Summit Envirosolutions

August 12, 2016

VIA EMAIL
Ms. Victoria Rutson, Director
Office of Environmental Analysis
Surface Transportation Board
395 E Street, SW
Washington, DC 20423-0001

Re: *Union Pacific U.S. Steel Industrial Lead, Baytown, TX*
STB Docket No. AB-33 (Sub-No. 324X)

Dear Ms. Rutson:

The Union Pacific Railroad (UP) is seeking to abandon the U.S. Steel Industrial Lead, a 2.23-mile railroad right of way in Baytown, Texas. In a filing dated April 1, 2016, UP submitted a combined Environmental and Historical Report to your office and to the Texas State Historic Preservation Officer (SHPO). On behalf of the Texas SHPO in a letter dated April 20, 2016, staff of the Texas Historical Commission (THC) requested a historical evaluation of the Cedar Bayou Bridge, which is within the proposed abandonment area. On behalf of UP, Summit Envirosolutions, Inc. (Summit) submitted the requested historic resources evaluation report to the THC (see Attachment 1). In a letter dated July 27, 2016, THC staff concurred that the Cedar Bayou Bridge is eligible for listing in the National Register of Historic Places and concluded that its demolition would be an adverse effect (see Attachment 2).

UP now requests from your office a Finding of Adverse Effect for the proposed abandonment of the U.S. Steel Industrial Lead in order that a Memorandum of Agreement (MOA) for resolution of the adverse effect may be executed, and the Section 106 consultation may be completed. UP understands that the steps for completing the Section 106 process are:

- Notifying the Advisory Council on Historic Preservation (ACHP) and the Texas SHPO of the Finding of Adverse Effect;
- Development of an MOA in consultation with the Texas SHPO and the ACHP, should they choose to participate; and
- Completion of mitigation measures stipulated in the MOA.

On behalf of UP, I thank you for your assistance in this matter and look forward to working with your office. If you have any questions or require additional information, please do not hesitate to contact me at 651-842-4202.

Sincerely,

Summit Envirosolutions, Inc.

Andrew J. Schmidt
Director of Cultural Resources

CC: Mack Shumate, Union Pacific Railroad (via email)
Olin Dirks, Union Pacific Railroad (via email)

Historic Resources Evaluation of the Cedar Bayou Bridge for the U.S. Steel Industrial Lead Abandonment, Harris and Chambers Counties, Texas

Submitted to
Union Pacific Railroad Company

Submitted by
Summit Envirosolutions, Inc.

HISTORIC RESOURCES EVALUATION FOR THE US STEEL INDUSTRIAL LEAD ABANDONMENT BAYTOWN, HARRIS AND CHAMBERS COUNTIES, TEXAS

STB Docket No. AB-33 (Sub-No. 324X)

Submitted to:
Union Pacific Railroad Company
1400 Douglas Street
Omaha, NE 68179-1580

Submitted by:
Summit Envirosolutions, Inc.
1217 Bandana Boulevard North
St. Paul, Minnesota 55108

Principal Investigator
Andrew J. Schmidt

Report Authors:
Sara Nelson and Andrew J. Schmidt

July 2016

MANAGEMENT SUMMARY

The Union Pacific Railroad Company (UP) proposes to file with the Surface Transportation Board (STB) for authority to abandon a segment of the U.S. Steel Industrial Lead (Line). The segment is 2.23 miles of railroad right-of-way between Milepost 2.4 and Milepost 4.63 including the bridge at Cedar Bayou in Harris and Chambers Counties, Texas. The right-of-way is currently inactive. The UTMs for the proposed abandonment are: 15N, 311820.4 E, 3288987.0 N (east end) and 309410.0 E, 3290152.5 N; (west end) (Figure 1). The UTM for the Cedar Bayou Bridge is 15N, 311810.8 E; 3288995.7 N.

As part of its responsibility to comply with Section 106 of the National Historic Preservation Act (16 USC 470) and its implementing regulations (36 CFR 800), UP sought comment on behalf of STB from the Texas State Historic Preservation Officer, who also serves as Director of the Texas Historical Commission (THC). Staff from the THC responded that the vertical lift span carrying the Line over Cedar Bayou may be a historic property and requested that UP evaluate the property for eligibility for listing in the National Register of Historic Places (National Register). To comply with this request, UP contracted with Summit Envirosolutions, Inc. (Summit) to prepare a historical evaluation report for the bridge.

In preparing the historical report, the Summit Principal Investigator reviewed bridge studies in Texas and other states, reviewed the history of the Cedar Bayou Bridge, and applied the National Register criteria of significance and integrity. Because it appeared to be a rare bridge type, and because the structure had been moved, the focus of the study was the bridge's significance for engineering under Criterion C, as well as Criteria Consideration B: Moved Properties.

The Line was built in 1967-1968 by the Missouri Pacific (MoPac) Railroad, which was effectively merged with UP on December 22, 1982 connecting the Missouri Pacific in Baytown with the new U.S. Steel plant. The railroad line itself is less than 50 years old and does not appear to have exceptional significance, and therefore, it is recommended as not eligible for listing in the National Register. The Cedar Bayou Bridge, which includes a vertical lift span, is recommended as eligible for listing in the National Register under Criterion C, as a rare extant example of a vertical lift truss span dating from the early twentieth century, while meeting Criteria Consideration B: Moved Properties.

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1.0 INTRODUCTION

The Union Pacific Railroad Company (UP) proposes to file with the Surface Transportation Board (STB) for authority to abandon a segment of the U.S. Steel Industrial Lead (Line). The segment is 2.23 miles of railroad right-of-way between Milepost 2.4 and Milepost 4.63 including the Bridge at Cedar Bayou in Harris and Chambers Counties, Texas (Figure 1). The right-of-way is currently inactive.

Because the STB has regulatory authority over railroad abandonment projects, this project must comply with Section 106 of the National Historic Preservation Act (16 USC 470) and its implementing regulations (36 CFR 800). UP, on behalf of the STB, has begun consultation with the Texas State Historic Preservation Officer, who also serves as Director of the Texas Historical Commission (THC). In a letter dated April 20, 2016, staff from the THC responded that the vertical lift span carrying the Line over Cedar Bayou may be a historic property and requested that UP evaluate the property for eligibility for listing in the National Register of Historic Places (National Register). To comply with this request, UP contracted with Summit Envirosolutions, Inc. (Summit) to prepare a historical evaluation report for the bridge.

The UTMs for the proposed abandonment are: 15N, 311820.4 E, 3288987.0 N (east end) and 309410.0 E, 3290152.5 N; (west end) (Figure 1). The UTM for the Cedar Bayou Bridge is 15N, 311810.8 E; 3288995.7 N.

