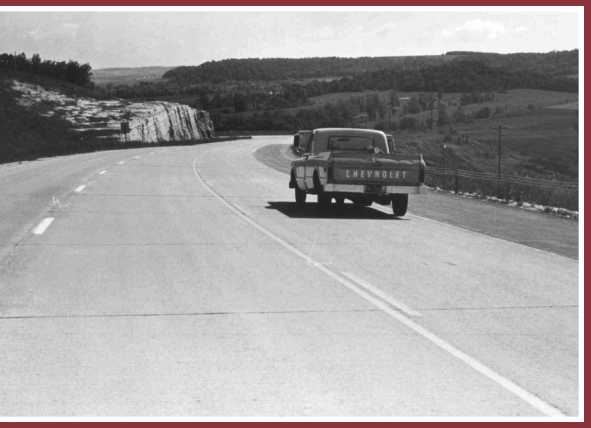
Transformation of Iowa Roadways in the Mid-Twentieth Century

Making a Modern Highway



ISHC 1970

ISHC 1956b

INTRODUCTION

This publication was completed on behalf of the Iowa Department of Transportation (Iowa DOT) by The Louis Berger Group, Inc. (Louis Berger), to mitigate the replacement of the Iowa 376 Bridge over the Chicago Central and Pacific Railroad and Taft Street in Sioux City, Iowa. The bridge (FHWA No. 53070) was surveyed by Louis Berger in 2011 and was recommended as eligible for listing in the National Register of Historic Places under Criterion C as the longest example of a continuous I-beam bridge in the state, with a main span length of 514 feet.

COVER PHOTO: Construction of four lane divided U.S. 20 in Moville (ISHC 1958)

Transformation of Iowa Roadways in the Mid-Twentieth Century

Making a Modern Highway

by
Camilla Deiber
THE Louis Berger Group, INC.

This historic context study was conducted under Iowa DOT project number BRF-376-1(6)--38-97 and in accordance with the Memorandum of Agreement (MOA) signed by the Iowa State Historic Preservation Office and FHWA in August 2012. The goal of the documentation project was to generate a brief historic context for 1950s bridge construction and infrastructure development, using FHWA No. 53070 and Herbert A. Arthur as the focal points, and development of a public document based on the historic context.

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History of Bridge and Infrastructure Construction in the 1950s

In 1947 the Iowa General Assembly passed the Farm to Market Road Act, designating a farm to market road system, which included 35,000 miles of secondary roads that were equally distributed amongst all counties (Iowa State Highway Commission [ISHC] 1963a:32). To ascertain the existing condition of Iowa's roads, the legislature empowered a road study committee to complete a survey (ISHC 1956b:3). The committee completed the survey and recommended to the legislature a formula to finance the construction needed over the next 20 years to modernize Iowa's roads.

The committee's recommendations were incorporated into a new law passed in 1949. Enactment of this law meant sweeping changes to existing highway laws. The new law was designed to increase the amount of road construction funds, delineate the role of the Iowa State Highway Commission (ISHC) and the counties in relation to the new secondary road system, and improve the engineering of roadway and bridge construction efforts in the state.

To increase the amount of funding for highway construction, the Iowa General Assembly created the Road Use Tax Fund. The fund consisted of monies taken from motor vehicle registration and motor carrier fees, 10 percent of the state sales tax, and a $.04 motor vehicle fuel tax. Money from the Road Use Tax Fund was distributed among the different state road systems—42 percent to primary roads, 35 percent to secondary roads, 15 percent to farm-to-market roads, and 8 percent to city and town streets. A $17 million ceiling on the primary road fund, imposed by state legislation, was also eliminated to curtail the practice of borrowing money for farm-to-market roads from the primary road fund—a practice that often left it completely depleted. By the end of fiscal year 1948/1949, the primary road fund totaled $27,417,000 (ISHC Annual Report 1963b:35-36).

The law gave the ISHC control of the overall mileage of secondary roads in each county, standard road and bridge designs, construction and inspection of projects, approval of plans and projects, and accounting of the farm-to-market road fund. Each county's Board of Supervisors was responsible for initiation of projects, purchase of right-of-way, surveys and construction plans, and secondary road maintenance (ISHC 1956b:14).

