A HISTORY OF

THE MISSOURI STATE HIGHWAY DEPARTMENT

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I. Prologue: Initial State Road Construction: 1907-1913

During the first quarter of the twentieth century, the rapid proliferation of automobiles and a continuing clamor for good roads led to an evolving state highway system. At the beginning of the century practically all of Missouri's roads were dirt roads haphazardly maintained by county governments and local township road overseers. The State government had not participated in any road or bridge construction since the Civil War, so there was nothing approaching an interconnected state road system. As motor vehicles became more and more pervasive, the Missouri General Assembly gradually responded to the need for statewide road improvements.

In 1907 (when Henry Ford first introduced his Model T at a cost of about $825 apiece), a series of new state laws sought to improve roads at the county level. Legislation that year established the office of State Highway Engineer within the State Board of Agriculture; provided for county highway engineers; required automobile licensing and registration; and created a state road fund of $500,000 for new construction or road improvements, distributed among the counties according to their assessed valuations. The first State Highway Engineer, Curtis Hill, had a largely advisory capacity to the county highway engineers who, in 1908, organized themselves into the Highway Engineers Association of Missouri. Additional legislation in 1909 reestablished the road fund on a permanent basis. Counties could now draw half the moneys needed for their road construction projects. That year Hill classified only 5,000 miles of roadways as "improved" out of the 110,000 miles of roads across the state.[1]

While administering the road fund, Hill also actively promoted the idea of cross-state highways. In 1911, with over 16,000 motor vehicles on Missouri roads, Governor Herbert S. Hadley appointed a committee to study the feasibility of three alternative cross-state highways from St. Louis to Kansas City which Hill had suggested and mapped out. Following a well-publicized inspection tour of the proposed routes, which included Governor Hadley and other dignitaries, the State Board of Agriculture selected the central route. Road bonds for the construction of the so-called Old Trails Road subsequently carried in Lexington, Columbia and Fulton, but support lagged elsewhere and the envisioned highway was not completed. Nevertheless, the publicity sparked by the cross-state highway idea did much to further the Good Roads movement. [2]

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[1]Floyd C. Shoemaker, "Chapter 62: Modern Highway Development in Missouri," in *Missouri and Missourians: Land of Contrasts and People of Achievements,* 5 Vols. (Chicago: Lewis Publishing Company, 1943), 2: 510-513; Lawrence O. Christensen and Gary R. Kremer, *A History of Missouri, Volume IV, 1875 to 1919* (Columbia: University of Missouri Press, 1997), 123; Harris B. Dickey, "History of the Missouri Highway Department," (manuscript, Highway Planning Survey Division, ca. 1942), 1-8.

[2]Dickey, "History of the Missouri Highway Department," 9-11; Shoemaker, "Modern Highway Development," 519-521.

In 1913, with the number of vehicles having more than doubled in two years to over 38,000, the Missouri General Assembly replaced the State Highway Engineer with a State Highway Commissioner and Deputy Commissioner, and created the Missouri State Highway Department. (The State Board of Agriculture was relieved of its responsibilities in matters of road construction and maintenance). The expanded duties of the new Highway Commissioner, Colonel Frank W. Buffum, and Deputy Commissioner W. S. Hawkins, included devising specifications and design plans for road construction, including "standard gauge roads" which would be designated by a given name or number. Other legislation allowed for inter-county seat "state roads" which would be selected and established by the proper county officials, with Buffum's approval. The State Highway Department had a limited role, which included furnishing tools and equipment for state road construction. Since road improvements still depended on local initiative, additional legislation created three-member county highway boards appointed by the county courts, to help guide the county engineers. Counties also received $15 per mile per annum for road dragging, paid out of the road fund. In 1914, Buffum estimated that unimproved dirt roads still totaled some 63,000 miles, but improved dirt roads had increased to about 54,000 miles. Gravel or macadam roads were still comparatively rare.[3]

During this period of increasing road travel, the most common means of maintaining the pervasive network of dirt roads was the use of the split-log road drag, invented in 1894 by D. Ward King of Maitland, Holt County, Missouri. The "King Drag" was a simple, ladder-shaped devise, easily and cheaply built, pulled by horse or mule to effectively smooth over roadway surfaces. The drag worked best on wet, muddy roads as it spread the mud out like mortar to fill the holes and ruts. King actively promoted its use through speeches, articles, and demonstrations until it became known as the "Missouri Idea." In 1906, delegates attending a Good Roads Convention at Chillicothe confirmed the practicality of King's road drag: "We strongly endorse the drag as the most effective and practical method of maintaining dirt roads, and would suggest that some law be enacted whereby its more general employment for this purpose may be effected."[4] Use of the drag spread quickly among county road districts and infant state highway departments throughout the Midwest. Writing in 1914 for *Illinois Highways* magazine, B. H. Piepmeier (later to become Missouri's Chief Engineer) lauded the use of the King Drag:

> Up to the present time, there has been no scheme or process of treatment for the earth road surface that preserves it more than the systematic use of the drag. There is no process that could be more generally used or recommended for maintenance of earth roads than dragging them. If there could be some means

[3]Dickey, "History of the Missouri Highway Department," 11; Shoemaker, "Modern Highway Development," 519-521.

[4]Missouri State Highway Commission, *Roads and their Builders* (Jefferson City: Division of Public Information, n.d.), 48-49.

provided whereby all could be led to use it intelligently, the earth road problem would be practically solved in many districts.[5]

The ever-growing popularity of automobile travel meanwhile sparked the formation of myriad regional and national Auto Trail associations. These various competing groups generally promulgated the Good Roads movement while promoting their own particular roads linking major cities, and indirectly their own commercial interests. Many groups solicited funds from the areas through which their road passed, often giving nothing in return. The more ambitious and reputable Auto Trail groups marked their routes with distinctive colored signs placed on utility poles, trees, and fence posts. The various signs often proved perplexing and bewildering to motorists. Among the more successful Auto Trail groups operating in Missouri was the National Old Trails Road Association, formed in 1912 to continue the crusade for the cross-state route between St. Louis and Kansas City. The Pikes Peak Ocean to Ocean Highway Association, based in St. Joseph, dubiously promoted their road as a link between New York City and Los Angeles; in Missouri, their route from Hannibal to St. Joseph was marked by red and white signs. The Jefferson Highway and the Ayr Line both claimed termini at St. Joseph and Des Moines. The Cannon Ball Trail meandered from Liberty to Quincy, Illinois. The Red Ball Route, marked by signs with a red ball on a white background, paralleled the Mississippi River from St. Louis to St. Paul, Minnesota. These and other named routes which criss-crossed Missouri did receive some improvements as state aid to counties increased, and some segments eventually became part of the early state road system. Sections of the National Old Trail, for example, became part of State Route 2 (U.S. Route 40), while State Route 8 (U.S. Route 36) closely followed the Pikes Peak Highway. The various Auto Trail associations gradually died out in the mid-1920s as Missouri and surrounding states began placing uniform signing on their numbered routes.[6]

II. The MSHD's First Years: 1913-1921

In its first years under Commissioner Buffum, the Missouri State Highway Department had little direct influence on road construction other than approving the plans submitted by the various county engineers and highway boards. During 1916, allotments to the counties for construction and dragging inter-county seat state roads totaled only $482,860. By the end of 1916, 7,520 miles of roadway or 7.6 percent of Missouri's total road mileage had been "hard-surfaced."[7] The highway department's restricted role would be expanded in 1917, partly through

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[5]*Mississippi Valley Conference of State Highway Departments, Historical Highlights, 1909-1974* (n.p.: Mississippi Valley Conference of State Highway Departments, 1974), I-24.

[6]Ibid., XI-1-4; Pikes Peak Ocean to Ocean Highway Association, *1926 Map Guide, Pikes Peak Ocean to Ocean Highway* (New York: Rand McNally and Co., 1926), 58-81; Dave Schul, "North American Auto Trails." October 10, 1999. http://falcon.cc.ukans.edu/~dschul/trails/trails.html (November 4, 1999).

[7]*Public Roads Magazine*, February 1919, 33-37, reprinted in *Mississippi Valley Conference of State Highway Departments*, XXI-28-32.

the efforts of Missouri Congressman Dorsey W. Shackleford, Chairman of the House Roads Committee, who stimulated Congressional debate on the federal government's role in highway construction.

