The Problem of Nonuser Revenues

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Nonuser revenues are distinguished by two classes (a) nonvehicular taxes levied to collect for highway use, and (b) nonvehicular taxes unrelated to highway use. The first serves an economic function, but it is difficult to justify the existence of the second on economic grounds. This conclusion is based on an analysis of highway taxation as an aspect of highway planning, in relation to the optimum distribution of traffic among all modes of transit and in relation to the general process of economic growth.

The first class of nonuser sources is analyzed for the extent to which it satisfies the criteria used in rejecting the second. Existing allocation procedures, including especially the relative-use method and the earnings-credit solution, are discussed for their economic implications. It is concluded that (a) economic efficiency could be furthered by planning highways with regard to the tax revenues expected to arise from them, and (b) a modification of the relative-use method might provide the basis for such planning insofar as traffic volume is concerned. A comparison is made with expenditures and highway use on existing highway systems.

•THE PROBLEM of nonuser revenues has beset almost every mode of transportation. Railroads were the beneficiaries of western land grants, air transport today functions with the help of subsidies of various kinds, and inland waterways are notoriously maintained from general tax revenues. Economists condemn the waterway situation. They usually assail the airline subsidies, and they applaud the fact that railroads by the beginning of the 1940's had more than repaid the Federal government for the value of land grants in the form of reduced rates on Federal traffic (1, pp. 105-109). All this is more than a simple penchant for operating in the black and avoiding operations in the red. Red ink and black ink have their significance for transportation just as they do for manufacturing. This is not true of many government functions, but it happens to be true of transportation, with only minor exceptions.

The exceptions are found in certain non-economic functions ascribed to highways. Some writers have noted a political responsibility of government to provide rights-of-way for all who wish to travel. Others emphasize aesthetic considerations. (Social costs as well as social gains attend highway location, including noise, fumes, smog, and accidents involving pedestrians and nonvehicular property.) To the extent that these matters are relevant, society-wide financing is called for. Otherwise, transportation in general and highway transportation in particular is an economic process to be judged by economic standards.

National defense is often cited as a traditional non-economic function and hence, it is argued that travel by military vehicles should be paid for from nonuser revenues. It is true that national defense should properly be supported by general tax revenues. But it is just as true that military travel is a user activity. To keep the record straight, revenues for defense had best be assigned to the Department of Defense and from there to highway agencies as user revenues. Similar observations apply to the postal service, fire and police services, and other government uses of the highways.

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The orientation of the present paper is economic. That is, the nonuser revenue problem is analyzed for the effects of highway finance on the efficiency of the economy in providing greater consumer satisfactions and increased productivity. In taking an economic orientation, the present paper is in the tradition of most highway studies dealing with the user-nonuser problem. So far, it appears that economic considerations are the only ones implicit in such frequently used methods of user-nonuser allocations as the relative-use method and the earnings-credit method. Economic criteria appear to be the only goals lying behind the interest in economic impact of highways. Thus, the present paper deals with the same objectives as most highway finance studies, but the conclusions are different.

ECONOMIC FUNCTION OF TRANSPORTATION

The history of economic growth testifies to the importance of improved transportation. At the earliest stages, in which today's underdeveloped countries find themselves, there is little transportation. Each community is a relatively independent economic unit. As long as pack-horse transportation sets the cost of moving goods, there are very few goods sufficiently valuable to be carried overland. A second stage in economic progress occurs with the growth of improved, and hence low-cost, transportation. More goods can stand the cost of shipment, markets are broadened, and more production can take place at the same location. Specialization, and later mass production, is made possible by trade which, in turn, is made possible by transportation.

As long as the costs of transportation are covered in the final sale price of goods transported, a test of the social desirability of transportation is readily available. The test consists in asking simply whether any given commodity can be obtained more cheaply by manufacture at home or by shipment in from elsewhere, provided that the cost of shipment is included as a cost to the buyer of the commodity. The cost of transportation is a cost of production in the truest economic sense. Transportation consumes material resources, labor, capital, etc., just as manufacturing does. Unless the cost of transportation plus manufacture elsewhere is less than the cost of home manufacture by itself, the inputs required for transportation are better used for some other purposes. Reorganizations in the location and method of production occur as a result of improved transportation. But only when there is full cost coverage of transportation expenses by users is there a way of being sure that such reorganizations result in overall productivity gains.

