

TWO THOUSAND YEARS OF ROAD BUILDING

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TWENTY FOURTH ANNUAL CONVENTION
AMERICAN ROAD BUILDERS' ASSOCIATION
CHICAGO, ILLINOIS,
January 10 - 14, 1927.

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Until it was possible for me to visit personally and in imagination to reconstruct the first great road building activities of the early Romans, this tremendous exhibit of roadmaking equipment and materials and this large gathering of typical representatives of every branch of the road building industry had not assumed as it does now one of the most significant demonstrations of human progress it is possible to assemble. What is more important to humanity at large than the substitution of inexhaustible mechanical power for the muscles of man and beast to accomplish the great physical undertakings? Or to accomplish with organization and equipment in a few days easily what required weeks and even months of time and the exhaustion and heartbreaking toil of hundreds of human beings.

Mechanical power, equipment and organized effort are the magic that have released human effort and human lives from the profitless toil that first built roads. Stand back far enough to see the road building of two thousand and more years and the big story of human progress is there typified. Even more there is for our profitable use now the undeniable experiences of other nations covering hundreds of years during which have been wrought the enduring policies of highway administration.

There have been just three great programs of highway building within recorded history that by the major tests of area served and mileage completed may be classed together:-

That of the Roman Empire, beginning with Julius Caesar and extending to Constantine;

That of France under the Emperor Napoleon;

That of the United States during the present decade.

It has not been possible to determine limiting dates with exactness for the Roman and French periods, nor is it necessary. There may not be entire agreement with the period assigned to the United States but the difference of a few years either way is not important. To understand the underlying reasons, principles and the results of these earlier great road building epochs is important. To gain from them their wealth of information bearing upon civilization and to apply this knowledge wrought out of national experience to the projecting of the long-time curve of the future in the United States is most important.

The Roman Road Building Period

The fact is recorded over and over that the Appian Way, the first of the great Roman roads, was commenced in the year 312 B. C. by the Censor, Appius Claudius, under the Republic, and extended from the Porta Capena, Rome, to Capua, about 125 miles distant. But we are confused by the assertion that the Via Aurelia, the second paved highway, was built about 242 B. C., or seventy years later. With the growth and extension of the

dominion of Rome, road building progressed so that we read, *
"The most ancient remarks we can find in the Roman history of the highways made in Italy to which several magistrates afterwards added so much, that in the days of Julius Caesar, the city of Rome was by them joined to all the regions and principal cities of Italy and though Augustus Caesar and the following emperors made extraordinary works there, it was rather to enlarge and repair them than to make new ones from beginning to end, excepting some made by Domitian, Aurelian and Trajan."

Julius Caesar extended the rule of Rome until there was included in the Western Empire the countries around the Mediterranean Sea, France, Belgium, Netherlands, Great Britain and parts of Germany, Austria and Hungary. At the height of his power, he was made Overseer of the Appian Way and in addition to public funds expended liberally from his private purse to repair and extend this great highway. The rulers sent from Rome to administer the provinces carried on the work of road building. But a little later we read of Augustus, **
"This great and fortunate Emperor finding himself in a settled peace with so many legions (estimated at 173,000 men) on his hands which might be debauched by sloth, thought he

* Bergier, p. 35, History of Highways.

** " " p. 42, " " "

could not better employ so many men, dispersed throughout the provinces, than in the making of new highways in all parts of his Empire;****." In addition there were drafted for this work the common people, the mechanics and artisans, the criminals and condemned persons, so that, * "In short, we may conclude it was not one kingdom or one region alone, that furnished men to work upon such a vast design, but that all Europe, Asia and Airick, set their hands to it. And that the greatest and most potent kingdoms that once flourished in said parts of the world were employed at it whilst they were subject to the Empire; which can not be said of any other work in the universe."

This work was carried forward sometimes in a desultory way and sometimes on a large scale under succeeding Emperors, but it reached its height under Augustus about 300 years after Appius Claudius began the Appian Way and in the decade before the birth of Christ.

