

# SOME OBSERVATIONS ON THE VALUE OF TIME SAVED TO MOTORISTS

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## SYNOPSIS

This paper is a general discussion of the value of motorists' time saved through highway improvement. No criteria are presented for determining the value of such time, the paper being intended rather to provoke discussion which will further our knowledge of the whole subject.

Time is divided into two classes—economic or productive time, and leisure time. Economic time is defined as that which affects cost of production, distribution, or conservation of goods and services to Society. This is primarily time lost or gained by business traffic. Leisure time is defined as time the gain or loss of which is a gain or loss of convenience. It includes time used by pleasure traffic, commuter traffic, and certain types of business traffic.

Economic or productive time loss or gain lends itself to statistical cost analysis so rather accurate determinations of its value can be made.

The value of leisure time varies widely between individuals depending upon their economic status, their whims, and the particular circumstances involved in each instance of time saving. It will be difficult to find general acceptance of any figures assigned to the value of leisure time. A further complication is due to the fact that motorists choose the route that offers the least irritation in travel even when that route is not necessarily the shortest or even the quickest way. They try to avoid traffic congestion whenever possible.

Justification for assigning a value to leisure time savings is presented. While these savings cannot be shown as economic benefits, they are convenience benefits of great magnitude. The economic justification of the expenditure of public money for convenience benefits has ample precedence: for example—parks, playgrounds, libraries, public buildings, public concerts, etc. These benefits are not evaluated on an economic basis; rather they are demanded by the public for the gratification of social or cultural desires. Nevertheless, if they are to be used in highway planning and design, some way of evaluating them is necessary.

Economic benefits compel improvements that make them possible; whereas convenience benefits place improvements in the class of desirables and such improvements should be made only when they can be afforded.

To obtain the greatest public benefit from highway expenditures planners and designers must be able to measure the benefits of highway improvements with some degree of accuracy. Then they can compare the benefits and the cost of any part of the highway system; they can fix the general scope of the work by selecting appropriate design features; and they can advise on the logical order of improvement.

One of the benefits of highway improvement is reduction of travel time. Frequent cognizance has been taken of the great losses of time in our congested urban centers; estimates running into astronomical figures have been made of the money congestion is costing the public. But, as yet, highway planners and

economists have not made a serious inquiry into the approximate value of time lost through congestion or what values may be recovered by highway improvement.

The following observations are offered with the hope of stimulating discussion of the value of motorist's time. The final purpose is the assembling of information and principles to crystalize opinion sufficiently in order that values useful in the planning of future highway improvements may be established.

A little reflection leads to the hypothesis that two classes of time are involved. The first is economic time, also called productive time. This is time gained or lost which affects the cost of production, distribution, or conservation of goods and services to society.

Necessarily the traffic affected is business traffic. It includes trucks carrying commodities and passenger vehicles of salesmen, business executives, repairmen, and all those who must travel during working hours.

The second class of time is leisure time. The saving or loss of this is a gain or loss of convenience. The time gained or lost lengthens or shortens the leisure time of individuals. It does not directly affect their income or their ability to purchase goods and services. It includes pleasure traffic, commuter traffic, and even business traffic in those cases where the gain or loss does not affect the cost of production and distribution.

Perhaps some savings of time to business traffic may not be classed as economic savings. Small time savings may merely be added to leisure time of individuals and not used for an economic purpose. Irregular and unexpected savings ordinarily are not economically useful. When regular and expected savings are small in amount there might be some resistance and inertia in their utilization. However, in a competitive society it is believed that a very large part of all time savings accruing to business traffic will eventually be used as an economic benefit to society.

There are other possible sources of economic savings which are indirect and apparently not measurable by traffic operations alone. These savings result from changes in our economic development incident to the large radius of operation of the automobile and its decentralizing influence which is furthered by urban congestion. By time savings remote places are, in effect, brought closer to urban centers, causing stimulation of development of these remote places. Land values are raised and living is cheaper. There are, however, large compensating losses to urban centers and places less remote. This phase of economics is so complex that it is not clear how time values or other economic values of overall benefits can be determined. But that there are some net economic benefits in reduction of travel time to remote places is, at least, probable. To contend otherwise would seem to deny the economic benefits of our existing road systems.