In 1912, Representative Shackleford introduced legislation proposing a $25 million "rental plan," in which the federal government would make payments to the counties for their use in improving rural post roads. Although this bill failed, over the next two years Shackleford served as vice-chairman on a joint House and Senate committee investigating federal participation in road construction. The committee's report issued in January 1915 recommended federal involvement, finding justification in a national consensus that "the demand for Federal Aid has become general and insistent." Shackleford submitted another bill in 1916 which again authorized $25 million for rural post road improvements with federal participation and oversight. The House passed Shackleford's measure in January 1916, with a vote of 281 to 81. In the Senate, John H. Bankhead of the Committee on Post Offices and Post Roads deleted Shackleford's bill and inserted stronger language written by the American Association of State Highway Officials (AASHO). The House and Senate approved Bankhead's legislation on June 27, and President Woodrow Wilson signed it into law on July 11.[8]

The Federal Aid Road Act signed by Wilson in 1916 provided a national impetus for road improvements. Meant to establish a national system of interstate highways, the act appropriated $75 million in federal funds for rural post roads, with the states matching the federal funds on a fifty-fifty basis. The act limited federal participation to $10,000 per mile, excluding bridges longer than twenty feet. To receive funding, a state had to have an adequate and competent state highway department and follow the specifications of the Office of Public Roads and Rural Engineering, U.S. Department of Agriculture (renamed the Bureau of Public Roads in 1918). This was the first comprehensive federal legislation and appropriation for the improvement of state roads.[9] The Missouri General Assembly formally assented to the federal act with the passage in March 1917 of the Hawes Road Law, named for its chief author, State Representative Harry B. Hawes. By then the price of the mass-produced Ford Model T had dropped to an affordable $350 each and the numbers of automobiles in Missouri had quadrupled in four years to over 151,000. The Hawes Law strengthened the role of the Missouri State Highway Department, placing it under the authority of a four-member, bipartisan State Highway Board.

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[8]Richard F. Weingroff, "Federal Aid Road Act of 1916: Building the Foundation." *Public Roads* (Summer 1996), http://www.tfhrc.gov/pubrds/summer96/p96su2.htm (November 4, 1999), 3-5; Richard F. Weingroff, "For the Common Good: The 85th Anniversary of a Historic Partnership," *Public Roads* (March-April 2001), http://www.tfhrc.gov/pubrds/marapr01/commongood.htm (May 16, 2001); *Mississippi Valley Conference of State Highway Departments*, X-6-10.

[9]Ibid., 4-5; A. E. Johnson, ed., *American Association of State Highway Officials, The First Fifty Years, 1914-1964* (Washington, D.C.: AASHO, 1965), 152; Weingroff, "For the Common Good."

The board appointed a State Highway Engineer, who in turn selected two assistant engineers and other necessary employees.[10]

Under the provisions of the Hawes Road Law, the State Highway Engineer's primary responsibility became the specific designation of a system of state roads totaling at least 3,500 miles. This system would be expanded annually by at least 500 miles, as funds allowed. The Engineer would select the state roads with the advice of the county courts and county highway boards, with considerations given to the counties' respective areas, populations, and mileages of existing roads. Section 18 of the act mandated the State Highway Engineer to furnish the counties with standard construction specifications for all types of roads, and standardized plans and specifications for all classes of bridges and culverts. The state roads were to be uniformly marked and built to a minimum width of forty feet, including right of way, with proper grades, bridges, culverts, and drainage. The state road fund which now derived its revenues from the motor vehicle license and registration fees, as well as other sources, would match the federal moneys to pay half the construction costs; the counties would pay the other half. The state road fund would also disburse $15 a mile for dragging inter-county seat highways not on the state road system, and supply another $400,000 biennially to help construct other local roads and bridges. Despite the State Highway Department's enlarged responsibilities, the various county highway boards, township road districts and special road districts still shouldered much of the burden. Specific projects depended on their initiative. Formal requisitions for state aid required the counties (generally through the county engineers) to furnish the survey and construction plans, specifications, and cost estimates. The State Highway Engineer and State Highway Board would approve a project, then seek approval from the Office of Public Roads and Rural Engineering. The counties also had to purchase rights of way, pay half the costs of a project, and afterwards pay half the costs of maintenance. The counties' moneys derived from local personal and property taxes placed into a road and bridge fund, as well as from the occasional bond issue.[11]

The first State Highway Engineer, Alexander W. "Boss" Graham, assumed his duties in March 1917 upon passage of the Hawes Law and promptly began outlining the state road system with the assistance of the county courts and the State Highway Board. Graham's proposed system of 5,000 miles (1,500 miles above the legislated minimum) connected all of the counties and the larger population centers. Graham's plan would remain the foundation of Missouri's road system. The State Highway Board approved the tentative system in June 1917. For both 1917 and 1918, the legislature appropriated $200,000 which was apportioned to the counties according to their assessed valuations, with no county receiving more than $6,000. Through December 1, 1918, the board approved 122 projects covering 1,590 miles in sixty-one counties. Of these projects, sixty-one were placed under contract in forty-three counties, while over 11,400

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[10]Dickey, "History of the Missouri Highway Department," 12-13; Shoemaker, "Modern Highway Development," 514-516; *Mississippi Valley Conference of State Highway Departments*, X-29-31.

[11]Missouri State Highway Board, *Report of the State Highway Board of Missouri for the Period Ending December 1, 1918* (Jefferson City: Hugh Stephens Company, Printers), *passim*; Christensen and Kremer, *History of Missouri*, 123; Dickey, "History of the Missouri Highway Department," 12-13; Shoemaker, "Modern Highway Development," 514-516.

miles of the inter-county seat highways were dragged and otherwise improved. Most counties requisitioned their full allotments in both years. Missouri State Highway Department engineers assisted the counties in developing their projects and made periodic inspections of the ongoing construction. This local, state and federally-funded highway system marked the beginning of Missouri's modern highway development.[12]

Graham and his small staff encountered numerous difficulties in the first two years. World War I caused a shortage of materials and labor, especially competent engineers and draftsmen. In collaboration with the State Prison Board, the department supplied the counties with prison labor housed in temporary camps near the construction sites. Cooperation from the 114 county courts, the county engineers and highway boards, and the various special road districts proved uneven at best. Some ignored Graham's initial requests to select their preferred routes to be taken into the state road system. He and his assistant engineers traveled to the different counties to personally secure the required information. The majority of the county engineers submitted their requisitions for state aid incorrectly, often neglecting the department's repeated instructions to fully complete the plans and specifications. Also, many counties failed to survey the entirety of their state roads and supply maps and profiles as required. Graham and his staff meanwhile endured cramped quarters in two rooms of the Supreme Court Library Building. Mandated to supply standard plans and specifications for roads and bridges but with no space for a drafting department, Graham traveled to Washington, D.C., in May 1917 and received some standard bridge designs from the Office of Public Roads and Rural Engineering. There Graham also secured Chester D. Mann as the department's first Bridge Engineer. Mann arrived in Jefferson City in June and set up a drafting room in the old House of Representatives Building, then moved to a small room off the department's quarters. Mann worked alone for several months until the department received enlarged quarters in October. Over the following year, Mann's Bridge Bureau produced standardized culvert designs which were readily adopted in county projects, and designed nearly all of the constructed bridges. The longer spans proved less amenable to complete standardization because of their various lengths, heights, substructure conditions and relative costs, but standard substructure and superstructure components could be selected and combined for a particular site. Highway Department engineers meanwhile produced standard plans for graded earth and hard surfaced roadways.[13]

In March 1919, the McCullough-Morgan Act amended the Hawes Law by providing for a Highway Superintendent who would generally oversee the State Highway Department operations and serve as secretary to the State Highway Board. The new act also increased the state road system to 6,000 miles, to be divided among the counties on a more equitable basis. It guaranteed each county at least two state roads totaling at least fifty miles. Total state road mileage in a given county would depend on its relative size. State and federal aid of $7,200,000 would be divided nearly equally, with each county receiving approximately $60,000 for its minimum fifty

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[12]Missouri State Highway Board, *Report for the Period Ending December 1, 1918, passim*; Dickey, "History of the Missouri Highway Department," 12-13; Shoemaker, "Modern Highway Development," 514-516.

[13]Missouri State Highway Board, *Report for the Period Ending December 1, 1918, passim.*

miles, or $1,200 per mile. The counties could continue the state road work with their own matching funds, and bring other county roads into the state system with the approval of the State Highway Board. The new legislation also appropriated funds for road dragging expenses. The counties continued to award all construction contracts.[14]

John M. Malang became the new Highway Superintendent. Formerly the superintendent of the Joplin Special Road District, Malang had overseen construction of the first concrete road on the state highway system--Federal Aid Project No. 2 from Webb City to the Kansas state line. Malang would continue to work tirelessly for the Good Roads movement. The McCullough-Morgan Act required Graham to complete surveys of the entire 6,000-mile system by the end of 1921. Therefore he divided the state into six districts and placed District Engineers in St. Joseph, Macon, Sedalia, Springfield, De Soto, and Sikeston. The Highway Department expanded further with bureaus of construction, surveys and plans, and audits headquartered in Jefferson City. The Bureau of Surveys and Plans under Carl W. Brown began surveys of the proposed roads with the help of the District Engineers, private engineering contractors, and county officials. By December 1920, 5,428 miles had been surveyed and plans completed for 3,127 miles. The Bureau of Bridges completed standardized designs of twenty-one concrete culverts, twenty-four concrete superstructures with spans of ten to fifty feet, and thirteen steel superstructures of fifty to 150 feet. They also drew plans for 185 individual bridges. Meanwhile, Superintendent Malang and Chief Engineer Graham continuously campaigned in the counties for local road bond issues. Fifty-nine counties and special road districts approved bond issues in 1919 and 1920 to construct portions of their highways afforded under the McCullough-Morgan Act. With the numbers of vehicles in the state now approaching 300,000 and progress on the state system proceeding at a snail's pace, Superintendent Malang, Governor Frederick Gardner, and the Missouri Good Roads Federation spearheaded an intensive campaign for a $60 million state bond issue to "Lift Missouri Out of the Mud." The bond issue passed in November 1920 in sixty-one of the 114 counties. The bonds provided much-needed additional revenues to advance the state road system more rapidly.[15]

The Centennial Road Law of 1921 marked the final step in the transition from local to state control over road construction. Designed to implement the 1920 bond issue, the Centennial Road Law passed in special session after long, heated debate and compromise between urban and rural legislators. It created a four-member Missouri State Highway Commission with broadened powers to locate, design, construct, and maintain the state highway system, let contracts, and purchase rights of way. The commission was authorized to appoint a Secretary to the

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[14]Dickey, "History of the Missouri Highway Department," 13-14; Shoemaker, "Modern Highway Development," 516-517; Missouri State Highway Board, *Report of the Missouri State Highway Board for the Period Ending December 1, 1920* (Jefferson City: Hugh Stephens Company, Printers), *passim*.