Improvement of the state's secondary road system had progressed by the early 1950s, but improvement in the primary road system lagged behind. The ISHC adopted an aggressive program to modernize primary roads that included the following.

- Widening 18-foot-wide pavement to 25 feet
- Eliminating sharp curves
- Reducing the grade of steep hills
- Widening narrow bridges
- Elimination of unprotected railroad crossings using gates or overpasses/underpasses

Plate 1. Narrow 18-Foot Highways ISHC 1956:3

Road Widening, Curves, and Grades

In the early 1950s increased use of trucks and larger automobiles led to concern over the narrow pavement (Plate 1). Most of Iowa's primary roads were 18 feet wide, and most roads with lip curbs had only 16 feet of road surface. This, coupled with a dramatic post-World War II increase in traffic—54 percent between 1947 and 1955—led to tremendous safety and traffic problems. The ISHC embarked upon a road widening campaign to address the problem. In the fall of 1953, a 3-foot-wide strip of Portland cement was added to each side of U.S. 30 between Ames and Nevada to increase the width to 24 feet. In May 1954 the same method was used along U.S. 65 between Mason City and Manly. The two pilot sections received such "prompt and strong" approval from the public that a statewide widening program was launched in 1955 to widen 1,000 miles of primary roads (ISHC Annual Report 1955a:4-5). The program was funded by an increase of $.01 to the motor vehicle fuel tax (ISHC Annual Report 1955a:4-5). In the first year of the program, pavement widening projects made up over 12 percent of ISHC construction projects (ISHC Annual Report 1956a:5).

The ISHC extensively utilized slip-form paving machines for road widening projects (Plate 2). Dump trucks delivered mixed concrete to the machine, which produced a 3-foot-wide strip of concrete (ISHC Employees' Information Bulletin 1954b:6). On U.S. 75 a 9-mile stretch of highway between Salix and Sloan was widened using a slip-form paver. As early as 1947, the ISHC had been exploring extrusion methods for concrete road construction. A small-scale working model of a paver was developed by November (Clauson 1961:2). Testing on the small-scale machine was successful enough that a larger-scale machine was built by February 1948. By 1949 a half-mile section of pavement in O'Brien County and a mile-long segment in Cerro Gordo County had been constructed using the paver (Clauson 1961:3). Although the prototype slip-form pavers were never used for actual road construction, commercial pavers based on the concept that ISHC developed were used extensively starting

around 1955. ISHC Chief Engineer L. M. Clauson noted that development of these slip-form methods led to their use in widening approximately 1,600 miles of pavement up to 1961 (Clauson 1961:3).

At the same time that roadways were being widened, routes were being modernized by eliminating sharp curves, reducing steep grades, and widening shoulders (ISHC 1957b:6). Some of this modernization meant the relocation of entire routes. In fiscal year 1958/1959 the ISHC relocated sections of major U.S. highways, including U.S. 30, 20, 169, 218, and 34. Removing both sharp curves and steep hills lengthened sight lines for drivers, thus reducing accidents caused by passing vehicles. Providing wider shoulders increased safety by providing extra space on the side of the road for stopped vehicles. As roads were leveled and straightened, road beds were raised above the surrounding grade, necessitating the "borrowing" of soil from higher elevations to reduce steep grades and maintain newly built roadsides. The ISHC roadside improvement division administered the seeding and maintenance of roadside ditches to prevent erosion on the newly constructed roads. As semi-tractor trailer hauling became more prevalent on Iowa's primary roads, ISHC installed "creeper" lanes in hilly areas (ISHC Annual Report 1954a:4). These extra lanes were added to the uphill side of the road to allow slower moving trucks to move over and allow faster vehicles to pass (ISHC Annual Report 1955a:4). Iowa Highway 90 from West Des Moines to Dexter was seen as the most "modern" highway in the state in 1954 because of the installation of these creeper lanes. The steep hills on the section of roadway were also lessened with cut and fill (ISHC Annual Report 1954a:4).

