NPS Form 10-900
(Rev. 8-86)

1828

OMB No. 1024-0018

United States Department of the Interior
National Park Service

SEP 29 1989

NATIONAL REGISTER

National Register of Historic Places Registration Form

This form is for use in nominating or requesting determinations of eligibility for individual properties or districts. See instructions in *Guidelines for Completing National Register Forms* (National Register Bulletin 16). Complete each item by marking "x" in the appropriate box or by entering the requested information. If an item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, styles, materials, and areas of significance, enter only the categories and subcategories listed in the instructions. For additional space use continuation sheets (Form 10-900a). Type all entries.

1. Name of Property

historic name Seventh Street Improvement Arches

other names/site number Bridge No. 90386, East Seventh Street Bridge

2. Location

street & number E. 7th Street over Burlington Northern right-of-way ☐ not for publication N/A

city, town St. Paul ☐ vicinity N/A

state Minnesota code MN county Ramsey code 123 zip code 55101

3. Classification

Ownership of Property	Category of Property	Number of Resources within Property	
		Contributing	Noncontributing
☒ private	☐ building(s)		buildings
☐ public-local	☐ district		sites
☐ public-State	☐ site	1	structures
☐ public-Federal	☒ structure		objects
	☐ object	1	0 Total

Name of related multiple property listing:
Minnesota Masonry-Arch Highway Bridges, 1870-1945

Number of contributing resources previously listed in the National Register 0

4. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act of 1966, as amended, I hereby certify that this ☒ nomination ☐ request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property ☑ meets ☐ does not meet the National Register criteria. ☐ See continuation sheet.

Nina M. Archabal — 9/22/89

Signature of certifying official Nina M. Archabal — Date

State Historic Preservation Officer

State or Federal agency and bureau Minnesota Historical Society

In my opinion, the property ☐ meets ☐ does not meet the National Register criteria. ☐ See continuation sheet.

Signature of commenting or other official — Date

State or Federal agency and bureau

5. National Park Service Certification

I, hereby, certify that this property is:

☒ entered in the National Register. ☐ See continuation sheet.

Entered in the National Register

Alberta Bryan — 11/6/89

☐ determined eligible for the National Register. ☐ See continuation sheet.

☐ determined not eligible for the National Register.

☐ removed from the National Register.

☐ other, (explain:) _____

for Signature of the Keeper — Date of Action

6. Function or Use

Historic Functions (enter categories from instructions)

Transportation, road-related (vehicular)

Current Functions (enter categories from instructions)

Transportation, road-related (vehicular)

7. Description

Architectural Classification
(enter categories from instructions)

Other: Stone-arch bridge

Materials (enter categories from instructions)

foundation Stone, limestone

walls

roof

other Stone, limestone

Describe present and historic physical appearance.

[x] See continuation sheet

Description: Seventh Street Improvement Arches

Carrying East Seventh Street across an abandoned railroad cut on the eastern edge of downtown St. Paul, the structure is a skewed, double-arched, limestone highway bridge constructed according to the helicoidal, or spiral, method.

Buttressed at each end by perpendicular wing walls, the bridge displays two arches surmounted by a well-defined coping on top of the parapet. Although the ring stones are cut to simulate the appearance of semicircular right arches, the two vaults are of skewed construction with voussoirs laid in helicoidal, or spiral, courses. The east arch measures 41 feet in oblique span, with a spring line about 9 feet above grade. The west arch is 11 feet shorter; it springs about 12 feet above grade.[1] Originally, the west arch accommodated 3 railroad tracks; the east arch 2 tracks. All trackage has been removed. Measuring 124 feet in width, the bridge supports at least 15 feet of earth fill surmounted by a concrete trestle, which, in turn, carries a four-lane black-top roadway and concrete sidewalks bordered by metal railings with concrete balusters. The trestle was constructed when the roadway was widened in 1930.[2] These alterations do not significantly affect the original design.