[15]Missouri State Highway Board, *Report of the Missouri State Highway Board for the Period Ending December 1, 1920, passim;* Richard S. Kirkendall, *A History of Missouri, Volume V, 1919 to 1953* (Columbia: University of Missouri Press, 1986), 36-37; Dickey, "History of the Missouri Highway Department," 13-16; Shoemaker, "Modern Highway Development," 516-517.

Commission, a Chief Counsel, and the Chief Engineer. The legislation detailed a 1,500-mile system of primary routes to be comprised of "high type" or hard surfaced roads to connect the principal cities. It also explicitly defined a secondary system of 6,100 miles, chiefly of graded earth and gravel, which interconnected all of the county seats. The law mandated that construction be carried on simultaneously as far as possible in all the counties; each county received an apportionment of $6,000 per mile. Governor Arthur Hyde appointed the first commission members on December 1, 1921: Theodore Gary, chairman; S. S. Connett, vice chairman; Murray Carleton; C. D. Matthews; and state geologist H. A. Buehler as an *ex officio* member. The new commission reinstated Graham as Chief Engineer.[16]

In tandem with the Centennial Road Law, the Federal Highway Act signed by President Warren Harding in November 1921 appropriated another $75 million, but restricted federal aid to an explicit system of interstate or primary highways and intercounty or secondary highways. It required each state to specify 7 percent of their total road mileage which would receive federal aid, marking the beginning of the Federal-aid primary highway system. The act also reemphasized the requirement for capable state highway departments, liberalized the states' matching fund requirements, and compelled the maintenance of existing roads.[17] Within Missouri, the federal aid system would overlap the state system with few exceptions. In 1922 the Missouri State Highway Department, with direction from the Missouri State Highway Commission and the Bureau of Public Roads, began their effort to lift Missouri out of the mud.

III. Out of the Mud: 1922-1930

During 1922, the new Missouri State Highway Commission began its work in constructing the state highway system as mandated by the Centennial Road Law. One of the first acts of the commission was the hiring of Rollen J. Windrow as a consulting engineer and personal representative of Chairman Theodore Gary. Windrow would travel to Washington, D.C., to confer with officials of the Bureau of Public Roads. In February 1922, Windrow and Chief Engineer Alexander Graham began locating and designating the 1,500-mile system of primary, hard surfaced roads. These cross-state highways would connect the principal cities having populations of 2,500 or more, using the most practical and direct routes while avoiding the smaller towns and villages. The primary road system would be so laid out to directly serve as much of the state population as possible. Graham and Windrow made personal inspections of the proposed primary road locations, giving special consideration to the primary route linking Kansas City and St. Louis. They ultimately chose a northern route which would cross the Missouri River at Boonville. On June 1, 1922, Bion H. Piepmeier replaced Graham as Chief Engineer. Born in 1885 near Appleton City, St. Clair County, Piepmeier had graduated from the University of Missouri in 1908 with a civil engineering degree. He worked for the Illinois State Highway Department from 1908 to 1922, holding a variety of engineering positions. Piepmeier

[16]Dickey, "History of the Missouri Highway Department," 16; Shoemaker, "Modern Highway Development," 524-526.

[17]Johnson, *AASHO*, 152; *Mississippi Valley Conference of State Highway Departments*, X-77-80.

and Windrow completed the study of the primary road system in July, which the commission adopted on August 1 after three days of public hearings. When constructed, the 1,545 miles of primary roads would connect twenty-six cities, serving 91 percent of Missouri's urban population and half of the state's total population. The state secondary routes connecting the county seats brought the total state road mileage to 7,640. Most of the highways would be constructed with federal aid. The State Highway Commission devoted one-third of the available funds to the primary routes and two-thirds to the secondary routes.[18]

In its first year, the State Highway Commission oversaw the expansion of the State Highway Department. In April 1922, the commission increased the number of field divisions from six to ten, adding additional offices in Hannibal, Kansas City, Jefferson City, Webster Groves, Joplin and Willow Springs. (The former division offices in Sedalia and DeSoto were closed). The ten divisions supplied preliminary surveys and plans, and estimates of construction costs and materials. In addition, the Bureau of Construction's Materials Testing Lab, which ensured the quality of construction materials, moved from the Engineering Department at the University of Missouri to the basement of the state capitol building. One major dilemma facing the commission in 1922 was the lack of funds for road maintenance. The Centennial Road Law and the Federal Highway Act both explicitly required the maintenance of highways, but no provision had been made for maintenance revenues. The situation was remedied by a constitutional amendment passed in November 1922, which allowed surplus vehicle registration fees to be applied to road maintenance. The Bureau of Maintenance was established immediately following passage of the amendment.[19]

During 1922, the Bureau of Bridges under Chester Mann rewrote the standard bridge specifications to comply with the standards of the Bureau of Public Roads, then began revising the standard bridge and culvert designs to conform to the new specifications. Meanwhile, over the course of the year, the bureau prepared designs for 293 individual structures. The bureau also oversaw planning of four major Missouri River bridges at Boonville, Glasgow, Waverly and Lexington, funded through federal aid and local bond issues. The bureau was stymied, however, by a provision of the Centennial Road Law, which prohibited using any of the bond money for bridges over navigable streams.[20]

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[18]Missouri State Highway Commission, *Third Biennial Report of the State Highway Commission of Missouri for the Period Ending December 1, 1922* (Jefferson City: Hugh Stephens Company, Printers), 68-83.

[19]Missouri State Highway Commission, *Third Biennial Report of the State Highway Commission of Missouri for the Period Ending December 1, 1922*, 69, 91, 119; Missouri State Highway Commission, *Annual Report of the State Highway Commission of Missouri to Governor Arthur Hyde for the Period Ending December 31, 1923* (Jefferson City: Hugh Stephens Company, Printers), 4, 84.

[20]Missouri State Highway Commission, *Third Biennial Report of the State Highway Commission of Missouri for the Period Ending December 1, 1922*, 127-128; Missouri State Highway

Although the State Highway Department received $10 million of bond money during 1922, it continued to administer a confusing array of funds remaining from the 1917 Hawes Law, the 1919 McCullough-Morgan amendment, and the 1921 Federal Highway Act. The first construction contracts using bond money were let on September 28, 1922, covering thirty projects for 110 miles of road improvements. A second letting on December 2 involved eighty-six projects totaling 297 miles. By that time, since the passage of the Hawes Law, the department had overseen construction of 514 miles of hard surfaced roads and 542 miles of graded earth roads. The commission noted that at that rate, it would take seventy-six years to complete the entire state road system. In its third biennial report, the commission concluded, "while there has been a marked increase in the progress of improving roads during the past two years, the advancement has not kept pace with the growth of public sentiment. The public is constantly demanding greater progress. Therefore, any undue limitations set up by statute should, as far as possible, be removed so that the Department may prosecute all road work at a rate that will more nearly meet the demand."[21]

In December 1922 the commission appealed to Governor Arthur Hyde to speed up the road construction program by increasing the sales of the road bond money to $15 million per year instead of $5 million as originally planned. Commission Chairman Theodore Gary addressed a joint legislative session in February 1923, asking for additional maintenance funds of $900,000 a year derived from increased license fees and a proposed gas tax. While the legislature had appropriated $3 million for maintenance in 1923, the commission informed Governor Hyde in September that an additional revenue source remained imperative. They again suggested that the bonds be issued at the rate of $15 million a year to complete the $60 million bond expenditures by 1927. The commission also conferred with the Senate Committee on Roads, stating that the bond money could be expended within four years provided that additional maintenance funds be made available; otherwise, only $2 million of bonds could be issued in 1924. Finally, in late November 1923, the commission issued a public statement reiterating the need for maintenance revenues, and recommending a 50 percent increase in vehicle registration fees.[22]

The public showed enthusiastic support for the progressing highway network. They insisted on nothing less than a completed system. In 1924, with over half a million vehicles now on the roads, the Automobile Club of Missouri sponsored an initiative petition--Proposition No. 5--designed to boost revenues and speed up the road construction through a gasoline tax of 2 cents per gallon and a 50 percent increase in vehicle registration fees; the increased revenues would allow for the sale of the road bonds at the faster rate of $15 million a year. It would also provide maintenance funds, and reimburse the counties for their work performed on state roads.

