MORRIS RUN BRIDGE
(Rickert Road Bridge)
Pennsylvania Historic Bridges Recording Project III
Rickert Road (TR 417) spanning Morris Run in Hilltown Township
Dublin vicinity
Bucks County
Pennsylvania

HAER No. PA-619

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

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

ADDENDUM TO:
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MORRIS RUN BRIDGE
(Rickert Road Bridge)

HAER NO. PA-619

LOCATION:	Rickert Road (TR 417) spanning Morris Run in Hilltown Township, Dublin vicinity, Bucks County, PA UTM: 18/481321/4468267
DATE OF CONSTRUCTION:	1908
DESIGNER:	A. Oscar Martin, Doylestown, PA
BUILDER:	S.B. Twining Company
PRESENT OWNER:	Bucks County, PA
PRESENT USE:	Vehicular Bridge
SIGNFICANCE:	Morris Run Bridge spanning Morris Run is an important example of an early reinforced concrete girder deck bridge by the Doylestown-based architect/civil engineer, A. Oscar Martin. A successful Doylestown architect, Martin also served as Bucks County Engineer for over two decades. In this capacity, he frequently proposed innovative designs in reinforced concrete that were constructed through competitive bidding by a number of contractors.
HISTORIAN:	Dr. Linda S. Phipps
PROJECT INFORMATION:	The Pennsylvania Historic Bridge Recording Project III is part of the Historic American Engineering Record (HAER), a long-range program documenting historically significant engineering, industrial, and maritime sites in the United States. The National Park Service, U.S. Department of the Interior, administers the HAER program. The Pennsylvania Historic Bridges Recording Project III was co-sponsored during the summer of 2002 by HAER under the general direction of E. Blaine Cliver, Chief; and the Pennsylvania Department of Transportation (PENNDOT), Bureau of Design, Dean A. Schreiber, Director; and the

Pennsylvania Historical and Museum Commission, Brent D. Glass, Executive Director and State Historic Preservation Officer. Ms. Kara Russell of the Bureau of Design's Environmental Quality Assurance Division served as principal liaison.

The fieldwork, measured drawings, historical reports, and photographs were prepared under the direction of Eric DeLony, Chief of HAER. The team consisted of Architects—Todd Croteau, Project Leader (HAER Architect), Roland S. Flores, Field Supervisor (HAER Architect), Marcy Ann Giannunzio (University of Michigan, Ann Arbor), Katherine Marie Kozarek (University of California, Berkeley), Sara Kryda (Illinois Institute of Technology), Jenna Michelle Murphy (University of Detroit-Mercy), Sandra Christine Pires (ICOMOS—Portugal); Dr. Linda S. Phipps and Dr. Richard Vidutis served as project historians under the direction of Dr. Richard O'Connor (Senior HAER Historian). Jose C. Colon (Pennsylvania State University, State College) was the project engineer and Professor Thomas E. Boothby, Ph.D., PE, RA (Pennsylvania State University, State College) was the consulting engineer. Jet Lowe (HAER photographer) took all large format photography. Justine Christianson (HAER Historian) prepared all documentation for transmittal to the Library of Congress.

Description

Morris Run Bridge is a reinforced concrete bridge carrying a local road through a sparsely populated rural area dominated by dairy farms. It has a span of 84' over Morris Run with a roadbed length of 65'. The width of the roadway is 16', but with the projecting inner curbs, the clear width is 15.2' near the center of the span. The underclearance of the bridge is 9'. Morris Run is a shallow stream running through a shallow valley.

The bridge is a five panel, closed spandrel, concrete arch bridge carried on reinforced concrete girders. The battered abutments are presently obscured by an overgrowth of vegetation. Plain parapets with shallow, raised panels support simple flat coping stones. The parapets rise in a graceful sweep from the road grade at the western approach to their apex at mid-span. The eastern approaches end in flat, unadorned parapet walls approximately 1' above grade. The parapets of these approaches are covered by two coping stones separated by expansion joints. Each of the stones is divided into two sections, each with a raised panel. Because of the sloping nature of the site, a simple galvanized iron pipe railing guards the northeastern approach. Below grade, a short stepped wing wall serves to buttress the northeastern retaining wall. This extra reinforcement was necessitated by Martin's decision to raise the overall grade of the roadbed. Concrete curb guards rise from the asphalt deck, occupying approximately two thirds of the inner surface of the parapets, and attaining a height of around 6" at the apex. A modern bituminous material covers the concrete deck that originally carried a 10" layer of macadam. While not part of the original design, a short concrete wing wall resembling a simple podium has been added to the southwestern approach. The texture of the concrete suggests that its composition varies from that of the original parapets. This podium is most likely a safety measure, since the grade drops about 4' from the road surface at that point. The sole ornamental element of the bridge, a dedicatory marble panel, occupies the center of the south parapet along its inner face. It says, "MORRIS RUN BRIDGE, NO—1908—21, C.F. MOYER, C.Y. STRADLING, S.M. FITE, COMMR'S, S.B. TWINING CO. CONTR', W. CADWALLADER CLERK." This is County Bridge Number 21, built in 1908. Curiously, there is no mention of Martin as the designer on this panel.

