

LOOKING TOWARD THE HIGHWAY FUTURE

Paper presented by Thos. H. MacDonald, Chief, U. S. Bureau of Public Roads, at Twenty-second Annual Convention of American Association of State Highway Officials, San Francisco, California, December 7, 1936.

To drive a modern motor car a quarter of a century, measured by traffic conditions, into the past, is an illuminating and valuable experience. In a public enterprise such as ours - the building of a system of universal highways for a nation - the test of time is all important. It measures the adequacy of the vision into the future, and the competency of the means adopted to meet the imagined requirements.

My recent opportunity to study traffic conditions in many of the countries of the old world clarified many uncertainties, and indicated the very definite directions that Federal and State highway policies of the future should take. A vivid panorama passed in review, with all the variations from the streets of London where motor traffic is congested to the point of near stoppage, to the roads of Jugoslavia where the motor vehicle is yet so novel that the horses in common use are frightened and frequently behave badly, as was true in this country more than a quarter of a century since.

Doubtless selected examples rather than generalities from these other countries present the best means of conveying the valuable information that we may gain. Especially is this true because of the long-time aspects which alone determine the inherent soundness of the policies which give form to the undertakings.

Some eight years ago I inspected the newly completed Great West Road leading out of London. The construction had been undertaken for the purpose of providing employment, but its conception was to provide a wide thoroughfare of large traffic capacity to permit uninterrupted flow between the heart of London and the suburban and rural districts to the west. The roadway was paved at least 50 feet wide, and designed to carry heavy units. At that time a considerable part of its length was bordered by open fields. Today it is lined by continuous large industrial enterprises of many kinds. Traffic conditions are as congested as on the roads previously existing which this new highway was expected to relieve. It has lost its visioned function to move traffic expeditiously over a considerable distance, and has become a crowded, local service road. If this actuality is projected against the by-pass designs which are in common use here, there is no essential difference in either the conception of their purpose or their design. The experience in this case leads directly to the conclusion that where the population is sufficient to make desirable by-pass or radial distance routes, population and industries will gravitate rapidly and certainly to

the new highways. Because of the better traffic facilities offered, new enterprises will come into existence, and within a surprisingly short time we have only another city street with congested traffic. It soon loses its ability to serve the original purpose.

Other examples might be given, but the trend everywhere is so clearly defined, the conclusion is inescapable that to serve as by-pass or through distance routes, the design must carry on separate roadways the through and the local traffic, and the local traffic must be so adequately served that it will only be necessary to give access to the through highways at infrequent intervals.

France presents the opportunity to observe major projects undertaken for the relief of street and highway congestion in the metropolitan area of Paris. Here we get the conception of the dynamic instability of the great population centers when new transportation facilities become available. Perhaps we have accepted the changing aspects of our own cities with the thought that these are characteristic of all youthful growth, but Paris is an old world city, itself ancient in comparison to any of our own. Nor is it a city that grew without direction. No single plan was adopted and adhered to through the years, but rather a series of progressive conceptions have been superimposed, each in harmony with those preceding. Because of the lack of apparent change in recent years, Paris had taken on an unchanging atmosphere, neither old nor young, but of no period of time. Highways and bridges of

the time of Louis XIV and Napoleon are yet in service - a tribute to the ability and courage of the engineers and architects of a century and a half ago. Because of their long vision, and because the rulers who today stand out historically as great leaders, made it possible for their conceptions to become realities, important changes have been infrequent. Today, however, major projects, forced by the growth of street and highway traffic, are under way, which will greatly modify and facilitate transportation in the area, but all are in harmony with, rather than destructive of, traditional values. So carefully are the projects designed to accord with the existing comprehensive plan for remodeling the city, with the old but yet fine buildings, with the principal boulevards and streets, and with the parks and other important public areas, that on completion they will have added greatly needed facilities presenting the appearance of graceful growth. Paris is not static - it is dynamic - and from this situation we can obtain real wisdom. This example challenges the great fallacy, so common in this country, of regarding the physical environments of people as permanent, - of regarding as almost sacred public works that have not yet physically deteriorated to the point of structural failure. We can get wisdom from what is being done there for two good reasons; first, the plans have been developed and the work is being executed by the National Department of Highways, the whole personnel of which has been trained in the Ecole des Ponts et Chaussées, the French School of Roads and Bridges,

whose beginnings go back at least to Louis XV and possibly before. This organization is entitled to the highest respect for its engineering standards developed over a long period. Second, there is the test of time; - one and one-half centuries permit a sound perspective that distinguishes between enduring principles and short-lived stopgaps. So it is of the highest significance that the competent French department of highways has selected, to meet two problems of traffic congestion, two distinctive types of highway planning; - first, an intercepting circular highway enclosing the city, and second, motor highways, radial from the city, reaching for a considerable distance beyond to connect with the existing national highways. This idea sounds simple, but in the detail of design lies the assurance of permanent relief to the traffic, and self preservation of efficient functioning through a long future period.

