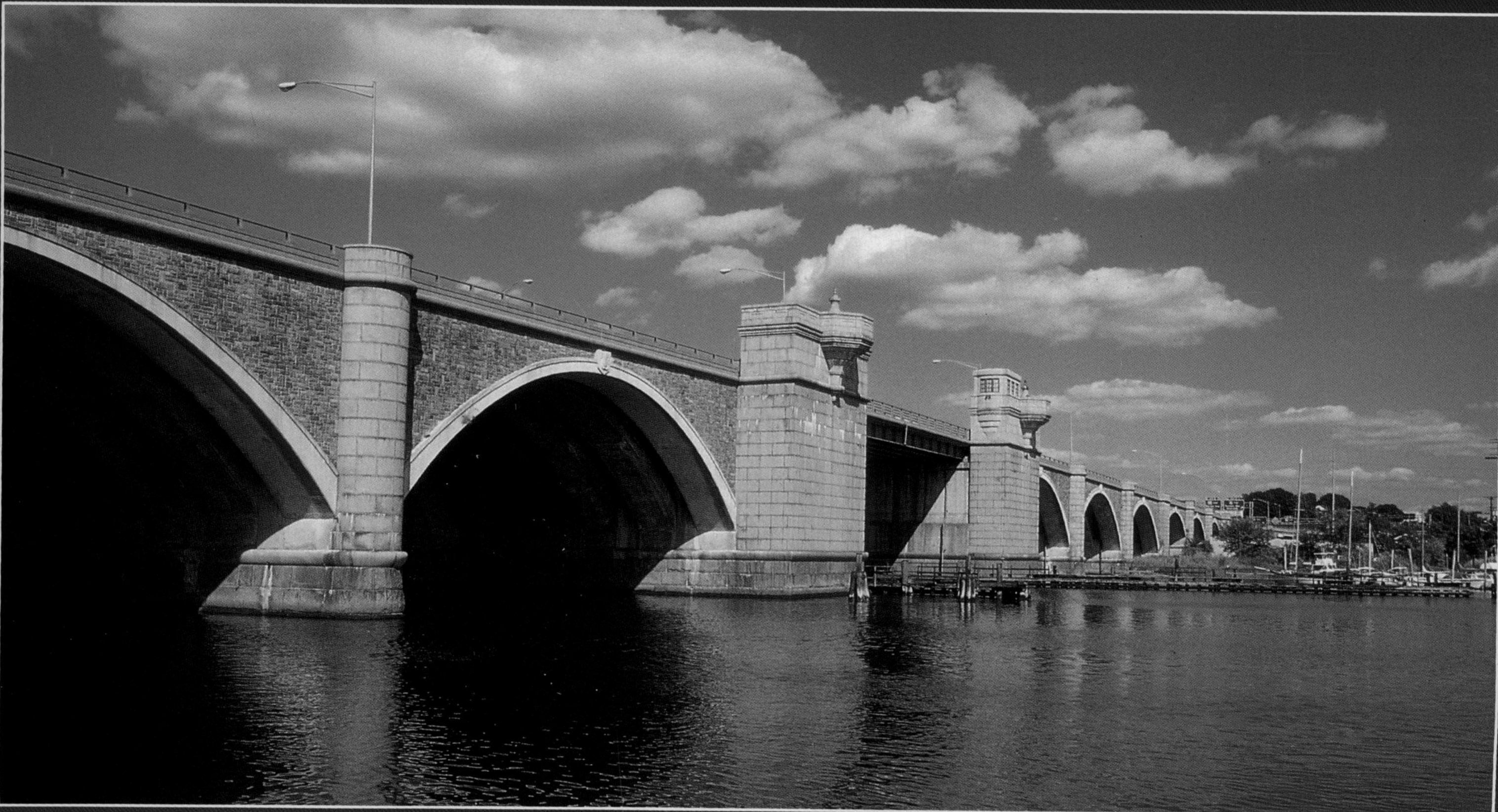
HISTORIC HIGHWAY BRIDGES OF RHODE ISLAND



RHODE ISLAND DEPARTMENT OF TRANSPORTATION ■ MATTHEW J. GILL, JR., *DIRECTOR* ■ EDWARD D. DIPRETE, *GOVERNOR*

HISTORIC HIGHWAY BRIDGES OF RHODE ISLAND

Published by
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Since the original publication:
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>some financial incentives referred to in these pages are no longer available;
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The Rhode Island Historical Preservation & Heritage Commission is your state agency for historical preservation. The Commission identifies and protects historic buildings, districts, landscapes, structures, and archaeological sites throughout the State of Rhode Island.

ACKNOWLEDGMENTS

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Book and cover design by Puffin Enterprises, Jamestown, Rhode Island.

Front cover: Washington Bridge South (Bridge #200), across the Seekonk River between Providence and East Providence.

Back cover: South Main Street Bridge/Globe Bridge (Bridge #958) across the Blackstone River in Woonsocket.

CONTENTS

"It is in the national interest to encourage the rehabilitation, reuse and preservation of bridges significant in American history, architecture, engineering and culture. Historic bridges are important links to our past, serve as safe and vital transportation routes in the present, and can represent significant resources for the future."

U.S. Congress, Surface Transportation Act of 1987

INTRODUCTION

Historic bridges are an important part of Rhode Island's heritage. Like the colonial houses on Providence's Benefit Street, the stone mills of Woonsocket, and the mansions of Newport, the State's historic bridges are artifacts of an age gone by, products of a period in time related to, but distant from our own. Bridges like those in this book, many of which are more than a century old, can help us understand important aspects of our past.

Bridges can tell us about technology in earlier periods—the skills and materials available in a locality, and the development of practical and theoretical engineering. Every bridge was built for specific reasons, and understanding those reasons will illuminate some chapter in Rhode Island's history, such as the effects of industrial growth, the cities' early twentieth century efforts to enhance their appearance, or the development of the State transportation system.

As prominent elements in historic landscapes and streetscapes, old bridges are community landmarks. An early nineteenth century stone arch or a Victorian period metal truss reminds us that the communities of Rhode Island did not spring up overnight, but that generations of citizens labored to build them.

Old bridges are remarkably complete artifacts. An historic house without its furnishings can only suggest the lives of the people who lived in it, and an old factory without its machinery can only provide the barest hint of its former productive might. But those historic bridges that survive usually retain their original appearance and structure, and most continue to serve their original function.

This book has been developed from an inventory of all the historic highway bridges of Rhode Island. The basic purpose of the Historic Bridge Inventory project, undertaken by the Planning Division of the Rhode Island Department of Transportation, was twofold: to determine the historical significance of the highway bridges of Rhode Island, and to help plan the preservation of those bridges that are historically significant. This book has been prepared to document the project and to share its results with the public.

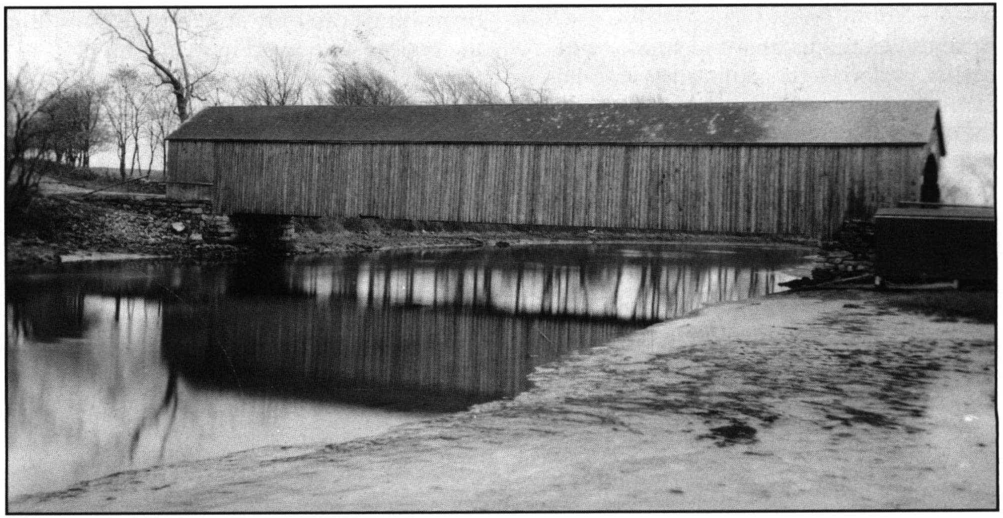
The first part of this book is a capsule history of bridge building in Rhode Island. Following that is a summary of the purposes, methods, and conclusions of the project. The final section contains detailed information and photographs for 37 bridges selected from the 51 Rhode Island highway bridges that were identified as having exceptional historical significance.

HISTORY OF BRIDGE BUILDING IN RHODE ISLAND

The bridges of colonial Rhode Island were simple wooden structures. They ranged from crude log bridges over small streams to the large covered bridges that were such a familiar part of the New England landscape. They were usually built by local carpenters and paid for out of town highway taxes. Since they used nearby sources of timber, wooden bridges were not expensive, but neither were they long-lasting. They were easily carried off by high water during floods, and rain and snow caused the wood to rot. In fact, protection from the elements was the chief reason that large wooden bridges were built with roofs. The Blackstone River crossing in Pawtucket was typical. The first wooden bridge built there in 1713 was followed by a succession of six replacements, each with an average lifetime of only twenty years. Although a handful of old wooden bridges were still in service on Rhode Island roads in the early 1900s, none survive today.

Another traditional method of building bridges, the stone arch, was rarely used before 1800. Stone construction cost two to three times more than wood. Townspeople could not afford such an extravagance, especially since they often had to replace several bridges at once following a flood. Stone arch bridges only became common as textile manufacturing spread throughout the Rhode Island countryside, bringing mills and villages along every stream. Textile manufacturers preferred stone bridges, and to get them built they used their influence with town officials, split the cost with the town, or paid for them outright.

A 1913 view of the old Governor Sprague Bridge in Narragansett, no longer standing.

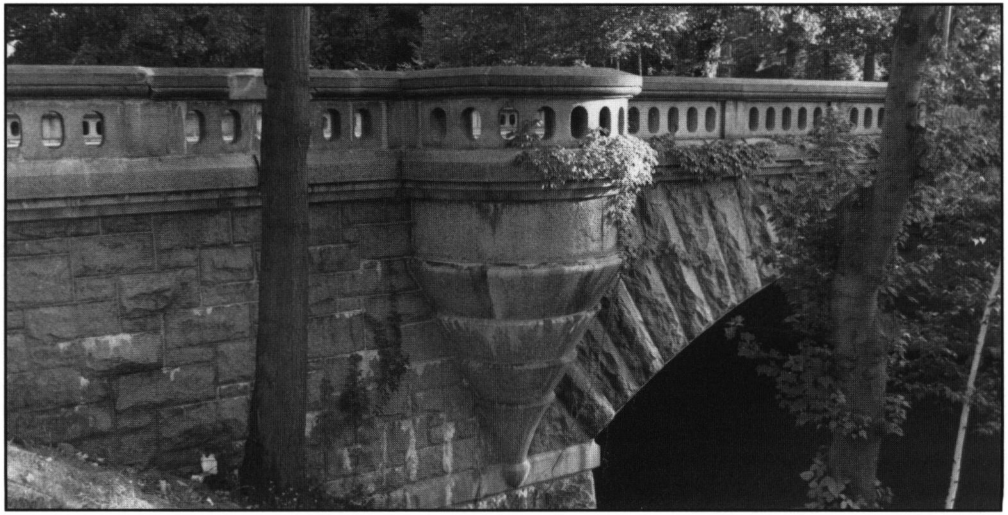


Mill owners had good reasons for wanting stone bridges. Strong, reliable bridges allowed them to bring in heavy wagons loaded with cotton and to send them out with finished cloth. By interfering with the normal flow of the river or stream, their mill dams increased the potential for flood damage, so it was doubly important for them to have substantial bridges. Some mill owners paid for stone bridges partly for philanthropic reasons, to benefit the community as well as their business. Whatever the reason, Rhode Island today is especially rich in historic stone arch bridges.

Toward the end of the nineteenth century, some of the larger towns began building stone arches as part of their programs to replace inadequate older bridges. These arches often had exceptionally fine stone work. They were expensive, but their attractiveness and durability justified the extra cost.

In the 1870s the prefabricated metal truss appeared as an alternative to traditional bridge building methods. Iron and steel trusses were far stronger than wooden bridges, and they were much more durable. Although they were made by specialized bridge fabricating companies using materials from faraway iron and steel mills, metal trusses were not much more expensive than wooden bridges. Bridge companies employed traveling agents to sell their products to local highway officials, often entertaining them lavishly and staging elaborate sales demonstrations. Once a town had bought a bridge from one maker, it frequently returned to the same company for more bridges. Smithfield, for example, bought

Although not highway bridges, the handsome arches built by the City of Providence on the roads in Roger Williams Park represent the height of the stone bridge building craft in Rhode Island.



at least three trusses from the Berlin Iron Bridge Company of East Berlin, Connecticut. Although bridge salesmen came from as far away as Ohio, three companies had the majority of the business from Rhode Island towns: Berlin Iron Bridge, Dean and Westbrook of New York City, and Boston Bridge Works of Boston, Massachusetts.

Rhode Island's earliest wrought iron trusses have many unusual features. The 1875 Atwells Avenue Bridge in Providence is a lattice truss formed from criss-crossed pieces of angle iron, an arrangement that was soon discarded in favor of stronger, more reliable, more economical designs. Berlin Iron Bridge Company used a unique patented truss design in which both the top and bottom chords were curved, giving the bridge a lens-shaped profile. The supposed technical superiority of this design was a selling point that Berlin agents impressed upon small town selectmen. Similarly, Dean and Westbrook's bridges had as their unique feature *Phoenix columns*, hollow pipe-like assemblies that took the place of an ordinary truss's riveted girders. Bridge fabricators in the late nineteenth century proudly identified their products with cast iron plaques attached to the bridges.

Late nineteenth century trusses (as well as many stone arches) often had elaborate Victorian iron railings. One common design combined latticework with cast iron rosettes at its intersections, and another featured upright pickets capped by spear-shaped or floral ornaments. The J.H. Tower Ironworks of Providence produced many of the state's most decorative iron railings.

In the 1890s, truss bridges became more standardized, and many features of earlier designs were discarded. Unlike stone bridges, which were built with traditional techniques that had remained unchanged since ancient times, truss bridges were subject to improvement as better methods and materials became available. Trusses were designed by professional engineers, most of whom had received their training in railroad construction. Engineers in the late nineteenth century debated the merits of various designs and techniques in engineering journals and at professional meetings. As a result, rigid riveted joints replaced the earlier practice of using large pins to connect the various truss members. Two basic patterns, the Pratt truss and the Warren truss, superceded the myriad of designs that had characterized early metal bridges. And with the widespread use of components made of steel, a significantly stronger material than wrought iron, truss construction achieved its final form.

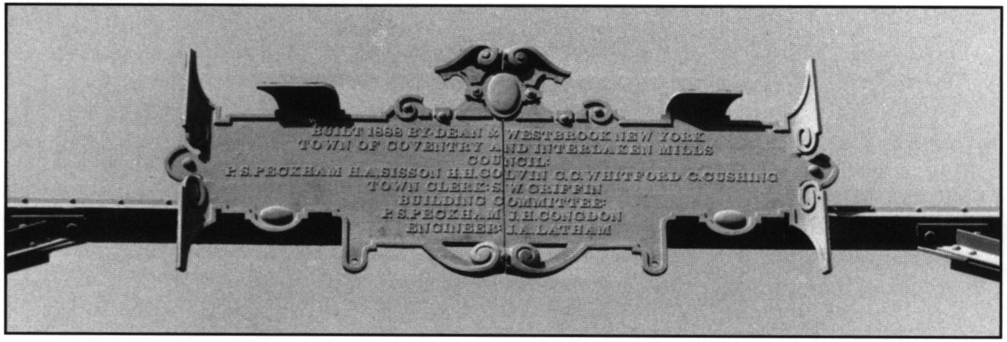
As the twentieth century began, two developments radically affected bridge building in Rhode Island: the creation of a State highway system with responsibility for bridges, and the introduction of concrete bridge techniques.

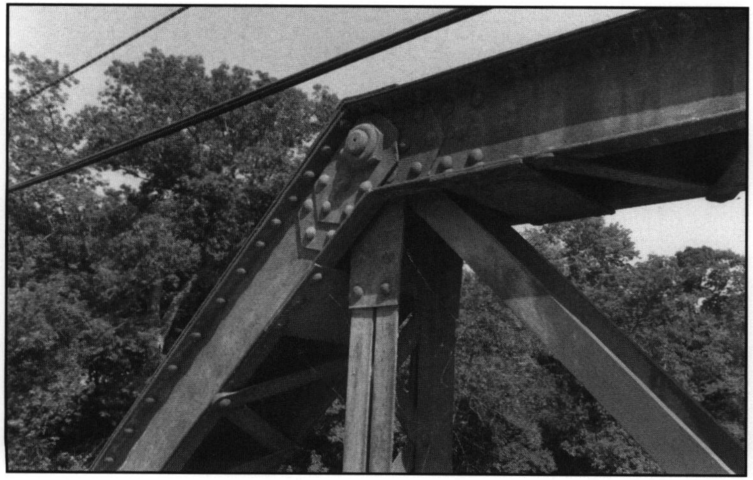
Although iron and steel bridges were durable, towns did not always maintain their trusses well, and by 1910 many had deteriorated. Moreover, twentieth century streetcars and motor vehicles often overloaded bridges designed for the horses and wagons of the nineteenth century. In 1912 a State funded study discovered that the Barrington and Warren bridges, already closed to trolley

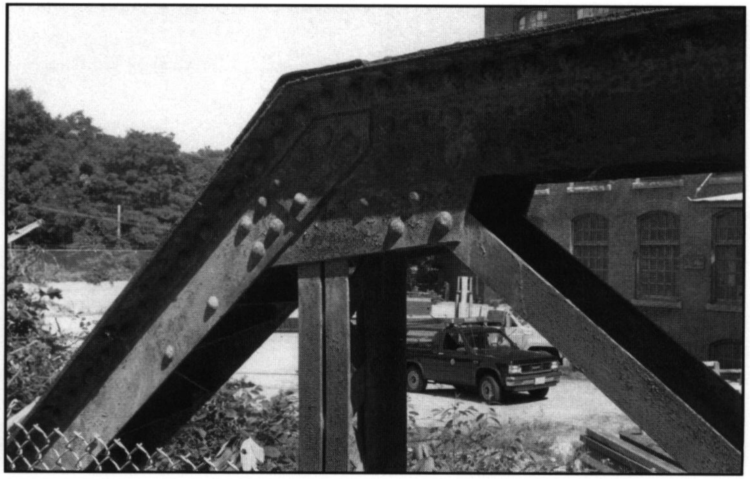
At right: *Iron trusses in the 1880s often had ornate plaques identifying the maker of the bridge and the town officials who purchased it.*

Below left: *Typical pinned truss connection.*

Below right: *Typical riveted truss connection.*



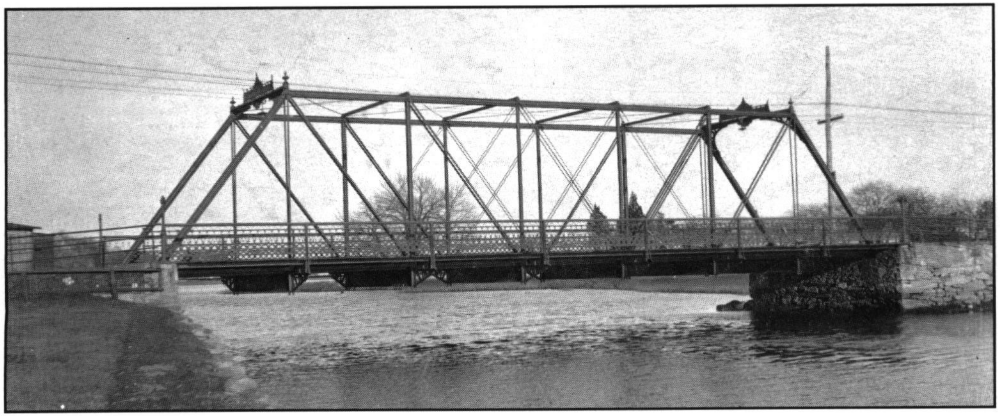




cars, would soon become unsafe for motor vehicles as well. These bridges, iron trusses built by the towns in 1885 and 1889, were critical links on a major route between Providence and Newport, Rhode Island's leading cities. Their impending failure created a crisis. The legislature considered funding a special commission to rebuild the bridges (the same way it had sponsored several other important bridges in the past), but decided instead to create a permanent Bridge Division within the State Board of Public Roads.