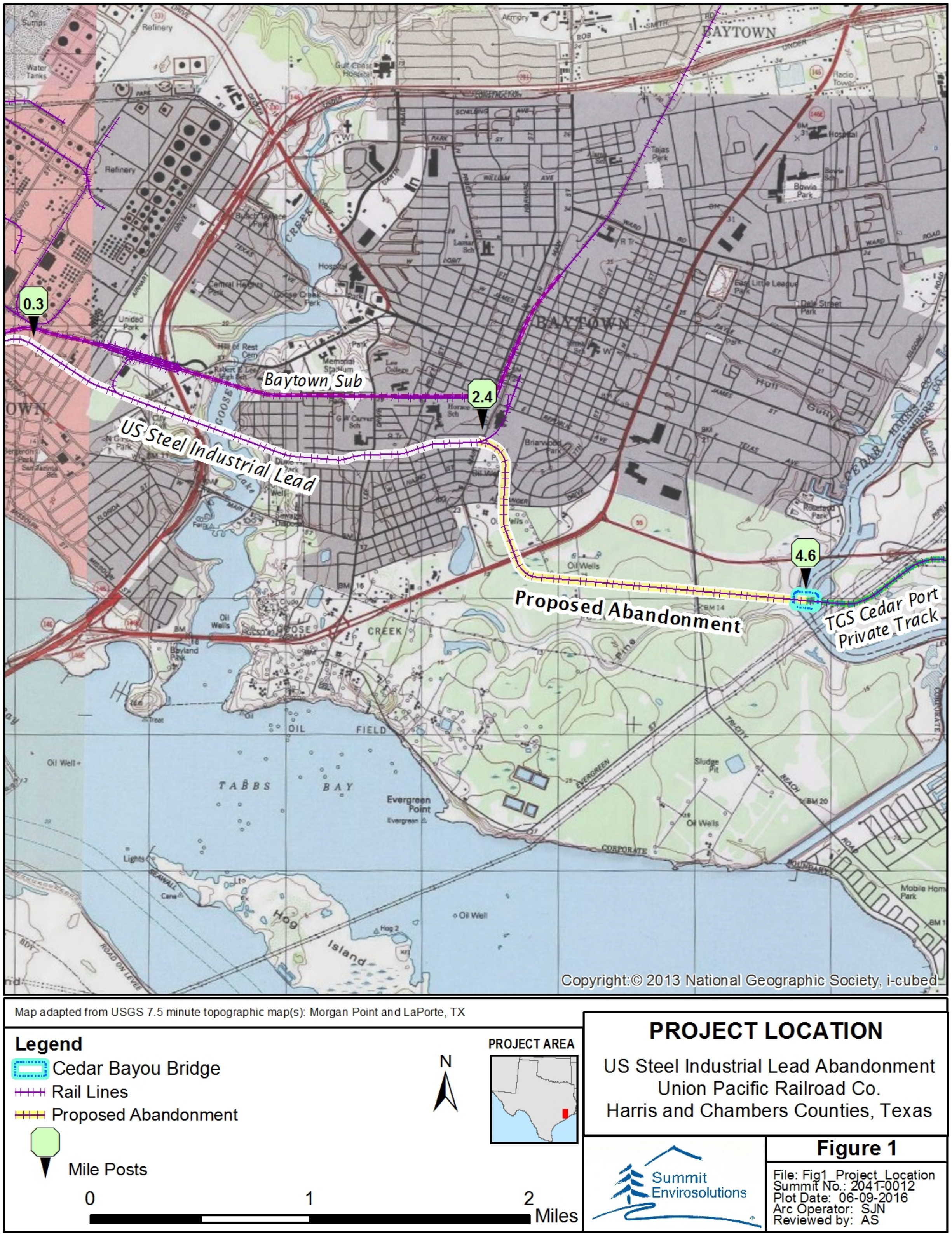


Figure 1. Project Location

2.0 METHODS

2.1 Methodological Overview

The intent of the historical study was to conduct a historic resources evaluation to establish the National Register eligibility of the Cedar Bayou Bridge within the portion of the U.S. Steel Industrial Lead right-of-way covered by the proposed abandonment. To complete the historical evaluation, the Principal Investigator applied the National Register criteria of eligibility, which are defined in 36 CFR 60.4 as follows:

> The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and
>
> A. that are associated with events that have made a significant contribution to the broad patterns of our history; or
>
> B. that are associated with the lives of persons significant in our past; or
>
> 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
>
> D. that have yielded, or may be likely to yield, information important in prehistory or history.

Because the vertical lift span and two approach spans of the Cedar Bayou Bridge were moved from their original location to the current location in 1967, the evaluation focused on Criterion C for potential significance in the area of engineering as a type, period, or method of construction. Furthermore, the property was evaluated under Criteria Consideration B: Moved Properties. In addition to the significance criteria, the bridge was evaluated for historic integrity. A property has historic integrity when it retains most of the following seven aspects: location, materials, design, workmanship, setting, feeling, and association.

2.2 Section 106 Consultation

On January 6, 2016, UP initiated Section 106 consultation with THC regarding the proposed abandonment on behalf of STB, as authorized in a memo from STB dated December 10, 2009 and in 36 CFR 800.2(c)(4). Staff from THC commented on January 20, 2016, that, although the Cedar Bayou Bridge was moved to its current location in 1967, it was originally constructed in 1912, and therefore, a historical evaluation of the bridge was warranted. No other structures over 50 years old were identified within the abandonment area. In additional correspondence dated April 20, 2016, THC staff reiterated their request that the Cedar Bayou Bridge be evaluated for National Register eligibility. This historical report addresses that request.

In the correspondence and in a telephone conversation with THC staff (personal communication with Justin Kochritz, May 30, 2016), no additional historical evaluations were requested beyond the Cedar Bayou Bridge. Furthermore, because no other structures on the U.S. Steel Industrial Lead are older than 50 years, only the Cedar Bayou Bridge (including the vertical lift structure, supporting towers, and approach spans, all dating from 1912) is evaluated for National Register eligibility.

