REINFORCED CONCRETE BRIDGES of LUTEN DESIGN

REINFORCED CONCRETE BRIDGES

DANIEL B. LUTEN
Designing and Consulting Engineer

INDIANAPOLIS, INDIANA
NINETEEN HUNDRED TWENTY-FOUR

NAVY MEMORIAL BRIDGE ON MAIN STREET OVER ARKANSAS RIVER, LITTLE ROCK, ARKANSAS
Thirteen spans of 49 to 192½ feet. Roadway 56 feet. Footings on rock 40 feet below low water.
For the Broadway Main Street Bridge Commission, Little Rock, Arkansas, 1920-24.
Cost $1,200,000.00

SASKATOON BRIDGE OVER SASKATCHEWAN RIVER, SASKATOON, SASKATCHEWAN, CANADA
Ten spans of 25 to 150 feet. Roadway 63 feet. Footings on clay.
For the Highway Commission of the Province of Saskatchewan, Regina, Saskatchewan, 1913-15.
Temperature range from 60 below to 100 above Zero, Fahr.

GEORGETOWN BRIDGE OVER WABASH RIVER, GEORGETOWN, INDIANA
Seven spans of 90 to 120 feet. Roadway 18 feet. Footings on rock.
For the Board of Commissioners of Cass County, Logansport, Indiana, 1912.
Photographed immediately after Easter Flood of 1913.

MAUMEE RIVER BRIDGE, WATERVILLE, OHIO.
Twelve spans of 75 to 90 feet. Roadway 16 feet. Footings on rock.
For the Ohio Electric Railway Company, Cincinnati, Ohio, 1907.
Two additional views on page 8.

MAUMEE RIVER BRIDGE, WATERVILLE, OHIO
Twelve spans of 75 to 90 feet. Roadway 16 feet. Footings on rock.
For the Ohio Electric Railway Company, Cincinnati, Ohio, 1907.
Other views below and on page 7.

MAUMEE RIVER BRIDGE, WATERVILLE, OHIO
Twelve spans of 75 to 90 feet. Roadway 16 feet. Footings on rock.
For the Ohio Electric Railway Company, Cincinnati, Ohio, 1907.
Other views above and on page 7.

MT. AETNA BRIDGE OVER WABASH RIVER, HUNTINGTON, INDIANA
Twin spans of 100 feet each. Roadway 24 feet. Footings on rock.
For the Board of Commissioners of Huntington County, Huntington, Indiana, 1918.
Open spandrel arches.

STERLING HEIGHTS BRIDGE OVER COAL RUN, FAIRMONT, WEST VIRGINIA
Span of waterway 80 feet. Roadway 20 feet. Footings on rock.
For the Sterling Heights Company, Fairmont, West Virginia, 1923.
Spandrel braced arch.

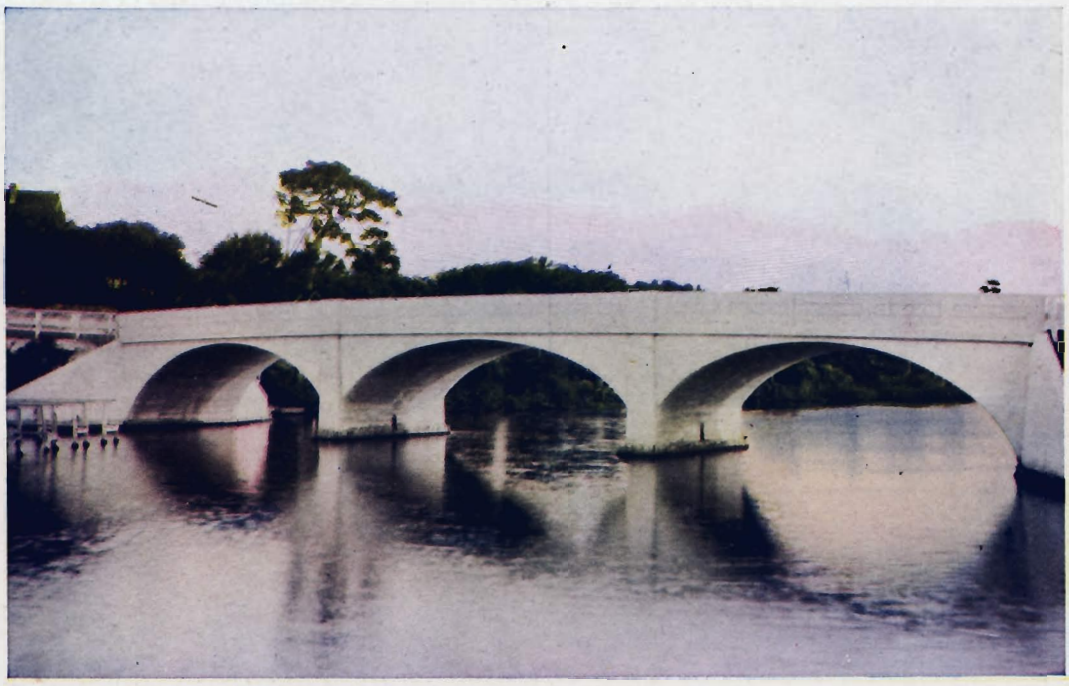
WEST WASHINGTON STREET BRIDGE OVER WHITE RIVER, INDIANAPOLIS, INDIANA
Seven spans of 106 to 120 feet. Roadway 77 feet. Skew 30 degrees. Footings on piling in gravel.
For the Board of Commissioners of Marion County, Indianapolis, Indiana, 1914-16.
Earth-filled arches replacing steel bridge destroyed by the 1913 Easter Flood.

BELLEVIEW BRIDGE, BELLEAIR, FLORIDA
Three spans of 30 to 60 feet. Roadway 18 feet. Footings on sand.
For M. F. Plant, New London, Connecticut, 1915.
The end spans are half-arches, not cantilevers.

COLWELL CUT BRIDGE OVER PITTSBURG & SHAWMUT R. R., COLWELL, PENNSYLVANIA
Span of opening 128 feet. Roadway 24 feet. Footings on shale.
For the Pittsburg & Shawmut Railroad Company, Kittanning, Pennsylvania, 1921.

DOUBLE-DRUM ARCH ON J. I. HOLCOMB ESTATE, INDIANAPOLIS, INDIANA
Span of opening 60 feet. Roadway 18 feet. Footings on loam.
For J. I. Holcomb, Indianapolis, Indiana, 1919.
Earth-filled arch having two four-inch rings with tamped earth between.

AMERICAN RIVER BRIDGE, SACRAMENTO, CALIFORNIA
Five spans of 112 to 125 feet. Roadway 21 feet. Footings on piling in sand.
For the Board of Supervisors of Sacramento County, Sacramento, California, 1915.



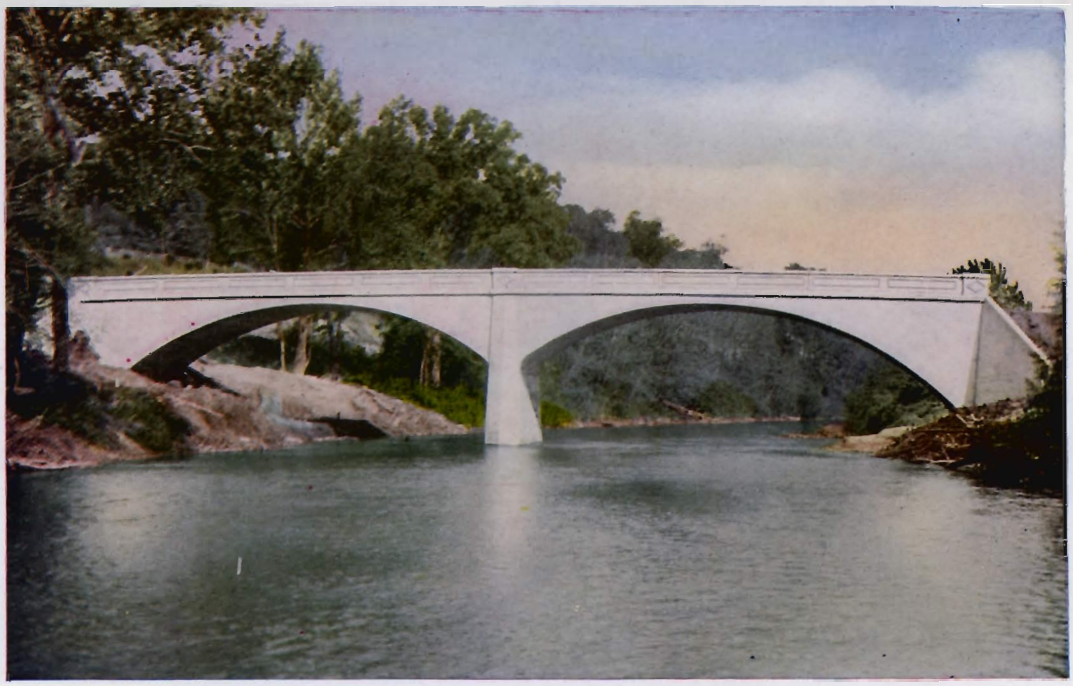
TILLMAN BRIDGE OVER TURKEY CREEK, BREVARD COUNTY, FLORIDA
Three spans of 32 to 36 feet. Roadway 16 feet. Footings on piling in sand.
For the Board of Commissioners of Brevard County, Titusville, Florida, 1919.

