NPS Form 10-900
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(Approved 3/87)

OMB No. 1024-0018

United States Department of the Interior
National Park Service

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. Use letter quality printer in 12 pitch, using an 85 space line and a 10 space left margin. Use only archival paper (20 pound, acid free paper with a 2% alkaline reserve).

1. Name of Property

historic name: Smyth Road Bridge

other names/site number: Beyer Bridge

2. Location

street & number: Smyth Road over North Branch of the Oconto River — N/A not for publication

city, town: Town of Lakewood — N/A vicinity

state: Wisconsin code: WI county: Oconto code: 083 zip code: 54138

3. Classification

Ownership of Property	Category of Property	No. of Resources within Property	
		contributing	noncontributing
____ private	____ building(s)		
x public-local	____ district	____	____ buildings
____ public-State	____ site	____	____ sites
____ public-Federal	X structure	1	____ structures
	____ object	____	____ objects
		1	0 Total

Name of related multiple property listing:
N/A

No. of contributing resources previously listed in the National Register 0

Smyth Road Bridge
Name of Property

Oconto County, Wisconsin
County and State

4. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act of 1966, as amended, I hereby certify that this _X_ 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 _X_ meets ___ does not meet the National Register criteria. ___ See continuation sheet.

Signature of certifying official — Date: 8/7/96

State Historic Preservation Officer-WI

State or Federal agency and bureau

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

Signature of commenting official/title — Date

Division of Historic Preservation
State Historical Society
816 State Street
Madison, WI 53703
(608) 264-6500

5. National Park Service Certification

_✓_ entered in the National Register
See continuation sheet — Edson H. Beall — 9.12.96

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

Entered in the National Register

___ determined not eligible for the National Register.

___ removed from the National Register.

___ other, (explain):

for Signature of the Keeper — Date

6. Functions or Use

Historic Functions (enter categories from instructions)	Current Functions (enter categories from instructions)
TRANSPORTATION/road-related (vehicular)	TRANSPORTATION/road-related (vehicular)

7. Description

Architectural Classification (enter categories from instructions)	Materials (enter categories from instructions)	
Other: Overhead Pratt Truss	foundation	CONCRETE
	walls	N/A
	roof	N/A
	other	STEEL

Describe present and historic physical appearance.

Description

The Smyth Road Bridge, located in the town of Lakewood in Oconto County, spans the north branch of the Oconto River. The single-span, overhead Pratt truss bridge was constructed in 1928 to serve as a vehicular traffic crossing. Upon construction, the bridge was near the community of Lakewood. The predominantly northern hardwood forest area has become the Nicolet National Forest, and the bridge continues to serve vehicular traffic within the boundaries of the forest.

The Smyth Road Bridge, also known as the Beyer Bridge, is a steel, six-panel, rigid-connected overhead Pratt truss. The bridge has a 90-foot span and an overall length of 93 feet. The roadway width is 23 feet, and the bridge's total width is 26 feet. The Smyth Road Bridge utilized field-riveted connections. The structural members of the bridge are standard, rolled-steel components. The portal of the bridge features single-angle sections connected with V-lacing and reinforced with gusset plates. Vertical members are paired channel sections connected with V-lacing. Diagonal members are paired angle sections tied with batten plates. The top chord and endposts are parallel channels tied with batten plates and V-lacing. Lateral bracing features back-to-back angles connected with V-lacing and reinforced with single angles. These members are connected with riveted gusset plates. The bottom chord is located below the deck and also features paired angle sections connected with batten plates.

The bridge's abutments, piers, and wing walls are concrete, and its deck surface is reinforced concrete set on rolled, I-beam stringers, supported by rolled, I-beam floor beams. The bridge rests on rocker bearings. Each side of the roadway features a steel railing of X-lacing between angle sections.

Integrity

The Smyth Road Bridge is essentially unaltered from its historic appearance. The bridge retains integrity of design, location, setting, and materials, because neither the structure or its physical surroundings have been significantly altered. The bridge continues to be used as a vehicular crossing. The bridge and its surrounding area have been encompassed within the boundaries of the Nicolet National Forest. The present location of the bridge within the forest boundaries has allowed for the retention of its historically rural setting.

8. Statement of Significance

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

____ nationally ____ statewide x locally

Applicable National Register Criteria ___ A ___ B _X_ 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	1928	1928
	Cultural Affiliation	
	N/A	

Significant Person	Architect/Builder
N/A	Wisconsin Highway Commission/Designer Milwaukee Bridge Company/Fabricator Garvey-Eyenberg Construction Company/Contractor

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

Statement of Significance

The Smyth Road Bridge, or Beyer Bridge, is eligible for the National Register of Historic Places under **Criterion C**, in the area of **Engineering**. Fabricated by the Milwaukee Bridge Company, the Smyth Road Bridge is an excellent example of a 1920s standard overhead truss abundantly used by the Wisconsin State Highway Commission (SHC). Designed by the SHC, the bridge's plan was adapted from a standard 1920s design, which had been a revision of a 1914 plan. The 1920s plan became a standard plan used for bridge construction throughout the state. The bridge is eligible at the local level.

_X_ See continuation sheet

According to the 1981 state wide truss bridge survey, there were 317 existing Pratt trusses in Wisconsin, 123 of which were overhead truss bridges, and of these, twenty were constructed between 1926 and 1931.[1] The Historic Bridge Advisory Committee (HBAC) identified the Smyth Road Bridge as the best surviving example of a Pratt overhead truss constructed between 1926 and 1931. In September 1993, a review of the Wisconsin Department of Transportation bridge files found that the twenty overhead truss bridges dating from this period were extant, but replacement projects were scheduled for three bridges. Typically, this era of truss bridges is characterized by heavier truss elements with members connected by riveted gusset plates. Built by the Milwaukee Bridge Company, a significant regional bridge fabricator, this bridge is characteristic in design and construction of typical bridges of this period.

Historic Setting

Two natural resources, water and timber, encouraged settlement of Oconto County in northeastern Wisconsin. Leasing land from the Menominee Indians, the county's first inhabitants, John P. Arndt and Ebenezer Childs of Fort Howard, erected a mill on the Pensaukee River in 1827. Oconto County, which was settled as early as 1835, was organized in 1851, only three years following statehood.[2] The county's population a year after it was organized was 452 and more than tripled in three years, with the population reaching 1,501 in 1855. But perhaps the most significant jump occurred from 1855 to 1890 when increased growth led to a population of 15,009.[3] Development of the county began quickly with the first state highway in the county in 1855. The highway replaced an old winding Native American trail, which led from Marinette, then part of Oconto County, through Peshtigo, Oconto, Pensaukee, Oak Orchard, and Suamico to Walnut Street in Green Bay.[4] Boundaries of the county were changed often in the mid-to-late-19th century, and it was not until 1885 when Oconto County was reduced to its current size, which is about 1/5 of its original size.