The bridge features 2 types of limestone: a locally quarried grey stone that was widely used in nineteenth-century St. Paul for foundation work, and a finer-grained, buff-colored stone from Mankato, Minnesota that was shipped throughout the state for a variety of building purposes.[3] The abutments, pier, and wing walls are built of the local material; the voussoirs, ring stones, coping and spandrel walls are of Mankato stone. All stonework is rock-faced, coursed-ashlar masonry with one-half-inch joints. By way of embellishment, intradosal surfaces are bush hammered and ring stones have tooled margins on top and bottom. The center pier also has a rounded, ornamental cutwater.

Notes

1. Plans of Seventh Street Improvement, unpublished, 1883, St. Paul City Engineer's Office.

2. Plan of "Trestle on South Side of East Seventh Street," unpublished, 1930, St. Paul City Engineer's Office.

3. W.A. Truesdell, "The Seventh Street Improvement Arches." Association of Engineering Societies Journal, 5 (July 1886), 322.

8. Statement of Significance

Certifying official has considered the significance of this property in relation to other properties:

☐ nationally ☒ statewide ☐ locally

Applicable National Register Criteria ☐ A ☐ B ☒ C ☐ D

Criteria Considerations (Exceptions) ☐ A ☐ B ☐ C ☐ D ☐ E ☐ F ☐ G

Areas of Significance (enter categories from instructions)	Period of Significance	Significant Dates
Engineering	1884	1884

Cultural Affiliation: N/A

Significant Person: N/A

Architect/Builder: Engineer: Truesdell, William Albert
Builders: O'Brien, Michael; McArthur Brothers

State significance of property, and justify criteria, criteria considerations, and areas and periods of significance noted above.

☒ See continuation sheet

The Seventh Street Improvement Arches embody engineering significance in the context of Minnesota masonry-arch highway bridges constructed during the period 1870 to 1945. Completed in 1884, the structure is notable for the rare and technically demanding nature of its skewed, helicoidal, stone-arch design. At the time of its construction, the bridge was thought to be one of the few of its type in the United States, and it is the only known example in Minnesota.

In February 1883, the Minnesota State Legislature authorized the City of St. Paul to issue bonds for the improvement of Seventh Street where it crossed the combined valley of Trout Brook and Phalen Creek, linking the downtown district with Dayton's Bluff to the east. Characterized as "the heaviest piece of public work ever attempted in that city," the project called for the construction of 4 major elements: a roadway embankment measuring 80 feet in height, 640-feet in length, and 66 feet in width; a stone-arch sewer, 320 feet in length, for the enclosure of Phalen Creek; a 300-foot-span iron bridge across the tracks of the Northern Pacific Railway; and a double-arch stone bridge at the crossing of the St. Paul and Duluth Railway. In the opinion of the contemporary engineering press, the stone-arch bridge was "the most interesting part."[1]

Originally known as the Seventh Street Improvement Arches, the structure was designed in the summer of 1883 by 38-year-old William Albert Truesdell, who had been hired by the City of St. Paul Engineer's Office to supervise the entire Seventh Street Improvement.[2] Raised on a farm in Wautoma, Wisconsin, Truesdell had studied engineering at the University of Wisconsin, receiving an undergraduate degree in 1867. After enduring "rather lean times" as a school teacher and a surveyor, he joined the engineering staff of the St. Paul, Minneapolis and Manitoba Railway in 1880. Except for occasional special projects -- such as his work on the Seventh Street Improvement -- he remained with that line and its successor, the Great Northern Railway, for the remainder of his career. During his years with the railroad, Truesdell was involved with "all lines of construction," often serving as an inspecting engineer. The Seventh Street Improvement Arches represent the only documented example of his design work.[3]

The construction of the Seventh Street Improvement Arches presented a number of challenges. Since Seventh Street intersected the St. Paul and Duluth Railway right-of-way at a 63-degree angle, the bridge required a skewed, or "oblique," design, which, even under ideal conditions, placed extra demands on engineer, stonecutter, and mason alike. As Truedell noted, the ordinary problems of skewed construction were compounded by the fact that "nothing of this kind had ever been built in this western country," so that "very few of our masons in St. Paul had ever seen one, and no one knew anything about the stone-cutting necessary."[4]

