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**TRANSPORT RESEARCH PROGRAM**

**Progress Report**

**December 1962 - June 1963**

**The Brookings Institution  
Washington, D. C.  
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The Brookings Institution  
Economic Studies Division

TRANSPORT RESEARCH PROGRAM

Summary Report

This program is designed to advance the state of knowledge concerning the role of transportation in development. Under a contract with the Agency for International Development, it is enlisting the participation of individual scholars, universities, and other agencies throughout the country and abroad in a comprehensive program of studies involving economics, political science, and technology. Wilfred Owen of the Senior Staff is directing the program, with the guidance of an Advisory Committee.\*

Nine projects have been initiated since the program was established in June, 1962:

"Transportation and Economic Development," by Wilfred Owen. A comprehensive examination of the role of transportation in the development of underdeveloped countries, highlighting general principles of transport development which are applicable to the developing areas, criteria for judging the economic desirability of transport investment decisions, and alternative ways of managing and financing transport systems.

"Government Controls on Transport," by Edwin T. Haefele. A study of transport controls which can be employed by underdeveloped countries to further their economic, political, and social policies.

"Transport Investment in the Context of Investment Planning," by Gary Fromm. An examination of the interrelationship between transportation investment and economic development under conditions in which there is a shortage of capital.

"Case Studies of Impact of Transport Investment on Development in Latin America," by George Wilson of the University of Indiana and Charles J. Stokes of the University of Bridgeport. An evaluation, through individual case studies, of the results of past transport investments on economic development in various countries of Latin America.

"Maintenance Costs as a Function of Capital Investment in Highways," by Mathew Betz of Arizona State University. An analysis of the relationship of maintenance costs to capital investment in highways with types of construction and environmental conditions.

\* See page 27.

"Administrative Structure of Transport Loans and Grants," a Syracuse University contract under the direction of John Lindeman. Assessment of the effects of administrative and organizational recommendations that have been made by various foreign aid organizations in connection with transport loans and grants.

"Harvard Transport Research Program," a university contract under the direction of Professor John R. Meyer of Harvard University. Focusing on major transportation investment problems in the under-developed countries, this program will bring together graduate students, faculty, and outside experts to develop and test new ideas in this field.

"Transport Planning and Investment Alternatives in India," an MIT contract under the direction of Professor Louis Lefebvre. A study to develop a long-run transportation development plan for India based on projections of regional economic activity and comparative cost studies of providing the services by alternative modes of transportation.

"Case Studies and General Analysis of Transport in City-Hinterland Complexes in Africa," a contract with Northwestern University Transportation Center under the direction of Professor Leon Moses. An examination of the activities of the city-hinterland complexes in Africa to determine how transportation investment can increase incomes in the hinterland and decrease the rate of migration into the congested urban areas.

In addition to these studies, four other projects are in advanced planning stages; progress was made on a major bibliography; and a background review of previously published development plans, country studies and transport surveys was completed for staff use.

Details of work are contained in succeeding sections of this report.

## Book Abstract

Immobility and Poverty  
The Relation of Transport to Development

by Wilfred Owen

Transportation is essential to nearly every objective the developing nations are trying to achieve. This report examines the relation between transportation and the affluence of developed countries, and between the immobility and poverty of traditional societies. It finds that in spite of current efforts to improve mobility and accessibility in Africa, Asia, and Latin America, the transportation gap between the rich nations and the poor remains. Moreover, the attempt to achieve adequate standards of transport by conventional methods has little chance of succeeding in this century. How can the transport revolution that has bypassed two-thirds of the world's people be applied to accelerate the development process?

The time and cost of breaking the transport barrier in the now developed countries impels us to find new solutions to old problems. In place of the evolutionary process that led to high standards of mobility in the past, we must now rely on the revolutionary potentials of science and technology, combined with the program guidance provided by economic planning. These are the two principal assets available to the developing countries that can turn the tide in their favor.

We need a strategy for mobility which will help to determine the total transport needs and to select alternative technologies in accordance with overall development goals. The task requires a fresh look at the pre-investment surveys of transport requirements we now rely on. It calls for a bold effort to marshal domestic resources—the necessary men, materials, money and management. And it necessitates an all-out program of foreign assistance. This report finds that in the transport sector we are doing too little for too few.

The United States is, of course, a developing country itself. Many of the steps that need to be taken by the less developed nations also need to be taken here. But the overall problems and prospects for America's economic growth lie not simply in how we act at home, but in how far we are willing to act abroad. Help in breaking the transport barrier for the poor nations may mean not simply aid for them but a better economic future for us.

This report, now in manuscript form, will be submitted to A.I.D. in the near future. Book publication is expected in the fall of 1963.

## Project Activity Report

### A. Research at the Brookings Institution

#### 1. Government Controls on Transport

Edwin T. Haefele

This project deals with the incidence, theory and effects of various patterns of government controls on transport to influence development. In every developing country, attempts are made to shape, stimulate, and otherwise control lines of economic growth by applying controls on the transport sector. These controls involve entry, service, prices, location of facilities, as well as investment in and ownership of transport modes. The issues are what controls, if any, are needed, given the policy objectives of the country and whether or not the controls can be effective. In more developed countries, it is clear that such controls have unintended side effects and that efforts are made to avoid controls by legal, extra-legal, or illegal means.

