A 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. Detailed are found in earlier chapters.

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.

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.
Benefit-cost analysis should not be the sole basis for decision-making. Benefit-cost analysis is scientific, but it is only meaningful where the effects of a project can be compared with goods on an open market. Many of the important impacts of transit alternatives do not have comparable goods.

Strict application of benefit-cost analysis could be discriminatory. A transit alternative could serve either high-income individuals or low-income individuals or some combination. Low-income individuals have less money they are willing to pay, so their benefits would be less. Transit alternatives that tend to serve high-income individuals would be preferred by a benefit-cost analysis, thereby overriding important equity benefits.

Some notions from benefit-cost analysis can be modified and enhanced for the purposes of quantifying some benefits. User benefits can be readily measured by methods similar to those of benefit-cost analysis. In particular, an enhanced consumer surplus approach provides a realistic way of expressing benefits as related to choice behavior.

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.

Combining of transit consequences can be misleading and can create more problems than it solves. Attempts to create a single measure of transit benefits that incorporates all possible consequences are subject to significant problems of double counting and require assumptions that are hard to justify. It is best to simply highlight significant differences among alternatives and let decision makers choose among the alternatives according to their best judgment as to what is best for the community.
RECOMMENDED PRACTICE

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

The benefits of transit improvements are larger in communities where highway congestion is severe. Simulations of transit systems, using state-of-the-art techniques, show that user benefits associated with better transit increase rapidly with the level of congestion on highway networks. Increases with congestion are seen in both benefits to transit users and benefits to highway users.

User benefits from a transit improvement remain almost as large when long-term effects of urban redevelopment are included in the analysis. Some researchers have claimed that reallocation of activities can severely undercut benefits gained from transit system improvements. When residential relocation is allowed in a travel simulation, user benefits achieved are smaller, but not significantly. A concentration of activities occurs with improved transit service. This concentration is associated with numerous benefits, including better utilization of existing infrastructure, preservation of open space and more economical services.

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.
**RECOMMENDED PRACTICE**

**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.

**Perform sensitivity and contingency analyses.** Both sensitivity analysis and contingency analysis help protect against uncertain future events. These techniques will help assure that the best alternative is selected, even if predictions of the future are faulty.

**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, termed enhanced consumer surplus. It encompasses time savings, comfort and convenience. It is also nondiscriminatory. Enhanced consumer surplus can be measured with readily available travel forecasting methodologies.

**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.

**Quantify air quality impacts.** A simple and direct method of quantifying air quality impacts is to compute emissions reductions from an alternative and compare them to mandated emission reduction goals.

**Avoid using employment impacts as benefits, unless it can be clearly demonstrated that the employment would be greater than the null alternative.**
RECOMMENDED PRACTICE

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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The following pages contain a full-sized, blank benefit tree. This tree is identical to the one presented in Section F, except that descriptions of the consequences have been removed. The tree can be photocopied and assembled. There are six different graphics – the treetop and five major branches. As a guide to assembly, match points have been indicated. When assembled the match points should appear as follows.

Match 5A  5A Match

The benefit tree was originally drawn in Excel 3.0 (MS-DOS) format. The original Excel files are available. Contact the Center for Urban Transportation Studies to obtain a copy (414-229-5787). The spreadsheet allows considerable flexibility in how the benefit tree can be presented. For example,

a. Boxes can be added and removed;
b. Boxes, text, and arrows can be given different colors;
c. Text can be modified; and
d. Arrows can be rerouted.

Having the ability to print the tree on a color printer would permit an even better visual display of the tree. The files contain the full text of the benefit tree, but the text can be easily blanked by coloring it white.
Major Branches

- Viewpoint:
  - Local
  - Regional
  - National

Connects O's and D's

- Provides Alternatives
- Travel by Transit
- Land Use/Economic Activity
- Transit Supply

Fewer Auto Trips

Transit Trips
Branch 1

Provides Alternatives

- Long Term Option
- Unusual Occurrences
- Recreational Riding
- Independent Living

- Severe Weather
- Family Circumstances
- Vehicle Breakdown
- Emergencies: Evacuation, etc.
- Access to Discretionary Activities
- Access to Health Care and Essential Activities
- Employment
- Reduced Public Cost
- Welfare

Viewpoint:
- Local
- Regional
- National
Branch 2

Viewpoint:
- Local
- Regional
- National

Travel by Transit

- Fewer Auto Trips
- Transit Trips

User Effects
- Time
- Operating and Parking Costs
- Destination Choice

Environmental Effects
- Energy Use
- Air Pollution
- Noise Pollution

Facility Needs
- Highways
- Parking
- Control Systems

User Effects:
- Fewer Auto Trips
- Operating and Parking Costs
- Destination Choice

Environmental Effects:
- Energy Use
- Air Pollution
- Noise Pollution

Facility Needs:
- Highways
- Parking
- Control Systems