WCLB-10), north side; view to the southeast (photograph courtesy of Whitman County Public Works).***


***Figure A-72. Spring Street Bridge (Field Number WCLB-10), plaque on inner side of north parapet; view to the north.***

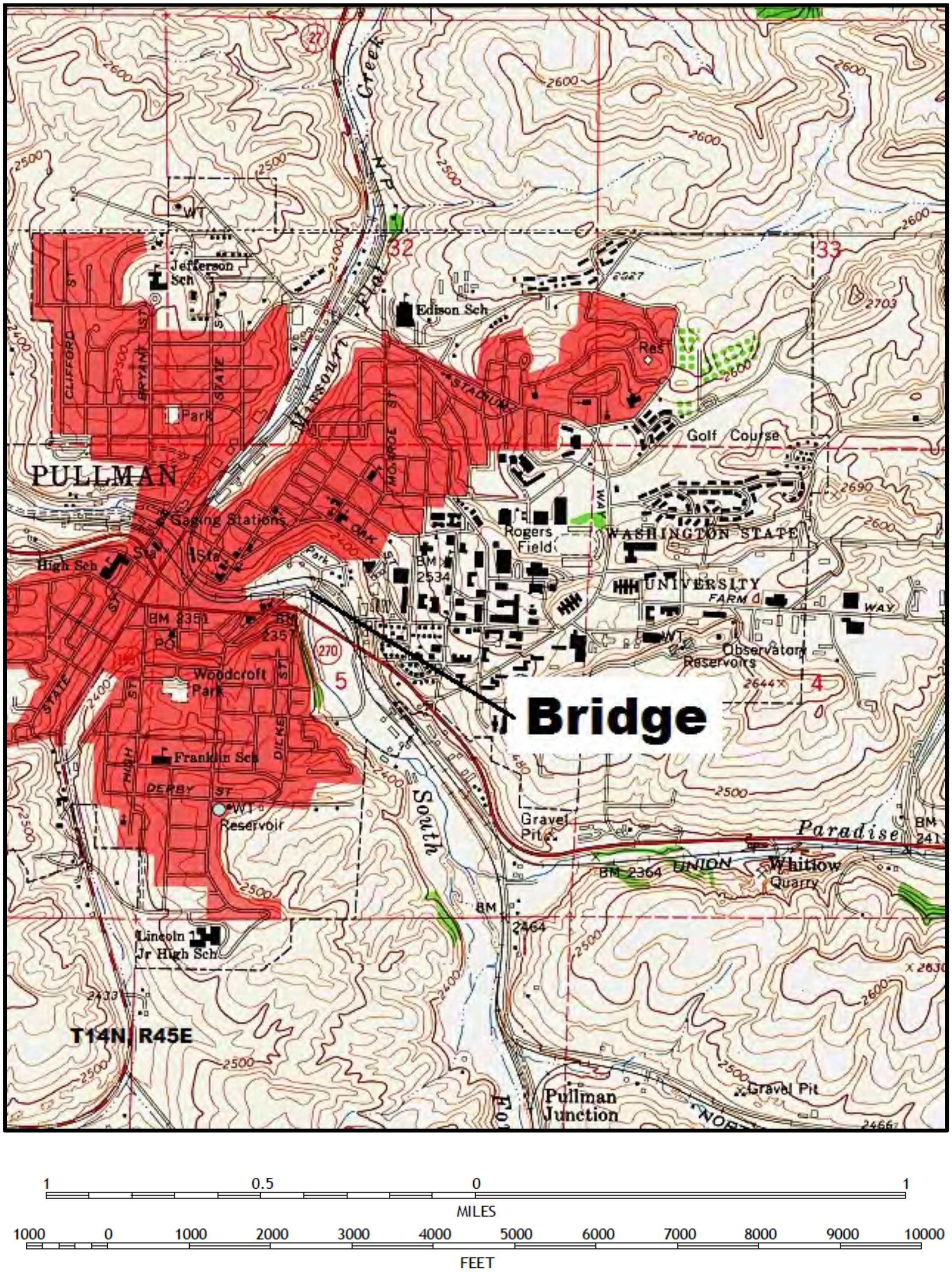



*Figure A-73. Location of Spring Street Bridge (Field Number WCLB-10); map adapted from Pullman, Wash., 7.5' quadrangle, U.S. Geological Survey, 1964.*

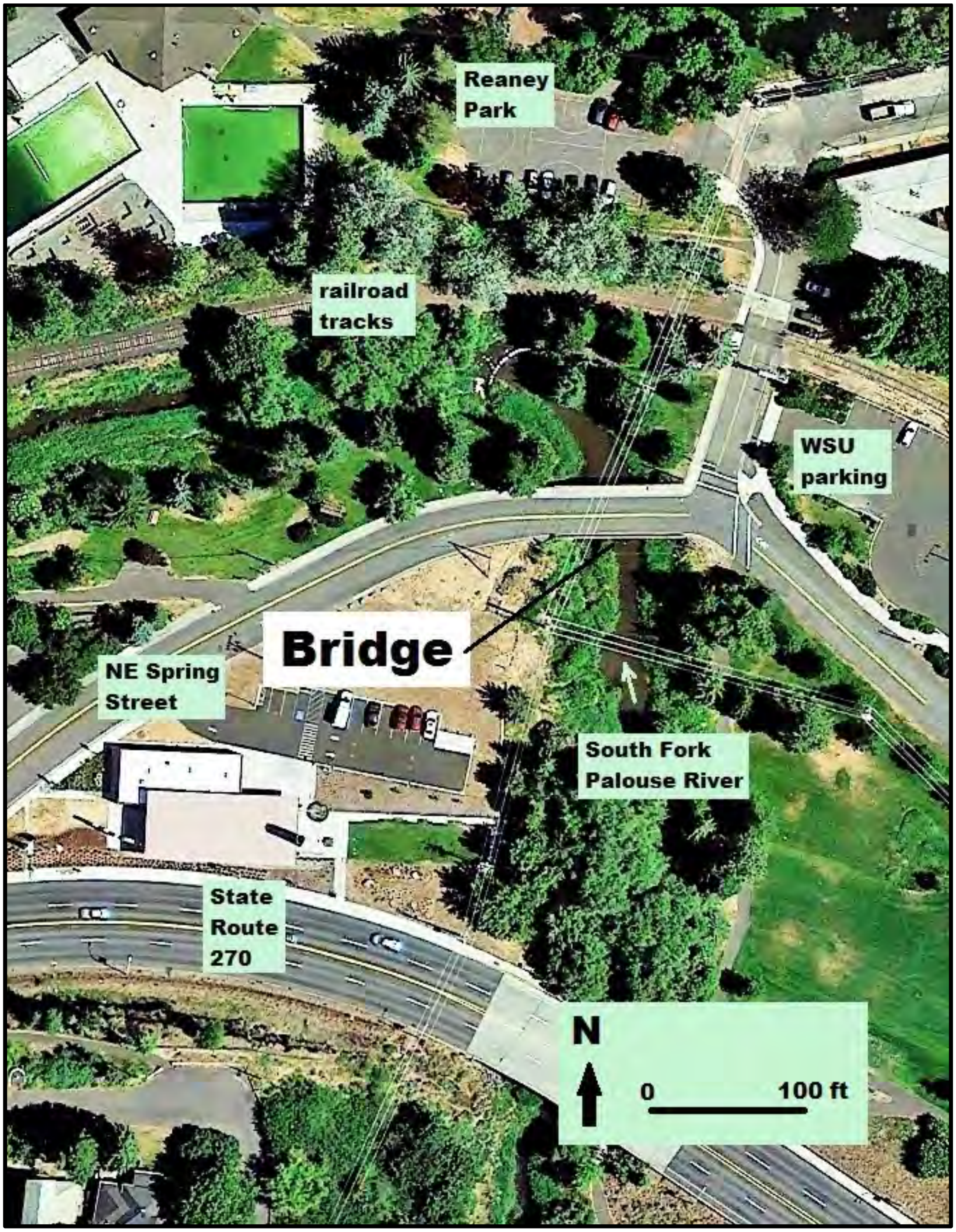



*Figure A-74. Spring Street Bridge (Field Number WCLB-10) vicinity; map adapted from Google Earth aerial photograph, 2015.*

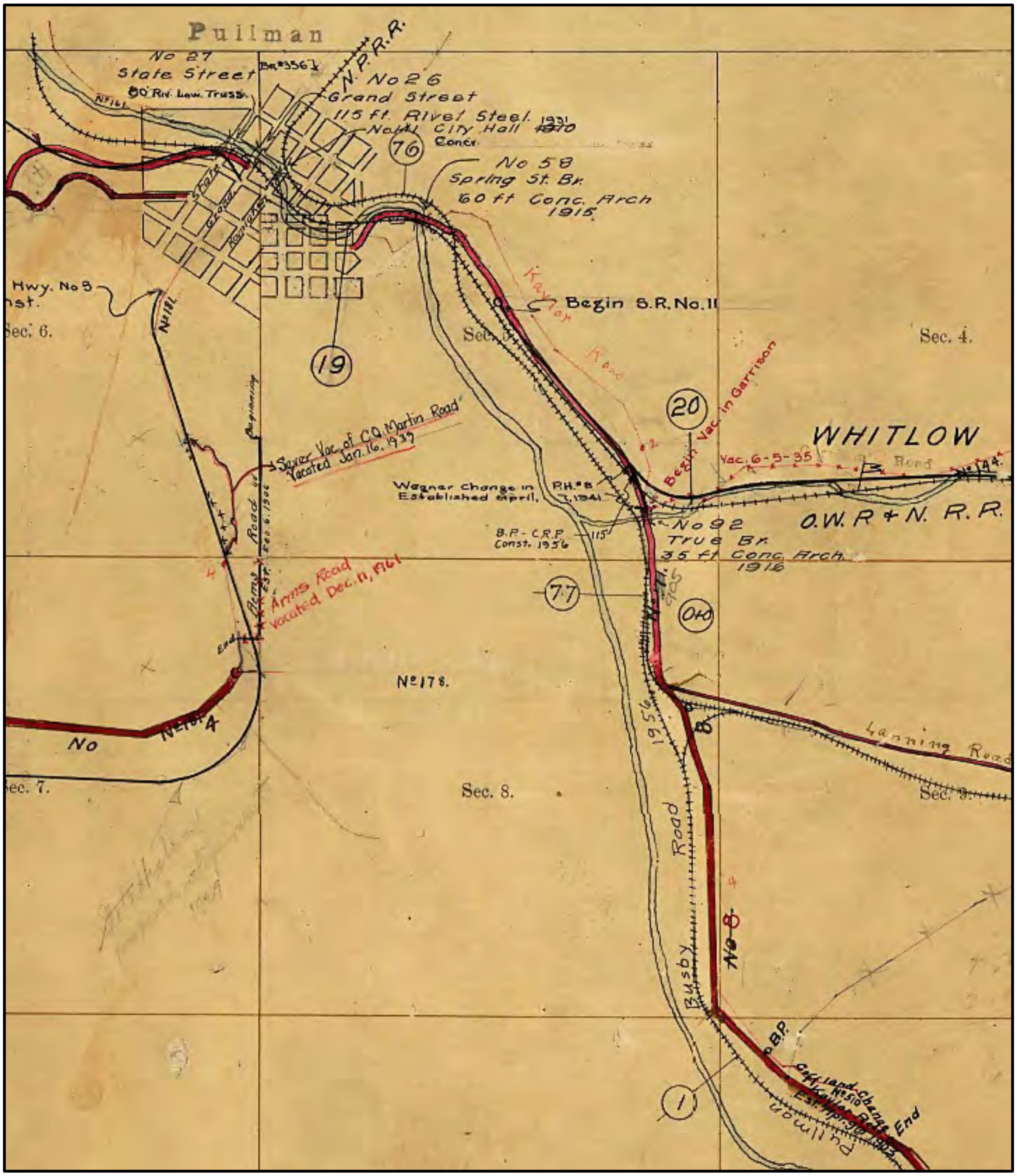



*Figure A-75. Spring Street Bridge (Field Number WCLB-10) depicted in the Whitman County Highway Plat Book, just east of Pullman; the bridge is identified as "No 58 Spring St. Br. 60 ft Conc. Arch 1915" (Whitman County ca. 1900s-1970s).*

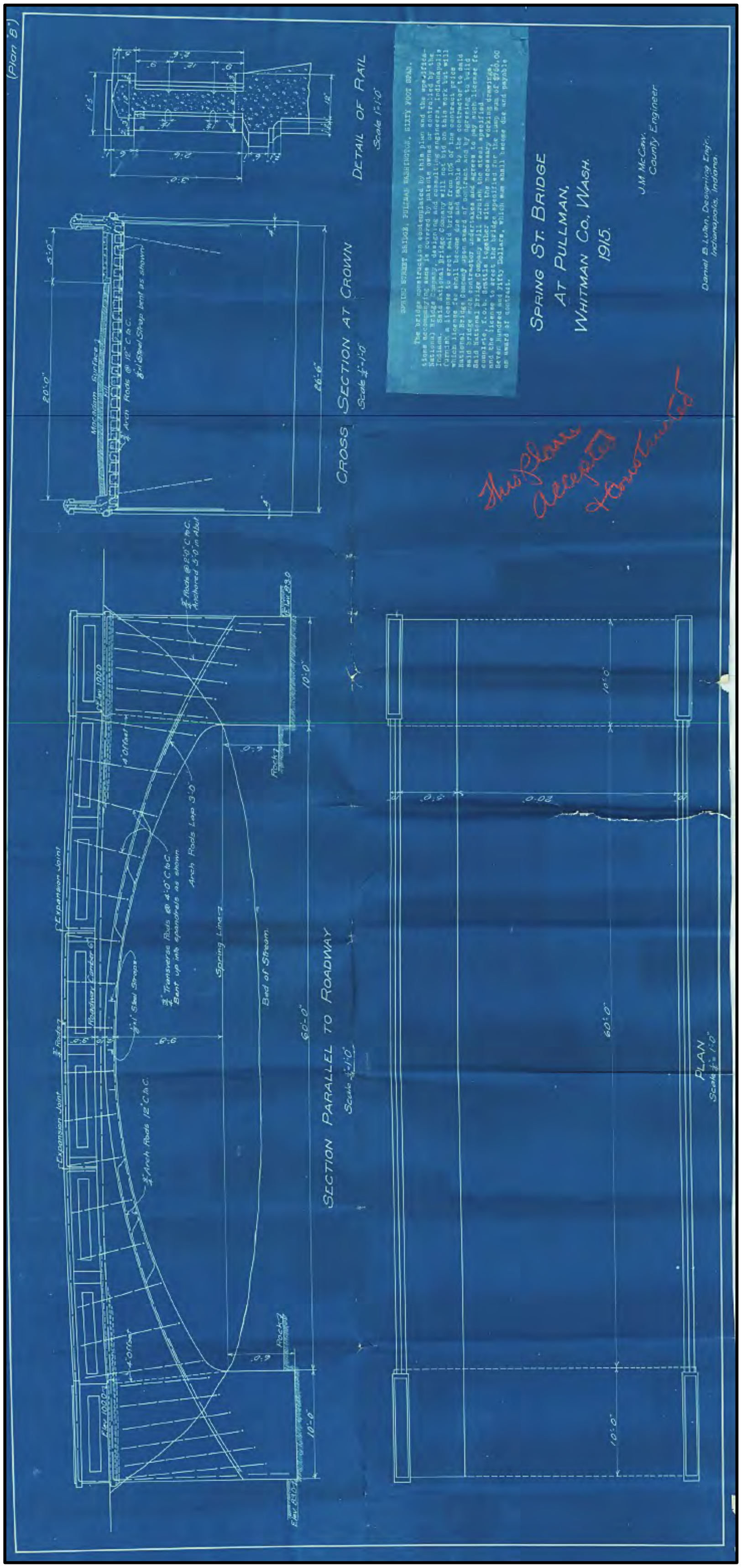



***Figure A-76. Spring Street Bridge (Field Number WCLB-10) engineering plans, 1915 (Whitman County 1915).***

## Wood Bridge No. 91 (historic name)
## U.S.A. Bridge (modern name)
## Project Field Number WCLB-11

Description:

This small single span reinforced concrete bridge – a filled spandrel deck arch type – conveys an unnamed private road over Paradise Creek just east of the City of Pullman and south of Washington State University. The bridge is immediately southeast of the intersection of State Route 270, the Pullman-Moscow Highway, and Terre View Drive, formerly Airport Road. When State Route 270 was constructed the new route was built up four or five feet above the original ground level. The surface of the small road conveyed by this bridge was subsequently raised at its northern end to the level of the new highway, obscuring portions of the inner parapet and northern abutments beneath fill.

The bridge is symmetrically arranged, approximately 56.5 feet long and 22.5 feet wide, with a 41-foot long semielliptical arch extending between the battered abutment faces. The sides of the abutments are flat and slightly wider than the adjacent closed spandrel walls. The abutments and spandrel walls were cast separately and impressions of the horizontal 5-inch wide board forms remain visible in both sections. Neither the abutments nor the spandrels are ornamented with geometric designs and little effort was apparently made to hide the mold seams. The arched lower edges of the spandrels are beveled, as are visible vertical edges of the abutments. The spandrel and abutment walls are capped with slightly overhanging concrete coping, beveled top and bottom on the exterior side of the bridge and unbeveled, forming a low curb where visible, on the side toward the roadway.

A low solid parapet railing, cast atop the coping of the spandrel and abutment walls, borders the bridge on both sides. Each parapet was cast in five sections – a narrow central segment, embellished on both inner and outer surfaces with a horizontal incised rectangle; a longer segment on each side of the central section, each embellished on inner and outer surfaces with two incised horizontal rectangles; and a segment of moderate length at each end of the parapet, embellished on both inner and outer surfaces with a horizontal rectangle. The two parapet abutment segments are slightly higher and wider than the three central (spandrel) segments, and are capped with slightly overhanging concrete coping with beveled upper and lower edges and a flat top. The spandrel parapet segments have flat tops with beveled edges, rather than coping. Vertical corners of the abutment parapet segments are beveled, while joints between the spandrel parapet segments are flush and separated by corroded sheet metal. A vertical line is incised into each visible parapet end.

The arch barrel was cast in four longitudinal sections: a 16-inch wide spandrel wall at each side and two approximately equal 9-feet wide sections in the center. (In Luten designs, the spandrel wall is generally placed beside rather than on top of the arch ring.) The arch barrel was cast in horizontal 5-inch wide board forms, the boards running perpendicular to the bridge and parallel to the stream. Minor spalling is visible in lower portions of the arch barrel and along barrel seams.

Although not visible, space within the bridge – over the arch barrel and bounded by the spandrel and abutment walls – is filled with packed earth and rock. A concrete deck was poured atop the fill and pavement has now been added, continuous with that of the private road. Engineering plans for the bridge depict steel reinforcing rods connecting all parts of the bridge – the abutments, streambed pavement, arch barrel, spandrels, and parapet. The bridge was apparently not built as designed, as the plans show wing walls rather than the present abutments (Whitman County 1916b).

Significance Evaluation:

This bridge, originally called Wood Bridge No. 91, was built in 1916 on Garrison Road. The bridge is a Daniel B. Luten reinforced concrete filled spandrel deck arch design, a typical example of Luten's highway bridge structures This segment of Garrison Road, which was replaced by Secondary Road No.

