

INCORPORATING ECONOMIC CONSIDERATIONS IN THE PREPARATION
OF ENVIRONMENTAL IMPACT STATEMENTS:
A SUGGESTED APPROACH

by

Gary R. Allen
Highway Research Economist

Virginia Highway Research Council
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SUMMARY

The purpose of this report is two-fold: To provide those persons in the Highway Department who prepare environmental impact statements a guide to the effects that highway improvements may have on the economic activity of an area; and to place in proper perspective the use of both user and nonuser impacts as measures of the costs and benefits of highways.

Although it is difficult to summarize the theoretical justification underlying the methodology proposed in this report several summary remarks are in order.

Observations Based on Research Conducted Prior To This Study

1. There appears to have been little systematic attention given to the problems of appropriately defining those impacts which should be considered in the economic portion of an environmental impact statement, and separating those impacts which are useful in deciding among alternative routes from those indicators which are not useful.
2. There has been a reluctance on the part of researchers to state candidly and concisely the weaknesses that exist in attempts to identify and predict highway effects on economic activity.
3. Some recent progress has been made in placing monetary values on non-marketable commodities such as freedom from noise and air pollution.

Findings and Conclusions Based Upon Research Conducted For This Study

1. Environmental impact statements should mainly utilize indicators of economic effects on nonusers, that is, effects on individuals as non-highway users.
2. Bypass studies in general approach the study of economic impact by emphasizing changes in economic activity which logically should be influenced by changes in traffic flow, e.g., gasoline, restaurant, motel, and hotel sales.
3. Sales tax data are useful measures, when available.
4. Care must be taken to avoid aggregating information to such an extent that it becomes misleading.
5. Economic activity is affected by numerous factors in addition to the highway improvement. Unlike the case in a laboratory experiment, these factors can't easily be controlled; therefore circumstances such as severe inflation in the area, or changes in national economic activity must be separated from changes brought about by the highway improvement. One is forced to use similar economic areas for this purpose.

6. Towns with small populations have more difficulty adjusting to a bypass than do towns with large populations and strong economic bases.
7. If businesses are not dependent on transient demand, a bypass around a town will likely have little effect on economic activity as measured by gasoline, motel, and hotel sales.
8. Contractor purchases do increase demand wherever an improvement occurs, but such a transitory change in spending is not appropriate as a criterion for choosing among alternatives.
9. A change in the property tax base due to highway takings is not an appropriate criterion for deciding among alternative routes.
10. An important question which should be addressed when writing an environmental impact statement is whether or not the money spent by the contractor will be injected into the income stream of the immediate area or spent outside the area affected by the highway.
11. Care must be taken to avoid counting benefits and/or costs of highways more than once.
12. Changes in economic activity that represent net changes must be distinguished from those merely representing transfers from one group to another.
13. It is important in any EIS that potential effects on political jurisdictions be addressed. Although most projects won't be expected to materially alter such political decisions as the supply of services and budgeting, the fact that some project might do so makes it a worthwhile consideration for the EIS.

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INTRODUCTION

Traditionally, public finance theorists have viewed roads and highways as "public goods." The basis for this view lies in the fact that over a broad range of travelers the use of the highway by an additional consumer does not prohibit those already using it from receiving the full benefits. More specifically, within certain congestion limits, the highway service can be extended to an additional user at zero marginal cost. Furthermore, the benefits of the highway and its activity cannot be limited to the direct recipients of the services, i.e., those who would purchase the product if it were privately produced. In this sense, highway services are what Carl Shoup calls a

group consumption good, that is, a good or service that can be supplied in a given amount to a given group of households or firms in a given area more efficiently [at a lower cost per capita] under a non-marketing technique of production and distribution, that is, a technique whereby the good must be supplied simultaneously to all members of the group, no particular one of which can be excluded from enjoying the service. (1)

The idea that transportation facilities are a group consumption good has often been used as an argument to justify the construction of more and better highways. Most economists would agree that the construction and operation of new highways and improvements produces nonuser, or external, effects. That is, the operations of new highways produces many effects on the community at large quite apart from the benefits or costs to the actual traveler. There are few, however, who would accept the suggestion that one can, on a priori grounds, always expect external benefits to be greater than external costs, a suggestion which must be accepted for secondary benefits to be a sole justification for expanding the highway network. It is in fact because of the concern over external costs* such as pollution, noise, and disruption in the quality of life that Congress has passed legislation requiring that the social, economic, and environmental effects of federally funded highway projects be appraised as early in the planning stage as possible.

*For a brief explanation of an external effect see Appendix I.

Specifically, Section I, Part 795 of "Action Plan-Process Guidelines" states:

The purpose of this Act is to provide to highway agencies and Federal Highway Administration (FHWA) field offices guidelines for the development of Action Plans to assure that adequate consideration is given to possible social, economic and environmental effects of proposed highway projects and that the decisions on such projects are made in the best overall public interest. These guidelines identify issues to be considered in reviewing the present organization and processes of a highway agency as they relate to social, economic, and environmental considerations, and in developing desirable improvements. (2)

One important step which is taken in complying with such federal regulations is the preparation of an Environmental Impact Statement (EIS) written by the state highway department or transportation agency. In Virginia, the Environmental Quality Division (EQD) is responsible for preparing the EIS on each federally funded project. Frequently, professional consultants or consulting firms have been engaged to prepare a portion or portions of the EIS for projects which are expected to have extensive economic or environmental effects. On projects of narrower scope, the Division's personnel write the EIS or prepare a "negative declaration."*

Although emphasis has been given in the EIS's to effects on the physical environment, little systematic attention has been given to what are called "economic effects." However, under legislation which requires that states develop an efficient Action Plan, section 795-8 explicitly calls for:

(a) [i]dentification of potential social, economic, and environmental effects, both beneficial and adverse, of alternative courses of action ... as early in the study process as feasible. Timely information on such effects should be produced so that the development and consideration of alternatives and studies can be influenced accordingly. Further the costs, financial and otherwise, of eliminating or minimizing possible adverse social, economic, and environmental effects should be determined. (3)
[emphasis added]

*The negative declaration is defined as:

A written document in support of a determination that, should the proposed highway section improvement be constructed, the anticipated effects on the human environment will not be significant.

PURPOSE

This report is an attempt to develop a systematic analysis of economic effects which will assist the EQD in preparing more complete EIS's than are now executed, and which will provide meaningful insights into the effects of specific highway projects. It is also anticipated that the information presented here can be used to critically appraise the analyses of economic effects presented in the EIS's that are prepared by consulting firms.

