Methods and Strategies for Transit Benefit Measurement

ALAN J. HOROWITZ AND EDWARD BEIMBORN

Benefit assessment is done to make decisions, and a general discussion is given of how to view benefits for that purpose. Benefit assessment practices from many agencies in the United States are described. Agencies' reported benefits and their use of benefit measures in actual practice are compared. The political environment surrounding transit decisions was found to have a major effect on procedures that are adopted for benefit analysis. The paper also shows how consequences of transit can be illustrated through the use of a benefit tree, which allows planners to show how transit service provides an alternative means of travel, results in changes of trip making by automobile and transit, affects land-use activity, and leads to direct and indirect employment. Approaches are described for quantifying benefits. As an example, a method is presented for calculating the enhanced consumer surplus as a broad measure of user benefits of a project alternative. Recommendations are made on how to effectively use benefit measures for selection of project alternatives within a political decision-making environment.

Recently there has been increased interest in public transit by local units of government. Many urban areas have undergone substantial reviews of their transit services and have developed ambitious plans for expanding service and for constructing new fixed-guideway facilities. This increased local interest often coincides with budget shortages at all levels of government and with increased automobile ownership and usage. Under such conditions this support for transit usually means a larger commitment of local funds. Very often such support is manifested through a referendum or through a major grassroots effort. There is a local perception that the benefits of transit are great, so great that people will accept increased local taxes to pay for them. This has occurred in many cities, but the benefits of transit are still poorly understood.

Benefits can be viewed as those consequences that are valued by some segment of the population. Benefits exist because people believe they are important, whether or not they can be measured (or if seemingly objective measurement shows them to be nonexistent). Some communities place a high value on public transit even though it is difficult to find significant benefits by methods used for other means of transportation. These communities value transit highly and are collectively willing to pay a substantial amount of money to support it. The level of monetary benefits of a transit system in such places must be viewed as being at least as high as the total local expenditures (user costs plus subsidies) for transit, maybe substantially higher.

Benefits can be viewed in different ways, and it is essential to distinguish among approaches. Much of the debate about benefits stems from the chosen point of view. Three common viewpoints are financial, economic, or political.

Center for Urban Transportation Studies, University of Wisconsin–Milwaukee, P.O. Box 784, Milwaukee, Wis. 53201.

A financial viewpoint includes only those benefits that can be recovered as income. Benefits are those things that contribute to the rate of return on the investment in transit. Returns (benefits of transit) should go directly to the agency to pay the expense of providing service. External benefits have no value unless they can be captured by the transit agency.

The economic viewpoint of benefits is broader in that benefits can accrue to others and still be of value. This viewpoint uses a willingness-to-pay criterion for benefits; that is, how much are users and nonusers of a system willing to pay for a service regardless of its price? The difference between willingness to pay and price can be viewed as a benefit: consumer surplus. The economic view also assumes that the benefits can be converted into monetary units. Benefits are derived from an analysis of supply/demand equilibrium and from the behavior of individuals who make choices in an open market condition.

The third viewpoint of benefits is a political one. The political process in a democratic system provides a way for a community to express its opinion of what is and what is not important. When duly elected officials make choices, ideally they are expressing the collective feelings of society about the benefits of different governmental activities. The value placed on transit by voters, primarily nonusers, is an indication of the benefits beyond those accruing to users. Promotional materials from transit agencies, citizen groups, and referenda advocates often include environmental improvements, access to jobs, economic development, better mobility for others, emergency transportation, and enhanced community image as reasons to support transit.

The political process involves tradeoffs and choices, and it can be a good indicator of community values. However, there are factors that may cause the political process to represent opinion poorly. Lack of open debate, unfair competition between ideas, overrepresentation of special interests, or consideration of other unrelated issues (e.g., educational policy or low-income housing) can inhibit the interpretation of transit decision making as a means of measuring benefits. This paper presents a summary of a larger work (*1*) that provides a look at benefit issues from each of these viewpoints.

DECISION BASIS FOR BENEFIT MEASUREMENT

Benefit analysis is done so decisions can be made. A decision could be made for a specific purpose, such as the selection of the best alternative, or for more general reasons, such as to generate support for all transit services. Understanding the nature of transit decisions is the key to benefit measurement. Benefits can be analyzed by looking at both the product and the decision-making process itself.

