BENEFIT/COST RATIO CALCULATION
METHODOLOGY

Introduction

This document is intended to provide a general understanding of how the benefit/cost ratio for CDTC's Project Information Procedure is calculated. A detailed explanation is in the TIP document in Appendix H. There are four quantitative calculations used to produce project benefits. Summary information for each is below. Note that the benefit/cost ratio does not take into account any non-quantifiable factors.

Facility Life Benefits

Intuitively, repairing or replacing a facility or service integral to the regional system is important because of the value of that facility or service to the transportation system. In other words, bridges are not replaced because they are in poor condition; they are replaced because it is important to keep those links open. Some major factors involved in the value of a repair are the number of travelers using the facility, available alternative facilities, the length of the facility (if applicable), and the condition of the facility before and after the repair. The CDTC calculation takes all of these into account and synthesizes them down to one number. (The cost of the repair is considered at the B/C ratio stage.) The facility life benefits of an infrastructure project are defined as:

Facility Life Benefits = (Total Facility Value) x (Percent Extended Life)
where:
Total Facility Value = Travel Time Savings + Operating Cost Savings

Travel time savings and regional operating cost savings attributable to the facility are calculated using the CDTC STEP Model. The model is run once with the facility in place; then a second time with the facility removed (or, for pavements, the speed limit reduced to 5 mph to allow for local traffic). The difference in regional system measures between the two runs is the quantifiable impact of the use of alternative routes due to the closing of the facility. It is, therefore, assumed to represent the total value of the facility or service. (This could also be referred to as "avoided detour costs".)

The percent extended facility life is the increase in the life of the facility attributable to the repair, expressed as a percentage, based on the condition of the facility before the repair. For example, Table H-5 in the TIP shows that a flexible pavement increasing in score from 6 to 10 has an increased facility life of about 46%, based on deterioration rates.

Safety Benefits

Safety benefits are measured in the dollar value of the projected reduction in accidents per year calculated using accident reduction factors, in a fashion similar to that of a NYSDOT analysis for safety funds.

Mobility Benefits

For mobility projects such as intersection improvements, the STEP Model is run with existing conditions, and then the STEP Model is run with the project's capacity improvements represented. Regional travel time costs and operating costs for the two traffic assignments are compared, and the benefits of the project are calculated.

User Cost Savings

User cost savings is the minor maintenance savings associated with improved pavement. It is calculated from factors in Table H-3 on page H-10 (from FHWA's Vehicle Operating Costs, Fuel Consumption, and Pavement Type and Condition Factors), in the TIP, using conditions before and after the project and comparing results.

Benefit/Cost Ratio

Quantifiable benefits are reported in $K/year. To calculate benefit/cost ratios, the cost of each project is also reported in $K/year. To obtain the cost/year for each project, CDTC starts with an estimated design life of the project. If there are multiple repairs being performed in a project, a weighted average of the respective design lives would be calculated. The design life of various facilities is in Table H-9 in the TIP. Using the design life of the project, a 6% Capital Recovery Factor is taken from Table H-8 in the TIP. Annualized costs (cost/year) are a product of the total project cost and the 6% Capital Recovery Factors. The total benefit/cost ratio is the sum of the quantifiable project benefits (from the four categories summarized above) divided by this annualized cost of the project, as in the below formula:

Benefit/Cost Ratio = Total Quantitative Benefits ÷ Annualized Cost

where:

Total Quantitative Benefits = Facility Life Benefits + Safety Benefits + Mobility Benefits + User Cost Savings

And:

Annualized Cost = (Project Cost) x (6% Cost Recovery Factor for Project Design Life)