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PROGRESS OF ROAD BUILDING IN THE MIDDLE WEST.

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INTRODUCTION.

Prior to the era of railroad building, which had its beginning in the decade following the close of the civil war, public road construction made the most progress in the States of the Middle West. This was under the toll-road system, and several of the States bordering the Mississippi River still retain the old toll-road enactments upon their statute books. These roads linked together the principal towns and connected the shipping and commercial centers with the interior. They daily presented busy scenes of travel and traffic, being the sole avenues of transit, as there was not a single mile of railroad west of the great river in 1850 and but a limited mileage up to 1870. While the toll-road system, with few exceptions, has been abandoned, these roads still remain and are maintained and kept free for public travel out of the general road funds of the counties through which they pass. There has been some further progress in road building in the counties containing important cities, and there are many substantial and beautiful stone and gravel roads leading to and from these centers. Some benefit has also been derived from grading, crowning, rolling, dragging, and draining the common earth roads; but, with these exceptions, no general progress in permanent improvement has been made in the last half century.

It is frequently asserted that, since the era of railway development, the railroad has assumed, to a greater and greater degree, the functions of the common road, and that the construction and extension of improved highways are no longer necessary, nor are they an indication of progress. This is true only to a limited extent. Railroads can never supersede the common roads; almost every ton of freight carried by them must be carried over highways at one or both terminals, and the cost of this highway transportation has a marked influence, not alone on the price paid by the consumer, but also on the profit realized by the producer. The highways are not only important as a means of local intercourse, but they act as feeders to the railway lines, thus becoming absolutely necessary to the perfection of modern transportation systems. The managers of the great railway systems of the country appreciate this, and are without exception actively favorable to any movement for better highways.

FORCES AT WORK FOR HIGHWAY IMPROVEMENT.

The extension of the free delivery of rural mails and the rapid development of motor vehicles are potent influences in advancing the era of highway improvement in these States. It is hardly necessary to dwell upon the effect of rural mail-delivery extension in creating the necessity for better roads. This division of the postal service has made it a prerequisite to the establishing of a rural delivery route that the road must be placed and maintained in good condition for efficient service. But there is a lack of proper inspection. Some carriers endure the worst road conditions without complaint to the authorities, while the postmasters, whose duty it is to report these road conditions, are, in many instances, indifferent and careless. However, the rapid extension of this system is having, and must continue to have, a commanding influence for improvement of the highways.

The great motor-vehicle interests are now beginning to direct their attention to the necessity of improved roads. It can hardly be explained why these people, alert in business and devoting their energies to the perfection of the motor vehicle, should have so long taxed their ingenuity to construct a machine which will resist the strain of grades, rocks, ruts, mud, and all kinds of miserable road conditions, and devoted so little of their time and effort to improving the conditions primarily essential to the success of this mode of transportation.

Other forces are hastening the period of highway betterment. The continued bad roads of the past two years, caused by the wet seasons in the Mississippi Valley States, have very materially affected the commercial interests of this section. The idea that "good roads" could be constructed and maintained by merely grading and draining the surface of the ground has been dispelled, and it is now evident that it will be necessary to surface these roads with some durable material which will render them permanent and efficient for traffic during all parts of the year, and especially those seasons when the roads are most needed for the movement of products. During the winter and spring of this year (1903) wagon transportation in many of these rich valley States was almost wholly suspended for weeks at a time. Long accustomed to these conditions, the people endure them with a patience and resignation they would not show under any other circumstances. What a cry would go up if the railway traffic of the country were suspended for any such period by reason of a failure to provide properly constructed railways to meet the conditions of all seasons of the year!

Business men are learning by experience that improved highways are primarily essential to uninterrupted trade and to their commercial prosperity. Their organizations are giving active consideration to the problem of building durable public roads leading to and from the trading centers of their respective communities. Retail merchants are seriously affected by bad roads, which frequently entail loss of business,

or at least prevent a profitable season's trade. When a country merchant is thus affected the effect in turn extends to the wholesale dealer. Collections become poor, remittances are delayed, extensions of credit are asked for, stock is left on hand to become shelf worn, and a generally unhealthy and profit-losing situation prevails. Commercial and industrial interests are, therefore, awakening to the necessity of their cooperation in hastening the era of road building.

THE RURAL POPULATION AND THE ROADS.