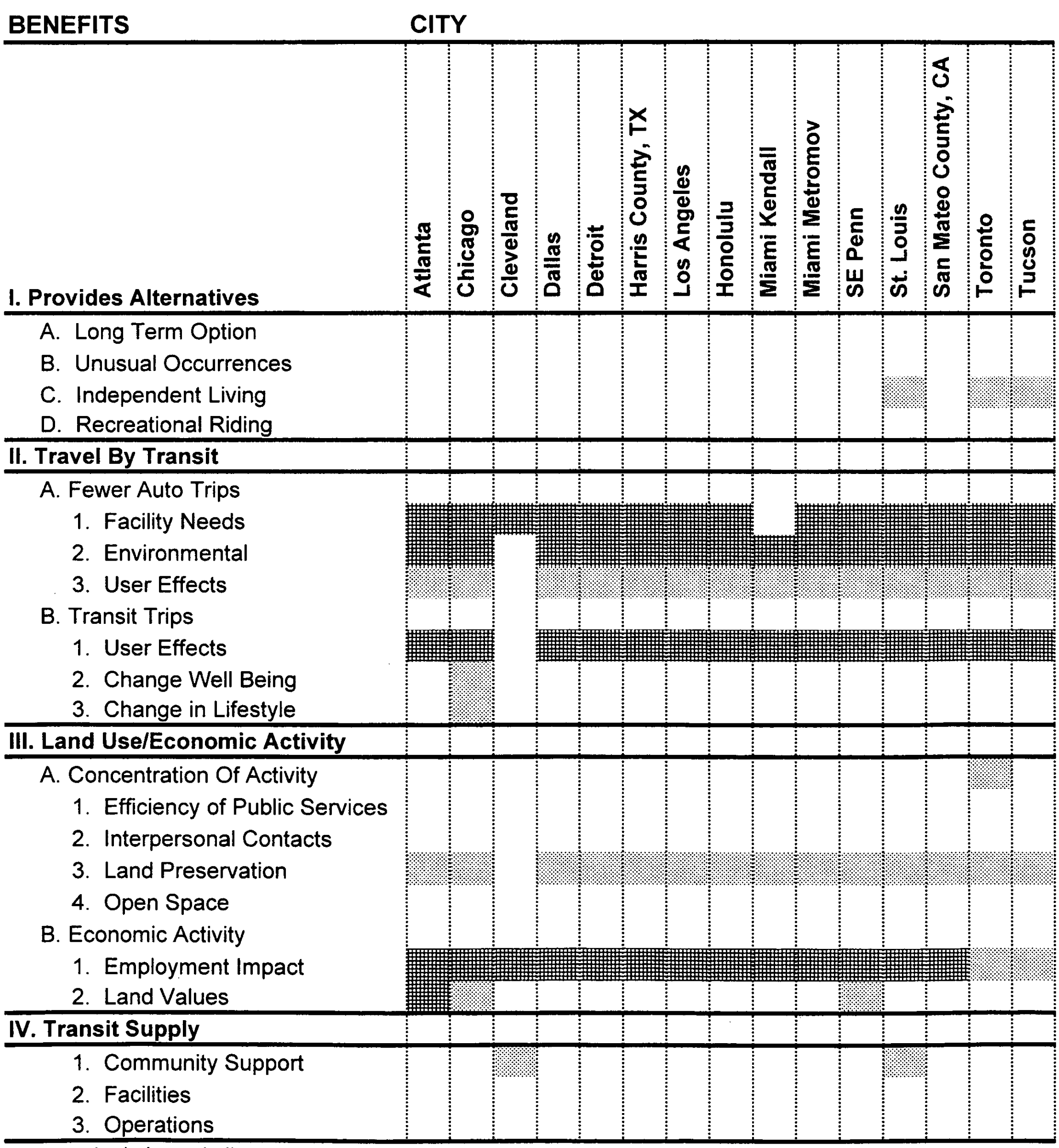
Product: Cited Benefits

A list of benefits and impacts was compiled from a selection of alternatives analysis/environmental impact statements (AA/EIS) for major transit investments. Within the AA/EIS, the federal government requires certain impacts to be quantified; local agencies can add other factors to this list or can elaborate on required items to make their case more convincing. AA/EIS provide evidence of which benefits are of greatest importance to each community.