SCOPE

Although the researcher has surveyed a large body of literature on the subject of economic effects as they relate to highway improvements, extensive discussions of the literature will not be included unless it is crucial to the justification of the economic indicator being discussed. The first major part of the paper consists of a discussion of the general considerations which must be taken into account in developing an acceptable set of indicators of economic impact. The second part consists of a list of the indicators which the researcher deems appropriate and a brief justification of each. A third major section includes the evaluation techniques, that is the formulas for calculating impacts, to the extent they are currently developed. The fourth and final section presents a guide to the data required for the evaluation techniques proposed.

BASIC ECONOMIC CONCEPTS AS THEY RELATE TO HIGHWAY IMPACTS

Defining an Appropriate Criterion for Judging Impact

In order to develop an acceptable set of indicators of economic impact, the appropriate criterion for judging impact must first be selected. There are two criteria from which to choose: (1) How much better off or worse off the road user is as a result of the highway improvement, and (2) how other people are affected as a result of the improvement. The choice is made easier once it is recognized that highway construction, maintenance, and use cause external effects which are significant.

Buchanan argues that one should view the road as a public utility because the benefits from use are divisible and motor fuel taxes, licenses, and registration fees act as user prices.⁽⁴⁾ If the user were to have remained the only party significantly affected by the building of highways, the focus of study for an EIS would obviously be those indicators relevant to use only: Time savings, a reduction in loss of life, and the savings in oil, motor fuel, and other operating costs. As a result of the substantial growth in traffic volume, external effects* in the form of noise, scenic disruption and

*See Appendix I.

air pollution, which had previously been considered insignificant at the margin*, have taken on greater importance to non-highway users. It is appropriate then that this report, which deals with the preparation of the economic portion of EIS's, be concerned mainly with indicators of economic effects on nonusers.**

Separating Factors Influenced by the Highway from Factors Which Aren't

Ideally, when one studies economic effects of any sort he would like to be able to say that his results reflect only the change in economic activity brought about by the situation in question. In reality there is no way to maintain what the economist calls ceteris paribus conditions. A hypothetical example may serve to illuminate this idea. Suppose that a bypass is built around the town of Acirema and that upon investigation it is discovered that all of the components of retail sales in the town have experienced a 15% increase compared to the sales level before the facility was built. Is it appropriate for the public officials of Acirema to infer that retail sales have grown 15% because of the new facility? Obviously not. In order to arrive at a realistic estimate, some comparison must be made between the percentage change in retail sales in Acirema and the percentage change during the same period in an economic region very similar to Acirema. Frequently the United States Department of Commerce, Bureau of Census combines counties with homogeneous economic, political and social bases into economic areas.⁽⁵⁾ With the aid of such information, the task of identifying areas suitable as control regions is made simple. In Virginia, homogeneous economic areas have not been defined by the Department of Commerce, however, this has been done by the Tayloe Murphy Institute of the Graduate School of Business Administration, University of Virginia.*** It is suggested that for projects which warrant before-after studies, comparisons be made between the rate of change of the economic activity in question and the rate of change of that activity in the defined economic area. Unless the study area's output of the activity in question is a large percentage of the total output for the economic area, it is not likely that one will be misled by this approach. It should be stressed that every community is unique, therefore an actual knowledge of each town's circumstances is very important.

*See "Externality" by James M. Buchanan and William Craig Stubblebine. Economica (November 1962).

**For a contrasting viewpoint see A. S. Lang and Martin Wohl, HRB Bulletin #268, "Evaluation of Highway Impact," pp. 105-114. The authors contend that nonuser benefits and costs are of no help in deciding location and design questions because they all stem from the user. Although the authors are correct concerning the origin of nonuser effects, to say these are unimportant is to assume away any possibility of an externality arising because of the use of the facility.

***The twenty-three economic areas are listed in "Income Estimates: Virginia, SMSA's and Other Economic Areas" selected years 1929-1968, p. 21 or "Estimates of the Population of Virginia Counties and Cities: Various years."

Incidence

If it were practical to consider only cost and benefit estimates at their final resting point, costs could be subtracted from benefits to derive a net benefit figure. This, in turn, could be compared to net benefits of alternative projects. If the choice criterion were maximizing net social benefit, the project with the largest net benefit (assuming costs were equal) could be given the nod. In practice, however, identifying the final resting point, i.e., who actually is made better off or worse off by the transportation improvement, is no easy task.

Richard Zettel considers this same question in a slightly different context. His concern is over how the surplus of benefits from highway use in excess of costs to the user should be distributed. To quote Zettel,

Suppose that it were public policy to recover this surplus, as well as highway costs from users. Motorists would enjoy no net gain but neither would they experience any loss. The immediate economic effect would be the reallocation of resources resulting from a shift from other economic activity to highway construction. But government would be left with the surplus, and its disposition would effect a redistribution of income. [General taxes could be reduced or more services could be provided with the same level of taxes.] (6)

In addition to discussing effects of highway improvements on the distribution of income, Zettel and his colleagues raise many points that are valuable in setting the stage for the proper consideration of changes in land values in EIS's.

Economists generally agree that the effect of highway improvements on land use and values seems to cause most concern as well as confusion among students of highway affairs. Although, for example, it is often claimed an advantage for land values to rise as a result of highway improvements, there is implicit in such ideas a basic confusion concerning rent theory and the source of the differential in property values. For most types of land use, transportation improvements don't add or subtract from fertility or productivity of the land; rather, any enhancement comes from accessibility values (which themselves are a function of preexisting transportation networks). Obviously, if land values fall there is a group of individuals who stand to lose: those who sell their property experience a loss on the sale which is the gain of the new owner. In short, there has been a redistribution of income, but not necessarily a loss in overall welfare. The contention that reduced property values (if they actually result) imply economic tragedy is misguided reasoning. The reduction is the result of a change in accessibility or site value but not likely a destruction of real wealth or productivity. An example may serve to clarify this point.

Assume that there is a level plain of equally fertile land stretching for 100 miles in all directions with a product market at its center. If there is no opportunity for buying and selling elsewhere, all goods must be transported by some means to the market. Assume also that the only use to which land is put is wheat growing. Finally, let there be a minimal number of feeder roads differing in quality as one gets further away from the

market, and let pure competition exist on both the product and input side of the market. Classical rent theory predicts that under conditions like these, the value of the land at the outer edge of the circle will be less than that at the center by an amount equal to the cost of transportation. The differential between land value at the market and at the "edge" arises in the following way: The land is equally fertile, regardless of location; therefore, wheat can be grown at equal cost anywhere within the circle. The price must cover the cost of production and transportation, if any. Thus the cost of production plus the transportation cost on the land farthest from the market determines the market price of wheat. Thus, land closer to the market will have a surplus above the cost of production value. This can be said to be a site rent or accessibility premium.

