MOUNT MERIDIAN BRIDGE
(Bridge No. 6729)
Spanning the Middle River at Virginia Route 769
Mount Meridian Vicinity
Augusta County
Virginia

HAER No. VA-98

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
Northeast Region
U.S. Custom House
200 Chestnut Street
Philadelphia, PA 19106

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HISTORIC AMERICAN ENGINEERING RECORD
MOUNT MERIDIAN BRIDGE
(BRIDGE NO. 6729)

HAER No. VA-98

LOCATION: Virginia State Route 769 over the Middle River, Mount Meridian vicinity, Augusta County, Virginia. USGS Grottoes, VA Quadrangle, Universal Transverse Mercator Coordinates: 17.687010.4236820

DATE OF CONSTRUCTION: 1907

BUILDER: Champion Bridge Co., Wilmington, Ohio

PRESENT OWNER: Virginia Department of Transportation

SIGNIFICANCE: The Mount Meridian Bridge is a representative example of a pin-connected steel Pratt through truss typical of late nineteenth century factory-manufactured bridges.

PROJECT INFORMATION: The Mount Meridian Bridge was recorded in 1993-1994 by the Cultural Resource Group of Louis Berger & Associates, Inc., Richmond, Virginia, for the Virginia Department of Transportation (VDOT). The recordation was undertaken pursuant to provisions of a Programmatic Memorandum of Agreement (Draft) among the Federal Highway Administration, VDOT, the Virginia SHPO, and the Advisory Council on Historic Preservation concerning management of historic metal truss bridges in Virginia. Project personnel included Richard M. Casella, Architectural Historian; Alison Helms, Historian; and Rob Tucher, Photographer.

DESCRIPTION

Mount Meridian Bridge (VDOT Bridge No. 6729) is a three-span, pin-connected steel truss through bridge which carries a single lane of Virginia State Route 769 in an east-west direction over the Middle River, 0.1 miles west of the junction of Route 769 and Route 865, in Augusta County, Virginia (Figure 1). From east to west, the spans are 98', 125', and 129' in length. Overall, the bridge is 359' 7" long.

At the point of the bridge, the riverbed, approximately 80' wide, is spanned by the center truss at a height of approximately 27' above the water. The east and west trusses span the floodplains at an average height of 17' and 19', respectively. In February 1975, the depth of the river in the middle was measured at 6'. The immediate area around the bridge is open rolling farmland and pasture with widely spaced farm complexes and residences.

The trusses are all of the Pratt type, with parallel chords, posts in compression, and diagonals in tension. All members of the bridge are steel, joined with pinned, riveted, or threaded connections. The three truss spans are all 20' high, and the truss pairs are 16' apart on center. The 129'-long west truss has seven panels; the two end panels are 17' wide and the five center panels are 19' wide (Figure 2). The center truss is 125' 1/2" long with seven panels; the two end panels are 17' wide and the five center panels are 18' 2-1/2" wide (Figure 3). The 98' east truss has six panels, with the two end panels 17' wide and the four center panels 16' wide (Figure 4).

Inclined end posts are riveted H-sections, 12" x 8-1/2" overall, built with 5/16" top plate, 8" x 2-1/2" side channels with flanges out, and 4" x 12" x 1/4" bottom stay plates spaced 28" on center. The truss rests on plate and roller-type bearings measuring 21" x 14".

Top chords are identical to the end posts in construction with the exception of top plate thickness, which is 3/16", and stay plate spacing, which is 36". Bottom chords consist of two loop-welded eye-bars and vary in size with each truss. The bottom chords on the east truss are of two sizes: the end post to first post chords are 3/4" x 1-1/2", and the first post to center post chords are 7/8" x 2-1/4". The bottom chords on the middle truss are of three sizes: the end post to first post chords are 1" x 1-3/4"; the first to second post chords are 7/8" x 3"; and the center panel chords are 1" x 3-1/2". The bottom chords on the west truss are also of three sizes: the end post to first post chords are 1" x 2"; the first to second post chords are 7/8" x 3-1/2"; and the center panel chords are 1" x 4".

The riveted H-section bar-lattice posts are 11" wide by 6" deep overall, made up of two 6" x 2" channels with flanges out, spaced 7" apart and connected by 1-1/4" x 13" bar-lattice.

