DALE CREEK CULVERT
(Bridge No. P-40-506)
Carries Southway over Dale Creek
Greendale
Milwaukee County
Wisconsin

HAER WI-118
HAER WI-118

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
U.S. Department of the Interior
1849 C Street NW
Washington, DC 20240-0001

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DALE CREEK CULVERT
BRIDGE NO. P-40-506

HAER No. WI-118

Location: Carries Southway over Dale Creek in the village of Greendale, Milwaukee County, Wisconsin.

The Dale Creek Culvert (Bridge No.P-40-506) is located at latitude 425607.86, longitude 875935.42. The coordinate represents the center of the bridge. It was obtained in 2014 by plotting its location in Google Earth. The location has no restriction on its release to the public.

Present Owner/ Occupant: Wisconsin Department of Transportation.

Present Use: Vehicular traffic.

Significance: The Dale Creek Culvert is a representative example of a concrete pipe culvert, which is a common post-1945 concrete bridge type.

Historian(s): Katie Kaliszewski and Christina Slattery, Mead & Hunt, Inc.; 2014.

Project Information: This documentation was prepared as mitigation for the Advisory Council on Historic Preservation (ACHP)'s *Program Comment Issued for Streamlining Section 106 Review for Actions Affecting Post-1945 Concrete and Steel Bridges*, noticed in the Federal Register on November 16, 2012. The Federal Highway Administration (FHWA) and the ACHP are the project sponsors and retained the team of Louis Berger and Mead & Hunt, Inc. (Mead & Hunt) to prepare this document. It was prepared by Katie Kaliszewski and Christina Slattery, Cultural Resources Specialists, at Mead & Hunt. Dietrich Floeter completed the photography.

Part I. Historical Information

A. Physical History:

1. **Date(s) of construction:** 1960.

2. **Engineer**: Unknown.

3. **Builder/Contractor/Supplier:** Unknown.

4. **Original plans and construction:** Not available.

5. **Alterations and additions:** None.

B. Historical Context: Culverts are small structures used to carry streams and other water under roadways that have been used for drainage for hundreds of years. They are traditionally used where bridges are not hydraulically needed, are more economical, or both.[1] Culverts are produced in two basic shapes, box and pipe, and typically span less than 20 feet.[2] Pipe culverts can be circular or elliptical-shaped structures that are then covered by embankment and road. To make them longer, several pipes can be laid next to each other to create multi-celled culverts.[3] Pipe culverts before the mid-1800s were made of wood or vitrified clay, but by the end of the nineteenth century more durable, prefabricated materials like cast iron and concrete were in use.[4] Metal was introduced in the twentieth century, and currently most pipe culverts are made with concrete, unreinforced and reinforced, or corrugated metal.

Culverts have historically been used to improve drainage for transportation facilities, including railroads and roads. Railroad engineers were at the forefront of bridge and culvert design since the railroad was the first constructed mass transportation system in the country.[5] Early culverts were made of timber or vitrified clay. By the 1890s the American Railway, Bridge, and Building Association advocated for the use of cast-iron pipe.[6] Cast-iron pipe culverts were more permanent, and were often prefabricated off-site

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[1] Federal Highway Administration, *Hydraulic Design of Highway Culverts, FHWA-HIF-12-026* (April 2012), 1.3.

[2] Federal Highway Administration, *Bridge Inspector's Reference Manual, FHWA NHI 12-049* (December 2012), 14.1.1.

[3] *The Official Good Roads Year Book of the United States* (Washington D.C.: American Highway Association, 1918), 209.

[4] Concrete pipe was used as early as 1842 in Mohawk, New York, for a sewer system and as early as 1869 for road culverts. A. Grant Lee, MCIP, RPP, "Century Concrete Pipe Does Exist," http://www.concrete-pipe.org/pdf/CenturyConcretePipeDoesExist.pdf (accessed 2 June 2014) and Arthur R. Hirst, *Road Pamphlet Number 4: Culverts and Bridges* (Madison, Wis.: Wisconsin Geological and Natural History Survey, 1907), 8.

[5] Charles H. Hoyt and William H. Burr, *Highway Bridges and Culverts, U.S. Department of Agriculture, Office of Public Roads – Bulletin No. 43* (Washington D.C.: Government Printing Office, 1912), 5-6.

[6] American Railway Bridge and Building Association, *Proceedings of the Annual Convention of the American Railway Bridge and Building Association, Vol. 2* (Concord, N.J.: Republican Press Association, Railroad Square, 1892), 21.

and transported to their location. Concrete pipe would become the preferred material with most railroad companies by the 1910s.[7] Concrete pipe had the advantage over other materials of the day due to its durability, lower price, prefabrication, or ability be constructed on-site by less skilled workers.[8] Railroad bridge and culvert practices would later influence bridge engineering, and their tested practices were then used for road construction.

