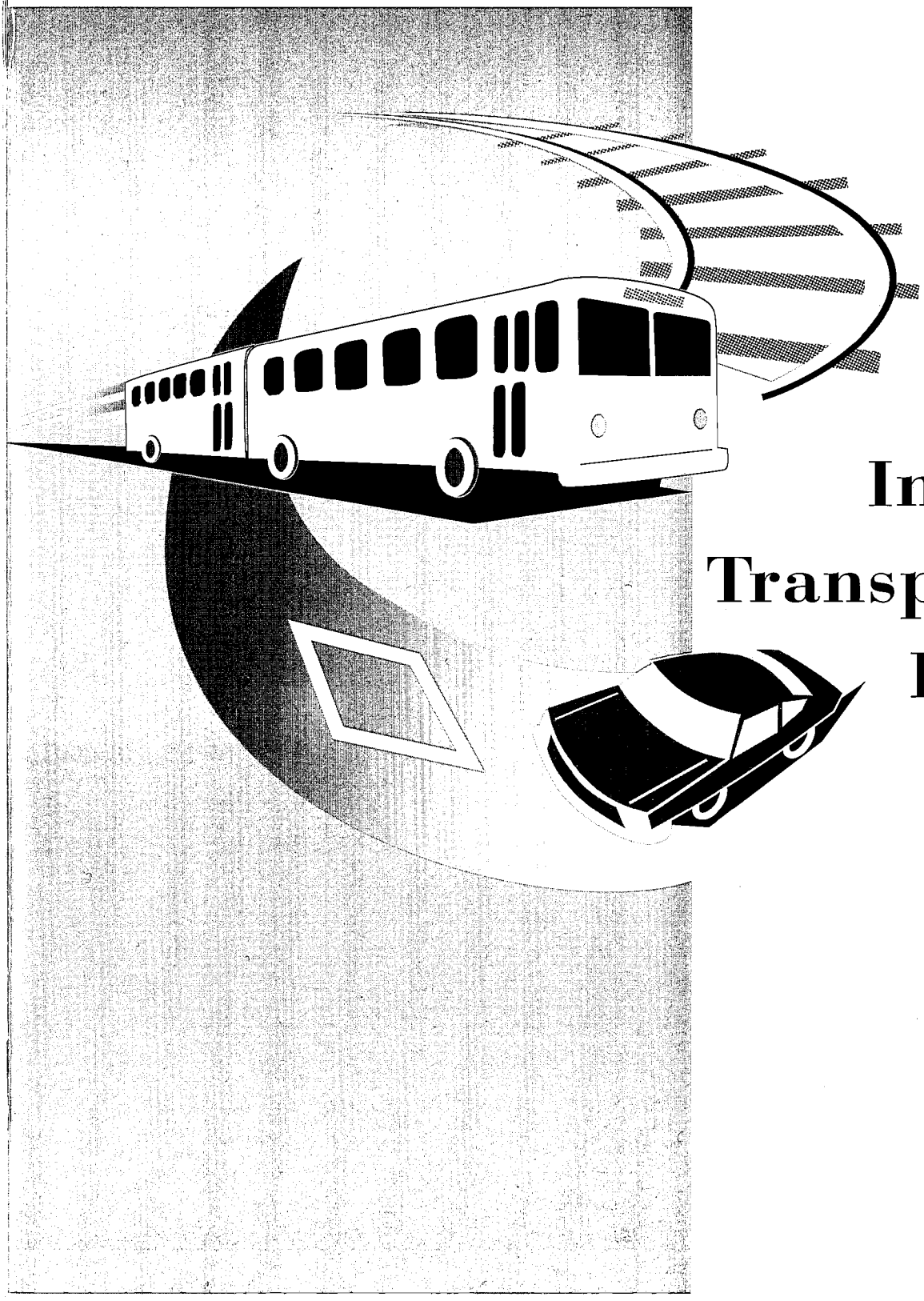
A Primer for Policymakers



Integrated Transportation Planning

June 1995

Puget Sound Regional Council
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REPORT TITLE: Integrated Transportation Planning—
Applying Least-Cost Planning Methods to Transportation System Analysis:
A Primer for Policymakers

SUBJECT: This report describes how Integrated Transportation Planning and the use of least-cost methods of analysis may help in developing cost-effective transportation facility investment decisions.