The Division was given authority over bridges on all roads that had received State funds in the past. The Bridge Division began with an on-site inspection of all the bridges, and then started work on the fifteen that required immediate replacement, including the Barrington and Warren bridges.

In their first year, Bridge Division engineers made several key decisions that laid the foundation for the State's modern bridge system. They adopted standard plans to facilitate mass bridge replacement, designed new bridges for road widths and loads that anticipated future needs, and chose reinforced concrete as the primary material for State bridges. The engineers preferred concrete because of its great strength, durability, and low maintenance. Concrete bridges also had appeal because, unlike steel trusses, they could be built by Rhode Island contractors using local materials and labor. Concrete bridges cost the same or less than trusses, and much less than stone masonry.



To design its first bridges the State retained Daniel Luten and Walter Denham of the National Bridge Company, an Indiana firm that promoted Luten's patented concrete arches. The State paid a royalty of twenty percent of the construction cost for the use of the plans. Soon, however, the State began designing its bridges in-house under

Starting in 1913, the State began replacing the iron trusses of the 1880s with concrete bridges. This truss in Wickford was replaced with a concrete arch in 1925.

the direction of Clarence L. Hussey, the State's first bridge engineer.

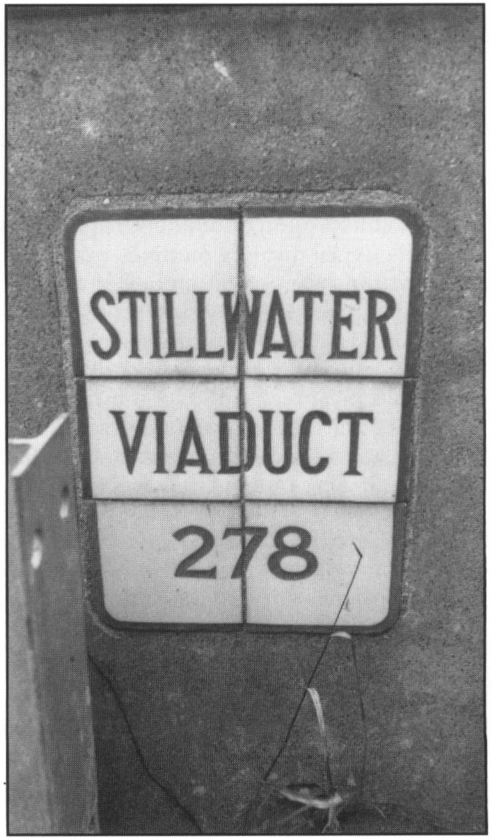
Funding for the bridge program received a boost in 1916 with the approval of the State Bridge Construction Loan program. From 1912 to 1916, the Bridge Division had depended solely upon annual appropriations from the Legislature. Sometimes bridge construction received no money at all. The 1916 Loan program provided funds from State bond issues so that bridges could be designed and built as needed, and their cost could be spread out over a number of years. In 1917 Rhode Island received its first assistance under the Federal Aid Road Act, which gave money to states for rural post roads. It was the beginning of the modern Federal-State highway partnership.

As roads were added to the State highway system, the Division became responsible for a growing number of bridges. In the period between 1912 and 1945, the State constructed hundreds of new bridges, choosing concrete arches for most of the longer spans. In designing these replacement bridges, the State engineers did more than just remedy patently unsafe conditions. They also planned for Rhode Island's future by anticipating the ever-growing number of cars and trucks that would use the State's roads.

The demand for new bridges increased in the 1920s and 1930s as the State constructed a system of major roads to link the various parts of the State. Some existing highways were relocated, rebuilt to wider dimensions, and connected together. In other cases the State built entirely new roads. Danielson Pike, Victory Highway, South County Trail, Louisquisset Pike, and Washington Highway were among the major State roads constructed in this period. All required the construction of several new bridges.

The Bridge Division developed standard plans for various situations. Simple concrete arches served for spans of up to about sixty feet, and open spandrel concrete arches were used for high crossings over river valleys, or where lengths exceeded one hundred feet. For bridges of lengths between sixty and one hundred feet, State bridge engineers devised what they called the "modified" plan, which combined the advantages of both simple and open spandrel designs. In the modified plan, the spandrels or sides of the bridge sloped inward to form a trough carrying fill below the roadway, and sidewalks were supported on cantilevered brackets. At first the modified arches used a single arch that extended the entire width of the bridge, but later examples were designed with two or three separate narrow arch ribs. The modified design was more complicated to engineer and construct than a simple arch, but for longer spans it saved money. Less concrete and fill were required because the bridge's footings and arch could be narrower than the overall width. The resulting reduction in weight allowed the arches to be thinner, thereby providing further savings. The modified plan was an innovation pioneered by Rhode Island's State bridge engineers.

The Bridge Division also standardized the decorative details on its bridges. An early railing design was abandoned after it became clear that its elegant urn-shaped balusters were easily damaged. The Divi-



Above: *Hope Valley Bridge (Bridge #46) is the sole surviving example of the State's early urn-baluster railing design.*

At right: *White and blue tiles identify the name and number of early State-built highway bridges.*

sion then developed two forms of standard railings: recessed panels for shorter bridges and square chamfered balusters for longer bridges. Other standard details included a raised outline of the arch ring and the use of contrasting surface textures. Typically, the arch ring and railings were smooth-finished, while the spandrels and recessed panels were given a textured finish by bushhammering the surface after the concrete had hardened.

In 1913 the State began the bridge numbering system that is still in use today. These numbers, along with the bridge's name (often reflecting the name of an earlier bridge at the site, a nearby mill, or a figure from local history) were prominently displayed on the bridge. At first bronze characters were embedded into the concrete, but after 1918 glazed tiles, white with blue letters, were used to identify the bridge's name, number, the contractor who built it, and the State agency in charge of bridges, the State Board of Public Roads. These tiles remained in use until the 1940s, by which time the Board of Public Roads had been reorganized into the Department of Public Works. The tiles testify to the State's pride in undertaking a massive program of public improvements.

Although the Bridge Division built the great majority of the State's twentieth century bridges, the legislature continued to create special arrangements for exceptionally large structures. A State commission built the 1,800-foot-long Washington Bridge between Providence and East Providence, and a private company was chartered to build and operate the impressive suspension bridge over Mount Hope Bay.

In the early twentieth century several Rhode Island communities built their own large, elaborate bridges as part of their civic improvement programs. These were usually monumental arches with elegant lamps, memorial tablets, and ornate railings. In most cases, elaborate stone work concealed a reinforced concrete structural system. At the time, these bridges were seen as a way of making the urban environment more attractive (the "City Beautiful" movement) and as a way of symbolizing the community's spirit and prosperity.

In our own post-World War II period the completion of the interstate highway system and the widening of state highways has created a new need for extensive bridge construction. Rolled steel and pre-cast concrete beams are available in sizes adequate for nearly any bridge, so the design of trusses and arches for new bridges has become a thing of the past. However, State bridge engineers have now undertaken a different challenge. Many of the bridges constructed before World War II are reaching the end of their useful life and require rehabilitation or replacement. Carrying out these improvements for the future, while preserving the significant bridges from the past, is the goal of today's Department of Transportation bridge engineers.

THE RHODE ISLAND HISTORIC BRIDGE INVENTORY

The Rhode Island Historic Bridge Inventory, the source of the information in this book, consists of a three-volume technical report and extensive accompanying documentation filed with the Rhode Island Department of Transportation. The purpose of the inventory, compiled in 1987-88, was to identify Rhode Island's historic highway bridges, evaluate their historic significance, and plan for their preservation.

The Historic Bridge Inventory investigated 124 highway bridges in Rhode Island that appeared to have some historic significance. The project excluded bridges under twenty feet in length, those built after 1945, those of marginal engineering complexity (such as concrete slab bridges and small trestles over railroads), and those for which replacement projects were already underway. The project team examined each bridge and researched it in newspapers, local histories, and state and town government reports. For each of the 124 bridges, the project produced a two-page inventory form, several black-and-white photographs, and a set of color slides. The inventory form includes a detailed description of the bridge and an analysis of its historical significance.

Of the bridges studied by the project, 47 were determined to be eligible for the National Register of Historic Places. The National Register is the nation's official list of cultural resources that are worthy of preservation. It is the chief planning tool used by state and federal agencies as they evaluate the impact of their projects on historic resources. The bridges found to be eligible for inclusion on the National Register joined four other Rhode Island highway bridges previously listed.

The final part of the Historic Bridge Inventory project is a Preservation Plan. The Plan has as its goal the preservation of as many of Rhode Island's historic highway bridges as possible. Because age and changing traffic conditions have rendered many of the bridges unsuitable for modern needs, the Plan presents a range of preservation options. These include upgrading the bridges while maintaining their historic character, bypassing them with new bridges, and relocating them to new sites. The Plan recognizes that despite all of the best efforts, it may not be possible to save some bridges. In these cases, the bridges will be documented using the standards of the Historic American Engineering Record, and photographs and text will be placed in an archive for future reference. In this way the information value of all of Rhode Island's historic highway bridges will be preserved.

LIST OF RHODE ISLAND HISTORIC HIGHWAY BRIDGES

Rhode Island Highway Bridges Individually Listed on the National Register of Historic Places:

Mount Hope Bridge (Bridge #300), R.I. Route 114, Bristol-Portsmouth, 1929 steel suspension bridge

Arkwright Bridge (Bridge #842), Hill Street, Coventry-Cranston, 1888 wrought iron through truss

Division Street Bridge (Bridge #965), Division Street, Pawtucket, 1877 stone and brick arch, nine spans

Main Street Bridge (Bridge #966), Main Street, Pawtucket, 1858 stone arch, two spans

Rhode Island Highway Bridges Determined Eligible for Listing on the National Register of Historic Places:

Elmwood Avenue Bridge (Bridge #1), Elmwood Avenue (U.S. Route 1), Cranston-Warwick, 1918 concrete arch, three spans

Clarence L. Hussey Memorial Bridge (Bridge #11), Boston Neck Road (R.I. Route 1A), North Kingstown, 1925 concrete through arch

Natick Bridge (Bridge #26), Providence Street (R.I. Route 33), Warwick-West Warwick, 1937 concrete open spandrel arch

Royal Mills Bridge (Bridge #27), Providence Street (R.I. 33), West Warwick, 1923 concrete arch

Centerville Bridge (Bridge #28), Centerville Road, West Warwick, 1926 concrete arch

Washington Bridge (Bridge #32), South Main Street, Coventry, 1919 concrete arch

Brownings Mill Bridge (Bridge #38), Old Noose Neck Hill Road, Exeter, 1913 concrete arch

Hope Valley Bridge (Bridge #46), Nooseneck Hill Road, Hopkinton, 1922 concrete slab

White Rock Bridge (Bridge #65), White Rock Road, Westerly–Stonington, 1907 steel combined highway-trolley truss

Oakland Bridge (Bridge #105), Victory Highway, Burrillville, 1918 concrete arch

Nasonville Stone Arch Bridge (Bridge #111), Victory Highway, Burrillville, 1907 stone arch

Barrington Bridge (Bridge #123), County Road (R.I. Route 103), Barrington, 1914 concrete arch, five spans

Warren Bridge (Bridge #124), County Road (R.I. Route 103), Barrington-Warren, 1914 concrete arch, three spans

Kenyon Arch Bridge, (Bridge #148), Kenyon Road, Charlestown-Richmond, 1913 concrete arch

Standard Oil Company Bridge (Bridge #158), Pawtucket Avenue, East Providence, 1919 concrete arch

Albion Trench Bridge (Bridge #163), River Road, Lincoln, 1887 wrought iron pony truss

Albion Bridge (Bridge #164), River Road, Cumberland-Lincoln, 1885 wrought iron pony truss, two spans

Sayles Bridge (Bridge #187), Walker Street, Lincoln, 1879 stone arch

Meeting House Bridge (Bridge #199), Nooseneck Hill Road (R.I. Route 3), Hopkinton-Westerly, 1924 concrete arch

Washington Bridge South (Bridge #200), Route I-195, Providence-East Providence, 1930 concrete arch, fifteen spans

Hunts Mill Bridge (Bridge #208), Pleasant Street, East Providence, 1926 concrete arch

Hope Bridge (Bridge #256), East Road (R.I. Route 116), Scituate, 1930 concrete arch

Slatersville Stone Arch Bridge (Bridge #273), Providence Pike (R.I. Route 5), North Smithfield, c.1855 stone arch, two spans

Ashton Viaduct (Bridge #275), Washington Highway (R.I. Route 116), Lincoln-Cumberland, 1945 concrete open spandrel arch, thirteen spans

Stillwater Viaduct (Bridge #278), Washington Highway (R.I. Route 116), Smithfield, 1932 concrete open spandrel arch, thirteen spans

Arnold Mills Bridge (Bridge #301), Sneech Pond Road, Cumberland, 1886 wrought iron pony truss

Broad Street Bridge (Bridge #305), Broad Street, Cumberland-Central Falls, 1915 concrete arch, three spans

Harrisville Mill Bridge (Bridge #306), East Avenue, Burrillville, 1902 stone arch

West Street RR Bridge (Bridge #401), West Street, Westerly, 1913 steel through truss

Rawson Road Bridge (Bridge #457), Rawson Road, Cumberland, c.1886 steel plate girder

Howard Road Bridge (Bridge #459), Howard Road, Cumberland, c.1886 wrought iron pony truss

Rawson Road Bridge (Bridge #460), Rawson Road, Cumberland, c.1886 wrought iron pony truss

Church Street Bridge (Bridge #564), Church Street, South Kingstown, 1882 stone arch

Harrison Avenue RR Bridge (Bridge #687), Harrison Avenue, Woonsocket, 1913 concrete arch

Stevens Street Bridge (Bridge #881), Stevens Street, Providence, 1894 stone arch

Church Street RR Bridge (Bridge #943), Church Street, Cumberland, 1882 wrought iron through truss

Stillwater Road Bridge (Bridge #949), Stillwater Road, Smithfield, c.1885 wrought iron pony truss

South Main Street (Globe) Bridge (Bridge #958), South Main Street, Woonsocket, 1903 stone arch, two spans

Court Street Bridge (Bridge #959), Court Street, Woonsocket, 1895 steel deck truss, four spans

Exchange Street Bridge (Bridge #964), Exchange Street, Pawtucket, 1928 concrete arch, two spans

Roosevelt Avenue Bridge (Bridge #968), Roosevelt Avenue, Pawtucket-Central Falls, 1910 concrete arch, three spans

Charles Street Bridge (Bridge #973), Charles Street, Providence, 1894 steel plate girder

Atwells Avenue Bridge (Bridge #975), Atwells Avenue, Providence, 1875 wrought iron pony truss

Branch Avenue Bridge (Bridge #976), Branch Avenue, Providence, 1909 encased in concrete steel lattice girders

Point Street Bridge (Bridge #980), Point Street, Providence, 1927 steel swing truss

Haven Street Bridge (Bridge #995), Cranston Street, Cranston, 1896 stone arch

Weekapaug Bridge (Bridge #997), Atlantic Avenue, Westerly, 1936 concrete beam, three spans

