CHAPTER VIII

CONCLUSIONS AND RECOMMENDATIONS

The model enables study of the inter-relationships between road design and construction standards, road maintenance policy, vehicle characteristics, traffic flow and growth, environment, and road deterioration. It is based on physical relationships to which any system of prices or costs can be applied and, as such, is a powerful tool for the transport planner. In addition to supplying information upon which engineering decisions can be made, RTIM can be of value in testing the practical implications of various engineering and economic policies. It can be used to study many aspects of a road investment project, such as the optimum geometric design standards of the road, the best choice between an earth, gravel or bituminous pavement, the choice between labour-intensive and plant-intensive methods of construction, and the benefits of adopting any of a number of different stage construction alternatives. The method can also allow the planner to study the consequence of uncertainties in traffic forecasts or in the discount rate. As with all models, its successful application depends finally on the quality of data that are presented. It is of particular importance to know the level of accuracy of the data in order to establish the probable level of accuracy of the result obtained; thus realistic sensitivity analyses must be undertaken in using the model as a tool to aid decision making.

In the present study, the main purpose was to examine the performance of the RTIM when applied to a real road in Thailand. Construction cost was to determine whether the results produced by the model were close to those of the actual construction contract amounts. The total construction cost estimated by the model was found to be within 4 percent of the actual construction contract. However, this does not imply that the model will always give cost estimates in this range when applied in Thailand. It must be recognized that this study was a first attempt at calibrating RTIM in Thailand and numerous adjustments and compromises between the actual design and the RTIM-acceptable inputs were made. The model can operate at different levels of data inputs, but accuracy obviously decreases as the data become coarser. In the present study, all data were obtained after the construction of the road had been completed, through most of the data were close to the values that would be known from the engineers' estimates. When using RTIM to predict the construction cost of a particular road, data would be obtained from the field surveys, and there would not be the opportunity to study the accuracy of the results as was done in this research.

Vehicle operating costs estimated by the model from basic costs(such as fuel, lubricating oil, tyre wear, depreciation, etc.) seem high, compared with the values used in Thailand. However, the RTIM program could be improved for use in Thailand by using the Thailand vehicle operating costs instead of the operating costs calculated internally by the model. This adjustment could be made by a programmer who is familiar with Fortran language and has some background in evaluating vehicle operating costs.

The road deterioration and road maintenance costs estimated by the model may be used in Thailand. However, if there were sufficient information and data, one could supply the details and unit cost of each maintenance operation and the model would estimate the total maintenance cost for those conditions. In practice, road maintenance cost accounting is very complex, and cost reporting and recording must be improved to enable the model to make good comparisons of various maintenance operations.

From the present study, it can be concluded that vehicle operating costs on the portion of the Saraburi - Lomsak Highway that was studied are about 85 percent of the total road transportation cost, road maintenance is less than 1 percent, and the amortization of the capital investment for the highway is about 15 percent.

Some of the difficulties encountered in the present research are summerized in the following paragraphs.

1) In estimating the construction cost, error may occur from the following causes.

a. The acceptable inputs describing the terrain are very rough. These data cannot adequately describe the actual features of the ground.

b. It is very difficult to evaluate average values of side slopes of the roadway cross sections, these have large effects on the cost of earthwork. The difficulty stems from the sophisticated cross sections commonly used in contemporary design: benched cut slopes, and "rolled" or variable embankment slopes.

c. The drainage system used in the model is rather impractical in that the model assumes the widespread use of pipe culverts, instead of box culverts or small bridges which are used in practice for minor river crossings.

2) The model cannot estimate the cost of major river crossings, nor the miscellaneous costs of the road.

3) Many of the road deterioration relationships and road user costs were derived from TRRL field studies in Kenya. Also, vehicle performance and road user relationships inherent in the present model were derived from surveys conducted by TRRL in Kenya. Whenever the Kenya data were found to be unsatisfactory or incomplete, data from other sources were used.

4) The model can calculate the foreign-exchange component of costs if the user specifies the percentage of cost requiring foreign exchange.

It is recommended that further study be conducted by applying RTIM to a planned highway that has not been constructed. The data should be obtained in the field, and compared with the selected contractor's estimates of the cost of construction. It is particularly recommended that studies of this type be made for lower-class (feeder) roads to gain experience with this very large sector of road planning. With such studies, research on the stage-construction options of RTIM could be usefully developed.