

# Metal Girder Bridges

government under the direction of county engineer Alban P. Shaw and general contractor Charles H. Dunleavy of Coatesville, Pennsylvania, the bridge is handsomely detailed with the fascia scored to appear like stone voussoirs. The uncommon cantilever design allowed for ease of construction with a minimum of false-work. It is similar to the earlier 1928 North Market Street Bridge over Brandywine Creek (State Bridge NC-575) in Wilmington, also a cantilevered multi girder bridge.

In 1993, deteriorated concrete encasement, deck, sidewalks, and parapets were removed by DelDOT and replaced using a lightweight concrete. Original architectural details, such as battered pylons and balustrades were carefully reproduced. Although new from the deck up, the bridge's unusual cantilevered steel multi girder superstructure remains intact, and the rehabilitation was done in a sensitive manner that does not detract from the original design.

The bridge is located in the Rockland Historic District, a 19th-century mill village with former paper mill, converted to condominiums.



**ABOVE:** The 1932 Rockland Road over Brandywine Creek bridge (State Bridge NC-2) is an unusual cantilevered steel multi girder design with Moderne-style details. The railings and pylons were reproduced carefully following a 1993 rehabilitation project by DelDOT.

**LEFT:** The underneath view of the Rockland Road bridge shows the haunched, encased steel girders.



The mill race and dam are upstream of the bridge. The steel multi girder bridge from 1933 replaced a wooden covered truss bridge that had carried Rockland Road since 1833.

### Washington Street over Mispillion River

*State Bridge K-501  
Milford, Kent County  
Designer/Builder: Unknown*

**1933**



*The 1933 Washington Street bridge in Milford (State Bridge K-501).*

The 1933 Washington Street bridge is a skewed, one-span, 44'-long, 41'-wide steel multi girder bridge. It has concrete diaphragms. It is finished with incised paneled concrete parapets and supported on concrete abutments. Two concrete light standards remain on the east side of the bridge but have been lost from the west side. State records indicate the bridge was built by Milford City in 1933. The designer

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and contractor are not listed in state records. The bridge is a well preserved example of the standard steel multi girder bridge type built by state, county and municipal governments throughout Delaware and the United States, from the 1910s through the 1930s.

## Silver Lake Road (Road 442) over Silver Lake Spillway

*State Bridge NC-407*

*Southeast of Middletown,  
New Castle County*

*Designer/Builder: Unknown*

**1935**

The Silver Lake Road bridge is a one-span, 22'-long, 22'-wide, encased steel multi girder bridge. It is supported on concrete abutments with wingwalls directing the flow of water on the downstream side of the Silver Lake dam spillway. The spillway floor is an invert concrete slab. The



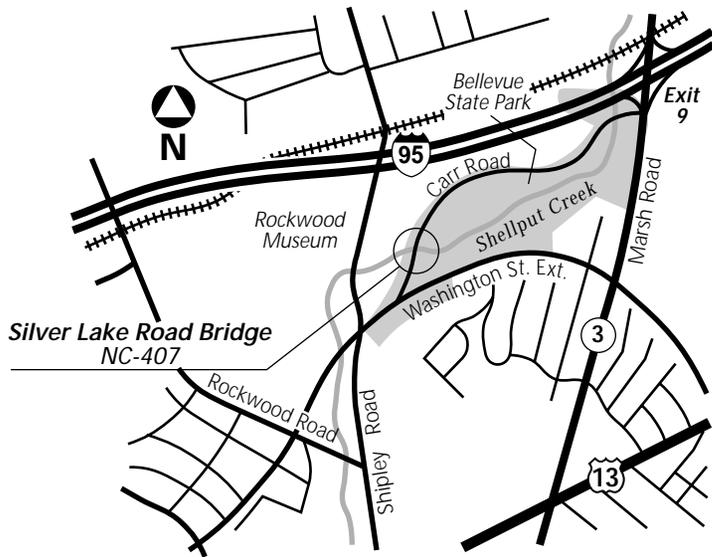
*The 1935 Silver Lake Road bridge (State Bridge NC-407) spans the Silver Lake Spillway. Sluice gates are built into the bridge's upstream side.*



bridge is finished with concrete parapets with diamond-shape panels and endpost pylons on the west elevation only. The pylons support concrete flower planters. A steel gate frame with wood sluice gates is built into the bridge's upstream side for controlling water flow from Silver Lake. The lake is a former mill pond, associated with a grist mill located at the northeast corner of the earthen dam. The mill has been converted to apartments.