Diagonal panel braces are of several types and sizes. On all three trusses, the second panel diagonals consist of two bars, 2" x 1", with loop-welded eyes, and the third panel diagonals consist of two bars, 1-1/2" x 3/4", with loop-welded eyes. The center panels of the west truss and middle truss have diagonals consisting of 1-1/4" square bar, with turnbuckles and loop-welded eyes. Panel three on all of the trusses has a single adjustable counter, 3/4" square, with a turnbuckle and loop-welded eyes.

Hip-verticals consist of two members: a 1" rod with a loop-welded eye at the top and a forged carriage head at the bottom which suspends an adjustable U-bolt hanger, and a 1-3/8" square bar with loop-welded eyes. Both members are attached with a 2" pin to a built-up H-section floor beam hanger consisting of two 5" x 1-3/8" channels, spaced 7" apart. Bottom chord and floor beam pins are 2-3/4"; top chords pins are 2-3/8".

The portal struts of each span consist of a double-intersecting Warren truss girder, 3' 3" high by 6-1/4" wide. Top and bottom flanges are riveted T-sections, 6-1/4" x 3", built of 3" angles. Webbing consists of 2" angles. The strut is braced with T-sections identical to the flanges. Upper lateral struts are lattice-bar I-sections, approximately 8" x 3" overall, consisting of T-section flanges and lattice-bar webbing. Upper lateral bracing rods are 3/4" in diameter with loop-welded eyes. Other than the portal bracing described, there is no intermediate sway bracing.

The floor beams on all three trusses are 15" x 5-1/2" rolled I-beams, riveted with angles to the posts, which hang from the bottom chord pins. Floor beams at the hip-vertical location are carried by the short post sections previously described. The floor stringers are 8" x 4" rolled I-beams, which vary in number and spacing with each truss as follows: east truss, eight stringers 22" on center; middle truss, nine stringers 20-1/2" on center; and west truss, ten stringers 18-1/2" on center. Bottom lateral braces are 1" rods, end threaded and attached to the floor beams with triangular washer plates and square nuts.

The bridge decking consists of 4" x 10" pressure-treated wood planks, coated with asphalt and attached to the stringers with carriage bolts and deck clips. The roadway is 11' wide and edged with 4" x 5" wood curbing raised 5" off the decking with wood blocks spaced approximately 4' on center. The bridge railings are of double lattice-bar construction, 24" x 1-1/2" overall, and are hung from the posts with short sections of 7" channel.

Both ends of the bridge rest on beveled-wing abutments of random rubble stone masonry with tooled mortar joints. Both abutments have been repaired with cast-in-place concrete encasements, 12" thick, which extend the full height of the abutment and 8' along the wings, leaving approximately 8' of the original stonework of the wings exposed. Both abutments are approximately 18' wide, 16' high, and battered 1:12.

The two stone piers supporting the center span are constructed of coursed random ashlar masonry with tooled mortar joints. The piers are both 22' high, 16' wide by 4' deep at the top, and 20' wide by 6' deep at the base. The piers are reinforced with two steel I-beam clamps located 8' and 14' up the piers.

A cast iron bridge company plaque, decorated in the Stick style, is bolted to the top center of the portal strut and reads:

1907
Champion Bridge Co.
Wilmington, O.

A cast iron builder's plaque hangs directly below the bridge company plaque and reads:

Bridge Comr's
John G. Fulton
E. L. Houff, Jr.
J. W. Ritchie

HISTORICAL INFORMATION

Background

The first planters in the Middle River Valley specialized primarily in tobacco until about 1790, when, during the French Revolution, the price of wheat in Europe soared, encouraging many valley farmers to convert to wheat crops (Upper Valley Regional Park Authority n.d.:2). The farmland on the northwest side of the Middle River opposite the village of Mount Meridian was patented to William Craig in 1797, and by that time, the property already contained a gristmill and an associated dam. The dam extended across the river some distance south of the present bridge site and provided a convenient early fording point for travelers. The precursor to State Route 769, also known as Snowflake Mill Road, was probably laid out during the 1790s to provide access to the mill. The road crossed the Middle River Valley, connecting the Valley Turnpike and the Staunton-Port Republic Road (Hotchkiss 1865; May 1987:11-12).

The mills at Mount Meridian prospered during the early and mid-nineteenth century under the ownership of Michael Whitmore, a planter who acquired the property from William Craig on September 27, 1813, for $10,000. Whitmore built a large brick plantation house on the northwest side of the river, south of the road leading across the valley, and operated the farm and mills with the assistance of slave labor. At Whitmore's death in 1857, the 411-acre plantation and improvements were valued at $34,278.75 (May 1987:12-13).