There was a time when Paris depended for defense on fortified walls extending around the city. At intervals, gates provided for the flow of traffic to all parts of the nation. These lines yet remain the major radial highways within and without the city, perpetuated in a national system of highways, originally adequately conceived and subsequently adhered to faithfully.

On the location of the old fortification a modern highway is under construction. The abandoned walls have long since served their purpose, but through the years has been preserved, free from encroachment, the land which now becomes the right of way for a

highway that will serve to carry traffic rapidly to connections with all of the radial streets and highways in and out of the city. At intersections the new circular highway is carried under the major radial routes. At some points these underpasses are relatively simple tunnels, beginning and ending far enough back of the intercepted streets to leave their full width available for traffic. Others are multiple-lane tunnels branching to connect with several streets. The design motive is to carry on separated levels the principal conflicting lines of travel to make possible a continuous traffic flow. The tunnel construction has necessarily provided for other underground services such as sewers, water and electric conduits. A feature that is new and highly desirable is the equalization of the intensity of lighting within and without the tunnels. This is accomplished automatically by the use of the photo-electric cell control, an achievement in tunnel lighting which destroys the unpleasant reactions to driving underground. It is my judgment that the French engineers have developed a new principle in the lighting of tunnels that will apparently overcome the generally unfavorable reaction, and will go far to popularize the use of this form of construction where it is the feasible answer to the problem.

Typical of the new radial highways is the St. Cloud auto road under construction on a wholly new location, to provide for a continuous flow of traffic to the northwest, beginning at the

Seine River and connecting with the existing national system at a considerable distance from the city. A new bridge is under construction across the Seine, and this new highway will pick up the traffic at the bridge head. After ascending a short grade to the level of a suitable soil stratum for tunnel construction, the line is carried beneath the St. Cloud hills. This ancient park and historic setting are thus left undisturbed, and beyond, the way lies through State forests and other lands on a wide right of way with all cross traffic separated. If pedestrians or bicycles are permitted, by-paths will be provided exclusively for them. As a part of this new development program, many of the old city bridges over the Seine are being replaced by new structures, but great care is taken to preserve the architectural harmony of the new with the old. These examples typify the plans to expand highway facilities to meet new conditions where the problem is one of adding to a system of highways originally laid out on a well conceived national basis. They sustain the principle that over a long period, a highway system originally well planned can be expanded to meet the growing needs without large abandonment of investment or changing to wholly new policies.

In Germany a wholly different situation is met. Until the present National Socialist Government took over the development, in 1933, of a national system of highways, the work was on a State and local basis. The situation is graphically described by

Dr. Allmers, President of the National Association of the Motor Industry of Germany. Quoting Dr. Allmers:

"In Germany there was a hopeless state of disintegration as in the Middle Ages. State and provincial governments, district and communal authorities, made every effort to obstruct a sound development based on uniform principles. The Ministry of Transport was powerless, and years elapsed before applications were sanctioned by the competent governments of the federal States. Every district road engineer built his roads in a different way, but nearly all of them built them in the wrong way, and only a few appreciated the requirements of automobile traffic and these few mostly lacked the necessary funds."

Here no national system had been planned and developed through the years, so it was necessary for the present German government to attack the problem of adequate national highways at the beginning. A two-part program was undertaken - the rehabilitation of the existing roads, which have have divided into national roads and highways of the first and second class. The work on these latter classes is administered, under general direction of the Inspector General of German roads, directly by the States and Prussian provinces. The second part of the program is the laying out and construction of a wholly new system of roads known as the Reichsautobahnen, under the immediate supervision of the General Inspector. The system as planned consists of about 4300 miles, which gives roughly three

