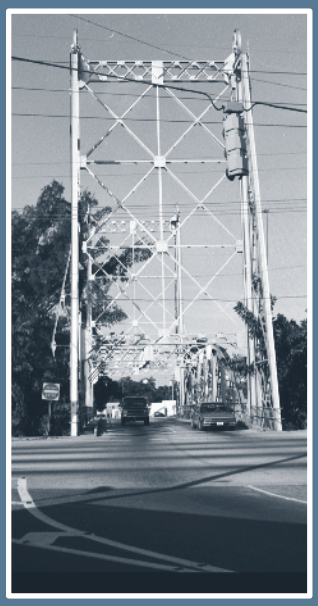
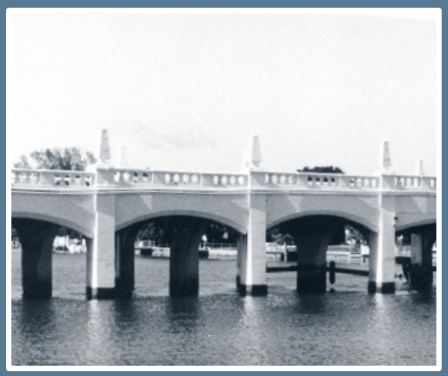
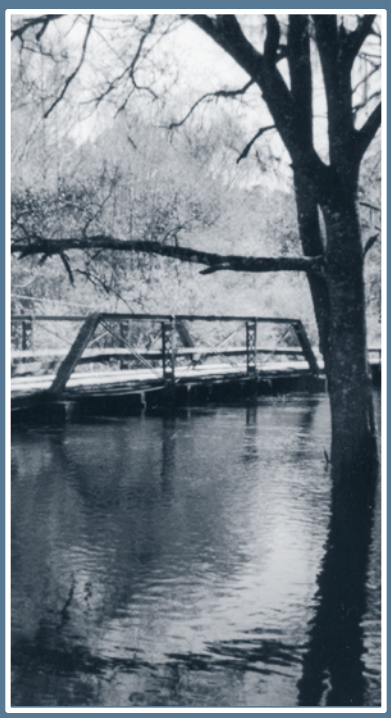
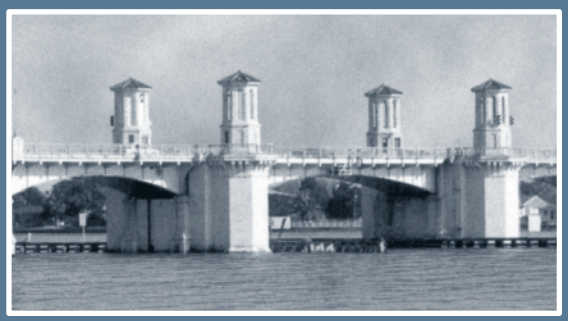
HISTORIC HIGHWAY BRIDGES OF FLORIDA



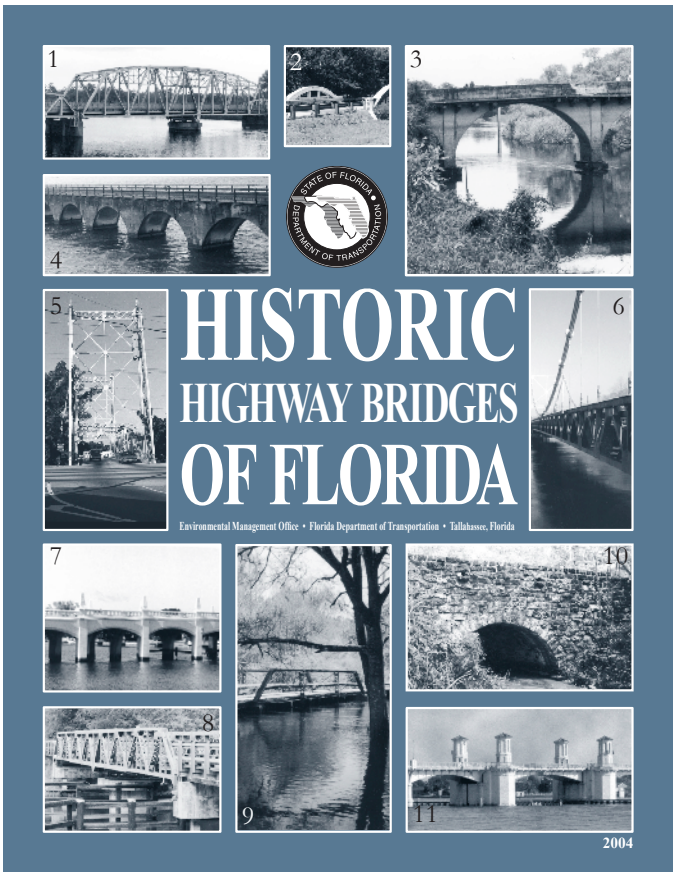
Environmental Management Office • Florida Department of Transportation • Tallahassee, Florida







2004



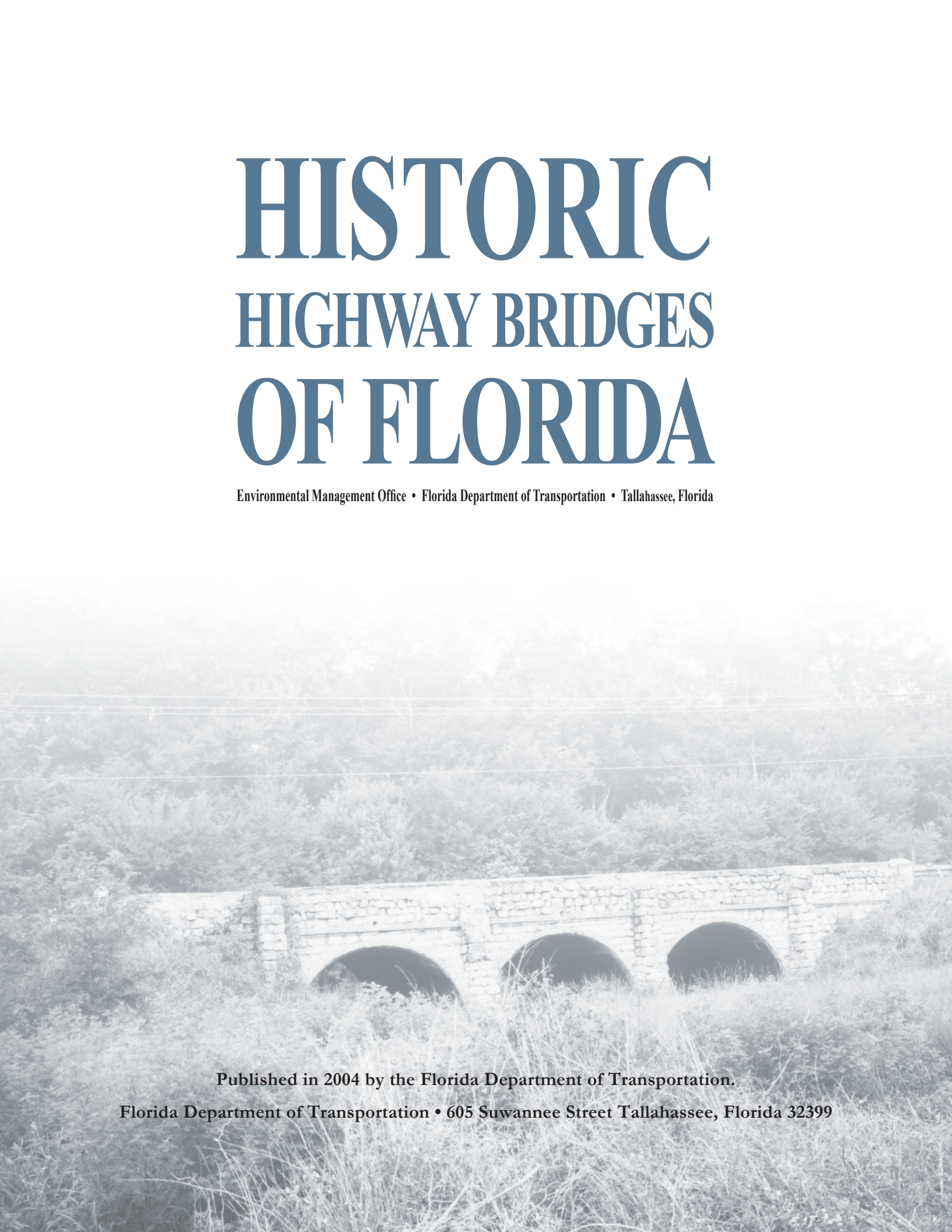
Front Cover Bridge Key:

1. St. Mary's River Bridge
2. Moss Rainbow Arch
3. Peace River Bridge at Arcadia
4. Long Key Viaduct
5. Hialeah Vertical Lift
6. Hal Adams Bridge
7. Indian Creek Bridge
8. Sharpe's Ferry Bridge
9. Steinhatchee Springs Pony Truss
10. Torreya Stone Arch Bridge
11. Bridge of Lions

Photo opposite page: Blackwater Creek Overflow Bridge in Hillsborough County

HISTORIC HIGHWAY BRIDGES OF FLORIDA

Environmental Management Office • Florida Department of Transportation • Tallahassee, Florida



Published in 2004 by the Florida Department of Transportation.

Florida Department of Transportation • 605 Suwannee Street Tallahassee, Florida 32399

Project Manager:
George R. Ballo
Environmental Management Office
Florida Department of Transportation

Prepared by:
Roy A. Jackson
Environmental Management Office
Florida Department of Transportation
in association with
Powell, Fragala & Associates, Inc.
Lakeland, Florida

Design & Production:
Janus Research
St. Petersburg, Florida

Illustrations on the following pages courtesy of the Delaware Department of Transportation, Division of Highways, Location and Environmental Studies Office. *Delaware's Historic Bridges, 2002:* 118, 190, 216

Photographic Sources:
Historic photos and illustrations in this book are from the collection of the Florida Department of Transportation unless otherwise noted.

Photographs, illustrations or other images on the following pages courtesy of Janus Research:
49, 57, 61, 63, 65, 67, 69, 70, 78, 93, 94, 108, 109 (bottom), 123 (top), 126 (bottom), 138, back cover

Photographs, illustrations or other images on the following pages courtesy of the Florida Photographic Collection:
23, 25-33, 37, 38, 40-43, 46, 52, 60, back cover (inset)

Photograph on page 66 courtesy of the City of Treasure Island

Postcard on page 72 courtesy of Miami Springs Historical Museum

Photograph on page 137 (top) courtesy of Jacksonville Transit Authority

Photograph on inside back cover courtesy, Tampa-Hillsborough County Public Library System

ACKNOWLEDGMENTS

The completion of this second installment of the Historic Highway Bridges of Florida is the result of the contributions and efforts of many people. It represents the culmination of months of research and fieldwork. Individuals and organizations from many different areas of the state, and even some outside of Florida, have helped to make this publication possible. Some of those who have helped are librarians, archivists, local and state historians, and others associated with local historic preservation societies and groups. Many of the individuals who provided information are professional bridge engineers, while others are simply historic bridge enthusiasts or architectural historians. I extend my gratitude to all who have helped by sharing their knowledge and expertise of historic bridges.

I would especially like to acknowledge the work of Dr. Joseph E. King of Texas Tech University and his team of researchers. They completed the first full study of historic bridges in Florida for the Florida Department of Transportation, upon which this current study is based. I also am indebted to Stephen Atkins and William Keeler for their earlier work on metal truss, swing, and vertical lift bridges. Much of the material contained in this book comes from those two efforts. These studies have been supplemented by other general works and by many other researchers and cultural resource specialists. One such person is Rebecca Spain-Schwarz of PBS&J, Inc., who has added material on many bridges in the state. Their findings are catalogued at the Florida Master Site File, and have provided much of the basic groundwork for a number of bridges included in this study. The Florida Master Site File staff, under the direction of Dr. Marion Smith, was very helpful at all times in providing information from their archives.

Leroy Irwin, Manager of the Environmental Management Office of the Florida Department of Transportation (retired), deserves special mention for his support of this project. He also has been unwavering in his commitment to creating and maintaining a strong historic resources program for the Department of Transportation and the state of Florida. There are many others who also deserve mention, though there are far more than can be listed in this brief acknowledgment. I wish to note that George Ballo of the Department has assisted in all phases of the work associated with this project from its beginning, as have other members of the Department's Environmental Management Office. The assistance of all the

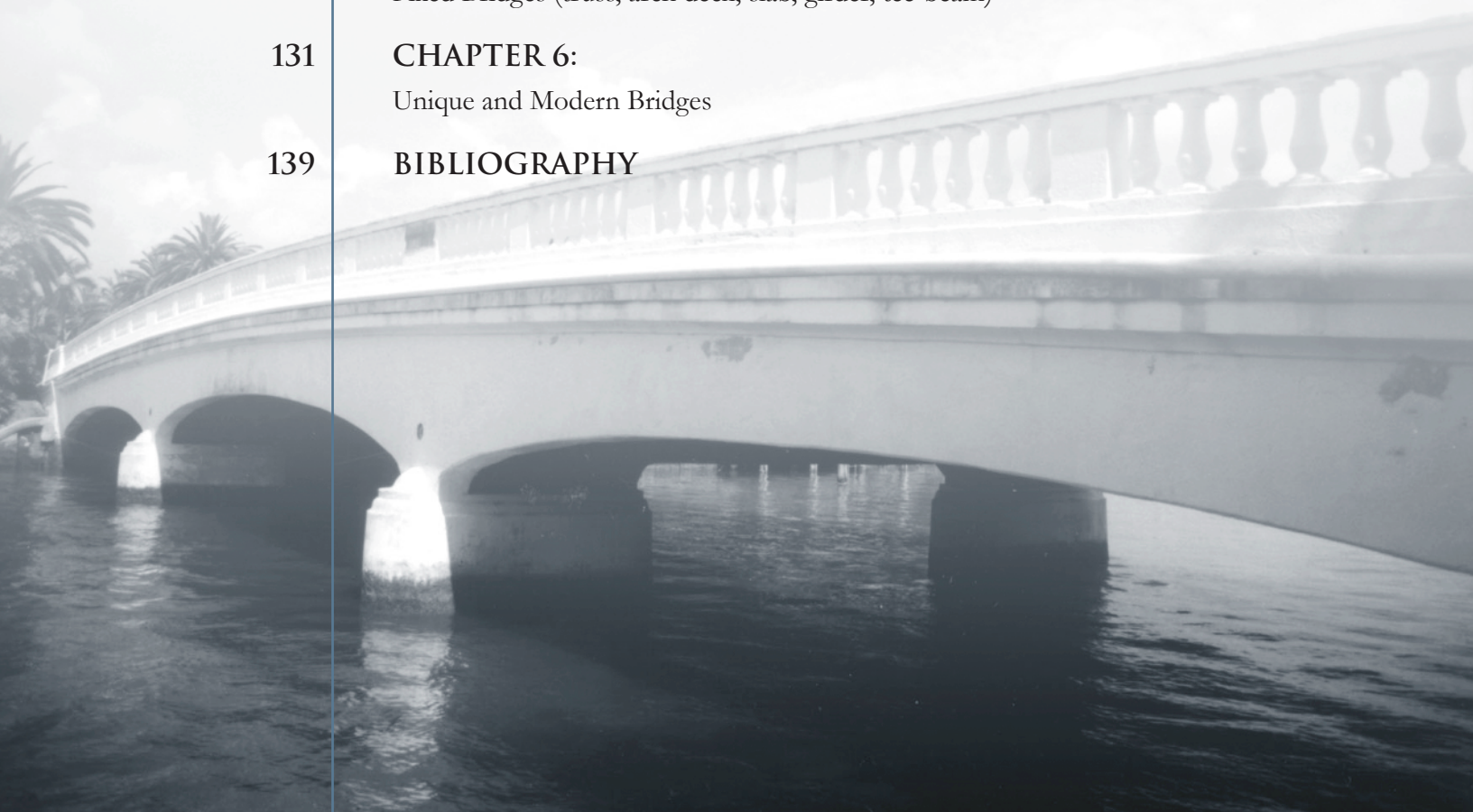
Cultural Resources Coordinators in the District Offices, particularly William Henderson in the Lake City Office and Cathy Owen in the Miami Office, proved invaluable, as did that of many of the Department's bridge engineers. Max Laney of the Chipley Bridge Maintenance Office was very helpful, as was the staff of the District Six (Miami-Dade and Florida Keys) Bridge Maintenance Office. I also wish to thank Barbara Mattick of the Florida Department of State for the time she spent and the guidance she lent in evaluating the many, many bridges covered by this project. In helping to bring this project to completion, I must mention the tireless efforts and assistance of Janus Research, who developed and implemented the design of this publication. Lastly, to anyone who contacted me with information, or told me of a bridge that would otherwise have gone unknown, I thank you. This project was improved by all of these people, and any faults it may have, belong to me.

Roy A. Jackson

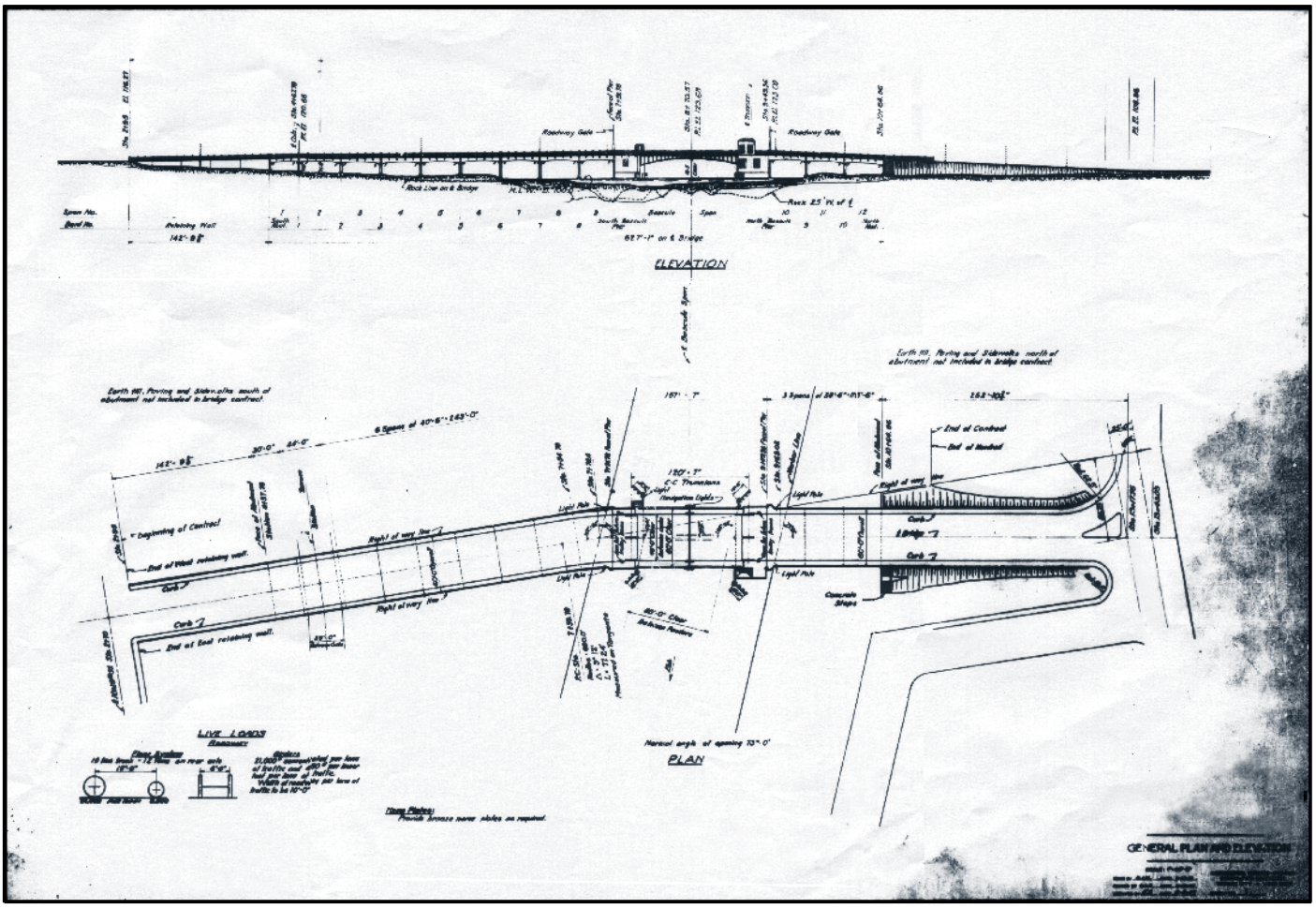
May 2004

Photo opposite page: Sunset Island Bridge in Miami-Dade County

TABLE OF CONTENTS



CHAPTER 1
INTRODUCTION



Typical historic bridge plan for a bascule bridge

Photo on previous page: The Northwest 12th Avenue Bridge in Miami

Early highway bridges provide valuable examples of our engineering and industrial heritage. In completing a statewide survey and evaluation, Florida contributes to the body of knowledge related to American bridge-building history and documents the engineering and design solutions to crossing the many waterways in the state. The inventory of Florida's historic highway bridges further functions as a planning tool that mediates between maintaining a safe highway system and affording protection for some of the state's most significant or valuable historic resources.

This current survey builds on two previous studies, conducted in 1981 and 1991 (Atkins and Keller, 1981 and King, 1991) that were designed to comply with the *Surface Transportation and Uniform Relocation Assistance Act of 1987*. This legislation required each state transportation agency to complete an inventory and assessment of historic highway bridges within the federal aid program ("on system") as well as those owned by county and municipal authorities ("off system"). The intent was to encourage the rehabilitation, reuse, and preservation of historic bridges that are listed on or eligible for the *National Register of Historic Places (NRHP)*. In passing this legislation, Congress also recognized the importance of historic bridges as "links to our past" that "serve as safe and vital transportation routes in the present, and can represent significant resources for the future."

Previous Surveys

The 1981 survey was conducted by Stephen Atkins and William Keeler of the Florida Department of Transportation and focused only on metal truss, swing, and vertical lift bridges. At that time, a total of 9,100 bridges existed in the state that represented 13 different design types. In order to provide a thorough and accurate treatment, the authors decided to take a phased approach to the survey that would focus on three types. Atkins and Keeler selected the metal truss, swing, and vertical lift bridges because of the numbers of such bridges still existing and the high percentage of them slated for replacement.

The first comprehensive survey of all bridge types was completed in 1991. Under contract with the FDOT Environmental Management Office, Joseph E. King and Donald R. Abbe of the Center for Historic Preservation and Technology

at Texas Tech University undertook a study of the historic bridges in the state. Included were all bridges constructed in 1950 or earlier. The results of this survey were published by the Department in 1991 under the title *The Historic Highway Bridges of Florida*.

The Update

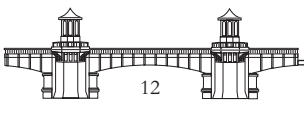
This current study, conducted by Roy Jackson of the Florida Department of Transportation, began in 2000 and encompassed bridges built prior to 1960. To maintain consistency, the methods mirrored those developed and used by King. This update began with a complete review of departmental bridge records designed to determine the current physical status of the bridges assessed by King and to "capture" those bridges that have subsequently become "historic." The initial efforts, therefore, retraced many of the steps undertaken by King's survey, such as the literature search in libraries, archives, and other repositories across the state. Ultimately, research encompassed a file review of more than 2,100 possible sites. By inspecting the bridge records and photographs maintained at the Florida Department of Transportation District Bridge Maintenance Offices, the Florida Master Site File records kept by the Florida Division of Historical Resources, local libraries, and other repositories, the number of bridge sites selected for field review was reduced to 415. This decision was based on the following factors:

1. Known historical associations. This consideration encompassed all the structures evaluated in the 1991 survey, as well as those identified in other historic resource surveys and those made known to the researchers through other contacts, such as local informants. This includes structures that represent contributing components to known or potential historic districts. Two very important examples of bridges uncovered through research and informant contacts are the Torreya Stone Arch and the Baggett Creek Arch Deck. The former was discovered during the review of the Florida Master Site File; the latter was identified through contact with a local informant. The Torreya Stone Arch originally was identified and evaluated as part of a general survey of New Deal Resources by Historic Property Associates. Dr. Brian Rucker informed the author of the existence of the Baggett Arch. The Baggett Arch proved to be an especially important find because further research on the structure showed it to be the first bridge constructed in Florida using funds from the landmark *Federal Aid Act*. But for the contributions of numerous individuals, many of the bridges contained in this survey would not have been identified. In particular, many professional bridge engineers across the state proved very helpful in making the researchers aware of many of the abandoned bridges.

2. Bridge Age. Following the first factor, bridge age represented the primary consideration. For most bridges to be considered for study, they must meet the Secretary of the Interior's standard age threshold of 50 years of age or older. As discussed above, in order to make the bridge study of use as a planning tool, this criteria was applied more leniently in order to include structures that have only reached 40 years of age, because these bridges will become historic over the next 10 years.

3. Bridge Type. Because most highway bridges are technological resources, bridge type represented a paramount concern in the selection of bridges to be studied. For example, all movable and arch bridges of sufficient age, as well as all truss bridges, were included in the field reviews. However, the far more common concrete and steel girder bridges were not automatically given a field review. Instead, file photographs and historical associations helped identify which representatives of these bridges would be further evaluated.

4. Appearance. Although normally classified as engineering resources, bridges also constitute sites that fulfill particularly important and highly visible functions. Frequently, communities hold several of their bridges in high regard. Oftentimes, the public raised the funding for them through local bonds or their design was a matter of great public debate. Other bridges may possess local prominence because they serve as the gateway to a neighborhood or city. They have been used in post cards, tour guides, and advertising for cities, localities, states, and even countries. As a consequence, many bridges remain important as aesthetic resources intimately connected with the communities they serve. As a result, impressive or attractive bridge designs, even when the bridge may be technologically unremarkable, usually reflect a bridge's importance to the community. This is particularly true for historic bridges because other historic elements of a community may have disappeared and only the bridge remains, its design representing the last standing reminder of the history of a community. Lastly, a pleasing or remarkable bridge design may also indicate a bridge's association with a particular designer or engineer of historical importance. The Carrick bridges of



Jacksonville with their Maltese crosses represent such examples, while Daniel Luten's graceful arches represent others.

5. Size and other technical features. The length of a bridge frequently indicates the level of engineering skill and community commitment to construct particular projects. Longer bridges are generally more challenging and almost always more expensive than their shorter counterparts. Coupled with age, the length of a bridge was sufficient to warrant a field review of the structure. In combination with any of the other four considerations, a bridge's length becomes very important in determining a structure's historical value.

Of the 415 bridges, only 288 warranted further consideration: identified sites were field inspected and further historical research on them was completed. Researchers then completed additional analysis on the structures, including the evaluation of the sites according to criteria established by the *National Register* for historical significance. These criteria have not changed since the completion of the 1991 bridge survey and are as follows:

The *National Register of Historic Places* Criteria:

The quality of significance in American history, architecture, archeology, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:

- **A.** That are associated with events that have made a significant contribution to the broad patterns of our history; or
- **B.** That are associated with the lives of persons significant in our past; or
- **C.** That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- **D.** That have yielded, or may be likely to yield, information important in prehistory or history.

(Properties must be 50 years or older, or possess exceptional importance if less than that, to warrant inclusion on the *National Register*.)

In addition to the *National Register* criteria, the evaluations included the consideration of the criteria adopted by the Historic American Engineering Record and the American Society of Civil Engineers for identifying and designating historic engineering sites.

HAER Guidelines for Documentation:

1. An engineering invention or innovation of importance to the economic or industrial development of an area, a region, or the nation;
2. Significant in the history of a particular branch of engineering;
3. Designed or built by famous engineers, mechanics, architects, or master builders;
4. Typical of an early engineering or identical structure commonly used throughout an area for a specific purpose; or
5. The sole remaining example or a representative example of a specific type.

What follows in the pages of this book are some of the most important historic bridges in Florida. Not all of the state's historic bridges are pictured or described in this book, but all the historic bridges that merited evaluation are given in the historic highway bridges list in Table 1. The bridges featured represent some of the best of their type and style. Within, the reader will find most of the bridges that represent technological resources of the first order as well as architectural masterpieces that remain focal points of communities. Some of these bridges carry traffic on rural roads, some on city streets; one even carries interstate traffic. But even at their best, these bridges represent a mere introduction to the historic highway bridges of Florida.

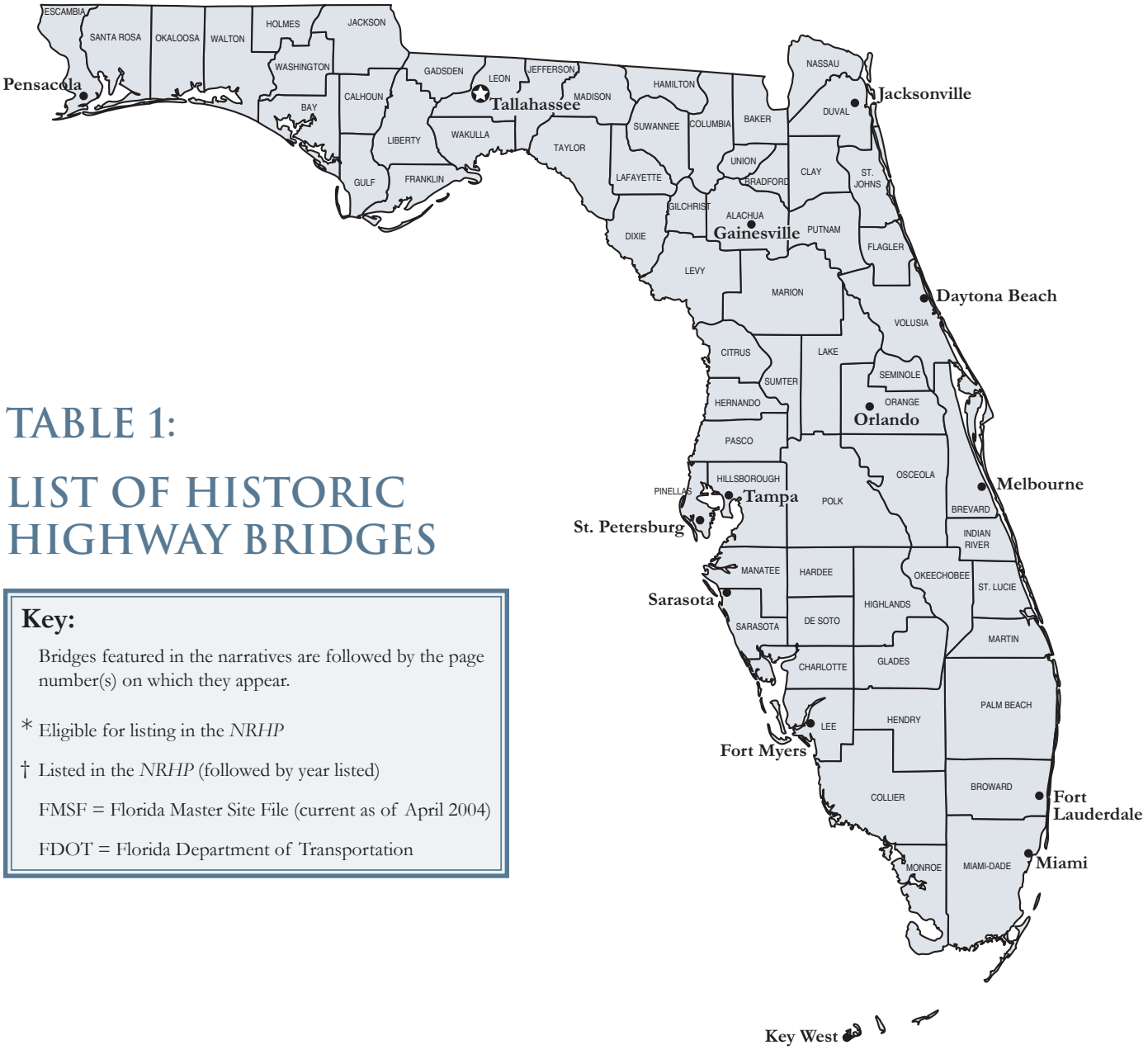


TABLE 1:

LIST OF HISTORIC HIGHWAY BRIDGES

Key:

Bridges featured in the narratives are followed by the page number(s) on which they appear.

* Eligible for listing in the *NRHP*

† Listed in the *NRHP* (followed by year listed)

FMSF = Florida Master Site File (current as of April 2004)

FDOT = Florida Department of Transportation

Bridge Name	FDOT#	FMSF#	Bridge Type	Year Built
Alachua County				
Rocky Creek Bridge	264126	8AL3510	Tee-Beam	1924
Santa Fe River Bridge	260005	8AL3276	Steel Stringer	1934
Baker County				
Sanderson Overpass	270001	8BA423	Tee-Beam	1936
Bay County				
*Frank M. Nelson Sr. Bridge	460053	none	Single-Leaf Bascule	1951
Bradford County				
Gum Creek Culvert	280037	none	Metal Culvert	1940
Olustee Creek Culvert	280034	none	Corrugated Steel Arch Culvert	1945

Bridge Name	FDOT#	FMSF#	Bridge Type	Year Built
Brevard County				
*Indian River Bridge (p. 81)	704049	8BR1699	Swing, Deck Girder	1949
*Mathers Bridge (p. 88)	704063	8BR1700	Swing, Pony Truss	1927
Broward County				
Atlantic Boulevard Bridge	860157	none	Double-Leaf Bascule	1955
Dixie Highway Arch Deck Bridge	865720	8BD3164	Concrete Arch Deck	1928
*Fiesta Way Bridge (p. 51)	865735	8BD3150	Concrete Girder	1948
*Grande Canal Arch Deck Bridge (p. 114)	865732	8BD3165	Concrete Elliptical Arch Deck	1925
*Isle of Venice Way Bridge (p. 51)	865734	8BD3149	Concrete Girder	1948
Northeast 4th Avenue Bridge	860470	none	Concrete Arch Deck	1942
*Nurmi Drive Bridge (p. 51)	865736	8BD3168	Concrete Girder	1947
Oakland Park Boulevard Bridge	860941	none	Double-Leaf Bascule	1955
*Royal Palm Drive Bridge (p. 51)	865737	8BD3169	Concrete Girder	1946
*Southwest 11th Street Swing Bridge (p. 81)	865748	8BD3171	Swing, Pony Truss	1925
Tarpon River Bridge	865752	8BD3172	Concrete Girder	1929
Calhoun County				
*Blountstown Truss (pp. 108-9)	470029	8CA37	Warren Through Arch, Deck Truss	1938
Citrus County				
Withlacoochee River Bridge	20008	8CI824	Concrete Girder	1935
DeSoto County				
*Peace River Bridge at Arcadia (pp. 115-6)	450001	8DE381	Concrete Arch Deck	1924
Duval County				
B.B. McCormick Bridge	720068-720069	8DU11900	Double-Leaf Trunnion Bascule	1949
Baldwin Overpass	720026	8DU11299	Steel Stringer	1940
Beaver Street Viaduct	720004	8DU11893	Steel Stringer, Concrete Girder	1930
Broward River Bridge	720056	8DU11899	Bascule	1948
East Duval Street Viaduct	724249	8DU11892	Concrete Girder	1915
Edison Avenue Bridge	724080	8DU11905	Concrete Girder	1929
Greenwood Avenue Bridge	724251	8DU11277	Concrete Slab	1950
Inconstantion Creek Bridge	720013	8DU11302	Concrete Girder	1932
*Interstate 95 Through Arch Bridge (p. 132)	720163	none	Steel Through Arch Overpass	1955
Laura Street Bridge (1987) (p. 53)	724175	8DU7538	Concrete Slab	1929
Liberty Street Bridge (1988) (p. 53)	formerly 724173	8DU7551	Concrete Slab	1929
Little Fishweir Creek Bridge	720007	8DU11895	Concrete Girder	1922
*Little Six Mile Creek Bridge (p. 122)	724072	8DU11902	Concrete Arched Girder	1926
*Main Street Bridge (pp. 75-6)	720022	8DU1553	Continuous Truss Vertical Lift	1941
Main Street Klutho Bridge (1989) (p. 53)	none	8DU7541	Stringer	1929
Market Street Bridge (1990) (p. 53)	724172	8DU7539	Concrete Slab	1929
*Mathews Bridge (p. 105)	720076	8DU1554	Cantilevered Steel Through Truss	1953

Bridge Name	FDOT#	FMSF#	Bridge Type	Year Built
Duval County (cont.)				
Maxville Overpass	720045	8DU11301	Steel Stringer	1937
McCoy's Boulevard Bridge	724078	8DU11915	Tee-Beam	1940
*Myrtle Avenue Bridge	724258	8DU13284	Concrete Girder	1930
Nassau River Bridge	720014	8DU11303	Steel Stringer	1932
Newnan Street Bridge (1991) (p. 53)	724171	8DU7540	Concrete Slab	1929
Little Trout River Bridge	724183	8DU11914	Steel Stringer	1926
*Ortega River Bridge (p. 92)	720005	8DU11167	Double-Leaf Rolling Lift Bascule	1927
Ribault River Bridge	720149	none	Concrete Girder	1955
Sisters Creek Bridge	720061	none	Bascule	1952
Smith Street Bridge	724076	8DU11903	Concrete Slab	1929
Stockton Street Bridge	724077	8DU11904	Concrete Slab	1946
*Trout River Bridge	724182	8DU11913	Arched Girder	1926
*West Second Street Bridge (p. 53)	formerly 724149	none	Concrete Slab	1929
Escambia County				
Bayou Chico Draw Bridge	480037	8ES2515	Double-Leaf Trunnion Bascule	1949
Cervantes Street Viaduct	480006	none	Steel Stringer	1940
Eleven Mile Creek Bridge	480002	none	Tee-Beam	1940
Flagler County				
Bunnell Overpass	730014	8FL184	Concrete Girder, Steel Stringer	1935
Shell Bluff Bridge	730000	8FL214	Tee-Beam	1933
State Road 100 Bridge	730012	none	Tee-Beam	1936
Hamilton County				
*Apalahoochee River Pony Truss (p. 110)	324302	8HA87	Pratt Pony Truss	1911
*Jennings Bridge (pp. 105-6)	none	8HA89	Pratt Through Truss	1902
Hardee County				
Doyle Carleton Bridge	60005	8HR371	Concrete Girder	1933
*Little Payne Creek Bridge	60034	8HR374	Concrete Arch Deck	1916
*Payne Creek Bridge	64069	8HR375	Concrete Arch Deck	1916
Peace River Bridge	60013	8HR168	Concrete Girder	1934
Peace River Overflow Bridge	60014	8HR169	Concrete Girder	1934
Hendry County				
Donna's Crossing	74002	8HN631	Concrete Arch Deck	c 1920
*Fort Denaud Bridge (p. 83)	70013	8HN632	Swing, Pony Truss	1940
Tanya's Crossing	74001	8HN630	Concrete Arch Deck	c 1920
Hernando County				
Brooksville Overpass	80001	8HE389	Steel Stringer	1936
Highlands County				
Lake Jackson Bridge	90030	8HG893	Concrete Arch Deck	1927