The abundance of lumber and natural water systems fostered the construction of mills on many of the important streams within the county. The lumber was shipped to markets in Milwaukee and Chicago. Often, the erection of a mill became a nucleus for settlement. A new mill was built on the Pensaukee River in 1837 by Isiah Powell, and prior to 1850 a steam mill was also erected on the site. The community of Pensaukee became a prosperous lumber mill town in the county.[5] The city of Oconto was also successful and became the county seat. The community of

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[1] Barbara Wyatt, ed. Cultural Resource Management in Wisconsin Volume 2 (Madison, Wisc.: State Historic Preservation Office, 1986), 12-1 - 12-16.

[2] William Benjamin Henry, "History of Oconto County," (Master's Thesis, University of Wisconsin-Madison, 1921), p. 2.

[3] Henry, p. 29.

[4] George E. Hall, Would You Believe It (Oconto Falls, WI: Herald Publishing Co., 1951), p. 21.

[5] Hall, p. 15.

Lakewood, in the northern part of the county, was the site of one of the county's most prominent mills. The Holt and Balcom Lumber Company was established circa 1880 on the banks of McCauslin Brook in Lakewood.[6] In addition to lumber, Oconto County also prospered from its farming industry, especially dairy. A large number of creameries and cheese factories were historically located within the county.[7]

The community of Lakewood had remained attached to Brown County for judicial purposes until 1857.[8] By 1897 the railroad serviced Lakewood, and the town was laid out by the Western Town Lot Company.[9] The 1903 Wisconsin State Gazetteer reported that Lakewood was the site of a post office, general store, and hotel.[10] By 1911 the population of Lakewood reached 80, and the community was home to three saloons, a hotel, post office and mercantile company. The community's population declined to 58 in 1913, but by 1915 it nearly doubled to 100.[11] In 1918, the community was enhanced by the services of a physician, Dr. D. J. Davis, and the establishment of both Catholic and Congregational churches. Lakewood's population of 140 in 1925 supported a post office, restaurant, hotel and mercantile company.[12] A fire through the community in 1921 burned many frame buildings, and the hotel was replaced with a brick structure. The community is currently within the boundaries of the Nicolet National Forest. Some 60 lakes and 300 miles of trout streams are located within a six-mile radius of Lakewood.[13]

Smyth Road Bridge

The Smyth Road Bridge plans were completed in January of 1928, and the bridge was constructed the same year. The single-span, Pratt overhead truss was designed by the Wisconsin State Highway Commission (SHC). The plan, A-90-24, was a 1920s revision of the 1914 standardized state plan. The bridge was necessary to provide a crossing

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[6] Hall, p. 33-34.

[7] Hall, p. 55.

[8] Henry, p. 24.

[9] Robert Gard and L.G. Sorden, The Romance of Wisconsin Place Names (Minocqua, WI: Heartland Press, 1988), p. 150.

[10] Wisconsin State Gazetteer and Business Directory 1903-1904 (Chicago, Ill.: R.L. Polk and Co., 1903), p. 556.

[11] Wisconsin State Gazetteer and Business Directory 1913-1914 (Chicago, Ill.: R.L. Polk and Co., 1913) 443 and Wisconsin State Gazetteer and Business Directory 1915-1916 (Chicago, Ill.: R.L. Polk and Co., 1915), p. 437.

[12] Wisconsin State Gazetteer and Business Directory 1918-1919 (Chicago, Ill.: R.L. Polk and Co., 1918), p. 496.

[13] Abbie Jane Hood, ed., Oconto County Centennial Magazine (Oconto, Wisc.: The Oconto County Reporter, 1984).

of the north branch of the Oconto River along Smyth Road and it continues to carry traffic. The Smyth Road Bridge was fabricated by the Milwaukee Bridge Company and was constructed by Garvey-Weyenberg Construction Company.

Design and Engineering

A historic context for bridges in Wisconsin has been developed by Wisconsin Department of Transportation historian, Robert S. Newbery, and is excerpted below.

There are three essential aspects of a truss. First, a truss is a combination of relatively small members which are "framed or jointed...to act as a beam."[14] Second, each component member is subjected only to tension or compression. (Tensile forces tend to stretch or elongate a member, while compressive forces tend to push or compress a member.) Third, the component members of the truss are configured in triangles, because "the triangle is the only geometrical figure in which the form is changed only by changing the lengths of the sides."[15] In other words, the triangle remains rigid until the forces applied distort or break the material used in the components.[16]

A truss bridge consists of two trusses, each with a top chord, bottom chord, and endposts. The space enclosed by these members is called the web. The web members reinforce the truss. The particular arrangement of the web members was the subject of much study in the mid- and late-nineteenth century, and different names were given to trusses with different web configurations. The two types of trusses most frequently used in Wisconsin were the Pratt and the Warren.

Truss bridges are generally divided into three categories: pony (or low) trusses, overhead (or through) trusses, and deck trusses.[17] Both pony and overhead trusses carry the traffic between the trusses and the roadway, either at or near the bottom chord of the trusses. A deck truss carries the roadway at or near the top chord; thus the roadway is on top of the trusses.

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[14]J. B. Johnson, C. W. Bryan, and F. E. Turneaure, The Theory and Practice of Modern Framed Structures (8th ed.; New York: Wiley & Sons, Inc., 1905), p. 3. Hereafter cited as *Johnson*. In other words, the "assemblage had rigidity and behaved as a unit." Ellis L. Armstrong, History of Public Works in the United States, 1776-1976 (American Public Works Association, 1976), p. 109.

[15]Milo S. Ketchum, The Design of Highway Bridges and the Calculation of Stresses in Bridge Trusses (New York: McGraw-Hill, 1908), p. 1.

[16]A rectangle, on the other hand, can become a parallelogram as everyone with a sagging screen door knows. The common solution to the sagging door is to run a small rod diagonally across it, thus creating two triangles. The resulting figure looks remarkably like one panel of a nineteenth century Pratt truss.