Now, if there are improvements so that transportation costs are reduced, the differential in land value from the market to the periphery will fall, i.e., site rent will be reduced. The fact is however, that productivity won't be altered in the least.

How does all this fit into double counting problems? Land values are frequently presented in studies of highway improvements without ever placing them into any logical framework. So, too, are other representations of nonuser effects. The sticky problem is whether certain nonuser benefits and costs can be included in benefit cost ratios that are used as a criterion for choosing one alternative over another. The danger of course lies in statements such as "Land values rose by 15% during the study period for a total of \$78,000. User savings were calculated as \$40,000 for a total benefit of \$118,000." The likelihood that some or all user savings just cited were capitalized* into land values is very great. Still, there is no conclusive evidence on the extent to which benefits and costs are shifted. This lack of evidence creates a dilemma for those who attempt to calculate the net costs and benefits of highway improvements. On the one hand it is possible to totally avoid double counting by looking only at costs and benefits to users, but in so doing the external effects which might arise are totally ignored. While one cannot easily avoid this dilemma, it is possible to suggest some ground rules which will make more sensible the efforts to calculate net social benefits.

First, isolated or very narrow studies utilizing benefit-cost ratios which include both user benefits and benefits in the form of changes in land values are more likely to misstate the ratio than studies of an entire highway system which uses both measures. Such overestimation or underestimation results because the changes in land values often attributed to a specific project more likely are a direct result of a change in the transportation system of which the project is a part. Secondly, measures of changes in land values offer the preparer of an EIS more than information about the tax base. As Zettel points out, "... the main purpose in studying land values may well be to get a better measure of user benefits." [They are most likely a reflection of the surplus of user benefits above what the user has to pay for use of the facility.] In other words, as user gains which are not charged for become capitalized into land values, there is created a key source of data for what non-measurable comfort and convenience are worth to people. (7)

*See later discussion headed "Land Values".

The author has yet to mention a very important aspect of economic analysis: that of whether the economic effect in question is a redistributional or a welfare effect. With one exception,* this aspect of analysis has not been explicitly considered in transportation economic impact studies.

Redistribution effects are those impacts on the neighborhood which are counter-balanced by another impact within the same or a different neighborhood. For example, a shift of consumers from one shopping mall to another is not a net gain to the neighborhood if both malls lie within the defined study area. If the mall from which consumers were attracted lies in a different neighborhood then the study area gains, but at the expense of others. In either case, the result remains one of a change in the distribution of income, not an addition to or subtraction from the overall level of demand.

Welfare effects, or what the RMC study chooses to call "income effects", are those economic effects which change community well-being, i.e. involve overall changes in output or income.

There are several reasons for separating effects on the basis of their being redistributional or a welfare effect. First, the relevance of redistributive effects in answering "Yes" or "No" with respect to a certain change in the highway network is not at all clear. There has been considerable controversy over the circumstances under which economists, in their role as social scientists, can say that one policy is better for the welfare of society than another policy. This important limitation of welfare economics derives from the fact that there is no scientifically meaningful way to compare the level of well-being of different individuals. In other words, there is no logically acceptable way to deduce that a piece of cake gives one person more satisfaction than another person. To quote Edwin Mansfield of the Wharton School of Economics, University of Pennsylvania,

Because we cannot make interpersonal comparisons of utility[well-being], we cannot tell whether one distribution of income is better than another. For example, suppose you receive twice as much income as I do. Economics cannot tell us whether this is a better distribution of income than if I receive twice as much income as you do. This is a value judgment, pure and simple. However, most problems of public policy involve changes in the distribution of income; therefore, it is correspondingly difficult to come to any conclusion as to whether or not such a decision is good or bad.⁽⁸⁾

*Highway Improvement As a Factor in Neighborhood Change: Volume I. Resource Management Corporation, Inc., March 1971. (Throughout the remaining text of the report this work will be cited as "the RMC study.")

The second reason for making a distinction between welfare and redistribution effects is that welfare effects are clearly relevant to decision making because they represent net changes to the neighborhood. For example, suppose an improvement in the highway network reduces transportation costs to such an extent that a mining operation which had not previously been undertaken becomes feasible. If the operation of the mine creates jobs for individuals previously unemployed, there would be a net addition to social welfare.

Thirdly, even though economists have been reluctant to involve themselves in questions of equity, the very nature of an EIS and citizen involvement dictates that effects which lead to redistribution be explicitly recognized, but excluded in the calculation of a cost-benefit ratio.

Effects on business income such as that of service stations, hotels, motels, and restaurants many times will represent redistribution effects, especially where bypasses lead to the closing of "in-town" businesses and the opening of new businesses abutting the new facility, a redistribution of income is likely to occur. If there is an absolute growth in income above what would normally have occurred for the business category, then there is an overall change in welfare.

Resident employment effects can be either redistributive or of a welfare nature. If industrial employment is replaced by highway oriented employment, this effect is redistributive. If X number of jobs are lost in industry but no employment opportunities are created, there is a loss of welfare; i.e. the group is worse off than they were before the highway improvement was made.

Tax losses apparently do not represent a reduction in welfare, even in the short run. Assume that the remainder parcels are not reassessed after the taking of right-of-way for construction of a highway. This means that local government revenue is reduced. Now, assuming that the public services being provided by the locality have positive value to the citizenry, there is a loss of utility because some services must be curtailed. But there has been a reduction in tax liability as well. In short, there has been a redistribution of income from the government to those citizens whose property was acquired. And unless there is evidence to the effect that the public services which had to be curtailed provided externalities, there is no justification for alleging that tax losses are welfare effects.

The Case of Bypassed Towns

Although the main purpose of this major section of the report has been to provide a firm conceptual basis on which to develop techniques for evaluating economic impact, it is believed worthwhile to synthesize the results of numerous bypass studies which have been completed by highway agencies and private research organizations into several general conclusions which may be useful to Highway Department field personnel in answering the questions of concerned citizens. In addition, these generalizations should be helpful in writing EIS's on projects similar to those described here.