Bridge Name	FDOT#	FMSF#	Bridge Type	Year Built
Hillsborough County				
Beach Park Bridge	none	none	Concrete Arch Deck	c 1930
Beachway Drive Bridge	none	none	Concrete Arch Deck	c 1930
*Blackwater Creek Overflow Bridge (pp. 56-7)	100037	8HI5042	Stone-Faced Culvert	c 1936
*Cass Street Bridge (p. 96)	105502	8HI6670	Double-Leaf Strauss Trunnion Bascule	1926
Causeway Boulevard Bridge	100066	8HI4540	Concrete Girder	1928
Delaney Creek Bridge	100065	8HI4542	Concrete Girder	1928
*Hillsborough River Lift Bridge (p. 76)	100920	8HI6669	Vertical Lift, Warren Pony Truss	1939
*James N. Holmes Bridge (pp. 122-3)	100069	8HI6668	Concrete Girder	1926
*Kennedy Boulevard Bridge (pp. 93-4)	100100	8HI640	Double-Leaf Scherzer Rolling Lift Bascule	1913
Lafayette Street Viaduct	100028	8HI6663	Concrete Girder, Steel Stringer	1926
*Lake Weeks Creek Bridge	100033	8HI6664	Concrete Girder	1915
*Laurel Street (Fortune Street) Bridge (pp. 96-7)	105503	8HI6671	Single-Leaf Strauss Trunnion Bascule	1926
*Michigan Avenue Swing Bridge (p. 88)	105504	8HI6672	Bobtail Swing, Deck Truss	1926
Old Mulberry Road Bridge	104426	none	Concrete Arch Deck	1940
*Platt Street Bridge (pp. 95-6)	105500	8HI862	Double-Leaf Strauss Trunnion Bascule	1926
Shore Crest Avenue Bridge	105614	8HI6675	Concrete Arch Deck	1935
Swann Circle Bridge	105617	8HI6678	Concrete Arch Deck	c 1930
Sylvan Ramble Bridge	105616	8HI6677	Concrete Arch Deck	1931
West Davis Boulevard Bridge	105608	8HI6673	Steel Stringer	1927
Jackson County				
*Bellamy Bridge (p. 35)	none	8JA399	Pratt Through Truss	1914
Lafayette County				
*Hal Adams Bridge (pp. 132-3)	330009	8LF22	Suspension	1947
*Steinhatchee Springs Pony Truss (pp. 111-2)	334001	8LF21	Pratt Half-Hip Pony Truss	1912
Lake County				
Crows Bluff Bridge	110063	none	Double-Leaf Trunnion Bascule	1955
Little Lake Harris Bridge	110026	8LA2044	Steel Stringer	1950
Mount Dora Overpass	114089	8LA2043	Concrete Girder	1934
Lee County				
*Billy Creek Lift Bridge (p. 77)	120001	8LL705	Vertical Lift, Steel Girder	1941
Levy County				
Ten Mile Creek Bridge	340045	8LV513	Concrete Girder	1933
Liberty County				
*Torreya Stone Arch Bridge (p. 56)	none	8LI338	Concrete Arch	1940
Madison County				
*Ellaville/Hillman Bridge (pp. 106-7)	350910	8MD185	Pratt Through Truss	1925

Bridge Name	FDOT#	FMSF#	Bridge Type	Year Built
Manatee County				
17th Avenue Bridge	135254	8MA995	Concrete Slab	1926
19th Avenue Bridge	135256	8MA996	Concrete Girder	1926
Cortez Bridge	130006	none	Double-Leaf Trunnion	1956
*Ninth Avenue Bridge over Ware's Creek (p. 116)	135251	8MA993	Concrete Arch Deck	1945
*Seventh Avenue Bridge	135250	8MA992	Steel Stringer	1949
*Twelfth Avenue Bridge over Ware's Creek (p. 123)	135252	8MA994	Concrete Girder	1938
Marion County				
*Daisy Creek Bridge (p. 57)	364060	none	Stone-Faced Culvert	1940
Dunnellon Overpass	360003	8MR2537	Concrete Girder	1936
*Northeast 145th Avenue Bridge (p. 57)	364150	none	Stone-Faced Culvert	1940
*Sharpe's Ferry Bridge (p. 84)	364110	8MR2539	Swing, Pony Truss	1926
*Southeast 137th Avenue Road Bridge (p. 57)	364120	none	Stone-Faced Culvert	1940
Martin County				
Gaines Avenue Bridge	894026	8MT928	Concrete Arch Deck	1928
Miami-Dade County				
*Aerojet Truss	none	none	Pony Truss	c 1910
Broad Causeway	875101	none	Bascule	1951
*Deering Estate Bridge (p. 128)	874425	8DA2815C	Concrete Arch Deck	1917
*Granada Boulevard Bridge (p. 128)	875306	8DA6438	Concrete Arch Deck	1930
*Hardee Road Bridge (p. 128)	875305	8DA6437	Concrete Arch Deck	1930
*Hialeah-Miami Springs Vertical Lift Bridge (pp. 74-5)	874129	8DA99	Parker Truss Vertical Lift	1927
*Indian Creek Bridge (p. 124)	876100	8DA6439	Concrete Arched Girder	1929
Little River Bridge	870002	8DA5096	Concrete Girder, Steel Stringer	1928
*Northwest 12th Avenue Bridge	870662	8DA6341	Double-Leaf Bascule	1928
*Northwest 17th Avenue Bridge (p. 91)	874161	8DA5886	Double-Leaf Trunnion Bascule	1928
*Northwest 54th Street Bridge over the Miami Canal (p. 82)	874130	8DA100	Swing, Warren Pony Truss	1924
Northwest 5th Street Bridge	870659	8DA6218	Double-Leaf Trunnion Bascule	1924
*Northwest South River Drive Swing Bridge (p. 83)	874135	8DA6431	Swing, Pony Truss	1930
*Seybold Canal Bridge (p. 129)	876400	8DA2384	Concrete Arch Deck	1919
Southwest 117th Street Bridge	874307	none	Through Girder	1937
Southwest 147th Avenue Bridge	874312	none	Through Girder	1937
*Southwest 1st Street Bridge (p. 91)	870660	8DA6222	Double-Leaf Trunnion Bascule	1929
*Sunny Isles Bridge (p. 115)	874218	8DA6441	Concrete Arch Deck	1925
*Sunset Island Bridge Number 1 (pp. 63-5)	876707	8DA6441	Concrete Arched Girder	1929
*Sunset Island Bridge Number 2 (pp. 63-5)	876708	8DA5828	Concrete Arched Girder	1929
*Sunset Island Bridge Number 4 (pp. 63-5)	876710	8DA5829	Concrete Arched Girder	1929

Bridge Name	FDOT#	FMSF#	Bridge Type	Year Built
Miami-Dade County (cont.)				
† Venetian Causeway (1989) (pp. 68-9)	various	8DA4736, 8DA5994 - 5998	Trunnion, Double-Leaf Bascule; Concrete Arched Girder	1925
West 23rd Street Bridge	874706	8DA6436	Concrete Arch Deck	1926
West 63rd Street Bridge	870613	none	Double-Leaf Bascule	1953
Monroe County				
*Bimini Drive Bridge (p. 55)	904603	none	Tee-Beam	1955
*Harbor Drive Bridge (p. 55)	904604	none	Steel Culvert	1955
† Overseas Highway Bridges (1979) (pp. 59-62)	various	8MO1229-31, 8MO3476, 8MO1484	Arch Decks, Concrete and Steel Girders, Through Truss	1912
*Rosen Bridge (p. 55)	904606	none	Tee-Beam	1955
*Truman Bridge (p. 54)	904602	none	Arched Steel Culvert	1955
Nassau County				
Deep Creek Bridge	740002	none	Concrete Girder	1934
McArther-Fishler Bridge	740055	none	Swing, Deck Girder	1948
*St. Mary's River Bridge (pp. 84-5)	740008	8NA240	Swing, Through Truss	1925
Okaloosa County				
*Baggett Creek Arch Bridge (p. 120)	none	none	Concrete Arch Deck	1924
*Log Lake Truss (p. 110)	none	8OK1662	Warren Pony Truss	c 1915
Okeechobee County				
*Taylor Creek Bridge (p. 98)	910054	8OB56	Single-Leaf Trunnion Bascule	1948
Orange County				
Lake Conway Bridge	755100	8OR8339	Concrete Deck Girder	1926
Lake Ivanhoe Bridge	755807	none	Concrete Girder	1942
*Washington Street Bridge over Fern Creek (pp. 116-7)	755806	8OR3190	Concrete Arch Deck	1926
Palm Beach County				
8th Street Bridge	930026	none	Trunnion Bascule	1949
Atlantic Avenue Bridge	930064	none	Trunnion Bascule	1952
*Belle Glade Swing Bridge (p. 86)	930072	8PB212	Swing, Deck Truss	1916
Flagler Memorial Bridge	930157	8PB9533	Double-Leaf Rolling Lift Bascule	1938
Geist Bridge	934408	8PB8111	Double-Leaf Trunnion Bascule	1939
Royal Palm Bridge	930022	8PB6678	Double-Leaf Rolling Lift Bascule	1928
Southern Boulevard Bridge	930097	8PB9531	Double-Leaf Trunnion Bascule	1950
*Twenty Mile Bend Bridge (Loxahatchee River Bridge) (p. 88)	930940	8PB231	Swing, Warren Through Truss	1937
Pasco County				
Crystal Springs Road Bridge	144002	8PA637	Concrete Arch Deck	1923
Old Cypress Creek Road Bridge	144022	8PA635	Concrete Arch Deck	1925

Bridge Name	FDOT#	FMSF#	Bridge Type	Year Built
Pinellas County				
*13th Street Bridge (pp. 125-6)	154701	8PI8738	Concrete Girder	1957
5th Street Bridge	157108	8PI8745	Concrete Girder	1926
9th Street Bridge	157117	8PI8746	Concrete Girder	1920
Belleair Causeway	154208, 154209	none	Causeway; Steel-Trunnion, Double-Leaf Bascule; Concrete Girder	1950
Bishops Creek Bridge	150910	8PI8731	Concrete Arch Deck	1926
Booker Creek Bridge	150023	8PI8727	Concrete Girder	1926
*Burlington Avenue Bridge (p. 126)	157127	8PI8747	Concrete Girder	1952
Coachman Road Bridge	154252	8PI8736	Concrete Arch Deck	1925
*Fish Basin Bridge (pp. 117-8)	154100	8PI8732	Concrete Arch Deck	1928
Ike's Creek Bridge	150062	8PI8729	Concrete Arch Deck	1927
*Luten "Half-Arch" (pp. 134-5)	159901	8PI8749	Arch Deck	1915
*Madonna Boulevard Bridge (p. 125)	154700	8PI8737	Concrete Girder	1957
Moccasin Branch Bridge	150012	8PI8724	Concrete Arch Deck	1926
*Moss Rainbow Arch (pp. 133-4)	150113	8PI8730	Concrete Through Arch	1926
Mullet Creek Bridge Number 1	157001	8PI8742	Concrete Arch Deck	1927
Mullet Creek Bridge Number 2	150009	8PI8742	Concrete Arch Deck	1926
Orange Avenue Bridge	154101	8PI8733	Concrete Arch Deck	1923
Overbrook Avenue Bridge	155509	8PI8741	Concrete Arch Deck	1924
*Salt Creek Bridge Number 1	150022	8PI8726	Concrete Arch Deck	1937
Salt Creek Bridge Number 2	157101	8PI8743	Concrete Arch Deck	1926
*Snell Isle Bridge over Coffee Pot Bayou (pp. 98-99)	157191	8PI8748	Double-Leaf Bascule	1928
Stevenson Creek Bridge	150007	8PI8740	Concrete Arch Deck	1927
*Treasure Island Causeway (pp. 66-7)	157800, 157820, 157840	8PI10574	Causeway; Double-Leaf Bascule; Concrete Arched Girder, Tee-Beam	1939
Polk County				
*Haines City Overpass (p. 127)	165700	8PO3013	Steel Stringer	1927
John Singletary Bridge	160064	8PO5440	Concrete Girder	1931
Old Bowling Green Road Bridge	164413	8PO5443	Concrete Girder	1916
Old Lake Wales Road Bridge	164336	8PO4047	Steel Stringer, Concrete Girder	1928
Putnam County				
*Old San Mateo Road Bridge (p. 128)	764024	8PU1210	Concrete Arch Deck	1916
Santa Rosa County				
*Coldwater Truss (p. 128)	none	none	Through Truss	c 1910
MacAvis Bayou Bridge	580013	none	Concrete Girder	1940
Milton Overpass	580014	none	Concrete Girder	1937

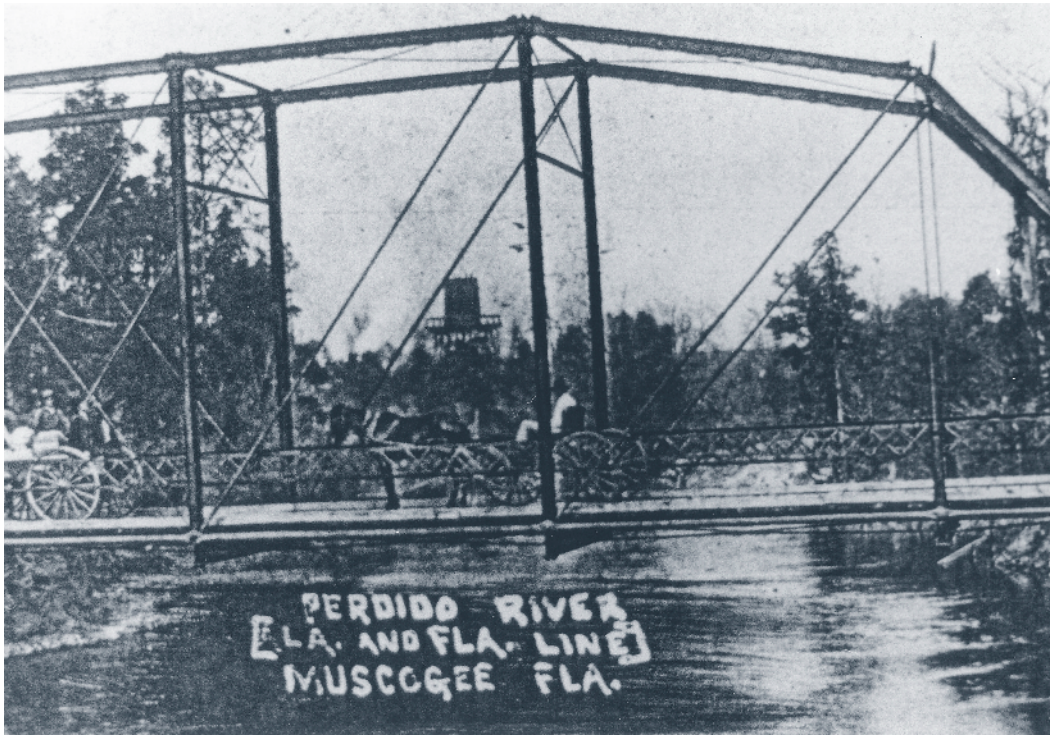
Bridge Name	FDOT#	FMSF#	Bridge Type	Year Built
Sarasota County				
† Blackburn Point Bridge (2001) (p. 87)	170064	8SO1890	Swing, Warren Pony Truss	1926
Hanson Bayou Bridge	170060	8SO2373	Arched Girder	1928
* Osprey Avenue Bridge over Hudson Bayou (p. 119)	175950	8SO2376	Concrete Arch Deck	1916
Whitaker Bayou Bridge	175660	8SO2375	Arched Girder	1926
Seminole County				
* Lake Monroe	formerly 770009	8SE77	Swing Through Truss, now fixed	1934
Mills Creek Bridge	770002	none	Concrete Girder	1935
St. Johns County				
† Bridge of Lions (1982) (pp. 99-100)	780074	8SJ2460	Double-Leaf Rolling Bascule	1927
King Street Bridge	780003	none	Concrete Girder	1947
St. Lucie County				
† Moore's Creek Bridge (2001) (p. 118)	945000	8SL1141	Concrete Arch Deck	1925
Sumter County				
Big Prairie Canal Bridge	184000	8SM171	Concrete Girder	1926
Wildwood Overpass	180056	8SM170	Steel Stringer	1942
Suwannee County				
Hogan Road Bridge	373013	none	Stone-Faced Steel Culvert	1940
Little River Bridge	374004	none	Stone-Faced Steel Culvert	1940
Mount Olive Road Bridge	374012	none	Stone-Faced Steel Culvert	1940
* Suwannee Springs Bridge (pp. 107-8)	374014	8SU116	Parker Through Truss	1931
Volusia County				
Carleton-Blank Bridge	790098	8VO7102	Double-Leaf Trunnion Bascule	1948
Daytona Avenue	795502	none	Concrete Girder	1945
* Deep Creek Arch Deck (p. 128)	794081	8VO7105	Concrete Arch Deck	1923
Highbridge Road Bridge	794025	none	Double-Leaf Trunnion Bascule	1955
Little Haw Creek Bridge	794065	8VO7104	Steel Slab	1930
Orange Avenue Bridge	704003	none	Double-Leaf Trunnion Bascule	1954
Tomoka River Bridge	790014	8VO7101	Concrete Girder	1932

Opposite page: Historic photo of the Northwest 54th Street Bridge in Miami

CHAPTER 2
THE PATH OF PROGRESS:

The Evolution of Bridge and Road Construction in Florida

With more than a thousand miles of coastline, many scenic rivers, a profusion of navigable waterways and countless lakes that dot its interior, Florida has posed extraordinary challenges for the builders of its roads and bridges. The role transportation plays runs parallel to Florida's growth and development, as previously isolated communities first became accessible only by way of rails, roadways, and bridges. While many arrived in Florida by ship during its earliest settlement period, its real growth couldn't begin until the construction of roads and bridges. The historical development of roads and bridges serves as the point of departure to measure Florida's economic and cultural development from colonial days to the present.



A horse and buggy carry a passenger across a trestle bridge on the Perdido River in Muscogee.

First European Contact: The Spanish (1565-1763)

Florida was controlled by Spain for nearly two and a half centuries, except for a brief twenty-one years under British rule. During the Spanish occupation of Florida, relatively little was accomplished in the building of roadways. Because the Spanish concentrated more on their rich and vast empire in South America than their territory in Florida, few efforts were made to build colonial settlements. Pánfilo de Narváez, an early Spanish explorer, proved the exception. He landed near Tampa in the 1520s and then marched to the vicinity of Tallahassee and the St. Marks River, leaving a route for others to follow. For the most part, the Spaniards and later visitors navigated through the state by using pathways that were created by Native Americans. One of these pathways, called the Alachua Trail, crossed the St. Mary's River between Georgia and Florida and had long been used by Indian hunters and traders. Evidence indicates that simple log bridges were used to cross streams along the trail.

The few wagon roads the Spanish constructed linked their growing number of military outposts to the missionary villages they established among the Indians. St. Augustine, founded by Pedro Menéndez de Avilés in 1565, became the first permanent European settlement in Florida, and the oldest city in the continental United States. It began as a fort, selected because of its strategic location. While the shipment of men and material to St. Augustine relied principally on ships, Indian pathways continued to be used overland. The Spanish at St. Augustine also set up military roads to connect them with the St. Johns River near present-day Jacksonville.

Portrait of Pedro Menéndez de Avilés, date unknown

Although its origins and actual route remain somewhat unclear, the most significant road built (measured by its long-term impact) during the Spanish occupation began in St. Augustine and ended in Pensacola. The "Old Spanish Trail," more a pathway than a built road, was used by the Spanish during the 17th century as an overland route to supply forts and missions, as well as to avoid the perilous journey of sailing around the Florida Keys. Streams along the trail were crossed at fords or by means of log rafts or simple pine-pole

bridges. In time, the Old Spanish Trail became a major transportation corridor and future railroad and road builders followed its course in the building of old State Road No. 1, U.S. 90, and Interstate 10.

Florida Under the English (1763-1783)

During the brief English occupation of Florida between the end of the French and Indian War (1763) and the close of the American Revolution (1783), the Crown supported the construction of roads that led to and from St. Augustine. Their efforts resulted in the "King's Road" that extended north through Cowford (Jacksonville) to the St. Mary's River and south to New Smyrna, a colony of indentured servants on the North Indian River. An attempt to bridge the San Sebastian River at St. Augustine during the 1760s failed when, according to one witness, "the great depth of the river joined to the instability of the bottom, did not suffer it [the bridge] to remain long." The crossing could only be made by ferry.

Florida, an American Territory (1821-1845)

According to C. B. Treadway, Chairman of the State Road Department in the 1930s, Florida's highway system actually began during the Territorial period when the United States government appropriated funds to build important roadways. In 1824, Congress provided:

"...that the President of the United States be, and is hereby, authorized to cause to be opened, in the Territory of Florida, a public road from Pensacola to St. Augustine, commencing at Deer Point, on the Bay of Pensacola, and pursuing the old Indian Trail to Cowford, on the Choctawhatchee River; thence, to the Ochesee Bluff, on the Apalachicola river; thence in the most direct practicable route, to the site of Fort St. Louis; thence as nearly as practicable on the old Spanish road to St. Augustine, crossing the St. Johns River at Picolata; which road shall be of the width of 25 feet."

The Congress further specified that only low stumps be left in the roadway and that "in long causeways, or through very wet ground, open log bridges must be constructed."

Captain Daniel Burch of the Army's Quartermaster Corps was assigned this daunting project. He contracted with planter John Bellamy for the slave labor used to build the road from St. Augustine to Tallahassee. The "Bellamy Road" was completed in 1826, with portions of it "corduroyed" by logs sunk crossways into the roadway, and ferries established across many streams. This road greatly aided the expansion of cotton and cattle production in northern Florida. Captain Burch

Ca. 1910 view down Bellamy Road, which was originally an old Spanish trail

also laid out another road between Tallahassee and Pensacola that also proved a boon to trade and communications. Unfortunately, it deteriorated from a lack of maintenance.

A by-product of the Army campaigns that waged war against the Seminole Indians was the expansion of Florida's road system. Federal troops that penetrated Florida's interior opened new trails and erected makeshift bridges in order to move supplies between forts. Among the temporary bridges built by Colonel Zachary Taylor, who operated in the area north of Lake Okeechobee, was an inflated pontoon made of cotton fabric and rubber that was used to cross the Kissimmee River. Later reports credited Taylor with constructing 848 miles of wagon roads and 3,643 feet of causeways and bridges during the late 1830s.

1830s era daguerreotype of Zachary Taylor

Toll Roads, Ferries, Steamboats and Subscribed Labor

Even while taking into account these earlier military accomplishments, there would still be no adequate road and bridge system in Florida before the Civil War. In fact, there were few improvements made as Florida approached the end of the 19th century. Roads remained strictly local matters falling under the jurisdiction of county commissioners. The commissioners divided their counties into districts and appointed road overseers, an honorary position until 1895. There were no requirements for these road overseers to have any knowledge or experience in either road making or bridge building. Counties required all adult males (exempting only disabled persons, those of unsound mind, and ministers) to labor several days each year as road workers, or pay a tax in lieu of service. Under this "system" commonly practiced throughout the United States, roads were built to serve the needs of the local

Counties required all adult males, (exempting only disabled persons, those of unsound mind, and ministers) to labor several days each year as road workers, or pay a tax in lieu of service. ◆

property owners and rarely became anything more than rudimentary, scratched-out paths that went unconnected with other roads. When it was necessary to cross water, simple log rafts or crude timber bridges were built.

1933 photo of log bridge in Columbia County built by the Civilian Conservation Corps

Before there was a Florida road building authority, some enterprising individuals built their own roads and bridges and also operated ferry services. Users of "toll roads" paid a fee established by the road owner. During the 1850s, Florida shared in the national enthusiasm for building plank roads made from sawed timbers spiked to wooden stringers and embedded in the roadway. Florida's abundant timberlands prompted the rise of many plank road companies, although few succeeded before the onset of the Civil War. The Newport plank road, running from Newport on the St. Marks River to the Georgia state line with a branch to Tallahassee, was perhaps the most successful. Another, the Alligator plank road, though only partially completed, extended from Jacksonville towards the village of Alligator, now Lake City.


Horse-drawn wagon being ferried across the Ocklawaha River, 1902

The privately-owned toll ferry had a long history of service on Florida's rivers. Frequently they were the subject of complaints by travelers, who called them slow, undependable, and dangerous. Today, the ferries are remembered by the numerous river crossings that still bear the name of old ferry operators, among them Kolar's Ferry on the St. Mary's River and Charles Ferry on the Suwannee. Like the roads they served, ferry service varied widely in kind and quality, ranging from mere rowboats to rope-strung rafts pulled by hand or dragged by mules on the bank. Bad roads, unreliable ferries and the few tottering

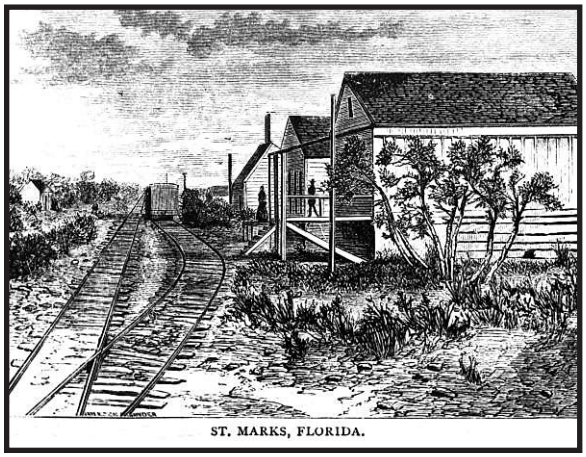
bridges that did exist discouraged long distance overland travel and limited the available transportation to a few stagecoach lines and freight wagon companies.

The failure to build and maintain roadways until the arrival of the 20th century is largely due to the more convenient and pleasant transportation afforded by steamboats and railroads. Steamboats plied many Florida rivers and operated along the coasts, hauling goods as well as passengers. The St. Johns, St. Marks, and Apalachicola rivers became major arteries of the steamboat trade, although these waterways required constant attention to remove snags, sandbars, and other obstacles in the channel. In some cases, navigation became impossible. Streams that reached deep into the back country of Florida and Georgia could not accommodate steamboats, thus leaving important agricultural regions without adequate transportation. Along with their navigational limitations, the expansion of the railroads, and later the popularity of the personal automobile, ultimately doomed the steamboat industry.

The Arrival of The Railroad:

The Technology of the Railroad Bridge and the Advent of the "Good Roads" Movement

The first railroads appeared in Florida prior to the Civil War mainly to haul farm goods from the interior to seaport towns. During the 1830s a mule-drawn railway was built to run the 23 miles between Tallahassee and St. Marks on the Gulf Coast, and there were even more ambitious projects to come. A major boost came when the State Assembly created the Internal Improvement Board that used public funds to promote transportation and to assist railroad companies. The board aided railroad construction at Jacksonville and Gainesville and helped to complete a major project, the Florida Railroad. The Florida Railroad connected the Atlantic and Gulf ports by cutting across the state from Fernandina to Cedar Key.



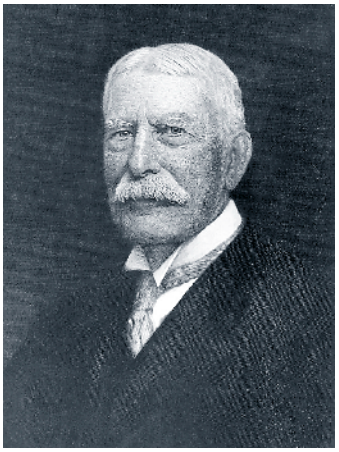
Engraving of railway depot at St. Marks, ca. 1876

The modest advancements made during the 1850s came to a halt with the Civil War. Although no prolonged campaigns or major battles occurred on Florida's soil, the conflict and the reconstruction period that followed left the railroads and other transportation facilities in damaged and deteriorated condition. An insolvent Internal Improvement Fund made matters worse. As a consequence, Florida did not resume expansion of its transportation system until the 1880s and 1890s. During this time the railroads entered a new and vigorous phase of construction that helped usher in a modern period of economic development. The state was "still frontier country" in 1880, wrote historians Rembert Patrick and Allen Morris, with "a few cities on the coasts, a developed agricultural area, and an almost uninhabited region in the south." Within 40 years, changes were to come so quickly that the transportation improvements made during the 1880s seemed virtually insignificant by comparison.

The steam-powered railroad became a potent force for change everywhere in the United States during the 19th century. In Florida, the railroad's role was critical, as it transformed the state by opening previously unoccupied lands to settlement, welding together a fragmented state into a single interdependent community and, most notably, integrating the state with the rest of the nation.

Men of the Florida East Coast Railway at opening of the Overseas Railway, 1912

In Florida, the growth of the railroad can be directly attributed to the role of private citizens, businessmen who promoted and financed projects that were to fundamentally shape the future of the state's transportation network. Among these men was William Chipley, who in the 1880s managed construction of the Louisville and Nashville Railroad across West Florida from Pensacola to the Apalachicola River. At that same time, Henry Plant established a system that extended from Georgia through north Florida and the peninsula to Tampa, reaching that city in 1884.


Portrait of Henry Morrison Flagler, date unknown

There were few men who could surpass the accomplishments of Henry Morrison Flagler. Investing a huge personal fortune earned with his partner John D. Rockefeller and their Standard Oil Company, Flagler pushed his Florida East Coast line from Jacksonville to Miami. After reaching Miami in 1896, Flagler began the unthinkable, the creation of an Overseas Railway that would link Miami with Key West over vast stretches of open water. Built between 1903 and 1912, the Overseas Railway garnered international attention as an extraordinary engineering

triumph. Flagler's Key West Extension convincingly demonstrated that railroad companies possessed a high level of engineering expertise and introduced numerous technological advancements to Florida. The railroad bridge is a striking example of that technology.

Railroad construction crew distribute cross ties on the Long Key Viaduct, 1907

Bridge construction was developed as a special branch of structural engineering, subsidized by railroad companies that needed rigid structures capable of carrying fast-moving, heavy loads. Metal truss bridges served this purpose well, and the railroads used them extensively. Some lines, such as the Pennsylvania Railroad, even originated exclusive designs for their own use. Florida's many waterways caused the railroads to become active bridge builders, and it was those companies who frequently constructed the first substantial spans over the rivers. Surviving structures built during this era of rapid growth are reminders of the railroads' enormous contribution to the state's economic and technological development. As an example, the Florida East Coast Railway built a swing span across the St. Johns River at Jacksonville in 1890.

The booming 1920s caused the need for expansion and, between 1924 and 1925 the company replaced the earlier span with a two-track bridge that included a trunnion bascule, or Strauss-type lift span. The single leaf, measuring 216 feet long, made it one of the largest of its kind at the time. The bridge continues in service today and commands a prominent place on the river.

At the same time that the railroads made possible reliable long distance travel, they also focused attention on the dismal state of the local roadways. Farmers and

merchants were beginning to realize that better roads and bridges meant access to railroad depots and larger markets. But it was the nationwide Good Roads Movement, started by urban bicyclists and joined later by the automobile industry, that influenced the improvement of roads.

GOOD ROADS MOVEMENT AND THE LEAGUE OF AMERICAN WHEELMEN

During the 1880s and 1890s, bicyclists wanted to extend their range of touring into the countryside. The League of American Wheelmen organized the National League for Good Roads at 1893's Columbian Exposition in Chicago. They delivered lectures, published articles, and pressured government at all levels for greater attention to road building and for increased public funding for those improvements. Since bicycling was a middle- and upper-class pastime, bicyclists were more influential among politicians than were the farmers. The Jacksonville Wheelman's Club was formed in the 1880s and lasted until about 1907. The Wheelman's Clubs across the country foreshadowed the advent of the automobile. In the case of Jacksonville, the first auto arrived in 1900, the first automobile dealership was established in 1903, and by 1911 about 1,000 cars were said to be on the streets. The automobile age had arrived. ◆

The Age of the Automobile

The vast changes that occurred in American society at the beginning of the 20th century affected every area of people's lives. In particular, the new mobility Americans experienced because of the availability of the personal automobile marked a monumental shift in both the way people lived their lives and where they chose to live it. In the transportation arena, local governments were abruptly made aware of the need to improve roadways. While provision for new and improved transportation corridors was in itself a formidable task, the construction of bridges presented the greatest challenge. Bridges were big, complex and costly.

To raise funds to build bridges, local politicians frequently chose to issue bonds, an approach that was unpopular and a step that was taken reluctantly. However, once they got beyond the funding barrier, the construction of a new bridge was cause for great excitement. As an example, in 1910 Hamilton County commissioners announced that, "notice is hereby given that the Board will receive bids at their next meeting... and contract with some firm or corporation for the purpose of building a steel bridge across the Alapaha River near Nobles Ferry, and all persons, firms, and corporations desiring to bid on said contracts will please govern themselves accordingly."

Between 1887 and 1902, Citrus County, needing to span the Withlacoochee River and other streams, advanced from erecting wooden bridges put together by local contractors at a cost of a few hundred dollars to acquiring its first metal bridge in 1902

for $3,000. One of the "side effects" of bridge building was the cooperation it engendered in neighboring localities. Because of the great costs involved and because waterways often defined county borders, bridges often became the reason for the first cooperative ventures between counties. After a dispute with neighboring Marion County over a poorly built span on the Withlacoochee, Citrus County shared the cost with Marion to erect a large steel truss bridge over the river at Dunnellon.

At that time Florida had no industry that fabricated metal truss bridges, so the state depended upon outside firms. The industrial belt of the northeast and midwest led the nation in both the technology and manufacture of metal trusses, a result of the region's iron and steel manufacturing plants. While numerous northern companies sold bridges in Florida, they met with strong competition from the few southern firms that drew upon the steel plants of Birmingham, Alabama. Truss builders active in Florida included:

American Bridge Company/ New York, New York

Austin Brothers Bridge Company/ Atlanta, Georgia

Champion Bridge Company/ Wilmington, Ohio

Converse Bridge Company/ Chattanooga, Tennessee

Groton Bridge and Manufacturing Company/ Groton, New York

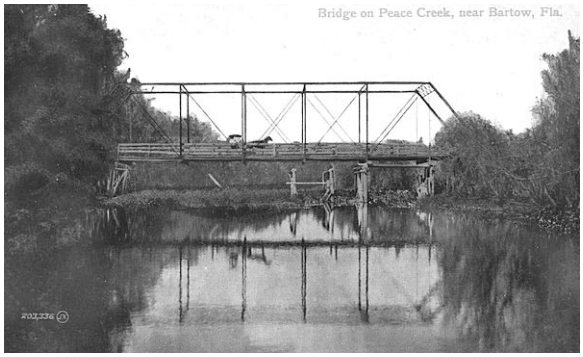
King Bridge Company/ Cleveland, Ohio

Nashville Bridge Company/Nashville, Tennessee

Vincennes Bridge Company/ Vincennes, Indiana

Virginia Bridge and Iron Company/ Roanoke, Virginia

Several of these companies garnered a significant amount of Florida's bridge building business. Among the leaders was the Champion Bridge Company of Ohio. This company was founded in 1860 as Zimri Wall and Company. In the early years, it erected timber and wrought iron bridges. Changing its name to Champion Bridge Company in 1881, it became the first to use steel in small highway bridges around that time. Champion was active in Florida from the 1890s through the early 1930s. The company constructed many movable bridges and it claimed that it introduced the rolling lift bascule bridge to Florida. Besides a "reputation for quality work and fair prices," this northern company shrewdly opened offices in Birmingham, Alabama and Atlanta, Georgia. To further cement their relationship with the more southern states, the company appointed local citizens as their agents and engineers. Hugh Quinn, an engineer trained



Timber bridge on Peace Creek, near Bartow

at the University of Georgia who constructed the DeLand Waterworks, joined Champion and in 1904 built a movable bridge at St. Augustine. Quinn later helped establish a firm at Fort Lauderdale that became the Powell Brothers, an important road and bridge contractor beginning in the 1920s.

Champion's principal competitor, particularly in the building of swing bridges, was the Austin Brothers Bridge Company of Atlanta, Georgia. The company began with George L. Austin, who once traveled in the south as an agent for the George E. King Bridge Company of Des Moines, Iowa. While his brother Frank set up an Austin Brothers bridge firm in Dallas, Texas (known today as Austin Industries), George became an independent contractor in the southeast and a leading builder of movable bridges in Florida.

Other bridge manufacturers that ranked among the leaders in Florida until the Great Depression of the 1930s included the Virginia Bridge Company of Roanoke, the Converse Bridge Company of Chattanooga Tennessee and the Nashville Bridge Company, also in Tennessee. William Converse, once an agent for Ohio companies, established his firm in the 1890s and sent his salesmen throughout the South. His company succeeded in winning contracts for pony and through truss bridges in counties of northern Florida, where a few Converse bridges remain today.

The Nashville Bridge Company was founded in 1902 by Arthur Dyer, a graduate engineer of Vanderbilt University. Dyer claimed to have built more than half of the bascule bridges in Florida. The firm's success in that field may be traced to its chief bridge engineer, L. O. Hopkins, who designed inexpensive and efficient bascule spans. The firm begun by Dyer remained active in Florida until the 1970s.

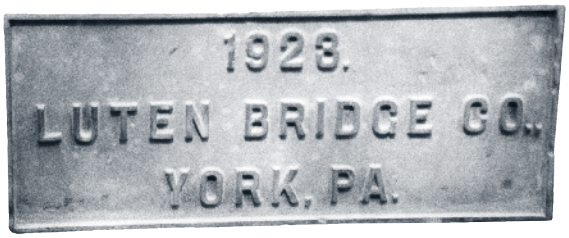
The Pensacola Shipbuilding Company emerged as Florida's principal "native" producer of steel bridges. Organized by Chicago financiers in 1917 to build ships for the war effort, the company developed a bridge building business in the 1920s. It often supplied bascule spans from designs patented by Chicago engineering firms, such as Strauss and Scherzer. The Pensacola Shipbuilding Company may have fabricated bridges itself or may simply have supplied and installed structures made elsewhere.

In the early decades of the 20th century, bridges from these companies reflected local needs and the availability of resources. Such factors as the population base, the level of economic development, the geographic locale and the transportation needs determined the type and scope of county road projects. As

a widely available and inexpensive material, timber answered most needs for building crude trestles or deck bridges. Counties that wanted more durability and greater permanence in their bridges opted for metal trusses or reinforced concrete spans. Jackson County in the western part of the state, for instance, contracted with the Converse Bridge Company to build a standard design Pratt through truss over the Chipola River near Marianna. Completed in 1914 for $2,289, the Bellamy Bridge measured 119 feet long and rested on filled metal cylinder piers. For lighter duties and narrower streams, the choice was frequently Pratt pony trusses. A good example of this is the 60-foot span purchased by Lafayette County from Converse in 1912 to cross the Steinhatchee River.