Commission, *Fifth Biennial Report of the State Highway Commission of Missouri for the Period Ending December 1, 1926* (Jefferson City: Hugh Stephens Press), 94.

[21]Missouri State Highway Commission, *Third Biennial Report of the State Highway Commission of Missouri for the Period Ending December 1, 1922*, 96, 237.

[22]Missouri State Highway Commission, *Annual Report of the State Highway Commission of Missouri to Governor Arthur Hyde for the Period Ending December 31, 1923*, 5-22.

Various road proponents and the Highway Commission campaigned vigorously, and in November 1924 Missouri voters passed Proposition No. 5 overwhelmingly by over two to one. By that time, the total mileage of completed hard surfaced roads had reached over 1,600 miles, or one-fifth of the 7,640-mile system; graded earth roads totaled over 1,800 miles.[23]

The State Highway Department's Bureau of Maintenance immediately proved indispensable to the advancement of the state road system. A Supervising Maintenance Engineer placed in each of the ten divisions oversaw County Superintendents within each county. "Road patrols" under the County Superintendents used mechanized equipment or horse teams to maintain or improve virtually the entire state system by the end of 1924, transforming many unimproved dirt roads to "all-weather" routes. Maintenance crews marked the entire 7,640-mile state road system with oval-shaped state highway signs featuring black letters and black borders on an orange background. They also stenciled telephone poles with route numbers, placed orange wooden arrows at intersections and turns, and erected various warning signs. The confusing array of other signs and markers erected by the various road trail associations began to disappear. In addition to grading and graveling sections of the state roads, maintenance forces refurbished older bridges taken into the state system, and replaced dozens of the smaller bridges and culverts. The State Highway Department also concentrated on eliminating at-grade railroad crossings, either by the construction of grade separation structures or the relocation of state roads away from railroad crossings. Other efforts focused on the procurement of high-quality construction materials. While encouraging the producers of sand, gravel and cement to enlarge their plants, the Division of Railroad Traffic, established in January 1923, coordinated railroad shipments of construction materials to job sites. The department also encouraged private construction contractors to increase their efficiency, thereby lowering construction costs. A Division of Equipment was set up to procure and maintain the department's growing fleet of cars, trucks, tractors and other equipment. Much of it consisted of surplus vehicles donated at the end of World War I. A central garage in Jefferson City was built of surplus war materials, while other garages were established at each of the division headquarters.[24]

The Bureau of Bridges continued to focus on the standardization of structures and the designs of individual structures. During 1923, the bureau completed a new series of culvert standards, and began standardizing various types of abutments and assembly drawings. The annual output of special bridge designs continued to increase, as the bureau completed 405 bridge designs in 1923, predominately reinforced concrete structures. Department bridge engineers continued to supervise construction of the four Missouri River bridges, and began the

[23]Missouri State Highway Commission, *Roads and their Builders*, 78; Shoemaker, "Modern Highway Development," 521; Dickey, "History of the Missouri Highway Department," 18.

[24]Missouri State Highway Commission, *Fourth Biennial Report of the State Highway Commission of Missouri for the Period Ending December 1, 1924* (Jefferson City: Hugh Stephens Press), 33, 51, 62, 183, 244, 254.

Gasconade River Bridge at Mount Sterling.[25] Lief J. Sverdrup succeeded Chester Mann as Engineer of Bridges on January 1, 1924. Born in Norway in 1898, Sverdrup immigrated to the United States at the age of sixteen. He received a B.A. degree from Minnesota's Augsburg College in 1915, served briefly as a First Lieutenant in the U.S. Army field artillery, then in 1919 returned to the University of Minnesota to resume his studies in civil engineering. Following his graduation in 1921 with a Master of Science degree, Sverdrup worked as a Project Engineer and Special Bridge Designer at the Minnesota Highway Department. He joined the Missouri State Highway Department in 1922 where he started as a bridge designer. During 1923 he became resident engineer for the department's Gasconade River Bridge project at Mount Sterling. With his promotion to Engineer of Bridges in 1924, Sverdrup oversaw completion of the four Missouri River bridges. His bureau also revised the standard bridge specifications, and developed a Manual of Bridge Construction for the project engineers and bridge inspectors.[26]

With the increased revenues allowed by Proposition No. 5, the State Highway Department made more rapid progress on the state highway system. By the end of 1926, over 4,900 miles of hard surfaced roads were complete, while all-weather roads comprised more than two-thirds of the state system. The counties and other civil subdivisions had constructed about 1,600 miles of hard surfaced roads which they then turned over to the state. A national system of numbered U.S. interstate highways had also been adopted upon the urging of the American Association of State Highway Officials (AASHO). In March 1925, the Secretary of Agriculture appointed a Joint Board on Interstate Highways comprised of various state highway officials (including Missouri's Chief Engineer B. H. Piepmeier) and officials of the Bureau of Public Roads. The board worked out a uniform system of U.S. numbered interstate routes which the Secretary of Agriculture approved in November 1925. Within Missouri, the U.S. routes included four north-south routes and seven east-west routes, or about 3,000 miles of the state highway system. The U.S. routes essentially overlapped the state's primary roads. Through 1926, the highway department's maintenance forces marked the former state routes with U.S. Route signs. U.S. Route 50 (formerly State Route 12) was completely hard surfaced by the end of 1926. U.S. Route 40 (formerly State Route 2) would have its pavement completed in 1927. The other U.S. Routes still stood in various stages of completion, but the commission hoped to have them finished by the end of 1932.[27]

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[25]Missouri State Highway Commission, *Annual Report of the State Highway Commission of Missouri to Governor Arthur Hyde for the Period Ending December 31, 1923*, 75.

[26]Gregory Franzwa, Legacy: *The Sverdrup Story* (St. Louis: Sverdrup Corporation, 1978), 1-4; Gregory Franzwa and William J. Ely, *Leif Sverdrup, Engineer Soldier at his Best* (Gerald, Missouri: Patrice Press, 1980), 1-31, *passim*; Missouri State Highway Commission, *Fourth Biennial Report of the State Highway Commission of Missouri for the Period Ending December 1, 1924*, 118-120; Missouri State Highway Commission, *Fifth Biennial Report of the State Highway Commission of Missouri for the Period Ending December 1, 1926* (Jefferson City: Hugh Stephens Press), n.p.

[27]Johnson, *AASHO*, 139-144; Missouri State Highway Commission, *Fifth Biennial Report of the State Highway Commission of Missouri for the Period Ending December 1, 1926*, 10, 15, 96-97.

In the two-year period following passage of Proposition No. 5, the Bureau of Bridges completed 450 new bridge designs, and made repair designs for numerous older bridges taken into the state system. In its bridge designs, the bureau determined "the best and most economical structure for each crossing," using "the most economical combination of span length and types." The larger bridge projects in 1925 and 1926 included the Black River Bridge in Butler County; the Gasconade River Bridge in Maries County, the only cantilevered bridge then in the state system; the Osage River Bridge in Benton County, a concrete arch bridge 820 feet long; and the Current River Bridge in Ripley County, then the longest bridge in the state system at 1,430 feet (excluding the Missouri River bridges). After Sverdrup's promotion to Assistant to the Chief Engineer in September 1925, Vaughn W. Enslow filled in as Acting Engineer of Bridges. A native of Iowa, Enslow had received his civil engineering degree from Iowa State College. He worked for the Iowa State Highway Commission for two years before joining the Missouri State Highway Department in 1919. He had served as the Assistant Bridge Engineer since 1921. Enslow's continued importance to the daily operations of the Bridge Division from 1921 onward is seen in his frequent correspondence regarding various on-going bridge projects.[28]

At the end of 1926, the Missouri State Highway Commission foresaw a need for the expansion of the state highway system, just as the last $5 million of the $60 million bond issue would be expended. The construction program for 1927 would total about $13 million, down from $23 million in both 1925 and 1926. The commission believed it necessary to add additional highway mileage to complete the federal interstate connections, to build spur routes to connect with other state roads, and to build connections to the growing state park system. The commission further recommended that future appropriations for construction and maintenance be combined, which would allow the maintenance forces to construct some sections of highways. They also requested a suitable building for the State Highway Department headquarters in Jefferson City.[29]

Thomas H. Cutler replaced B. H. Piepmeier as Chief Engineer in February 1927. A native of Kansas, Cutler received his engineering degree from the University of Kentucky in 1903. Before joining the Missouri State Highway Department in 1923, Cutler worked for the Illinois Steel Company and the United States Steel Company, and as an independent contractor from 1909 to 1917. During World War I he served as Captain of Engineers and Major of Chemical Warfare. At the Missouri State Highway Department, Cutler held the positions of Project Engineer, Supervising Maintenance Engineer, Assistant Division Engineer, Assistant

[28]Missouri State Highway Commission, *Fifth Biennial Report of the State Highway Commission of Missouri for the Period Ending December 1, 1926,* 140; *Jefferson City Post-Tribune*, October 21, 1985.