11, was vacated in 1935 (Whitman County ca. 1900s-1970s, 1916b). Today, according to County Assessor's records, the bridge is owned by the United States, which owns the surrounding parcel.

During the late nineteenth and early twentieth centuries, Daniel B. Luten pioneered the use of reinforced concrete as a bridge construction material, patented his designs and methods, and widely publicized his results. As a result, Luten-designed reinforced concrete bridges were built throughout the nation during the 1910s and 1920s period. Although Luten designed other types of reinforced concrete bridges, his typical design was a filled spandrel deck arch bridge, often with solid parapet railings and incised geometric ornament. Reinforced concrete filled spandrel deck arch bridges of Luten design are therefore a significant bridge type which, if retaining sufficient integrity of location, design, setting, materials, workmanship, feeling, and association, are eligible for listing in the National Register of Historic Places. Such bridges are significant under Criterion C, at the state level, for their association with Daniel B. Luten's pioneering efforts in reinforced concrete bridge construction and as examples of Luten's distinctive filled spandrel deck arch designs.

Increasing automobile ownership during the early twentieth century led to a growing demand throughout the nation for improved roads, and state and local governments became actively involved in road construction and maintenance. Bridges were important features of these new transportation systems, and such structures, if retaining sufficient integrity of location, design, setting, materials, workmanship, feeling, and association, are eligible for listing on the National Register of Historic Places under Criterion A, at the state or local level, for their contributions to the development of regional road and highway networks.

Wood Bridge, despite alteration of the roadway surface, retains all aspects of integrity to a sufficient degree and is therefore recommended eligible for listing in the National Register of Historic Places under Criterion A at the local level and under Criterion C at the state level.

***Figure A-77. Wood Bridge (Field Number WCLB-11), east side; view to the northwest (photograph courtesy of Whitman County Public Works).***

*Figure A-78. Wood Bridge (Field Number WCLB-11), west side; view to the southeast (photograph courtesy of Whitman County Public Works).*

*Figure A-79. Wood Bridge (Field Number WCLB-11), south approach; view to the north. The road conveyed by the bridge has been built up to the level of State Route 270, which is visible in the background.*

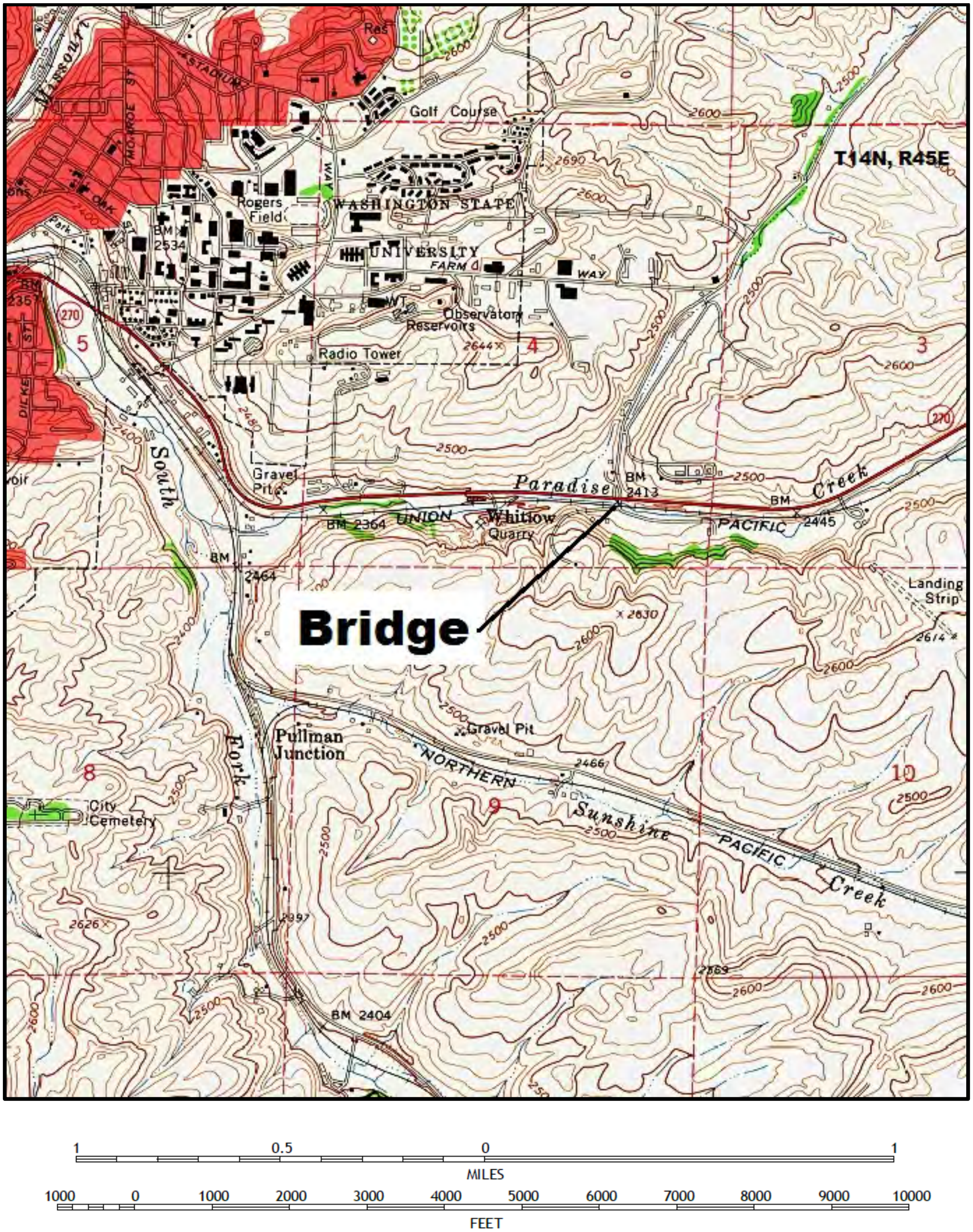



*Figure A-80. Location of Wood Bridge (Field Number WCLB-11); map adapted from Pullman, Wash., 7.5' quadrangle, U.S. Geological Survey, 1964.*

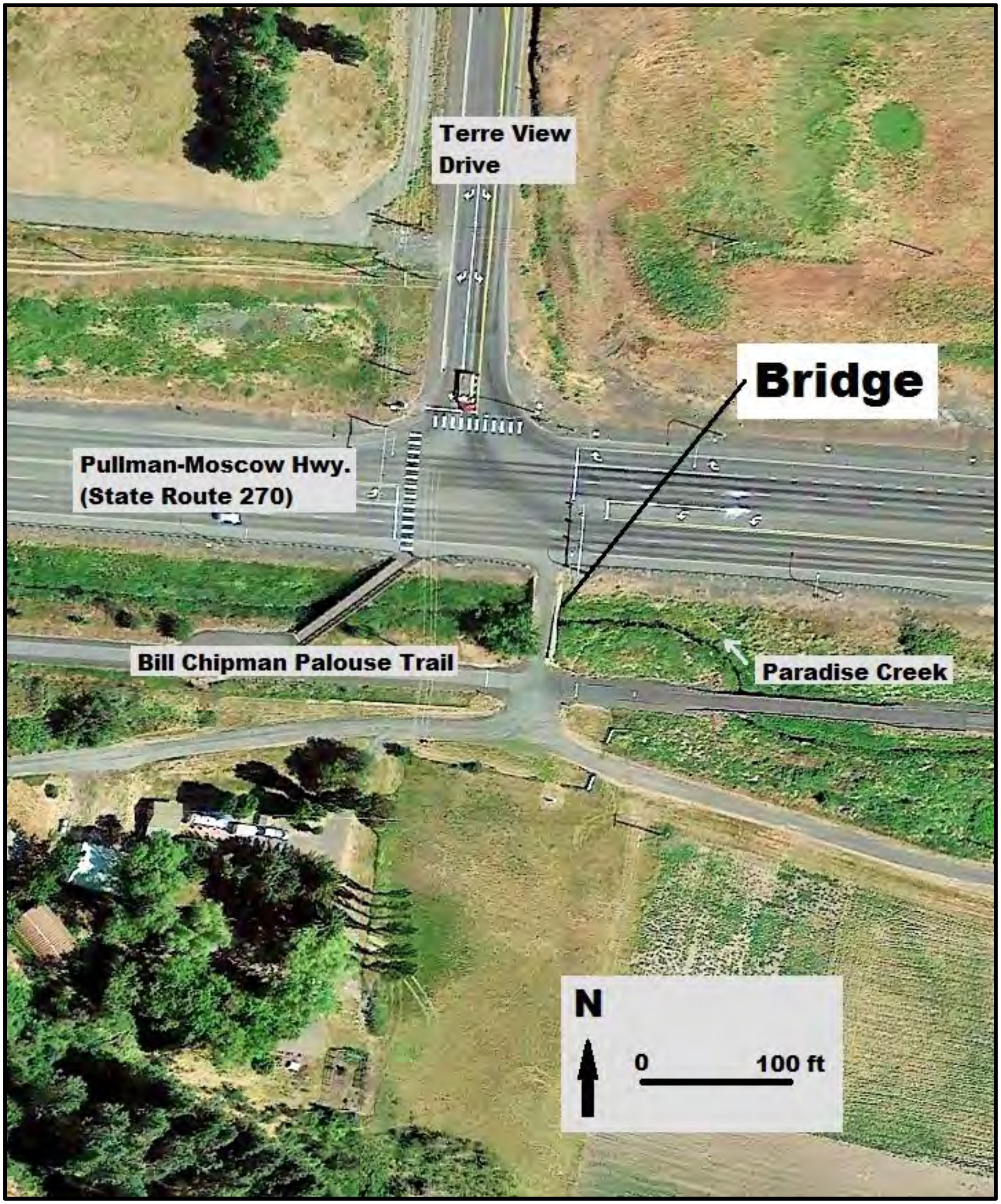



*Figure A-81. Wood Bridge (Field Number WCLB-11) vicinity; map adapted from Google Earth aerial photograph, 2015.*

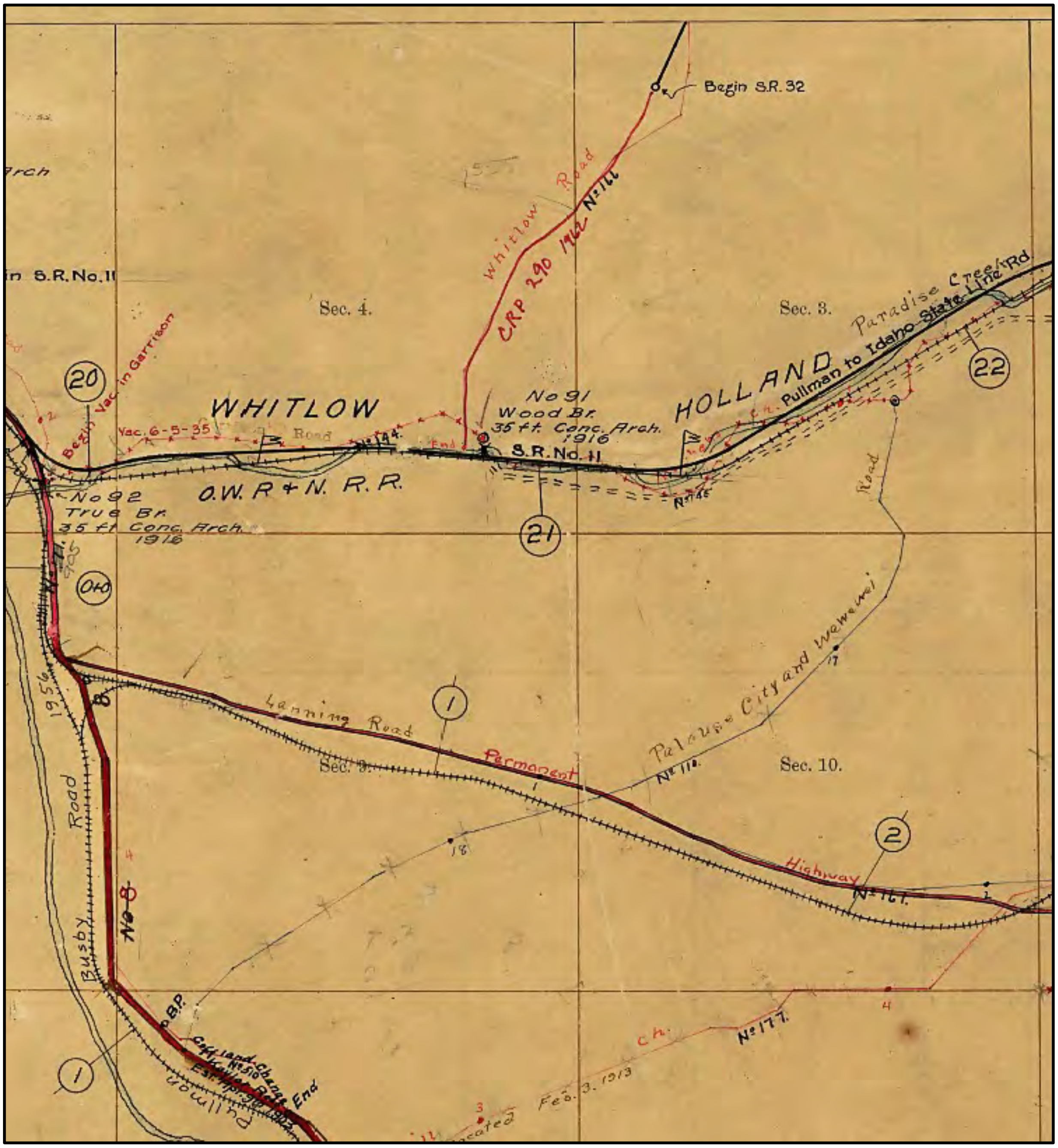



*Figure A-82. Wood Bridge (Field Number WCLB-11) depicted in the Whitman County Highway Plat Book on Garrison Road, which generally paralleled Paradise Creek; the bridge is identified as "No 91 Wood Br. 35 ft. Conc. Arch. 1916" (Whitman County ca. 1900s-1970s).*

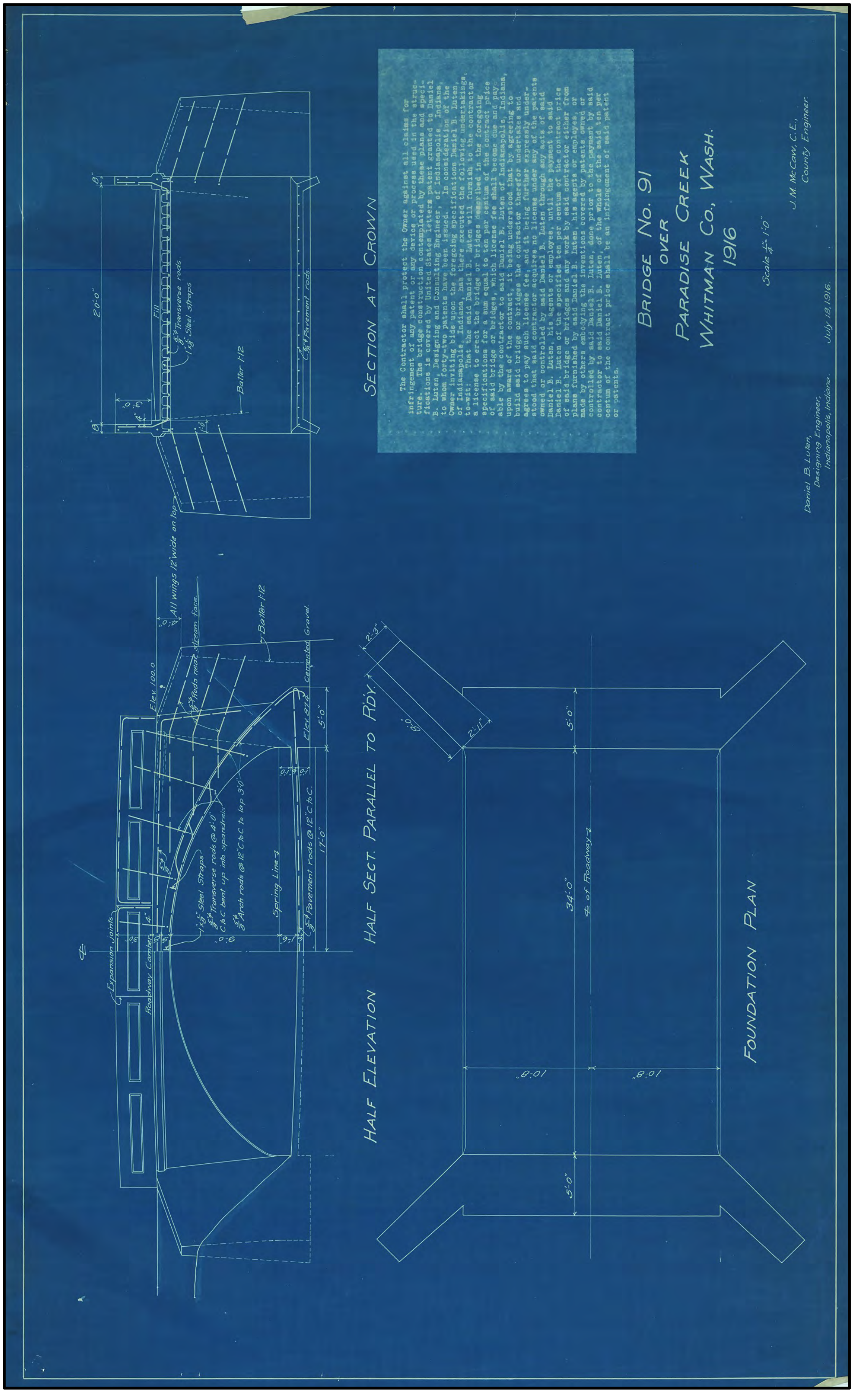


*Figure A-83. Wood Bridge (Field Number WCLB-11) engineering plans, 1916 (Whitman County 1916b).*

## Devine Bridge No. 157 (historic name)
## Tucker Living Trust Bridge (modern name)
## Project Field Number WCLB-12

Description:

This small single span reinforced concrete bridge – a filled spandrel deck arch type – conveys an unnamed agricultural access road over Paradise Creek, in the area of the former Garrison rail stop, 0.1 mile south of present State Route 270 and one mile west of the Idaho state line. The agricultural road originates on a drivable remnant of old Garrison Road (later Secondary Road No. 11) to the north, and is immediately south of the Bill Chipman recreation trail, the former railroad grade.

The bridge is symmetrically arranged, approximately 42 feet long and 22 feet wide, with a 32-foot long semielliptical arch extending between the wing wall abutments. The wing walls are approximately 6 feet long and angle away from the bridge, at 130 degrees at the southwest, southeast, and northeast corners, and at 90 degrees at the northwest corner. The wing walls and adjacent closed spandrels were cast separately and impressions of the horizontal 5- and 7-inch wide board forms remain visible in both sections. Neither the wing walls nor the spandrels are ornamented with geometric designs, although a thin layer of cement stucco was applied in an effort to hide the mold seams. The arched lower edges of the spandrel walls are beveled. The spandrel walls are capped with slightly overhanging concrete coping, beveled top and bottom on the exterior side of the bridge and unbeveled, forming a low curb where visible, on the side toward the roadway.