[17]T. Allen Comp and Donald Jackson, "Bridge Truss Types: A Guide to Dating and Identifying." American Association for State and Local History, Technical Leaflet 95, History News, 32 (May, 1977), pp. 5-11.

Materials

The relative merits of cast- versus wrought-iron for bridge construction were still being debated in the late-nineteenth century, when the first surge of building truss bridges began in Wisconsin. Because cast-iron is brittle, it is subject to sudden and dramatic failure. Thus, it was "an unsatisfactory material for bridges, and quite a number of failures occurred."[18] Shunned for a time in the United States in the 1850s, cast-iron bridges made a comeback, and then only "gradually, but stubbornly," fell out of favor.[19] As late as 1870, one bridge engineer wrote that "the rigidity of cast-iron is the very quality needed in a compression member." Moreover, as the quality of casting in the United States was excellent, "nothing can be found that will compare with cast-iron for resisting strains of compression either in reliability or in cost."[20]

Before the issue of cast- versus wrought-iron had been completely resolved, a new material entered the picture: steel. Steel was not a newly discovered material, of course, but high cost and small output had limited its use mainly to the manufacture of tools. The Bessemer and Siemens-Martin processes reduced the cost and greatly improved the quantity of structural steel available.[21] Steel was used for special purposes and special bridges beginning with the Eads Bridge in St. Louis in 1874. From the late 1880s to the early 1890s, structural shapes (beams and columns) were rolled in both wrought-iron and steel by the major manufacturers. The qualities of wrought-iron and steel remained controversial until the turn of the century, and engineers continued to debate the relative merits of the two metals.[22] Nevertheless, steel was the predominant if not exclusive structural material for

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[18]James A. L. Waddell, Bridge Engineering (New York: J. Wiley & Sons, 1925), p. 16. Hereafter cited as *Waddell (1925)*.

[19]Theodore Cooper, "The Use of Steel for Bridges, " Transactions of the American Society of Civil Engineers, VIII (Oct. 1879), 265. Important railroad bridges in the United States were built of cast-iron in the 1870s and thousands of short span cast-iron girder bridges were still in use on the railroads in England and Wales as late as 1896 (*Waddell (1925)*, pp. 17, 24); Henry Grattan Tyrrell, History of Bridge Engineering: From the Earliest Times to the Present Day (Chicago: By the author, 1911), p. 151.

[20]Captain William E. Merrill, Iron Truss Bridges for Railroads (New York, 1870), p. 126.

[21]Bessemer's initial claim that tons, rather than pounds, could be mass-produced was met with skepticism. After early disappointments, however, this proved true. Douglas A. Fisher, The Epic of Steel (New York: Harper & Row, 1963), p. 117. Hereafter cited as *Fisher*.

[22]David Plowden, Bridges: The Spans of North America (New York and London: W. W. Norton & Co., 1974), pp. 125-7; *Fisher*, p. 103; Herbert W. Ferris, ed., Rolled Shapes: Historical Record--Dimensions and Properties--Steel and Wrought-iron Beams and Columns (New York: American Institute of Steel Construction, 1953).

bridges by the mid-1890s. Although some bridge-building companies continued to advertise bridges built of either metal as late as 1900, after 1892 wrought-iron structural shapes were no longer being produced.[23]

In the twentieth century, the continued development of steel focused on alloys. James A.L. Waddell devoted an entire chapter to alloy steels in his 1916 textbook and its 1921 sequel.[24] By 1921, one English engineer indicated that developments since the turn of the century had made both the "mild" steel of the 1890s and wrought-iron old fashioned. Both the engineer and the metallurgist developed an increasingly sophisticated understanding of the variations that resulted from changes in the chemical composition, heat treatment, macrostructure, and microstructure.[25] Because the major advantages of alloy steels are most applicable to very long span bridges and bridges having welded connections—the latter feature not becoming common until after World War II—it is assumed that metallurgical developments were not a major concern for bridge engineers designing modest rural bridges such as the ones that predominated in Wisconsin.[26]

Historical Context

On Wisconsin highways, the predominance of metal-truss bridges for crossings of all lengths seems to have lasted from about 1890 to 1910. Trusses remained an important bridge type in Wisconsin until the advent of World War II, but after 1910, most short crossings (less than 35 feet) employed girder, beam, or slab spans of steel and/or concrete. The SHC, established in 1911 to improve the quality of road and bridge construction in the state, was particularly enthusiastic about using concrete for culverts and small bridges.[27]

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[23]A number of companies, including Wisconsin Bridge and Iron, continued to advertise both iron and steel bridge until the turn of the century. See the advertisements for Wisconsin Bridge and Iron Company, in Polk's Wisconsin State Gazetteer and Business Directory, 1895-96, p. 687; and for Wrought-iron Bridge Company in Cassier's Magazine, 17:6 (1900), pp. 25-26. On the page opposite the Wrought-iron advertisement, the Berlin Iron Bridge Company prominently advertised only "Steel Bridges and Buildings."

[24]*Waddell (1925)*, Chapter IV, "Alloy Steels"; and James Waddell, Economics of Bridgework: A Sequel to Bridge Engineering (New York: J. Wiley & Sons, 1921), Chapter V, "Economics of Alloy Steels." Hereafter cited as *Waddell (1921)*.

[25]Leslie Aitchison, Engineering Steels (London: MacDonald, 1953), p. vii; W. E. Dalby, Strength and Structure of Steel and Other Metals (London: E. Arnold, 1923) relies on three sophisticated laboratory instruments designed and developed by the author. A brief overview of twentieth century structural steels is in Edwin H. Gaylord and Charles N. Gaylord, Design of Steel Structures (New York: McGraw-Hill, 1957), pp. 43-46.

[26]Although the Biennial Reports were not sophisticated in their engineering discussions, they did highlight new techniques and designs. The lack of any mention of metallurgy in the Biennial Reports is taken as a measure of a lack of priority.

[27]Hans Nelson Brue, "The Development of Highway Bridges in Wisconsin" (unpublished thesis, University of Wisconsin, 1916) pp. 4-5. The historical record is sketchy here, and there is no reliable census of bridges by type for this period. The 1880s and 1890s saw a large number of metal trusses built, often with some controversy of the higher first cost when compared to the familiar old wooden bridge. It was not just a phenomenon of the late nineteenth century. Simple wood beam, beam-and-pier, and truss bridges were recommended for the cost-conscious land owner in Frederick S. Langa, "Bridge Your Way to a Low-Cost Lot," Rodale's New Shelter (April 1981) pp. 66-75.