Narrow bridges were also seen as a dangerous problem on Iowa roads (Plate 3). Governor Leo A. Hoegh offered a time-saving and cost-effective solution to this problem. He suggested that the ISHC examine the possibility of widening existing bridges while keeping them open to traffic. In fall 1954 ISHC Bridge Engineer Neil Welden was sent to investigate bridge-widening projects underway in Colorado. Upon returning, Mr. Welden reported to the ISHC that

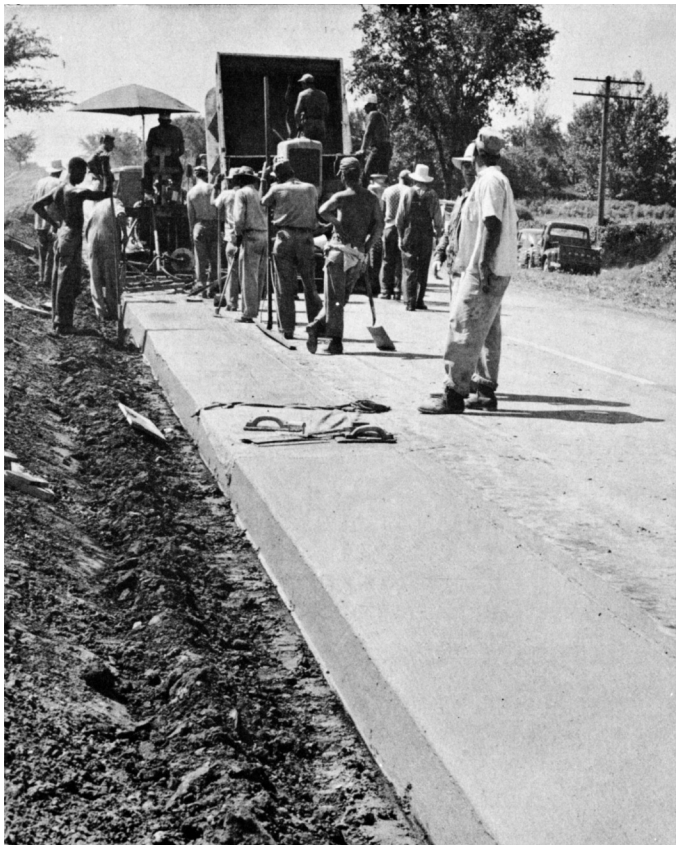


Plate 2. Slip-Form Paver in Use in Road Widening Project ISHC 1956:7

TABLE 1 NUMBER OF BRIDGES WIDENED IN IOWA FROM 1955 TO 1963

FISCAL YEAR (JULY-JUNE)	BRIDGES WIDENED
1955/1956	47
1956/1957	52
1957/1958	47
1958/1959	10
1959/1960	24
1960/1961	10
1961/1962	None reported in Annual Report
1962/1963	18

Plate 3. Photograph Showing Narrow Bridge ISHC 1956:7

such projects were feasible (ISHC 1964:16). The ISHC came up with a plan that involved adding a deck to either side of a bridge while the bridge was still in use—a method used mostly on pony truss and beam bridges. By May 31, 1955, contracts had been given to widen 11 bridges costing $215,537—11 new bridges would have cost $429,870 (ISHC Annual Report 1955a:5).

The modernization of Iowa's primary highway system had a profound impact on the rural landscape. Narrow iron truss bridges were eliminated in favor of wider concrete and steel beam structures (Plate 4). Construction of a modern highway system eliminated steep hills as well as sharp, narrow, winding roadways. Roadways no longer followed the existing topography of the area that was traversed. Curves were softened and steep hills flattened. Roadways were widened with additional space along the shoulders and elevated, which undoubtedly impacted roadside attractions and establishments. All of these changes created a linear network of highways that appeared almost uniform despite the surrounding landscape (Plate 5).

Surveys and plans for the first sections of the interstate highway system in Iowa were underway in 1956. By June 30, 1957, 18.55 miles of interstate had been graded in Clarke, Harrison-Pottawattamie, Polk, and Warren counties and 32 bridges and culverts had been constructed (ISHC Annual Report 1957a:57). By June 1958 the first section of interstate "in regular service" was the I-29 approach to the Combination Bridge (demolished in 1981) over the Missouri River in Sioux City (ISHC Annual Report 1958:3). A small section of I-35 on the southwest side of Des Moines was completed and opened to traffic around that same time. By Thanksgiving Day in 1958, a 44-mile segment of I-35 was open from Merle Hay Road to Osceola in Clarke County (Fraser Design 1994:11).