It has long been considered in this country that the public roads are for the exclusive use and benefit of the people living in the rural districts, and that this class alone should be held responsible for their construction, care, and maintenance. This is an erroneous idea. It is true that in the Middle West a large majority of the population resides in the country, either in the small towns or on the farms. In Iowa, with a population of more than 2,200,000, there are residing in the country districts 1,650,000. In Missouri, with a population of more than 3,100,000, there are living in the country nearly or quite 2,000,000; and conditions are much the same in the other Middle West States. In this section the rural population has, during the ten years ending with 1900, increased faster in comparison with the urban population than during previous decades. This has resulted from the building of trolley and steam-railroad lines. If such a result is produced by the extension of electric lines and steam railways, how much more may be expected when the common roads of the country are brought up to the same degree of perfection! It will speedily remove apprehension of the serious evils growing out of the overcrowded and congested condition of our cities; it will dispel the isolation of country life, and it will assure happy homes with pure air and elbow room for a larger element of our population. A large majority of the people will be directly benefited by the improvement of the roads. It may be asserted that, as the greater number of the people live in the country and as the agricultural interests are more directly benefited by good highways, it is but just that they should bear the burden of their cost and maintenance. It must not be overlooked, however, that the cities are the centers of commerce and wealth, the focus points of all public roads, and that they are sustained principally by this rural population. They should, therefore, bear their part in maintaining adequate means of intercommunication. As the whole people are benefited by improved roads, all should share the burden of their cost and maintenance. The plan of depending upon the rural districts alone to provide durable highways has signally failed.

REASONS FOR LACK OF PROGRESS IN ROAD BUILDING.

That we have heretofore made no substantial progress in road building may be attributed to several causes.

First. The excellence and rapid development of our railway systems, and our extensive waterways.

Second. Our long familiarity with bad roads and the indifference of those in charge of highway affairs.

Third. The lack of appreciation of the social, commercial, and economic value of good roads, and the fear of increased taxation on the part of the rural population.

Fourth. The wasteful and ineffective system of requiring personal service of the rural population on the highways.

Fifth. The lack of general authority, intelligent supervision, provisions for equitably distributing burden of cost, and business methods in highway construction and maintenance.

STATE AND NATIONAL AID.

The experience of Europe in road improvement shows that the highways should be taken as much as possible out of the hands of local authorities and be administered by the State governments. Washington recommended in a letter to Patrick Henry that the roads of Virginia be taken away from the control of the county courts and be placed under the State authorities. Alexander Hamilton was an enthusiast on the subject of road improvement, and recognized thoroughly that roads left to local authority would never be satisfactorily built or extended.

The States of Massachusetts, New York, New Jersey, and Connecticut have made the greatest progress in the permanent improvement of their highways. The administration of the road affairs of these States is in the hands of competent State commissions of engineers. The roads are constructed under what is known as the State-aid plan, the cost being apportioned to the State, the county, and the local district, thus insuring proper system, supervision, construction, and maintenance, and giving the people, in return for money expended, good public roads, which they welcome with growing appreciation. There seems to be an increasing sentiment in Middle Western States in favor of State and National aid in permanent road building. Replies to direct inquiries in a majority of the counties in Iowa and Missouri have in nine cases out of ten been favorable to this plan. Practical experience in the older States has demonstrated that State administration and aid in highway construction is a great step toward the solution of the road problem. The Government's work for good roads at present is merely educational and experimental. It is now claimed by some that, if the Government can aid railways and waterways, and construct carriage drives through the National parks and reserves, and wagon roads for Porto Rico and the Philippines, there is no satisfactory reason why it may not lend aid to the improvement of the highways in the States, especially the principal postal roads, thereby advancing the commercial, agricultural, industrial, social, and educational interests of the people.

It is impossible in any State to provide a fit system of highways by the action of boards which have only local authority, and which are necessarily swayed by local, if not individual, interests. No good system of roads has ever been developed except under authority lodged in the hands of some central administration. Under any other system we may expect at best occasional good roads, which will serve only the needs of those who pay for them, while the poorer or less enterprising communities which may lie on either hand will do little or nothing to improve the roads. The principle of the "State-aid plan" is worthy of strong commendation to the States of the Middle West, but not to the exclusion of all other means of securing road betterment. While in any case competent State supervision seems necessary to insure uniformity, and to establish at least a minimum standard for roads, there may be at the same time provision in the road laws of each State permitting localities, counties, or districts to provide for highway construction by direct taxation, issuance of bonds, private subscriptions, or other means, and to build or contract for building their roads under general State supervision.

