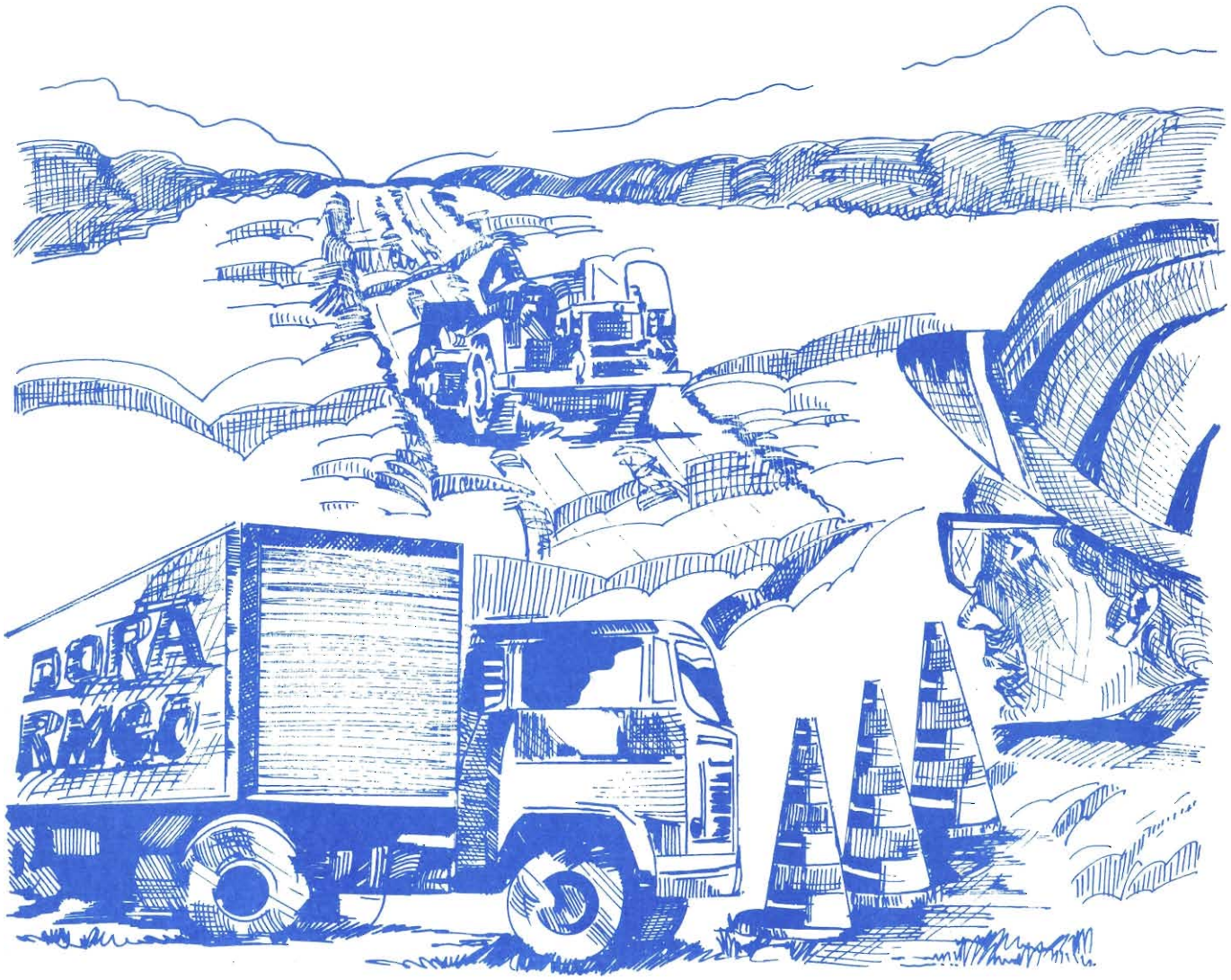
REPÚBLICA FEDERATIVA DO BRASIL

MINISTÉRIO DOS TRANSPORTES

United Nations Development Programme (UNDP)

Research on the Interrelationships Between Costs of Highway Construction, Maintenance and Utilization

Final Report - 1981



VOLUME 9 – MODEL OF TIME AND FUEL CONSUMPTION (MTC)

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SPONSORED BY:

MINISTÉRIO DOS TRANSPORTES
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International Bank for Reconstruction and Development (IBRD)
Texas Research and Development Foundation - TRDF

WITH THE PARTICIPATION OF:

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VOLUME 9 – MODEL OF TIME AND FUEL CONSUMPTION (MTC)

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Conteúdo: v.1 Summary of the ICR Research v.2 Methods and organization v.3 Instrumentation v.4 Statistical guide v.5 Study of road user costs v.6 Study of vehicle behavior and performance v.7 Study of pavement maintenance and deterioration v.8 Highway cost model (MICR) v.9 Model of time and fuel consumption (MTC) v.10 Model for simulating traffic (MST) v.11 Fundamental equations v.12 Index to PICR documents.