The following excerpt from a study recently completed in Wyoming characterizes the significance bypassing can have:

A new interstate highway can have pronounced effects on an area through which it is routed. The highway replaced by the new interstate may have been routed through the principal municipalities in the area. The interstate will be routed to bypass them. The spatial distribution of economic activity may be altered. Land values will change; some will rise sharply; others will probably fall. New businesses may spring up in new locations and these may prosper; wealth and income will be redistributed. (9)

Usually attention should be placed upon changes in economic activity which are logically expected to be influenced by rerouting the highway: gas stations, restaurants, motels, and hotels. The presupposition is of course that because of a change in traffic patterns some resulting change has taken place in the spatial nature of demand. (10) Equally important as indicators are changes in the level of business activity as measured by business sales, tax payments, and changes in land value and land use near or along the old and new facilities.

Some studies⁽¹¹⁾ grouped business activity into categories such as:

Cafes	
Taverns	highway oriented
Service Stations	
Food	
General Merchandise	general retail
Motor Vehicles including mobile homes	
Services	

It is correct to use sales tax data where available* for each activity listed as an indicator in before-after studies; however, if the data are aggregated into large groups, the conclusions drawn can be misleading. For example, assume that because of a new bypass gasoline sales of relocated stations rose by 50%; suppose also that "Cafes" and "Taverns" experienced a sharp drop in patronage. Grouping of these activities under one heading, "highway oriented activities", could obviously overstate or understate the effect of the bypass on each of the businesses.

For bypass studies in particular it is appropriate to break retail sales into separate categories. If one is concerned with answering questions in a public hearing, he should be explicit in his answers rather than being overly dependent on aggregate

*Usually not available for gasoline stations.

data. It is very unsatisfactory to answer the service station attendant who is concerned over a potential loss in sales by saying, "In general the result of the new facility will be to increase economic activity."

Bypass facilities usually are and should always be built for the purpose of speeding on their way those who have a destination point beyond the town bypassed. If the bypass route remains in close proximity to mainstreet (such as the Rte. 250 bypass in Waynesboro, Va.) and land of an easily developable type abuts the proposed route, the building of the facility should have little, if any, detrimental effect on gasoline sales or retail activity, because such a facility does not significantly alter the flow of traffic through the town. Consequently there is little justification for expecting demand to be materially altered.

It is unusual, especially for the case of limited access facilities, that bypasses fit the special conditions noted above. Usually, how a bypass will affect a town is less easily foreseen. We can make some qualified forecasts, though.

It is generally to be expected that towns with smaller populations (below some reasonable level) will be more adversely affected by a bypass. This should not be taken as a hard and fast rule, but very small towns often lack an industrial base and therefore are to a great extent dependent on transient traveler demand. (12)

In contrast, towns in which the highway oriented businesses — service stations, restaurants — depend mainly on local demand will likely experience little change in welfare. (13) The verdict for motels and hotels is not so encouraging, unless of course the affected establishments can economically pursue one of several alternatives: By means of advertising, encourage travelers to spend the night in town; build a new establishment close to the bypass; or alter the existing business so that a different product can be sold. The last alternative raises a question which those who draft EIS's for bypasses should always attempt to answer: Can the highway oriented firms, (service stations, restaurants, motels) without an undue amount of new investment, readjust to the production of a new or different product which will maintain former income levels? As a rule of thumb, gasoline stations may be able to adjust to the production of garage and towing services if in fact they had previously been dependent on transient demand. As for the motels and hotels, there is little that can be said a priori about their ability to adjust. (14)

Although it has rarely been discussed, one potential effect of a limited access freeway/bypass is that it may enable a small community to become a quiet, well-serviced residential enclave. It is unlikely that this should occur except in communities close to large metropolitan labor centers. Furthermore, assuming that a community is quiet, relatively pollution free, and offers the desired level of public tax supported services, it will still not become a bedroom community

unless there is easy access to the central city business district. Bypassing the community with a high speed free-way between two major metropolitan areas can fill this easy-access requirement and in so doing, alter the pattern of demand for land and housing. (15)

Although the level of economic activity is altered shortly after construction, such changes are usually short-lived. For purposes of information in the EIS, forecasts about the relative magnitude of such transitory changes in demand are appropriate. However, since they are temporary in nature no routing decisions should be based on such effects.

INDICATORS OF ECONOMIC IMPACT

Potential Tax Losses

L. B. Wallerstein of the Office of Environmental Policy, FHWA pointed out in a July 1972 seminar on economic impacts before the Illinois Department of Transportation that one obvious item of special concern to local governments is the change in property tax revenues that may result from a highway improvement because state property is not included in the tax base. Depending on the nature of the change, the need may arise to alter the locality's revenue sources or expenditure proposals. To quote Wallerstein,

Taxes are important because evidence shows that the acquisition of property for highway use does have the short-range effect of removing from the taxrolls some previously taxable property. However, longer range effects of highway construction on tax revenues have proven to be generally favorable. (16)

Although the acquisition of right-of-way does at the time of taking reduce the property tax base and causes an immediate tax loss until reassessment, it does not follow that the tax base will be reduced permanently. The improvement may cause land values to rise faster than they would have (given that other prerequisites for development exist). The implication is, of course, that long run consequences are the most relevant. However, it is important that EIS's present estimates of short run losses in tax base in order that local public officials be able to adjust their budgetary process accordingly.

Assuming no change in nominal tax rate or assessment ratio, the effect on tax revenue can be calculated as follows: For each year from the date of acquisition of the right-of-way until a reassessment occasioned by the highway improvement occurs, the loss in tax revenue due to the condemnation of the right-of-way equals the market value (estimated) times the assessment ratio times the tax rate.

Ideally, one would prefer data representing bona fide sales of parcels to substitute for "market value" in the equation above. However, the acquisition of property by the

state does not represent such sales in the strictest sense. The concept of "market sale" implies that a seller has mutually agreed with a buyer that a fair price for the property is \$X. Although such explicit bargaining does not take place between the owner of property and the state during condemnation,⁽¹⁷⁾ a relatively small proportion of condemnees exercise their legal right to a court settlement. Therefore, it is a workable estimating procedure to take actual acquisition costs as a close approximation to market value of the right-of-way at the time of the taking. An estimate of acquisition cost figures for each proposed route can be obtained from the Right-of-Way Division of the Virginia Department of Highways.

