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Transport and National Goals

Edwin T. Haefele *Editor*

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Foreword

TRANSPORT PLANNING is closely related to many aspects of national development policy. It is not enough merely to weigh the costs and benefits of alternative means of moving people and goods. The possibilities of trade off between transport investment and other capital investments must be taken into account. Moreover, since transport expenditures are often important as inputs in other economic programs, what may appear to be an efficient transport investment when viewed in isolation may be very inefficient when viewed in the broader context of national planning.

In this volume, one of a series of studies financed under a grant from the Agency for International Development, the authors explore some of the effects that national policies and goals in other sectors have on transport decisions. The authors include Edward S. Mason of Harvard University; Robert Jones of the Regional Plan Association; Wilfred Owen of Brookings; William Hughes, formerly of the University of British Columbia and now with the International Bank for Reconstruction and Development; Richard Weisskoff of Harvard University; and Edwin T. Haefele, formerly of Brookings and now with Resources for the Future, Inc. Mr. Haefele acknowledges with gratitude the perceptive and indefatigable support of Eleanor B. Steinberg, Edna Lusher, and Susan Gilbert in the editing of the volume. The index was prepared by Rachel M. Johnson.

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The volume was reviewed by John Adler, Robert T. Brown, and Benjamin Chinitz, whose comments were extremely helpful in revising the manuscript. Their help as well as that of Robert E. Asher is gratefully acknowledged. The Transport Research Program, under the direction of Wilfred Owen, is conducted as part of the Economic Studies Program of Brookings, directed by Joseph A. Pechman.

The opinions expressed by the authors do not necessarily reflect the views of those who read and commented on the manuscript, the Agency for International Development, or the trustees, officers, or other staff members of the Brookings Institution.

KERMIT GORDON
President

May 1968
Washington, D.C.

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Introduction

EDWIN T. HAEFELE

PREVIOUS BOOKS IN THIS SERIES have been concerned with the hard question of transport investment in an economic development context. This volume is an extension of those earlier volumes; in particular of Clell Harral's careful analysis of transport projects[1] and Gary Fromm's succinct outline of transport sector planning.[2] Harral and Fromm, however, did not attempt to cover the broader reaches of national policy which affect transport planning. These broader questions, which are discussed in this volume, must be raised upon a foundation of transport project analysis and transport sector planning. The present volume is not a substitute for either.

This volume does not present a complete picture of national development policy; it only probes a few of the areas in which such policy and transport planning are vitally connected. Even in these few areas most of the conclusions are tentative and the empirical evidence suggestive rather than definitive. The development field is one in which there is a great deal to be tentative about and no apologies are offered on that score.

Inasmuch as the reader must move from one subject to another very abruptly the essays have been grouped into what are, hopefully, logical

[1] This report was prepared as part of the Transport Research Program and is now available as Clell G. Harral, *Preparation and Appraisal of Transport Projects*. U.S. Department of Transportation, Office of Technical Assistance (1968).

[2] Gary Fromm, "Design of the Transport Sector," in Gary Fromm (ed.), *Transport Investment and Economic Development* (Brookings Institution, 1965).

sections. The first two chapters are concerned with trade offs—situations when more investment in some nontransport sector means that less transport is needed. Thus, Edward S. Mason, investigating the large demands on transport made in India by coal shipments, asks whether there are substitutes for coal that would reduce transport demands and whether changes in industrial location could profitably reduce all shipments of energy sources around the country. Raising the question in this way enables him to achieve additional degrees of freedom in the planning process. The task then becomes one of adjusting the energy, transport, location, and rate policy variables so as to increase real output at minimum additional cost consistent with other national objectives rather than the usual transport task of supplying additional transport capacity at minimum additional cost consistent with other *transport* goals. Moreover, by broadening the scope of the question, the important economic trade offs between energy source cost and transport capacity cost are highlighted. Traditional transport analysis, on the other hand, is apt to focus on the costs of supplying transport capacity by alternative means and never to ask why this much capacity is needed.

A far different kind of trade off with transport investment is postulated by Robert Jones in his analysis of transport and other urban design costs. Again taking a single empirical case, in this instance Venezuela, he shows the sensitivity of transport costs to policies and plans regarding urban patterns. Since urbanization continues to grow in all countries, there needs to be explicit recognition that decisions on housing, street layout, and community development have measurable impacts on transport costs. The fact that different government budgets may be involved should not stand in the way of calculating total social costs of alternative urban design plans, whether they be incremental plans or plans for new cities.

These two areas—energy and urban design—do not exhaust the trade off possibilities in transport and development planning. In the development context the question of avoiding or postponing transport investment should always be raised.

The second section of the volume (Chapters 3 and 4) illustrates cases where transport investment is a factor input to other processes and thus the amount of transport required is a subordinate decision. Strictly speaking, of course, transport decisions are always subordinate deci-

sions in the sense that they are dependent on goals or purposes in other sectors, but there are instances, as in the two cases presented, where this dependence is so simple and uncomplicated that transport is better treated as a direct input.

This is best illustrated in the agricultural developmental process. Current methods of analysis of the demand for transport in rural areas are meaningless. Hence Wilfred Owen, viewing the provision of transport as an input to the food production process, obtains his estimate of rural transport requirements directly from the urgent need to increase food production in the developing countries. Concerned with increasing food production, Owen sees transport as a way to move fertilizers, seed, and technicians in, and to distribute food throughout the country, minimizing the cost of spoilage and pilferage. While there are trade off situations in this process—transport versus improved storage, for example—the chief concern is getting the transport capacity decision inside the food production decision. Transport becomes an input to the food production process rather than an outside constraint upon the production of food.

Making education and social welfare facilities available to people in rural areas is another concern which is recognized by the transport analyst as being important. He has no criterion by which to measure its importance, however, and is rarely in a position to evaluate a transport investment decision on the basis of the increases in social welfare which the investment will bring. Decisions to improve social welfare are taken as a matter of course by the government agencies whose responsibility lies in those areas. Transport is a tool which these non-transport planners can and should use in their planning activities. It is an input to the performance of their task. William Hughes presents in Chapter 4 some evidence of how effective transport can be in this task. Using interview material from over 2,700 rural households affected by five rural roads recently constructed in Malaya, Hughes' account vividly illuminates the many forms increased personal mobility takes in a traditional culture.

Other examples of transport as a direct input could be cited. While no chapter deals specifically with scale economies in manufacturing and transport investment, the transport decision may well be taken in the context of the production process, especially if all facilities are yet to be built. Even when some transport facilities are in place, the pro-

vision of new facilities is clearly influenced by production economics of goods to be moved.[3]

The final two chapters deal with the political dimension of the transport decision. All decisions to spend public monies are ultimately political decisions and decisions to spend public monies on transport seem to get political a little faster than they do in some other fields. There are two aspects of the political dimension in transport decisions. The first is a straight distribution dimension and this is illustrated by Richard Weisskoff in Chapter 5. While Weisskoff writes of the experience in Colombia, the problem is universal. The criteria for choice of investment locale will rarely be so unequivocal or determinate that considerations of regional balance, of trading one favor for another, or of simple and compound equity will not enter into the decision process. The case of Colombia is especially apt because strenuous efforts *were* made to plan transport investment on economic criteria. In spite of such efforts, however, the record which Weisskoff presents is a political one.

The final chapter is a plea, in effect, to recognize the inevitability of the distribution problem and to plan its resolution through the political process. It is also an attempt to show how the political process must ultimately be depended upon for the final resolution of the social choice questions which are raised in the previous chapters. At the highest level of development planning, when decisions regarding transport policy, energy policy, housing policy, and all the rest are made, there should be no confusion about the extent to which technical experts can be utilized. The highest goals of a nation are stated and defined by such decisions, and beyond delineating what is possible and what the probable effects of various decisions will be, the transport planner and other technical experts have no role to play. This injunction is even more binding in cases—quite common—when the technician is not a citizen of the country affected by the decision.

The book is addressed both to the transport planner and to the general planner. We hope it helps the former to ask better questions and the latter to use transport more efficiently in the provision of real increases in material and social welfare.

[3] For example, see Alan J. Abouchar, "Rationality in the Prewar Soviet Cement Industry," *Soviet Studies*, Vol. XIX, No. 2 (October 1967).

CHAPTER I

Transport and Energy in India's Development

EDWARD S. MASON

THE FIRST SECTION OF THIS CHAPTER is devoted to a general discussion of the interrelationships between energy and transport and the consequent need for the two to be considered in tandem. The proportion of total investment allocated to these two important components of infrastructure and their relation to GNP are examined. Various economic aspects of policies concerning transport and energy in the context of the developing economy are then considered. The remainder of the chapter deals with specific aspects of these problems in the Indian setting.

Capital Investment: Requirements and Decisions

It is common knowledge that the capital requirements for transport and energy are large, and that for most less developed countries the foreign exchange requirements are also substantial. It is also true that there are strong interdependencies and possibilities of substitution in the development of energy and transport which are frequently overlooked by those concerned with economic development policies and programs. Different modes of transport have very different energy requirements and the different forms in which energy is used have different transport implications. These interdependencies and possibilities

of substitution need to be taken into account if transport and energy requirements are to be satisfied at minimum cost. The magnitude of the investment requirements for these two sectors emphasizes the importance of careful planning.

Country Data

It would be useful if comparative data on investment in transportation and energy were available for countries at different stages of development. Unfortunately this is not the case. There are numerous differences in classification of expenditures and, in addition, certain conceptual difficulties. In Mexican statistics, for example, investment in pipelines and the fleet of trucks of Petroleos Mexicanos (the publicly owned petroleum company) is included in transportation. In some other countries, this type of investment is included in the energy sector.[1] In United Nations statistics on less developed countries, transportation is lumped with communication and warehousing.[2] In the energy field, electricity, gas, and water are placed in one category, but investment in coal mining is included in the general mining category and petroleum is listed separately. Investment in port facilities, which presumably should be included in transportation, tends to be included in a general construction category. Road vehicles are not typically included in transport investment, though railway rolling stock is.

There are, moreover, certain conceptual difficulties. In Pakistan, power and water are put together in one investment category. Water development supplies the needs of irrigation, flood control, and, to a small extent, navigation. Here is the familiar problem of joint costs, and the separating out of power for the purpose of achieving a total figure on energy investment would inevitably be somewhat arbitrary. If a country is heavily dependent on oil imports, should a figure on energy investment include the foreign investment required to produce these imports? Presumably if it is a heavy oil exporter, investment for export purposes would not be included in an assessment of its own energy investment requirements.

Properly defined, transport investment should include total investment in railways, roads and road vehicles, pipelines, inland and coastal

[1] U.S. Department of Commerce, *Investment in Mexico: Conditions and Outlook for United States Investors* (1955), p. 9.

[2] U.N. Department of Economic and Social Affairs, *Yearbook of National Account Statistics, 1962* (1962).

waterway development, ships and shipping, port facilities, airports and planes, and probably ropeways and other somewhat exotic transport media. On this definition, the bits and pieces of existing information suggest that transport investment, as a percentage of the total, in less developed countries, is in the range of 15 to 25 percent. As a fraction of total *public* investment it is, of course, much more important. Owen presents figures for fifteen less developed countries of *planned* transport and communications investment as a percent of total planned public expenditures (capital plus current) for periods from 1955 to 1961. These range from 12 to 46 percent.[3]

Energy investment requirements are somewhat better understood as the result of the recent study of the OEEC Energy Advisory Committee.[4] This study, which attempts to estimate the investment requirements for energy development in Western Europe to 1975, breaks down the investment categories as follows: coal, imported liquid fuels, indigenous liquid fuels, coke and manufactured gas, indigenous natural gas, imported natural gas, and electricity. Estimates that the investment requirements inside Europe for prospective energy development will amount to 12.2 to 12.6 percent of total investment, depending on whether a sizable nuclear energy development is contemplated, have been included. A study of prospective Indian energy investment requirements, using the same concepts, arrives at the conclusion that something of the order of 13 percent[5] of total investment will be required in India. Estimates of energy investment requirements in most less developed countries ranging between 10 and 15 percent of total investment are probably fairly reasonable. Thus, transportation and energy together (assuming a broad definition of these sectors) are likely to require from 25 to 40 percent of total investment in less developed countries. This is obviously a large slice of the investment pie.