Fifteen alternative analyses, environmental impact statements, and economic impact assessments were reviewed. These particular cities were selected because they had had relatively recent projects and because their analyses appeared to be complete. Results from this analysis are given in Figure 1. Cited benefits are indicated, as well as whether an effort was made to quantify the benefits. A reading of the AA/EIS reveals that communities cite a wide variety of benefits. There are considerable differences among cities. None of the cities considered the option value of transit, and most considered the reduction in automobile trips, land preservation, and transit operations as benefits.

Process: Local Use of Benefit Measures

Cities around the country were visited to gain a better understanding of transportation decision making and the role of benefits analysis. Cities were selected where expansion of the transit system has been a significant local issue and where extensive analysis has been or is being made of the benefits of transit. Four cities were visited, each of which had undergone or is currently experiencing substan-



*Darker shaded area indicates a quantified benefit

FIGURE 1 Cited benefits in AA/EIS.

tial discussion of local transit alternatives. The purpose of these visits was to examine how analytical estimates of benefits were used in decision making and to identify critical factors that lead to the choice of particular courses of action. This effort also looked into the role of referenda as a way to gain a community expression of transit benefits, that is, to determine whether one could estimate overall perceived benefits by looking at how much a community was willing to tax itself voluntarily to support transit.

In each community, interviews were conducted to understand better the technical and political arguments for and against the transit expansion. In-depth interviews were held with staff members of transit agencies, local government, and metropolitan planning agencies, and citizens and members of the academic community. A large number of documents were also obtained, including planning documents and promotional information that helped to understand the social, political, and philosophical history of transportation decision making. There was good agreement among those interviewed about the key political issues and the areas of dispute.

Issues of Debate

In the communities we visited we found diverse opinions on the general value of transit and even more disagreement on specific projects. This disagreement was especially evident when the issue of building a rail system was a point of local controversy. In these places transit, in general, may have widespread support, but particular parts of rail system proposals are seriously questioned. Debates over courses of action tended to center on benefit issues. Advocates believed there were substantial benefits of transit investment, and those people opposed doubted that such benefits exist. In most cases, these opinions existed independently of any attempts to quantify benefits. Studies that measured benefits were ignored or discredited or cited as authoritative depending on one's position on the proposed project. In most places we visited benefits were a matter of belief rather than an agreed fact. Furthermore, many benefits cited were intangible and difficult or impossible to measure.

The strongest criticisms came from those who believed that rail development cannot possibly be cost effective; that is, it cannot generate sufficient ridership and farebox revenues to justify the investment. In a role reversal, some critics accused political leaders of being too visionary, of not appreciating the obstacles to a successful system, and of placing too much faith in travelers' willingness to adapt to the changing transportation system. Technical analysis used to justify rail programs was challenged by opponents who said that the positive results were predetermined by the chosen methods. The critics have taken a conservative position relative to the potential benefits of a rail program, suggesting that most of the benefits are small and that overall nonquantified benefits do not exist. They say that it would be better to spend the money on bus services that can blend with the automobile-oriented life style of the community. Advocates, on the other hand, placed high weight on nonquantified consequences and were optimistic about other effects.

In the cities visited, those interviewed felt that the community supported transit principally because of the promise of congestion relief. Concerns about air pollution and energy consumption were also expressed in some locations. Supporters of transit included downtown interests, who believed that the center of the city could not experience any future growth without an increase in transportation system capacity. Comparisons to other "world class" cities were made in a few of the cities we visited. Transit was seen as an important factor in civil pride and prestige. However, it was also mentioned in some cities that transit was supported by people who feel that they would not personally use it. In other words, their view was that people want transit so that other people can ride it.

These reasons for transit support in some cities appear to be based on frustration with the highway system. Transit was presented as a palatable way of solving the seemingly intractable problem of traffic congestion. It was mentioned in some places that the city once had a fine streetcar system and things were better then. Lacking tangible evidence that a rail system would actually mitigate today's traffic problems, decision makers accepted this contention as an act of faith.

In some places the issue of socioeconomic status of riders was mentioned. There was a general agreement that trains have more status than buses. They can attract a better class of rider because of the promise of personal safety, comfortable seats, smoother ride, and attractive surroundings. Asked why these same attributes could not be given to buses, it was candidly stated by one person that a better bus environment could not be maintained, given the type of people taking the bus. A decision has apparently been made to create trains for affluent travelers, leaving buses as they were for poor people. Subsequent to these interviews, a lawsuit has been filed in one community concerning socioeconomic separation of train and bus riders.