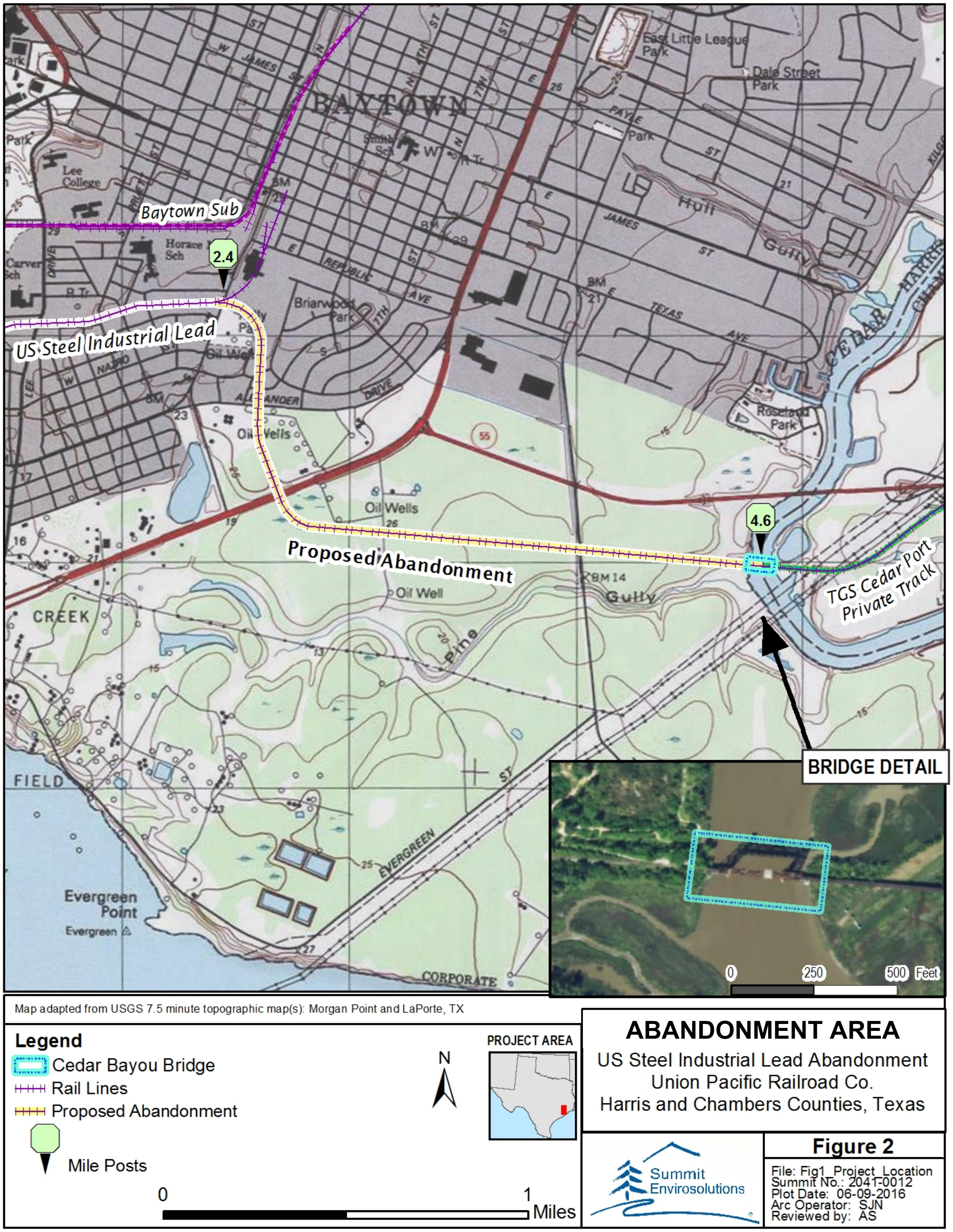


Figure 2. Abandonment Area with Bridge Detail

3.0 LITERATURE SEARCH RESULTS

3.1 Previous Investigations

The following is a discussion of the bridge studies that were utilized in the evaluation of the Cedar Bayou Bridge.

"Historic Road Infrastructure in Texas MPDF:" This study, recently completed by the Texas Department of Transportation, provides statewide historic contexts, including "Historic Bridges of Texas, 1866-1965," identifies historic bridge types, and establishes National Register eligibility requirements for bridges (Jensen 2015).

Studies prepared for the New Jersey Department of Transportation prior to the removal of the Wittpenn Bridge over the Hackensack River documented the Hackensack River Vertical Lift Bridges Historic District. This proposed historic district was composed of four consecutive vertical lift bridges that were built in 1928-1930 to replace earlier swing span bridges.

"A Context for Common Historic Bridge Types:" This study, sponsored by the National Cooperative Highway Research Program, identified bridge types that "are very common and those that are much less common" and evaluated the technological and historical significance of those types. In assessing vertical lift bridges, this study stated that:

> These bridges [vertical lift spans] are less common than many of the bridge types described in this study and, if the structures possess their character-defining features, they possess a high level of significance within the context of this study. Character-defining features include two towers, the lift span (which will possess the character-defining features of the relevant span type), drive machinery, cables, pulleys, counterweight and piers or abutments. Another feature that may be considered character-defining is the operator's house (Parsons Brinkerhoff and Engineering and Industrial Heritage 2005: 3-121).

Statewide MPDFs have been completed for historic bridges in Arkansas (1989) and Nebraska (1991). Both studies noted the rarity of vertical lift spans and evaluated them as a significant bridge type. The Arkansas document identified only two examples of extant vertical lift bridges in the state, describing them as "significant contributors to the historic landscape of the state" (Bennett et al. 1989: F-7). In the Nebraska study under the Metal Truss Highway Bridges property type, a consideration for eligibility was a bridge with a "design utilizing new technology or technology rarely used in Nebraska," such as a vertical lift span (Roise 1991: F-46).

In addition to context studies, a number of individual vertical lift span bridges have been documented for National Register listing and Historic American Engineering Record (HAER) documentation.

- Snowden Bridge (1913), Richland County, MT; (HAER) No. MT-27. This bridge, designed by Waddell & Harrington, includes a 296-foot riveted Parker through truss and three 267-foot fixed riveted Parker through truss spans. The bridge carried a Great

Northern railroad line over the Missouri River, and at the time it was built, it was the longest vertical lift span and had the second largest clear opening of any movable bridge.

- City Waterway Bridge (1911), Pierce County, WA; National Register-listed in 1982 in Historic Bridges/Tunnels in Washington State Thematic Resource; HAER No. WA-100. This bridge, designed by Waddell & Harrington, includes a 214-foot riveted Pratt through truss vertical lift span flanked by two 190-foot riveted fixed Pratt truss spans. The bridge was built across the City Waterway to connect Tacoma's business and industrial districts.
- White River Bridge at De Valls Bluff (1924), Prairie County, AR; National Register-listed in 1990, Historic Bridges of Arkansas Multiple Property Submittal (MPS); HAER No. AR-21. This bridge, designed by Harrington, Howard & Ash, includes a 204-foot riveted Pratt through truss vertical lift span flanked by two 201-foot riveted Pratt through truss spans.
- Meridian Bridge (1924), Cedar County, NE; listed in the National Register in 1991 and included in Highway Bridges in Nebraska MPS (1993). This bridge, designed by Harrington, Howard & Ash, includes a 250-foot riveted Pratt through truss vertical lift span and additional Pratt through truss spans. The trusses were designed as double-deck spans for both railroad and automotive traffic and, in 1953, converted to two one-way automotive decks. Although there were alterations in 1983 to some of the bridge's character-defining features, including removal of the lift machinery, cables, and counter weights as well as the operator's house, the bridge was.
- Sacramento River (Tower) Bridge (1936), Sacramento County, CA; National Register-listed in 1982; HAER No. CA-73. This bridge, designed by Alfred Eichler, includes a 209-foot Pratt through truss vertical lift span with a rare use of Streamline Moderne styling in the lift towers.
- Neches River Bridge (1941), Beaumont, Jefferson County, TX; National Register eligible. This bridge includes a 239-foot Warren-with-verticals through truss vertical lift span.