The bridge is a representative example of the steel multi girder bridge type that was prevalent in Delaware during the first half of the 20th century. It was chosen for

its historical and technological significance from the population of similar multi girder bridges because of its historic association with the dam/spillway, custom-design parapets, and integrity of original design. Records state that the superstructure of the bridge was placed in 1935 after a flood had partially destroyed the previous bridge.



The bridge was rebuilt reusing the surviving abutments, which were placed in 1931. An inscription in the north abutment confirms the 1931 date. The bridge was built by the county, but no engineer or contractor are cited in any available records.

### Carr Road (Road 213) over Shellpot Creek

*State Bridge NC-543*

*Bellevue State Park, New Castle County*

*Designer/Builder: Delaware State  
Highway Department/Union Paving  
Company*

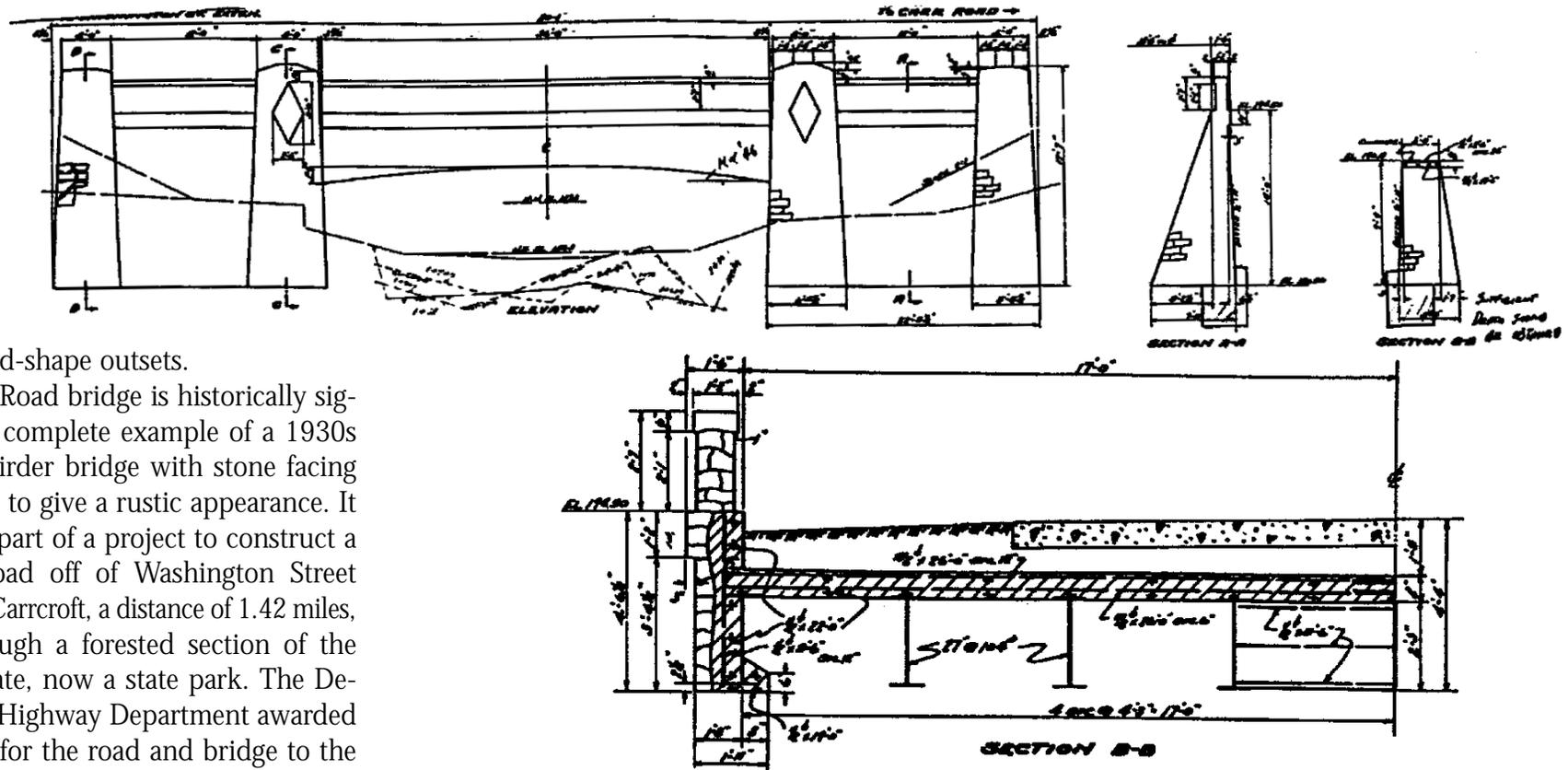
**1936**



*The 1936 Carr Road bridge (State Bridge NC-543) has stone facing and parapets to present a rustic appearance.*

