

## INTERSTATE OR SUPER HIGHWAYS

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There are really two important phases of highway design and administration carried in the topic assigned to me which provides a welcome opportunity to distinguish between the two concepts, and perhaps to clarify some misconceptions. It is a matter of concern to the Public Roads Administration that the realization of an adequate interstate system may be jeopardized by the false assumption that design standards will be arbitrarily fixed at levels which are prohibitive because of high costs. This approach is unintelligent, since it denies the precise engineering policies now actually incorporated in practice. Design decisions founded largely upon personal opinion and sometimes pressures of various kinds are being replaced rapidly by highway planning techniques and criteria evolved through long, patient and intelligent studies of the relations between highway use and highway improvements. This relationship is so intimate it is never free from self interest. Many times I read with appreciation the little placard which Mr. Frank Page, one of the great pioneers in modern road improvement, whose vision was not limited to State horizons, kept hanging above his desk, - "I am prepared to admit that your road is the most important in the State; now, what else?" It signalized Mr. Page's desire for a factual rather than an opinionative approach. The latter undeniably has been a potent

influence in the writing of highway legislation. But the virtue of a democracy is its concern for all interests measured in terms of the common good. It is sound democratic doctrine that the priority and form of public undertakings should bear an equitable relation to the needs of the community served.

The practical application of this principle has led to road classification based primarily upon the number of people who are served. Perhaps the distinction is not written into the laws, but back of the laws the classification of roads has been one of the means employed for reasonable adjustment of the degree of road improvement to the order of road need. Road classification by groups has evolved over a long period, and the conception of an interstate system of highways is a logical outgrowth of the concentration of traffic on a limited mileage of major roads. This is a National rather than a local characteristic. It was acutely apparent during the war. It is factually confirmed during peace times. So the idea of an interregional, or legally an interstate, system of roads, was a logical conclusion when through the State-wide planning surveys the fact was established that a National system of about one percent of our public road mileage could be selected having a potential service totaling 20 percent of our rural highway traffic.

On the other hand, the idea of super highways stemmed from the demonstrated incapacity of the conventional street or highway to carry efficiently the volume of traffic concentrated on particular sections. The term "super highway" is not a very good engineering term. It lacks definite meaning.

There are many terms rather loosely applied to describe highways of the class more precisely defined by the design characteristic which they have in common, i. e., controlled access. The terms, "parkways" and "freeways" are used frequently in legislation, but with certain distinctions of location or of the traffic to be carried. "Expressways" and "super highways" are also in more or less common use, but these carry indefinite and sometimes confusing implications. Referring to the assigned topic, interstate highways should be planned for development as controlled access highways, if and when the traffic requires that type of design, but there are many miles of highways and city streets which should be designed as controlled access facilities quite apart from their relation to the interstate system. This class of highways has a service potential so important, and in limited mileage occupies so important a place in the solution of acute local problems, that the application of the design principles should not wait upon, or be limited to, what must necessarily be the slow realization of a complete improvement of the interstate system.

#### Controlled Access Highways.

Probably the first examples in the United States of roads with controlled access consist of the four streets which cross Central Park in New York City from 5th Avenue to 8th Avenue. These were constructed in the 1880's or 1890's for the use of horse-drawn truck traffic crossing Manhattan Island from one water front to the other without impairing the park environment. They are still in existence. They are depressed with stone retaining walls on both sides. They are crossed with stone bridges

for the accommodation of carriage roads through the park that are probably the first examples of highway-highway grade separations. The carriage roads themselves also could be considered examples of controlled access. Similar examples are the Fenway in the Boston Park system and the roads in Fairmount Park in Philadelphia. These were probably constructed in the early part of the present century.

Nature has entered the design area in the roads which by their physical limitations become controlled access highways, such as the roads through swamps in the Carolines.