3.3 Historic Contexts

3.4.1 Development of Truss Bridges and Movable Spans

Metal Truss Bridges

The engineering principles underlying the development of metal truss systems for railroad traffic during the mid-nineteenth century were based on the same principles that led to the development of earlier wooden truss systems. Although metal railroad trusses were more stoutly designed to resist the heavy live loads associated with railroad traffic, the truss types developed by pre-railroad engineers and the configuration of their posts, chords, and bracing elements remained essentially unchanged. Typically, fixed metal bridges were installed at permanent river crossings, and utilized a variety of truss types, the most common of which were the Howe, Pratt, and Warren varieties. Trusses of all varieties could be constructed as *through trusses* (in which traffic passes between the bridge's main girder panels and under a series of cross-bracing elements tying the panels together); *pony trusses* (in which traffic passes between the bridge's main girder panels, but the main girders are not situated high enough to warrant the use of an upper portal brace); and *deck trusses* (in which traffic loads rest directly on the top surfaces of the main girders).

After 1840, Howe truss bridges became an early standard truss for use on railroads. Howe trusses have inclined portal posts, with vertical members in tension and a set of mirrored diagonal members in compression. Additional diagonal members may be present to cross-brace each truss panel. The Pratt truss, patented in 1844, has vertical members in compression and diagonal members in tension. Early examples of this type have inclined portal posts, intermediate posts, hip verticals, and bottom chord joints with pin and eyebar connections. Riveted joints became common during the early twentieth century, and welded joints were typical after World War II. Variants of the Pratt truss include the Parker or camelback truss (with a single slanted upper chord in the panel medial to each portal strut), the Baltimore truss (with additional vertical and diagonal bracing in the bridge panels), and the Pennsylvania or Petit truss (combining elements of the Parker and Baltimore variants). The Warren truss, which was patented in 1848, typically has inclined portal posts and diagonals which carry both compressive and tensile forces. The Subdivided Warren variant adds vertical beams to help brace the triangular web system. Warren trusses may also have arched, polygonal upper chords.

Metal truss bridges and viaducts built of iron or wrought iron typically predate the mid-1890s. After that date, most metal trusses were constructed of steel. Steel trusses built during the period between circa 1894 and 1900 were early examples of the use of the material and represent an important transitional type of design and construction. The pin-connected Pratt truss and riveted Warren truss were the most common truss bridges constructed on railroad lines during the late nineteenth and early twentieth centuries.

Movable-Span Bridges

By the early twentieth century, there were three primary movable bridge types in the United States, the swing span, the bascule, and the vertical lift span. Swing spans, which are bridges that pivot in a horizontal plane about a central pier, were developed during the mid-nineteenth century to cross navigable waters. With spans that rotated horizontally, swing-span bridges had unlimited vertical clearance; the central pier, however, created a potential navigation hazard. Because the tall-masted narrow ships common during the mid-nineteenth century required high vertical clearance but not wide navigation channels, swing-span bridges were a suitable solution (Nyman 2002: 1).

By the late nineteenth century, as ships grew larger (i.e. wider) and shifted from sail to steam power (eliminating the tall masts), wider navigation channels than provided by swing spans were needed. In addition, passage of the federal Rivers and Harbors Act of 1890 increased restrictions on obstructions to navigation and required approval by the U.S. Army Corps of Engineers prior to the construction of potential obstructions. As a result, during the early twentieth century, two bridge types, the bascule and vertical lift, became the most common movable bridges. Both types of bridges eliminated the obstruction to navigation caused by the center pier and could open and close more quickly than swing spans, reducing delays to water and land traffic. A bascule bridge has a movable span with a trunnion or a roller on one end, and the span moves in a vertical plane about the trunnion or roller. A variation is the double leaf bascule with a trunnion or roller on both ends and a break in the middle of the span (Hool and Kinne 1943: 1, 20).

In 1872, Squire Whipple patented a small-scale vertical lift bridge designed to cross canals and small streams where high vertical clearance was not required. The first large-scale vertical lift bridge was designed and patented by John Alexander Low Waddell in 1893 to cross the Duluth, Minnesota, ship canal. Although this bridge was not built, Waddell produced a similar design to cross the Chicago River at South Halsted Street in Chicago, and this bridge was built in 1894. This bridge had a 130-foot Pratt truss lift span that could be raised to a height of 155 feet. Although there were flaws in Waddell's initial design, he and John Lyle Harrington would partner to produce much improved designs, resulting in at least 24 bridges built to the designs of Waddell & Harrington during 1907-1914 (Nyman 2002: 6, 13).

The typical vertical lift bridge built during the early twentieth century could be described as:

> "…composed of two towers located on either side of a waterway, with a truss span between. The truss span is lifted by cables that are attached at the ends of the span and run over pulleys [also known as sheaves] at the tops of the towers down to counterweights on vertical runways within the towers. The truss remains in a horizontal position throughout the operating cycle, and can be raised far enough to provide clearance for the largest ships or boat" (Parsons Brinkerhoff and Engineering and Industrial Heritage 2005: 3-121).

Waddell and Harrington were the most prominent designers of vertical lift bridges during the early twentieth century, both during their partnership and with their subsequent firms after Waddell & Harrington dissolved in 1914. Although Waddell and Harrington did not invent the fundamental elements of the bridge type, they adapted the principles for "relatively inexpensive low-level railroad bridges across navigable waterways" (Layton 1976: 697).

J.A.L. Waddell and J.L. Harrington

Waddell was born in Port Hope, Ontario, in 1854, and studied engineering at Rensselaer Polytechnic Institute, graduating in 1875. After a series of jobs, including design work for the Government of Canada, Canadian Pacific Railroad, and a coal mining company in West Virginia, Waddell was hired in about 1880 as the chief engineer of the bridge building firm Raymond & Campbell in Council Bluffs, Iowa. In 1887, Waddell formed his own firm in Kansas City, Missouri, and although initially he often partnered with the Phoenix Bridge Company, after 1892 he worked independently of that firm. Although Waddell is perhaps best known for his pioneering designs for the Duluth ship canal and the South Halsted Street Bridge, he also designed numerous truss, suspension, and arched fixed-span bridges, as well as swing spans and bascules (Nyman 2002: 2-3).