Below the bridge, the intrados is divided into five cellular compartments that resemble recessed panels. These panels are defined by a series of reinforced concrete girders that support the deck and the parapet walls. There are significant delaminations in the surfaces of the girders and the intrados of the deck. Due to the spalling of the concrete at these points, the rectangular deformations of the rebar are readily visible. Numbering the panels from the west to the east, the second panel shows significant delaminations of the concrete along the north edge of the deck and along the transverse girder. The transverse girder dividing panels three and four, at the crown, also shows marked delaminations on the north edge. Morris Run flows downstream toward the bridge from the north. Thus, this side of the bridge has the greatest exposure to the oncoming moisture from the air above the stream as it flows beneath the span. If this moisture has been penetrating the concrete, it might explain the increased rate of deterioration on that side.

A weight limit of 4000 pounds is currently posted for the single lane bridge. Despite its rural context, it carries a fair amount of traffic, approximately 200 vehicles per day.[1]

Significance

Morris Run Bridge is an important example of a concrete girder bridge during the formative and experimental years of reinforced concrete bridge design. Its forms attest to the design prowess of the architect engineer A. Oscar Martin. Rickert Road runs east-west between the small towns of Dublin and Blooming Glen in Hilltown Township. Surrounded by pastures, the bridge crosses Morris Run at the site of an earlier and much shorter bridge in a predominantly agricultural area.

As the Engineer for Bucks County during the early twentieth century, A. (Adam) Oscar Martin (1873-1942) designed a number of reinforced concrete bridges. A native of Doylestown, Martin was the son of a local contractor who went on to study architecture at the Drexel Institute in Philadelphia. His formal study was supplemented by years working as a draftsman, first in Philadelphia for Hazelhurst & Huckel and subsequently for architectural firms in Buffalo, New York and Lansdale, Pennsylvania. Returning to Doylestown, Martin had established an architectural practice by the early 1900s.[2] His work ranged from residential structures to churches, schools and office buildings. By the middle of the first decade of the twentieth century, Martin had also become a registered engineer. His design work for Bucks County included bridge design and repair.

Martin's successful practice of these two professions is particularly American in its marriage of pragmatic design based on knowledge of structure and materials with the artistry normally claimed as the exclusive domain of architects. As architects and engineers sought public recognition as highly skilled professionals, they sought to limit access to their respective professions and to define their respective spheres of practice. In his mastery of both, Martin joined the ranks of other American architects such as Frank Lloyd Wright who refused to allow such institutional limitations to inhibit their designs. Thus, Martin also anticipated the embrace of engineering by modernists during the 1920s and 1930s.

By 1928, Martin's son, Fred, had graduated from the architectural program of the University of Pennsylvania, and the two established a partnership, A. Oscar Martin and Son, that endured until Oscar's death in 1942. We are indebted to Fred Martin for donating his father's architectural and engineering drawings to the Spruance Library of the Bucks County Historical Society. These drawings offer a sampling of Martin's artistic production and help clarify much about his activities as a bridge designer. Over one hundred of these drawings, which are signed and dated, depict bridge designs or

[1] The measurements and related information regarding safety postings and traffic flow are based on a March 2, 2001 Inspection Report by Pennoni Associates Inc. The author is indebted to Joseph Bush, Jr., Director of the Bucks County Department of Public Works for providing her with a copy of this report.
[2] Much of the biographical information about Martin comes from Sandra L. Tatman, "Martin, Adam Oscar (1873-1942) Architect, Biographical Information," Philadelphia Architects and Buildings, (website), http://www.philadelphiabuildings.org

repairs by Martin in his capacity as Bucks County Engineer. Beginning in 1900, drawings of stone arch and covered wooden bridges delineate suggestions for extensions and repairs for county bridges. Yet, nearly half of the drawings in the collection are of designs for proposed or executed new concrete highway bridges. The earliest images of designs for reinforced concrete bridges by Martin date from 1906, a mere two years before the Morris Run Bridge. Thus, Martin belongs to that generation of young engineers who deliberately engaged the new material in order to develop strong, inexpensive designs for the local government. As an economical, strong and seemingly maintenance-free material, reinforced concrete appealed to county commissioners with modest construction budgets. Many such structures were deployed in rural contexts like Rickert Road.