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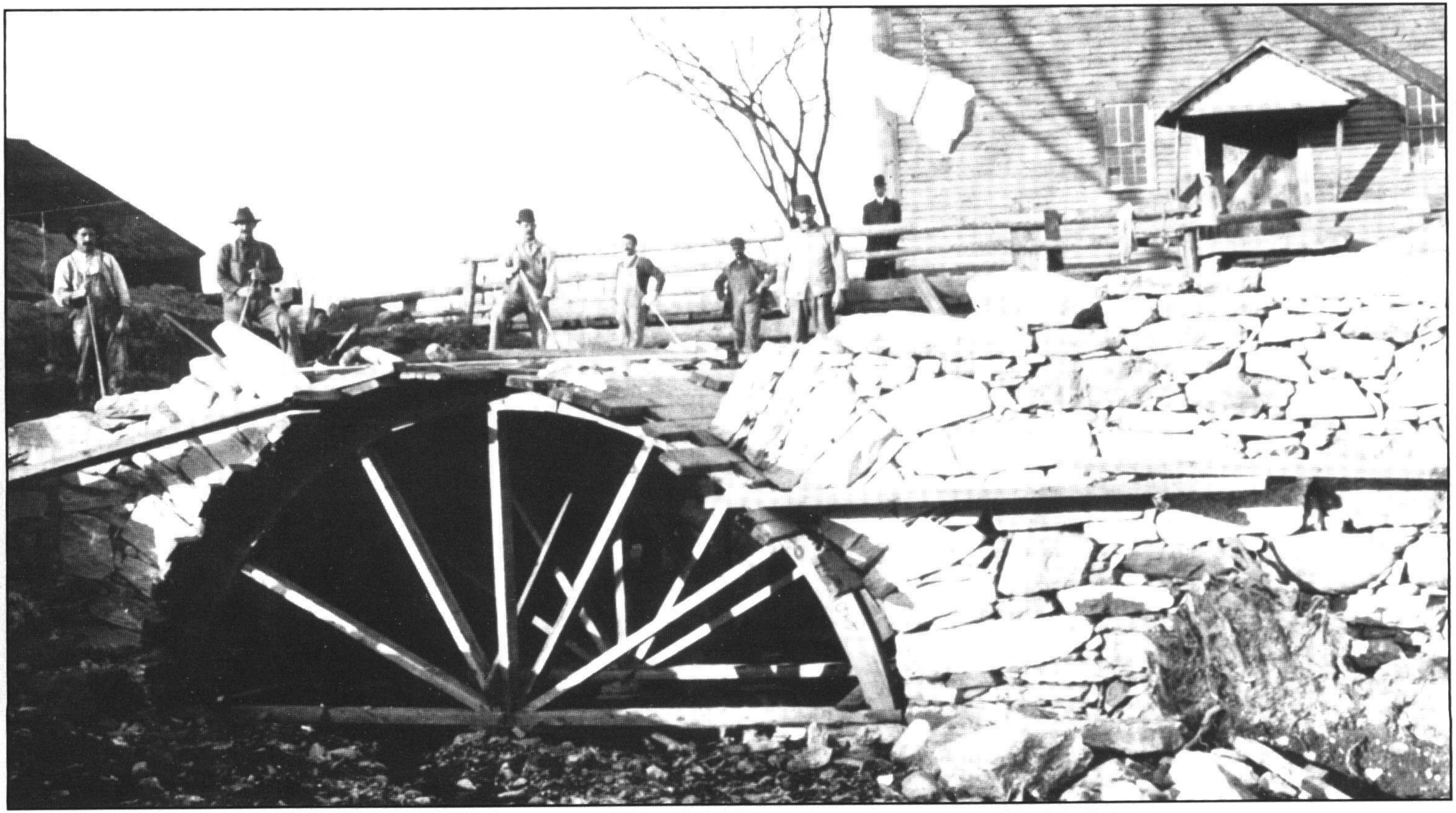
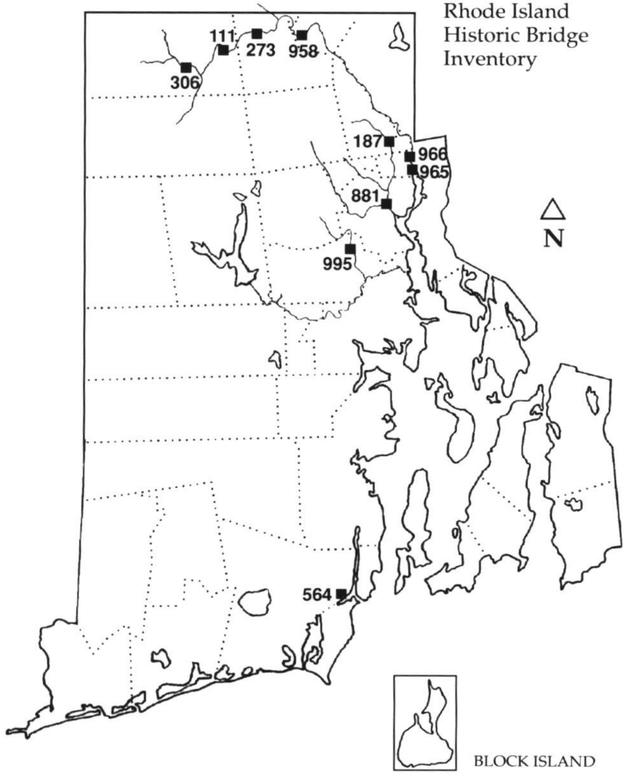
MASONRY ARCH BRIDGES

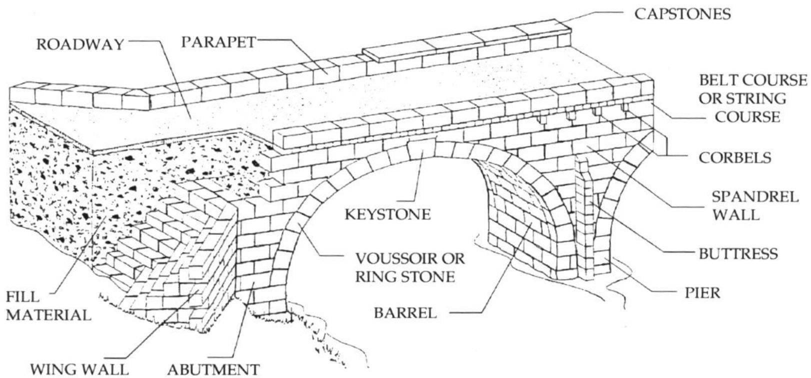




MASONRY-ARCH BRIDGES

Masonry-arch bridges could be built using only the traditional construction skills once found in every rural New England community. After the stream had been diverted, carpenters built a temporary wooden form, called the centering. Then masons carefully positioned large stones on top of the centering to form an arch. As the arch took shape, the side walls or spandrels were built, and the bridge was filled with stone, gravel and earth to support the roadway. The stone arch shown under construction on page 18 was built somewhere in southern New England around 1900.

MASONRY ARCH TERMS



Adapted from *Historic Highway Bridges in Pennsylvania. Preservation Guide*. Used with permission.

SLATERSVILLE STONE ARCH BRIDGE

- **BRIDGE #273**
- Providence Pike
  (R.I. Route 5) over Branch River
- North Smithfield
- 1855
- Maximum Span Length: 40 feet
  (2 spans, 100 feet total)

The Town of North Smithfield built this double arch bridge in 1855 at the urgent request of William F. Slater, owner of the textile mill immediately east of the bridge. One of Rhode Island's oldest surviving stone bridges, its arches are semicircular in shape and each is 40 feet long. The spandrels or side walls of the bridge continue above the level of the roadway to form low railings capped with large granite coping stones. The bridge stands as an excellent example of traditional masonry construction, combining carefully cut stone work in the arch rings with irregularly shaped stone in the spandrels. The sidewalk on the west side was added in 1940.

The bridge is part of the Slatersville Historic District, which is listed on the National Register of Historic Places.

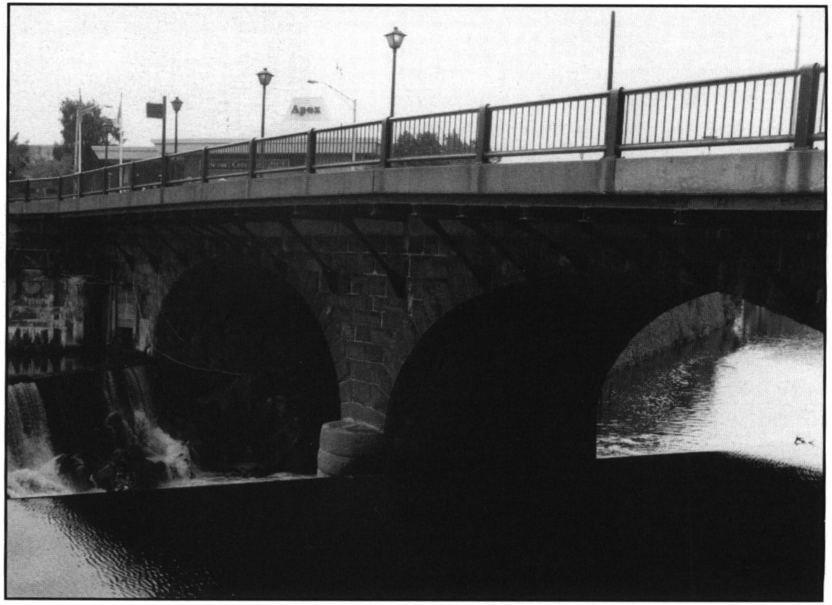
MAIN STREET BRIDGE

- **BRIDGE #966**
- Main Street over Blackstone River
- Pawtucket
- 1858
- Maximum Span Length: 40 feet
  (2 spans, 105 feet total)

Pawtucket's Main Street Bridge is located on what was historically the major highway between Providence and Boston. A wooden bridge had been built in this location in 1713, followed over the years by no fewer than six replacements, all of wood. Finally, in 1858, a special Rhode Island State commission built these substantial stone arches. The bridge cost about $15,000. The Pawtucket Fire District paid $12,000; the Town of North Providence (which at that time included the west side of Pawtucket) paid $1,500; and the Town of Pawtucket in Massachusetts (at that time the east side) paid $1,500. After 1862, when the line between Massachusetts and Rhode Island was redrawn, the bridge no longer had one end in each state.

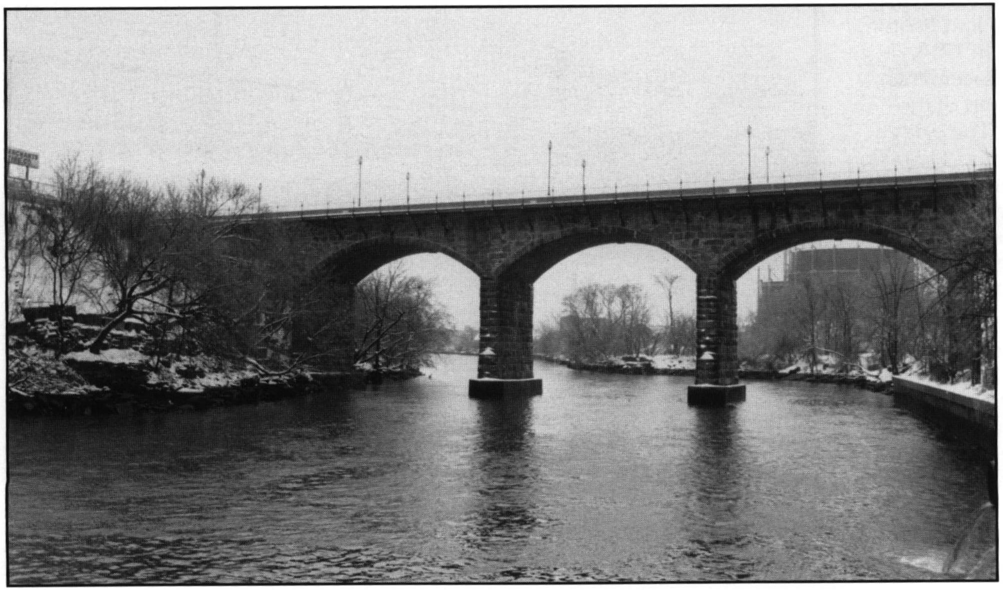
The bridge is a fine example of the stonemason's craft. Its carefully laid courses of rough-hewn granite blocks were the work of Fall River mason Luther Kingsley. Civil engineer Samuel Cushing of Providence designed the structure, making it one of the first professionally engineered bridges in the state. Sidewalks, railings, and the steel beam structure added on the downstream side all date from the 1960s.

Located just south of the Slater Mill Historic Site, the bridge is listed on the National Register of Historic Places.



DIVISION STREET BRIDGE

- **BRIDGE #965**
- Division Street over Seekonk River
- Pawtucket
- 1876-77
- Maximum Span Length: 54 feet (9 spans, 425 feet total)



Rising high above the Seekonk River, a short distance below the Falls in Pawtucket, Division Street Bridge is the longest masonry arch structure in Rhode Island. Its nine segmental arches (three of which cross the river) spring from tall piers of rough-hewn granite blocks. The arch rings and keystones are made up of squared and dressed blocks, but the sides of the bridge are built of irregularly shaped stone. The arches themselves are constructed of brick. Cushing & Company of Providence designed the bridge and Pawtucket mason Horace Foster built it. Its impressive size, fine stone work, and original ironwork make Division Street Bridge a significant example of nineteenth-century masonry arch construction.

In 1874 the portion of the community on the west side of the river, which up until then had been part of North Providence, was legally joined with the Town of Pawtucket on the east side. Thus the bridge provided both an important river crossing and a symbol of Pawtucket's unity. It cost $95,000.

Restoration of Division Street Bridge's masonry earned the State the Federal Highway Administration's 1986 Excellence in the Design of Highway Facilities Award. The bridge is listed on the National Register of Historic Places.

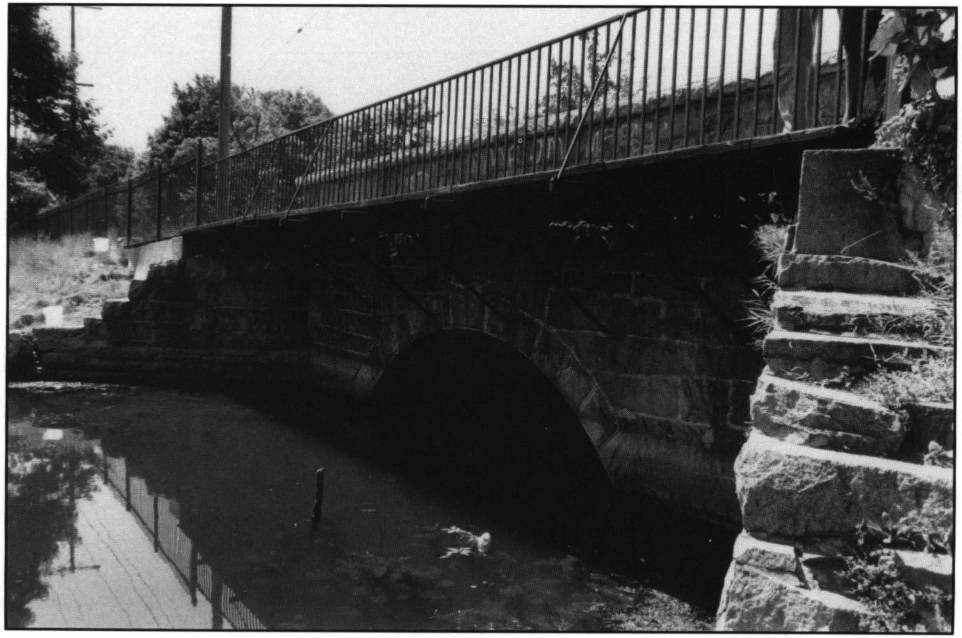
SAYLES BRIDGE

- **BRIDGE #187**
- Walker Street over Moshassuck River
- Lincoln
- 1879
- Span Length: 15 feet

This small bridge in Saylesville is one of the best preserved stone arches in the state. Its date of construction—1879—is carved into the keystone of the arch ring. Consisting of rough-hewn gray granite blocks, the bridge's stone work continues upward to form low railings topped with large capstones of lighter colored granite. The surface of the railings facing the road is smooth. Stepped stone wing walls lead down to the millpond. On the south side, large iron brackets carry a wooden sidewalk with an iron railing; the sidewalk probably dates from 1886.

The bridge was built as a cooperative effort between the Town of Lincoln and William F. Sayles, the owner of the extensive textile bleaching works which gave the village its name. The Town reimbursed Sayles $5,000 for the bridge itself, and the mill paid for widening the road and constructing the iron fences leading to the bridge.

The bridge is part of the Saylesville Historic District, which is listed on the National Register of Historic Places.



CHURCH STREET BRIDGE

- **BRIDGE #564**
- Church Street over Saugatucket River
- South Kingstown
- 1882
- Span Length: 40 feet

Peace Dale's Church Street Bridge is a well preserved example of stone arch construction. The bridge's cut ring stones, including large keystones, outline a semi-elliptical arch that begins about five feet above the level of the water. The sides of the bridge, built of rough, irregularly shaped stone, continue above the roadway to form railings capped with large flat stones. A tablet on the outside of the north railing is inscribed, "Planned and Builded For the Public Use by Rowland Hazard 1882."

Rowland Hazard was the third generation of his family to own Peace Dale's woolen mills, which employed most of the village's residents. In addition to several stone bridges, the Hazards built a Congregational church (also designed by Rowland Hazard), endowed the local library, and set up one of the state's first profit-sharing plans. Such paternalistic philanthropy was common in the mill villages of Rhode Island. As a system, it worked best when times were good, but it rarely survived times of economic severity, when mill owners cut wages and laid off workers to save money.

The bridge is part of the Peace Dale Historic District, which is listed on the National Register of Historic Places.

STEVENS STREET BRIDGE

- **BRIDGE #881**
- Stevens Street over Moshassuck River
- Providence
- 1894
- Span Length: 33 feet

The elegant and varied stone work of the Stevens Street bridge — rough-hewn ring stones and keystones, sides of more smoothly dressed rectangular blocks, and finely cut capstones — hides the fact that its arch is formed not of stone but of several courses of brick. Another hidden but significant feature is that the roadway rests not on earthen fill, as in the traditional stone arch, but on a layer of poured concrete. This early use of concrete, without the reinforcing bars which give it greater strength, foreshadowed the concrete arch bridges of the twentieth century. The bridge retains its original iron railings, which have two sizes of uprights and fluted end posts.

Stevens Street Bridge cost $9,300 and was expensive for its day. It was built as part of an intensive effort to modernize Providence's many small bridges. Its fine stone work and decorative railing show that it was intended to be not only functional, but also a handsome addition to its surroundings. The bridge lies within the Moshassuck Square and Blackstone Canal Historic Districts.

HAVEN STREET BRIDGE

- **BRIDGE #995**
- Cranston Street over Pocasset River
- Cranston
- 1896
- Span Length: 40 feet

First known as the Print Works Bridge because of the nearby cloth printing factory, this stone arch is typical of its period and retains many original features. It has rough-hewn ring stones, and its sides are constructed of irregularly shaped stone topped by large capstones. The date of construction, 1896, is carved into keystones on both sides. Much of the bridge's original railing, consisting of wrought iron rods and an elaborate cast iron end post, survives on the south side.

In the 1880s and 1890s, Cranston replaced many of its bridges with stone arches like this one. Although relatively expensive (this bridge cost $8,350 when built), stone arches were strong and durable. Consulting engineer J.A. Latham of Providence designed the bridge. He did most of Cranston's bridge design and highway surveying in the late nineteenth century.