Waddell has been credited with the design of 74 vertical lift bridges (Nyman 2002: 12). During his long career, Waddell was the sole owner or senior partner of numerous firms:

- J.A.L. Waddell (1887-1898)
- Waddell & Hedrick (1899-1907)
- Waddell & Harrington (1907-1914)
- Waddell & Son (1915-1920)
- J.A.L. Waddell (1921-1926)
- Waddell & Hardesty (1927-1945)

After Waddell died in 1938, his last firm continued for another seven years until 1945, when it was reorganized as Hardesty & Hanover.

Harrington was born in Lawrence, Kansas, in 1868 and studied engineering at the University of Kansas, graduating in 1895. Prior to graduation, Harrington completed an internship with Waddell, and the two remained in contact. While working as the chief engineer and manager of the Locomotive and Machine Company in Montreal, Harrington completed a second Bachelor's degree and a Master's degree at McGill University. Although Waddell had designed the first modern vertical lift bridge in 1893, the lift mechanism and other aspects needed improvement. After Harrington replaced Ira Hedrick as Waddell's partner in 1907, he utilized his background in mechanical engineering to develop more successful lift-bridge designs, refining the design of nearly every component and changing from steam to electric power. Together Harrington and Waddell established a successful partnership for the design and construction of bridges, and they were awarded four joint patents between 1909 and 1913 (Brown 1989; Layton 1976: 697).

After Waddell & Harrington dissolved in 1914, Harrington formed the firm of Harrington, Howard & Ash. This firm was very active in bridge design, especially lift bridges, and Harrington was a partner until 1928 when he left to form Harrington & Cortelyou with Frank Cortelyou. This firm continued to operate after Harrington's death in 1942, and it is currently a subsidiary of Burns & McDonnell. In 1928 Harrington's former partners formed the firm Howard, Needles, Tammen & Bergendoff, which became HNTB Corporation (Brown 1989).

3.4.2 Missouri Pacific Railroad

The Missouri Pacific Railroad, originally chartered as the Pacific Railroad in 1849, was one of the first railroads west of the Mississippi River when it began building west from St. Louis in 1851. The Pacific Railroad reached present-day Kansas City in 1865. The railroad struggled financially, however, and in 1872, the company was reorganized as the Missouri Pacific Railway. In 1879, this company was in turn acquired by financier Jay Gould, who owned numerous railroad companies operating in Arkansas, Texas, Louisiana, Nebraska and Colorado.

Another predecessor line to the Missouri Pacific Railroad was the St. Louis, Iron Mountain and Southern Railway (Iron Mountain). Originally chartered as the Cairo and Fulton in Missouri in 1851 and in Arkansas in 1853, the railroad company began building south from St. Louis in 1856 and reached Desoto, Missouri, the following year. Slowed greatly by the Civil War and financial insolvency, the company, reorganized as the St. Louis and Iron Mountain in 1867, finally reached the Missouri-Arkansas state line in 1872. Meanwhile, the Cairo and Fulton in Arkansas reorganized as the Cairo, Arkansas and Texas (CA&T) and completed its line from the Iron Mountain line to Little Rock in 1873 and to Texarkana in 1874. Also in 1874, the CA&T and the St. Louis and Iron Mountain merged to form the St. Louis, Iron Mountain and Southern. Despite the consolidation, the company continued to struggle financially, and in 1880, the Missouri Pacific acquired a controlling interest in the Iron Mountain. Over the next 30 years, the company would continue to operate as the Iron Mountain railroad and would build and acquire a network of lines in Arkansas and Texas (Condren 2014; Hodge 2012).

During the 1870s, multiple smaller independent railroad companies established railroad networks in eastern Texas, and Houston/Galveston became a railroad hub as well as a shipping port. Over the next decade after 1880, the railroad mileage in Texas would nearly triple, from 2,400 miles to over 6,400. In addition, during the 1880s, many of the independent lines were acquired or controlled by outside interests and were consolidated into railroad systems, including the Southern Pacific and the Atchison, Topeka and Santa Fe (Santa Fe). Jay Gould expanded his railroad network into Texas by gaining controlling interest in the Texas and Pacific, the International and Great Northern, and the Missouri, Kansas and Texas, which he then leased to his Missouri and Pacific. Although the leases were terminated by the end of the decade, Gould and his son George maintained control of the lines until the early twentieth century (Werner 2010).

During the early twentieth century, railroad companies built thousands of miles of railroad lines in Texas, reaching a peak of 17,078 in 1932. The Gould system broke up after 1915 when the Missouri Pacific Railway slipped into bankruptcy, and George Gould lost control of the company and the lines it controlled. In 1917, the company was reorganized as the Missouri Pacific Railroad, and the Iron Mountain was formally merged with the new company. During the 1920s, the Missouri Pacific acquired numerous railroads in Texas until, by 1932, 70 percent of the railroad mileage in Texas was controlled by the Missouri Pacific, the Santa Fe, and the Southern Pacific (Werner 2010).

4.0 RESULTS

4.1 Description

The project is the abandonment of a portion of the U.S. Steel Industrial Lead, formerly a Missouri Pacific Railroad corridor in Baytown (see Figure 1). The Cedar Bayou Bridge runs east-west across the Cedar Bayou and its flood plain approximately ¼ mile south of Highway 99.

The railroad corridor crosses the Cedar Bayou with the Cedar Bayou Bridge, a 853-foot long structure consisting of multiple spans, including a vertical lift span with approach spans that, combined, measure 313 feet in length (Figures 3-5). The main span with its lift towers and approach spans were built in 1912 and moved together to the current location in 1967. The vertical lift span consists of a 162-foot, through riveted-steel truss in Warren-with-verticals configuration, flanked by 118-foot steel lift towers. The two deck plate-girder approach spans each measure 75 feet. The main span is supported on concrete piers; the west approach span shares the west pier and rests on a concrete abutment on the west bank, and the east approach span rests on concrete pilings. East of the east approach span, 13 deck plate-girder spans resting on steel I-beam pilings extend 540 feet to an embankment (Figure 6). The decking of all spans consists of wood cross members, and a wood-plank catwalk with steel railing runs along the south side of the deck. The bridge substructure and the 13 deck plate-girder spans were built in 1967 when the Line was constructed. Each 118-foot steel lift tower rests on an approach span and consists of four columns braced together – two vertical front columns and two inclined rear columns (Figure 7). The towers are equipped with concrete counterweights and electric-operated pulleys. The electric motor is housed in a corrugated-steel, gable-roofed shed situated atop the lift-span truss. A shed-roofed maintenance shed is located approximately 50 feet west of the west approach span (Figure 8).