[29]Missouri State Highway Commission, *Fifth Biennial Report of the State Highway Commission of Missouri for the Period Ending December 1, 1926*, 34.

Engineer of Construction, and Engineer of Construction before becoming Chief Engineer. He would serve in that capacity until 1936 when he joined the Kentucky Highway Department.[30]

Both the public and the state legislature remained supportive of the commission's agenda. In 1927, the legislature passed the Painter-McCawley Act, which authorized the creation of county highway commissions within each county. The county highway commissions could designate up to 100 miles of county roads as state supplementary, "farm-to-market" roads, subject to the approval of the State Highway Commission. However, the legislation made no appropriations for construction of the supplementary system. Recognizing the need for continued progress on the state's highways, the Citizens' Road Association organized in 1927, chaired by Hugh W. Stephens of Jefferson City. A publisher and banker, Stephens had served on the State Highway Commission in 1925-1926. His father, E. W. Stephens, had been another good-roads supporter as a leader of the earlier Old Trails Road Association. When the Citizens' Road Association and other road advocates agitated for another road bond issue, Governor Sam A. Baker named a bipartisan Citizens' Road Committee to formulate a plan for advancement of the state highway system. The committee included members of the State Highway Commission, the Citizens' Road Association, the Automobile Club of Missouri, and the state at large. The committee encapsulated its recommendations in Proposition No. 3, a constitutional amendment adopted by Missouri voters in November 1928.[31]

Proposition No. 3 provided for another $75 million in bonds to be expended under the direction of the State Highway Commission, rather than the state legislature as before. It added 300 miles of additional state roads, approximately 300 miles of traffic relief routes in the St. Louis and Kansas City metropolitan areas, plus nearly 100 miles of new roads to connect with the state parks. It also provided for construction of the supplementary system within each county totaling approximately 7,000 miles. While there had been a deceleration of construction in 1927 and 1928, due to the exhaustion of the original $60 million bond issue, progress on road and bridge construction had continued. Construction costs had been reduced with more efficient construction methods, improved equipment and machinery, and state-furnished construction materials. At the end of 1928, the entire state road system as outlined by the Centennial Road Law had been surveyed. The efficient placement of road locations had actually reduced the state system mileage from 7,640 to 7,527. Three-fourths of the primary system and one-half of the

[30]Floyd Calvin Shoemaker, ed., Missouri and Missourians, Land of Contrasts and People of Achievements (Chicago: Lewis Publishing Company, 1943), 2: 539-540; Missouri State Highway Commission, *Seventh Biennial Report of the State Highway Commission of Missouri, for the Period Ending December First 1930* (Jefferson City: Hugh Stephens Press, 1930), n.p.
[31]Missouri State Highway Commission, *Seventh Biennial Report of the State Highway Commission of Missouri for the Period Ending December 1, 1930* (Jefferson City: Hugh Stephens Press), 34-35, 65; Dickey, "History of the Missouri Highway Department," 18; Shoemaker, "Modern Highway Development," 528-529, 540; Lloyd C. Stark, "The $75,000,000 State Road Bond Issue," *Missouri* (October 1928), 12, 27.

secondary system had been graded and surfaced. The State Highway Department meanwhile gained its new, four-story headquarters building situated next to the state capitol.[32]

During 1927 and 1928, the Bureau of Bridges had produced designs of 307 new bridges and repair designs for forty-seven older bridges. Among the more notable bridge construction projects, the Osage River Bridge at Osceola had the longest concrete arch span in the state, at 225 feet. Two concrete arch bridges had been erected near Carthage. The Pomme de Terre River Bridge in Greene County consisted of three concrete arch spans and girder approach spans. Another concrete arch bridge at Stouts Creek in Iron County was remarkable for its "very beautiful location." A Missouri River bridge at St. Joseph, financed by municipal bonds, would be the state's first continuous span bridge. The Bridge Bureau began annual inspections of its state-built bridges in 1927, and in the following year placed bridge number plates on all the state bridges.[33] Norman R. Sack became the Engineer of Bridges in May 1928. Born in St. Joseph in 1895, Sack attended the University of Missouri and worked in railroad and county highway construction before enlisting with the U.S. Engineering Corps during World War I. He joined the Missouri State Highway Department in 1920, becoming the Assistant Division Engineer for Division No. 1 in St. Joseph in 1921, and its Division Engineer from 1922 to May 1928 when he was named Engineer of Bridges. He would remain in that capacity until 1942.[34]

Proposition No. 3 expanded the main state system to approximately 8,200 miles, and added approximately 7,000 miles of the supplementary, farm-to-market roads. The State Highway Commission resolved to concentrate its main efforts on the completion of the Centennial Road system. However, initial survey and design work also began on the state spur routes, park connections, traffic relief routes, and the supplementary system. First to be completed was the state's 1,600-mile primary system (generally corresponding to the U.S. highways), which was virtually finished by the end of 1930. It had taken only eight years to construct these principal cross-state highways linking most of Missouri's major towns and cities. Two-thirds of the secondary system of over 5,900 miles had been graded and surfaced by the end of 1930; the commission expected its completion within another three to four years. Survey work had been completed for the state park connections and the additional state roads, with some survey work remaining on the traffic relief routes; construction of these additional state roads had only just begun. The county highway commissions in consultations with the State Highway Department had, for the most part, chosen their state supplementary routes. By late 1930, the commission had approved the supplementary systems for 101 counties, and started construction

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[32]Missouri State Highway Commission, *Sixth Biennial Report of the State Highway Commission for the Period Ending December 1, 1928* (Jefferson City: Hugh Stephens Press), 27-47, 65-71, 133, 182.

[33]Missouri State Highway Commission, *Sixth Biennial Report of the State Highway Commission for the Period Ending December 1, 1928,* 168-172.

[34]Missouri State Highway Commission, *Seventh Biennial Report of the State Highway Commission of Missouri, for the Period Ending December 1, 1930* (Jefferson City: Hugh Stephens Press, 1930), n.p.

work in ninety-eight counties. These supplementary roads would be lettered routes. Because they carried relatively light traffic, the supplementary roads would be constructed to less rigorous standards allowing for steeper grades and narrower roadways.[35]

The Bureau of Bridges under Norman Sack designed over 500 new bridges during 1929 and 1930. These included several large, steel through truss and concrete arch bridges. One major design was the Weldon Spring (Daniel Boone) Bridge over the Missouri River, planned as part of a traffic relief route for Route 40. It featured a cantilever through truss with deck truss approach spans, although its construction still lay several years ahead. The bridge bureau designed another large cantilever truss for the Niangua River Arm of the Lake of the Ozarks. The Meramec River Bridge on Route 30 in Franklin County was one of the longer, multiple-span open spandrel concrete arch bridges designed and constructed during this period. As it turned toward the development of the supplementary system, the bureau devised a new set of standard bridge designs because of the reduced load limits on these routes. Existing bridges were refurbished when practical, while new bridge designs on the supplemental routes focused on economy. These structures would span only the stream channels rather than the entire floodplains, and used creosoted timber pile bents or light concrete bents. The first standard designs included steel beam spans and timber beam spans with both concrete and timber floors, and concrete beam and slab spans. The bridges planned for the traffic relief routes also required special designs. Many involved grade separation structures at railroad crossings and highway intersections, and featured greater roadway widths. The bureau gave special consideration to the aesthetic appearance of these structures in the metropolitan areas, using the structure types, "which give the more pleasing effect." Some even included stone facings to enhance their appearance.[36]

Other efforts at roadside beautification came during the late 1920s as the State Highway Department encouraged local civic groups to clean up unsightly areas and embellish roadsides with landscape plantings. The department hired a landscape architect who spoke before the community organizations regarding beautification efforts. In 1929 and 1930, the department sponsored roadside beautification contests offering $1,000 in cash prizes. For its own part, the department's maintenance forces mowed the roadside shoulders and slopes, landscaped around the maintenance buildings and at certain highway intersections, and cleared and trimmed portions of highway rights of way to reveal scenic vistas. The department began erecting maintenance

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[35]Missouri State Highway Commission, *Seventh Biennial Report of the State Highway Commission of Missouri, for the Period Ending December 1, 1930,* 30, 55-69, 97, 209.
[36]David C. Austin, "Camden County, Route 54, Bridge No. J-296 over Niangua River Arm, Lake of the Ozarks," Missouri Department of Transportation, April 1998; Clayton B. Fraser, Missouri Historic Bridge Inventory, 5 Vols., Missouri Department of Transportation, Project No. NBIH (6) (Loveland, Colorado: Fraserdesign, Inc., 1996); Missouri State Highway Commission, *Seventh Biennial Report of the State Highway Commission of Missouri, for the Period Ending December 1, 1930,* 255-263.

buildings across the state, all built to a standard plan, while construction of a new fireproof garage and records storage building in Jefferson City was begun in 1930.[37]