The project is presently concerned with the effects of the pattern of controls on rail transport in Central Africa and the implications of changing governmental alignments on the present pattern. A preliminary analysis of this case is now being prepared in article form.

The second case to be investigated under this project is the supra-national transport agency in East Africa, i.e., the East African Railway and Harbour Administration. Both cases illustrate the dichotomy between a single-country oriented transport plan and a rational allocation of resources over a multi-country region.

#### 2. Optimal Transport Investment and Economic Development Planning

Gary Fromm

The purpose of the study is to examine the interrelationship between optimal transportation investment and economic development under conditions in which there is a shortage of capital.

The value of transportation is a function of its interaction with other sectors of the economy and the extent to which they jointly contribute to economic growth. This means that transport investment decisions should be considered within a framework of alternative locations of markets and industries and levels and methods of production in all sectors of the economy. Nevertheless, at present most transportation investments, perhaps necessarily, are viewed in isolation because of the complexity of defining and resolving all these simultaneous relations. Transportation requirements

are calculated, capital availabilities are surveyed, and a mode of transport selected that will suffice for revealed or expected future demand to an arbitrary date. However, due to the indivisibilities of transport facilities, excess capacity must be constructed and, thus, fixed capital is underutilized.

The extent of the underutilization of transport capacity depends, of course, on the level and rate of increase of demand and the mode of transport. For the most part, there seems to be little awareness of opportunity costs and this leads to significant errors in the allocation of funds. Given the complexity of an economy and the planning tasks, perhaps such errors are inevitable. On the other hand, further analysis can narrow the probability of error.

The determination of the proper level of transport investment falls into two stages: first, the broad gross decision of the output and location of industries and the provision of appropriate transport links to meet production and marketing requirements; and second, the detailed evaluation of individual projects within the context of this overall development plan. Ideally, the entire determination would be completed in one stage, but because of the extreme detail required and the large number of factors to be considered in such an attempt, a single-stage solution is impossible. A two-step analysis is more manageable and should yield results that are superior to those obtained from the widely utilized technique of only undertaking cost-benefit project evaluations.

A conceptual framework of an economy will be devised and manipulated to observe the impact on the level, mode of service, and real costs of the transport sector altering: (1) final demand, capital, and capital constraints; (2) production functions; and (3) the location of industries.

While this conceptual approach is probably useful, its value will be greatly enhanced if the model can be empirically tested and validated and employed to formulate policy prescriptions for a particular country. Time and data inputs permitting, it is hoped to attempt such empirical verification for a simple, underdeveloped economy—perhaps that of Puerto Rico.

### 3. Case Studies on Latin American Transport Investments

George W. Wilson

Charles J. Stokes

This study will examine, through individual case studies, the results of past transport investments (provision of new or improved facilities) on economic development in various countries of Latin America.

The case study approach will be used (a) to examine the impact of transportation improvements within several different institutional frameworks (i.e., particular regions or countries) and (b) to analyze the impact of different kinds of transportation improvements. The two are clearly interrelated and any particular case study will provide evidence pertinent to both aspects.

Cases chosen will involve situations where a major transportation improvement has recently (i.e., within the past several years) taken place and where there exists abundant evidence of the situation prior to the improvement. The case would consist of assembling this prior information, giving details of the improvement and concomitant investments or policies, and, most significantly, attempting to discern what has subsequently occurred including any actions or activities not directly related to the transportation improvement.

It has been decided to concentrate initially upon Latin America rather than Africa or Asia mainly because of the major interest of the United States and AID in the region under the Alliance for Progress. In this way, the study should be more uniquely relevant to the allocation of the Alliance's developmental funds. At the same time the proximity of Latin America renders it more suitable for a series of studies of particular transportation investments. However, various studies of a comparable nature for Africa and Asia are available and will form part of the ultimate analysis and synthesis. Utilization of some of the staff and resources of ECLA is anticipated.

To assess the developmental impact of improved transportation, information concerning changes in some or all of the following would be required. (The data or other evidence may refer to local, regional, or national totals depending upon the extent of the transport network affected by additional investment and over a time period long enough for the developmental impact to be widely felt.)

1. Freight rates, costs and traffic (volume and composition).
2. Passenger fares, costs and traffic.
3. Volume, composition, and value of output.

4. Population, labor force and employment.
5. Wages, interest, profits.
6. Income distribution, consumption patterns, and level of living.
7. Attitudes, incentives, and so on.

It is clear that the interrelation of most of these factors will make it difficult to isolate the role of transportation. This is especially the case at the national level where so many other influences are continuously at work. On a regional level, the impact of improved transportation should be more easily discerned, although adequate data will be harder to come by. In any event, attention will be focussed initially on the transportation improvement. When the facility is under construction, it will augment incomes and employment. When it is ready for use, the change in freight rates, costs, service, and so on would be linked with changes in traffic volumes and patterns. These in turn should have impact upon output, efficiency, and the other items listed above.

\*4. Transport Investment Criteria for Developing Countries  
Tillo E. Kuhn

The dilemma of how to choose among alternative investments is acute in the real world. In the underdeveloped world where the marketplace provides few answers and where public investments are undertaken for diverse reasons, the dilemma becomes almost insoluble by any rational process. Yet these decisions must be made and cannot be postponed until all the necessary data are collected and all other avenues for investment explored.