The "bowstring" truss bridge may have been the state's first, common, all-metal truss configuration. Nationwide, thousands were apparently built, but the popularity of this design in Wisconsin is difficult to determine.[28] Although records of a number of them exist, none remain on Wisconsin highways. Seven are preserved in parks and wildlife refuges.[29]

The two truss designs that came to dominate highway bridge construction by the late nineteenth century were the Warren and the Pratt. The Warren truss was patented by two British engineers in 1840. In this design, the vertical members handle only nominal stress, while the diagonals serve as both tension and compression members. The vertical members, like the diagonals, were usually paired angles, but of smaller dimension. In Wisconsin, Warren trusses are by far the most common type of highway truss, having been promoted by the SHC after 1911. Of the approximately 450 Warren trusses in Wisconsin in 1980, over four-fifths were riveted pony trusses built according to SHC standard plans.[30]

The Pratt truss, patented by Caleb and Thomas Pratt in 1844, features vertical compression members and diagonal tension members. Although originally built as a combination bridge, the Pratt truss was not as efficient in that form as the Howe. As an all-metal bridge, however, the Pratt had the advantage because it used less iron and was easier to erect. The oldest existing truss bridge in Wisconsin, the 1877 White River Bridge in Burlington, is a Pratt.[31]

During the 1870s, an important variation of the Pratt design was introduced for long-span bridges. Because the depth of truss required in the center of a bridge is greater than at the abutments, a considerable amount of material can be saved on a long-span structure by "bending" the top chord into a polygonal configuration known as a "Parker" truss. If the top chord has exactly five sides, the bridge, by convention, is called a "camelback" truss. The addition of substruts and/or subties makes a Pratt into a Baltimore and a Parker into a Pennsylvania.[32]

The development of the Pratt and its variations was influenced by a debate over the merits of pin connections versus riveted connections for main truss members. Proponents of riveted bridges usually cited the advantages of increased structural rigidity and the reduction of damaging vibrations. In pin-connected bridges, vibrations caused the pin to grind on the eye-bar, thus enlarging the pin hole. Advocates of pin-connected bridges, on the other hand, emphasized the theoretically correct distribution of stresses and the smaller amount of metal required and criticized

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[28]Diane Kromm, "Milford Bridge," (HAER No. WI-21), Historic American Engineering Record Report, unpublished, 1987. Hereafter cited as *Kromm*.

[29]Oconomowoc City Clerk Records, 1871, unprocessed collection, Archives Division, SHSW; *Kromm*, pp. 2-4.

[30]Comp and Jackson; Working Files, HBAC. Hereafter cited as *Comp*.

[31]*Comp*. A few all-metal Howe trusses were built, including, apparently, one built in Watertown in 1875. *Kromm*, p. 2.

[32]*Comp*.

the difficulty of ensuring that a riveted joint was properly fabricated, especially in the field. The pin-connected bridge, they argued, was the reason why Americans surpassed the rest of the world in bridge building.[33]

The issue of pin versus riveted connections was complicated by practical factors, including machinery, tools, and power sources, both in the shop and in the field. The debate also was easily sidetracked by tangential issues as, for example, when some commentators denied that the pin *per se*, was the most important feature of "characteristically American" bridgework. In addition, both connection types came to incorporate features that were not an intrinsic part of the design. Many early riveted spans, for example, used the lattice girder (or multiple triangulation) design, which was clearly excessive in material, while many pin-connected bridges were dangerously light, particularly in their details. Thus, a fair comparison between the two systems was not always made.[34]

According to Waddell, the controversy raged in engineering circles for a dozen years around the turn of the century. No dramatic resolution of the issue occurred, but "time and steady development of the real science of bridge designing" gradually changed minds. Significant changes in rivetting technology also altered the terms of the debate.[35] A compromise of sorts was finally reached, resulting in the adoption of the best features of each design. Riveted bridges were designed with less duplication of members, and pin-connected bridges were still accepted for long-span highway bridges.[36]

In Wisconsin, SHC officials clearly favored riveted construction from an early date. Consequently, the distinction between pin connections and riveted connections establishes an important subcategory boundary, separating the era of state-planned bridges from the preceding period in which bridge companies were largely responsible for bridge

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[33]*Waddell (1921)*, pp. 73-74; Alfred P. Boller, Practical Treatise on the Construction of Iron Highway Bridges, (4th ed.; 1890), pp. 44-49; "Discussion of American Railroad Bridges," American Society of Civil Engineers, Transactions 26:429 (1889), p. 593. According to Boller (p. 47), "Whatever objection has been urged against shop-riveting is intensified in a high degree when the field-riveter steps in to do his part of the work." For an argument that pin-connected Pratts require more metal than riveted Warrens, see *Johnson*, p. 276.

[34]*Waddell (1925)*, p. 7; "The Development of Bridge Trusses," Engineering Record, 42 (November 3, 1900), p. 411. Hereafter cited as *Development*.

[35]Charles Evan Fowler, "Machinery in Bridge Erection," Cassier's Magazine, 17.4 (1900), pp. 327-44; Charles Evan Fowler, "Some American Bridge Shop Methods," Cassier's Magazine, 17.4 (1900), pp.200-15; "Pneumatic Percussion Riveters," Engineering News, 39 (March 3, 1898), pp. 148-149; "Field Riveting by Power," Engineering News, 42 (October 27, 1900), p. 385; "Pneumatic Field Riveting in Railway Bridgework," Engineering News, 42 (October 27, 1900), pp. 393-94.