FLORENCE BRIDGE OVER ARKANSAS RIVER, FLORENCE, COLORADO
Twin spans of 65 feet each. Roadway 16 feet. Footings on gravel.
For the Board of Commissioners of Fremont County, Canon City, Colorado, 1913.

BLAIR BRIDGE OVER NORTHWEST BRANCH, MONTGOMERY COUNTY, MARYLAND
Span of waterway 55 feet. Roadway 22 feet. Footings on gravel and clay.
For the Maryland State Road Commission, Baltimore, Maryland, 1910.

CENTENNIAL BRIDGE ON NORTHWESTERN AVENUE OVER WHITE RIVER, INDIANAPOLIS, INDIANA
Five spans of 87 to 94 feet. Roadway 40 feet. Footings on piling in gravel.
For the Board of Commissioners of Marion County, Indianapolis, Indiana, 1921.
To commemorate the one hundredth anniversary of the founding of Indianapolis.

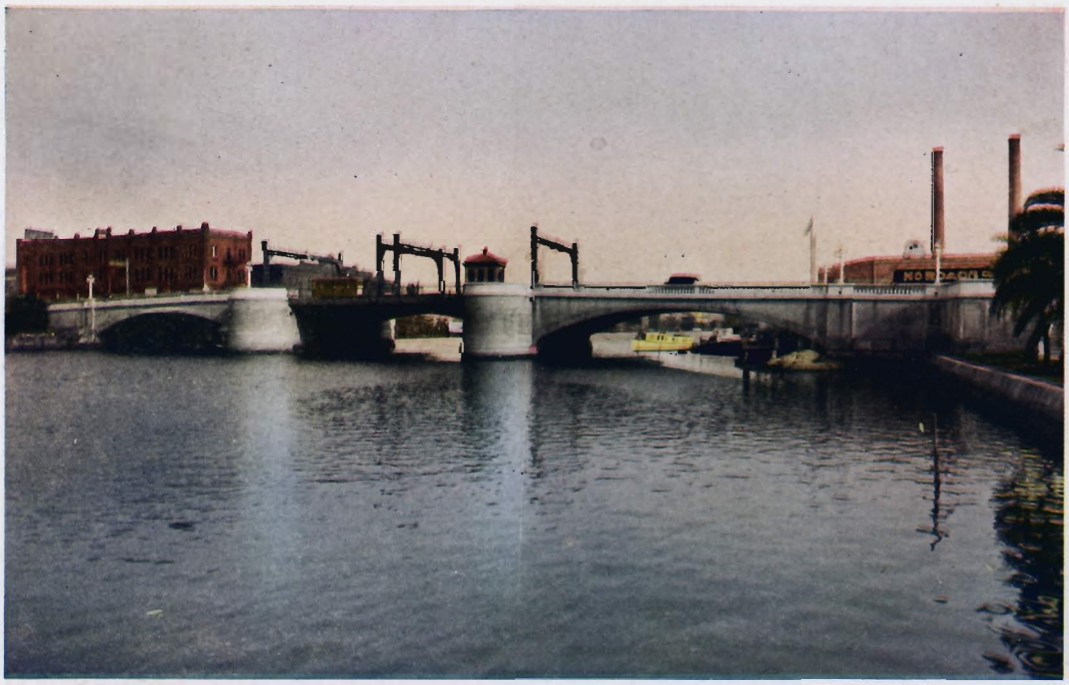
SOUTH THIRD STREET BRIDGE OVER LEHIGH RIVER, EASTON, PENNSYLVANIA
Three spans of 92 to 105 feet. Roadway 62 feet. Footings on rock.
For the Board of Commissioners of Northampton County, Easton, Pennsylvania, 1912.
Illustrating three intersecting lines of transportation.



VONORE BRIDGE OVER TELLICO RIVER, VONORE, TENNESSEE
Twin spans of 65 feet each. Roadway 16 feet. Footings on rock.
For the Monroe County Road Commission, Madisonville, Tennessee, 1913.
Illustrating thin pier, 4 feet at springing, 5 feet at base, for 75 ton load on one span.

NOCCALULA FALLS BRIDGE OVER BLACK CREEK, GADSDEN, ALABAMA
Span of waterway 56 feet. Roadway 18 feet. Footings on rock.
For the County Court of Etowah County, Gadsden, Alabama, 1916.

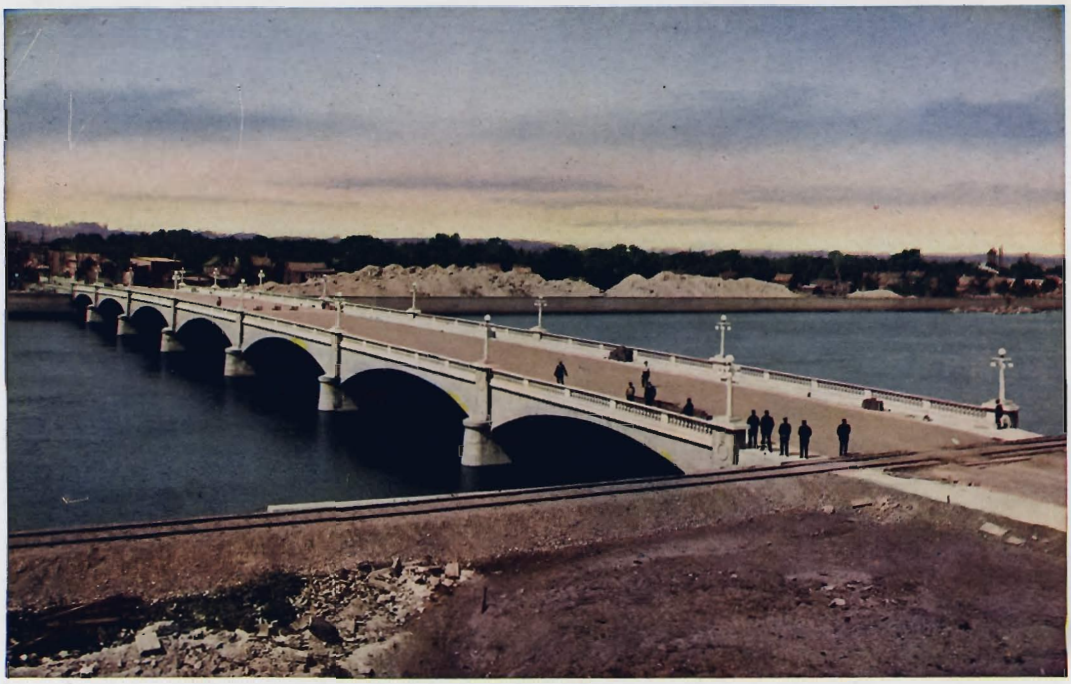
CHESTNUT STREET BRIDGE OVER ARKANSAS RIVER, ARKANSAS CITY, KANSAS
Nine spans of 47 to 59 feet. Roadway 18 feet. Footings on cylindrical caissons to rock.
For the Board of Commissioners of Cowley County, Kansas, 1914.
Cantilevered slab at crown, brackets at piers for roadway, no sidewalks.



LAFAYETTE STREET BRIDGE OVER HILLSBORO RIVER, TAMPA, FLORIDA
Twin spans of 93 feet 4 inches and steel lift of 84 feet. Roadway 77 feet 8 inches. Footings on rock.
For the Board of Public Works, City of Tampa, Florida, 1913.
Located in tide-water one-quarter mile from Tampa Bay barely visible in background.

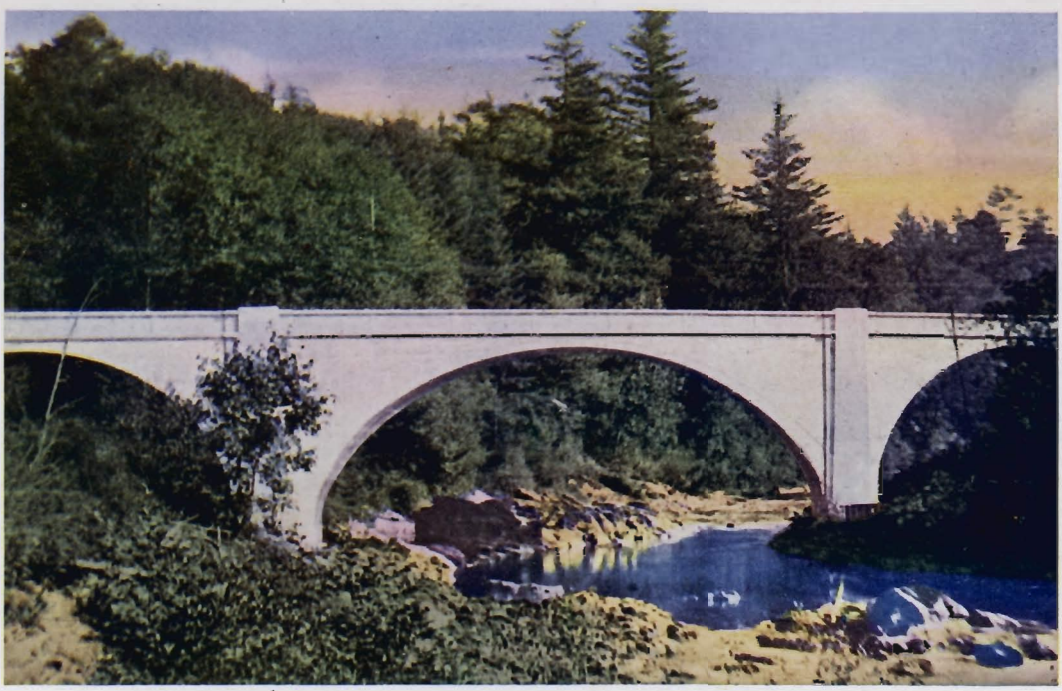
ZIMMERMAN BRIDGE OVER WABASH RIVER, COUNTRY CLUB, LOGANSPORT, INDIANA
Four spans of 110 feet each. Roadway 20 feet. Footings on rock.
For the Board of Commissioners of Cass County, Logansport, Indiana, 1917.