In 1955, while work was underway on the interstate highway system in Iowa, improvements were being made to the state's primary road system "for the immediate preservation of the public peace, health and safety and for the promotion of the general welfare" (ISHC 1956b:4). The ISHC studied traffic volumes

and traffic volume capacity on various highways in the state and found that some routes were being used more as "through traffic service roads" than local service roads (ISHC 1959b:2-3). Thus in 1955 the 56th General Assembly of Iowa authorized the designation of a substantial portion of the primary road system as controlled access highways. By 1956 the Commission had defined two different types of controlled access highways: complete control and planned control. Completely controlled access highways allowed connections to selected public roads only—completely prohibiting other crossings and direct private driveway connections. Planned control access highways allowed some private driveway connections and other crossings (ISHC 1957a:50-51). By June 30, 1957, the ISHC had declared 8,554.7 miles of primary roads as controlled access highways (ISHC 1957a:51).

Along with controlled access highways came "urban relief routes," which were contemplated as early as 1938 in Waterloo, where several "high volume" highways converged in the downtown area causing chronic traffic problems (Iowa State Planning Board 1938:4). By 1955 the ISHC had adopted "extensive employment of by-pass highways in the vicinity of cities and towns" (ISHC 1956a:4). As by-passes became more common, local businesses expressed their worries about the economic impact of by-pass routes. The public at large did not, however, share these fears.

Trends in Bridge Construction in the 1950s

Bridge building in Iowa reached an all-time high, in terms of sheer numbers, at mid–century; from 1947 to 1960, 5,874 bridges were constructed in Iowa, according to the Structure, Inventory, and Appraisal (SI&A) sheet for Iowa (a total of 580 bridges was constructed during the calendar year 1950). An overwhelming majority of those bridges, 5,021, were built on local highways, roads, and streets (Figure 1). A total of 428 bridges were constructed on federal highways. Bridges built on state highways numbered 425. Though local bridges constituted 85 percent of the bridges built, only 58 percent of the primary road fund

