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GOOD ROADS AND THE AUTOMOBILE IN THE UNITED STATES 1880–1929

PETER J. HUGILL

THE widespread adoption of the automobile by Americans in the early decades of the twentieth century resulted from the development of a major technical and socioeconomic complex during the late nineteenth century. The technical and socioeconomic elements of that complex were equally important. The interplay between them created conditions that allowed the use of the automobile to diffuse from a small economic elite to the rest of American society. In this article I outline the major technical and socioeconomic elements and discuss their effects on the American adoption of the automobile through the beginning of the Great Depression.

Technical Elements

Petroleum, discovered in Pennsylvania in 1859, was used principally for household lighting. As petroleum refining developed during the 1860s, little use was found for a volatile byproduct, gasoline, that was easily converted into a gaseous state for combustion. In the same year as the discovery of oil in Pennsylvania, the Frenchman Etienne Lenoir devised a crude internal-combustion engine that ran on natural gas. The engine rapidly achieved popularity as a source of industrial power. Improved by Nicholas Otto's addition of the compression stroke, the engine was in large-scale production by 1876.[1] The engines ran well on natural gas, but the volume needed precluded their use on self-propelled carriages. Gasoline, the once useless byproduct of petroleum refining, provided the solution. With the invention of the atomizing carburetor in 1892 by Wilhelm Maybach, the partner of Gottlieb Daimler, the internal combustion engine became safe and efficient.[2]

Perhaps the most important technical element in the complex was mass production of the bicycle, which was achieved by the 1890s and involved cold-rolled steel, accurately machined gears, ball and needle bearings, and pneumatic tires, all necessary for a successful automobile.[3] Through the 1890s, production of bicycles kept pace with the rapid increase of riders, estimated to have been approximately four million in 1896.[4] Pneumatic tires were necessary for a comfortable ride. Between 1887 and 1894 twenty-four patents were issued in the United States for the tire and the crucial problem of holding it on the wheel of

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[1] Carlo M. Cipolla and Derek Birdsall, The Technology of Man (New York: Holt, Rinehart & Winston, 1979), pp. 208–209.

[2] John Day, The Bosch Book of the Motor Car: Its Evolution and Engineering Development (New York: St. Martin's Press, 1976), pp. 42–43.

[3] Archibald Sharp, Bicycles and Tricycles: An Elementary Treatise on Their Design and Construction (London: Longmans, Green, 1896); and Martha M. Trescott, The Bicycle, A Technical Precursor of the Automobile, *in* Business and Economic History (edited by Paul Uselding; Urbana: University of Illinois Press, 1976), pp. 51–75.

[4] Richard Harmond, Progress and Flight: An Interpretation of the American Cycle Craze of the 1890's, *Journal of Social History*, Vol. 5, Winter, 1971–72, pp. 235–257.

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the bicycle. The appearance of the bead in 1890 solved that problem. For a variety of reasons, primarily legal, the inferior clincher tire was preferred for automobiles in the United States until about 1905.[5]

The condition of late-nineteenth-century roads was deplorable. Bicyclists used their League of American Wheelmen to launch a campaign for smooth-surfaced roads. The technology of the macadam road had been available since the early nineteenth century but had fallen into disuse after the success of the railroad. The main restrictions on road-building at the end of the nineteenth century were the lack of a satisfactory method of finance and the absence of a way to reduce the huge costs associated with manual labor.

Socioeconomic Elements

Americans at the end of the nineteenth century put great value on individual mobility. The origin of this value lay in rapidly growing wealth from industrialization, an intensified concern with the aesthetics of nature, and an increased focus on the life and mind of the individual rather than the group. In such behavior Americans were following British and European precedents. The bicycle allowed many Americans to realize both the goal of individual mobility and a sense of personal freedom. As one observer wrote in 1897: "*The cycler need think of no one but himself: he is the perfection of selfishness*—the real Ruskin on tour."[6]

The League of American Wheelmen not only agitated for good roads but also published touring maps and guides, erected road signs, and identified inns and hotels that provided appropriate accommodations for middle-class and upper-middle-class urban tourists who were seeking the pleasures of the American countryside.[7] That level of organization and the emphasis on the conveniences of touring formed the groundwork for the automobile owners when the automobile superceded the bicycle as the means to see the United States. Inherent in the elite's approval of the bicycle was a desire to escape the masses as well as the fixed lines and the schedules of the railroad; however, the bicycle required an inordinate amount of work on the part of the operator. The automobile was "sweat-free" and, because it was more expensive, its ownership was a far better mark of distinction.

Rural isolation as an element in the evolving complex differed from elitist concerns for privacy and individual mobility, but efforts to reduce rural isolation had an important role in the development of the technical and sociocultural complex of automobiles and good roads. Late-nineteenth-century United States can be divided in two parts. The rural sector had poor transportation and limited interpersonal contact with other than immediate neighbors, while the urban was characterized by high population densities and good public transportation that allowed high levels of interpersonal contact (Fig. 1).

Agitation for improved transportation by the farmers' Granges, however, was based primarily on economic considerations—improved access to markets

[5] Walter E. Burton, The Story of Tire Beads and Tires (New York: McGraw-Hill for the National Standard Company, 1954).
[6] Gary Allan Tobin, The Bicycle Boom of the 1890's: The Development of Private Transportation and the Birth of the Modern Tourist, *Journal of Popular Culture*, Vol. 7, 1974, pp. 838–849.
[7] Tobin, footnote 6 above, pp. 842–843.

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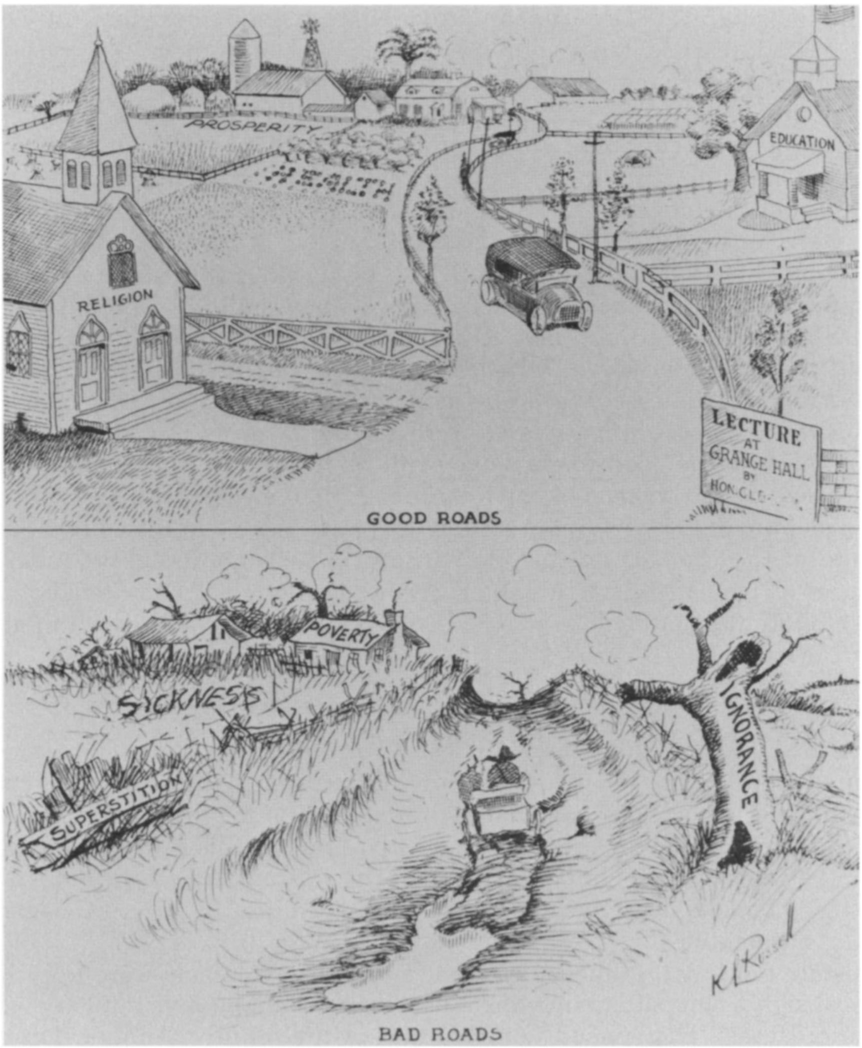

FIG. 1—Idealized effect of good roads on the American rural landscape. *Source: Better Roads and Streets,* Vol. 5, December, 1915, p. 9.

would lower costs.[8] Estimates that improved roads would reduce transportation costs as much as 60 percent were very convincing arguments, particularly to the farmers in the old, established sections of the country who were struggling against competition from the American West, Australia, New Zealand, and other newly opened agricultural regions.[9] Speakers from state highway departments were in heavy demand at farmers' Granges. For example, in 1906

[8] Maurice O. Eldridge, Good Roads for Farmers, *in* The Future of Road-Making in America (edited by Archer B. Hulbert; New York: AMS Press, 1971 [originally published 1902-05]), pp. 81–169.
[9] Office of Road Inquiry, Proceedings of the Good Roads Convention of Texas (Washington, D. C.: U.S. Department of Agriculture, 1895).