PROCTOR'S CREEK BRIDGE, FULTON COUNTY, GEORGIA
Span of waterway 60 feet. Roadway 20 feet. Footings on rock.
For the Board of Commissioners of Fulton County, Atlanta, Georgia, 1921



LEONARD STREET BRIDGE OVER GRAND RIVER, GRAND RAPIDS, MICHIGAN
Seven spans of 73 to 90 feet. Roadway 63 feet. Footings on rock.
For the Board of Public Works, City of Grand Rapids, Michigan, 1912.

TIDEWATER BRIDGE OVER BIG SNAKE CREEK, DADE COUNTY, FLORIDA
Three spans of 60 feet each. Roadway 18 feet. Footings on piling in sand.
For the Board of Commissioners of Dade County, Miami, Florida, 1917.



KANASKET BRIDGE OVER GREEN RIVER, KANASKET, WASHINGTON
Three spans of 50 to 100 feet. Roadway 20 feet. Footings on rock.
For the Board of Commissioners of King County, Seattle, Washington, 1918.
The end spans are half-arches, not cantilevers.

RIPLEY BRIDGE, RIPLEY, NEW YORK
Span of waterway 80 feet. Roadway 16 feet. Footings on rock.
For the Town Board of Ripley, New York, 1908.

HARRIMAN BRIDGE OVER EMORY RIVER, HARRIMAN, TENNESSEE
Seven spans of 85 to 120 feet. Roadway 24 feet. Footings on rock and on gravel.
For the Bridge Committee of the City of Harriman, Tennessee, 1916.

NORTON POINT BRIDGE, MANCHESTER-BY-THE-SEA, MASSACHUSETTS
Six spans of 25 to 48 feet. Roadway 20 feet. Footings on clay.
For William A. Tucker, New York City, 1912.

TWENTY-THREE MILE CREEK BRIDGE, ANDERSON COUNTY, SOUTH CAROLINA
Twin spans of 55 feet each. Roadway 16 feet. Footings on rock.
For the Anderson County Highway Commission, Anderson, South Carolina, 1920.

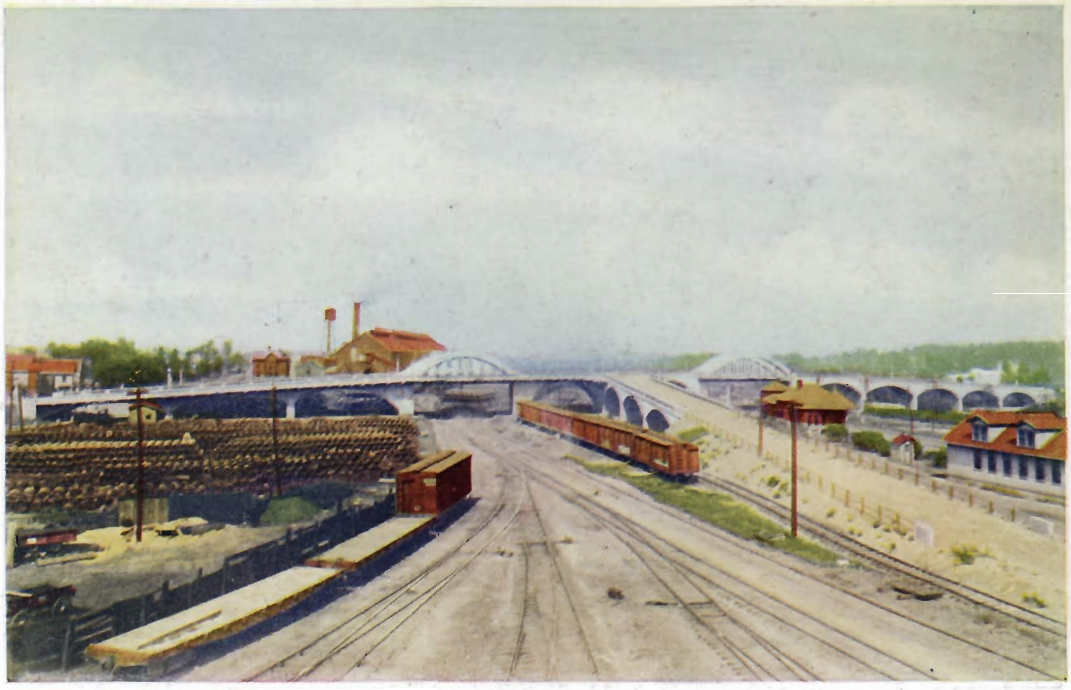
YORKTOWN BRIDGE OVER BUCK CREEK, YORKTOWN, INDIANA
Span of waterway 95 feet. Roadway 16 feet. Footings in gravel with tie-plate.
For the Board of Commissioners of Delaware County, Muncie, Indiana, 1904.

LA JUNTA BRIDGE OVER ARKANSAS RIVER, LA JUNTA, COLORADO
Seven spans of 60 to 90 feet. Roadway 24 feet. Footings on shale.
For the Board of Commissioners of Otero County, La Junta, Colorado, 1914.
This bridge was submerged to the hand rails in the 1921 Flood, without damage.

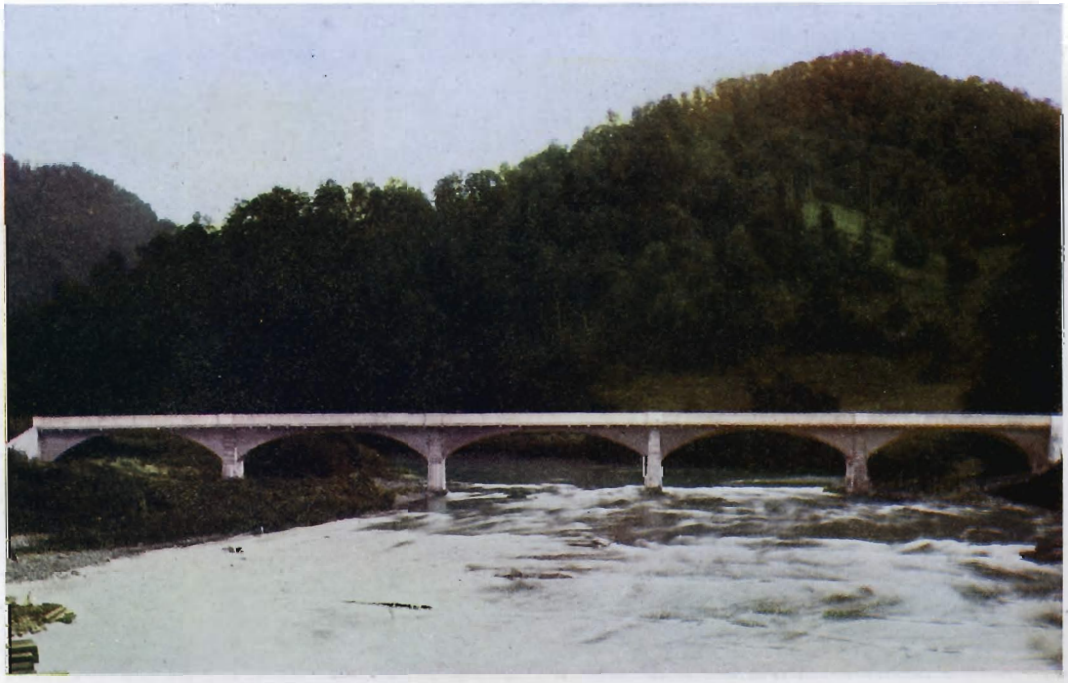
THIRD STREET BRIDGE OVER EEL RIVER, LOGANSPORT, INDIANA
Four spans of 87 to 93 feet. Roadway 65 feet. Footings on rock.
For the Board of Commissioners of Cass County, Logansport, Indiana, 1917.

CLEAR CREEK BRIDGE, WASHINGTON COUNTY, ARKANSAS
Three spans of 30 to 40 feet. Roadway 16 feet. Footings on rock.
For the Commissioners of Road Improvement, District No. 1, Fayetteville, Arkansas, 1922.
Federal Aid Project No. 37.

CEMETERY BRIDGE, BENTON HARBOR, MICHIGAN
Span of waterway 86 feet. Roadway 12 feet. Footings on gravel with tie-plate.
For the City of Benton Harbor, Michigan, 1915.



TUSCARAWAS AVENUE VIADUCT OVER PENNA., B. & O., AND ERIE R. R., BARBERTON, OHIO
Fifteen spans of 58 to 84 feet. Roadway 52 feet. Footings on piling in clay.
For the Board of Public Works, City of Barberton, Ohio, 1917.
Two bowstring spans for rectangular railroad clearance.



HUNTDALE BRIDGE OVER TOE RIVER, MITCHELL AND YANCY COUNTIES, NORTH CAROLINA
Five spans of 65 to 75 feet. Roadway 16 feet. Footings on rock.
For Board of Road Commissioners of Mitchell and Yancy Counties, North Carolina, 1923.