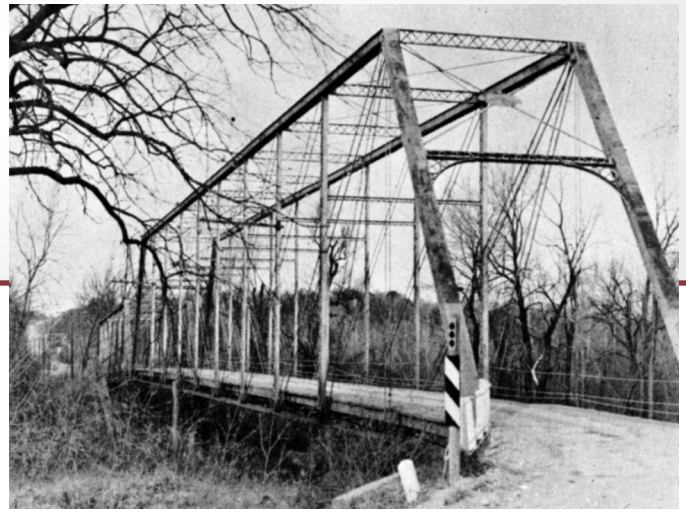


Plate 4. Old Iowa 89 Truss Bridge ISHC 1956b:8

Plate 5. Modernized Highway of the 1950s ISHC 1957:19

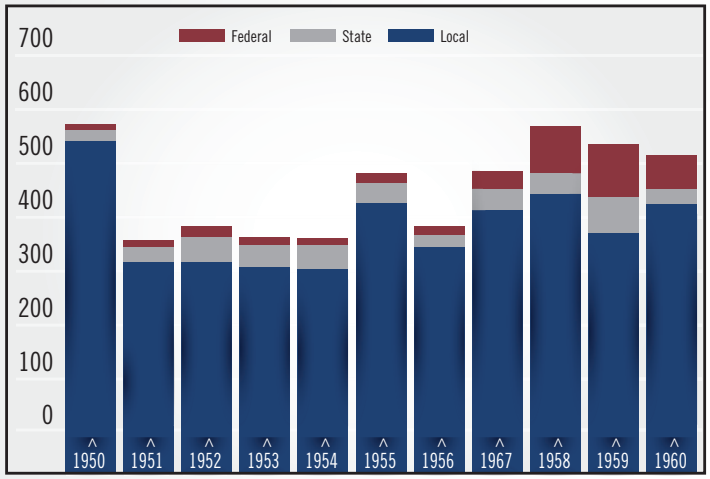


Figure 1. Number of Bridges Built by Road Type

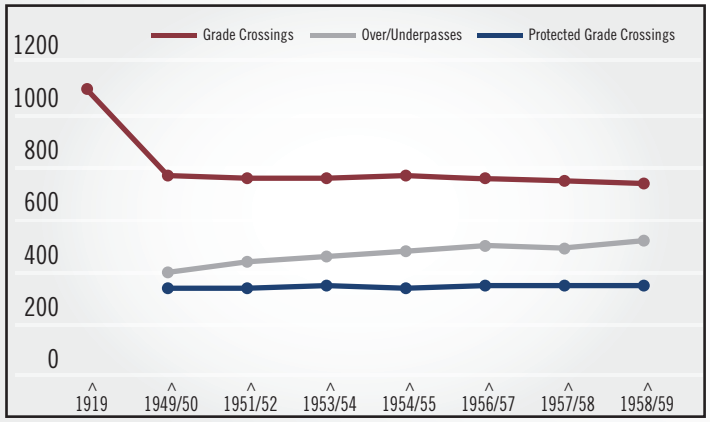


Figure 2. Reduction of Railroad Grade in the 1950s

was dedicated to state and local routes.

As one might expect, bridges on federal and state routes were longer because many were associated with interstate highways and controlled access routes that were being built increasingly in the 1950s. The average length of a bridge built on a federal route during that time period was 204 feet, and the average length of a bridge on a state route was 157 feet. Often engineers were required to design each structure rather than follow standard designs, and thus bridges on federal and state routes were more expensive to construct. In contrast, the average length of local bridges was 79 feet, and they were most often built according to standard designs.

Elimination of Unprotected Railroad Crossings

As part of the modernization program, ISHC initiated a program to eliminate railroad crossings by constructing overpasses or underpasses. At that time the majority of crossings did not have signals or gates to warn vehicular traffic of oncoming trains. Some railroad crossings were eliminated as a result of abandonment of railroad lines. Active railroad crossings at grade were eliminated through construction of underpasses and overpasses. The ISHC reported that in 1919, 1,063 railroad grade crossings were located on the 6,400-mile primary road system, which averaged one crossing for every 6 miles of primary road (ISHC 1949:19). The ISHC constructed flashing light signals and gates at those crossings that couldn't be avoided by overpass/underpass construction. By June 1950, 398 of the 781 crossings were protected with "gates, watchmen, or mechanical guards" (ISHC 1949:19). As highways were relocated, new overpasses needed to be constructed. Viaducts were also constructed for relocated or newly constructed routes in urban areas. Figure 2 shows the progression of overpass/underpass construction and protected grade crossings.

Bridge Engineers of the 1950s

Starting in fiscal year 1956/1957, outside engineers were contracted by ISHC for large bridges with highly complex technical designs—they were often large river bridges or interstate highway bridges (Gee 2003; ISHC 1956a). In that first year consultants completed 9 percent of the commission's total design work. During fiscal year 1957/1958 consultants completed nearly 50 percent of design work for interstate bridges, 10 percent of interstate culvert design work, and 3 percent of design work for primary road bridges (ISHC 1958:9). During the early years of interstate development, no new bridges or culverts were designed by ISHC on secondary or farm-to-market road systems—plans were only "checked and approved" by ISHC staff.