While railroads remained the preferred method of mass transportation until the twentieth century, by the 1890s there was a growing interest in the advancement of roads. First with the rise of bicycle use and then with car ownership, the public demanded permanent, all-weather roads through the "good roads movement."[9] With the push for all-weather roads, the role of drainage and bridges became important. At this time, there was no standardization of design or materials of culverts, which led to inefficient products. As a result, a number of engineers and universities began to research the best practices for road, bridge and culvert construction, beginning with what methods had worked well in railroad construction. One of the first engineers to begin to experiment on culvert use was Arthur N. Talbot of the University of Illinois. In 1887 Talbot proposed a formula to evaluate the hydraulic flow for culverts and bridges that is still in use today.[10] At the forefront of much of the culvert research was the Experiment Station at Iowa State University. From the early 1900s to the 1950s Iowa State University undertook over 3,300 experiments in its research of underground conduits and culverts.[11] As culverts are drainage structures, the proper installation and size of the openings were imperative and engineers produced new formulae to evaluate the hydraulic needs for different regions across the county.

Another early-twentieth-century publication on culverts was completed in 1907 by Wisconsin Highway Engineer Arthur R. Hirst. In *Road Pamphlet Number 4* for the Wisconsin Geological and Natural History Survey, Hirst discussed both the proper material and placing for culverts. Hirst claimed that "under ordinary conditions [concrete] pipe…are cheaper than the pipe cast separately, and more permanent on account of there being no possibility of settlement after building."[12]

By 1910 the Office of Public Roads (OPR) established the Division of Bridge and Culvert Engineering to collect and publish the ongoing research for national consumption.[13] Prior to this, some states had their own specifications for culvert and bridge design, though there was no standard nationwide. With the

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[7] Howard F. Peckworth, *Concrete Pipe Handbook* (Chicago: American Concrete Pipe Association, 1958), 419.

[8] Hirst, 12.

[9] Al Hogan, "Course 2: Concrete Pipe Historical Overview of the RPC Industry Materials & Manufacturing Process for Reinforced Concrete Pipe" (American Concrete Pipe Association, Professional Pipe Promotion), 2.

[10] John G. Henderson, Jr. *Hydraulics of Culverts* (Chicago: American Concrete Pipe Association, 1957), 13; Arthur N. Talbot, *Tests of Cast-Iron and Reinforced Concrete Culvert Pipe* (Urbana, Ill.: University of Illinois Engineering Experiment Station, 1908), 64.

[11] Peckworth, 25.

[12] Hirst, 23.

[13] Parsons Brinckerhoff and Engineering and Industrial Heritage, *A Context for Common Historic Bridges Types*. NCHRP Project 25-25, Task 15 (October 2005), 2-24.

passage of the Federal-Aid Act of 1916, the Bureau of Public Roads (BPR), successor to the OPR, became the agency placed in charge of distributing federal matching grants and required states receiving those grants to adhere to BPR standards for road and bridge construction. The BPR worked collaboratively with the American Association of State Highway Officials (AASHO), the National Research Council, and the Highway Research Board to conduct research on new materials and technologies.[14]

Two national groups that were increasingly interested in the use of concrete pipe for culverts were the American Concrete Pipe Association (AMPA) and the American Society for Testing Materials (ASTM). The AMPA was founded in 1907 by several farm drain tiles manufacturers in Iowa as the Interstate Cement Tile Manufacturers Association. In 1914 it changed names to the AMPA, and as the concrete pipe industry grew outside of sewer and into culvert and road drainage, it became vocal on specifications for concrete culvert specifications.[15] The ASTM was founded in 1898 in response to poor material production for railroads.[16]

In 1919 the Joint Concrete Pipe Committee was formed by the AMPA to develop national standard specifications for concrete pipe culverts. The committee was composed of two representatives from the ASTM, AASHO, BPR, American Society of Civil Engineers (ASCE), American Railway Engineering Association (AREA), and the American Concrete Institute (ACI). The committee issued its first progress report in 1926, including “tentative specifications.” Members of the committee studied and tested 167 pipes that ranged from 12” to 60” in diameter from eight commercial plants to develop the tentative specifications. The final report, “Second Report of the Joint Concrete Culvert Pipe Committee: Submitting Tentative Standard Specifications for Reinforced Concrete Culvert Pipe," was published in 1928 and was adopted by railroad and highway officials.[17]

In 1930 further work to refine recommendations was assumed by Committee C-13 of the ASTM. That year it released ASTM Designation C76-30T “Tentative Specifications for Reinforced Concrete Culvert Pipe,” which had minor changes from the 1928 report.[18] By 1935 more tests were completed by Committee C-13 and the “Tentative Specifications for Reinforced Concrete Culvert Pipe, ASTM Designation: C76-35T” was released. At that time, it was adopted as standard by the AASHO, who had begun publishing highway bridge standard specifications in 1931.[19] Specifications laid out the correct fill and diameter of pipe for different drainage areas and the correct concrete mixture and thickness for culverts for their length and increasingly larger diameter.