Transportation, Energy, and GNP

Investment in transportation and energy not only accounts for a large fraction of total investment in less developed countries, but in early stages of development, transport and energy requirements in-

[3] Wilfred Owen, *Strategy for Mobility* (Brookings Institution, 1964), p. 45.

[4] Organization for European Economic Cooperation, *Toward a New Energy Pattern in Europe* (Paris: OEEC, January 1960).

[5] "Report of the Energy Survey of India Committee" (processed; New Delhi, 1964). This report is also cited as Energy Survey. For additional information on its background, see note 21, p. 17.

crease much faster than the rate of growth of GNP. This is in marked contrast to the current experience of developed countries. In the United States and Canada ton-miles of intercity freight per dollar of GNP remained practically constant from 1940 to 1960.[6] Commercial energy inputs per dollar of GNP increased at an annual rate of 2.9 percent in the United States from 1880 to 1910. But between 1920 and 1955, energy input per dollar of GNP decreased at an average annual rate of 1.2 percent per annum.[7]

The experience of less developed countries in early stages of industrialization is markedly different. Owen presents figures for thirteen Asian countries, drawn from data collected by the Economic Commission for Asia and the Far East, comparing rates of growth of ton-kilometers of rail and road traffic with rates of growth of GNP mainly for the period 1947-57. In all but one country freight traffic increased substantially faster than GNP. In all but two countries passenger kilometers on roads plus rail increased more rapidly than GNP.[8] This reflects in part a shift from self-sufficiency to production for the market with its attendant transportation requirements. However, the main reason is a change in the structure of production toward manufacture with its large ton-mile freight requirements per dollar of output. Transportation requirements are influenced, moreover, by the structural changes within industry. Light diversified manufacture generates much less traffic per dollar of output than heavy industry. In India, for example, which has favored heavy industrial development, in the period 1955 to 1962, "coal, iron and other ores, limestone and dolomite, iron and steel products, petroleum products, cement and fertilizer accounted for 85 percent of the total increase of 63 million tons in freight tons originating. Virtually all the remaining increase was in railway materials themselves."[9] During the same period railway transport (in ton-miles) increased at approximately twice the rate of GNP.

The rapidity of growth in transport requirements during the industrializing stage of development implies a rapid growth in transport in-

[6] Owen, *op. cit.*, p. 48.

[7] Sam H. Schurr and Bruce C. Netschert, *Energy in the American Economy: 1850-1975* (Johns Hopkins Press, 1960), p. 164.

[8] Owen, *op. cit.*, p. 49.

[9] Surveys & Research Corp. and Coverdale & Colpitts, "India Coal Transport Study" (processed; June 1964), Vol. II, p. 7. This study is also cited as Coal Transport Study. For additional information on its background, see note 21, p. 17.

vestment. Owen, quoting Lockwood on the Japanese experience, says that, "In 1896, approximately 56 percent of capital investments was in transport and petroleum. In 1913, the figure was 49 percent, and by 1929, the transport share of total investment was still as high as 36 percent. It was not until after 1925 that the growth of manufacturing proceeded at a more rapid rate than transport."[10]

Energy requirements also tend, in early stages of development, to increase substantially faster than GNP. The main reason energy requirements increase is the rapid growth of the "energy-intensive" sectors of the economy, i.e., industry, mining, and transportation. In the mid-1950's, for the world as a whole, 65 percent of total energy consumption was in the areas of industry (including mining) and transportation.[11] Transportation requirements in the early stages of industrialization can, as we have seen, grow at twice the rate of GNP. The same is true of industrial output. Energy requirements increase accordingly. "Broadly speaking," according to Daniel and Robinson, "a country with 10 times the national income of another has 26 times the fuel consumption."[12]

This average, of course, hides enormous differences and its applicability must be limited to countries in early stages of growth. There is an even greater variation among industries in energy consumption per dollar of output than in transportation requirements per dollar of output. Consequently the rate of growth of energy consumption will depend as much on the structure of industrialization as on the rate of industrialization. But in any industrializing economy energy and transport requirements tend to increase much faster than GNP.

Competition versus Concentration of Modes in Transport

The share of transport investment in total investment will also be heavily influenced by the choice among different modes of transport. Should the planners emphasize complementarity or is a substantial de-

[10] Owen, *op. cit.*, p. 32. William W. Lockwood, "The Scale of Economic Growth in Japan, 1868-1938," in Simon Kuznets, Wilbert E. Moore, and Joseph Spengler (eds.), *Economic Growth: Brazil, India, Japan* (Duke University Press, 1955), p. 148.

[11] "World Energy Requirements," in *United Nations Conference on Peaceful Uses of Atomic Energy* (Geneva: U.N., 1955), Vol. I.

[12] G. H. Daniel and E. A. G. Robinson, "Planning of Investment in Fuel and Power in Under-Developed Countries," *World Power Conference* (Belgrade, 1957).

gree of competition desirable among the various alternative modes? Here again the historical experiences of developed countries suggest different modes. In North America and Western Europe competition among different modes of transport, although constrained by regulation, has been relatively free and open. The Soviet Union and, to a less extent, Japan have been predominantly railway economies with a strong insistence by the authorities that alternative modes not duplicate railway services. Such insistence may well economize transport investment but inevitably this economy is to some extent at the expense of consumers of transport services. Speaking of the Soviet Union, Williams observes that, "Under the head of service amenities . . nothing is provided except, over most main routes, a high frequency of freight service which arises naturally from the high density and concentration of freight traffic and the relatively light net train load. By ignoring amenities that are forced upon carriers in a competing system, Soviet railways simplify their task considerably."[13]

If "amenities" are interpreted to mean conveniences of no particular importance, the less developed countries may be well advised to economize transportation investment by copying the somewhat spartan Soviet practice. If "amenities," however, include speed of transport, costs of loading, unloading, and transferring to point of consumption, and loss in transit, these are considerations that markedly affect the total output of goods and services that can be produced from a country's available resources. The cost of transport to the economy includes not only the costs borne by carriers, but also the costs (including storage, inventory, etc.) of conveying goods and persons from point of origin to destination borne by transport users, a quantity to be minimized. In the economic choice among modes of transport, much will depend upon the existing and prospective structure of production and location of producing facilities. These are matters that are amenable to some control in all economies and to a high degree of control in some. As Holland Hunter remarks of the Soviet Union: "Neglect of diversified light industry means that fuel, ores, building materials, and a handful of similar freight categories will dominate the flow of traffic. These are precisely the kinds of freight for which railroads have pronounced advantages over intercity trucking. Moreover, as we shall see, Soviet loca-

[13] Ernest W. Williams, Jr., *Freight Transportation in the Soviet Union* (Princeton University Press, 1962), p. 91.

tion policy tended in the same direction, since it generated concentrated flows of heavy freight among a limited number of industrial complexes."[14]

Factor Proportions: Input and Output

Transport investment can and should be influenced by the relative scarcity of inputs—by the factor proportions—characteristic of the economy. In India and Pakistan the scarcity of capital and abundance of labor suggest that hand loading and unloading may be cheaper than the use of mechanical facilities. In the United States factor proportions induce economy in the use of transport labor and large investment per unit of output. In Western countries in general, average capital output ratios in transport of 6 or 7 to 1 are not uncommon.[15] On the other hand, according to Hunter, "The experience of Soviet railroads shows conclusively that with intensive utilization, both average and incremental capital-output ratios can be in the neighborhood of 3 or 2 to 1."[16] These low ratios imply both a high input of labor per unit of output and a strict limitation on services rendered to users.

Energy

Turning briefly now to the subject of energy, as noted earlier, the average total energy investment in less developed countries tends to be roughly half that of total investment in transport. Total energy investment includes investment in primary sources—coal, oil, gas, hydropower, and nuclear energy; investment in conversion facilities—coal into coke and coke into gas, coal, oil, gas, or nuclear fuels into electric power; and transmission and distribution facilities for electricity. Investment in oil and gas pipelines is sometimes included in transportation and sometimes in the energy sector. Energy inputs are as essential

[14] Holland Hunter, "Transportation in Soviet Development," in Gary Fromm (ed.), *Transport Investment and Economic Development* (Brookings Institution, 1965), p. 126.

[15] See Wassily Leontief and others, *Studies in the Structure of the American Economy* (Oxford University Press, 1953), p. 215.

[16] Hunter, *op. cit.*, p. 130.

to production as transportation, and both should be included under the term "infrastructure," which implies a network of services essential to most production for the market.

However, the provision of energy supplies has rarely enjoyed the status of transportation as a deliberate instrument of development. While emphasizing the importance of availability when needed, few have suggested "building ahead of demand" to promote economic growth. In all countries, energy investment appears to be made on calculations similar to those governing transport investment in the Soviet Union, i.e., to overcome existing or to avoid anticipated bottlenecks. In part this difference in attitude toward energy vis-à-vis transport no doubt results from the fact that for most types of economic activity, energy is a small part of total cost. In only a few industries are energy costs an important locational factor. In part, the difference may be the result of a somewhat exaggerated and romantic estimate of the dynamic developmental significance of transportation.[17]

Although availability of energy may be "more important" than costs and total energy investment not much more than half that in transportation, the economizing of energy investment is still a highly relevant consideration for less developed countries. A choice among different energy sources similar to the choice among various modes of transport comes into play. There are, however, differences affecting this choice both on the demand and on the supply side. On the demand side, it is useful to treat energy as unit, although there are still important technical obstacles to the substitution of one type of energy for another. The most serious technical limit to substitution is encountered in the use of liquid fuels for automotive transport. Another case where substitution is impossible is the coking coal required by the iron and steel industry. If an industrialization program emphasizes iron and steel, a heavy investment in mining and in coke ovens is an indispensable part of total energy investment. On the other hand, a recent study of the technical possibilities of substituting oil for coal in southern India con-

[17] See Hans A. Adler, "Economic Evaluation of Transport Projects," in Gary Fromm (ed.), *Transport Investment and Economic Development* (Brookings Institution, 1965), p. 189. "It is frequently assumed that all transport improvements stimulate economic development. The sad truth is that some do, some do not, and that even some of those that do may not be economically justified in the sense that there may be better investment opportunities."

cluded that about 50 percent of present coal consumption was technically replaceable. Also, electric power is substitutable for most (but not all) types of mechanical energy.

Investment requirements are heavily influenced on the supply side by the natural resource endowment of a country. Reserves of coal, oil, natural gas, and hydropower are very unevenly distributed over the earth's surface. In the United States large reserves of high-grade coal, oil, and gas have certainly lowered the energy investment required per dollar of GNP. In many countries the choice is between high investment requirements at home and importation of fuels from abroad. The fact that coal, gas, and, particularly, oil can be shipped in international trade has served to lessen the differential in energy costs among countries, and, indirectly, the differences in investment requirements per unit of energy output. If and when nuclear energy becomes more competitive, the negligible costs of shipping nuclear fuels will lower these differentials still further. At present, the investment requirements of energy generation depend on the character of the natural resource endowments.