A low solid parapet railing, cast atop the coping of the spandrel walls, borders the bridge on both sides. Each parapet is cast in three sections – a narrow central segment, embellished on both inner and outer surfaces with a horizontal incised rectangle, and a longer segment on each side of the central section, each embellished on inner and outer surfaces with two incised horizontal rectangles. The parapet segments have flat tops with beveled edges, rather than coping. Vertical corners of the parapet segments are beveled at the bridge ends and flush where two segments meet. A vertical line is incised into each parapet end. The parapet was cast in horizontal 5-inch wide board forms and a thin coat of cement stucco applied to hide the mold seams.

The arch barrel was cast in four longitudinal sections: a 16-inch wide spandrel wall at each side, and 8- and 10-feet wide sections in the center. (In Luten designs, the spandrel wall is generally placed beside rather than on top of the arch ring.) The barrel was cast in horizontal 7-inch wide board forms, the boards running perpendicular to the bridge and parallel to the stream. Some spalling was noted along arch barrel seams and in the lower barrel.

Although not visible, space within the bridge – over the arch barrel and bounded by the spandrel and wing walls – is filled with packed earth and rock. A concrete deck was poured atop the fill and gravel has now been added to form the driving surface. Steel reinforcing rods presumably connect all parts of the bridge – the footings, abutments, arch barrel, spandrels, and parapets.

Significance Evaluation:

This bridge, originally called Devine Bridge No. 157, was built in 1916 on the Devine Change in the Garrison Road, a route established in 1907. Secondary Road No. 11 was built in 1934 and this section of Garrison Road was vacated the following year. Although no engineering plans were located, the bridge appears to be a Daniel B. Luten reinforced concrete filled spandrel deck arch design, a typical example of Luten's highway bridge structures (Whitman County ca. 1900s-1970s). Today the bridge is privately owned and used to access agricultural fields.

During the late nineteenth and early twentieth centuries, Daniel B. Luten pioneered the use of reinforced concrete as a bridge construction material, patented his designs and methods, and widely publicized his results. As a result, Luten-designed reinforced concrete bridges were built throughout the nation during the 1910s and 1920s period. Although Luten designed other types of reinforced concrete bridges, his typical design was a filled spandrel deck arch bridge, often with solid parapet railings and incised geometric ornament. Reinforced concrete filled spandrel deck arch bridges of Luten design are therefore a significant bridge type which, if retaining sufficient integrity of location, design, setting, materials, workmanship, feeling, and association, are eligible for listing in the National Register of Historic Places. Such bridges are significant under Criterion C, at the state level, for their association with Daniel B. Luten's pioneering efforts in reinforced concrete bridge construction and as examples of Luten's distinctive filled spandrel deck arch designs.

Increasing automobile ownership during the early twentieth century led to a growing demand throughout the nation for improved roads, and state and local governments became actively involved in road construction and maintenance. Bridges were important features of these new transportation systems, and such structures, if retaining sufficient integrity of location, design, setting, materials, workmanship, feeling, and association, are eligible for listing on the National Register of Historic Places under Criterion A, at the state or local level, for their contributions to the development of regional road and highway networks.

Devine Bridge retains all aspects of integrity to a sufficient degree and is therefore recommended eligible for listing in the National Register of Historic Places under Criterion A at the local level and under Criterion C at the state level.

***Figure A-84. Devine Bridge (Field Number WCLB-12), east side; view to the northwest (photograph courtesy of Whitman County Public Works).***

***Figure A-85. Devine Bridge (Field Number WCLB-12), west side; view to the northeast.***

***Figure A-86. Devine Bridge (Field Number WCLB-12), north approach; view to the southwest. The bridge is currently used as for agricultural access.***

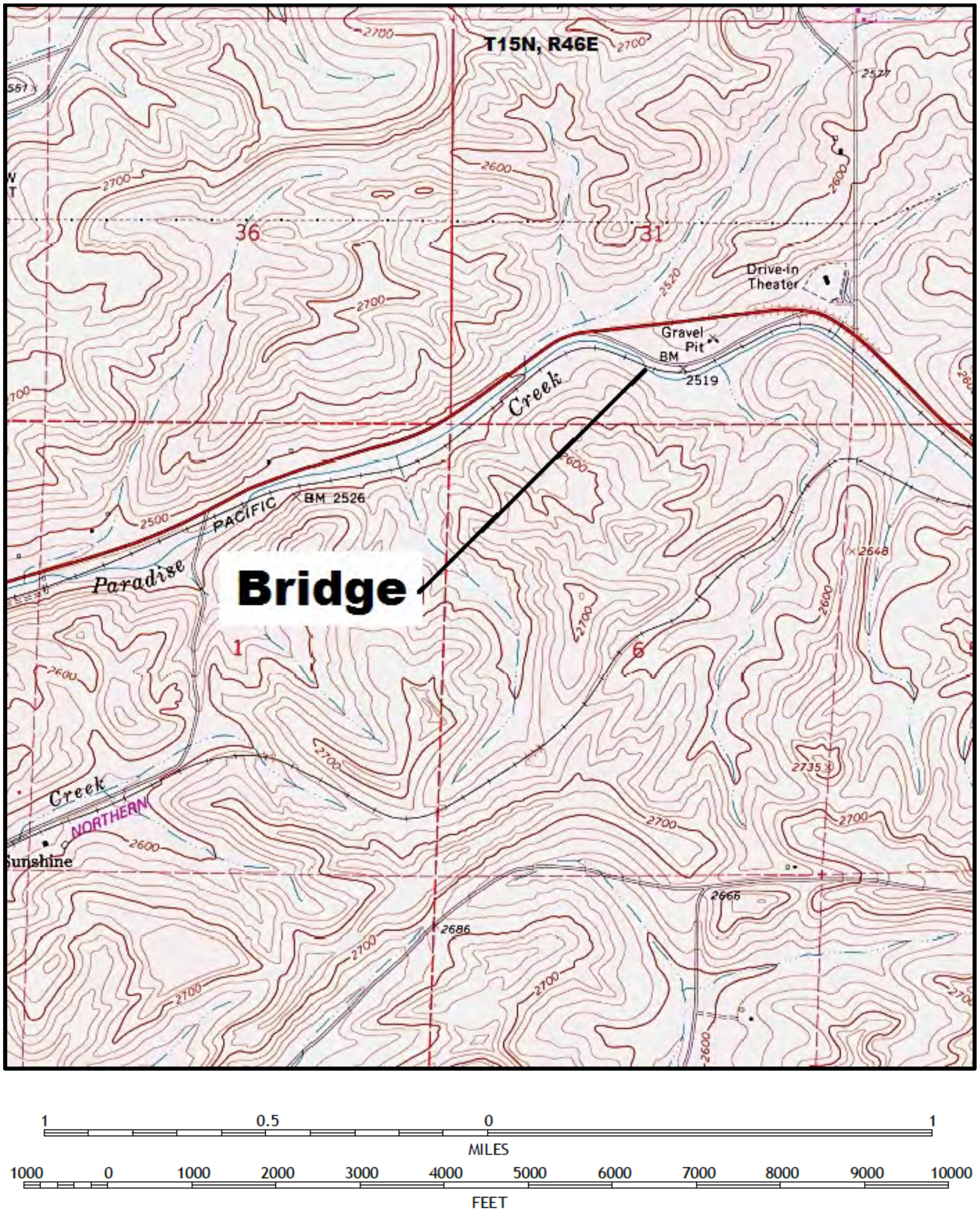



***Figure A-87. Location of Devine Bridge (Field Number WCLB-12); map adapted from Moscow West, Wash.-Idaho, 7.5' quadrangle, U.S. Geological Survey, 1964, photorevised 1975.***

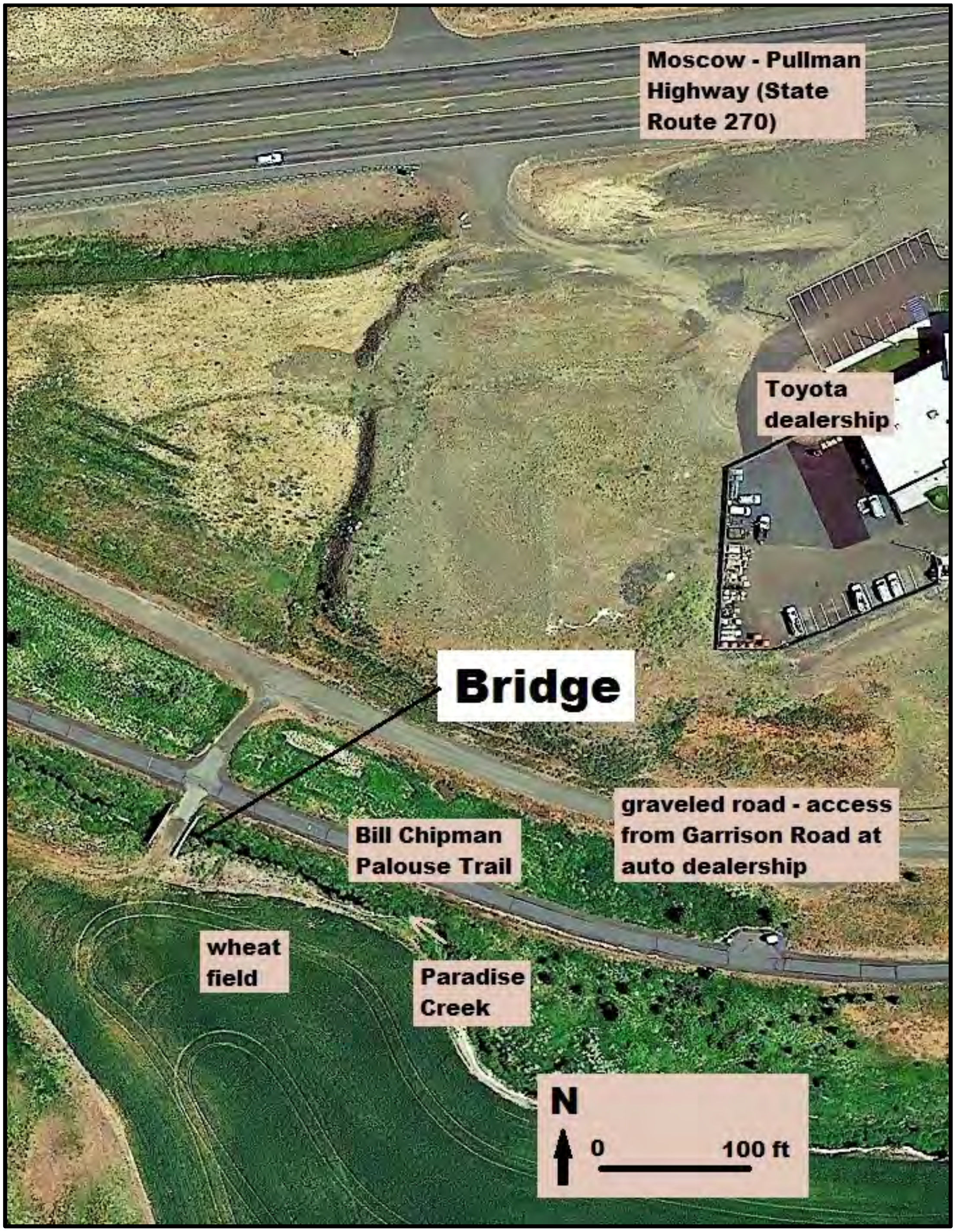



*Figure A-88. Devine Bridge (Field Number WCLB-12) vicinity; map adapted from Google Earth aerial photograph, 2015.*

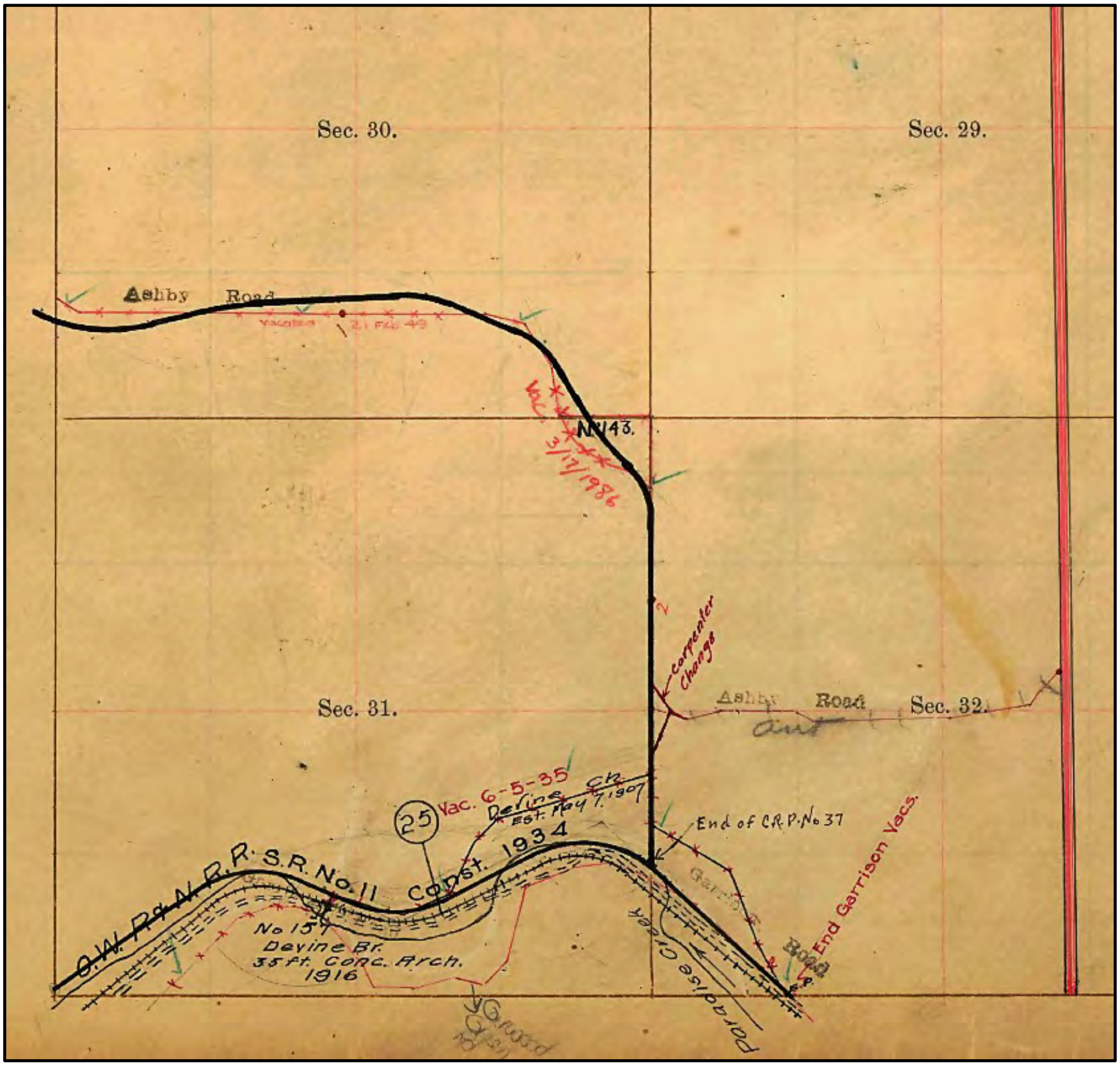



*Figure A-89. Devine Bridge (Field Number WCLB-12) depicted in the Whitman County Highway Plat Book conveying the Devine Change in the Garrison Road over Paradise Creek; the bridge is identified as "No 157 Devine Br. 35 ft. Conc. Arch. 1916" (Whitman County ca. 1900s-1970s).*

## Bridge No. 317 (historic name)
## Ashburn Bridge North (modern name)
## Project Field Number WCLB-13

Description:

This single span reinforced concrete bridge – a filled spandrel deck arch type – conveys Sauve Road, a lightly used and privately owned agricultural access route, over Spring Creek, 0.5 mile south of Uniontown and 0.1 mile west of U.S. 195.

The bridge is symmetrically arranged, approximately 44.5 feet long and 22.5 feet wide, with a 21-foot long semielliptical arch extending between the battered abutment faces. The sides of the abutments are flat and slightly wider than the adjacent closed spandrel walls. The abutments and spandrel walls were cast separately and impressions of the horizontal 5-inch wide board forms remain visible in both sections despite application of a thin coat of cement stucco to hide the mold seams. Both the spandrels and abutments are ornamented with incised geometric designs: Two large triangles embellish each spandrel, one on either side of the arch with each hypotenuse curved to match the curve of the arch ring, and a large rectangle ornaments each abutment, the visible vertical line paralleling the abutment's battered face. The arched lower spandrel edge is beveled, as are visible vertical edges of the abutments. The spandrel and abutment walls are capped with slightly overhanging concrete coping, beveled top and bottom on the exterior side of the bridge and unbeveled, forming a low curb, on the side toward the roadway.

A low solid parapet railing, cast atop the coping of the spandrel and abutment walls, borders the bridge on both sides. Each parapet is cast in five sections – three segments of moderate length in the center, each ornamented on both inner and outer surfaces with a horizontal incised rectangle, and a slightly longer segment over the abutment at each end of the parapet, also embellished on both inner and outer surfaces with a horizontal rectangle. The two parapet abutment segments are slightly higher and wider than the three central (spandrel) segments, and are capped with slightly overhanging concrete coping with beveled lower edges and corners and a nearly flat upper surface. The spandrel parapet segments have flat tops with beveled edges, rather than coping. The vertical corners of all parapet segments are beveled, except where the spandrel segments adjoin the abutment segments, and a vertical line is incised into the end of each parapet. The parapets were cast in horizontal 5-inch wide board forms and finished with a light coat of cement stucco to hide the mold seams.

The arch barrel was cast in four longitudinal sections: a 12-inch wide spandrel wall at each side and two approximately equal 10-feet wide sections in the center. (In Luten designs, the spandrel wall is generally placed beside rather than on top of the arch ring.) The barrel was cast in horizontal 5-inch wide board forms, the boards running perpendicular to the bridge and parallel to the stream.

Although not visible, space within the bridge – over the arch barrel and bounded by the spandrel and abutment walls – is filled with packed earth and rock. A concrete deck was poured atop the fill, now covered with gravel, continuous with that of Sauve Road. Steel reinforcing rods presumably connect all parts of the bridge – the footings, abutments, arch barrel, spandrels, and parapets.

Significance Evaluation:

This bridge, originally called Bridge No. 317, was built during construction of the Inland Empire Highway, probably by Seattle contractor H. C. Malott in 1919 (Allen 1921:54, 109, 114; Whitman County ca. 1900s-1970s). Dan Hall, present Whitman County Public Works Right-of-Way Agent (personal communication 2018), noted that, "[This segment of] the Inland Empire Highway was later replaced and realigned with Primary State Highway No. 3. The State of Washington transferred ownership of the old Inland Empire Highway to Whitman County. The County vacated the old Inland Empire Highway and bridges in 1934. The bridges have been located on private property since 1934."

Although engineering plans were not located, the bridge appears to be a Daniel B. Luten reinforced concrete filled spandrel deck arch design, a typical example of Luten's highway bridge structures.