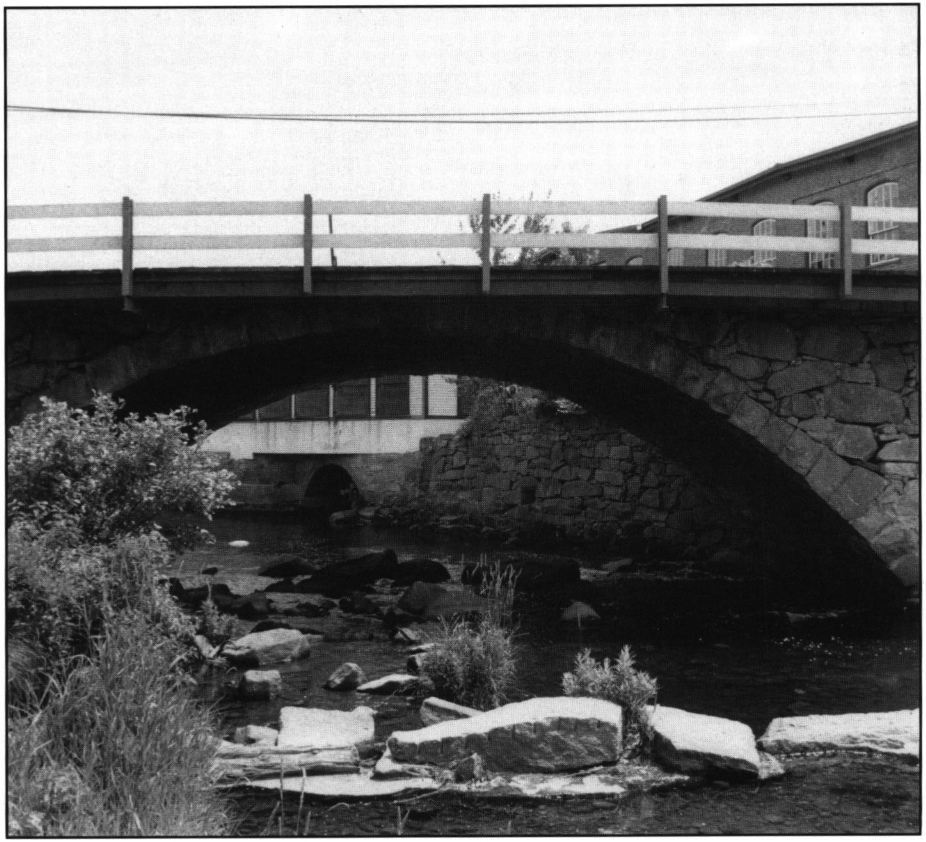
HARRISVILLE MILL BRIDGE

- **BRIDGE #306**
- East Avenue over Pascoag River
- Burrillville
- 1902
- Span Length: 50 feet

This stone bridge in Harrisville was built in 1902 by the Town of Burrillville at a cost of $4,300. It demonstrates the continued use of traditional stone masonry into the twentieth century. Its cut ring stones and side walls of irregularly shaped stone are typical of the rough-hewn stone work found in bridges in numerous Rhode Island mill villages. The bridge's date of construction is carved into the south side keystone.

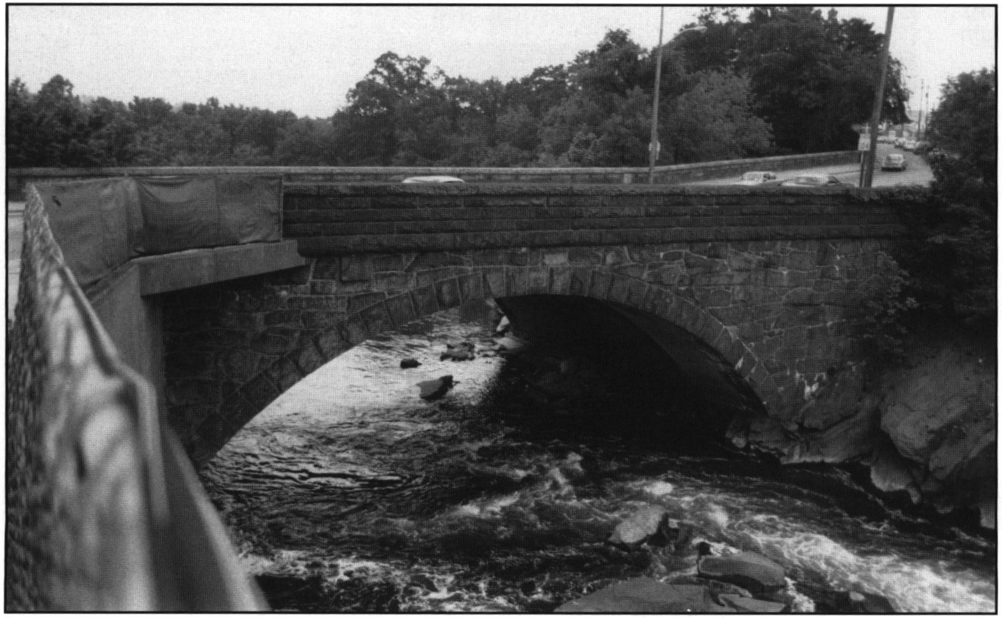
Local people designed and built the bridge. Dr. Henry J. Bruce, a Pascoag physician who supplemented his medical practice with civil engineering, devised the plans. Dr. Bruce did most of Burrillville's highway surveying in this period. Harrisville stonemason F.L. Matthewson built the bridge. The railings and sidewalk are modern; originally the bridge had pipe railings.

The bridge is adjacent to a large former woolen mill that dates from 1894, and forms a scenic landscape with nearby stone dams and river channel walls. It is part of the Harrisville Mill Village Historic District, which is listed on the National Register of Historic Places.



SOUTH MAIN STREET BRIDGE/GLOBE BRIDGE

- **BRIDGE #958**
- South Main Street over Blackstone River
- Woonsocket
- 1903 (rebuilding of two nineteenth-century arches)
- Maximum Span Length: 60 feet (2 spans, 260 feet total)



Woonsocket's Globe Bridge consists of two widely separated arches, between which is a large ledge outcropping that divides the Blackstone River into two channels. The east span is a nineteenth-century stone arch that was widened on both sides in 1903 by the first known Rhode Island use of reinforced concrete for bridge construction. At the same time, the west stone arch (also of nineteenth-century origin) was taken completely apart and rebuilt. The arches are about the same size and have similar stone work, with cut ring stones, side walls of irregularly shaped stone, and keystones carved with "1903." Running the entire length of the bridge are railings built of coursed, rough-hewn stone, including a raised base course and large capstones. On the south railing is a tablet commemorating the bridge's construction. The bridge was designed by City Engineer Frank H. Mills and built by the C.W. Blakeslee Company of New Haven, Connecticut.

The bridge is an early example of the monumental arches erected in many cities in the early twentieth century. Its fine stone work, date stones, and commemorative tablet indicate an attempt to make the bridge a stylish addition to the city's environment.

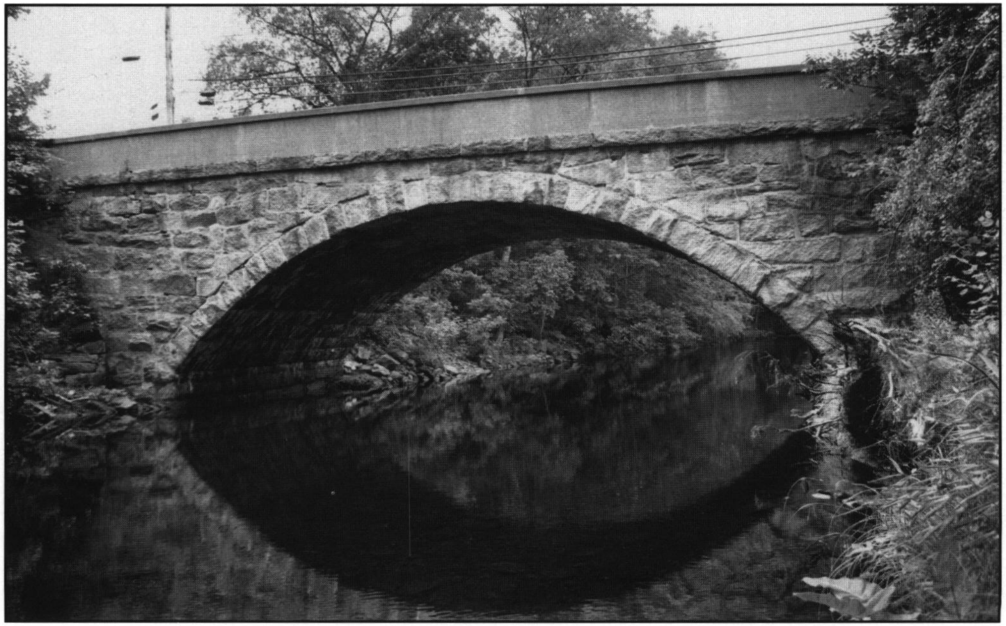
NASONVILLE STONE ARCH BRIDGE

- **BRIDGE #111**
- Victory Highway over Branch River
- Burrillville
- 1907
- Span Length: 50 feet

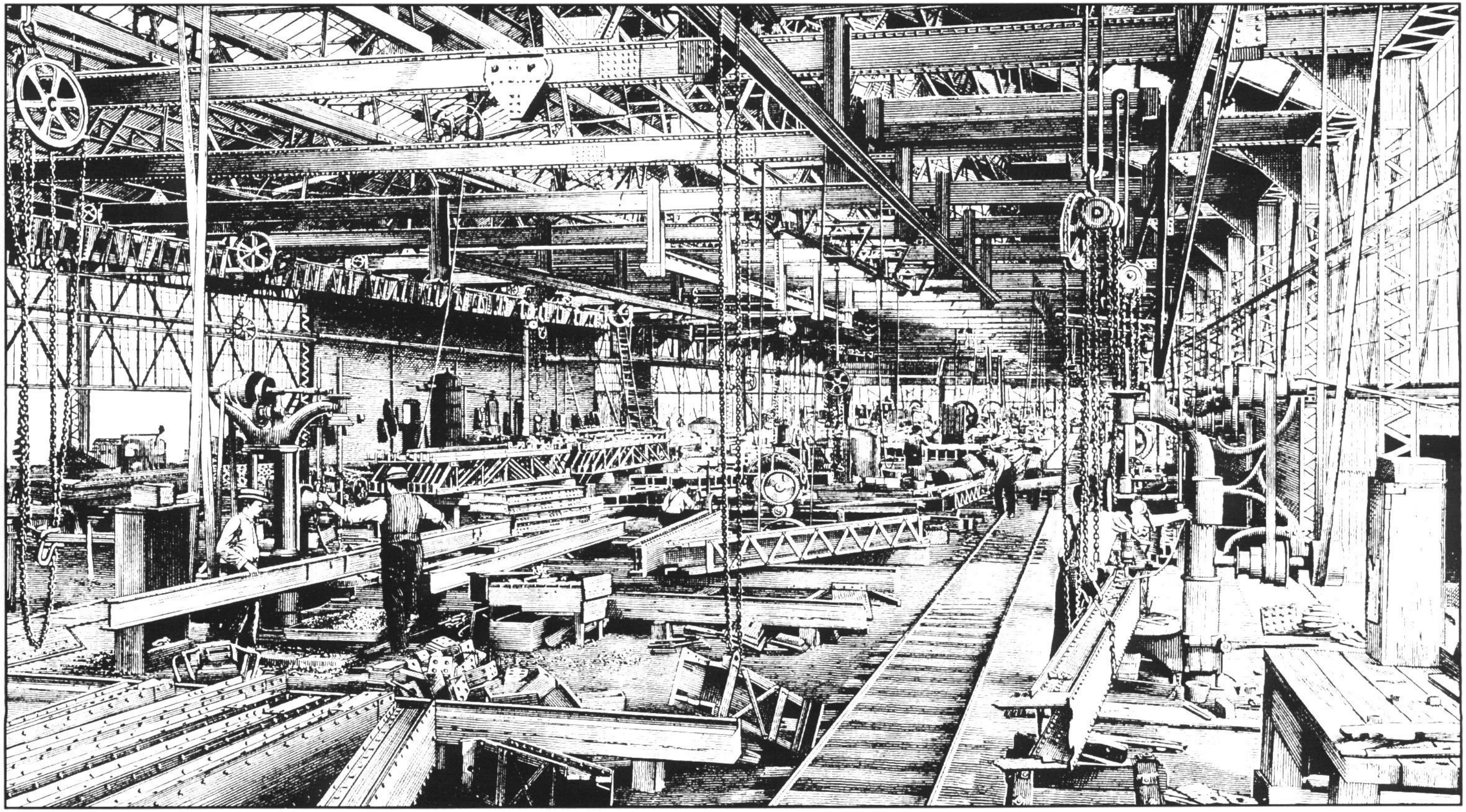
Like the nearby Harrisville Mill Bridge, the Nasonville Stone Arch shows the persistence of traditional stone bridge construction into the twentieth century. Its graceful semi-elliptical shape, rough-hewn finish, square-cut ring stones, and side walls of irregularly shaped stone are typical of the state's small stone arches.

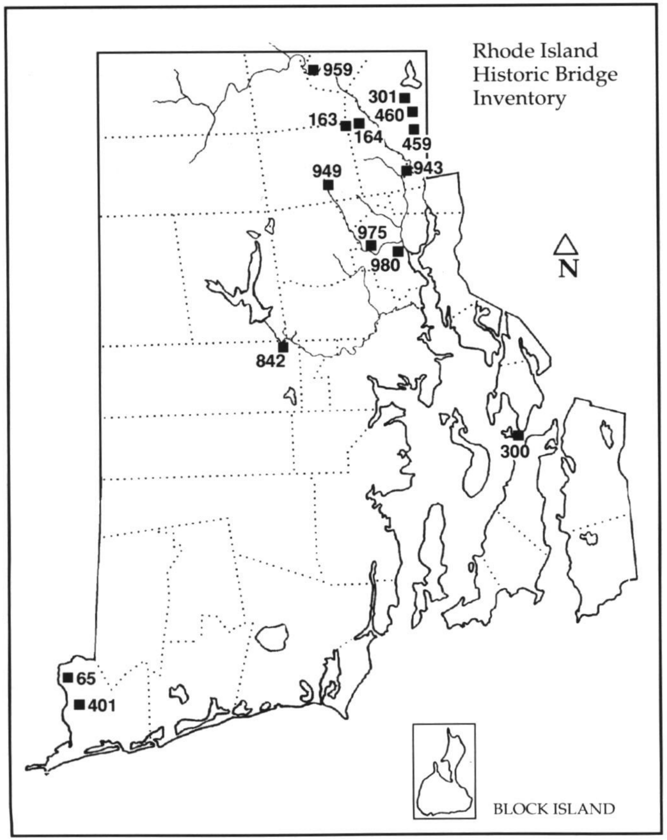
Built by the Town of Burrillville in 1907, the bridge was designed by Woonsocket civil engineers Arnold Seagrave and Samuel B. Lincoln.

Its original iron picket railings were replaced by the present concrete railings in 1924. The railings were intended to prevent vehicles that had lost control on the steep hill to the west from plunging into the river.



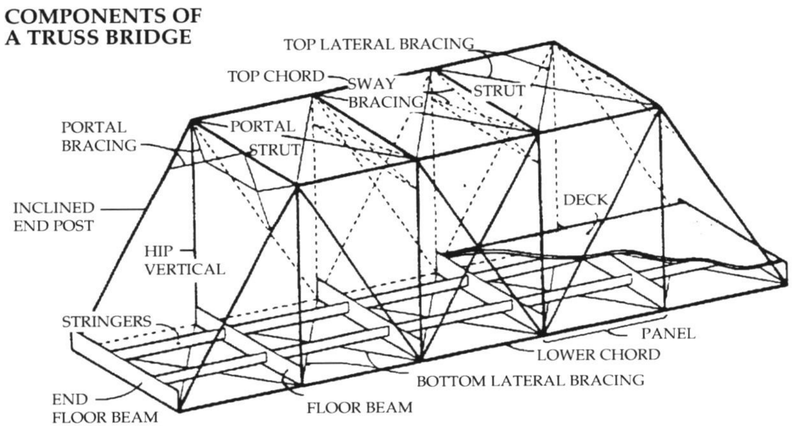
METAL-TRUSS BRIDGES





METAL BRIDGES

Truss components were fabricated in bridge-building shops from basic forms of wrought iron or steel, such as bars, plates, and angles. When all the pieces were ready, they were shipped to the site and assembled into a bridge. In the c.1895 view of the Berlin Iron Bridge Company's shop in East Berlin, Connecticut, shown on page 30, workers are using riveting machines to make box girders. Workers in this shop fabricated numerous Rhode Island highway bridges, of which Stillwater Road Bridge (Bridge #949) in Georgiaville is the sole surviving example.



Source: Historic American Engineering Record.

ATWELLS AVENUE BRIDGE

- **BRIDGE #975**
- Atwells Avenue over Woonasquatucket River
- Providence
- 1875
- Span Length: 44 feet

Atwells Avenue Bridge, the earliest surviving metal bridge in the state and among the oldest in the nation, has many unusual design and ornamental features. Each of its four trusses is made up of crisscrossed angle iron diagonals riveted to the large T-sections which make up its top and bottom chords. The ornamental iron castings that cover the vertical end posts, decorated with moldings and star and knot designs, are typically Victorian. The bridge's wood plank deck (now paved over) is supported on a series of small I-beams between the trusses. Originally the roadway was divided by another truss running down the center. It was removed in the early 1900s to provide a clear path for trolley cars; a large girder was placed beneath the roadway to support the center of the bridge.

The bridge's trusses could also be considered lattice girders. The use of large lattice girders as major structural members enjoyed only a brief popularity before other types of trusses and beams became standard in bridge building.