The Carr Road bridge, built in 1936 by the state highway department, is a one-span, 40'-long, 37'-wide, steel multi girder bridge consisting of nine lines of rolled I-beams. The fascia beams are haunched and have a stone veneer to present the appearance of an arch bridge. The bridge is supported on stone abutments with U-shaped wingwalls and is finished with stone parapets and a corbeled stone belt course extending across the fascia at roadway level. Stone pilasters are located at each of the abutment corners. The pilasters form the parapet end posts, which are decorated

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with diamond-shape outsets.

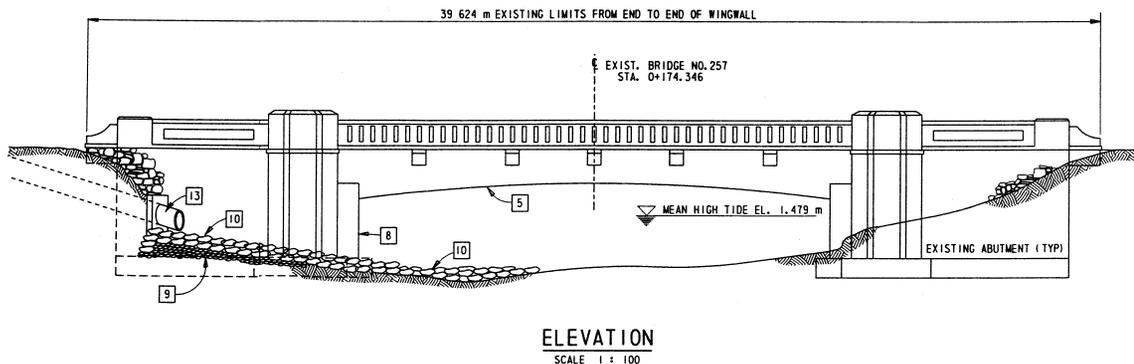
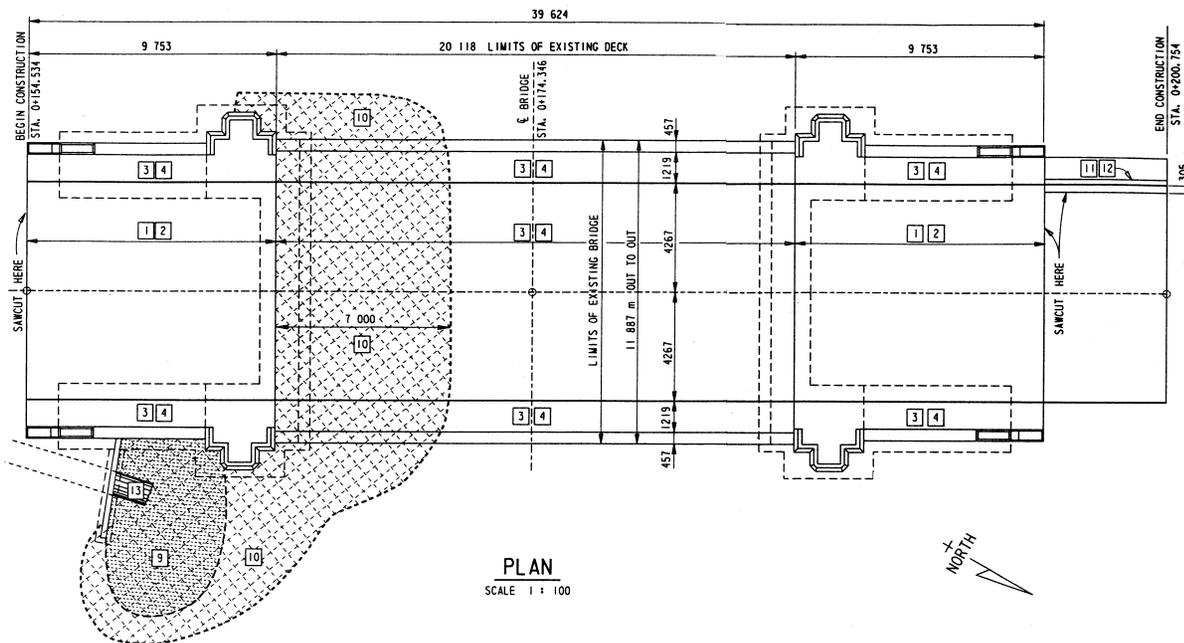
The Carr Road bridge is historically significant as a complete example of a 1930s steel multi girder bridge with stone facing and parapets to give a rustic appearance. It was built as part of a project to construct a new spur road off of Washington Street Extension to Carrcroft, a distance of 1.42 miles, passing through a forested section of the Bellevue Estate, now a state park. The Delaware State Highway Department awarded the contract for the road and bridge to the Union Paving Company of Philadelphia for over \$50,000.