During the late nineteenth and early twentieth centuries, Daniel B. Luten pioneered the use of reinforced concrete as a bridge construction material, patented his designs and methods, and widely publicized his results. As a result, Luten-designed reinforced concrete bridges were built throughout the nation during the 1910s and 1920s period. Although Luten designed other types of reinforced concrete bridges, his typical design was a filled spandrel deck arch bridge, often with solid parapet railings and incised geometric ornament. Reinforced concrete filled spandrel deck arch bridges of Luten design are therefore a significant bridge type which, if retaining sufficient integrity of location, design, setting, materials, workmanship, feeling, and association, are eligible for listing in the National Register of Historic Places. Such bridges are significant under Criterion C, at the state level, for their association with Daniel B. Luten's pioneering efforts in reinforced concrete bridge construction and as examples of Luten's distinctive filled spandrel deck arch designs.

Increasing automobile ownership during the early twentieth century led to a growing demand throughout the nation for improved roads, and state and local governments became actively involved in road construction and maintenance. Bridges were important features of these new transportation systems, and such structures, if retaining sufficient integrity of location, design, setting, materials, workmanship, feeling, and association, are eligible for listing on the National Register of Historic Places under Criterion A, at the state or local level, for their contributions to the development of regional road and highway networks.

Bridge No. 317 retains all aspects of integrity to a sufficient degree and is therefore recommended eligible for listing in the National Register of Historic Places under Criteria A and C at the at the state level.

***Figure A-90. Bridge No. 317 (Field Number WCLB-13), east side; view to the northwest.***

*Figure A-91. Bridge No. 317 (Field Number WCLB-13), south approach and west side; view to the northeast.*

*Figure A-92. Bridge No. 317 (Field Number WCLB-13), detail of east side; view to the north.*

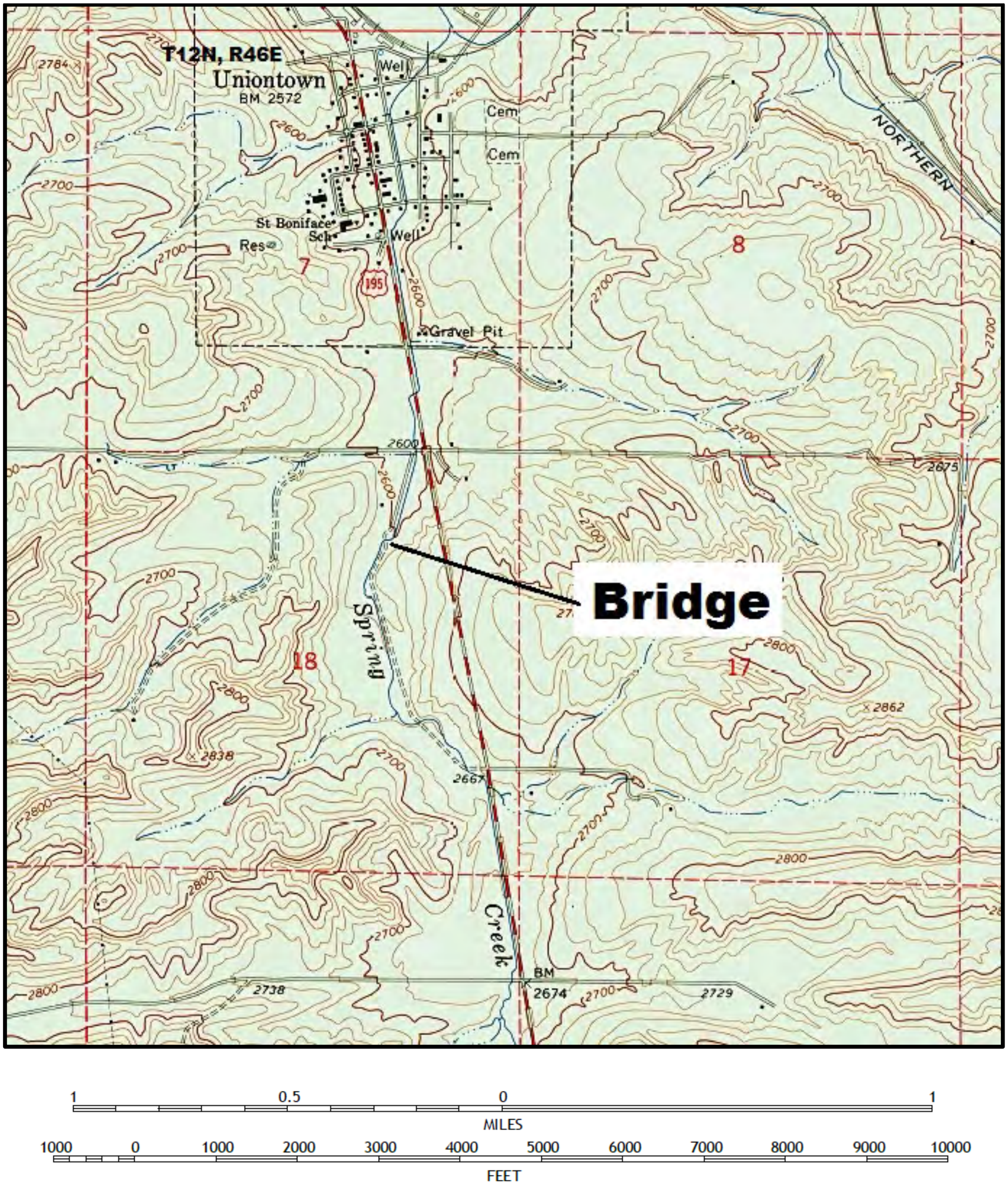





***Figure A-93. Location of Bridge No. 317 (Field Number WCLB-13); map adapted from Uniontown, Wash.-Idaho, 7.5' quadrangle, U.S. Geological Survey, 1964.***

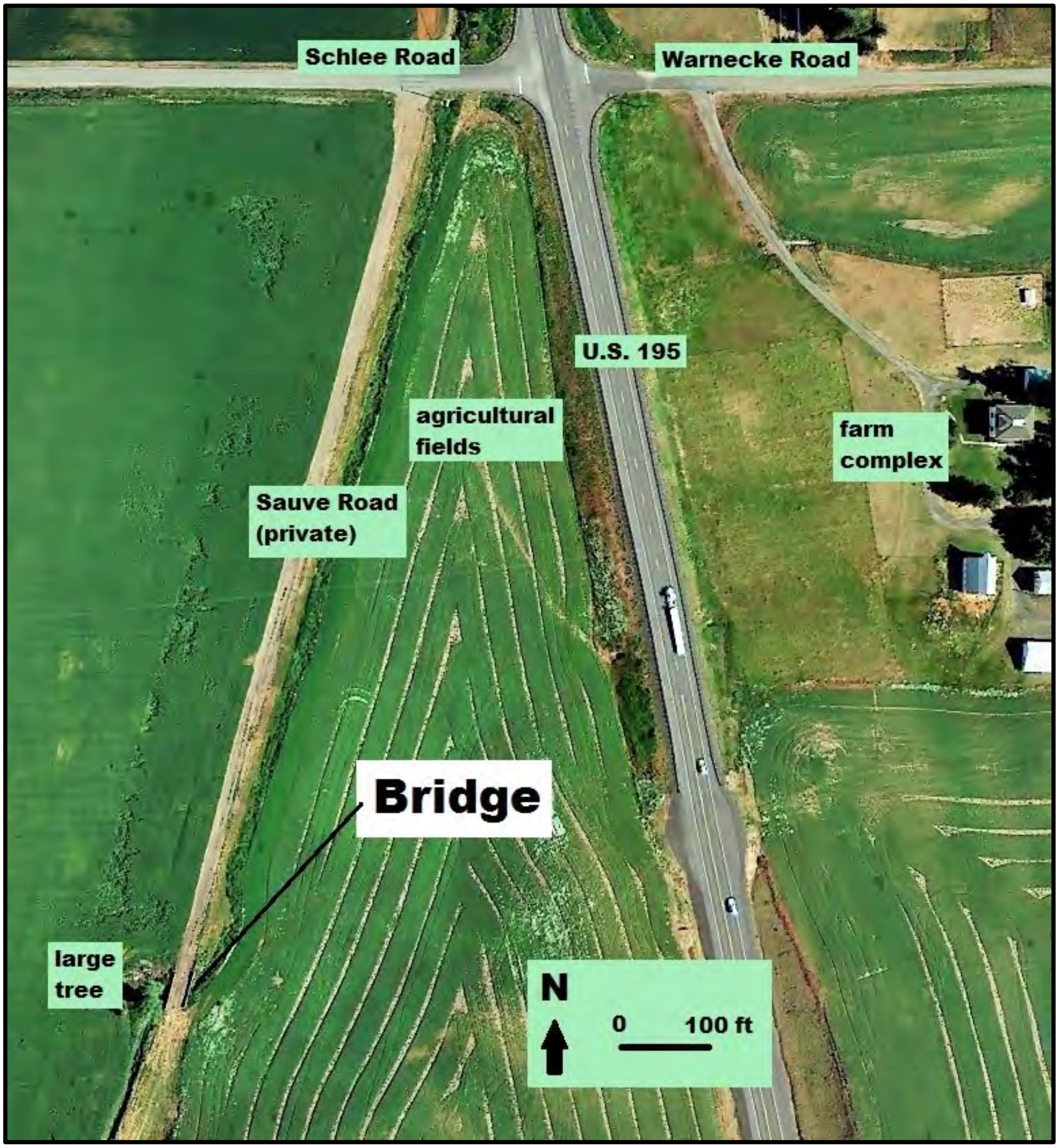



*Figure A-94. Bridge No. 317 (Field Number WCLB-13) vicinity; map adapted from Google Earth aerial photograph, 2015.*

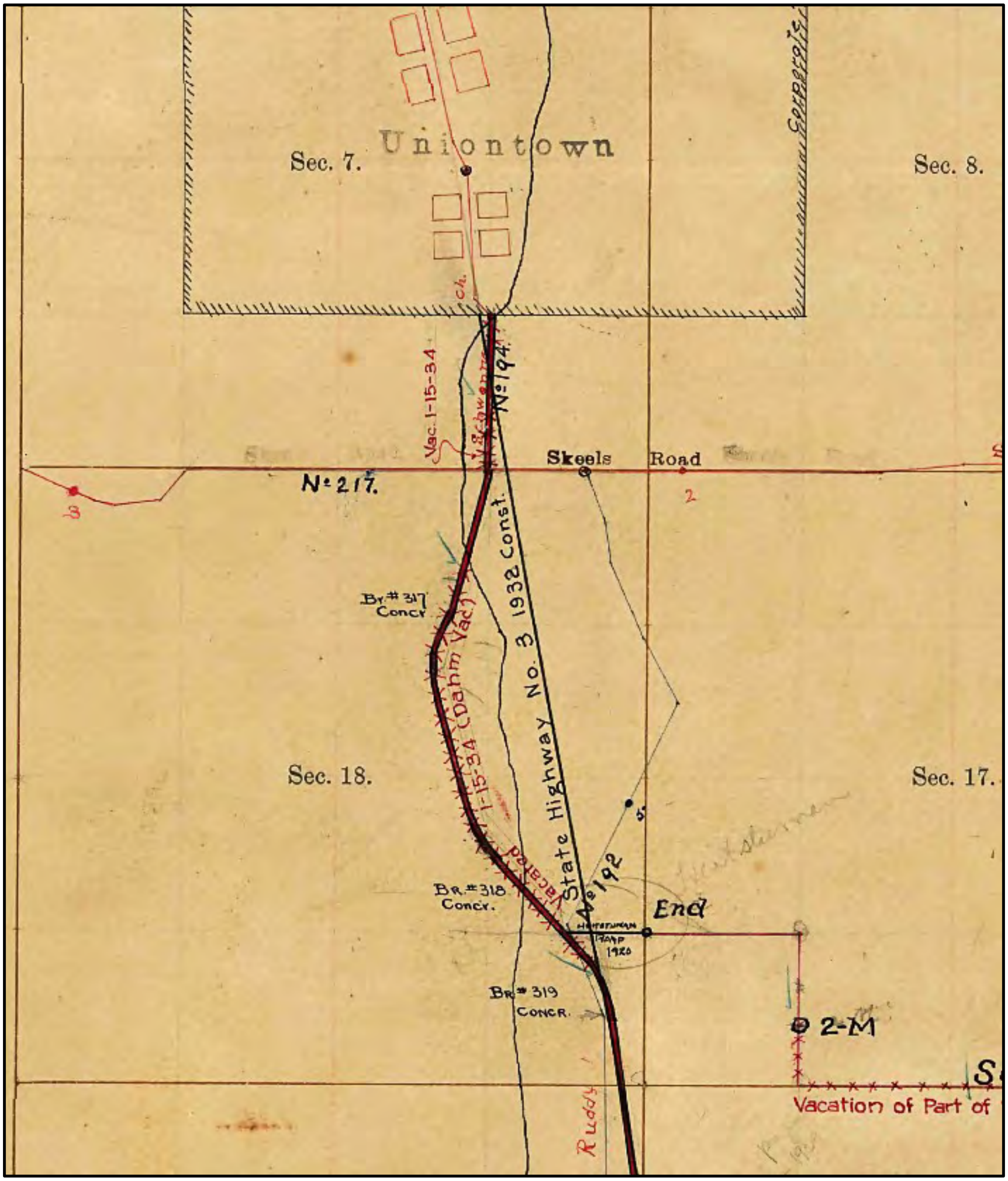



*Figure A-95. Bridge No. 317 (Field Number WCLB-13) depicted in the Whitman County Highway Plat Book south of Uniontown; the bridge is identified as "Br. #317 Concr." (Whitman County ca. 1900s-1970s).*

**Bridge No. 318 (historic name)**
**Ashburn Bridge South (modern name)**
**Project Field Number WCLB-14**

Description:

This single span reinforced concrete bridge – a filled spandrel deck arch type – conveys a dirt road, a lightly used and privately owned agricultural access route, over Spring Creek, one mile south of Uniontown and 0.1 mile west of U.S. 195.

The bridge is symmetrically arranged, approximately 35 feet long and 27.5 feet wide, with a 19-foot long semielliptical arch extending between the battered abutment faces. The sides of the abutments are decoratively curved and slightly wider than the adjacent closed spandrel walls. The abutments and spandrel walls were cast separately and impressions of the 7-inch wide board forms – vertical for the abutments and horizontal for the spandrels – remain visible in both sections despite application of a thin coat of cement stucco to hide the mold seams. Both the spandrels and abutments are ornamented with incised geometric designs: Two large triangles embellish each spandrel, one on either side of the arch, the hypotenuse curved to match the curve of the arch ring, and a large rectangle ornaments each abutment, the visible vertical line paralleling the abutment's battered face. The arched lower spandrel edge is beveled, as are visible vertical edges of the abutments. The spandrel and abutment walls are capped with slightly overhanging concrete coping, beveled top and bottom on the exterior side of the bridge and unbeveled, forming a low curb where visible, on the side toward the roadway.

A low solid parapet railing, cast atop the coping of the spandrel and abutment walls, borders the bridge on both sides. Each parapet is cast in five sections – a wide section in the center, ornamented on both inner and outer surfaces with a horizontal incised rectangle flanked on either side by an incised vertical line; a segment of moderate length on each side of the central section, each embellished on inner and outer surfaces with one horizontal rectangle; and a wide segment at each end of the parapet, curved to match the shape of the abutment below and embellished on both inner and outer surfaces with a horizontal incised rectangle flanked on either side by an incised vertical line. The two parapet abutment segments are slightly higher and wider than the three central (spandrel) segments, and are capped with slightly overhanging concrete coping with beveled lower edges and corners and a flat upper surface. The spandrel parapet segments have flat tops with beveled edges, rather than coping. The vertical corners of all parapet segments are beveled, except where the spandrel segments adjoin the abutment segments, and a vertical line is incised into the end of each parapet. The parapets were cast in 5-inch wide board forms – vertical for the abutments and horizontal for the spandrels –and finished with a light coat of cement stucco to hide the mold seams.

The arch barrel was cast in four longitudinal sections: a 12-inch wide spandrel wall at each side and two nearly equal approximately 10-feet wide sections in the center. (In Luten designs, the spandrel wall is generally placed beside rather than on top of the arch ring.) The barrel was cast in horizontal 5- and 7-inch wide board forms, the boards running perpendicular to the bridge and parallel to the stream. Some spalling was noted on the lower arch barrel and along seams, and scouring has exposed the upper 1 to 2 feet of the concrete footings on both sides of the barrel.

Although not visible, space within the bridge – over the arch barrel and bounded by the spandrel and abutment walls – is filled with packed earth and rock. A concrete deck was poured atop the fill, now covered with earth, continuous with that of the access road. Steel reinforcing rods presumably connect all parts of the bridge – the footings, abutments, arch barrel, spandrels, and parapets.

Significance Evaluation:

This bridge, originally called Bridge No. 318, was built during construction of the Inland Empire Highway, probably by Seattle contractor H. C. Malott in 1919 (Allen 1921:54, 109, 114; Whitman

County ca. 1900s-1970s). Dan Hall, present Whitman County Public Works Right-of-Way Agent (personal communication 2018), noted that, "[This segment of] the Inland Empire Highway was later replaced and realigned with Primary State Highway No. 3. The State of Washington transferred ownership of the old Inland Empire Highway to Whitman County. The County vacated the old Inland Empire Highway and bridges in 1934. The bridges have been located on private property since 1934." Although engineering plans were not located, the bridge appears to be a Daniel B. Luten reinforced concrete filled spandrel deck arch design, a typical example of Luten's highway bridge structures.

During the late nineteenth and early twentieth centuries, Daniel B. Luten pioneered the use of reinforced concrete as a bridge construction material, patented his designs and methods, and widely publicized his results. As a result, Luten-designed reinforced concrete bridges were built throughout the nation during the 1910s and 1920s period. Although Luten designed other types of reinforced concrete bridges, his typical design was a filled spandrel deck arch bridge, often with solid parapet railings and incised geometric ornament. Reinforced concrete filled spandrel deck arch bridges of Luten design are therefore a significant bridge type which, if retaining sufficient integrity of location, design, setting, materials, workmanship, feeling, and association, are eligible for listing in the National Register of Historic Places. Such bridges are significant under Criterion C, at the state level, for their association with Daniel B. Luten's pioneering efforts in reinforced concrete bridge construction and as examples of Luten's distinctive filled spandrel deck arch designs.

Increasing automobile ownership during the early twentieth century led to a growing demand throughout the nation for improved roads, and state and local governments became actively involved in road construction and maintenance. Bridges were important features of these new transportation systems, and such structures, if retaining sufficient integrity of location, design, setting, materials, workmanship, feeling, and association, are eligible for listing on the National Register of Historic Places under Criterion A, at the state or local level, for their contributions to the development of regional road and highway networks.

Bridge No. 318 retains all aspects of integrity to a sufficient degree and is therefore recommended eligible for listing in the National Register of Historic Places under Criteria A and C at the at the state level.