Opposite page: *Atwells Avenue Bridge.*

Far left: *Detail of northernmost truss, view east.*

At left: *Detail of end-post casting.*

STILLWATER ROAD BRIDGE

- **BRIDGE #949**
- Stillwater Road over Woonasquatucket River
- Smithfield
- 1886
- Span Length: 50 feet

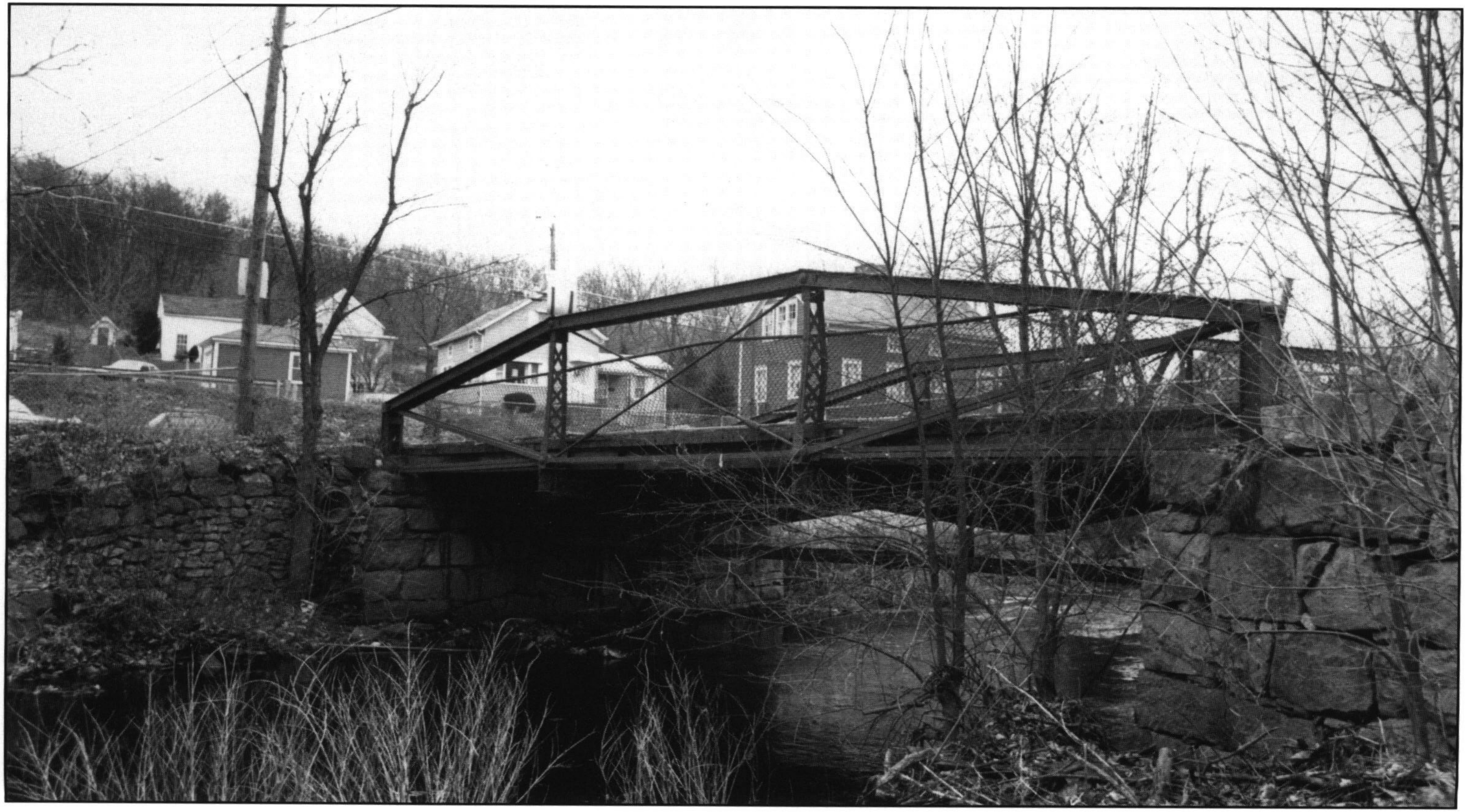
Stillwater Road Bridge in Georgiaville has many archaic features from the early days of metal truss bridge building. Its narrow width and light structural members reflect its origin in the age before motor vehicle traffic. It has pinned joints, rather than the riveted connections that later became standard. Its material, wrought iron, soon became obsolete in favor of the stronger steel. Finally, several of its components, such as tapered uprights, fell from use in favor of simpler forms.

The bridge uses the patented truss design of the Berlin Iron Bridge Company of Berlin, Connecticut. Promoted as the "parabolic truss" because of its distinctive profile, in which oppositely curving upper and lower chords meet at the end posts, the design is also known as a lenticular (lens-shaped) truss. Berlin Iron Bridge Company agents used the distinctiveness of their design to sell their product to local highway officials.

The company sold numerous bridges to towns throughout Rhode Island in the 1880s and 1890s, including at least two in Smithfield. One Smithfield town official even provided an endorsement for the firm's 1889 bridge catalog. Like many other medium-sized fabricators, the Berlin Iron Bridge Company was absorbed into the American Bridge Company in 1900.

Opposite page: *Stillwater Road Bridge*

At right: *Detail of vertical and joints, view west.*

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CHURCH STREET RAILROAD BRIDGE

- **BRIDGE #943**
- Church Street over Providence and Worcester Railroad
- Cumberland
- 1882
- Span Length: 109 feet

Church Street Railroad Bridge is the older of the only two surviving nineteenth-century through trusses in Rhode Island. It is an early example of the use of riveted connections. Although built by the City of Cumberland, it shows the influence of railroad bridge engineering. At the time it was built, bridge engineers were divided over which were better – riveted or pinned joints. Railroads preferred riveted construction because of its greater rigidity. For the same reason, they favored multiple web designs like this double intersection Warren truss, in which two superimposed truss patterns share the load.

The bridge was fabricated by Boston Bridge Works. Founded in 1876, Boston Bridge Works built hundreds of railroad and highway bridges in New England before the company went out of business in the Depression. Church Street Railroad Bridge's decorative features, as well as several construction details, are identifying signs of the company's work. Among the distinctive ornamental characteristics is the bridge's railing pattern, a lattice with cast iron rosette medallions and chamfered end posts. Three posts still have the gas lamps that originally lighted the bridge.

Opposite page: *Church Street Railroad Bridge.*

At right: *Detail of railing and gas lamp.*

ALBION TRENCH BRIDGE and ALBION BRIDGE

- **BRIDGES #163 AND #164**
- River Road over Blackstone River and millrace
- Cumberland-Lincoln

- **BRIDGE #163:**
- 1887
- Span Length: 56 feet

- **BRIDGE #164:**
- 1885
- Maximum Span Length: 98 feet (2 spans, 202 feet total)

River Road in Lincoln provides a chance to see late nineteenth-century bridge building technology in transition. To the east, across the river, are the large pin-connected pony trusses of Bridge #164, built in 1885. To the west, across the headrace of a nearby former textile mill, is Bridge #163, a much smaller 1887 pony truss with riveted connections. Both the river spans and the bridge across the millrace are Pratt truss structures, and both were fabricated by Boston Bridge Works. Apparently, Boston Bridge Works' engineers were willing to use the more forward-looking riveted technique in their small bridges, while at the same time preferring pinned connections for larger spans. Both bridges have Boston Bridge Work's distinctive latticed railing with rosettes. The bridges are located within the Albion Historic District.

At right: *Albion Bridge.*

Opposite page: *Albion Trench Bridge.*

ARNOLD MILLS BRIDGE

- **BRIDGE #301**
- Sneech Pond Road
- Cumberland
- 1886
- Span Length: 62 feet

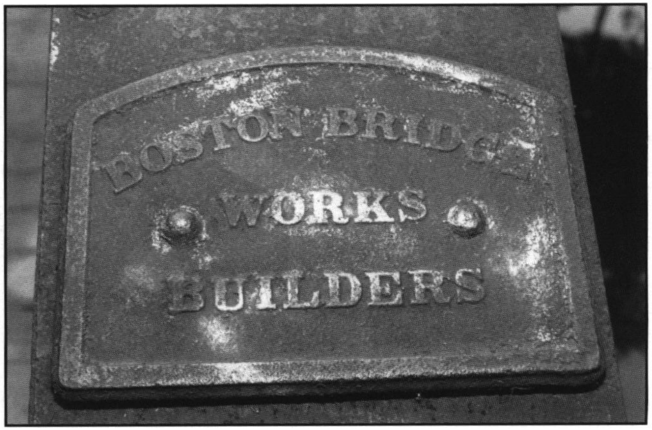
Opposite page: *Arnold Mills Bridge.*

Below: *Howard Road Bridge.*

Below right: *Builder's Plate, Rawson Road Bridge.*

The flood of February 1886 damaged or destroyed nearly every bridge in the Town of Cumberland. As a consequence, the Town contracted with Boston Bridge Works to provide four new bridges across Abbott Run for $22,000. Three of these bridges remain today. They are nearly identical riveted Pratt pony trusses, and all have the characteristic lattice railings and builder's plates that identify them as Boston Bridge Works products. This bridge, located within the village of Arnold Mills (a National Register Historic District), is the only one of the three with a sidewalk. The bridge illustrates how nineteenth-century engineers went to great lengths to save on metal; the dimensions of the members that make up the side without the sidewalk are a fraction of an inch smaller than their counterparts.

The other similar bridges in Cumberland are **Howard Road Bridge (Bridge #459)** and **Rawson Road Bridge (Bridge #460)**. The Rawson Road crossing includes, in addition to the truss across Abbott Run, a plate-girder bridge spanning an adjacent mill tailrace. Also built by Boston Bridge Works, it may represent the earliest Rhode Island use of metal beams as the primary bridge structure.



ARKWRIGHT BRIDGE

- **BRIDGE #842**
- Hill Street over Pawtuxet River
- Coventry-Cranston
- 1888
- Span Length: 128 feet

Arkwright Bridge is one of only two remaining nineteenth-century through trusses in the state. Although the Pratt truss design of the bridge is standard for its day, the form of the wrought iron compression members is unusual. The bridge's uprights and top chord are made of Phoenix columns, a type of hollow column built up of four rolled segments, each a quarter circle in section, bolted together along exterior flanges. Such columns were used in factory construction as early as the 1860s, but they are rarely found in bridges. The need for special connections to join the columns to each other and to other bridge parts made them unwieldy. However, the maker of this bridge, Dean and Westbrook of New York, made a specialty of using Phoenix columns. This was probably done as a selling point to distinguish their product from those of competitors.

The year after the boundary between Coventry and Cranston was changed to the Pawtuxet River, the two towns cooperated to build this bridge. The nearby Interlaken textile mill also contributed toward the construction. The bridge is listed on the National Register of Historic Places.

At right: *Detail of Phoenix column.*

 Opposite page: *Arkwright Bridge.*

COURT STREET BRIDGE

- **BRIDGE #959**
- Court Street over Blackstone River
- Woonsocket
- 1895
- Maximum Span Length: 142 feet
  (4 spans, 522 feet total)

Woonsocket's Court Street Bridge is outstanding because of its impressive size. At 142 feet, the river span is the longest truss inventoried, and its 50-foot width is exceptional for the nineteenth century. It is also the inventory's only deck truss, in which the roadway runs across the top of the truss rather than through it. The depth of the Blackstone Valley here made a deck truss the logical choice for this bridge, which connects Depot and Court squares, two important parts of Woonsocket's downtown business district.

Like Arkwright Bridge, Court Street Bridge was built by Dean and Westbrook of New York. All four spans are pin-connected Pratt trusses of heavy construction, in which box girders form the top chord and verticals, and large eye-bars form the diagonals and lower chord. Complicating the engineering for the bridge were the need to widen the roadway at the west end, where it leads to Depot Square, and the angled placement of the granite ashlar piers, which required skewed trusses with sides of unequal lengths. The bridge originally had streetcar tracks running down the south half of the roadway. The steel grate deck, guardrails, and sidewalk railings are all modern alterations.

Below and opposite page: *Court Street Bridge.*

WHITE ROCK BRIDGE

- **BRIDGE #65**
- White Rock Road over White Rock Canal and Pawcatuck River
- Westerly-Stonington
- 1906
- Maximum Span Length: 126 feet (2 spans, 233 feet total)

This bridge is a complicated hybrid, in which parallel highway and trolley routes share a common center truss. The south and center trusses, which carried the streetcars, are of heavier construction than the north truss, which carried only half the weight of highway traffic. Moreover, the electric railway's river crossing is carried by a large through truss, one side of which is strengthened with extra members to handle the additional weight of the highway portion. In all, the bridge combines two sizes of Pratt pony trusses, a Warren pony truss, and a half-Pratt and half-Baltimore through truss.

The bridge was built by the Norwich Traction Company, which operated an electric railway connecting Westerly with Norwich, Connecticut. The line was opposed by Pawcatuck merchants, who feared it would bypass their village and direct business elsewhere. Perhaps to mollify them, the Traction Company was required to maintain a highway crossing as well as their own bridge here; this may account for the structure's unusual configuration. The trolley line ran until the 1930s, when the bridge became the property of the two towns. Seriously deteriorated, it now serves only to carry a water line over the river and millrace.

Electric railways, both urban and interurban, played a major role in turn-of-the-century New England, providing inexpensive transportation even to small town and rural areas. Except for a few trolley barns, isolated stations, and bridges such as this, little is left today to recall the era of trolleys.

Below and opposite page: *White Rock Bridge.*

WEST STREET RAILROAD BRIDGE

- **BRIDGE #401**
- West Street over Amtrak (Shore Line)
- Westerly
- 1913
- Span Length: 141 feet

West Street Railroad Bridge stands as a prime example of early twentieth-century steel truss construction. Its Pratt truss pattern was one of two standard designs then in use (the other was the Warren truss), and its riveted joints contrast with the earlier practice of pinned connections. Its concrete abutments and lack of ornamentation are also typical of the period. Other than Providence's Point Street swing bridge (Bridge #980), it is the only early twentieth-century through truss highway bridge in the state.

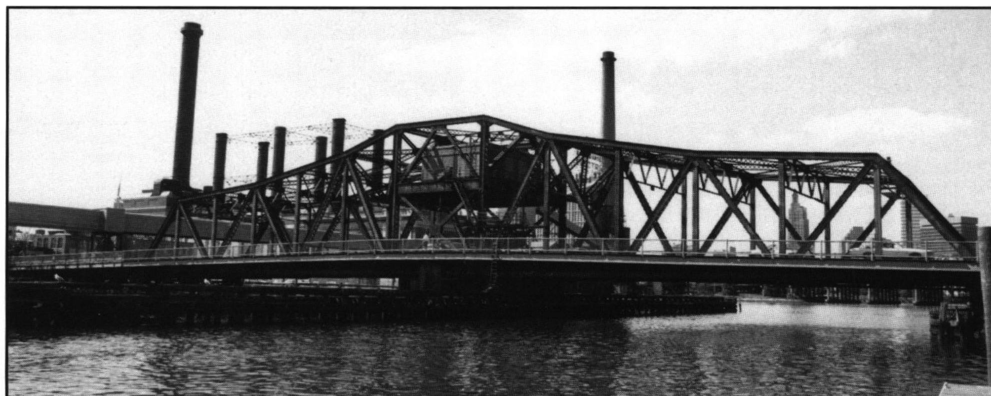
The bridge was built by the New York, New Haven & Hartford Railroad to carry West Street over its main passenger line and over the numerous freight sidings which formerly served downtown Westerly. In addition to cars, trucks, and pedestrians, West Street also carried the local streetcar system over the tracks. Extra heavy I-beams underneath the west lane of the roadway mark the location of the trolley tracks.

POINT STREET BRIDGE

- **BRIDGE #980**
- Point Street over Providence River
- Providence
- 1926-1927
- Maximum Span Length: 141 feet (7 spans, 528 feet total)

Point Street Bridge, the third swing bridge on the site, recalls the days when commercial shipping in Providence's inner harbor was an important part of the city's economic life. The Dyer Street docks, upstream from the bridge, were still active in the early twentieth century, and warehouses, factories, and utility plants in the area relied on water-borne shipping. At that time, Point Street was the only way to cross the river south of the downtown area. Therefore, a large and reliable draw bridge was needed, both to permit river navigation and to carry the growing numbers of cars and trucks on the streets of Providence. The bridge is the only remaining movable highway bridge in Providence.

Point Street Bridge was a large project for its day, costing over $550,000. Providence took pride that it was designed entirely by City Engineer Frank S. Nolan and his department. Fabricated by Boston Bridge Works, it is typical of early twentieth-century bridges in its Warren truss design and riveted construction. The electrically powered swing span was built at Fox Point and was floated to Point Street on barges; as the tide fell, the bridge settled onto its bearings and was ready to operate.



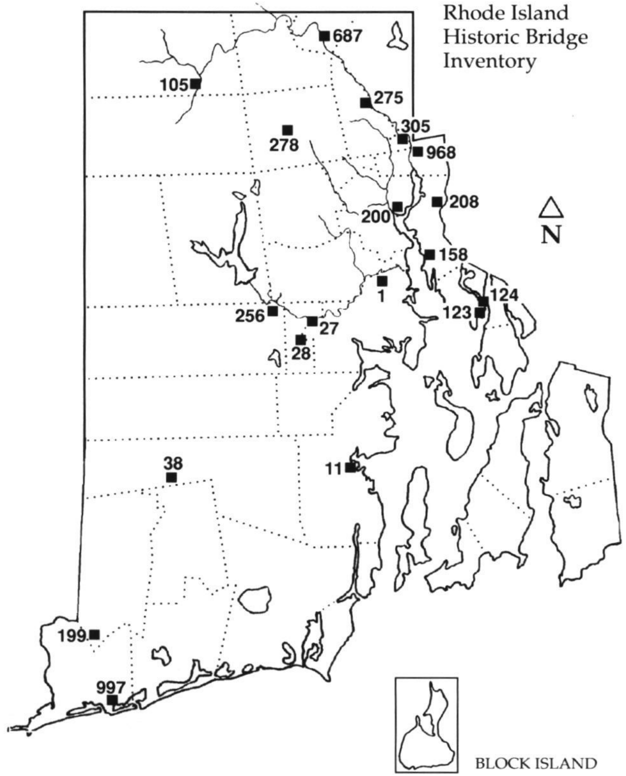
MOUNT HOPE BRIDGE

- **BRIDGE #300**
- R.I. Route 114 over Mount Hope Bay
- Bristol-Portsmouth
- 1927-1929
- Maximum Span Length: 1,200 feet (6,130 feet total)

With its 285-foot towers, gracefully curving cables, and roadway soaring 135 feet above the waters of Mount Hope Bay, this magnificent suspension bridge is a prominent scenic landmark as well as a significant historic bridge. In the 1920s, widespread interest focused on completing the highway link between Providence and Newport by replacing the Bristol-Portsmouth ferry with a bridge. After deciding the project would be too expensive, the State Legislature gave a private company the right to build a toll bridge across the bay. Completed at a cost of 2.5 million dollars, the bridge was the longest suspension bridge in New England for many years. It was designed by one of America's leading bridge engineers, David B. Steinman, and incorporates many technical innovations. However, one attempt at innovation proved disastrous. Over Steinman's objections, heat-treated steel had been chosen for the bridge's cables. Four months from opening day, the cables were declared unsafe. At a cost of one million dollars, the bridge was taken down, new cold-drawn cables were strung, and the roadway was re-erected. The bridge was completed on time, and the contractor, McClintic-Marshall, paid for the changes.