The main choices for investment are between importation and domestic production on the one hand and among alternative sources of locally produced energy on the other. In making the first choice, a consideration of the whole range of export and import possibilities is at issue. Should a country economize its scarce supplies of foreign exchange by satisfying its energy requirements from domestic production, using its foreign exchange for imports of goods in which domestic production is at a still greater disadvantage than in the energy field? Or should a country attempt to increase its export earnings along the lines of comparative advantage, using the foreign exchange proceeds to cover the costs of imported fuels? Correct choices in this area are unlikely to be made without the help of an exchange rate that fully reflects the opportunity cost of acquiring and using foreign exchange.

The choice among domestic energy sources is, or should be, strongly influenced by existing and prospective factor proportions. In most underdeveloped countries where labor is plentiful and capital is scarce, the choice between coal, the production of which is highly labor intensive, and oil, which is highly capital intensive, may be different from that in most developed countries.

Another choice, of great importance in many less developed coun-

tries, is between hydropower and thermal power. Thermal generation involves relatively high operating costs, mainly fuel, and comparatively low capital costs; hydrogeneration requires very high capital but very low operating costs. Obviously the interest rate used in discounting future anticipated benefits and costs will greatly influence the choice. There is substantial evidence that in many less developed countries the decision has been made in favor of hydrogeneration by the use of a discount rate that in no way reflects the opportunity cost of capital.[18]

In sum, then, the divergent experiences of developed countries suggest that the less developed countries, in economizing transport and energy investment, should pay particular attention to several considerations. How closely capacity should be adapted to expected demand is one important consideration. Even more important is the choice among alternative modes of transport and alternative sources of energy supply. Since these alternative modes and sources have very different capital and labor inputs per unit of output and differing foreign exchange requirements, relative factor prices and the exchange rate are governing considerations. But it is only if these relative factor prices fairly reflect factor proportions and if the exchange rate reflects the opportunities and costs of using foreign as against domestic currencies that these important choices will be effectively made.

Interdependencies between Transport and Energy

In addition to substitution possibilities within the transport sector of the economy and within the energy sector, it is important to note the influences which the two sectors have on each other.

An economy based on coal as its principal source of primary energy will inevitably generate large requirements for rail and, if possible, water transport. The requirements are large mainly because coal has a relatively low caloric content per ton. It is typically less than two-thirds that of oil per ton. The demand is for rail and water transport because these are, given certain minimum volumes and distances, by

[18] A number of comparisons of the relative cost of thermal generation and hydrogeneration at alternative interest rates have been made by the International Bank for Reconstruction and Development. See, for example, Herman G. van der Tak, *The Economic Choice between Hydroelectric and Thermal Power Developments*, World Bank Staff Occasional Papers No. 1 (Johns Hopkins Press, 1966).

far the lowest cost carriers. The trucking of coal is impractical except for short distances. The earlier expectations of low-cost transport of coal by pipeline seem to have been disappointed. In recent years coal carriage has amounted to around 40 percent of total ton-miles of traffic on Indian railways.

Even though rail costs of coal per ton-mile are much lower than road transport costs, the delivered cost of coal per ton and per contained Btu rises rapidly with distance. At 300 to 500 miles from mine head the delivered cost is apt to be double the mine head price. When carriage runs to between 1,500 and 2,000 miles, as in India, the delivered cost can be four to five times the cost at point of origin. Since oil per ton contains twice or more the Btu content of high-ash-content Indian coal and since oil transport, even by rail, costs somewhat less than coal (largely because of much lower costs of loading and unloading), the advantages of substituting oil for coal rise rapidly with coal transport distances.

Furthermore, oil and gas have other transport possibilities which do not apply to coal. Above certain volumes, pipeline costs per ton-mile and Btu-mile are much lower than rail costs. The only transport medium that offers still lower costs is, under certain circumstances, water transport.[19] Given certain initial price relationships, then, between coal and its principal substitutes, distance from sources of supply greatly favors the substitutes. Taking these considerations fully into account will largely influence not only the optimum volume of investment in transport and energy but the optimum allocation among the various modes of transport and sources of energy.

Hydroelectric generation avoids altogether the transport costs of bringing fuels to thermal plants. On the other hand, the location of hydrofacilities may frequently impose heavy transmission costs in getting power to market. The investment saved in transportation facilities may be more than overbalanced by the additional investment in the energy sector.[20]

[19] Owen, *op. cit.*, p. 107, presents the following unit cost set of index figures based on methods of American experience: pipeline, 1.0; ocean tanker, 0.5-0.8; barge, 1.0-3.0; rail, 4.0-8.0; truck, 6.0-8.0.

[20] Writing of American experience, Schurr and Netschert, *op. cit.*, p. 339, observe: "There has been a tendency to locate coal-fired generating stations near electricity consuming centers rather than near the coal fields, because the cost of

Coking coal used for making iron and steel usually requires washing, and the washing process creates supplies of by-product coal at the washeries. If power plants are located at the washeries, fuel inputs become available at low or zero transport costs. The same economy of transport is obtained by locating thermal plants at the coal mines. Transmission of electric current can, then, for certain uses, substitute for the transport of fuels, and coordination of transport and energy investment will take account of these possibilities.

Refinery output of heavy fuel oils for industrial purposes produces at the same time diesel oils and lighter fractions for other uses. The availability of diesel fuels and gasoline for rail and road transport should have an effect on the choice among alternative modes of transport. The proper balance of products from refinery through-puts has been an issue in the energy policy of a number of countries, and sensible energy policy is apt to involve adjustments in transportation policy. In Western Europe, until recently, the most pressing petroleum demand has been for black oils, and a problem has been the disposal of lighter joint products whose use was discouraged by high taxation. The situation in the United States has been the reverse.

These are a few of the interrelationships between transportation and energy development that planners need to consider. Frequently, they are not taken fully into account in less developed countries, and one result is unnecessarily high investment in areas in which investment is inevitably large. It is clear that if sensible choices are to be made, comparison has to be undertaken of the costs of alternative courses of action. The prices of inputs to be used in making these calculations become, then, of central importance. Alternative modes of transport and the various types of energy production exhibit a wide range of variation in the relation of capital to operating (mainly labor) cost. There are also large differences in the import content of both capital and operating costs. As stated earlier, it is imperative that the interest, wage, and exchange rates used in these calculations bear as close a relation as possible to the productivity of the relevant inputs in other uses for the economy.

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moving electricity has generally exceeded the cost of transporting the equivalent net energy in the form of coal. Advances in recent years, however, have begun to affect this relationship." These advances are principally in the field of extra high voltage transmission. At the same time, it should be noted, developments have taken place which reduce the cost of moving coal, such as unit trains.

The Indian Case[21]

Like many other less developed countries, India is still heavily dependent on noncommercial sources of energy and primitive localized transport. Even today well over half of total energy consumption comes from firewood, waste products, and cow dung. Although no data are available on ton-miles carried by bullock cart as compared with other means of transport, there is no doubt that this accounts for a large fraction of total traffic. Nevertheless, investment in commercial energy and transport amounts to perhaps 30 percent of total investment, and the rate of growth of consumption of commercial energy and transport services is twice or more the rate of growth of Indian national income. During the last decade commercial energy consumption increased at an average annual rate of 7.5 percent. During the same period, ton-miles of traffic on the Indian railways increased at an average rate of 7.2 percent per annum and, although adequate data are lacking, it is estimated that intercity road traffic increased at a higher rate.[22] The rate of growth of Indian GNP was about 3.5 percent per annum during this time period.

Despite the rapid growth of commercial transport and energy ser-

[21] This discussion of the relation between transport and energy development in India draws heavily from two recent studies, the "India Coal Transport Study" (June 1964) and the "Report of the Energy Survey of India Committee" (June 1964). The first was a study undertaken for the International Bank for Reconstruction and Development and the Indian government by two American consulting firms, Coverdale & Colpitts of New York and the Surveys & Research Corporation of Washington, D.C. These two firms were assisted in India by a considerable number of staff drawn from the principal transport agencies. The study was supervised by a two-member steering committee consisting of the author of this chapter, who represented the International Bank, and G. L. Bansal, Secretary General of the Indian Federation of Chambers of Commerce and Industry, who represented the government of India. The study (mimeographed) appeared in four volumes, plus four volumes of appendixes (exhibits).

The Energy Survey was prepared by a sizable staff of Indian and foreign experts for a committee appointed by the Indian government consisting of government and private members. The chairman of the committee was Shri M. R. Sachdev, former Secretary of the Ministry of Irrigation and Power. Joint chairmen were Mr. Walker Cisler of the United States and Professor Austin Robinson of Great Britain. This study was financed in part by the United States Agency for International Development.

[22] Energy Survey, p. 28. Over the seven-year period, 1955-62, "The volume of energy used in road transport increased by about 2.7 times the rate of growth of national income and about 1.2 times the rate of growth of industrial production."

vices, both transport and energy supply have lagged behind requirements. At times, these lags have constituted serious bottlenecks to India's growth. Shortage of railway capacity has been the subject of a series of official investigations in recent years, the last one in 1961. For a number of years, there have been both a shortage of electricity generating capacity and an inadequate distribution system. This has led to a cutting off of supplies in periods of excess demand, to limitations on amounts supplied to individual customers, and to refusals of applications for connections. If India is to make up arrearages in both areas, meet the heavy requirements of an industrializing society, and accommodate a desirable, if not inevitable, shift from noncommercial to commercial sources, the share of transport and energy in total investment will probably have to increase over the next decade or two.[23] It is highly important, therefore, that India develop a coordinated investment program taking full account of the principal interdependencies in this area.

Coal, Oil, and Methods of Transport

The organized, market-oriented, and rapidly growing sectors of India depend mainly on rail for transport and on coal for power. Although road traffic data are unreliable, railways account for approximately 80 percent of the ton-miles of intercity freight traffic. Coal accounts for nearly 80 percent of the commercial energy output in India. Perhaps the two most important policy questions to be confronted in the transport-energy area over the next few decades are the extent to which transport should be shifted from rail to road and energy supply shifted from coal to imported oil. These changes would reinforce each other. Any substantial shift from rail to road tends greatly to increase oil consumption at the expense of coal. One of the important considerations involved in the substitution of oil for coal is a saving in rail trans-

[23] A relative shift from noncommercial to commercial sources of energy is particularly important. According to the Energy Survey, ". . . the greater part of the firewood of India comes from the cutting of trees in open country or in areas not technically defined as forests and regarding which no statistics exist. No one knows what may be the consequences to India of the continuous cutting of timber on the scale on which it has been going on for many decades. No one knows whether the present rate of cutting can be maintained only by progressive denudation of the Indian countryside" (p. 65).

port of coal. There are many other important interrelationships but these are of central importance.

The predominance of rail transport in India is a product of physical factors, of the pattern of industrialization, and of federal and state policies affecting, particularly, road transport. Nature has endowed India with a system of rivers that does not lend itself to the development of inland water traffic. These rivers are mainly fed by monsoon rains which cause violent changes in channel depths, velocity of current, location of banks, and, frequently, location of the channel itself. At the request of the Indian government, the Coal Transport Study undertook a comparison of the cost of carrying coal on the Ganja (Ganges) to Faizabad and Allahabad with present railway rates. Under the most favorable conditions for river transport, rail-cum-water cost of carriage was estimated to cost about four times the existing rail rates.[24] This particular route was judged one of the most favorable inland water possibilities in India.