Although the lift mechanism and counterweights were replaced in 1967, the current materials and configuration of the lift system appear to be similar to the original. The operation of the lift span was described in 1912 as follows.

> The lift span will be raised and lowered by eight wire ropes [cables] at each corner, which will pass up and over sheaves at the tops of the towers and are connected to two counterweights of concrete and steel, exactly balancing the span. The operating machinery, which is carried on top of the lift span at the center, consists of four spirally grooved drums, actuated through trains of gears by a gasoline engine. Each drum controls two operating ropes; the one at the top leads over a sheave at the corner of the span, thence downward, and is fastened near the bottom of the tower; the one from the bottom of the drum leads under the same sheave at the corner of the span, thence upward, and is fastened at the top of the tower. All four drums are similarly connected, and when they are revolved in one direction ropes leading to the tops of the towers are wound on and those connected to the bottoms of the towers are wound off, thus raising the span by the lifting force exerted on the corner sheaves. Reversal of direction of revolution of the drums lowers the span. Brakes with automatic stops control the movement of the span, and a hand brake is provided for manual control. The span may also be operated by hand in case of emergency (*Tradesman* 1912: 33).

Figure 3. Cedar Bayou Bridge, Looking South

Figure 4. Cedar Bayou Bridge, Looking South

Figure 5. Cedar Bayou Bridge, Looking Southwest

Figure 6. View of Girder Spans and Lift Tower, Looking Southwest

Figure 7. View of Girder Spans and Lift Tower, Looking West

Figure 8. View of Deck and Lift Tower, Looking East

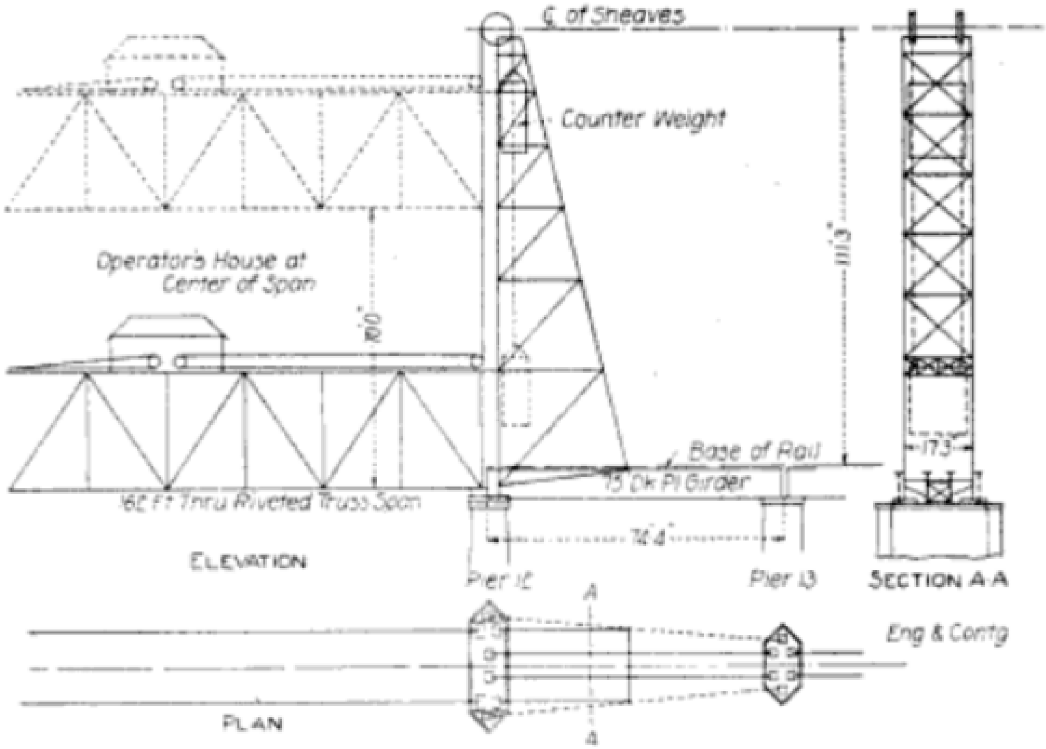
4.2 Historical Background

The Cedar Bayou Bridge includes a vertical lift span that was originally constructed in 1912 over the St. Francis River in Cody, Lee County, Arkansas. The bridge carried a railroad line of the St. Louis, Iron Mountain and Southern Railway (Iron Mountain; Missouri Pacific Railroad after 1917). This railroad line was first contemplated in 1903 to provide a more direct connection to Memphis from the south. By 1911, the railroad had acquired right-of-way and had begun grading for the tracks, but completion of the line was delayed by the St. Francis River crossing. The War Department (Army Corps of Engineers) objected to the bridge's proposed location immediately above a prominent bend in the river, and requested that a new location be chosen. When the railroad appealed, noting that the location had been previously approved and that considerable costs had been incurred, the War Department approved the location with the stipulation that the bridge be a movable span placed at a right angle to the river current (American Railway Engineering Association 1913: 236).

The new Iron Mountain railroad line crossed the St. Francis River between Marianna, Arkansas, and Memphis, Tennessee. During the early twentieth century, the St. Francis River was used by steamers with large tows, principally by the logging industry, which often transported four barges abreast. The proposed location of the Iron Mountain railroad bridge was approximately 30 miles upstream of the confluence with the Mississippi River, and therefore, maintaining shipping was a concern. By utilizing a vertical lift bridge design rather than a swing or bascule span, a wide navigation channel could be retained.

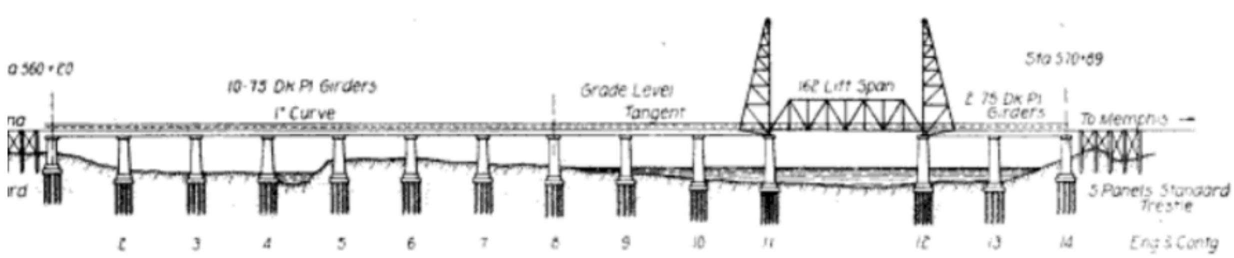
With its controlling interest in the Iron Mountain railroad, the Missouri Pacific Railway Company undertook the planning for the St. Francis River bridge construction, led by its bridge engineer C.E. Smith. The bridge was designed by Waddell & Harrington (see Section 3.4.1 above). The foundation work was completed by the Kansas City Bridge Company, and the bridge was fabricated and erected by the Virginia Bridge & Iron Company (Figure 9).

