CHAPTER I

INTRODUCTION

Benefit-Cost Analysis for Highway Improvements

Before a proposal for highway improvement can be accepted, some analyses must be made on the justification of the expenditure to be incurred and the worth of the proposed improvement compared with other alternatives. This is what benefit-cost analysis attempts to do.

Very often, decisions of an economic nature have to be made in considering alternatives for expenditure of road funds. This arises from the fact that capital resources are limited and there must be some way to indicate project priority to further improve or replace portions of a road system.

In highway projects as in business ventures, a profit should be returned on an investment. An estimate of the initial cost of the project as well as the continuing cost is essential. The total cost of a highway is the cost to improve and maintain the highway and to operate all the vehicles on it. Thus the selection of a particular route and the choice between alternatives can best be done by calculating the cost of vehicle operation, road maintenance and resurfacing in addition to the initial or construction cost. In this way, the economic desirability of any highway project would be established.

A benefit ratio is the expression of the benefits to be derived from the project to the costs involved in the undertaking. For every project to be worthwhile, the ratio must be at least 1:1 which means that benefits are just sufficient to cover costs incurred. A ratio higher than 1:1, for example, 2:1, means that the project is in receipt of net benefits. However, just obtaining the ratio for one project is not enough to tell whether it would be more worthwhile than another project. Hence, ratios must be obtained for two or more projects competing for the limited resources and a comparison of these ratios has to be made in order to decide which project should be given priority. Obviously the one with the highest ratio should be given first consideration.

A benefit analysis can be carried out only if those factors under consideration are measurable in terms of money. Those that have no common unit of measurement cannot be evaluated even though their effects may be considerable, for example, effects of intangibles such as greater comfort in travelling, safety and convenience. Secondary benefits may also accrue, for example the construction of a highway may increase land values along its route and factories may be able to reap the benefits of the highway. Although secondary and intangible benefits are not measurable, they should not be completely ignored. Clues as to their impact can often be given, for instance, one can roughly estimate the impact of road improvement on accident reduction. The extent to which secondary effects should be counted depends on how the given one benefit-cost ratio is compared to another. They should be treated as additional considerations quite separate from and less precisely defined than primary effects which are measurable.

'Evaluation of secondary effects is chiefly important from a local or regional point of view. At the national level, secondary effects, being diffused throughout the economy, are more difficult to identify and to measure. In any case, it is likely that they are offset somewhere in the economy.'[1]

When determining the benefit ratios of alternative projects, several factors have to be taken into account:

(1) 'Solvency of a system or group of systems of highways;

(2) Land and community benefits from highways and their improvements;

(3) Costs of construction and improvement of highways;

(4) Costs of maintenance and operation of highways and their appurtenances;

(5) Direct benefits to road users in the form of reduced vehicle operating costs and saving in time on improved highways;

(6) Benefits to road users in the form of

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[1] W.R.D. Sewell, John Davis, A.D. Scott and D.W. Ross: <u>Guide to Benefit-Cost Analysis</u>, 1962, p. 15

increased comfort and convenience, and

(7) Benefit to road users in the form of over-all accident reduction.[1]

However, in theory, it is not possible to consider all these factors. In this analysis, only factors (3), (4) and (5) will be considered because of the lack of specific values for the other factors.

Application of Theory to Two Alternative Proposals

There is no doubt that an improvement of transportation facilities will enhance economic development of a country. But no matter how much this social overhead contributes to the growth of the economy, all expenditures have to be justified. One way of proving a project's worth is to compare its benefit ratio with those of alternative projects. In fact, the scope of this essay is the application of the theory of benefit-cost analysis to two proposed highway alternatives.

Project I is a proposal for the construction of a road over that section of the Kuala Lumpur-Kuantan highway known as Route 2 in the map on page 45. (For the sake of convenience and to avoid complications later on, it shall be known as the Tunnel Road). It covers a total distance of 9 miles, following the old railway route surveyed in the 1920's. It includes a tunnel ½ mile long through a peak connecting the two valleys on either side of a mountain pass. This Tunnel Road is to be compared with the basic or existing highway known as Route 1 on the map. However, it is important to note that only a part of Route 1 is relevant. This is the section between the two junctions where the Tunnel Road deviated from the existing highway and this section shall be known as Existing Highway #I. It covers a distance of 14½ miles. This means that the Tunnel Road will cut short the distance by 5½ miles. The gradients and curvature over the basic highway are very severe and their effects on vehicle operating costs are mainly in the form of increased costs on fuel, tyre and brakes. The new road not only has a less severe gradient but is free of curvature, i.e. curvature is so slight that it does not increase vehicle operating costs. Moreover, speed of travel will be greater over the

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[1] Road User Benefit Analysis for Highway Improvements, American Association of State Highway Officials, 1960, p. 10.

Tunnel Road. This will result in the saving of wage costs paid to drivers, lorry attendants and bus conductors. Savings will accrue on the Tunnel Road when operating costs of vehicles on the two roads are compared. A benefit ratio will be derived by the expression of these benefits to the increase in highway costs. This ratio measures the worth of the project.

Project II is a comparison of Route 1 with Route 3 (refer map). For our purpose, Route 1 will be known as Existing Highway II and Route 3 as Klang Gates Road. In order to compare the benefit ratio of Existing Highway II with that of Klang Gates Road, the two roads must lie between the same two points or junctions. Since Existing Highway II stretches from Setapak Junction to Karak and Klang Gates Road stretches from the dam to Karak (refer map), a comparison is not possible. Therefore it has to be assumed that the proposed road stretches between Setapak Junction and Karak and that the additional length from the dam to Setapak Junction would follow the already existing road as shown in the map. (Klang Gates Road would from now on refer to the stretch between Setapak Junction and Karak and not from the dam to Karak). This new road covers a total distance of 31 miles while Existing Highway II is 53.75 miles in length. If the new road is built it would mean a reduction in distance of 22.75 miles. Savings in vehicle operating costs will accrue as a result of a decrease in costs associated with gradient and curvature (because the severity of these two will be greatly reduced) and from an increase in speed. A benefit ratio has to be derived for this project, as in Project I. These two ratios are then compared with one another to determine which one of the two projects should be given priority. In other words, there will be two main steps involved:

(1) the determination of a benefit ratio for each of the two projects. This ratio indicates whether expenditure to be incurred in each project will be justified by the gains to be reaped.

(2) a comparison of the benefit ratio of Project I with the benefit ratio of Project II so as to indicate which project should be given priority. According to benefit-cost analysis, the road with a higher benefit ratio would be considered for implementation first.