

## CHAPTER I

### INTRODUCTION



#### Statement of Problem

When new roads are to be built, or existing roads improved, numerous factors influence the decisions as to location, timing, and standards for the project. When traffic data indicate that a new road should be built or an existing road upgraded, engineering and economic decisions must be taken with regard to the location and the standards of design for the road in relation to the expected economic return from the investment. The interaction between investment in roads and economic development is complex and controversial. One school of thought favours the idea that a new road or an improved road acts as a catalyst for development, whilst others contend that additional investments must be made, concurrently or sequentially with investment in a road, to enable economic development to occur. This latter argument is finding new proponents and it suggests that the construction or upgrading of a road is a necessary but not sufficient condition for development to take place. Irrespective of whether a road acts chiefly as a catalyst, or whether it plays an essential but incomplete role in the development process, rational criteria and methods are needed to optimize economic and social benefits and to aid in ordering the investment in roads vis a vis other investment opportunities.

## Literature Review

This research describes the calibration of a computer model which has been developed to aid investment decision - making in the road sector in developing countries. The model was designed for use by senior administrators, engineers, and planners, and for use by those responsible for developing improved techniques for the appraisal of road investments.

The initial step towards producing this model was made in 1968 by the International Bank for Reconstruction and Development (IBRD) when the Bank considered a "highway design study" project. Shortly afterwards, the Transport and Road Research Laboratory (TRRL) were invited to participate in the proposed study. The next step was the awarding of an IBRD research contract to the Massachusetts Institute of Technology (MIT) to carry out a literature survey and to construct a model based on information already available.

The "Highway Cost Model" produced by MIT under the IBRD research contract served especially to indicate those areas where research was needed to replace relationships which would be inappropriate in the context of a developing country, and to develop such additional relationships as would be needed for application of the model.

As a result of this study, TRRL and IBRD agreed in 1970 to conduct a study in Kenya to remedy the deficiencies and to produce a model employing the data collected in the field. Kenya was selected as a suitable location

for the field research, and the Kenya Government were agreeable that the work be done there. Moreover, the topographic and climatic conditions in Kenya are not untypical of a large part of the developing tropical countries.

Through personal contacts, it was learned that the current version of the Road Transport Investment Model (RTIM), which emanated from the field work in Kenya, could be made available to Chulalongkorn University for further study and calibration. The opportunity to calibrate this model for an appropriate primary highway in Thailand should ensure that future applications of the model by the Thai Highway Department, or the World Bank, will have cognizance of any conditions that are unique to Thailand. This research has led to a better understanding of the many factors influencing the initial and continuing costs of highways in Thailand. Whilst the intended applications of the RTIM do not include ex-post evaluation of highways, it was deemed appropriate to select a completed primary highway for which all input data -- traffic, geometric standards, and materials -- as well as actual construction costs, were available. Thus, the Saraburi - Lomsak Highway in Central Thailand was chosen as a suitable highway for detailed study. This high - standard primary highway was the subject of an engineering and economic feasibility study (DE LEUW, CATHER, 1964). It was constructed in the period 1967 -1969 to designs prepared by the consultants, DE LEUW, CATHER AND CO., LTD. (1967), and financed in part by an IBRD loan to the Royal Thai Government. Fortunately, De Leuw, Cather and Company are still working in.

Bangkok and were able to provide many details and replies to queries pertaining to this highway. The Saraburi-Lomsak Highway has been in service for five years, which is long enough to provide an experience of service conditions as time has passed and vehicles have travelled along it. Also, this highway was the subject for an ex-post evaluation of the economic impact of the highway on the territory it serves (PUMPKHEM, 1975).

#### Purpose, Scope, and Limitations

The main purpose of this research was to examine the performance of the Road Transport Investment Model when applied to a real road in Thailand. The aim of studying the construction costs was to determine whether those produced by the model were close to those of the actual construction contract. The purpose of the analyses of road maintenance and vehicle operating costs was to investigate road maintenance costs and vehicle operating costs with respect to various selected traffic growth rates and selected discount rates.

The preliminary version of the TRRL Road Transport Investment Model which is currently available is intended primarily for development and testing. The finding of the present research pertaining to the model should be taken only in this context and may subsequently be found to be invalid when considered with other factors which evolve from cognate studies being conducted elsewhere.

## Plan of Investigation

The first step necessary was to study the TRRL Road Transport Investment Model, a computer program which is written in Fortran computer language, and to assess the required basic inputs. Then, data for the Saraburi - Lomsak Highway were collected for use as the input of the model using cards punched in fixed format. The study program which was used was based on the following selection of variables.

- (a) Discount rate of 12 percent, traffic growth rate of 5 percent, and the use of the designer's location of the intersection points of vertical curves. (If the vertical curve intersection points were not put into the model, it would generate its own vertical alignment which might be at considerable variance with the actual conditions.) The main comparison of this analysis was of the model - generated construction costs with those of the actual construction contract.
- (b) Discount rate of 12 percent, traffic growth rate of 5 percent, and not supplying the intersection points of vertical curves. The main comparison of this analysis was of the vertical alignment generated by the model with the engineers' design, with especial attention being paid to the construction cost as a figure of merit.
- (c) Varying the traffic growth and the discount rates. Traffic growth rates of 5, 10, and 15 percent and discount rates of 10, 12, and 15 percent were studied to determine the sensitivity of the final result (total discounted construction,



road maintenance, and vehicle operating costs) to combination of the varies rates.

#### Sources of Data

The data and information used for this study were mostly obtained from Departments of the Royal Thai Government and from private companies. Some data had to be obtained from field surveys; these were conducted by the author as required.

The principal sources of the data were the Department of Highways and De Leuw, Cather and Co., Ltd. From these sources, study was made of the route location, the design standards, the terrain, the materials employed for construction, the unit costs of construction, the traffic volumes, and the recurring maintenance costs. Much of the data was found in the Engineering and Economic Feasibility Study (DE LEUW, CATHER, 1964), the construction Plans (DE LEUW, CATHER, 1967), and the Final Report (DE LEUW, CATHER, 1970) for this highway. Traffic volumes were obtained from the Planning Division of the Department of Highways. A field survey was conducted to study gross vehicle and axle weights. These data were collected by recording the weights at the Highway Department weighting station at Hin Khong, near Saraburi.

#### Expected Usefulness of the Research

The research is a case study of the TRRL Road Transport Investment Model applied to the Saraburi-Lomsak Highway which is situated in the

central part of Thailand. The study has led to a better understanding of some of the many factors influencing the initial and continuing costs of highways in Thailand. The study has enabled learning how to use this powerful analytic tool under conditions extant in Thailand.

The research is a pioneering effect that should provide guide lines for using computers to aid in making investment decisions within the road sector in Thailand. It is believed that the model can be used in Thailand if there were adequate data and suitable adjustments were made to the model to allow it to fit the specifications of the Department of Highways. The model can be used to investigate a large number of routes with an acceptable precision of results, which would otherwise be extremely time - consuming and costly to perform.