Used first only for small spans, and later for longer spans as the engineering improved, reinforced concrete gained greater popularity during the teens and twenties. A number of companies with national reputations built reinforced concrete bridges in Florida, including A. Bentley and Sons of Toledo, Ohio and the Concrete Steel Bridge Company of New York City. Local firms were also established and they became important bridge contractors. These companies include C. T. Felix of St. Petersburg and George D. Auchter of Jacksonville.

The need for numerous inexpensive, low maintenance, and durable highway bridges enabled the Luten Bridge Company of York, Pennsylvania to become a leading builder of reinforced concrete structures, in particular concrete arches. Engineer and entrepreneur Daniel B. Luten (1869-1946) of Indianapolis designed and promoted bridges that he and his agents sold as superior to "tin bridges." The company's bridges gained a reputation for strength and reliability under the hot, humid, and sometimes salty conditions in Florida. Luten succeeded in reducing the quantity of concrete required in his bridges without sacrificing its strength or resistance to floods. In some instances, he extended the steel tie rods from the bridge to underneath the stream bed and buried them in concrete. This method reduced the need for heavy abutments, particularly desirable when stream banks were weak. In 1915, he also built an innovative half-arch bridge at the entrance to the luxurious Belleview Hotel near Belleair. This bridge was built with a 46-foot main span and 23-foot half spans. While the half arches, which remain today, appear to be cantilevered, the fact that they are supported by abutments makes them true arches. The bridge maker claimed to have achieved greater stability and efficiency in material use.



Luten Bridge Company plaque

Luten patented his designs and put them in catalogs. He promoted them by establishing relationships with business partners throughout the country. By the mid-1920s, Luten reportedly held fifty patents for reinforced concrete bridges and had built more than 14,000 spans throughout the United States.

The Role of the Bridge in Cities

Often the most ambitious bridge building took place in Florida's rapidly growing urban areas. In Tampa, the spread of subdivisions west of the Hillsborough River necessitated the building of a new bridge. In 1913, an impressive bridge with concrete arches and a double-leaf Scherzer rolling lift main span was constructed on Kennedy Boulevard and named the Lafayette Street Bridge. Its classically-inspired design expressed the pervasive influence of the nationwide City Beautiful Movement. The bridge is a fine example of the melding of function and form that created an attractive centerpiece in downtown Tampa.

Built after World War I, the Acosta Bridge over the St. Johns River in Jacksonville is another good example. The Acosta Bridge was the first vertical lift span in the state. The decision to build a vertical lift span was based on the river's operating needs that resulted from the heavy maritime traffic. The construction of this bridge involved several notable engineering accomplishments. Its designer, J. L. Harrington, enjoyed a national reputation as a distinguished engineer and co-founder of a prominent engineering firm. The Missouri Valley Bridge and Iron Company of Leavenworth, Kansas built the foundation and was experienced in subaqueous construction. The building of the Acosta Bridge required pneumatic methods never before used in the region to sink the caissons. Acosta's size (2,865 feet) and cost ($1.2 million) made it a fitting symbol of the booming 1920s and its ever increasing automobile traffic. At the beginning of the 1990s, the state replaced the Acosta Bridge and used the historic span as an artificial reef for Atlantic sea life.

CITY BEAUTIFUL MOVEMENT

At the turn of the 20th century, urban population had increased significantly, and crime, poverty, and overcrowding were becoming problems. In response, the nationwide City Beautiful Movement sought solution through beautification in city planning. Influenced by the public squares, radiating boulevards and neoclassical architecture of Renaissance Europe, this movement had three objectives: the destruction of social ills through beauty, the encouragement of middle- and upper-class money via inviting city centers, and cultural equality with Europe via use of the Beaux Arts style. Architecture, landscaping, and public art were brought to bear in achieving these aims. City Beautiful ideals were first expressed by Daniel Burnham in his designs for the World's Columbian Exposition of 1893 in Chicago. Landscape designer Frederic Law Olmsted designed the fair's landscapes. Despite this and other achievements, the movement failed to wholly transform any city. ◆

Travel in Rural Florida

In the years following WWI, traveling by automobile in Florida remained an adventure in most areas because of the poor roads. They more often resembled stump-ridden, overgrown and sandy trails.

Some counties made an effort to improve their roadways by grading, adding a sand-clay mixture, or spreading pine needles or oyster shells on the surface. The specifications for spreading shell on the roadway called for the shell to be laid four inches deep and seven or eight feet wide. There were no rolling, binder or drainage facilities or anything of the sort. Mule and ox hooves, the iron tires of wagons and the travel of a few automobiles over the surface was thought to be sufficient to convert the shell into a "high-speed" highway surface. After this shell was laid, cars that could negotiate the sand road between Melbourne and Eau Gallie could make the 40-mile trip from Melbourne to Titusville, the county seat, in a half day. That is, of course, only if the vehicles weren't shaken to pieces by the hard sand pull.

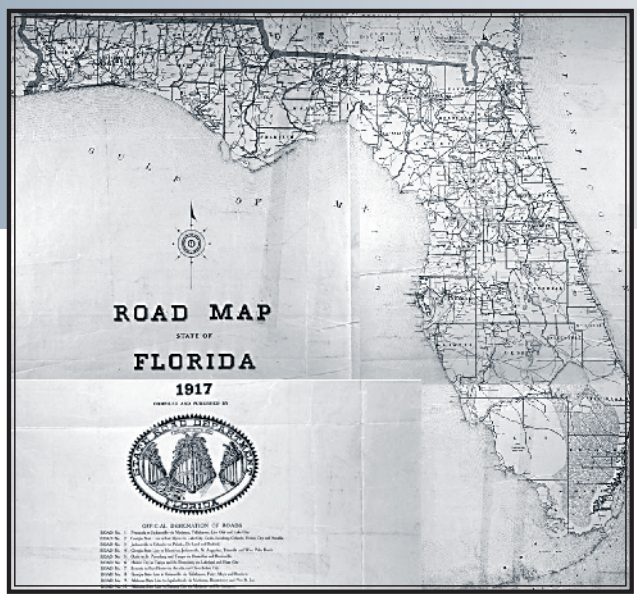
Sand road in Fulford-by-the-Sea, Miami, 1924

More satisfactory results came from gravel or crushed rock mixed with asphalt. One popular method combined asphalt with crushed slag that was shipped in from the steel mills of Birmingham, Alabama. Polk County, which was using trails dating from the Seminole War, responded to Good Roads advocates, and in 1916 contracted for 217 miles of asphalt road. When it was completed, the citizenry raised a triumphal arch declaring, "Our roads are smooth and free of dust at all seasons, and we have no mud." The Champion Bridge Company opened an office in Bartow in order to construct bridges for Polk County.

Miami Beach developer Carl Fisher, whose Indianapolis company Prest-O-Lite invented a vastly improved automobile headlight, became a champion for improving roadways. In 1915, to convince the public that Florida could be reached by car, Fisher organized a 15-car caravan that made the trip from Indianapolis to Miami. He called his expedition the "Dixie Highway Pathfinding Tour." That approximate route would be followed when the Dixie Highway was built. Counties that wanted to be included in this grand plan took on road construction projects. Some counties, particularly in the area south of Jacksonville in St. Johns, Flagler, and Putnam counties, laid nine-foot-wide brick roads. The majority of the paving bricks came from Birmingham, Alabama. Other brick roads extended from Tampa and Orlando.

The Creation of a Road Department

Since the 1890s the federal government had been encouraging and offering some support for highway building. In 1916, Congress made a quantum leap when it passed the Bankhead Bill (*The Federal Aid Road Act*) that committed federal funds to the construction of rural post roads. The legislation required that each state establish a road department to administer the program. In anticipation of this federal legislation,



1917 map of Florida, published by the State Road Department

Florida created a State Road Department in 1915 and subsequently appointed William F. Cocke, an engineer in the Virginia Highway Department, as its first State Road Commissioner or Highway Engineer. In Florida, as elsewhere around the nation, the transition from solely local control of roads to state supervision slowly moved ahead, and was further impeded by the national crisis created by the First World War. As a result, it was not until 1923 that the Florida Legislature officially designated a system of state roads and authorized the Road Department to complete those routes. The "first system" or priorities were:

Road No. 1 - Pensacola to Jacksonville

Road No. 2 - Georgia state line at Jennings to Fort Myers

Road No. 3 - St. Mary's River at Wild's Landing, through Jacksonville, to Orlando

Road No. 4 - Georgia state line south of Folkston, Georgia, to Miami

Road No. 5 - High Springs to Fort Myers

Road No. 8 - Haines City to Fort Pierce

Road No. 19 - Tallahassee to Ocala

Road No. 27 - Fort Myers to Miami

A "second system" was designated in 1925:

Road No. 5A - High Springs to Perry

Road No. 10 - Tallahassee to Milton

Road No. 11 - Georgia state line south of Thomasville to Capps

Road No. 13 - Cedar Key to Yulee

Road No. 15 - from near Wakulla to St. Petersburg

Road No. 20 - Cottondale to Panama City

Road No. 28 - Lake City to San Mateo

Road No. 47 - Jacksonville to East Palatka

The Florida Real Estate Boom: An Era with No Limits

Florida's road system experienced a hectic period of growth and change in the 1920s due to the impact of a frenzied real estate boom. In 1926, the boom was to begin its abrupt end, as a series of events caused a collapse in the Florida market. By 1928, virtually all building activity had ceased. Conditions worsened in 1929 when the stock market crash plunged the state and nation into the prolonged Depression of the 1930s.

During those boom years of extravagant prosperity, the whole state, wrote one observer, "acted as though it were on a glorious bender–beautifully intoxicated and wildly hysterical." The tourist trade flourished as well as the year-round residents. In 1920, Florida's population was 968,470 and by 1930 had reached 1,468,211. In 1926, *Florida Highways Magazine* concluded that the counties with the highest land values were also those counties that had the best roads. In that frenzied economic climate, which seemed to have no end in sight, some counties voted enormous issues of bonds to build roads and bridges. Orange County put $7 million worth of bonds on sale, Lake County budgeted $6 million, and sparsely populated Monroe County spent $4 million, partially building a highway parallel to Flagler's railroad from the mainland to Key West.

Frank C. Wright, the editor of the respected *Engineering News-Record*, reported from Florida in 1926 on the importance of engineering on the building of roads. He said:

> *Without the engineer and the contractor the Florida real estate boom would be a frivolous and empty thing, for climate, even Florida's climate, does not attract new money by itself alone. What has been done in Florida is to attract thousands, perhaps millions, of investors and prospective residents by physical evidences of development, by making roads where once jungle was, by building homes with all the conveniences of a modern city where a year ago was only sand and pine, and by turning a swampy shore into a tropical winter resort. To do this at all takes engineering skill; to do it in the short time that has been permitted has required both engineering skill and construction enterprise.*

The frantic pace of development made it difficult for the State Road Department to adequately supervise highway projects. Despite the vast sums spent, roads and bridges dating from the Boom were often built hastily and cheaply to meet pressing demand. Editor Wright also noted that, "The demand for engineers has been so great, however, that the report has spread all over the country and from every state, engineers good and bad, have been pouring into Florida." The period produced many large bridges, but relatively few that could be considered distinguished by their high quality of design or innovative engineering. In 1935, Road Department Chairman Chester B. Treadway commented that, "until a comparatively recent date, the importance of bridges and bridge building was apparently overlooked, to a large extent. In the enthusiasm that surrounded highway construction during the days of the Boom, when money was literally plentiful, it is surprising to note that only a mere handful of the essential bridges connecting up the roads that were built were given consideration. There seems to have been an attitude that bridges, if not really of secondary consequence, should be placed in a classification other than that of actual road building."

Like the railroad barons before them, individual citizens were often the reason for the construction of bridges and building of roadways during the Boom. Though built with public money, the previously discussed Acosta Bridge (1921) on the St. Johns River was largely a result of the efforts made by Jacksonville commissioner St. Elmo W. Acosta, who saw the project through to its completion. George Gandy, who spanned the bay from Tampa to St. Petersburg, was the most notable of the private builders. Gandy's toll bridge that opened in 1924 was comprised of two-and-one-half miles of reinforced concrete spans and three miles of causeway. The new bridge enabled a traveler to complete the passage from Tampa to St. Petersburg in half the time it used to take.

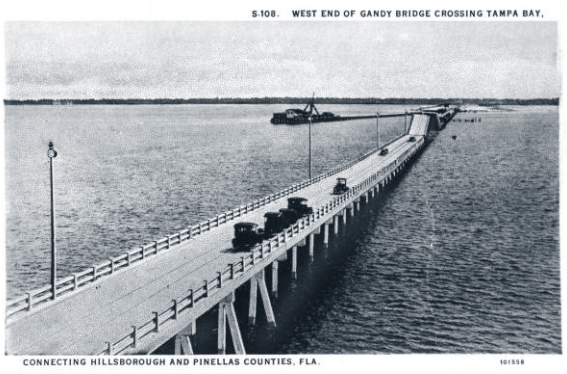
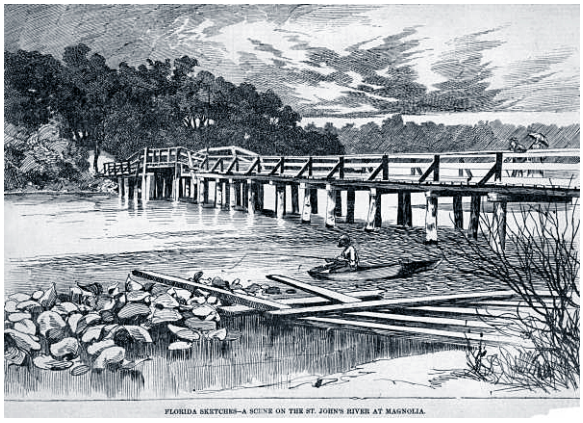


Photo of west end of Gandy Bridge crossing Tampa Bay

In Miami, a local private development company constructed a series of concrete spans, called the Venetian Causeway, to Miami Beach in 1926. The Venetian Causeway, listed in the *National Register of Historic Places*, replaced a huge timber structure erected by pioneering Miami Beach developer John Collins.



Pen and ink drawing of a timber bridge over the St. Johns River at Magnolia

While there are a number of examples that illustrate the role of private development in the creation of roads and bridges, two projects in particular illustrate this. Ernest Kouwen-Hoven, developer of the resort Indiatlantic-by-the-Sea, for instance, built a wooden trestle and an $8,000 drawbridge on the Indian River near Melbourne in 1921. On a grander scale, in 1928, Clay County banker and farmer Allie G. Shandy attracted New York and St. Louis investors to construct an 11,500-foot timber bridge with a Strauss bascule lift span on the St. Johns River at Green Cove Springs. It was reported that it took more than two million feet of southern pine to build the bridge. The "Shandy Bridge" was the longest timber vehicular bridge ever built. When engineers encountered problems in setting piers on the soft river bottom, they curved the bridge to firmer ground on the east end.


Stone archway on Tamiami Trail marking boundaries of Dade and Collier counties, 1928

For its sheer scope and ambitious design, few projects in the state have matched the construction challenge of the Tamiami Trail. The "Trail" linked Miami and Tampa via Fort Myers by a road dug out of Everglades muck. Begun in 1915, the building of the Trail was fraught with delays as, underneath the surface, the hard limestone rock required 40,000 pounds of dynamite per mile to pulverize it. After its completion in 1928, *Florida Highways Magazine* described the project as "a wilderness finally overpowered which will soon hum to the tune of heavy automobile traffic."

New Yorker William Conners also made a dramatic impact on the Everglades environment. In 1917 he began his extensive efforts to drain areas around Lake Okeechobee, seeking access to his reclaimed properties. Conners built a toll road in the 1920s from West Palm Beach to the town of Okeechobee, a technical feat in overcoming the natural obstacles. On both the Tamiami Trail and the Conners Highway, the bridges were generally wooden stringers resting on timber piles sunk in the mud. Conners alone built twenty-six timber pile trestles on his road.

Timber remained a common bridge building material in the 1920s and beyond, though reinforced concrete grew in popularity for permanence and on heavily-traveled routes. In 1927, the State Road Department estimated that there were 11,214 feet of concrete bridges and 12,875 feet of timber structures on State Road No. 1 (The Old Spanish Trail). Based on a design of its own engineer, St. Johns County erected about 40 creosoted timber bridges on county roads utilizing a series of standard short spans combined with a central drawbridge. In 1928, Volusia County erected two pressure-treated timber stringers on the Halifax River at Daytona Beach, each one exceeding 2,000 feet in length. The timber's low cost and ease of construction were among the factors that convinced the county to use the material.

The decision to use timber as a construction material was based not only on the number of waterways that would need to be crossed, but was also based on the present and potential size of those waterways. Many of the state's rivers frequently overflowed their banks, thus requiring the provision of long causeways or multiple relief spans across wide "swamp valleys" to handle freshets. As an example, in building a timber pile bridge over the Hillsborough River near Zephyrhills in 1934, engineers took into account that the normally placid stream measuring 100 feet wide and 20 feet deep would grow to become 1,700 feet wide and 25 feet deep during a flood stage.

The Boom also produced several exceptional examples of reinforced concrete construction. One particularly striking example is St. Augustine's majestic Bridge of Lions across the Matanzas River. The bridge was built in 1926 from a design by the engineering firm of J. E. Greiner in Baltimore and used concrete to create a distinctive Mediterranean style on a steel arched girder bridge with a bascule span. It quickly became a landmark in the old Spanish city known for its historic landmarks.

Concrete lions flank the entrance to the Bridge of Lions in St. Augustine, 1982.

Daniel Luten, particularly successful in building small reinforced concrete arch deck bridges in Florida, erected a large and handsome shallow arch bridge (now demolished) over the Little Manatee River at Wimauma

in 1922. He completed the impressive Putnam County Memorial Bridge on the St. Johns River at Palatka in 1927. This bridge was 2,600 feet in length and cost $1.25 million. The structure consisted of thirty concrete arch spans, ten with open spandrels, and a double-leaf bascule bridge at midstream. By all appearances, the Memorial Bridge represented one of Luten's finest works. Yet the concrete structure that garnered the greatest attention and praise within the State Road Department was the Victory Bridge over the Apalachicola River at Chattahoochee. The bridge was built by the Masters-Mullen Construction Company of Cleveland, Ohio between 1921 and 1922 as one of the first major bridge projects of the Department. At 2,027 feet in length, it may have ranked at the time of its construction as the largest reinforced concrete arch bridge in the South. While concrete found greater applications in bridge building, it also appeared in road paving. The first concrete highways in the state were built from Jacksonville west towards Lake City, in DeSoto County, and near the town of Fellsmere in Indian River County.

Daniel Luten built this now-demolished bridge over the St. John's River in Palatka.

The road and bridge developments of the time could not capture the public's imagination in the way that the exuberant real estate boom with its glittering resort communities could. But it was these improvements that made more stable growth possible. The Road Department expressed this view of bridges in 1924, "Our first idea is permanence, and in most cases the bridges which are being built today will no doubt outlive the memory of many of us who are instrumental in their construction."

Bridges over Navigable Waterways

Since before the 1880s, local governments and individuals were building drawbridges over the state's navigable waterways. Most of these structures were crude affairs, differing little in appearance and operation from medieval models that crossed over moats at castles or fortresses. In Florida, they were manually operated, hoisted by rope, built of wood with some iron parts, and placed in the middle of simple wooden deck bridges supported by spindly timber poles. In the latter years of the 19th and into the 20th century, engineers vastly improved the movable span. This was sometimes accomplished by wedding the technology of steel truss bridges to swing pivots and lifting towers as a means of moving the structure to provide clearance for ships in the channel. Similarly, the application of new technology to the ancient principles of the drawbridge, which

was counterweighted or balanced like a child's seesaw, resulted in the modern bascule bridge. The bascule would be built under various patented designs.

The swing bridge, either in its older rim-bearing or its improved center-bearing

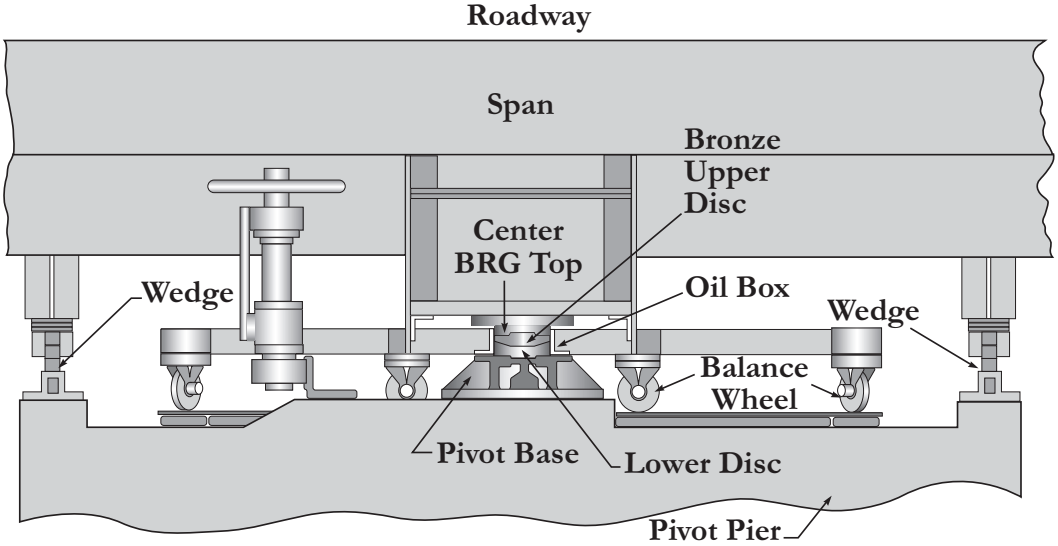


Diagram of Center-Bearing Swing Mechanism

version, became popular in Florida because of its simplicity, lower cost, ease of construction and dependability. It did, however, create an obstruction in the channel because of its pivot pier. Ohio's Champion Bridge Company, along with the Austin Brothers Company in Atlanta, took the lead in building swing spans, beginning in Florida at the turn of the century and lasting until the late 1920s. Essentially a truss bridge, generally of the Warren configuration, the swing span could be moved from side to side. In later years some Florida swing bridges found their way to Caribbean countries and even into South America.

When there was a need for full clearance in the channel or when the channel was known to shift, engineers chose the vertical lift bridge type. The vertical lift bridge consists of a truss span hoisted by cables that are mounted on pulleys in high steel towers. The towers also contained heavy concrete counterweights. Lifts are ordinarily classified by the location of their drive machinery, whether in the tower or on the span itself. Though smooth and efficient in operation, the vertical lift generally costs more to fabricate and erect. Only a few examples remain in Florida, such as the massive Main Street Bridge over the St. Johns River at Jacksonville and the small, unusual hydraulically-operated lift at Fort Myers.

Believed to possess a number of advantages over other movable types, the bascule bridge steadily won wider acceptance among bridge builders. It opened a clear channel, operated swiftly and dependably, utilized simple mechanisms with few moving parts, offered strength and safety, and lent itself to artistic treatment. Engineering firms, primarily from Chicago where many of this type were built, sold patented designs. Inventor William Scherzer claimed that his rolling-lift type bascule bridge operated with less friction and therefore reduced power. But the trunnion type, improved by Chicago engineer Joseph Strauss, who designed the Golden Gate Bridge in San Francisco, became the most preferred. In this type, the bascule span rotated around a trunnion or axle and made use of a heavy counterweight.

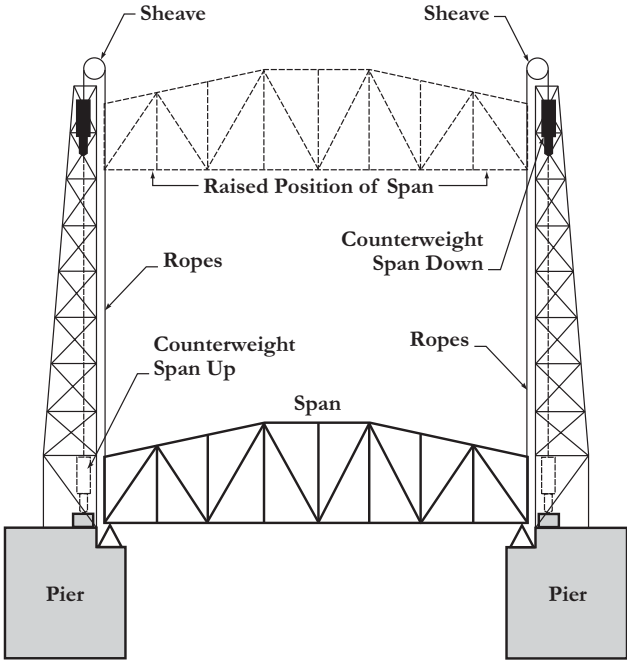
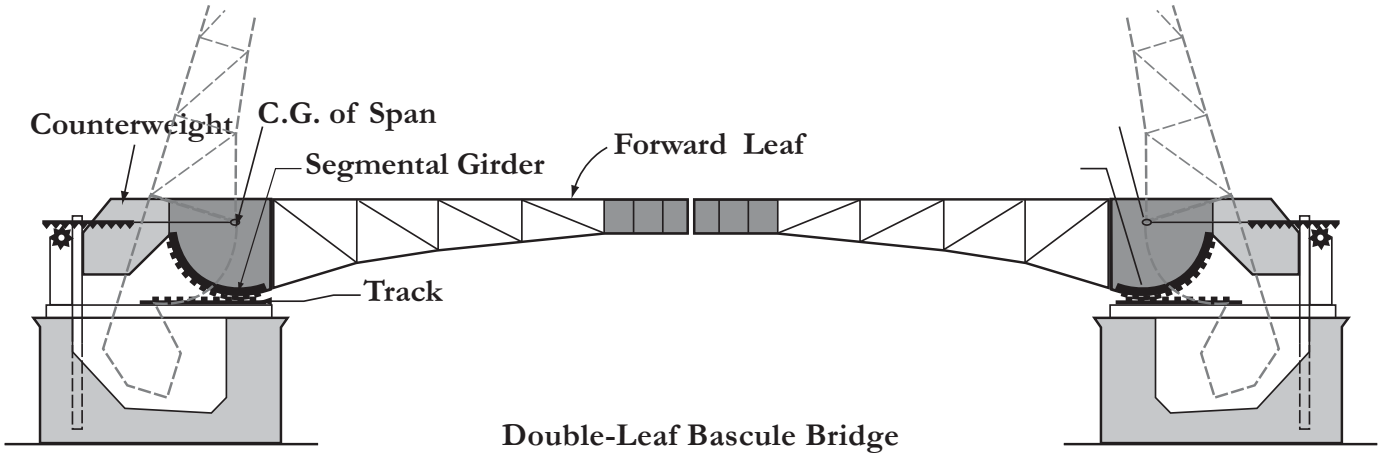


Diagram of Vertical Lift Bridge

The bascule bridge was particularly suitable for Florida's many navigable streams. The prestigious engineering firm of Harrington, Howard and Ash of Kansas City, which specialized in movable structures, designed several bascule bridges to cross the Miami River in the 1920s. Tampa, likewise experiencing traffic congestion downtown and to new suburbs, built bascule bridges on the Hillsborough River. Among the most notable was the Laurel Street Bridge that used a Warren pony truss span in an overhead counterweight trunnion-type bascule. The contract for the Laurel Street Bridge was awarded to a Philadelphia company which began as a builder of gas systems, a somewhat odd choice of contractors. The prosperous twenties brought all manner of bridge builders to Florida.



Double-Leaf Bascule Bridge

The Great Depression

The bright optimism of the 1920s all but disappeared during the dark days of the 1930s when the nation's economy suffered its severest crisis in history. Attempting to relieve the ill effects of the Great Depression, President Franklin Roosevelt implemented his New Deal programs. To stimulate the economy and to "make work" for the unemployed, the building of roads became a high priority. Led by the *Hayden-Cartwright Act of 1934* and similar legislation that committed greater levels of national support for roads, the federal government expended about $1 billion on highway construction between 1933 and 1938. The total of all federal spending in Florida grew from $12,772,000 in 1930 to $62,718,000 in 1934 and reportedly averaged $54,000,000 during the mid-1930s. Under these circumstances, the state's road program leaped forward. One of the largest projects ever undertaken in Florida, the building of the Overseas Highway, was to take place at this time.

In 1935, a ferocious hurricane struck the Florida Keys, resulting in great losses of life and property. The Florida East Coast (FEC) Railway, which provided service from the mainland to Key West, was destroyed. The local economy was crippled, but state and federal officials were quick to respond to this emergency.

This Florida East Coast Railway locomotive was literally blown off the tracks by the hurricane of 1935 during an attempt to assist in the evacuation of Islamorada.

Purchasing the bridges and the abandoned roadbed from the FEC Railway, the state secured extensive federal assistance from the Public Works Administration to convert the former Flagler line into a highway. The concrete arches, steel plate girders and trusses, along with a bascule and a swing bridge, were transformed into vehicular spans. When the narrowness of the Bahia Honda Through Truss Bridge could not provide for two lanes of automobile traffic, engineers transformed the structure into a deck truss by building the roadway on the top chords and cantilevering cross beams off each side to provide sufficient width. Completed in 1938, the Overseas Highway was the product of considerable skill and imagination in its engineering and construction. The Highway helped revive the area's economy, and enabled Key West to serve critical military purposes during the Second World War.

Florida added a number of important bridges during the Great Depression. At Fort Myers, the Thomas Edison Memorial Bridge over the Caloosahatchee River enhanced the value of the Tamiami Trail. What was called the Gulf Coast Highway gained an impressive new structure in 1935 when the Gorrie Bridge opened to traffic over the Apalachicola Bay in Franklin County. To provide a sturdier foundation, contractors drove some timber piles as much as 100 feet into the bottom of the bay as footing for the concrete piers. The central span of the 12,400-foot structure consisted of an electrically-operated swing that opened wide channels on each side of the pivot pier. Using federal aid, Calhoun County completed a major long span steel bridge over the Apalachicola River near Blountstown. Erected by the Wisconsin Bridge and Iron Company and opened in 1938, it utilized a continuous truss design, a first for the state, and stood 52 feet above the river to permit unrestricted navigation. Jacksonville gained a substantial and costly structure with the completion of the Main Street Bridge in 1941. The bridge contained a 365-foot vertical lift span. The contractor had to take steps to protect the steel pilings by encasing them in additional layers of concrete. Built by the Mt. Vernon Bridge Company of Ohio, the structure reflected the rapidly expanding size of Jacksonville and the increasing flow of traffic south to the suburbs and beaches.

The Second World War and the Beginning of the Modern Age

In 1941, America entered the Second World War. The war effort quickly curtailed work on the state highways, except for defense-related work. During the war years, the State Road Department provided access roads to military establishments and improved highways that were deemed crucial to the movement of military traffic. Projects were conducted at Pensacola, Tampa, Jacksonville, Orlando, and around the state at military installations. Contractors modernized and shortened the Overseas Highway to Key West (which was assigned an important wartime role) and new bridges were constructed over the Banana and Indian Rivers to serve naval facilities at Cocoa. Camp Blanding near Starke, one of the state's major military bases, received extensive improvements by way of connecting roads.

The war would also bring an end to the tradition of private toll roads and bridges. The move to eliminate private tolls on bridges, roads and ferries had begun during the Great Depression, but there were holdouts. Two remaining toll bridges in Tampa–the Davis Causeway to Clearwater and the Gandy Bridge–became public property during the war and were freed of toll charges despite resistance by the owners of the Gandy Bridge. The federal government took the position that tolls were impediments to the defense effort. They invoked wartime powers and took over the structure.

The post-WWII period opened the modern era of road and bridge building in Florida. Florida emerged as a highly desirable place to live and work, and as a favorite tourist destination. This population influx put

1934 photo of the Davis Island Causeway showing toll booth

considerable pressure on the state highway system to expand and improve, and at the same time underscored the value of careful planning, sound construction techniques and innovative engineering. In 1947, for the very first time, the Road Department chose a suspension design for a bridge over the Suwannee River near Luraville, Lafayette County. When engineers concluded that the riverbed was unstable, they knew that it would hamper the setting of a foundation, and therefore made the choice of a suspension bridge type.

William E. Dean, State Bridge Engineer from 1948 to 1962, gained national prominence for advocating the use of prestressed concrete in bridge construction. He introduced prestressed concrete slabs into the state system when he sought a durable replacement for timber decks on spans along the Tamiami Trail. Many of Dean's progressive ideas and methods went into the building of the Sunshine Skyway across lower Tampa Bay in 1954.

The Sunshine Skyway was a vast project costing $22 million that would facilitate the development of the entire Gulf Coast. The Skyway stretched for approximately fifteen miles and linked the St. Petersburg and Bradenton areas. Long, filled-in causeways led to a cantilevered steel truss which rose 155 feet above the bay and provided wide clearance for shipping into busy Gulf ports. The size of the project gave bridge engineer Dean many opportunities to demonstrate the value and strength of prestressed concrete construction. In 1969, a virtually identical structure was completed next to the original to accommodate the increasing volume of traffic. However, a tragic accident occurred in 1980 when a ship rammed a concrete pier and toppled a main span into Tampa Bay. Consequently, a new Sunshine Skyway, utilizing a dramatic cable-stayed design, opened in the 1980s, providing the area once again with an exceptional example of bridge engineering.

The vigorous bridge building program begun in the 1950s has maintained its momentum throughout more recent decades. In 1967, Jacksonville acquired an imposing continuous through truss bridge, named for Isaiah Hart, that provides a 1,093-foot clear channel for shipping on the St. Johns River. Still another reminder of Jacksonville's historical tradition as a crossing point on the St. Johns occurred in 1988 with the opening of the Napoleon Bonaparte Broward Bridge at Dames Point, a major transportation facility in the city and state. Designed by the engineering firm of Howard, Needles, Tammen & Bergendoff, the cable-stayed bridge, having the longest central span of this type in the United States, is a graceful addition to the river.

The evolution of bridges in Florida is the story of ingenuity and perseverance. Begun as the proud achievements of their time, the historic bridges of Florida serve as a benchmark of Florida's growth and development.

CHAPTER 3
THEMATICALLY & GEOGRAPHICALLY RELATED BRIDGES

Historic resources exist all around us. Usually we think of them as individual resources, such as the first school in a city. Sometimes we think of them as collections of sites, such as the old shops and restaurants of a community's original downtown area. Often with bridges, there is a tendency for us to see them only as individual resources as they span a waterway. In rare instances, we may connect them with the neighborhood surrounding them. This view, however, usually remains reserved for those bridges built to link an island community to the mainland. Less often noticed are the bridges associated with other bridges. The most obvious examples of these are causeways – they usually consist of several bridges that stretch across the same body of water and were constructed during the same time frame. Perhaps the most interesting of the thematically and geographically related bridges are those that were designed by the same individual for the same community or purpose. These usually present a common appearance or possess some other similarity. Because Florida has an immense coastline cut by innumerable waterways, it possesses examples of many different types of thematically and geographically related bridges.

These sets of bridges range from ones confined to a narrow geographic area (as in the case of the Klutho Bridges in Confederate Park, Jacksonville) to ones that can be found throughout the state, such as the New Deal Bridges. Much like individual bridges, these bridge groups include structures important for their technology, aesthetics, and association with a specific historical development.

Photo on previous page: The Long Key Bridge in Monroe County

THE NURMI ISLES NEIGHBORHOOD BRIDGES

The four bridges that make up the Nurmi Isles Neighborhood Group were constructed in 1948 across the Las Olas Canal in Broward County to provide access to the Nurmi Isles neighborhood in Fort Lauderdale. These bridges include the Isle of Venice Way Bridge, the Fiesta Way Bridge, the Nurmi Drive Bridge, and the Royal Palm Drive Bridge. Though technologically simple structures, the style of the bridges and their association with the Nurmi Isles neighborhood make these bridges significant historic resources. The bridges were designed to be stylistically compatible with the character of the neighborhood, and therefore represent an important part of this historic community. The Nurmi Isles Neighborhood Bridges exhibit an intentional uniformity that reflects an Art Moderne influence. All four structures reach 72 feet in length, contain 3 spans of 24 feet each, and are 27 feet wide. The railings are solid concrete with both large rectangular and smaller square balusters, set in a uniform pattern on each bridge. In addition, all four structures feature planters at each corner of their approaches.

Nurmi Isles Bridge

THE CONFEDERATE PARK BRIDGES

All six of the Confederate Park Bridges span Hogan's Creek in Confederate Park, a part of the historic Springfield neighborhood of Jacksonville in Duval County. Their aesthetic designs joined to their associations with the historic development of Jacksonville and with Henry J. Klutho, a notable Florida architect, establish the historic importance of these unique and beautiful bridges. Working with civil engineer Charles V. Imeson, Klutho prepared plans in 1929 for a city project to transform Hogan's Creek, a waterway that had become little more than an open sewer, into a "Grande Canale" within a large park. Their plans focused upon beautifying and renewing Springfield, the city's oldest neighborhood and, through Springfield, contributing to the improvement of Jacksonville. However, since the Great Depression followed the project almost immediately, Klutho's hope of generally improving Jacksonville was not fully realized at the time. But what remains of the attempt leaves an impression of sensitivity to the interrelationship between man made and natural aesthetics. The project involved re-channeling the creek, building locks, lakes, and a pumping plant, and constructing six reinforced concrete bridges for automobile traffic, as well as several pedestrian bridges. Robert G. Lassiter Company of Oxford, North Carolina, an important bridge builder in Florida and the Southeast, constructed the project. Ultimately, the project drew praise from the local newspaper as Klutho's masterpiece.

The Springfield Historic District, located just north of downtown Jacksonville, features buildings dating from ca. 1885–1930. These are mostly Frame Vernacular residential buildings, though other styles such as Prairie, Colonial Revival and Queen Anne, are also evident. The district was listed in the *National Register of Historic Places* in 1987. ◆

Portrait of Henry J. Klutho

Each one of these structures represents a historically important individual resource. Taken together they form a thematically related group. This arises from both their role in the historic development of the Springfield and Confederate Park areas of Jacksonville already mentioned, and their relationship to each other.

Henry J. Klutho gained repute by introducing the Prairie School style of architecture into north Florida during the early 20th century. His designs helped rebuild Jacksonville after a fire destroyed the downtown in 1901. A student of Frank Lloyd Wright and Louis Sullivan, he became one of Florida's most accomplished architects. ◆

Although the bridges present the standard structural design of concrete girders and slabs, they exhibit the artistic touches of Henry Klutho. He designed all of these bridges in a Beaux Arts/ Neoclassical Revival style. The shared decorative elements include solid concrete railings supporting obelisks, urns, decorative lighting, and relief sculptures.

At a length of just more than 46 feet, the Laura Street Bridge represents the longest of these ornate bridges in Confederate Park. The Liberty Street Bridge consists of a small concrete slab structure decorated with the ornamentation characteristic of its five sister bridges in the park. A relief sculpture with the date "1929" inscribed upon it appears on the outside of the balustrade.