The Civil War interrupted the settlement of the Whitmore estate for ten years. During this time, the area was apparently the site of some military activity, being located on the fringe of the Piedmont Battlefield. In 1867, the Whitmore plantation was purchased by Robert Samuel Harnsberger, a prominent citizen of the Weyer's Cave community. Harnsberger, who owned the property until 1880, built a unique octagonal bank barn on the north side of the road soon after the purchase, which provided enough room for a four-horse team to turn around and off-load hay. The barn, which stands near the Mount Meridian Bridge, has been listed on the National Register of Historic Places (May 1987:13-14; Nuckols 1993; Nutt 1992; Virginia Historic Landmarks Staff 1980).

By 1865, the village of Mount Meridian had formed on the southeast side of the river, where the road leading across the valley met the Staunton-Port Republic Road. The settlement prospered in the decades following the Civil War, during which time farmers and craftsmen in the area profited from expanding market opportunities provided by the Shenandoah Valley Railroad, and by serving increasing numbers of tourists attracted by the nearby caverns known as "Weyer's Caves" (Hotchkiss 1885:76-77; Marshall 1978). By 1885, the village of Mount Meridian included "Snowflake Mills," a carpenter shop, a blacksmith shop, a post office, two churches, and a school (Hotchkiss 1885:76). The name Snowflake Mills was probably linked with the brand of refined flour the mills were producing at the time; other similar locally produced flours included "Belrose," "Melrose," "White Star," "White Lily," and "Pearl" (Hamrick 1982:5).

The residents of the Mount Meridian community were presented with wider social and economic opportunities beginning in 1890 when the industrial and resort town of Shendun was founded, approximately one and one-half miles to the east, in Rockingham County. Jed Hotchkiss, a mapmaker and civil war veteran, began to purchase large tracts of land in the area in 1899 and, as president of the Grottoes Land Company, vigorously promoted development of the town. Supported by industrial development and a healthy tourist trade at Weyer's and other caverns, Shendun, later named Grottoes, rapidly expanded into a center of industry and commerce. By 1891, the town's population had doubled to 709, and amenities included banks, a telephone service, a newspaper, a streetcar line, a plumber's supply works, two brick factories, a woolen mill, a plaster factory, a tile factory, and a large, impressive hotel. The Eutsler Brothers established a large carpentry business there and became the prominent house carpenters of the area (Marshall 1978; Upper Valley Regional Park Authority n.d.:8; VDHR file 7-990).

Situated on the road between the Weyer's Cave Station on the Valley Branch of the Baltimore & Ohio (B&O) Railroad and the caverns, Mount Meridian saw many tourists pass through the village from the time the caves were first opened to the public in 1808. A bridge was probably built across the Middle River at Mount Meridian to accommodate local business and tourist access to the caves during the 1870s, when the Shenandoah Valley Railroad was put into operation, and when the Valley Branch of the B&O began to achieve popularity. During the

early 1890s, as the town of Shendun boomed, traffic on the road through Mount Meridian increased. This activity was short lived, however, because Shendun was hit hard by the depression of 1893, as were many other Shenandoah Valley boom towns. In 1893, the Grottoes Land Company went into bankruptcy. Woodworking and blacksmithing industries were reestablished at Shendun after the turn of the century, and by 1912, the population of the town stabilized at 400. The caves have remained a tourist attraction to the present (Marshall 1978; Toner 1991; Upper Valley Regional Park Authority n.d.:3,8; Wayland 1912:206-207).

History of Mount Meridian Bridge

Mount Meridian Bridge was constructed in the spring of 1907 as a replacement for an earlier bridge which was deteriorating. The earlier bridge, consisting of a single iron span on masonry abutments with wooden approaches, was probably built soon after the Shenandoah Valley Railroad began operating in the area in the 1870s. Between July and October of 1884, the Road Board of the Middle River District repaired the then-existing bridge by covering the exposed timbers with metal roofing and applying two coats of paint to the woodwork and one coat to the iron span, for a total cost of $151 (Augusta County Court Order Book 71:149).

On June 6, 1903, a warrant for $156.21 was issued to the Road Board for making additional repairs to the Mount Meridian Bridge (Augusta County Board of Supervisors Order Book 4:186, 232). This sum was deemed inadequate, and two and one-half weeks later, the Road Board petitioned the county court for $800 in estimated repair costs. Witnessed by John G. Fulton, Supervisor; J.W. Byers, Road Commissioner; and two members of the Road Board, the petition for increased repair funds judged the bridge to be in dangerous condition and considered that extensive repair work was a public necessity (Augusta County Court Order Book 74:44).