[36]*Waddell (1921)*, p. 74; *Development*, p. 411.

design. As early as 1908, state engineers advocated the use of riveted pony trusses for short-span bridges.[37] When the SHC was formally established in 1911, the riveted Warren became the state's standard pony design. In that year, the SHC also drafted a standard plan for riveted, overhead, Pratt trusses, and by 1914, the agency had adopted riveted construction for all overhead Pratt variations. As SHC engineer A. R. Hirst wrote in 1913, "Very seldom do we use a pin-connected truss..."[38]

In the mid-1930s, the SHC seems to have developed a preference for overhead Warren trusses for long-span bridges, although some overhead Pratts continued to be built. Riveting remained dominant in bridge building until well after World War II. As late as 1931, the construction specification of the American Association of State Highway Officials (AASHO) stated, "Welding of steel shall not be done except to remedy minor defects and then only with the approval of the engineer." Shortly thereafter, however, riveting rapidly disappeared and was replaced by better welding and high-strength bolts.[39]

The State Highway Commission

The involvement of local governments in bridge repair, replacement, and construction projects was the subject of numerous laws in the late nineteenth-century. With the Good Roads Movement of the late 1890s and early 1900s,a specific set of proposals was put forth for greater involvement by the state government in promoting good quality bridges.[40]

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[37]See, for example, the photograph of "a riveted steel [Pratt pony truss] highway bridge 40' span...built under the supervision of the Highway Division" in Arthur R. Hirst and M. W. Torkelson, Culverts and Bridges (2nd ed.; Madison, Wisc: Highway Division, Wisconsin Geological and Natural History Survey, Road Pamphlet No. 4, 1908), p. 43. The SHC standard plan (dated 1908) for a riveted Warren pony truss with a 40-foot span is found in Microfilm Reel M-1, "Miscellaneous Standards," Bridge Section, WisDOT.

[38]A. R. Hirst, "Bridges and Culverts for Country Roads," Engineering News (October 9, 1913), p. 729. With minor modifications, these standards are reiterated in Wisconsin Highway Commission, Second Biennial Report, p. 24.

[39]U. S. Department of Transportation, Federal Highway Administration, "Design and Construction of Welded Bridge Members and Connection" (Washington, D.C.: Government Printing Office, 1980), pp. 1, 6-9.

[40]Ballard Campbell, "The Good Roads Movement in Wisconsin, 1890-1911," Wisconsin Magazine of History, 49 (Summer 1966), pp. 273-93. Hereafter cited as *Campbell*. M. G. Davis, A History of Wisconsin Highway Development, 1825-1945 (Madison, Wisc: Wisconsin Department of Transportation, 1947), pp. 218--222. Hereafter cited as *Davis*. Wisconsin Statutes, Second Session of the Legislature, January 10, 1849 (Southport, 1849), pp. 182-83; Town Laws of Wisconsin, 1858, p. 157; Legislature of Wisconsin, Private and Local Laws, 1867, pp. 60-61, 179-82; Laws of Wisconsin, 1881, Chapter 315, pp. 407-08; Laws of Wisconsin, 1885, Chapter 187, pp. 162-64. Richard N. Current, The History of Wisconsin, Vol. II: The Civil War Era, 1848-1873, Edited by William Fletcher Thompson (Madison, WI: State Historical Society of Wisconsin, 1976), p. 28; Robert Nesbit, Wisconsin, A History (Madison, WI: University of Wisconsin Press, 1973), p. 197. A sampling of available county board records suggest that county-aid bridge projects were infrequent during the 1880s, and numbered five to ten per county per year during the 1890s.

In 1907, the state legislature established a Highway Division within the Wisconsin Geological and Natural History Survey to conduct experiments in road design and to advise local governments about specific projects. Town governments, traditionally reluctant to hire an independent engineer to assist in bridge building, could now avail themselves of free engineering counsel from the state. At the same time, the legislature required counties to make a commitment to professional oversight and increased funding by appointing "a competent engineer or experienced road builder" to serve as County Highway Commissioner and by levying a tax of not less than one-fourth nor more than two mills on the assessed valuation of all county property for the county road and bridge fund.[41]

In 1908, Wisconsin voters removed their greatest obstacle to creating a progressive statewide system of bridge and highway construction. In that year, by a three-to-one margin, voters eliminated the state's constitutional prohibition against direct state aid to transportation projects. When the legislature made its first appropriation for highway improvements in 1911, it also transformed the Highway Division of the Geological Survey into an autonomous State Highway Commission (SHC), which was given the responsibility of overseeing the expenditure of state funds for the development of a state highway network.[42] Like the former Highway Division, the SHC emphasized the use of standardized plans for various types of bridges and culverts.[43] The first set of standardized truss plans encompassed spans ranging from 36 to 128 feet, generally in five-foot increments. All but one had a sixteen-foot roadway. Revised several times by the 1920s, these plans gradually provided for wider bridges, and continually incorporated the latest engineering wisdom and detailing.[44]

In the first three and one-half years of its work, the SHC designed over 1,500 bridges of all types. All were designed to carry a live load of 15 tons. Believing firmly in the use of reinforced concrete to "the fullest extent practical," the SHC was pleased that all but three of their designs had concrete floors. These figures included almost 900 bridges requested by local governments in 70 counties. Practically all the local bridges in the state during these years were either designed by the SHC or were based on SHC standard plans.[45]

Despite its enthusiastic support for concrete construction, the SHC declared in 1926 that the steel bridge "is not looked upon with disfavor," and it continued to refine its truss designs. In the late 1930s, it made a major commitment to keeping its standardized plans up to date by dropping the Pratt design in favor of the Warren for all overhead truss configurations. Newly completed SHC-designed truss bridges, both monumental and modest, also

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[41] *Campbell*, p. 278-79; Laws of Wisconsin, 1907 (Madison, 1907), Chapter 552, p. 292.

[42] *Campbell*, pp. 279-84; *Davis*, p. 104.

[43] SHC, Second Biennial Report, July 1, 1911 to January 1, 1915 (Madison, 1915), p. 24.

[44] WisDOT, Bridge Section, Microfilm Reel M-1.

[45] *Davis*, pp. 112-13; SHC Second Biennial Report, pp. 14, 21, 30; see also SHC, Preliminary Biennial Report, July 1, 1911 to January 1, 1913 (Madison, WI: 1913), p. 17.

continued to be featured in the photographic sections of the agency's biennial reports. Nevertheless, the SHC clearly favored concrete spans, citing advantages of lower cost, greater compatibility with aesthetic treatment, and greater adaptability to remodeling, especially in terms of roadway widening.[46] The metal truss, however, remained cost effective in many situations, and the SHC continued to design some truss bridges until well after World War II.