Nor, apparently, is there a large potential for coastal shipping. "India has a coastline of over 3,000 miles which, in general, is but little indented, and the ports are then exposed to summer and winter monsoons and occasionally to cyclones."[25] The lack of navigability of the water between the mainland and Ceylon means that vessels destined for India's west coast have to circumnavigate Ceylon which makes the water distance much greater than rail. By sea the distance, for example, from Calcutta to Bombay is nearly 4,000 kilometers. The rail distance is just short of 2,000. For the last decade coal has accounted for about half of all coastal traffic and in the year of largest shipments, 1962, amounted to only 1,600,000 tons. Recent coal shipments have been heavily subsidized since their costs have ranged up to twice the level of rail rates to the same destinations. Rail rates for coal are substantially below cost on long hauls. Nevertheless, when all costs are properly calculated, to make competitive coastal carriage a possibility would require a new and different type of coastal fleet and substantial investment in port facilities. The Coal Transport Study's final conclusion is that unless means can be found to avoid the use of the heavily congested Calcutta port, coastwise shipping cannot be an effective way of transporting coal. The development of a large port at Haldia would

[24] Coal Transport Study, Vol. I, p. 130.
[25] *Ibid.*, Vol. III, p. 70.

provide an alternative to Calcutta, but whether the sizable investment required for such a port can be justified is not clear at present. In any case, coastal shipping is unlikely to contribute much to the solution of India's transportation problem.

Pipelines are an even less important part of India's transportation network. The pipeline now under construction from the oil fields in Assam to the Calcutta area is the only line of any length in India. To date, oil and gas discoveries have not been of a magnitude to justify further investment in this form of transport. The Coal Transport Study was asked to examine the economics of two specified locations for coal slurry pipelines. The findings were that probable costs would be three to four times the rail costs between the same points of origin and destination. A similar conclusion was reached with respect to rail and ropeway costs. In sum, the only alternative mode of transport of much quantitative significance is road carriage. An evaluation of the economics of road versus rail is considered later in this chapter.

Dominance of Rail Transport

The predominance of railway transport has also been encouraged by the pattern of Indian industrialization. Strongly influenced by the government, heavy industry has been developed much more rapidly than light manufacture. During the period of the Second Plan (1955-60), the output of five branches of heavy industry—mining and quarrying, basic metals, nonmetallic mineral products, petroleum products, and chemicals and chemical products—grew at an average annual rate of 11.2 percent as compared with approximately 7 percent for organized industry as a whole.[26] These industries are heavy generators of bulk traffic in the carriage of which railways have a pronounced advantage. In fact, only four commodity groups—coal, iron ore, limestone and dolomite, and iron and steel—accounted for 74 percent of the total increase in railway ton-miles in the period 1955 to 1962.

In addition, the importance of railways in the transport network has been encouraged by policies, both in the states and in the central government, inimical to road transport. The federal government has seriously restricted the freedom to acquire private automobiles, has taxed heavily the import and use of petroleum and petroleum products, and

[26] *Ibid.*, Vol. II, p. 4.

has been unwilling to devote more than a small fraction of total investment to highway improvement and expansion. The state governments have afflicted road transport with a large number of local taxes and a maze of regulations. Whether this favoring of the railways at the expense of road transport is sensible policy at this stage of Indian development is a question to be examined presently.

Energy Resources

The Indian subcontinent is not, on the basis of present knowledge, well endowed with primary energy resources. As noted above, coal accounts for nearly 80 percent of total domestic commercial energy output. India has ample supplies of low-grade noncoking coal. The ash content is very high, averaging about 25 percent. The Energy Survey estimates that the washing of coking coal will yield a by-product content of as much as 45 percent of the weight of the raw coal. This means that the carriage of coal involves the carriage of vast amounts of inert material, or high transport costs per contained Btu.

The West Bengal-Behar coal fields in northeast India produce about 80 percent of coal output—in 1963, 50,100,000 tons of a total of 63,800,000 tons. Over 50 percent of the value added in organized industry is generated in western and southern India, which includes such industrial centers as Bombay, Madras, and Delhi. Close to 50 percent of all energy is consumed in this region, which means that coal is hauled over very long distances. The so-called outlying fields in north central India are increasing their share of total output and this will substantially decrease the haul to destination. However, the ash content of these coals is very high and the average haul to principal areas of consumption is still long. The average distance for all coal shipped in 1960-61 was 726 kilometers.[27]

India is substantially better endowed with hydroelectric potential than with other primary sources of energy. Although hydropower in 1960-61 constituted only about 8 percent of commercial energy consumption (in terms of coal equivalent), it represented nearly 40 percent of kilowatt-hours generated. According to the Energy Commission, "There is understood to be little reason to think that the sites already exploited are significantly more favorable than the remaining

[27] *Ibid.*, Vol. II, p. 132.

sites, or that the average capital costs of exploitation per KWH is likely to increase progressively as exploitation proceeds."[28] Considering the poor average quality of Indian coals and their geographical concentration it is unlikely that thermal generation will play the same role in India as in the United States and United Kingdom. Projections of the Energy Commission suggest that by 1975-76, hydrostations will still generate about 40 percent of electric power produced in India. Even so, this will represent no more than 7 or 8 percent of total commercial energy consumption. The currently known reserves of natural gas in India are small.

Domestic oil production in India amounted in 1960-61 to a half-million metric tons. By 1963 this had increased to 2 million tons of which two-thirds came from Assam and one-third from Gujerat (near Bombay). Output in 1963 represented the equivalent of about 2 percent of Indian commercial energy consumption. Oil exploration in India is proceeding apace but, to date, with rather discouraging results.

There remains the possibility of nuclear energy. India indeed is one of the less developed countries in which the high delivered cost of conventional fuels opens large possibilities for nuclear development. The Energy Survey recognizes these possibilities but thinks they will materialize mainly in the next century. The contribution of nuclear energy "to the problems of the next twenty years cannot represent more than a small fraction of India's total energy requirements."[29]

So much for domestic production possibilities in the field of primary energy. The only quantitatively important alternative to coal is imported oil. Oil imports now account for a large share of commercial energy consumption in India and that share has been increasing rapidly. In 1953 India derived 34 percent of her commercial energy from oil; by 1960-61 the figure was 40 percent. In that year 5.5 percent was domestically produced and 94.5 percent imported. Certainly India must push the exploitation of economic hydrosites, pursue vigorously the search for domestic oil and gas, and develop nuclear power in areas of high electricity consumption where the delivered costs of conventional fuels are exceptionally high. However, over the next decades, and on the basis of current evidence, a central policy problem in the energy field will be a decision on how rapidly and in what areas oil should be

[28] Energy Survey, p. 144.
[29] *Ibid.*, p. 6.

substituted for coal. The Energy Survey envisages that by 1970-71 oil will account for 50 percent of India's commercial energy consumption, "if supplies can be made available," and that by 1975-76 it may require 3.3 million rupees[30] ($693 million) to pay for oil imports, which might represent one-third of India's then total import capacity. The Energy Survey goes on to observe:

> We have not regarded it as within our competence to determine whether this is too heavy a load on India's foreign trade. . . . It will be for the Government of India, on the advice of the Planning Commission, to consider whether the trends are likely to be dangerous to the longer term balance of payments policies and whether it may be wise to go even further in the direction of giving incentives to use Indian coal or electricity in preference to imported oil.[31]

Choice of Mode of Transport

The oil-coal substitution problem obviously has an important bearing on the choice among modes of transportation. In India, this choice is essentially, of course, a choice between road and rail.

Public policy in India has strongly favored railway expansion and has neglected road transport development. While railway investment is planned with careful regard to projected requirements, investment in highways is both meager and subject in its planning to many economically irrelevant considerations. With rapidly growing transport requirements impinging on an acute shortage of investment funds, there are strong reasons for avoiding duplication of facilities. The Russian model of transport development may well be more appropriate for India than Western practice. But there is ample evidence that in India road transport has been seriously handicapped in carrying the traffic for which it is definitely the superior instrument.

Currently the railways are the overwhelmingly important carriers of freight in India. In 1960-61 railway freight carriage amounted to approximately 88 billion ton-kilometers. There are no adequate data on highway freight traffic. However, a series of road surveys initiated by the Coal Transport Study and carried out in 1963 on sixteen routes by

[30] In 1965 1 rupee equaled $0.21. In June 1967 (after a devaluation) 1 rupee equaled $0.133.

[31] *Ibid.*, p. 119.

the Department of Transport yields an extrapolated estimate for India as a whole of about 16 billion ton-kilometers of intercity truck carriage.[32] This is the most careful estimate of road freight transport made to date, but the figures still suggest only an order of magnitude. If these figures are accepted as approximately correct, the Indian highways currently account for about 15 percent of combined rail and road intercity freight traffic. This is not a negligible percentage and, furthermore, road traffic has in recent years been increasing faster than rail.

This volume of traffic and rate of increase took place despite an appallingly bad highway system, a highly cumbersome vehicle licensing system, high tax rates on vehicles and fuels, and a method of tax collection that may well add more to the cost of carriage than the tax rates themselves. The total mileage of hard-surfaced national highways in India in 1962 was 12,676 miles. Of this, only 2,653 miles were double lane. Most of the intercity freight traffic uses the hard-surfaced national highway system. Most of the bridges are single lane, and on heavy density routes this frequently means substantial delay in crossing. The limited strength of bridges and road surfaces prohibits the use of large trucks and the truck-trailer combination. "The condition of the highways in India . . . is unquestionably one of the most important factors limiting highway traffic at the present time."[33]

Every truck, whether for private or public use, must have a permit. Permits are issued by intrastate Regional Transport Authorities, and in order to carry goods outside the region they must be countersigned by other authorities. Interstate trucking requires similar countersignatures from other states. Many states insist on equalizing the number of permits issued by requiring reciprocity. No permit is issued without hearings, at which existing permit holders, the railways, and local and public authorities testify as to whether existing permits are sufficient or in excess of needs. This occasions long delays in the granting of regional permits and the obtaining of necessary countersignatures. In the administration of the relevant legislation the most serious handicaps are placed on long distance trucking. The Road Transport Reorganization Committee, reporting in 1959, found "that the number of trucks

[32] Coal Transport Study, Appendix D, p. 46.
[33] *Ibid.*, Vol. III, p. 55.

allowed to operate on interstate routes is fixed arbitrarily with the result that the demand exceeds the supply many times over."[34]

Taxes on road transport are levied at the federal, state, and local level, and the total adds up to a formidable impost. The central government imposes excise and import duties on vehicles, tires, fuel, and lubricants and an income tax on the earnings of truckers. The state governments levy sales taxes on fuel and vehicles, passenger and goods taxes, and taxes on vehicle operations. Local governments employ wheel taxes and terminal taxes. Carlin estimates that the yield of all road transport taxes in 1960-61 was nearly two billion rupees and considers this to be about double the annual cost of building and maintaining the Indian highway system.[35] Total taxes on railway operations on the other hand were relatively light. Their yield in 1958-59 was 219 million rupees.[36]

Methods of tax collection, particularly at the state and local level, add greatly to the cost and detract from the value of service of road transport operations. Most interstate traffic has to pay a tax in every state through which it passes. Although some states have reciprocal arrangements with adjoining states for a limited number of vehicles whereby tax reciprocity is conceded, this is by no means universal. "There is not a single state with the exception of the Delhi Administration which has reciprocal arrangements with all its immediate neighbors."[37]

The administration of local taxes, particularly the octroi,[38] is even more onerous. The India Road Transport Reorganization Committee reports with feeling on this subject:

While certain municipalities issue transit passes enabling through traffic

[34] Ministry of Transport and Communications, Department of Transport, *Report of the India Road Transport Reorganization Committee, 1959* (New Delhi, 1959), p. 39. This report is also cited as *Road Transport Report*. In the opinion of the Committee on Transport Policy and Coordination in *Preliminary Report, 1961* (New Delhi: Government of India Planning Commission, 1961), the *Road Transport Report* was biased against railway interests. It "does not appear to have given adequate thought to the public service obligations of the railways" (p. 128).