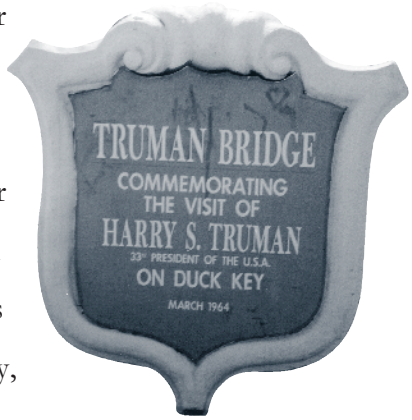
The balustrade on Klutho's Main Street Bridge for Confederate Park features a sculpted cartouche. The most significant alteration to the structure occurred prior to the 1991 survey, when a portion of the bridge railing was removed in order to provide space for an adjacent building. The Market Street Bridge is a 41-foot-long concrete slab with a 40.5-foot roadway. As on the Liberty Street Bridge, the exterior of the railings carry ornamental tablets inscribed with the year "1929."

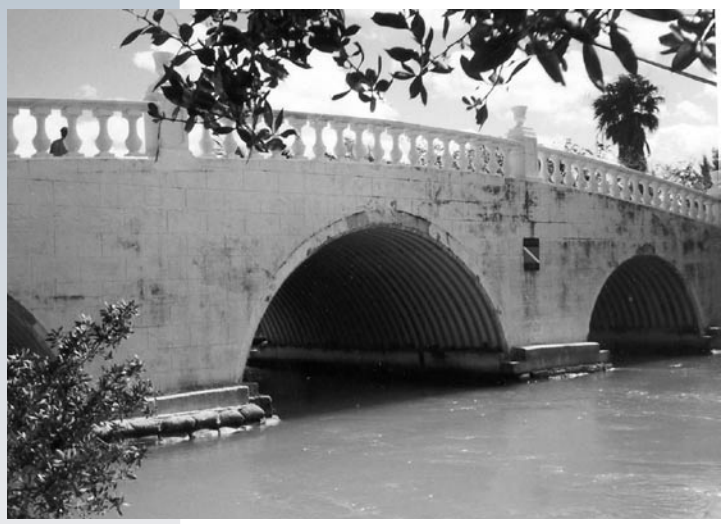
As with the five other Klutho-designed bridges in Confederate Park, the Newnan Street Bridge and the West Second Street Bridge possess many distinguishing aesthetic features such as relief sculptures, urns, and obelisks.

Main Street Bridge, one of the Confederate Park Bridges

THE DUCK KEY BRIDGES

In the decades following the Second World War, bridge design tended towards strict functionality and uniform design standards. Ornamentation on bridges extant from about the mid-1940s up to the 1990s is almost wholly absent. Aesthetic considerations were, for the most part, neglected in designing and building bridge structures. The four Duck Key bridges in Monroe County represent a vivid exception to that rule. As a result, these four bridges represent historically notable resources for their aesthetics as well as their historical association with the real estate development of Duck Key. As part of the planned development of Duck Key, each was designed with a view towards appearance. Interestingly, the various aesthetic treatments on the bridges gives them a unity of design without sacrificing the unique character of each bridge's individual appearance. All structures feature concrete balusters interspersed with rectangular concrete piers. These piers, in turn, are topped with a decorative element. The designs of these decorative elements, as well as the balusters and piers, are unique to each bridge. All four Duck Key Bridges were constructed in 1955 and all were rehabilitated in 1982, though the rehabilitation left their historic appearances intact.





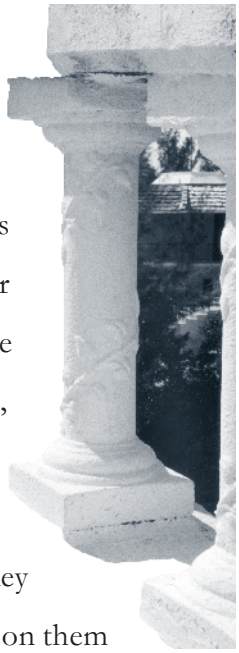
The Truman Bridge, one of the Duck Key Bridges

Dedicated to President Harry S. Truman in 1964 to commemorate his many visits to Duck Key, the Truman

Duck Key remained virtually unsettled from the 1830 collapse of the islands' salt producing industry until the mid-1950s and the establishment of the Indies Inn, a fashionable resort on Duck Key. In 1955, developers constructed a viaduct joining Duck Key to the Overseas Highway, as well as these four historic Duck Key Bridges. The building of these bridges was related to the development of the Indies Inn, and to the opening of Duck Key to resettlement. The Indies Inn went out of business, but the site remains in operation as Hawks Cay Resort. ◆

Bridge carries Duck Key Drive across the unnamed waterway that separates Indies Island from the remainder of Duck Key. The structure consists of three arched steel culverts and is 75 feet long. Its balustrade sports urn-shaped balusters bounded by rectangular concrete piers topped with concrete planters. In addition, a sign commemorating the naming of the bridge is set in molded concrete flanking the approach to the bridge.

The Bimini Drive Bridge, a concrete channel beam structure, is close to 43 feet long and carries Bimini Drive over Sam's Canal. As on the Truman Bridge, the bridge railings feature urn-shaped balusters and rectangular concrete piers. Unlike the Truman Bridge, the piers are topped with sculpted concrete papayas. Though the concrete papayas and rectangular tiers of its balustrade exist on other bridges, the lace-like balusters on the Harbor Drive Bridge are highly unusual and make this structure the most unique of the four. In addition, six relief diamonds decorate both sides of the bridge.



The Rosen Bridge carries Seaview Drive over an unnamed channel and presents yet another unique blend of features on its bridge railings, the hallmark of these four Duck Key Bridges. On this structure, the balusters are cylindrical concrete columns with ivy sculpted on them (*detail above, right*). On this bridge, the posts are topped with molded concrete pineapples (*detail on top of previous page*). The Rosen Bridge is a concrete tee-beam and is close to 56 feet long. A metal bridge plaque dedicating the bridge "In Memory of Cathy Rosen Duck Key Bridge Tender" is located on a railing post at the east approach.

The Harbor Drive Bridge possesses distinctive lace-like balusters.

THE NEW DEAL BRIDGES

Typical WPA bridge date marker

Across Florida during the 1930s, the United States government funded a large number of public works projects. The activities and products of these federal undertakings included the construction of a number of bridges. The eight bridges included in this group share two important features: each appears to have been built during the Great Depression, and they all have stone or rubble façades. In every case, the rubble is of local origin, and this local origin is a significant element in many Civilian Conservation Corps (CCC) and Works Progress Administration (WPA) undertakings nationwide. Five bridges built during the New Deal era are discussed below and on the following pages.


Torreya Stone Arch

The Torreya Stone Arch Bridge spans Rock Creek in Torreya State Park in Liberty County. The CCC erected the bridge in 1940 as part of its development of the park. Originally, this bridge carried the park entrance drive over the small creek, but the entrance has been reoriented and the bridge now serves as part of the park's trail system. The bridge consists of a concrete structure with limestone facing and a concrete curb. The limestone façade gives the bridge a rustic appearance that seems to emphasize the structure's rural, park setting.

The Blackwater Creek Overflow Bridge represents one of the most historically important stone-faced bridges in the state. This bridge retains its integrity, and

its setting has been especially preserved to enhance its association with the CCC and the New Deal. The Blackwater Creek Overflow Bridge is a 45-foot, three-arch, stone-faced culvert that carries State Road 39 over an overflow branch of the Blackwater Creek in Hillsborough County. The culvert arches are of corrugated steel and the principal structural material of the bridge consists of poured concrete. The stone facing set into the concrete walls of its elevations and its railings represents its most important feature. This bridge is an unusual type in Florida and remains the only stone-faced culvert in the west central section of the state.

Blackwater Creek Overflow Bridge

Because the use of local stone on the façade represents a common feature among Depression-era WPA structures, the 1930s has been offered as the most probable date of construction – even though some records indicate the construction date of 1915. Several research efforts have failed to verify any specific construction date but the materials and manner of construction seem to reflect the probable association with the WPA efforts located across the state.

Angled view of Blackwater Creek Overflow Bridge

Marion County provides three additional examples of WPA construction: the Daisy Creek Bridge, the Southeast 137th Avenue Road Bridge, and the Northeast 145th Avenue Bridge. All are culverts and all present stone faces. These three structures each possess an engraving of the initials "WPA" following "Marion County" and "1940" on the interior surfaces of their bridge railings. They are the only bridges surveyed on which the WPA left such a marking, and can therefore almost be viewed as a specific set of bridges within the broader category of New Deal Bridges.

The Great Depression and the New Deal Programs

The Great Depression of the 1930s defined a period of history and became the prelude to World War II. The economic storm paralyzed the industrialized countries of the Western World and, most of all, the United States. In Florida, the economic problems were compounded by the collapse of the state's 1920s Land Boom. In response, the federal government, under the leadership of President Franklin Roosevelt, launched a number of government relief programs under the name "New Deal." They included programs for the construction of bridges, parks, and roads and helped revive U.S. productivity by providing employment for the jobless and infusing capital into the American economy. The Works Progress Administration (WPA) and the Civilian Conservation Corps (CCC) represented two major components of Roosevelt's program, and produced several of the bridges listed in this section as well as several others across the state. The effort to stimulate a national economy through government programs represents one of the major historical trends of the 20th century.

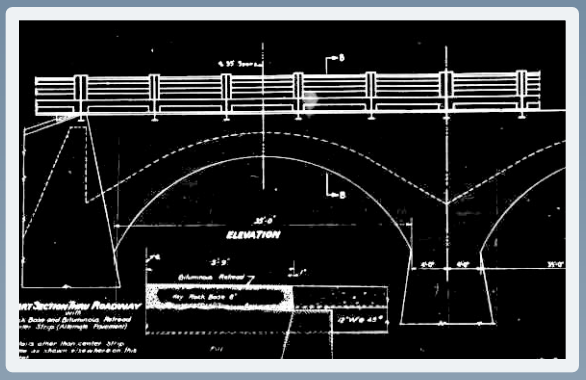
Southeast 137th Avenue Road Bridge

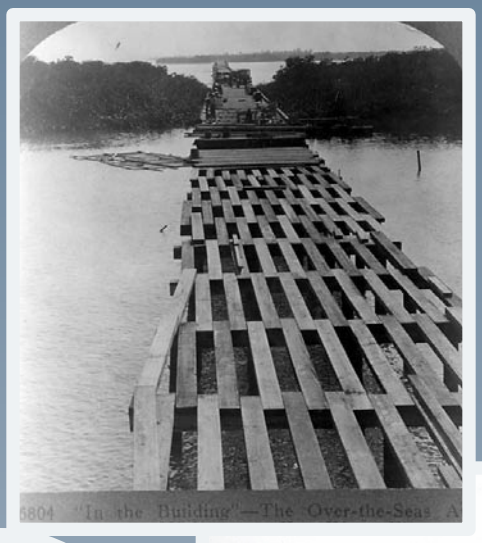
THE OVERSEAS HIGHWAY

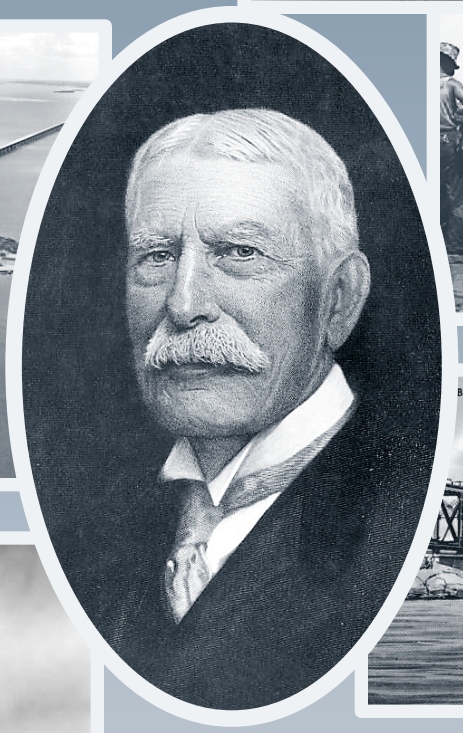
The Overseas Highway is a system of bridges in Monroe County connecting the islands of the Florida Keys to the Florida mainland. The historical importance of these structures arises from many sources, both technological and historical. They are associated with the historical development of southeast Florida and the Florida Keys. Tangentially, they are related to the Florida Land Boom of the 1920s, a horrific Labor Day hurricane that struck Florida in 1935, and the Great Depression of the 1930s. Finally, they stand as representatives of two massive engineering efforts, the construction of the Overseas Railway and its Depression-era conversion into the Overseas Highway. All of these factors combine to make this entire linear resource one of Florida's most important resources in terms of technological history.

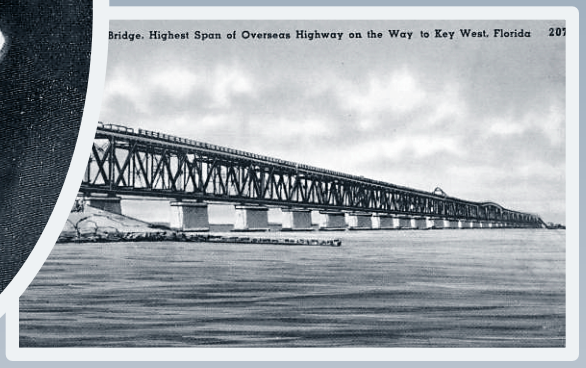
Railroad magnate Henry Flagler sponsored construction of the Overseas Railway in 1904 as an extension of his Florida East Coast Railway. In 1912, the extension was completed, thereby providing a rail link from Key West to Miami and, from there, to the rest of the United States. The railroad continued to function despite periodic interruptions due to hurricanes and other storms until a tremendous 1935 hurricane, spawning winds of 200 miles per hour, irrevocably damaged it, and the Florida East Coast Railway could no longer afford to maintain it. In an effort to keep a transportation link between the mainland and the Keys, the rail line was converted into a roadway facility by the Overseas Highway and Bridge Authority and integrated into the state highway system. To do this, a massive engineering effort, second only to the original construction of the

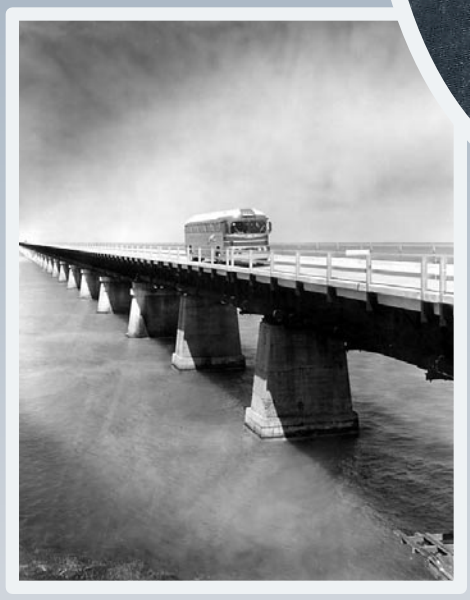
Twenty-three of the Overseas Highway/Railway bridges remain, of which three of the structures – the Bahia Honda Bridge, the Knights Key or Seven Mile Bridge, and the Long Key Bridge – were listed on the *National Register of Historic Places* in 1979. ◆

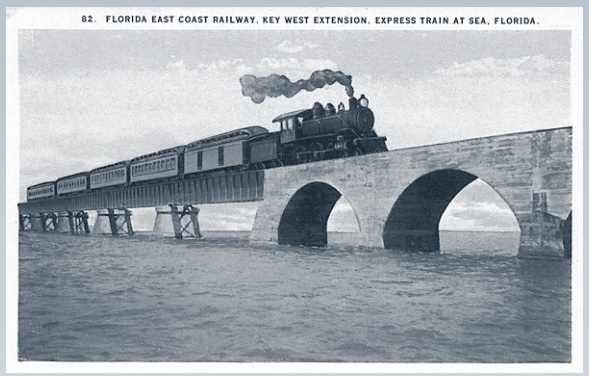












Clockwise from upper left: blueprint of Overseas Highway project (1937); Overseas Highway to Key West under construction; construction of smaller bridge, Overseas Highway (between 1936 and 1938); postcard of Bahia Honda Bridge (postmarked 1942); Florida East Coast Railway, Key West extension: express train at sea, Florida; Miami-bound Greyhound Lines bus traveling the Overseas Highway Bridge (1948); aerial view of the Overseas Highway and Pigeon Key (1954). Center: Henry Morrison Flagler, engraved portrait.

railroad bridges, was initiated. As the majority of the structures inherited from the railroad were arch structures, the Overseas Highway and Bridge Authority added decking to the top of the rail bed in order to widen the structures from 11 to 22 feet.

Most of the structures built for the Florida East Coast Railway at the beginning of the 20th century continued in service until the 1980s, when the Florida Department of Transportation undertook the construction of a new Overseas Highway. The state removed much of the old Overseas Highway at that time, and left 23 structures in place. Several of these were converted into fishing piers.

Long Key Viaduct

Many of the Overseas Highway Bridges are of the concrete arched spandrel type. They tend to be primarily functional, with little ornamentation. The Long Key Viaduct, which joins Long and Conch Keys, is an 11,950-foot-long concrete arched spandrel viaduct with a 20-foot-wide roadway. It features concrete abutments, a concrete slab deck, and a concrete railing. The bridge is currently composed of 222 spans.

Seven Mile (Knight's Key) Bridge

The Spanish Harbor Channel Bridge, also a concrete arched spandrel, connects Big Pine Key to Spanish Harbor Key. This 0.6-mile bridge is in deteriorated condition and is no longer open to traffic. Small portions of the original railings, consisting of the old rails taken from the railroad bed, still exist on the eastern

approach. The Seven Mile Bridge, also known as the Knight's Key Bridge, joins the islands of Marathon Key and Bahia Honda Key. This 6.7-mile-long structure features two distinct portions. The eastern portion exhibits steel deck construction, and the western portion is a concrete arched spandrel.

The Bahia Honda Bridge remains the most distinctive and impressive span of the Overseas Highway. Since a through truss provided the support system for this bridge, the Overseas Highway and Bridge Authority could not widen this bridge without removing or widening the truss. As a result, the Authority chose to construct the highway deck on the top of the truss, thereby converting the railroad's through truss into a deck truss for the highway. The continuing importance of the Overseas Highway is reflected in the present effort aimed at bringing these structures back into service as part of a historic and recreational trail.

Historic photo showing the conversion of the Bahia Honda Bridge from a railroad into a highway

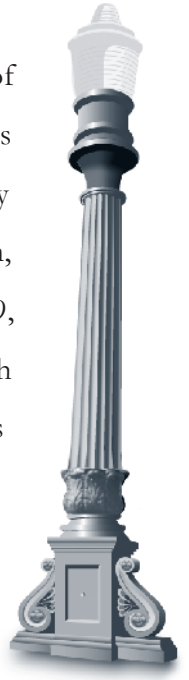
Bahia Honda Bridge with section removed to accommodate water traffic

THE SUNSET ISLAND BRIDGES

The Sunset Island Bridges in Miami-Dade County represent three of the four bridges originally connecting the Sunset Islands of Biscayne Bay with Miami Beach. All three have been determined to represent significant historic resources. The fourth bridge, Sunset Island Bridge Number 3, did not constitute a significant historic resource, and it was replaced in 1995.

The three remaining bridges are continuous concrete girders. Although technologically simple structures, their arched girders, decorative balustrades, and ornate, wrought iron lampposts unify and provide these bridges with a notably elegant appearance. Their association with the 1920s development of the Sunset Islands heightens the importance of these bridges. The Sunset Island Company planned these bridges, placing emphasis on their appearance in hopes of attracting development to the islands. Development on the islands did not actually begin until 1936 as a result of the collapse of the Florida Land Boom of the 1920s, just as these bridges became available.

The FDOT recently completed historic rehabilitations of two of these structures (Numbers 2 and 4). In general, these rehabilitations improved both structures in order to meet current roadway safety standards while maintaining their historical integrity. In addition, both bridges had suffered a great deal of deterioration since 1929, especially on the balustrades. All four balustrades were replaced with matching balustrades and, as with all the other repairs, the work was completed in accordance with historic preservation standards.



Secretary of the Interior's Standards for Rehabilitation

REHABILITATION: The act or process of making possible a compatible use for a property through repair, alterations, and additions while preserving those portions or features which convey its historical, cultural, or architectural values.

1. A property will be used as it was historically or be given a new use that requires minimal change to its distinctive materials, features, spaces, and spatial relationships.
2. The historic character of a property will be retained and preserved. The removal of distinctive materials or alteration of features, spaces, and spatial relationships that characterize a property will be avoided.
3. Each property will be recognized as a physical record of its time, place, and use. Changes that create a false sense of historical development, such as adding conjectural features or elements from other historic properties, will not be undertaken.
4. Changes to a property that have acquired historic significance in their own right will be retained and preserved.
5. Distinctive materials, features, finishes, and construction techniques or examples of craftsmanship that characterize a property will be preserved.
6. Deteriorated historic features will be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature will match the old in design, color, texture, and, where possible, materials. Replacement of missing features will be substantiated by documentary and physical evidence.
7. Chemical or physical treatments, if appropriate, will be undertaken using the gentlest means possible. Treatments that cause damage to historic materials will not be used.
8. Archeological resources will be protected and preserved in place. If such resources must be disturbed, mitigation measures will be undertaken.
9. New additions, exterior alterations, or related new construction will not destroy historic materials, features, and spatial relationships that characterize the property. The new work will be differentiated from the old and will be compatible with the historic materials, features, size, scale and proportion, and massing to protect the integrity of the property and its environment.
10. New additions and adjacent or related new construction will be undertaken in a such a manner that, if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired.

Sunset Island Bridge Number 1 is a fine example of a conventional bridge type – the concrete girder. In developing its real estate holdings on small islands in Biscayne Bay, the Sunset Island Company built this 128-foot-long, three-span bridge across Sunset Lake Canal in the 1920s. The best available documentation puts the construction date at 1929. The bridge's most notable features are the arched girder spans and the cast concrete railings with spindle-shaped balusters.

Sunset Island Bridge Number 2

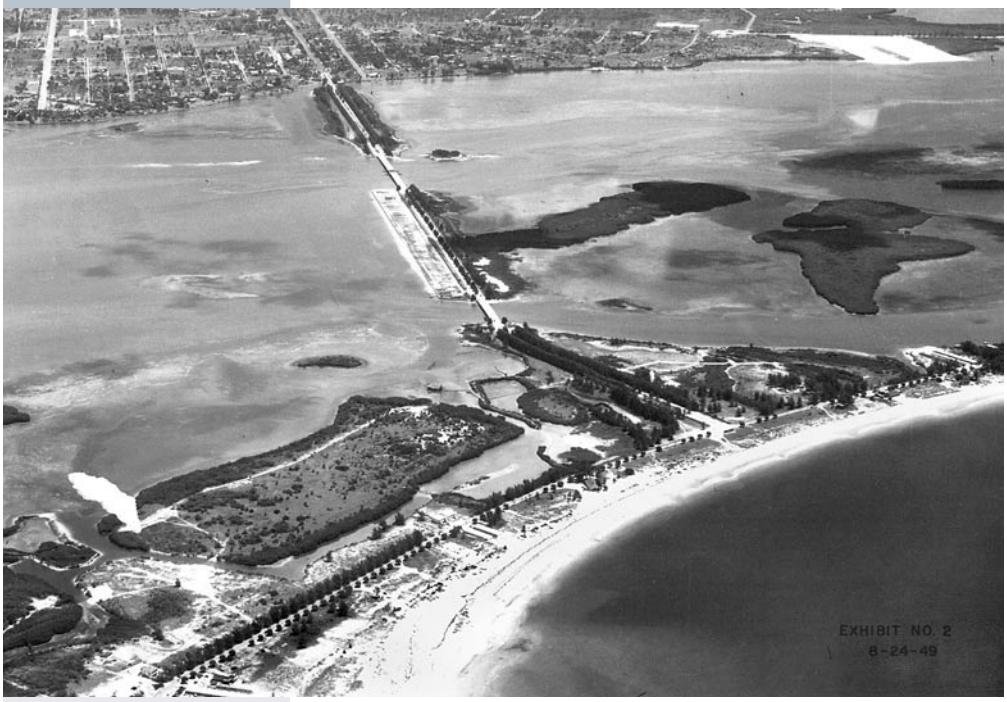
The Sunset Island Company constructed Sunset Island Bridge Number 2 in the same year (1929), in essentially the same way that it built Sunset Island Bridge Number 1. This second bridge also carries Sunset Drive over the Sunset Lake Canal. At 146 feet in length, this structure represents the longest of the three remaining Sunset Island Bridges. The arched girder spans, classical treatment on the cast concrete railings, and the decorative lampposts combine to make it an attractive structure.

Sunset Islands Bridge Number 4, the last bridge of this group, crosses Sunset Canal. The Florida Department of Transportation rehabilitated this structure in 1999. The 144-foot-long bridge utilizes arched girders, a decorative, classical-style railing with cast concrete balusters, and period lampposts. The structure retains its original character and provides a good example of an aesthetically pleasing treatment of a standard girder bridge.

Sunset Island Bridge Number 4

THE TREASURE ISLAND CAUSEWAY

Completed in 1939, the Treasure Island Causeway crosses Boca Ciega Bay in Pinellas County and connects St. Petersburg with Treasure Island. The firm of Kunde, Driver, Simpson and Associates designed the three bridges included in the 1.8-mile causeway. Though composed of standard bridges from a technical perspective, the causeway possesses historical associations and aesthetic features that combine to make the structure an important historic resource. Two of the spans of the causeway sport arched façades, and the whole causeway is linked to the historic development of Florida's Gulf Coast barrier islands and the man made bay islands of Treasure Island.



Aerial view of Treasure Island Causeway, 1949

Two of the bridges are concrete girder structures, while the third is a bascule with concrete girder approaches. The main span of the bascule structure is 80 feet in length and the entire structure is roughly 1,000 feet in length. The façades of the bascule and the east bridge reveal their slightly arched girder construction and, when coupled with the solid concrete railings present on all three structures, give the bridges a modernistic and artistic quality. The wrought iron railings placed upon the attached sidewalks, though painted white in keeping with the presentation of the bridges, detract somewhat from the appearance of the structures, as do the

more contemporary lighting fixtures. The corner railings reflect the stepped qualities of Art Deco design.

Detail of concrete girders on Treasure Island Causeway

In the mid-1970s, the bridge tender station underwent a major alteration when a glass second story was added to it. The first story is essentially a vernacular concrete structure. Therefore, the second story glass addition appears somewhat awkward on top of the earlier tender station. Then, in 1982, the original gear mechanism of the trunnion bascule was replaced with a hydraulic drive system and the electrical system was completely replaced, along with the traffic warning signals, the barricades, and the navigational lighting. Finally, computer controls were installed, as well as an emergency, or back-up, generator.

Treasure Island Causeway

Another view of the Treasure Island Causeway showing open bascule

THE VENETIAN CAUSEWAY

The Venetian Causeway, linking Miami and Miami Beach, was built in 1926 during the Florida Land Boom of the 1920s, and is the oldest causeway in Miami-Dade County. It consists of 12 bridges that cut across one natural and five man made islands. The entire causeway runs about 2.5 miles in length, from Northeast 15th Street in Miami to Dade Boulevard in Miami Beach.

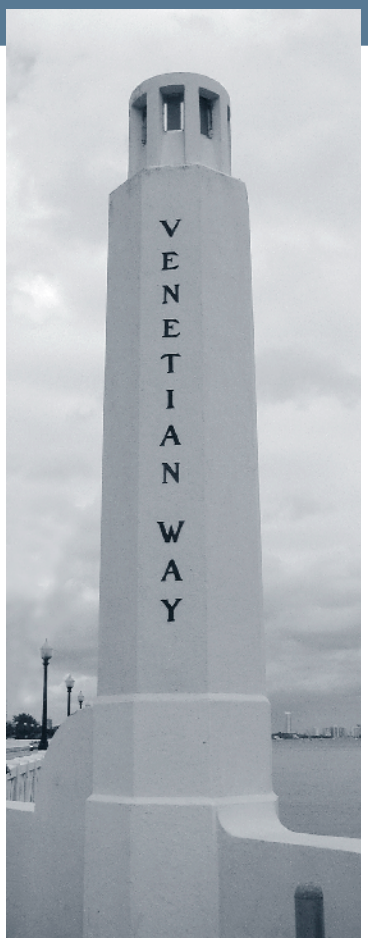
In 1913, on the same site as the current causeway, Miami Beach pioneer John Collins built one of the longest timber deck trestles in the nation to link his beach community with the mainland. This was replaced in 1925–1926. The Bay Biscayne Improvement Company and its contractor, the Raymond Concrete Pile Company of New York City, seemed to stress the functional purpose of the causeway, which was to unify the island communities.

In 1996 and 1997, the Florida Department of Transportation undertook a major rehabilitation and reconstruction project on the 12 bridges of the Venetian Causeway. The vast majority of the work completed on these structures involved the in-kind replacement of damaged and deteriorated components. In addition, the rehabilitation project resulted in the restoration of a number of historic elements that had either been altered or removed in the last 20 to 30 years. For example, circa-1920s lighting was installed on the bridges and the tender stations were restored. The principal alterations to the resource involved the West End Bascule Bridge, of which the historic bascule portion was removed, along with a portion of the adjoining fixed spans, in order to supply a wider clearance

for watercraft on the Intracoastal Waterway. Despite the alterations, the series of bridges retain their listing on the *National Register of Historic Places* and so, the Venetian Causeway must be considered one of Florida's premier historic bridge resources.

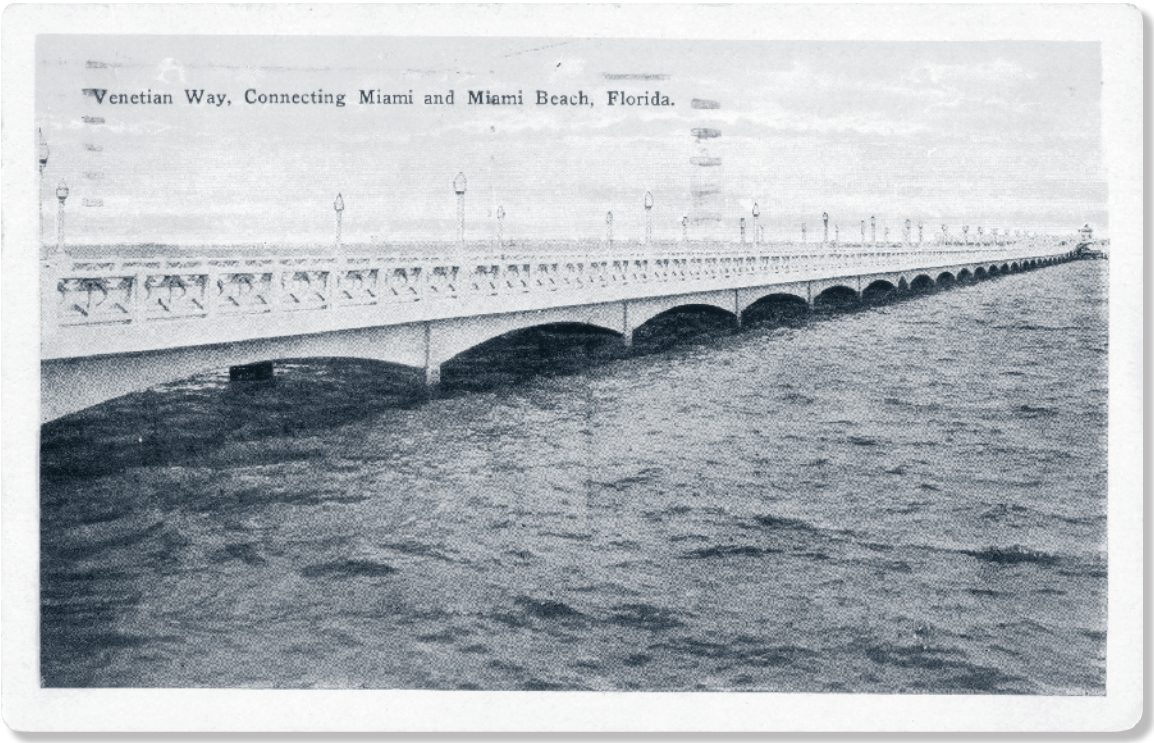
Two of the bridges, Bridges 1 and 10, are steel bascule spans with fixed-span concrete arch approach spans. The other 10 bridges are fixed-span concrete arch types of varying lengths. At the western end of the causeway is a pair of tapering octagonal concrete towers that flank the roadway's entrance onto Bridge 1. These fixtures are topped by lights and resemble lighthouses. The north and south towers are inscribed with the words "Short Way" and "Venetian Way," respectively.

Venetian Causeway Bridge



Detail of concrete south tower on Bridge 1

Their concrete arched girder spans and their distinctive railings link the bridges stylistically. The spans are constructed of cast-in-place tee-beams. Each span has five beams placed 8.5 feet on center. The deck cantilevers are 3.25 feet on each side of the exterior tee-beams. The superstructure is supported on square pier columns that rest on concrete pile caps. The concrete railings feature a pierced geometric design at a low height, which allows a continuous view of the bay. Each panel consists of radiating diagonals, which form a double-X pattern. These panels are divided by square capped posts, with larger posts located at the end of each span. The railings are splayed at the end abutments.



Postcard, postmarked January 1929, of Venetian Causeway in Miami

Photo opposite page: The Cass Street Bridge spans the Hillsborough River in Hillsborough County

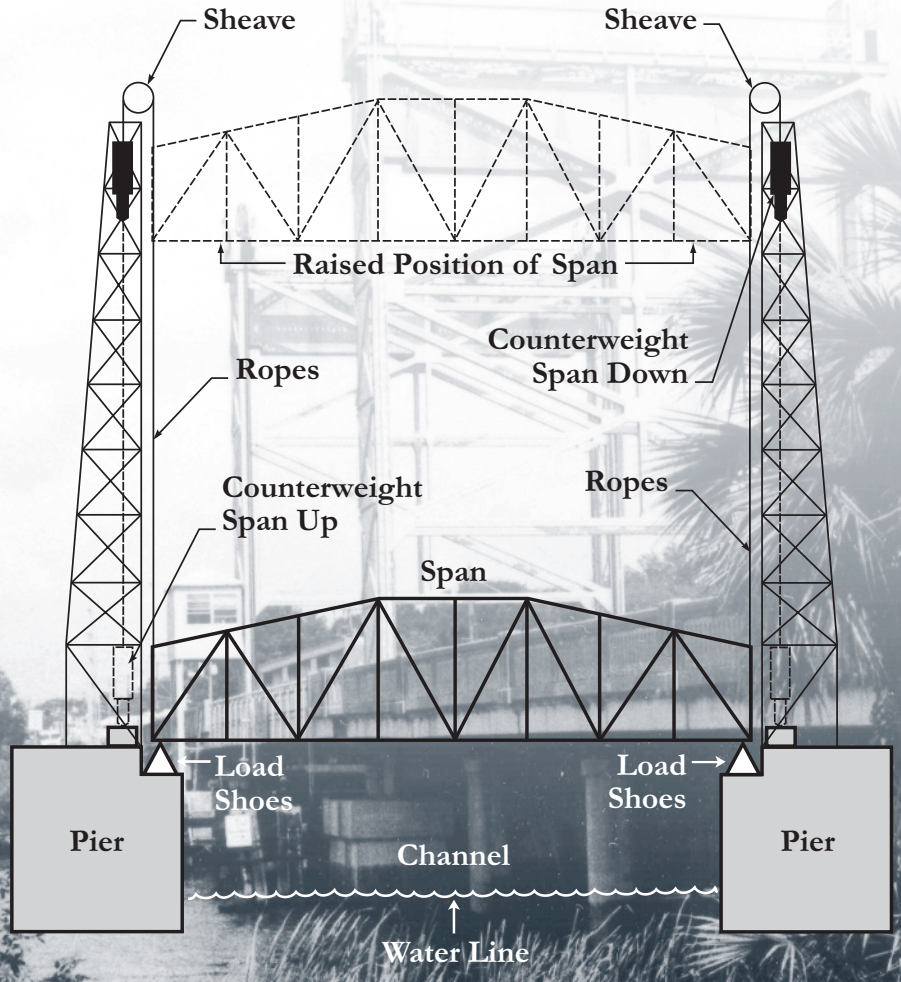
CHAPTER 4
MOVABLE BRIDGES

Due to Florida's many navigable waterways and its historical reliance on these routes for transportation, it was imperative that bridges accommodate both waterway and roadway traffic. Historically, bridge designers met this engineering challenge with movable bridges. Consequently, the movable bridge was a very popular type in Florida. Three basic types exist: the vertical lift, the swing, and the bascule.

Postcard with 1924 photo of the Warren Pony Swing Truss Bridge in Hialeah taken from the roof of the Curtiss-Bright Company Administration Building

Photo opposite page: The Hillsborough River Lift Bridge in Hillsborough County

VERTICAL LIFT BRIDGES



Vertical lift structures were first constructed in Europe. Beginning in the 1870s, increasing numbers were constructed in the United States. Vertical lifts generally include a central span that is raised vertically to provide channel clearance for marine traffic. This span is hoisted by means of cables housed in towers located at each end of the main, or lift, span. Often, the towers also hold the drive machinery for the lift bridge, though this machinery was sometimes placed on the main span. These spans are typically of a truss configuration.

The Hialeah-Miami Springs Vertical Lift Bridge, Miami-Dade County

The oldest of Florida's surviving lift bridges, the Hialeah-Miami Springs Vertical Lift Bridge was designed and constructed in 1927. This bridge is also known as the Miami Canal Bridge and East 1st Avenue Bridge.

Hialeah-Miami Springs Vertical Lift Bridge

It carries East 1st Avenue across the Miami River Canal and connects the cities of Miami Springs and Hialeah. Initially, it carried Northwest 36th Street over the Miami Canal in Miami-Dade County but was relocated to its current location in 1954. Although no longer operable, it is the oldest example of vertical lift technology extant in the state and the only example of a Parker through truss lift span. It reopened as a companion structure to the Miami River Canal Warren Pony Swing Bridge and serves as an important engineering, transportation and communication link between Miami Springs and Hialeah.

The main, or lift, span features a Parker type, pony truss and the operating system incorporates span drive technology. As with most lift bridges, the towers at each end of the main span visually dominate the structure. Originally, the drive machinery stood in the towers but was removed at the time of relocation. The Champion Bridge Company designed, fabricated and built the Hialeah-Miami Springs Vertical Lift Bridge. The truss consists of I-beam chords and posts with ladder-type bracing and riveted

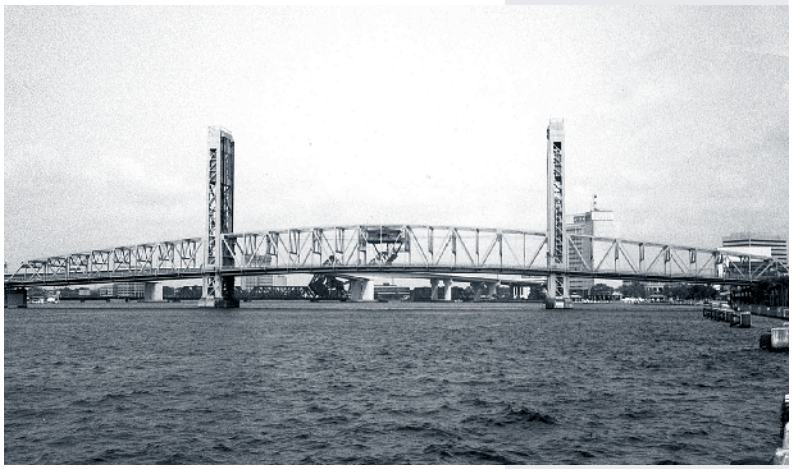
posts. Both the towers and truss consist of steel with a concrete substrate and both maintain their original appearance. The wooden decking was replaced with asphalt in 1954 and the counterweights were removed in 1983. Currently, the FDOT is rehabilitating this bridge while maintaining its historic character.