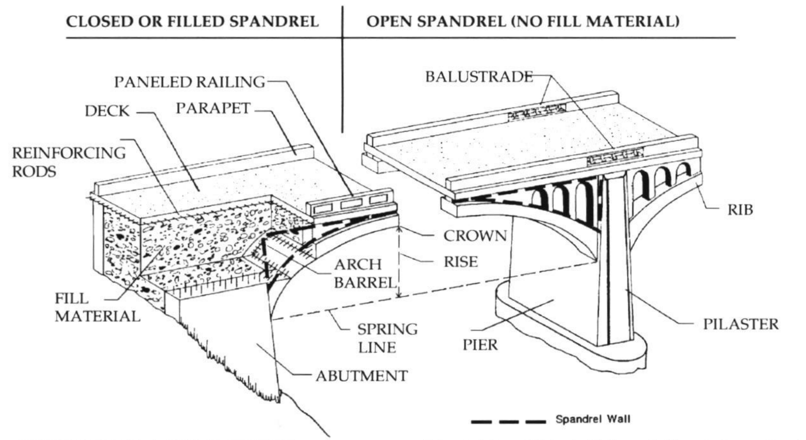
At right and opposite page: *Mount Hope Bridge.*

CONCRETE BRIDGES



CONCRETE BRIDGES

Whether an arch, a slab, or a series of beams, a reinforced-concrete bridge began with wooden forms that defined the final shape of the bridge. Concrete was poured into the forms over a pattern of steel reinforcing bars which gave the material tensile strength. After the forms were removed and the concrete completely cured, the final surface texture, if any, was applied. Most Rhode Island concrete bridges were built by local contractors. The bridge shown under construction on page 52 is the Hope Bridge (Bridge #256) in Scituate.



CONCRETE ARCH TERMS

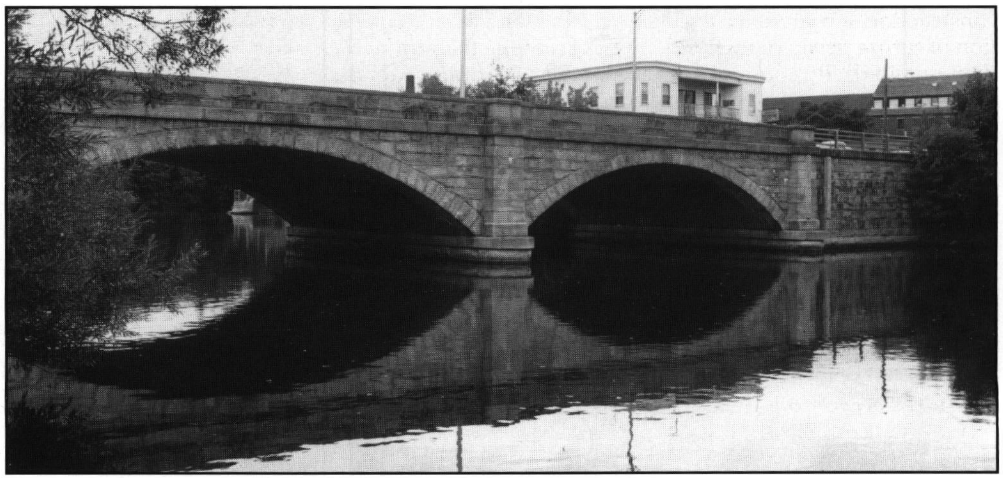
Adapted from *Historic Highway Bridges in Pennsylvania. Preservation Guide*. Used with permission.

ROOSEVELT AVENUE BRIDGE

- **BRIDGE #968**
- Roosevelt Avenue over Blackstone River
- Pawtucket - Central Falls
- 1910
- Maximum Span Length: 65 feet (3 spans, 189 feet total)

This stone-faced, concrete arch structure is an excellent example of the ornate bridges erected as part of the "City Beautiful" movement. In the early twentieth century, municipal leaders tried to improve the appearance of their cities with bridges that were aesthetically pleasing as well as functional. Often modeled on the bridges of Renaissance Europe or Classical Rome, they were intended to show that a community was progressive, tasteful and prosperous. Pawtucket's bridge, with its large proportions, multiple arches, and fine stone work, amply fulfilled these goals. Soon after its completion in 1911, the bridge was featured in *American City*, a national civic improvement magazine. As part of the bridge's dedication, Governor Aram J. Pothier took the controls of the first trolley car to cross the bridge.

The special commission that built the bridge hired noted Boston engineer Joseph R. Worcester to design the structure. Worcester is best known for the recently demolished 1905 steel arch across the Connecticut River at Bellows Falls, Vermont.



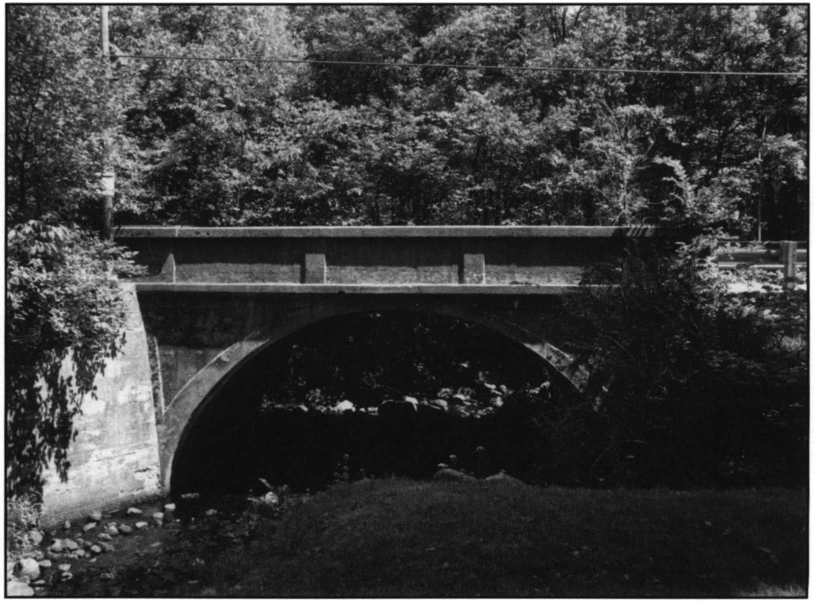
BROWNINGS MILL BRIDGE

- **BRIDGE #38**
- Old Nooseneck Hill Road over Roaring Brook
- Exeter
- 1913
- Span Length: 30 feet

Brownings Mill Bridge was one of the first projects undertaken by the Rhode Island Board of Public Road's Bridge Division. Established in 1912, the Bridge Division immediately began work on fifteen bridges. This small arch illustrates many key decisions made in that first year: a commitment to concrete construction, a preference for the arch form, and an anticipation of future needs (wider and stronger bridges than traffic then required). It is one of only two surviving bridges from the Bridge Division's first season.

To design its first bridges, the Division hired engineers Daniel Luten and Walter Denham of the National Bridge Company in Indianapolis and paid them a commission of 20 percent of construction costs. A leading proponent of concrete bridges, Luten had patented many aspects of their design and construction. Although his patents failed to hold up, he played a major role in popularizing concrete bridges throughout the country. Luten's influence is apparent in the similarity of this bridge to the dozens of Rhode Island arches that State engineers designed on their own in subsequent years.

The bridge's arched form and obvious age add greatly to the scenic qualities of its setting, the Brownings Pond recreation area.



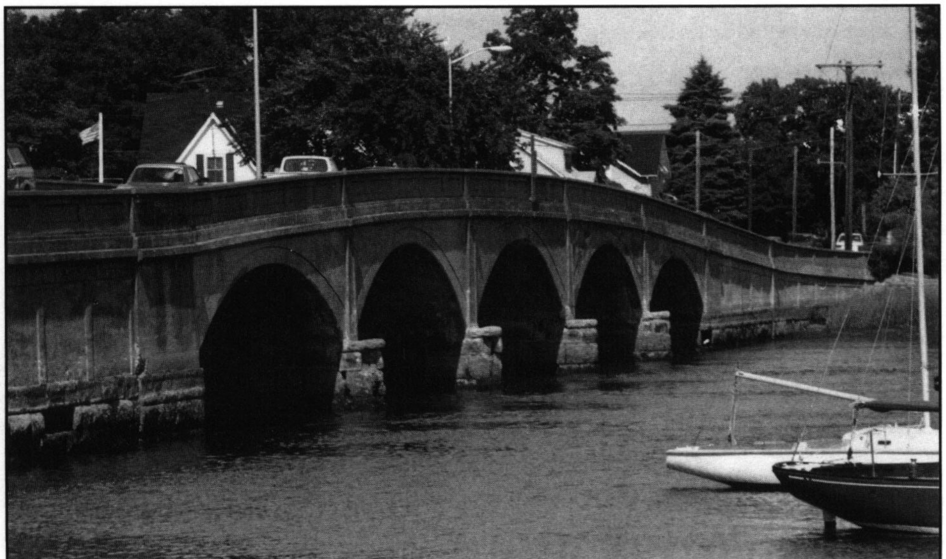
HARRISON AVENUE RAILROAD BRIDGE

- **BRIDGE #687**
- Harrison Avenue over Providence and Worcester Railroad
- Woonsocket
- 1913
- Span Length: 51 feet

The shallow arch of the Harrison Avenue Railroad Bridge rests on high straight sides that elevate the bridge about 20 feet above the level of the railroad. This profile, known as a high stilted arch, provided the necessary clearance for the Providence and Worcester Railroad's main line, which was four tracks wide at that time. Woonsocket City Engineer Frank H. Mills designed the bridge, one of Rhode Island's earliest examples of concrete arch construction. Mills was familiar with concrete bridge design; ten years earlier, he had used concrete arches to widen Woonsocket's stone arch Globe Bridge. Brien and Bouvier, a local contractor, built Harrison Avenue Bridge.

BARRINGTON AND WARREN BRIDGES

- **BRIDGES #123 AND #124**
- County Road (R.I. Route 103) over Barrington and Palmer Rivers
- Barrington-Warren
- 1914
- Barrington Bridge—Maximum Span Length: 60 feet (5 spans, 334 feet total)
- Warren Bridge—Maximum Span Length: 67 feet (3 spans, 228 feet total)



The total deterioration of the previous Barrington and Warren bridges was one of the chief reasons for creating the Bridge Division within the State Board of Public Roads in 1912. Consequently, the Division made construction of new bridges at this site its top priority. With a total length of over one quarter mile, the crossing was a vital link between the towns on the eastern side of Narragansett Bay and the rest of the state. The Barrington and Warren Bridges were the State's first large project. They took almost three years and $200,000 to complete. The State engineers were especially proud of these bridges, as is evident from their annual report of 1914:

"Built mainly by Rhode Island labor, with every precaution for public safety and convenience, of acknowledged excellence of material and workmanship, these bridges are a source of pride and satisfaction to the Board and a credit to the State."

One thing that did not satisfy the Board was the bridges' original urn-shaped railing balusters. Some of the balusters cracked soon after the bridges were built, and in any case, they offered little resistance to impact damage. A single automobile mishap could destroy 40 feet of balusters. Eventually both bridges had their railings replaced with the more rugged paneled design used on later bridges.

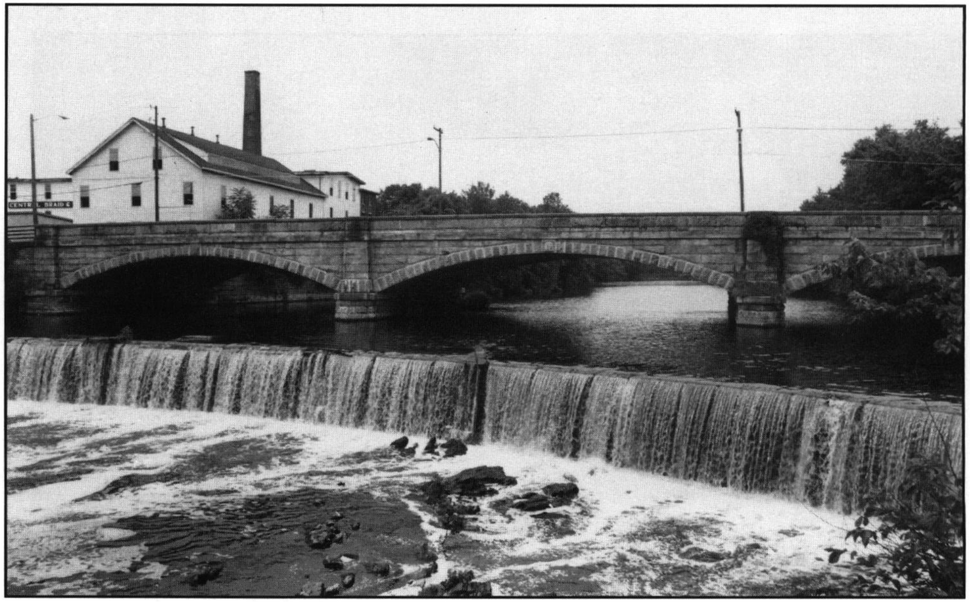
At left: *Barrington Bridge.*

BROAD STREET BRIDGE

- **BRIDGE #305**
- Broad Street over Blackstone River
- Cumberland-Central Falls
- 1915
- Maximum Span Length: 72 feet
  (3 spans, 225 feet total)

Although missing its original lamps and commemorative plaques, the Broad Street Bridge is an excellent example of the large, stylish arched bridges erected in Rhode Island cities in the early twentieth century. The bridge's massive railings, elaborate stone work that conceals the concrete, and date stones at the apex of its center arch all indicate that the purpose of the bridge went beyond simple transportation; it was intended to be an attractive addition to the landscape as well. The picturesque stone work is especially attractive. Its rough-hewn texture contrasts with the smooth-finished stone in the cap and at the base of the railings. Pilasters and a prominent stringcourse add depth to the bridge's appearance in profile.

Cumberland's City Council initiated the bridge project by appropriating $35,000. The State then required Central Falls to contribute its share of the construction costs. Engineers Howard F. Esten and Frank H. Black of Pawtucket designed the structure.

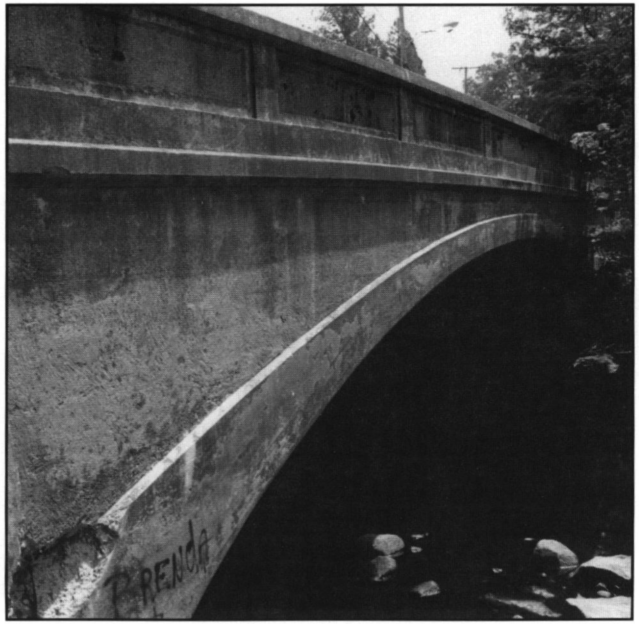


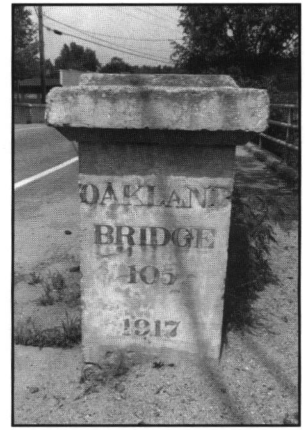
OAKLAND BRIDGE

- **BRIDGE #105**
- Victory Highway over Pascoag River
- Burrillville
- 1917
- Span Length: 60 feet

Oakland Bridge is an early example of the State's standard design for medium-sized concrete arches. The bridge's shallow arched profile, raised arch ring, and simple paneled railing would be repeated in scores of bridges constructed by the Bridge Division of the State Board of Public Roads in the 1920s and 1930s. The contrasting smooth and textured surface finish, created by bush-hammering the spandrels of the arch and the recessed panels in the railing, was also standard. The only feature that distinguishes it from later bridges of its type are the bronze characters, giving the bridge name, number, and date of construction, that are imbedded in the railing ends. Such characters were soon superceded by white and blue identification tiles. The original design for the bridge included anchors for a sidewalk hidden in the concrete, but the sidewalk was not built until 1966.

Oakland Bridge was the first structure built with State bridge bonds, a program that was started in 1916. The bonds aided bridge construction by spreading the cost over many years.