Truesdell was aware that most American skewed stone-arch bridges were built according to the ribbed-arch method, which utilized "a number of short right arches or ribs in contact with each other, each successive rib being placed a little to one side of its neighbor."[5] Although such a design might have been suitable for a simple highway

Significance Con't.: Seventh Street Improvement Arches

bridge, the Seventh Street Arches were intended not only to carry pedestrian and vehicular traffic, but also sewer and water pipes, which required a substantial layer of fill. As Truesdell later explained: "The ribbed arch plan was first considered, and then rejected. Such a structure would have been unstable for this locality on account of the great weight of earth the arches would have to sustain. The stones of one rib could not be bonded into those of the next rib." Truesdell next considered the classical French method of skewed construction, where the voussoirs are custom cut in a variety of shapes to fit the configuration of the arch. "The voussoirs of such an arch," he concluded, "could never have been cut in this locality. It would have required a great number of patterns and the cost of such a work would have been beyond all consideration."[6]

One alternative still remained: the helicoidal, or spiral, method. Introduced by the English architect and mathematician Peter Nicholson in 1828, the method was explained with clarity and precision by the English engineer George Watson Buck, whose Essay on Oblique Bridges, first published in 1839, went through 3 editions by 1880.[7] In the United States, the helicoidal arch seems to have been little studied and less understood. When an American writer, in 1886, attempted to clear away "the confusion and misunderstanding" surrounding the subject, he noted that "the general opinion has arisen, that helicoidal arches are of the most intricate construction, and too often their consideration has been abandoned with disgust."[8] Truesdell, however, was equal to the challenge of the helicoidal method. According to his biographer, he was imbued with "the desire to go the beginning of things" and studied mathematics as a hobby.[9] When he himself discussed his work on the Seven Street Arches, he passed over the technical difficulties of helicoidal design, remarking only that "very few have ever been built in this country."[10]

In the traditional helicoidal method adopted by Truesdell, the voussoirs are cut with curved surfaces so that they form a series of parallel spiral courses. As Truesdell explained, each spiral is "generated by a straight line which intersects the axis of the arch, and is continually at right angles with it, and which moves uniformly along that axis and at the same time revolves uniformly around it."[11] Although the initial calculation and cutting of the curves are difficult, the helicoidal method has one overriding advantage: all the voussoirs (with the exception of the ring stones) are of the same size and shape so "that one set of patterns answers for all . . . and when the stone-cutters are once taught to cut a stone no further difficulty is encountered."[12] On the Seventh Street Arches, the voussoir stones were quarried and cut at the quarry of W. D. Craig and Company in Mankato, Minnesota. According to Truesdell, "the only difficulty . . . was in making the stone-cutters understand the importance of accurate and careful work with the patterns instead of the ordinary work to which they had been accustomed. This was overcome by placing an intelligent and trustworthy foremen [, Mr. Thomas Russell,] in charge of all stone-cutters."[13]

Significance Con't.: Seventh Street Improvement Arches

Construction of the Seventh Street Arches began in September 1883, with Michael O'Brien of St. Paul serving as general contractor for excavation, foundations, and abutments. After O'Brien's work was completed in June 1884, the project passed to McArthur Brothers of Chicago as part of a general contract for the Seventh Street Improvement. In late November, the Chicago firm finished the masonry work and began grading the roadway over the arches, which opened for traffic on December 18, 1884.[14] Although the significance of the Seventh Street Improvement faded from popular consciousness, Truesdell's professional colleagues remembered his achievement. On his death in 1909, the Association of Engineering Societies Journal characterized the Seventh Street Improvement Arches as "the most important piece of masonry in the city."[15]

Notes

1. "The Arches of the Seventh Street Improvement, St. Paul, Minn.," Engineering News and American Contract Journal, 14 (October 17, 1885), 245.

2. W. A. Truesdell, "The Seventh Street Improvement Arches," Association of Engineering Societies Journal, 5 (July 1886), 317.