CHAMPION BRIDGE COMPANY OF OHIO

Active in Florida from the 1890s to the early 1930s, the Champion Bridge Company of Ohio constructed many movable bridges. Along with the Austin Brothers Company in Atlanta, it took the lead in building swing spans in Florida during that period. One company historian claimed Champion introduced the rolling lift bascule bridge to Florida. This northern company opened offices in the South and appointed southerners as agents and engineers. Hugh Quinn, an engineer trained at the University of Georgia, joined Champion and later helped establish a firm in Fort Lauderdale that became Powell Brothers, an important road and bridge contractor beginning in the 1920s. ◆

The Main Street Vertical Lift Bridge, Duval County

One of the premier historic bridges in Florida, the Main Street Vertical Lift Bridge crosses the St. Johns River in Jacksonville. This bridge represents a resource important not only for its technology, but also for its visual importance as a defining element in the Jacksonville skyline. The entire bridge consists of 14 spans–11 steel stringers and three Warren through trusses–and extends a total of 1,680 feet. The steel frame lift towers rise to 200 feet, and the central lift span alone measures 365 feet in length. The lift mechanism is operated via a span drive system located on the movable span. The towers, in turn, house the concrete counterweights. It is the largest of the four remaining vertical lift bridges in the state and remains operable.



Main Street (or John T. Alsop) Bridge, Jacksonville

Construction of the Main Street Bridge cost approximately $1.5 million and required 3,800 tons of steel, 460 tons of metal reinforcements, and 30,000 tons of concrete to create the appearance of strength, endurance, and grace possessed by this

In 1958, the Main Street Vertical Lift became the John T. Alsop Bridge in honor of the mayor of Jacksonville at that time. ◆

structure. Duval County voters approved the project in 1935. In 1938, the U.S. Bureau of Roads agreed to pay one-half of the costs associated with the project. In 1941, the Shell Products Company of Ohio, the Foundation Company of New York City, and the Mt. Vernon Bridge Company of Ohio contributed money to complete the construction of the bridge.

The Hillsborough River Lift Bridge, Hillsborough County

The Hillsborough River Lift, or T. N. Henderson, Bridge, carries State Road 600 over the Hillsborough River in Tampa. It is the only tower-driven, mechanical lift bridge remaining in the state and is one of the two operable vertical lifts in the state. The bridge consists of nine spans and extends 358 feet. The main, or lift, span features a 94-foot-long Warren pony truss, and the lift mechanism remains in excellent condition. J. H. Dowling of the State Highway Department designed the structure. A Tampa construction company, the Cone Brothers, built the bridge.

Hillsborough River Lift Bridge, Hillsborough County, constructed in 1939

The bridge underwent rehabilitation in the late 1990s and remains in use alongside a new bascule bridge. As a result of its technology, its association with the historic growth of the Tampa area, and the rarity of this bridge type, the Hillsborough River Lift Bridge represents one of Florida's important historic highway bridges.

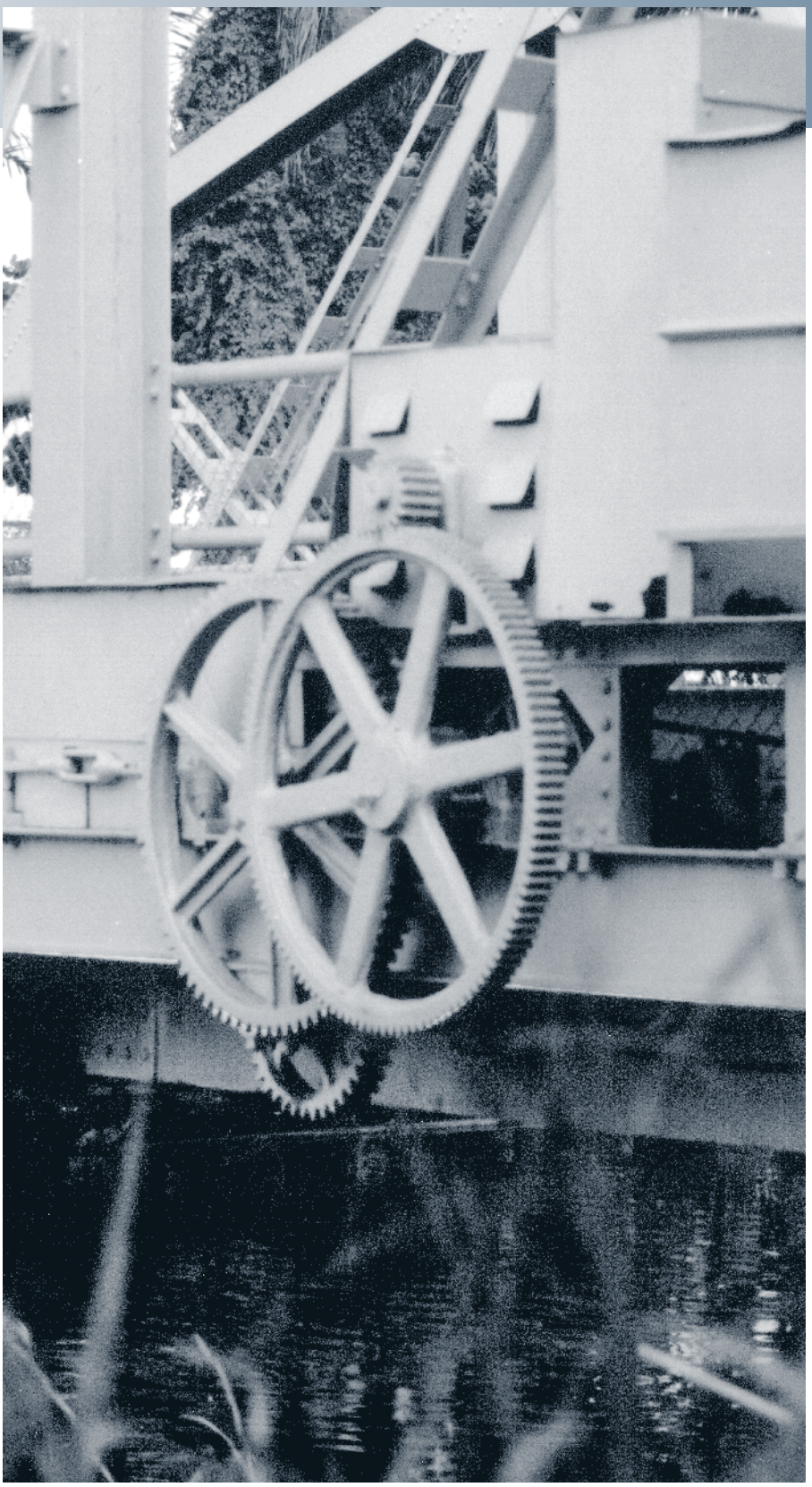
Billy Creek Lift Bridge, Lee County

The Billy Creek Lift Bridge remains one of the few vertical lift bridges in the state. It has been inoperable since 1987. To date, only two other bridges featuring a tower-driven hydraulic lift have been noted in the United States. The St. Petersburg firm of C. T. Felix Construction Company constructed this bridge in 1941 according to designs from the State Road Department. The Joyce-Cridland Company, of Dayton, Ohio, provided the hydraulic equipment.

The structure consists of two concrete girder approach spans and a 32-foot-long steel girder main span. Interestingly, the lift mechanisms for the structure consist of four separate jacking units housed in each of the four lift towers. When the bridge was operable, these jacks hoisted the main span only about five feet. The bridge was raised by the flow of pressurized oil and, as the oil was drained from the unit, gravity lowered the deck.

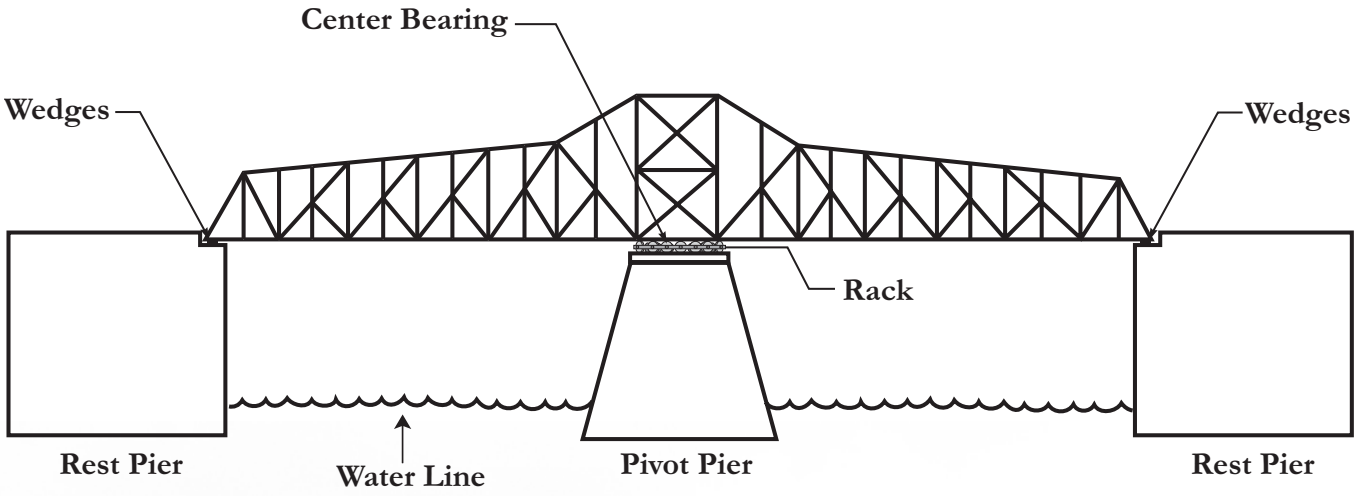
With a total length just under 120 feet, the Billy Creek Lift is the smallest lift bridge in the state. Perhaps the bridge's most distinctive features are its four hydraulic lift towers, rare elements on vertical lift bridges. The structure never possessed a tender station because local merchants operated the lift on a prearranged schedule.

The Billy Creek Lift Bridge in Lee County is the smallest lift bridge in Florida



Detail of cogs on the Hialeah-Miami Springs Vertical Lift Bridge

SWING BRIDGES



More common than vertical lifts but still an endangered bridge type, swing bridges represent another type of historic movable-bridge technology. Swing bridges accommodate river navigation by rotating (or "swinging") the main, or movable, span on a pivot pier into a position parallel to the channel. Unfortunately, this central pier usually lies in, and therefore often blocks part of, the navigable channel. Consequently, bridge engineers developed several modifications of this technology. Sometimes the designers simply extended the length of the movable span so that the central pier could be located outside the channel. With time, this effort changed the nature of the central spans as more technology was applied to extending their length. As a result, the most recent and longest examples of swing technology are the deck girder swing spans.

An earlier method of adapting swing bridges for channel clearance involved changing the location of the pivot pier in relation to the swing span. This variant form became known as "the bob-tailed" swing because of the asymmetrical location of the pivot pier. Swing bridges also utilize one of two main types of pivot piers, center bearing or rim bearing. Center-bearing pivots support the swing span via a cross-girder situated over a disc. Balance wheels are utilized along the rim of the pivot pier to stabilize the center span while it is opening. The movable span on rim-bearing pivots is supported by a circular girder that is, in turn, supported by rollers placed along its outer edge.

Besides the above-mentioned difference in forms and machinery, swing bridges also present varying types of structural technologies. Most swing bridges in Florida use a truss configuration on the main span, though rarely on the approach spans. More recent examples generally use a girder structural system.

Slow, cumbersome in operation, and restrictive of the channel, swing bridges passed their peak use by the 1930s. Currently, 14 swing bridges remain in Florida. The majority are electrically-operated, center-bearing, standard swing bridges with some type of truss system utilized on the main span. Also included are three bob-tailed swings, three manually operated swings, and four rim-bearing pivots. In addition, there are three deck girder main spans, seven pony trusses, two deck trusses, and two through trusses.

Photo previous page: The St. Mary's River Bridge in Nassau County

Indian River Bridge, Brevard County

With a span of 1,772 feet, the Indian River Bridge in Titusville is the longest span swing bridge in the state of Florida. It consists of 43 concrete girder spans and a 220-foot-long steel girder, swing-type main span. The structure features the late 1940s standard plan railings composed of heavy concrete posts linked by two horizontal rows of concrete rails. The tender station is an ordinary, flat-roofed cube located at the side of the bridge. The Indian River Bridge is one of three steel girder swing bridges built across the Indian River after World War II. Constructed in 1949, it alone survives of the three built. It is also one of three deck girder swing bridges remaining in the state, the others being located in Nassau and Charlotte counties, respectively.

The Indian River Bridge in Titusville is the longest span swing bridge in Florida.

The Southwest 11th Street Swing Bridge, Broward County

The Southwest 11th Street Bridge crosses the New River in Fort Lauderdale.

A reputation for craftsmanship and the durability of its structures made the Champion Bridge Company of Ohio a principal builder of swing bridges in Florida during the 1920s. The company built this swing, a

Warren pony truss with verticals, in 1925 to carry Southwest 11th Street across the North Fork of the New River in a growing residential area of Fort Lauderdale.

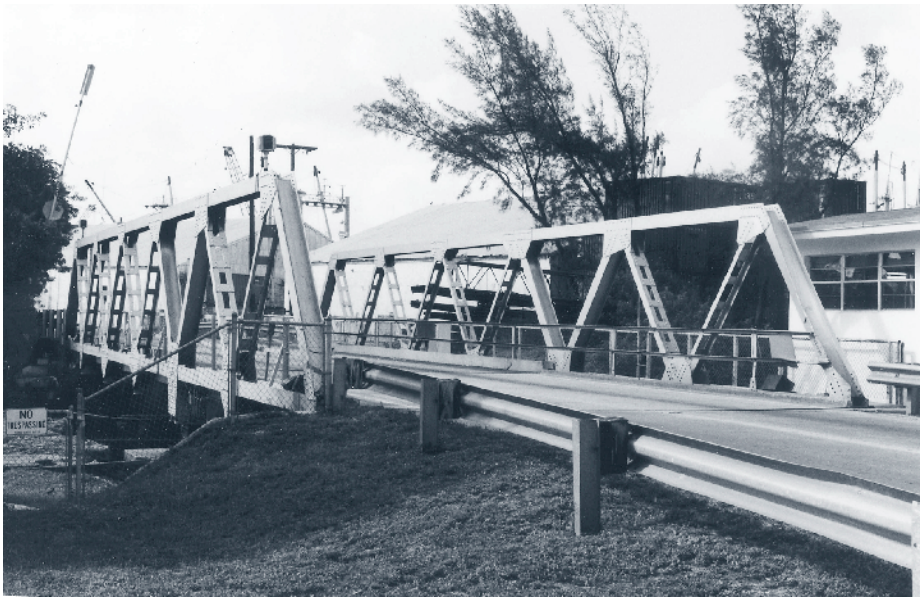
The 148-foot structure exhibits the standard construction technology of Champion in its swing bridges. The truss is constructed of steel beams for the chords and end posts, angles in the vertical posts and diagonals, stay plates in the columns, and gussets at the joints. It is rigidly connected. A rim-bearing assembly sits on the concrete pivot pier in mid-channel. Initially hand operated, a Ford gasoline engine was installed in the 1930s and an electric motor in the 1950s. Renovations that took place during 1983-1984 left the structure's original appearance intact.

Northwest 54th Street Bridge over the Miami Canal, Miami-Dade County

This bridge, also known as the Miami River Canal Warren Pony Swing Bridge, carries Northwest 54th Street across the Miami River Canal and connects the cities of Hialeah and Miami Springs. As such, it represents a central symbol of the downtown centers of these communities. Designed by the Pompano and Dania Bridge Company of Broward County, the bridge was fabricated and installed by the Champion Bridge Company of Ohio in 1924. The 112-foot swing span consists of a Warren pony truss with verticals that include steel beam top and bottom chords and end posts, angles in the vertical posts and diagonals, rigid connections, and gusset plates. Rather than placing the pivot pier in the usual location at mid-channel, it is bob-tailed and located near the bank in order to provide extra clearance for vessels using the canal. The rack and pinion of the swing mechanism were removed, and the bridge was widened in 1941. The wooden sidewalks originally appended to the outside of the truss also were removed in 1941. In 1981, asphalt replaced the original wooden deck. Currently, the FDOT is rehabilitating this bridge while maintaining its historic character.

The Northwest 54th Street Bridge spans the Miami River Canal in Miami-Dade County.

Although few bob-tailed spans remain in the state, they represent a noteworthy adaptation of a major and important bridge technology. The Northwest 54th Street Bridge's importance derives from its builder, age, technological type, and association with the rapid growth of Hialeah and Miami Springs during the 1920s.



The South River Drive Swing Bridge carries Northwest South River Drive across the Tamiami Canal in Miami.

South River Drive Swing Bridge, Miami-Dade County

This structure, carrying Northwest South River Drive across the Tamiami Canal in Miami, consists of a 120-foot-long Warren pony truss swing bridge. The rim-bearing pivot is placed on a concrete pier near the bank in bob-tailed fashion so as to give greater clearance in the channel. The steel-built truss consists of beams used for the chords and end posts with angles utilizing the truss web. All joints are rigidly connected.

Department records indicate the bridge was built in 1930. This date remains unverified and the builder is unknown. As one of only three bob-tailed swing bridges remaining in the state, the South River Drive Bridge represents a valuable example of technological history.

The Fort Denaud Bridge, Hendry County

The Fort Denaud Bridge over the Caloosahatchee River consists of five prestressed concrete slab approach spans, with a low concrete railing. The spans are joined to a 132-foot-long Warren pony swing span on a rim-bearing pivot. The total length of this bridge is 435 feet. The Powell Brothers Construction Company of Fort Lauderdale, established by former Champion Bridge Company engineer Hugh Quinn, built the structure in 1940. The State Road Department dismantled the bridge in 1958 and re-erected it at its present location in 1963. (Atkins and Keeler [1981] date this reconstruction to 1959, but departmental records indicate 1963.) The structure was rehabilitated in 1987. The most important alteration during the rehabilitation was the addition of shallow cable stay supports along the top chords of the truss.

The Fort Denaud Bridge on the Caloosahatchee River

The Sharpe's Ferry Bridge, Marion County

The Austin Brothers Bridge Company of Atlanta constructed this 117-foot-long swing span in 1926. Located at Sharpe's Ferry, it crosses the Ocklawaha River east of Ocala, on the edge of the Ocala National Forest. The structure bears the typical features of Austin Brothers' swing bridges. The Warren pony truss, with verticals, uses steel structural members with joints that are rigidly connected; the center-bearing assembly is mounted on a concrete pivot pier.

The Sharpe's Ferry Bridge crosses the Ocklawaha River on the edge of the Ocala National Forest.

A major renovation took place in the early 1970s that primarily affected the secondary spans. Three steel stringer approach spans, supported on concrete pile bents, connect with the swing. The additions also included aluminum safety rails as well as a new, angularly-shaped concrete pivot pier. These changes maintained the original appearance of the bridge. The Sharpe's Ferry Bridge is one of two remaining swing bridges with a Warren pony truss main span built by the Austin Brothers Bridge Company in the state.

The St. Mary's River Bridge, Nassau County

The St. Mary's River Bridge carries U.S. 17, also known as the Atlantic Coastal Highway, across the border of Florida and Georgia. When constructed, U.S. 17 was the principal federal highway providing northern access into Florida. A 563-foot-long structure consisting of six concrete girder approach spans and three steel trusses, this bridge helped open Florida to travelers from the northeastern part of the nation.

Also a part of the Dixie Highway, this unusual structure reputedly made possible the "only ferry-less route to Florida," by replacing an undependable ferry at what was called Wilds Landing.

Although partially owned by Georgia, the State of Florida, with federal aid, constructed the St. Mary's River Bridge and continues to maintain the bridge. The St. Mary's River Bridge was constructed by the Pensacola Shipbuilding Company. Acting as subcontractors, A. Bentley and Sons of Ohio built the substructure and approaches, and the Virginia Bridge and Iron Company of Roanoke fabricated and erected the trusses. The bridge opened to traffic in February 1927 after approximately 11 months of construction. Both states conducted ceremonies to mark its opening. For several years after its construction, Florida State Road Department publications featured this bridge in its publications for its engineering and because it opened the border between the two states.

The structure is unusual within Florida for its combination of a Warren through truss span (202-foot) with a polygonal top chord and pony truss secondary spans. Another distinctive feature is the camelback design used on the pony trusses. The camelback derives from the curvature found in the top chord resulting from changing

A significant structure for both engineering and historical reasons, the St. Mary's River Bridge played a crucial part in opening Florida to tourists and settlers from northern areas and enabled Jacksonville to become a gateway to Florida's Atlantic Coast. Furthermore, it is one of only two bridges remaining that the Virginia Bridge and Iron Company constructed, both of which are manually operated structures (the other one being the Belle Glade Swing Bridge in Palm Beach County). The distinctive technical features of the bridge and its combination of truss styles make it an interesting example of truss building and swing span design from the 1920s. ◆

St. Mary's River Bridge

the inclination of the chord in each panel. The bridge used a channel bar for the chords, beams for the vertical posts, and angle bar in the struts, sway braces and diagonals. The center-bearing pivot mechanism is manually operated, but rarely, if ever, used. A solid concrete railing, with rectangular panels cast in for detail, runs along the approaches.

The Belle Glade Swing Bridge, Palm Beach County

The Belle Glade Swing Bridge crosses the Okeechobee Rim Canal at Point Chosen. It provides access from Belle Glade on the mainland to Torry Island, located on the southeastern edge of Lake Okeechobee. Constructed in 1916, this bridge is one of only two structures remaining in the state built by the Virginia Bridge and Iron Company. The project was completed by the W. S. Lockman Company. Apparently, the bridge originally stood over the St. Lucie River at Stuart and was reconstructed at its present site in 1935. At that time, a new concrete pivot pier and timber approach spans were added.

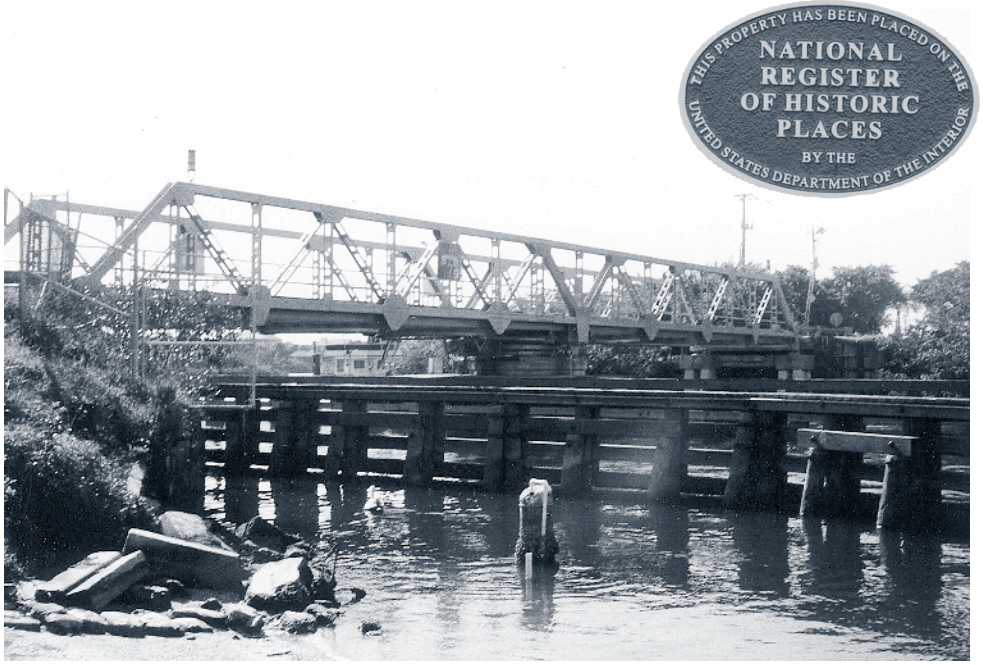
The Belle Glade Swing Bridge in Palm Beach County provides access from the mainland to Torry Island on Lake Okeechobee.

The 428-foot Belle Glade Bridge consists of 28 approach spans and a 152-foot-long, center-bearing swing span. What appears to be essentially a Pratt truss has been set at approximately three-quarter level with the roadway, leaving the top chord about 3 feet above the deck. Channel bars are used in the top and bottom chords and in the parallel end posts, and angles compose the diagonals and counterbraces. In a technique rarely found, lacing bars on the exterior sides of the members reinforce the verticals. Such reinforcement is typically located on the interior. The single lane bridge still has a timber plank deck and remains manually operated. It is the last functioning example of a hand swivel in the state.

Rehabilitation of the Belle Glade Swing Bridge in 1983 and 1999 resulted in the replacement of the wood pilings and beams with concrete and steel ones. The swing span and gear system also were refurbished. None of the rehabilitation significantly affected the historical integrity of the bridge.

The Blackburn Point Bridge, Sarasota County

This 142-foot-long, Warren pony truss swing span carries Blackburn Point Road over the Intracoastal Waterway, linking the old Tamiami Trail (U.S. 41) with Casey Key. Sarasota County built this bridge as part of an effort to spur development and tourism on the Gulf Beaches. For the sum of $22,890 in 1925, the Champion Bridge Company supplied Sarasota County with one of its typical swing bridge designs. A second Champion bridge (now demolished) crossed Little Sarasota Bay further to the north of the Blackburn Point Bridge. The Blackburn Point Bridge is a Warren truss, with verticals, that operates on a center-bearing pivot located in mid-channel. Rigidly connected and sturdily built, it uses steel beam chords and angle bars, strengthened with stay plates, for the verticals.



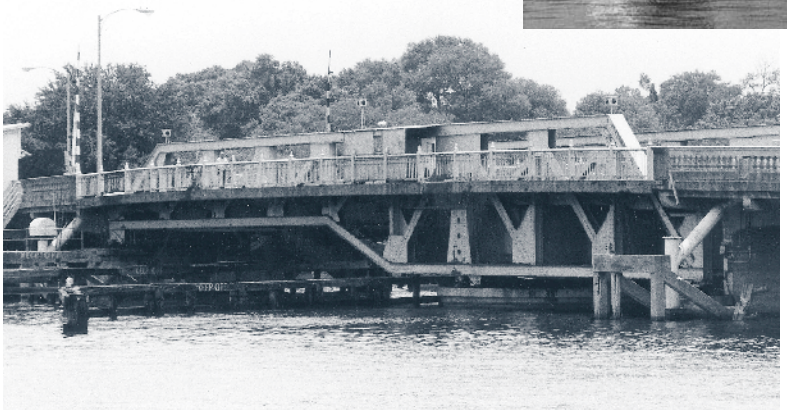
The Blackburn Point Bridge in Sarasota County spans the Intracoastal Waterway, linking the mainland to Casey Key.

The Blackburn Point Bridge represents one of seven remaining pony truss swing bridges in the state. Repairs during the last 12 years include the replacement of the majority of its structural steel truss members and its entire fender system. The mechanical and electrical components also have been repaired. The Blackburn Point Bridge remains in good condition and has served travelers for 65 years, testifying to the durability of the steel truss swing span. Once a familiar sight in Florida, particularly over coastal waterways requiring many simple, sturdy, movable spans, the truss swing bridge is found in dwindling numbers on the state's roadways.

Other examples of swing bridges in Florida

The Twenty Mile Bend Bridge, or Loxahatchee River Bridge (above), features a 188-foot-long Warren through truss mounted on a center-bearing pivot. The steel for this bridge carries the mill marks of "Carnegie USA."

Relocated in 1949 to its current location, the Mathers Bridge (below) represents a fine example of the work of the Austin Brothers Bridge Company of Atlanta. Despite changes in its history, the movable truss span of this bridge has retained its structural integrity and original appearance.

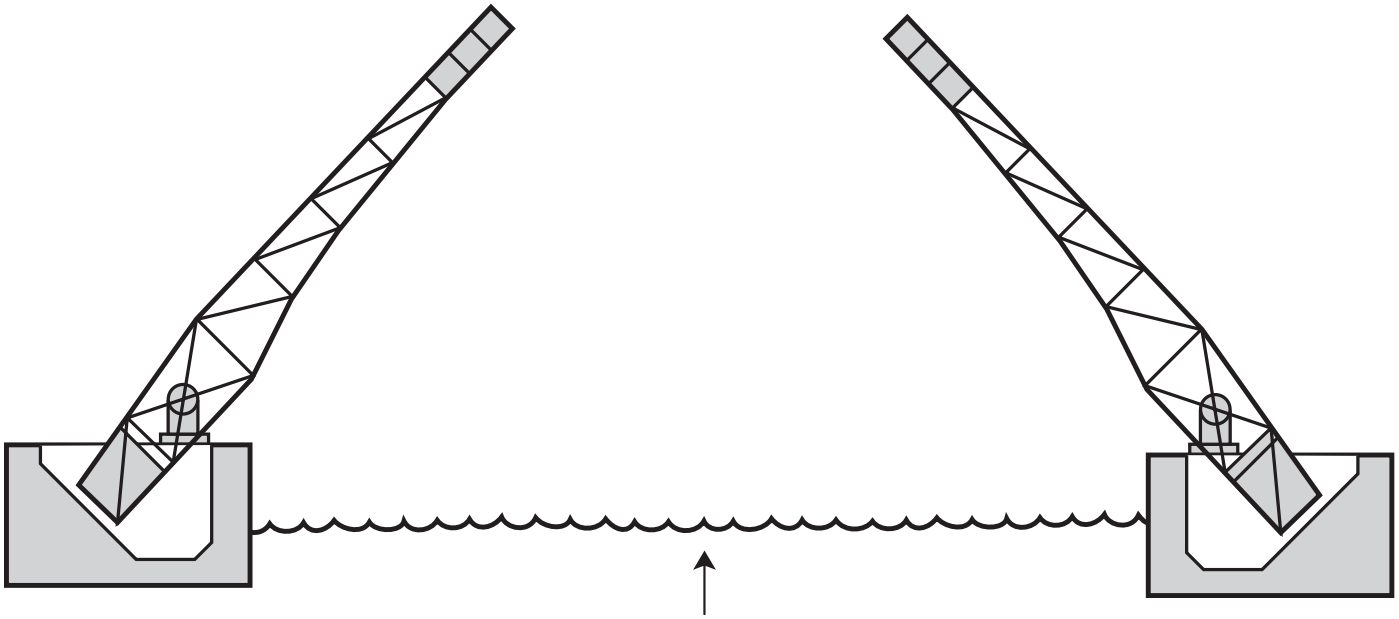


The Mt. Vernon Bridge Company of Ohio, an important Florida bridge builder, fabricated and installed the Michigan Avenue Swing Bridge across the Hillsborough River in Tampa in 1926. It sports an unusual bob-tail swing main span with a distinctive Warren pony truss.

Bridge plate from the Michigan Avenue bridge

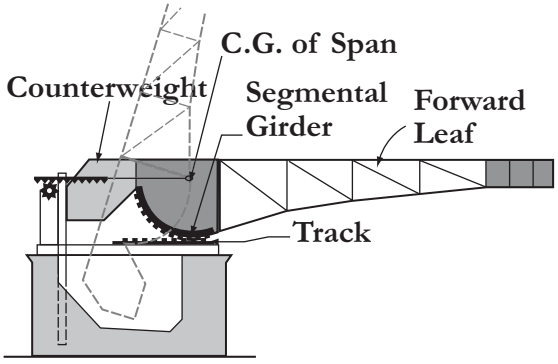
Photo on opposite page: The Frank M. Nelson Sr. Bridge combines the typical bascule design elements with the unique technology of a single-leaf bascule main span.

BASCULE BRIDGES

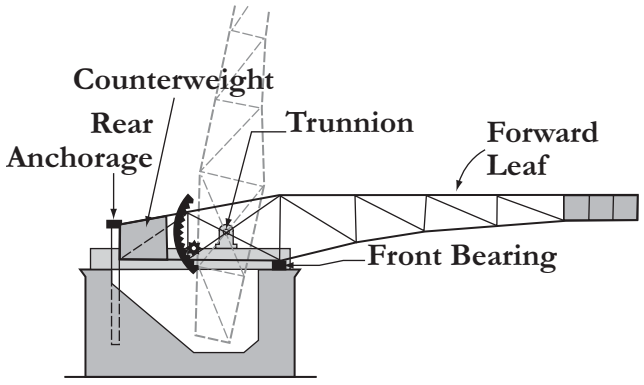


Believed to possess a number of advantages over other movable types, the bascule, or drawbridge, provides an open channel with unlimited clear headway, swift and dependable operation, and simple mechanisms with few moving parts. It consists of a single or double leaf which rotates from a horizontal to a near vertical position. The weight of the counterweight is adjusted by removing or adding balance blocks in pockets to position the center of gravity of the moving leaf at the center of rotation. In a single-leaf, the entire span lifts above one end, while the double-leaf has a center joint and half of the span rotates about each end. The most common types of bascule bridges are the rolling lift (Scherzer) bridge, the simple trunnion (Chicago) bridge, and the multi-trunnion (Strauss) bridge.

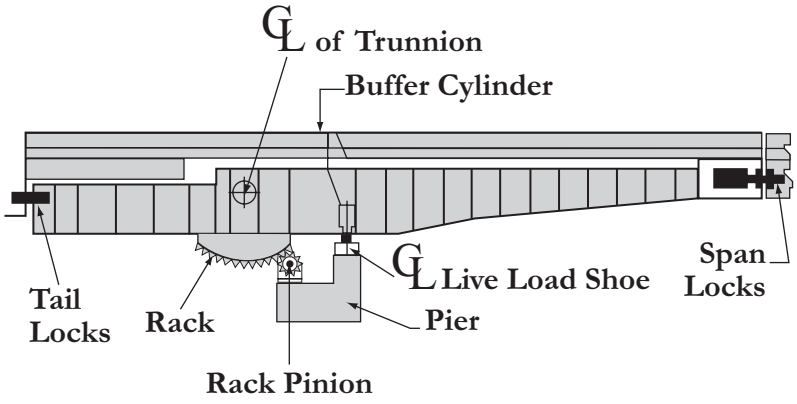
The bascule also offered strength and safety and could be aesthetically treated. Engineering firms, mainly from Chicago, where many of this type of bridge were built, sold patented designs. Inventor William Scherzer claimed that his rolling-lift type operated with less friction and, therefore, reduced power. But the trunnion type, improved by Chicago engineer Joseph Strauss, who designed the Golden Gate Bridge, became dominant. In this type, the bascule span rotated around a trunnion or axle and made use of a heavy counterweight.



Double-Leaf Bascule



Trunnion Bascule



Rolling Lift Bascule

Southwest 1st Street Bridge, Miami-Dade County

After a successful $2.15 million bond election in 1926, Miami established plans to construct five bridges over the Miami River to facilitate expansion to the south and west of downtown. As a navigable waterway, often crowded in those days with vessels hauling supplies into the city, the river required movable spans. For design and specifications, Miami selected the engineering firm of Harrington, Howard and Ash of Kansas City, nationally recognized for its work in planning drawbridges. The Southwest 1st Street Bridge was completed in 1929 at an approximate cost of $300,000.

The Southwest 1st Street Bridge in Miami was completed in 1929 at a cost of $300,000.

Thirteen steel stringer approach spans join a 150-foot, trunnion-type, double-leaf bascule main span, bringing the entire bridge to a total of 651 feet. Plain concrete abutments house the operating machinery, and a concrete balustrade runs along the approaches. The contract to build the foundation and approaches went to the W. S. Lockman Company of West Palm Beach. The Tampa Shipbuilding and Engineering Company supplied the steel bascule. The Southwest 1st Street Bridge represents one of two remaining bascule bridges associated with the Harbor Bond Issue of 1926, a major bond initiative passed for the sole purpose of constructing bridges in the Miami area. The other Harbor Bond Issue bridges have been or are scheduled for demolition.

Northwest 17th Avenue Bridge, Miami-Dade County

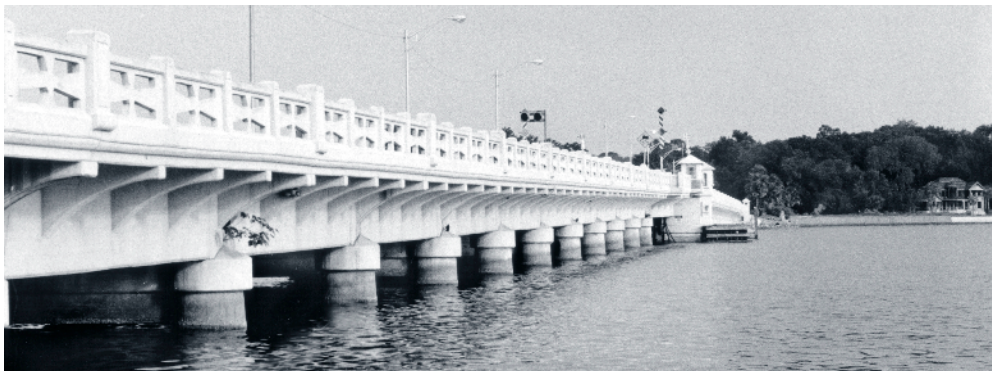
This bridge, along with the Southwest 1st Street and Northwest 12th Avenue bridges, was constructed as part of the Harbor Bond Issue of 1926. The engineering firm of Harrington, Howard, and Ash in Kansas City, quite likely the nation's leading designer of movable bridges at the time, developed the plans for this 148-foot, trunnion-type, double-leaf bascule bridge. The entire structure measures 391 feet in length with the five concrete tee-beam approach spans. In most respects it is a conventional bascule structure. It has a functional

The Northwest 17th Avenue Bridge was constructed as part of the Harbor Bond Issue of 1926.

appearance that is exhibited by the simple steel railings and plain concrete abutments housing the operating equipment. Though essentially a utilitarian structure, the designers added some details reflecting a slight Mediterranean Revival orientation. The terra cotta coloring of the bascule span further highlights these elements. Lockman Construction Company of West Palm Beach built the structure, with the bascule span supplied by the Central Station Equipment Company of Miami.

