

the developments might have taken place in this area anyway. Much of the area was rocky and swampy, and it seems unlikely that the development would have taken place had the highway not been built there.

The efforts of certain promoters have been an important factor. They came in early, bought up the land, and offered package deals to individuals --making it quite attractive for them to locate there. Other promoters are still beginning to enter this activity.

The method of attack so far has paralleled that described by Mr. Adkins for the Dallas study. We are working with the cities and towns, because their governments in Massachusetts possess most of the useful information. Afterwards, we will have to assemble the data and try to see to what extent the highway has influenced growth.

In the town of Needham, for example, a new industrial center was opened and has now nearly reached saturation so far as available industrial sites are concerned. The net values created, minus cost of the improvement, have amounted to a savings of about \$5 per \$1,000 of evaluation on all taxable property in Needham in 1956.

The Chicago Transportation Study **J. Douglas Carroll, Director** **Chicago Area Transportation Study**

In the Chicago Area Transportation Study an attempt is being made to simulate, in model form, an entire metropolitan area, so that it can all be "remembered" on a computer in a very crude way. The operation consists of two parts: all of the land use of the metropolitan area is recorded and its transportation network also is recorded.

The economy of the area and the population are going to grow. But the shape of the growth is affected by the location of the transportation utilities. It is hoped, by manipulating this on a computer, first by revising locations and capacities of the network, to see what the consequences are in terms of land use readjustments. On the other hand, it is planned to examine land use growth potential to see what effect it has on the location of the highway network. We hope that these studies will yield some measures of the related effects of road improvements on land uses and, thus, land values.

In terms of total benefits, the problem is an interesting one. The benefits are calculated by simulating traffic flows through the road network and calculating the direct costs for building and the user's costs after each improvement has been added. If only one highway or one rapid transit route is built, the benefits accruing to the users from that particular facility would be very high, because of the low quality of competing facilities, that is, the benefits per unit of cost would be high.

As another piece of the network is added, the incremental savings due to the second facility would be slightly less per mile than the first one was; and so on, until the network is completed.

Now, the problem is how large a network to construct. Should one build to the point at which the gross benefits are exactly equal to the gross costs? At this point, we have perhaps substituted highways and transportation for health and welfare and other similar things. Obviously, we don't go all the way; we stop at some intermediate point.

This is really a question of criteria for the allocation of limited resources in order to arrive at a transportation system which has benefits of a particular magnitude in proportion to the outlays involved.

We don't know the answer to this. We have only come to this position by starting with benefit-cost studies and discovering how inadequate they are to give the complete answer. In these analyses the service of the facility is compared with its investment cost, thus you can see what you are dealing with in a limited framework.

The early studies done in California compared the actual cost of driving over a mile of expressway as compared with driving over a mile of city streets. They showed that expressways were something like two and a half times as efficient in terms of direct user costs. We all recognize, however, that those who use an expressway must also use additional portions of city streets to get on and off it; moreover, persons using expressways travel farther to reach the same destination, so that the appropriate consideration must be the whole journey—not just one mile on expressway as opposed to one mile on city streets. Therefore, we began to measure the entire cost of the trip over the alternate routes.

This really did not give an immediate answer to location problems because when the entire benefit-cost picture was assembled it was found that it did not measure the effect of relative location. A shift in the location of one route might, in effect, reduce the vehicle miles of travel, but what the shift in location would do to the balance of the network could not be determined without a tremendous amount of new calculation.

Moreover, one link in a highway system might make all the others more productive because it provided greater route choice and longer stretches of freeway to drive on. The ultimate answer could really only be achieved by the crudest kind of calculation in which an entire design was tested against the growth of the community at a mid-point in its development. It became a self-defeating problem to consider doing this by conventional methods.

We are attempting a unique experiment; namely, to relate the entire land use pattern envisioned to the entire highway network through use of the memory device of the electronic computer, and then to measure the actual costs to the driver of using various alternate routes of travel.

As far as the indirect benefits go, we have not been able to measure them. We do have a means of calculating the mean accessibility of every point in the metropolitan area in terms of time and distance to every other point in the metropolis both with and without this network. It is our assumption that as this accessibility enlarges, or as time-distances shrink, we thereby increase the benefits to each site in the metropolitan area. This represents a social benefit, but we don't know yet how to measure it.

Method of Analyzing Agricultural Land Impact

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Let us begin with a concrete situation of the economic impact on agricultural land. I am thinking now of high-priced cash grain land in the middle of the cash grain area. Here are broad 200- to 300-ft highway rights-of-way located through the center of the land sections and avoiding