The Napoleonic Road Building

A brief word is necessary to bridge the Dark Ages (500 to 1150 A. D.) and the Middle Ages into the Eighteenth Century. With the decay of the Roman Empire the world road system as such broke down, although quite different conditions prevailed in different countries. Religious pilgrimages, the Crusades, the

* Bergier, p. 47.

journeys of the secular rulers and the high dignitaries of the Church leave some record of the use of transstate and trans-continental routes, but the records of commerce are meagre. The general tendency was all toward feudal government which resulted in neglect and the actual tearing up of some of the ancient roads as a method of protection by isolation. Also, not only the roads but the magnificently built public and private buildings were wrecked to provide building materials. During this period ancient Rome was ravished to a much greater degree to provide building materials and metals than by conquest, fire or other causes.

Napoleon became first consul of France in 1799 and began at once to build a system of national roads. In 1804 through a plebiscite the people by an overwhelming vote decided he should become Emperor, and that year before the high altar of the Notre Dame Cathedral he placed a golden laurel wreath upon his own head. Also he crowned himself king at Milan of the monarchy of North Italy. Thus at the beginning of the Nineteenth Century, a large part of the same area that had been ruled by Rome, twelve and one half centuries later was again brought under an Empire, this time that of France.

The Corps des Ponts and Chaussees had been established in 1796, and was composed of trained engineers through the workings of the earlier established technical schools. So

when the Emperor demanded and vigorously supported a big program of road building, large accomplishments were possible through a trained organization. From 1804 to 1813, the expenditure for roads and bridges from the national treasury is placed at 300 million francs. On December 16, 1811, a decree was issued which established a uniform system of highway administration the general principles of which have remained unchanged. This decree divided the roads into imperial and departmental routes, and fixed financial responsibility upon the Federal Government and the Departments. It designated fourteen imperial roads of the first class leading from Paris to the principal cities of the frontier, thirteen imperial roads of the second class from Paris to the less important cities on the frontier, and 202 roads of the third class joining interior cities, a total of about 17,000 miles. The departmental roads numbered 1,165, in all about 12,000 miles. These national routes included the Mont-Cenis, completed in 1805 to connect Paris with Turin and the Simplon, completed in 1807 to connect Paris with Milan, Rome and Naples.

In an incomplete, imperfect way these facts present the only great road building programs that may be compared in relative extent with that upon which the United States is now engaged, but their aspects are very different than we have been led to believe. Both the Roman and the French systems have

come down through history as military highways. On the contrary the greatest expenditures were made and the most extensive mileages built after the boundaries of both empires had been extended to their greatest dimensions. Certainly these roads were used for military movements, but both the Emperor Augustus and the Emperor Napoleon threw their energies into road building to make possible the administration of a great empire, to stimulate commerce and to provide food sufficient. Napoleon said, "He feared popular insurrections due to economic causes though he was not afraid of political uprisings." In other words, a transportation system, adequate and complete, is a fundamental requirement of a nation large in its physical dimensions. On this basis we must, in our conception, link our railroads and motor vehicles and highways. Together they supply the most adequate, most efficient transport system any like area in the world possesses or has ever known.

In the Empires, authority from a single source was supreme; in this Democracy we are dependent upon cooperation between the States themselves and between the States and the Federal Government to complete an orderly system of highways that will permit traffic and commerce to flow uninterrupted. In a major degree also we must depend upon cooperation, not legislation, to establish coordination between railway and highway.

More than one hundred and twenty-five years ago France placed her highways under competent technical direction and provided for a system of technical instruction to train men. Generally speaking, the technical equipment of our highway engineers is very good and constantly improving. When fitness for the position and integrity of character are made the first requirements for appointment to highway departments, there will be no more highway administration scandals. Until this is done we can hardly fail to have at least isolated cases of a breakdown of efficient and honest administration.

A Glance at Present Day Conditions

Of chief interest to us in the United States is the effect that past history has had upon present day road conditions since it may help us to see ^a further ahead and certainly the experiences of civilization in the older countries ought to have much of value in formulating broad plans for the future.