The Ortega River Bridge, Duval County

The Ortega River Bridge consists of 27 concrete girder spans joined to a double-leaf, rolling lift bascule main span operated by an electric motor. Crossing the Ortega River, sometimes referred to as McGirts Creek, the 1,143-foot-long structure replaced a wooden bridge in the 1920s. It was designed to provide better access to the southern suburbs of Jacksonville, such as Ortega and Venetia. Although it utilizes standard concrete girder spans, the bridge possesses interesting architectural details. Each panel in the concrete railing features two stylized Maltese crosses. The railings themselves extend outward along the bridge on cantilevered floor beams that support the deck. Ornamental sentry booths with pyramidal roofs stand at each entrance and at each corner of the bascule span, one of which serves as the tender station. The architectural features of the bridge reflect the influence of Duval County Bridge Engineer T. B. Carrick, whose trademarks were the Maltese cross design and decorative booths. The Ortega River Bridge represents the largest and best example of T. B. Carrick's influence on bridge building in the Jacksonville area. Its age, design, and role in the development of Jacksonville contribute to its importance.



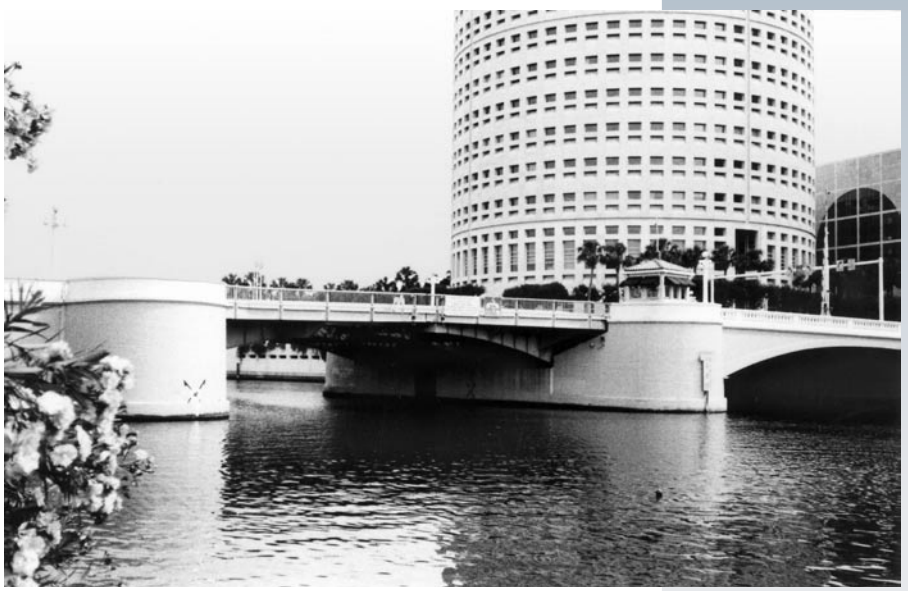
The Ortega River Bridge reflects the trademark Maltese cross design and decorative tender stations of bridge engineer T. B. Carrick.

Bentley and Sons Construction Company of Ohio built the structure between 1924 and 1927, with the rolling lift span supplied by the American Bascule Bridge Company of Pensacola. High tides and difficult working conditions contributed to a long construction period. The Ortega River Bridge opened to traffic in early 1927. On July 1, 1929, the City of Jacksonville accepted the bridge as a "gift" from the Duval Board of County Commissioners.

In 1978, this bridge underwent minor alterations including rehabilitation of the machinery, the renovation of the tender station, and replacement of its grating. However, the bridge continues to maintain a high level of integrity and has undergone further rehabilitation work aimed at the restoration of its principal historical features.

The Kennedy Boulevard Bridge, Hillsborough County

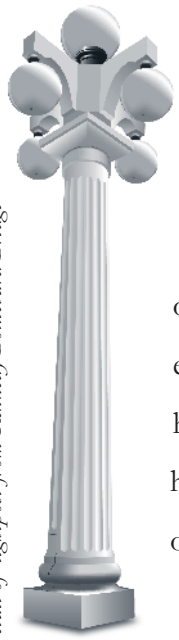
One of Florida's premier historic bridges, the Kennedy Boulevard Bridge (also known as the Kennedy Drawbridge and Lafayette Street Bridge) consists of a patented, double-leaf, Scherzer rolling lift main span and two reinforced concrete arch deck approach spans.



The Kennedy Boulevard Bridge in Hillsborough County is the oldest bascule type bridge in Florida.

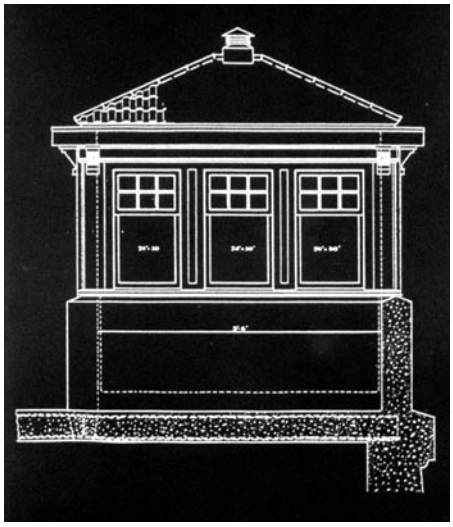
The Scherzer bascule was infrequently chosen for highway use because it required a complicated mechanism with a curved base which rocked back on a girder track and required more substantial foundations. For these reasons, designers preferred the trunnion-type bascule.

Constructed in 1913, the Kennedy Boulevard Bridge is the oldest bascule span in the state. It was the third bridge built on the site, having replaced a narrow swing span that replaced an earlier 1888 structure. The Kennedy Boulevard Bridge spans the Hillsborough River to facilitate travel between downtown Tampa and



Detail of lightpost from Kennedy Boulevard Bridge

the Hyde Park neighborhood of West Tampa. An architectural centerpiece of downtown Tampa, the bridge exhibits Neoclassical Revival styling, which was popular from the late 19th to mid-20th centuries. The Neoclassical Revival style was an eclectic renewal of Georgian, Adam, Early Classical Revival and Greek Revival architecture, and its academic approach was related to the Beaux Arts tradition. This style was commonly used as part of the City Beautiful Movement to improve the aesthetic quality of metropolitan areas. The effort at beautification shows in the sculpted, urn-shaped balusters in the concrete railings, the handsome steel railing on the bascule span, and particularly in the tender stations. Each house has a terra cotta roof and sits in a curved bay at the entrances to the bridge. Efforts to retain the original appearance have succeeded. The most noticeable changes have occurred in the removal of light fixtures from the railings and the metal frames that held wires for the streetcars.



Detail of original drawing for bridge tender station

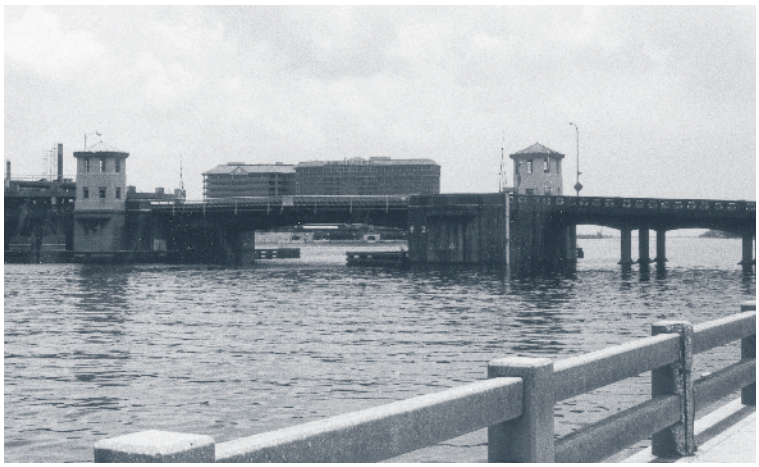
The bridge's attractiveness may be due to Alexander Twombley of New York City who, associated with engineers Bolles, Hodges and Baird, selected plans for the structure. He seems to have purchased patents and design rights from the Luten Bridge Company, a dominant influence on Florida concrete bridges at the time. Building the project, however, went to the Edwards Construction Company of Tampa, a well-respected and active firm in the city. The Pennsylvania Steel Company fabricated the bascule spans at their Steelton plant from designs supplied by the Scherzer Rolling Lift Bridge Company of Chicago. The project began in 1912, ended in 1913, and cost $240,000. The Tampa Electric Company shared in the expense in order to run streetcars across the structure. During the 1920s, the increasing demands of traffic led to the construction of four additional bridges in proximity to Lafayette Street.

Kennedy Boulevard Bridge plaque showing 1913 date

In 1995, the Florida Department of Transportation rehabilitated the bridge and restored much of its historic appearance, including rehabilitating much of the bridge's operating machinery. Consequently, the bridge continues to represent a structure of distinctive quality and high historical importance.

The Platt Street Bridge, Hillsborough County

The Platt Street Bridge, 518 feet long, consists of 10 arched concrete, tee-beam girder approach spans joined to a double-leaf, Strauss design trunnion bascule main span, 103 feet in length. The Mediterranean appearance of the bridge reflects Florida's fascination with that architectural theme during the great economic development of the 1920s. The style is reflected in the two octagonally-shaped and stuccoed control houses, which feature hipped roofs clad in metal shingles and highly ornate metal trim with projecting palm leaves and lion's heads. These two-story houses stand at each end of the bascule and on opposite sides of the roadway. A distinctive concrete railing, which ties the bridge to adjoining Bayshore Boulevard and Janus Park, uses a geometric pattern that resembles an eight-point star. The same design appears on the metal railing along the bascule span. Also unusual is the pedestrian tunnel on the western end that accommodates the walkway along Bayshore Boulevard.



Platt Street Bridge

The city of Tampa constructed this bridge during the years 1925 and 1926 as part of a major bridge building program launched by the city in 1924. The effort was made to help relieve congestion on the 11-year-old Lafayette Street Bridge (today known as the Kennedy Boulevard Bridge) as well as to connect Bayshore Boulevard to downtown. The city awarded the contract to build this structure, along with the Cass Street Bridge, to Tibbets, Pleasant, Green, and Beckman, a general construction firm in Oklahoma City. These bridges are believed to be the company's only structures in Florida. The Strauss Bascule Bridge Company of Chicago provided the bascule design, the Lakeside Bridge and Steel Company of Milwaukee fabricated the spans, and Tampa's city engineer, R. D. Martin, prepared the specifications. The

Detail of plaque from Platt Street Bridge

bridge cost $325,000. According to a later city engineer, the strength and durability of the structure's concrete came from its mixture of cement and pebbles.

The architectural embellishments signify both the affluence of the era and the importance given to the bridge's place at the confluence of Hillsborough Bay and the Hillsborough River. Thus, age, type, aesthetic qualities, landmark position, and association with the 1920s expansion of Tampa all contribute to the bridge's historical value.

The Cass Street Bridge, Hillsborough County

Tampa's need to expand its road system across the Hillsborough River and into the western suburbs during the great spurt in growth of the 1920s led to the construction of the Cass Street Bridge. Though a few feet shorter, at 511 feet in length, this structure is virtually identical in all of its major technical, architectural, and historical characteristics to the Platt Street Bridge (see above), which was erected under the same contract that spanned 1925 and 1926. The Cass Street structure is in a less conspicuous location than its counterpart on Platt Street.

Cass Street Bridge over the Hillsborough River, Hillsborough County

The Laurel Street Bridge, Hillsborough County

The Laurel Street Bridge (originally Fortune Street Bridge) is a unique, imposing, and historically important structure across the Hillsborough River in Tampa. Its most distinguishing characteristic is its 99-foot-long main span, a Warren pony truss with verticals that comprises the single leaf of an unusual overhead, counterweight, Strauss trunnion bascule bridge. With 10 concrete girder approach spans, the bridge measures 368 feet in length.

While the single-leaf design has the advantage of only one set of lifting machinery, the length of the span in this case seemed to require the truss as a stiffening element, along with the use of three bow-type structures (two together at the west end) that arch over the leaf to give torsional support. Choosing not to build a counterweight pit, designers put the huge counterweight above the deck in a framed steel tower that guides the weight up and down during an opening cycle.

The Laurel Street (or Fortune Street) Bridge in Hillsborough County measures 368 feet in length.

Alterations over the years, with a major renovation in 1969, have changed the bridge. The two original wooden bridge tender stations are gone. They have been replaced by a modernistic, glass enclosed tower that sits on a new concrete addition above the original abutment, which holds the operating mechanism. The new girder spans have plain concrete parapets topped by a pair of steel tubular handrails.

The City of Tampa constructed this bridge during 1926 and 1927 after receiving voter approval in 1924 to issue bonds for several new Hillsborough River bridges. The contract went to the United Gas Improvement Company's construction division, the UGI Contracting Company of Philadelphia. Its unusual name led the company to write city officials explaining that it had built dams, power plants, factories, and defense installations during World War I, thus attesting to its ability to do this job. The Strauss Bascule Bridge Company of Chicago designed the movable span. The project cost was $401,343.

The Taylor Creek Bridge, Okeechobee County

The Taylor Creek Bridge in Okeechobee County is a trunnion type bascule bridge.

The Taylor Creek Bridge consists of a 248-foot-long, bascule type structure with a 94-foot-long, single-leaf trunnion main span. The five approach spans are built of standard plan concrete girders on piers, with railings typical of those constructed in the 1940s and 1950s. Trunnion type bascule bridges represent a long established and continuing engineering solution to accommodating both boat and automobile traffic. This structure, built in 1948, is unusual in its use of a single-leaf draw span.

Snell Isle Bridge over Coffee Pot Bayou, Pinellas County

The Snell Isle Bridge over Coffee Pot Bayou in St. Petersburg exhibits a number of elegant architectural features.

The Snell Isle Bridge across Coffee Pot Bayou in St. Petersburg consists of six concrete tee-beam girder spans with a steel, double-leaf bascule central span. The bascule has been locked in a closed position. Built in 1928 to serve a growing residential area, the bridge exhibits a number of elegant architectural features, including curved brackets that support the railings of sculpted balusters, arched girders, textured fascia, and gracefully curved entrances. Short, square columns

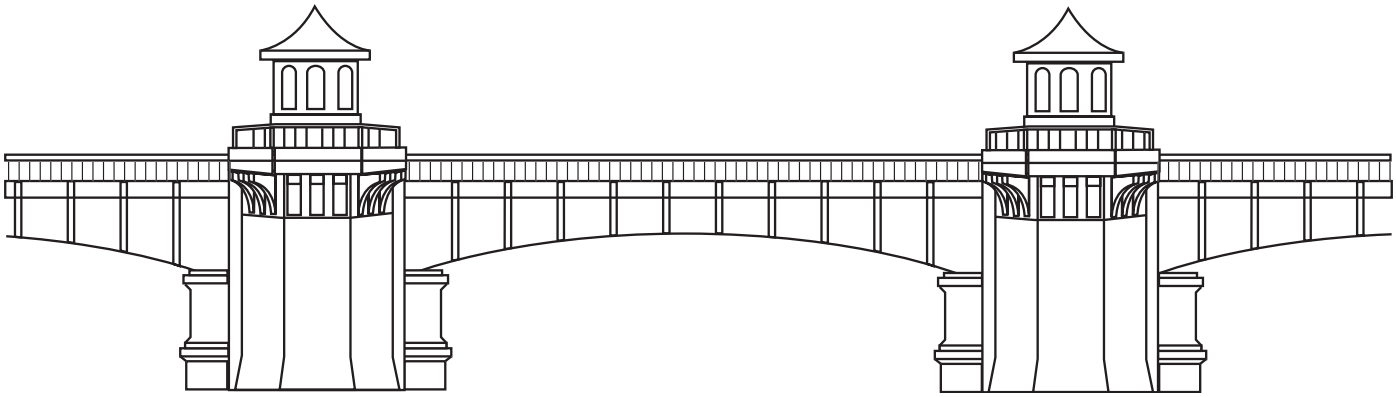
anchor the balustrade and originally supported eight tall lampposts. Renovation to the bridge occurred in 1981. This bridge is historically important because of its age, its bascule technology, and for the effective way it expresses the classical architectural treatment favored by many Florida developers during the 1920s.

The Bridge of Lions, St. Johns County

One of Florida's best known bridges, often used to advertise the state to outsiders, the Bridge of Lions is one of the most highly visible and distinctive bridges in the state. Also known as the Matanzas River Highway Bridge, it consists of 23 approach spans and an 87-foot, double-leaf, rolling lift bascule main span. The bridge totals 1,538 feet in length and carries State Road A1A over the Matanzas River, or the Intracoastal Waterway, to link St. Augustine with Anastasia Island.

The Bridge of Lions in historic St. Augustine was listed on the National Register of Historic Places in 1982.

Architectural qualities were emphasized in all parts of the bridge, from the graceful steel arched-girder approaches to the features meant to beautify the superstructure. The reinforced concrete roadway is lined by a classically-styled concrete railing that uses urn-shaped balusters set in panels. At the ends of the panels stand short, square columns that project above the railing. These columns serve as end posts for the balustrade, delineate the concrete piers, and support ornamental lampposts. The most prominent features on the structure are four towers, one used as a control house, that mark the corners of the bascule span. The towers reflect a Mediterranean Revival style through their octagonal shape and tiled roofs. Two large Carrera marble lions,



This illustration shows the Mediterranean Revival style used in the four towers that mark the corners of the bascule span.

donated by a local citizen, guard the west end and account for the more popular Bridge of Lions name.

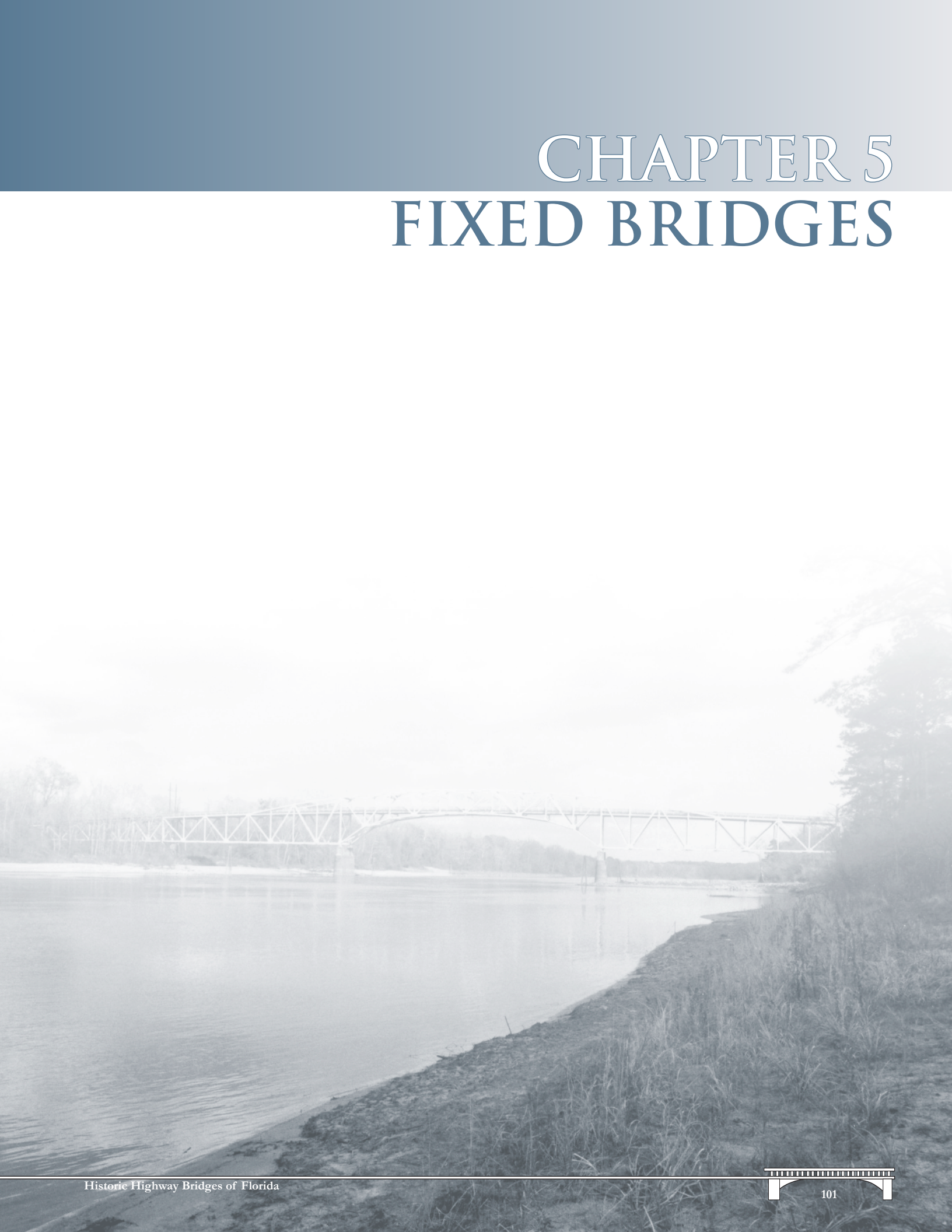
Discussions began as early as 1917 on the need to replace an 1895 wooden bridge located on the site. Greater urgency for the project came with the booming expansion of Florida in the 1920s, when St. Augustine hoped to share in the rising tourist trade and the new resort industry, particularly with the development of Davis Shores on Anastasia Island. In 1925, the public approved building a bridge that could fit the historical character of St. Augustine, but also provide downtown with a new centerpiece and a modern transportation facility. The project, undergoing changes during construction, cost $1,008,735, an enormous expense for a small community.

The highly regarded engineering firm of J. E. Greiner in Baltimore provided plans for the structure, designed to serve both promotional needs and artistic purposes. The city awarded the construction contract to the P. T. Cox Company of New York City, who selected the Virginia Bridge and Iron Company to fabricate and install the rolling lift bascule. Construction was completed in February 1927 after 21 months, which included the challenge of placing the timber pile supports in the Matanzas River. The "million dollar bridge" almost at once became a prominent local landmark and a new symbol for the "oldest city." The historical value of the Bridge of Lions has been recognized by its listing on the *National Register of Historic Places* in 1982.

In order to address safety requirements and structural problems, the Bridge of Lions will undergo a major rehabilitation, which is scheduled to begin in 2004. The rehabilitation will maintain the overall design, detail and proportions of the bridge in order to preserve its historic character. Changes will consist primarily of widening the travel lanes and adding barriers between the travel lanes and the sidewalks on both sides of the bridge.

Photo opposite page: The Blountstown Truss Bridge over Calhoun County

CHAPTER 5
FIXED BRIDGES



Although Florida possesses a great number of navigable waterways, the majority of its bridges cross smaller bodies of water, rail lines or roadways. In these cases, road builders used standard fixed bridges constructed of steel or concrete. In Florida, there are three main categories of fixed bridges: truss, arch deck, and girder or beam bridges.

The truss is a simple skeletal structure comprised of several small beams that together can support a large amount of weight and span great distances. Typically, the design, fabrication, and erection of trusses is relatively simple.

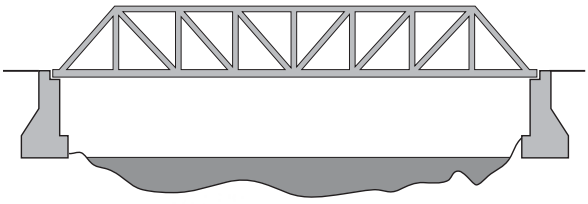
The arch deck represents one of the oldest types of bridges because of its natural strength. In these bridges, the arch transfers the weight of the traffic and structure from the deck to the land on both sides by means of abutments. The abutments carry the load and keep the bridge from spreading out.

In its simplest form, the girder or beam bridge can be a plank or log across a stream. It consists of a horizontal beam supported at each end by piers. The beam must be strong enough to support both its own weight and the traffic that crosses it. When a load pushes down on the beam, the top edge is compressed together, while the bottom edge is stretched.

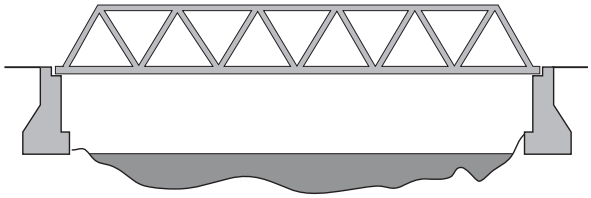
Photo opposite page: This Warren type through truss was originally the main swing span crossing the St. Johns River north of Lake Monroe. It now serves as a fishing pier located alongside its former route.

TRUSS BRIDGES

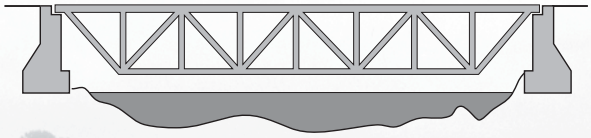
Truss bridges contain lattices, including cords, and vertical and diagonal web members, which are connected in a triangular formation. They represent an important phase in the development of American bridge building and were often the first attempts at making permanent improvements on county roads. Three main types of fixed truss technology exist in Florida: through, deck, and pony. These terms describe the placement of the travel surface in relation to the superstructure. A through truss is cross-braced above and below the traffic, which flows through the truss. In a deck configuration, the traffic travels on top of the main structure. In a pony truss, the traffic passes between the parallel superstructure.



Through Truss



Pony

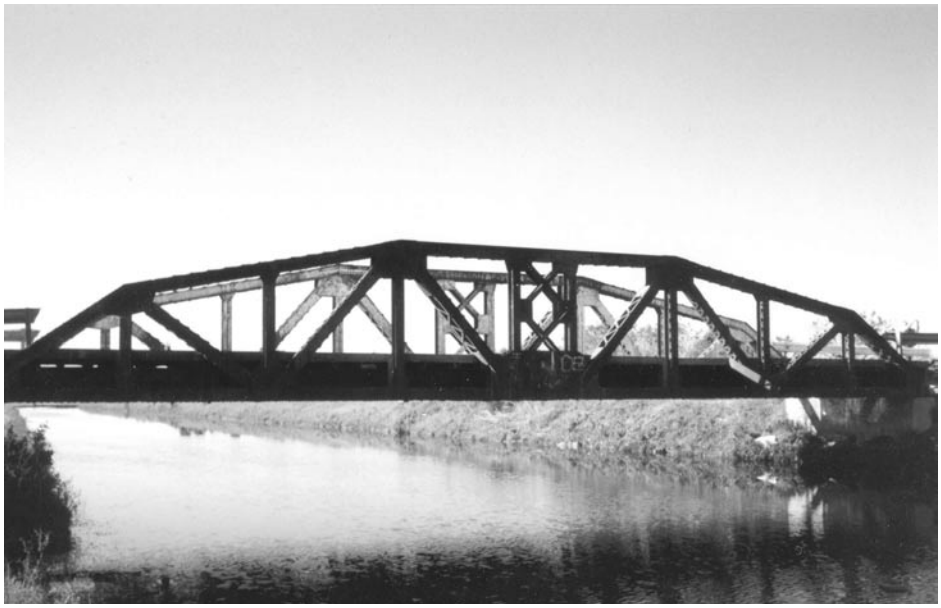


Deck

In 1991, the Historic Highway Bridge Survey for Florida identified and evaluated a total of 11 truss bridges. Remarkably, none of these structures has been demolished since the completion of that study. The field survey and background research for this current survey uncovered an additional four historic truss structures. Two of these are abandoned truss structures located in northern Florida. The third is still carrying vehicular traffic for the South Florida Water Management District in Miami-Dade County. Finally, the fourth results from the conversion of the Lake Monroe Swing Bridge into a fishing pier, therefore causing its reclassification from a swing to a fixed truss bridge.

Most of the identified truss bridges are abandoned or exhibit varying degrees of deterioration. Less than one-half of the identified truss structures remain in service. Consequently, only two of the small truss structures, the Steinhatchee Springs Bridge and the Aerojet Truss, still function as vehicular bridges.

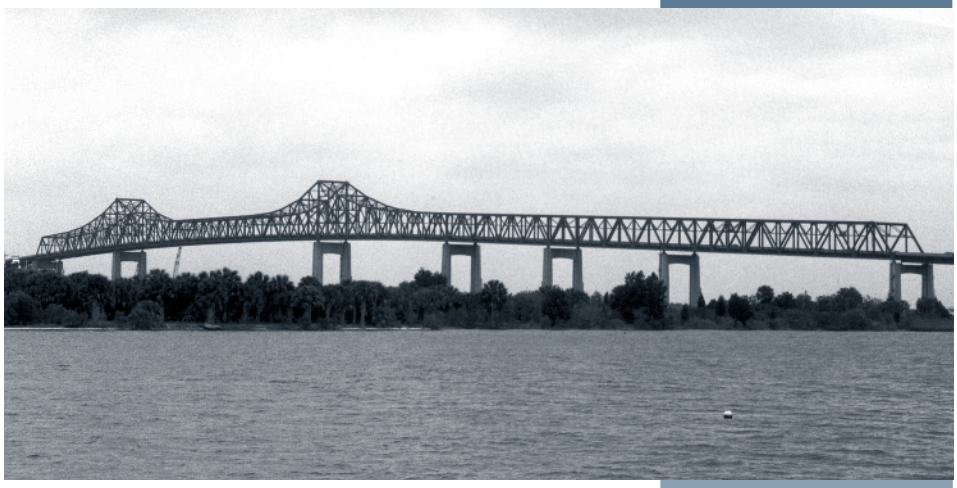
On the larger truss structures, Florida is faring better. For the most part, this results from their more recent construction and the greater costs which would be associated with any replacement of them. The Blountstown Truss, or Apalachicola River Bridge, has recently been rehabilitated, and the Lake Monroe Bridge, with its conversion to a fishing pier, will certainly remain standing for some years to come.



The Aerojet Truss Bridge. This former railroad bridge probably dates to the first decade of the 1900s. It was relocated to this site just outside of the Everglades National Park at an unknown date. It still carries a small amount of service traffic and its steel members were fabricated by Bethlehem Steel.

The Mathews Bridge (Arlington Bridge), Duval County

The John E. Mathews Bridge over the St. Johns River is a massive cantilever, steel, through truss bridge, one of two such structures in the state, and the only one remaining in use. It measures 7,382 feet long, and consists of six main span panels and 59 approach spans. The central spans, those which join the two major piers and which cross the main channel, extend 810 feet.



Mathews Bridge (Arlington Bridge)

Built between 1951 and 1953 to facilitate traffic into the expanding suburbs east of Jacksonville, the project enlisted several engineering and construction firms. The bridge was dedicated to Judge Mathews, who had urged building on the site since the early 1930s. The structure is historically notable for its type, contribution to the area's development, and landmark status in the city.

The Jennings Bridge, Hamilton County

The Jennings Bridge, Hamilton County

The Jennings Bridge crosses the Alapaha River east of Jennings. Built in 1902-1903, this 119-foot-long, one span, Pratt through truss bridge has been documented

as the oldest highway bridge in Florida. The American Bridge Company of New York City, which was created in 1900 by banker J. P. Morgan to consolidate bridge builders and to expand the U.S. Steel Corporation, erected the structure for Hamilton County. Typical of lower cost bridges at the time, it consisted of channel bar members, steel rod lower chords, pin connections, and lally-column piers.

Not much remains of the Jennings Bridge. Its timber plank deck, most of the floor beams and stringers, and its approaches have been lost, and it is collapsing into the river. Despite its serious deterioration, it is historically important on many counts, including its age, type, and association with early efforts at building permanent bridges on county roads when horse-drawn transportation still predominated.

The Ellaville/Hillman Bridge, Madison County

The Ellaville/Hillman Bridge has historical value, since it represents the finest example in the state of a Pratt through truss, and it also once provided an important river crossing on a major state and federal highway. Taking its name from a once busy sawmill town on the Suwannee River, the bridge consists of 26 concrete girder approaches and three steel, fixed Pratt, through truss spans, each measuring 123 feet in length. The approach spans sit on concrete pile bents and have a solid concrete railing with a concrete base and cap. The truss spans rest on concrete piers and have a metal railing. A concrete deck runs the entire, 915-foot length of the bridge.

Ellaville/Hillman Bridge, Madison County

Thomas and Caleb Pratt patented the first Pratt truss in 1844. It represents the first scientifically designed truss type. ◆

Erected in 1925-1926 as a federal aid project on State Road 1 (now U.S. 90), the bridge served on a major east-west artery that linked Jacksonville and Pensacola. Long used as a crossing point on the Suwannee, the site has possessed a bridge since the 1870s. The bridge was constructed by R. H. H. Blackwell of East Aurora, New York, a company active in Florida during the 1920s. Slated for heavy duty, the truss makes use of channel beams for upper and lower chords and the end posts, the portals are braced, and all connections are rigidly made. Careful attention to workmanship and the use of high quality materials are evident throughout the structure.

The Suwannee Springs Bridge, Suwannee County

By the time the Suwannee Springs Bridge was built, the Parker through truss, which is a Pratt truss with a polygonal top chord of more than five slopes, had become the popular choice for engineers who needed a heavy-duty structure exceeding a length of 150 feet. The Suwannee Springs Bridge consists of nine concrete girder approach spans and the 163-foot Parker through truss. The Austin Brothers Bridge Company of Atlanta built it for the Road Department in 1931.

Suwannee Springs Bridge

The solid construction of the bridge is evident in the main span, which uses channel bars for the chords, end posts, and diagonals; angles strengthening the verticals; and portal and lateral bracing. The truss has been fastened with rivets, and a simple steel balustrade runs along the span. A standard concrete railing serves on the approach spans.

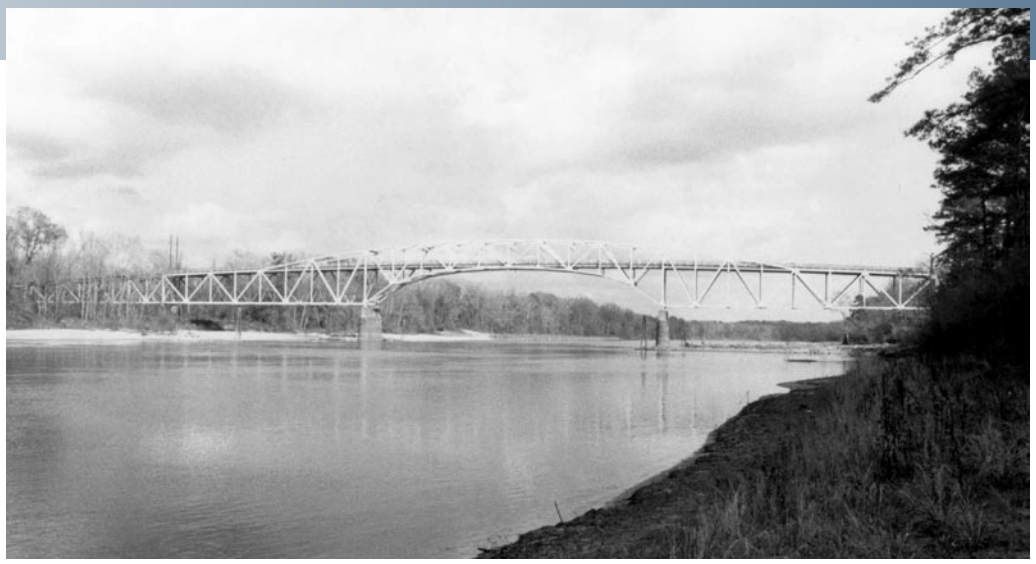
Once reported to have "infallible mineral waters," Suwannee Springs had emerged in the 1890s as one of Florida's earliest and best-known health resorts. In the 1930s, however, public interest in the baths faded and the community began to decline. ◆

Although it is now abandoned and deteriorating, the bridge originally carried State Road 50 (U.S. 129) over the Suwannee River to link Live Oak and Jasper and to provide a new means of reaching Suwannee Springs. Seemingly suspended over the Suwannee River between heavily forested banks in an unusually serene setting, the bridge remains a local landmark that is portrayed on picture postcards. The Suwannee Springs Bridge is the last fixed Parker truss main span in the state. These factors, and its association with the old health spa, contribute to its historical value.

The Blountstown Truss, Calhoun County

Improvements in the science and technology of building continuous trusses led in the 1930s to greater acceptance of this bridge type. Florida's first example was the Blountstown Truss Bridge, which spans the Apalachicola River, a major state waterway. This bridge offers the only historic example of continuous truss technology and incorporates two truss designs: through and deck. Completed in 1938, it measures 8,397 feet in length. A Warren truss configuration with verticals

Blountstown Truss, Calhoun County



The Blountstown Truss in Calhoun County spans the Apalachicola River.

was used to construct the secondary deck truss sections and the central through truss that arches over the river channel. Concrete and steel piers support 202 steel stringer approaches that extend the structure over a bluff on the east side and across marshland on the west bank.

The bridge was named for Blountstown, the seat of Calhoun County, which had long sought a bridge on the site. The county and the federal government, through the Depression-era Public Works Administration, jointly funded the project, which cost approximately $936,000. The Allied Engineering Corporation provided the designs and the Wisconsin Bridge and Iron Company of Milwaukee built the structure.

It stands as a monument to Depression-era public works projects in Florida and represents the culmination of Calhoun County's drive to improve the regional economy through better transportation. The project gave work to a great number of unemployed people in a depressed area of northern Florida. By transforming State Road 20 into a major secondary route between Tallahassee and western Florida, the bridge bolstered the local economy. Despite its excellent condition, the narrow roadway (26 feet in width) hinders its ability to meet modern traffic demands. In the late 1990s, the truss was raised to a greater height above the bridge deck and the setting was altered by the construction of an adjacent higher and more massive modern concrete bridge.

Detail of trusses on the Blountstown Truss Bridge, Calhoun County

PONY TRUSSES

The Log Lake Truss, Okaloosa County

Though abandoned and deteriorating, the Log Lake Truss represents one of only three remaining fixed pony trusses in the state. It once carried traffic across the Yellow River on what is now called Log Lake Road. No historical records of this structure have been located, but the style and materials of the structure indicate a

Log Lake Truss Bridge

pre-1920 construction date. The wooden deck is disintegrating and the bridge no longer connects to either side of the river. All that remains are some of the wooden stringer approach spans and the main span, which is a good example of a Warren pony truss. The road has been reclaimed by nature, indicating that the bridge has remained unused by traffic for some time. On the north side, an embankment to raise the bridge elevation above the river is slowly eroding.

The Apalahoochee River Pony Truss, Hamilton County

The Apalahoochee River Pony Truss Bridge, located northeast of the old cotton and lumber town of Jennings near the Georgia state line, is a 75-foot-long, 12-foot-wide, single-span Pratt pony truss. Joints for the relatively lightweight

Apalahoochee River Pony Truss, Hamilton County

trusses are pinned connections, allowing for flexibility, and the structure retains a wooden deck. The vertical posts, made of a pair of channel bars horizontally braced, widen at the bottom to provide greater strength. Simple lally-column piers, concrete- and/or stone-filled steel cylinders, support the bridge. Two angle iron rails on each side serve as guardrails.

Built in 1911 at a cost of $2,200 by the Roanoke Bridge Company of Virginia, a major regional builder, the bridge represents a typical, relatively inexpensive structure chosen by county officials from catalogs or plan books supplied by the bridge company. Bridges of this kind were once numerous in northern Florida and built by the thousands across the nation. As the oldest Pratt pony truss in Florida and one of only two such structures in the state, the Apalahoochee River Bridge possesses historical importance. At present, unchecked deterioration threatens the bridge.