In cities there are good examples of a "boulevard" type of development. One of the outstanding is the Grand Boulevard in the Bronx. Long ago the pioneer planners envisioned and constructed a street, on wide right-of-way, which consists of a central pavement for through traffic, two frontage roads for the service of adjacent land, and liberal park widths between them, one of which was used in early days for equestrians. Before 1910 plans were under way for carrying several other important cross streets under the Grand Boulevard despite the fact that the construction might necessitate excavation through solid rock. These long grade separations carrying pedestrians, vehicular and trolley traffic generally under the Grand Boulevard, were outstanding examples of construction to free the Grand Boulevard from cross traffic.

One of the earliest examples of the more modern controlled access highway is the Bronx River Parkway in Westchester County and Bronx County, New York. This project was begun as an attempt to protect the historical

old Bronx River, but as studies developed, protection was found to be feasible only if the land on both sides were purchased, and once the land was purchased it appeared desirable to use it for park purposes and then for a parkway to relieve the congestion on the heavy north-south streets of the area. This parkway was designed about 1914 and completed in the early 1920's. It stands as a demonstrated proof of the value of controlled access because, whereas other roads of much higher roadway standard built later have since become obsolete because of roadside interference, the Bronx River Parkway is more beautiful than ever, and is still, except for a worn surface, fully usable at the 35 miles per hour for which it was designed.

More recently a number of such highways have been built, which, because of fantastic increases in highway traffic, have progressively recognized the need to obtain maximum capacities. Of these, the system of controlled access highways around New York City, such as the West Side and Grand Central parkways, the Merritt Parkway in Connecticut, the Arroyo Seco freeway out of Los Angeles, the Shirley Highway and Pentagon road system across the Potomac from Washington in Virginia, are good examples. Prior to the war, the German Autobahnen were well under way. In Italy there was a limited but earlier development of the Autostrada, and Holland had started a limited mileage of motorways.

#### Design Characteristics of Controlled Access Highways.

From the earliest beginnings certain characteristics distinguished this type of highways. Foremost is the provision for access, or exit, at predetermined locations, with the design arranged to feed traffic

into the main stream directionally. Cross traffic at grade is eliminated. Generally, the opposing traffic flow is separated by a median strip and where needed parallel frontage roads are provided to give access to local property. Provision is made for different types of traffic. This requirement has been given less attention in this country because motor traffic has become almost exclusive of any other type. In other countries this is not true. In Holland, for example, separate paved ways are provided for bicycles. More emphasis should be given in this country to walks for pedestrians, particularly in suburban and urban areas, where they would have great use, provided they are constructed to standards which would encourage their use. This would mean a good surface, direct for the probable movement, well drained, and not too close to the through traffic pavements.

Also little provision has been made for bicycles. The number of bicycles runs into millions, and if proper facilities were provided, their use would increase, not as a means of transportation as they are used in several European countries, but for recreational purposes.

#### Geometric Design.

Width of right-of-way should bear some relationship to the value of the land. Where frontage roads are to be constructed, in addition to the through traffic lanes, about 300 feet is a desirable minimum, but the width need not and should not be arbitrarily fixed. Where heavy cuts and fills are involved, there should be sufficient right-of-way for flat slopes to decrease hazards and cost of maintenance. Variable-width landscaped areas between opposing pavement, and on the roadside as well,

are pleasing designs. As far as the individual driver and passengers are concerned, a controlled-access highway having a minimum of protective width and a minimum of median is only one step better than the heavily traveled, non-protected highway. On the other hand, the median width should not be so wide as to burden administration with high maintenance costs.

The movable median, as used on Chicago's Lake Shore Drive, has limited application. To a greater and greater extent, traffic in peak hours is heavy in both directions, and the comfort of a median of appreciable width justifies the construction of additional traffic lanes for the one-way peaks. On expensive facilities such as long-span bridges, where shuttle traffic is pronounced, an alternation of the direction of traffic on the middle lanes may be justified. This is done on the Delaware River Bridge at Philadelphia and one or two other places. At these locations the change in direction is effected by traffic light control, which, from the standpoint of maintenance, is superior to the movable curb though not as safe.

