

THE TREND OF MODERN HIGHWAYS

Paper by Thos. H. MacDonald, Chief, U. S. Bureau of Public Roads, presented at the 67th Annual Convention of the American Society of Civil Engineers, Detroit, Michigan, July 21, 1937.

Any attempt to reach far into the future of highway development invades a speculative field if limited to isolated examples of the unusual. However, if taken as a whole, each one of the major public undertakings changes slowly in character through definite causes. These changes, if relatively slow, are none the less sure and continuous, depending upon the rate of progress in science and invention and upon movements in the social structure.

The most important causes of change in highway utilization and improvement, viewed nationally and in the mass, have in themselves a variety of checks and balances which determine their actual course and influence. For example, the national market for large numbers of motor vehicles has resulted in the investment of so much capital, the growth of industrial plants of such large dimensions, and the establishment of such complicated routine of production, that year to year changes in the product are limited by the necessity of conserving the investment in plant by the requirements of mass production and by considerations of time. Thus, the change in the motor vehicle becomes definitely pronounced over a fairly long period, rather than from year to year.

Thus, the most serious loss in the highway investment over the past decade is the obsolescence resulting from changes in the number and speed of motor vehicles operating on the highways.

The revenues accruing to the public treasuries from the special taxes levied upon the motor vehicle and its users in all the various forms have been increasing in their total over a long period save for the temporary recession during the worst of the depression years.

First intended and levied for highway improvement, the growth of income from these special taxes should permit highway officials to build more adequate and consequently more costly roads. But because there have been large diversions of this income to other purposes, and because these funds have been spread over an ever increasing mileage, many States are faced with a constantly growing financial dilemma.

Highway research is moving forward steadily on many fronts with definite objectives. The responsibility for carrying on intensive studies in the physical and economic fields, has been accepted as a continuing obligation by highway engineers and scientists in allied fields. Concurrently, the necessity for greater street and highway safety has become a national emergency.

These are but a few of the factors which will determine the trend of modern highway development, but they are the most important.

Faced with the constantly increasing demand for the construction of new highways and the spreading of the income over a rapidly growing mileage, the highway officials, State and Federal, realized the impossible situation developing and in a number of States actually current. Out of this situation was born the State-wide highway planning surveys which are now being carried on co-operatively in 44 States and the Territory of Hawaii. These surveys and supplemental studies will present a factual basis upon which to plan the complete administration of all the highways based upon sound principles and factual data. One of their important phases is the determination of the relation of the highways to other types of transportation and communication and to population distribution.

Beginning with water transportation and continued by railroad development, the influence of transportation in the past has been exerted to concentrate large populations in small areas. It is only necessary to examine the maps of this country, or any other, to visualize clearly the concentrations of population in cities which have resulted inevitably from the characteristics of waterway and railway transportation.

Highway transportation by motor vehicle is the first great decentralizing transportation agency. The first notable effect of this dispersing influence is the formation of the wide bands of suburban development around the cities. Even cities of moderate size have developed, within a decade, a suburban band five to ten

miles in width, and depending upon topography, partially or completely enveloping the old city. The automobile in conjunction with rail suburban service has attracted city workers to make their homes in rural districts for distances easily up to 50 miles from the city.

The next logical step is the breakdown of over-sized industrial units into smaller units that will be free of many of the undesirable characteristics of over concentration, yet of sufficient size to retain the economies of mass production. Sufficient progress in this direction has already taken place to indicate how inevitable must be this process even though slow. It is reasonably well established that economy of production can be secured in units of moderate size, and the national thought along social lines is becoming a potent force toward decentralization because of the opportunities presented for a more healthful and more desirable mode of life for the workers and their families.

It will be noted that no conjecture or uncertainty is involved in these statements, but simply a recognition of existing facts. The implications are clear that the scientific planning of highways and highway systems of State-wide and Nation-wide dimensions will be the most characteristic trend in highway development.

Without such scientific administration there will be no possibility of providing adequate highways to serve both urban

and rural needs, or to keep the cost of highway improvement, including maintenance, within the limits of revenues that can be raised by reasonable road user taxes. This means a reversal of the present trend in many States where the maintenance cost of the rapidly growing mileage of local poorly built roads is mortgaging far too large a portion of the highway budget. This situation has been produced largely by legal mandate and other public policies adopted and pushed into effect without any consideration for sound highway administration. The Nation-wide movement, through the State and Federal highway departments, to place highway administration on a sound economic engineering basis, is not only the most important trend, but is also the cause of other trends which on this account may be predicted with some certainty. Out of the planning surveys will come definite specification for the division of highways into groups classified by the service they are called upon to perform. By research and experience the details are being rapidly defined that will determine the general type of highway design for each highway service group. In this the principal items will be the alignment with limiting curves, sight distances, the number of traffic lanes, their widths, the shoulder widths, divided roadways for multiple lane highways and many other details.