The Steinhatchee Springs Pony Truss, Lafayette County

Constructed for Lafayette County in 1912, the Steinhatchee Springs Pony Truss rates among the state's oldest bridges and is one of only four of its type that remain. In addition, it is the only wooden-decked version of this group that is still carrying traffic. Standing over the Steinhatchee River in the small timber-covered community of Steinhatchee Springs, this 60-foot, Pratt half-hip pony truss is joined to 21 wooden trestle approach spans, making the whole structure 225 feet long. Recently painted and fitted with a new timber plank deck, the span appears in good condition.

It serves as an example of construction by the Converse Bridge Company of Chattanooga, an important bridge builder throughout the Southeast and within Florida. Standard features on the bridge include the

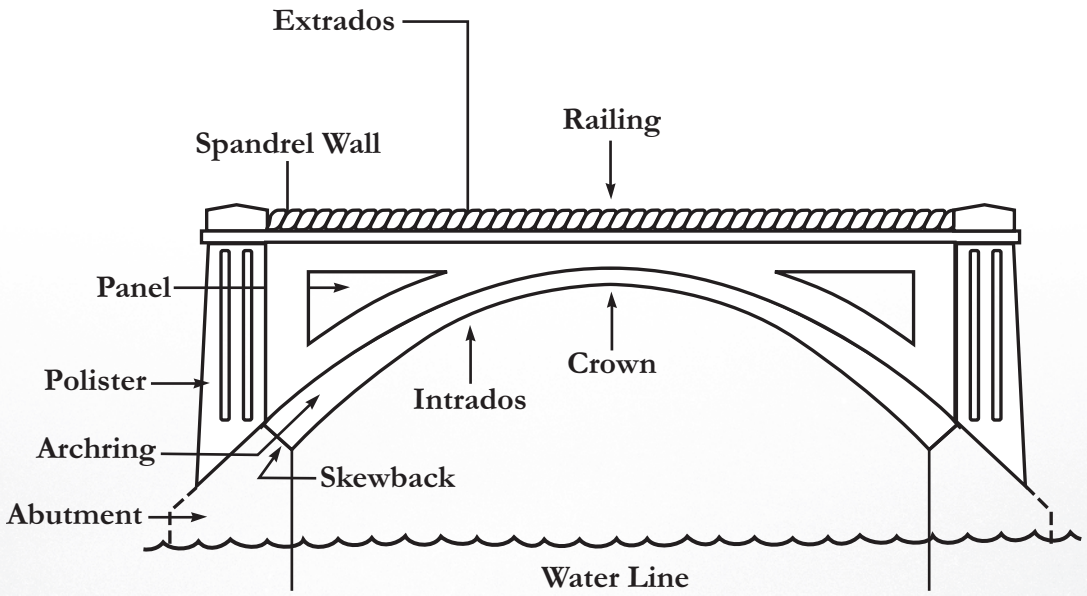
channel bar top chord and end posts, steel rods for the bottom chord, diagonals and counterbracing, and the pinned connections; cotter pins are used for fasteners. Timber piles have been added as a support for the main span. A concrete abutment stands at one end, while two concrete-filled cylinder piers support the other.

Steinhatchee Springs Pony Truss

Photo opposite page: Once the largest reinforced concrete arch bridge in Florida, this remnant of the 1922 Victory Bridge only extends a short distance into the Apalachicola River today.

CONCRETE ARCH DECK BRIDGES

An arch deck bridge consists of an arched support system with a deck placed over it. Almost all of the arch bridges in Florida are concrete arched decks with filled spandrels. There are two examples of concrete bridges with open spandrels: the remnant of the Victory Bridge near Chattahoochee and the recently constructed Willis Bridge in Calhoun County. Many historic examples of arch bridges remain in Florida, although this technology is not generally used for modern bridges.



The Grande Canal Arch Deck Bridge, Broward County

The Grande Canal Arch Deck Bridge is a 46-foot, single span, reinforced concrete, elliptical arch bridge that carries Southeast 18th Avenue over the Grande Canal in Fort Lauderdale. The concrete railings feature balustrade sections alternating with solid walls, all topped by a heavy concrete cap. Its narrow arch supports a wider deck that has been cantilevered on the sides to provide for an ornamental railing and room for pedestrian traffic.

This Arch Deck Bridge carries Southeast 18th Avenue over the Grande Canal in Fort Lauderdale.

The Luten Bridge Company built this structure in 1925 as part of a residential development along Las Olas Boulevard, a main artery between Fort Lauderdale's central city and the oceanside. The bridge design is compatible with and contributes to the architectural character of the surrounding neighborhood.

Luten reinforced concrete bridges are, as a group, important in the history of bridge development in Florida. They represent work by the principal builder of concrete spans in the state, whose activity in turn reflected the efforts of state and local governments to keep pace with the population growth of the 1920s.

The Luten Bridge company of York, Pennsylvania, was to become a leading builder of reinforced arch bridges in the country, and in Florida in the early 20th century. Engineer and entrepreneur Daniel B. Luten (1869-1946) of Indianapolis designed bridges that maintained strength and reliability under the hot, humid, and sometimes salty conditions in Florida. Utilizing reinforced steel, Luten succeeded in reducing the quantity of concrete required in his bridges without sacrificing their strength or resistance to floods. In some instances, he extended the steel tie rods from the bridge to underneath the stream bed and buried them in concrete. This method reduced the need for heavy abutments and was particularly desirable when stream banks were weak. In 1915, he also built an innovative half arch-bridge at the entrance to the luxurious Belleview Hotel in Belleair; the half arches remain today. Luten was active in patenting his designs and promoting them by establishing relationships with business partners throughout the country. By the mid-1920s, he reputedly held fifty patents on reinforced concrete bridges and had built more than 14,000 spans in the United States. ◆

The Sunny Isles Bridge, Miami-Dade County

This bridge is one of three virtually identical spans that carry Atlantic Avenue over the Ocean Canal in the community of Sunny Isles, north of Miami Beach. Two of the bridges are new, having been constructed in 1993 to replace two historic structures. The remaining historic bridge was constructed in 1925 and was designed to complement the Mediterranean Revival architectural theme of Sunny Isles. This bridge consists of a 41-foot, single-span concrete arch deck bridge. The outer walls are faced with rubble stone and the stuccoed, whitewashed inner surface of the railings create a distinctive appearance. Its age and apparent use as a focal point and promotional element in the community's development contribute to this bridge's historical importance.

Sunny Isles Bridge, Miami-Dade County

The Peace River Bridge at Arcadia, DeSoto County

In 1925, DeSoto County replaced a multiple-span, metal truss bridge with this four-span, reinforced concrete arch deck, measuring 201 feet long. For $25,500, the Luten Bridge Company built one of its typical, efficiently designed bridges. It included a standard solid parapet with cast-in rectangular patterns. The closed spandrel walls were most likely filled with compacted earth and rock, and sturdily built across the Peace River at Arcadia. It carried old State Road 18, a major east-west route across the Florida peninsula.

Peace River Bridge at Arcadia

The structure, abandoned for many years, now serves pedestrians and carries a utility pipeline over the river. The installation of the pipeline led to damage to the wing walls at each end of the south railing. Aside from those changes, the removal of the original lampposts, and the need for repair and maintenance, the structure has retained its historical appearance.

The Peace River Bridge played a significant role in the transportation history of the Peace River area. It gains further merit by its association with the Luten Bridge Company, representing the largest bridge constructed by them that remains in the state.

The Ninth Avenue Bridge over Ware's Creek, Manatee County

This small, concrete arch deck bridge with distinctive railings stands over Ware's Creek in Bradenton. The 36-foot-long bridge features deck railings that contain a "w" or "zig-zag" pattern, found on only one other bridge in Florida, the Seventh Avenue Bridge over Ware's Creek, a steel stringer. The design originated with Freeman H. Horton, the engineer who designed this bridge as well as others in Manatee County during the 1930s and 1940s. Its 1945 construction date makes it a relatively late example of the use of an arch deck bridge. The bridge is more structurally complex than girders or slabs. That characteristic, along with the unusual and attractively designed railing and association with Freeman Horton, makes the structure notable.

Ninth Avenue Bridge showing zig-zag pattern on deck railings

The Washington Street Bridge over Fern Creek, Orange County

This bridge, which carries Washington Street over Fern Creek in Orlando, represents an especially nice example of a reinforced concrete arch deck bridge. It is located near a city park within an attractive, older residential section of Orlando. Three 20-foot-long arches form the substructure that supports the deck, and cantilevered floor beams widen the bridge to provide walkways on both sides. The concrete railing consists of urn-shaped balusters in panels separated by low pilasters, giving the bridge a classical appearance. The style extends to the light fixtures, which are set upon tapered posts that stand on the railings at both approaches to the bridge. The brick roadway of this bridge adds an interesting aesthetic quality.

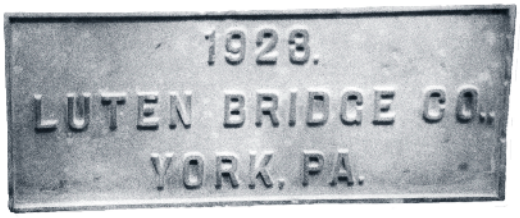
Morton Hagartney, an Orlando city engineer, designed this bridge, which was constructed in 1926 by the Concrete Steel Bridge Company of Florida. Headquartered in New York, the firm was a recognized leader in construction technology and maintained an office in Miami Beach. Its type, age, and association with a well-known bridge building company render this bridge notable. It gains additional value because it represents an excellent example of architectural quality and demonstrates how a bridge can achieve more than a functional role to become a central piece and distinctive asset within an urban neighborhood.

The Washington Street Bridge, a fine example of a reinforced concrete arch deck bridge

The Fish Basin Bridge, Pinellas County

Fish Basin Bridge, constructed by the Luten Bridge Company, over Smith Bayou in Ozona, Florida

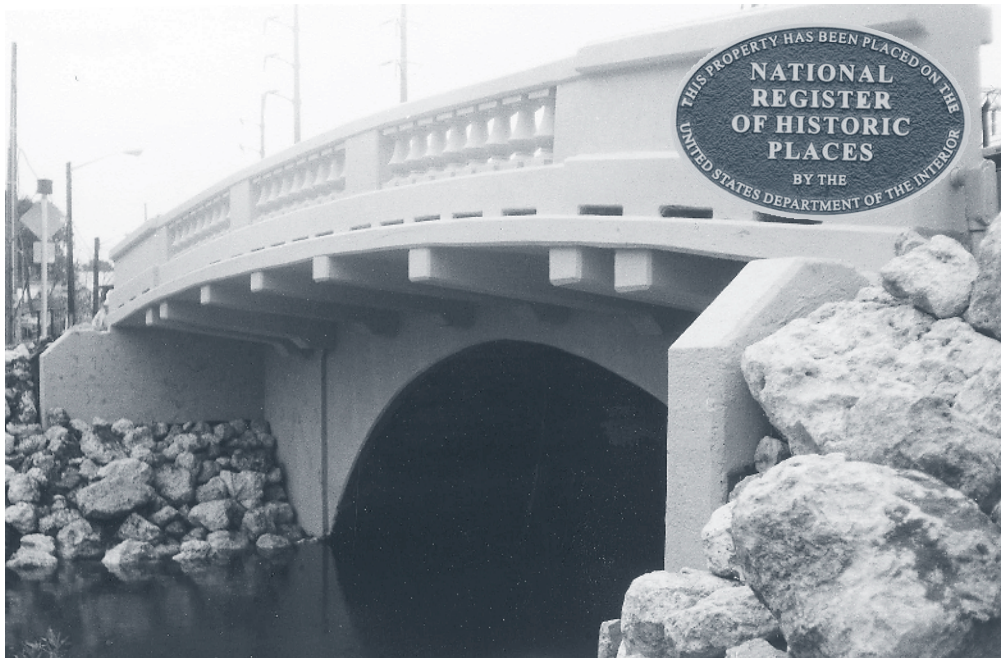
Between 1927 and 1928, the Luten Bridge Company constructed this 53-foot, one-span, reinforced concrete arch bridge over Smith, or Fish Basin, Bayou in Ozona, north of Dunedin. A handsome example of a well-engineered bridge, it exhibits typical features of Luten arch deck structures, including the smoothly finished spandrel walls, graceful Luten arch, and classical styling to the railing–which consists of three panels of urn-shaped balusters. Wing walls extend from



the abutments to provide support for the stream banks. Both aesthetically pleasing and functional, this well-maintained bridge has historical importance due to its age, type, and association with the Luten Bridge Company, a successful builder of concrete bridges. It also provides one of the best examples of Luten's craftsmanship.

The Moore's Creek Bridge, St. Lucie County

The City of Fort Pierce contracted with the Palatka office of the Luten Bridge Company in 1925 to construct this 30-foot-long, single-span, reinforced concrete arch deck bridge over Moore's Creek, near the banks of the Indian River. The effort resulted in a typically attractive Luten bridge with an arch narrower than the deck, which is supported on cantilevered floor beams. An ornate concrete railing contains urn-shaped balusters, and it once held decorative light fixtures. The deck and balustrade gracefully curve over the stream. In 1990, the structure stood behind locked security gates on the grounds of a power plant and showed serious signs of deterioration.

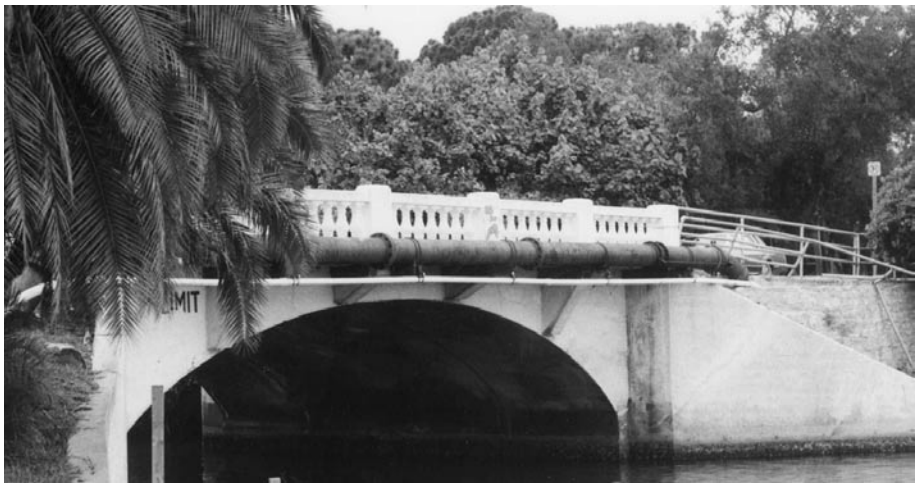


The recently rehabilitated Moore's Creek Bridge in St. Lucie County is a notable example of a Luten Arch Deck Bridge.

In 1997, however, Fort Pierce rehabilitated the structure, producing a beautiful bridge that once more represents an important landmark in the city. At the time of the rehabilitation, the substructure was in good and original condition. The rehabilitation restored the urn-shaped balusters on the bridge railings which gives it a Neoclassical style that, when joined to the gentle curve of the bridge arch, creates an aesthetically pleasing bridge. In addition, the rehabilitation incorporated the original bridge plate and added a new bridge plate commemorating the 1997 restoration. The Moore's Creek Bridge is historically important as a notable example of Luten's arch deck bridges from the 1920s. Through its decorative features and its recent restoration, this bridge reflects the intention of Fort Pierce to add and maintain an attractive element to the city's riverfront.

The Osprey Avenue Bridge over Hudson Bayou, Sarasota County

Built by Manatee County in 1916, before the state created Sarasota County, this 43-foot-long, single-span, reinforced concrete arch deck bridge carried the first Sarasota-to-Venice "hard road" (now known as Osprey Avenue) over Hudson's Bayou, south of downtown Sarasota. The county included this bridge as part of a large contract awarded to the Luten Bridge Company to construct bridges and culverts as part of an improved roadway to Venice. A major endeavor at the time, and in a region somewhat remote from the county seat at Bradenton, the project came under the supervision of the district Engineer-in-Chief, Charles A. Brown. The local newspaper reported that a seven-man crew, along with a foreman and superintendent, built the bridge of solid concrete, reinforced with steel barbs every 12 inches. Observing that the concrete abutments were placed on rock foundations, the newsman concluded that the structure would "stand all the ravages of time." With the substructure completed, the builders added a classical balustrade. In later years, perhaps during the 1930s, steel pipe handrails were extended from the balustrade. This bridge represents an important early effort at road improvement between Sarasota, Osprey, and Venice and should be considered an important historic bridge. It is in good condition and is an excellent example of pre-World War I Luten bridges.



The Osprey Avenue Bridge in Sarasota carried the first Sarasota-to-Venice "hard road" over Hudson's Bayou.

The Baggett Creek Arch Bridge, Okaloosa County

This abandoned arch bridge is the lone remnant of the first federal aid project in Florida launched under the *Federal Aid Road Act of 1916*. It carried a narrow road from the town of Milligan to just east of the small town of Galliver. The Baggett Creek Arch Bridge was constructed in 1924 and was designed by George Derrick, who would later serve as the State Bridge Engineer. The bridge is located north of U.S. 90 (State Road 10) alongside the Louisville and Nashville Rail line. The roadway it once served has been almost completely reclaimed by nature.

The Baggett Creek Arch's only decorations consist of the rectangular designs carved into the interior and exterior faces of the bridge railings. Perhaps the most interesting aspect of the site, however, is the continued survival of many stubs from the wooden frame used during the construction of the bridge. These can be seen in the waterway below the structure. Importantly, although this bridge has remained abandoned for some time, it remains in good condition with little evidence of wear.

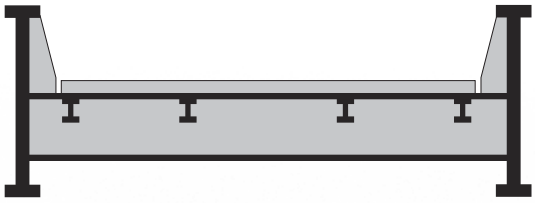
The Baggett Creek Arch Bridge (note wooden stubs beneath bridge)

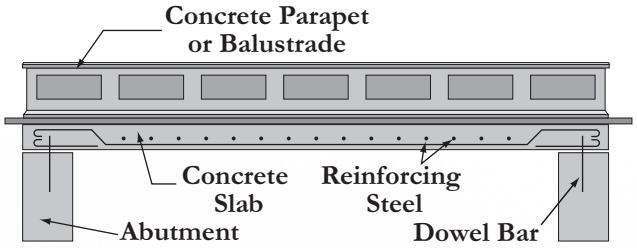
Photo opposite page: The Indian Creek Bridge in Miami-Dade County

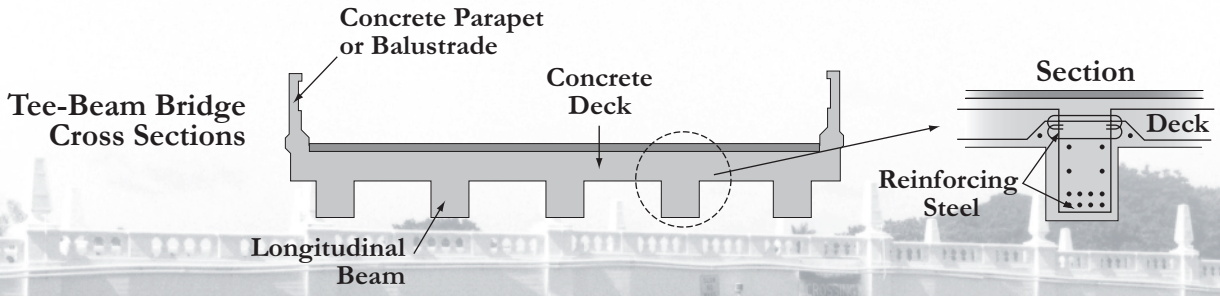
GIRDERS, SLABS & TEE-BEAM BRIDGES

Girders, slabs, and tee-beams represent the simplest, most straightforward methods of creating a bridge. Although technologically simple, modern developments in steel and concrete technology have often made them some of the most durable bridges constructed. Some of the most beautiful bridges in the state are girders, slabs, and tee-beams.

Girder bridges can be steel or concrete and are characterized by a deck that is supported by girders or stringers running lengthwise. Slab bridges use cast-in-place concrete reinforced by steel in the lower portion of the slab, where bending is the greatest, and at the ends, where shear is maximum. Tee-beam bridges are constructed with cast-in-place reinforced concrete beams with flanking integral deck sections. Reinforced steel runs longitudinally at the bottom of the beam stem and perpendicular to the stem in the deck.







The Little Six Mile Creek Bridge, Duval County

This bridge, along with several others in Duval County, reflects the work of T. B. Carrick. Built in 1926, it is located near Dinsmore, northwest of Jacksonville on the Old King's Highway, which was a route used by the British in the 18th century to travel between New Smyrna and Georgia. The structure features a concrete railing with stylized Maltese cross patterns in each panel.

As a two-span, 70-foot-long arched girder structure, the bridge relies on standard design and construction methods. Despite this, this bridge and three other Carrick bridges on the Old Kings Highway have been determined to represent an important historic resource. The four bridges reflect the design of a prominent engineer of the period, and are associated with the history of the area. Two of these four bridges have been demolished and the remaining two (this structure and the Trout River Bridge) are scheduled for removal.

T. B. Carrick was a prominent Duval County bridge engineer of the 1920s. The Maltese Cross design of the concrete railings, a design favored by Carrick, distinguishes his bridges. Carrick's experience with bridge building in South America may have influenced his designs. ◆

Little Six-Mile Bridge, designed by T. B. Carrick

The James N. Holmes Bridge, Hillsborough County

Quick to build and sturdy under traffic, the reinforced concrete girder proved ideal for shorter spans. This bridge consists of four 40-foot spans. Though technologically simple, it features decorative Neoclassical Revival railings with shaped balusters made of cast concrete.

The James N. Holmes Bridge was built in 1926 by a consortium of private citizens to carry Florida Avenue over the Hillsborough River. These citizens–S. B. Denton, B. L. Hamner, H. G. Warner, H. H. Regner, A. R. Phillips, Charles W. Lyons, W. L. Waring Jr., and M. H. Mabry–felt that a bridge was needed to stimulate commercial development in this section of Tampa. The Board of County

The James N. Holmes Bridge, Hillsborough County

Detail of cast concrete balusters on the James N. Holmes Bridge in Hillsborough County

Commissioners, at the urging of Commissioner James N. Holmes, voted to accept the proposition – as long as the County Engineer and the City of Tampa engineer approved the plans, and as long as the county had the right to acquire the bridge at a later date. As the structure stands now, it appears to be original and intact. While the technology of the bridge is simple and many examples are extant, its age and the unusual circumstances of its funding lend the structure local historical importance.

The Twelfth Avenue Bridge over Ware's Creek, Manatee County

The Twelfth Avenue Bridge over Ware's Creek is a simple and small, 28-foot-long concrete girder bridge. It is a standard bridge type with Neoclassical concrete railings, a somewhat common aesthetic treatment on bridges from the 1920s and 1930s.

Twelfth Avenue Bridge over Ware's Creek in Manatee County

The bridge dates to 1938, when Bradenton engineer Freeman Horton designed the structure and supervised its construction, perhaps with federal relief assistance. Horton designed other bridges and buildings in the city during the 1930s and 1940s. This bridge is considered an important historic resource, as one of a select group of bridges in Bradenton associated with Freeman Horton.

The Indian Creek Bridge, Miami-Dade County

A 13-span, 367-foot-long reinforced concrete tee-beam bridge, the Indian Creek Bridge provides access to the village of Indian Creek, an island community in Biscayne Bay. Designers lavished attention on the aesthetic qualities of the bridge, transforming a technologically standard bridge type into an impressive architectural structure. The concrete girders are arched and the central span has been lengthened to suggest a stylized bascule. Extending up the face of the bridge are pilasters that connect the piers to the short, square columns that form a part of

The Indian Creek Bridge provides access to the island community of Indian Creek in Miami-Dade County.

the ornate railings. Tapered pylons stand on top of each column, and alternating pylons function as light fixtures. The railings feature a Neoclassical Revival motif, with urn-shaped balusters topped by a heavy concrete cap.

Designed by engineer Richard A. Belsham with assistance by construction architect Robert A. Taylor, both local men, the structure was built during 1929 and 1930 for the Indian Creek Golf Club. Construction was undertaken by the R. G. Lassiter Company of North Carolina, whose president, Robert G. Lassiter, owned a home in the Miami Beach area and may have been a club member.

The Indian Creek Bridge is a historically important structure. It represents a superior example of decorative architectural treatment of a standard concrete bridge. In addition, its age, prominent place in the Indian Creek community, and construction by an important builder substantially enhance its value.

The Madonna Boulevard Bridge, Pinellas County

The Madonna Boulevard Bridge is one of two structures built for Pinellas County in 1957 to serve the community of Tierra Verde. (The other is the 13th Street Bridge–*see below*.) It crosses the Tierra Verde Canal and is a standard concrete girder bridge consisting of three 40-foot spans.

The unique railings of the Madonna Boulevard Bridge reflect a Neo-Expressionist styling.

While it possesses no notable technological characteristics, it has truly unique railings. These sculpted concrete railings give the structure a space-age appearance best described as an example of Neo-Expressionist styling. This design was in keeping with the general design of the streetscape throughout the neighborhood. The Madonna Boulevard Bridge remains essentially unaltered.

The 13th Street Bridge, Pinellas County

Neo-Expressionist-style railings give a space-age appearance to the 13th Street Bridge in Pinellas County.

The 13th Street Bridge is virtually identical to the Madonna Boulevard Bridge described above. It was also built for Pinellas County in 1957 to cross the Tierra Verde Canal. Like the other structure, it is a simple standard concrete girder bridge, with three 40-foot spans and the same unique, sculpted concrete railings with a space-age appearance. Unlike the Madonna

The 13th Street Bridge from its western approach

Boulevard Bridge, some rehabilitation work was completed on the 13th Street Bridge in 1993, but this does not seem to have affected its overall integrity of design.

The Burlington Avenue Bridge, Pinellas County

The city of St. Petersburg built this small, standard reinforced concrete girder span. Its reported construction date is either 1942 or 1946. At 51 feet long, it carries Burlington Avenue over Booker Creek.

The railing panels on each side of the central pilaster exhibit typical features of the Moderne or "streamline" architectural style – curved ends and horizontal lines in the walls. The Moderne styling makes the bridge somewhat unique in Florida, particularly since the removal of the Northwest 27th Avenue Bridge in Miami.

Although the structure is a standard girder type, the bridge should be considered an important historic resource because of its unique styling.

Moderne Styling of the Burlington Avenue Bridge, Pinellas County

The Haines City Overpass, Polk County

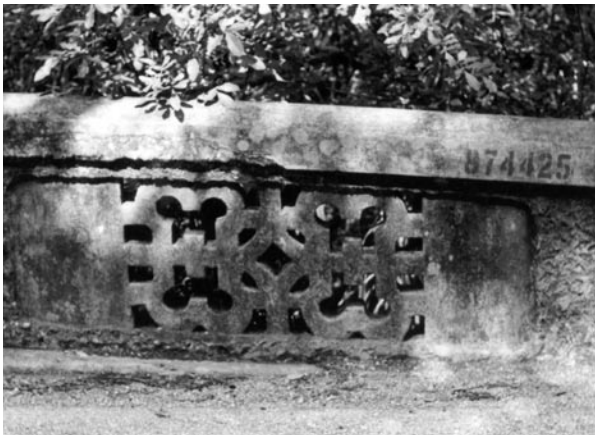
The Haines City, or Atlantic Coast Line, Overpass was built during 1926 and 1927 as a joint project between the municipality and the Atlantic Coast Line Railroad. It was designed by Joe Hill of Haines City and was built by the railroad and Walter W. Hoops. The structure consists of a three-span steel stringer, 125 feet long, with a concrete deck and railings. It carries Lilly Avenue over the Atlantic Coast Line rail line in Haines City. The solid concrete railings feature the rectangular recessed panels that commonly appeared on bridges at that time.

Though conventional in engineering and construction, the overpass appears to be the oldest example of a grade separation remaining in the state. It also exhibits a graceful arched look that sets it apart from most railroad overpasses. As a result, it is a unique and important historic structure within Florida.

The Haines City Overpass carries Lilly Avenue over the Atlantic Coast Line rail line in Haines City, Florida.

Other examples of fixed bridges in the state of Florida

The **Coldwater Truss** *is a fixed through truss located just outside of the Blackwater State Forest, just off State Road 191. Little remains of this abandoned structure and no evidence of the former associated road exists. It is one of only four Pratt-type through trusses remaining in the state and appears to date from the first two decades of the 20th century.*



This detail is from the **Deering Estate Bridge**. *The bridge's three-foot-high railing includes seven panels of intricate, oriental-styled latticework that appears on no other bridge in Florida. The bridge was built around 1920 and is associated with the NRHP-listed Charles Deering Estate in Miami.*

In the early 1920s, probably 1920 or 1921, Volusia County contracted with the Luten Bridge Company to build this four-span, reinforced concrete arch deck bridge on **Deep Creek**. *The bridge once occupied a key location on a locally important roadway, called the St. Johns River Scenic Road.*

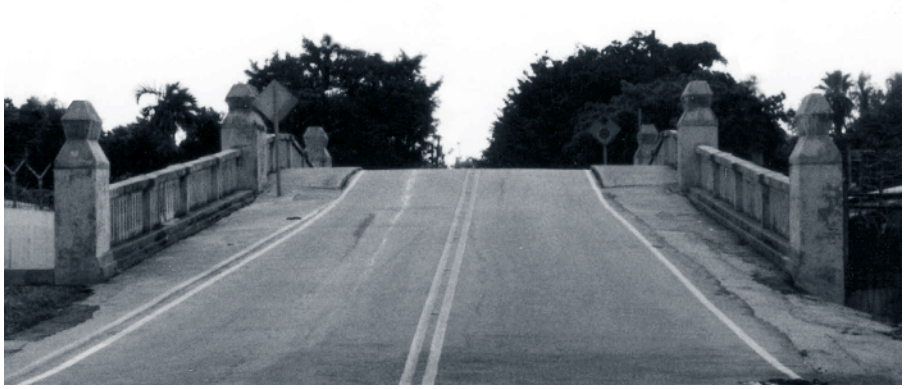
One of the oldest examples of Daniel Luten's work in the state, the **Old San Mateo Road Bridge** *once carried a brick road connecting the small town of San Mateo with Palatka.*

Granada Boulevard *(above)* **and Hardee Road Bridges** *(right)*

These aesthetically pleasing 1930s spans represent historic structures associated with the residential development of Coral Gables. The distinctive railing designs of these bridges are an interesting feature.

The 1914 **Bellamy Bridge** *over the Chipola River, north of Marianna, derives its name from a nearby plantation. This Converse Bridge Company structure was shipped in parts by rail and quickly and inexpensively erected on the site.*

Associated with the development of Spring Garden, the **Seybold Canal Bridge** *represents an interesting example of an early concrete arched design. This barrel arched bridge has a pronounced arched rib, and large, geometrically-shaped, concrete caps top the heavy, square abutments.*



The Hardee Road Bridge in Coral Gables

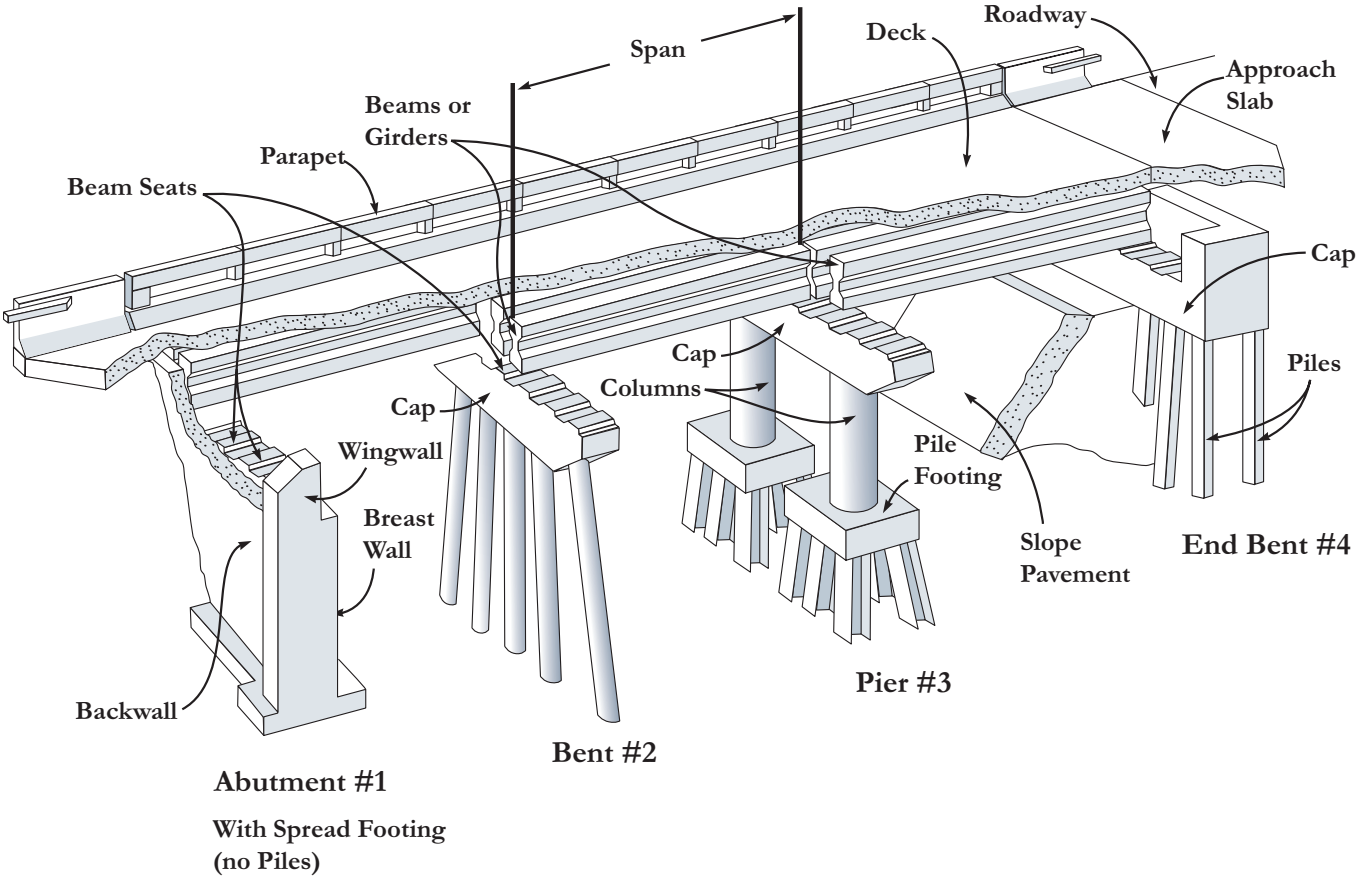


Diagram of a typical girder bridge

Photo opposite page: The Willis Bridge in Calhoun County

CHAPTER 6
UNIQUE & MODERN BRIDGES

The Interstate 95 Through Arch Bridge

The I-95 Through Arch Bridge is an impressive 1,431 feet in length.

This steel through arch overpass carries Interstate 95 over Myrtle Avenue and a railroad line in downtown Jacksonville. Departmental records indicate that it was constructed in 1955. The main span extends 386 feet. Sixteen steel girder approach spans join the main span and bring the entire bridge length to an impressive 1,431 feet. The Interstate 95 Through Arch Bridge represents the state's only steel arch and is one of only two through arches found in Florida. In addition, it is Florida's only grade separation with an arch design.

The Hal Adams Bridge

Florida added its only suspension bridge to the highway system in 1946-1947 when the L. J. and W. J. Cobb Construction Company of Tampa built the Hal Adams Bridge over the Suwannee River near Luraville.

The Hal Adams Bridge over the Suwannee River in Lafayette County is Florida's only suspension bridge.

Hal Adams was a veteran circuit court judge from northern Florida. This structure replaced a 40-year-old, multiple-span through truss bridge on the site where a ferry previously had operated. Small among structures of this type–420 feet between towers–the bridge nevertheless makes an impressive appearance in its rural, forested setting on the road between Mayo and Live Oak.

Another view of the Hal Adams suspension bridge, completed in 1947

Designers in the road department's engineering division chose the suspension type because of the unstable river bottom and deep potholes that made setting foundations difficult. The suspended span utilizes a Warren-type stiffening truss. Four steel beam towers, approximately 50 feet high and braced by cross girders, support steel wire cables which are fastened to steel shoes embedded in concrete anchorages. Although placed within the area between the anchorages and the towers, the approaches themselves are not suspended. The south end rests on the embankment, while the northern approach consists of eight concrete girder spans on concrete supports. Because of this arrangement, the cables extending between the towers and the anchors have differing lengths and angles, a distinguishing feature of this bridge.

The Hal Adams Bridge has historical merit as the only suspension span bridge in Florida. Its small size, for a technology ordinarily employed on major projects, adds another distinction.

The Moss Rainbow Arch

This rainbow arch, a type of reinforced concrete through arch, is the only one of its type in Florida. It was erected in 1926 by the Luten Bridge Company, the most active and widespread builder of concrete arch bridges in Florida through the 1920s. A road entering a subdivision in Pinellas County is carried over Alligator Creek by the bridge.

The Moss Rainbow Arch Bridge in Pinellas County

Made of reinforced concrete, the 37-foot-long, single-span bridge uses a design in which the arch springs from the abutment and passes through the railing to cross over the waterway. Hangers suspended from the arch connect with the floor beams that support the concrete deck. While the design is believed to have the

Although the Luten Bridge Company seems to have constructed a number of rainbow arch bridges in southeastern states, including Virginia and West Virginia, the use of this design by Luten was surprising given that Luten and Marsh were great rivals in bridge building, as well as personal foes. They battled long and hard in the courts about patent rights on concrete designs and quarreled about proper conduct by professional men. ◆

advantage of permitting the floor to expand and contract, it makes widening the roadway virtually impossible. As a bridge form, the rainbow arch, also known as the Marsh arch, primarily owed its design and promotion, as well as its construction in various states of the Midwest, to engineer and bridge builder James Marsh of Iowa.

The Moss Rainbow Arch's rarity in the state seems confirmed by Daniel Luten, Jr. This rainbow arch has historical importance for its age, type, and rarity within Florida. It survives as the only one of its kind in the state constructed by the foremost builder of reinforced concrete arch bridges in Florida.

The Luten "Half-Arch"

A unique and historically important bridge stands on a private drive over Ike's Creek (now called Golf Course Creek) in Belleair. Built in 1915 by the Luten Bridge Company, it once controlled the entranceway to the 600-room Belleview Hotel–a vast, luxurious resort developed by railroad magnate Henry B. Plant. The complex later became the Belleview Biltmore Casino, regarded by many as the grandest resort on Florida's Gulf Coast.