[35] Alan P. Carlin, "An Evaluation of U.S. Government Aid to India" (doctoral dissertation, Massachusetts Institute of Technology, June 1964), pp. 116-17.

[36] *Ibid.*, p. 117.

[37] *Road Transport Report*, p. 27.

[38] Taxes collected at state boundary stations.

to move between octroi posts, others insist on heavy deposits being paid by the drivers before vehicles can enter the municipal limits. For example, lorries which have to pass through Jhansi have to pay a refundable deposit of something like Rs.2,500 on certain commodities, and the formalities of obtaining the refund involve needless waste of time and money. Many municipalities do not allow vehicles in transit to pass through the octroi gates after 7 P.M., and on Sunday the gates are open only during restricted hours even during daytime. Other municipalities, as for example Lucknow and Delhi, collect terminal taxes on through traffic and do not refund them.[39]

When one considers the state of the Indian highways, the level of taxation, the licensing system, and methods of tax administration, it seems little short of a miracle that road transport carries as large a tonnage as it does. Yet this tonnage is increasing rapidly and the larger trucking companies are earning a return at least double the rate of return on railway investment. The answer, of course, is in the value of service rendered by road transport. The cost per ton-mile of road carriage in India for all except the shortest distances is a multiple of rail costs and rail rates. However, the advantages of door to door delivery, the much greater speed,[40] and other values of road transport to the user and to the economy as a whole, more than make up for this cost difference on much high-rated traffic.

It requires only a superficial examination of the Indian transport situation to justify the conclusion that additional investment in road transport is likely to yield high returns, particularly if state and local tax administration can be simplified and licensing procedures relaxed. At the same time, the shortage of capital and particularly foreign exchange is such that every effort must be made to avoid duplicating transportation facilities. The railways are, with the possible exception of certain sea coast routes, by far the lowest cost carriers of bulk commodities for other than very short distances. This is the type of traffic that is increasing most rapidly in India, and the railways will be hard pressed to keep capacity ahead of requirements. Much more of the high-rated traffic than that already shifted to road transport should be and would be shifted if India had a sensible road transport policy.

[39] *Ibid.*, p. 25. The committee recommends a thoroughgoing reorganization and simplification of the local tax system.

[40] According to the India Road Transport Reorganization Committee, freight trains average about 48 miles per day as against 150 miles for trucks. *Ibid.*, p. 42.

Pricing Policy for Railways

Such a shift to road transport would involve long overdue changes in the Indian railway rate structure. The Indian railways, in fixing rates, have tended to follow the "value of service" principle so common in the West. This principle allocates a high percentage of fixed costs to high-value commodities able to "bear the burden," because, even with high rates, transport costs are a low percentage of delivered cost. A low percentage of fixed costs is allocated to bulk commodities, and the resulting low rates are justified on the ground that the transport demand for such commodities is elastic. The application of this principle makes some sense if there is excess railway capacity and if the carriage of high-rated commodities meets with little competition from other modes of transport. Neither of these conditions exists in India.[11] Railway capacity tends to be fully utilized and it is difficult to expand capacity sufficiently to keep ahead of demand. Western railways following the value of service principle have seen their high-rated traffic shifted to the highways and this is happening in India. It would happen even faster with a sensible road transport policy. This means that, if the railways are to earn a return on investment commensurate with the return on other types of investment in India, the rates on bulk commodity shipments over long distances will have to be reexamined.

Indian railway rates on bulk commodity shipments taper markedly with distance. A principal justification for the taper is the quasi-political argument that minimizing differences in the delivered price of bulk commodities in different parts of the country will tend to equalize development opportunities.[12] This is at least partially true but it is doubt-

[11] See Louis Lefeber and M. Dutta Chaudhuri, "Transportation Policy in India," in Paul N. Rosenstein-Rodan (ed.), *Pricing and Fiscal Policies: A Study in Method* (M.I.T. Press, 1964), p. 97.

[12] The Ministry of Railways offers the following justification for tapered coal transport rates (quoted in Carlin, *op. cit.*, from *Structure of Railway Freight Rates* [New Delhi, 1961], pp. 11-12): "Transportation charges on coal exert a very great influence upon the location of commercial enterprise, particularly of those industries which are dependent for their operational power on coal. If, therefore, the inflationary effects of distance on coal transportation charges are not controlled within fairly narrow limits, the expansion of industry in all parts of the country would be hampered, and in many cases areas situated far from the coal fields but suitable in other respects will develop no industries at all."

ful whether, considering her shortage of capital, India can afford to continue to subsidize at present levels the long distance transport of bulk commodities.[43]

If railway rates were more closely adjusted to cost of carriage to destination, and the special handicaps to road transport removed or relaxed, what changes in the pattern of transportation would be likely to emerge? The distances over which bulk commodities can be economically carried by road would increase somewhat. Road transport would carry a larger percentage of high-rated traffic than it does at present. Some further development of coastal shipping would probably be economic. Over time some relocation of industry would take place. It would become clearer than it is now that in developing new transport facilities in low density areas roads are usually preferable to railways.

[43] The India Coal Transport Study undertook a detailed study of the cost to the railways and the cost to the economy of transporting coal. (See Vol. III, Chap. IV, pp. 93-132.) The costs were applicable to through-goods trains on the broad gauge operations of the six major railways and were allocated to terminal costs per ton and to line-haul costs per ton-kilometer. The costs were also divided between operating costs and capital charges. In calculating capital charges the study took as its investment base "the total historical cost of asset purchases" and applied to this base the 4.25 percent rate charged to the railways by the Indian government. The result was an estimate of the cost to the railways of carrying coal in 1961-62 of terminal costs per ton of 1.943 rupees plus line-haul costs per ton-kilometer of 0.0178 rupee. A comparison of rail rates with these computed costs indicated that rates exceeded costs for hauls up to about 1,400 kilometers.

In calculating costs to the economy the study used a shadow rate of foreign exchange 50 percent above the present rate and a shadow interest charge of 12 percent. The effect of using the foreign exchange adjustment together with an elimination of taxes was "a reduction of approximately 5 percent applicable to full working costs excluding return of investment . . ." (p. 129). In other words, the elimination of taxes (mainly import duties) more than balanced the effect of the exchange adjustment. In calculating capital charges at a 12 percent interest rate the study reports: "This rate is applicable, in full, to net assets. However, the railway assets have been in use and depreciated. Consequently, we have assumed an approximate average rate of 6.25 percent on original cost as the equivalent of a rate of 12 percent on net assets after depreciation" (also p. 129). This implies an assumption that railway assets on the average are about 47 percent depreciated. If so, the price increase factor that would be needed to convert the investment base to replacement cost would be substantial. A report of the Ministry of Railways, dated April 14, 1964, indicates that the replacement cost of various assets included in capital at charge was nearly 100 percent above the original cost of these assets. If this is approximately correct, it suggests that original cost undepreciated may be a fair approximation of present cost depreciated.

Using a current (replacement) cost basis would yield, roughly calculated, a full cost of transporting coal perhaps 25-30 percent above the full costs to the economy as calculated by the Coal Transport Study. The primary purpose of these cost

With current prices for petroleum products, the substitution of oil for coal would become economical over wider areas than at present. Many of these shifts are already in train and a more careful consideration of relative costs would merely accelerate the process.

The process is unlikely to be accelerated, however, as long as road transport is subjected to the uncoordinated mixture of federal, state, and local regulation and taxation, and as long as the railways enjoy their present preponderance of political and administrative support in New Delhi. The railway administration in India is a separate ministry. It is well organized and possessed of a long-established and distinguished tradition. It exerts its very considerable influence to limit, where possible, the length of truck haulage and the diversion to the roads of high-rated traffic.[41] Road transport, on the other hand, is the charge of a relatively small and understaffed unit in the Ministry of Transport. Although an Inter-State Transport Commission was established some years ago, it has had, at least until recently, little influence on road transport policies.

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calculations, however, was to compare the additional cost of carrying bulk commodities by rail as against the additional cost by alternative means of transport. For alternative transport media, additional costs are very close to full costs since very few of the facilities required for increased volume of traffic exist, and virtually all of the costs are costs to be incurred in the future. This is not, however, true for the railway system, particularly if the recommendations of the study for the expansion of line capacity are accepted. These recommendations imply, broadly speaking, that future operations should be based on the use of much heavier trains. This means "... increasing use of electric and diesel locomotives; the cessation of building four-wheel wagons; the replacement of vacuum brakes with air brakes, at least on goods trains; and the extension of an improved signaling system as the traffic requires" (Vol. III, p. 214).

In this connection the Coal Transport Study undertook an estimation of the additional cost per ton-kilometer of moving coal on a sample of railway movements on the assumption that tonnages would be increased by 100 percent (Vol. III, pp. 198-99). These calculations suggest that long-run incremental costs may be of the order of 60-70 percent of full costs. In calculating the economies of substituting oil for coal at various locations the study estimated incremental transport costs for both coal and oil to be 75 percent of full costs.

If these estimates of the difference between historic full costs and replacement full costs and between incremental cost and replacement full costs are approximately correct, the study's estimate of historic full cost may be a fair approximation of the incremental costs which are relevant to the comparisons at issue.

[41] See *Road Transport Report*, p. 41: "In evidence before this Committee the spokesmen of the Railways went to the extent of suggesting that road transport should not normally be allowed to operate over distances of more than 75 miles at the most."

It is relatively easy to see, in general, what types of changes would be brought about in the pattern of Indian transport if the pricing of transport services supplied by different modes of transport were adjusted to properly calculated costs. It is, however, a long step from this to conclusions on what specific investment in the various modes of transport would be necessary to economize the supply of total transport services in India, with attention to the desirability of avoiding duplicate facilities where possible. It is unlikely that progress can be made toward these conclusions until much more is known than at present about Indian road transport. What types of goods are carried, over what distances, and at what costs? How would costs be affected by changes in road surfaces and the introduction of heavier trucks and truck-trailer combinations?[15] In the light of this information, on what routes would additional road investment be likely to yield the highest return? The expansion of railway capacity in India is based on careful estimates of probable traffic requirements and the relative costs of alternative methods of increasing rail capacity. In contrast, highway investment in India is relatively unplanned.

If transport services in India were to be planned on the basis of economizing total transport costs through the appropriate use of each mode of transport, the costs in question would need to be interpreted as costs to the economy rather than as costs as now seen by various transport media based on present tax rates and the prices of various inputs. The different modes of transport currently show wide differences in capital-labor ratios, particularly with regard to domestic vis-à-vis imported inputs. Furthermore, each mode is subjected to very different tax burdens and each earns markedly different returns on investment. Any calculation of costs to the economy would need to include estimates of the opportunity cost of capital and foreign exchange to India, as well as appropriate adjustments of tax burdens and rates of return.

[15] The road surveys initiated by the Coal Transport Study and carried out in 1963 by the Development of Transport (Roads Wing) of the Ministry of Transport threw considerable light on the types of goods carried on sixteen routes in India. The Coal Transport Study also undertook a careful estimate of trucking costs under various assumptions concerning size of truck and type of road surface (Appendix D). But the study team was exclusively concerned with bulk traffic, primarily coal, and did not pretend to an opinion on the relative merits of road transport for other types of traffic.