Contract drawings and notes provide insight into the desire to construct the bridge with a stone facing and parapets. State Bridge Engineer Arthur G. Livingston commented that “the site shows exposed rock thickly located around the entire vicinity; con-

*Elevation and section drawings for the Carr Road bridge. The drawings were prepared by the state highway department’s bridge division in 1933.*

struction should conform as closely as possible to the surrounding country.” He also indicated his design was influenced by other nearby stone-faced structures: “[The bridge] will be similar to the structure already built

across the same stream about a half a mile [away]. This will make on the Shellpot Creek three rubble masonry structures and an I-beam span on the Industrial Highway.” Livingston, like many bridge engineers, was



**Plans for repairs to the State Route 7 bridge in 1996. DelDOT redecked the bridge, repointed the masonry, and strengthened the rolled I-beam girders with stiffener plates and diaphragms. The repairs maintained the bridge's historic appearance.**

influenced by the ideas of landscape architects who promoted the idea that a structure's surrounding should influence its form. Stone masonry was an appropriate response to the landscape of upper New Castle County, where there are many rock outcroppings and buildings, walls, and fences built of native granite.

## State Route 7 over Christina River

*State Bridge NC-257*

*Christiana, New Castle County*

*Designer/Builder: Delaware State Highway Department*

**1937**

The State Route 7 bridge is a one-span, 66'-long, 39'-wide, steel multi girder bridge built in 1937 by the Delaware State Highway Department. The fascia girders have been faced with stone to appear as shallow stone arches complete with voussoirs and keystones. The bridge is finished with stone balustrades and parapets over the wing-

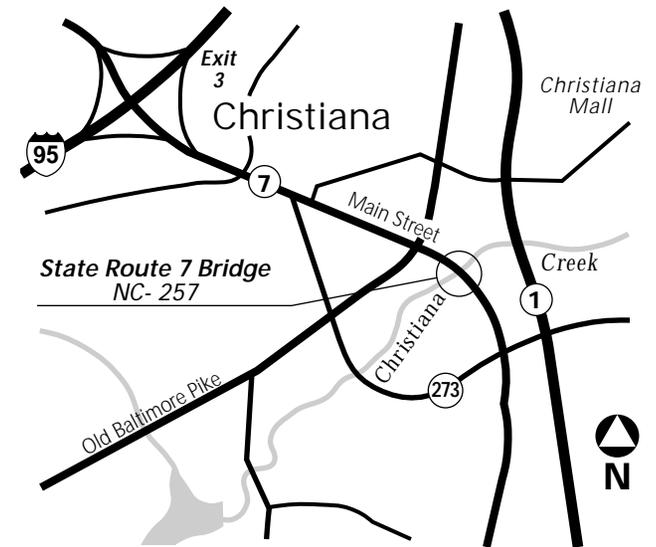
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walls. It is supported on rubble masonry abutments. The bridge is historically significant as one of the longest and best preserved of several 1930s stone-veneered steel multi girder bridges in New Castle County. State Bridge Engineer Arthur G. Livingston designed the bridge with local stone to blend with the natural environment and imitate traditional stone arch construction.

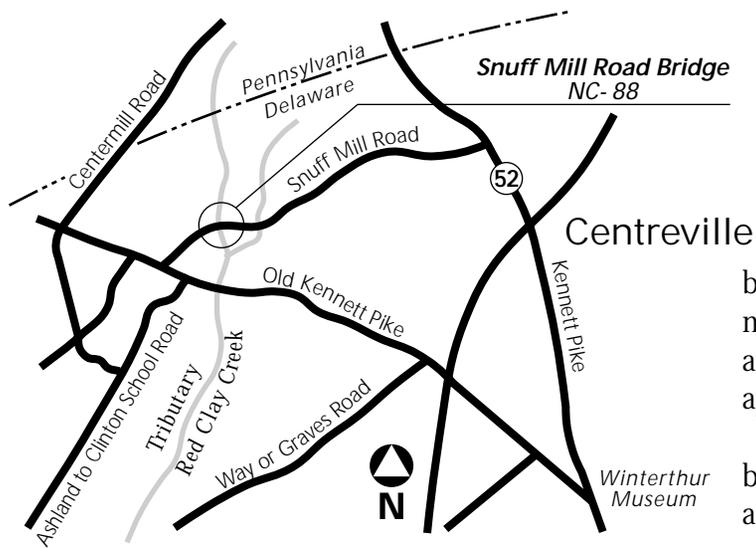
Original drawings on file at DelDOT indicate that the State Route 7 bridge replaced a pony truss swing span bridge at the same location. The center-bearing swing span was supported on rubble masonry pier and abutments with wingwalls, and specifications for the replacement structure allowed for the reuse of the stone, providing it was cleaned and free of all mortar. By the 1930s, the upper reaches of the Christina River were no longer important to navigation, and permission was received from the U. S. Army Corps of Engineers to replace the movable bridge with a fixed span.