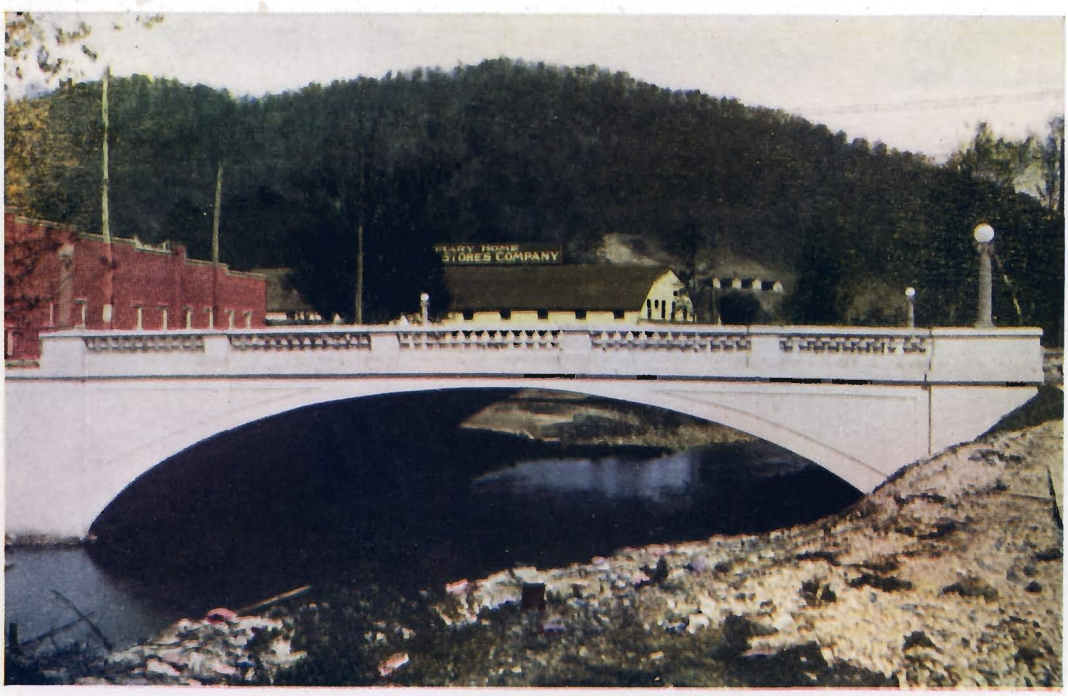
SHERWOOD BRIDGE OVER EAGLE RIVER, SHERWOOD, COLORADO
Twin spans of 55 feet each. Roadway 16 feet. Footings on gravel.
For the Board of Commissioners of Eagle County, Red Cliff, Colorado, 1913.

MADISON HILL BRIDGE OVER PENNSYLVANIA RAILROAD, MADISON, INDIANA
Span of opening 36 feet. Roadway 16 feet. Footings on rock.
For the Board of Trustees of the Southeastern Hospital for the Insane, Madison, Indiana, 1921.

CICOTT STREET BRIDGE OVER WABASH RIVER, LOGANSPORT, INDIANA
Six spans of 96 to 108 feet. Roadway 35 feet. Skew 20 degrees. Footings on rock.
For the Board of Commissioners of Cass County, Logansport, Indiana, 1913.
Replacing steel bridge destroyed in 1913 Easter Flood.

ROCK CREEK BRIDGE, MURRAY COUNTY, GEORGIA
Three spans of 30 feet each. Roadway 18 feet. Footings on rock.
For the Board of Commissioners of Murray County, and the State Highway Department, Atlanta, Georgia, 1921.
Federal Aid Project No. 190.

BRIDGE 816, C. & L. M. RY., OVER SUGAR CREEK, LIMA, OHIO
Twin spans of 60 feet each. Roadway 22 feet. Footings on clay.
For the Ohio Electric Railway Company, Cincinnati, Ohio, 1907.
This bridge was built under the wooden truss that carried traffic during construction.



CENTRAL AVENUE BRIDGE OVER INDIAN CREEK, LAFOLLETTE, TENNESSEE
Span of waterway 64 feet. Roadway 58 feet. Footings on rock.
For the Board of City Commissioners, LaFollette, Tennessee, 1921.

BIG SNAKE CREEK BRIDGE, DADE COUNTY, FLORIDA
Five spans of 26 feet each. Roadway 16 feet. Footings on piling in sand.
For the Board of Commissioners of Dade County, Miami, Florida, 1917.

BUCKINGHAM BRIDGE, LAKE FOREST, ILLINOIS
Three spans of 45 feet each. Roadway 36 feet. Footings on clay.
For the Town of Lake Forest, Illinois, 1912.
Illustrating details of concrete baluster hand rail.

THIRD STREET BRIDGE OVER WABASH RIVER, LOGANSPORT, INDIANA
Three spans of 96 to 101 feet. Roadway 49½ feet. Footings on rock.
For the Board of Commissioners of Cass County, Logansport, Indiana, 1913.
Carries 60 ton interurban cars. Replacing steel bridge destroyed in 1913 Easter Flood.

MEYERS BRIDGE, WETZEL COUNTY, WEST VIRGINIA
Span of waterway 75 feet. Roadway 16 feet. Footings on gravel.
For the County Court of Wetzel County, New Martinsville, West Virginia, 1919.

T. H., I. & E. RY. BRIDGE OVER WHITE LICK CREEK, PLAINFIELD, INDIANA
Five spans of 35 to 42 feet. Roadway 16 feet. Footings on clay.
For the Terre Haute, Indianapolis and Eastern Traction Company, Indianapolis, Indiana, 1906.
Carries 60 ton cars; designed for 100 ton cars.

ISLAND PARK BRIDGE, WINFIELD, KANSAS
Three spans of 35 to 45 feet. Roadway 24 feet. Footings on piling in sand.
For the Board of Commissioners of Cowley County, Winfield, Kansas, 1912.
Cantilever slab at crown, brackets at piers.

CAMP CREEK BRIDGE, MACON COUNTY, GEORGIA
Twin spans of 55 feet each. Roadway 18 feet. Footings on piling in clay.
For the Board of Commissioners of Macon County and the State Highway Department, Atlanta, Georgia, 1921.
Federal Aid Project No. 164.

JACKSON'S MILL BRIDGE, NEAR WESTON, WEST VIRGINIA
Twin spans of 70 feet each. Roadway 16 feet. Footings on rock.
For the County Court of Lewis County, Weston, West Virginia, 1913.
Showing Mill at left in which Stonewall Jackson worked as a boy.

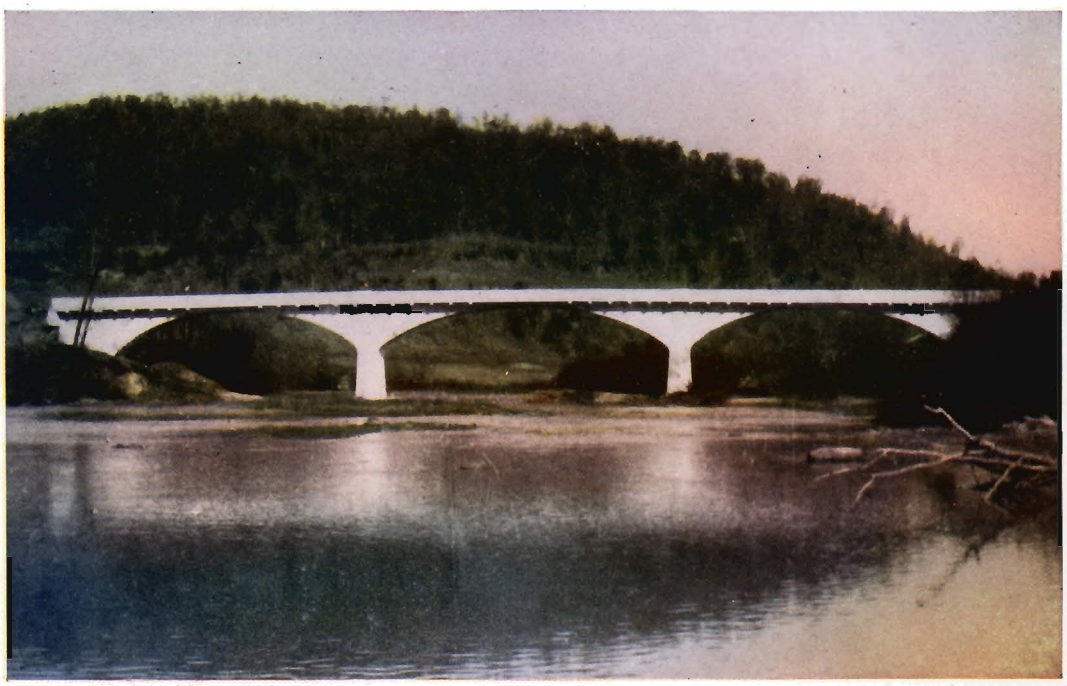
SHAWNEE BRIDGE ON UNION STREET, OVER GREAT MIAMI RIVER, PIQUA, OHIO
Five spans of 94 to 110 feet. Roadway 50 feet. Footings on piling in gravel.
For the Board of Commissioners of Miami County, Troy, Ohio, 1914.

MINERS FORD BRIDGE, IOLA, KANSAS
Three spans of 70 feet each. Roadway 16 feet. Footings in clay with tie-plate.
For the Board of Commissioners of Allen County, Iola, Kansas, 1907.