***Figure A-96. Bridge No. 318 (Field Number WCLB-14), east side; view to the west.***

***Figure A-97. Bridge No. 318 (Field Number WCLB-14), west side; view to the northeast.***

***Figure A-98. Bridge No. 318 (Field Number WCLB-14), north approach and east side; view to the southwest. Note curvature of abutments and abutment parapets.***

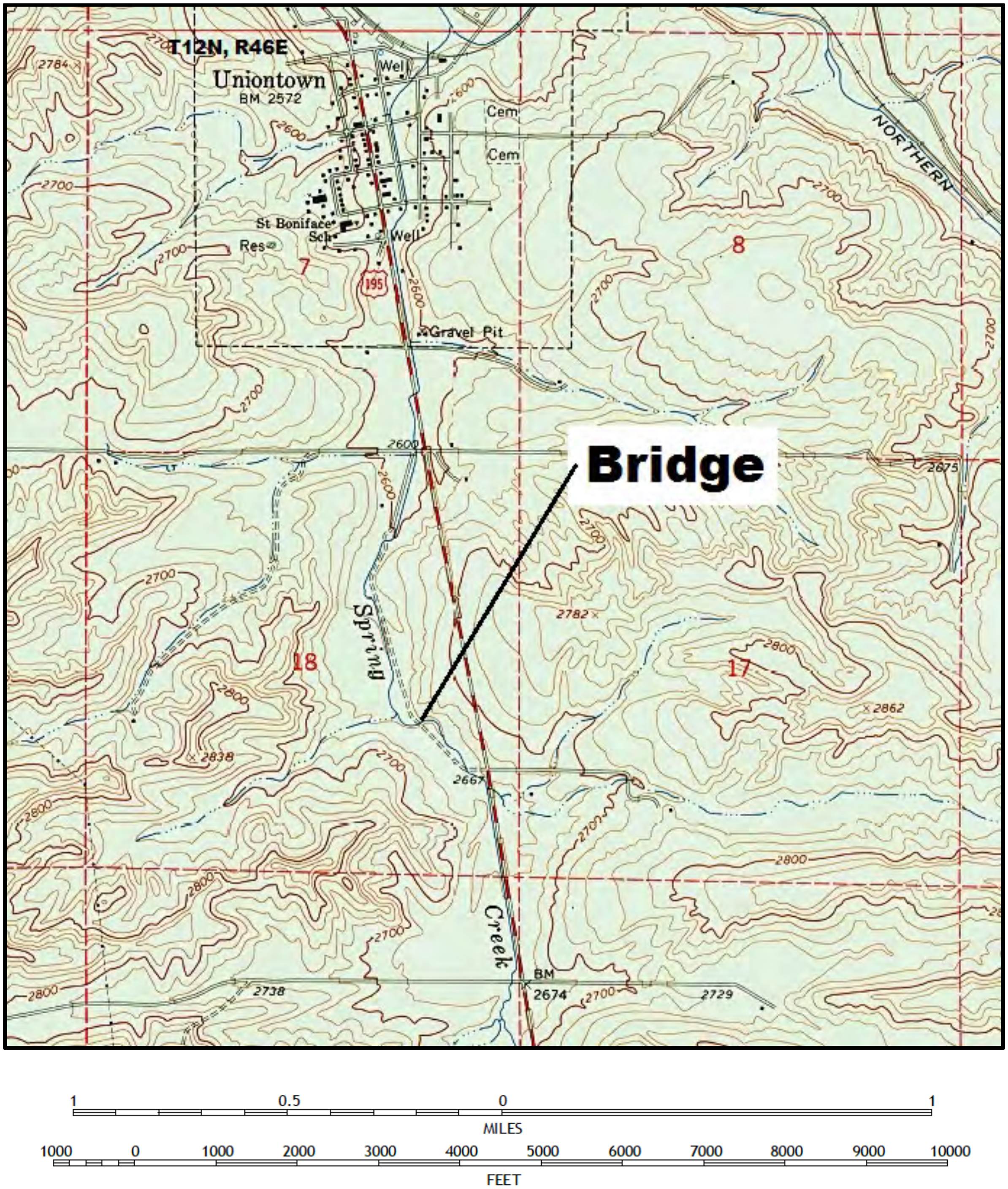



***Figure A-99. Location of Bridge No. 318 (Field Number WCLB-14); map adapted from Uniontown, Wash.-Idaho, 7.5' quadrangle, U.S. Geological Survey, 1964.***

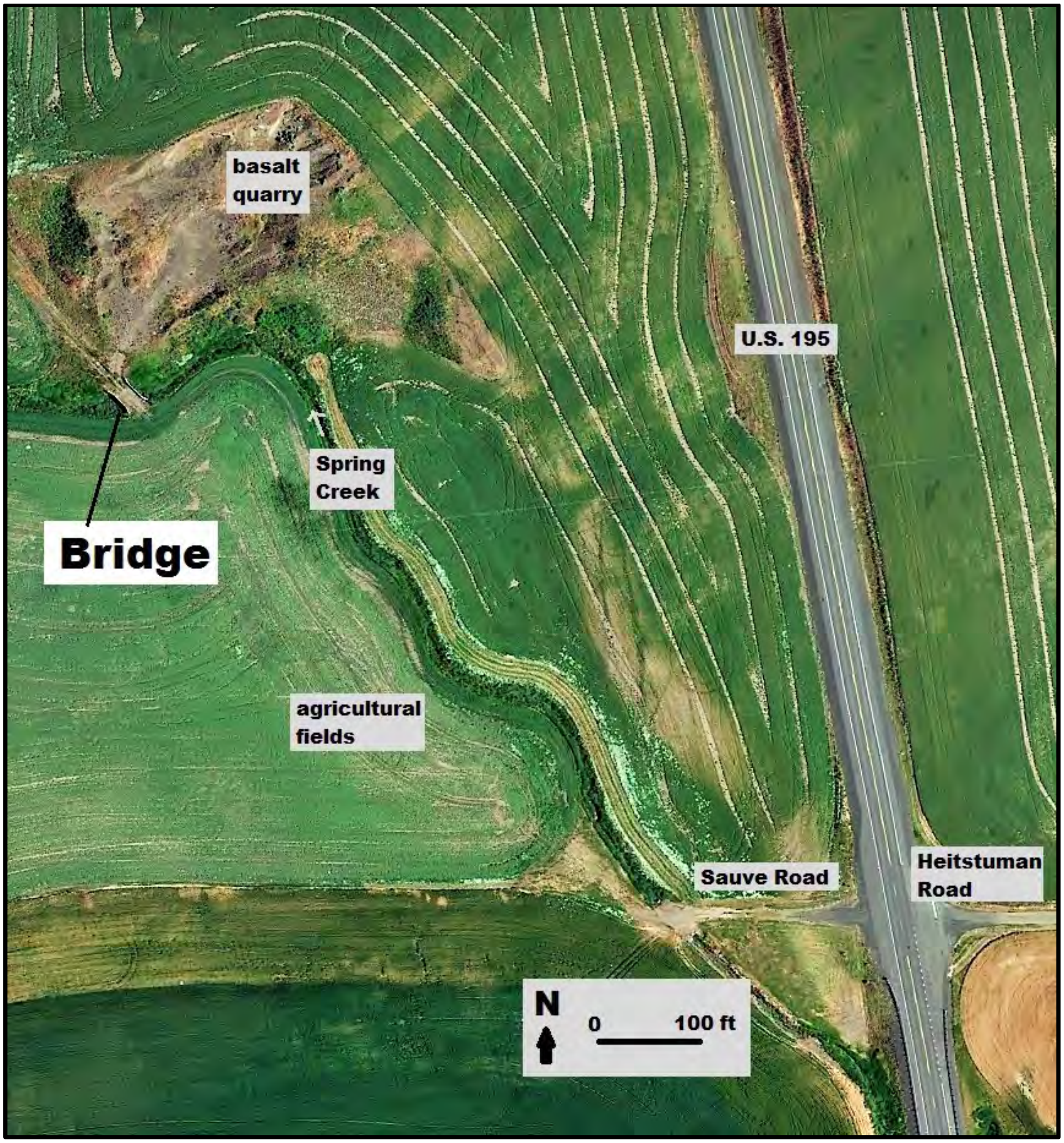



*Figure A-100. Bridge No. 318 (Field Number WCLB-14) vicinity; map adapted from Google Earth aerial photograph, 2015.*

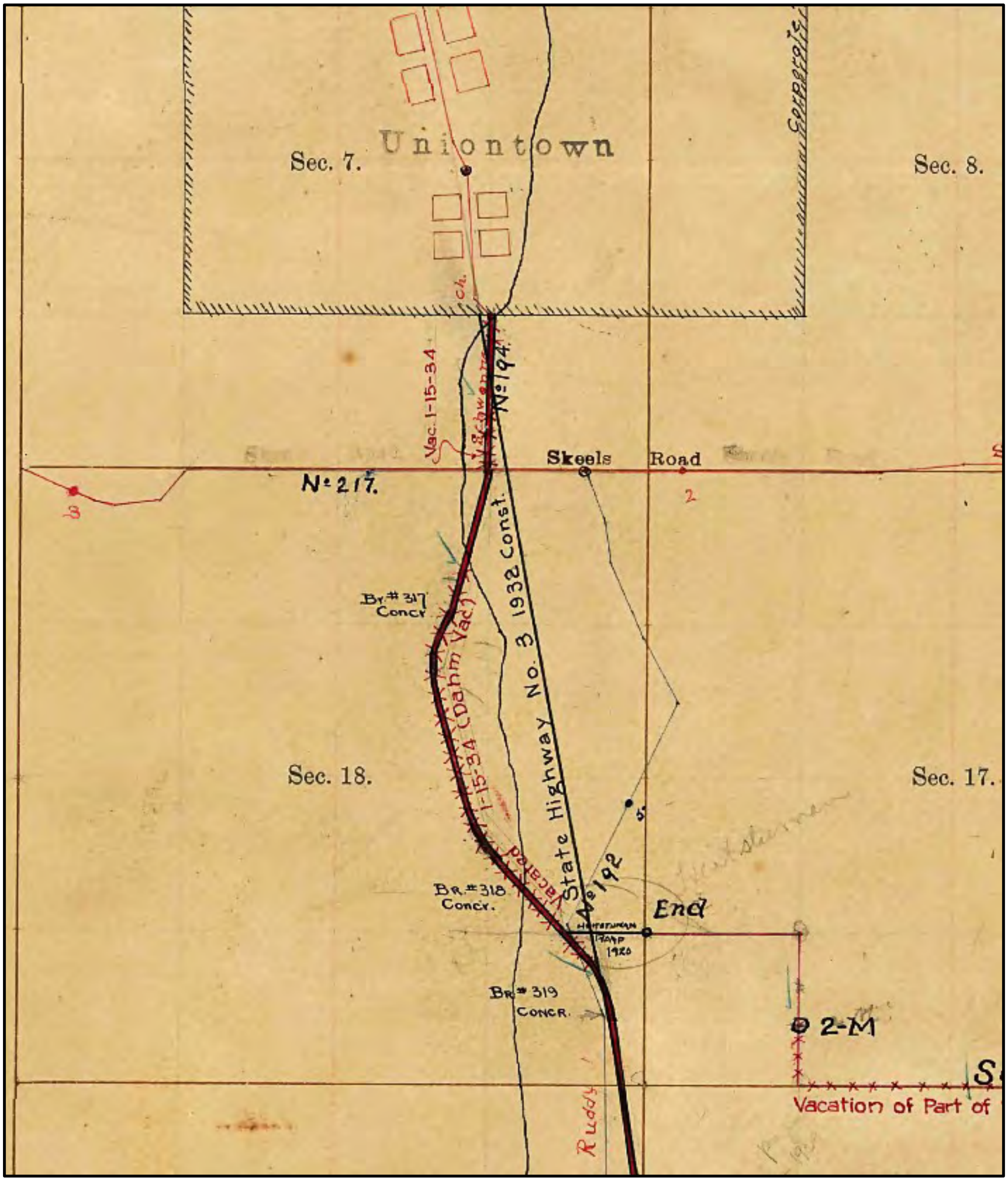



*Figure A-101. Bridge No. 318 (Field Number WCLB-14) depicted in the Whitman County Highway Plat Book south of Uniontown; the bridge is identified as "Br. #318 Concr." (Whitman County ca. 1900s-1970s).*

## Rhodes Bridge No. 209 (historic name)
## Logen Bridge (modern name)
## Project Field Number WCLB-15

Description:

This single span reinforced concrete bridge – a filled spandrel deck arch type – conveys a privately owned graveled road over Cottonwood Creek, three miles northwest of St. John and immediately north of State Route 23 (SR 23). The bridge was recorded at the reconnaissance level, based on archival records and observations from SR 23, since the landowner did not grant access.

The bridge is symmetrically arranged, with a long semielliptical arch extending between the battered abutment faces. The sides of the abutments are flat and slightly wider than the adjacent closed spandrel walls. Neither the abutments nor the spandrels are ornamented with geometric designs. The spandrel and abutment walls are capped with slightly overhanging concrete coping, beveled top and bottom on the exterior side of the bridge and unbeveled, forming a low curb where visible, on the side toward the roadway.

A low solid parapet railing, cast atop the coping of the spandrel and abutment walls, borders the bridge on both sides. Each parapet is cast in seven sections – a narrow central segment, embellished on both inner and outer surfaces with a horizontal incised rectangle; a longer segment on each side of the central section, each embellished on inner and outer surfaces with two incised horizontal rectangles; another narrow segment on each side, embellished on both inner and outer surfaces with a horizontal incised rectangle; and a segment of moderate length over the abutment at each end of the parapet, embellished on both inner and outer surfaces with a horizontal rectangle. The two abutment segments of each parapet are slightly higher and wider than the five central (spandrel) segments, and are capped with slightly overhanging concrete coping. Some coping is deteriorated or missing. The spandrel segments have no coping.

Although not visible, space within the bridge – over the arch barrel and bounded by the spandrel and abutment walls – is filled with packed earth and rock. A concrete deck was poured atop the fill, now covered with gravel continuous with that of the graveled road. Engineering plans for the bridge depict steel reinforcing rods connecting all parts of the bridge – the footings, abutments, arch barrel, spandrels, and parapets (Whitman County 1918b).

Significance Evaluation:

This bridge, originally called Rhodes Bridge No. 209, was built in 1918 on Improved Road No. 1, the Steptoe - St. John - Ewan Road. This road was later replaced by Permanent Highway No. 18, which became State Route 23. The bridge is a Daniel B. Luten reinforced concrete filled spandrel deck arch design, a typical example of Luten's highway bridge structures (Dan Hall, personal communication 2018; Whitman County ca. 1900s-1970s, 1918b). The construction contractor was probably H. C. Malott of Seattle, as an entry in the April 1918 *Western Engineering* journal notes, "Contract for construction of two bridges on the Steptoe-Ewan road has been awarded to H. C. Malott, Seattle, for $13,730" (Western Engineering 1918). The bridge is now privately owned.

During the late nineteenth and early twentieth centuries, Daniel B. Luten pioneered the use of reinforced concrete as a bridge construction material, patented his designs and methods, and widely publicized his results. As a result, Luten-designed reinforced concrete bridges were built throughout the nation during the 1910s and 1920s period. Although Luten designed other types of reinforced concrete bridges, his typical design was a filled spandrel deck arch bridge, often with solid parapet railings and incised geometric ornament. Reinforced concrete filled spandrel deck arch bridges of Luten design are therefore a significant bridge type which, if retaining sufficient integrity of location, design, setting, materials, workmanship, feeling, and association, are eligible for listing in the National Register of Historic Places.

Such bridges are significant under Criterion C, at the state level, for their association with Daniel B. Luten's pioneering efforts in reinforced concrete bridge construction and as examples of Luten's distinctive filled spandrel deck arch designs.

Increasing automobile ownership during the early twentieth century led to a growing demand throughout the nation for improved roads, and state and local governments became actively involved in road construction and maintenance. Bridges were important features of these new transportation systems, and such structures, if retaining sufficient integrity of location, design, setting, materials, workmanship, feeling, and association, are eligible for listing on the National Register of Historic Places under Criterion A, at the state or local level, for their contributions to the development of regional road and highway networks.

Although Rhodes Bridge appears to retain sufficient integrity to qualify for listing in the National Register of Historic Places under Criteria A and C, on-site inspection would be needed prior to making such a recommendation.

***Figure A-102. Rhodes Bridge (Field Number WCLB-15), west side, left, State Route 23, right; view to the northeast.***

***Figure A-103. Rhodes Bridge (Field Number WCLB-15), west side; view to the northeast.***

***Figure A-104. Rhodes Bridge (Field Number WCLB-15), south approach; view to the northwest (photograph courtesy of Whitman County Public Works).***

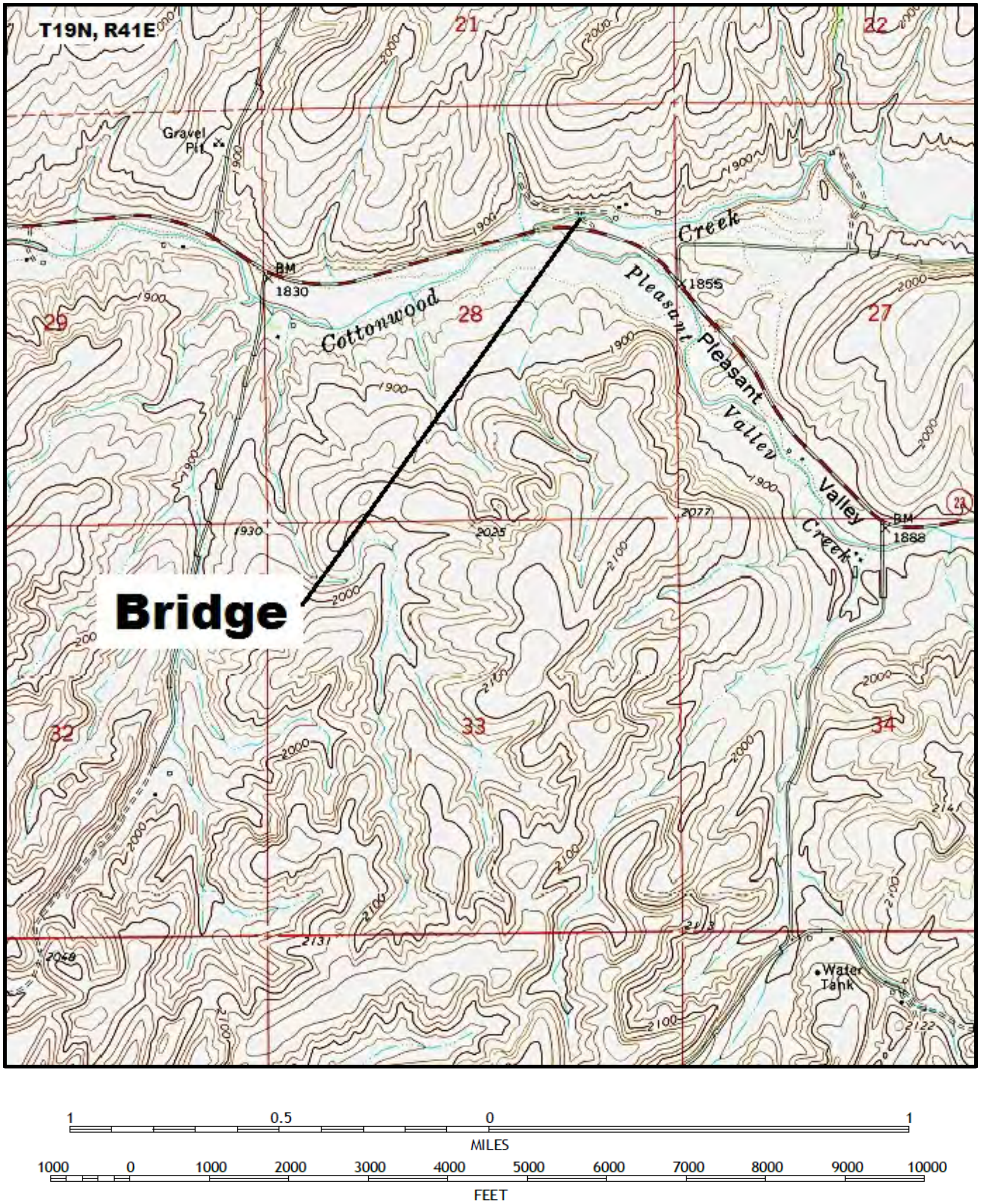



*Figure A-105. Location of Rhodes Bridge (Field Number WCLB-15); map adapted from Ewan, Wash., 7.5' quadrangle, U.S. Geological Survey, 1964.*