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Integrated Transportation Planning:

Applying Least-Cost Planning Methods to Transportation System Analysis

Introduction

Deciding on surface transportation programs and projects gets harder every year. Fifty years ago, the direction for transportation investment was clear technically and politically—build highways. But the more vigorously technicians and politicians pursued this policy, the less effective it became. In the wake of new federal and state legislation, policymakers have now embraced the concept of "multimodalism" which recognizes that urban mobility is served not only by streets and highways, but also by sidewalks, bus routes, railways and other technologies.

But choosing the right technology for personal and freight mobility is only part of the challenge—policymakers must find solutions while addressing public demand for fiscal restraint. Money for public investments is scarce at the very time that key segments of the transportation system are reaching full capacity. How do policymakers determine which of the potential solutions to our transportation problems make the most sense? How do they build and sustain agreement with the public about problems and solutions?

Integrated Transportation Planning may offer answers. Integrated *resource* planning is a method of analyzing investment strategies that has evolved from decisions faced by electric utilities in the Pacific Northwest. It was developed to choose the lowest cost approach for providing a given level of electric service. Utilities also refer to the process as *least-cost planning* although most energy experts now prefer the term integrated resource planning. Substitute House Bill 1928, passed by the Washington legislature in 1994, instructed Regional Transportation Planning Organizations to apply least-cost planning principles to their investment decisions. In response to that legislative mandate, the Regional Council is developing the concept of Integrated Transportation Planning to reflect the legacy of methods developed by electric utilities, but to also call attention to the dissimilarities between planning for electric utilities and planning for surface transportation.

Many of the principles of least-cost planning applied by the electric utility industry are relevant to planning for transportation investments. This brochure describes how Integrated Transportation Planning could apply to decisions about transportation infrastructure undertaken by organizations such as the Regional Council, state agencies, and local jurisdictions. While the basic principles of Integrated Transportation Planning have solid foundations in economics and good planning practice, the methods to implement these principles have not often been applied in public deliberations of transportation alternatives.
The Regional Council is now engaged in a process to define Integrated Transportation Planning and determine how to apply it. This brochure reflects the current thinking of the staff of the Regional Council about what integrated transportation is and how it could improve decision-making about transportation investments.

What is Integrated Transportation Planning?

Integrated Transportation Planning is an approach to making decisions about how to allocate scarce resources. It includes methods for collecting, analyzing, evaluating and displaying information for policymakers and the public. It includes both analytic *methods* for evaluating alternatives and a planning *process* for selecting them. The five key principles of Integrated Transportation Planning require:

- Consider*ing of a full range of transportation alternatives.* There are many different approaches to solving transportation problems, ranging from those that increase the supply of transportation (e.g., new roads, rail lines, and exclusive freight lanes) to those which reduce demand (e.g., rideshare programs, parking restrictions, and pricing mechanisms). Integrated Transportation Planning ensures that all of these approaches are considered in the development of a long-term transportation strategy. And it recognizes that no single project or policy constitutes a complete long-term strategy.
- *Using cost-effectiveness as a key criteria for selecting transportation investments and policies.* Integrated Transportation Planning emphasizes an evaluation of the full social costs and benefits of transportation alternatives. When applied in the electric utility industry, integrated *resource* planning uses an estimate of the total social cost for generating a kilowatt hour of electricity assuming that the benefits per kilowatt hour are constant. This approach means that alternatives can be compared on the basis of the cost per kilowatt hour. However, the wide variety in the characteristics of travel alternatives does not permit a simple comparison of costs per trip. Since travelers do not value trips by different modes equally, Integrated Transportation Planning requires a full evaluation of both costs *and* benefits to select the most efficient alternative.
- C*onsidering all significant social costs in the evaluation of alternatives.* The evaluation of costs includes not just the resources committed by the public sector for capital construction and operation but also the costs that transportation users incur when they use a particular facility. These include out of pocket costs such as vehicle costs, gas and parking as well as the value of the time transportation users spend traveling and waiting. Ideally, environmental costs such as reductions in air quality would be quantified in dollars and included in the calculation of total social costs. Often, however, these effects are best analysed by estimating their physical impact on the environment and then considering their effects with other non-cost factors.
- *Engaging the public in the selection of a comprehensive transportation strategy.* While every impact can not be expressed in dollars, better information about benefits and costs can help build consensus around the mix of actions that is in the region's long-term best interest. For example, though utility executives and environmental groups initially had very different views about how to meet future energy demand, integrated *resource* planning offered them a common analytic framework for discussing and evaluating their differences. Getting agreement on the terms of the debate and building confidence in the quality of information used to analyze alternatives helped develop common ground for choosing the best approach to meet future demand for energy.
- *Monitoring and adjusting a comprehensive transportation strategy.* Integrated Transportation Planning requires careful monitoring of the actual costs and performance of different transportation measures. Feedback about how projects actually perform provides better information on cost-effectiveness and improves the models used to predict travel behavior. Integrated Transportation Planning should involve constant reevaluation of which measures work and the corresponding adjustments to long-term strategies.

