CHAPTER 4
MTC LIMITATIONS AND OUTLOOK

As all models, the MTC has its limitations. Some of them originate in attempts to simulate highly complex phenomena in which such factors as driver behavior and environmental influences are important. Others originate in the experiments and analyses which produced the equations and parameters. Finally, there are those of the computer program which expresses the model.

Although the limitations originating in the necessity of simplifying the representation of the behavior of drivers and environmental influences are either explicit or implicit in this and other *ICR Research* reports, attention should be called to the assumption of *free speed*, which dominated the entire conception of the Model. This means that the MTC predictions are only valid for roads on which traffic is so low that there is no interaction among vehicles.

The *ICR Research* team has already gathered the necessary data and formulated the logic of the *Traffic Simulation Model - MST* (see Volume 10 of this Report), which will consider the influence of traffic on vehicle speed. Once this influence is modeled and associated to the MTC, one will have a prediction of speed and fuel consumption as a function of the relevant characteristics of the vehicle, road and traffic. In view of reductions in team personnel and the priority given to the ICR and MTC (second version) models, there is no current forecast as to the time it will take to conclude the MST. Until such time, the aforementioned MTC limitation will remain.

As regards the limitations originating in the experiments and analyses, one should note the following:

- Incomplete Calibration

The calibration of the MTC produced good results within the context of the TB-6 and FC-4 calibration experiments, as described in Volume 6. In certain aspects, however, the inference space in these experiments is limited. Consequently, not all of the options permitted by the MTC could be calibrated. In relation to the sections used in both calibration experiments, the most apparent limitation is that of the low degree of road-surface roughness. However, this is not a serious problem, since the inference space in the basic experiments (TB-1, TB-2, FC-1, etc.) is quite ample in terms of the roughness factor. Aside from this, speed-control sections were not considered in the calibration experiments, nor was their effect on the behavior (and fuel

consumption) of the vehicles. The use of the MTC on speed-control sections could, therefore, lead to unrealistic predictions. It is probable that calibration experiments will be carried out on sections with a high degree of roughness or on speed-control sections, or both, in 1982.

- Equations of Deceleration and Acceleration

The equations of deceleration were derived exclusively from observations of the behavior of vehicles before horizontal curves (Experiment TBS-3). New analyses and, perhaps, even new experiments are needed (particularly on speed-control sections) in order to improve these equations. With regard to the equations of acceleration, one could consider it to be inconsistent to use the Project's test fleet, and instruct the drivers as to the manner in which they should accelerate, instead of observing the behavior of the vehicle population. New experiments involving deceleration and acceleration have been suggested for 1982.

- Omission of Alcohol-Powered Vehicles

Some alcohol-powered vehicles (including factory vehicles and others converted to use this fuel) have already been tested. According to plans, next year an additional one or two vehicles will be tested, the results analysed, and the computer program modified to also include this type of fuel in the MTC.

- Representativeness of the VW 1300

The present version of the MTC does not distinguish classes among automobiles and seeks to determine the consumption of the various types of this class, based simply on variations in gross weight. In cargo vehicles, there is a clear correlation between admissible gross weight and the power or cylinder capacity of the engine and, consequently, consumption. In automobiles, however, this correlation is not as evident. So, the equations and parameters depend on the representativeness of the Volkswagen 1300 sedan, in relation to the automobile population of the country, since this was the only automobile in the *ICR Research* test fleet. Tests using medium and/or large automobiles are being proposed for 1982 or 1983.

As regards the limitations of the MTC program, it is very important to consider the fact that, when the program was conceived, there was no intention of using it in direct and isolated applications (see description in the next chapter). This type of application became apparent only after conclusion of the program. From that moment forward, it became obvious that modifications would have to be introduced into

some aspects of the program, as listed below:

- Small capacity for storing analysis data. The maximum number of positive and negative grades, curves, etc., that can be considered at a single time is insufficient for the analysis of long and hilly sections (for example, those longer than 20 or 30 km), thus making it necessary to subdivide them into shorter sections. Besides this, due to the unpredictability of the combination of analysis arrays in the creation of the links with which the program works, the user does not have a precise indication of this capacity. However, this limitation will not create any problems for the user who follows the recommendations contained in the appended Manual. In most cases, it is possible to analyse road sections up to 100-km long on a single run without exceeding program capacity, by simply dividing the section into five or six consecutive links. This limitation is scheduled to be totally eliminated by means of a modification in the logic of the program to be introduced in 1982.

- Possible occurrences of lack of continuity in the speed profile between consecutive segments. This is due to the fact that the model assumes that the initial speed of a vehicle on one segment will be the exit speed of the previous segment. For example, if the exit speed of the car class is 80 km/h, this will also be its entry speed into the subsequent segment. Should a speed-control section with a maximum permitted speed of less than 80 km/h be located at the start of the second segment, a lack of continuity will occur in the speed profile, leading consequently to error in speed predictions, since the vehicle would then have two speeds at a single point on the road. The modification to be introduced into the logic and structure of the program, as previously mentioned, should greatly attenuate or even make this limitation irrelevant, since there will then be no need of sectioning the road into segments in the conventional analyses.

- Stratification of vehicle classes. This does not correspond to the conventionally adopted classification in traffic reports such as, for example, those produced on the basis of origin and destination reports (O/D), of the National Highway Department (DNER). The MTC first classifies utility and cargo vehicles as *empty* and *loaded*, only later classifying them by size (three classifications for cargo vehicles). In the O/D reports, the classification begins on the basis of size (four for cargo vehicles) and only later goes on to the question of whether the vehicles are loaded or empty. The model accords great emphasis to utility vehicles, reserving separate classes for

those that are loaded and those that are empty. In the standardized O/D output reports, utilities do not exist, though it is possible to obtain them from field reports. These differences cause some degree of difficulty in making the MTC inputs compatible with the conventional reports. Aside from this, in the output reports of the model, consumption of diesel-powered trucks is a weighted mean. For example, if 50% of these trucks are classified as light, with consumption of 3 km/ℓ, and the other 50% are semi-trailers, with consumption of 1 km/ℓ, the result printed on the output report will be 2 km/ℓ. This difficulty, however, can be easily avoided by running the program separately for each type of truck. A modification is scheduled to be introduced into the program inputs in 1982 to make it simple to achieve compatibility between the program and the O/D output reports of the DNER.

In conclusion, it is anticipated that the present limitations of the MTC program will be largely liminated or avoided through the elaboration of a new version of the MTC in 1982. Aside from this, the new version of the system will have a modular structure, designed to optimize its operation. The principal purpose here is to make easier both the maintenance of the system and the coupling of new programs.