The bridge underwent repairs in 1996.

It was redecked using a lightweight concrete, the stone balustrades were repointed, and the rolled I-beam girders strengthened with stiffener plates welded to the webs. The sidewalks were divided from the roadway by the addition of metal pedestrian



***The 1937 State Route 7 over Christina River bridge (State Bridge NC-257) is one of the longest of several 1930s stone-veneered steel multi girder bridges in New Castle County.***



barriers. The repairs were performed in a manner sensitive to the original materials and that maintained the bridge's original appearance from both elevations.

The bridge straddles the southeastern boundary of the Christiana Historic District, a commercial village that thrived prior to

1850 because of its location at the Christina River's navigable headwaters.

### Snuff Mill Road (Road 244) over Red Clay Creek Tributary

*State Bridge NC-88*

*West of Centreville, New Castle County*

*Designer/Builder: Delaware State  
Highway Department/Olivere Paving &  
Construction Company*

**1939**

The Snuff Mill Road bridge is a one-span, 37'-long, 27'-wide, encased steel multi girder bridge supported on concrete abutments. The bridge has stone faced veneer and stone parapets. Built in 1939, the bridge is a complete and well-proportioned example from among several similar stone-faced multi girder bridges built in New Castle County during the 1930s. This bridge was designed by the Delaware State Highway Department's bridge department and built by contractor Olivere Paving &



*The 1939 Snuff Mill Road bridge (State Bridge NC-88).*

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Construction Company of Wilmington. The department instructed the contractor to match the stone for the bridge with stone used by Mr. Haskell, owner of an adjacent estate property. The bridge is another example of the department's efforts to match its bridges with the existing landscape. Nationally, stone veneers were applied frequently to steel girder and other bridge types like reinforced concrete arches and slabs beginning in the early 20th century. In northern New Castle County, the practice reached its height during the 1930s.

## State Route 82 (Mt. Cuba Road) over Red Clay Creek

State Bridge NC-119

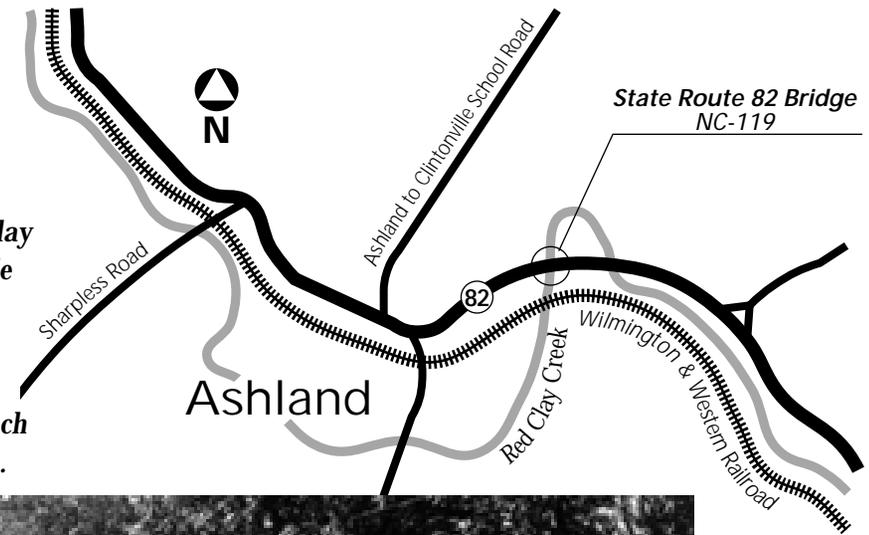
Ashland, New Castle County

Designer/Builder: Delaware State Highway Department/Olivere Paving & Construction Company

