CHAPTER 7
APPLICATIONS OF THE MODEL

7.1 INTRODUCTION

After discussing the calibration and validation of the MST, the potential applications of this Model can be now examined.

The MST can be used in the development of correlations between the operating speed and fuel consumption of the vehicles, on the one hand, and the geometry, surfacing type and roughness, on the other. These correlations can be used in models of highway planning such as the Model for the Interrelationships of Highway Costs-MICR (see Vol. 8), which, in turn, can define the interrelationships of the three components of highway transportation costs: construction, maintenance and utilization.

7.2 STRATEGIC PLANNING

The NIMPAC planning model, developed by the NAASRA *Data Bank System Study (DBSS)* and described by Linsten (1978), utilizes the speed-geometry relations of the MODMERRI model, developed by the former Commonwealth Bureau of Roads (CBRds).

In the case of free-flow speeds, the MODMERRI uses free-speed tables associated with width, horizontal and vertical geometry and roughness of the highway. These tables were developed on the basis of an analysis of free-speed data gathered in 30 rural locations in New South Wales (Both, Harris and O'Loughlin, 1972). The general expressions of grade and curvature were compared with the grade and curvature data from the Australian Road Survey file. Grade was described in terms of type of terrain (level, rolling, and mountainous), and the curvature in terms of average highway speed. Aside from this, the CBRds model was aggregated in its form, with the main objective of determining warranted expenditures in the highway systems. On the other hand, the NIMPAC model of the NAASRA was designed for an intermediate level, concentrating on individual highways or routes, and thereby demanding more detailed data. The form used for the NAASRA data bank contains details on grades and horizontal and vertical curvatures.

In terms of computation costs, the NIMPAC may become efficient if a free-speed model (SPEEDS or MTC) is incorporated into it, as a subroutine. Up to the moment, the NIMPAC has only been tested on a 5-km section, using an arbitrary acceleration-speed relation, with a computer run time for both lanes that is lower than one second in the Cyber-172 computer.

In conditions of non-free flow, the MODMERRI uses a speed-flow relation that relates the operating speed to the free speed, and to the ratio between the hourly traffic volume (in units of equivalent passenger cars) and capacity. This is shown in Figure 1 of the Both and Bayley article (reproduced herein as Figure 7.1). The Model uses two tables: one of these tables provides the absolute hourly capacity in units of cars for each one of the states of the highway, that is, point B in Figure 7.1; the other table gives the units equivalent to passenger cars for various grades and types of trucks.

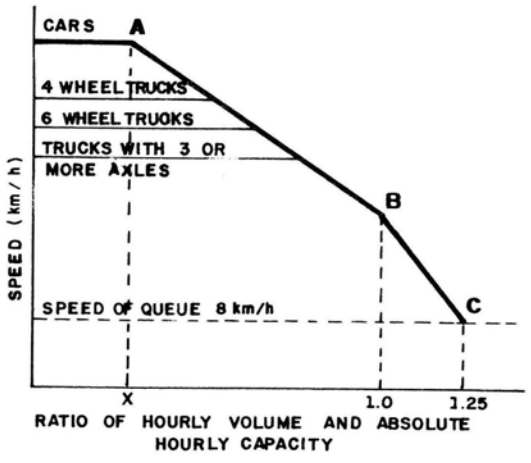

FIGURE 7.1 - SPEED-FLOW RELATIONSHIP.

The relatively high cost of running this simulation model makes its use difficult in aggregate or intermediate models, since various runs would be necessary in order to determine operating speed and fuel consumption at the various traffic levels which would

occur during the period of analysis. However, the MODMERRI may be used to develop a functional relation between the average speed on the section for each vehicle class, and road geometry, traffic flow, traffic composition and direction.

A controlled experiment could be designed to use the average speed on the section and the fuel consumption calculated by the MST for several levels of the independent variables listed previously.

7.3 *HIGHWAY DESIGN*

Since the elaboration of highway designs is usually a short-term task, the MST, together with a free-speed model (MTC or SPEEDS), could be used directly to determine the most economical road design in terms of operating cost, under non-free flow conditions. Other applications can also be foreseen, such as the establishment of justification for a climbing lane (third lane) and for lane duplication. The user can analyze the effect of the introduction of a third lane on each traffic direction. This lane could have any length whatsoever, provided it is not longer than the section itself.

7.4 *TRAFFIC ANALYSIS*

The MST is very useful for traffic analyses. One can evaluate the impact of a number of alternative operating policies and of alternative technology on the traffic flow. This evaluation involves travel time, speed, fuel consumption, headway between vehicles, safety margin, etc. For example, one can evaluate the effect of introducing new vehicles or technologies (e.g., the multitrailer truck) or of operational changes, such as the temporal segregation of light and heavy vehicles.