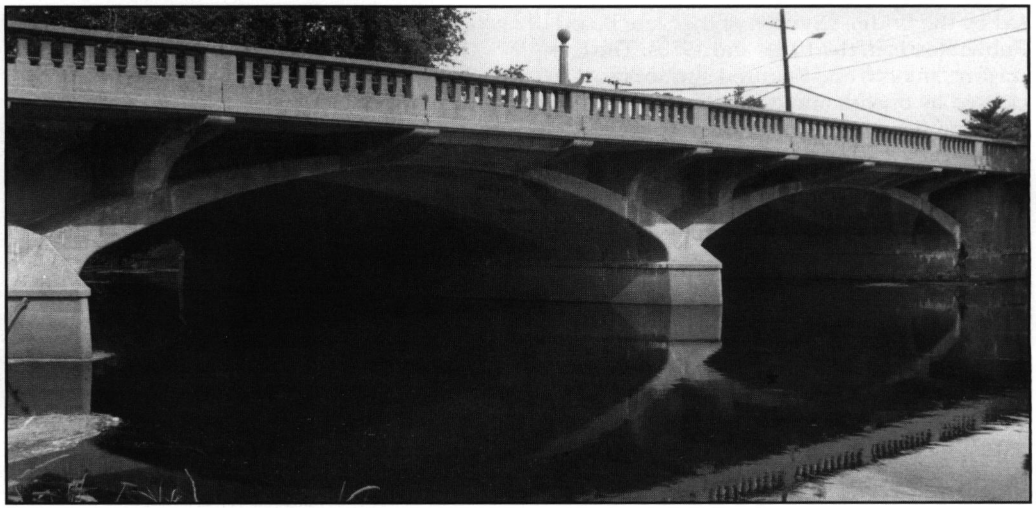


Above: *Detail of railing end.*

ELMWOOD AVENUE BRIDGE

- **BRIDGE #1**
- Elmwood Avenue (U.S. 1) over Pawtuxet River
- Cranston-Warwick
- 1918
- Maximum Span Length: 42 feet (3 spans, 153 feet total)

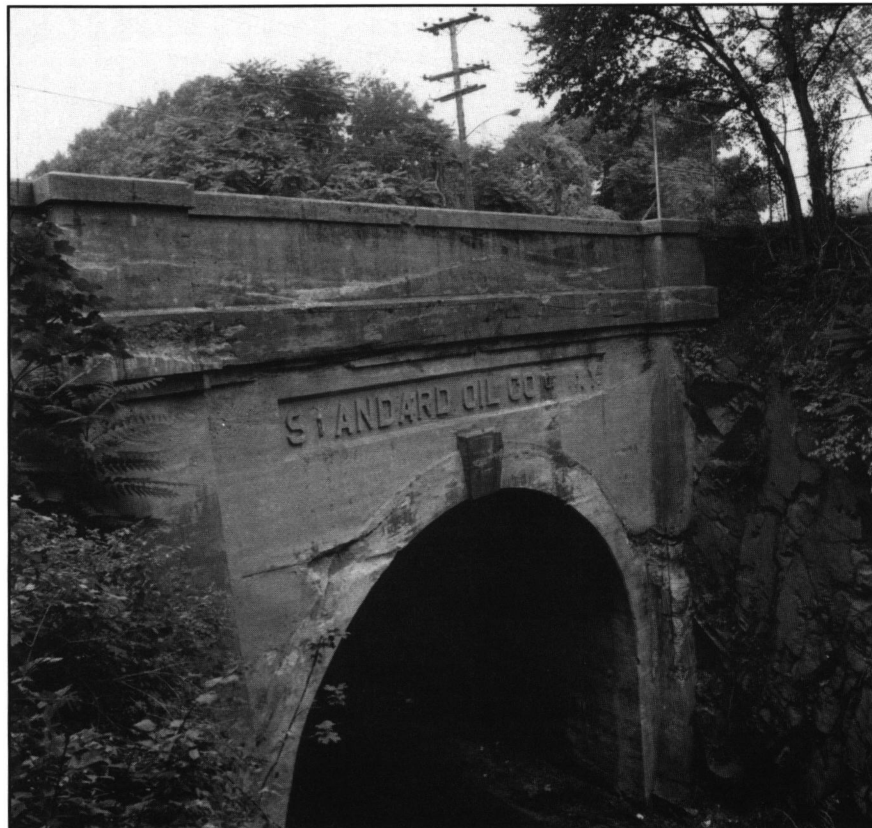
With Elmwood Avenue Bridge, the Bridge Division of the State Board of Public Roads pioneered its innovative sloped spandrel design. In this type of bridge, the normally straight sides that contain the roadway fill are slanted inward toward the center line of the arch barrel. This technique had several advantages: less fill was needed, reducing the dead weight of the bridge; less stress was put on the outside edge of the arch barrel; the arch barrel itself could be narrower, saving on both arch and foundation costs; and the brackets for the cantilevered sidewalk could bear directly on the arch barrel. The design was repeated in several large State bridges and was further refined by substituting separate ribs for the single arch barrel. Elmwood Avenue Bridge was widened on both sides in 1931, keeping the distinctive spandrel and sidewalk configuration. At the same time, the original urn baluster railing was replaced with a square baluster design. The bridge's original lamp standards remain in place.



STANDARD OIL COMPANY BRIDGE

- **BRIDGE #158**
- Pawtucket Avenue over private railroad spur
- East Providence
- 1919
- Span Length: 32 feet

Standard Oil Company of New York built this concrete arch bridge in 1919 as part of what it claimed would be "the most important oil terminal on the Atlantic Coast." The 1,100-acre East Providence facility was built despite considerable opposition by local farmers, fisherman, and other residents. It included an oil refinery, a naphtha plant, a large dock on the river, and dozens of large storage tanks. Servicing the property was a two-mile-long private railroad that connected the river front to the main storage area adjacent to present-day Route 114. To build it, Standard Oil (the predecessor to Mobil Oil Corporation) had to blast away more than 60,000 yards of traprock. This bridge allowed the rail line to pass under Pawtucket Avenue. With its prominent corporate identification, the bridge is a symbol of industrial development in East Providence during the early years of the twentieth century.



MEETING HOUSE BRIDGE

- **BRIDGE #199**
- Nooseneck Hill Road (R.I. Route 3) over Pawcatuck River
- Hopkinton-Westerly
- 1924
- Span Length: 80 feet

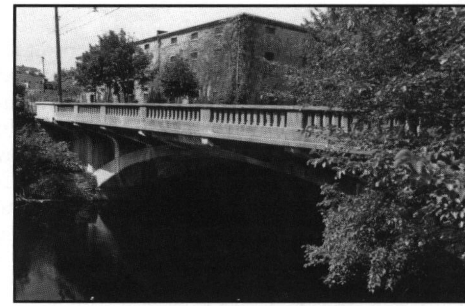
Opposite page: *Meeting House Bridge.*
Below: *Royal Mills Bridge.*
Bottom: *Royal Mills Bridge showing arch ribs.*

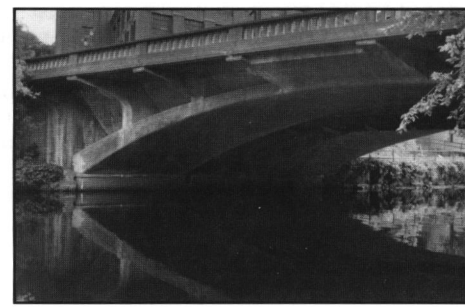
Meeting House Bridge is one of five surviving examples of a type of concrete arch developed by Rhode Island State bridge engineers for spans of 60 to 100 feet. The design, halfway between the solid-spandrel filled arch and the open-spandrel design, is a further modification of the slanted spandrels first used in the Elmwood Avenue bridge. In this design, the single arch barrel is replaced by two or three arch ribs, providing further savings in material. The gradual refinement of concrete arch designs is a testament to the ingenuity and professional abilities of the State's bridge engineers. These ribbed, slanted-spandrel bridges (which the State referred to as a "modified arch" design) also exhibit the standard details, such as the identification tiles and the square-baluster railing, used on nearly all long bridges of the 1920s and 1930s.

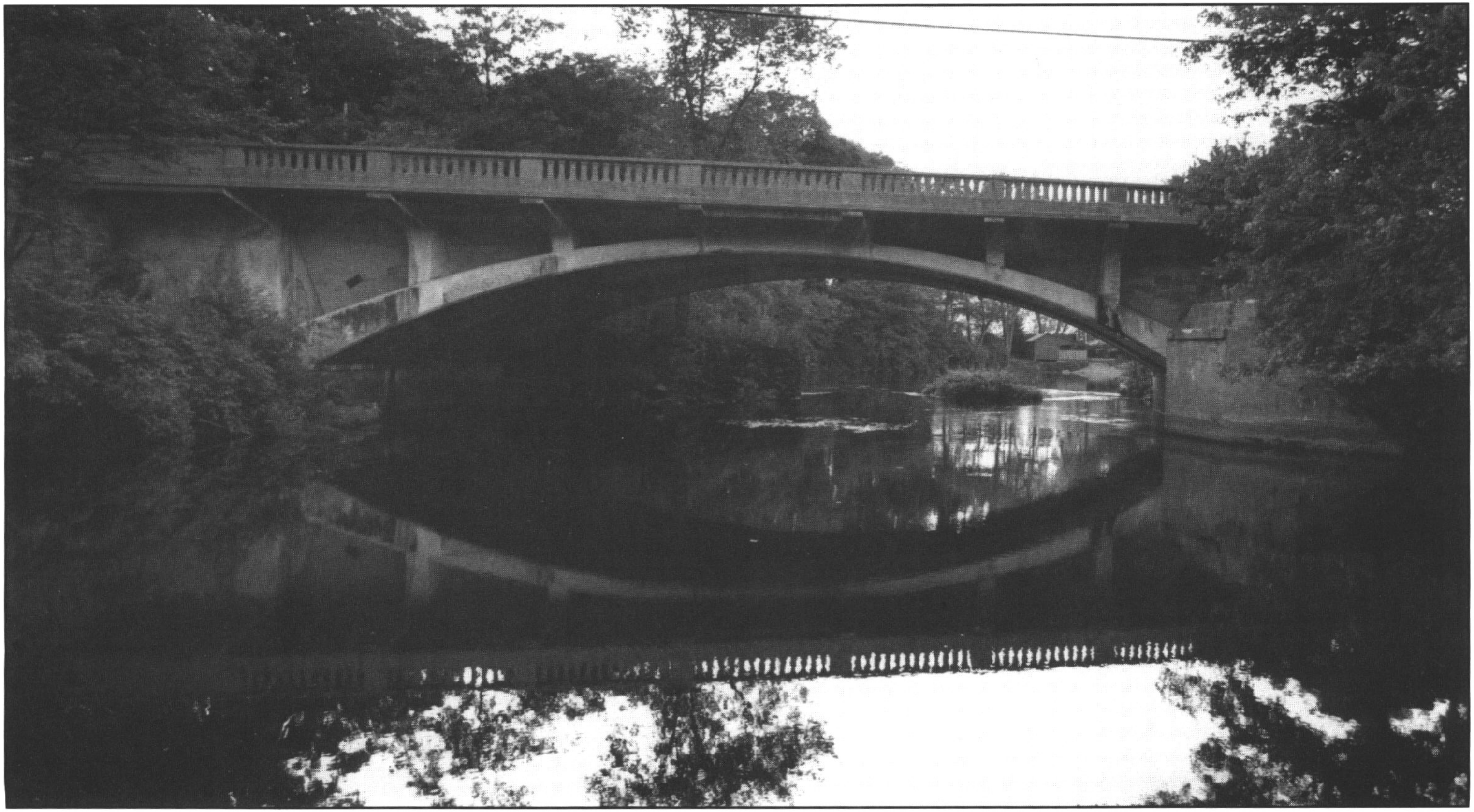
Meeting House Bridge was built as part of the construction of Nooseneck Hill Road, a highway linking Providence with Rhode Island's southwest corner. Road and bridge designers worked in close cooperation to minimize the total project cost. Although this bridge was more expensive than some alternatives, its cost was more than offset by a less expensive road alignment.

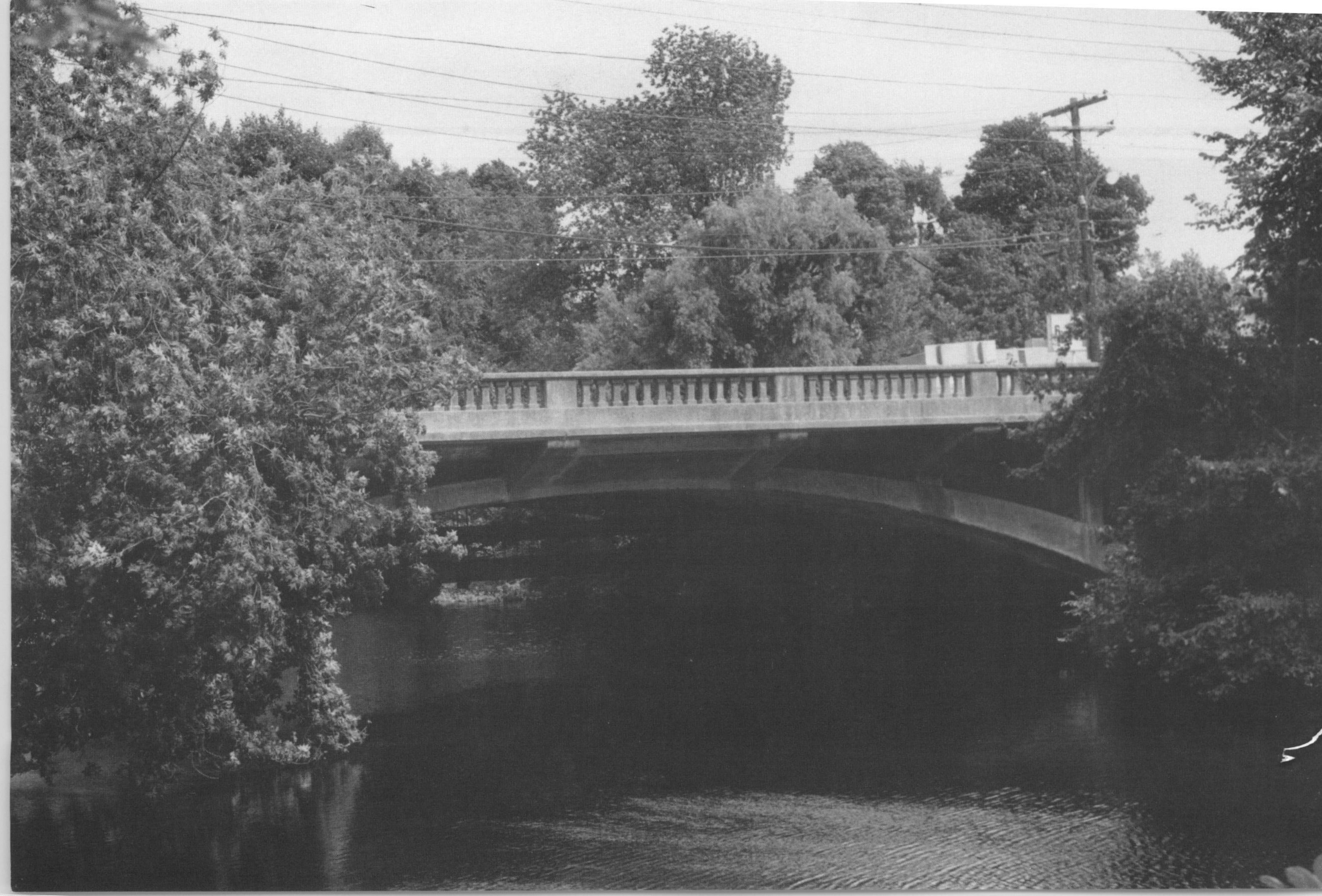
The bridge is also notable because it was the first built with funds from the Federal Highway Act of 1921. As a consequence of the funding, Federal engineers reviewed the bridge's design and made some minor changes to strengthen the bridge. This was the beginning of the Federal-State partnership in bridge construction that continues to the present.

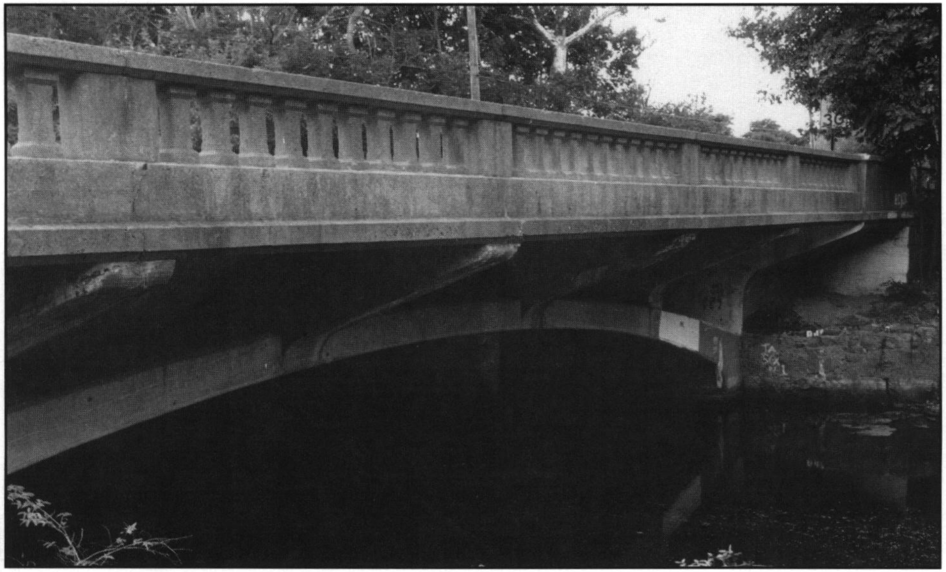
The other bridges of this type are **Royal Mills Bridge (Bridge #27)**, Providence Street (R.I. Route 33), West Warwick, 1923; **Centerville Bridge (Bridge #28)**, Centerville Road, West Warwick, 1926; **Hunts Mill Bridge (Bridge #208)**, Pleasant Street, East Providence, 1926; **Hope Bridge (Bridge #256)**, East Road (R.I. Route 116), Scituate, 1930.