PESHASTIN CREEK BRIDGE, LEAVENWORTH, WASHINGTON
Twin spans of 55 feet each. Roadway 20 feet. Footings on boulders.
For the Board of Commissioners of Chelan County, Wenatchee, Washington, 1920.

MOCKING BIRD LANE BRIDGE, OVER TURTLE CREEK, HIGHLAND PARK, TEXAS
Span of waterway 55 feet. Roadway 30 feet. Footings on rock.
For the Town of Highland Park, Texas, 1923.

WAYNE STREET BRIDGE OVER WABASH RIVER, PERU, INDIANA
Seven spans of 75 to 100 feet. Roadway 32 feet. Pier footings on rock, abutments on clay with tie-plate.
For the Board of Commissioners of Miami County, Peru, Indiana, 1905.
The only highway bridge on sixty miles of the Wabash River to survive the 1913 Easter Flood.

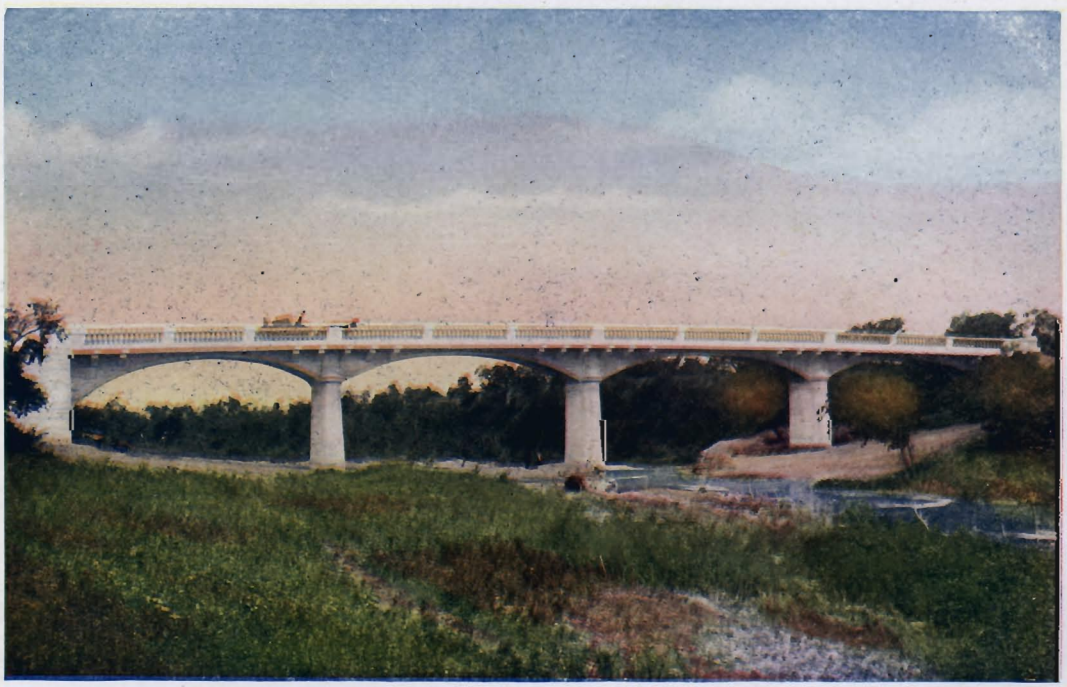


SUTTON'S MILL BRIDGE OVER CUMBERLAND RIVER, WHITLEY COUNTY, KENTUCKY
Three spans of 97 to 106 feet. Roadway 18 feet. Footings on rock.
For the Fiscal Court of Whitley County, Williamsburg, Kentucky, 1923.

SNOQUALMIE RIVER BRIDGE, FALL CITY, WASHINGTON
Three spans of 38 to 44 feet. Roadway 20 feet. Footings on clay.
For the Board of Commissioners of King County, Seattle, Washington, 1916.

SEVENTEENTH STREET BRIDGE, BOULDER, COLORADO
Span of waterway 70 feet. Roadway 24 feet. Footings in gravel with tie-plate.
For the City of Boulder, Colorado, 1906.

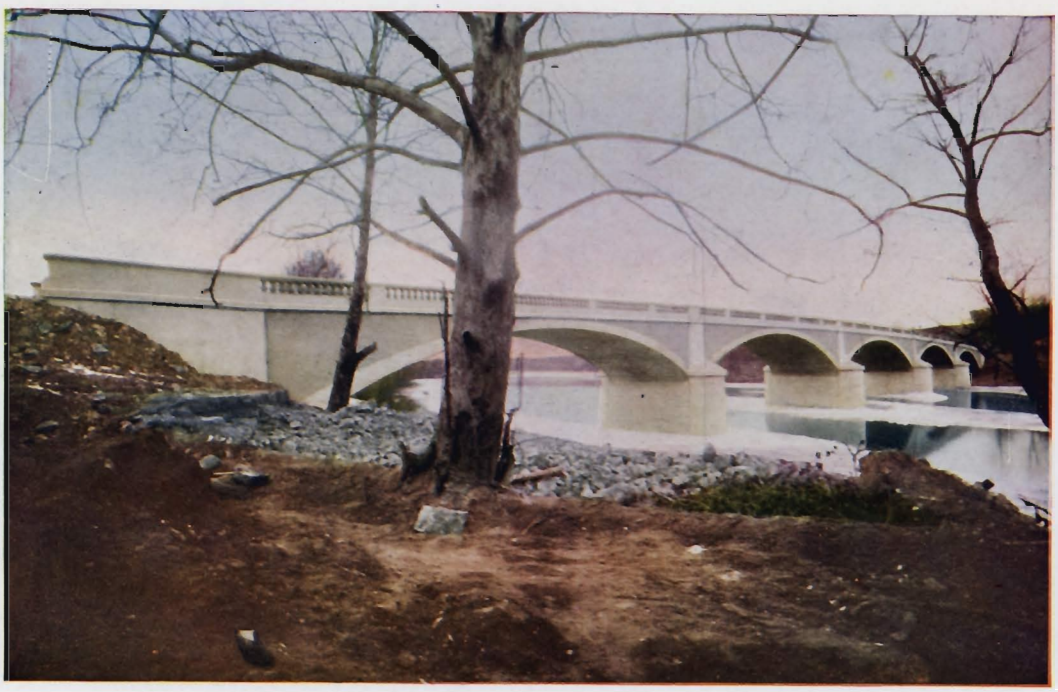
LITTLE BLUE RIVER BRIDGE, HANOVER, KANSAS
Five spans of 65 to 70 feet. Roadway 18 feet. Footings on rock.
For the Board of Commissioners of Washington County, Washington, Kansas, 1916.
Cantilever slab at crowns, brackets at piers.



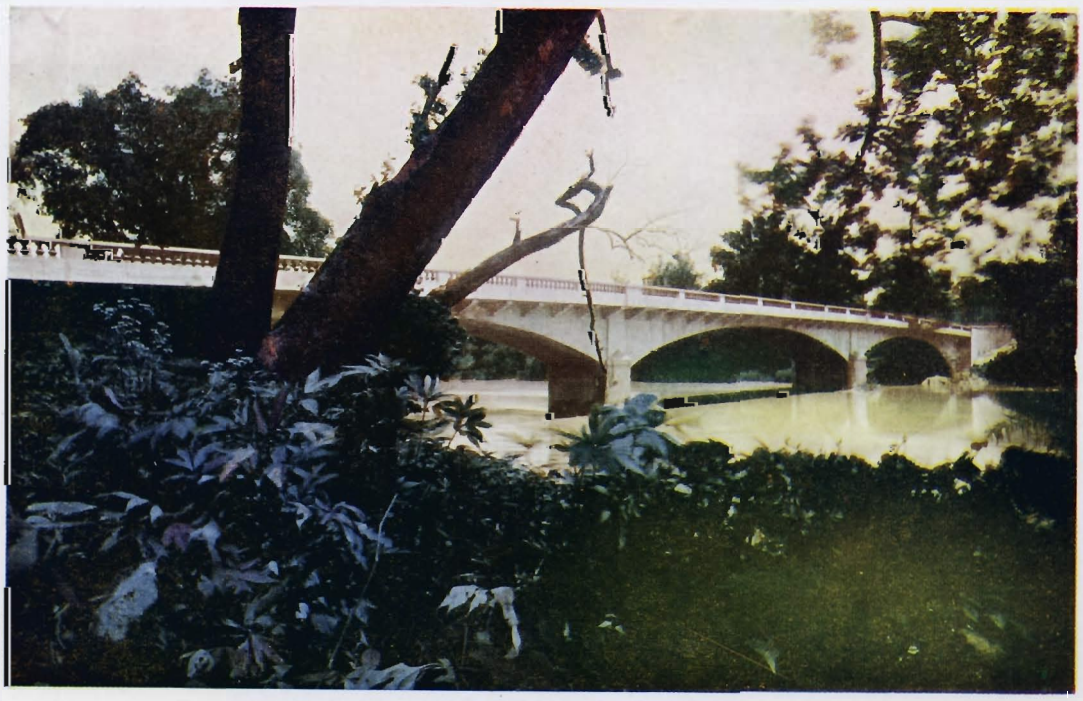
SOMERSET BRIDGE OVER LEON RIVER, BEXAR COUNTY, TEXAS
Four spans of 50 to 55 feet. Roadway 18 feet. Footings on piling in sand.
For the County Court of Bexar County, San Antonio, Texas, 1915.
Cantilever slab at crowns, brackets at piers.