lines across Germany north and south and three east and west. The literal translation of the word Reichsautobahn is national auto road, which gives immediately a vision of these great national thoroughfares, built on their own new wide right of ways to provide for a continuous flow exclusively of motor traffic over the whole mileage without conflict with the cross traffic on intersecting highways or railroads. The design calls for very easy gradients, long sight distances and long radius curves. There is some difference in these standards as applied in different areas, depending upon the general topography. The section design calls for two roadways, each approximately 29 feet in overall width, separated by a sodded strip 13.65 feet wide. Each roadway consists of a Portland cement concrete slab 24.37 feet, an inside curb 1.3 feet, and an outside curb 3.25 feet, in width. These curb strips are covered with a bituminous mix, thus giving the grayish-white center a wide black border. Cross highway traffic is generally carried over the autobahn without materially raising the level of these cross roads, meaning that sections of the autobahnen are placed in deep cuts. The autobahn in some cases is carried over railways. Various types of access roads have been developed, depending upon the actual amount of traffic eventually expected. The clover leaf design is in less general use with its 4-way connections than the so-called trumpet design. At the present time, upwards of 1000 miles of the autobahnen have been completed, although all of this mileage is not as yet open for public use.

As a national system, relative to the area of the country, this conception of the German Government goes far beyond any modern similar undertaking by any nation, when measured by miles, by the generous dimensions of the typical design, and by all of the auxiliary work, including structures, approaches and landscaping.

The construction features, as will be inferred from the description of the design, involve heavy grading. The carrying of the autobahnen below cross roads to provide high clearances alone accounts for heavy yardage because of the wide sections. The slopes are designed to permit the quick establishment of ground cover, and all the work, even that recently finished, is well sodded. The top soil has been conserved and replaced, and in an inspection covering most of the completed mileage there was no evidence of unprotected slopes or destroying erosion. Mechanical equipment in service is for large scale production. For hauling, use is made of industrial locomotives and small narrow-gauge steel dump cars rather than trucks which are common in this country. In the operations of pavement construction the curbs are first built. These provide tracks for steel rails on which move the combined mixer and distributor, the tamper and the finishing machines. A very dry mix concrete is used, and is heavily tamped. The quality of construction is good. The surfaces are smooth riding, and both the design and workmanship of the structures are particularly good. While the structures are largely of reinforced concrete or of

reinforced concrete substructures with steel superstructures, there are variations in the larger viaducts. In a few examples observed, masonry arches were used; long highway viaducts were largely of steel.

Where construction has been fully completed the meticulous attention which has been given to the final finish is praiseworthy, and the large scale operations reflect high-class engineering and efficient supervision. The German officials in charge, from General Inspector Doctor Todt, through the whole staff and including the workmen, can be proud of the high quality of the work they are producing.

There is little basis for comparison of this undertaking in Germany and the highway improvement going forward in this country. The situation in Germany is the very antithesis of that in the United States. Here the highway builders have been waging an almost losing struggle to provide highways for the already developed motor traffic. In Germany the system of super-highways is being built largely ahead of the highway traffic. Germany has recognized the utility of highway transport to the extent of having embarked on the building of these large capacity highways, and as a complementary national policy there has been put into effect every inducement to encourage the development of motor traffic. In all of Europe the motor car has previously been looked upon as a luxury and taxed as such. The relatively slow development there resulted from

high-priced cars and taxation handicaps against their utilization. Germany has not only done away with special taxes on the motor car in recognition of its potential general utility, but is actually permitting the cost price of trucks and business cars to be deducted from income on which taxes are paid. The encouragement thus offered by the Government has been so outstanding that the licensing of new cars jumped from 41,000 in 1932 to 180,000 in 1935, - an increase of 340 per cent. In addition the industry has been brought under governmental supervision, so that the commercial practices which had brought demoralization of the business have been rectified. Those most importantly interested now give highest praise to the stabilization of the industry which has thus been effected by the Government. Here we have an unusual expression of faith in the utility of highway transport. While the highway program was undertaken as one of the means for providing employment, which, according to reports, in 1932 reached one out of each three who were able to work, the policy of highway building represents a large investment on the part of the Government which there is no immediate possibility of recovering directly from imposts on the road users.

Since conditions are so dissimilar, what relationships are there, then, which we can take as warning or which we can emulate?

The most important is that we must grasp this highway problem in this country more firmly. We must raise our standards to the new levels demanded by the universal utility of the motor vehicle.