Socioeconomic status is also affecting route alignments. There is a discernible tendency to locate rail lines away from richer areas and near poorer areas, somewhat undercutting the objective of increasing the proportion of affluent riders. The desire to serve poorer areas is understandable; poorer areas already have a demonstrated need for transit. The desire to avoid rich areas is not totally explained by population density or automobile ownership considerations. Interviewees suggested that the rich do not envision taking transit themselves but fear an increase in crime in their neighborhoods by "those" people who do take transit. Another impediment to providing rail transit in rich neighborhoods is a perception by some individuals that it is visually unattractive and noisy.

Role of Political Process

Transit planning, especially for new rail systems, is fundamentally a political process, assisted by technical analysis. Our interviews showed that most local planners do not believe that it is necessary to evaluate the benefits of its rail program because they have received a mandate for the program in the form of a clear political victory or successful referenda. The decision makers are all actors in the political process, and they decide which parts of the transit program receive funding.

Transit is seen by some elected officials as a means of revitalizing the community, containing sprawl, and encouraging growth in high density corridors. There is a strong belief in the cities visited that they have a dynamic community, rapidly changing in both its urban form and its demographics. The vision of rail transit development is that it can help reshape the community into a more efficient one and that it can overcome the almost complete dependence on highway transportation.

Transit relies on key elected officials for its support. If these key officials lose elections or leave office, there can be significant changes in direction. Projects are dropped or scaled back as other issues gain emphasis. The level of benefits may remain the same, but different people pursue other political objectives.

In some cases support for transit occurs because of a compromise among highway goals, environmental interests, and other factors. Some level of transit investment is needed to gain support for overall transportation programs that include substantial investment in other modes of transportation. Furthermore, support of advocates for environmental protection is obtained by promoting transit in exchange for compromises in development policy. Transit is another issue that mixes into an overall package of programs assembled by elected officials. When the overall picture is explained, the level of support for transit can make more sense than if transit is looked at by itself.

DECISION-BASED FRAMEWORK FOR BENEFIT ANALYSIS

A number of techniques can be devised to assess benefits of transit projects in a manner consistent with the decision process. This section focuses on just two techniques: the benefit tree and enhanced consumer surplus. They do not form a complete evaluation framework, but they indicate the needed breadth for transit decision making. Other techniques may be found in the original report for this study (*1*).

Benefit Tree

Despite the large amount of prior work on transit benefits, there have been few systematic efforts to deal with the interrelationships among different benefits nor have there been many attempts to provide a comprehensive picture of transit benefits. This section describes a framework that was developed for understanding the interrelationships among benefits of transit service. The framework takes the form of a tree diagram.

The benefit tree provides a display of what might happen as the result of a change to transit service. These consequences may not necessarily be benefits but merely impacts resulting from the improvement of a transit system. Impacts can be significant or insignificant depending on the chosen viewpoint, the scope of analysis, and the nature of the null alternative.

The benefit tree shows how consequences are related. The tree is divided into five branches. Vertically, the tree grows more specific from top to bottom. Double counting occurs when benefits are included at multiple levels on the tree. Some benefits can be quantified, others cannot. Nonetheless, the tree can provide a way to consistently compare alternative transit. The five branches are as follows:

1. Alternatives;
2. Travel by transit: fewer automobile trips;
3. Travel by transit: transit trips;
4. Land use/economic activity; and
5. Transit supply.

The tree has a total of 77 consequences, and it is too big to reproduce here in its entirety. Part of the tree is shown in Figure 2. The benefit tree can be used to identify and display the potential benefits of a transit alternative. The first step is to identify those boxes on the diagram where a transit alternative will be significantly different from the null alternative. Only those consequences generate benefits or disbenefits. Each remaining box would then be filled with numerical or descriptive information to describe the effect.