CARTERSBURG BRIDGE OVER WHITE LICK CREEK, CARTERSBURG, INDIANA
Twin spans of 90 feet. Roadway 22 feet. Footings in clay with tie-plate.
For the Terre Haute, Indianapolis and Eastern Traction Company, Indianapolis, Indiana, 1907.
Photograph taken from Penna. R. R. Bridge since destroyed by protruding load on car striking steel trusses.

PARK STREET BRIDGE, WALLA WALLA, WASHINGTON
Span of waterway 50 feet. Roadway 60 feet. Footings on cemented gravel.
For the Commissioners of the City of Walla Walla, Washington, 1921.
Arch square but roadway skewed on arch thirty degrees.



LEWISBURG BRIDGE OVER WABASH RIVER, LEWISBURG, INDIANA
Five spans of 83 to 90 feet. Roadway 18 feet. Footings on piling in gravel.
For the Board of Commissioners of Cass County, Logansport, Indiana, 1913.

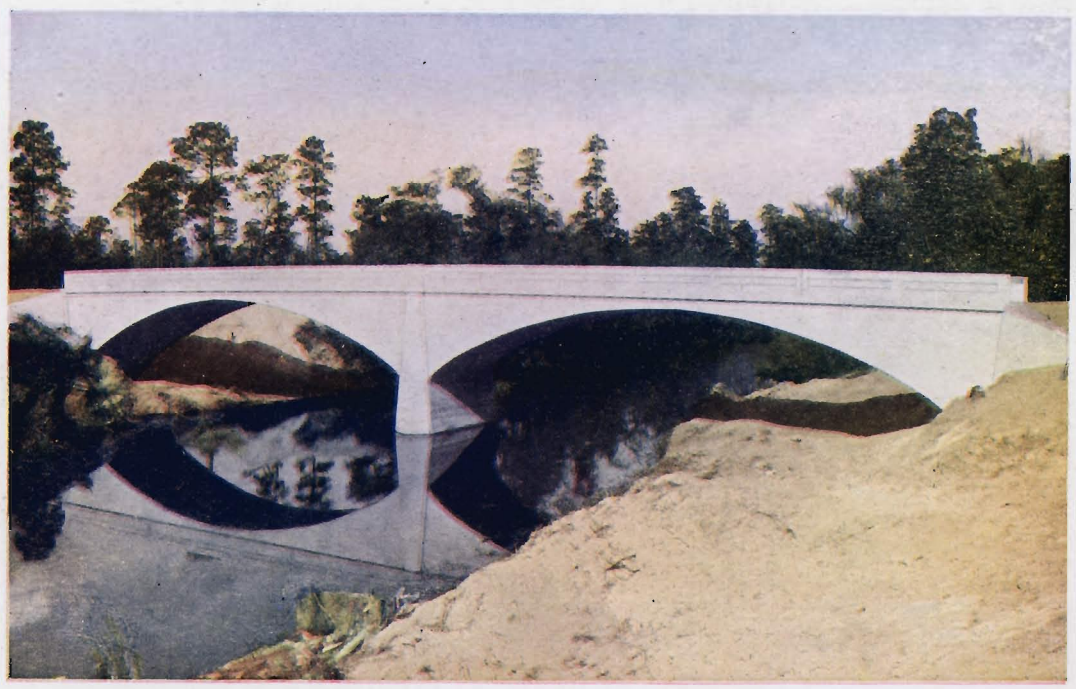


THIRD STREET BRIDGE OVER MISSISSINNEWA RIVER, MARION, INDIANA
Three spans of 102 to 108 feet. Roadway 30 feet. Footings on hard-pan.
For the Board of Commissioners of Grant County, Marion, Indiana, 1917.

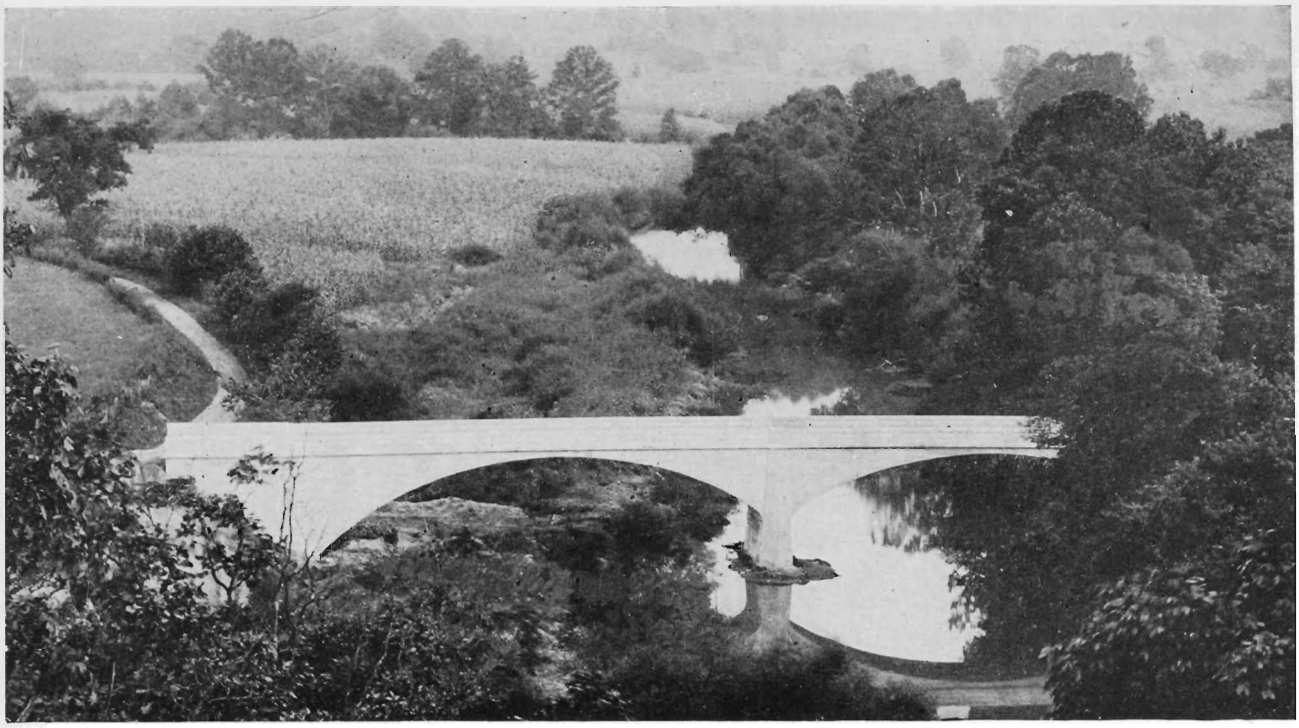
ELKINS BRIDGE OVER WHITE RIVER, WASHINGTON COUNTY, ARKANSAS
Three spans of 62 to 68 feet. Roadway 16 feet. Footings on rock.
For the Board of Commissioners of Washington County, Fayetteville, Arkansas.

ILLINOIS STREET BRIDGE OVER WATER SUPPLY CANAL, INDIANAPOLIS, INDIANA
Twin spans of 52½ feet each. Roadway 24 feet. Skew 60 degrees. Footings on clay.
For the Board of Commissioners of Marion County, Indianapolis, Indiana, 1920.
Angle of crossing 30 degrees. Built with taper abutments by Royse formula.

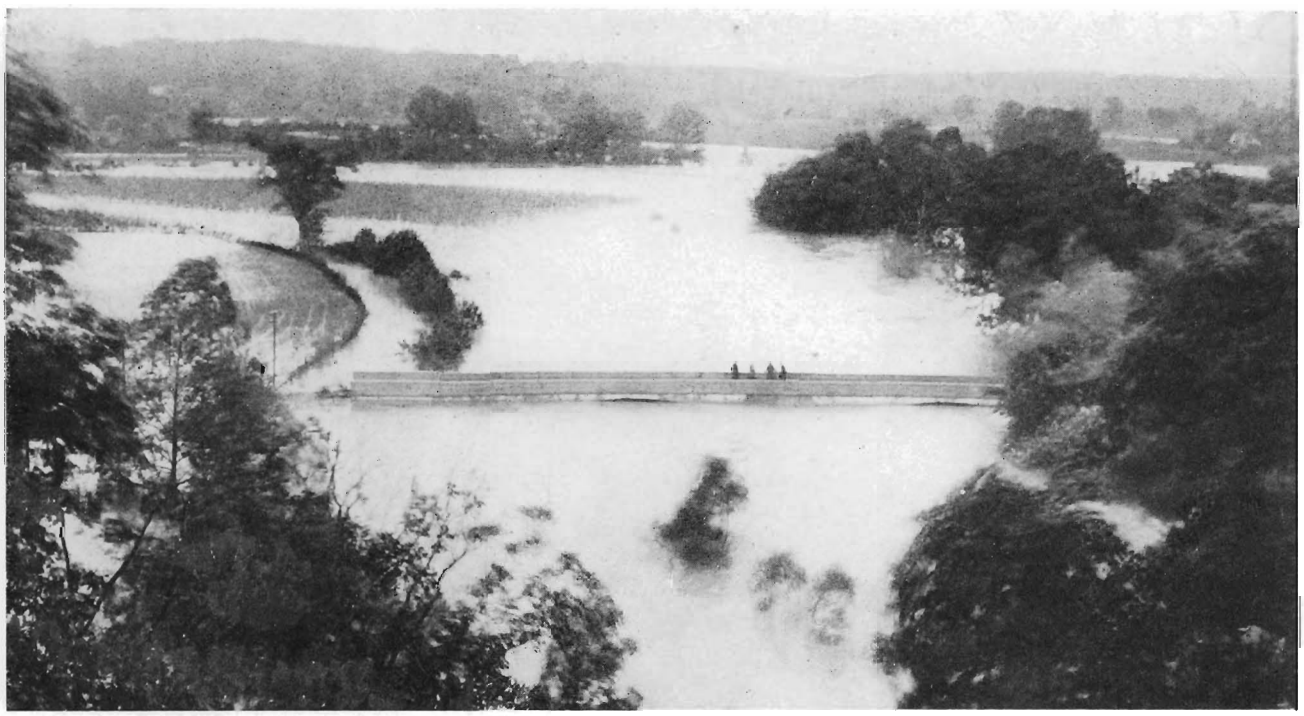
SPRING RIVER BRIDGE, WEBB CITY, MISSOURI
Twenty-two spans of 50 to 75 feet. Roadway 11 feet. Footings on piling in clay.
For the Southwest Missouri Railroad Company, Baxter Springs, Kansas, 1917.
Entire structure completed in three months.