When the same logic is applied to highway transportation, if the users of the highways do not want to pay for the highways, this means that the highways are not worth the money they cost. If consumers are not willing to pay a price that covers all transport charges, including the cost of the highway itself, this is evidence that they prefer to get substitute products locally or to make other uses of their money. In this case, what is to be gained by hauling the goods to them out of general tax revenue? Similar observations can be made on the subject of passenger travel.

The trouble is that these ancient tenets of economics are sometimes obscured by the effects of highways on land values. The condition of a highway can mean economic life or death to a roadside establishment or it can determine the location of a suburban real estate development. Numerous studies of economic impact furnish all the evidence needed on these facts and then some. But they do not usually recall another proposition from classical economics—location is the one fixed attribute of land that can be neither created nor destroyed. As a result, land is the recipient of an unearned surplus called economic rent. Pure rent is unearned in the sense that nothing need be done to get it. The farmer who finds that his property will be better served by a highway improvement is in the same position as the farmer who finds that his property contains oil. Neither needs to turn a hand to realize his bonanza. (A different way of looking at the change in land values of property attached to land is to recognize them as capitalized gains or losses in commercial opportunities resulting from the change in transport benefits or costs and the servicing of transport at the location in question.)

This irritates everyone and the immediate thought is to tax the unearned increment. God put the oil there, but men built the highways. So, when it comes to highway finance, it is sometimes thought obvious who should get the tax revenue.

The real point is not so much whether the increased property values from highway improvement are taxed; even the unearned increment may be taxed. The point is that such taxes should not be used for the support of highways. If any revenues other than those from highway users are diverted to highways, more will be being spent for highway transportation than the transportation function itself warrants, as judged by those who use it and indirectly by society in its paying for products transported.

The distinction between highway user revenue and general tax revenue is founded on a distinction between transportation and traditional government functions. The latter are characterized by collective consumption, whereas transportation is a case of individual consumption. Thus, public health and justice are received by all members of the community even though these government services may be rendered only to a few. The few cannot appropriate to themselves alone the government services rendered to them. Like the enjoyment of public gardens, public goods may be received by many without being diminished by those who first receive them. The distinction between public and private goods is made rigorously by Samuelson (2, 3).

In contrast, a highway (or a set of railroad tracks) provides a fixed, divisible, and separately received unit of output, the trip opportunity. A trip made by one vehicle is of no advantage to another vehicle, except, of course, by market happenstance when an economic relationship exists between the products transported. In this last case, indirect effects become direct effects through the market mechanism if highway costs are covered by users. The main point is the absence of extramarket relationships among highway users and other members of society. Economic benefits of transportation are individually received by users and can be taxed accordingly.

The result of this situation is that highway planning is economically the same as private investment planning. Both are dealing with the establishment of a plant, the product of which can be sold on a quid pro basis; i.e., according to units consumed. Both depend on the receipt of revenues equal at least to total costs over the expected lifetime of the plant. As a by-product of the conclusion favoring sole reliance on user finance, a criterion for highway planning is discovered—a traffic volume should be planned for that will yield enough user revenue to cover the cost of the plant over its lifetime, plus all other costs of operation and maintenance.

There is the additional question of effects on other roads, consisting largely of diversion of traffic, but also perhaps congestion on feeder routes. The question is whether expected traffic effects elsewhere in the highway network should enter as benefits and costs in the planning of a highway improvement. Two kinds of considerations are illustrated for traffic diversion.

First, each highway could be treated as a separate economic unit in competition with all other highways. If traffic (and hence "tax earnings") are reduced on alternate routes, this might reflect increased quality of service and hence obsolescence of the older routes. In such a case, the useful lives of highways in general should be calculated with a view to recovering costs before they become obsolete (which is presumably a shorter period of time than their physical life expectancy). If there is no difference in quality, the use of the same (user) standards in planning the new highway as were used for the design of the old, would lead to the introduction of the new highway only when traffic density reached too high a level on the old.

Second, the highway network would be treated as a whole. This approach would be justified on the ground that highway planning should be designed to make use of highways over their entire physical lifetime. If so, the loss of "tax earnings" on the reduced-traffic highways would be charged as a cost against the proposed new highway.

Whatever the choice between these two alternatives when dealing with highways, it is clear that long-run productivity becomes a sufficiently important consideration to favor the first alternative when considering the effects of a proposed highway on other modes of transport.