The example shows Branch 5 of the tree, transit supply, as filled out for a rail transit alternative compared with the null alternative, an all-bus system. Plan design and travel demand analysis lead to the determination that the rail alternative requires 30 light rail vehicles to operate on 32 km (20 mi) of track. Operations and construction require the resources shown in the tree. A fully filled out tree could illustrate all consequences and help focus decision making on key trade-offs among alternatives and aid in the selection of a locally preferred alternative. This example uses the viewpoint of a local decision rather than a national decision. As such, consequences that have differential effects at the local level are included. Decisions at other levels of government may use different assumptions and data.

A drawback to the benefit tree is that it is static. It is not possible to show how consequences occur over time. Should the timing of a consequence be an issue, then a suitable comment should be added to its box.

Broad Measurement of Travel-Related Benefits

The largest components of the consequences of transit are those that relate directly to travel. Travel-related benefits are those that result from increased accessibility when a transit system is improved. Benefits can accrue to a transit patron because a trip can be made with less time, cost, or inconvenience by transit than by some other alternative. Benefits can also accrue to an automobile driver or a passenger because there might be less congestion on some streets because of increased transit usage. Benefits can also accrue to traveler who might choose to make an additional trip by either mode or might choose to switch modes.

Many past benefits studies have determined that the largest single user benefit from a transportation system improvement is travel time savings. Additional user benefits include savings in costs of fuel, tolls, fares, vehicle ownership, and vehicle maintenance. Intangible user benefits can include the comfort of travel and the ability to make entirely new trips or to satisfy trip purposes by traveling to better but more distant destinations.

In the nation's largest cities, there has been an increasing interest in transit's impact on traffic congestion. There are two aspects to this impact: (*a*) the degradation of traffic flow associated with buses mixed with automobiles; and (*b*) the improvements in traffic flow that might occur if some drivers can be persuaded to take transit. Both of these effects should be components of user benefits.

When dealing exclusively with highway travel, it is sometimes possible to estimate user benefits by adding individual components. For example, by ignoring changes in mode or destination it is possible to compute time saving from a highway improvement by subtracting the "after" total travel time from the "before" total travel time. Transit benefits are far more complicated, so it is easiest to estimate them directly from the net consumer surplus of the system change. If calculated properly, net consumer surplus will include all the cited benefits, both tangible and intangible.

Essential Ingredient: Travel Forecast

User benefits in the form of net consumer surplus can be easily estimated, provided that a good travel forecast has been prepared for the transit alternative and the null alternative. It is important that the