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the Illinois Highway Department provided forty-eight speakers, of whom thirty-one addressed Granges and other assemblies of farmers.[10]

Another effort to reduce rural isolation was the establishment of rural free delivery (RFD) of mail. Republicans favored RFD as early as 1891, but the first large-scale experiment occurred in Carroll County, Maryland, in 1899. The success there and the support of the McKinley administration led to the rapid expansion of the program. In 1902 there were fewer than 8,000 routes; by 1905 there were more than 32,000. Rural parcel delivery was initiated in 1913, by which time the effect of the automobile was being felt.[11] RFD was a major force for improvement: the post office refused to deliver mail unless roads were of reasonable quality. Farmers liked RFD because it reduced the influence of monopolistic express services on the prices of incoming and outgoing goods. If good roads were necessary for RFD, then farmers agitated for good roads.

The vast distances to be covered were another factor in the adoption of the automobile and the good-roads movement. By the end of the nineteenth century Europe was so criss-crossed with railroads that few people lived more than ten miles from one. Comparable density was not possible in the United States. In spite of the changes the bicycle brought to personal mobility, American distances as well as the harsh winters in the northern states militated against its use. Only the automobile was fast enough to reduce rural isolation at the American scale.

Elite Adoption of the Automobile

The first commercially successful automobiles in the United States were imported from France for the elite of the northeastern cities, who had chauffeurs, money for luxuries, and hard-surfaced streets for their imported vehicles.[12] American manufacturers began to copy French models in order to avoid the 45 percent tariff on imported goods. The nascent American automobile industry followed the French pattern: manufacturers of bicycles began to produce automobiles.

Despite the initial influence of French industry, Germans were to provide the most significant pattern on which the American automotive industry would rise to greatness. Dissatisfied with the turn-of-the-century Daimler, Emil Jellinek urged Wilhelm Maybach to redesign the vehicle.[13] Named after Jellinek's daughter, the 1901 Mercedes was an impressive automobile that introduced motorists to the possibility that they could travel as fast as a railroad train.[14] Anyone who could buy a Mercedes at the New York City price of $12,450 became the owner of a car that could cruise at the then awesome speed of fifty miles an hour.[15] However, the Mercedes, built low for better handling, required relatively smooth-surfaced roads.

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[10] Illinois Highway Commission, First Annual Report, Springfield, Ill., 1907, p. 21.

[11] Wayne E. Fuller, RFD: The Changing Face of Rural America (Bloomington: Indiana University Press, 1964).

[12] James J. Flink, America Adopts the Automobile, 1895–1910 (Cambridge, Mass.: MIT Press, 1970).

[13] L. J. K. Setright, The Designers: Great Automobiles and the Men Who Made Them (Chicago: Follett, 1976), pp. 157–158.

[14] John Bolster, The Upper Crust: The Aristocrats of Automobiles (Chicago: Follett, 1976).

[15] Handbook of Gasoline Automobiles, 1904 (New York: Association of Licensed Automobile Manufacturers, 1904), p. 70.

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The impressive sales of the Mercedes affected European and American automobile manufacturers. Every European manufacturer who wanted a share of the elite market rushed copies of the Mercedes into production, and by 1904 American manufacturers had followed suit. The Mercedes had three major effects on the American market. The car and copies of it by European manufacturers were imported. American firms copied European designs, and European manufacturers established factories in the United States to assemble parts or licensed American companies to do so in order to avoid import duties.

The 1904 automobile show in Madison Square Garden introduced Americans to a large number of Mercedes derivatives, most of them new models from American manufacturers which adopted the four-cylinder upright engine and long wheelbase.[16] The first handbook of the Association of Licensed Automobile Manufacturers (ALAM) in 1904 listed thirty-five firms. Eleven were European; the average price of their automobiles was slightly more than $8,000. Thirteen were American, with an average price of almost $3,700 for their cars. Eleven other American manufacturers did not catalog copies of the Mercedes.[17] By 1906 the designs of all twenty-seven American members of ALAM were clearly derived from Mercedes: open, low-built tourers with twenty to sixty horsepower and four cylinders.[18]

Of the European-owned assembly plants set up in the United States or American firms licensed to produce European-designed automobiles, nine firms seem to have been relatively successful. American Mercedes, assembled by Steinway (of piano fame) in Long Island City from 1904 to 1907, was the most significant.[19] But as cheaper and more sophisticated American-made automobiles with six-cylinder engines came on the market, the licensing arrangements ended by 1909.[20] Although the Mercedes set the design of automobiles for the next sixty years, a Mercedes-style performance required smooth-surfaced, all-weather roads.

The efforts of the League of American Wheelmen, the Granges, and the Post Office had achieved little expansion of a network of good roads, even in states such as New York where innovative public investment in transportation had been commonplace since the success of the Erie Canal.[21] The macadam technology for road construction was restored from long neglect and supplemented by new inventions. Four of them—the steamroller between 1859 and 1866, the jaw rock crusher in 1858, the leaning wheel grader in 1885, and the track-laying tractor in 1904—allowed the macadam process to be mechanized.[22] Neverthe-

[16] *Country Life in America*, Vol. V, No. 5, March, 1904.

[17] Handbook of Gasoline Automobiles, footnote 15 above.

[18] Handbook of Gasoline Automobiles, 1906 (New York: Association of Licensed Automobile Manufacturers, 1906).

[19] The American Car Since 1775 (New York: Automobile Quarterly, 1971), p. 237.

[20] Andrew D. Young and Eugene F. Provenzo Jr., The History of the St. Louis Car Company (Berkeley, Cal.: Howell-North, 1978), pp. 62–69.

[21] D. W. Meinig, The Colonial Period, 1609–1775, Geography of Expansion, 1785–1855, and Elaboration and Change, 1850's–1960's, *in* Geography of New York State (edited by John H. Thompson; Syracuse: Syracuse University Press, 1966), pp. 121–196.

[22] R. J. Forbes, Roads to c. 1900, *in* A History of Technology (New York: Oxford University Press, 1958), Vol. 4, pp. 520–547; Harwood Frost, The Art of Roadmaking (New York: McGraw-Hill, 1910); Charles W. Wixom, Pictorial History of Roadbuilding (Washington, D. C.: American Road Builders Association, 1975), p. 96; Reynold M. Wik, Benjamin Holt and the Invention of the Track-Type

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less, the construction of the first macadam road networks still required large amounts of both human labor and capital.

Initially the states had to bear the financial burden of road construction, because the federal government did not become heavily involved until after 1916. State bonds were used to finance road building in the northeastern states where motorists had adopted the Mercedes and its derivatives. The costs were shared with counties and townships, but the states paid the lion's share. State highway departments were established to implement construction. The first such department was formed in New Jersey in 1891, and other northeastern or progressive states quickly followed: Massachusetts in 1892, California and Connecticut in 1895, and Maryland, New York, and Vermont in 1898. The midwestern states generally did not establish highway departments until after 1900, and the impoverished southern states even later.[23]

The success of state financing ended the much-abused *corvée* labor system that required each able-bodied male in a county to work a certain number of days a year on county roads or pay a fine. Neither the fines nor the roads amounted to much. State highway boards hired state and county engineers, bought good machinery, and built roads according to plans negotiated in the state legislatures, although procedures and policies varied from state to state.

Massachusetts laid out a four-tiered system of improved, that is, macadam, roads in 1897. In the previous year, forty-seven miles of highway had been completed to give a total of 109 miles of improved roads in the state. Road construction in 1896 cost more than a half million dollars, or slightly more than $11,000 for each mile of macadam road that the early automobiles were destined to destroy.[24] The four-tiered system was to consist of a radial network serving Boston, two east-west links between the Atlantic coast and upstate New York, rural-service roads along the major river valleys, and a long recreational spur linking Boston with Cape Cod (Fig. 2). By 1907 this network had been elaborated, and substantial portions of it were completed. An important innovation in Massachusetts was the subletting of road contracts to private contractors rather than awarding them to town or municipal authorities. This innovation further concentrated professionalism in a few contractors who moved about the state.

Roads that were well constructed for horses and their loads were not necessarily suitable for automobile traffic. For example, in 1907 the highway commission of Massachusetts complained that "the destructive work of automobiles during the past year was even more marked than in 1906."[25] An experiment to reduce wear by treating the compacted gravel surface of the macadam road with a coat of tar was undertaken, but the situation differed little from 1896. Forty-seven miles of new macadam roads were constructed in 1907 at a cost of $467,943, or slightly less than $10,000 a mile, but the cost rose to $15,000 a mile when expenses for repairs and administration were included.