In analyzing prospective future traffic volume, it is appropriate to consider the value of elapsed time to travelers, safety, and vehicle wear-and-tear. The effects on local industrial development and tourist traffic are both relevant considerations. But the reason for considering these is to determine user demand; i.e., the relationship between user charges and traffic volume. User demand then gives a basic (subject, of course, to the errors of forecasting) for calculating expected future revenues against which costs of the highway plant are to be compared.

In principle, this is not the same thing as making recommendations about the tax structure on already existing highways. The difference comes from the fact that a highway, like a private manufacturing plant, is a fixed investment expected to last for a long time. Economic rationality requires that planning for each must be based on expected revenues from each. But after investments have actually been made, the only strictly relevant cost considerations are for operation and maintenance.

Notwithstanding the difference in long- and short-term economic considerations, highway planning and finance might establish the tax structure for highways after they are constructed if bond financing and trust funding requires the establishment of a retirement schedule that dictates tax policy. Moreover, for administrative reasons, tax policies are not likely to be changed frequently. Finally, as a result of equity considerations, it is customary to tax vehicles in accordance with highway plant costs for which they are responsible. This appears to be the rationale behind the incremental cost approach and is equally relevant for other methods of plant costing.

USERS AND NONUSERS

The concept of highway user must be broad enough to include special uses for access, parking, and other purposes. Many analysts refer to access traffic as nonuser traffic because nonvehicular taxes are employed in financing it. This is an unfortunate custom. Previous discussion suggests the importance of maintaining the distinction between those who occupy highways and those who do not. The term "user" is employed to refer to highway occupants and "nonuser" to refer to nonoccupants. The question of what taxes users pay is another matter.

The next step in working toward a tax structure is to define a unit of highway use. The trip opportunity was used in previous discussion to indicate the separable output of a given highway. It is also a measure of highway capacity. The greater the capacity, the larger the number of trips that can be made on a highway between any two points by the same class of vehicle, say automobiles, under defined operating conditions. The operating conditions can be defined in as complicated a way as desired, to include, for example, a distribution of speeds around some norm rather than a single uniform operating speed. An example of the use of the trip-opportunity concept can be found in Beckmann, McGuire, and Winston (4). The orientation in Beckmann et al. is for optimization in the use of existing highway plant, in contrast to the emphasis of the present paper on highway planning.

When different classes of vehicles simultaneously travel over the same highway, the larger vehicles with lower horsepower-to-gross weight ratios will, of course, reduce trip opportunities of others more than in proportion to their numbers. This effect can be represented by the concept of effective space occupance. The number of automobile trips eliminated by a trip of one four-axle semitrailer might be five, for example, on a given highway. Obvious adjustments of effective space occupance would be required for different highways, operating conditions, and vehicle classes.

The main reason for bringing space occupance in at this point is to deal with local traffic. In the problem of access, residential access is encountered on all rural and urban roads except for limited-access freeways. It is well known that a vehicle gaining access or egress is consuming trip opportunities that might be used by other vehicles. A certain amount of space occupance can therefore be assigned to the access function.

In the most extreme case of rural secondary roads, the space occupance of local residents is considerable. Farmers affect traffic flows with their livestock crossings, tractors on the roads and slow-speed hauling with wagons. A space-occupance measure must allocate a high proportional consumption of trip opportunities to such uses.

Similar observations apply in urban business districts. Traffic-flow effects from adjacent property bear on elapsed time, safety, and driver strain. Local business parking, frequent cross-streets, and traffic controls due to schools and local pedestrians shift a larger user burden to the shoulders of local groups.

It would seem worth the trouble to develop space-occupance factors for access and other local highway uses even if all through traffic were lumped in the same space-occupance category. There are important space-occupance differences between vehicle classes, as already noted. Whether these are taken into account depends on how fine a study is conducted and whether the vehicular tax structure is being judged.

Space occupance is a unit pertaining to geometric capacity of the highway and as such might be employed in distinguishing geometric costs among vehicular classes. This, however, is not the point of the present discussion. Nor is there any intention to claim space occupance as the only unit of use. When pavement thickness is involved, the axle load is presumably a better unit of use. The present discussion is limited to geometric use. Primary interest here is in the relation of vehicular to nonvehicular taxes.

CAPACITY BY HIGHWAY LEVEL

The most important part of the difference usually assigned to vehicular and nonvehicular taxes arises from differences in highway cost per vehicle-mile. Vehicle mileage is sometimes distinguished by vehicle classes, but not for the purpose of making vehicular-nonvehicular tax responsibility calculations in the relative-use or earnings-credit methods. The effect, therefore, is analogous to that where space-occupance factors are not distinguished by vehicle classes in making space-occupance calculations.