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[14] Mead & Hunt, Inc., *Minnesota Bridges, 1955-1970,* prepared for Minnesota Department of Transportation (July 2013), 61.

[15] American Concrete Pipe Association, *Brief History of the ACPA*, http://www.concrete-pipe.org/pages/history.html (accessed 2 June 2014).

[16] American Society for Testing and Materials, *ASTM 1898-1998: A Century of Progress*, http://www.astm.org/ABOUT/history_book.html (accessed 30 May 2014).

[17] Morris Wooten Loving, *Concrete Pipe Lines* (Chicago: American Concrete Pipe Association, 1942), 253.

[18] Loving, *Concrete Pipe Lines, 253.*

[19] Loving, *Concrete Pipe Lines, 253.*

With the standards first developed by the Joint Concrete Culvert Pipe Committee and then the ASTM, by 1930 all state departments of transportation (DOTs) were using concrete pipe culverts in their highway construction.[20] Between the Great Depression to 1950 the annual production of concrete pipe grew to 4 million tons.[21] State DOTs continued to take advantage of standardization and prefabrication of culverts and bridges as a means of controlling quality, meeting tight schedules, and containing costs. By 1958 there were over 500 companies across the United States supplying concrete pipes to every state's highway department.[22] Throughout this period, the use of concrete pipe culverts grew due to new research, methods of construction, and larger diameters up to 108". Due to this ever-changing landscape, throughout the 1950s a number of road and concrete manufacturers worked together to create new standards and specifications for national roads and Interstates, and the ASTM continued to update the "Standard Specifications for Concrete Culvert Pipe," until 1957, when it became known as "ASTM C76-57T: Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe."[23]

By the 1960s concrete pipe culverts were produced in up to five standard strength classifications and wider diameters, though the technology behind their production and use had changed little over time. The construction of larger, multi-cell pipe culverts could replace smaller highway bridges. They could be installed quickly, without the need for a detour, and were cheaper than box culverts due to their mass prefabrication.[24] Multi-cell culverts are also used to create the correct amount of drainage under low embankments or wide waterways. By 1967, after an increased emphasis on bridge safety by the FHWA, many small bridges were replaced by multiple barrel culverts. At this same time, elliptical shaped culverts were first produced. Elliptical culverts could be used when the distance between the waterway and the road is limited, or there is a need for wider flow area.[25] By the 1970s more than 10 million tons of concrete pipe for culverts and sewers were being produced annually.[26]

Currently pipe culverts are still commonly used by all state DOTs on highway projects. The ASTM (now the American Society of State Highway and Transportation Officials—AASHTO) continues to update its specifications for culverts that include their growing diameters, lengths, and the use of new materials in their production. Culverts are still typically prefabricated in regional plants and shipped to the location their needed. New materials are being evaluated for use, including high-density polyethylene (HDPE) pipe, which some engineers have found is more durable and has a lower cost.[27]

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[20] Peckworth, 419.

[21] Hogan, 2.

[22] Peckworth, 3.

[23] Peckworth, 26-27.

[24] Peckworth, 428.

[25] Federal Highway Administration, 14.1.1, 14.1.12.

[26] Hogan, 2.

[27] Dr. Patricia D. Galloway, "Read Between the Pipe," in *Storm Water* (Fall 2006), http://www.concrete-pipe.org/pdf/2006FallR&BStormwatersuppbyGallowaypipesreprint.pdf (accessed 13 June 2014).

Part II. Structural/Design Information

A. General Statement:

1. Character: The Dale Creek Culvert (P-40-506) is a concrete pipe culvert and is a representative example of this common post-1945 concrete bridge type.

2. Condition of fabric: Very good.

B. Description:
The Dale Creek Culvert is located in the village of Greendale, Wisconsin, and carries Southway over Dale Creek. Southway runs approximately one-half-mile from Greendale High School east to West Loomis Road.

The Dale Creek Culvert is a three-cell, reinforced-concrete, horizontal pipe culvert and was completed in 1960. It has an overall structure length of 26.2' and an out-to-out length of 95'-0". It carries a 48'-0" road, with sidewalks on either side. Each elevation features a plain concrete headwall. Like most post-World War II, concrete pipe culverts, it is relatively simple in design with no ornamentation or decorative features.

C. Site Information: The Dale Creek Culvert Bridge spans Dale Creek in the Village of Greendale, Wisconsin. It is located in an urban area.

Part III. Sources of Information

A. Primary Sources:

American Railway Bridge and Building Association. *Proceedings of the Annual Convention of the American Railway Bridge and Building Association, Vol. 2.* Concord, N.J.: Republican Press Association, Railroad Square, 1892.

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B. Secondary Sources:

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Parsons Brinckerhoff and Engineering and Industrial Heritage. *A Context for Common Historic Bridges Types*. NCHRP Project 25-25, Task 15, October 2005.

Peckworth, Howard F. *Concrete Pipe Handbook.* Chicago: American Concrete Pipe Association, 1958.