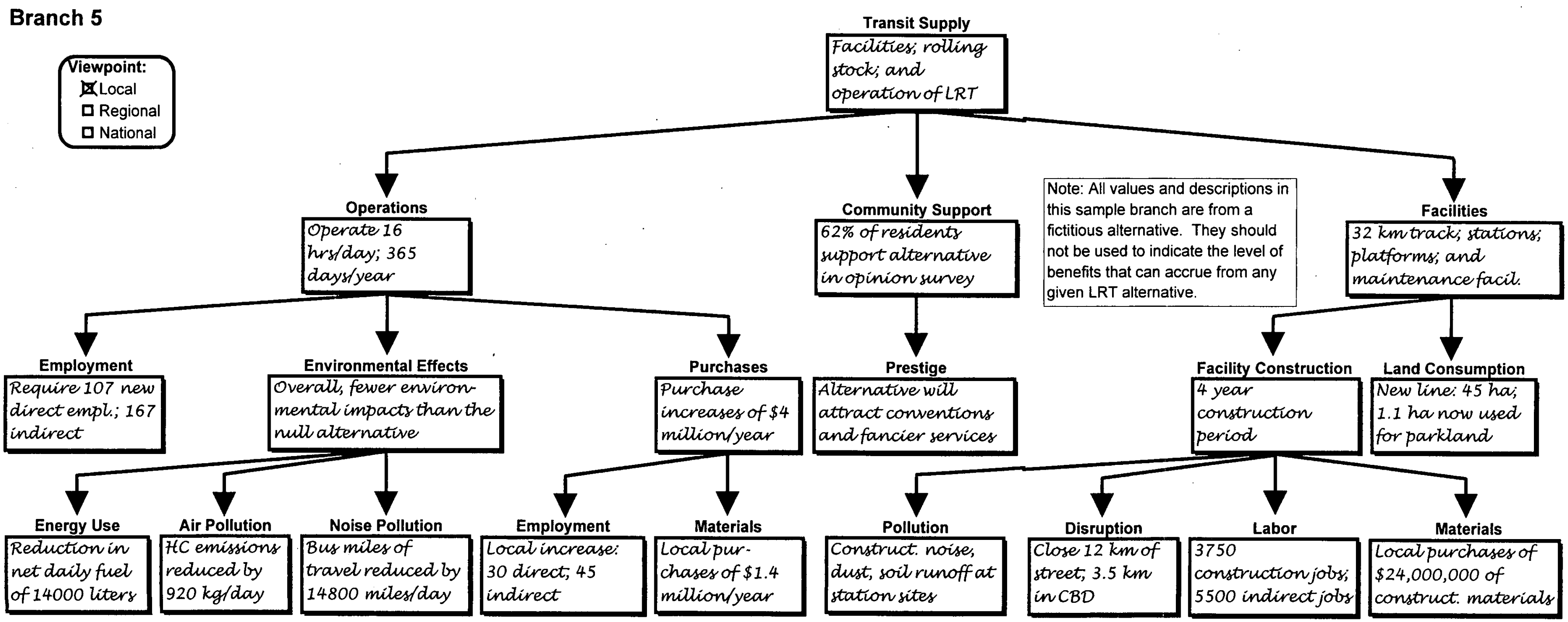


FIGURE 2 Example of one branch of benefit tree.

spatial distribution of trips within the forecast should be sensitive to the amount of transit service, enabling shifts in origin-destination patterns because of transit improvements. Most travel forecasting models do not provide this sensitivity; however, it can often be added with little difficulty. Furthermore, the spatial distribution of trips and mode split should be sensitive to the level of congestion on highways. Some travel-forecasting models can do this automatically, others cannot. Planners sometimes refer to a forecast with this property as having "elastic-demands."

Procedures for creating such a forecast have been developed over the past several years and are already available in off-the-shelf travel-forecasting packages. The essence of this approach is to use behavioral travel choice models as the indicator of willingness to pay and the basis for benefit measurement. Additional elements may be needed, depending on the nature of the transit system modification and its long-term effects on urban development.

Travel Benefits as Measured by Enhanced Consumer Surplus

Economists tell us that benefits of any public project can be ascertained by calculating net consumer surplus. Consumer surplus is the difference between the amount an individual is willing to pay for a good and the amount the individual actually pays.

For any given transit trip it is possible to calculate a comprehensive measure of its costs and inconveniences, called the trip's "disutility." Disutility is most easily interpreted when it is expressed in units of automobile riding time. A typical disutility function would look like:

Disutility = automobile riding time + (transit riding time)
· (transit riding weight) + (walking time)
· (walking weight) + (waiting time)(waiting weight)
+ (transfer time)(transfer weight)
+ initial wait penalty + first transfer penalty
+ second transfer penalty + fare/(value of time)
+ (tolls + parking costs
+ vehicle operating costs)/(value of time)
+ (vehicle ownership costs)/(value of time) (1)

In this equation, the value of time is the rate at which travelers would be willing to trade money for time savings. The weights, penalties, and values of time are easily extracted from mode split models or from psychological scaling studies. Equation 1 deals exclusively with time, cost, and convenience issues. Additional terms could be provided for other significant elements of comfort, such as protection from inclement weather and privacy, if they were factors in traveler choices.

The only vehicle ownership costs that should be included in Equation 1 are those that can be attributed to a single trip. It has been found that travelers do not correctly perceive the full value of their vehicle ownership costs while making mode choice decisions, so this term is sometimes omitted. However, it may be that a user regularly chooses transit to avoid ownership of a second car. In that case the ownership cost of an automobile should be included in the automobile disutility equation for those who qualify.

Travelers have a willingness to pay in units of travel time (*2*). They will choose to ride only if the disutility of travel (in time units) is less than their willingness to pay (in time units). Consequently, travelers possess a consumer surplus of disutility in time units. This disutility may be mathematically expressed as a time savings or maybe converted to monetary units by multiplying by the value of time.