The trend here is first to classify highways, based upon service, and next to design closely in accord with the classification, - contrasting with the all too prevalent practice in the

past of applying single standards to long mileages, and without change, to roads of widely varying traffic service requirements.

In the field of highway design, the most important single development is found in the possibilities of soil stabilization.

The intensive research work of more than a decade has borne fruit in the understanding that now exists of the physical and chemical properties of soils and methods of utilizing the knowledge no longer stop at mere superficial applications to the immediate subgrade, but go further, to affect the entire graded roadbed in both cut and fill sections. Among the most important additions ever made to the highway organization are the soil technician and his specialized soils laboratory. The application on a broad front of this new knowledge will come as rapidly as engineers may be given the specialized training, and as a result there will be for the first time the possibility of building really scientifically designed roadway sections since these will be placed upon foundations of predictable behavior.

With a large program of grade separation under way at railway and highway intersections and with the changed public policy in paying construction costs largely from public funds, grade crossing elimination has become a fixed policy that will continue until all important railway-highway grade crossings have been eliminated and minor ones protected by adequate devices.

This same policy is being rapidly extended to the separation of important highways at intersections and one of the important trends of highway design in the immediate future will be to rule out intersections at grade as a possibility in efficient highway design.

In this connection, incidentally the widespread use of "stop" and "go" lights is not a solution for traffic movement, but has been a development of necessity imposed upon a system of highways designed and built before the present dimensions or speeds of highway traffic were considered possible. Obviously, the trend of highway improvement in the future must be to provide in the congested area traffic flow arteries that will permit continuous flow of traffic from downtown areas well into the suburban areas. While the cost will be high, it is only through such arteries that capital invested now in land and buildings in the hearts of the business districts, can be even reasonably preserved.

The pioneer roadway even on main traffic routes was conceived as the single important objective. Now, with the recognition of values inherent in highway transportation beyond the bare utility, the roadway design has come to embrace the whole right-of-way. The trend of modern design is to provide landscaping of the roadsides, side walks, foot paths, bridle paths and to stop and protect against soil erosion. The required

additional attention and expense, are paying large dividends through greater durability and through the recreational values inherent in attractive waysides.

There is more or less discussion in which the term "super highways" is used without any adequate definition of what is intended by this term. Perhaps, it is more frequently used in connection with a very limited number of transcontinental highways designed for high speed and with multiple lane roadways to carry traffic from coast to coast.

The German system of super highways which is now under construction embodies this idea. In that country a system of approximately 4500 miles of highways, which gives approximately three lines across the nation in each direction, is being built on wholly new, wide rights-of-way without access from abutting lands except at infrequent intervals. This design is for high speed, motor vehicle through traffic. The travel section is composed of two roadways about 30 feet in width separated by a parking. Both the horizontal and vertical alignment are exceptionally good. All cross traffic is carried over or under these highways. No detail that comes within the purview of highway engineering that will make a more safe or efficient highway has been left out. The most advanced highway design technique has been embodied in this development. The economic utilization is not so clear.

In this country there is need for a considerable mileage of highways having similar characteristics, but the disposition of this mileage to be most efficient must be planned on the basis of the careful studies now going forward. The system of German roads is being built in advance of, and to promote the development of, highway transport. In the United States the situation is just the reverse. We are proceeding on the principle that the utilization of the highways must directly produce the revenues with which to finance their construction. So long as we adhere to this method of financing, the building of super-highways must be limited to those areas where the present and prospective traffic will justify. As a trend of highway development, it is apparent from the important beginnings already made here that a considerable mileage of motor super-highways will be developed, that their location will be carefully integrated with the population centers and that the layout will not be on the transcontinental basis.

In France, where a system of national roads has been developed over a long period, the present construction is to take care of the traffic around the metropolitan districts, particularly the vicinity of Paris by a system of circumferential and radial roads in combination. Here the detail of outstanding importance in the design is the separation of cross traffic.

From the developments abroad and in this country we can conclude that super-highways will be developed but only in the vicinity of our metropolitan areas for relieving traffic congestion within these areas and for connecting metropolitan areas which are separated by relatively short distances. The first function has already been served to a considerable extent by parkways. It is logical that there will be further developments of the type of the Blue Ridge Parkway now under construction to connect the Shenandoah and the Great Smoky Mountain National Parks. The development of such parkways recognizes the large use of motor vehicles for recreational purposes.

Finally, the power of highway improvement to accelerate the shift of population from areas of low productive potentials to areas more favorably conditioned will be consciously used in the national policies developed for the long-term attack upon land use problems. A definite start is already being made in this direction and will become more apparent in the layout of the system of secondary or feeder roads. This thought definitely emphasizes that we have completed the pioneer stage of road development and every trend of highway development of the future must be an intelligent meeting of the particular service to be rendered.