Herbert A. Arthur

Herbert Arthur attended Iowa State College in Ames, obtaining his architectural engineering degree in 1936. He immediately obtained a position at the ISHC as a draftsman in the bridge department (*Ames Daily Tribune* 1936). During World War II Arthur left the commission and conducted defense work for three and a half years. The Arthur family continued to live in Ames at their home at 1219 9th Street. After the war Arthur worked as chief draftsman for the Detroit firm of Smith, Hinchman and Grylis. From 1943 to 1944, Arthur worked as resident architect for an expansion program at the Iowa Ordnance Plant in Burlington, Iowa (*Ames Daily Tribune* 1945).

In February 1945 Arthur opened his own temporary office in the Ames National Bank Building in Ames (*Ames Daily Tribune* 1945). In 1948 Arthur designed an addition to an ISHC maintenance garage in Jefferson, Iowa (*Jefferson Bee* 1948).

Arthur continued to design structures for a variety of different buildings throughout Iowa. In 1951 Arthur was the supervising architect on the construction of the new St. Cecilia Convent at the corner of Lincoln Way and Elm in Ames (*Ames Daily Tribune* 1951). The building was designed by Bernard J. Slater, an instructor at the department of architectural engineering at Iowa State College. In the early 1950s Arthur designed a series of comfort stations and sanitary sewer structures for the City of Ames (*Ames Daily Tribune* 1953a). In 1953 Arthur was a consulting architect with B.E. Landes of Des Moines on a new addition to the Materials and Tests Building at the ISHC. The two-story addition was 105 feet long by 38 feet wide and housed a library, conference room, and offices (*Ames Daily Tribune* 1953b).

Arthur worked with William N. Nielsen Associates in 1955 and 1956 on the design of a dental office at 313 Main Street and a new building for the Elks club at the corner of 6th and Douglas Streets in Ames (*Ames Daily Tribune* 1955, 1956). Arthur also designed a fire station in Jewell, Iowa in 1955 (*Jewell Record* 1955).

In 1950 Arthur designed one of his first bridges, a structure over the Shell Rock River in Union Township of Black Hawk County (*Waterloo Daily Courier* 1950). By November of that same year, he had been awarded a contract to design three I-beam bridges in Cass County, Iowa (*Anita Tribune* 1950). Arthur continued to design bridges in Marshall, Black Hawk County, from 1951 to at least 1956. Arthur primarily designed bridges on farm-to-market roads under the purview of county boards of supervisors, but also for cities. In 1956 he designed a pre-stressed reinforced concrete bridge over Willow Creek in Mason City, Iowa, for the extension of Pierce Street NW (*Mason City Globe Gazette* 1956).

In November 1959 Roy E. Braun joined Arthur as a bridge consulting engineer after retiring from a 41-year career at the bridge design department of the ISHC (*Ames Daily Tribune* 1959). In 1961 Arthur and Braun were awarded a contract to design a 55-foot-long pre-stressed concrete bridge in Palo Alto County (*Emmetsburg Democrat* 1961).

History of the Iowa Highway 376 Bridge

Plate 6. Aerial of U.S. Highway 75 Iowa DOT Photo: HA11.019.0011

Plate 7. Construction of U.S. Highway 75 Bridge over Floyd River, 1956 Iowa DOT Photo: HA11.019.0014

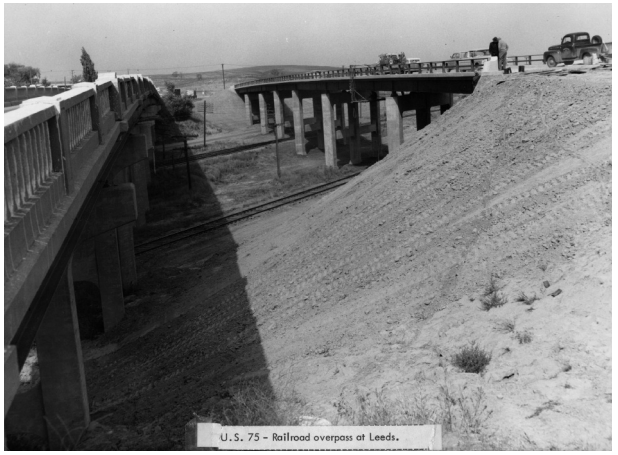


Plate 8. U.S. Highway 75 Railroad Overpass at Leeds, 1956 Iowa DOT Photo: HA11.019.0013

Through the 1920s and 1930s, the ISHC made improvements to U.S. 75 [now Iowa Highway 376] through paving and realignments. The highway was paved from Le Mars to Whiting at the time of its designation on October 16, 1926 (Hancock 2011). In 2001 the segment from the northern edge of Sioux City to I-29 was designated as Business 75/Iowa Highway 376 (Morrison 2012).