1939

**B**uilt in 1939 by the state highway department, the State Route 82 bridge is

*The 1939 State Route 82 bridge (State Bridge NC-119) over Red Clay Creek has distinctive Moderne-style stepped pylons at the corners. It illustrates the adoption of then-current architectural styles to embellish common bridge types, such as the steel thru girder bridge type.*





*The photo shows the bridge as it appeared when completed in August 1939. The adjacent truss railroad bridge, which carries a single track of the Wilmington & Western Railroad, still exists.*

a one-span, 110'-long, 27'-wide, steel thru girder bridge with distinctive Moderne-style stepped pylons at the corners. The concrete wingwalls are finished with concrete parapets with stepped end posts. The superstructure consists of two, 7'-deep, built-up girders with I-beam floorbeams carrying a concrete slab deck. The bridge is supported on concrete abutments.

The thru girder bridge is an example of a common 20th-century bridge type with fine custom details, illustrating the adoption of Moderne-style parapets by the state highway department in the late 1930s. Moderne style railings continued to be used by the department through the 1950s. Thru girder bridges were most often built as utilitarian structures devoid of embellishment, and this bridge illustrates the extra efforts that Delaware's state highway department often took with custom details.

The previous bridge at this crossing was a covered bridge that was destroyed by a

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flood on July 13, 1938. The state highway department bridge department designed the replacement bridge and awarded the contract to Olivere Paving & Construction Company of Wilmington for approximately \$28,500 in December 1938. A portion of the replacement cost was funded by the federal New Deal program administered by the Public Works Administration.

## State Route 20 Eastbound (*Stein Highway/ Tull Crossing*) over Conrail (*Delaware Railroad*) and Cedar Street

*State Bridge S-257E*

*Seaford, Sussex County*

*Designer/Builder: Delaware State Highway Department/M. J. McDermott*

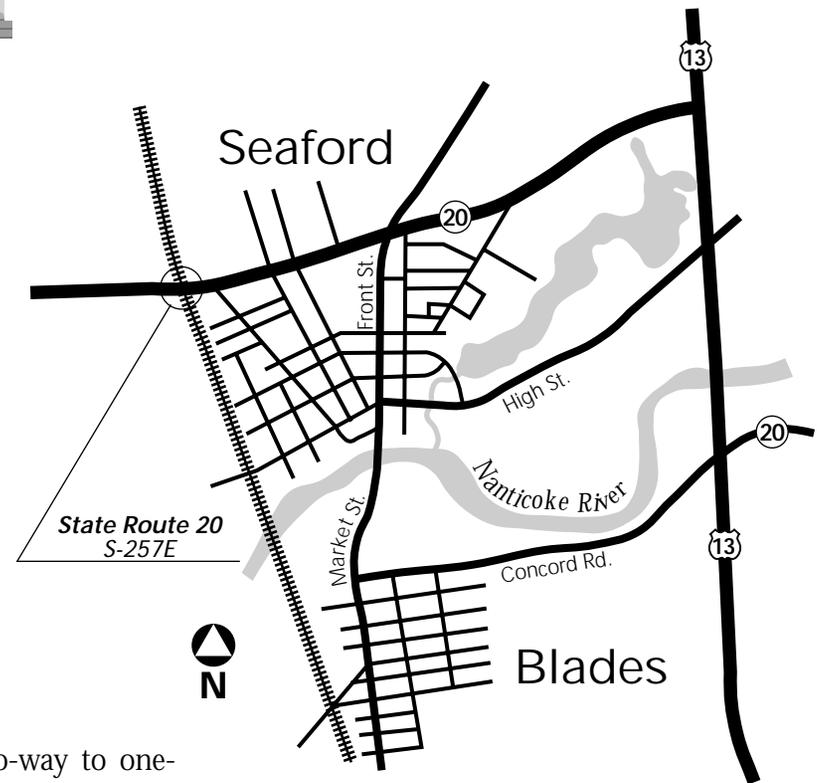
**1940-41**

The 21-span, 567'-long bridge consists of a 40'-long encased steel multi girder main span over the railroad, and continuous, variable-depth, reinforced concrete slab ap-

proach spans. The bridge is finished with handsome concrete parapets with bush hammer-finish panels and red diamond-shaped tiles. It is supported on arched concrete bents with brackets. The bridge has no history of significant alterations or modifications, although it has been converted from two-way to one-way traffic.