The difference in vehicle-mile costs with level of highway design is given in Table 1 for all roads and street systems in the United States according to Bureau of Public Roads calculations. The costs are total costs including maintenance, administration, and capital costs. Capital costs are in 1956 prices without consideration of interest accruals. Maintenance and administration costs and vehicle-miles of travel are estimated for 1975. By this last date, the Interstate program is expected to be completed and travel on the various highway systems adjusted to it. For the same reason, this table gives intrinsic differences in travel cost between systems and hence levels of design.

The inverse relationship between cost per mile and cost per vehicle-mile is readily apparent on the rural systems. The continuity is broken only by the "other State" classification among the rural systems. There is no break in the continuity among the urban systems. Indeed, the urban systems show a remarkable similarity of costs per vehicle-mile except for the last class (other local highways).

An equality of highway costs per vehicle-mile on all systems would mean (with some approximation) that vehicular taxes could be relied on to finance all highways because revenues from vehicular taxes vary roughly in proportion to vehicle-miles. This is administratively convenient, but it does not take account of space-occupance costs of local users. The latter complicate the problem by requiring a nonvehicular tax in whatever degree there are such local space-occupance effects.

Returning to the rural systems, there appear to be two principal explanations for the high cost per vehicle-mile or low traffic density on lower level highways: (a) it may be that lower level systems are used to capacity when account is taken of the high space occupance of farm uses, or (b) it may be that lower level highways are overdesigned as compared with the uses that are made of them. Undoubtedly, minimum safe operating conditions and performance standards would have something to do with capacity design and hence any final judgment on the second point would have to take these considerations into account.

Table 2 gives the same data as Table 1 (plus miles of system) for the four subclasses of highways in the Bureau's last rural group (other roads and streets). The inverse relation between level of highway and cost of travel also characterizes this group, except at the lowest level, unsurfaced roads. If overdesign is the problem on low traffic density roads, the example provided by the unsurfaced type may be highly relevant.

TAX STRUCTURE

A tax structure that taxes users on different highway systems differently must identify the users and associate a tax with them. This is a tall order, though some suggestions

TABLE 1

ANNUAL HIGHWAY COST OF HIGHWAY TRAVEL, CONTINENTAL UNITED STATES, 1975[1]

Highway System	Rural Cost		Urban Cost	
	Level of Design ($ per mi)	Cost of Travel ($ per veh-mi)	Level of Design ($ per mi)	Cost of Travel ($ per veh-mi)
Interstate	19,165	0.00415	73,798	0.00370
Other Federal-aid primary	9,634	0.00756	32,633	0.00497
Federal-aid secondary:				
State	4,444	0.01254	16,147	0.00499
Local	2,401	0.01620	9,568	0.00505
Other State	5,464	0.01871	16,031	0.00499
Other local	1,134	0.02567	5,614	0.00997

[1] Table III G-1 (5).

TABLE 2

ANNUAL COST OF HIGHWAY TRAVEL ON OTHER LOCAL ROADS AND STREETS, RURAL, CONTINENTAL UNITED STATES, 1975[1]

Highway Class	Thousands of Miles in System	Level of Design ($ per mi)	Cost of Travel ($ per veh-mi)
High	149	4,941	0.01380
Intermediate	348	1,837	0.03118
Low	1,261	877	0.05000
Unsurfaced	522	203	0.02200
Total	2,280	1,134	0.02567

[1] Table III G-1 (5).

have already been made to deal with it. In particular, space-occupance factors might be developed for access and egress traffic and for various other urban and rural interferences. Property taxes can probably be used to cover associated revenue responsibility, though it is important to note that such taxes would be for highway space occupance and should be separated from general tax revenues.

Another, and very important part of the problem consists in identifying travel itself with appropriate tax source. A variety of methods are used for doing this (5). Almost all the methods rely on a philosophic foundation made most explicit in the relative-use method. Approximations of various kinds are employed in other methods, but a satisfactory comparison of the ideas in this paper with their counterparts in current practice can be made by dealing only with the relative-use method.

The best way to present the issues is to summarize the basic principles of the relative-use method. The classic work on this method is by St. Clair (6). These are already familiar to many.