Tractor, *Technology and Culture*, Vol. 20, 1979, pp. 90–107; and Fifty Years on Tracks (Peoria, Ill.: Caterpillar Tractor Company, 1954).

[23] Thomas H. MacDonald, The History and Development of Road Building in the United States, *Proceedings of the American Society of Civil Engineers*, Vol. 53, 1927, pp. 1545–1570.

[24] Massachusetts Highway Commission, Fourth Annual Report, Boston, 1897, p. 9.

[25] Massachusetts Highway Commission, Fifteenth Annual Report, Boston, 1908, p. 12.

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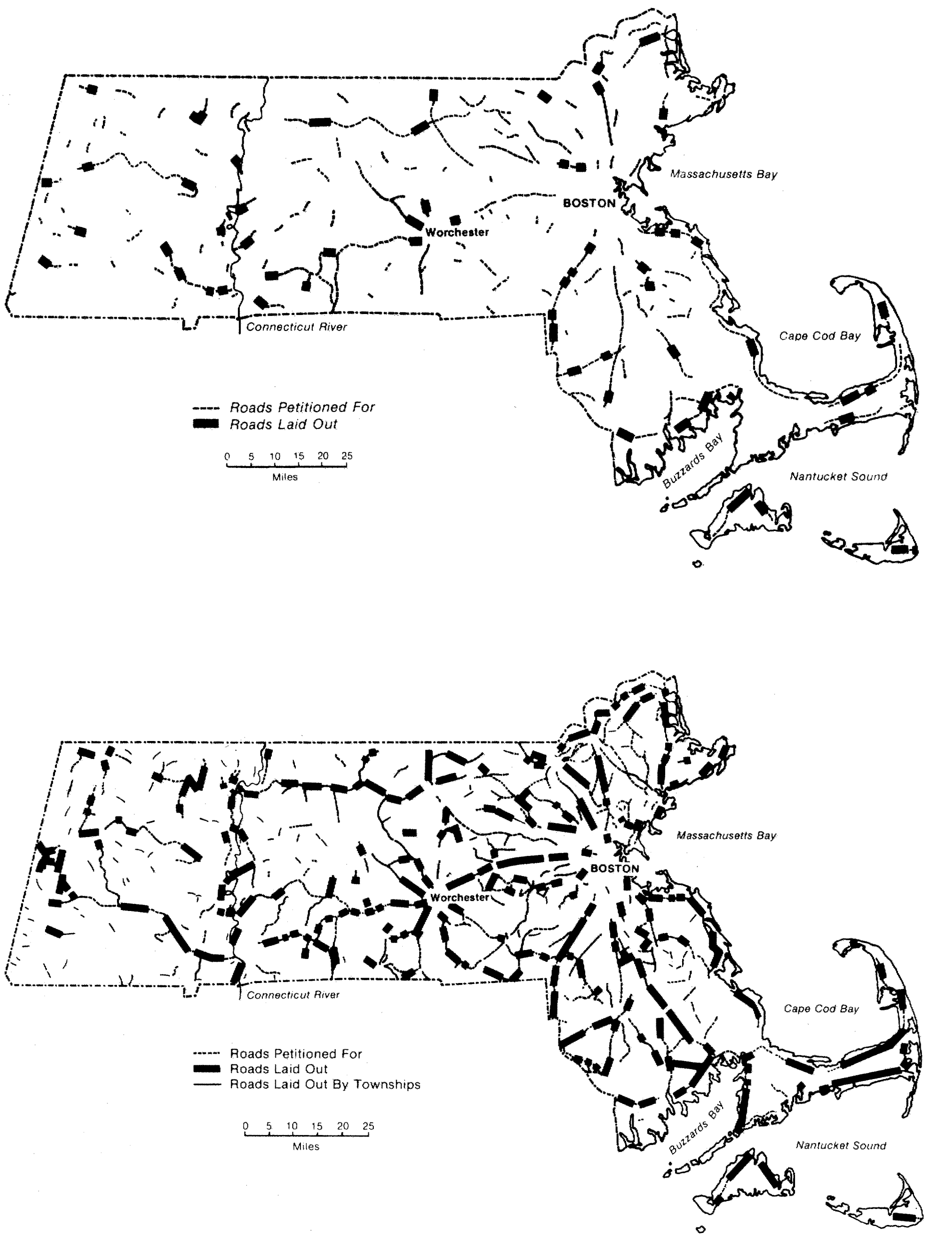

FIG. 2—Good-roads networks in Massachusetts in 1897 (top) and 1907 (bottom). *Sources:* Massachusetts Highway Commission, text footnotes 24 and 25.

Many other state highway networks followed the pattern devised by Massachusetts. New York used a funding program that was extremely favorable to local authorities and encouraged private contractors from the outset. New York instituted a four-tiered road network comparable to that in Massachusetts and issued bonds in 1905 and 1912 to pay for that network. A total of $100,000,000

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was available to build some 10,000 miles of macadam roads.[26] The New York plan had four components: suburban networks around major cities; long-distance, cross-state linkages among the major cities; a relatively light rural network emphasizing seats of local government; and a recreational network (Fig. 3). The suburban network was omitted around the essentially blue-collar city of Syracuse; the long-distance network followed the shore plain of Lake Ontario; and three recreational linkages were built—a trans-Adirondack link, a link through the Catskills, and one along Long Island.[27]

Only one of the four-tiered networks directly benefited farmers. The others benefited the elitist owners of Mercedes-style automobiles who were able to commute from suburbs to central cities, to make intercity trips, and to tour scenic parts of the state with a hitherto undreamed freedom. Some measure of the elitist enthusiasm for automobiles can be gathered from the monthly magazine, "Country Life in America," which began publication in 1901. After March, 1903, advertisements for automobiles became a mainstay of the magazine. Articles about automobile use were featured, although enthusiasm waned toward the end of the decade as the automobile became commonplace. Although touring was stressed, the versatility of the automobile was not neglected. An article in August, 1905, discussed the role of the automobile in commuting. By 1909, however, "Country Life" regarded the automobile as an absolute necessity of American country life and turned their enthusiasm toward "the new sport of air sailing."[28]

Toward an American Automobile

Attempts to resolve the problems of the bad roads and the high price of the Mercedes-style cars focused on two American-designed automobiles: the runabout and the highwheeler. After experiments with various placements of the engine, European manufacturers concluded in 1891 that the *système Panhard* was best. The engine was placed at the front of the automobile and connected to the rear axle by a drive shaft or chains. Despite the complications of the long drive train, the arrangement allowed the seats to be lowered so that mounting and dismounting were easier for passengers. The arrangement also allowed a lowered chassis as on the Mercedes. The lowered center of gravity meant better road handling, but reduced ground clearance. These features were not necessarily advantageous in the United States because of the poor road surfaces, and American designers saw no purpose to the long, breakdown-prone drive trains.

Early American-designed automobiles placed the engine under the seat, directly ahead of the driven rear wheels. Many of those designs were reasonably priced; the 1903 curved-dash Oldsmobile, for example, sold for $695. But those automobiles had two major drawbacks: there was virtually no protection from the weather, and the size of the engine was restricted. The engines on the early American-designed automobiles produced very little power for their

[26] William M. Curtiss, The Development of Highway Administration and Finance in New York, *Bulletin No. 680, Cornell University Agricultural Experiment Station*, Ithaca, 1937.
[27] New York State Engineer and Surveyor, Annual Report, Albany, 1906.
[28] *Country Life in America*, Vol. 15, No. 3, January, 1909.