During its early years, the SHC was guided by five key figures, all of whom had previously worked at the Highway Division of the Geological Survey. These staff members were W.O. Hotchkiss, first chief of the Highway Division; Arthur R. Hirst, first State Highway Engineer; Martin W. Torkelson, first State Bridge Engineer; Herbert C. Keulling, assistant highway engineer; and Walter C. Buetow, assistant bridge engineer. When these men moved on to the SHC, they found a helpful ally in Frederick E. Turneaure. Turneaure was Dean of the College of Engineering at the University of Wisconsin and had been instrumental in establishing the new state highway agency.[47]

Historic Bridge Advisory Committee

The systematic study of Wisconsin truss bridges began in 1976. Under the sponsorship of the State Historic Preservation Office (SHPO) of the State Historical Society, George M. Danko produced two volumes. The first volume was based on an extensive literature search, and traced related developments in engineering, metallurgy, and manufacturing to provide a general historical overview of truss-bridge design and construction on both a state and national level. In 1977, Danko conducted an intensive field survey of truss bridges in 11 Wisconsin counties. Using the records of the Wisconsin Department of Transportation (WisDOT), he focused his study on counties that he hypothesized would have a high concentration of truss bridges and high replacement pressures. Danko's second volume included intensive survey forms for 35 bridges. The forms for bridges Danko thought significant were starred.[48]

By 1980, when WisDOT established the Historic Bridge Advisory Committee (HBAC), 17 bridges had been listed in or found eligible for listing in the National Register of Historic Places. Neither Danko's studies nor the individual nominations and determinations of eligibility provided a fully developed statewide historical and chronological context or specific criteria for rating truss bridges. The goal for HBAC, then, was a statewide inventory that would

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[46]The SHC succinctly assessed the pros and cons of steel and concrete bridges in its Sixth Biennial Report, 1925-1926 (Madison, WI: 1926), p. 67. From 1911 to 1915, truss bridges in Wisconsin cost considerably less per foot to build than concrete structures, but then steel began its "great advance in price." see SHC, Fourth Biennial Report, 1916-1918 (Madison, WI: 1918), pp. 11-12; see also the comparative cost chart in Engineering News, 47 (February 28, 1917).

[47]Brief biographies of these men are in Robert S. Newbery, Jeffrey A. Hess, and Robert F. Frame, III, Truss Bridges: Vol. II, Historic Highway Bridges of Wisconsin (Madison, WI: Wisconsin Department of Transportation, forthcoming).

[48]Ibid.

expedite the evaluation of truss bridges, which, in 1980, accounted for approximately one-tenth of the state's 10,386 surviving highway bridges built before 1950.

The HBAC was guided by the basic assumption that all distinctive types of truss bridges are worthy of some degree of preservation. Thus, the planning for the statewide survey focused on two major information sources in the WisDOT Bridge Section: (1) a card file containing rudimentary structural information and a photograph for every highway bridge in the state; (2) a computerized data bank adapted to meet the FHWA's interest in a statewide inventory to promote an engineering evaluation of all bridges in the state. These two sources generated an initial pool of 996, pre-1941 truss bridges representing 18 structural types.[49]

The 1941 cut-off date was selected to satisfy, with a comfortable margin, the 50-year age criterion customarily required for National Register eligibility. Moreover, Danko had only located one truss built after that date. Although subsequent research located several dozen trusses built after 1941, they were markedly different in design. Thus, the 1941 date is an appropriate interim boundary, if not final marker, for the truss bridge era in Wisconsin.[50]

On the basis of data derived primarily from WisDOT sources, the initial pool was carefully studied to identify, for each truss type, those bridges that had the earliest known construction dates, were in the best condition, had the best available historical data (e.g., bridge plates, SHPO research files, previous historical studies), and had the most obvious noteworthy features (e.g., longest span, greatest number of spans, unusual workmanship). This winnowing reduced the initial pool by approximately 75 per cent. Up to this point, the study had focused exclusively on bridges on or over public thoroughfares, including city streets, county highways, and town roads. Some bridges of historical interest, however, were known to exist in park settings and were included in the study. With these additions, the study sample totaled 247 bridges.

To determine the most significant bridges within each truss category, a set of evaluation criteria with a corresponding numerical rating system was developed using the model developed by the State of Virginia.[51] A trial run was conducted on the bedstead-truss (truss-leg) category. Because this category consisted of only 8 examples, it was possible to rate all examples and compare the results with a "subjective" analysis of the entire group. The criteria were revised in light of this experience and then applied to each category with more than a dozen examples.

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[49]Originally, Pratt pony trusses with a single vertical member were considered to be a separate category, but this distinction was subsequently dropped and the number of categories was reduced to seventeen.

[50]George M. Danko, "The Development of the Truss Bridge, 1820-1930, with a Focus Toward Wisconsin" (unpublished report prepared for the State Historic Preservation Office, State Historical Society of Wisconsin, 1976); George M. Danko, "A Selective Survey of Metal Truss Bridges in Wisconsin" (unpublished report prepared for Historic Preservation Division, State Historical Society of Wisconsin, 1977). Hereafter cited as *Danko*.

[51]Howard Newlon, Jr., "A Trial Rating System for Bridge," Interim Report No. 1, Criteria for Preservation and Adaptive Use of Historic Highway Structures., Virginia Highway and Transportation Research Council, 78-R29, January 1978.

Evaluations included a field review of the structure and, when time permitted, limited historical research. Results were presented to HBAC at bimonthly meetings. Members of the HBAC found a slide show to be a useful complement to the evaluation sheet and other printed materials.

The HBAC evaluation process yielded a final group of fifty-three bridges deemed potentially eligible for the National Register. A thematic determination of eligibility, however, was not completed, and some attrition occurred. In 1986, WisDOT reevaluated the remaining truss bridges, selected "next-best" substitutes for those that had been replaced, and initiated an intensive survey to document authoritatively the National Register eligibility of the sample. The field survey was conducted on a contract basis by historians Jeffrey A. Hess and Robert M. Frame III. The intensive field-survey sample contained a total of fifty-four bridges, including two that were already on the National Register (P-18-720 and P-53-162) for which additional information was desired. In addition to an in-depth field inspection, the consultants compiled historical research dossiers on the various bridges from local and state archives, libraries, and local residents.

The results of the intensive field-survey indicated that forty-eight bridges were immediately eligible for the National Register and that two bridges would soon be eligible when they reach fifty years of age (P-09-715 and P-10-266). These fifty bridges represented a total of thirty-three of Wisconsin's seventy-two counties. The SHPO determined that two wood king post bridges (P-04-043 and P-04-044) were ineligible for the National Register because they were built in the 1950s. One has subsequently been replaced.[52]

In 1981, HBAC identified twenty extant overhead Pratt truss bridges that were constructed between 1926 and 1931. Of these bridges, the Smyth Road Bridge was identified as the best example of this type of bridge from this period. An update of the survey in September 1993, identified three of the twenty bridges that had replacement projects underway.