This study will explore methods of raising the present level of methodology now available to government decision-makers, consultants and aid personnel for investment decisions. The attempt will be made to narrow the gap between the body of theory available in the learned journals and the operational tools now being employed in the field. Emphasis will be placed on workable field techniques rather than on a further development of pure theory. Mr. Kuhn has recently completed a field study of transport in Honduras and is expected to conduct other field investigations as a part of the project. An operational manual will be produced as one of the end products of this study.

\* Approval process at Brookings not yet completed.

## 5. Impact and Role of Highway Maintenance Practices in Developing Countries

Mathew J. Betz

The construction of roads with a balanced level of construction and maintenance expenditure is one of the most important planning aspects of roads in developing areas. If a road is initially "over built" beyond the country's ability to maintain it, it may soon disintegrate to the point that it will be of less use to the economy than a low-cost road that can be maintained to its proper level.

It is not true that more expensive construction always means lower maintenance costs. Indeed as the level of construction increases, the proper level of maintenance also increases. More understanding of these relationships could directly affect policy on foreign aid spending for roads. It could take the form of encouraging different levels of construction and/or the use of maintenance grants to aid the developing country in performing proper maintenance. Some developing countries are now being faced with the problem of finding internal financing for maintenance of expensive roads built with foreign funds. It may well be that some of these roads were "over built" in relation to the country's ability to maintain them.

The purpose of the proposed study is to analyze the levels of maintenance needed to protect the capital investment in various types of roads in developing areas. The goal would be to establish levels of maintenance for various construction types and environmental conditions.

Data for the analysis will come both from the United States and from foreign countries. In the U.S. a number of states have begun to break out maintenance costs according to type of road and this information is available through state highway departments and the Bureau of Public Roads. For overseas data, the major researcher has material from the Sudan, where he spent a year, and from Ghana. Additional data are available for Nigeria and Uganda from Hawkins' work in these areas.

## \*6. Transport Implications of Latin American Economic Integration

Robert T. Brown

Under the impetus of the Alliance for Progress a spurt in country planning in Latin America is occurring. In almost all cases such country plans as have been completed to date have viewed the transport sector in a traditional focus, i.e., outward to world markets. Yet it is clear that economic integration among Latin American countries will grow; certainly not with the speed or comprehensiveness of the Common Market in Europe but to the

\* Approval process at Brookings not yet completed.

degree that outward focussed transport facilities will not suffice. In many instances, it is possible that deliberate attention now to the possibilities of trade between Latin American countries could accelerate growth in this area and reduce some of the chronic foreign exchange problems now inhibiting growth. The provision of transport facilities between appropriate countries may well be a necessary first step in encouraging such trade.

The project will examine the potential of intra-Latin American trade, identify the commodities and areas of greatest promise and determine the transport implications of such trade. Mr. Brown, an American economist who has resided in Chile for several years, has been concerned with economic development and transport planning for the Chilean government.

\*7. Transport and Soviet Development: A Comparative Analysis of Rail Productivity  
Holland Hunter  
Alan Abouchar

Since 1928 the USSR has economized in transportation investment, relative to previous Tsarist and Western practice, using the resources thus released for rapid development of heavy industry. Critical evaluation of the Soviet record can suggest important lessons, both positive and negative, concerning relations between transportation and rapid economic development.

A statistical picture of the Soviet economy around 1928, and of its structural changes over the next decade, has not yet been reconstructed in any great detail. Thus answers to the most fundamental questions cannot yet be attempted. Ultimately one would hope to compare: (a) the current costs and investment outlays forced on transport-using sectors of the economy by Soviet transport-economizing practices, with (b) the current savings and averted investment outlays of the carriers, primarily the railroads, who benefited from these practices. It is obvious that the net gains for the economy as a whole were smaller than the gross gains of the carriers alone, and it may even appear that Soviet policy went too far, producing a net drag on the development process.

Another focus of effort in the study would be investigation and experimentation with various aggregate production functions for Soviet railroads. Of course the production of freight traffic service is anything but homogeneous, being affected by the commodity composition of the traffic, the geographic pattern of shipments, the operating profile of routes used, average lengths of haul, seasonal variations, types of motive power and rolling stock employed, the nature of operating practices, etc. Nevertheless, the recent

\* Approval process at Brookings not yet completed.

work of Meyer, et al., and of Borts, together with the stimulus of studies in the Kendrick manner, suggest that Soviet data could be similarly analyzed. Moreover a technical comparison could be made between Soviet rail freight traffic production functions and those of India; it might indicate directions in which Indian operating practice could be improved.

A third area of interest would lie in attempting to evaluate Soviet regional development policy, and the associated transportation decisions, from a regional input-output point of view. Data-collection will be aided by the existence of several other studies currently underway that deal with the Soviet switch from coal to oil and gas; some of their underlying statistics will supply material for a transport-oriented analysis.