The determination of approximate values of the direct economic savings in the reduction of travel time would involve a process of sampling the operations and practices of

business traffic. This should furnish adequate data to arrive at acceptable and supportable values. These can be applied to economic benefits toward the justification of highway improvements.

The value of savings of leisure time is a controversial subject. Arriving at values that will find general acceptance based on supportable arguments may be complicated and perhaps even arbitrary. Some observations are offered on the subject.

The first observation is that there is little uniformity in the use of leisure time. Many people find good use for all of their leisure time. To many others "time hangs heavy", so adding to it would benefit neither the individuals nor society. Secondly, there is little uniformity in the relative values placed on productive and leisure time. Some people would gladly sacrifice a part of their income for more leisure time. Others would as gladly exchange a portion of their leisure time for more income. The value individuals place on additions to leisure time varies with the economic status and the whims of the individual, also with the particular circumstances and the amounts saved. For instance, most individuals would think it worth very little to avoid rising five minutes earlier in the morning or arriving home five minutes later at night. But if the loss were an hour or two the value put on the time lost would probably be significant but not in direct proportion to the time lost.

In trying to find a value of additions to leisure time one thing confuses the attempt—that of irritation in travel. Motorists choose the path that seems to offer the least resistance. This may be the shortest way or the quickest way. Or, perhaps more often, it is the way of the least irritation. Motorists seek ways to avoid the delays caused by traffic congestion. Is it to save time or is the real purpose to avoid the irritation? Even when the time saved is used for no particular purpose motorists generally like to avoid irritating delays.

Toll roads, bridges, and tunnels are generally located to save time and to avoid irritations; their free flowing characteristics attract many motorists. Just what the motorist has in mind when he chooses to use the toll facility is not known. Perhaps most motorists are not too clear in their own minds on this point. It

has been asserted that the cost of the toll is a measure of the value the motorist puts on the time he saves. It may be that the motorist has no particular thought of the value of the time but places a high value on the extra convenience, since convenience is one of the principal reasons for owning an automobile. Reduction of traffic irritants is a convenience benefit which is similar in its effect to reduction in travel time. It is a separate and unexplored subject.

While some would question the justification for counting any value for leisure time savings it is admissible that they are benefits to the users who make up a large part of society. Although they cannot be shown as economic benefits, they are convenience benefits of great magnitude in the aggregate.

The expenditure of public money for convenience benefits does not always require economic justification, as there are ample precedents. Public money is used for many things of doubtful economic benefit but of considerable social, cultural, or recreational benefit. Parks, playgrounds, libraries, elaborate public buildings, and public concerts are some of these. The yardsticks of benefits for these things are sufficient public demand and approval. When the people want them and feel that they can afford them they approve the expenditures. Evaluation of benefits on an economic basis is not attempted for any of these things. The appeal is usually to the gratification of some social or cultural desire. Nevertheless, if convenience benefits are to be used in planning and design of highways some way of measuring them in money terms is necessary.

Perhaps it will appear that in these remarks a restricted view has been taken of the subject of economics by dividing time into productive and leisure time with the resulting benefits being classed as economic benefits and convenience benefits. It may be alleged that our standard of living and, hence, our economy includes our whole way of life. Leisure and recreation are regarded as essential parts of our standard of living. Vacation and touring expenditures are important items in our national economy. Money spent for a pleasure trip may have equal significance with money spent for the products of industry, the automobile, for instance. From this it may be argued that the time saved on vacation trips for pleasure

also has economic significance to the same degree, but this does not appear to be so. The time saved may influence where the money is spent and thus make an economic difference as between places—the gain of one place being the loss of another. But the time saved may have little or no bearing on the total amount of money spent.