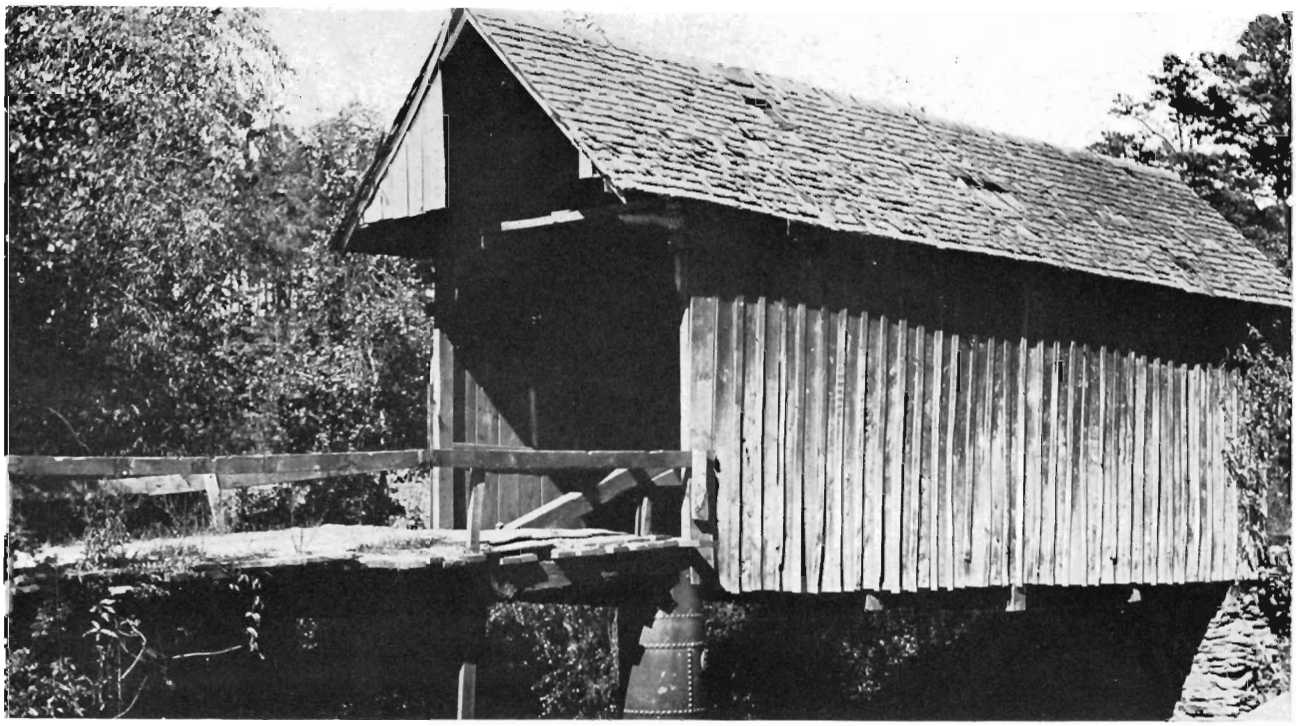
LITTLE RIVER BRIDGE, COLQUITT AND COOK COUNTIES, GEORGIA
Twin spans of 70 feet each. Roadway 16 feet. Footings on marl.
For the Boards of Commissioners of Colquitt and Cook Counties, Georgia, 1922.



FREDERICKSBURG BRIDGE, SALEM, INDIANA
Twin spans of 80 feet each. Roadway 16 feet. Footings on clay.
For the Board of Commissioners of Washington County, Salem, Indiana, 1910.
The view below shows the same bridge in 1913 Easter Flood.



FREDERICKSBURG BRIDGE, SALEM, INDIANA
Showing the same bridge at top of page in 1913 Easter Flood. No damming of river, no obstruction to debris. Debris is deflected by the water cushion at the haunches to the crowns of the arches. Water level at end of bridge at left shows that the bridge is discharging the entire flood.

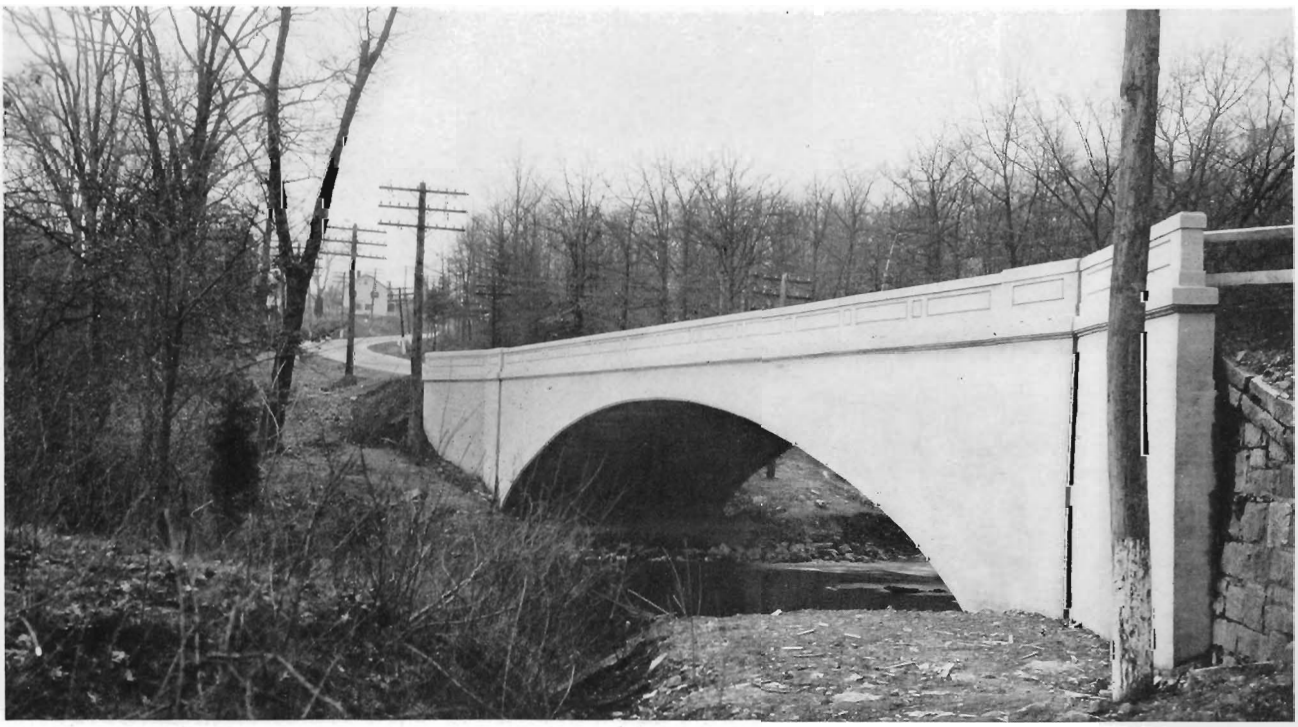


OLD WOODEN BRIDGE AT SITE OF FOE-KILLER BRIDGE, MILTON COUNTY, GEORGIA
Replaced in 1919 by the concrete bridge shown in the view below.

FOE-KILLER CREEK BRIDGE, MILTON COUNTY, GEORGIA
Span of waterway 40 feet. Roadway 20 feet. Footings on rock.
For the Commissioners of Milton County and the State Highway Department, Atlanta, Georgia, 1919.
Federal Aid Project No. 22. This was the first Federal Aid Bridge built in Georgia.