Manufacturer: The Milwaukee Bridge Company

Originally organized in 1902 as Milwaukee Steel Structural Company, the firm changed its name in 1903 to Milwaukee Bridge Company. In that year, the company received its first major contract for the design and construction of a bascule bridge in Milwaukee. The first officers were C. H. Starke, president; Conrad Trimborn, vice-president and treasurer; Max W. Nohl, Secretary; and F.W. Moore, engineer.[53]

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[52]Richard W. Dexter to David H. Pantzlaff, January 20, 1988. WisDOT Project ID 8355-04-00; SHSW: #88-0053.

[53] Milwaukee City Directory, 1903 44; Articles of Incorporation of Milwaukee Steel Structural Company, 2 September 1902; Amendment to Articles of Incorporation, changing the firm's name to Milwaukee Bridge Company, 25 February 1903, in Volume Q 348, 601, Incorporation Papers, Milwaukee County Historical Society. Jeffrey A. Hess, "Bascule Bridge Intensive Survey Form for Muskego Avenue Bascule Bridge (P-40-610)," ms., 1986, Wisconsin Department of Transportation.

President Christopher H. Starke had been active in a number of firms involved in construction since 1869. He was a laborer in 1865, a piledriver by 1870, and a dredger and piledriver by 1871.[54] He joined Henry and Conrad Starke in the firm of Conro and Starke Co., dredgers. Conro and Starke was a successor to Hasbrouch and Conro, contractors, who also had a tugboat operation. By 1878, Christopher, Conrad, Henry, and Fritz, along with W. H. Meyer, formed Starke Bros. and Co., proprietors of Milwaukee Tugboat Line. By 1882, the company had evolved into Starke, Smith and Co., and by 1899, C.H. Starke Dredge and Dock Co. Christopher Starke was not, however, listed as an officer of this latter company. Instead, he was by this time president of Milwaukee Tugboat Line.[55] He appears to have remained as president of both Milwaukee Tugboat Line and Milwaukee Bridge Company until 1914.[56]

In 1886, Conrad Trimborn was a clerk in an unnamed business. Two years later, with his brothers Joseph A., August W., and Peter W., he had established Trimborn Brothers, selling building materials, wood, and coal. By 1890, Trimborn Brothers was just August and Conrad. By 1892, the two brothers had added the manufacture of lime and selling of cement to their business. In 1894, Conrad Trimborn joined C.H. Starke and Co., and, in 1903, he became vice-president and treasurer of Milwaukee Bridge Company. He became president in 1915. Trimborn remained president and secretary of Milwaukee Bridge Company into the 1930s. In 1961, a third generation of the Trimborn family was still in charge of the company.[57]

In 1891, F.W. Moore was a draftsman with Keepers and Wynkoop, and in 1892, he was a civil engineer, possibly with Wisconsin Bridge and Iron Company.[58] He then worked for Milwaukee Variety Iron Works and Milwaukee Bridge and Iron Works. In 1899, he became engineer for J. G. Wagner Company. At the time,

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[54] Milwaukee City Directory, 1865 262; 1869-1870 294; 1870-1871 270; 1871-1872 281.

[55] Milwaukee City Directory, 1878 469; 1892 878; 1882 561; 1892 742; 1894 963; 1899 934.

[56] Milwaukee City Directory, 1902 1056; 1903 1108; 1904 1168; 1905 1197; 1906 1258; 1907 1367; 1909 1426; 1911 1515; 1913 1571.

[57] Milwaukee City Directory, 1886 748; 1888 789; 1890 929; 1893 993; 1894 1015; 1895 945; 1899 985; 1903 1171; 1927 1886; 1932 1596; 1938 792; 1950 823; 1961 1058; Wisconsin State Gazetteer, 1915-1916 803.

[58] Milwaukee City Directory, 1891 623; 1892 648. No company affiliation is given for Moore in 1892. The name "Moore," however, appears on plans for the Hewitt Street Bridge constructed by the Wisconsin Bridge and Iron Company in Neillsville, Clark County in 1892.

Wagner was also proprietor of Milwaukee Bridge and Iron Works. Moore joined Milwaukee Bridge Company in 1903 and was listed as chief engineer in 1904 and 1905. He remained with this company at least through 1913.[59]

Conclusion

In conclusion, the Smyth Road Bridge is eligible for the National Register under criterion C, in the area of Engineering. This bridge, constructed in 1928, is an excellent example of a standard plan overhead Pratt truss bridge designed and used throughout the state by the Wisconsin Highway Commission. The Smyth Road Bridge, recognized through the HBAC survey as the best extant example of this bridge type constructed between 1926 and 1931, has undergone very few modern alterations and continues to function as a vehicular passageway. The bridge has retained its integrity of setting, location, design, materials and construction.

[59] Milwaukee City Directory, 1893 691; 1894 705; 1895 659; 1899 687; 1900 732; 1901 724; 1902, not listed; 1903 810; 1904 858; 1905 878, 1906 921; 1907 998; 1909 1042; 1911 1102; 1913 1141. Fred Moore is listed, without company affiliation, as "ctr" [i.e., contractor] in 1915 (p. 1272) and as "civeng" [i.e., civil engineer] in 1916 (p. 1065).

9. Major Bibliographical References

_X_ 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:

X State historic preservation office

X Other State agency

___ Federal agency

___ Local government

___ University

___ Other

Specify repository:

Wisconsin Department of Transportation

10. Geographical Data

Acreage of property Less than one acre

UTM References

	Zone	Easting	Northing		Zone	Easting	Northing
A	16	389080	5018705	B		/////	//////
C		/////	//////	D		/////	//////

___ See continuation sheet

Verbal Boundary Description _X_ See continuation sheet

Boundary Justification _X_ See continuation sheet

11. Form Prepared By

name/title	Christina Slattery / Architectural Historian		
organization	Mead & Hunt, Inc.	date	21 June 1995
street	6501 Watts Road, Suite 101	telephone	(608) 273-6380
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Verbal Boundary Description

The general area is a rectangle, 93 feet by 26 feet, the long center axis of which is oriented on an east-west axis. The Smyth Road Bridge is situated over the north branch of Oconto River in Lakewood, Oconto County Wisconsin, NW 1/4, NE 1/4 Section 30, T33N, R17E.