In spring 1953 the ISHC met with local towns and cities to discuss making U.S. 75 into a four-lane divided highway. In September 1954 survey crews began the work of surveying the land between Le Mars and Sioux City (*Le Mars Sentinel* 1954). The new four-lane highway necessitated several new bridges, including two bridges at Merrill, two over the Floyd River in Sioux City, and a second bridge near Leeds (Plates 6-8). An existing bridge used for the existing highway was to be incorporated into the new highway. The bridge at Leeds was designed by the ISHC in August 1955. Engineer Consultant Herbert A. Arthur is also noted on the blueprints for the bridge. The bridge project was put into letting on December 15, 1955 (ISHC 1955b).

By February 1956 a Sioux City construction company had begun work on the bridge (*Floyd Valley Farmers News* 1956). Over 200 pilings were to be driven for the new bridge, which was completed by the end of the year.

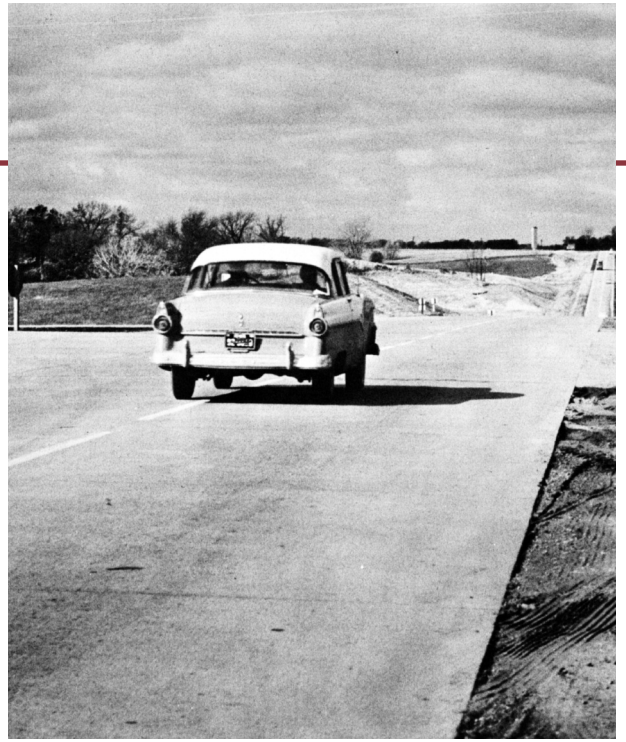
On June 25, 1957, the majority of the four-lane highway was opened to the public. The only unfinished section was a short distance of road without shoulders through the town of Merrill (*Le Mars Globe Post* 1957).

Conclusion

Across the state, the ISHC was improving the highway system by adding lanes, limiting access, and reducing railroad crossings to create a fully modernized system. This newly modernized highway system changed the landscape of Iowa by reducing grades, flattening out curves, and widening and standardizing the width of the highway and shoulders. Highways thus had a uniform look regardless of the surrounding landscape.

The Iowa Highway 376 Bridge represents a significant development in the use of continuous I-beam structures by the ISHC in the ever increasing network of limited access highways and is significant in the development of transportation in the state as the third longest example of the steel stringer, multi-beam or girder bridge (Type 302) bridge used extensively in the state from 1942 to 2001. The continuous I-beam girder bridge provided a solution for larger crossings that couldn't be accommodated by standard concrete or steel bridge designs.

The bridge was designed by the ISHC in August 1955 and constructed in 1956. Engineer Consultant Herbert A. Arthur is also noted on the blueprints for the bridge. Herbert A. Arthur was an architect/engineer with a practice in Ames, Iowa. An American Architects Directory from 1956 lists numerous buildings completed by him, including ISHC Laboratory Buildings in Ames, 1954; and ISHC District Office Building in Mason City, 1955 (Bowker 1956:15).



ISHC 1957a

ISHC 1957a

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