The relative-use method divides each individual trip into three components: access, neighborhood, and through (Fig. 1). The access component is generally defined as that part of a trip from origin to the nearest street intersection and from the nearest street

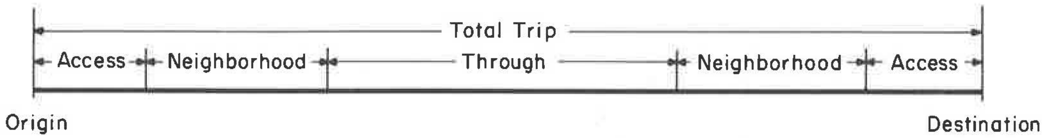

Figure 1. Relative-use travel allocation concepts.

intersection to destination. Thus, there is an access component at both ends of a trip. The average access component will be one-half block long in municipal areas and longer in rural areas.

The neighborhood component is more difficult to define. It is generally defined as an average radius that must be traveled to reach a collection of facilities, including schools, churches, and local businesses considered to constitute a neighborhood, but subtracting out the access components at both ends of this radius. Again, the length of trip considered as the neighborhood component will vary with the density of population. There is a neighborhood component at both ends of all trips long enough to include them. Numerical values for the length of the neighborhood component are given elsewhere (5, p. 115).

Finally, the through component is defined as all the rest of the trip exclusive of access and neighborhood travel. It is possible for short trips to include no through component.

From origin-and-destination studies, it is possible to get total vehicle-miles in each category on each mile of road, each highway, and each highway system. (The practical problems of doing this are considerable, but for present purposes, it is best to pass over these problems and concentrate on general principles.)

Tax responsibility is then assigned according to relative proportions of access, neighborhood, and through vehicle-miles on each highway system. Various taxes, discussed later, are selected to represent payments by the access, neighborhood, and through travel components.

The effect of the foregoing procedure is to deal with differences in the level of cost per vehicle-mile on each system by changing the proportion of the cost of each system covered by the different tax groups. If the taxes selected actually represent responsibility for use, the result will be to charge users for what they get. No one will object to high costs per vehicle-mile if these costs are paid by persons who consume the vehicle-miles. But if the proportions do not represent use, the effect of the system is to finance one man's travel at another man's expense.

The use of absolute rather than relative measures of highway use would reduce the danger of paying for one highway system at the expense of another. Planning could take account of separately measured demand for each highway use.

EVALUATION AND APPLICATION

The discussion that follows applies the principles developed earlier in the present paper to an evaluation of the relative-use method and to the design of a tax structure that corresponds to highway usage. Similarities and differences with the relative-use method are not to be stressed for their own sake. The purpose is mainly to show how the broad user concept developed herein takes care of what is often referred to as "the nonuser revenue problem," or its legitimate parts.

The access component of travel is traditionally associated with special local assessments of abutting property owners and therefore is usually considered to be the responsibility of the local units of government levying these assessments. This is the same identification of tax with user as previously made in the present paper, but there are certain difficulties with charging access users according to relative vehicle mileage. Access travelers have, in fact, already paid vehicle taxes for their vehicle-miles of travel. They did this in paying the same vehicular taxes that through travelers paid. The only extra charge to which they are economically subject as users is the previously-mentioned space occupance arising from the act of access itself. There is no reason to think that vehicle-miles of access measure this aspect of use.

It is true, as noted in Table 1, that costs of highway per vehicle-mile are higher on local roads than on primary highways. But this fact would suggest that all travelers on local roads pay more for a vehicle-mile of travel on them—through travelers as well as access travelers. A way of making vehicular taxes higher on secondary systems than on primary systems has yet to be found.

Similar observations apply to the proportion of vehicle-miles in neighborhood travel. The issue is not whether local travel can be identified with a local tax source. Perhaps it can, though the definitions applicable for neighborhood travel are more arbitrary than for accéss travel. The question is what measure of use is attached to the neighborhood component. A vehicle-mile of travel is a vehicle-mile of travel, and there is no obvious reason why neighborhood vehicle-miles should be charged more than through vehicle-miles. What is actually sought is the special costs that arise from the cluster of establishments that account for local businesses, social organizations, etc. If this is the case, the space-occupance concept would seem to give a direct approach to the problem.

In the neighborhood case, it is probably more difficult than in any other to pinpoint a tax that should be used for all of the direct services of streets. Further study might well lead to the conclusion that, as a practical matter, general tax revenues must be employed, not because of any indirect benefits of the community, but because many aspects of community life other than travel itself constitute road and street use. Any revenues for neighborhood highway use should be separated from other general revenues in a highway fund so as to maintain the distinctions explained earlier.