Thus, the exploration and analysis of values of travel savings of leisure time has many ramifications, each replete with controversy. The view that leisure time savings have equal value with productive time savings would seem to put a uniform value on all time. Would not the value of time then be the national income divided by the total time of all individuals in the nation?

However, time used which neither subtracts from nor adds to our income as individuals would not appear to have the same value as time used to produce more goods and services. We know that our national income bears a pretty close relationship to the time spent in production and distribution of goods and services. Moreover, we know that the time spent productively is almost a direct measure of our standard of living. As productive time increases prosperity increases relatively. During depressions leisure time is plentiful and cheap. The premise that time of itself has no value but assumes value only when and as it is used for a valuable purpose appears to be the only acceptable premise in an economic sense.

The separation of time saving benefits into economic benefits and non-economic, or convenience, benefits probably has some merit in the planning process. Economic benefits—provided they are sufficient—compel improvements that make them possible. Convenience benefits place improvements in the class of desirables and such improvements should be made only when they can be afforded. The fact that most improvements produce both kinds of benefits may not make too much difference; their effects can be segregated and weighed separately or together.

Most of the strictly economic benefits are probably easier to measure and to secure universal acceptance of their value. The convenience benefits are hard to evaluate and it may be difficult to reach an agreement on their

value. Their values may be elastic, varying with the temper of the people, rising and falling with the rise and fall of prosperity.

However, in view of the favorable public reaction to reducing travel time it is important to arrive at acceptable values in order to take the fullest credit for benefits of all kinds in justifying such improvements, in governing the scope of their planning, and in selecting their priority. The value of time

may well be influential in shaping the yearly programs of construction and the character of future highway systems.

The foregoing observations are not intended as criteria for determining the value of time. Rather it is hoped to provoke extended discussion which will rapidly further our knowledge of the subject. Early conclusions as to time values will enhance the planning process of highway projects now under consideration.

## DEPARTMENT OF DESIGN

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### ACTIVITIES OF THE COMMITTEE ON REINFORCED CONCRETE RESEARCH OF THE AMERICAN IRON AND STEEL INSTITUTE

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#### SYNOPSIS

The Committee on Reinforced Concrete Research of the American Iron and Steel Institute has sponsored laboratory research in reinforced concrete since its organization in November 1943. This paper describes the various projects, giving objectives and conclusions wherever final results are available.

The first research project was established at the University of Illinois to study reinforced concrete wall and column footings. Tests were begun in the spring of 1944 and were finished in the spring of 1948.

Important developments from these tests include: (a) Definite proof that the tensile and bond resistance depend upon the bending moment and shear found by statics by consideration of the full applied load, and not 85 percent thereof, as assumed in current building codes; (b) Hooked ends of bars showed no particular advantage in bond resistance over straight bars, particularly when deformed bars of new improved types were used; (c) Hooked bars produced very little effect on resistance to diagonal tension, much less than is commonly assumed; (d) Welded mats proved particularly effective in resisting end slip of bars; (e) Footing caps or piers are effective in reducing the amount of reinforcement and in increasing the load capacity of footings; and (f) Diagonal tension seems to be the point of weakness in current design practice. The factor of safety of thin footings in this respect appears greater than in thick footings, and is generally greater in rectangular than in square footings when the conventional methods of computation are used.

Two investigations of the comparative bonding efficiencies of more than twenty different designs of reinforcing bars have been conducted at the National Bureau of Standards. Three sizes of bar have been tested in both beam and pull-out specimens with three strengths of concrete. Bars were placed in both bottom and top position and slip values were measured at both loaded and free ends. The data have not yet been assembled but a report should be available in published form in the near future.

In October 1946 we established a research project at Cornell University to study the longitudinal distribution of bond stress in reinforced concrete members. A new and unusual technique has been employed in which the reinforcing bar is split lengthwise, a small groove is cut on the interior of the bar to permit the placement of SR4 strain gages and their connections on the inside.

In general, the conclusions to be drawn from the results obtained thus far are