Illinois, by legislative enactment, has named a commission to inquire into road conditions in the State, and also into the merits of the State-aid plan, and if it is approved to prepare a bill embodying the principles thereof and making the same applicable to the conditions in that State, and to report the same to the next general assembly. The platforms of both political parties in the State of Iowa in the last campaign contained planks favoring this modern road legislation. The good-roads associations of the States of Arkansas and Minnesota, strongly supported by popular sentiment, have prepared, and will submit to their respective State legislatures, measures embodying the essential features of this modern road legislation. Other States are contemplating similar action.

ANTIQUATED METHODS.

The system under which the public roads are managed in the States of the Middle West is antiquated and wasteful, each year repeating the experience of the one before in expenditure of money and labor with no permanent good accomplished. The sum of money practically wasted under present methods in the attempt to maintain passable roads would cause alarm in any other business of such proportions, public or private, and would call for the most radical and prompt reform.

There are in the State of Iowa 100,257 miles of public roads, including 1,039 miles of macadam and gravel roads, the remainder being common earth roads, of which about one-fourth are principal roads. These roads, judging from the last year's expenditure, cost the people of the State the sum of \$2,650,000 annually. With the exception of the 1,039 miles of improved roads, of which there is no complaint,

every year there are periods of at least three months' duration when these roads are very bad, at times almost impassable. For the past two years a season of good roads has been the exception in that State. During the winter and spring of 1903, movement of grain and other products from the farms to the elevators and stations was almost suspended for weeks at a time.

Missouri has a total road mileage of 89,946 miles, of which 1,262 miles are macadam, gravel, or slag roads (Pl. LVI, fig. 1), while the remaining portion are the natural dirt roads common to the section. The people of the State spend about \$1,660,000 on the roads and highways, and as a result they have rough, bad roads in a large part of the State all the time, and muddy, nearly impassable roads at least one-third of the year. This showing for Iowa and Missouri fairly illustrates the methods and results under the present management of roads and highways in the other States of the Middle West. If the money and labor expended each year on highways without permanent results were used under competent State supervision, it would revolutionize road making in these States and bring astonishing results within a few years.

ROAD LAWS AND CONDITIONS IN SEVERAL STATES.

The road laws of the States of the Middle West as a rule follow the old-time models, with here and there special acts permitting the construction of permanent roads by petition at the cost of the owners of abutting property. In some instances the county or township boards having charge of road matters may macadamize or surface a particular piece of road or a strip that is extremely bad, provided they can defray the cost from the general road fund. In some cases enactments enable the township and the county to share with the adjoining property the cost of the construction of some special stretch of highway. Though there are such exceptions as those just noted, still the old-time slovenly and wasteful methods are in use in most of the road districts, including the old feudal method of ordering out the hands to work the roads, generally under an inexperienced and incompetent overseer. There is probably no other feature which has done so much to maintain the low state of road making as the forced-labor system. It has bred a shiftless method of work which has led our people to look upon road building as a farce. There is no situation in which the citizen makes so unsatisfactory an appearance as when he is endeavoring to make the least possible amount of labor count as a day's work on the highways of his district. Iowa by a recent law has enlarged her road districts to the limits of her township lines, abolishing the forced-labor system, and requiring all road taxes to be paid in money. This is a most commendable step. The new law will create a substantial road fund in all the counties in the State, and if the next legislature will follow this with enactments under which this money may be properly



FIG. 1.—THE JOPLIN, MO. SPECIAL ROAD DISTRICT COMMITTEE INSPECTING THE FINE ROADS CONSTRUCTED OF MINING SLAG UNDER THEIR SUPERVISION.
[There are about 100 miles of these roads, built at a cost of about \$150,000.]



FIG. 2.—JUNCTION OF CHESTER LEVEE AND BEMIS ROADS, NEAR JACKSON, TENN.
[This road was built of novaculite gravel, shipped from quarries in Illinois by Samuel Lancaster, city engineer, at a cost of \$3,500 per mile.]

and intelligently expended we shall see a beginning made in road improvement in that State.

Missouri devotes a portion of her saloon-license moneys to the permanent improvement of the highways, and a few counties are making favorable progress in permanent road extension. There are ample provisions in her statutes for the building of macadam roads, their principal defect being that they require a petition from a majority of the abutting landowners, upon whom is laid the entire burden of cost of the improvement.