What are the potential advantages of applying an Integrated Transportation Planning approach?

New federal and state mandates now require that policies and plans be chosen using Integrated Transportation Planning methods. Policymakers at the federal and state level are encouraging this approach because they believe it offers the following advantages.

- *It is comprehensive.* Integrated Transportation Planning requires that a full range of alternatives be considered and that the alternatives be *real* alternatives, not ones that are selected to make a predetermined favorite look good.
- *It is consistent.* Integrated Transportation Planning provides a consistent way to compare different policies according to how people value them. Seemingly different policies—different modes, or even supply-side and demand-side measures—can be evaluated and compared.
- It *is understandable.* Policymakers and the public understand the importance of making efficient and fair decisions; Integrated Transportation Planning provides information in ways that help everyone to better understand the impacts of policy choices.
- *It is necessary.* Policymakers must allocate diminishing resources among an increasing number of competing projects. Integrated Transportation Planning can help guide policymakers in choosing alternatives which have the best chance of providing a good return for these resources.

What are the potential disadvantages of trying to apply Integrated Transportation Planning?

While many of the principles of Integrated Transportation Planning are familiar, applying it to existing planning processes poses some serious challenges:

- *The analytic techniques and planning processes are not fully developed.* While many of the techniques for measuring the full social costs and benefits of individual transportation projects are well established, some of the approaches to broad system level planning are less well developed. Planning agencies will have to invent and refine some of the methods as the process moves ahead.
- *Some will object to an over-reliance on the cost-effectiveness criterion.* While cost-effectiveness is not the only criterion for decisions in an Integrated Transportation Planning context, it may ultimately be the dominant factor especially if least-cost methods are vigorously applied. Proponents of projects and or modes that don't pass the cost-effectiveness test may find the results of an Integrated Transportation Planning process difficult to accept.
- *Integrated Transportation Planning requires greater coordination among jurisdictions.* The state, regional, and local transportation agencies in the central Puget Sound region have made major strides toward greater cooperation to comply with the planning requirements of the state's Growth Management Act and federal transportation policy. Nonetheless, Integrated Transportation Planning will require even greater cooperation to the extent that agencies must apply comparable evaluation techniques and monitoring procedures as they evaluate and continuously assess their transportation investments.

Can planners really expect to express every impact from a transportation project in dollars?

No. Not every impact can be translated into dollars and cents but many of the most important ones can. In particular, we have the information to do a much better job of estimating the dollar value of the benefits to people who will use a new transportation facility. Models used to predict how travelers will respond to changes in transportation capacity can give considerable insight into how travelers value riding a bus, train, or single occupant vehicle. With careful analysis we can develop good estimates to answer the question, "How much do travelers value the proposed improvement?"

Answering the question "How do we value the potential changes in air quality or land use patterns?" is much more difficult. Some techniques are available but they suffer from lack of reliability and disagreement about how and when they should be applied. In most instances, the best analysts can do is to give an honest estimate of the likely range of physical effects from different alternatives and let policy makers consider this information along with data on costs and benefits.

How does Integrated Transportation Planning deal with uncertainty about the future?

No analysis is certain, especially one that attempts to estimate the future costs and benefits from major transportation system investments in a complex metropolitan area. In transportation planning, there are many sources of uncertainty, including the growth rates of population and the regional economy, the capabilities of new and existing technologies to cope with increased traffic, the accuracy of travel models and the value of some environmental impacts. Integrated Transportation Planning should incorporate the following techniques to deal with these uncertainties:

- *Test how forecasts change with changes in assumptions.* In the case of uncertain forecasts, or uncertain monetary valuation, planners can show how the total benefits and costs change within a reasonable range for key variables. They can simulate uncertainties in the forecasts and observe how the final results change. This method improves the typical "best-case" and "worst-case" analyses by providing more information about the "most likely" case, and the degree to which the future reality may diverge from that estimate.
- *Look at alternative scenarios.* Benefits and costs from transportation investments can change significantly depending on unforeseen economic developments or changes in technology. Integrated Transportation Planning should test an alternative strategy across a wide range of scenarios to determine how well it will perform. This approach checks how robust an alternative is given the uncertainty about the future.