3. All biographical information is derived from Truesdell's obituary in Association of Engineering Societies Journal, 28 (June 1909), 369-371. The earliest description of the stone-arch bridge clearly states that the structure was "designed by and erected under the supervision of Mr. W. A. Truesdell"; see "The Arches of the Seventh Street Improvement," 245. Only Truesdell's name appears on an original plan of the structure, dated July 1883, in the City of St. Paul Engineer's Office.

4. Truesdell, 318.

5. Ira O. Baker, A Treatise on Masonry Construction (New York: John Wiley and Sons, 1900), p. 442.

6. Truesdell, 318.

7. George Watson Buck, A Practical Essay on Oblique Bridges (London: Crosby Lockwood and Co., 1880). A brief historical discussion of the helicoidal method is found in Edward Dobson, Rudimentary Treatise on Masonry and Stone Cutting (London: John Weale, 1859), pp. 28-32.

8. John L. Culley, "Treatise on the Theory of the Construction of Helicoidal Oblique Arches," Van Nostrand's Engineering Magazine, 208 (April 1886), 265.

Significance Con't.: Seventh Street Improvement Arches

Notes Con't.

9. Obituary, Association of Engineering Societies Journal, 370-371.

10. Truesdell, 318.

11. Truesdell, 318.

12. Truesdell, 318. Dobson, who described several techniques for constructing a spiral arch, characterized Truesdell's approach as "the ordinary method"; see pp. 28-29, and especially Plates 2 and 3.

13. Truesdell, 321.

14. Truesdell, 321-322.

15. Obituary, Association of Engineering Societies Journal, 28 (June 1909), 370.

9. Major Bibliographical References

☒ See continuation sheet

Previous documentation on file (NPS):

- ☐ preliminary determination of individual listing (36 CFR 67) has been requested
- ☐ previously listed in the National Register
- ☐ previously determined eligible by the National Register
- ☐ designated a National Historic Landmark
- ☐ recorded by Historic American Buildings Survey # _____
- ☐ recorded by Historic American Engineering Record # _____

Primary location of additional data:

- ☒ State historic preservation office
- ☐ Other State agency
- ☐ Federal agency
- ☐ Local government
- ☐ University
- ☐ Other

Specify repository: _____

10. Geographical Data

Acreage of property Less than 1 acre

UTM References

	Zone	Easting	Northing
A	15	493920	4970910
B			
C			
D			

☐ See continuation sheet

Verbal Boundary Description

The nominated property consists of a rectangle measuring 90 feet east-west and 272 feet north-south, whose northeast and southwest vertices coincide with the outside corners of the bridge's northeast and southwest wing walls.

☐ See continuation sheet

Boundary Justification

Based on measurements derived from the original bridge plans in the City of St. Paul Bridge Department, the boundaries enclose the bridge's superstructure and substructure, including wing walls.

☐ See continuation sheet

11. Form Prepared By

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United States Department of the Interior
National Park Service

National Register of Historic Places Continuation Sheet

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Bibliography: Seventh Street Improvement Arches

"The Arches of the Seventh Street Improvement, St. Paul, Minn." Engineering News and American Contract Journal, 14 (October 17, 1885), 245.

Baker, Ira O. A Treatise on Masonry Construction. New York: John Wiley and Sons, 1900.

Buck, George Watson. A Practical Essay on Oblique Bridges. London: rCrosby Lockwood and Co., 1880.

Culley, John L. "Treatise on the Theory of the Construction of Helicoidal Oblique Arches." Van Nostrand's Engineering Magazine, 208 (April 1886), 265-272.

Dobson, Edward. Rudimentary Treatise on Masonry and Stone Cutting. London: John Weale, 1859.

Truesdell, W[illiam] A[lbert]. Plan of the Seventh Streeth Improvement Arches, July 1883. Unpublished. City of St. Paul Engineer's Office.

_____. "The Seventh Street Improvement Arches." Association of Engineering Societies Journal, 5 (July 1886), 317-342.

"William Albert Truesdell." Association of Engineering Societies Journal, 28 (June 1909), 369-371. plan of the structure, dated July 1883, in the City of St. Paul Engineer's Office.