Two distinct programs are indicated. First, the systematic rehabilitation of existing highways by the actual incorporation of new construction to promote safety and greater utility. It is not a part of this discussion to elaborate the relationship of safety to highway design, since that subject is adequately covered by the paper to be presented by the Chief of the Division of Design of the Bureau, Mr. Toms. The second program is the long-time plan which will be based upon the principles illustrated by these examples from other countries, and by wide experience in our own country. The highway transport surveys now under way are basic. It is my deep seated hope that the highway department of each State will recognize the essential quality of the information which is being gathered. If the program of the next five to ten years is to provide the public with highway service that is not now even approached in any State, it must rest on this transport survey foundation. The underlying soundness of planning a belt line intercepting highway plus radial roads on new right of ways to serve the metropolitan areas, and introducing the new feature of providing this complete service only for the passenger motor vehicle, is supported by the traffic studies heretofore made. These studies indicate the overwhelming preponderance of passenger motor vehicle movements in the metropolitan areas, particularly on week-ends and holidays. To provide free flow highways leading from the cities well into the country, and to

permit the distribution of vehicles on these radial highways, from and to their own quadrants in the city over one or more belt line highways, will add immeasurably to the potential utility of the motor vehicle to the urban dweller, and such development will be supported by this increased use. This conception goes further, however, and recognizes that the trend of the world is toward a greater recognition of social values. The motor car is one of the instruments from which we are not securing the potential social services in the nightmare of congested streets or highways at times of peak traffic. Unfortunately there is no way to stagger Saturdays, Sundays and holidays. The city dweller either makes use of his car along with his tens of thousands of neighbors, or does not use it. These radial roads will be reserved for automobile traffic. There is need in some limited sections of the country for the extension of such roads until they connect with those radiating from other large centers of population to form continuous routes wholly disconnected from our present system of highways. To the extent that other traffic, such as pedestrians or bicycles, may use such routes, separate ways must be provided. But the design must go a step further than does the design of the German, the French or of our own roads, and provide for the complete separation of local from through travel by parallel service roads. The exclusion of local travel, as on the German roads, is unthinkable. In fact, the exploding of the cities by the development of small

accreages for homes is dependent upon the provisions for local traffic service. In our programs, both for the rehabilitation and for the long term plan, we must accept as an essential the separation of grades at major highway intersections. This is one of the most important factors in stepping up the safe utility of our existing highways.

Notwithstanding the very extensive operations which have been carried on cooperatively by the State highway departments and the Bureau of Public Roads, for the past several years, this discussion is largely devoted to the problem of lifting the standards of future operations rather than to the recording of the activities of these immediate years, which have been filled with earnest endeavors to give the maximum of employment. The State highway departments and the highway contractors merit an expression of sincere appreciation on the part of the Federal officials for their diligence, patience and effective efforts to carry into effect regulations which were diverse and difficult. This problem of employment is yet with us and to a large degree will remain with us, but we can, in addition, recognize more fully that we must intelligently look at what we are doing, and determine the method of attack on these problems of highway traffic that are growing constantly more difficult.

Since the emergency programs to provide employment were undertaken in 1933, the highways put under way by the State highway departments and the Bureau from funds under the immediate direction

of the Bureau have reached more than 62,000 miles. This is equivalent to at least 12 highways across the country from north to south, and an equal number from east to west. More than 21,600 miles have been included in the construction programs of the last 18 months only. Even this immense program has been too slow. It has not with sufficient rapidity absorbed the funds available for construction. There are many causes that have delayed the beginning of work on important projects, particularly right of way difficulties, but I am bringing this observation into the discussion here since we have now to face the formulation of a new large program for the coming year. Highway construction, including State and Federal funds, can reach above \$800,000,000 if the States all meet their Federal aid apportionments. The only way that the public can be led to see its loss in the drag in State programs because of diversion of highway funds to other than road purposes is by the formulation of the timely programs that are possible if these funds are conserved and used for the purposes for which these special taxes are levied. As an integral part of the present highway policy, the participation in the improvement of major traffic routes within the cities and the grade crossing elimination projects are rapidly maturing facilities of the utmost value. In our new program there is the introduction of the secondary road improvement program as a part of the permanent highway legislation. Without going fully into the approach to this important new development,

two principles will be observed in the regulations which are issued, - first, that the Federal Government will deal only through the State highway departments, and second, that the application of the funds will be upon a definite secondary road system.

This year when the need exists to raise the standards of highway planning and engineering to higher levels, it is particularly fitting that the Association should meet in San Francisco. The intelligent vision that has produced the Bay Bridge fills the heart of every highway department member with pride to be in and of the fraternity. The maturity of the conception, the graceful design, the complexity of the problems overcome, and the now apparent tremendous economic influence that the bridge will exert, are symbolic of what highway transport means to our nation. The completed bridge is an enduring record of devotion to the public service of the State Highway Officials of California. To the members of the State Highway Department and the Director of Public Works, the congratulations of the highway officials of the nation. To Charles H. Purcell, Chief Engineer, to C. E. Andrews and the corps of able engineers assisting them, the acknowledgment of us all of a public service faithfully and manfully carried through to a magnificent success.