How does Integrated Transportation Planning deal with future benefits and costs?

One of the difficulties in evaluating major investments in transportation infrastructure is that most of the costs occur up front while the benefits stretch into the future. How should policymakers value a project that costs billions today and yet may provide service for three generations? Economists advocate the principle of discounting future benefits and costs and expressing all figures in "present value" terms. Present values are calculated using a discount rate that is set by looking at the rate of return on alternative investments.

The selection of the discount rate can have a significant effect on the estimated net present value of a transportation project. An investment whose benefits are primarily ten or twenty years in the future will look much less attractive when applying a discount rate of 10% instead of 3%. Deciding on a reasonable range for the discount rate and including that range in the evaluation of uncertainty is an important element of the Integrated Transportation Planning process.

What about fairness?

Anyone who has watched how transportation investment decisions get made knows that who might "win" and who might "lose" money for major infrastructure investments can influence a decision. For example, much of the recent debate about a regional high capacity transit system for the Puget Sound area focused on whether one geographic area would benefit from the plan at the expense of another. The public vote showed that support for the system was weakest in areas that perceived a lack of service and benefits under the proposed plan. Policymakers and the public need to know who pays and who benefits before making a final decision.

Transportation planners rarely devote the same level of effort to analyzing the equity implications of proposed policy as they do to modeling a proposal's performance. This is a mistake. Knowing who wins and who loses—and determining if there is a better way to balance the benefits of transportation investments—is at least as important as forecasting how many people will use a proposed transportation improvement. The challenge for planners is to use performance data as part of a general evaluation of benefits and costs and then determine how performance affects different stakeholders.

Integrated Transportation Planning could evaluate the equity effects of a policy by:

- geographic area
- income group
- other characteristics (e.g., race, ethnicity, special needs)

Identifying the net benefits of a policy and how they are distributed among different groups will help policymakers select options that are both cost-effective and fair.

Does Integrated Transportation Planning take into account our region's existing comprehensive land-use plans and policies?

Decisions about alternative transportation strategies are closely tied to decisions about land use. While Integrated Transportation Planning does not require an inherent preference for a particular urban form, it does attempt to quantify the congestion and air quality effects of development patterns. To the extent that an alternative reduces congestion and air pollution, it should perform better than other alternatives when analysed using least-cost methods.

Through the comprehensive planning process under the state's Growth Management Act, policymakers in the central Puget Sound region have determined their vision for how the region should develop. Within this planning context individuals and firms acting in the private land and transportation markets will make decisions about where to live, work and invest—and how to move from one location to another. Integrated Transportation Planning attempts to estimate how individuals and firms value alternative transportation and land-use configurations. Policymakers may choose an alternative that yields lower net benefits because it serves a long-term vision about how the region should grow. Integrated Transportation Planning doesn't prevent these kinds of policy choices, but it does require policymakers to make explicit the underlying assumptions and tradeoffs associated with their decisions.

How will Integrated Transportation Planning help with our decision-making?

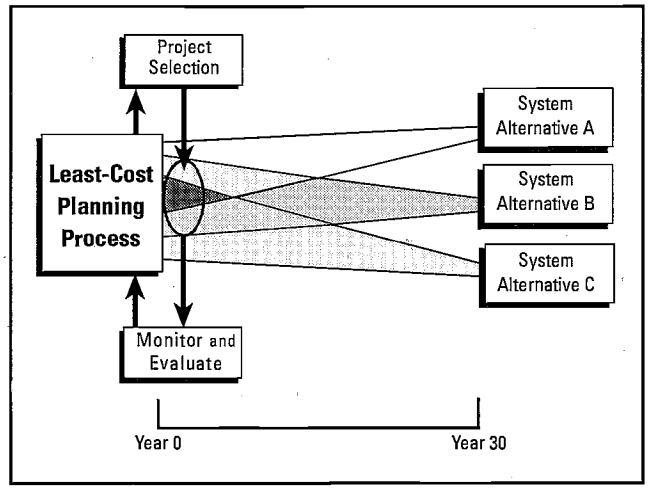
In spite of all the math and modeling that goes into quantifying benefits and costs, not all of the complexities of transportation, land use, regional economic policy, social welfare, and politics can be captured in an estimate of net present benefits. Integrated Transportation Planning embraces a multiple-objective approach to decision-making, which acknowledges that there is no way to assign a reasonable value, or range of values, to some of the important outcomes of transportation policy decisions. Integrated Transportation Planning places these outcomes along side those that can be estimated in dollars to engage policymakers and the public in a discussion about the implicit values they place on certain environmental and social effects.

