

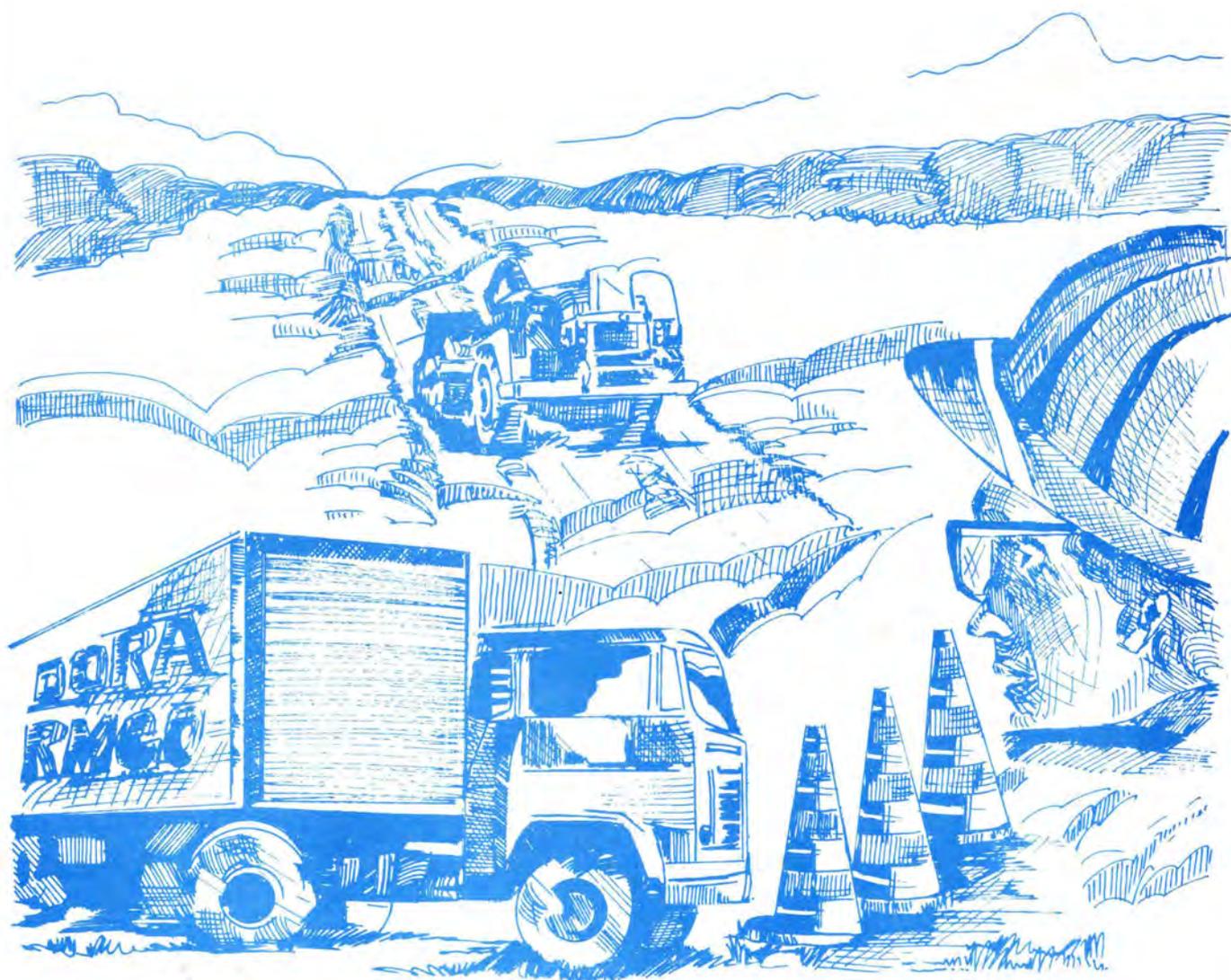
REPÚBLICA FEDERATIVA DO BRASIL

MINISTÉRIO DOS TRANSPORTES

United Nations Development Programme (UNDP)

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

Final Report - 1981



VOLUME 1 – SUMMARY OF THE ICR RESEARCH

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**

**SPONSORED BY:**

**MINISTÉRIO DOS TRANSPORTES**

**SECRETARIA DE PLANEJAMENTO DA PRESIDÊNCIA DA REPÚBLICA**

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**UNITED NATIONS DEVELOPMENT PROGRAMME (UNDP)**

**International Bank for Reconstruction and Development (IBRD)**

**Texas Research and Development Foundation - TRDF**

**WITH THE PARTICIPATION OF:**

**Departamento de Estradas de Rodagem de Goiás - DER/GO**

**Departamento de Estradas de Rodagem de Minas Gerais - DER/MG**

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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 Government, 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, Maintenance 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, Juiz de Fora, Minas Gerais and Texas, and the Western Australia Main Roads Department, which placed some of their best and most experienced personnel at the service of this project to fill many key positions on the research staff.

Finally, thanks are due 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

This volume describes the objectives of the Research on the Interrelationships Between Costs of Highway Construction, Maintenance and Utilization (PICR), as well as the data and variables covered by its surveys and experiments.

The original objective of the PICR was the development of methods and models which would minimize the cost of highway transportation in Brazil, particularly on non-urban highways characterized by a low volume of traffic. To reach this objective, wide-ranging field research was performed - one of the largest projects of its type ever carried out in Brazil or abroad - with the objective of determining the costs of the three major components of the *total cost of highway transportation*, namely: the costs of highway construction, maintenance and utilization. In short, an effort was made to determine the influence of highway characteristics on the cost of vehicle operation. As major factors, highway geometry and surface quality were studied, to quantify their influence on operating cost. Traffic-provoked highway deterioration was also studied, as well as the behavior of highway users.

This first volume of the Final Report presents a brief description of the work carried out during the PICR, its organization and the basic data surveyed. It also indicates where this information can be found in the different volumes of this report, and provides an evaluation of the tasks performed.

This Final Report is composed of 12 volumes, 6 appendices (in the form of Manuals for the three models developed) and 53 Working Documents (containing all of the documentation produced during the research project). Chapter 5 of this volume presents a description of the other volumes of this report, with a summary of the subjects treated in each volume, as well as a listing of the working documents produced by the PICR, together with capsulized information on the content of each.