The repairs accomplished in 1903 did not have long-lasting results, and on October 26, 1906, Mr. John G. Fulton, a Mount Meridian native and a member of the county Board of Supervisors, was ordered to contract for "the work necessary to be done for putting the Mount Meridian Bridge in good repair" (Augusta County Board of Supervisors Order Book 4:412; Rohrer & Diamond 1899:51). Fulton suggested the possibility of erecting a new bridge, and on November 26, 1906, the Board ordered that the matter of repairing the existing bridge or replacing the same with a new bridge be referred to the Road Board of the Middle River District. The Road Board was empowered to act on the issue and to do what they deemed best for the County of Augusta and for the public generally (Augusta County Board of Supervisors Order Book 4:422-423).

The decision was made to erect a new iron bridge, and a month later, on December 24, 1906, John G. Fulton, acting as chair of the building committee, was authorized to contract with the Champion Bridge Company of Wilmington, Ohio, to furnish the superstructure at a price of

$7,000 (Augusta County Board of Supervisors Order Book 4:426; May 1987:13). The bridge was completed the following spring, and on June 27, 1907, the Board issued a $7,000 warrant for the work (Augusta County Board of Supervisors Order Book 4:448).

During the course of construction, the Champion Bridge Company hired John G. Fulton and E.L. Houff, Jr., to purchase the lumber necessary for the work. In handling the account, Fulton and Houff made a net profit of about $140.00, which they reported to the Board on August 26, 1907. That day, the county paid Supervisor Fulton $30.00 for his services in contracting for the new bridge, and authorized him, along with Mr. E.L. Houff, to retain the $140 profit they had made in securing the lumber necessary for bridge construction. The Board considered this to be an individual matter, and one in which the county had no interest. Since the bridge was purchased for a net sum complete, the account was deemed to rightly belong to Fulton and Houff and not to the county (Augusta County Board of Supervisors Order Book 4:460).

About five years after the bridge was completed, additional work on the abutments was carried out under the direction of W.V. Smiley, Superintendent of Roads for Augusta County. November 28, 1912, Smiley reported that he had finished the required work; E.T. Carpenter was paid $190 for cement, and Smiley himself was reimbursed $323 for money he advanced for the job (Augusta County Board of Supervisors Order Book 5:432).

John G. Fulton, II, the lead member of the bridge committee, was a member of the county Board of Supervisors from 1897 until his death in 1924. A lifetime resident of the Mount Meridian-Grottoes community, he began to acquire real estate in Mount Meridian in November 1885, when he purchased a 48-acre tract near the Mount Meridian school, bounded on the east by the Staunton-Port Republic Road and on the west by the Middle River. His holdings were expanded during the next six years through the purchase of an adjoining 94-acre tract in 1888, and by the addition of another 123 acres three years later. While he was an active member of the county Board of Supervisors, Fulton operated a farm and mill at Mount Meridian and dealt in grain, flour, and livestock (May 1987:15-16, 19; Rohrer & Diamond 1899:51). In 1917, four years after the Mount Meridian Bridge was completed, John G. Fulton, II, added the former Whitmore-Harnsberger plantation on the northwest side of the river to his holdings (May 1987:14).

Periodic flooding has resulted in costly bridge repair and maintenance efforts over the years. The bridge was closed after the last damaging flood, in 1985, but it was reopened after the community resisted abandonment (Nuckols 1993).

Thomas Pratt and the Pratt Truss

Thomas Pratt was born in Boston in 1812, the son of noted Boston architect Caleb Pratt. Thomas was thoroughly educated by his father in the sciences, entered Rensselaer Polytechnic

Institute at age 14, became an engineer with the United States Army Engineers at 18, and began a professional engineering career with the Boston & Maine Railroad at age 21. At the beginning of his career, which lasted until his death in 1875, Pratt was probably the best educated bridge engineer in America. Pratt worked his entire life in the employ of various New England railroad companies, including the Providence & Worcester, the Hartford & New Haven, and the New York & Boston (American Society of Civil Engineers [ASCE] 1876:332-333; Condit 1960:108).