Integrated Transportation Planning also helps policymakers distinguish between long-term strategies and near-term implementation. Integrated Transportation Planning involves the continuous verification of the performance of past investments and policies to determine what projects and policies are the most cost-effective. It also involves regular updating of forecasts of future traffic conditions as analysts gain experience within a region about what projects and programs really work and how travelers behave. By regularly looking back on past performance and then forward to readjust forecasts, Integrated Transportation Planning ensures that policymakers can adapt their transportation strategy to account for changing conditions.

Planning in the Face of Uncertainty: Making Strategic Investment Decisions

One can't pick up a book or magazine about business management without reading about the rapid pace of change, the uncertainty of the market place, and the unknown ways that technological change will affect future business practices. An entire industry has grown up to respond to this uncertainty by providing strategic planning services. Integrated Transportation Planning incorporates many of the lessons of strategic planning. The following figure illustrates several important strategic elements that are part of the Integrated Transportation Planning approach.

Strategic Elements of Integrated Transportation Planning



Suppose a planning organization has incorporated Integrated Transportation Planning principles into its long-term planning process. After considering the benefits and costs of different combinations of projects and policies that add new transportation capacity and control the demand for new facilities, policymakers selected System Alternative B over alternatives A and C. System B performed the best under the most likely future growth scenarios given current understanding about how travelers respond to different measures and how society values various external effects. However, decision-makers know that there is uncertainty around these estimates and under some possible future conditions, System Alternative A might be superior to B.

Using the framework of the long-term system plan, (in this example, it is System Alternative B), decision makers select projects and programs for implementation over the first five years that are indicated by the oval in the figure. Note that while most of the projects inside the oval are in Alternative B, elements of both A and C are included. Part of the oval includes projects in Alternative A that are not part of B. These projects are included because they will provide information about the performance of these options that are part of the monitoring and evaluation that feeds back into the Integrated Transportation Planning process.

One of the weaknesses of current transportation planning is that agencies rarely go back and evaluate how well their projects and programs perform relative to what was predicted. Integrated Transportation Planning builds this evaluation into the process. Over time planners gather better information about how different supply and demand side measures perform, and they learn more about the actual patterns of population, employment and travel growth. This information is fed back into the Integrated Transportation Planning process to inform future planning efforts.

If, over the course of several planning cycles, policymakers learn that the conditions have changed in such a way that Alternative A begins to appear superior to B, the appropriate changes can be made to the long-term plan. Understanding the lead times required for different measures can help shape the mix of projects and polices that fall within the approved project oval to preserve future flexibility. At some point, however, policymakers must choose. They cannot straddle the two paths indefinitely. The key elements in making informed strategic decisions are the following:

- *Identify key decision points in the process.* This is strongly linked to lead times for major projects, which in turn determine when decisions have to be made about whether to invest in them. It is best to collect as much information as possible before making these decisions, particularly about external conditions.
- *Monitor and evaluate past decisions.* Information on the consequences of past decisions should inform future policy and investment decisions. Hence, any planning decision should entail a program of evaluation. The information from the evaluation can be used to assess future decisions, and to improve the methods and models used for policy analysis.

Uncertainty can never be eliminated entirely from the evaluation of different alternatives, but by strategically selecting projects and evaluating their performance, planners can reduce the amount of uncertainty before making final decisions.

People have been talking about benefits and costs for years: What's new about Integrated Transportation Planning?