A fourth topic in the study would be evaluation of Soviet policy since 1950 toward expansion of railroads versus intercity trucking, pipelines, and water transportation. The general background is reviewed in the Hunter and Williams books, but recent sources can yield material for a more detailed analysis of choices made in the last decade under contemporary technological conditions. Because of many decisive differences in relevant conditions, one country's wisdom may be another country's folly. Nevertheless, an evaluation of recent Soviet policy ought to have comparative interest for those concerned with similar issues in other economies.

#### 8. Other Research Activities at Brookings

In addition to the projects described above, several other projects are in preliminary planning stages. Two young economists, Messrs. Harral and Weiner have been added to the staff of the Transport Research Program. Mr. Weiner's interests are in capital budgeting and public finance while Mr. Harral is planning to work in the general area of country planning models and their relevance to operational decision-making in the transport field. Mr. Kanaan, a Ph.D. candidate in Geography at Syracuse University has submitted a proposal for a transport study of Syrian transport requirements using the newly developed technique of graph theory for transport projections.

A number of conferences on specific topics of relevance to the program, involving U.S. and foreign scholars are also planned.

## B. Research at Other Institutions

### 1. Evaluation of Administrative Recommendations in Transport Made by Granting/Lending Agencies

John Lindeman, Syracuse University

A large proportion of loans and grants to underdeveloped countries has been for transportation facilities. In many cases the actual investment program has been preceded by recommendations of study missions or of individual transportation experts, and these recommendations almost invariably have included proposals for administrative and organizational reforms in the operational and regulatory branches of government which have to do with transportation policy. In many cases foreign financial assistance has been conditional on specific administrative and organizational changes.

Several questions arise which require investigation:

a. To what extent have these recommendations and conditions been consistent in their content? One must, of course, make allowance for different conditions in different countries; i.e., a specific recommendation for administrative and organizational arrangements in country "A" would not necessarily be suitable for country "B". But there is some evidence—so far inconclusive—that the differences in recommendations sometimes reflect not so much the objective differences among countries as they do the personal opinions and biases of the experts who make the recommendations. This possibility should be tested. Similarly, there can be conflicting recommendations to the same country from different lending (or granting) institutions, reflecting differences of expert opinion on the same set of objective facts. And, finally, within any given country there may be a kind of expert parochialism which leads to expert recommendations on, e.g., railroad management which conflict with and perhaps vitiate other experts' recommendations on highway policy.

b. To what extent have these recommendations and conditions been tied into the countries' total development programs? It is one thing to make trains run on time and to set a rate structure which lets the system pay its way. It is an entirely different matter to organize and administer a transportation system which furthers basic development aspirations: agricultural reforms, colonization, community development, efficient use of energy, etc.

c. To what extent have the recommendations been followed by the governments to which they have been made? What have been the results? It is clear that in some cases the recommendations have been followed to

the letter, while in others they have been followed only partially or not at all. It should be possible in some countries to evaluate the consequences of accepting or rejecting the expert recommendations. This part of the problem is two-fold; it involves an appraisal of the relevance of the recommendations to the complex of problems facing the government of the underdeveloped countries as well as an appraisal of the receptivity of the countries to expert advice (and loan/grant conditions) and their capacity to follow the advice.

The research will logically fall into two parts, both as to time and as to content.

a. The first step will be to catalogue the recommendations that have been made by study missions and individual experts on the administrative and organizational aspects of transportation arrangements in as many countries as possible within time and budget limitations.

One purpose at this stage would be to evaluate the consistency and relevance of the expert advice and/or formal conditions. A fairly large number of countries would be covered in this survey—perhaps twenty or thirty, depending on the availability of information.

b. The second step will be to make field surveys of a few selected countries to see how they have received and used expert advice, or how they have conformed to certain formal loan and/or grant conditions. Here again, the purpose would be two-fold: to evaluate the impact of the advice (or conditions) on policy decisions, and to evaluate the consequences of accepting, or rejecting, the advice. Field surveys will have to be limited to a small number of countries, probably four to six. The countries will be selected after the first stage of the study is well advanced on the following criteria:

- (1) There must have been a significant investment effort in the field of transportation.
- (2) There should have been considerable foreign aid for transportation investment from more than one foreign aid agency.
- (3) Some of the countries should have shown definite progress in the administration of transportation programs, and others should have shown little progress.
- (4) Investment programs involving recommended administrative and organizational reforms should be well enough advanced to have shown results.

**\*\*2. Harvard Transport Research Program**  
John R. Meyer, Harvard University

This proposal contemplates the development of a number of research projects on transport investment in relation to economic development by young economists through a research seminar. The program will draw together graduate students, faculty, and outside experts, and will also serve as the forum for testing new ideas and preliminary reports on individual research. The research program uses its technical director and research assistantship funds to attract doctoral candidates writing theses and provides the guidance to individual research projects.

One of the crucial transportation problems in most underdeveloped countries is determining the proper locations and priorities for additional transportation investments. Planning such investments is, of course, basically a problem in capital budgeting, and therefore a prime emphasis of the research in this project will be upon capital theory and capital budgeting techniques.

A major difficulty with evaluating transportation investments in underdeveloped countries is that the value of such investments can only be assessed properly in the light of a fairly comprehensive plan of overall economic development. But a good plan, in turn, requires as one of its inputs a thorough knowledge of transportation possibilities or at least of the probable availability of actual transportation facilities. In short, important interactions exist between design of an efficient transportation system and the design of a comprehensive development plan. Accordingly, an attempt to develop better analytical and empirical procedures to take these interactions into account would be a primary objective of the research.