Calculation of Enhanced Consumer Surplus

This enhanced measure of consumer surplus is illustrated in Figure 3 for a single trip. A demand curve shows the relationship between numbers of trips and trip disutility, expressed in time units. Point 1 represents the original disutility and number of riders taking the trip. Point 2 shows a new disutility and the number of riders after a service change, such as shortening the headway. Because of the service improvement, more people have chosen to take this trip. Some new riders switched from the automobile, some new riders have changed their choice of destination, and some new riders are making an entirely new trip. T_1 is the original disutility, and T_2 is the new disutility. All the old riders receive a windfall consumer surplus of $T_1 - T_2$. This windfall is illustrated as the shaded area *A*. New riders have a net consumer surplus shown in the shaded area *B*. Consequently, the total consumer surplus can be found from the roughly trapezoidal, combined area:

$$\text{Net consumer surplus} = -\int_{T_1}^{T_2} Q(T)dt \qquad (2)$$

where $Q(T)$ is ridership as a function of disutility. Because of the integral sign, Equation 2 looks more complicated than it really is. Integral calculus is never actually used to perform such a computation. Instead, simply divide the service change into several small increments and approximate the net consumer surplus as a trapezoid as each increment is applied.

In a multimodal transportation system it is necessary to sum the net consumer surplus over all possible modes. Total net consumer surplus for the whole system can be found from this relationship,

$$\text{Net consumer surplus} = -\sum_m \sum_i \sum_j \int_{T_{1mij}}^{T_{2mij}} Q(t)dt \qquad (3)$$

for all modes (*m*), all origins (*i*), and all destinations (*j*). As before, the integral is performed by summing the areas of flat, wide trapezoids.

The benefit tree does not require that benefits be converted to monetary units. If it is found to be necessary, enhanced consumer surplus can be converted to money by multiplying by the value of time.

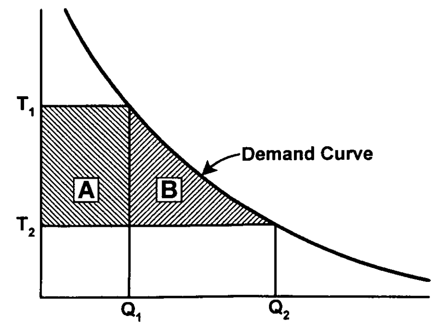


FIGURE 3 Calculating net consumer surplus from demand curve.

Technical Issues

A travel forecast that can properly measure enhanced consumer surplus is no more difficult to run than a conventional forecast, provided care is taken to compute the necessary values of disutility and demand for all modes. The types and amount of data, calibration requirements, and necessary expertise are essentially unchanged. However, there are certain technical and procedural questions that must be dealt with.

Composite Disutilities Most travel forecasts find the spatial distribution of trips throughout the community with a model steps that exclude information about the quality of transit service. Consequently, such a forecast will not be properly sensitive to changes in transit service. Forecasters have sometimes included transit service into the trip distribution step and the land use step by computing composite disutilities between origins and destinations that account for both highway and transit service. The following composite cost function has been found to provide the correct amount of sensitivity (*3*):

$$T_{cij} = \ln[\exp(-\alpha T_{bij}) + \exp(-\alpha T_{aij})]/-\alpha \quad (4)$$

where

- T_{cij} = the composite disutility from origin i to destination j,
- T_{bij} = the disutility by transit,
- T_{aij} = the disutility by automobile, and
- α = the coefficient for in-vehicle time in a logit mode split model.

The composite disutility is always smaller than the smallest value of its components.

Approximating Net Consumer Surplus Integral with Trapezoids Transit service changes can be either discrete or continuous. An example of a discrete service change would be the addition of a new rail station. An example of a relatively continuous service change would be an improvement in headways. It would make sense to compute the net consumer surplus of only part of a headway improvement, but it would make little sense to compute the net consumer surplus of only part of a new station. For discrete service changes, there can be only two possible valid forecasts: with and without the change. Consequently, net consumer surplus must be computed as a trapezoid, which will have a slightly larger area than an integral would find.

For continuous service changes, the calculation of net consumer surplus can be more precise. The service change can be arbitrarily divided into several increments, and the net consumer surplus can be computed for each increment as the area of a flat trapezoid. The sum of the net consumer surpluses for each increment is the total net consumer surplus. The major drawback to subdividing service changes in this manner is the added computation time necessary to evaluate each amount of intermediate service.

Need for Realistic Null Alternative Net consumer surplus is always calculated between a before case and an after case. The most relevant before case is the null alternative, that is, the most likely state of the community without the service change. The null alternative is not necessarily the current state of affairs. The null alternative could include growth or decline, redistribution of activities, or natural changes in the character of the community. Good null alternatives are difficult to construct, but they are essential to a valid calculation of consumer surplus.