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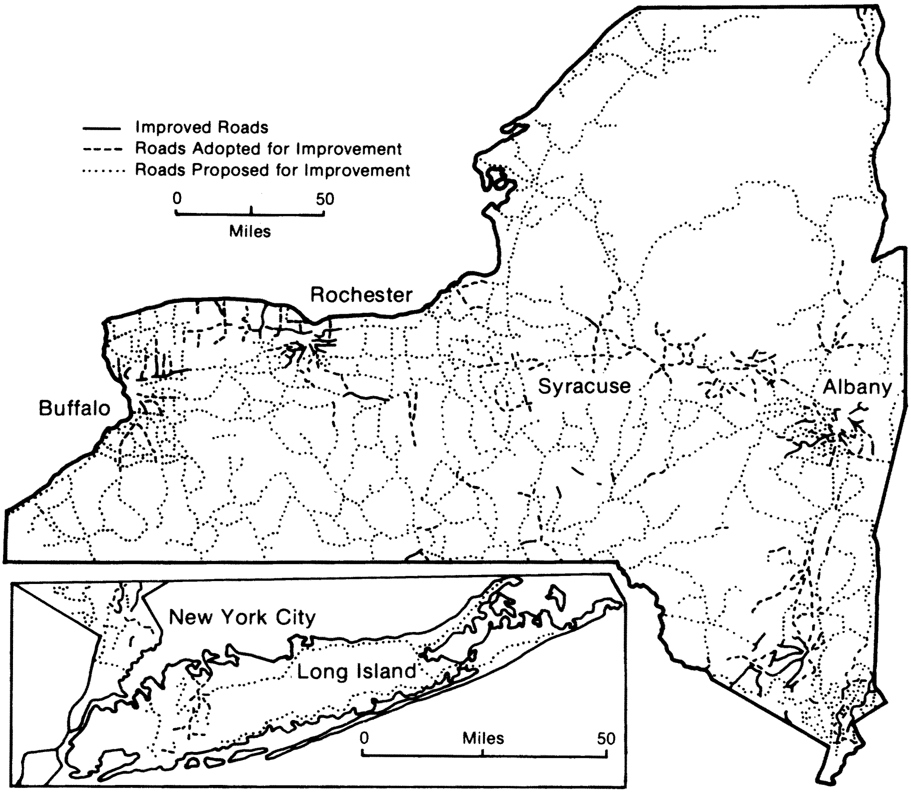

FIG. 3—Good-roads networks in New York in 1906. *Source:* New York State Engineer and Surveyor, text footnote 27.

cylinder capacity, and the only means to increase horsepower was to add cubic inches, which meant larger engines and more cylinders. As the revolutionary, four-cylinder Mercedes had demonstrated, multicylinder engines ran more smoothly and made the car easier to drive. Engine placement on the American runabout limited a car to two small cylinders at the most. The cars ran unevenly, were unable to carry more than two persons, and lacked sufficient power to pull clear when bogged down.

The runabout was a motorized buggy with European antecedents, but the highwheeler was a motorized buckboard that was entirely American in origin. It was a standard, highwheeled farm wagon with a motor that usually drove the rear wheels. Almost all highwheelers went to the rural market, and manufacturers tended to be concentrated in northeastern and midwestern farm states and cities with farm-implement manufacturing.[29] Some 123 manufacturers produced large quantities of highwheelers in seventy-four cities in nineteen states between 1898 and 1916, although most of the production was concentrated between 1905 and 1912. Most production was discontinued after 1912, because the manufacturers were too small to participate in the mainstream

[29] The American Car, footnote 19 above, pp. 232–372.

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development of the American automobile industry. The highwheelers were crude in design and construction. The Duer had rope final drive, and other varieties had friction final drive. Low prices—the St. Louis-produced Success cost only $250—could not compensate for features such as iron tires and a side-mounted, single-cylinder, two-stroke engine.

American automobile manufacturers were convinced from the outset that the future of the automobile lay with the average person, not the elite. What was required was an automobile that was less expensive than the Mercedes derivatives but retained their advantages of comfort, speed, and reliability. Three solutions were essayed: the use of cheaper materials, fewer materials, or high-volume production to lower unit costs. Many manufacturers around 1910 tried to produce an inexpensive Mercedes-style car with cheap materials. Vehicles such as the KRIT, produced between 1909 and 1916, enjoyed brief success, but the popular suggestion that the initials meant "keeps right in town" attests to its durability on poor roads.[30] Efforts to use fewer materials restricted passenger capacity to two persons and the engine to one or two cylinders and involved fabric bodies and bicycle wheels. Such machines, called cyclecars, were usable only on well-paved city streets and enjoyed a brief vogue in the United States between 1910 and 1916.[31]

The real solution was to continue the use of high-grade materials in a well-built automobile, but to use high-volume production and unskilled labor for low unit costs. Only Henry Ford saw this solution. He first designed a suitable vehicle in the form of his 1909 Model T. He then moved his factories toward vertical integration and an increasingly complex division of labor that culminated in the moving assembly line.

By 1912 the stage was set for the adoption of the automobile by the urban middle class and by farmers in rural areas. A considerable amount of road building, financed by town, county, and state bonds, was under way (Table I). There was a tremendous concentration of road building in New York, although Rhode Island, New Jersey and Connecticut had relatively high, if not comparable, expenditures in terms of dollars a square mile. California slightly exceeded New York in terms of dollars per inhabitant, and Indiana was relatively close. Kentucky reported 10,628 miles of macadam roads in 1914, built at only $107 a mile and only two years after the creation of the state highway department. New York, with excellent records and a state highway department since 1898, had built only 5,718 miles of macadam road and 3,169 miles of tarred macadam road by the same year and at 100 times the cost a mile. Presumably Kentucky and New York differed at least on the definition of macadam road. The extremely high cost for each mile of completed road in states such as New Mexico reflected their late participation in the good-roads movement.

Henry Ford designed his Model T for rural America and its poor road surfaces, but it was enthusiastically adopted first in the northeastern states with their burgeoning networks of macadam and tarred macadam roads.[32] New York was one of the first states in which the Model T was widely adopted; in 1903

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[30] David Burgess Wise, The Illustrated Encyclopedia of Automobiles (London: Hamlyn, 1979), p. 214.

[31] The American Car, footnote 19 above, pp. 232–372.

[32] John B. Rae, The American Automobile (Chicago: University of Chicago Press, 1965), p. 58.

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almost 20 percent of the registered automobiles in the country were in that state (Table II). Although the share of registrations in New York dropped to 7.71 percent in 1909, the proportion rose to 13.37 percent in 1910, a reflection of the popularity of the Model T in the state. By 1920 New York registrations decreased to 8.32 percent of the countrywide total.

Ford's concept of a car for rural America and the middle class triumphed in three areas: roadworthiness, ease of driving, and ease of servicing. At only 1,200 pounds the car was light; with twenty horsepower it was powerful for its weight. High-grade materials made it strong. More important than the horsepower was the high torque of the Model T engine, a necessity partly because the transmission had only two speeds. The torque and the light weight allowed the Model T to pull itself through mud that would have incapacitated heavier automobiles.[33] The light weight also made the Model T easy to steer, and the foot-controlled planetary transmission, even though it had only two speeds, obviated the problem of changing gears that almost all drivers had and would continue to have until General Motors patented the synchromesh transmission in 1929.[34] Production and productivity increased rapidly after the introduction of the Model T in 1909, and unit costs dropped dramatically.

The Ford Motor Company established an extensive network of almost 7,000 dealers throughout the country by early 1913. Every urban center in the United States with a population of 2,000 or more people had a Ford dealership. In response to the accelerating demand for the Model T, the company progressively reduced the area allotted to any dealer, and dealerships appeared in smaller and smaller centers. By 1930 Ford had 38 percent of its dealerships in towns of fewer than 1,000 persons in comparison to 27 percent for non-Ford dealerships. Ford also had some 65 percent of its dealers in rural areas, while only 46 percent of non-Ford dealers were in rural areas.[35]

The company was particularly keen to have dealerships in county seats where farmers visited routinely, and dealerships were located as close as possible to the courthouses. In the sections of the United States with courthouse squares, the Ford dealer frequently located on one corner of the square, but not until the late 1920s did Ford's competitors begin to locate on opposite corners. The Ford Motor Company was slow to establish dealerships only in the poverty-ridden Deep South.

Ford also introduced the policy of fixed costs for spare parts and repairs.[36] The ease of maintaining the Model T particularly appealed to the farm community, which was already well acquainted with machinery.[37] Parts for the Model T rapidly became available through mail-order houses, and most farmers did their own repairs. In addition, Henry Ford's populist public image was one calculated to appeal to rural America.[38] By 1920, 30.7 percent of the 6.5

[33] Allan Nevins, Ford: The Times, The Man, The Company (New York: Charles Scribner's Sons, 1954), p. 387.
[34] Day, footnote 2 above, p. 105.
[35] *Automotive Industries*, Vol. 62, February 22, 1930, p. 268.
[36] Nevins, footnote 33 above, pp. 402–403.
[37] Michael L. Berger, The Devil Wagon in God's Country: The Automobile and Social Change in Rural America, 1893–1929 (Hamden, Conn.: Archon, 1979), pp. 46–52.
[38] Reynold M. Wik, Henry Ford and Grass-Roots America (Ann Arbor: University of Michigan Press, 1972).