During 1930, as the Centennial Road system neared completion, general unemployment at the beginnings of the Great Depression, and a protracted summer drought across the state prompted the Missouri State Highway Commission to alter its scheduled road program. Governor Henry Caulfield urged the commission to use local labor in the construction of the supplementary routes. Beginning with its August 1930 letting, the commission required contractors to employ local labor whenever possible, and asked the counties to secure rights of way to speed up construction projects. Chief Engineer Cutler and Maintenance Engineer C. P. Owens instructed the Division Engineers to employ manual laborers in their maintenance work. Additional men and horse teams replaced trucks and machinery in graveling roadways, mowing roadsides, stockpiling materials, and in other highway maintenance work. The Commission advanced several construction projects, originally scheduled for 1931, to the latter months of 1930. These projects totaling some $4 million employed 10,000 more men. As the Great Depression worsened in the 1930s, Missouri's highway construction program shifted to accommodate the growing numbers of Missouri's unemployed. Federal emergency relief funds and New Deal work relief legislation would help spur completion of the Centennial Road system and advance the highway expansion program authorized by Proposition No. 3.[38]

Since the passage of the Hawes Road Law in 1917 and the creation of the Missouri State Highway Commission in 1921, Missouri had undergone a remarkable transformation over a short period of time. The construction of modern highways and bridges across the state during the 1920s revolutionized transportation, and had a profound impact on the lives of most Missourians. By 1930, although more work remained, the state highway system defined in the Centennial Road Law was 70 percent complete. Paved highways criss-crossed the state and improved secondary roads reached into every county. Some 2,500 new bridges spanned the state's rivers and streams. The beginning improvements to the supplementary system promised even greater access to the counties' more remote towns, villages and farms. The highway program charged the state's economy. Material producers of sand, gravel, cement and steel benefited, as did numerous road and bridge contractors whose work spurred development of more efficient, mechanized construction equipment. New roadside businesses appeared in the form of gas stations, garages, restaurants, tourist courts and automobile dealers. Bus lines and trucking firms carried passengers and freight directly to their destinations, siphoning off commerce from the railroads. Businesses began to converge in the larger towns served by the new highways, while other communities bypassed by the roads suffered declining fortunes. The greater mobility allowed by automobile travel spawned the beginnings of a tourism industry. More importantly, the network of improved roads began to erode the isolation and provincialism plaguing many rural areas. Overall, Missouri citizens, both urban and rural, proved supportive of the highway

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[37]Missouri State Highway Commission, *Seventh Biennial Report of the State Highway Commission of Missouri, for the Period Ending December 1, 1930*, 267, 427-431, 483-484.
[38]Missouri State Highway Commission, *Seventh Biennial Report of the State Highway Commission of Missouri, for the Period Ending December 1, 1930*, 84-93.

construction program. Although sometimes expressing impatience at the seeming lack of progress, local residents also showed appreciation for a new bridge or a completed section of paved highway, often holding massive celebrations. From the beginning, the Missouri State Highway Commission had dismissed all political considerations in the advancement of the state highway system. In their efforts to "lift Missouri out of the mud," the commission had gained an early reputation of "fairness, honesty, persistence, and efficiency."[39]

IV. The MSHD in Depression and War: 1930-1945

During the Great Depression of the 1930s, the Missouri State Highway Department faced new challenges involving a measure of responsibility for unemployment relief, and an increased coordination with an array of new federal agencies. At the same time, the highway department recognized a need to reexamine its own priorities and objectives. Following the stock market crash of 1929, the Great Depression affected virtually every sector of Missouri's economy--agriculture, banking, manufacturing, mining, railroads, and retail--driving unemployment to above 38 percent during 1932 and 1933. The highway department, however, remained relatively immune to the economic upheaval, even though the depression cut into the department's sources of funding. The numbers of registered vehicles fell for the first time, reducing revenues from automobile licensing fees and gasoline taxes. The General Assembly exacerbated the problem in 1933 by cutting the registration fee for passenger cars. Yet through 1933, the department continued to receive bond income from 1928's Proposition No. 3. The federal government also offset the reductions in state revenue sources through significant amounts of federal aid provided through emergency relief funds, work relief programs, and New Deal agencies of the Franklin Roosevelt administration. These revenues and the available manpower of the unemployed allowed the State Highway Department to continue its road program without significant interruption.[40]

Congress appropriated the first emergency relief funds for road construction in 1931 and 1932. States received advances of federal aid for construction projects-- Missouri received over $6 million--but this money, essentially a loan program, would be paid back through deductions from future federal aid allotments. Beginning in 1933, Roosevelt's New Deal legislation offered more substantial assistance through a variety of new agencies and programs. The Federal Emergency Relief Act (FERA) allocated direct and matching grants to state and local agencies for direct aid and work relief. The highway department used $730,000 from FERA to construct portions of the state supplementary system with local labor. The National Industrial Recovery Act (NIRA), passed in June 1933, authorized $400 million for public highway construction and

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[39]Quote from Shoemaker, "Modern Highway Development," 533; William T. Parrish, Charles T. Jones, Jr., and Lawrence O. Christensen, *Missouri: The Heart of the Nation* (Wheeling, Illinois: Harlan Davidson, Inc.), 294; Kirkendall, *A History of Missouri,* 75-76.

[40] Kirkendall, *A History of Missouri,* 131-133; Shoemaker, "Modern Highway Development," 521-522.

related projects. Missouri's allotment of NIRA funds totaled over $12 million. These dollars were automatically earmarked for projects on the Federal Aid Highway system, including up to 25 percent for municipal projects, 50 percent for projects outside of municipalities, 25 percent for "farm-to-market" roads, plus additional grants specifically for railroad grade separation structures. While the act originally required state matching funds, that provision was later repealed, setting a precedent for 100-percent federal-aid funding. It also lifted previous restrictions on urban projects where many of the unemployed were concentrated. The Missouri State Highway Commission initially balked at some of the federal provisions such as the minimum wage requirements. In August 1933, shortly after passage of NIRA, Assistant Chief Engineer Carl W. Brown provided the commission examples of projects where "very little, if any, advantage could be received in applying for these [NIRA] funds, as the extra cost of labor more than offsets the amount received from the federal government." Accordingly, the commission resolved to apply for the funds only when it would financially benefit the highway department. Nevertheless, the commission expended its allotment rapidly, and within a year of the act's passage had awarded contracts totaling over $10.5 million, with the balance of the NIRA funds committed to other projects then in the final stages of design. Missouri also received another $1.1 million through the Public Works Administration (PWA) created under NIRA.[41] One notable project constructed through the PWA was the Mark Twain Memorial Bridge over the Mississippi River at Hannibal, which President Roosevelt would dedicate in 1936.[42]

This infusion of revenues and the remaining bond money allowed the virtual completion of the Centennial Road system by the end of 1933. The department also made beginning progress on the additions to the system authorized under Proposition No. 3, namely the traffic relief routes, state park connections, and the numerous supplementary highways within the counties. These supplementary highways, or "farm-to-market roads," became the focus of much of the department's construction work in the 1930s. The State Highway Commission, assuming a responsibility for relieving unemployment, speeded the advancement of the supplementary routes. In 1933, the department completed over 1,100 miles of the supplementary system, and in 1934 added another 1,500 miles. Two-thirds of the nearly 800 new bridges erected during this period were on the supplementary system. The commission awarded these construction contracts as rapidly as possible, often at one-week intervals. The unemployed provided the bulk of the labor. Department representatives established local relief committees within each county who provided lists of those needing work to construction contractors. The commission adopted the

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[41] Shoemaker, "Modern Highway Development," 523-524; "State Highway News," *Missouri Magazine* (July 1934), 28-29; Missouri State Highway Commission, *Ninth Biennial Report of the State Highway Commission of Missouri, for the Period Ending December 1, 1934*, 112-113, 178-179, 183; "Report on the Use of NRA Funds on Bridges and Grade Separations," August 31, 1933, Minutes of Proceedings of the Missouri State Highway Commission, Secretary's Office, Missouri State Highway Commission, Jefferson City.