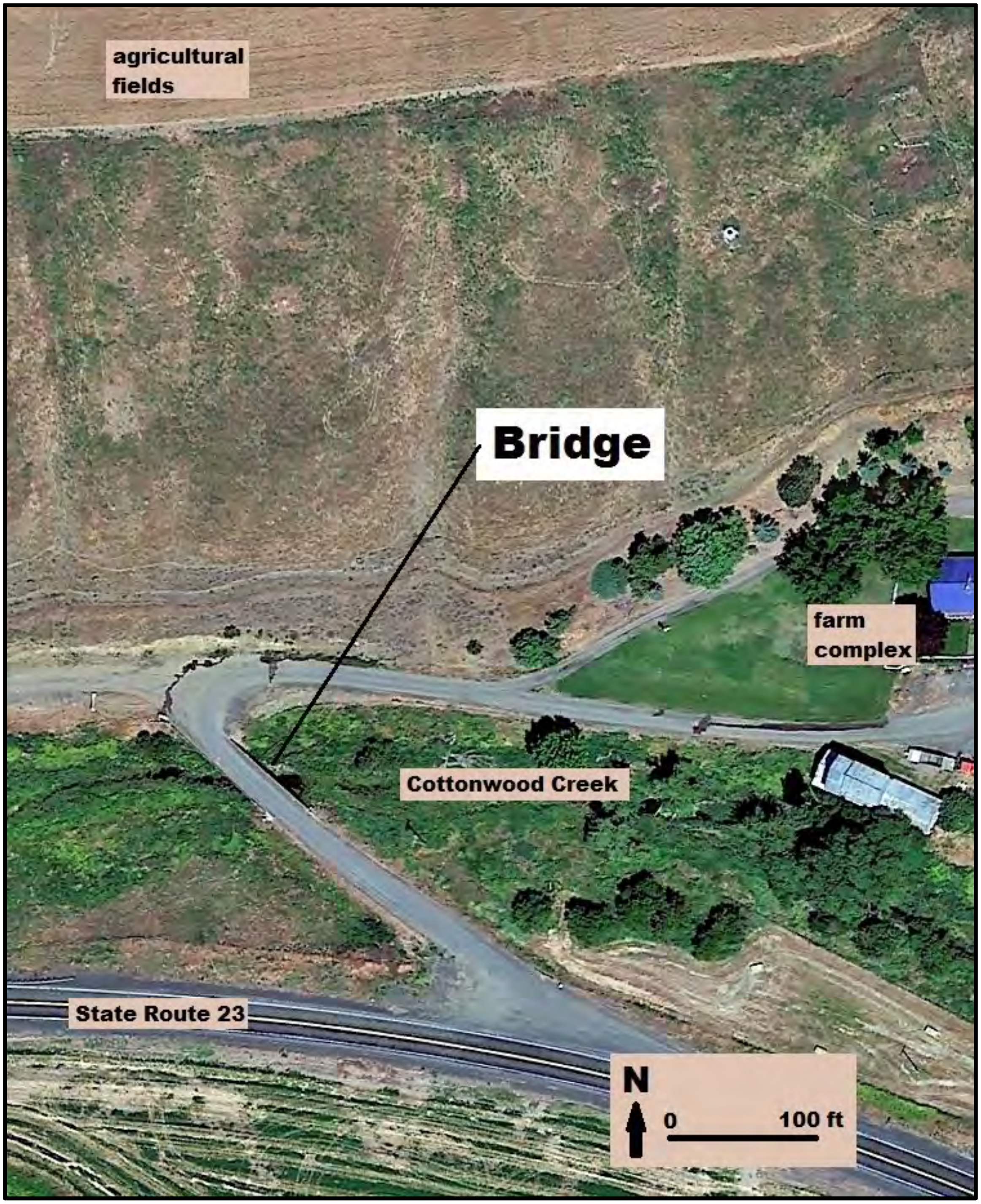



*Figure A-106. Rhodes Bridge (Field Number WCLB-15) vicinity; map adapted from Google Earth aerial photograph, 2017.*

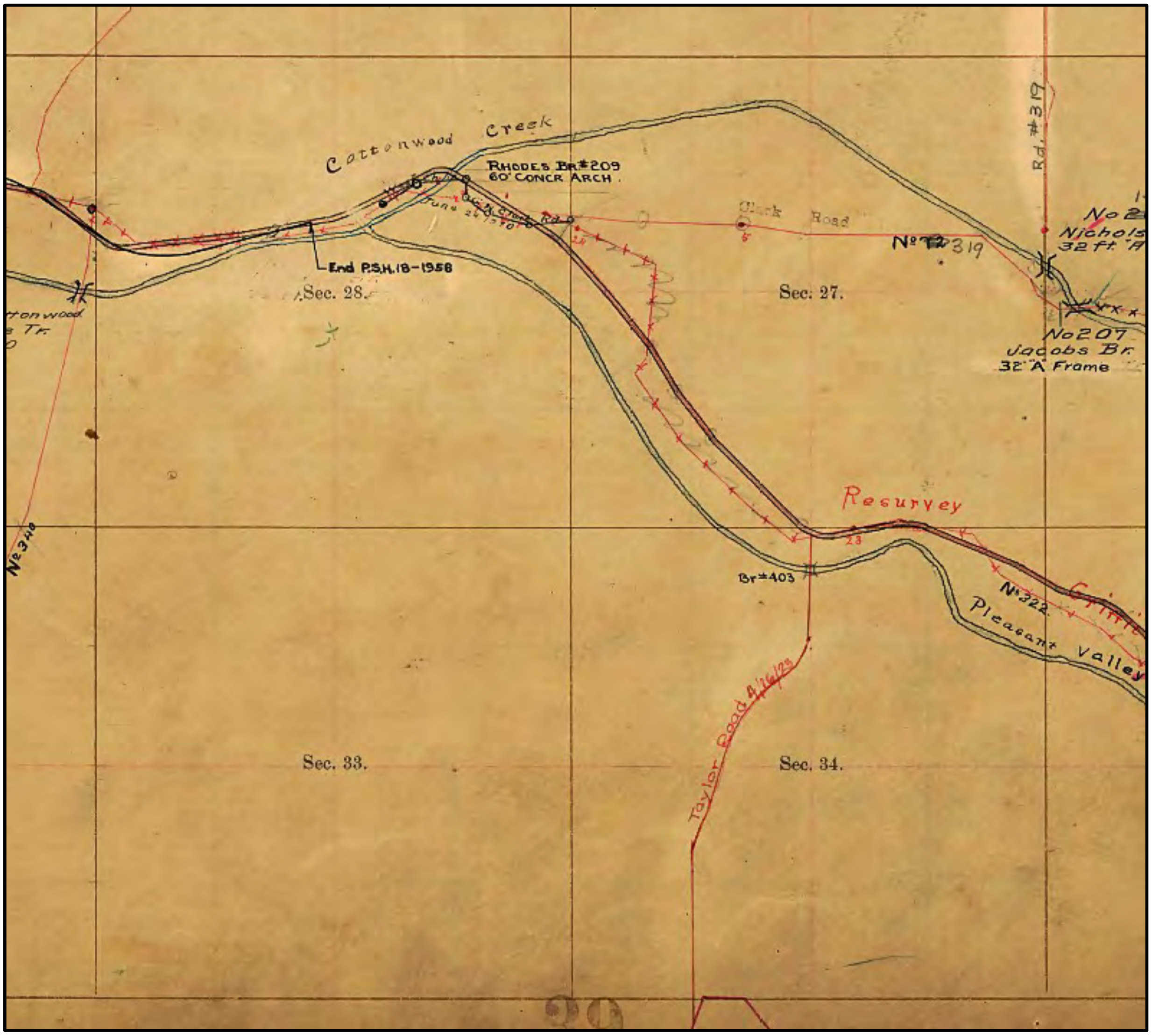



***Figure A-107. Rhodes Bridge (Field Number WCLB-15) depicted in the Whitman County Highway Plat Book; the bridge is identified as "Rhodes Br. #209 60' Concr Arch" (Whitman County ca. 1900s-1970s).***

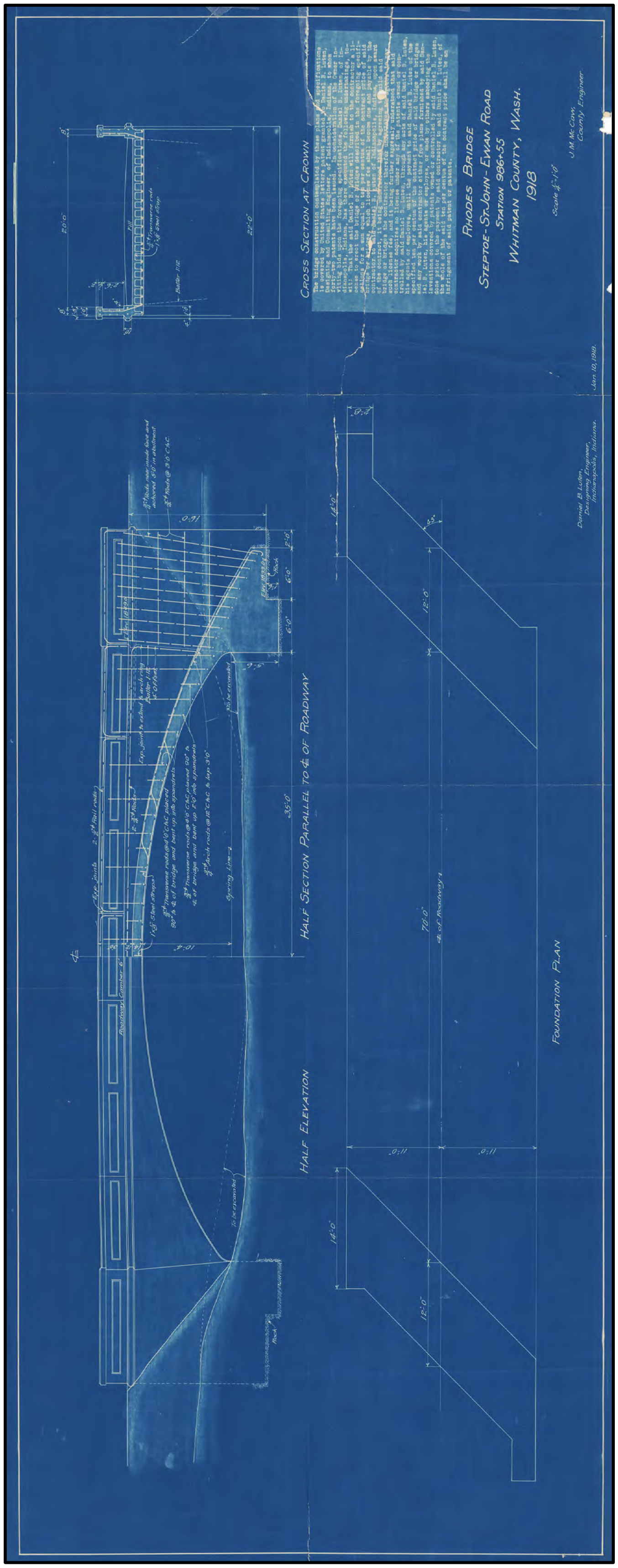



***Figure A-108. Rhodes Bridge (Field Number WCLB-15) engineering plans, 1918 (Whitman County 1918b).***

## Kelley Bridge No. 134 (historic name)
## Hozim Ranch Inc. Bridge (modern name)
## Project Field Number WCLB-16

Description:

This large single span reinforced concrete bridge – a filled spandrel deck arch type – conveys a graveled road, a lightly used and privately owned agricultural access route, over Spring Creek, 1.5 miles east of Oakesdale and 0.1 mile south of State Route 27.

The bridge is symmetrically arranged, approximately 66 feet long and 22 feet wide, with a 36-foot long semielliptical arch extending between the battered abutment faces. The sides of the abutments are decoratively curved and slightly wider than the adjacent closed spandrel walls. The abutments and spandrel walls were cast separately and impressions of the 5-inch wide board forms – vertical for the abutments and horizontal for the spandrels – remain visible in both sections despite application of a thin coat of cement stucco to hide the mold seams. Both the spandrels and abutments are ornamented with incised geometric designs: Two large triangles embellish each spandrel, one on either side of the arch, the hypotenuse curved to match the curve of the arch ring, and a large rectangle ornaments each abutment, the visible vertical line paralleling the abutment's battered face. The arched lower spandrel edge is beveled, as are visible vertical edges of the abutments. At the southeast corner of the bridge the rear of the abutment has been extended as a low angled wing wall, while the other three abutments appear truncated and altered. The spandrel and abutment walls are capped with slightly overhanging concrete coping, beveled top and bottom on the exterior side of the bridge and unbeveled, forming a low curb where visible, on the side toward the roadway.

As originally built, a railing was cast atop the coping of the spandrel and abutment walls, bordering the bridge on both sides. These features have now been removed, leaving stubs of ½-inch diameter square ferrous metal reinforcing rods protruding in places from the tops of the spandrel and abutment coping.

The arch barrel was cast in four longitudinal sections: a spandrel wall, estimated at 21 inches wide, at each side and two somewhat equal central sections, each estimated at 5 to 7 feet wide. (In Luten designs, the spandrel wall is generally placed beside rather than on top of the arch ring.) The barrel was cast in horizontal 5-inch wide board forms, the boards running perpendicular to the bridge and parallel to the stream. Some spalling was noted on the lower arch barrel and along seams.

Although not visible, space within the bridge – over the arch barrel and bounded by the spandrel and abutment walls – is filled with packed earth and rock. A concrete deck was poured atop the fill, now covered with earth and gravel continuous with that of the access road. Engineering plans for the bridge depict steel reinforcing rods connecting all parts of the bridge – the footings, abutments, arch barrel, spandrels, and parapets (Whitman County 1918c).

Significance Evaluation:

This bridge, originally called Kelley Bridge No. 134, was built in 1918 during construction of the Inland Empire Highway (Allen 1918:72-74; Whitman County ca. 1900s-1970s, 1918c). Dan Hall, present Whitman County Public Works Right-of-Way Agent (personal communication 2018), noted that, "[This segment of] the Inland Empire Highway was later replaced and realigned with Primary State Highway No. 3 around 1934 to a location where the bridge was no longer on a public highway." The bridge appears to have been built as a Daniel B. Luten reinforced concrete filled spandrel deck arch design. The construction contractor for grading and bridge construction on this segment of the Inland Empire Highway – the Oakesdale South (Oakesdale to Garfield) section of the Eastern Route Second Division – was H. C. Malott of Seattle. Malott was awarded the contract in May 1919 and finished on August 20 of that year. He came in close to budget: the contract price was $21,916.44 for the entire project and the final estimated cost came to $22, 265.83. (Allen 1918:72-74; Engineering and Contracting 1918:30; Pullman Herald 1918:6).

During the late nineteenth and early twentieth centuries, Daniel B. Luten pioneered the use of reinforced concrete as a bridge construction material, patented his designs and methods, and widely publicized his results. As a result, Luten-designed reinforced concrete bridges were built throughout the nation during the 1910s and 1920s period. Although Luten designed other types of reinforced concrete bridges, his typical design was a filled spandrel deck arch bridge, often with solid parapet railings and incised geometric ornament. Reinforced concrete filled spandrel deck arch bridges of Luten design are therefore a significant bridge type which, if retaining sufficient integrity of location, design, setting, materials, workmanship, feeling, and association, are eligible for listing in the National Register of Historic Places. Such bridges are significant under Criterion C, at the state level, for their association with Daniel B. Luten's pioneering efforts in reinforced concrete bridge construction and as examples of Luten's distinctive filled spandrel deck arch designs.

Increasing automobile ownership during the early twentieth century led to a growing demand throughout the nation for improved roads, and state and local governments became actively involved in road construction and maintenance. Bridges were important features of these new transportation systems, and such structures, if retaining sufficient integrity of location, design, setting, materials, workmanship, feeling, and association, are eligible for listing on the National Register of Historic Places under Criterion A, at the state or local level, for their contributions to the development of regional road and highway networks.

Although Kelley Bridge is a historical structure, removal of both railings and alteration of the abutments has severely compromised the property's integrity of design, materials, workmanship, and feeling. Today the bridge is virtually unrecognizable as a Daniel B. Luten design or as a historical bridge of the period. Kelley Bridge is therefore recommended not eligible for listing in the National Register of Historic Places.