Students and faculty associated with the project would be expected to carry out different parts of the research project according to their own interests, needs and preferences. For the most part, an attempt would be made to permit the individual participants considerable latitude in their choice of topics within the framework of the program. Certain research projects, however, would receive special priority. These would be of the following types:

1. Conceptual papers: These would deal with problems of developing capital budgeting procedures that yield results consistent with stated maximization objectives for at least a fairly wide range of applications and circumstances. Primary emphasis, moreover, would be upon development of means to take account of the more important interactions between transportation and general economic planning in underdeveloped countries.

\*\* Not yet approved by AID.

2. Empirical Cost Studies: These would be aimed at creating reasonably simple procedures for making comparative cost analyses of different transportation techniques under different geographic and economic conditions, with particular emphasis on differences in labor and capital costs.

3. Policy Studies: Prime emphasis would be on an attempt to develop techniques for more explicitly recognizing the implications of different public transportation policies and, in particular, studies to evaluate the impact of transport subsidies in achieving stated public policy objectives.

Selection of individual projects would be made in consultation with Brookings staff to avoid overlap and duplication of research efforts.

### 3. A Long Range Transportation Plan for India

Louis Lefebvre, Massachusetts Institute of Technology

This study will develop a long run transportation development plan for the Indian economy. Though such research could be undertaken in any other country, India was selected for several reasons. First, the economic problems of India are probably the most formidable of all the underdeveloped countries committed to a democratic form of government; second, the methodology of planning developed in the context of India may be adaptable to other overpopulated countries operating in the framework of a mixed planned and free-market economy; third, the data required for research are more readily available in India than in other underdeveloped countries; fourth, the Center for International Studies at MIT has long research experience in India coupled with excellent personal and professional relationships established in the course of eight years of continuous operations in the country.

Indian economic development suffers because of an inadequate and inefficient transportation plant. Serious signs of transportation shortages developed during the Second Plan. The investments scheduled for the railways were completed, but other significant targets were not attained. The shortages developed during this period are carried over into the Third Plan; outstanding registrations (undelivered general cargo accepted by the railways) are running high and the failure to maintain an adequate flow of coal to industrial users jeopardizes the growth of private and public industrial production. At the same time, alternative modes of transportation cannot alleviate the burden; road transport is severely hampered by an assortment of direct and indirect controls, while coastal shipping, unable to compete with discriminatory railway rate policies, is definitely on the decline.

No investigation of sufficient generality was ever undertaken by the Government or other agencies which could provide the basis for an efficient long run plan for Indian transport development. Nonetheless such a plan would be needed if sensible policy decisions about the alleviation of the increasing transport shortage are to be reached.

A long run plan for transportation development must be based on a projection of regional economic activity on the one hand and comparative cost studies of providing the services by alternative modes on the other hand. Currently neither projections nor sufficiently reliable cost studies exist in spite of the increasing concern with the problems of Indian transportation. Nor are there — according to our knowledge — comparable studies existing or currently conducted in connection with the development plans of any other country.

The demand and supply of goods embodied in the plan targets are national aggregates by commodity groups and do not indicate the geographical distribution of production and consumption. Hence, the targets would have to be broken down into regional production and consumption estimates. The task is a big one but not an impossible one. We know the current distribution of the population, trends of city formation and the rough regional distribution of economic activity. From the existing information, 'growth points' can be identified and with suitable methods the target productions and demands regionally allocated.

The demand for transportation has to be met by the supply — otherwise the targets of the plan cannot be attained. The required supply, however, can be met by the expansion of several modes. The bulk of long-distance traffic is currently carried by rail; hence, the railways will have to play a continued important role. But as far as the railways are concerned, several important questions must be answered.

- 1) Are there relatively minor investments and organizational changes which could bring relief to the operation of congested routes?
- 2) What exact rate structure is required such that only efficient commodity movements are induced?
- 3) What major investments are required to enable the railways to cope with the growing demand?
- 4) Are the current plans for electrification rational or would dieselization be preferable?
- 5) To what degree should modernization be extended to any one regional railway system (network)?

- 6) How much of the incremental transportation demand generated by the new plan targets should be met by the railways?

The last two questions can be answered only in the context of comparative cost-benefit analysis. The alternatives to railway transportation are road hauling and shipping. Whereas shipping is insignificant (but the need for its revitalization should be studied) road transport is assuming an increasingly important role. In South India, for instance, it has already developed to such a degree that the abandonment of the Southern Railway System could be seriously considered. (The Southern System operates on meter gauge; consequently, transshipment is required on traffic from the Northern and Central broad gauge systems.) Furthermore, there is an increasing nationwide demand for long distance road transportation in spite of much higher rates, because of the superior speed and reliability of the service.

Cost analysis must determine whether road transportation is not more suitable to meet the demand in areas where traffic is thin and where the cost of creating new and operating existing railway lines is high. More than that, cost analysis is required to determine whether the railways should expand beyond their current operation or be confined to strengthening their existing trunk lines, leaving all other transportation to highways and coastal shipping.