[42] David C. Austin, "Mark Twain Memorial Bridge, Historic American Engineering Record, HAER No. MO-77," (Jefferson City: Cultural Resources Section, Missouri Department of Transportation, 1995).

federal wage scales and other rules detailed under NIRA, requiring minimum wages of 35 cents an hour for unskilled labor and 50 cents an hour for skilled labor. (The Missouri Federal Relief and Reemployment committees later assumed the coordinating efforts that had first been established by the highway department). Road construction employed over 26,000 men by the end of 1933, and through 1934 gave work to between 15,000 and 20,000 at any given time. The department also hired 8,600 additional laborers for road maintenance, survey and construction, while thousands more found work directly with road contractors and producers of roadway materials. State, county and municipal road and bridge construction would continue to provide a nucleus of employment through the remainder of the depression years.[43]

The Hayden-Cartwright Act of June 1934 provided another infusion of federal funds. The legislation authorized $200 million more for highway projects, with a minimum of 25 percent to be expended on secondary and feeder roads. It also provided the first money specifically earmarked for planning surveys to identify future construction needs. Missouri received approximately $6 million under this act. A searing heat wave and prolonged drought in 1934 prompted another $2 million federal grant in August, which went toward the supplementary system in cooperation with the county relief committees.[44] At the end of 1934, the Missouri State Highway Commission recognized the beginning of a transitional period. The highway department had completed the Centennial Road System authorized in 1921, and was progressing rapidly on the additions to the system authorized in 1928. The commission, therefore, would refocus its efforts away from highway construction and toward maintaining and improving the newly-built infrastructure. In light of the larger and faster vehicles now traveling the highways, a new emphasis would be placed on highway safety; widening and resurfacing existing roads; the realignment of routes to improve access to major cities; and traffic studies to determine the extent of highway usage.[45] This new approach had the support of the Citizens' Road Committee, which earlier had campaigned for Proposition No. 3. Still chaired by Hugh Stephens, the committee had opposed the reduction in license fees in 1933, and had conducted a study of Missouri's county road systems with the help of engineering students. Renamed the Citizens' Road Association, in July 1934 the group resolved that future highway improvements should be based on a systematic study of traffic demands, and petitioned the commission for a comprehensive highway planning survey. With the money for such surveys available under the

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[43] "1933 A Great Year For Missouri Highways," *Missouri Magazine* (November 1933): 27; "State Highway News," *Missouri Magazine* (July 1934): 28-29; "State Highway News," *Missouri Magazine* (September 1934): 25; Missouri State Highway Commission, *Ninth Biennial Report*, 183.

[44] "Farm to Market Road Program," *Missouri Magazine* (August 1934): 12; Missouri State Highway Commission, *Ninth Biennial Report*, 177-180; *Mississippi Valley Conference of State Highway Departments*, X-116-118.

[45] Missouri State Highway Commission, *Ninth Biennial Report*, 427.

Hayden-Cartwright Act, the commission in cooperation with the Bureau of Public Roads launched the study in September 1935 under the direction of J. H. Long.[46]

The Emergency Relief Appropriation Act of April 1935 marked a shift away from direct relief to a large-scale national works program for the unemployed. The act funded the Works Progress Administration (WPA), an agency created under an Executive Order signed by Roosevelt on May 6. The WPA would oversee a wide variety of projects designed to provide employment, including a range of civil engineering projects. Missouri received over $6 million through the WPA to continue the work on the farm-to-market roads. The commission reiterated its pledge to complete the supplementary system, dismissing a proposal by the State Planning Board to construct an "Ozark Parkway" to the Lake of the Ozarks. By the end of 1935, 5,700 miles of the 7000-mile supplementary system were finished. By July 1939, the WPA had constructed or improved over 13,000 miles of county roads and state supplementary routes, plus some 14,600 new culverts and bridges. In addition, the WPA provided funding for the continued elimination of at-grade railroad crossings, a program first initiated in the 1920s. The program had stalled as the depression caused financial difficulties for the railroads, which normally paid half the costs of the grade separation structures. The WPA and the highway department also collaborated to produce *Missouri: A Guide to the "Show-Me" State*, a comprehensive guidebook to the state featuring descriptive tours along Missouri highways.[47]

The WPA along with the Bureau of Public Roads also helped to fund the statewide highway planning survey initiated in 1935. Meant to identify specific needs for future highway improvements, the survey included complete road inventories, traffic counts, and financial investigations. Road and bridge inventories covered every mile of roadway in the state. The survey produced a complete set of county highway maps detailing the locations of county and state roads as well as other cultural and geographical features. It conducted traffic counts on both local and state roads to show the usage of roads and highways by various types of vehicles, resulting in annual traffic flow maps. The survey also examined financial data involving receipts and expenditures for roads and streets over the entire state. The planning survey studied methods of local highway financing, and conducted research on the life of highway pavements. The

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[46] Hugh Stephens, "People of Missouri Must Keep Road Program Moving," *Missouri Magazine* (March 1934): 5; "For Good Roads," *Missouri Magazine* (July 1934): 11; Dickey, "History of the Missouri Highway Department," 20.

[47] Missouri State Highway Commission, *Tenth Biennial Report of the State Highway Commission of Missouri, for the Period Ending December 1, 1936* (Jefferson City: Missouri State Highway Commission, 1936), 251-252; Norman M. Higgs, "Missouri Sixth in Improved Roads," *Missouri Magazine* (May 1935): 13-14; "Summary of Farm-to-Market Roads Shows Much Progress," *Missouri Magazine* (February 1936): 18; State Highway Planning Survey, *Special Report on Missouri State Highway Needs* (Jefferson City: Midland Printing Company, 1939), 55-56; Missouri State Highway Commission and the Writers Program of the Works Progress Administration, *Missouri: A Guide to the "Show Me" State*. The American Guide Series. (New York: Duell, Sloan, and Pearce, 1941).

survey completed its initial field operations in 1937, and while the data-gathering processes would continue, the survey planning office issued its first reports detailing Missouri's existing highway system and its future needs. A 1939 report concluded that much of the existing system would have to be overhauled and improved with wider traffic lanes and shoulders, reconstructed pavements, the elimination of traffic hazards, extensions of the supplementary system, and the inclusion of city arteries within the state system.[48]

The reports of the Missouri Highway Planning Survey, and similar reports from other states, became incorporated into a national study conducted by the Bureau of Public Roads. The federal highway act of 1938 called for a feasibility study of a potential national toll road network of "superhighways" consisting of three east-west routes and three north-south routes. Thomas H. McDonald, the chief of the Bureau, and his top aide Herbert S. Fairbank, consequently issued a report in 1939 entitled *Toll Roads and Free Roads*. The report demonstrated that the bulk of national traffic was regional rather than transcontinental, and indicated that toll superhighways would not be financially feasible. Part II of the report, "A Master Plan for Free Highway Development," called instead for a 26,700-mile interregional network of free highways, said to be the first formal description of the future interstate system. Much of the proposed interregional network, the report argued, could follow existing two-lane highways through rural sections. Additional lanes and limited access highways could be provided in high-traffic areas. The report maintained that metropolitan areas had the greatest need for both inner and outer beltways, and for radial expressways leading from the cities' decaying cores to the growing suburban areas. When he submitted the report to Congress in April 1939, Roosevelt recommended:

> [A] special system of direct interregional highways, with all necessary connections through and around cities, designed to meet the requirements of the national defense and the needs of a growing peacetime traffic of longer range.[49]

By 1938, the Missouri Highway Planning Survey had begun to identify a new set of priorties for the state's highway network. There would be a new emphasis on the overall maintenance of the system while modernizing segments to safely accommodate increasing traffic, heavier vehicles and greater highway speeds. That year the Missouri General Assembly approved legislation increasing the state gasoline tax from two to three cents per gallon. Proceeds from the gas tax provided the largest share of the highway department's revenues. The measure would require voter approval in the November general election. At the same time, the Citizens' Road Association placed an initiative petition on the ballot which would authorize state

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[48] Dickey, "History of the Missouri Highway Department," 19-20; Shoemaker, "Modern Highway Development," 535-536; State Highway Planning Survey, *Special Report on Missouri State Highway Needs*, *passim*.

[49] Richard F. Weingroff, "Federal-Aid Highway Act of 1956: Creating the Interstate System," *Public Roads* (Summer 1996): 1-2, http://www.tfhrc.gov/pubrds/summer96/p96su10.htm (July 7, 2000); Richard F. Weingroff, "The Genie in the Bottle: The Interstate System and Urban Problems, 1939-1957," *Public Roads* (September-October 2000):3-4, http://www.tfhrc.gov/pubrds/septoct00/urban.htm (February 2, 2001).

highway construction within cities of over 2,500 population, add an additional 5,000 miles to the supplementary system, and establish a three-cent gas tax for a ten-year period. In the end, voters rejected both measures. Two other conflicting proposals on the 1940 ballot, meant to either fix or reduce license fees, also failed.[50]

In 1940, Missouri had the nation's fifth largest highway system totaling 15,870 miles, yet still imposed a two-cent gas tax, the lowest in the United States. Under Chief Engineer Carl W. Brown,[51] the highway department had essentially completed the extensions to the system authorized by Proposition No. 3, including over 7,500 miles of supplementary routes, 363 miles of traffic relief routes, and 435 miles of additional state routes and state park connections. Future work to maintain and improve the system, however, was delayed by the onset of World War II. In 1940, as the nation prepared for possible entry into the conflict, the states were called upon to identify critical roads leading to military bases and important industrial facilities. The Missouri State Highway Department identified approximately 1,900 miles of state highways within the so-called Strategic Network. The department also began surveys and designs of Access Roads leading to defense-related facilities in the state. These roads soon became the major focus of the department's efforts when the United States entered the war in late 1941. Other work on the state highway system came to a virtual standstill.[52]

The impact of World War II on Missouri's economy and domestic affairs included a sharp curtailment of activity within the state highway department. Thousands of men and women entered military service and war-related industries, resulting in a shortage of skilled and unskilled labor in the highway department's engineering, maintenance and construction forces. Rationing of such commodities as gasoline and rubber restricted travel, reducing revenues from vehicle registration fees and gasoline taxes. The Public Roads Administration (successor to the Bureau of Public Roads) withheld its approval of construction projects unrelated to national

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[50] Shoemaker, "Modern Highway Development," 529; Dickey, "History of the Missouri Highway Department," 19; Missouri State Highway Commission, *Twelfth Biennial Report of the State Highway Commission of Missouri for the Period Ending December 31, 1940* (Jefferson City: Missouri State Highway Commission, 1941), 279.

