

An Exploratory Study To Identify and Measure The Benefits Derived from the Scenic Enhancement of Federal-Aid Highways

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•THE Highway Beautification Act of 1965 is a joint attempt by the Federal Government and the various state governments of the United States to provide for scenic development and road beautification of Federal-Aid highway systems. There are three major sections of the Act: Title I and Title II deal with provisions for limiting and controlling outdoor advertising and junkyards adjacent to highways; Title III is concerned with the need for landscaping and scenic enhancement of highway systems.

The primary objective of this study is to focus on Title III by concentrating on the problems involved in identifying and quantifying the benefits and costs that result from highway beautification.

In undertaking such a study, problems arise as to the selection of the proper method for evaluating the economic effects and social benefits of the scenic enhancement of highways. Also confusion exists as to what constitutes scenic enhancement. Moreover, the lack of proper data necessary for the determination and measurement of the effects of highway beautification has proved to be a troublesome factor.

Two procedures yielding two widely different measures of the expected effects of a highway beautification program can be suggested. The first, which has been suggested by the U.S. Bureau of Public Roads, is the economic impact study. This approach is a valid way of measuring the regional effects of scenic enhancement on employment, income and levels of economic activity. It fails to measure, however, the total net benefit of the proposed action to the whole nation, and therefore, it does not reveal whether the project should be undertaken in order to increase the national welfare. Instead, impact studies merely measure the "make work" capacity of a government project; this type of analysis is relevant from the national viewpoint only as a measure of counter-recessionary efficacy—despite its obvious attractions to local real estate interests and local chambers of commerce.

Whereas economic impact studies reveal only the redistributive effects of government action on particular sectors within the economy, the use of the second type of study, a cost-benefit approach, can be made to reveal the costs, or disadvantages to the nation as a whole, and the benefits, or advantages to society of the various alternatives (governmental programs), thus developing a systematic basis for analyzing the desirability of public expenditure on scenic enhancement programs. This approach can indicate the net gain or loss to society from allocating economic resources to programs for scenic enhancement of highways.

The main problem of utilizing the cost-benefit approach is in correctly enumerating and evaluating the benefits and costs involved. (The same problems are, of course, found in other areas in which cost-benefit analysis has been applied—weapons systems, air pollution, water resources use, etc.) Fortunately, the cost aspect seems to contain no major difficulties and can be readily ascertained from engineering estimates of the cost of scenic enhancement per mile of highway; although the problem of exactly

what it is that constitutes scenic enhancement and how it differs from highway improvements has to be thoroughly defined. The identification and economic quantification of benefits is considerably more difficult, however, especially in the absence of market transactions.

Possible benefits derived from scenic enhancement of highways appear to fall into four categories: (a) visual pleasures which make a more enjoyable trip, (b) a possible change in the accident rate, (c) a possible alteration in the average time of trips, and (d) a possible difference in vehicle operating costs and in highway maintenance costs. Hopefully, these and perhaps other benefits to both users and non-users of the highway can be identified in the course of the study.

The measurement of these benefits, once they are identified, hinges on the availability of appropriate data to determine the significance and magnitude of the benefits, as well as their economic value and particular applicability to the populations of specific states possessing widely different social and economic characteristics affecting highway use.

Preliminary investigation of the available literature reveals that very little data have been collected primarily for the purpose of allowing selected benefits of scenic enhancement to be analyzed through statistical techniques. Data related to the aesthetic benefits derived from scenic enhancement, for example, seem to be almost entirely lacking. Given the time limitations of our study, it did not seem that this problem could be surmounted by a sample survey.

Accordingly, attempts are being made to utilize data collected from various sources for other purposes to enumerate and evaluate (a) the persons who engage in driving for visual enjoyment (benefits) and (b) to see if differences in accident rates can be statistically associated with scenically enhanced highways.

BENEFITS FROM DRIVING ON SCENICALLY ENHANCED HIGHWAYS

A survey of 922 households by the Michigan Survey Research Center in the fall of 1959 was the basic source of data. Among the many socioeconomic and attitudinal questions asked of each household was the frequency of engaging in pleasure driving over the past 12 months.

A multivariate regression analysis of these data has been undertaken to isolate the significant variables that influence the desire to engage in pleasure driving. Our concern is, of course, not only with whether a person went pleasure driving or not, but also the number of times during the year that such an event occurred. The natural approach might seem to be using days of pleasure driving as the dependent variable, regarding those who did not go as zero days. There is a statistical weakness in this approach, however, since there may be many non-pleasure drivers. This will lead to a concentration of values at zero, while there can be no negative observations. Thus, while an estimated linear regression relation will have a tendency to be above the axis over the relevant range, the relationship will tend to be very flat because of the bunching of the zero observations. This will lead to an underestimate at the high end of the relationship. Therefore, the normal regression model is likely to be inappropriate when the variation of the dependent variable is bounded and there is a concentration of observations at the boundary.

To avoid this problem, the regression analysis is broken into two stages. Initially, the regression analysis is being utilized to determine the conditional probability of participation in pleasure driving via dummy dependent variables with a zero vs one code for no participation during the past 12 months vs participation (regardless of amount). If this stage is successful in indicating the major significant explanatory variables which affect the probability of engaging in this activity, then, at the second stage, the zero participants are removed from the sample and the actual days of participation are used as the dependent variable of the pleasure driving sample population. A multivariate regression analysis of this group will yield a predictive equation for the number of days of pleasure driving for any given hypothetical population.

In general, the independent variables that we are testing consist of two types, socioeconomic variables (e.g., age, income, sex, and race) and locational or physical

variables (i.e., variables related to region of the county, urban-nonurban environment, and age of car).