A width of 12 feet for traffic lanes on controlled-access highways is becoming increasingly accepted, though an occasional 13-foot traffic lane appears on some plans. In urban and suburban areas where large peak volumes are likely to occur, the provision of shoulders enough for accommodating all stopped vehicles is essential, but the surface should not encourage their use as a traffic lane. The evidence supporting this need is piling up, particularly in the New York and northern

New Jersey area, where highways reach peak capacity loads frequently. The original narrow shoulders of the German Autobahnen proved a defect even with an over-capacity in the pavement width.

It is also a serious error to design long stretches without varying the width of the median strip, the alinement and gradients of the opposing roadways. If an exact, never-changing cross-section is used, the flow of the multiple parrallel lines impacting upon the driver's vision becomes hypnotic. Such a design is deadly monotonous and results in fatigue and drowsiness. The opposing roadways may each follow the topography on independent grades, and swing outward to the limits of the right-of-way, and again inward with a profitable return in construction costs and a much more pleasing effect. The DuPont Highway in Delaware and the Suitland Parkway out of the District of Columbia to Andrews Field, are examples of this type of design. Both of these highways also prove the good planning which should be followed in developing the interstate systems. In each case the right-of-way was acquired for at least a four-lane divided highway, but only one roadway, for use in both directions, was built. The second roadway has been added to the DuPont Highway, but only the graded second roadway has been built on the Suitland Parkway, and a number of the separation structures have yet to be built. These examples are given since they set the very important precept that controlled-access highways can, and generally should, be planned for stage construction. This is quite true of the rural sections of the system.



### Capacity Cost Comparison.

Very naturally, the first reaction of the highway official is that highways of this class are too expensive. This results from our thinking in terms of cost per mile, which has long been our unit of measure, rather than cost measured by vehicle capacity per lane per hour. Some such cost unit will have to be used in the future in our plans to relieve urban congestion. One well designed four-lane express-way will carry the same number of vehicles at nearly double the average speed as five 40-foot-wide ordinary city streets on which parking is prohibited, and under favorable control of cross traffic from intersecting streets. Under unfavorable conditions eight 54-foot-wide city streets would be required to carry the same volume of traffic that may be carried by a single four-lane controlled-access highway. These comparisons are so startling that many well-informed engineers will not easily accept them. They will doubtless accept, as a fair measure to use in cost comparisons, the proven lane capacity per hour rather than the per mile cost without qualification as to capacity per hour. The per-hour capacity is all important in meeting the problems of urban congestion, because it is the normal pattern of morning and late afternoon periods of peak traffic which ties our arterial streets in knots.

### Safety Record.

The safety record of controlled-access highways is excellent. The Arroyo Seco Parkway compared to major streets in the same vicinity has five to eight times less fatal and personal injury accidents. The

Merritt Parkway in Connecticut has shown the amazing record of 3.5 fatalities per 100 million miles of travel. At the time of the President's Highway Safety Conference in May, the National average was 12 per 100 million vehicle miles. It has since been materially reduced, but as yet stands at 8.

#### Legal Aspects.

The old English concept of the public highway was not a physical utility. It was rather a right to pass, that is, a right to pass over lands, which was established by use. Today some of the old paths still exist in the metropolitan area of London. They are carefully kept open for use, although too narrow for any but pedestrians. These were the former paths between farm fields. Through the years this concept of the right to use the road has gradually changed until the public highway has become subordinate to the lands through which it passes.

The opening of new points of entry, sometimes at short intervals, is only one of the demands frequently made by the owners of adjacent property. Another is the establishment of service stations and roadside markets, which providing no space for customers, lead to parking upon the traveled roadway itself. The loss of safe capacity of our major highways from these and similar causes is a matter of grave concern to highway officials who are endeavoring to build safety into our roadways.

This situation has become so serious that legislation has been enacted by 24 States to establish as a legal entity the controlled-access highway. This type of design is also recognized in the Federal highway

legislation of 1944. Before planning a highway of this character, proper legislation must be secured to safeguard the investment. There is no idea of not permitting adequate service to the land adjoining. Actually, this is much better provided by local service roads which are brought into the through lanes of travel at selected intervals where safe provision is made for the traffic entering or leaving.

