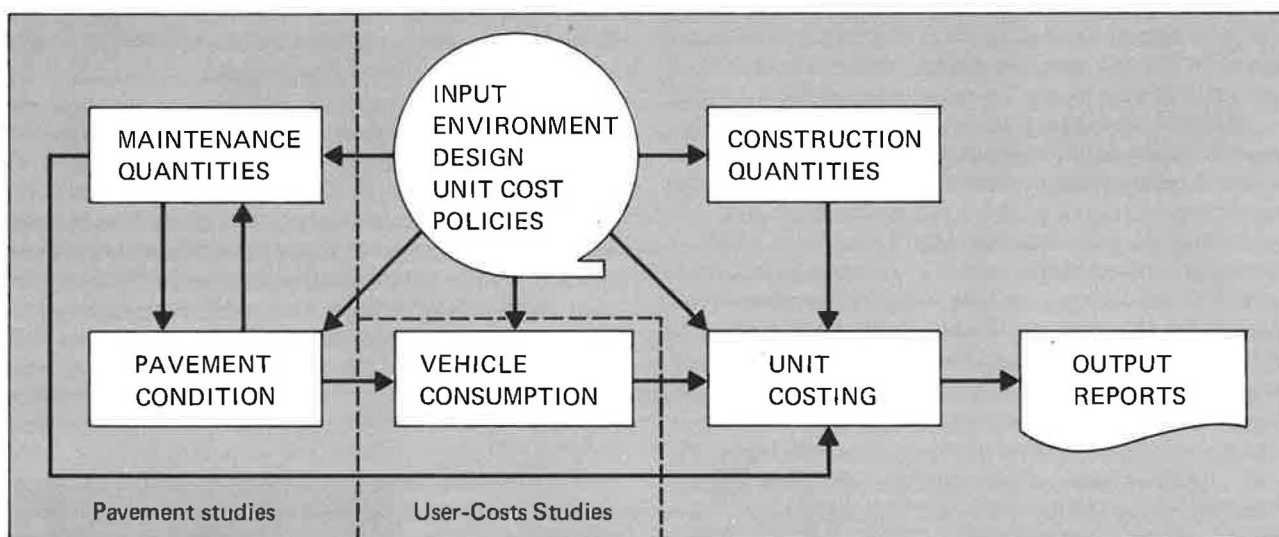


RESEARCH PROJECT IN BRAZIL MAY BE MODEL FOR DEVELOPING COUNTRIES



W. R. Hudson

Highways serve national and public needs by providing transportation links that reduce the cost of moving people and goods and thus stimulate economic growth and the development of natural resources. This is especially important in developing countries. Because funds for new roads and for expansion of rural road systems are limited, objective models are needed to establish priorities. Furthermore, the governments of these countries and the international funding agencies such as the International

Bank for Reconstruction and Development (IBRD), regional development banks, and the U.S. Agency for International Development all need objective methods for comparing costs and benefits for highway projects in order to establish priorities for financing. Some information is available for determining these costs, based on research by IBRD and by the U.K. Transport and Road Research Laboratory, but these data are inadequate.

A major research program now being conducted in Brazil will help fill these needs. The project involves the collection and analysis of empirical data on road design, deterioration, maintenance, and user costs. The results will be used to extend present highway planning models that analyze the interrelations of the three components affecting road transportation costs, i.e., construction, maintenance, and use. Such a planning model can be used to assist administrators in Brazil and in other developing countries to get the most out of highway dollars. The Brazilian project, sponsored by the Brazil Ministry of

The author is a professor of civil engineering at the University of Texas at Austin and was the international technical director of the research project described in this article. Having spent a year in Brazil assembling the project team and getting the work started, Professor Hudson returned to his duties in Texas, but will be visiting Brazil frequently as work progresses and will participate actively in the final analysis phase.



Hudson (left), the international technical director of the project, discusses progress with Jose Teixena, the Brazilian director, and Ted Lustosa, of the Brazilian survey team.

Transport and the United Nations Development Program (UNDP), will further develop a planning model, which simulates real-world relations between construction and maintenance standards on the one hand and vehicle user costs on the other. The model will be used to study alternative design and maintenance standards and blend them to minimize total transportation costs.

Scope of the Project

The basic activities in the research include (a) making a series of surveys to determine vehicle operating costs in Brazil, (b) conducting experiments to relate speed and fuel consumption, (c) carrying out pavement performance and maintenance experiments, and (d) developing and extending policy-decision models. These studies will relate construction, maintenance, and use costs to road construction and design standards and to pavement performance and maintenance.

