

give access to the through pavements only at limited intervals. Where pavements pass through highly developed areas, I think such service drives will be necessary to overcome constant interference of traffic turning in and out of the property with through traffic. These service drives would not, of course, be improved to nearly as high type as the through pavements. In most cases a surfacing of gravel or crushed stone would be sufficient, and the design standards employed could be much below those which we would apply to a high-speed road.

STATE ROUTES THROUGH CITIES

Early in my talk I stated that I would confine my discussion largely to rural highways. I think it is appropriate to remark, however, that most all states have some critical problems to solve in cities. Our biggest problem in Illinois, of course, is in the city of Chicago. Numerous schemes have been proposed for bettering traffic facilities there, and, frankly, that is indeed a real problem. If the various governmental agencies involved had unlimited funds on which to draw, there is no question but what they could construct a system of super-highways, elevated or not, which could take traffic into and out of Chicago with dispatch. Various interests have proposed numerous schemes, but almost without exception they disregard the tremendous outlay of money for construction and property damage. However, it is a problem with which we have to cope in Illinois, and I assume that other states have situations which approach it. Earlier in my remarks I stated that while only a small percentage of our roads would ever justify more than two-lane construction, that small percentage of roads was highly important because of the large amount of traffic served. The same is true of our highway situation in Chicago. The mileage involved is an almost insignificant percentage of our primary road system; however, that limited mileage is of great importance to hundreds of thousands of highway users. It is natural, therefore, that the situation there should be of major concern to us, and we may expect the ultimate solution to be far removed from the two-lane highway, from which point I started this discussion.

BEYOND THE TWO-LANE ROAD

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I wish to compliment Mr. Surman on his very interesting and able presentation of the subject "Beyond the Two-Lane Road." I have had the pleasure on another occasion of listening to Mr. Surman present a paper on design of divided-lane highways, and I wish to say I consider him one of the best

qualified engineers in highway work to speak on this subject.

We wish to agree with Mr. Surman that a properly designed, two-lane pavement should carry more than 3,500 vehicles per day, 15% of which are trucks, before more than two lanes are needed. This measure of capacity we accept in Indiana, but we believe that another factor enters into the problem; and that is the accident rate which occurs on those stretches of road under consideration for divided-lane construction.

The financing of multiple-lane highways presents a serious problem to most of the middlewest states, and especially is this true in Indiana. Many of our 18-foot, high-type roads have so deteriorated that rebuilding or replacement is a necessity. The problems of width of pavement and number of lanes are the first questions facing the engineer for solution. We immediately call on our traffic engineers for a traffic analysis over the extent of road under consideration. With all our data at hand, it is still possible that we may be wrong in our decision as to type.

The value of the data developed by the State-Wide Planning Survey is invaluable in selecting our road types on new construction and reconstruction. The mass of information assembled by this survey can answer almost any traffic-flow problem that the design engineer wishes to ask. The forecasting of future needs can more easily and accurately be arrived at than ever before.

We have constructed in Indiana, on new location, several projects of two-lane road-width for the present, but we have provided sufficient width of right-of-way for construction of the additional lanes when future traffic density or traffic accidents make it necessary. Purchase of the additional width of right-of-way for a second lane in central and northern Indiana costs on an average approximately one thousand dollars per mile more. We feel fully justified in making this expenditure where forecasts of requirements indicate the necessity for the additional lanes within the next ten years.

CENTER MEDIAN STRIP

During the past year we have built two projects with a center median strip separating the opposing traffic. One of these projects is adjacent to Indianapolis; an existing thirty-foot concrete road was widened to forty-four feet, four feet of which is used for the four-foot median strip in the center. This strip is but five inches in height and can be safely crossed at moderate speeds. As this is through a suburban area, cross streets occur at an average of about 400 feet. At all street intersections crossovers are provided.