In marrying the tensile strength of steel with the compressive strength of concrete, reinforced concrete became stronger than the sum of its parts. Engineers such as Edwin Thacher (New York) and Daniel Luten (Indiana) developed ideas for safe, strong new forms for bridges in this material. Royalties for patents issued to these innovator-engineers became important sources of revenue. There was considerable financial incentive to develop unique patterns for the reinforcement of concrete through reinforcing bars or rebars. Luten was among the most prolific of those who integrated elastic theory with economical and pragmatic design. By conceiving of reinforced concrete as a monolithic material, Luten's bridge designs were more economical than those of contemporaries like Thacher. Luten demonstrated that he could use significantly less metal in reinforcements and still attain a strong safe structure. Through the Concrete-Steel Engineering Company, and the National Bridge Company, Thacher and Luten, respectively, marketed their designs nationally. The first decade of the twentieth century saw considerable growth in such patents. Like earlier metal truss bridges before them, reinforced concrete bridge designs were most effectively marketed to other engineers and to potential clients through trade catalogues.[3]

Martin's own innovations become clear through a careful examination of the detailed linen drawing dated February 6, 1908, and entitled, "Reinforced Concrete Arch Bridge over Morris Run." Intended to communicate his ideas to contractors with little or no formal training in civil engineering, Martin's drawing succinctly defines the internal structure. It is a composite drawing, offering an elevation of the south side, a plan, a half longitudinal section, three transverse sections and a detailed drawing of the galvanized pipe railing situated within the concrete of the approach.[4] More importantly, Martin schematically depicts the disposition of rebar of varying sizes throughout the structure.

The plan clarifies the relationship between the 1908 bridge and its diminutive predecessor. Based on the 1/8" scale drawing, the original bridge appears to have been

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[3] Persons using a patented design would be charged a fee. For a comprehensive discussion of Luten's unique contributions see James L. Cooper, Artistry and Ingenuity in Artificial Stone: Indiana's Concrete Bridges, 1900-1942 (Greencastle, IN: n.d.), chapters 2 and 3.

[4] Copyright restrictions prohibit the reproduction of this drawing on the HAER website, but readers are welcome to view a photocopy of the drawing in the HAER field records, available at the Prints & Photographs Division, Library of Congress, Washington, D.C. The originals in the collection of the Spruance Library in Doylestown are available for public viewing during library hours, but researchers are advised to contact the library in advance. There is an admission fee for non-members. A. Oscar Martin, A. Oscar Martin Drawings Collection, Spruance Library, Bucks County Historical Society, Doylestown, PA.

something like a culvert with a clear span of only 7'. This could be a rough approximation intended simply to convey extant conditions surrounding the construction site in general terms. While this older bridge simply spanned the creek, Martin's new structure would bridge the entire shallow valley drained by Morris Run. Martin's bridge not only had a clear span of 60', but with abutments of 12', the bridge reached an additional 24' to offer an 84' structure significantly higher than the former structure and its associated roadway. In a site plan and in a section detailing the new retaining wall, Martin clearly indicates his intentions to transform the landscape as well. He raises the grade of the former road approaching from the east by 4' and establishes a retaining wall to hold the fill in place. The "breast of dam" depicted below the eastern approach to the bridge is puzzling, as it is not clear if this represents a masonry work that carried the former roadway to the earlier bridge, or if it is a feature intended by Martin to avoid erosion of the abutment on that side. Another inexplicable feature of the drawing not present in the executed structure is the wing wall projecting to the southeast. The present wing wall stretches to the northeast. The instructions, "Fill in here," directly behind the wall, appear on what is now the level ground of an adjacent pasture to the southeast.[5]