Boundary Justification

The boundary is the periphery of the rectangular parcel on which the bridge stands.

PHOTOS

Photo 1 of 9.
Smyth Road Bridge.
Town of Lakewood, Oconto County, Wisconsin.
Photo by C. Bartholomew
Negative at State Historical Society of Wisconsin.
View of General Setting.

Photo 2 of 9.
Smyth Road Bridge.
Town of Lakewood, Oconto County, Wisconsin.
Photo by C. Bartholomew.
Negative at State Historical Society of Wisconsin.
View of Approach.

Photo 3 of 9.
Smyth Road Bridge.
Town of Lakewood, Oconto County, Wisconsin.
Photo by C. Bartholomew.
Negative at State Historical Society of Wisconsin.
General View.

Photo 4 of 9.
Smyth Road Bridge.
Town of Lakewood, Oconto County, Wisconsin.
Photo by C. Bartholomew.
Negative at State Historical Society of Wisconsin.
General View.

Photo 5 of 9.
Smyth Road Bridge.
Town of Lakewood, Oconto County, Wisconsin.
Photo by C. Bartholomew.
Negative at State Historical Society of Wisconsin.
View of Truss System.

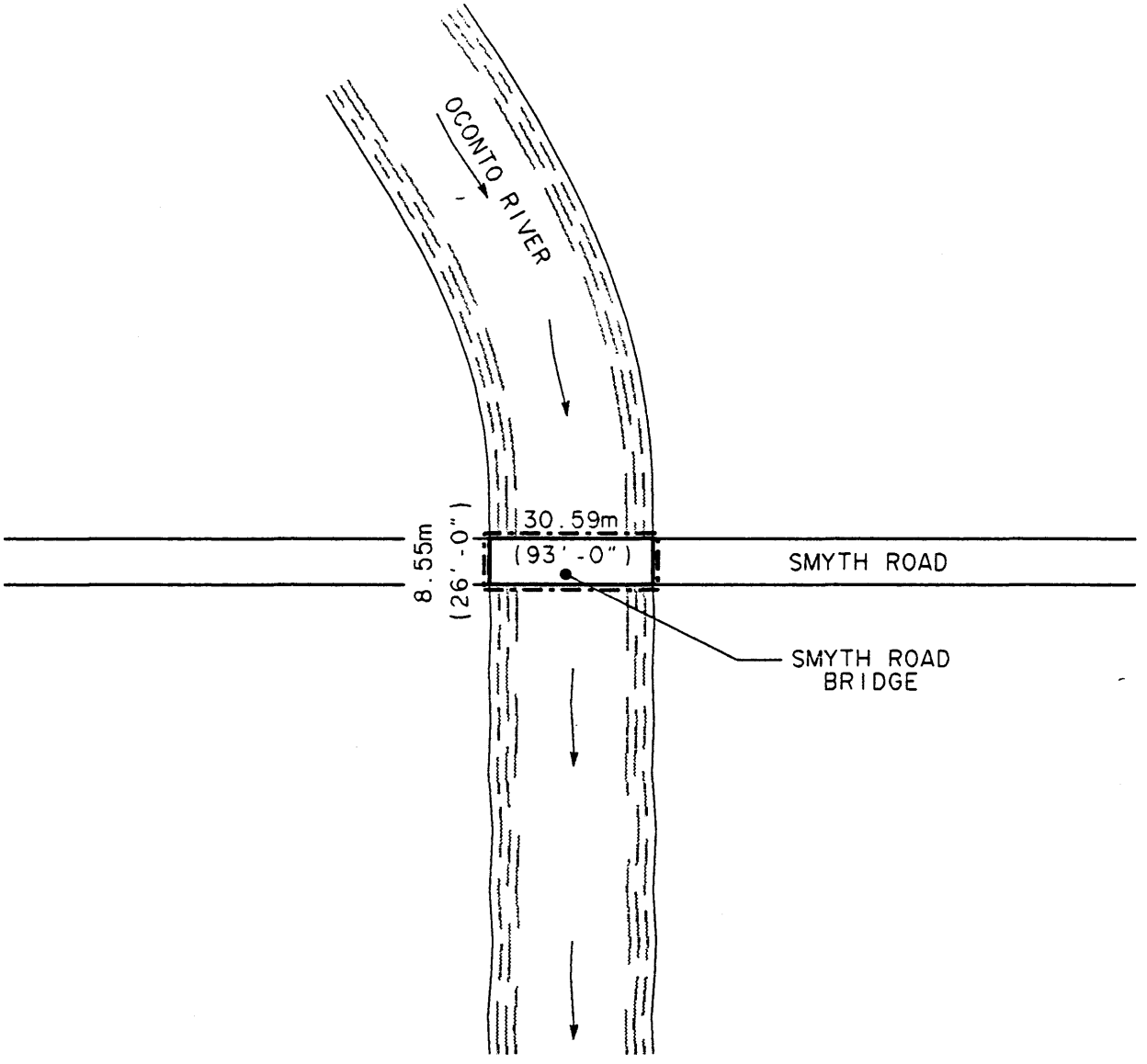
Photo 6 of 9.
Smyth Road Bridge.
Town of Lakewood, Oconto County, Wisconsin.
Photo by C. Bartholomew.
Negative at State Historical Society of Wisconsin.
View of Overhead Truss Members.

Photo 7 of 9.
Smyth Road Bridge.
Town of Lakewood, Oconto County, Wisconsin.
Photo by C. Bartholomew.
Negative at State Historical Society of Wisconsin.
View of Bottom Chord.

Photo 8 of 9.
Smyth Road Bridge.
Town of Lakewood, Oconto County, Wisconsin.
Photo by C. Bartholomew.
Negative at State Historical Society of Wisconsin.
View of Bridge Deck.

Photo 9 of 9.
Smyth Road Bridge.
Town of Lakewood, Oconto County, Wisconsin.
Photo by C. Bartholomew.
Negative at State Historical Society of Wisconsin.
View of Rocker Bearing.

Owner
Town of Lakewood
17258 North Road
Lakewood, Wisconsin 54138



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SMYTH ROAD BRIDGE

TOWN OF LAKEWOOD
OCONTO COUNTY, WISCONSIN

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LEGEND:

HISTORIC BOUNDARY