***Figure A-109. Kelley Bridge (Field Number WCLB-16), east side; view to the southwest.***

***Figure A-110. Kelley Bridge (Field Number WCLB-16), east side; view to the northwest. Note the curved abutments and missing parapets.***

***Figure A-111. Kelley Bridge (Field Number WCLB-16), west side; view to the southeast.***

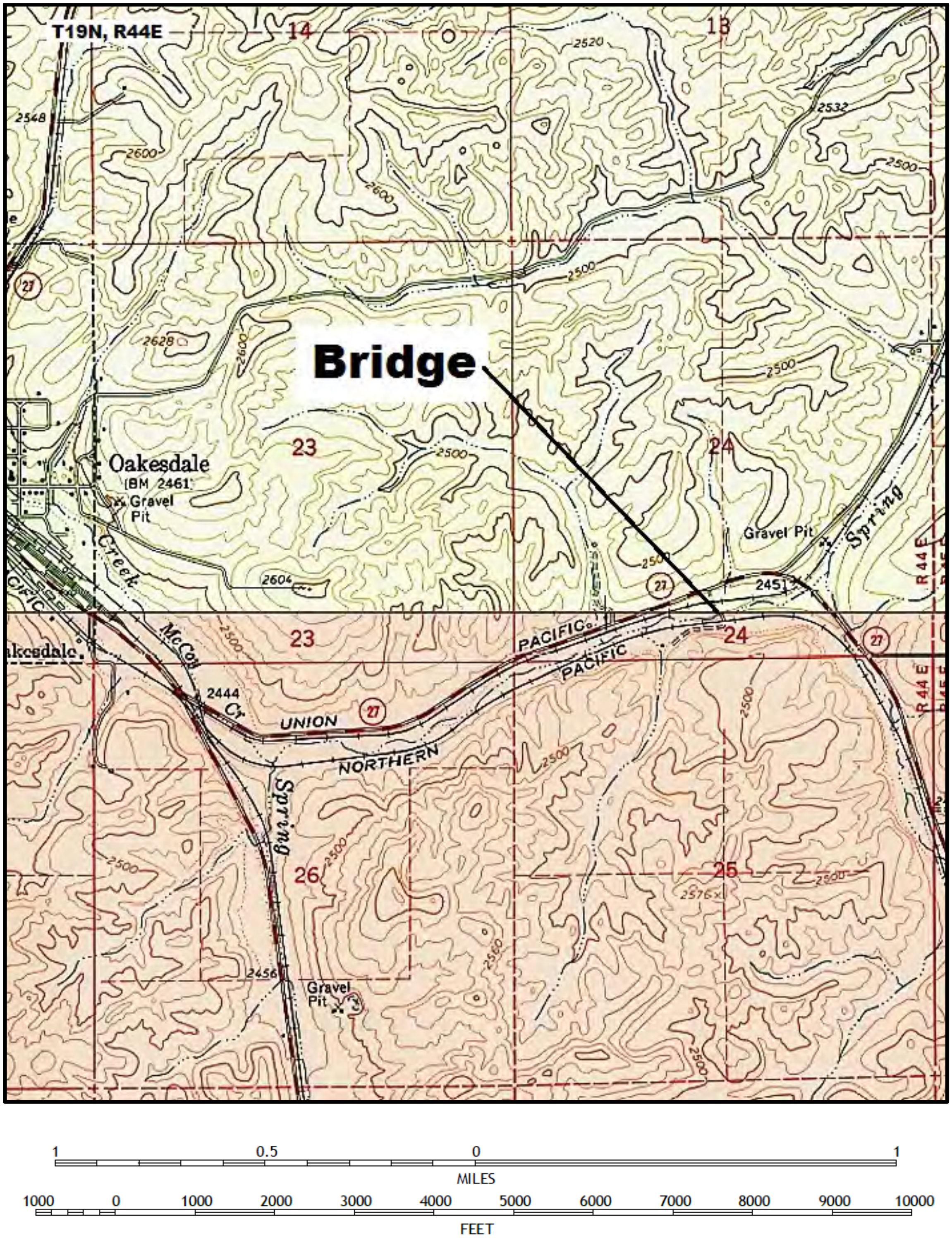



*Figure A-112. Location of Kelley Bridge (Field Number WCLB-16); map adapted from Oakesdale, Wash., 7.5' quadrangle, U.S. Geological Survey, 1964, north section, and Garfield, Wash., 7.5' quadrangle, U.S. Geological Survey, 1964, south section.*

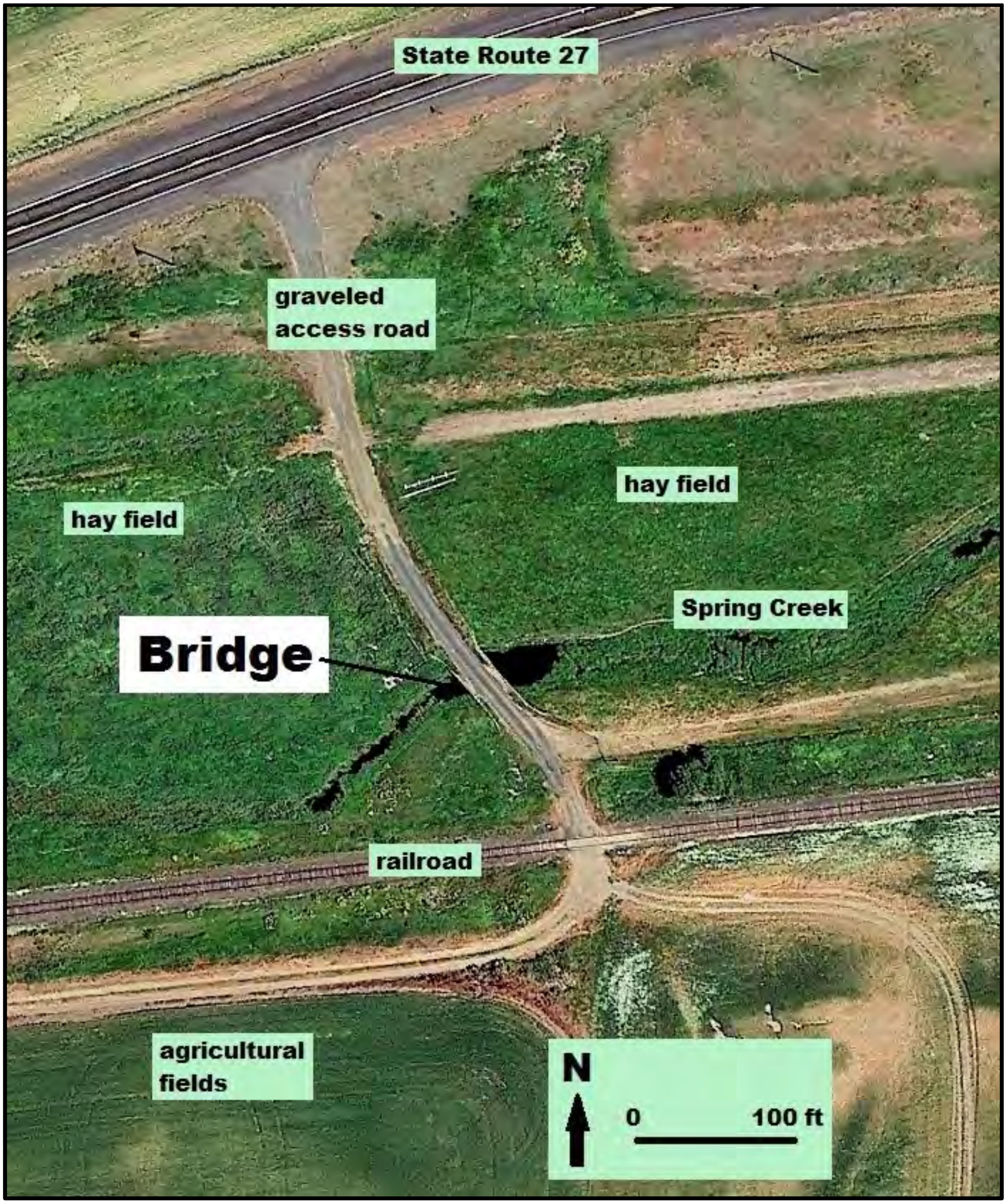



*Figure A-113. Kelley Bridge (Field Number WCLB-16) vicinity; map adapted from Google Earth aerial photograph, 2015.*

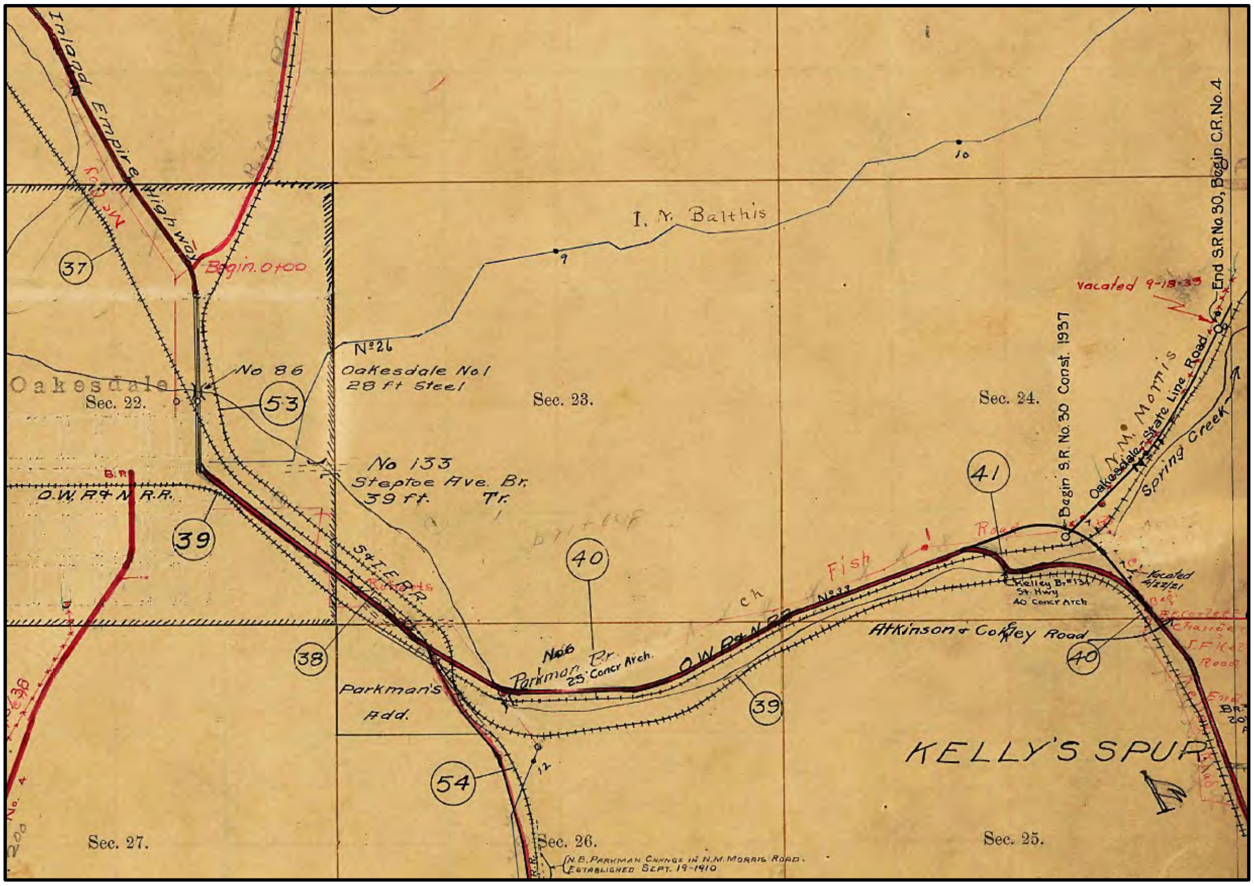



***Figure A-114. Kelley Bridge (Field Number WCLB-16) depicted in the Whitman County Highway Plat Book 1.5 miles east of Oakesdale on the Inland Empire Highway; the bridge is identified as "Kelley Br #134 St. Hwy 40' Concr Arch" (Whitman County ca. 1900s-1970s).***

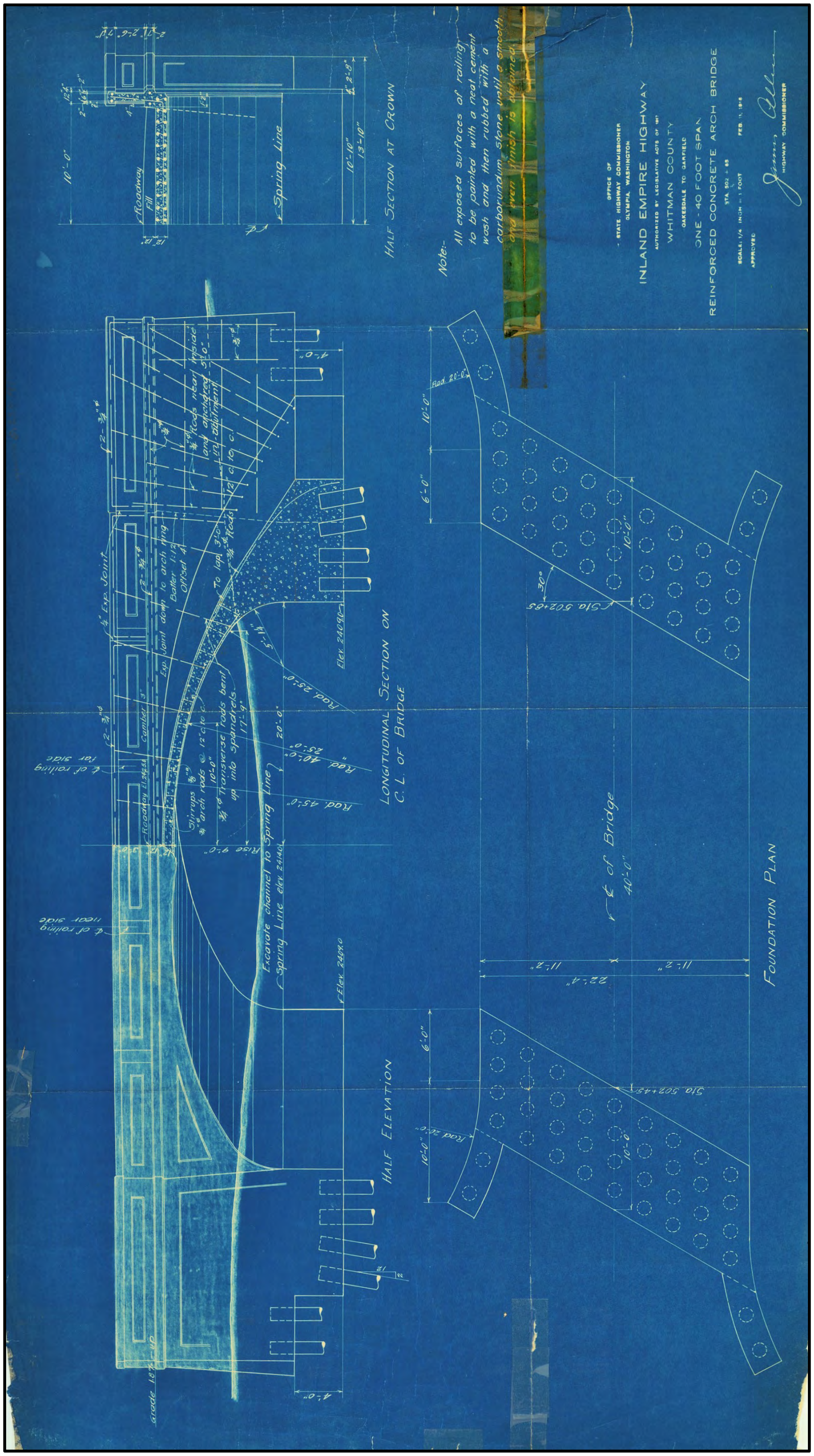



***Figure A-115. Kelley Bridge (Field Number WCLB-16) engineering plans, 1918 (Whitman County 1918c).***

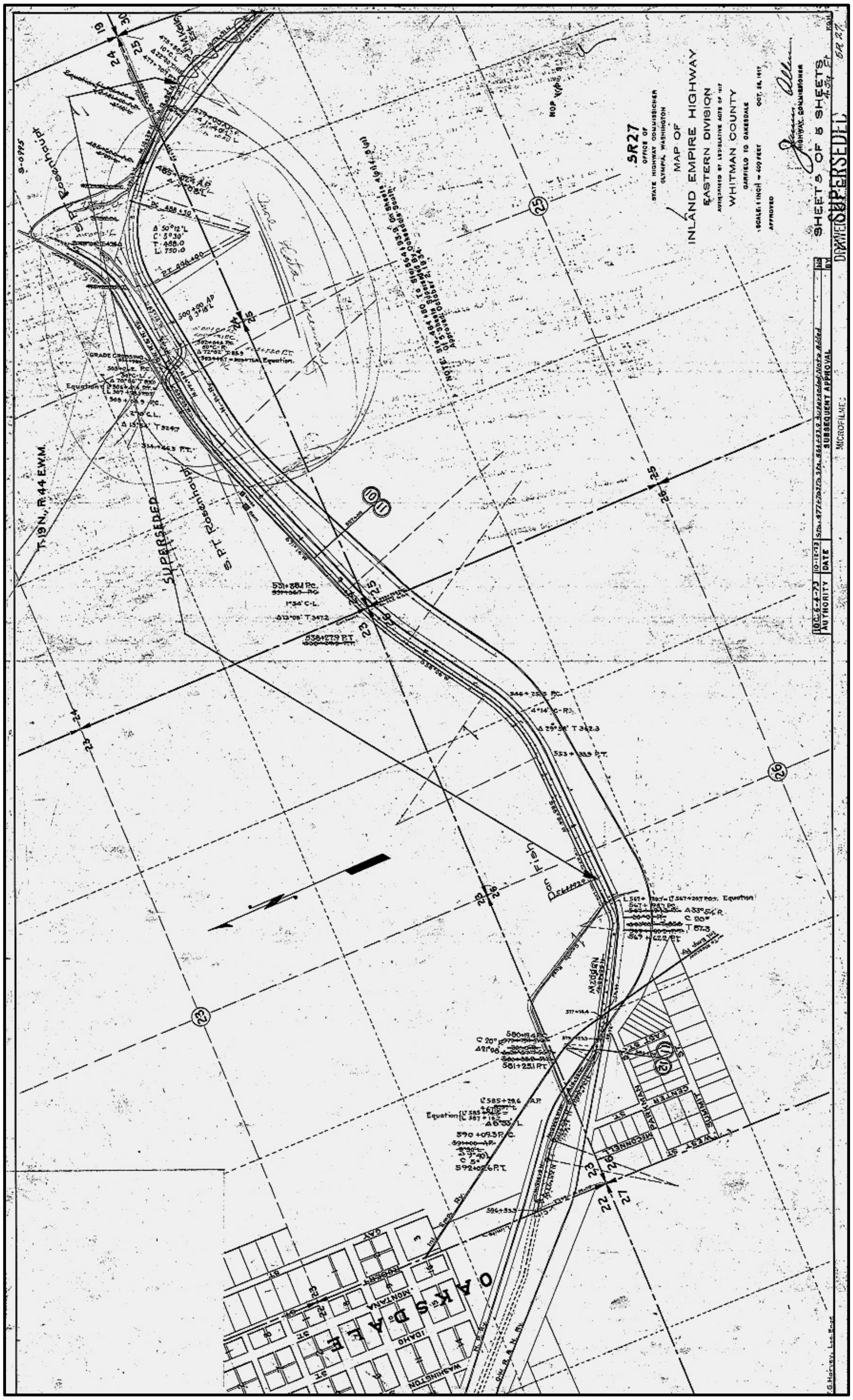



*Figure A-116. Stream crossing in the future location of Kelley Bridge (Field Number WCLB-16) shown on the 1917 Inland Empire Highway engineering plans – Section 24 in upper right of sheet (Washington State Highway Commissioner 1917)*

## Sanders Bridge No. 280 (historic name)
## Foreyt Bridge (modern name)
## Project Field Number WCLB-17

Description:

This large two-span reinforced concrete bridge – a filled spandrel deck arch type – conveys what is currently a privately owned gravel road over Union Flat Creek, several hundred feet south of present State Route 26 and seven miles west of Colfax.

The bridge is symmetrically arranged, approximately 132 feet long and 23 feet wide, with two 50-foot long semielliptical arches extending between the battered abutment faces and the slender battered central pier. The exterior sides of the abutments and central pier are slightly wider than the adjacent closed spandrel walls. The abutments, pier, and spandrel walls were cast separately and impressions of the horizontal 5-inch wide board forms remain visible in all three sections despite application of a thin coat of cement stucco to hide the mold seams. All three features are ornamented with incised geometric designs: Two large triangles embellish each spandrel, one on either side of the arch with each hypotenuse curved to match the curve of the arch ring; an incised trapezoidal shape ornaments the central pier, the sides paralleling the battered sides of the pier and the bottom notched to mimic the peak of the projecting wedge-shaped ice-breaker below; and a large rectangle is incised on each abutment, the visible vertical line paralleling the abutment's battered face. The arched lower edge of each spandrel is beveled, as are visible vertical edges of the abutments and pier. The spandrel, pier, and abutment walls are capped with slightly overhanging concrete coping, beveled top and bottom on the exterior side of the bridge and unbeveled, forming a low curb, on the side toward the roadway. Below the arch spring line, the central pier is a large concrete block with wedge-shaped ends, also cast in horizontal board forms. Scouring has now exposed part of the concrete footing beneath the pier. Square ¾-inch diameter ferrous metal reinforcing rods, some still embedded in concrete, protrude from the abutments and both sides of the central pier, remnants of the bridge's streambed reinforcing pavement.