Owing to the large area of rich, deep alluvial soil, Illinois is said to have worse road conditions in wet seasons than any other State in the Union. Good materials for making roads are not very liberally diffused over the State, and it has not yet solved the difficulties of highway improvement. A large share of her \$346,000,000 worth of farm products raised annually must be hauled through the mud. It is confidently expected that the new commission already referred to will present to the next legislature a road measure which will receive its approval and thus inaugurate a State system for the improvement of the highways. A recent enactment provides for the preparation of road material in the State penitentiaries for use by the counties.

There are large deposits of a gravel, known as "novaculite," in the southern portion of Illinois, which is an excellent road-making material. The streets of the city of Jackson, in Madison County, Tenn., are paved with it, and the county has constructed about 7 miles of public road of the same material (Pl. LVI, fig. 2). This mileage will be extended at the opening of the spring season, as the county has arranged for the issuance of bonds for some \$300,000 for the improvement of its roads. About 1,000 yards of road constructed of this material was built at Jackson by the operators on the Illinois Central good-roads train in the spring of 1901. It has endured heavy and constant travel and traffic, and is at this date in perfect condition, having so far required no repairs. There is no road-making material within considerable radius from Jackson, while a deep alluvial clay soil similar to the black soil of Illinois has to be dealt with in road making. They prepare the foundation by proper grading and thorough rolling with a steam roller. The first course, which is of common river gravel, is shipped in from a distance of 60 or 75 miles. This is put on about 4 inches thick and rolled down to about 3. Then a layer of about 4 inches of novaculite is spread on and rolled to about 3 inches, making the full thickness of the roadbed about 6 inches. These roads are constructed with easy grades, 12 to 16 feet in width, and at an average cost of about \$3,000 per mile. It is a singular fact that, while Illinois complains of lack of material, Tennessee can buy and ship road material from that State and build durable roads on a similar soil, and that within a reasonable cost.

Kansas has built a number of miles of macadam roads in the vicinity of her penitentiary by utilizing her convict labor. Special road laws authorize counties and districts to construct permanent roads, and provide that their cost shall be equitably prorated upon the county, the road district, and the abutting property.

The friends of road improvement in Minnesota are much encouraged over the passage by their senate of a bill providing for a State board of highway commissioners, and for a State tax of one-twentieth of a mill (in addition to the general road tax) to be used in paying one-third of the cost of road improvement by the State, the remainder to be paid by the counties and local districts. The main highways are to be under the control and supervision of this board. It is expected that this bill will become a law at the next session of the legislature. There is a limited mileage of substantial and beautiful macadam and gravel roads in this State, especially in the counties of Hennepin and Ramsey, in which are situated the cities of Minneapolis and St. Paul (Pls. LVII and LVIII). There are fine quarries of granite, limestone, and slate rock, all very good material, in various parts of the State. An excellent quality of gravel is plentiful along the numerous streams and is frequently found in extensive deposits. Minnesota, like the Dakotas, Nebraska, and Kansas, has an advantage over some other States by reason of the vast area of level prairies, with a kind of soil which compacts well and affords perfect natural roads for nearly all the year. But in long wet seasons they become indescribably bad, and frequently impassable. With such natural road advantages, these States could build under State cooperation surfaced roads alongside nature's roads and have ideal highways at all seasons.

Arkansas presents every variety of road condition, from the mountainous and rugged to the level and swampy. She has every kind of road-making material in abundance, and well distributed. The State is making creditable progress in road building, and the last legislature considered with favor a State-aid measure similar to the New York law. It was introduced too late in the session for final action, but it seems reasonably certain to become a law at the coming session.

ROAD MATERIAL.

A quality of limestone rock similar to that of which the excellent turnpike roads of Kentucky, Tennessee, southern Ohio, and Indiana are constructed is widely scattered over the States of the Middle West, and nearly all the macadam roads are built of this class of rock with satisfactory results. Trappean rock is found in southern Missouri and Arkansas. There are rocks with fine road-making qualities in all the States, but not generally distributed. Gravel, limestone, mining slag, and other materials may be expected to lie immediately contiguous to the roads or to require at most a short haul by rail or water. Experiments have been made with burnt or vitrified clay or ballast



OSSEO GRAVEL ROAD, 3 YEARS OLD, 4 MILES NORTH OF MINNEAPOLIS.



OSSEO MACADAM ROAD, 5 YEARS OLD, 3 MILES NORTH OF MINNEAPOLIS.

with some promise of success. There are no oil roads in this section, and it is not believed that they could be made successful, on account of adverse soil and climatic conditions.