Italy, a relatively small nation in area, of about 120,000 square miles, has a population of nearly 40,000,000. The life of the people clusters thickly in the villages along the lines of highways. Private use encroaches upon the rights of way, already too narrow. Traffic conditions are difficult. Near the population centers there are numerous carts, large and small, pulled by slow-moving oxen, donkeys, and less frequently by horses. There are many bicycles and pedestrians

and all of this traffic uses at will either or both sides of the roadways. The number of motor vehicles is as yet not large, about 114,700 or one to 345.8 persons. The maximum rate of automobile traffic reported near the population centers is 3300 in 15 hours. The Italian Premier, Benito Mussolini, in his final address to the Road Congress stated, "Italy has a great road problem to solve; new roads necessary to promote her agricultural life, to facilitate her commerce, and finally arteries necessary for international tourism in order to render her beauties accessible. She possesses, moreover, a conspicuous road patrimony formed during many centuries by the work of countless generations." With a rolling and mountainous topography covering so much of the area, many of the roads follow side hill locations and the surfacing is almost entirely untreated stone macadam. These roads were planned and well engineered for a traffic that did not include the motor vehicle. Now they are too narrow for the motor vehicle along with the other traffic, and the dust in the dry season is unbearable. The difficulty of financing new construction and the necessity for adequate highways leading from inland to the lakes have been largely responsible for the granting by the Government of a franchise to a private company which has built about 52 miles of motor toll road connecting the inland with the lakes, Como, Varese and Maggiore. The toll rate would average for an

ordinary car a little under 3 cents per mile. Italy has very capable engineers and they are faced with a tremendously difficult problem of financing the rehabilitation of their road system. This must consist first of all in providing adequate surface over the major part of their whole system.

France and Belgium have a wonderful heritage in the systematic plan that was laid out and begun prior to, and developed and completed since, the Napoleonic Decree of 1811, so that the layout and classification of the highway systems in these countries on a nationwide basis for uniformity and adequacy of planning are perhaps superior to anything in any like area. The Polytechnic School and the Ecole de Ponts et Chaussées supply the highest ranking engineering graduates for the highway work. In both of these countries there is a considerable mileage of main routes paved with stone blocks, but the surfacing problem on long mileages of stone macadam is now the real problem. The Minister of Public Works reports that of the system of national roads, approximately 25,000 miles in length, more than 90 per cent are rock surfaced roads, and that he has for the maintenance of these roads at the present, about 5000 francs per kilometer, which, at the present exchange rate, is equivalent to approximately \$300 per mile. He lists as the roads most urgently in need of repairs, practically all of the main routes leading from Paris to the

important cities and ports of France. He also says, however, that, "We are using a judicious propaganda to attract tourists whose expenditures constitute the so-called 'invisible exports' and who each year leave billions in the country. But to get them to come is not the whole of the question; we must also make it possible for them to circulate comfortably and for this must provide for the maintenance of our roads which have been damaged by the war and by the ever increasing automobile traffic." He also points out that adequate roads are directly profitable and that they have collected for the first 9 months of 1926, 309 million francs or approximately 12-1/4 millions of dollars. A series of experimental roads have been built near Paris for testing various types of concrete slab and bituminous construction, as well as surface treatments.

In Austria and in Czechoslovakia also the surfacing problem on the main roads is of first importance. There are in existence some splendid highways which we are informed date back to the time of Marie Therese. Near Vienna and again near Prague experimental roads are under construction in which both the bituminous mixed types and concrete slabs have been used. These appear to be the first roadways which have been laid in these countries corresponding to the standard types of pavement in general use here. We were informed that following the establishment of a school for technical instruction in France, a school was established in Prague, and whether from this school

emanated the standards that were set up for the national road construction is not made clear, but in any event some of the best roads, those more nearly corresponding to the best modern standards in alignment, substantial proportions, width and adequacy, are found near Prague. Where such foundations exist an adequate modern surface will complete roads of the highest class. But the financing will be extremely difficult. The area and supporting population of Austria have both been reduced to only a fraction of their former dimensions, and some method of borrowing must be resorted to if the highways are to be rehabilitated. The Czechoslovakian Government hopes to inaugurate a road program, but must first secure the legislation necessary to provide the revenues. Such legislation will undoubtedly contemplate higher taxation of the motor vehicle in some form. There is no question as to the very active interest in road improvement on a national scale, and an association of motor users and commercial interests has been formed which is projecting the scheme for the building of 10,000 miles of new highways or widening and improving those now existing.