Built in 1940-41 for the state highway department, the State Route 20 bridge is historically significant as a complete example of a New Deal-era grade crossing elimination bridge with Moderne-style details. The bridge, also known as "Tull Crossing," was designed to eliminate a grade crossing with the Delaware Railroad, a division of the Pennsylvania Railroad, on the northeast end of Seaford. In the early 20th century,

grade crossings posed an increasingly dangerous junction between railroad and highway traffic, accounting for thousands of fatalities in the United States. Railroads took measures to eliminate dangerous crossings, especially in congested urban areas where automobile traffic also caused delays to the railroad's own traffic, but it was not until after 1919 and the era of federal and state funding for highways and bridges that





***The 1940-41 State Route 20 bridge (State Bridge S-257E) is historically significant as a complete example of a New Deal-program grade-crossing elimination bridge with Moderne-style details.***

wholesale grade crossing elimination programs were undertaken outside of larger cities. The Delaware State Highway Department announced a systematic program to eliminate hazardous crossings in 1926, and this effort was supplemented after 1935 by a New Deal program that offered federal funding for such overpasses. In 1940-41, the State Route 20 bridge was built with federal funding from the Federal Aid Grade Separation program matched by funds from the Delaware State Highway Department

and the Pennsylvania Railroad.

The state highway department's bridge department designed the State Route 20 bridge with the final plans forwarded to the Pennsylvania Railroad's engineering department for approval. The contractor for the bridge was M. J. McDermott of Georgetown, Delaware, for a price of over \$74,000. As first contemplated, the bridge was to have approach embankments on fill, but this was abandoned as aesthetically unsuitable for an in-town location where an open-type

structure of approach spans on concrete bents was preferred. It provided better access to properties adjacent to the structure.

The approach spans are an early use of continuous, variable-depth, reinforced concrete slab technology. The continuous design is an economical use of material, allowing longer spans for the given depth of slab than would have been possible with simple, non-continuous spans. Continuous designs, both in reinforced concrete and steel, came to the fore nationally in the 1930s,

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and were ubiquitous by the late 1940s and early 1950s.

## State Route 141 (Tyler McConnell Bridge) Over Brandywine Creek And Road 260 (Brecks Lane)

State Bridge NC-587

East of Greenville, New Castle County

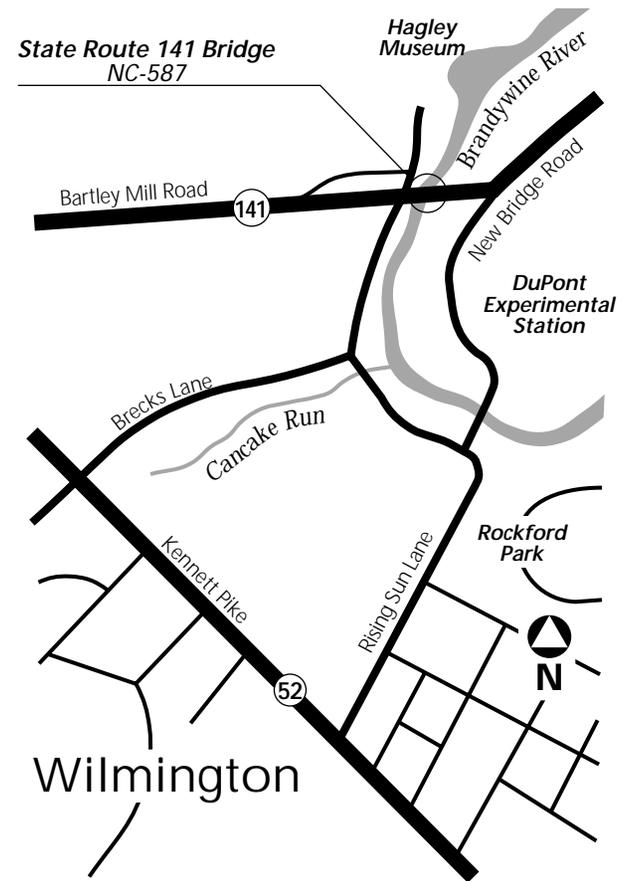
Designer/Builder: Parsons, Brinckerhoff, Hall & MacDonald/James Julian Inc.