When, as, and if full calculations are made of the revenues arising from trips and from space occupance of all kinds that interfere with trips, there is still the real possibility that the revenues will not cover the costs on secondary roads and streets. It would be remarkable if they did, in view of the figures in Table 1. Public policy would then face the two alternatives: (a) to tax all users on lower level highway systems at a higher rate than they are now paying, or (b) to reduce the design level of sparsely used systems.

The first alternative would be particularly difficult because of the problems of identifying all users of secondary roads and separating them for taxation. It could be argued that a very rough approximation might be realized by simply determining vehicular-nonvehicular proportions in accordance with space-occupance principles and making no other changes in existing patterns of finance. This approach might be rationalized with the thesis that most vehicle operators account for mileage on each system in about the same proportions as the average distribution of vehicle-mileage. If so and if all user revenues were put in the same kitty, the same users would be financing their use of the secondary highways from their operations on the primary. This thesis probably does not come close at all to describing the situation. More important from an economic standpoint, highway users should be made aware of the costs per vehicle-mile on the lower level systems for what this might imply about reorganization of their own activities.

If a direct approach to the question of who uses the lower level systems were made, using origin-and-destination data or otherwise, it is conceivable that relationships predictable in the statistical sense might be discovered between trip length and vehicle mileage by highway system. To whatever extent valid relationships are found, some thought might be given to taxing commercial vehicles according to probable mileage on each system, or for those who want to keep records, according to actual mileage by system. Higher rates on low-level systems combined with the usually poorer capacity conditions would work to further reduce the problem of heavy vehicles on such systems. For private passenger cars, statistical classifications of trip length might have sufficient significance by occupational and income groups of their owners to justify graduated registration fees. These are primarily research suggestions at the present time, designed for the case where the marked difference in cost per vehicle-mile is expected to continue between highway systems.

Adjustment of the highway plant itself would, of course, reduce the need for adjustment of revenues. Downward adjustment of capacity and design on low traffic density highways would be the easiest method of dealing with intersystem differences in cost per vehicle-mile, provided that due recognition can be given to space occupance and safety. The relatively favorable cost per vehicle-mile of unsurfaced roads was given in Table 2. It is true, of course, that unsurfaced roads cause more wear and tear on vehicles. But it is also true that the vehicle costs are incurred by the users of the low density roads. This is the very result sought in the design of an intersystem tax structure.

A final caution is that capacity limits on lower level highways might be reached before traffic density is brought into adjustment with user revenues. Vehicular earnings are roughly proportional to vehicle-miles, but geometric use (whether vehicular or otherwise) is by space occupance. There is no guarantee that reducing the level of secondary road design can be made to solve the whole problem.

SUMMARY

The discussion extended from a consideration of user-nonuser distinctions to the design of a tax structure dealing with what is commonly considered the nonuser revenue problem. The major conclusion was that only user taxes can be justified on economic grounds; however, the word "user" is defined broadly to include all those who directly affect the number of trips on a highway, not only the travelers themselves.

The result of this approach was to establish a basis for taxing nonvehicular sources, but according to their effects on trip opportunities of vehicles, as measured by space occupance. A comparison of the qualitative differences of the space-occupance approach and the relative-use method showed that the heart of the nonuser revenue problem lies in the definition of the units by which nonvehicular responsibility is measured. Some research suggestions were made for resolving interhighway cost differences without throwing more of the burden on nonvehicular tax sources than would be indicated by a space-occupance analysis. Deeper study will doubtless reveal other means of implementing a space-occupance approach.

REFERENCES

1. Locking, D. P., "Economics of Transportation." 5th Ed., Richard D. Irwin (1960).
2. Samuelson, P.A., "The Pure Theory of Public Expenditures." Rev. Econ. Stat., Vol. 36 (Nov. 1954).
3. Samuelson, P.A., "Diagrammatic Exposition on the Pure Theory of Public Expenditures." Rev. Econ. Stat., Vol. 40 (Nov. 1958).
4. Beckmann, M., McGuire, C.B., and Winston, C.B., "Studies in Economics of Transportation." Yale University Press (1953).
5. U.S. Bureau of Public Roads, "Final Report of the Cost Allocation Study." House Document 54, 87th Congress, 1st Session (1961).
6. St. Clair, G.P., "Suggested Approaches to the Problem of Highway Taxation." HRB Proc., 27:1-6 (1947).