The work required to draw up a coherent transportation plan for India may require as much as three years since much of the methodology and statistical material would have to be created in the process. Nonetheless, it would be a worthwhile enterprise since the methodology and much of the comparative cost studies could be directly useful and adaptable for similar studies in other countries.

MIT is currently engaged in discussion with other sources of funds to augment funds asked of Brookings. The proposed budget for Brookings' participation would provide roughly 50 percent of the total. The project would be under the direct supervision of Professor Louis Lefebvre.

#### 4. Case Studies on African City-Hinterland Development Leon Moses, Northwestern University

One of the most striking features of recent economic development in Africa is the rapid rate of urbanization that is apparently taking place along with the economic growth of these areas. The governments of the continent have been presented with a series of difficult problems as a result of this phenomenon. They find it necessary to provide expensive

public facilities required to support the rapidly expanding urban population. Their problems are made more difficult by the fact that the expansion of urban economic activity does not necessarily provide either full employment for incoming labor or increased per capita income in the hinterlands where that labor originates. Often, the rising incomes of the employed portion of the urban population are translated into more demand for imports rather than for domestically produced products, indicating that the city's "hinterland" for many commodities is the world market, while per capita income in the domestic agricultural hinterland is restricted by low productivity, high transfer costs, or both.

Low agricultural productivity in the food producing hinterlands seems, in most of Africa, to persist in the face of rising urban demand not so much because of the lack of investment in increasing total agricultural output as because the apparent risks of transforming agricultural technology toward the production of commodities with a higher income elasticity of demand are too great to justify extensive private investment. Much of this riskiness seems to be based on an inefficient system for transferring agricultural products to urban markets — a system that features weak transport links, inefficient storage and distribution facilities, and limitations on the supply of finance necessary for more efficient distribution of sales over time. All these factors operate to maintain a gap, possibly a widening one, between the income of the urban employed labor force and that of the economically active population of the agricultural hinterland. Insofar as emigration from the agricultural sector is affected by apparent income differentials, this gap causes continuing migration into the city and a consequent reinforcement of the social problem of developing a viable urban culture and the economic problem of providing power, water, sewage, education, transportation and other facilities for the urban population.

The practical issue of finding solutions to these growing problems forces the national governments of Africa to seek criteria according to which the investment funds available under current development programs can be divided among the activities of the city-hinterland complex. Important on the list of alternative uses is investment in the transportation network linking the city to its hinterland.

Is it possible that a redirection of public investment to the hinterland, or to transportation, or to both, would increase incomes in the hinterland and decrease the rate of migration into the congested urban areas? If either or both of these results occurs, is the outcome desirable? What type of transportation facilities would best promote balanced economic development in the city-hinterland complexes? The proposed research is meant to be a first approach to an answer to these questions. The idea behind the proposal is that, speaking very broadly, economic development

might be encouraged by a reduction of investment in the city to a level lower than that implied by current rates of migration, because the ultimate pay-off to directly productive investment elsewhere in the economy would be earlier achievement of desired living standards. In order to lay an empirical foundation for such an analysis, it is proposed to study three or four specific city-hinterland complexes in detail, to establish accurately the costs associated with migration and the changes in transportation investments that might lower these costs.

Two central questions will be posed in the three or four case studies suggested:

- 1) What is the relation of public overhead expenditures in the large cities to migration rates and total urban population?
- 2) What have been the effects of changes in transportation costs on population movements, the product mix in hinterland agriculture, the growth of processing and related activities in the hinterland, and the content and size of trade in goods between city and hinterland?

The following cities are suggested as candidates for study:

Accra, Ghana  
 Monrovia, Liberia  
 Freetown, Sierra Leone  
 Lagos, Kano, and Ibadan, Nigeria  
 Nairobi, Kenya  
 Dar-es-Salaam, Tanganyika  
 Entebbe, Uganda

In all of these places, censuses and/or sample surveys provide basic data on population, migration, and the structure of the urban labor force. In most of them, price and wage series are also available, and limited studies of special agricultural problems in the hinterlands have brought out data on the costs and structure of indigenous agriculture. The published government data contain detailed information on the costs of public facilities in the city and on the overall costs of recent major changes in the transportation system. It should be possible to select three or four of these places that will produce case studies as detailed as could be desired with a reasonable expenditure of research effort.

5. Technological Alternatives in Transport Investment.  
(Unassigned)

One of the critical elements in transport investment is the choice of technologies to be employed to supply needed transport capacity. While there is a limited degree of substitutability among modes in developed countries, each mode choice has implications in terms of labor skills, supply industries and external effects which must be closely considered by the developing countries. Alternative modes must be considered, therefore, not only on the purely technical differences in inputs and outputs, though these are critical, but also on the indirect effects which each mode may be expected to have on the rest of the economy. Entrepreneurial activity, for example, is more likely to be encouraged by road development than by rail.

It is also evident that, although introduction of new technology proceeds reasonably well in developed countries, a conscious evaluation must be made by countries just beginning to make large capital investment in fixed transport plant. Few developing countries can afford the luxury of chronic over-capacity in the transport sector. Evaluation must be made, therefore, not only of traditional modes but must include new techniques, e.g. ground effects machines, solids in pipeline slurry and the like, if serious waste of resources is to be avoided.