1951-52

The 12-span, 816'-long Tyler McConnell Bridge consists of three-span continuous, haunched, built-up, deck girder main spans with span lengths of 87'-156'-87', flanked by six, 53'-long steel multi girder spans to the west, and three to the east. The main spans have rolled steel floorbeams, stringers, and crossbracing. The concrete deck is finished with concrete safety shape parapets with metal hand railings, placed in

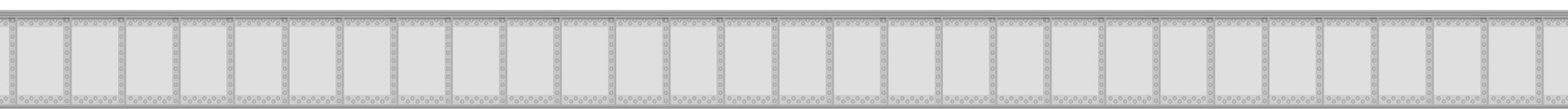
1980-82. The 33'-wide bridge is supported on reinforced concrete abutments and high reinforced concrete hammer head piers consisting of hammer-shaped pier caps integral with single column stems. The piers are accented by checkerboard-pattern scoring.

The Tyler McConnell Bridge, built in 1951-52, is a technologically significant deck girder bridge reflecting important mid-20th-century refinements of the steel girder bridge type. The bridge is Delaware's largest pre-1957 continuous steel girder bridge, and one of the earliest documented examples of the use of hammer head piers in the nation. Long-span continuous steel girder bridges were increasingly popular after 1945 because of the economy of material achieved in comparison to simply supported spans. Continuous designs allowed for longer spans for the given depth of beam. The 156'-long haunched girders reflect this economy of material, achieving their great-



est depth over the piers of the main span where the stresses are greatest.

Hammer head piers were an important refinement of substructure design. They were first used beginning in the early 1950s and became increasingly popular because of the



economy of material, lessening the weight on the foundation and cost of construction. The style of pier was made possible in part because of the increased availability of higher strength concrete. The hammer head design had the additional advantage of less foundation work in the ground. The design was frequently used for the interstate highway programs of the 1960s and 1970s, and it continues to be built. Thus, the 1951-52, Tyler McConnell Bridge documents the introduction of an important new substructure design.

Planning for the bridge began in 1948, when the E. I. DuPont de Nemours Company (DuPont) approached the state highway department with its plans to expand its experimental station on the east bank of the Brandywine Creek in North Wilmington. The company desired better access to the facility, and it offered to donate \$250,000 toward the construction of a new bridge (about half the original cost), as well as provide preliminary survey work.

In cooperation with DuPont, the state

highway department hired Parsons, Brinckerhoff, Hall & MacDonald, consulting engineers of New York City, to design the bridge. Assigned to the project was the firm's chief bridge engineer, Alfred Hedefine (1906-1981), one of the nation's leading bridge designers of the mid-20th century. He was largely responsible for such important structures as the 1939 World's Fair Trylon and Perisphere; the Talmadge Bridge, Savannah, Georgia (1950-51); the Arthur Kill Bridge, Staten Island, New York (1959); the Newport Suspension Bridge, Newport, Rhode Island (1965-69); and, the Fremont Bridge, Portland, Oregon (1973).

The first task facing Hedefine was consideration of a steel arch bridge versus a steel deck girder bridge for the Brandywine Creek crossing. Although all agreed that the former was more aesthetic, calculations proved the latter design far more economical, and the deck girder bridge was selected based on cost. It was Hedefine who met with Delaware state officials at the bridge site in

April 1950, presenting a sketch of a new type of pier with a hammer-head shape and recommending its substitution for more conventional bents or solid-stem piers. Construction began in February, and the piers, perhaps the most innovative part of the project, were a detail of frequent discussion between the engineers and the contractor, James Julian of Wilmington. Having no experience with the construction of hammer head piers, careful consideration was given to the formwork, with several revisions made before Hedefine was satisfied that it was strong enough to support the cantilevered portion of the pier heads. Although the substructure was complete by late 1951, a steel strike delayed delivery of the superstructure from the Phoenix Bridge Company, Phoenixville, Pennsylvania, until June 1952. The bridge opened to traffic in December 1952, and was dedicated the J. H. Tyler McConnell Bridge in April 1953. McConnell was a member of the Delaware State Highway Commission. ■

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***ABOVE: Tyler McConnell Bridge (State Bridge NC-587) over the Brandywine Creek as seen from downstream. Opened in December 1952, the bridge provided a new crossing of the stream near the DuPont Company's experimental station.***

***RIGHT: The Tyler McConnell Bridge was constructed during 1951-1952. It is Delaware's largest pre-1957 continuous deck girder bridge.***



***The reinforced concrete hammer head piers were an innovative design, lessening the weight on the foundation and reducing the cost of construction. The Tyler McConnell Bridge is one of the nation's earliest documented uses of hammer head piers. They remain one of the most popular pier types in use today.***