This vertical lift span bridge, when erected in 1912, consisted of "twelve single track deck plate girder spans, one single track through riveted vertical lift span, with towers, counterweights and operating machinery, all on concrete piers, and trestle approaches at each end" (*Tradesman* 1912: 33) (Figure 10). Each deck plate girder span was 75-feet long and weighed 450 tons. The full length of the bridge was 1,069 feet. The lift span, which rose to 70-feet above the high-water mark, was a 162-foot through riveted truss span, and was a near duplicate of an earlier bridge constructed by the Missouri Pacific, with "light alterations having been made to provide for the necessary attachments" (*Engineering and Contracting* 1913: 327-330). The span was operated by a 25-horsepower gasoline engine. It was typical in earlier vertical lift span bridges to "attach the tail legs of the lifting towers to masonry or to the hips of adjoining truss spans." In order to create a more efficient design without the "extra expense of additional supports or of approach truss spans that would otherwise have been necessary, it was decided to support the tail legs of the towers on cantilever brackets extending out from the approach girders" (*Engineering and Contracting* 1913: 327-330). The design of the vertical lift span would have been appealing to the railroad because it "required relatively simple construction, small foundations, and [had] moderate power requirements" (Nyman 2002).



(Reprinted in *Engineering and Contracting* 1913: 329)

Figure 9. Drawing of Lift Towers, Counterweights, and Lift Mechanism for 1912 Construction



(Reprinted in *Engineering and Contracting* 1913: 328)

Figure 10. Elevation Drawing for 1912 Construction

Although the vertical lift span was rarely put into use, the bridge remained in operation until 1967, when the Missouri Pacific Railroad abandoned its line between Marianna and Memphis. Concurrently, the Missouri Pacific was building a new spur line near Baytown, Texas, to serve the U.S. Steel Texas Works steel mill, which was also under construction. The new steel mill was located on the east side of Cedar Bayou, whereas Baytown and the railroad connections were on the west side. Therefore, to build an industrial spur that would serve the plant, the Missouri Pacific Railroad needed to bridge Cedar Bayou, which was a navigable channel. As described by Missouri Pacific Railroad's chief engineer E.T. Franzen, "[the] spur track that we are building out of Baytown, Tex. required, by ruling of the Corps of Engineers, a high-level crossing or movable span. The high-level crossing was not economical, and fortunately, we had available in a line recently abandoned west of Memphis a 162-ft. lift span" (Franzen 1968: 505-510). Although it would require an 830-mile move of a 260-ton truss span, plus two 75-foot approach girder spans and the 118-foot towers, this move was still less costly than new construction. The spans and towers were floated on barges down the Mississippi River and across the Gulf of Mexico to the new location near Baytown. The lift span and approach spans were erected as part of an 853-foot long bridge.

Although the lift span, approach spans, and towers were moved, some elements of the Cedar Bayou Bridge were built in 1967: the substructure, the spans extending east of the east approach span, the counter weights, and the electric motor and its housing atop the lift span.

In 1982, UP acquired Missouri Pacific, including the spur line serving the U.S. Steel mill, although the merger did not become official until 1997 due to outstanding bonds of the Missouri Pacific. U.S. Steel operated the steel mill until 1986, and another manufacturer operated the mill for two more years. The steel mill shut down permanently in 1988 and was redeveloped as the Cedar Point Industrial Park. The railroad line has been inactive in recent years.

4.3 Evaluation

Bridges were necessary for railroad expansion, and that need was the catalyst for civil engineers to develop the structural mechanics of iron (and later steel) truss bridges during the last half of the nineteenth century. In addition, as railroad lines crossed navigable waterways, a movable span was needed if the crossing would have insufficient clearance for shipping. As discussed in the contexts above, three main types of movable spans developed during the late nineteenth and early twentieth centuries: the swing span; the bascule; and the vertical lift span. Although swing spans were most common during the nineteenth century, bascule and vertical lift generally replaced swing spans after 1910. The firm of Waddell & Harrington was an early leader in the design of vertical lift span bridges and was awarded several patents during the early 1910s.

Although a statewide study of railroad bridges has not been completed in Texas, a study of historic roadway infrastructure provides National Register eligibility requirements for roadway bridges in Texas. In "Historic Road Infrastructure of Texas," it is stated that, "Historically, the majority of movable bridges were located across major rivers and waterways in the eastern part of Texas. All of the major movable span bridges designed by THD [Texas Highway Department] before World War II were constructed over the Sabine River separating Louisiana from Texas" (Jensen 2015: F-257-258). Although this quotation references roadway bridges rather than railroad bridges, it indicates the relative rarity of movable spans in Texas. Regarding vertical lift bridges, this same document highlights only two known extant vertical lift bridges carrying roadways in Texas, and both of them postdate World War II. Although the number of movable bridges in general and vertical lift spans in particular that were built for railroads is not known, it is expected that this property type is rare. In addition to the Cedar Bayou Bridge, one other vertical lift span railroad bridge is known to be extant in Texas, the Neches River Bridge in Beaumont.

"Historic Road Infrastructure of Texas" lists numerous considerations under which bridges may be eligible for listing in the National Register. The Cedar Bayou Bridge appears to meet three of those eligibility considerations: Early Use of a Bridge Type; Design, Fabrication, and Construction; and Period or Method of Construction.

Early Use of Bridge Type

"A bridge may be significant as an early example of its type" (Jensen 2015: F-260). Although the first modern vertical lift bridge was built on Halsted Street in Chicago in 1894, no more are known to have been built until 1909, by which time Waddell & Harrington were correcting the mechanical design flaws of the Halsted Street Bridge. Only nine vertical lift bridges are known to have been built nationwide prior to 1912 (Nyman 2002: 13). Because it was built in 1912, the Cedar Bayou Bridge represents an early example of the vertical lift span bridge type.

Design, Fabrication, and Construction

The significance of a bridge's "design, fabrication, and construction are evaluated by an examination of length, special features or designs, innovations, and standardizations," and one of the indicators of significance is "uncommon bridge type" (Jensen 2015: F-260). The Cedar Bayou Bridge is a vertical lift span, which was an uncommon bridge type when originally constructed in Arkansas and is currently a rare extant example of this type in Texas. Historic context studies, as well as a search of Bridgehunter.com, indicate that the Cedar Bayou Bridge may be the only extant example of a pre-World War II vertical lift span bridge in Texas.