Pleasure driving is apparently a ubiquitous phenomenon with almost 80 percent of the households in the sample indicating some engagement in this activity in the 12 months prior to the survey. Moreover, 12 percent indicated that they wished to participate even more often than they had in the past year. Unfortunately our data do not indicate whether the inaccessibility of facilities or some other factor is constraining participation in pleasure driving.

The initial runs have provided some interesting results. For example, the age of the car was not a significant variable in explaining the probability of participation. Apparently if an individual goes pleasure driving, his demand for this activity is not impaired by the age of his car. At the present time, research has not indicated that either region of the country or the degree of urbanization of the area in which the respondent resides affects the probability of his engaging in this activity.

Although this stage of the analysis is not complete, it does appear that age of the head of the household, income level, the sex of the respondent, and the presence of children under 14 are the major significant socioeconomic variables in explaining the probability of driving for pleasure. Although the statistics are tentative, indications are that the probability of participation in pleasure driving decreases, all other things being equal, by approximately 0.007 for each year of age. Thus the probability of a 40-year-old individual going pleasure driving is about 0.14 less than a 20-year-old who has all the other socioeconomic characteristics except the age of the 40-year-old. Therefore, despite the fact driving does not require strenuous, physical activity or agility which is normally associated with youth, age does reduce the probability of participation somewhat.

The probability of pleasure driving increases with income by approximately 0.013 per thousand dollars of income. Thus it would appear an increase of \$1000 in income level would, all other things being equal, increase the probability of pleasure driving by 1.3 percent. The importance of income is fairly obvious, at least at low levels of income, since some minimum is required to own or at least operate a car for pleasure. The analysis shows that 40 percent of the sample population whose income is below President Johnson's poverty line did not participate in pleasure driving at all. This compares with 24 percent whose income is between \$3,000 and \$4,999, 12 percent of the \$5000 to \$7499 income group, and 8.6 percent of the \$7500 to \$9999 income group. Only in the \$10,000 and over group does the proportion of the population who did not participate reverse this downward trend; 20.5 percent in the highest income group did not participate.

The conditional probability analysis of the effect of income shows that the probability of pleasure driving increases with rising income until about a level of \$10,000, when it begins to decline. This suggests not only the importance of some above poverty income level, which is necessary to engage in pleasure driving, but also that at the highest income level the pull of competing activities (either recreational or vocational) reduces the probability of pleasure driving for the rich. Consequently, both the very rich and the very poor are less likely to drive for pleasure.

Attempts are being made to delve further into this income effect to find out what proportion of the population indicates a preference to engage in even more pleasure driving than they did in the observed 12-month period. In the below \$3000 class, 16.4 percent wanted to pleasure drive more than they did before. This compares with 11.3 percent for the \$3000 to \$4999 class, 9.3 percent for the \$5000 to \$7499 class, 12.1 percent for the \$7500 to \$9999 class and 11.1 percent for the \$10,000 or more class. Thus, the top two classes do show increasing preference for more activity. Since it would not appear that lack of income would be the constraint, it may well be that the pull of vocational activities limits the pleasure driving of the rich.

Despite the pronounced income effect, differences in the probability of participation between white collar and blue collar occupations have not been identified. People not normally in the labor force, e.g., housewives, students, and retired people, have a significantly lower probability of pleasure driving (even after their income level is taken into account) than those who normally are in the labor force.

The most surprising result obtained so far is that the probability of engaging in pleasure driving is 5 percent greater for females than males. A similar but more restrictive finding was obtained in the 1960 National Recreation Survey, which indicated that the percentage of females who went driving for pleasure exceeded males in general, especially in the 18 to 24 age category. So far, no evidence has been found that race significantly affects the probability of pleasure driving. At present this is all that can be reported on the statistical findings about users of scenically enhanced highways.

EFFECT OF SCENIC ENHANCEMENT ON ACCIDENTS

Whether or not one can associate a significant difference in accident rates on scenically enhanced highways vs non-scenically enhanced highways is being analyzed. For this purpose, the New Jersey State Highway Department provided data on some 92 highway segments throughout New Jersey. Besides indicating whether each segment was, in the opinion of highway engineers, scenically enhanced or not, the Highway Department gave statistics on number of accidents, injuries, and fatalities, volume and type of traffic, speed limit, access points per mile, traffic signals per mile, type of median, number of lanes and their width.

A multiple regression analysis of these data is being performed. If it is found that scenic enhancement reduces accidents, then it will be possible to put a dollar value on the reduction in accidents in order to get a measure of benefits from this aspect. If, on the other hand, an increase in accidents on scenically enhanced highways is found, this must be included as a negative benefit or cost, over and above the landscaping costs of scenic enhancement.

TIME AND SCENIC ENHANCEMENT

So far, we have been unable to obtain similar highway data which give the same highway descriptive variables as the accident data plus data on travel time between two points. Ideally, what is needed is some information on average speed or travel time over highway segments which can be categorized as scenic or not, plus data on speed limits, access points, traffic signals, volume and number of lanes. Even less complete information would be welcome, since a sample of one is better than a sample of zero.

SUMMARY

In this study the object is to attempt to enumerate and evaluate net social benefits accruing from scenic enhancement of highways. Rather than proceeding directly to a new survey, we have attempted to examine existing data to identify and quantify benefits applicable to New Jersey highways.

We are not overly optimistic about deriving completely satisfactory answers from the analysis. We do hope to glean some useful insights into such things as (a) what are the socioeconomic characteristics of the pleasure driving population, (b) some estimate of the amount of pleasure driving the future population of New Jersey will engage in, and (c) whether differences in accidents or travel time can be statistically ascribed to scenic enhancement. If this much is accomplished, we will have made an advance in solving the major problem of estimating the benefits from enhancement and, at the same time, be able to suggest areas for further surveys and analysis.

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