This project will evaluate the probable range of capital and operating costs of different modes of transport, the support requirements of each mode and the external or indirect effects each mode is likely to have on the total development process.

### Bibliography on Transportation and Economic Development

A bibliography on Transportation and Economic Development has been in preparation since January 1963. At this juncture it contains several hundred items which have been classified into the following categories: General Transportation, Theory, Africa, India and Pakistan, Russia, Miscellaneous Countries; Air Transportation - General, Miscellaneous Countries; Railroad Transportation - General, India, Russia, Miscellaneous Countries; Road Transportation - General, India, United Kingdom, Miscellaneous Countries; Water Transportation; and Transportation and Economic Development - General, Theory, Empirical Studies. In addition to a bibliographical listing of titles of journals and books, a large number of items of particular interest have been reviewed and annotated further to aid students of the subject. It is expected that this bibliographical effort will continue throughout the life of the project and a final version published in book form upon its completion. This will be the first time that such a compilation has been made available to scholars in the field.

Harvard Transport Seminar

As a prelude to the Harvard Research Program to be directed by John R. Meyer, assisted by Martin Wohl, a seminar in transportation and economic development was established during the spring semester, February-May 1963. This seminar, with weekly sessions, was conducted by Gary Fromm and Richard B. Heflebower and had as its purpose the awakening of student interest in the topic and an introduction to the complexities of the subject. Emphasis in the seminar was given to the determination of optimal transport investment within the context of a development plan under conditions of economic growth and the constraints operating in developing societies.

The program of the seminar consisted of a series of guest lectures followed by discussion by outstanding economists in the field, student term papers, and informal dinner discussions. It is contemplated that a volume of papers of the seminar presentations, to serve both as a record of the ideas expressed and as a guide to future students of transportation and economic development, will be published by the Brookings Institution under the Transport Research Program by January 1964.

The speakers presented and the titles of their lectures were as follows:

1. February 7: Introduction  
Presentation of the Problem  
Outline of the Seminar  
Speakers: Gary Fromm and Richard B. Heflebower
2. February 14: The Objectives of Transportation in Economic Development  
Speaker: Hans Heymann, The Rand Corporation
3. February 21: The Economic Characteristics of the Transportation Industries  
Speaker: Richard B. Heflebower, Visiting Professor in Economics
4. February 28: Optimal Transportation Investment and the Dynamic Growth Process  
Speaker: Louis Lefeber, M.I.T.
5. March 7: Transportation in the Economic Development Process: The Case of the Soviet Union  
Speaker: Holland Hunter, Haverford College and the Harvard University Russian Research Center

6. March 14: Transportation and Technological Change  
Speaker: Wilfred Owen, The Brookings Institution
7. March 21: Transportation, Production and Regional Location  
in Less Developed Nations  
Speakers: Leon Moses and Mitchell Harwitz, Northwestern  
University Transportation Center
8. March 28: Pricing and Relative Rates for Transport  
Services: Normative Prescriptions for Underdeveloped  
Countries  
Speaker: James R. Nelson, Amherst College
9. April 11: Economic Evaluation of Transport Projects in  
Underdeveloped Countries: Theory and Application  
Speaker: Hans Adler, International Bank for Recon-  
struction and Development
10. April 18: Financing Transport Investment in Underdeveloped  
Countries  
Speaker: Robert Sadove, International Bank for Recon-  
struction and Development
11. April 25: 1. Summary Reports by Students on their Term  
Papers  
2. Criteria for Designing a Model of the Transport  
Sector in an Economic Development Plan  
Speaker: Gary Fromm

On the average there were from thirty to forty graduate and a few undergraduate students and three to four faculty members in attendance at each session. Eight students enrolled in the course for credit and are producing term papers on various aspects of the subject ranging from complete models of transportation and economic development to the selection of highway design for individual projects. The students were drawn from Harvard and M.I.T. (though largely from the former) and from such diverse disciplines as city planning, civil engineering, economics, government, public administration, and social studies. In addition to a sizable complement of U.S. students, there were scholars from Burma, India, Indonesia, Italy, Nigeria, Pakistan, and several other countries. A number of those from foreign nations were also Public Service Fellows (career government employees with five to ten years experience on a year's academic sabbatical) in the Harvard Graduate School of Public Administration.

The course was generally viewed as excellent by both students and faculty, and the prospects for a highly successful continuing seminar and research program in transportation and economic development seem bright.

## Relations With Other Research Agencies

The Transport Research Program has as one of its objectives the exchange of knowledge and experience between the developed and less developed countries as well as among different underdeveloped countries. In the discharge of this responsibility, relations have been established with a number of foreign and international agencies.

### 1. The Economic Commission for Latin America

Michael Sapir, the Director of Transport, Natural Resources and Regional Planning, visited the Brookings Institution in the spring of 1963 and spent several days advising us about the transport program at ECLA and personnel in Latin America who might participate in the Latin American case studies. Mr. Sapir will give occasional time to the program as a consultant. He is at present directing the preparation of a manual to assist Latin American countries in planning and programming transportation projects. This manuscript will be made available for comment and criticism by the Brookings staff when a preliminary draft has been completed.