In Germany the road work has been carried on by the individual States rather than through any central direction, so that the highway service now is on a state rather than a national basis. The Federal Director of Traffic states that

the major problem is to provide national routes. An experimental track, similar to that used in the Pittsburg and Arlington tests, has been built by one of the states for testing the relative values of the various types of construction that may be used.

In Great Britain, with an area of 50,000 square miles and a population of 37,000,000 people, the traffic problem has become acute within and between the big cities. The Ministry of Transport has built arterial roads to relieve bottle necks and to establish through lines of communication. Where these have been completed as parts of established routes they are carrying a very heavy traffic and have afforded wonderful relief. This work, however, was taken up at the particular time to assist in providing employment, and a part, at least, did not accord with the views of the Ministry of Transport. Where entirely new roads have been opened, width of roadway, alignment and engineering features show splendid vision in providing for the future. But in order to make them fully effective much more work and further expenditures are necessary and this is the difficult problem.

New sections of important roads are being built to by-pass the congested narrow streets of villages and towns. A typical illustration of the fact that human nature is very much the same the world over, is the record of the fight made by one of the towns established possibly during the time of William the Conqueror to prevent a by-pass being constructed around the town to take the traffic out of the narrow crooked streets of a very

densely populated district. The problem of new bridges over the Thames and opening of new traffic ways in London County present problems of first magnitude which the Ministry of Transport is now courageously attacking. It is difficult for us to realize in this country the obstacles imposed by the tremendous weight attached to personal and property rights in Great Britain.

To illustrate: Because in the olden days the City of London collected customs at its gates, farmers having supplies to sell formed the habit of stopping just outside the gate and the people came out from the city to buy. So gradually there was established a market. At Aldgate a hay market was established. As the population settled and as villages grew up all around the city of London, which itself is just one mile square, the hay market still persisted and today one of the main traffic arteries to the docks and warehouses now runs through this old market. On certain days of the week the hay carts are parked from curb to curb leaving only room for passage of the street cars in the center. It is doubtful if any area in this country presents as complex and difficult problems as the London County area in the immediate vicinity of the City of London, many of which emanate from ancient rights, customs and traditions. The country roads are largely of macadam construction, surface treated with bitumen. They fit comfortably if somewhat haphazardly into the English countryside and offer most delightful recreational opportunities, but they can not supply the facilities necessary to heavy traffic arteries.

In Sweden experimental roads of different types have been built near Stockholm and a very active debate is taking place as to the best types of road construction. The existing roads are for the most part narrow and winding with numerous grades. Much of the construction for realigning and widening will be expensive because of the necessity for cutting through and handling so much rock. A limited amount of excellent modern construction has already been laid and the Royal Swedish Automobile Club is actively behind the program of adequate road improvement. Sweden is very rapidly adopting the motor vehicle and it will be a most attractive country for touring.

In Amsterdam, as would be expected, the foundation problem is very important, but high technical skill has been exhibited in the construction of roadways. Some of the best asphalt pavements in Europe are in this city.

Denmark is supplied with an arterial road system with ample right of way and a large mileage of stone block pavements. There are also experimental stretches of road near Copenhagen and there is a departure from the usual type of such roads in that parallel lanes of different materials have been built and the traffic is divided between the pneumatic, solid rubber and steel tired vehicles, each taking the lane provided for that particular type. One of the notable types of traffic here is the bicycle. In a population of 3,289,183, we are told there are one and one-quarter millions of bicycles, and apparently most of these are on the road at the same time.