Both the Coal Transport Study and the Energy Survey use shadow rates of interest and foreign exchange and comparable tax adjustments in calculating the cost to the economy of using alternative modes of transport and alternative sources of energy. It is to be noted that the most striking result of this recalculation of costs is to improve the competitive position of oil vis-à-vis coal. Import duties on crude oil are now very high. A cost calculation which equalizes tax rates on coal and oil and uses a shadow rate of exchange, implying a lower degree of domestic preference than the present import duty on oil, inevitably operates to the disadvantage of coal. The Coal Transport Study concludes that large transport economies would be secured by substituting oil for coal in southern and western India. This would avoid long hauls of coal from the mines and accelerate the use of diesel motive power on the railways. The Energy Survey concludes that an economical use of fuels would result, by 1970-71, in a situation in which 50 percent of India's commercial energy is generated from oil, mainly imported. The figure for 1960-61 was 40 percent. In projecting future energy requirements, the Energy Survey tacitly assumes that present policies with respect to road transport will continue. The Coal Transport Study, as mentioned earlier, finds that railway rates fall substantially short of covering costs on long distance shipments of bulk commodities. If it were assumed that the current handicaps to road transport were eliminated, and railway rates on bulk commodities adjusted upward, estimates of the place of oil in India's energy future would have to be revised upward.

The low Btu content per ton of Indian coals and the long average distance of shipments versus the high Btu content of imported oils and their ready accessibility to ports in southern and western India confronts Indian development policy with a difficult dilemma. Imported oil already accounts for 40 percent of commercial energy consumption. This is despite an import duty of over 100 percent on crude oil. If railway rates covered the full costs of carrying coal on long hauls, as on economic grounds they should, the substitution of oil for coal in southern and western India would be accelerated. If existing uneconomic handicaps to road transport were removed, the consumption of oil products would still further increase. This poses the question of whether the country should become dependent on imported oils to an extent hardly compatible with prospective export earnings, or whether India should strictly curtail oil imports and develop her economy on

the basis of low-grade coals carried long distances. The solution of this problem is unlikely to be attained without: (1) the use in relative cost calculations of an exchange rate that fully reflects the relation between the internal and external future value of the rupee; (2) a freight rate structure that adjusts rates approximately to the cost of coal carriage; and (3) a pricing system for coal that more closely than at present approximates the value of different grades of coal to the user.

If these changes were made, they would probably, over time, have a substantial effect on the location of Indian industry and, possibly, on the structure of Indian industrial development. The relevance of exchange considerations is discussed below. The question of railway rates for coal has already been considered. Coal pricing in combination with rail rates has a direct bearing on the location of power plants and on other aspects of the conversion of coal into electric power, of great importance to Indian energy policy.

Electricity: Production and Consumption

Although the consumption of electricity per capita in India is very low, it has been growing rapidly—13 percent per year from 1953 to 1963. Furthermore, the Energy Survey projects an eightfold increase by 1975-76. Currently the installed capacity in hydroelectric units is nearly as large as in thermal plants, but it may be that hydroinstallations have been unduly favored by the use, in cost estimates, of too low an interest rate. The Energy Survey recommends a rate of 10 percent in future calculations.[46] Although the survey suggests that "India will be well advised to continue to exploit hydel resources whenever there are suitable sites available" and foresees a nuclear capacity of perhaps 5 million kilowatts by 1975-76, a major part of the projected growth in electricity requirements will have to be met by thermal plants using conventional fuels.

At present the economic efficiency of electricity supply from thermal plants is very low. This is due primarily to the small size of generating facilities; to a marked orientation toward consuming centers, involving long distance carriage of coal; and to the inadequacy of interconnections among generating units. In 1962 there were only 15 steam plants

[46] Energy Survey, p. 129.

of a total of 107 with capacity exceeding 50 megawatts. Economies of scale are large up to at least a capacity of 100 megawatts. The average distance of coal shipped to thermal power plants in 1961-62 was 803 kilometers. With respect to interconnections the Energy Survey observed:

> In Indian conditions, the absence of sufficient interconnection has not only involved interruption of supplies in conditions in which, with interconnection, this might have been avoided, but has also precluded the obtaining of the potential economies of stand-by plant. Many Indian stations are completely isolated from other stations and are incapable of being assisted in case of accidental outage.[47]

The main lines along which India must move to economize investment in electricity supply are reasonably clear. So far as feasible, the average size of generating units must be increased; they must be located closer to coal supplies, which in some areas will involve transmission by extra high voltage, and interconnections must be improved. With regard to the question of interconnections, the Energy Survey observed:

> Investment in transmission can save very considerable amounts of investment in generation. The investment in transmission now has a high indigenous-content and a low import-content. The reverse is true, and likely to remain true, of investment in generation. We think that in the plans for the next periods, the investment in transmission should be assumed to be not less than 100 percent of the investment in generation.[48]

There remains the question of the appropriate size and location of thermal power plants. It should, of course, be recognized that there are serious physical limitations affecting size and location. The distribution and thinness of the demand in most of India means that many generating units must be small and located near consumers. There is the further fact that the gestation period has been as long as five years for thermal plants and nine years for hydel plants. These gestation periods reflect the worst of Indian experience; with reasonable efforts they could be substantially reduced. For the time being, as the Energy Survey stated: "The planning of electricity has been pushed far ahead on the basis of consumer-located generation."[49] Nevertheless, over time,

[47] *Ibid.*, p. 127.
[48] *Ibid.*, p. 132.
[49] *Ibid.*, p. 136.

large economies are possible in electricity supply in India. A major part of these economies have to do with lowering the transport burden to the railways in the carriage of coal.

The realization of these economies is heavily dependent on proper pricing policies for coal and railway transport. One of the striking new elements in the Indian energy situation is the emergence of large quantities of by-product coal incident to the washing of coking coal for the rapidly expanding iron and steel industry. The Energy Survey estimates that by 1970-71 the annual output of by-product coal at the washeries will be from 11 to 14 million tons.

> The washery by-products are not only high in ash-content, they are also inevitably, as the result of the washery process, pulverized to small size. There are relatively few uses to which in practice they can be put, almost all, unfortunately, outside the normal uses of coking coal; they can be used for thermal generation of electricity; they can be used for brick making; they can be used, less advantageously, and with some difficulty, for cement manufacture. Because of their small size and high ash-content, the washery by-products cannot at all easily be used in making a domestic fuel.[50]

Coal By-Product Use and Pricing

Cement production and brick making may be dismissed as unimportant potential uses of by-product coal at the washeries. These are activities which, because of the weight of the finished products and the ubiquity of material inputs, are inevitably consumer oriented. If the increasing supplies of by-product coal are to be effectively used, they will have to be consumed in part by thermal power plants located at or near the washeries. How much power capacity can be economically located in these areas depends mainly on the price of by-product coal and the costs of electricity transmission, in part by extra high voltage. It will also depend on the locational attraction of low-cost power to energy-intensive industries.

If the possible uses of by-product coal at some positive price do not add up to a demand sufficient to take the available supplies off the market, then the price, from a national point of view, should approach zero. Indeed, on economic grounds it might be negative because otherwise by-product coal will have to be disposed of, which costs something.

[50] *Ibid.*, p. 98.

At a zero price, however, several possibilities unfold. First, the delivered price of by-product coal would be substantially less than the cost of newly mined coal at various points in the outlying coal fields It would be possible, if the tonnages were large, to organize coal transport between two points on a closed-circuit, full-train basis at costs that are a fraction of the cost per carload lot.

Second, at a zero price at the washeries, it may become economical to generate power in large stations at or near the washeries for extra high voltage transmission over long distances. The Energy Survey undertakes a comparison of the implied costs per kilowatt-hour, under particular assumptions, of delivery of power over extra high voltage lines from plants located at the washeries, versus the cost of generating power at points of consumption from zero-priced coal carried in closed-circuit full trains. The conclusion is that, "The relative costs of rail transport and extra high voltage transmissions depend . . . on a number of complex factors and it seems probable that each individual case will have to be considered on its own merits."[51] The survey's figures suggest that, under circumstances in which closed-circuit operations are possible, the power transmitted by extra high voltage would have to be in very large volume—of the order of 500 megawatts or above—to yield lower delivered costs. Still another use for zero-priced coal could well be the establishment of energy intensive industries in the vicinity of the washeries to take advantage of low-cost power.

A consideration of some of the long-run consequences of a zero price for by-product coal makes it appear probable that the price will in fact be above zero. What the long-term equilibrium price of by-product coal at the washeries is likely to be is impossible to say. In addition to the considerations already mentioned, it will depend on the rate of growth of the Indian iron and steel industry and its demand for washed coking coal. The growth rate is likely to be high and this has a bearing on the cost and price of Indian coke. If coke production has to bear the full cost of washing—if, that is, something approaching a zero value is assigned to the by-product—the cost of coke to the Indian steel mills becomes high. The cost may be so high that, if washed coking coal has to bear almost the whole cost of the mining and washing, it may become economic at present prices to import some coke rather than make it locally.

[51] *Ibid.*, p. 134.

It is clear then that the pricing of by-product coal is pregnant with economic consequences. The same observation may be made with respect to the pricing of raw coal in India. As elsewhere in the world, there is a wide range of variation in the quality of Indian coals and in the costs of mining. In general, India is very short of high-grade coals and long on low-grade supplies with an ash content of 25 percent or above. Yet the coal pricing policies favored by the Indian government fall far short of recognizing the large differences in the value of different grades of coal to users and the large differences in costs of coal extraction. One of the objectives of coal pricing appears to be the limitation of incomes from the more favorably situated mines. Because of the government's reluctance to allow prices to cover normal costs of extracting coal from the most difficult mines and of the lowest quality necessary to meet current demand, the incentive to private sector mining to expand output from existing mines appears inadequate. Nor are the price incentives to users adequate to induce that consumption of low-grade and to economize the use of high-grade coals required by the situation.

National Planning and Pricing Policy

Indian planning, in general, has been allergic to allowing prices to perform their classical functions of providing producers with the incentives required to supply the market with the quantities and qualities of product required, and of permitting users a choice among inputs best suited to their needs at prices covering the cost of meeting these requirements. There has been a heavy reliance on controlled distribution from producers to consumers as in the case of coal and, until recently, of iron and steel products. Thus, the pricing system has been distorted to accomplish certain social or political objectives, such as assuring low delivered prices of coal and other bulk commodities at long distances from the point of shipment. In recent years there has been evidence of a marked change in attitude in India toward a greater reliance on the market and classical pricing procedures. This change in economic philosophy has not yet had much effect on pricing policies in the fields of energy and transport.

If, however, the prices of finished products or services are to perform their proper function, they must be based on input prices that

represent at least approximately the scarcity value of these inputs to the economy. This observation has special relevance to the inputs of capital and foreign exchange of which the Indian economy is in conspicuously short supply.

Both the Energy Survey and the Coal Transport Study use shadow prices for capital and foreign exchange in calculating what the Coal Transport Study calls "costs to the economy" of providing transport and energy services. The Energy Survey employs a rate of return on investment of 10 percent inclusive of taxes and a foreign exchange premium of 33 percent. In selecting a rate of 10 percent, the survey apparently gave weight to estimates showing the gross return to capital in private Indian industry as ranging between 10 and 15 percent.[52]

With respect to the foreign exchange adjustment the Energy Survey reports:

> In planning projects, there is clearly advantage in giving preference to those solutions of a technical problem which make less call on imports and have a lower import content. In our calculations we have assumed that the desirable preference will be secured by adding a tax of 33 percent to the import content of cost. This 33 percent has been assumed to include the actual duties now paid.[53]

No further justification for this particular rate is offered.