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TABLE I—INVESTMENT IN AND MILEAGE OF GOOD ROADS BEFORE 1916

STATE	OUTSTANDING COUNTY/ TOWNSHIP ROAD BONDS 12/31/12 ($)	AUTHORIZED STATE GOOD ROADS 12/31/12 ($)	$ A SQ. MI. OF STATE[a]	MILEAGE OF ROAD SURFACES 12/31/14						$ A MILE GOOD ROADS	$ A MILE SURFACED ROADS
				Macadam	Bit. mac-adam	Brick	Concrete	Total good roads	Total surfaced roads[b]		
Alabama	3,760,000	—	72	431	31	—	1	463	4,989	8,121	754
Arizona	76,000	—	1	11	14	—	—	25	253	3,073	300
Arkansas	766,500	—	14	363	4	—	21	388	1,098	1,983	698
California	10,021,162	18,000,000	177	837	878	—	929	2,644	10,280	10,596	2,726
Colorado	87,000	—	1	3	—	—	2	5	1,194	17,091	73
Connecticut	826,500	4,500,000	1,073	923	128	1	24	1,076	2,975	4,945	1,790
Delaware	858,000	—	362	162	36	—	—	198	244	4,355	3,524
Florida	1,786,510	—	30	829	43	256	12	1,140	2,830	1,567	631
Georgia	481,500	—	8	234	87	2	c	323	12,342	1,490	39
Idaho	378,941	193,000	7	43	12	—	5	60	679	9,694	842
Illinois	1,050,120	—	19	1,675	122	83	149	2,029	11,606	518	91
Indiana	25,437,122	—	700	10,291	168	35	53	10,547	30,962	2,412	822
Iowa	2,547,950	—	45	171	—	—	6	177	615	14,390	4,146
Kansas	1,121,665	—	14	194	—	4	1	199	1,149	5,615	976
Kentucky	1,147,073	—	28	10,628	59	c	3	10,690	12,403	107	92
Louisiana	417,111	—	9	—	—	—	—	—	2,068	—	202
Maine	—	2,000,000	61	55	44	c	11	110	2,762	18,207	724
Maryland	531,900	6,000,000	530	489	1,042	—	189	1,720	2,489	3,797	2,624
Massachusetts	1,272,874	2,500,000	456	834	1,337	—	—	2,171	8,506	1,737	444
Michigan	2,818,467	—	49	1,021	95	—	107	1,223	7,828	2,305	360
Minnesota	616,504	—	7	120	19	c	18	157	3,968	3,921	155
Mississippi	4,674,622	—	100	86	30	—	14	130	2,133	36,097	2,191
Missouri	694,500	—	10	1,531	59	1	3	1,594	6,713	436	103
Montana	1,065,606	—	7	78	—	—	—	78	609	13,662	1,749
Nebraska	200,670	—	3	39	1	2	8	50	1,205	3,778	167
Nevada	152,000	—	1	2	—	—	—	2	262	76,000	580
New Hampshire	245,135	1,000,000	133	62	154	—	7	223	1,660	5,579	750
New Jersey	11,505,832	—	1,399	1,809	418	—	—	2,227	5,897	5,167	1,951
New Mexico	466,700	500,000	8	—	5	—	—	5	262	193,340	3,697
New York	7,168,713	100,000,000	2,178	5,718	3,169	149	244	9,280	15,636	11,532	6,854
North Carolina	2,713,273	—	52	1,111	9	—	1	1,021	6,004	2,657	452
North Dakota	21,000	—	.30	—	—	—	—	—	955	—	—
Ohio	20,941,541	—	510	12,904	1,066	640	316	14,926	30,569	1,403	685
Oklahoma	1,230,000	—	18	7	3	—	—	10	122	126,804	10,115

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Table I—Continued

STATE	OUTSTANDING COUNTY/ TOWNSHIP ROAD BONDS 12/31/12 ($)	AUTHORIZED STATE GOOD ROADS 12/31/12 ($)	$ A SQ. MI. OF STATE[a]	MILEAGE OF ROAD SURFACES 12/31/14						$ A MILE GOOD ROADS	$ A MILE SURFACED ROADS
				Macadam	Bit. mac-adam	Brick	Concrete	Total good roads	Total surfaced roads[b]		
Oregon	—	—	—	1,001	137	—	28	1,166	4,726	—	—
Pennsylvania	19,329,183	—	428	1,882[d]	198[d]	269[d]	—	2,349	9,983	[e]	[e]
Rhode Island	—	1,800,000	1,442	353	107	—	—	460	693	3,910	2,596
South Carolina	345,000	—	11	28	4	—	—	32	3,271	11,129	106
South Dakota	33,109	—	.43	—	10	—	—	10	363	3,311	91
Tennessee	6,931,098	—	165	4,550	148	[c]	2	4,700	8,102	1,474	855
Texas	16,939,592	—	64	511	181	—	11	703	10,527	24,083	1,609
Utah	371,500	260,000	7	49	16	—	3	68	1,154	9,425	547
Vermont	4,000	—	.42	2	—	—	—	2	1,442	2,062	3
Virginia	3,514,800	—	82	1,178	256	—	—	1,434	3,910	2,452	899
Washington	324,262	125,000	7	503	166	26	79	774	4,922	580	91
West Virginia	575,800	—	24	772	63	121	19	975	1,065	591	541
Wisconsin	186,125	—	3	1,408	183	2	83	1,676	13,399	111	14
Wyoming	—	—	—	—	—	—	—	—	469	—	—
United States	155,633,955	136,878,000	97	64,898	10,502	1,591	2,349	29,285	257,293	3,687	984

Sources: Good Roads Yearbook, 1913 (Washington, D. C.: American Highway Association, 1913), pp. 398 and 419; and Good Roads Yearbook, 1917 (Washington, D. C.: American Highway Association, 1917), pp. 28 and 475.

[a] Rounded to nearest dollar.

[b] Includes improved surfaces as well as gravel, sand-clay, and other unimproved surfaces.

[c] Less than one mile of this type of surface in state.

[d] State roads only.

[e] Data not comparable.

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TABLE II—RATIO OF POPULATION TO REGISTERED MOTOR VEHICLES 1910, 1920, 1930

STATE	1910	1920	1930
Alabama	1,201.2	31.5	9.4
Arizona	243.3	9.7	3.9
Arkansas	1,369.1	29.7	8.4
California	53.9	5.9	2.8
Colorado	170.7	7.3	3.3
Connecticut	118.8	11.6	4.8
Delaware	210.8	12.2	4.2
District of Columbia	52.4	12.8	3.1
Florida	1,106.8	13.1	4.4
Georgia	581.1	19.8	8.4
Idaho	692.8	8.5	3.7
Illinois	158.6	11.4	4.6
Indiana	267.1	8.8	3.7
Iowa	213.7	5.5	3.2
Kansas	161.2	6.0	3.1
Kentucky	854.4	21.4	7.8
Louisiana	453.8	24.6	7.5
Maine	183.8	12.2	4.2
Maryland	231.7	14.1	5.0
Massachusetts	107.7	14.0	5.0
Michigan	135.9	8.9	3.6
Minnesota	137.0	7.4	3.5
Mississippi	1,182.3	26.1	8.4
Missouri	268.4	11.5	4.7
Montana	365.1	9.1	3.9
Nebraska	105.1	5.9	3.2
Nevada	178.0	7.4	3.0
New Hampshire	122.7	12.8	4.1
New Jersey	153.6	13.9	4.7
New Mexico	696.4	20.3	5.0
New York	145.4	15.4	5.4
North Carolina	685.2	18.2	6.9
North Dakota	124.1	7.1	3.7
Ohio	144.7	9.3	3.7
Oklahoma	2,437.0	9.5	4.3
Oregon	126.7	6.8	3.7
Pennsylvania	205.2	15.3	5.4
Rhode Island	91.8	12.0	5.0
South Carolina	673.5	17.9	7.9
South Dakota	180.2	5.3	3.4
Tennessee	979.7	23.0	7.0
Texas	542.7	10.9	4.2
Utah	276.6	10.5	4.4
Vermont	163.3	11.1	4.1
Virginia	684.9	20.0	6.4
Washington	156.2	7.8	3.5
West Virginia	1,387.6	18.1	6.4
Wisconsin	164.4	9.0	3.7
Wyoming	405.5	8.1	3.6
United States	196.3	11.4	4.6

Source: Highway Statistics: Summary to 1975 (Washington, D. C.: U.S. Department of Transportation, 1977), Table MV 213.

million farms in the United States had automobiles; by 1930 the figure had increased to 58 percent, although the decade of the 1920s was marked by an agricultural depression.