The basic research is being conducted on rural highways in the states of Minas Gerais, Goais, and Sao Paulo and in the Federal District; satellite studies will be conducted in other areas as needed. The aim is to provide full coverage of the variables involved. Where possible, the data and results will be presented such that they can be defined and translated for use on rural highways anywhere in the world.

This is the most comprehensive study ever undertaken

to develop vehicle-user cost data and will involve a concentrated data collection effort from 1976 to 1979.

The agreement for this project was signed in January 1975 between the Government of Brazil and UNDP; IBRD is the executive agency for UNDP. The research team was assembled by the Government of Brazil and UNDP through the Empresa Brasileira de Planejamento de Transportes (GEIPOT) and the Texas Research and Development Foundation (TRDF). GEIPOT is a Brazilian corporation solely owned by the Brazil Ministry of Transport and charged with transportation planning and coordination. The total project staff involves more than 150 persons; 140 are from Brazil, and 10 are from other countries.

The National Highway Department (DNER) is cooperating with GEIPOT through its Road Research Institute (IPR), and both have received grants from the Institute for Economic and Social Planning (IPEA) and from the Secretariat for International Economic and Technical Cooperation (SUBIN) for the research.

The approach of the UNDP and IBRD in the Brazilian study is to organize a group of experts from all over the world to provide technical information from many sources to solve the problem in cooperation with Brazilian counterparts. IBRD contracted with TRDF to provide the foreign staff for the project, which includes professionals on loan from the University of Texas at Austin and from various other institutions of the United States, Ecuador,

The staff and international advisors to the Highway Cost Research Project. The author is in the center of the group, wearing dark glasses.



Australia, Great Britain, and South Africa. The Brazilian staff is made up of 25 senior technicians.

Major Parts of Study

The Brazilian study is divided into three major parts: road-user cost surveys, road-user cost and traffic experiments, and pavement performance and maintenance studies. To develop reliable road-user cost information, the road-user cost surveys group is monitoring vehicle operating costs for as many as 500 vehicles of various types operating on a limited number of routes. These vehicles are drawn from 40 to 60 organizations operating buses, trucks, and automobiles in Brazil. These data will be analyzed to establish relations between user operating cost elements, such as tires, fuel, and lubricant consumption, depreciation and maintenance, and those characteristics of roadways that influence user operating cost. This survey of user data will also be used to validate similar relations being established experimentally.

Tire and fuel savings are two of the important benefits that accrue to users through road improvements, and they



1 Cores of asphalt taken from Brazilian highways will be tested in the central project laboratory.

2 Test pits are being dug in 600 locations on Brazilian roads in connection with the pavement portion of the study.



can be readily measured. The study group is developing parameters to be used in a computer-based user-cost simulation model that will predict speed and fuel-consumption relations. These parameters will be developed from data collected from the observation of existing traffic streams and from experimental vehicles operating on a variety of road designs, including extremes of geometry, roughness, and environment. Nine experimentally equipped vehicles, ranging from a Volkswagen 1300 to a 27-Mg (30-ton) Scania L-11038, equipped with a triple-axle trailer, will be used during these studies.

Because of the magnitude and complexity of this project, a working group of advisors was established to meet periodically with the project personnel. The experience and the knowledge of the advisors have been extremely helpful in formulating the study plan and in solving some of the critical problems that have risen from time to time. The advisors will also be of great value in the analytical phase of the project.

Instrumentation

Over \$0.5 million has been expended on equipment and instrumentation for this project. For example, pavement roughness, or riding quality, is an important independent variable that is related to user costs, including vehicle maintenance and depreciation costs, vehicle speed-fuel consumption relations, pavement design, construction cost, and pavement maintenance cost. For this reason, significant attention has been given to measuring roughness. A surface dynamics road profilometer is being used for calibration and measurement, and routine roughness measurements are being done with Mays road meters.

Instruments have also been bought to carry out vehicle speed-fuel consumption and axle-load studies and to evaluate pavement condition and pavement deflection. The dynaflect, a dynamic loading and deflection measuring device, is being used for pavement evaluation. A device for weighing vehicles in motion, developed by Clyde Lee at the University of Texas at Austin in cooperation with the Texas State Department of Highways and Public Transportation, is being used to evaluate traffic loads.

More than 160 pavement test sections encompassing various surface design types and different geometrics, ages, traffic, and maintenance levels will be located, structurally evaluated, and monitored during a 3-year period of performance. In addition, supplemental sections in satellite areas will be studied to evaluate the effect of rainfall and the performance of soil-cement bases.

Summary

This project began in 1975 and is nearly half completed. A report of the preliminary results available at midterm will be published this summer. Information from the project should be useful in determining fuel consumption policies in Brazil.

Trucks like this Mercedes-Benz, carrying heavy loads over gravel roads, are a common sight in Brazil.

