CHAPTER V

THE BENEFIT RATIO Method I

or return on investment can be determined and it will be employed in the calculation of the return on investment for the Tunnel road as well as for Langtang road.

In this method, the initial investment is assumed to take the form of a grant given by the Central Government to the local authorities and is therefore interest-free and not repayable. However, there is an implicit cost to this - opportunity cost. If the government were to lend to the local authorities, it would charge a rate of interest varying from 2½ to 4½% depending on whether the loan is short-term or long-term. Highway projects are usually of a long-term nature and although in this case, investment is free, annual costs have to be incurred in maintaining and resurfacing the road. These continuing costs will be the same every year. Hence, they have to be reduced to present value and the appropriate rate to use in the long-term lending rate of the government.

Benefits, however, will be discounted at the borrowing rate of the development loan fund, i.e., at 5½%, to bring them to present value.

Calculations are made from 1965 onwards and not from 1964 because it is assumed that the new road, if accepted, will only be completed and opened to traffic in 1965. This means that benefits will begin to accrue from this year onwards. To simplify calculation, benefits are assumed to accrue only at the end of each

1Discounting is necessary because people value the present more than the future: a dollar today will be worth less tomorrow.
year. For example, benefits in 1965 will be the year's
(although in actual fact they accrue daily to road users),
maintenance and resurfacing costs are also calculated
from this year onwards.

It is important to note that maintenance and
resurfacing costs here refer to the discounted costs
incurred as a result of the new investment. In other
words, these are the differences in recurring costs between
existing highays and the new road. In the case of
Project 1 and between existing highay and the new roads,
the savings made in the case of Project 1 and its
because a comparison has to be made between these costs and the
gross savings (which are the differences in road user
cost when vehicles operate on the existing highway in
the case and on the improved road on the other) for each
of the two projects.

Total gross savings over 10 years less mainte-
nance and resurfacing costs (also over 10 years) give
the total net benefits which are then compared with the
initial investment or construction costs to arrive at the
total return on investment over 10 years, expressed in
terms of percentage. From this, the average annual
return on investment or the benefit ratio is obtained.

In comparing Project 1 (tandem road) with
Project 2 (tandem road), using the method of
calculation, it is found that tandem road has a
higher benefit ratio. It exceeds the benefit ratio of
the tandem road by about 7% (refer Tables 1 and 12).

Method II

This is another method and in the determination
of the benefit ratio, here, the initial investment does
not take the form of a grant or subsidy, it takes the
form of borrowed capital and is therefore repayable.
Since the analysis extends over a period of 10 years,
the initial cost will have to be repaid by the end of
the tenth year, i.e. one-tenth of the cost is repayable
annually. This provided for the calculation of the
initial investment.

Since capital is borrowed, interest has to be
calculated and the rate charged is 5.5% per annum, which is the
borrowing rate of the financial institution. The
interest has to be included in the annual recurring costs on
a declining balance, i.e. in the first year, 1965,
interest will have to be paid on the full amount of the
initial investment. In the second year, 1967, however,
the interest on the initial cost is already on
### Table 1

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**Annual savings, discounted at 5% to present value, of operating costs of**

- 5-ton trucks
- 3-ton trucks
- Vans
- Buses
- Cars
- Taxis

**Annual Gross Benefits**

|          | 1,149,119 | 1,149,119 | 1,149,119 | 1,149,119 | 1,149,119 | 1,149,119 | 1,149,119 | 1,149,119 |

**Less: Maintenance and leasing costs**

|          | 24,316 | 21,718 | 21,718 | 21,718 | 21,718 | 21,718 | 21,718 | 21,718 |

**Annual net benefits**

|          | 2,907,618 | 2,907,618 | 2,907,618 | 2,907,618 | 2,907,618 | 2,907,618 | 2,907,618 | 2,907,618 |

**Total net benefits over 10 years = $280,753,20**

**Return on Investment = $280,753,20 / $10,000,000 = 28.08% over 10 years**

**Average Return on Investment per year = 28.08%**
paid in the process of amortization in the previous year (1.6), interest need be paid on the remaining balance only.

The actual figures, costs and returns, not only include maintenance and rebuilding, but also provide for amortization and interest against the original capital.

In computing maintenance and rebuilding costs, a rate of 50 per cent will be used, as it should while benefits will be calculated at the rate of 5 per annum.