THE WARTIME DESTRUCTION OF ROADS

On December 26, 1917, the federal government commandeered all mainline steam railroads in the United States solely for the transportation of matériel for

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the duration of World War I. Before that action, the quartermaster general had announced that all trucks destined for Europe would be driven under their own power to the Atlantic coast. The ability of the northeastern states to keep their roads clear of snow was about to be tested along with the quality of the road surfaces when spring came. The army-truck convoy departed Toledo, Ohio, for Baltimore, Maryland, in early December, 1917, and encountered a severe winter storm in the Allegheny Mountains. Although the trip took three weeks, it proved the mechanical capabilities of the trucks and the ability of the state highway departments to keep highways clear of snow; the trip also underscored the desirability of a wintertime snow-clearance force on state highways.[39]

Lightly constructed macadam roads disintegrated under the grossly overloaded trucks almost immediately after the onset of spring. The Maryland legislature was appalled by the damage and opened its 1918 session by prescribing motor-vehicle licenses at $20 a year for a one-ton truck, $100 for a four-ton truck, and $500 for a seven-ton truck.[40] The New York commissioner of highways, urging a strict limit on the weight of a truck, observed that a three-ton truck did little damage to existing highways, but that a five-ton truck needed a much stronger road construction.[41]

Costs rose precipitously because of the damage by trucks. Roads built at a cost of $10,000 a mile required an additional $32,000 a mile to repair the truck damage.[42] Roads in New York that proved sturdy for automobiles became impassable under a weight of traffic that averaged thirty trucks a day. In Delaware a truck with a gross load of eleven tons broke up the entire length of a road.[43] The New York highway commissioner pointed out that a weight limit not only was needed to permit reconstruction of the damaged roads but also should remain in effect for a number of years to allow proper design and construction of new roads to meet the new type and volume of traffic.[44] The devastation to roads caused by the new, long-distance trucking can hardly be overestimated.

Four-wheel drive was developed for trucks, partly because of the condition of American roads and partly because of the needs of the armies bogged down in the mud of Flanders.[45] Exact data on truck manufacturers are more elusive than on automobile manufacturers. All four and Success were formed in 1918 to produce four-wheel-drive trucks, but the demise of the firms within three years reflected the military nature of their market. Other producers of four-wheel-drive trucks flourished on the war demand and continued to manufacture after the end of the war.[46]

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[39] America's Highways, 1776–1976: A History of the Federal Aid Program (Washington, D. C.: U.S. Department of Transportation, 1979), pp. 95–97.
[40] J. N. Mackall, Abnormal Traffic Causes Maryland to Ask $500 Fee for Heaviest Trucks, *Public Roads*, Vol. 1, No. 2, June, 1918, pp. 8–10.
[41] Edwin Duffey, New York Advocates Placing Reasonable Limit Upon Total Load of Motor Trucks, *Public Roads*, Vol. 1, No. 2, June, 1918, pp. 4–7.
[42] Duffey, footnote 41 above, p. 5.
[43] America's Highways, footnote 39 above, p. 95.
[44] Duffey, footnote 41 above, p. 5.
[45] Developing Freight Routes on Highways with Motor Trucks and Trailers, *Engineering News-Record*, Vol. 81, No. 2, July 11, 1918, p. 106.
[46] The American Car, footnote 19 above, pp. 409, 419, 437, and 440.

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The Concrete Road

The discovery that a concrete pavement eight to nine inches thick in Wayne County, Michigan, withstood some of the heaviest truck traffic in the country was made in the spring of 1918.[47] The use of a concrete surface for improved roads had been implemented since 1910. Although the northeastern states were still experimenting with the concrete surface, California embraced it enthusiastically, because of the transportation needs of its agriculture and the relative lack of railroads. By 1914, 35 percent of the 2,600 miles of improved roads in California was covered with concrete. In contrast, New York with almost 9,300 miles of improved roads had only 244 miles of concrete surface (Table I).

The experimental work that led to California's leadership in the laying of concrete roads was performed by the state highway commission, headed by Austin B. Fletcher, whose pioneering of macadam roads in Massachusetts had gained him a countrywide reputation.[48] Along with the use of concrete surfaces, California generated two other innovations: banked bends of roads for safety, and concrete curbs to prevent soil erosion during floods.[49]

The chief problem with concrete construction was that the process had to be virtually continuous. Except at a joint, work could not stop for more than thirty minutes; otherwise a crack was almost certain to appear. Mechanization and the development of the paving train solved this problem.[50] Concrete roads were more expensive per mile than other types of roads, but the excellent record of concrete pavement in California and in eastern United States under wartime conditions and the low maintenance costs contributed to the wholesale adoption of concrete roads throughout the United States in the early 1920s.

The Federal Government as Roadbuilder

The Good Roads Act of 1916 began the involvement of the federal government in road construction, although the provisions of the act were somewhat inadequate for the needs. Long after the state of New York had approved road bonds valued at $100 million, the federal government's first appropriation for highway construction countrywide was only $75 million.[51] The Highway Act of 1921 changed federal participation to a cost-per-mile basis that stablized at $15,000 a mile in 1924. The act concentrated federal funds in limited, interconnected systems and stipulated that interstate roads could not be less than eighteen feet wide, although the act recognized that differences in road requirements existed among the states. The act strengthened the role of the state highway departments, especially in their maintenance functions, and rejected the idea of a countrywide highway system under federal control. The act, nevertheless, greatly increased the federal road construction—in 1922 the fed-

[47] America's Highways, footnote 39 above, p. 98.

[48] Austin B. Fletcher, The Construction of Macadam Roads, *Bulletin 29, U.S. Office of Public Roads*, Washington, D. C., 1907.

[49] Ben Blow, California Highways: A Descriptive Record of Road Development by the State and by such Counties As have paved Highways (San Francisco: by author, 1920), pp. 30–38.

[50] W. A. McIntyre, The Concrete Road and its Proper Construction, *Better Roads and Streets*, Vol. 5, No. 9, September, 1915, pp. 18–26 and 40.

[51] America's Highways, footnote 39 above, p. 86.

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eral government built 10,247 miles of highway, or 3.5 times as many federally financed roads as were constructed in the preceding five years.[52]

At the end of World War I the army had huge amounts of material and machinery suitable for road building. Several pieces of federal legislation made the materials available to state highway departments. In addition to almost 25,000 trucks, the most urgently sought items were the 1,500 track-laying tractors nicknamed "caterpillars" because of their ability to move on the most rudimentary surfaces. Those tractors could pull almost any piece of basic road-making equipment over any type of surface. The direct transfer of caterpillar tractors to state highway departments on the basis of state population was approved in the spring of 1920.[53] One reason for the transfer was the argument that the equipment would encourage road building and thereby provide employment for returning veterans in their hometowns. The transfer also provided the mechanical basis for the postwar surge of road construction and for the continuance of the trucking industry which started during the war and was then adjusting to the demands of peacetime.

Limited Access Highways

William K. Vanderbilt suggested the construction of the forty-five-mile Long Island Motor Parkway from Great Neck, New York, to Lake Ronkonkoma in 1904. The toll-road company was capitalized at $2,500,000 by private citizens in 1906, and construction, entirely of concrete, began in 1908. By 1914 the highway was being advertised by popular beach resorts as "the only road of its kind in the country for the use of automobiles exclusively . . . ."[54] As with the initial use of the automobile, the first limited-access highway in the country was begun for and by the economic elite, but it was available to the middle class that could afford the toll.

The construction of the Bronx River Parkway in New York marked the first use of state money to fund limited-access highways. The New York legislature passed a bill in 1906 to appoint a commissioner to investigate the possibility of cleaning up the historic, but polluted Bronx River. A year later the duties of the commissioner were expanded to include the acquisition of land along the river for the eventual construction of a fifteen-mile motor parkway. Arguments over state financing of parkways and the outbreak of World War I delayed completion of the parkway until 1923.[55] The Bronx River Parkway had substantial influence on the thinking of the most effective pioneer of state-financed parkways, Robert Moses. In the early 1920s, Moses began his rise to power in New York through his control of the state park system. He planned a series of automobile parkways, modeled on the Bronx River Parkway, to link various units of the park system. Realization of his concept came at the end of the

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[52] America's Highways, footnote 39 above, pp. 108–114.

[53] H. L. Bowlby, Distribution of Surplus War Materials for Road Building, *Public Roads*, Vol. 2, No. 24, April, 1920, pp. 23–28.

[54] Fred J. Wagner, Long Island's Motor Parkway, *House Beautiful*, August, 1914.

[55] Gilmore D. Clarke, The Parkway Idea, *in* The Highway and the Landscape (edited by W. B. Snow; New Brunswick, N. J.: Rutgers University Press, 1959), pp. 33–55.

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1920s with the Southern State Parkway, which ran almost parallel to Vanderbilt's Long Island Motor Parkway.[56]

AN AUTOMOBILE–ORIENTED WAY OF LIFE 1920–1929

The United States by 1921 was on the verge of transformation to a society with many homogeneous characteristics. The forces of mass production and scientific management, epitomized by Ford's Model T and Frederick W. Taylor's writings, expanded standardization to most areas of American life.[57] After World War I Ford and his successful competitors such as Chevrolet had conclusively demonstrated that the future of the automobile in the United States was linked to production on a massive scale achieved by a high level of standardization. It was evident not only in the factories but also in highway design and construction, adoption of road markings, and publication of road maps for a mass market.