Several words of caution are in order regarding the use of the simple equation given above. First, the entire right-of-way is not usually acquired in a single year. Rather, a portion is acquired each year from the date that a final location is decided upon to a date just prior to construction. This means that an adjustment has to be made for the normal change in market value that occurs from year to year. Secondly, condemnation awards frequently include damages to the remainder parcel in addition to the award for the land. Amounts representing damages should not be included when estimating market value. Thirdly, it is not at all clear that if one were to conduct a cost-benefit analysis he should include the change in property tax revenue for purposes of calculation. The answer to this question hinges on what is happening, if anything, on the expenditure side of the locality's budget and how land values and use will change if one alternative route or interchange point is chosen as opposed to another. To clarify this idea, consider the following: Assume that a new limited access highway is to be built to connect two urban areas. Suppose also that among three alternative routes (each of which lies in a different locality) two are estimated to have a greater loss of tax revenue than the third during the period of time prior to the completion of the project. What help in deciding upon route location does this information provide? In short, very little. It does not allow the decision maker to choose the third alternative unless a good case can be made that minimizing tax revenue losses in the short run is an appropriate decision-making criterion. Neither does such "revenue loss" information rule out the other two routes; it says nothing about the possibility that a short run revenue loss can be completely offset by changes in land use and the associated reassessment which usually follows. Even though it is usually the case that losses from the tax base are made up through reassessment following changes in use and value, the lag between the time that the change in land value occurs and the reassessment is frequently long and variable.⁽¹⁸⁾

Theoretically it is desirable to arrive at a figure representing the net change in tax revenue attributable to the building of the facility. In other words, will the value of remainder parcels and other land in the taxing jurisdiction increase beyond what it normally would have in the absence of the highway so that at sometime in the near future the highway-induced loss from the tax base will be more than offset? Ideally, one would like to be able to calculate net change in revenue as the market value of condemned right-of-way times the effective tax rate plus any change in land value of the remainder parcel times the effective tax rate. But as will be discussed under the heading "Land Values", land value estimation for future periods is an extremely difficult and tedious task. Any estimates over very long periods should be viewed with skepticism. Therefore any estimates of long run net change in revenue due to highways cannot be precise in any sense. See later discussion headed "Evaluation Techniques — Potential Tax Losses" for additional comments on this subject.

Impacts on employment may include indirect losses and gains from takings and replacements, and actual changes from construction activity itself. Those changes induced by construction activity are short-term and are best described as transitory. As a practical matter, transitory changes in employment which occur during the period in which the facility is being constructed are relatively more easily estimated than the longer run, indirect effects of highway construction. Wallerstein and his colleagues in FHWA suggest as rules of thumb the following parameters: "... one direct construction job creates between one and two jobs in support services; each \$1,000 spent in new construction results in the creation of about 224 man hours of work."⁽¹⁹⁾ These rules of thumb are useful when considering alternative routes. Even though it is not agreed that highway construction is viable as a means of alleviating unemployment problems, as among two alternatives equal in all other respects, if one has adverse effects on employment significantly greater than the other, the latter should be chosen.

An important question one should attempt to answer when writing an EIS is what portion of the money spent by the contractor will be injected into the income stream of the immediate area and what portion will be spent outside the mini-economy affected by the highway. The answer depends of course on whether or not the contractor hires local labor and buys supplies locally. (The former is more likely to occur than the latter.) Obviously, the impact will vary greatly between these two options of purchasing inputs. If the contractor uses a substantial portion of local labor, additional summer jobs will likely be created, and some people in the labor force who were previously unemployed will find that there no longer (at least for the duration of the project) exists a buyer's labor market. Further, if businesses are to be displaced by the facility, the rise in unemployment so occasioned may be offset partially by the contractor's demand for labor. By the time the project is completed, the labor market may have adjusted so that the displaced members can be absorbed into permanent jobs. If the employment situation at the time of construction is particularly acute, even a reduction in unemployment due to an increase in transitory employment may give the economy of the area a welcome boost.

Frequently, the building of a transportation facility necessitates displacing business firms. This implies X number of jobs are no longer available. Estimates of this impact will require some basic data collection. Ideally, information is desired that indicates how the highway affects net employment. Figure 1 is exemplary of how this may be approached.

In addition to providing information in the EIS on the expected number of job changes, it might be desirable to convert the figures into rough dollar estimates. This conversion however, is not absolutely necessary and probably is much more arbitrary than actual estimates of job changes regardless of the care taken in deriving multipliers by which to convert number of job changes to dollars.

Alternative	Liquidated Firms (-)	Relocated Firms (±)	Firms Remaining, But Possibly Affected (±)	Attracted by Facility (±)	Net (±)
A					
B					
C					

Figure 1. Job changes (±).

Local Government Operation

Closely related to changes in the tax base, yet an effect which appears to have been given little attention in most studies of impact, is the way in which proposed improvements might alter local government operation, particularly financing of and demand for services. Although in the past the magnitude of such effects has been marginal, it is likely that these will take on more importance as time passes. This is particularly to be expected because of the increase in the number of bedroom communities and changes in the resident to employment ratio which accompany the increased accessibility that results from highway improvements.

In addition to the immediate reduction in tax base which was discussed above, the construction of a facility or network may have any or all of the following consequences:

- (a) Change the demand for local tax supported public goods and services. for example, better accessibility occasioned by a highway improvement may spark increased building in the perimeter of a jurisdiction. Subsequently, additional sewage treatment, police and fire protection, and school facilities may be required.
- (b) Preclude local expenditures on other priority programs or projects because of limitations on local tax or grant income.
- (c) In rare cases (usually in a highly urbanized area) lead to a substantial portion of the population being relocated outside the jurisdiction. If this indeed occurs, the per capita basis on which grants may be allocated will be reduced.

It is important in any environmental impact statement that these potential effects on political jurisdictions be addressed. Although most projects won't be expected to materially alter such political decisions as the supply of services and budgeting, the fact that some project might do so makes it a worthwhile consideration for the EIS.

Portions of the discussion of the variables below follow closely the approach taken by the RMC study. There is little information of an original nature, therefore where citation is necessary original sources will be referred to rather than the pertinent passage in the RMC study. The author prefaces the brief discussion on this subject by noting that very little empirical work has been done on the housing market except at aggregate levels. For purposes of planning, aggregate information is not very valuable. In fact, research opportunities are almost endless on the aspect of highway and transportation impacts dealing with the housing market.

If a highway improvement requires that a certain portion of the housing stock be demolished, the result in the short run (that is the period of time during which supply is fixed) is that the per unit price of housing must rise. Although not a welfare effect, such a redistribution of income from renters to landlords should not be ignored in an environmental impact statement, if time and manpower permits an appropriate analysis.