A low solid parapet railing, cast atop the coping of the spandrel, pier, and abutment walls, borders the bridge on both sides. Each parapet is cast in nine sections – a very narrow central segment atop the central pier, embellished on both inner and outer surfaces with an incised diamond shape; a long segment on each side of the central section, each embellished on inner and outer surfaces with two incised horizontal rectangles separated by two vertical incised lines; then one segment of moderate length to each side, embellished on inner and outer surfaces with an incised horizontal rectangle with a vertical line incised near each end of the segment; another long segment on each side, embellished on inner and outer surfaces with two incised horizontal rectangles separated by two vertical incised lines; and a segment of moderate length over the abutment at each end of the parapet, embellished on both inner and outer surfaces with one horizontal rectangle. No evidence of a bridge plaque was noted, although at some point the date "1916" was crudely inscribed within the diamond on the central pier's north inner parapet. The abutment and pier segments of each parapet are slightly higher and wider than the six central (spandrel) segments. All parapet segments are capped with slightly overhanging concrete coping with a faintly rounded upper surface and beveled lower margins. The coping is highly deteriorated or missing in places, and in one area a square ¾-inch diameter ferrous metal reinforcing rod is exposed. The vertical edges of most parapet segments are beveled, and a vertical line is incised into the end of each parapet. The parapets were cast in 5-inch wide horizontal board forms and finished with a light coat of cement stucco to hide the mold seams.

Both arch barrels were cast in four longitudinal sections: the west arch with a 2-foot wide spandrel wall at each side and 6- and 12-foot wide central sections, and the east arch with a 1.5-foot wide spandrel wall at each side and two nearly equal 9-foot wide central sections. (In Luten designs, the spandrel wall is generally placed beside rather than on top of the arch ring.) The arch barrels were cast in horizontal 5-inch wide board forms, the boards running perpendicular to the bridge and parallel to the stream. Today some deterioration and spalling of the concrete can be seen in lower portions of the arch barrels and along seams.

Although not visible, space within the bridge – over the arch barrels and bounded by the spandrel and abutment walls – is filled with packed earth and rock. A concrete deck was poured atop the fill, now covered with earth and gravel continuous with that of the private road. Engineering plans for the bridge depict steel reinforcing rods connecting all parts of the bridge – the streambed pavement, footings, pier, abutments, arch barrels, spandrels, and parapets (Whitman County ca. 1917, 1917).

Significance Evaluation:

This bridge, originally called Sanders Bridge No. 280, was built in 1917 during construction of the Colfax South segment of the Inland Empire Highway. The bridge is a Daniel B. Luten reinforced concrete filled spandrel deck arch design, a typical example of Luten's highway bridge structures, and the builder was H. C. Malott, a Seattle contractor (Allen 1918:72-74; Whitman County ca. 1900s-1970s, ca. 1917, 1917). Dan Hall, present Whitman County Public Works Right-of-Way Agent, noted that, "The Inland Empire Highway was later replaced and realigned with Primary State Highway No. 3 around 1934 to a location where the bridge was no longer needed for a public highway. The State of Washington transferred ownership to Whitman County. Whitman County vacated the portion of old roadway and bridge because there was no need for the roadway and bridge to be in the County [road system]" (Dan Hall, personal communication 2018). The bridge and road segment are now privately owned and are used as a residential access route.

During the late nineteenth and early twentieth centuries, Daniel B. Luten pioneered the use of reinforced concrete as a bridge construction material, patented his designs and methods, and widely publicized his results. As a result, Luten-designed reinforced concrete bridges were built throughout the nation during the 1910s and 1920s period. Although Luten designed other types of reinforced concrete bridges, his typical design was a filled spandrel deck arch bridge, often with solid parapet railings and incised geometric ornament. Reinforced concrete filled spandrel deck arch bridges of Luten design are therefore a significant bridge type which, if retaining sufficient integrity of location, design, setting, materials, workmanship, feeling, and association, are eligible for listing in the National Register of Historic Places. Such bridges are significant under Criterion C, at the state level, for their association with Daniel B. Luten's pioneering efforts in reinforced concrete bridge construction and as examples of Luten's distinctive filled spandrel deck arch designs.

Increasing automobile ownership during the early twentieth century led to a growing demand throughout the nation for improved roads, and state and local governments became actively involved in road construction and maintenance. Bridges were important features of these new transportation systems, and such structures, if retaining sufficient integrity of location, design, setting, materials, workmanship, feeling, and association, are eligible for listing on the National Register of Historic Places under Criterion A, at the state or local level, for their contributions to the development of regional road and highway networks.

Sanders Bridge retains all aspects of integrity to a sufficient degree and is therefore recommended eligible for listing in the National Register of Historic Places under Criteria A and C at the state level.

***Figure A-117. Sanders Bridge (Field Number WCLB-17), south side; view to the northwest.***

***Figure A-118. Sanders Bridge (Field Number WCLB-17), north side of west arch; view to the southeast.***

***Figure A-119. Sanders Bridge (Field Number WCLB-17), detail of central pier on south side; view to the northwest.***

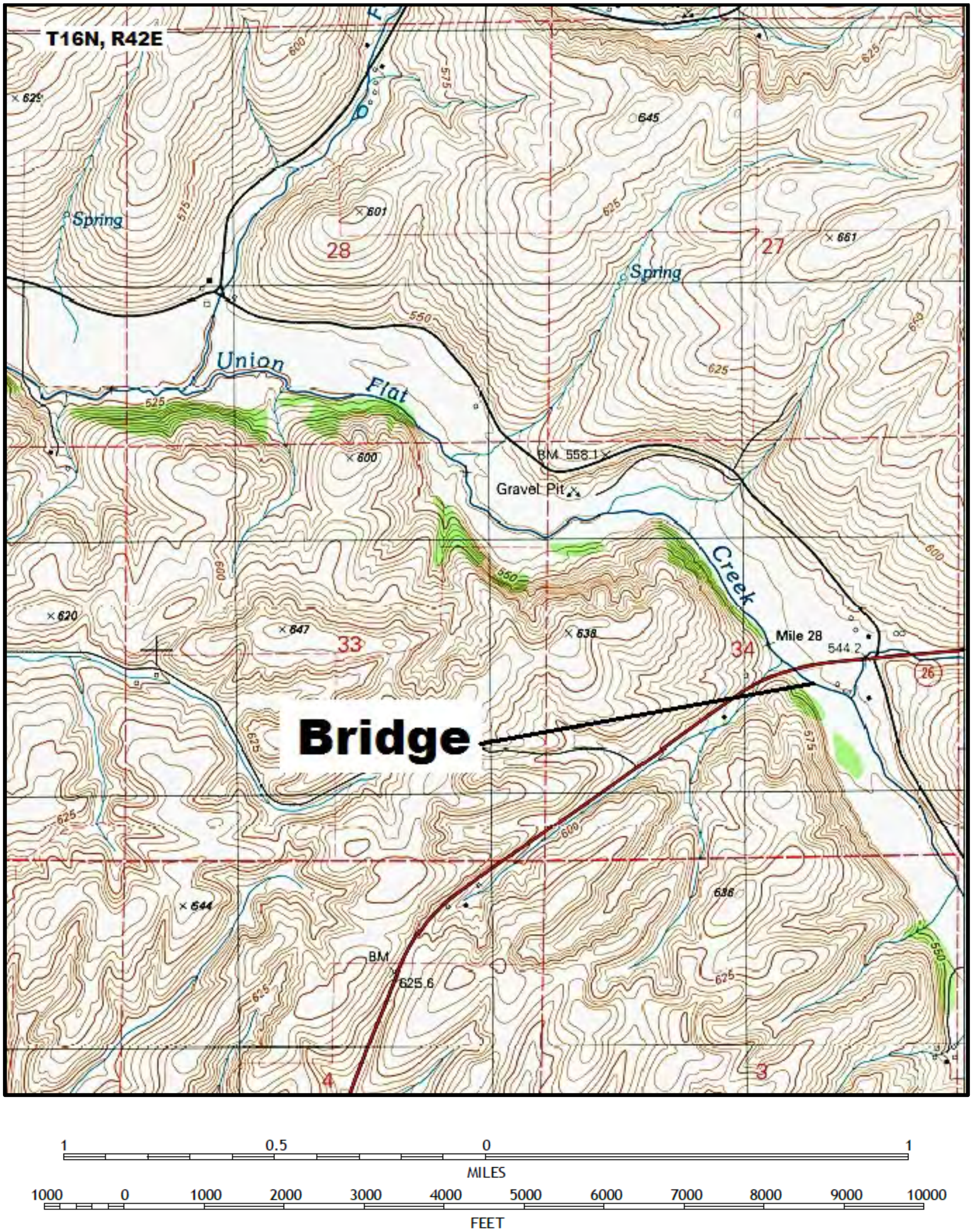



*Figure A-120. Location of Sanders Bridge (Field Number WCLB-17); map adapted from Little Penawawa Creek, Wash., 7.5' quadrangle, U.S. Geological Survey, 1981.*


***Figure A-121. Sanders Bridge (Field Number WCLB-17) vicinity; map adapted from Google Earth aerial photograph, 2017.***

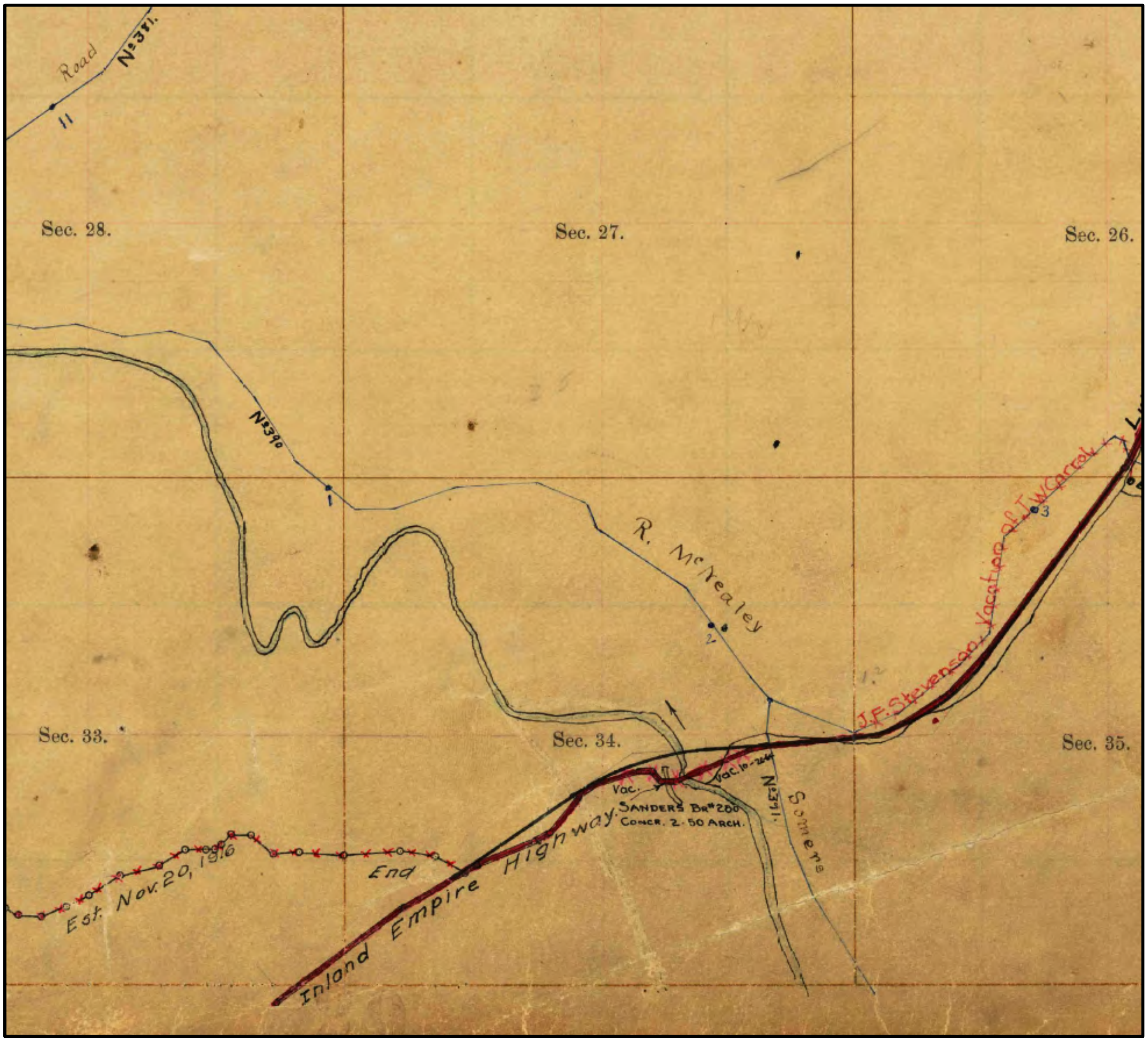



***Figure A-122. Sanders Bridge (Field Number WCLB-17) depicted in the Whitman County Highway Plat Book on the Inland Empire Highway; the bridge is identified as "Sanders Br #280 Concr. 2 - 50 Arch" (Whitman County ca. 1900s-1970s).***

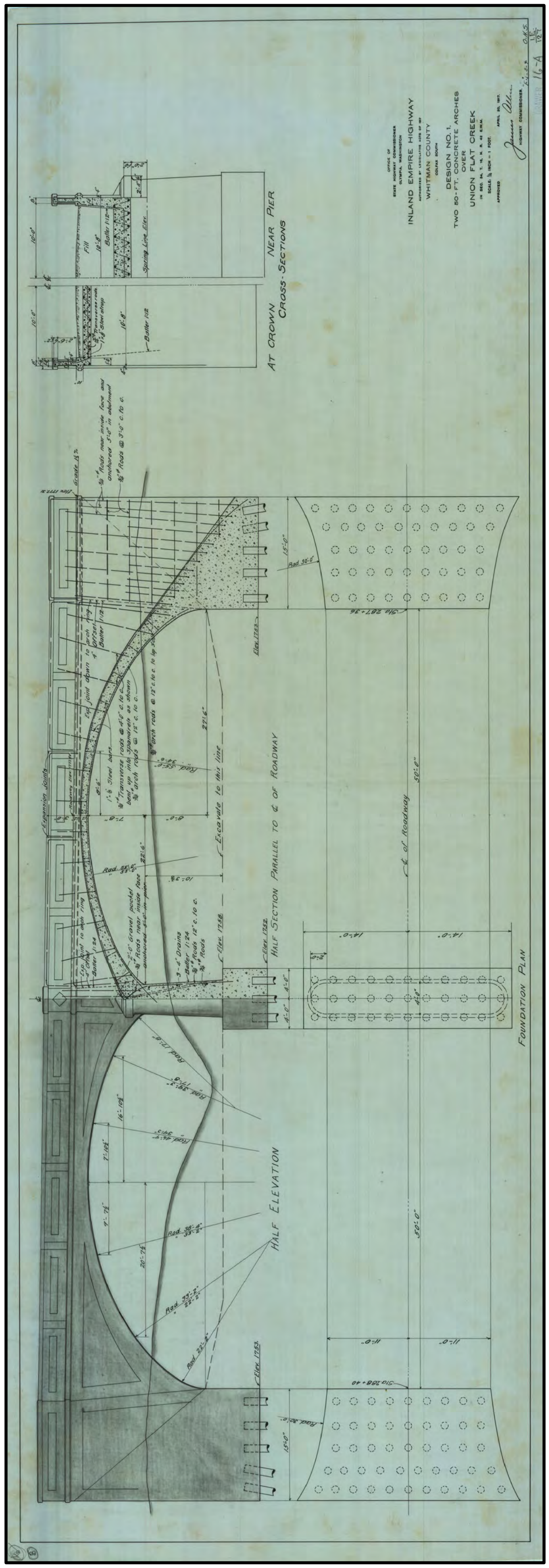



*Figure A-123. Sanders Bridge (Field Number WCLB-17) Design No. 1 engineering plans, 1917 (Whitman County 1917).*

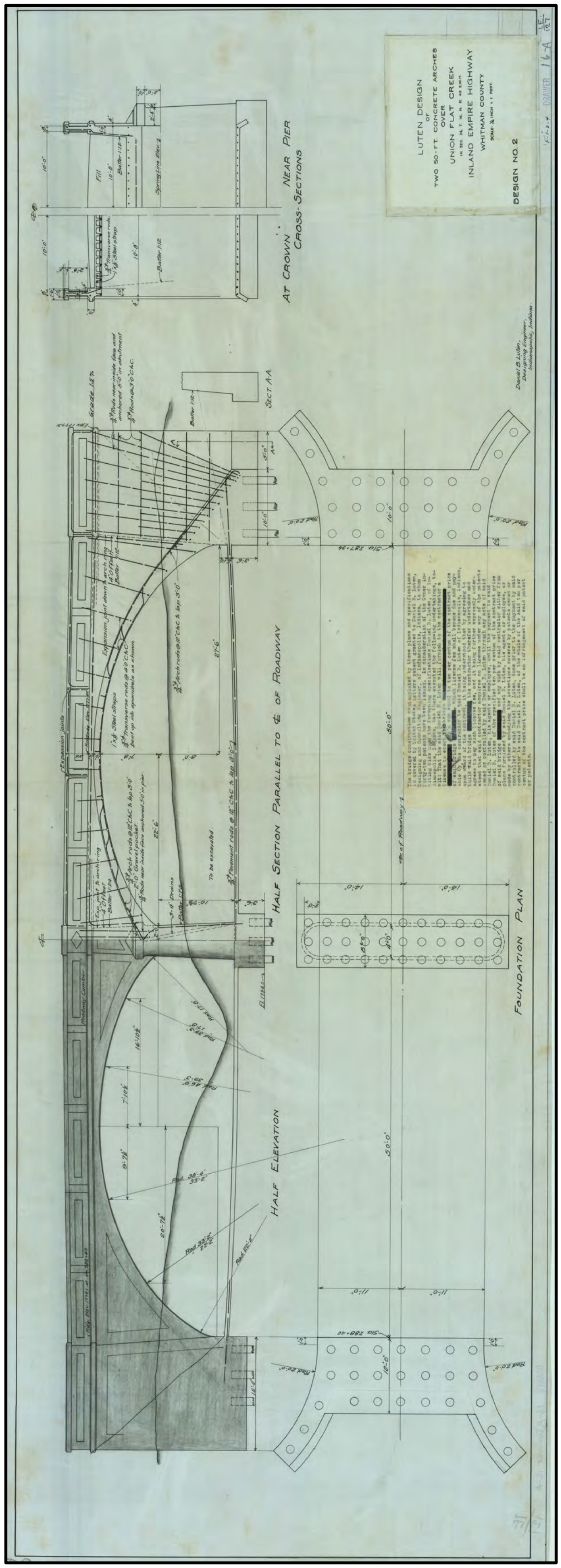



***Figure A-124. Sanders Bridge (Field Number WCLB-17) Design No. 2 engineering plans, ca. 1917 (Whitman County ca. 1917).***