The Bureau of Public Roads adhered to a state-construction policy in the early years of federal aid. That policy encouraged macadamization of minor roads as the first stage of improvement and left the provision of hard-surface roads for heavy traffic to the second stage. The South, the Midwest, and the West benefited greatly from that two-stage program because it allowed rapid improvement or construction of light-duty roads and in some instances a less expensive relocation of those roads in response to changing traffic patterns. Also changes in construction required by new, standardized regulations were less expensive to implement.[58]

The Committee on Standards of the American Association of State Highway Officials established countrywide engineering standards in 1928 that made mandatory ten-foot traffic lanes, eight-foot shoulders, a minimum concrete-surface thickness of six inches, and a one-inch crown on a two-lane concrete highway. Traffic-control devices such as signposts were first developed by private automobile clubs in the northeastern states but were standardized by the late 1920s.[59] The practice of numbering routes began in Wisconsin in 1918. The use of a white center line on roads started in Wayne County, Michigan, in 1911; the stop sign was first used in Detroit in 1915. The intersection traffic signal evolved between 1910 and 1920 from a hand-operated semaphore to a four-way, three-color device.[60]

Rand McNally published the first road atlas of the United States in 1926. That atlas, containing information on road-surface conditions in every state, revealed graphically for any reader the vast amount of improved, hard-surfaced roads in the northeast and California that resulted from pioneering, state-funded programs, early research, and the necessities of war. Also apparent was the absence of such roads elsewhere in the country, with the exception of Texas (Fig. 4).

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[56] Robert Caro, The Power Broker: Robert Moses and the Fall of New York (New York: Vintage, 1974), pp. 161–162 and 281–282.

[57] Frederick W. Taylor, The Principles of Scientific Management (New York: Harper and Brothers, 1911).

[58] America's Highways, footnote 39 above, pp. 388–389.

[59] Manual and Specifications for the Manufacture, Display, and Erection of U.S. Standard Road Markers and Signs (Washington, D. C.: American Association of State Highway Officials, 1927).

[60] America's Highways, footnote 39 above, pp. 404–405.

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Despite the effects of standardization, automobile travel in the early 1920s was still an adventure, particularly in inclement weather. The first decade of the twentieth century witnessed the evolution of a reliable automobile; the second decade gave rise to the hard-surfaced road; the third decade saw the refinement of an all-weather automobile. Most American automobile manufacturers were producing closed-top sedans by 1918. The amount of hand labor that went into the wood frame and metal or fabric panels made closed sedans considerably more expensive than open tourers. In 1922, when Hudson dropped the price of its sedan to only $300 more than the open tourer, a new era began for the automobile. The technological breakthrough that permitted the economically practical production of sedans was the development of large steel presses that could stamp the whole top of an automobile in one piece.[61]

The market for sedans expanded quickly. Closed models accounted for 43 percent of sales in 1924, 72 percent in 1926, and 85 percent in 1927. Chevrolet became the acknowledged leader in the low-priced, closed-car field. The price of the two-door Chevrolet sedan fell from $735 in 1925 to $594 in 1927. In the same year Ford dropped the price of the increasingly outmoded Model T sedan from $580 to $495, but nearly $100 worth of extras were required to make it as well equipped as the Chevrolet. But the light weight chassis of the Model T flexed under the weight of a sedan body, and thus rapidly became noisy and leaky. Also in 1927 the Chrysler Corporation introduced the inexpensive, closed Plymouth to compete with Chevrolet.[62] By the end of the 1920s, the all-weather sedan was the cornerstone of the automobile market.

Other improvements during the 1920s made the automobile safer and usable in all types of weather conditions. As early as 1919 electrical lighting, using a battery and generator, was commonplace on all but the cheapest mass-market automobiles. Ford, however, persisted until 1925 with its magneto-driven headlights that varied in brightness with engine speed.[63] Electrical starters were introduced on Cadillacs in 1912; 8 percent of all new vehicles had them by 1914; and 100 percent by 1921.[64] The introduction of the electrical starter opened the market for women drivers who could not easily crank large engines by hand. In the mid-1920s the development of tetraethyl lead additives to gasoline allowed higher octane fuels and in turn higher compression ratios and more powerful engines than previously.[65] Balloon tires, introduced in the early 1920s, used a much lower pressure than earlier tires and lasted far longer than the approximate 2,000 miles of use that were normal for high-pressure tires.[66]

New designs for brakes and suspension were perhaps the most significant improvements in roadworthiness. The higher speeds permitted by the increasingly powerful engines and improved roads required better braking, which was best achieved by having brakes on all four wheels rather than on the rear

[61] Michael Sedgwick, Cars of the Thirties and Forties (London: Hamlyn, 1979), p. 20; and Edward S. Lawrence, The Manufacture of Steel Sheets (Cleveland: Penton, 1930), pp. 213–214.
[62] Alfred P. Sloan Jr., My Years with General Motors (Garden City, N. Y.: Doubleday, 1964), pp. 161–162.
[63] Sedgwick, footnote 61 above, p. 17.
[64] Herbert Chase, Design Tendencies in 1921 American Passenger Car Chassis, *Automotive Industries*, Vol. 44, No. 7, February 17, 1921, pp. 309–311.
[65] Sloan, footnote 62 above, p. 225.
[66] Sedgwick, footnote 61 above, pp. 12 and 17.

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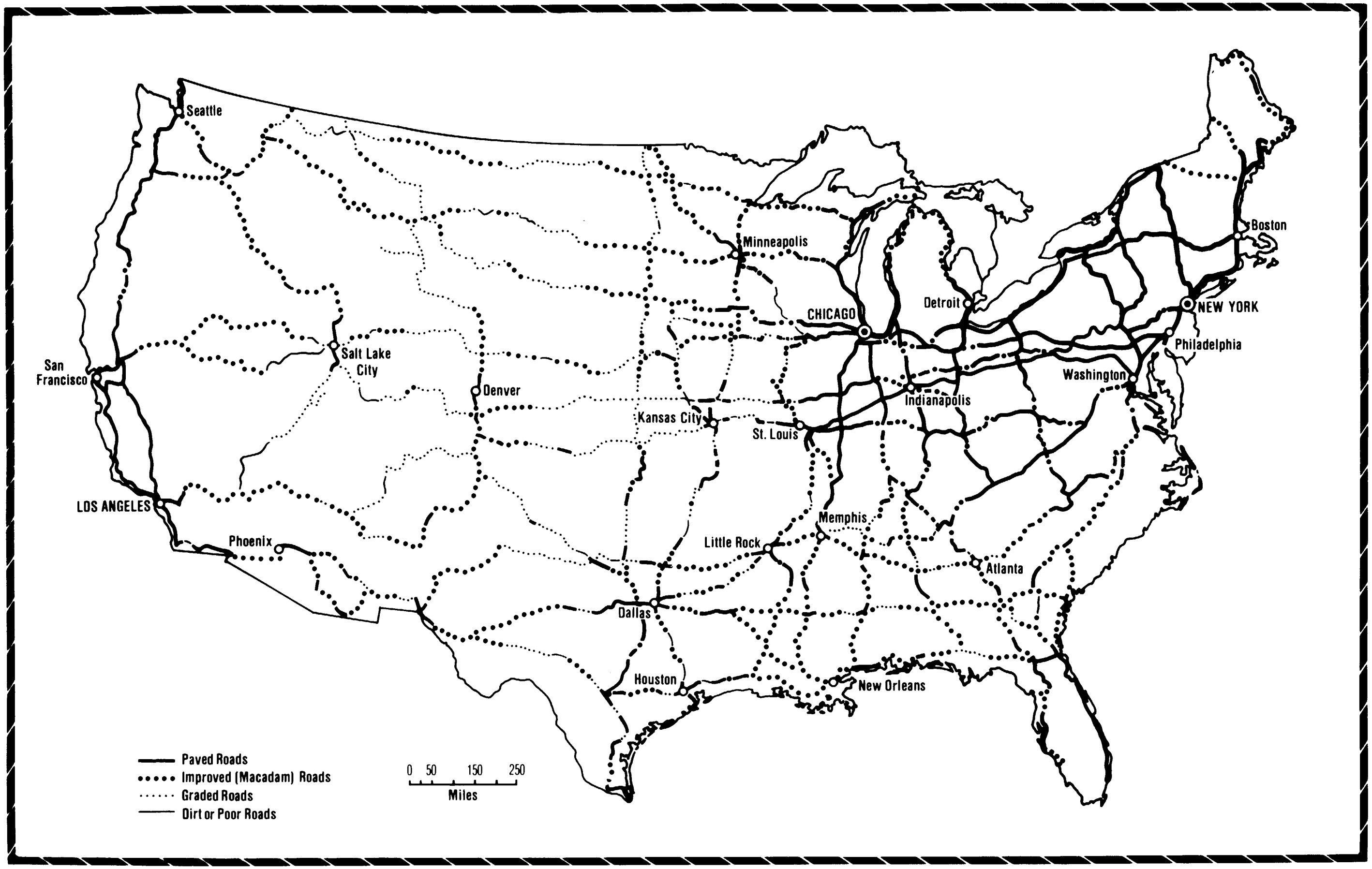

FIG. 4—The American highway network in 1926. *Source:* Rand McNally Road Atlas (Chicago: Rand McNally, 1926).