The benefit index of return on investment over the period of 10 years is determined by the formula:

\[
\text{return on investment} = \frac{\text{net annual benefit}}{\text{initial investment}} \times 100
\]

From this, the average annual return on investment can be obtained by dividing the result by 10.

In section II, returns indicate that there is a preference for project II (the Chic. and B., 7%) whereas the benefit ratio for this project is 0.95, as compared to 214.7% in the case of the original capital project, the former exceeding the latter by 7. This percentage is the same as in section I. Hence it can be said that the average annual return on investment is section II.

CONCLUDING RESULTS OF THE STUDY

When sections I and II are compared, it is found that in the original capital project, the rate calculated by method I exceeds the rate of section II by about 15%. Similarly, in the new capital original project, the results of method I also exceed that of section II by 15%. This difference is due to the fact that in method I allowance is made for the amortization of the initial investment and for the payment of interest and hence it can be expected that the average annual return on investment will be lower.

Another method for section II is used in calculating the benefit ratio, results of the other method lead is to be referred since its benefit ratio exceeds that of the original capital, about 70%. The means that in the computation for limited resources, project II should be given priority.
### Table 20

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<td>Return on Investment = $\frac{18,736,499 \times 10 \times 2.10}{18,736,499} \approx 2.10'$ over 10 years.</td>
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<tr>
<td>Average Return on Investment per year = 2.10%</td>
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<td>5.7% assuming interest</td>
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Total net benefit over 70 years = $522,607,407.

Return on investment = $522,607,407 x 100 = 7.35% over 70 years.

After 70 years, the net investment per year = $7,45,999.

Average return on investment per year if existing benefit is related to 1 = 77.5%.
So far, it has been assumed that a new proposal has been accepted for widening, the existing highway (with which the enforcement costs would have to be related, i.e., in what can be called to maintain the return on investment on both methods of a route.

However, it is in one area that it is likely Gates Road will be built, existing roadway is usually have to be returned for the use of those vehicle operators. the find it convenient or necessary to operate on this road. For example, traffic consist for Sentry, and Hemlock, and vice versa will have no choice but to use existing highway II since along Gates Road does not enable traffic to reach Sentry, and Sentry traffic cannot be divided. However, traffic from the west bound for Sentry and vice versa, will have to use existing highway II, especially when vehicles operate between Sentry, and these areas not accessible by main Gates Road. In this case, when the government decides to continue maintaining existing highway II, the return investment on the road, Gates Road project will have to be altered. Recent value of the maintenance and resurfacing costs of the basic highway will have to be subtracted from the total net benefits and a new return on investment calculated.

As can be expected, the return on investment after providing for the maintenance of the existing highway, will be lower. Table 5 shows that the new return on investment is smaller by about 10%.

However, if the new route were to be accepted and then real for the existing highway I will not be returned, since traffic in and from Sentry, can operate on the new road at an extraordinary cost (in fact at less cost), hence, no new return on investment for the maintenance of existing highway II is required in the case of the new road.

Even after consideration has been given to the government's desire to retain existing highway II, the new return on investment for main Gates Road still indicates that it should be given priority as compared to the return on investment for the other route, which does not provide for the maintenance of the existing highway.

Conclusion

Although the subject for main Gates Road involves a smaller on cost base, the project for the
Survival, it is a wise and vital alternative as far as realities of the analysis are concerned. This leads to prove that the cheapest project is not necessarily the one which has cost the least money for least money in this case, but the one which results the greatest (or greater) returns in proportion to the amount of money on it. This is an important point to note in the planning and design of highway facilities.

Interrelated projects such as the two under analysis, mean that if one is carried out, the other will not, unless in future years each activity dictates the realization of the latter project too. Hence, once one project is accepted and implemented, the other project cannot be considered a second cost unless another cost and gain assessment is made to compare it with other alternative projects and not receive evaluate it is a wise survival project among the group of alternatives.

Transportation policy should not only enable adequate growth of facilities to accommodate economic development but should also ensure that investment is made in each form of transportation in accordance with its potential contribution to an efficient overall transportation system. Government should evaluate and keep current and comprehensive plans for its investments in all types of transportation facilities. With each type of facility, it should continue to develop economic standards of analysis to compare costs with benefits for each project and a benefit-cost analysis provides a rather comprehensive method of calculation and evaluation.