1. Rodovias - custos - Brasil 2. Rodovias conservação - Brasil 3. Rodovias - utilização - Brasil - I. Título.

PREFACE

This research project was funded through an agreement signed in January, 1975 by the Brazilian Government and the United Nations Development Programme (UNDP). The Ministry of Transportation, acting through the Brazilian Transportation Planning Agency (GEIPOT), assumed the responsibility for the project on behalf of the Brazilian Govern - ment and the International Bank for Reconstruction and Development (IBRD) acted as the executing agency for UNDP.

The research was carried out by GEIPOT and the National Highway Department (DNER), acting through its Road Research Institute (IPR). Funding from the Brazilian Government was channeled through the Institute for Economic and Social Planning (IPEA) and the Secretariat for International Economic and Technical Cooperation (SUBIN), along with the Ministry of Transportation.

The World Bank contracted the Texas Research and Development Foundation (TRDF) to organize the international technical staff and to select and purchase the imported equipment needed for the research. The participation of the TRDF continued until December of 1979.

This report is comprised of twelve volumes (each edited in both English and Portuguese) which summarize the concepts, methods and results obtained by December, 1981 by the project entitled "Research on the Interrelationships Between Costs of Highway Construction, Mainte - nance and Utilization (PICR)". It includes a documentary index volume which will aid researchers in locating topics discussed in this report and in numerous other documents of the PICR. This report contains much detailed analysis which is being presented for the first time, and also incorporates relevant parts of earlier reports and documents produced under the 1975 Agreement, updating them through the inclusion of new results and findings.

A special mention is due the Highway Departments of the States of Minas Gerais and Goiás, the Universities of Aston, Birmingham and Texas, and the Western Australia Main Roads Department which placed some of their best and most experienced personnel at the service of this pro- ject to fill many key positions on the research staff.

Finally, thanks are due to the Transport and Road Research Laboratory for its assistance during the initial stages of the project, along with specialists from various countries who periodically visited Brazil to discuss the work being done in the PICR and to assist the permanent research staff in conducting analyses.

JOSÉ MENEZES SENNA
President

VOLUMES IN THIS REPORT

VOLUME 1 - SUMMARY OF THE ICR RESEARCH

VOLUME 2 - METHODS AND ORGANIZATION

VOLUME 3 - INSTRUMENTATION

VOLUME 4 - STATISTICAL GUIDE

VOLUME 5 - STUDY OF ROAD USER COSTS

VOLUME 6 - STUDY OF VEHICLE BEHAVIOR AND PERFORMANCE

VOLUME 7 - STUDY OF PAVEMENT MAINTENANCE AND DETERIORATION

VOLUME 8 - HIGHWAY COSTS MODEL (MICR)

VOLUME 9 - MODEL OF TIME AND FUEL CONSUMPTION (MTC)

VOLUME 10 - MODEL FOR SIMULATING TRAFFIC (MST)

VOLUME 11 - FUNDAMENTAL EQUATIONS

VOLUME 12 - INDEX TO PICR DOCUMENTS

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* Volume 1 contains a brief description of the contents of each volume, while Volume 12 provides a subject index to this report and all other PICR documents, including technical memoranda and working documents.

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SUMMARY

The Model of Time and Fuel Consumption (MTC) is presented in this Report with all the information and elements needed for immediate utilization by the nation's highway transportation planners.

Aside from explaining the purpose of the Model, Chapter 1 also presents the reader interested in evaluating the potentialities and limitations of the MTC with some considerations on the necessity of familiarizing himself with the tests in which the Model originated. This should be done through examination of the other *ICR Research* publications. However, this Chapter contains figures and schematic drawings which, in a simplified manner, have the objective of indicating just how these tests were utilized and associated in the elaboration of the MTC.

Chapter 2 contains the primary objective of the document, a detailed description of the fundamental concepts and the logic of the MTC. Chapter 3 presents the speed and fuel consumption equations utilized in the MTC, together with the tests which gave rise to these equations and the respective mnemonics utilized in the MTC program. Chapter 4 demonstrates the major limitations of the present version of the Model, and suggests how to correct or by-pass them in the near future.

MTC application possibilities are analyzed in the final chapter. It initially evaluates the MTC as a model of independent usage in forecasting the speed and fuel consumption of vehicles on specific road segments, whose geometric and road surface characteristics are already known, at the project scale level. This is followed by a discussion of the applications of the MTC as an auxiliary model for generating equations for forecasting speed and consumption, through the utilization of more aggregate road description and geometry variables.

Appendix I (bound separately) contains the *MTC User's Manual*. It supplies conventional instructions on roads, and diverse Model application examples, along with a number of explanations on certain aspects of the MTC program. These clarifications are aimed at avoiding most of the doubts which can occur to those who, for the first time,

prepare and codify the entries of the MTC program.

Appendix II (also bound separately) presents the *MTC Programmer's Manual*, with additional information on the MTC, including the definition of all program variables and a complete flowchart and program listing.