A transportation system management (TSM) alternative is not a null alternative; a TSM alternative, by itself, can have significant benefits over the current state of affairs. It would be better to look at consumer surplus among different sets of alternatives; that is, TSM versus null, proposed versus null, proposed versus TSM, and so on. This way the net benefits versus costs can be determined.

CONCLUSIONS

The review of existing practice of benefits evaluation suggests that improvements are needed. It is essential that an evaluation be consistent with community values and with observed travel behavior. The following list of major findings and recommended procedures should serve as a set of guidelines for any benefits analysis.

Major Findings

Transit decision making is dominated by intangibles that do not easily lend themselves to quantification. Some of the most important benefits of transit are community pride, health effects of pollution, potential for urban redevelopment, equity of transportation service, and its option value.

The political decision process cannot be replaced by an objective technical evaluation scheme. The political process for transit decision making is firmly entrenched. Further, the political process is too complex, too fluid, and too subjective to be replicated by an objective evaluation procedure.

The political decision process is sensitive to good analysis but may not respond as the analyst desires. Good technical analysis is always worthwhile and is appreciated by many political decision makers. However, decision makers will reject any technical analysis that fails to confirm their beliefs or fails to convince them that their beliefs are incorrect. Given that the political process is not objective, it may be difficult to extrapolate on past experiences when assessing new project alternatives.

The results of any technical evaluation procedures must be intuitively correct. Any deviation from intuition will be quickly recognized and will undermine the acceptance of the analysis.

There are many interrelated benefits, leading to problems of double counting. Double counting can be explicit or implicit. It is the responsibility of the planner to avoid double counting and to indicate where unavoidable double counting occurs. This can be avoided by not aggregating measures and by using the benefit tree.

Evaluations of benefits in environmental impact statements or in alternatives analyses are limited. Agencies need to become more aware of good evaluation methodologies and to use the methodologies in their studies. Many agencies still need to recognize the importance of EIS and AA to their decision making.

Recommended Procedures

Use the benefit tree to identify important impacts and to help identify sources of double counting. The benefit tree is a comprehensive listing of potentially positive impacts of transit service improvement. Not all impacts may be realized in any given community. Two impacts in close proximity on the benefit tree may constitute double counting, especially if one of the impacts is directly above the other.

Avoid aggregation of benefit measures. Aggregation destroys information. Transit decision making is complex, and that complexity must be apparent to decision makers. Each decision maker has a different way of weighing benefits; no aggregation scheme can possibly represent every set of weights.

Quantify as many benefits as possible. Quantification facilitates comparisons of alternatives, permits sensitivity analysis, and helps eliminate ambiguities.

Use a broad-based measure of consumer surplus for travel-related benefits. This report describes a direct measure of overall improvement in society, which is termed enhanced consumer surplus. It encompasses time savings, comfort, and convenience. Enhanced consumer surplus can be measured with readily available travel-forecasting methodologies. Because of the possibilities of significant congestion relief, all steps of the travel-forecasting model should be sensitive to changes in assigned travel times.

Examine changes in efficiency of land uses. Efficiencies occur because of regional changes in land use and because of local concentrations of activities. The effect of regional changes can be incorporated in enhanced consumer surplus. Local concentrations are difficult to predict, but their impacts of infrastructure efficiency may be significant.

Avoid using employment impacts as benefits, unless it can be clearly demonstrated that the employment would be greater than the null alternative. A common pitfall in benefits studies is to count employment shifts as gains. It would take a very sophisticated analysis to demonstrate a net increase in employment for most transit improvements:

Describe benefits that are not quantified. An objective description of a benefit should be provided, even if the benefit cannot be calculated. It is a mistake to omit valid benefits that do lend themselves to a particular evaluation scheme.

Tell how quantified benefits are calculated. The quantification of some benefits can be technically complicated. Nonetheless, it is important to explain the methodologies used in doing the calculation, including any assumptions made. Techniques must be explained in a manner understandable to a decision maker; otherwise it is best to avoid quantification.

Present information in a manner that facilitates decision making. It is important to treat decision makers with respect and honesty. Information must be presented in a clear and concise manner, avoiding hidden assumptions and highlighting those issues that are salient or controversial.

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