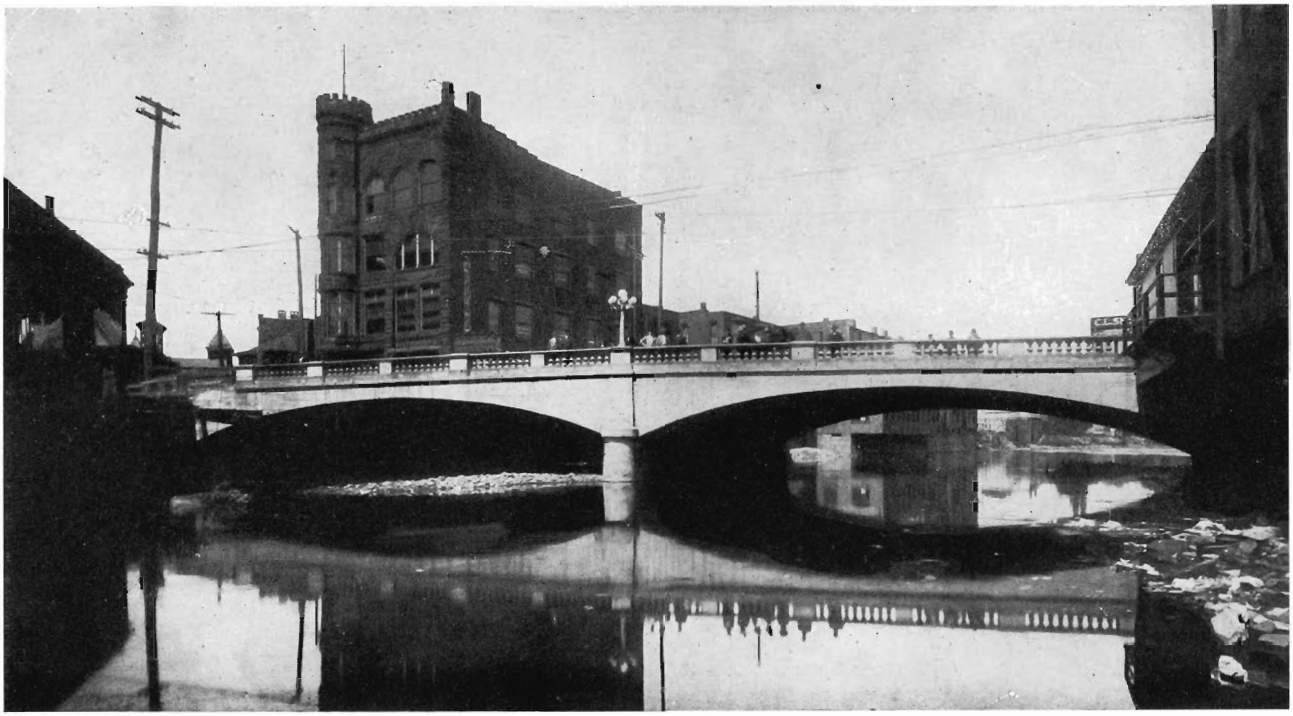
STEEL BRIDGE ON BALTIMORE-WASHINGTON BOULEVARD, SAVAGE MARYLAND

Wrecked on September 21, 1923, by an automobile truck, colliding with the steel truss in attempting to pass another vehicle. Data sent to Indianapolis by wire and contract for new bridge awarded on September 24, 1923, on quantities and dimensions wired from Indianapolis. See new bridge below.



SAVAGE BRIDGE, BALTIMORE-WASHINGTON BOULEVARD, SAVAGE, MARYLAND

Span of waterway 97 feet. Roadway 24 feet. Footings on rock.
For the Maryland State Road Commission, Baltimore, Maryland, 1923.
See view above. This bridge completed 31 days after collapse of steel bridge, on plans mailed from Indianapolis three days after collapse.



PITTSBURGH STREET BRIDGE OVER NESHANNOCK RIVER, NEWCASTLE, PENNSYLVANIA
Twin spans of 75 feet each. Roadway 60 feet. Footings on piling in gravel.
For the Board of Commissioners of Lawrence County, Newcastle, Pennsylvania, 1909.
The view below shows this same bridge in the 1913 Easter Flood.

PITTSBURGH STREET BRIDGE OVER NESHANNOCK RIVER, NEW CASTLE, PENNSYLVANIA
This photograph shows the bridge at top of page during the 1913 Easter Flood. The two 75-foot arches are flowing full, yet free from debris, because of the turbulent cushion of water against the haunches which deflects the debris through under the crowns of arches.

ADVANTAGES OF CONCRETE BRIDGES

Concrete for permanence.

Concrete bridges are permanent improvements.

Concrete bridges have no wooden floors that are periodically out of repair.

A concrete bridge is the only bridge that grows stronger as it grows older, thus providing for increased weight of traffic.

Concrete bridges are built of permanent materials throughout. The embedded steel is protected against rust by concrete, the most perfect preservative known for steel.

As time passes, traffic on our highways grows heavier; steel and wooden bridges grow weaker, concrete bridges grow stronger; to build a concrete bridge then, is just plain common sense.

Concrete bridges have their supports beneath the roadway; they can be widened to provide for increased volume of traffic without destruction of the original investment.

Concrete bridges can be modified in appearance when they are widened, to conform to artistic development of the surroundings.

Concrete bridges are built with home labor and materials. The money expended for a concrete bridge returns directly to the taxpayers.

Concrete arch bridges are readily adapted to soft foundations.

Concrete arch bridges have abutments with maximum pressure at the back of a wide base distant from scour.

Concrete arch bridges have the dominating span in the middle of the stream, shorter spans towards the ends.

Concrete arch bridges have copings and roadway cambered in graceful vertical parabolic curves.

Concrete arch bridges have beauty of curve and line secured by proper proportions.

Heavy concrete arches are not easily moved by ice or flood.

The concrete arch may be erected under the old bridge or around trestle bents with no interruption of traffic.

The concrete arch, properly designed, adapts itself automatically to all temperature changes without deterioration.

The concrete arch employs concrete most efficiently.

For equal waterway, the concrete arch has the longest span at lowest level, thus relieving floods at early stages instead of damming them back; it is most efficient in discharge because its center of pressure is lowest and when flowing full its hydraulic radius greatest.

The concrete arch also provides the highest opening for a given span thus permitting passage of debris at highest flood stages.

The concrete arch will discharge more flood water for a given flood level than other forms of opening of the same area.

The concrete arch bridge provides for maximum waterway by use of piers assumed elastic. (Hool's Reinforced Concrete Construction Vol. III, Chapter VII.)

Concrete arch bridges offer less obstruction to extreme floods than collapsed truss bridges.

The concrete arch harmonizes readily with its surroundings and if well designed is an attractive structure for any location.

Concrete arch bridges have their arch rings whitened by polishing, their walls softened by bush-hammering.

The concrete arch is difficult to design but easy to erect, hence the ideal bridge for the expert designer.

Concrete bridges carry the roadway itself and not merely the traffic across the opening spanned.

Concrete bridges are flood-proof and frost-proof, rust-proof and fire-proof.

A concrete bridge to cost $100,000 can be designed complete in five days.

A concrete bridge to cost $100,000 can be erected complete in three months.

A concrete bridge once built is built for all time.

STATEMENT OF EXPERIENCE

Daniel B. Luten, Designing and Consulting Engineer, Indianapolis, Indiana, was born at Grand Rapids, Michigan, in 1869. He was graduated from the University of Michigan in 1894 with the degree of Bachelor of Science in Civil Engineering. He was then appointed Instructor in Civil Engineering at the University of Michigan, assistant to Professor Charles E. Greene, one of the foremost authorities on the elastic theory of arch analysis, and Author of Greene's Graphic Method of Truss and Arch Analysis.

After one year he resigned this position to become Instructor in Architectural Engineering at Purdue University, Lafayette, Indiana, including the courses in arch design and theory of hydraulics. In 1900 he resigned from the Faculty of Purdue University to practice engineering and after one year in general practice of roads and pavements, entered actively on the design and construction of reinforced concrete bridges. Since 1901 he has followed this specialty exclusively.

During the first five years he designed and contracted and erected approximately five hundred concrete bridges. Since 1906 he has limited his practice to design and supervision only and not including contracting or construction. During the twenty-three years of experience in this specialty, he has supervised the design of approximately 20,000 concrete bridges, of which over 13,000 have been erected of spans from five to 192½ feet each. The accompanying pages show approximately 75 examples of these Luten Design structures.

He has conducted numerous experiments on reinforced concrete and on arches and has published approximately one hundred articles in technical journals. Some of the more important are published in the following journals: Engineering News, February 15, 1900; June 13, 1901; May 8, 1902; March 5, 1905; May 11, 1905; March 29, 1906; May 3, 1906; May 10, 1906; May 24, 1906; June 28, 1906; July 19, 1906; Sept. 27, 1906; Feb. 27, 1908; June 19, 1913; Railroad Gazette, May 11, 18, 1900; Sept. 12, 1902; Oct. 3, 1902; Apr. 20, 1906; Harper's Weekly, Sept. 22, 1900; Cement, July, 1905; Aug. 15, 1908; Good Roads Magazine, Nov. 1906; Oct. 1908; Jan. 1909; Concrete, May, 1912; Journal of Western Society of Engineers, Sept. 1912.

He has delivered numerous illustrated lectures on permanent bridges before engineering societies and is equipped with five hundred colored stereopticon views of bridges. He has an organized staff of twelve assistant engineers and thirty-five associate engineers located in all parts of the United States, Canada, and Australia. He has made numerous improvements in design and erection of concrete bridges.

He is a member of the American Society of Mechanical Engineers, Member of the American Federation of Arts, Member of the Western Society of Engineers, Member of the American Association of Engineers, Member of the American Society of Engineers, Member of the American Concrete Institute, Member of the American Roadbuilders Association, Member of the Indiana Engineering Society, Member of the Iowa Engineering Society, Member of Illinois Society of Engineers, Member Engineering Society of Wisconsin, Member of the Indiana Board for Registration of Professional Engineers, and registered as a Professional Engineer in all States requiring registration, now twenty in number.