A substantial amount of primary data is needed:

- the number of units demolished, categorized according to price (or some other appropriate criterion)
- the number of persons or families displaced
- the vacancy rate for the area: this tells how many dis-locatees can be absorbed without any change in the stock of housing
- the net change in housing stock of each specific type
- the elasticity of demand for housing
- the normal filtering* rate to the relevant cost

Concern here will be mainly with the short run or price change effects. The building of a facility, if any homes are taken, theoretically involves the following chain of events: the reduction in the supply of housing stock causes a decrease in normal vacancy rates, which in turn creates excess demand in the housing market. In the short

*The concept of "filtering" is important in understanding the normal operation of the housing market. One can think of an unobservable entity called "housing service." Each dwelling yields a certain quantity of service per time period. An owner, by adding to or subtracting from the flow of investment period, adds to or subtracts from the flow of services. This changing flow of services can be thought of as "filtering." [See "A Competitive Theory of the Housing Market," E. Olsen, American Economic Review, September 1969.]

run, price must rise because quantity is fixed (see Figure 2). As for the long run, price should return to equilibrium: Supply must be replaced because Section 206, 1970 Federal Aid Highway Act, requires that housing be constructed as a last resort when sufficient housing isn't available.

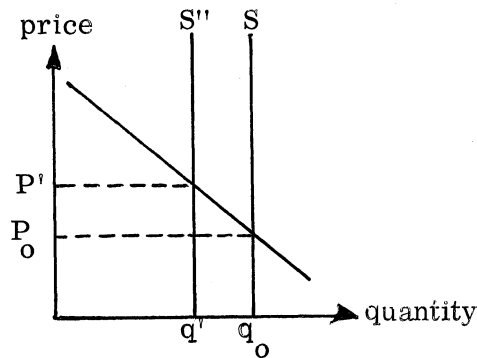


Figure 2. In the short run, the supply curve is vertical. S denotes the supply prior to the taking of right-of-way. The reduction in housing is represented by S''. Assuming no change in demand, D, housing service is reduced to q' and a new price P' is established.

There are certain preliminary steps which need to be taken before use can be made of the formula for estimating the change in the price of housing services which is presented later under Evaluation Techniques: Formulas. These are:

1. Appropriately separate the housing units demolished into price classifications. For apartment houses, some attempt should be made to capitalize (see the discussion on capitalization on page 21) the yearly rental price of each unit into a market price by discounting over the expected life of the units.
2. Assume normal vacancy rates are 1% for owner occupied housing and 5% for tenant occupied housing. (21)
3. Subtract the assumed normal vacancy rate from the actual vacancy rate for the housing classification in question.

Slum Costs

Some estimates of the reduction in social costs arising as a result of removal of slums due to highway construction are presented in the RMC study. (22) For Virginia

it does not appear that such effects can be construed to be welfare effects. If a highway is built through a slum area, one can logically contend that there is a reduction in the potential cost of fire. It is not clear however, that any significant cost reduction will occur since most of the costs of fire protection come from high rent areas. Further, if any kind of monetary tag could be placed on the value of removing a slum, it would be redistributional in nature because the removal of slum housing in one area simply leads, by way of market demand forces, to slums springing up elsewhere. (See Jerome Rothenberg, An Economic Evaluation of Urban Renewal, Brookings Institution, 1967, and the AER article by Olsen which was cited above.)

Land Values

The last indicator of economic impact to be discussed is land values. The author will synthesize some very recent work on this subject into practical guides where possible and note misconceptions which should be avoided. The reader is reminded to be conscious of the discussion on incidence and double counting so that the use of changes in land values can be kept in proper perspective when preparing EIS's.

Several generalizations can be made about the relationship between highway improvements and land values.

- (a) Improvements are usually undertaken in areas already substantially developed and in some sense are a result rather than a cause of development and increasing demand for land. There is little doubt, however, that highway improvements hasten any change in land values already under way.
- (b) The value of land and its use are very closely related. The most frequent result of a highway improvement is that the land in close proximity is rezoned to more intensive use. Although some persons have suggested that industrial parcels appreciate more than unimproved land, (23) it is not clear that this should hold in the majority of cases. One can argue that industry would not have located on a parcel had not adequate transportation facilities been available. On the other hand, one would expect vacant land, especially at interchanges, to receive the greatest increment in value because the highway (if one did not previously exist) or the improvement increases accessibility and ripens the land for commercial or industrial purposes.
- (c) Land values are important because beneficial and/or harmful effects of highways will likely be capitalized into higher or lower property prices. An example will best serve to explain the concept of "capitalization." A piece of property has value because of the flow of services it yields through time. The services yielded by a residential parcel might be such things as peace and quiet, easy access, the availability of water and sewer services, pretty views, clean air, good neighbors, etc. The flow of these services has some monetary value each year. By predicting, within reason, the

life of the asset, it is possible to convert this yearly service flow to a present value figure, (see later discussion on housing market impact calculation), with the use of the current discount rate. (This value usually ranges from 6% to 9 or 10%.) Assume that prior to the highway improvement a residential parcel was valued at \$17,000 by the above procedure. Suppose also that as a result of increased average daily traffic, noise and air pollution immediately reduces the flow of services from the parcel. The result is a reduction in the market price. In this instance the increase in pollution has been capitalized into a lower property value.*

- (d) Because use and changes in value are so closely related, reliable results can be maintained only by grouping parcels of comparable use together as residential, commercial, industrial, and agricultural.
- (e) The point to be discussed here can not receive enough emphasis. The author is aware of no easy to apply method of estimating, before the fact, what change will occur in land values as a result of a highway improvement. Land use modeling is still a very young science, and most models require a great deal of data. Until reliable use models are developed, the accurate prediction of price change is almost impossible. This does not mean that there exists no basis on which to make educated guesses about land value changes and highway improvements.

With the aid of multiple regression analysis, data from past highway improvement projects can be gathered by researchers to determine whether variables such as noise, air pollution and accessibility significantly alter land values. A team of economists from the Pennsylvania State University have conducted research of this nature on four residential communities bisected by interstate highways.⁽²⁴⁾ They found for the eighty-five parcels abutting I-495 in North Springfield, Virginia, that for each increase of 1 dBA of noise the value of a parcel was reduced by \$69.⁽²⁵⁾ The author doesn't intend that this should be taken as a strict guide for estimating changes in property values due to noise, but on limited access facilities like I-495 it might at least give one an estimate of the order of magnitude of such effects.

The most appropriate closing for the discussion on land values is to note that very little hard and fast evidence is available. Statements concerning changes in land values as they relate to highway improvements should be viewed with caution until more hard evidence can be developed.