Large areas of the broad lands of the Mississippi Valley are without any road material. This renders road making more difficult and expensive. But as a rule it will be found that the increased cost of material is offset by the lessened expense of grading, on account of the level character of the lands. It is the rare exception when satisfactory road material can not be secured where desired at a price to justify its transportation, either by rail or by water. In the writer's work in these States, involving careful investigation and study of the conditions, he has not yet found an obstacle to highway improvement which could not be overcome by the application of earnest, intelligent effort.

ROAD CONSTRUCTION.

The science of road building, as evolved from long experience in the countries of Europe and in many of our older States, is applicable to the conditions in the Middle West. In fact they are in position to profit by the experience of other States, to take advantage of modern machinery and processes, and to build highways with much greater rapidity and at much lower cost. In this connection, it may be stated that it is impossible to gather any data that will yield an accurate idea of the cost of building macadam or gravel roads. There is such a small aggregate mileage of improved roads in this part of the country, and the construction has been under such diverse conditions, that any positive statement of cost would be misleading and tend to confuse rather than to inform.

The following statement from Mr. George W. Cooley, county engineer of Hennepin County, Minn., will give some practical ideas as to construction and cost.

We have built in this county about 150 miles of gravel and 10 miles of macadam roads in the past five years. Our gravel roads are 10 to 16 feet wide, 6 to 8 inches thick, and cost \$700 to \$2,000 per mile, depending on distance material is hauled.

We put on our gravel roads from 18½ to 30 cubic yards per station of 100 feet, or 1,000 to 1,700 cubic yards per mile. We do not roll the roads until they are from one to three months old, preferring to consolidate by travel and roll when settled by traffic.

Some items of cost are as follows:

	Per cubic yard.
Gravel in pit.....	\$0. 10
Loading 10
Hauling 25
Distributing and dressing road 10
Total per cubic yard delivered on work.....	. 55

This makes the cost \$550 to \$935 per mile for one-mile haul.

Our macadam roads are built 12 to 18 feet wide and cost \$3,000 to \$5,000 per mile. They are constructed as follows: One layer of 2-inch broken stone 4 inches thick, watered and rolled; then 2 inches of gravel binder, watered and rolled; then 4 inches of broken stone, 1 to 1½ inches in size, watered and rolled; then 2 inches of gravel for wearing surface, watered and rolled.

Technical knowledge of the method of construction and estimated costs of the different elements of the work may be easily obtained from bulletins issued by the Office of Public Road Inquiries, and from several engineering works upon the subject found in public libraries.

A FEW SUGGESTIONS.

It is desirable for many reasons to preserve the natural dirt road alongside and parallel to the surfaced road where possible.

It seems wise to recommend, particularly for level country where material is scarce, the building of macadam and gravel roads from 8 to 10 feet wide. Some will say: "These roads are not wide enough. How will two loads of hay pass on an 8-foot road?" The answer is: "Two loads of hay seldom meet; usually both are going to the same market at about the same time; so it is useless to construct a road to meet a condition which seldom arises." Of course, these widths are only for strictly country roads, upon level lands where it is easy to turn out. On main highways, where travel is extensive, a width of at least 16 feet should be maintained.

In these States it might be well that the vagrancy laws should have stricter enforcement, and that tramp and prison labor be employed upon the roads and in the preparation of material.

A common but erroneous impression prevails that when a road is once macadamized, graveled, or surfaced with any hard material, it is then finished and must endure for ever. An improved road needs constant attention, and unless this is given in a systematic manner like the railroads the road will rut, ravel, disintegrate, and go to ruin. Railroads build and ballast their roadways to the highest standard of perfection, then employ section men to keep up every mile.

EDUCATIONAL WORK.

The Office of Public Road Inquiries has done a great deal of experimental and educational work in the States of the Middle West. A number of object-lesson roads have been constructed under direction of expert road engineers sent out by the Department of Agriculture. Schools of instruction, or conventions, have been held in connection therewith. Much of the present interest awakened is the result of these efforts. Many bulletins treating the different phases of the road subject in a practical and instructive manner have been freely distributed to individuals showing interest. But there is still a great deal of work to be done in the way of education and experiment to make the people acquainted with the science and art of highway building, so that they will appreciate the fact that good roads mean much in the social, religious, and intellectual development of their communities, and rest upon a deeper foundation even than the demands of commerce and agriculture.