[51] Carl W. Brown, born in Ralls County, Missouri, was a graduate of the University of Missouri. He had held various engineering positions before becoming the highway engineer and county surveyor for Ralls County in 1915. Brown joined the Missouri State Highway Department in 1918, becoming the head of the Bureau of Surveys and Plans, and in 1920 the Assistant to the Chief Engineer. Brown then oversaw construction of the supplementary road system before becoming Chief Engineer in September 1936. He would serve in that capacity until 1951. Shoemaker, "Modern Highway Development," 540.

[52] Shoemaker, "Modern Highway Development," 541-542; Missouri State Highway Commission, *Thirteenth Biennial Report of the State Highway Commission of Missouri for the Period Ending December 31, 1942* (Jefferson City: Missouri State Highway Commission, 1941), 23-25, 67; State of Missouri, Dwight H. Brown, comp., *Official Manual for Years Nineteen Forty-one and Nineteen Forty-Two* (Jefferson City: Dwight H. Brown, Secretary of State, 1942), 762.

defense or public health and safety, while the War Production Board strictly controlled the allocation of critical materials and equipment otherwise used in highway construction. In the relatively few projects that were constructed during the war, plans were often redesigned to eliminate materials needed for the war effort. The department summarized the war's impact in this 1944 statement:

> The normal progress in state highway construction, which has prevailed in previous years, has been interrupted during the past biennium by war conditions. Road materials have been difficult to get; man-power has been limited; motor vehicle fees and gasoline tax receipts have decreased. All construction work not directly related to the war effort has been abandoned for the time being. Routine maintenance has been hampered by lack of man-power. Needed repairs have been had to be deferred [sic]. The state road program is at a standstill for the duration of the war.[53]

The highway department constructed a number of access roads to military installations and war industry plants where operations were hampered by traffic congestion. As noted by the Missouri State Highway Patrol,

> National Defense Projects came to Missouri with an escort of traffic collisions and deaths unparalleled in the history of the State. The problems resulting from the construction of Ft. Leonard Wood are illustrative of the fact that in almost every instance existing facilities have been inadequate to handle the tremendous increase in traffic volume adjacent to military projects. Counties which had formerly experienced normal traffic records quickly found themselves in the midst of a paralyzing congestion which brought enormous increases in injuries and fatalities.[54]

Although fairly limited in total mileage, the access roads built by the state highway department led to Fort Leonard Wood in Pulaski County; Camp Crowder in Newton County; Knob Noster Air Base in Johnson County; Rosencrans Air Field in Buchanan County; and to various munitions and industrial plants in St. Louis and Jackson counties. The department also conducted traffic studies in and around the defense plants, and prepared reports for the Office of Defense Transportation relating to vehicle use on Missouri highways. Otherwise, the war precluded any significant construction. From December 1, 1942 to December 1, 1944, only thirteen new bridges were designed and constructed. The department took advantage of the lull in construction activity by planning for future road improvements once the war ended. A post-war planning bill passed in July 1943 provided $1.5 million for engineering design studies. By the end of 1944, the department had prepared designs for $24 million worth of road and bridge

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[53] State of Missouri, Dwight H. Brown, comp., *Official Manual for Years Nineteen Forty-three and Nineteen Forty-four* (Jefferson City: Dwight H. Brown, Secretary of State, 1944), 815; Missouri State Highway Commission, *Fourteenth Biennial Report of the State Highway Commission of Missouri for the Period Ending December 31, 1944* (Jefferson City: Missouri State Highway Commission, 1945), 23-24.

[54] State of Missouri, *Official Manual for Years Nineteen Forty-one and Nineteen Forty-Two,* 809.

projects awaiting letting and construction, and was in a strong financial position to carry on the work.[55]

By the end of 1944, the department had also begun considering the selection and design of highways in Missouri to be included within a proposed "National System of Interregional and Defense Highways." In April 1941, President Roosevelt had appointed a National Interregional Highway Committee to elaborate on the master plan outlined in the 1939 report, *Toll Roads and Free Roads*. The committee completed its study entitled *Interregional Highways* in 1941, although it was not submitted to Congress until January 1944. The report recommended a 34,000-mile national system of urban and rural, limited-access freeways built to high design standards and connecting the nation's principal cities and geographic regions. The interregional network would follow existing federal primary highways wherever possible. Where traffic exceeded 3,000 vehicles a day, the highways would be upgraded with additional lanes separated by medians, allowing two-lane traffic to flow in opposite directions. The system would be designed to accommodate predicted traffic expected twenty years from the date of construction.[56]

National design standards for dualized highways--those with multiple traffic lanes separated by medians--had been developed and adopted by the end of World War II. From 1938 to 1944, Joseph Barnett of the Public Roads Administration headed the Committee on Planning and Design Policies of the American Association of State Highway Officials (AASHO). Barnett's committee developed seven policies on highway geometric designs involving such concerns as alignments, sight distance, gradients, right of way widths, and controlled or limited access. Although the design policies were released through AASHO, the Public Roads Administration strongly encouraged their adoption in federal-aid projects. The 1944 *Interregional Highways* report recommended the implementation of the high design standards within the proposed interregional network, although as long-range objectives to be accomplished within a ten to twenty-year period. In its 1944 biennial report, the Missouri State Highway Commission found the new standards "generally acceptable for this state, with modifications to meet local conditions." AASHO would formally adopt the "Design Standards for the National System of Interstate Highways" on August 1, 1945.[57]

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[55] State of Missouri, *Official Manual for Years Nineteen Forty-one and Nineteen Forty-Two,* 762-763, 767; [55] State of Missouri, *Official Manual for Years Nineteen Forty-three and Nineteen Forty-four,* 815, 826-828, 833; Missouri State Highway Commission, *Fourteenth Biennial Report*, 23-24, 139.

[56] Edward Weiner, "Urban Transportation Planning in the United States: An Historical Overview," Fifth Edition, (Travel Model Improvement Program [TMIP], 1997), Chapter 2, "Early Highway Planning," 5-6, http://www.bts.gov/tmip/papers/history/utp/ch2.htm (May 24, 2001); Weingroff, "Federal-Aid Highway Act of 1956," 2-3.

[57] Weiner, "Urban Transportation Planning," 4-6; James P. Harshbarger and Mary E. McCahon, "The Importance of Using Context to Determine the Significance of Dualized Highways," (Paramus, New Jersey: Lichtenstein Consulting Engineers, n.d.), 4; Missouri State Highway Commission, *Fourteenth Biennial Report*, 27-29.

On December 20, 1944, Roosevelt signed the Federal-Aid Highway Act which authorized the designation of 40,000 miles of a "National System of Interstate Highways." The individual state highway departments would recommend the routes to be included, based upon traffic needs, population densities, manufacturing centers, national defense and other factors. Final approval of the selected routes rested with the Public Roads Administration. However, Congress failed to allocate funds specifically for the interstate system. It wrongly assumed that the states would give priority to its construction using regular federal-aid primary funds, on a 50-50 matching basis. The 1944 act also allowed federal aid for highways within urban areas, and for rural secondary or "feeder" roads (equivalent to Missouri's supplementary system). This enlarged Federal participation in the nation's primary, secondary, and urban highway network came to be called the "ABC" program.[58]

At the close of World War II in the summer 1945, the Missouri State Highway Department faced a serious backlog of highway needs dating back to the late 1930s. However, a new state constitution adopted earlier in February 1945 removed previous obstacles to state highway construction, and gave the State Highway Commission new authority in three major areas. First, the commission could now expand the state system to relieve heavily-congested traffic areas in and around urban areas. The new constitution allowed the construction of highways within the cities and towns having populations over 2,500; previously, the cities had built and maintained the state highways that fell within their boundaries. In addition, the 1945 constitution allowed the highway department to limit or control access along any state highway, thereby restricting commercial developments which otherwise impeded the flow of traffic. State revenues from license fees and gas taxes would now be earmarked for a road fund to be used exclusively for highway purposes. Overall, the Missouri Constitution of 1945 empowered the State Highway Commission to build any road it deemed necessary to satisfy transportation demands, setting the foundation for the expansion of the state highway system during the 1950s.[59]

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[58] Weingroff, "Federal-Aid Highway Act of 1956," 3-4; *Mississippi Valley Conference of State Highway Departments*, X-121; Weiner, "Urban Transportation Planning," 5-6; Federal Highway Administration, "The Dwight D. Eisenhower Interstate System," http://www.fhwa.dot.gov/infrastructure/progadmin/Interstate.html. (February 2, 2001); Weingroff, "The Genie in the Bottle," 7.

[59] State of Missouri, Wilson Bell, comp., *Official Manual for Years Nineteen Forty-five and Nineteen Forty-six* (Jefferson City: Wilson Bell, Secretary of State, 1945), 160-162.