Pratt is best remembered for a bridge truss he designed in 1842 that consisted of two parallel chords connected by vertical wood posts in compression and double wrought iron diagonals in tension. The design, while similar in appearance to the truss patented by William Howe around the same time, functioned structurally opposite to the Howe truss, Howe having put the verticals in tension and the diagonals in compression. Modern engineers consider the Pratt design to be the first scientifically designed truss (Condit 1960:109). Pratt had recognized and applied a basic principle of structural engineering to truss design: reducing the length of the member in compression reduces the bending moment, allowing members of smaller cross section to be used without sacrificing overall strength. The basic design premise of a truss is to provide equal strength with less weight and material than a solid beam, and Pratt's innovation applied that principle to the design of the components of the truss itself.

In 1844, Pratt and his father were granted a patent for two truss designs, one with parallel chords and one with a polygonal top cord. Either design could be built of a combination of wood and iron, or of iron alone. The polygonal version again reflected Pratt's understanding of the application of mathematical principles in calculating the forces involved and the precise strength of material required to counter those forces. Pratt's patent was renewed in 1858. The use of the Pratt truss for the deck of John Roebling's Niagara River Suspension Bridge in 1855 drew worldwide attention to the design and undoubtedly contributed to its increased usage. One of Pratt's best works was the Eastern Railroad's Merrimac River Bridge at Newburyport, Massachusetts. The Merrimac bridge, completed in 1865, consisted of seven wooden Pratt trusses and a center draw span of iron (ASCE 1876:334-335; Cooper 1889:11; Johnson 1929:179).

In its wooden form, the Pratt truss never attained the popularity of the Howe design, but by 1889 in its iron form it ranked first in usage (Cooper 1889:11). The first all-iron Pratt truss bridges were built by J.H. Linville for the Pennsylvania Railroad in 1850. Application of the Pratt truss in its original form reached a high point with the construction of the Erie Railroad Bridge at Portage, New York, in 1875, and the Cincinnati Southern Railroad Bridge at Cincinnati in 1876, both early landmarks in railroad bridge engineering. Literally thousands of bridges, both highway and railroad, have been built following the Pratt design or some variation (Condit 1960:111,112,302).

The Champion Bridge Company

The Champion Bridge Company was founded by Zimri Wall, who was building wood truss bridges in Clinton County, Ohio, as early as 1860. He was joined by his brother Jonathan in 1871 to form Z. & J. Wall & Company. They began experimenting with wrought iron for bridge construction and patented an iron arch truss bridge in 1873, which they sold under the name "Champion Wrought Iron Arch." The partnership was renamed the Champion Iron Bridge & Manufacturing Company, and the first fabrication shops were built in Hamilton, Ohio (Miars 1972:7).

The operation moved to Wilmington, Ohio, in 1875, was incorporated in 1878, and changed its name to the Champion Bridge Company in 1881. Abel C. Briggs joined the firm in 1884 and held the positions of Chief Engineer from 1885-1916, and President from 1916 to his retirement in 1934 (Miars 1972:15). Champion expanded rapidly during the period of 1885-1910 and opened offices in Birmingham, Atlanta, and Chattanooga to reach the southern market. A major expansion and modernization of the fabrication shops was undertaken in 1893 (Miars 1972:19). Cash L. Richardson was hired in 1905 as erection foreman and achieved notoriety upon his death in 1965 for having erected more bridges than any other man in the United States. Richardson was responsible for the erection of most of the bridges in Virginia, including the 1,023' New River Bridge at Narrows, Virginia, one of the heaviest bridges built by Champion. This five-span camelback bridge was replaced in the 1960s (Miars 1972:23, 27).

Through the twentieth century, Champion Bridge diversified its manufacturing capabilities to include concrete bridges, steel building frames, and material handling equipment. In the mid-1970s, the company ceased its bridge construction and repair operations completely, ending what may have been the longest continually operated bridge company in the United States (Miars 1972:33).

According to *A Survey and Photographic Inventory of Metal Truss Bridges in Virginia, 1865-1932*, a study conducted by the VDOT Research Council in 1973, the Champion Bridge Company built a total of forty-seven metal truss bridges in Virginia: twenty-six in the Staunton VDOT Construction District, five in the Culpeper District, one in the Lynchburg District, eleven in the Salem District, and four in the Bristol District (Deibler 1973). Two other Champion Company bridges, Knightly Bridge (VDOT Bridge No. 6149) and Little Calfpasture River Bridge (VDOT Bridge No. 6081), both in Augusta County, are included in the seventeen historic metal truss bridges recorded by VDOT in 1993-1994, of which this report is a part.