*R. G. Ridker and J. A. Henning, using St. Louis as a study area, estimate that a 1% increase in air pollution (.25 mg/100cm²/day) decreases land value .05% to .1%. See "The Determinants of Residential Property Values with Special Reference to Air Pollution," Review of Economics and Statistics. May 1967. Also see, R. G. Ridker, Economic Costs of Air Pollution. Praeger: New York 1967.

EVALUATION TECHNIQUES: FORMULAS

No techniques are proposed to estimate local government operation effects or changes in slum cost.

Potential Tax Losses

A discussion concerning tax losses attributable to highways must consider the situation where no reassessment is made for the period of time during which an EIS is being written and the case where the assessment ratio changes.

Consider the following situation. Reassessments usually are not made each year; sometimes five years or more may pass before a jurisdiction changes the assessment ratio. Assume that a limited access facility route was decided upon seven years ago (1968) and that a portion of the right-of-way has been bought in each successive year. The estimated right-of-way costs as of 1968 probably wouldn't closely approximate the taxable value of the acreage taken because of the long lag in acquisition. A ball park figure can be estimated, however. Real estate assessments (obtainable in courthouse records) per acre can be collected for the base year and the last year in which right-of-way was acquired. Then the average assessment per acre can be calculated and compared for the two years.

For example, denote

A_1 = 1968 average assessment per acre (including buildings)

A_2 = 1974 average assessment per acre

A_{ij} = assessment ratio (ij represents year; for example 68 = assessment ratio in 1968)

Now, adjust A_1 and A_2 to average market values per acre by the assessment ratio (available in Research Division, Department of Taxation, Richmond) for the respective years:

$$\frac{A_1}{A_{68}} = \frac{\text{1968 average assessment per acre}}{\text{1968 assessment ratio per acre}} = \text{1968 average market value per acre}$$

$$\frac{A_2}{A_{74}} = \frac{\text{1974 average assessment per acre}}{\text{1974 assessment ratio}} = \text{1974 average market value per acre}$$

Calculate the change,

$$\frac{A_1}{A_{68}} - \frac{A_2}{A_{74}} = K = \text{change in average market value per acre from 1968-1974.}$$

Assuming for simplicity that the change in market value is equally distributed through time, divide K by 6 (the number of years between 1968 and 1974). Then $\frac{K}{6}$ is the average per acre market value increase for each year in which right-of-way was acquired.

$$\text{Suppose } \frac{\bar{K}}{6} = \$80, \text{ and } \frac{A_1}{A_{68}} = \$800$$

Suppose also that the Right-of-Way Division acquired 100 acres for the corridor in 1970 (two years). The per acre market value in 1972 would be \$960, that is, $(800 + 2 \times 80)$ and the total market value taken = $\$960 \times 100 = \$96,000$. This figure represents the estimated market value of right-of-way, and when multiplied by the assessment ratio for the locality in 1970 yields the loss in tax base that year.

Employment and Wage Impact Calculation

The RMC study offers a method of estimating the employment and wage impact of a neighborhood disturbed by the construction of a highway. The author has altered this slightly in the equation below. At the present time little else is available from which to work; still, it is suggested that caution be exercised in using the parameters that the RMC study presents.

It is suggested that in cases where field work is required for the gathering of other pertinent information for the EIS, the average number of employees for businesses totally dependent upon the former facility be substituted as an estimate of the employees per liquidated business in equation (1),

$$Z = a (E) \cdot (d) \cdot (B)^{(26)} \quad (1)$$

where

- Z = labor force change in liquidated businesses
- a = proportion of employees that are residents of the study area
- E = employees per liquidated businesses
- d = proportion of liquidated businesses
- B = number of condemned firms

The reader will note that equation (1) requires another parameter — the proportion of firms liquidated. Early in the planning stage, it is very difficult to know with any degree of accuracy what percentage of dislocated firms will actually fail. As the time for moving approaches, entrepreneurs will have to predict the ability of their firm to move. Depending upon the type of improvement, businesses which could be considered as marginal and dependent upon the existing facility will fold. First, non-highway oriented businesses likely will be harder. Secondly, the larger the firm the less likely it is to liquidate. Thirdly, businesses that have a well established, long-standing, local clientele will likely

relocate successfully. William Kinnard estimates that between 22% and 40% liquidate. (27) These estimates are likely high for geographic areas where vacant land is plentiful.

Housing Market Impact Calculation

Several preliminary steps necessary for estimating changes in the price of housing were listed in the earlier discussion on the housing market. Step 1 requires discounting the income stream over the life of the housing stock to present value. A dwelling, whether owner occupied or tenant occupied, costs the dweller an annual dollar amount to retire the mortgage or retain the lease. This can be thought of as being appropriately divided over the life of the dwelling. The value of the dwelling is not the simple sum over the life of the asset, however. Because dollars in the future are less valuable than dollars today, income streams in the future must be adjusted or discounted by the interest rate one could receive if he invested the same number of dollars in the bond market rather than the housing market.

Consider a rental property paying incomes of Y_1 , Y_2 , Y_3 at the end of year one, year two, and year three respectively. Then, assuming an interest rate i , the present value, i.e. the capital value of this rental property is

$$Y = \frac{y_1}{(1+i)} + \frac{y_2}{(1+i)^2} + \frac{y_3}{(1+i)^3} \quad (2)$$

or

$$Y = \sum_{t=1}^3 y_t \cdot (1+i)^{-t} \quad (3)$$

In general,

$$Y = \sum_{t=1}^n y_t \cdot (1+i)^{-t} = \frac{y_1}{1+i} + \frac{y_2}{(1+i)^2} + \dots + \frac{y_n}{(1+i)^n} \quad (4)$$

An example may prove helpful. Assume that a house has an expected life of three years. Also assume that its rental value per year is \$1,000. At an interest rate of 7% the present value of the house is

$$Y = \frac{1000}{1.07} + \frac{1000}{(1.07)^2} + \frac{1000}{(1.07)^3}$$

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$$\begin{aligned}
 &= 934.57 + \frac{1000}{1.145} + \frac{1000}{1.225} \\
 &= 934.57 + 873.36 + 816.32 \\
 &= \$2,624.25
 \end{aligned}$$

For each classification of housing, the immediate impact is the reduction in stock occasioned by demolition or a reduction in vacancy rates. The percentage change in housing supply in each classification, $\% \Delta S^*$, is calculated as

$$\% \Delta S^* = \frac{S_t}{S_{(t-1)}} = \left[C_t - (V_{(t-1)} - V^*_{(t-1)}) \cdot S_{(t-1)} \right] \div S_{(t-1)} \quad (5)$$

where

- ΔS_t = change in supply of occupied units during time due to condemnation
- $S_{(t-1)}$ = number of units during the period prior to construction
- C_t = number of units of the class of housing in question which were demolished
- $V_{(t-1)}$ = the actual vacancy rate for the period prior to construction
- $V^*_{(t-1)}$ = normal vacancy rates. (Assume 1% for owner occupied units and 5% for tenant housing.)