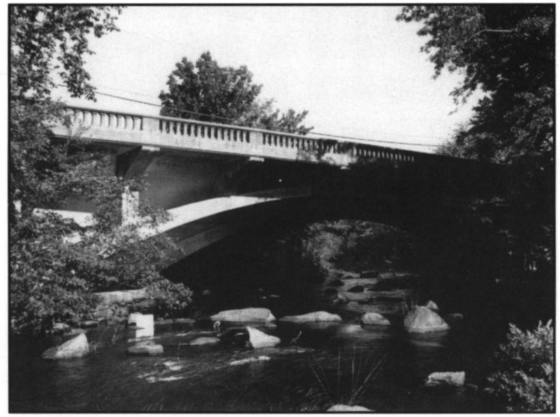


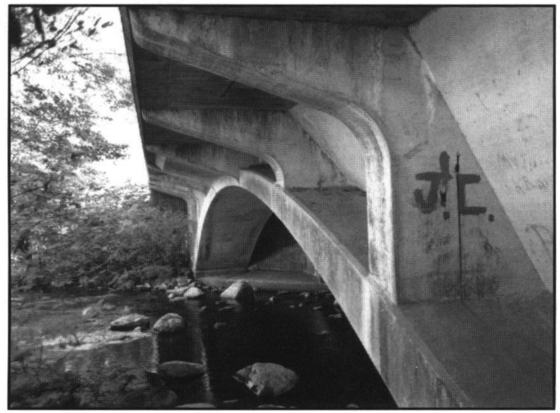












Opposite page: *Centerville Bridge.*

Above: *Hunts Mill Bridge.*

Above right: *Hope Bridge.*

At right: *Hope Bridge showing detail of sidewalk bracket and slanted spandrel.*

CLARENCE L. HUSSEY MEMORIAL BRIDGE

- **BRIDGE #11**
- Boston Neck Road (R.I. Route 1A) over Wickford Cove
- North Kingstown
- 1925
- Span Length: 80 feet

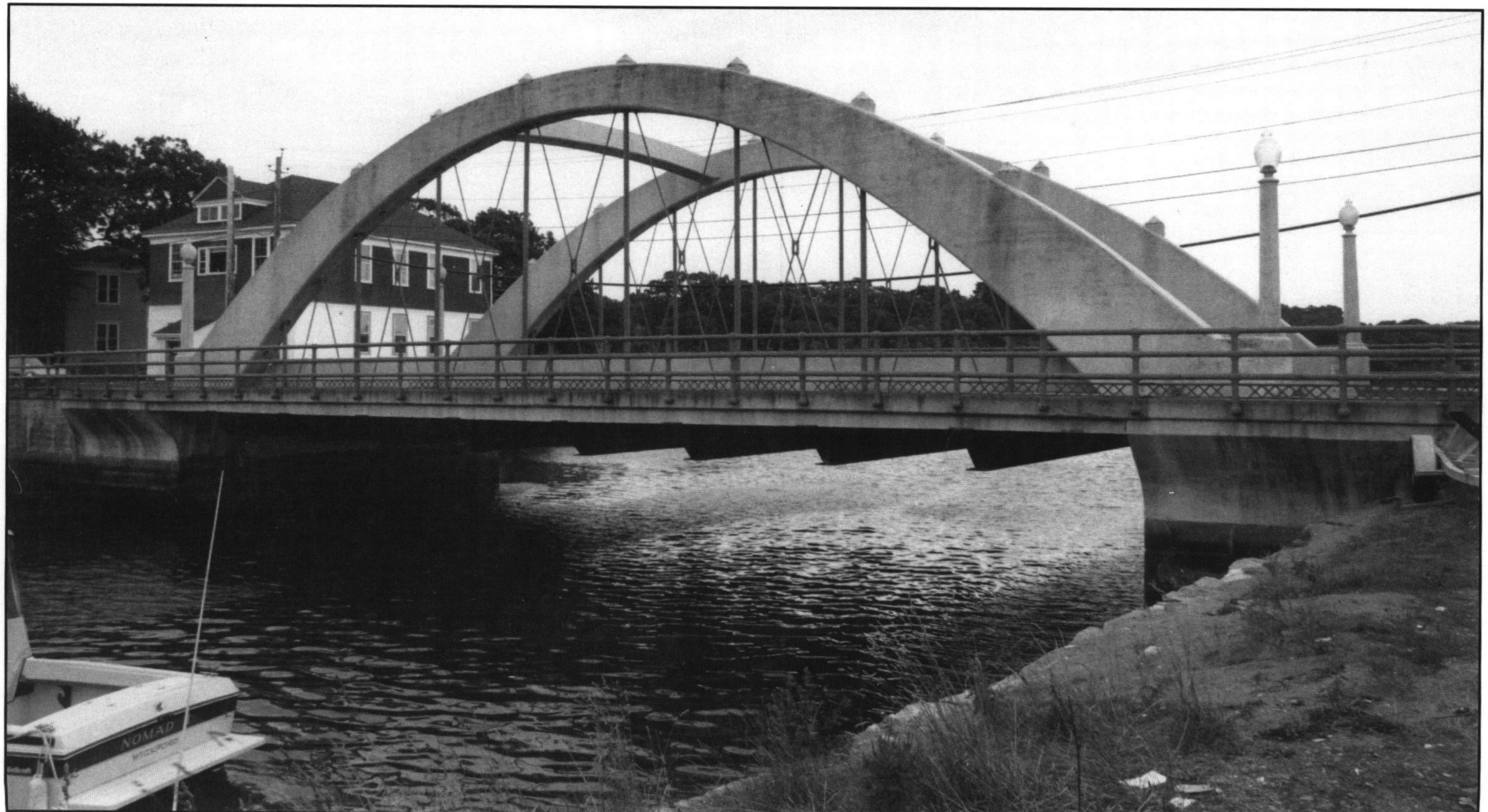
The only one of its type in Rhode Island, this bridge is an example of the concrete through arch configuration, sometimes called a rainbow arch. In this type of construction, a suspended roadway runs between the arches rather than being supported from below. Two considerations led to the choice of a through arch: there was a need to allow small-boat navigation under the bridge and it was impossible to raise the road level in the village of Wickford. A pair of substantial parabola-shaped arch ribs, connected by two large concrete struts, support the bridge's concrete slab roadway. Among the bridge's special features are steel suspender rods encased in bitumen-filled iron pipes to prevent corrosion; a system of diagonal tension rods to stiffen the bridge; unique fixtures for attaching the suspenders to the large I-section floor beams; and stone facing below the abutments' high water mark to prevent salt water damage to the concrete. The bridge's special status is indicated by the ornamental bosses at the upper connecting points, its large monumental lamps, and its special smooth surface finish (recently redone in a manner similar to the original).

Clarence L. Hussey, the State's first bridge engineer, died suddenly just after the bridge was completed. Hussey planned the State's massive bridge program, designed most of the early spans, and built the Bridge Division into an agency with outstanding professional capabilities. The bridge is an especially suitable memorial to Hussey; it was the last bridge he supervised and one of the most technically demanding.

The bridge is part of the Wickford National Register Historic District.

At right: *Clarence L. Hussey.*

 Opposite page: *Hussey Memorial Bridge.*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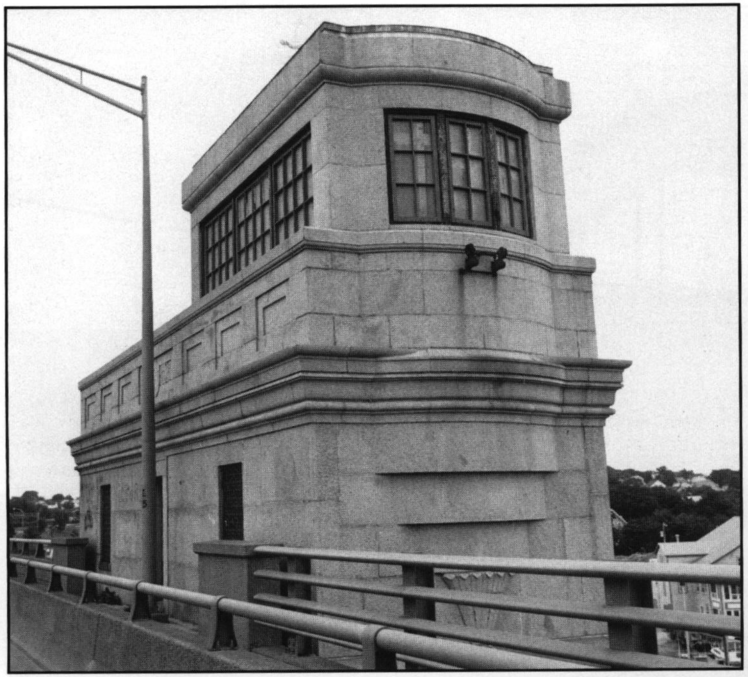
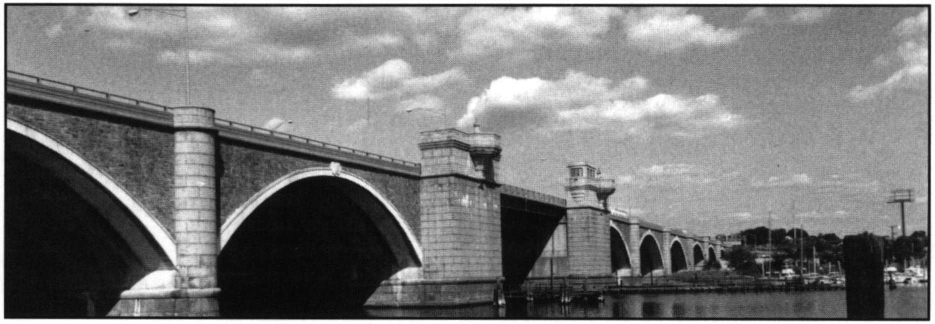


Above: *Operator's house.*

At right: *Monument at east end of Washington Bridge South.*

WASHINGTON BRIDGE SOUTH

- **BRIDGE #200**
- Interstate Route 195 over Seekonk River
- Providence-East Providence
- 1930
- Maximum Span Length: 124 feet
  (15 spans, 1,864 feet total)



In addition to being a major engineering project, the Washington Bridge is a work of architecture unparalleled among the bridges of Rhode Island. Designed by engineer Clarence W. Hudson and architect Carl L. Otto, both of New York City, the bridge's multiple arch form and extensive decorative detailing make it an excellent example of the Classical Revival movement. At each end, tall structures of smooth-finished stone, with deeply cut joints and a Classical frieze and cornice (freely adapted to include an American eagle), mark the entrance to the bridge. Towers at each end of the center span are built of smooth ashlar masonry and have molded cornices, paneled parapets, and round balconies overlooking the water. Similar stone work is found in the rounded piers that separate the twelve arched spans. Adding further distinction to the bridge are raised arch rings, tablets with the State seal at the apex of each arch, and large bronze commemorative tablets at the portals. The sides of the arches are faced with a random ashlar of granite and provide a contrast to the courses of smoother, larger blocks in the pier, tower, and portal stone work. The stone sides conceal the arches' true structure and material; each is a six-rib, open-spandrel concrete arch.

The previous bridge across the Seekonk River at this site was a narrow draw bridge that had to be swung completely open whenever any vessel passed. The replacement bridge was designed with 40 feet of clearance between its bascule-lift center span and the channel, so that the bridge would have to be opened only for the largest ships. The replacement bridge was well adapted to the needs of twentieth-century traffic. It was exceptionally wide for its time (85 feet) and was raised well above the surface streets to avoid congestion at its ends. Along with the Mount Hope Bridge, the Washington Bridge provided the first direct highway connection between Providence and Newport, Rhode Island's two leading cities. Because of the size of the undertaking, the State created a special Washington Bridge Commission to build the bridge.

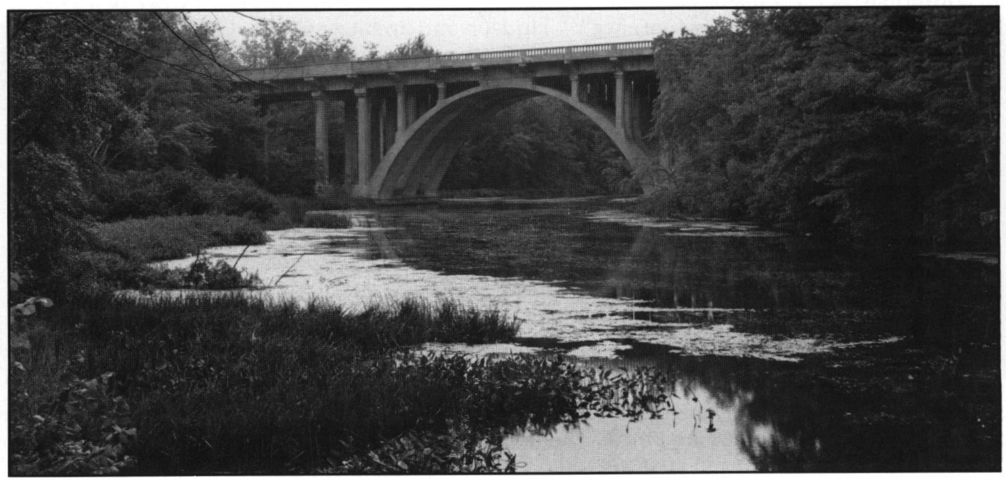
Westbound traffic now crosses on a parallel concrete beam bridge to the north, which was completed in 1971. From the side, its appearance echoes the older bridge's arched form. The north-side portal structures were relocated to maintain visual and stylistic continuity, and at the same time, a fixed steel beam span replaced the southern bridge's bascule.

STILLWATER VIADUCT

- **BRIDGE #278**
- Washington Highway (R.I. Route 116) over Woonasquatucket River
- Smithfield
- 1932
- Maximum Span Length: 80 feet (13 spans, 449 feet total)

When it was opened to traffic in 1933, the Stillwater Viaduct was the longest and highest bridge built by the Bridge Division of the State Board of Public Roads. It crosses the broad valley of the Woonasquatucket River with twelve concrete beam approach spans and an open-spandrel arch river span. The viaduct was one of the final links in the Washington Highway, a major State road in northeastern Rhode Island.

The bridge's open-spandrel design was complicated compared with the more common solid-spandrel filled arch, but it was economical for long, high bridges. The use of columns between the arch and the roadway reduced the weight on the arch, and thus allowed for thinner ribs. Instead of employing the usual time-consuming technique of building temporary arch supports out of wood, the Stillwater Viaduct's builders constructed its river span on top of a prefabricated steel arch that had been dropped into place with a crane. The steel arch was removed once the concrete had set.

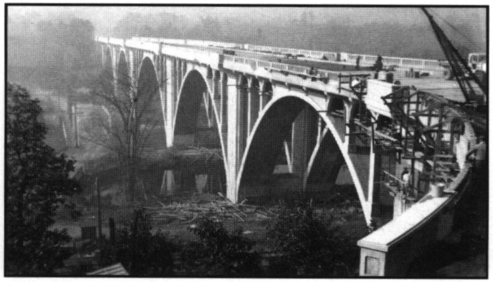


ASHTON VIADUCT

- **BRIDGE #275**
- Washington Highway
  (R.I. Route 116)
  over Blackstone Valley
- Cumberland-Lincoln
- 1934-1945
- Maximum Span Length: 160 feet
  (13 spans, 870 feet total)

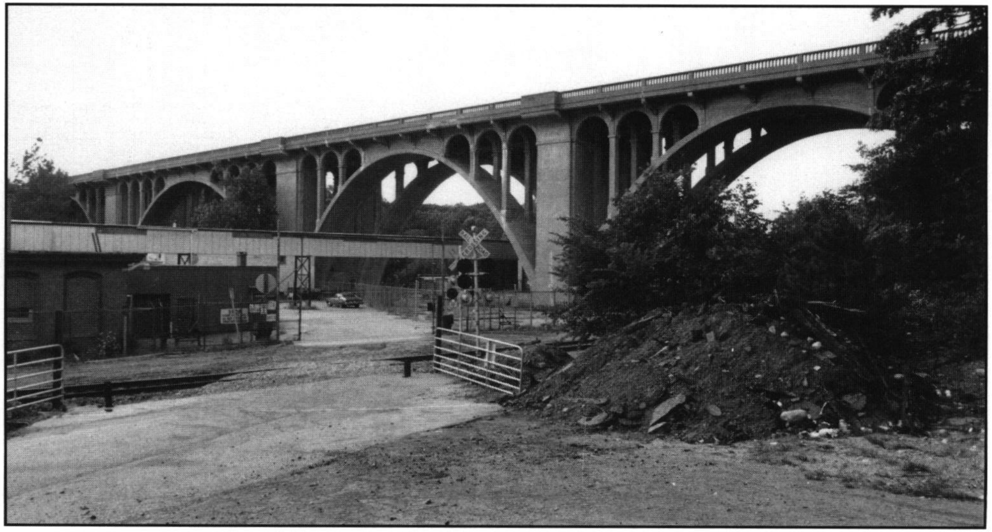
Along with its companion at Stillwater, the Ashton Viaduct was intended as a final link in the Washington Highway. However, budget problems during the Depression and wartime labor shortages delayed its completion for more than a decade. The footings were completed in 1934, but work did not resume on the superstructure until 1942.

Spanning the broad Blackstone River Valley, the viaduct soars more than 50 feet above the river, the railroad, and the mill yard below. Its river span of 160 feet, and the four side spans of 114 to 125 feet, are the largest concrete arches in Rhode Island. The viaduct's thin-ribbed, open-spandrel design gives the structure an exceptionally graceful appearance. Decorative arches between the columns add to the bridge's aesthetic qualities, and sidewalk alcoves allow the pedestrian to pause and view the scenic river valley below.



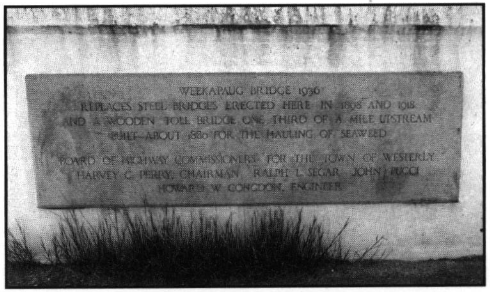
Above: *Ashton Viaduct nearing completion in November 1944.*

At right: *Ashton Viaduct as it appears today.*

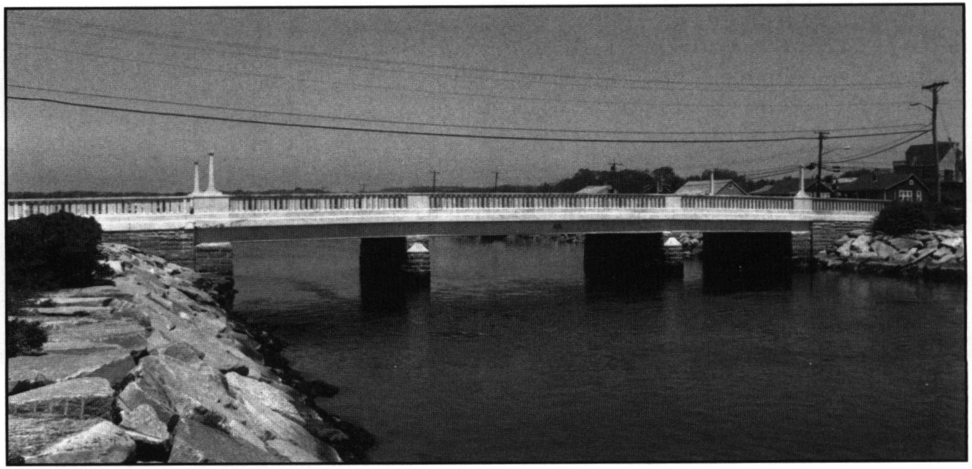


WEEKAPAUG BRIDGE

- **BRIDGE #997**
- Atlantic Avenue over Weekapaug Inlet
- Westerly
- 1936
- Maximum Span Length: 55 feet (3 spans, 124 feet total)



Although its structure is typical for its day (six large reinforced concrete beams in each span), the Weekapaug Bridge's railing, lamps, and commemorative tablets show that it was intended to be more than an ordinary bridge. One tablet simply gives the name of the bridge, while another identifies the bridge's engineer—Howard W. Congden—and gives an account of previous bridges at the site. In contrast to the Neo-Classical style commonly constructed earlier in the century, the details of this bridge (especially the lamps) exhibit the stylized influence of the Art Deco movement. Also notable is the use of granite for its piers and abutments. Although stone facing was a way of protecting concrete from salt water, the quantity of stone above the high water line of this bridge may have been a response to the Westerly Granite Cutters Union's request that the Town build an all stone bridge to help unemployed stone cutters.



Atlantic Avenue was the major thoroughfare for Weekapaug, a busy summer resort. In addition to improving a narrow, dangerous crossing, the new bridge had another benefit; it reduced stagnation in Winnapaug Pond by allowing more water to flow through the inlet.

Upper right: *Detail of tablet.*