### 2. The Economic Commission for Asia and the Far East

Memos describing the Brookings program have been supplied to Mr. M.S. Ahmad, Director of Transport and Communications for ECAFE in Bangkok. Mr. Ahmad has requested assistance from Brookings on the developing of a "Transport Development Planning Manual." This is to be a practical manual for use in the field to assist in planning transport programs in relation to overall development programs. An outline of the project has been sent by ECAFE for review, and arrangements are now being made for a Brookings staff member to join with consultants from France and Britain to assist ECAFE in its work in the fall of 1963.

### 3. The Economic Commission for Africa

The Economic Commission for Africa has held meetings on transportation in East Africa and in West Africa. These meetings were discussed with the ECA transport economist, Mr. Dagogo Alagoma, in Madrid, and the reports emanating from the African regional meetings have been made available to Brookings. The Brookings program is in turn supplying ECA with requested data on transport economics.

#### 4. The Institute of Economic Research, University of Chile

In connection with other business in Latin America, Joseph A. Pechman, Director of Economic Studies at Brookings, visited the Institute at the University of Chile in December 1962. Mr. Pechman discussed the work of the Institute with the staff in Santiago and arranged for the Institute's transportation economist, Mr. Robert T. Brown, to spend his year abroad with the Brookings program in Washington, beginning in January 1964. The former director of the Institute, Mr. Joseph Grunwald, will be joining another division of the Brookings staff later this year to study the problem of economic integration in Latin America. It is anticipated that Robert Brown's study of transport's role in economic integration will be closely tied to the overall study on this subject at Brookings.

#### 5. Road Research Laboratory, Ministry of Transport, Great Britain

Discussions have been held both in Madrid and Geneva with staff members of the Tropical Research Division of the Road Research Laboratory. This organization is engaged in case studies of transport in North Borneo, Jamaica, East Africa, and other countries. Mr. Ray Millard, Director of Road Research, visited the Brookings Institution in April 1963 to discuss the desirability of a meeting late in 1963 at which French, British and American case study experience would be discussed. The Road Research Laboratory has recently completed the field work of a three-year study of motor truck operating costs under controlled conditions on various types of road surfaces in East Africa. These materials are now being analyzed and will be made available to Brookings later in the year.

Participation in Conferences, Seminars

Staff of the Transport Research Program have participated in seminars and conferences on the transportation aspects of development. The purpose of this participation has been to explain the Brookings program, to further our own understanding of the problems being dealt with, to learn about other related research activities, to solicit help from other agencies, and to recruit personnel. Following are the principal meetings in which Brookings staff participated:

1. The Economic Development Institute of the World Bank  
Washington, D. C., January 17, 1963  
A two-hour seminar was given at the Institute on the subject Transportation and Development for participants representing government and business in the developing countries.
2. The United Nations Conference on the Application of Science and Technology for the Benefit of the Less-Developed Countries  
Geneva, Switzerland, February 4-20, 1963  
The Director of the Transport Research Program was a member of the U.S. delegation, and chairman of the sessions on National Transport Policy and on Transport to Achieve Other Goals. The Brookings reports for the conference included the Introduction to Volume V of the U.S. papers on Transportation, and the paper Transport Technology and Economic Development.
3. The Harvard University Transport Research Seminar  
Cambridge, Massachusetts, March 14, 1963  
A two-hour seminar was conducted for forty graduate students and faculty on the subject: Transport Technology and Economic Development.
4. The Brookings Institution Public Affairs Seminar  
Washington, D. C., April 3, 1963  
The Director of the Transport Research Program addressed an eighteen-member group of industrialists who are representatives of business, labor, and the professions, and who combine an intensive educational program at Brookings with assignments in government agencies at the policy-making level. Topic: Transport, Technology, and the Underdeveloped Areas.

5. Society for International Development

New York, N.Y., April 4, 1963

Participation in the Annual Meeting of the Society, on a panel to discuss the implications of the Geneva meeting on Science and Technology.

6. Economic Growth Center

Yale University, New Haven, Connecticut, April 24, 1963

An informal two-hour meeting was held with members of the country survey project en route to overseas posts in developing countries, where they will study specific economic aspects of growth and their influence on development. Subject: The Brookings Transport Research Program.

7. The Issues and Challenges of Air Transportation: The Impact on Technology.

The Hartford Symposium, May 15-17, 1963

This meeting of 500 representatives of government and industry was focused on new technology in transportation and its social and economic implications. Subject of Brookings paper and panel participation: Technology to Fight Poverty.

8. Other conferences attended by Brookings staff:

American Economic Association, Pittsburgh, Pennsylvania, December 1962. Personnel were interviewed and new staff selected.

Conference on Transportation Economics, sponsored by the Universities-National Bureau Committee for Economic Research, Northwestern University, Evanston, Illinois, April 26-27, 1963. Meetings held with directors of proposed subcontract studies.

National Conference on International Economic and Social Development, Washington, D. C., May 28-29, 1963.

9. Two papers by staff were prepared for the Ninth Pan American Highway Congress, Washington, D. C., May 6-18, 1963. These were:

Guides in Planning the Transport System, by Wilfred Owen.

Road Construction as a Means of Developing Areas Served, by Edwin T. Haefele.

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 Gary Fromm  
 Charles J. Stokes  
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\* Scheduled to join staff after June 1, 1963

\*\* Scheduled to work on projects at their respective universities