In what was then an experimental project, pioneer designer and builder of reinforced concrete bridges Daniel B. Luten constructed the bridge with a 46-foot main span and two half-spans of 23 feet each. While the half-arches appear to be cantilevered, Luten made them as true arches, meaning they are supported by abutments. He claimed to have achieved stability, greater efficiency in the use of materials, as well as a more pleasing appearance in crossing the ravine at Belleview. It is not known if he built any others like this in the nation. No others are believed to have been built in Florida.

Keeping with Luten's desire for an artistic appearance, the structure possessed a classical balustrade and decorative lampposts at each corner of the entrances. Later, perhaps at the time a new bridge was built immediately adjacent to it, the original railings were removed and replaced with a modern type. Dense undergrowth obscures the structure.

Because of its cultural and technical worth, the structure rates as a principal historic bridge in Florida. It is a demonstration of the unique and experimental half-arch construction undertaken by an important Florida bridge builder. The highly visible role assigned the bridge at the entrance to the Belleview Hotel gives it additional importance. Despite the removal of the original railing and the construction of the new adjacent bridge, the significant substructure remains undisturbed.

The Luten "Half-Arch" Bridge in Pinellas County with the Belleview Biltmore buildings in the background

The Hathaway Bridge in Panama City features the largest number of single-cell boxed segments in the U.S.

The Hathaway Bridge

The Hathaway Bridge carries State Road 38 (U.S. 98) across St. Andrews Bay to connect Panama City with the beach communities located on the barrier island to the west. The HNTB Corporation of Orlando designed this impressive structure. Constructed by Granite Construction Company of Tampa in 1960, the Hathaway Bridge features a 327-foot steel through truss and has the largest single-cell boxed segments in the United States. The structure includes 33 approach spans and reaches 3,300 feet in length.

This bridge predated the existing Hathaway Bridge over St. Andrews Bay and has since been demolished.

Hart Bridge

The Hart Bridge in Jacksonville was constructed in 1967.

The Hart Bridge represents the most recent addition to Jacksonville's collection of impressive steel structures. It clears almost 1,100 feet for the St. Johns River channel and extends almost 3,900 feet in length. This continuous through truss was constructed in 1967 and carries State Road 228.

Willis Bridge

Fairchild Florida Construction Company built this pleasing structure across the Chipola River in 1997. The Calhoun County Board of County Commissioners hired Preble-Rish, Inc. to design the structure. This bridge is notable primarily as the only example of an open spandrel arch currently carrying highway traffic in Florida. The only historic example of this type is the remnant of the historic Victory Bridge near Chattahoochee.

The Willis Bridge in Calhoun County is the only open spandrel arch in Florida that serves as a highway bridge.

The Napoleon Bonaparte Broward Bridge (Dames Point)

The Napoleon Bonaparte Broward Bridge at Dames Point spans the St. Johns River northeast of downtown Jacksonville. Two miles long and 175 feet above the main channel of the river, the Napoleon Bonaparte Broward Bridge connects northern Duval County with the Arlington and Beaches area of Jacksonville via State Road 9A. Opened to traffic in 1989, it is a good example of the simplicity of the cable-stayed bridge. This structure is two miles long and 175 feet above the main channel of the river. The central span of the bridge is 1,300 feet between the two towers, which are 471 feet above the waterline at the top. The concrete

and steel deck is suspended by 168 steel cables that extend from the towers and connect to the edge girder of the span at 35-foot intervals. The cables consist of steel cable sheathed within steel pipe.

The Napoleon Bonaparte Bridge at Dames Point on the St. Johns River near Jacksonville features a harp stay arrangement.

Designed by Howard, Needles, Tammen and Bergendoff, it represents the second cable-stayed bridge to be built in Florida (Tampa Bay's Sunshine Skyway was completed in 1984). It is the only bridge in the United States to feature the harp (parallel) stay arrangement on two vertical planes, a design that rivals suspension bridges for strength and beauty.

The Sunshine Skyway

The Sunshine Skyway, a cable-stayed bridge, carries Interstate 275 across Tampa Bay to link Pinellas and Manatee counties. This bridge replaced a cantilever metal truss that was damaged in 1980 when a freighter hit one of its piers and caused the collapse of its center span. The

Photo showing the original Skyway Bridge that was damaged and consequently replaced when a freighter caused the collapse of its center span.

new bridge features a precast deck superstructure designed by Figg & Muller and includes a bridge protection system designed by Parsons Brinckerhoff. This protection system consists of large concrete bumpers, called dolphins, located around the piers and designed to withstand an impact from an 87,000-ton tanker traveling at 10 knots.

The current Skyway Bridge reaches a total length of 29,040 feet and spans Tampa Bay, connecting Pinellas and Manatee counties.

The Sunshine Skyway Bridge reaches a total length of 29,040 feet with a main span measuring 1,200 feet and a vertical clearance of 193 feet. This bridge uses a single plane of cables, and the deck, made of prestressed concrete segments, serves as both the structure and the roadway surface. Twenty-one steel cables, encased in steel pipes painted yellow, support the roadway. The roadway is located on either side of the cables, affording travelers an unobstructed view of Tampa Bay and the surrounding area.

BIBLIOGRAPHY

FLORIDA HISTORY

Akin, Edward N. *Flagler: Rockefeller Partner and Florida Baron*. Kent, Ohio: Kent State University Press, 1988.

Blackman, E. V. Miami and Dade County, *Florida: Its Settlement, Progress and Achievement*. Washington, D.C.: Victor Rainbolt, 1921; reprint, Chuluota, Florida: Mickler House, 1977.

Broward, Robert C. *The Architecture of Henry John Klutho: The Prairie School in Jacksonville*. Jacksonville: University of North Florida Press, 1983.

Davis, Thomas Frederick. *History of Jacksonville, Florida, and Vicinity, 1515 to 1924*. Jacksonville: Florida Historical Society, 1925.

Derr, Mark. *Some Kind of Paradise: A Chronicle of Man and Land in Florida*. New York: William Morrow & Co., 1989.

Dunn, Hampton. *Tampa: A Pictorial History*. Norfolk, Virginia: Donning Company, 1985.

Dunn, Hampton. *Yesterday's Clearwater*. Miami: E. A. Seeman Publishing, 1973.

Dunn, Hampton. *Yesterday's St. Petersburg*. Miami: E. A. Seeman Publishing, 1973.

Florida. Ed. by D. B. McKay. St. Petersburg: St. Petersburg Printing Co., 1950.

Fritz, Florence I. *Unknown Florida*. Coral Gables: University of Miami Press, 1963.

Grismer, Karl H. Tampa, *A History of the City of Tampa and the Tampa Bay Region*.

Grismer, Karl H. *The Story of Fort Myers: The History of the Land of the Caloosahatchee and Southwest Florida*. St. Petersburg: St. Petersburg Printing Co., 1949.

Hetherington, M. F. *History of Polk County, Florida: Narrative and Biographical*. St. Augustine: The Record Co., 1928.

Marth, Del. *Yesterday's Sarasota; Including Sarasota County*. Miami: E. A. Seeman Publishing and Sarasota County Historical Commission, 1973.

Martin, Sidney Walter. *Florida During the Territorial Days*. Athens: University of Georgia Press, 1944.

McGovern, James R. *The Emergence of A City in the Modern South: Pensacola 1900-1945*. DeLeon Springs, Florida: The Author, 1976

Michaels, Brian E. *The River Flows North: A History of Putnam County, Florida*. Palatka: Putnam County Archives and History Commission, 1976.

Morris, Allen, comp. *The Florida Handbook*. Tallahassee: Peninsula Publishing Co., 1947-1988.

Patrick, Rembert W., and Allen Morris. *Florida Under Five Flags*. 4th ed. Gainesville: University of Florida Press, 1967.

Schofield, Arthur C. *Yesterday's Bradenton Including Manatee County*. Seeman's Historic Cities Series No. 20. Miami: E. A. Seeman Publishing and Manatee County Historical Society, 1975.

Smiley, Nixon. *Yesterday's Florida. Seeman's Historic States Series No. 1*. Miami: E. A. Seeman Publishing, 1974.

Tebeau, Charlton W. *A History of Florida*. Coral Gables: University of Miami Press, 1971.

Ward, James Robertson and Dena Elizabeth Snodgrass. *Old Hickory's Town: An Illustrated History of Jacksonville*. Florida Publishing Co., 1982.

Watson, Henry B. *Bicentennial Pictorial History of Volusia County*. Daytona Beach: The News-Journal Corporation, 1976.

Weidling, Phillip I. and August Burghard. *Checkered Sunshine: The Story of Ft. Lauderdale 1793-1955*. Gainesville: University of Florida Press, 1966.

WPA Guide to Florida. American Guide Series. New York: Oxford University Press, 1939; reprint, New York: Pantheon books, 1984. Introduction by John I. McCollum.

ROADS AND BRIDGES: SECONDARY SOURCES

All Florida Motorist. March 1926.

Armstrong, Ellis L., Michael C. Robinson, and Suellen C. Hoy, eds. *History of Public Works in the United States; 1776-1976*. Chicago: American Public Works Association, 1976.

Atkins, Stephen B. and William E. Keeler. "Survey of Metal Truss, Swing, and Vertical Lift Bridges in Florida." Tallahassee: Florida Department of Transportation, 1981.

Bannerman, R. L. "Bridge Construction in Florida." *Florida Highways*, 4 (March 1927): 1-2.

"Bascule Bridges." *Engineer*, 115 (March 28, 1913): 340-343.

Becker, Donald N. "Development of the Chicago Type Bascule Bridge." *American Society of Civil Engineers Proceedings*, 69 (February 1943): 263-293 and 70 (April 1944): 555-558.

Bigelow, Lawrence N. "Fifty-Year Development-Construction of Steel Truss Bridges." American Society of Civil Engineers, *Journal of the Construction Division*, 101 (June 1975): 239-258.

Billington, David P. "History and Esthetics in Concrete Arch Bridges." American Society of Civil Engineers, J*ournal of the Structural Division*, 103 (November 1977): 2129-2143.

Birtley, H. M. "Face Lifting the Eighth Wonder." *Florida Public Works*, 16 (August, 1939): 1-4, 10-13.

Bockleman, Charles W. *The King's Road to Florida, The Stagecoach Route*. Publisher unknown, 1975.

Borman, Henry. *Bridges*. New York: Macmillan, 1934.

Boyd, Mark F. "Early Highways of Florida." *Florida Highways*, 19 (June, 1951): 6-8, 30-35.

"Building the Overseas Highway." *The Excavating Engineer*, 22 (July 1928): 253-260.

Buker, George E. *Sun, Sand and Water: A History of the Jacksonville District U.S. Army Corps of Engineers, 1821-1975*. Jacksonville: U.S. Army Corps of Engineers, n.d.

Cash, W. T. "Roads of Early Days in Florida." *Florida Public Works*, 18 (October, 1941): 20-21.

Champion Bridge Company. *Catalog*. Wilmington, Ohio: Publisher unknown, 1901.

City Hall Records: Bellair, Bradenton, Fort Lauderdale, Ft. Pierce, Haines City, Jacksonville, Miami, St. Petersburg, Sarasota, and Tampa.

Collier Engineering Company. *The Elements of Bridge Engineering*. Vol. 2. New York: Burr Publishing House, 1897.

Commonwealth of Pennsylvania, Pennsylvania Historical and Museum Commission, and Pennsylvania Department of Transportation. *Historic Highway Bridges in Pennsylvania*. 1986.

Comp, Alan T., and Donald Jackson. "Bridge Truss Types: A Guide to Dating and Identifying." Nashville, Tennessee: American Association for State and Local History, 1977.

Condit, Carl. *American Building*. Chicago: University of Chicago Press, 1968.

Condit, Carl. *American Building Art: The Twentieth Century*. New York: Oxford University Press, 1961.

County Commission Minute Books: Broward, Dade, DeSoto, Duval, Hillsborough, Manatee, Orange, Pasco; Pinellas, Polk, Putnam, Sarasota, and Volusia.

Dean, W. E. "A General Review of Florida's Highway Bridges." *Florida Highways*, 16 (September, 1948): 11-15.

Darnell, Victor C. *Directory of American Bridge-Building Companies, 1840-1900*. Occasional Publication No. 4. Washington, D. C.: Society for Industrial Archeology, 1984.

Dean, W. E. "Low Cost Bridge Construction." *Florida Highways*, 17 (November, 1949): 4, 40-42.

Dovell, J. E. "The Development of Florida's Highways." *Economic Leaflets*, 11 (October 1952).

Dovell, J. E. *The State Road Department of Florida*. Gainesville: Public Administration Clearing Service of the University of Florida, 1955.

Duncan, B. M. "Making a Highway by Conversion of the Florida Overseas Railroad." *American Highways*, 17 (October 1938): 8-11, 16-17.

Emerson, Charles Stafford. "Millions in Bridges." *Florida Public Works*, 18 (May, 1941): 6-9.

"The First American Road in Florida. Papers Relating to the Survey and Construction of the Pensacola-St. Augustine Highway." Introduction by Mark F. Boyd. *Florida Historical Quarterly,* Part I, 14 (October 1935): 72-106; Part II, 14 (January 1936): 138-192.

Engineering and Contracting. 1911-1920. *Engineering News-Record*. 1914-1936, 1939-1942.

Florida Department of State, Division of Archives, History and Records Management. *A Guide to Florida's Historic Markers*. Tallahassee: Department of State, 1972.

Florida Department of Transportation, Environmental Management Office. *The Historic Highway Bridges of Florida*. Tallahassee, 1991.

Florida Department of Transportation. *Florida Keys Preservation of Access. A Critical Bridge Report*, August 15, 1973. Tallahassee: Department of Transportation, 1973.

Florida State Road Department. *Biennial Reports*. Tallahassee: Florida State Road Department, 1915-1970.

Florida. *The State Road System of Florida, As Designated by the Legislature*. Publisher unknown, (1929).

Florida. *Your Florida Road Department*. Orlando: Florida Press, 1959.

"Florida and the Horseless Carriage." *Florida Trend*, 10 (June 1967): 12-18.

Florida Engineering Society. *The Florida Engineer and Contractor*. Jacksonville: Florida Engineering Society. Scattered issues, 1924-1926.

Florida Highways, 1923-1953. Replaced by *Florida Public Works*, 1933-1942. Monthly magazine published by the Florida State Road Department.

Ford, Howard C. "A Reinforced Concrete Arch." *Journal of Engineering* (University of Colorado), 3 (May 1, 1907): 5-12.

Frankland, F. H. "Design and Construction of Small Span Suspension Bridges." *Roads and Streets*, 76 (March, 1933): 109-112.

"Gandy Viaduct Across Tampa Bay, Florida." *Engineering*, 119 (June 12, 1925): 729-730.

Good Roads in Florida. Jacksonville: Arnold Printing Company, 1917-1918. A monthly publication.

Hartman, J. Paul. "Florida's Historic Bridges." *Proceedings of Second Historic Bridges Conference*, Ohio State University. Columbus: March 11, 1988.

Hool, George A., and W. S. Kinne, eds. *Movable and Long-Span Steel Bridges*. 2nd ed. New York: McGraw-Hill, 1943.

Hool, George A and W.S. Kinne, eds. *Reinforced Concrete and Masonry Structures*. New York: McGraw-Hill Book Co., 1924.

Hopkins, Alice. "The Development of the Overseas Highway." *Tequesta*, 46 (1986): 45-58.

Hopkins, Henry J. *A Span of Bridges: An Illustrated History*. New York: Praeger Publishers, 1970.

Hovey, Otis E. *Movable Bridges*. Vol. l, *Superstructures*. New York: Praeger Publishers, 1970.

Howard, Ernest E. "Vertical Lift Bridges." *American Society of Civil Engineers Transactions*. Paper No. 1478. 84 (1921): 580-695.

Illinois Bridge Company. *Bridges of Concrete and What They Cost*. Chicago: Publisher unknown, 1914.

Jackson, Donald C. *Great American Bridges and Dams*. Washington, D.C.: The Preservation Press, 1988.

Jacoby, Henry. "Recent Progress in American Bridge Construction." *Science*, 16 (July 4, 1902): 12-24.

Kaufman, Philip L. "The 'Heel Trunnion' Bascule Bridge." *Engineering News*, 67 (May 2, 1912): 830-833.

Kelley, E. F. "Outstanding Problems in Highway Bridges Design." *The American City*, 30 (February-March, 1924): 182-184, 271-273.

Kendrick, Baynard. *Florida Trails to Turnpikes, 1914-1964*. Gainesville: University of Florida Press, 1964.

Ketchum, Milo S. *The Design of Highway Bridges and the Calculation of Stress in Bridge Trusses*. New York: Engineering News Publishing Co., 1909.

Lawrence, Frank E., and R. Y. Patterson. "Building a Motor Road Across the Florida Everglades." *Engineering News-Record*, 93 (September 11, 1924): 412-417.

Legler, Dixie and Carol M. Highsmith. *Historic Bridges of Maryland*. Crownsville: Maryland Historical Trust Press, 2002.

Lewis, John H. "Defects in Bridges." *American City* (Town and Country Edition), 18 (February 1918): 108-111.

Lichtenstein, Abba G. "Historic Bridges: Conflicts Ahead." Reprint. *Civil Engineering* (May 1987).

Lichtenstein Consulting Engineers, Inc. *Delaware's Historic Bridges: Survey and Evaluation of Historic Bridges with Historic Contexts for Highways and Railroads*, 2nd ed. Dover: Delaware Department of Transportation, Division of Highways, Location and Environmental Studies Office, 2000.

Lin, Tung Y., and Felix Kulka. "Fifty-Year Advancement in Concrete Bridge Construction." American Society of Civil Engineers, *Construction Division Journal*, 101 (September 1975): 491-510.

Luten, Daniel B. "Curves for Reinforced Arches." *Engineering Record*, 53 (April 14, 1906): 482-483.

Luten, Daniel B. "Double-Drum and Cantilever Arches." *Engineering World* (July 1921): 11-15.

"Manufacture of Bridge and Building Structural Shapes." *Scientific American*, 89 (December 12, 1903): 432-433.

McDonald, Thomas H. "The History and Development of Road Building in the United States." *American Society of Civil Engineers Transactions*. Paper No. 1685, 92 (1928): 1181-1206.

McDonald, Walter H. , comp. *Highways of Florida*. Tallahassee: State Road Department of Florida, Division of Statewide Highway Planning Survey, (1937).

Meuser, William. "The Development of Reinforced Concrete Bridge Construction." *Cornell Civil Engineer*, 33 (May 1925): 160-165, 178-183.

Miars, David H. *A Century of Progress: The History of the Champion Bridge Company and the Development of Industrial Manufacturing in Wilmington, Ohio*. Wilmington, Ohio: Privately Printed, 1972.

Mock, Elizabeth. *The Architecture of Bridges*. New York: Arno, 1972.

National Bridge Company. Indianapolis: 1907. *Catalog*.

"Official Opening Program and Pictorial History of the Gandy Bridge," November 20, 1924. Pamphlet. Special Collections, University of Tampa Library.

Ohio Department of Transportation. *The Ohio Historic Bridges Inventory Evaluation and Preservation Plan*. Columbus: Ohio Department of Transportation, 1983.

P.A.C. Spero & Company, *Delaware Historic Bridges: Survey and Evaluation*. Dover: Delaware Department of Transportation, Division of Highways, Location and Environmental Studies Office, 1991.

Parker, Senator F. P. "History of the State Road Department of Florida." Typescript prepared by the Division of Highway Planning, April, 1939.

Paxson, Frederic L. "The Highway Movement, 1916-1935." *American Historical Review,* 51 (January 1946): 236-253.

Plowden, David. Bridges: *The Spans of North America*. New York: Viking, 1974.

Portland Cement Association. *Architectural Design of Concrete Bridges, Concrete for Permanence*. Chicago: Portland Cement Association, [1937].

Portland Cement Association. *Concrete Bridges*. Chicago: Portland Cement Association, n.d.

Ramsey, G. Robert. "Lessons Taught by Road Building Experience in Florida." *Municipal and County Engineering*, 56 (February 1919): 73-74.

Reese, Joe Hugh. *History of the Tamiami Trail and a Brief Review of the Road Construction Movement in Florida*. Miami: The Tamiami Trail Commissioners and the County Commissioners of Dade County, Florida, 1928.

Reichmann, Albert. "American Bridge Type Bascule Bridges." *Journal of the Western Society of Engineers*, 29 (April 4, 1924): 177-181.

Scherzer Rolling Lift Bridge Company. *Scherzer Rolling Lift Bridges*. Chicago: The Company, 1901.

Schneider, Charles C. "The Evolution of the Practice of American Bridge Building." *American Society of Civil Engineers Transactions*, 54 (July 1905): 213-234.

Schneider, Charles C. "Movable Bridges." *American Society of Civil Engineers Transactions*, Pages No. 1071, 60 (1908): 258-336.

Sellards, Elias H., H. Gunter, and N. H. Cox. "Roads and Road Materials of Florida." *Florida Geological Society Bulletin No. 2*. St. Augustine: The Record Co., 1911.

Skinner; Frank W. "Standard American Methods of Erecting Steel Bridges." *Cornell Civil Engineer*, 19 (April 1911): 225-238.

Stewart, Seldon L. "Building Roads in the Everglades." *Municipal Journal*, 43 (November 29, 1917): 531-532.

Thacher, Edwin. "Concrete and Concrete-Steel in the United States." *American Society of Civil Engineers*, Transactions, Part E, 54 (1905): 426-458.

Traer, Will M. "Old Time Roads in Florida." *Florida Public Works*, 12 (November, 1935): 166-170.

Transportation Research Board. *Use of Historic Transportation Structures*. Washington: National Transportation Research Board, 1983.

Transportation Research Board. *Historic Bridge-Criteria for Decision Making*. Washington: Transportation Research Board, 1983.

"Two Creosoted Timber Bridges Connect Daytona Beach, Florida, with Mainland." *Wood Preserving News*, 6 (July 1928): 92-94.

Tyrrell, Henry G. *History of Bridge Engineering*. Chicago: By the Author, 1911.

Tyrrell, Henry G. "Trunnion Bascule Bridges with Fixed Counterweights." *Engineering and Contracting*, 39 (April 16, 1913): 426-428.

United States Department of Transportation. *America's Highways, 1776-1976: A History of the Federal-Aid Program*. Washington, D.C.: Government Printing Office, 1976.

United States War Department. U.S. Army, Corps of Engineers. *List of Bridges Over the Navigable Waters of the United States*. Washington, D.C.: Government Printing Office, 1925.

Van Cleve, Horatio P. "Mechanical Features of Vertical Lift Bridges." *Engineering and Contracting*, 50 (November 27, 1918): 95-97.

Vanderhill, Burke G. "The Alachua Trail: A Reconstruction." *Florida Historical Quarterly*, 55 (April 1977): 423438.

Waddell, John A. L. *Bridge Engineering*. 2 vols. New York: John Wiley, 1916.

Waddell, John A. L. "Simple Truss Bridges." *American City* (Town and Country Edition), 16 (February 1917): 114-120.

Walzer, Norman and Claudia McFadden. *Linking America: The County Highway System*. Washington: National Association of Counties, 1989.

Weaver, Paul. National Register of Historic Places–Nomination Form, Springfield Historic District, St. Augustine: Historic Property Associates, 1986.

Whitney, Charles S. Bridges: *A Study in Their Art, Science and Evolutio*n. New York: William E. Rudge, Publishers, 1929; reprint, New York: Crown Publishers.

Wright, Frank C. "Florida," *Engineering News-Recor*d, 96 (January 7, 1926): 20-24.

Wright, Frank C. "Florida as an Engineer Sees It," *Engineering News-Record*. Pt. I: "The Boom Itself," 96 (January 14, 1926): 58-64; Pt. II: "Engineering and Contracting Conditions," 96 (January 28, 1926): 162-164; Pt. III: "Railroads and Ports," 96 (February 11, 1926): 243-246.

ROADS AND BRIDGES: PRIMARY SOURCES

Bradenton City Council Minutes. Book 12 (January 1945): 252

Bradenton City Council Minutes. Book 13 (May 1949): 86.

Bradenton City Council Minutes. Book 7 (March 1926): 14.

Bradenton City Council Minutes. Book 11 (October 1938): 270.

Brevard County. "Commissioner Minutes." August 4, 1925.

"Bridge Inspection Report." Polk County Engineer's Office, Bartow. N.d.

City of Fort Pierce. "City Commission Minutes." Book 1 (July 5, 1925): 152, (August 14, 1925): 175, and (September 29, 1926): 295.

City of Jacksonville, Engineer's Office. "Council Minutes." Book V (November 1929)

City of Jacksonville, Engineer's Office. "Plans of Duval Street Viaduct." January 1915.

City of Jacksonville, Engineer's Office. "Cross Sections of McCoy's Creek." December 1926.

City of Jacksonville. 10, 1915: 536-537.

City of St. Petersburg. "Index to Contract Files" N.d.

City of St. Petersburg. "Resolution File." April 17 and July 14, 1936; April 27, 1937.

City of St. Petersburg. "Filed Index to Resolutions and Contracts–Bridge Salt Creek and 3rd Street." March 1925.

City of St. Petersburg. "Index to Resolution File." December 16, 1941 and August 20, 1946.

"Contract, City of Tampa and Roberts Supply Company." May 16, 1926. *City of Tampa, Contract Records*, Roll 1.

Dade County. "Commissioner Minutes." July 1924.

Miami Herald. July 10, 1988.

Dieterick, Emily, Elise Braub-Hoessly, Robert Carr, and Michael Zimny. "Nomination of the Charles Deering Estate to the National Register of Historic Places." 1986.

Engineering News Record, 103 (August 8, 1929): 65.

Engineering News Record, 103 (August 8, 1929): 65

Engineering News Record, 100 (March 8, 1928): 71, and (June 14, 1928): 72.

Engineering News Record, 98 (February l7, 1927): 71, (May 29, 1927): 59, and (June 30, 1927): 49.

Engineering News Record, 96 (April 22, 1926): 237.

Engineering News Record, 96 (January 7, 1926): 4, and (January 14, 1926): 16.

Engineering News Record, 96 (May 6, 1926): 275.

Engineering News Record, 93 (July 10, 1924): 16.

Engineering News Record, 75 (May 11, 1916): 19 and 331.

Engineering News Record, 76 (August 24, 1916): 96.

FDOT Archives. Box 590 -- "Project 613."

Florida Department of State, Division of Historical Resources. Florida Master Site File.
Located at the R.A. Grey Building. Tallahassee, Florida.

Florida Department of State, Division of State Libraries. Florida Vertical Files. Located in the Dorothy Dodd Room, R.A. Grey Building. Tallahassee, Florida.

Florida Department of State, Division of State Libraries. Florida Photograph Archives. Located at the R.A. Grey Building. Tallahassee, Florida.

Florida Department of Transportation. "Survey and Inventory of Florida Historic Highway Bridges," 1989. Manuscript on file with the Environmental Management Office or the Florida Department of Transportation. Tallahassee, Florida.

Florida Highways, 16 (November 1948): 8.

Florida Highways, 17 (October 1949): 29.

Florida Highways, 5 (April 1928): 17.

Florida Highways, 6 (January, 1929): 8.

Florida Highways, 9 (February 1932): 14.

Florida Highways, 15 (July 1938): 116.

Florida Public Works, 13 (September 1936): 147

Florida Public Works, 12 (September 1935): cover.

Florida Public Works, 12 (May, 1935): 65 (photo).

Florida Public Works, 11 (February 1933): 10.

Florida Public Works, 11 (February 1933): 12.

Florida Public Works, 9 (September 1932): front cover.

Florida Times Union. January 3, 1968

Florida Times Union. June 1, 1950.

Florida Times Union. October 23, 1949.

Hillsborough County Commissioner Minutes, Vol. R (August 27, 1926): 538-539.
Minutes. 14 (April 11, 1939): 403.

Pasco County. 1923): 248. "County Commissioner Minutes." Book 4 (April 1923): 248.

Pinellas County. "County Commissioner Minutes." Book 6 (July 13, 1926): 98, and (July 20, 1926): 113.

Pinellas County. "County Commissioner Minutes." 91 Book 4 (June 21, 1922): 265.

Torres, Cristobal J. "Field Inspection Report, Atlantic Avenue Bridges Over Ocean Canal." FDOT, 1988.

Town of Belleair. "Commissioner Minutes." Entries for March 30, 1926; July 12, 1932;
July 25, 1933; April 24, 1934.

Webb, Harold. Telephone conversation with Donald Abbe, February 26, 1990

INTERNET SOURCES

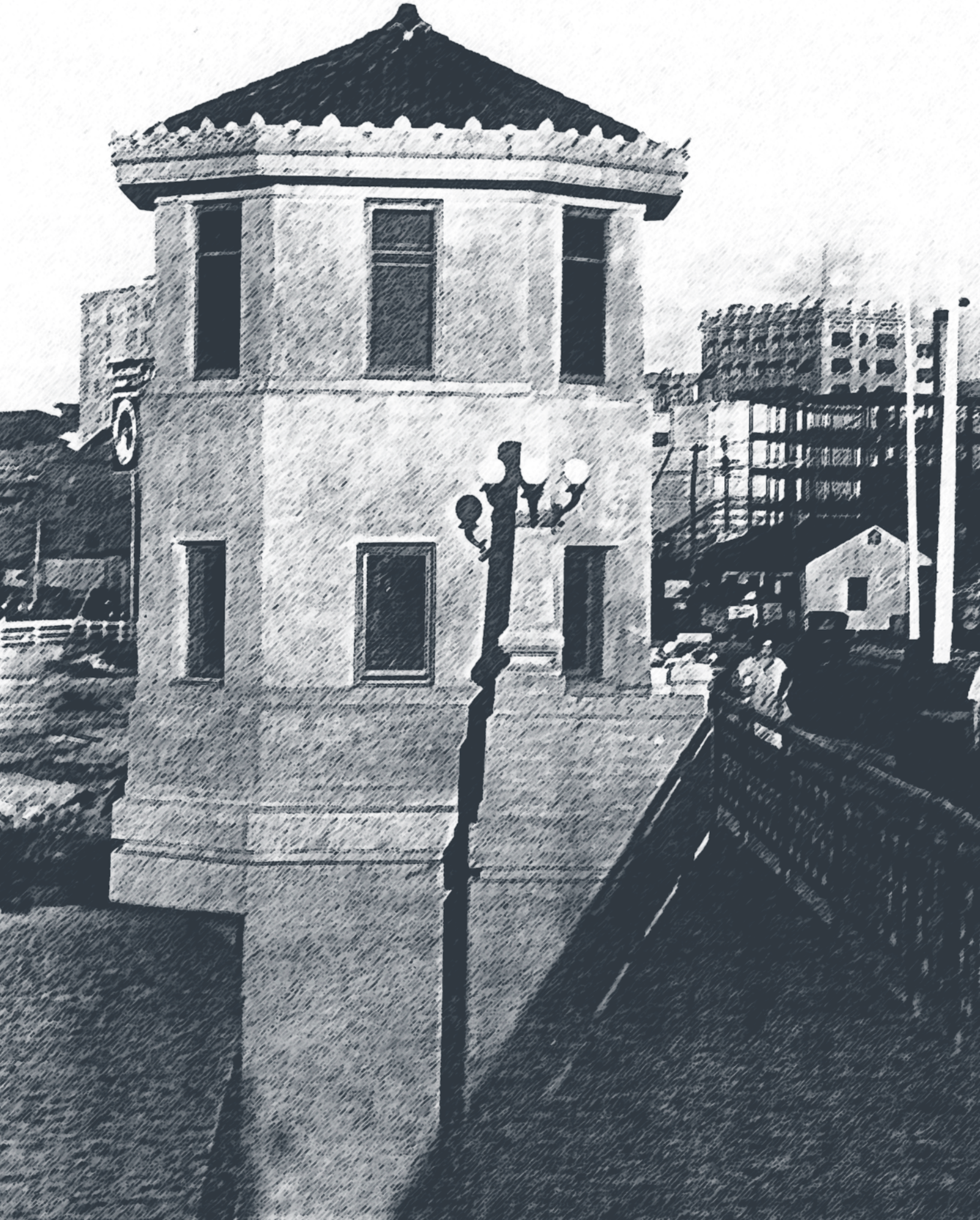
Delaware Department of Transportation. Delaware's Historic Bridges, page 8. Found online at
http://www.deldot.net/static/projects/archaeology/historic_pres/delaware_bridge_book/PAGE_8.PDF. n.d.

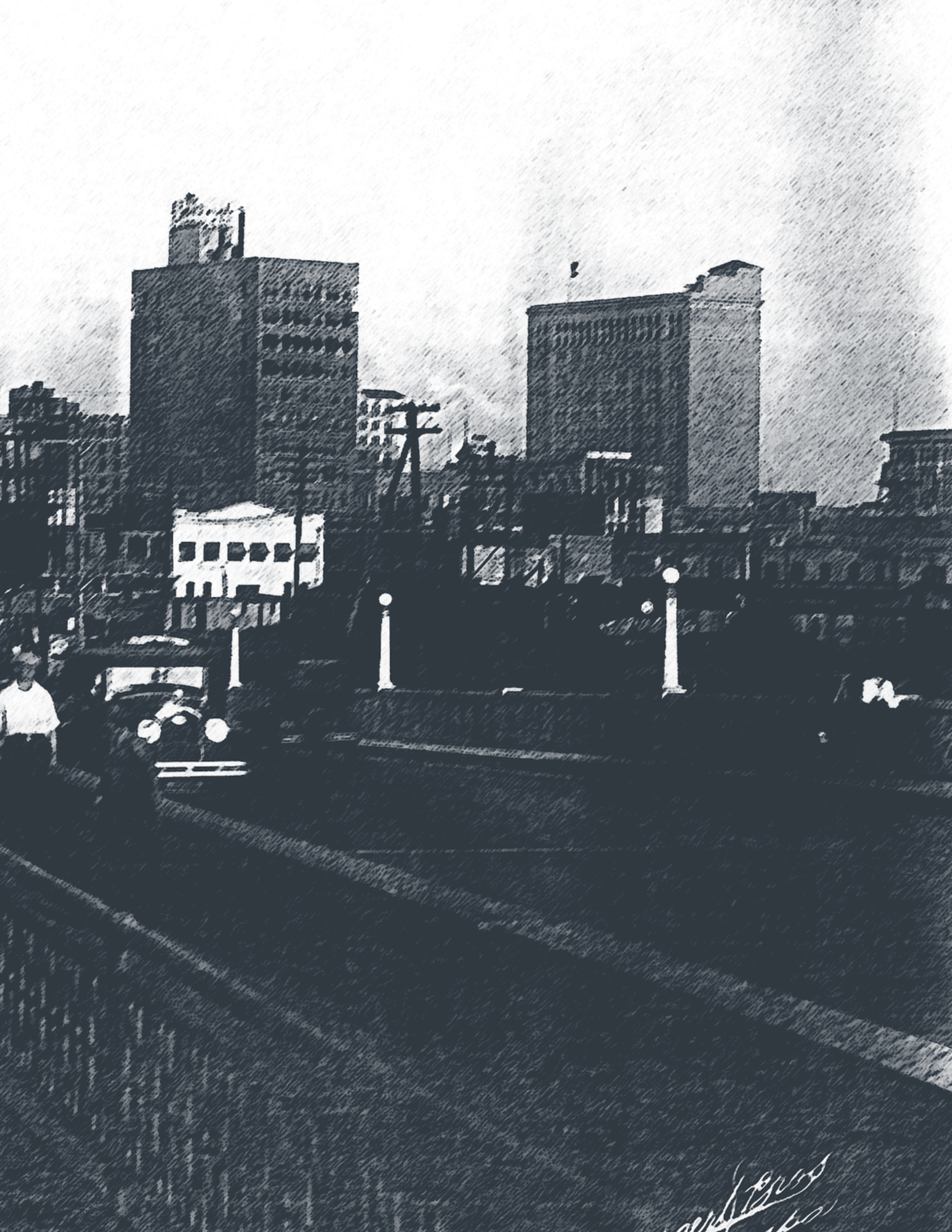
Nerhaugen, Dan. When Winona was Young. Found on *Winona Post* website at
http://www.winonapost.com/011701/wpo011701.html. n.d.

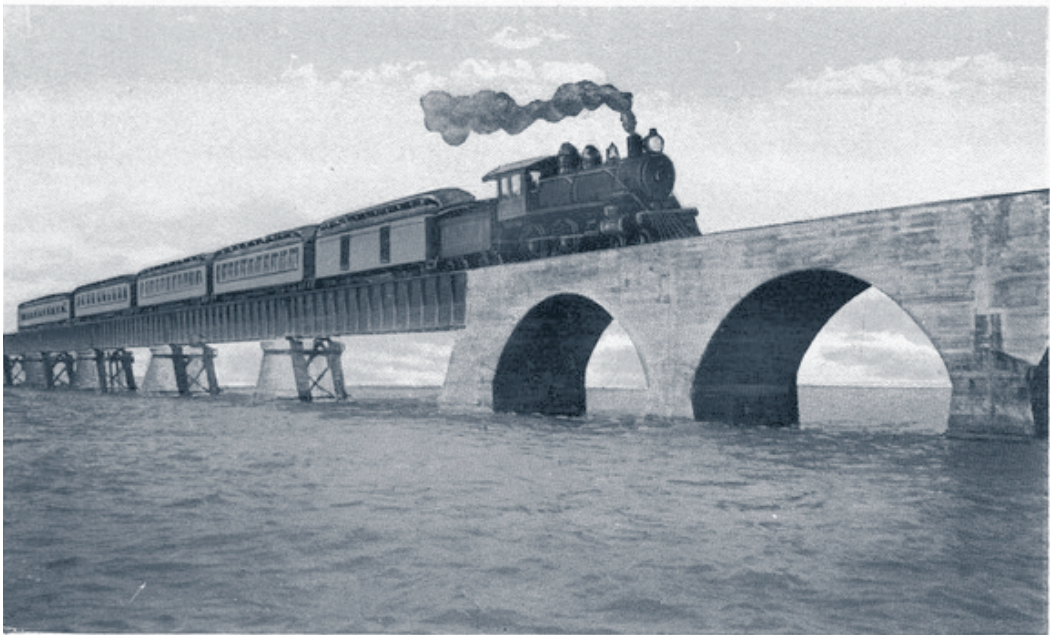
Rogers, Elizabeth Barlow. Definitions: The City Beautiful Movement. Definitions for lecture notes. Found online at:
http://www.elizabethbarlowrogers.com/lecture/defintions/def_citybeautiful.htm. n.d.

Rose, Julie K. The City Beautiful Movement. In "City Beautiful: The 1901 Plan for Washington, D.C." Found online at:
http://xroads.virginia.edu/~CAP/CITYBEAUTIFUL/city.html. 1996.

Photo opposite page: This statue of a World War I "doughboy" from the first Memorial Bridge, which is now demolished, still stands beside the replacement bridge at the crossing of the St. John's River in Palatka.
Photo inside back cover: Bridge tender's building on Cass Street Bridge, from Burgert Brothers, 1926







Florida Department of Transportation
Environmental Management Office
Tallahassee, Florida