This pavement was opened only last fall and up to the present I am disappointed in this type of median dividing strip. The divided lane section is about four miles long, and

the median strip is constructed in three different colors over this distance. A recent trip over this road after dark convinced the speaker that there is much to be desired in visibility. The different colors could not be distinguished one from the other. In fact, at times, it was difficult even to see the four-foot median strip. My last inspection was just after a snowfall, and the median strip had been splashed with mud and slush until its visibility was practically zero.

I like the suggested design of the speaker—a four-foot bituminous strip dividing his two-lane road. If the lanes are of concrete and the four-foot median strip is bituminous, the contrasting color will do a great deal to eliminate medial friction. We shall watch this construction with much interest. May I venture the prophecy that if this two-lane construction is increased to four lanes later, the four-foot median strip will have proved so satisfactory that it will be left in place rather than replaced with a curb section.

SOME ACCIDENT RECORDS

When we opened the fourteen-mile project on U. S. 30 east from U. S. 41 a little more than a year ago, we felt that we had the most modern and best highway in Indiana and one on which accidents would be reduced to a minimum. This section consists of two, 22-foot lanes divided by forty feet of park section and built on a 200-foot right-of-way, all on new location.

The accident experience on this dual lane section just compiled by our traffic department for the calendar year of 1938 is very interesting. The dividing parkway has made it impossible for medial accidents to occur on this road; yet in one year on this fourteen-mile section, two persons were killed and property damage of \$3,340 was reported in twenty-one accidents.

During the year there was reported from rural highways of the state system, a total of fewer than 10,000 accidents, which makes an over-all average of one accident per mile. Here we have this road representing the highest type of construction in the state, with a light traffic load, averaging 1.5 accidents per mile. Seventeen of the accidents were on dry pavement, and thirteen occurred during daylight hours. One, occurring on October 22 at 3:00 P. M. on a dry pavement, is particularly interesting. A driver sneezed while passing a car; result, two persons injured and \$440 estimated property damage.

These statistics are not an argument against construction of this kind of road but they clearly demonstrate that the best engineering practice will not eliminate or prevent accidents. The human equation is very much in evidence, and there is no doubt that eliminating medial exposure also results in increased speed on the part of drivers who assume that high

speeds are safe on this type of road, with the resulting increase of other types of accidents.

Somehow the message must be conveyed to drivers of cars and trucks that all safety engineered into our highways can be completely nullified by increased speeds.

REMEDIES FOR TRAFFIC CONGESTION IN METROPOLITAN DISTRICTS

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A metropolitan district is commonly known as a district which includes a large center of population. Congestion, when applied to traffic, means overcrowding or mutual interference. Remedy, of course, means a cure or correction. To state the subject in a different way, one might say we are discussing what can be done to facilitate driving conditions in cities and their immediate vicinities.

Streets and highways have been called traffic arteries, and rightly so. The traffic which moves over these arteries is the very life blood of our economic existence. A city exists because of transportation facilities. It must be connected with its neighbors. Each citizen must be able to receive from distant sources all the commodities which he eats and which he uses in his business. Our traffic arteries must be used to transport and distribute those articles which the city dweller produces. No chain is stronger than its weakest link. Our major traffic arteries in cities furnish one of the strongest links in our national transportation system.

A city has been defined as a "large aggregation of people having a high degree of density and a facility for intercommunication." Without this intercommunication, a city would die. As we meet or fail to meet the increased demand on our traffic arteries in cities, so does the growth of our cities increase or decrease in direct proportion.

In Missouri, one of the early problems confronting the highway department in its road-building program was that of providing ingress and egress to cities for local traffic without at the same time penalizing through traffic by routing it through the congested sections. At the start the department encountered old, long-established conditions set up by the slow-moving, horse-drawn vehicles and a system of county roads converging toward the business sections. This was not a serious condition at the time that the road program was planned, for traffic was then relatively light and originated within a few miles of the city. With the increase in the use of automobiles, however, the converging of routes toward the business sections resulted in much congestion of downtown