Contrast with the United States

Considering the rural highways there are two outstanding contrasts between the United States and the countries here touched upon, the character and extent of highway traffic and the highway finances. The motor passenger car is regarded still, as in an earlier time in the United States, as a luxury and treated as such, and so it is a luxury. The prices of new cars are high, though there is a very rapidly growing production of lower priced types. Motor fuel is high. Annual taxes are high. Consequently the development of the use of passenger cars in any of these countries can not be remotely compared with the use in the United States. Driving over the national roads of France for example, once outside the immediate influence of a large city the motor traffic is so small, in fact all traffic is so limited, that it is evident there is a very different kind of life prevailing in the rural communities than that which exists here. While there is much very short radius motor traffic in the large cities, the people generally have not discovered the potentialities of motor transportation either for business or recreation. They have not yet found motoring a delightful way to know their own countryside, their country's scenic attractions or the commercial advantages of fast, convenient transportation. From a limited viewpoint, conditions appear very much as they did in this country ten or fifteen years ago, just before the avalanche of motor vehicles enveloped us.

A greater turning to the use of motor vehicles will come but probably it will be somewhat the reverse of our experience. Our private motors came first and the public later. Possibly in Europe the public motor vehicle may develop first in a large way, both busses and commercial trucks, to be followed by a larger use of the private motor.

Financial Aspects

Everywhere the highway officials are laboring under the severe handicap of lack of funds. When it is remembered how many of the European countries finance the entire cost of the national highways, it is easily understood, with the national treasuries and currencies in their present conditions, what great difficulties stand in the way of renewing and rebuilding their highways to modern standards. It is undoubtedly this situation that has turned Italy toward a favorable consideration of the motor toll road, privately owned.

In view of the demonstrated capacity of improved highways to stimulate commerce and to make possible new lines of profitable production, it came as a shock when we were informed that a bond issue for a much needed rehabilitation of important highways in one country had been forbidden because such expenditures are not capable of producing a direct return -- proof unanswerable, that in high places modern highway transport is believed a luxury and not a commercial necessity.

Simple but important conclusions shape themselves with the present day highway conditions of Europe projected against the background of the highway history of the two thousand years since the beginning of the Appian Way. A section of this world famous highway may be seen today crossing the Campagna, toward the Alban hills, preserved as an interesting and valuable historical record; but today's traffic is carried over another highway and itself has about the same relationship to modern roadways as the skeleton outlines of the cliff dwellings in our West have to modern architecture. Also, the likeness to the original is about the same in each.

Highways are a thing of service. Service requires changes; our highways must themselves change; and to provide adequate service over the largest possible mileage and at the least cost is the requirement just now, and there is abundant evidence that this has always been the policy when efficient highway service was required over a large area.

This building up under service, only another name for stage construction, has always prevailed. Our roads must be maintained and strengthened, certainly and constantly, but this has always been the case. Referring again to the Appian Way, we have the record of its being repaired and rebuilt during at least five hundred years although the first section was, we read, so extensively built as to wreck the Roman treasury.

History asserts loudly the fact that once he has set traffic going over a highway, the work of the engineer has just begun.

As to standards of construction, there again is fixed only the one unfailing measure, that of adequate, satisfactory service at minimum annual cost. No more, no less, is necessary.

On the other hand, what tremendous support history supplies for correct principles of administration. France and other countries which for a long time, from 100 to 150 years, have had an adequately planned national system with the roads classified in accord with their importance and with a highly qualified technical corps to carry into execution the administrative principles, have today a heritage of untold value. Their national roads have right of way widths, alignment, gradients, compacted road beds and fine bridges. They lack in many sections top surfacings suitable for heavy motor traffic but these will be supplied as the financing becomes possible. This great heritage for future generations is not a product of extraordinary expenditures but rather the accumulated result of years of consistently following out right principles of administration.

France is not large - about 200,000 square miles; the United States, about 3,000,000 square miles, and in this great national area we are attempting to secure through cooperation between the States and the Federal Government under the Federal Highway legislation, national routes of high standards.

The progress has been such that the eyes of the road builders of the older countries are now turned this way and the methods and results here will exert a profound influence in other nations. This is voiced in no vain or boasting spirit. Rather it is only to build any further protection possible that will guard against any breakdown of the spirit of cooperation between the States and the Federal Government.

This would bring disaster to the completion of a national system of highways. No one can study the rise and fall of highway progress through the years or observe the existing evidence without being forced to this conclusion.