Observed Costs and Costs to the Economy

For purposes of converting observed costs to costs to the economy, the Coal Transport Study used 12 percent as the rate of return on investment and a foreign exchange premium of 50 percent. In arriving at these percentages, the consultants excluded import duties and excise and sales taxes on grounds that they are not payments to factors of production and do not represent the use of real resources. In addition, rates of return on investment in the private sector (as opposed to the relatively low rates earned by some government-owned enterprises) were used in the calculations.[54]

The interest rates used by both studies in calculating costs to the economy are substantially above the returns currently accruing to in-

[52] *Ibid.*, p. 158.
[53] *Ibid.*, p. 129.
[54] Coal Transport Study, Vol. II, pp. 83-85.

vestments in electric power and railway transport in India. According to the Energy Survey:

> The average rate of return to all electricity undertakings in 1958-59 was 3.3 percent. This was made up of an average return of 6.7 percent to the mature and somewhat more slowly expanding private companies in the big cities where electricity supply was first introduced, and an average return of 2.6 percent in the rapidly expanding public sector undertakings.[55]

In 1961-62 and 1962-63 the Indian Railways earned a return of 6.3 percent on book value of assets.[56]

There is evidence, however, that Indian authorities are becoming aware of the inadequacy of return to investment in public undertakings and are tending to use a higher discount rate in screening investment projects.[57] According to the Energy Survey the State Boards are being encouraged to use a 10 percent rate of return in fixing rates for electricity.[58] The Ministry of Railways announced in April 1964 that the rate of interest on capital made available to the railways by the Indian government had been increased from 4.5 percent to 5.75 percent. The same announcement went on to say that, "The Board have decided that, in all new works taken up from 1964-65, the financial implications, for the purpose of determining remunerativeness or otherwise, should be worked with reference to 6.75 percent of the outlay."[59]

Whether 6.75 percent comes closer than 10 percent or 12 percent to reflecting the opportunity cost of capital in India is difficult to say. The returns on capital employed in twelve central government enterprises in 1961-62 varied all the way from 0.2 percent for Hindusthan Shipyards to 19.8 percent for Hindusthan Antibiotics. The average return for these twelve undertakings in 1961-62 was 4.5 percent.[60] The ratio of adjusted net income to capital employed for 1,333 joint stock compa-

[55] Energy Survey, p. 158.

[56] Ratio of "adjusted net income" to "depreciated value of plant and equipment plus investment in stores" (International Bank for Reconstruction and Development, "Appraisal of the Indian Railways Project," August 11, 1964). The return on replacement cost of assets depreciated would be substantially less.

[57] See *Price Policy for Coal Undertakings*, Report of the Planning Unit of the Indian Statistical Institute (New Delhi, February 1963), and *The Pricing of Electricity*, Report of the Planning Unit of the Indian Statistical Institute (New Delhi, June 1962).

[58] Energy Survey, p. 158.

[59] Government of India, Ministry of Railways (Railway Board), April 14, 1964.

[60] Coal Transport Study, Appendix C, pp. 181-82.

nies whose returns were tabulated by the Reserve Bank of India averaged, in 1961 and 1962, 12.8 percent, and by industry groups varied from 7.1 percent for jute textiles to 27.9 percent for matches. The return to investment in traditional agricultural production may be as low as 3 percent.[61] On the other hand, Indian moneylenders lend at from 25 to 30 percent admittedly on very risky security. It seems to be generally true that public investments in irrigation projects in India yield a conspicuously low return.

If a shadow rate of return is going to be used in screening public sector projects and in fixing prices for their output, this rate should be applied generally. There is no case for applying it only to energy and transport undertakings while allowing other proposed investments to slip through a screen of much wider mesh. If "external economies" or some other justification is offered for a lower rate of financial return on particular projects, it needs to be shown not only that these external economies are plausible with respect to these investments but also that they are unlikely to be available to alternative investments meeting a higher financial standard.

Finding the Opportunity Costs for Capital

It seems to be generally agreed that a completely satisfactory opportunity cost for capital can be found only by way of a general equilibrium solution in which prices and quantities are simultaneously determined along with an efficient allocation of resources among uses and an efficient relationship between inputs and outputs. The correct shadow price for capital is known only if the optimum allocation of investment is also known and since over any planning horizon factor endowments, input coefficients and price and income elasticities are changing, what is really needed is a time-path of shadow prices.[62] In the present state of the art this conception is not of much help, and the practical question is whether a discount rate can be found that is more satisfactory either as a screening rate for proposed investments or as a deter-

[61] Carlin, *op. cit.*, p. 30, citing Theodore W. Schultz, *Transforming Traditional Agriculture* (Yale University Press, 1964).

[62] See S. Chakravarty, "The Use of Shadow Prices in Programme Evaluation," (processed; Massachusetts Institute of Technology, Center of International Studies, 1960, India Project c/60-5).

minant of the proper costs of products or services from these investments than the relatively low rates now in use in the programming and price policy procedures of governments.

In general, efforts to find an answer to this question have proceeded along two routes. The first route attempts to wring a solution from aggregative data on the growth rate of the economy, the saving (investment) ratio, and the share of property income in total income. The higher the growth rate (savings and the share of property income remaining constant), the higher the marginal return to capital. The higher the property share, other things being equal, the higher the return. The larger the savings ratio, other things being equal, the lower the marginal return. A formula derived by Chakravarty from Solow's earlier analysis is stated as follows:

$$p = \frac{gD}{s}$$

where p = the rate of interest
g = the growth rate
s = the savings (investment) coefficient
D = the share of profit (property) income in the total.

This analysis has been developed under highly restrictive assumptions which depart very far from observed conditions in less developed countries.[63] Nevertheless, Chakravarty applies the above formula to obtain an estimate of an interest rate in India on the assumption of a steady growth of 4 percent in national income and a value for s/D of between 0.5 and 0.3. He concludes that the return to capital lies between 8 percent and 12 percent. Another attempt to apply the formula to Indian data for the period 1955-60 yields a figure of 5.8 percent. During this period the average growth rate was 3.5 percent per annum, the savings (investment) ratio was 0.18 and it is assumed that property incomes amounted to 30 percent of total income.

[63] This line of thought derives from the classic paper of John von Neumann, "A Model of General Equilibrium," *Review of Economic Studies*, Vol. XIII (1945-46). In recent years it has been developed by, among others, Robert M. Solow, "Notes Toward a Wicksellian Model of Distributive Shares," in F. A. Lutz and D. C. Hague (eds.), *The Theory of Capital* (New York: St. Martin's Press, 1961), Chap. 12; and by S. Chakravarty, *op. cit.*

The significance of this interest rate, or return to investment, is not quite clear. It cannot approach very closely the shadow rate, or opportunity cost, of capital of a general equilibrium solution, since few if any of the conditions of this general solution are fulfilled. At best it is an approximation of what, on the average, investment under Indian conditions can be expected to yield. It seems probable that such an average figure for India is heavily weighted in the downward direction by the low returns on both private and public investment in agriculture.

The second route attempts to use interest rates in other markets or marginal returns to investment in other sectors of the economy. Both the Energy Survey and the Coal Transport Study consider that returns to investment in large-scale private industrial undertakings offer the appropriate comparison, and both rely heavily on earning figures assembled from this sector by the Reserve Bank. More or less explicitly stated is the argument that the proper opportunity cost of capital to the Indian government is the marginal yield obtainable if public capital were invested in the organized private industrial sector. In the words of the Coal Transport Study, it is the "rate of return which that capital could earn if otherwise employed, in the general range of investment opportunities in India."[61]

It is, however, not at all clear that it should be assumed that capital is freely allocable between the public and private sectors. The Indian government, for reasons that may be good or bad, has explicitly reserved certain important sectors exclusively to public investment. If an alternative assumption is adopted—that what is public remains public and what is private remains private—then presumably the government would, if it is economically motivated, array its investment opportunities in order of expected returns, to the limit of the financial resources available to it. There remains the question of what rate would be used in discounting the time series of expected benefits and costs of particular projects to establish this array. There is no reason, however, to expect that this rate would approximate marginal returns to investment in the private sector. If the assumption is made that investment is free to move into and out of the public and private sectors, in search of the highest returns, the marginal returns now expected in each sector would, in time, be subject to considerable realignment. All sorts of

[61] Coal Transport Study, Vol. II, p. 84.

price and quantity changes would be involved, but it seems reasonable to suppose that returns in the private sector would be lower as more capital moved in to take advantage of higher prospective yields, and that returns in the public sector would be higher.

Perhaps enough has been said to indicate that the choice of a shadow rate of return on investment, to be used as a screening device in choosing among investment opportunities, is pretty much a crystal ball type of operation. It is true that this rate need not be known in order to improve programming decisions so long as the movement away from existing rates is in the direction of the appropriate shadow rate. My guess—and it is only that—is that the screening rate of 6.75 percent now used by the Indian Railways is too low but that anything above the mystical 10 percent apparently favored by the World Bank and various Indian government commissions is difficult to justify.

An appropriate shadow rate of exchange is perhaps easier to estimate than a shadow rate of return on investment. At least it is clearer that a substantial shift from the existing rate is in order. What the rupee would be worth in terms of foreign currency if all impediments to foreign trade and capital movements were removed is anyone's guess, and it is also irrelevant. Any less developed country in search of development, including India, will dampen the demand for foreign currency by the imposition of barriers to the import of luxury items. In India's case, the availability of foreign exchange has been, and no doubt will continue to be, augmented by a flow of grants and loans on concessional terms from foreign governments and international agencies. The inflow of private investment could be increased by various policy changes, and there is some evidence that these may be forthcoming. On the other side an attempt is made to control strictly the outflow of capital from India. It is only within the framework of plausible assumptions concerning the inflows of private and public capital, the probable debt service burden, the probable effectiveness of capital outflow controls, and the impact of limitations on nondevelopment imports, that one can begin an examination of an appropriate shadow rate of exchange.

The data that are directly relevant to the external value of the rupee under these circumstances are mainly the import duties that still need to be imposed and the export subsidies that need to be granted in order to bring India's foreign payments into some sort of balance with

the foreign exchange available to her. Looking beyond the present situation, how would these duties and subsidies need to be changed if the balance of payments is to be sustained under the impact of the foreign exchange requirements of India's development program?

In short, what is needed here is a shadow rate of exchange to be used in comparing the relative value of foreign versus domestic inputs and in comparing the relative value of exports versus domestic consumption. Whether the real rate should approximate a shadow rate used only for accounting purposes raises a broader range of questions beyond the scope of this chapter. If the real rate does not approximate the shadow rate, then the shadow rate must be given effect by duties and subsidies that are relatively uniform among imports and among exports. Currently in use in India is a wide range of import duties and export subsidies justified in part, with respect to imports, by differences in the supply elasticities of domestic substitutes and, with respect to exports, by differences in demand elasticities for Indian exports in foreign markets. No doubt some exceptions to a policy of a uniform shadow price applicable to all imports and exports can be justified. Over the long run, however, if resources are to move from low yield to higher yield employment, and if favorable opportunities for export promotion are exploited, decisions will need to be made on the basis of a common valuation of the relationship between the internal and external value of the rupee.[65] The argument for a uniform exchange rate for accounting purposes is the same as the argument for a uniform accounting rate of interest to be used in screening investment projects.