Benefit-cost analysis has occasionally been applied to specific transportation projects in the past. Integrated Transportation Planning places the tools of benefit-cost analysis in a broader transportation planning context that provides a more systematic process for evaluation and public decision making. Some of the features that distinguish Integrated Transportation Planning from earlier benefit-cost approaches include:

- *Comprehensive view.* Benefit-cost analysis has traditionally been applied to the analysis of individual projects that add new capacity in a small part of a region. Integrated Transportation Planning begins with a systemwide view that includes assessing both supply and demand side measures. At the systemwide level, alternatives include increasing the supply of roadways, rubber-tired transit, and rail transit as well as demand management and pricing measures. At the project level, Integrated Transportation Planning applies benefit-cost analysis to the best, most cost-effective alternatives that have been identified within the overall system plan.
- *Consistent framework.* Integrated Transportation Planning links system-level planning with the evaluation of alternatives at the subarea level for a particular segment of road or railway. A consistent analytic framework applies from top to bottom.
- *Explicit consideration of uncertainty.* Integrated Transportation Planning formally considers uncertainty in evaluating alternatives. It uses the best techniques available for forecasting travel behavior and then rigorously defines the likely bounds of uncertainty. Integrated Transportation Planning works to identify alternatives that perform well across a range of possible futures.
- *Verification of project performance and regular adjustment of system strategy.* Integrated Transportation Planning requires that existing projects and programs receive regular evaluation of their cost-effectiveness as a way to inform future decisions and influence future planning
- *A regular process for public involvement.* While some aspects of Integrated Transportation Planning are very technical, the process is not technocratic. The analytic framework does not make the decisions; policymakers and the public do. Integrated Transportation Planning should provide better information as part of a public process for selecting an optimal strategy to meet our transportation needs.

Benefits and Costs: What counts and what doesn't.

Improper accounting of costs and benefits has badly skewed some past analyses of transportation projects. It is not uncommon, for example, for evaluations to count costs as benefits, and sometimes more than once. To build a transportation project, one must use up labor. It is a cost. But evaluations often count it as a benefit (income to the economy), then double or triple it (the multiplier effect), and then count it as a benefit yet again under the heading of jobs. While this may be good politics, it is not good policy analysis.

A related point is that what are often listed and added as either benefits and costs are really transfers. Revenues from taxes and grants are usually transfers: money may move from one place to another, but no resources are used up. The proper analytic perspective for evaluating benefits and costs is that of all society, rather than a particular jurisdiction. Federal grants, for example, represent a transfer from one level of government to another and are not a true social benefit; the use of those funds on a local project represents the consumption of real resources and is a real cost of the project. Transfers from the federal government and other jurisdictions should also be accounted for in evaluating the equity or distributional impacts of any proposal.

- **Costs are real economic resources used by a policy or project.** Money facilitates the exchange of useful resources, but is not a resource itself. Steel, concrete, labor, driver time, and gasoline *are* real resources that get used up in the process of trip-making. Concrete used for a freeway is concrete not available for buildings, and vice versa. Economists express this idea by referring to opportunity cost, the value of a resource in its next best use (if it hadn't been used for what it was, in fact, used for). Most goods in a market economy sell at their opportunity cost—thus market costs can be used to measure the value of many benefits and costs. The cost of goods purchased from subsidized markets (e.g., goods purchased from the public sector) may need to be corrected to account for the true economic cost. Costs should be counted when, and only when, resources are actually used in a project.
- **Decreased costs are benefits.** Many of the benefits of transportation improvements are best expressed as reductions in the costs that would have been incurred in the absence of the improvement. Examples include reductions in travel time, accidents and operating costs. The convention in the transportation literature is to talk about these decreases as user benefits. This convention derives from the reasonable assumption that for any transportation improvement to merit consideration, it must have a very high probability of decreasing travel costs, and that these reductions in costs are benefits for the users.
- **Measuring all benefits and costs means considering some that do not have obvious market prices.** The most obvious example is loss of environmental quality from pollution (e.g., from tailpipe emissions). Less obvious is the loss of time because of congestion. Though air quality and travel time are not traded in any established market, they still are real impacts that must be considered in any full evaluation of the impacts of transportation investments.

What are the next steps to apply Integrated Transportation Planning to our own planning process?

Many aspects of Integrated Transportation Planning have been applied within this region although they have not all been brought together a unified and strategic planning effort. Several steps over the near term could help build our understanding about how this approach could influence future decision-making:

- Estimate the benefits and costs of system alternatives using data that are available from existing planning efforts, such as the Regional Council's recently completed Metropolitan Transportation Plan. (A case study to test this idea has recently been approved for funding by the Federal Highway Administration.)
- Develop and agree on standard procedures for estimating benefits and costs using existing data; identify the areas where data are lacking and current modeling capabilities are inadequate.
- Work with policymakers to introduce the idea of Integrated Transportation Planning and determine how they think it could be used to build and sustain consensus on transportation investment strategies.

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