#### Interstate Highways.

From this discussion it will be seen that controlled-access roads are not necessarily confined to the interstate system. Conversely, there is a large percentage of the mileage that will constitute the system on which the volume of traffic will not require standards necessitated by high volumes of traffic. This is only another way of saying that the principle of engineering design and of sound planning based on factual surveys, will govern the improvements as they are undertaken, and not some arbitrary determination.

Probably many of you are familiar with the reports issued by Public Roads on Toll Roads and Free Roads and Interregional Highways, so it is unnecessary to review the long, detailed studies of the Statewide planning surveys upon which these reports were based. The report on Interregional Highways was issued under authority of the National Interregional Highway Committee appointed by President Roosevelt in 1941. On the basis of recommendations made in the latter report, Congress, in the 1944 Federal highway legislation, authorized the selection of a system of interstate highways

not exceeding 40,000 miles. In the selection of the system the same plan has been followed that has prevailed since the establishment of the Federal-aid highway system following the Act of 1921. The recommendations of the State highway departments have been sought, and the Public Roads Administration has been acting as the coordinating agency. The States have been generously helpful. There have been so few instances of failure to agree between the States that these are negligible. As of the present, about 37,000 miles are agreed upon, of which 2,800 miles are in urban areas. There are only a few rural routes of any consequence whose determination is now pending. These will soon be settled and the system officially established.

#### Policies of Improvement.

This is the current status. But what will be the policy as to the improvement of the system? Perhaps, first, the question is pertinent as to why we need this system. Based on prewar traffic data, the 37,000 miles of the system were carrying upwards of 100 million vehicle miles daily. Now the total is substantially greater. In eleven States the average daily traffic was above, in some of these far above, the safe capacities of the conventional two-way road. Four more States are rapidly reaching this status. Moreover, these are States in which the particular routes were among the earliest improved, with the characteristic poor alinement, short sight distances and excessive grades. Thus, a major rebuilding program is inevitable. Standards reasonably uniform

between the States are needed. This is one ruling reason for the establishment of the system. During the war we experienced the essential service of our highways, but we found the required services were Nationwide, and not confined to any group of States. National services for peace times as well as for emergencies requires an adequate National system. The proposed system has been carefully scrutinized by the War Department.

But the most compelling reason is the fact that these major routes are piling enormous volumes of traffic into our cities, large and small, and adding congestion to already over-filled streets and over-crowded parking facilities. The need to plan and to get under way the urban distribution and terminal facilities is paramount. Our traffic studies show that the purely urban traffic has an influence extending radially from six miles to 30 miles outward from the heart of the city, the distance varying with the size. Generally, then, it is within this urban zone that the Public Roads Administration will be most interested in the development of the Interstate System, with standards that provide opportunities to use stage construction, so that as a long-term undertaking the controlled-access type will evolve where and when the traffic volume justifies. On the rural sections the main concern will be, as renewals and reconstruction of existing highways are undertaken, to make certain that the location, alignment and available right-of-way will permit future expansion to meet a growing traffic.

In summary, it is apparent there is now the need to plan and to carry out major improvements in the urban areas. Employment of the controlled-access type of design will be useful to relieve congestion and to relieve local traffic and local business of through traffic interference, but such projects will be limited in mileage. The important principle is to work toward an adequate pattern. For the major routes of the State, whether on the Interstate system or not, where replacement projects are planned, they should be so conceived that they can be added to, rather than discarded. North Carolina, for example, has a good many miles of highways on which the traffic is rapidly overtaking the present capacity. The State has a long and enviable record of road building. Probably the average citizen does not appreciate how great a burden the State took upon its shoulders in assuming the improvement and upkeep of all the roads. This organization can be most helpful in bringing home to the people of the State the constantly growing traffic requirements, and the need for more adequate financial support if these requirements are to be met.