Period or Method of Construction

An indicator of significance for Period or Method of Construction is the construction type of the bridge, specifically a rivet-connected bridge constructed before 1917 (Jensen 2015: F-220). The Cedar Bayou Bridge is an example of a rivet-connected metal truss built before 1917. Although the significance discussion regarding rivet connections is related to roadway bridges in Texas, it is expected that an all-riveted larger truss span would be a transitional, non-standardized design in Arkansas as well as Texas during the early 1910s. The Cedar Bayou Bridge is an early example of this connection type and illustrates the transition from pin-connected to riveted trusses.

Representing the Work of a Master

The Cedar Bayou Bridge was designed by the firm Waddell & Harrington. The firm's principals, J.A.L. Waddell and John Harrington, were prominent bridge engineers and were the foremost designers of vertical lift span bridges during the early twentieth century, both during their partnership in the 1910s and with their subsequent firms during the 1920s and 1930s. Both Waddell and Harrington can be considered master engineers. To be significant in this area, however, a bridge also "should be considered important within a body of work to be considered significant as the work of a master" (Jensen 2015: F-221). Although the Cedar Bayou Bridge was designed by master engineers, it does not appear to be an important design within the body of work of Waddell or Harrington. For example, the first Waddell & Harrington vertical lift span to be built was the Sand Point Bridge, constructed in 1909 in Sand Point, Idaho. Other notable Waddell & Harrington vertical lift spans include: the ASB Bridge, which includes a 245-foot lift span over the Missouri River in Kansas City; Steel Bridge over the Willamette River in Portland, Oregon, whose upper and lower decks lifted independently; and the Penn Lines Railroad Bridge, which featured twin skewed spans over the Calumet River in Chicago (Nyman 2002: 13).

Although the Cedar Bayou Bridge is not significant as the work of a master, the bridge does meet three other areas of significance within the area of Engineering under Criterion C: Early Use of a Bridge Type; Design, Fabrication, and Construction; and Period or Method of Construction.

In addition to National Register Criterion C, the Cedar Bayou Bridge meets Criteria Consideration B: Moved Properties. This consideration states that: "A property removed from its original or historically significant location can be eligible if it is significant primarily for architectural value or it is the surviving property most importantly associated with a historic person or event." As discussed above, the Cedar Bayou Bridge is significant under Criterion C for Engineering.

Because the Cedar Bayou Bridge meets Criterion C, the recommended period of significance is 1912, which is the year that the vertical lift span, lift towers, and approach spans were built.

Integrity

According to "Historic Road Infrastructure of Texas," to meet Criterion C, a bridge should retain the seven aspects of integrity; however, "integrity of design, workmanship, and materials are typically more important because they allow engineered structures to convey their physical features and to characterize the types, periods, or methods of their construction." Furthermore, alterations to a truss' location do not result in the same level of diminished integrity under Criterion C" (Jensen 2015: F-214, 223). Trusses were designed and constructed of prefabricated parts that allowed for relocation of the bridges, and such relocations were common for highway departments and railroads. This document also indicates that bridges significant under Criterion C can still retain overall historic integrity even if they have been moved.

National Register Criteria Consideration B states that: "A moved property significant under Criterion C must retain enough historic features to convey its architectural values and retain integrity of design, materials, workmanship, feeling, and association." Furthermore, "moved properties must still have an orientation, setting, and general environment that are comparable to those of the historic location."

The Cedar Bayou Bridge retains excellent integrity of materials, design, and workmanship in its Warren truss lift span, two lift towers, and plate girder approach spans. These features retain original materials, clearly convey the design principals of a Waddell and Harrington vertical lift span, and illustrate workmanship through their riveted connections. Although the lift machinery and concrete counter weights were replaced when the spans were moved, they appear to be similar to the originals. After the relocation, the bridge remained in use for a railroad crossing a navigable waterway, and therefore, it retains integrity of feeling, association, and setting. Although the bridge is no longer in its original location, this change does not diminish its overall integrity or its ability to convey its historic significance as an early vertical lift bridge, an uncommon bridge type, and an early riveted span.

5.0 SUMMARY AND RECOMMENDATIONS

UP proposes to file with the Surface Transportation Board (STB) for authority to abandon a 2.23-mile portion of the U.S. Steel Industrial Lead (Line) between Milepost 2.4 and Milepost 4.63 in Harris and Chambers Counties, Texas. The proposed abandonment must comply with Section 106 of the National Historic Preservation Act (16 USC 470) and its implementing regulations (36 CFR 800). The UP contracted with Summit to complete a historic resource evaluation of the Cedar Bayou Bridge proposed for abandonment.

Although the Line was built in 1967, the bridge carrying the Line over Cedar Bayou includes a vertical lift span that was originally built in Arkansas in 1912 and moved to its current location in 1967. The railroad line itself is recommended as not eligible for listing in the National Register. The Cedar Bayou Bridge is recommended as eligible for listing in the National Register under Criterion C, as a rare extant example of a vertical lift truss span with lift towers and approach spans dating from the early twentieth century, as well as Criteria Consideration B: Moved Properties.

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July 27, 2016

Andrew Schmidt
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St. Paul, MN 55108

Re: *Project review under Section 106 of the National Historic Preservation Act of 1966, proposed abandonment (demolition) of Union Pacific railroad ROW in Baytown, Jefferson County, Texas (STB/106)*
THC Tracking #201609257

Dear Mr. Schmidt,

Thank you for your correspondence regarding the above referenced project, which we received on July 11, 2016. This letter serves as comment on the proposed undertaking from the State Historic Preservation Officer, the Executive Director of the Texas Historical Commission.

The History Programs Staff, led by Justin Kockritz, has completed its review and determined that the above referenced property is eligible for the National Register under Criterion C and meets Criterion Consideration B. The period of significance for the bridge is 1912.

The Division of Architecture, led by Lydia Woods, has completed its review of the project documentation provided and due to the rarity and significance of this bridge, determined that the demolition of the bridge will have an adverse effect. In order to complete the Section 106 process, we are requesting a condition report of the bridge and an assessment on why demolition would be preferable over keeping the bridge in place. During the Section 106 process you will need to draft an MOA to be approved by the THC. After completion of the MOA we are requesting written evidence that the public has been notified and had a chance to comment on the possible demolition.

Thank you for your cooperation in this federal review process, and for your efforts to preserve the irreplaceable heritage of Texas. We look forward to further consultation with your office and hope to maintain a partnership that fosters effective historic preservation. **If you have any questions concerning our review or if we can be of further assistance, please contact Lydia Woods at 512/463-9122.**

Sincerely,

Lydia Woods, East Texas Project Reviewer
For: Mark Wolfe, State Historic Preservation Officer

MW/lw

Cc: Theresa Goodness, Chair, Jefferson County Historical Commission