In order to estimate the change in rent or price of housing (remember a rental stream can be converted to present value by discounting) it must be assumed that the demand for housing does not significantly change. There is evidence indicating that such an assumption is not unwarranted. Few individuals dislocated by highways leave the immediate area permanently. Under this assumption about demand, the change in rent is equal to the price elasticity of demand times the percentage reduction in housing stock times the average rent prior to construction, or

$$\text{Rent}_t \text{ is equal to } (\eta_d) \cdot \text{Rent}_{(t-1)} \cdot \% \Delta S^*$$

where

- η_d = price elasticity of demand for housing; parameter estimates are $1.0 \leq \eta_d \leq 1.6$.⁽²⁸⁾ (Price elasticity is the percentage change in quantity demanded associated with 1% change in price.) In this instance, rents rise because supply has been reduced with no

immediate change in demand. The extent to which they rise depends on how large the reduction in stock of housing is and how fast price must rise to assure that demand is curtailed proportionally to the reduction in stock.

$\text{Rent}_{(t-1)}$ = the average rent prior to construction of the type of housing in question.

$\% \Delta S^*$ = calculated from equation (4).

Judgment is very important in deciding what estimate of η_d to use. Where there is severe pressure on the existing stock of housing, it is to be expected that η_d will be near the upper limit.

Land Values

Again it must be emphasized that this subject needs additional research; in fact more basic work needs to be done in Virginia. In addition to the estimates on noise effects given in the Pennsylvania State study, the following may serve as a guide for air pollution effects.

The present value of the cost of air pollution due to a highway facility is

$$P_c = \sum_t \frac{1}{(1+r)^t} \cdot [\% \Delta \text{Pollution}] \cdot [\text{Pollution Elasticity}] \cdot [\text{Res. Land V}] \cdot [\text{Res. Acr.}] \quad (6)$$

where

t = the number of years for which estimating the cost is deemed necessary

$\% \Delta \text{Pollution}$ = the percentage by which pollution is increased

$\text{Pollution Elasticity}$ = the percentage by which residential property values fall for each 1% increase in measured air pollution. Using the study results by Ridker and Henning $.05\% \leq \text{Pollution Elasticity} \leq .10\%$.

Res. Land V = Residential land value per acre. This figure should be an average for the area in question.

Res. Acr. = Residential acreage affected. Technical knowledge in the EQD will render this an easily accessible figure.

A GUIDE TO DATA REQUIRED FOR THE PROPOSED EVALUATION TECHNIQUES

Secondary data are those collected by various agencies (either public or private) and published on a regular basis for use by the public. Primary data are usually thought of as being information gathered in the field for use in a specific research project. Although the preparation of EIS's necessitates the gathering of some primary data on noise, air pollution, and other effects on the physical environment, a significant proportion of the information required to accurately assess economic impact can be obtained without gathering data in the field.

It was stated earlier that sales tax data can be useful as a monitor by which to gauge highway related changes in economic activity. The State Department of Taxation issues a Quarterly Report on Taxable Sales by business classification for each county and city. If data are required for smaller geographic areas, the businesses themselves may have to be contacted, with the assurance that the information will be kept confidential. The Annual Report, also published by the Department, contains tables of assessed values of all taxable property given by cities and counties. The assessed value of real estate will be most valuable information to the writer of an EIS.

The reader will remember that certain of the formulas presented require the tax rate on real estate and the assessment ratio for the locality in question. In addition to the Research Division of the State Department of Taxation, another source of this information is a publication entitled Tax Rates in Virginia Cities and Urban Counties, prepared annually by the Institute of Government of the University of Virginia in cooperation with the Virginia Municipal League. This publication is available directly from the Institute of Government.

There are other sources of information particularly relevant to employment effects and effects on local government operation. The Division of State Planning and Community Affairs in Richmond publishes Economic Data Sheets for each county. These show various demographic characteristics such as age, income, and occupation. The sheets also contain figures for average annual employment, unemployment, and wage information by industry. Frequently this information is separated by labor market areas as well as for cities and counties.

The information necessary for estimating housing market effects is likely the most difficult to obtain. Actual vacancy rates for each classification of housing displaced by the highway improvement may be found in Census of Housing Publications, specifically, General Housing Characteristics, Virginia. In this publication, vacancy rates are given for SMSA's and places with populations greater than 10,000. The data on the expected number of housing units displaced or destroyed can be obtained from the Right-of-Way Division of the Department of Highways.

Equation (6) above shows the extent to which air pollution may reduce the value of residential land. Residential land value per acre, which is required in the equation, can be calculated from information available in the local tax assessor's office.

Although this discussion does not encompass all secondary data sources, the ones noted here are those which will likely be of most value in the preparation of the economic portion of EIS's.

FOOTNOTES

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APPENDIX I

AN EXPLANATION OF EXTERNALITY

Although more rigorous definitions could be presented, an appropriate one [taken from David N. Hyman's, The Economics of Government Activity (New York: Holt, Rinehard, Winston, 1973)] is: "An externality arises when goods and services produced and consumed through the market mechanism bring about benefits or costs to third parties, that is, to individuals other than buyer and seller." For example, assume that a highway is built which circumvents an established residential community. The consumer of highway services, the driver, sees the cost of using the highway differently than does society as a whole; that is, the potential user sees cost as equal to the per mile cost of oil, gasoline, and other operating expenses (including congestion). The seller of highway services, the government, has set gasoline, tire, and other excise taxes to cover construction and maintenance costs. In this sense there is a quid pro quo between buyer and seller.

Further, suppose that those living in the residences bordering on the highway right-of-way find that due to the traffic exhaust fumes, the shrubbery and gardens are dying and the noise of the semi's is very bothersome at night. Granted, it is difficult to put a value tag (Roland N. McKean's, Public Spending) on such, but in the long run, it is reasonable to expect these costs to be capitalized into lower property values. Those people in the homes abutting the highway are third parties (neither buyer nor seller of highway services) and are faced with external costs.