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two only as in previous decades. Four-wheel braking was adopted after Duesenberg introduced the technique to the United States in 1920.[67] By 1926 63.2 percent of American automobile manufacturers supplied four-wheel brakes; in 1928, when the innovation was adopted by both Ford and Chevrolet, the figure rose to 97 percent. By 1929 all American-built automobiles had four-wheel brakes.[68]

The road boom of the 1920s had a negative effect on Ford's Model T. The suspension that had been superb on poorly surfaced roads proved unsatisfactory on smooth roads and at high speeds (Fig. 5). Under those conditions the Model T rolled like a ship in a bad storm.[69] The addition of the front-wheel brakes and the balloon tires produced a disastrous front-end shimmy when braking at high speeds.[70] As roads improved, drivers wanted large, fast, smooth-riding cars cushioned by good springs and shock absorbers. Urban customers in particular wanted a standard three-speed, selective transmission rather than Ford's two-speed, pedal-operated device.[71]

Ford ceased production of the Model T and introduced the Model A, which incorporated many innovations associated with the success of Chevrolet: closed, stylish bodywork, a three-speed transmission, and an improved chassis and front axle. Ford, however, was the first to use safety glass in the windshield of an inexpensive automobile and hydraulic shock absorbers. The latter feature made the Model A a most roadworthy automobile, and the excellent ride in combination with the powerful new engine and light weight allowed the Model A to recapture in 1929 the market preeminence that had been lost to Chevrolet.[72]

The 1920s saw the complete realization of an automobile way of life. Robert S. Lynd and Helen Lynd in "Middletown," their classic study of Muncie, Indiana, inquired about bathtubs in twenty-six particularly run-down houses. All twenty-six families had automobiles, but only five had bathtubs. In 1923, when the data for "Middletown" were gathered, there were two automobiles for every three families in Muncie.[73]

In many ways the technological complex of good roads and automobiles revolutionized American lifestyles during the early 1920s. The most notable effect was on the leisure activities of the working class. Workers who enjoyed vacations with pay had a greatly extended radius. Workers who did not receive paid vacations could take short trips for the day or weekend. With the diffusion of the automobile from the elite to the middle and working classes came elitist ideas about recreation, which underwent some significant modifications.

The elite's preferences for accommodations were not totally accepted by the other classes. Grand hotels were too expensive, and middle-class families dis-

[67] Duesenberg Car Has Straight Eight Engine and Four Wheel Brakes, *Automotive Industries*, Vol. 43, No. 21, November 18, 1920, pp. 1007–1009 and 1031.

[68] Current Trends in Passenger Car Design, *Automotive Industries*, Vol. 58, No. 7, February 18, 1928, pp. 244–245; and Specifications: American Passenger Car Chassis, *Automotive Industries*, this footnote, pp. 286–288.

[69] L. J. K. Setright and others, Anatomy of the Motor Car (London: Orbis, 1974), p. 157.

[70] Sedgwick, footnote 61 above, p. 17.

[71] Allan Nevins and Frank Ernest Hill, Ford: Expansion and Challenge, 1915–1933 (New York: Charles Scribner's Sons, 1957), p. 417.

[72] Nevins and Hill, footnote 71 above, pp. 450, 456, and 477.

[73] Robert S. Lynd and Helen M. Lynd, Middletown (New York: Harcourt, Brace, and World, 1929), pp. 253–263.

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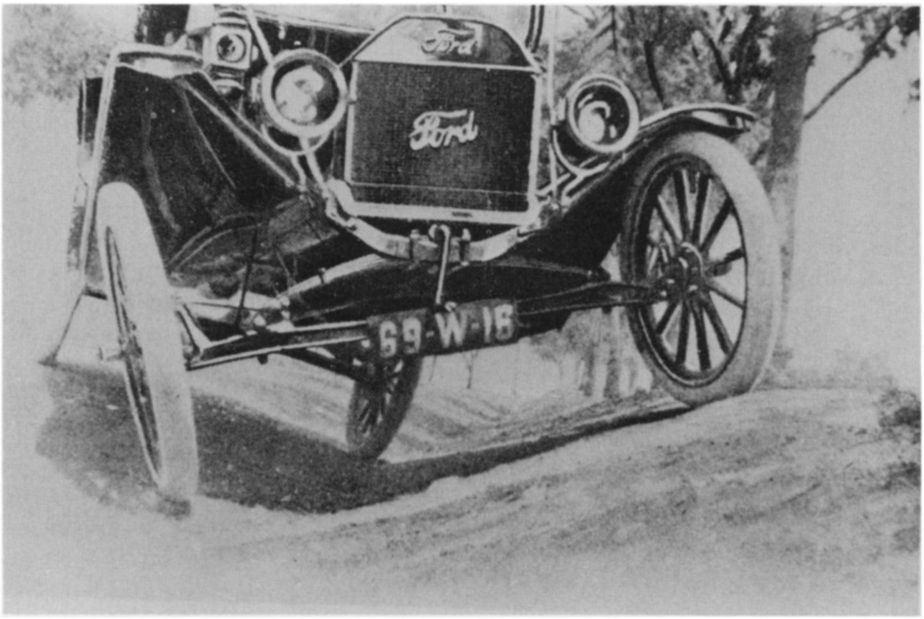

FIG. 5—Ford's three-point suspension. *Source:* Courtesy of the Henry Ford Museum, The Edison Institute, Dearborn, Michigan.

liked most small-town hotels with their poor food,· fixed eating hours, and omnipresent traveling salesmen. Camping became a favorite not only because it was cheaper than hotels but also because it fitted with contemporary opinions about the value of fresh air and posed no problems of fixed eating hours.[74] By the early 1920s many books and pamphlets lauding the romance of motor camping and giving practical advice and information about equipment and techniques were available.[75] Even the elite was not immune to the romance of camping; Henry Ford, Thomas A. Edison, and Harvey Firestone Sr. were joined on an automobile-camping trip by President Warren G. Harding in 1921.[76]

Muncipal campgrounds appeared in the early 1920s as a solution to the problems posed by roadside camping. At their inception these facilities were often free and were usually intended to encourage tourists to patronize local merchants. Many such camps soon imposed fees to restrict access to persons deemed undesirable.[77] The first primitive motels appeared in the mid-1920s, usually as a cluster of cabins around food stands, grocery stores, boarding houses, and gas stations. By the end of the decade the motor court had appeared, and several oil companies were making tentative plans for countrywide chains of standardized accommodations.[78]

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[74] Warren J. Belasco, Americans on the Road: From Autocamp to Motel, 1910–1945 (Cambridge, Mass.: MIT Press, 1979), pp. 42–47.
[75] Elon Jessup, The Motor Camping Book (New York: G. P. Putnam's Sons, 1921).
[76] Belasco, footnote 74 above, p. 72.
[77] Belasco, footnote 74 above, pp. 77 and 106–112.
[78] Belasco, footnote 74 above, pp. 141–142.

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Conclusions

The automobile, good roads, and an automobile-oriented culture pervaded American life by 1929. The Great Depression could not reduce the effects. Originally a means for the elite to extend its social distance from the rest of the population, the automobile was quickly made available to a broad spectrum of American society by mass production and ingenious designs. The good-roads movement of the northeastern states used state bonds to finance the improvement of roads. The movement spread throughout the country, and the federal government became involved in road construction. The American road network, with the exception of the Interstate Highway Program of later vintage, was substantially completed by the end of the 1920s. Countrywide standards for road design resulted in safe, hard-surfaced roads throughout the United States, and mass production and consumer demand combined to standardize a comfortable, reliable, all-weather automobile.

No part of American life was untouched by the transformation wrought by the automobile. Churches, schools, hospitals, and stores became centralized as automobiles increased the distances people could travel. Many local services disappeared, and even the most rural folk had improved access to urban services. By ending much rural isolation, the automobile also brought to a close a period of regionalism in American culture. Weekly trips to the movie theaters exposed Americans to a homogenized view of American life. National brands advertised in county newspapers and increasingly on the radio were readily available in local stores. No longer was the adjoining county or even state so mysterious or inaccessible, nor perhaps was the move of sons and daughters to the city in search of better economic opportunities so seemingly final or distant.

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