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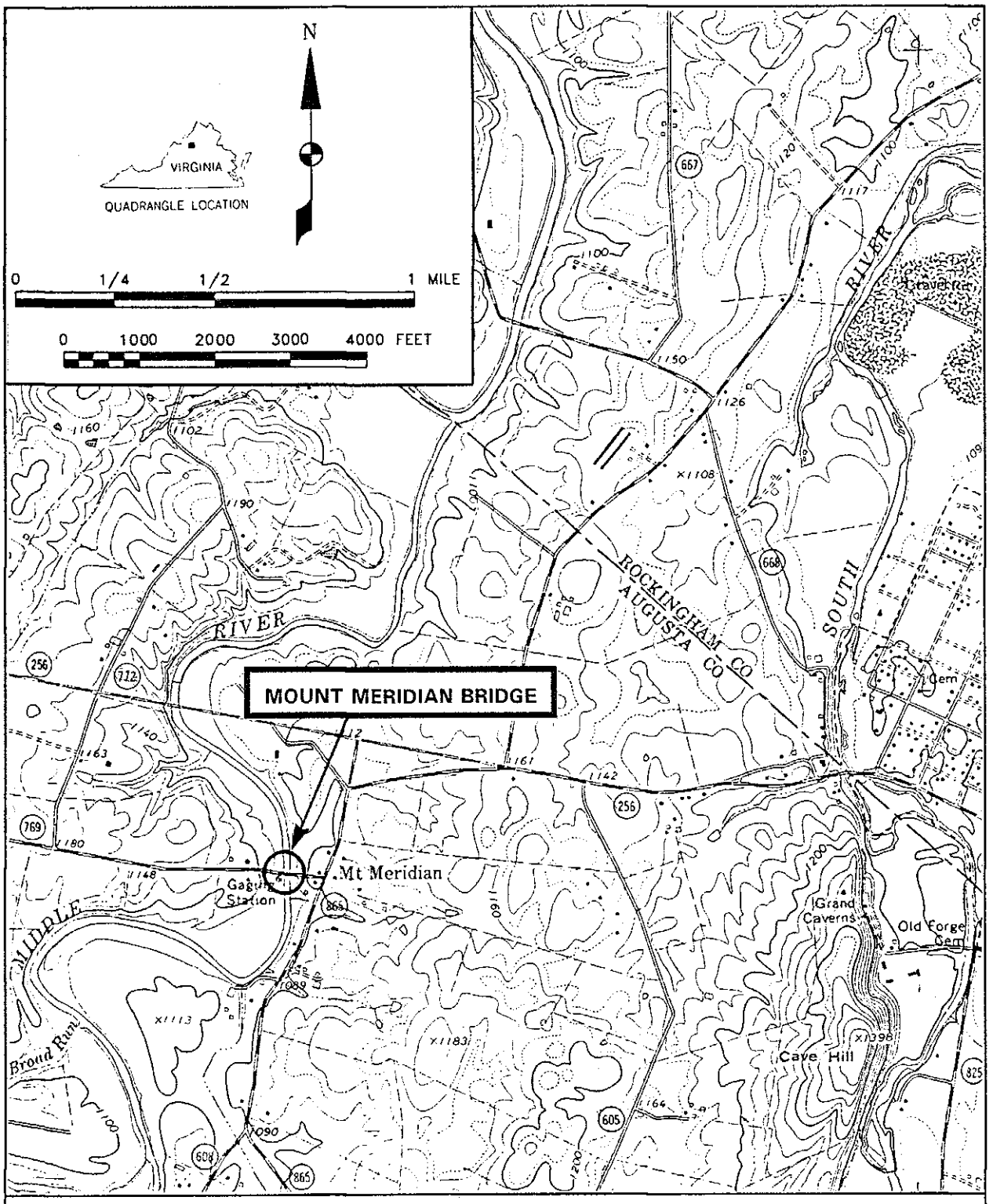

FIGURE 1: Location Map

SOURCE: USGS Grottoes, VA, 7.5 Minute Quadrangle, 1964 (Photorevised 1987)

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No Scale

TRANSVERSE VIEW

SOURCE: *Virginia Department of Transportation 1975*

FIGURE 2: Original Bridge Report, Bridge No. 6729, February 25, 1975

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0% Grade

SOURCE: Virginia Department of Transportation 1975

FIGURE 3: Original Bridge Report, Bridge No. 6729, February 25, 1975

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-20% Grade

SOURCE: Virginia Department of Transportation 1975

FIGURE 4: Original Bridge Report, Bridge No. 6729, February 25, 1975