The most innovative aspects of the bridge include Martin's use of two concentric tiers of three 1" diameter rebars to reinforce the arch and to stabilize it by tying it deep into the abutments. In the half longitudinal section, this arrangement gives the reinforcements a profile resembling an elliptical or three-centered arch. It also indicates that these rebars may rise up above the deck into the curved forms of the curb guards along the inner faces of the parapets. The two tiers are also tied to one another through a series of 5/8" bands arranged in a radial pattern. Beginning in the abutments, the bands radiate until they reach the haunches of the arch. Then, Martin instructs the builder to deploy them on 3' centers across the arch ring. The lower tier of rebars is to be deployed 2" from the face of the concrete that comprises the intrados of the arched girders supporting the parapet walls. The organization of such a tied arch structure recalls innovative designs by Edwin Thacher of the Concrete Steel Engineering Company of New York, established in 1901. Thacher aggressively marketed his patented designs, and frequently published his explorations in engineering journals. Unlike Thacher, however, Martin seated his arch ring reinforcements deep within the abutments, running them almost to the foundations. Metal bands tied the two tiers of rebars together. Despite the resemblance of Martin's work to that of some of the most innovative engineers of his time, none of the designs for reinforcements in the Morris Run Bridge appear to have been simply borrowed. In fact, the individuality of Martin's designs is striking.

A lower tier of ten 3/4" rebars supported the transverse girders, which in turn supported the deck. The deck was supported by 1/2" transverse bars on 9" centers, with "every other one bent up." In two separate transverse sections, the rebars appear to be bent back at an angle in a way suggestive of a Luten truss. Given their deployment in a flat transverse span, as a girder, this application would readily lend itself to such a configuration. Named after its inventor, Daniel Luten, the truss consisted of a series of interlocking steel rods bent back and tied into themselves at an angle in order to provide

[5] None of the local histories of the region discuss this road, local inhabitants, industry, or the bridge so it is difficult to know how the former bridge came to be established or why its intended replacement was to be so much larger.

tensile strength to concrete at a point where it was required to span a space such as one required by the girders in Martin's bridge. These rods would be stretched along the lower edge of a beam or girder such as those suggested in the Martin drawing. Yet, although Luten had applied for a patent for his truss structure, it was not awarded until 1910, after the Morris Run Bridge was completed.[6] That Martin was thinking along similar lines further indicates the innovative aspect of his work. It also suggests that more needs to be understood about Martin's own contributions as a bridge designer within the greater context of these pioneering experiments in early reinforced concrete bridge design.

The extensive deployment of rebar throughout the bridge, in such relatively static sections as the retaining walls and the parapets is clearly evident throughout the drawings. Diameters of the bars and their precise locations are clearly spelled out so that any contractor could easily translate Martin's intentions into built form. This drawing may have been used to solicit bid proposals from contractors.

On Monday, February 17, 1908, Martin presented plans and specifications for two reinforced concrete bridges to the county commissioners. They included a bridge over Cabin Run in Bedminster Township and the Morris Run Bridge in Hilltown Township. This was the second pair of new bridges designed by Martin for the county during the year. Based on these plans, the commissioners advertised for bid proposals from construction companies. Meeting on March 16, the commissioners opened the bids, which ranged from $2,805 to $5,620. The Philadelphia-based firm of S.B. Twining Company won the contract for the Morris Run Bridge with the low bid.[7] According to drafts written to A. Oscar Martin by the County Clerk, Martin received $50 for his plans and specifications plus a 5 percent commission based on the cost of the bridge ($140.25 based on the $2,805 contract with Twining) for his supervision of the construction. Thus, he received a total of $190.25 for his work.[8] Martin did not receive a regular salary from the county. Instead, he was paid on a contractual basis, like a consultant. The $50 remuneration for the bridge design was twice what he was normally paid for similar work for repairs to extant bridges. The drawings in the Martin collection at the Spruance Library include designs from as late as 1923, suggesting that Martin served in his official capacity as County Engineer for more than two decades. In this way, he was able to maintain an independent architectural practice while continuing to design innovative bridges for Bucks County.

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[6] For a discussion of Daniel Luten's truss and arch reinforcement designs as well as the marketing of these designs through his National Bridge Company, see Cooper, p. 52

[7] Meeting Minutes from Jan. 27, Feb. 3, Feb. 17, March 2, March 16, 1908. Board of Commissioners, Minutes, 1903-09, Bucks County Commissioners Office, Bucks County Courthouse, Doylestown, PA.

[8] While there are references to Martin's compensation in the Commissioners' meeting minutes, a file of drafts and related invoices from the County Commissioners in the archives of the Spruance Library at the Bucks County Historical Society offer a much more detailed picture of how such actors as Martin and the related contractors were paid. See invoice from A. Oscar Martin to the Bucks County Commissioners, June 15, 1908.

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