Whether a "domestic preference adjustment" of 33 percent comes closer to approximating a proper shadow rate than 50 percent is not, I think, very difficult to determine. There are, of course, some monumental uncertainties in the situation. How would India's nontraditional exports respond to a uniform export subsidy of 33 percent or 50 percent? More importantly, will India at some stage have to meet from its foreign exchange earnings the colossal bill for food imports now covered

[65] As the Coal Transport Study puts it: "We recognize that in the short run the elasticity of supply of certain domestic goods and services is greater than that of others and also that the mobility and interchangeability of domestic resources is limited. Decisions which determine the manner in which resources may be used over long-term periods, however, should, we believe, reflect long run conditions. These, we believe, will tend to equalize the value in all uses of domestic resources relative to foreign exchange" (Appendix C, p. 184).

on concessional terms by Public Law 480 shipments? When one looks at the import requirements of India's proposed development programs, including the staggering requirements for imported oil already noted, it is difficult to avoid the conclusion that a 50 percent "domestic preference adjustment" is a much closer approach to an appropriate shadow rate than 33 percent.

It has been argued throughout this chapter that sensible decisions on investment in alternative modes of transport, alternative sources of energy supply, alternative technologies, and the exploitation of various possibilities of substitution, require the use of prices for important inputs approaching the scarcity value of these inputs to the Indian economy. This discussion of shadow rates of interest and foreign exchange has, perhaps, indicated how difficult it is to approximate these values in an actual situation. It must be repeated that any movement from existing rates toward rates that are more appropriate is a step in the right direction. There is little doubt in anyone's mind that the rates of interest used for screening investment projects in the public sector in India have been too low. There is also no doubt whatever that the rupee is heavily overvalued. It would be wise to assume that any increase in the screening rate of interest up to 10 percent and any increase in a "domestic preference adjustment" up to 50 percent would represent steps in the right direction.

Summary and Conclusions

A consideration of the magnitude of actual investment in transportation and energy should presumably include, for transport, total railway investment, investment in roads and road vehicles, pipelines, inland and coastal waterway development and shipping, some part of investment in port facilities, air transport, and probably ropeways and other somewhat exotic transport media. The energy area should include domestic investment in domestic consumption of coal, liquid fuels, coke and manufactured gas, natural gas, electricity, and nuclear energy. Presumably domestic investment for energy exports should be excluded and foreign investment for energy imports included. Investment in transportation and energy by this definition accounts for a large fraction of total investment in all countries. Bits and pieces of evidence

suggest that in less developed countries this fraction is from 25 to 40 percent of total investment. In the early stages of American development it may well have been larger since, up to the 1890's, investment in railways alone exceeded total investment in manufacturing.

There is substantial evidence that in the early stages of industrialization, transportation and energy outputs increase substantially faster than GNP and in many countries approximate the rate of growth of industrial output. In the transportation area, road transport, and in the energy area, electric power, increase with particular rapidity. Both the magnitude of the investment and the rate of growth will vary among countries at similar stages of development and with similar rates of development by reason of factors lying outside of human control. In the transportation field the density and distribution of the population and topography are of particular importance. In the energy field natural resource endowments vary substantially among countries. There are, nevertheless, possibilities of economizing transport and energy investment and, in view of the magnitude of this investment, they are well worth careful consideration.

These possibilities of economizing involve a number of important policy issues. First, to what extent should investment in transportation and, to a less extent, in energy be used as an instrument of development, building ahead of demand to induce economic activity? Or should such investment be undertaken only in response to a careful appraisal of expected requirements? There is general agreement that transportation and energy bottlenecks are serious impediments to economic growth. Furthermore, in industries characterized by "lumpy" investment, some building ahead of demand is inevitable. Nevertheless, there is a huge difference between the excess transportation capacity that marked the building ahead of demand in the economic development of the United States and the very intensive use of transportation facilities one observes in the Soviet Union and to a lesser extent in Japan. There seems reason to believe that in a country like India, the Soviet model may be more appropriate.

Second, to what extent should the allocation of investment among alternative forms of transportation and alternative sources of energy be left to competitive pressure, with government attempting so far as possible a posture of neutrality? Or should government follow a more positive policy designed to prevent duplication of facilities and assigning to

each mode of transport and form of energy supply that role for which it is best adapted? "Best adapted" presumably must be interpreted in terms of relative cost of providing the service, and when the nature and value of the service differ, there are serious difficulties in calculating relative costs. If, for example, certain types of trucking render a larger bundle of services to users than rail transport, the value of these services should presumably be deducted from truck costs before comparing these with rail costs. These difficulties are probably not insuperable and it seems obvious that a policy attempting to achieve complementarity will lead to a different pattern of transport and possibly energy development than a policy of neutrality among competing services. Whether over the long run it would be a better pattern is not so clear.

Third, there are important possibilities of substituting energy services for transportation services and vice versa, which provide substantial opportunities for economizing total transport-energy investment. The choice between oil and coal is largely a question of the transport cost per Btu at various points of delivery. The location of thermal plants is largely a question of the cost of transporting coal (or other primary sources) to the plant versus the cost of delivering electric energy over transmission facilities. If these and other possibilities of substitution are to be exploited, it suggests the necessity of some degree of overall planning of transport and energy development.

A sensible allocation of investment among different modes of transport and different sources of energy supply and an exploitation of various possibilities of substitution require a comparison of probable costs and benefits. If this comparison is to be useful, the value of services must be calculated at prices approximating long-term marginal costs, and cost calculations must take account of the scarcity value of inputs to the economy. Prices and quantities of inputs and outputs are interdependent and this type of approximation is a job for the market. It is a job that the market in most developed capitalist countries can, with the help of a certain amount of public utility regulation, do well enough.

In most developing countries, the market does not perform this function. Certain transportation and energy services are characteristically underpriced in comparison with others; capital inputs are characteristically priced at figures approximating the borrowing rates of governments which are usually substantially below the value of capital in

other sectors of the economy; and inputs requiring foreign exchange are frequently undervalued. In the absence of the kind of information that would make a dynamic interdependence analysis fruitful, adjustment of input and output prices in such fashion as to promote a more sensible comparison of costs and benefits is a rather hit or miss affair. In a country like India one starts from the nearly indisputable premise that electrical rates and the rates for various types of railway services are too low even at present input prices; that the rate at which the government borrows is much too low to be used as a screening rate in allocating public investment funds; and that the present foreign exchange rate seriously overvalues the rupee. Under these circumstances changes in certain strategic prices can hardly fail to improve resource allocation whether or not, after adjustment, these prices approximate dynamic equilibrium values.

Assuming India wishes to economize total investment in transportation and energy over time by taking advantage of major possibilities of substitution while providing adequate service at prices covering long-run marginal costs to the economy, what principal changes in existing policies and practices need to be undertaken? The major directions of change can be suggested though specification in detail is difficult. Most of these directions of change are, in fact, elaborated in the Coal Transport Study and the Energy Survey.

India has been essentially a railway and coal economy, and the character of Indian industrialization and the shortage of foreign exchange suggest that this will continue to be true. Railways are by far the lowest cost carriers of bulk products and heavy industry is among the most rapidly growing sectors in the Indian economy. Shortage of foreign exchange will force a maximum exploitation of low-grade coal despite the much greater thermal efficiency of imported oil.

This does not mean, however, that road transport and the use of oil will not and should not grow much faster than their competitors. The handicaps to the development of road transport are much greater than any policy favoring "complementarity" among modes of transport would justify. It seems probable that investment in the expansion of road transport would yield high returns, though the absence of information on the character of freight traffic on the Indian highways makes it difficult to specify the most fruitful direction of road transport investment. The high cost of carrying low-grade coal over long distances sug-

gests the economy of a much larger substitution of oil for coal than at present in southern and western India, even with a domestic preference of 50 percent above the present rate of exchange.

The Coal Transport Study has made it clear that, with the possible exception of coastwise shipping, the development of other modes of transport including rail and waterways, coal pipelines, and ropeways, all of which seem to have had numerous devotees in India, is not worth considering. The feasibility of expanding coastal shipping for the transport of coal and other bulk commodities seems to depend largely on the development of a port of shipment alternative to Calcutta. Expanded coastal shipment of bulk commodities from the overloaded and high-cost port of Calcutta would apparently not be justified even if ships and other port facilities more adapted to this traffic than existing ones were provided.

The Energy Survey sees domestic coal and imported oil as the overwhelmingly important primary sources of energy in India. Although there are many promising hydrosites as yet undeveloped, hydropower is expected to supply only a decreasing proportion of India's commercial energy requirements. The large-scale development of nuclear energy in India belongs to the next century. Electric power is expected to come increasingly from thermal plants, and large economies in investment can be realized through the location of large generating plants at or near the coal mines and washeries and the development of more adequate transmission facilities. These economies are largely economies of coal transport.

The sensible development of transport and energy in India would be greatly facilitated by certain changes in price policy, in the screening rates that are used to justify investment, and in the degree of preference given to domestic production. There is evidence that some of these changes are in process. Numerous public authorities have suggested a 10 percent capital charge in screening electrical investments and in determining electricity rates. The Indian railways have recently increased their investment screening rate and have instituted rate increases designed to increase the yield on investment. Price policy and the use of market tests continue, however, to be a somewhat neglected area in Indian planning. A primary purpose of this chapter is to suggest that a greater cultivation of this area has much to contribute to the effective coordination and allocation of transport and energy investment.

CHAPTER 2

Transport, Urban Design, and Housing

ROBERT JONES

IT IS THE THESIS OF THIS CHAPTER that there are trade offs in urban design among housing, transport, and other amenities and services necessary for urban life that should be taken into account in underdeveloped countries when new cities are designed or old cities are modernized and expanded to provide for the vast increases in urban population.

Introduction: Urban Population Pressures

Population has grown rapidly in the cities of the developing countries; in many cases more rapidly than the population of the country as a whole. In Latin America, for example, from 1950 to 1960 the total population (including that of the West Indies) increased from 158.5 million to 203 million, implying a compound rate of growth of 2.5 percent per year. In the same period, the population in urban areas with about 2,000 or more inhabitants increased from 62.2 million to 92.4 million, implying the high rate of growth of 4.0 percent per year.[1]

Much of the growth of the urban areas is accounted for by migration

[1] A little of this growth probably is accounted for by towns which had fewer than 2,000 people in 1950 and more than 2,000 by 1960, but most of the increase in urban population undoubtedly occurred in towns that already had 2,000 people in 1950. The population figures are from the United Nations, *Economic Bulletin for Latin America,* Vol. V: Statistical Supplement (U.N., 1960), Table 6, p. 13.

from the rural areas. Since the rates of natural increases in population generally are higher in the rural areas than in the cities, the population of the cities would grow more slowly than the population of the country as a whole if there were no migration to the cities.[2] Because of the generally poor employment opportunities in the rural areas and the apparently greater opportunities for work and excitement of the cities, millions of people have migrated to cities despite the wretched living conditions for most poor urban families. Millions more are likely to migrate to the cities and towns in the coming decades, adding to the normal increase that will come from a larger number of births than deaths.

Urban Population Projections and Living Conditions

The magnitude of the projected growth of the world's urban population for the remainder of this century has been described by Ernest Weissmann (Director of the United Nations Center for Housing, Building, and Planning):

> . . . In 1950, the world was still about 80 percent rural. At present, between 50 and 60 million people are being added to the world's total population every year. This rate of growth will become 75 million a year in 1975, and 125 million in the year 2000. At that rate, the world's population will reach 4,000 million in 1975, and some 6,000 million at the turn of the century. By then 60 percent of the world's population will probably be urban. Thus, an urban environment, tolerable both from the physical as well as the socioeconomic viewpoint, will have to be provided in the last five decades of the twentieth century for thirteen times as many people as in the previous 150 years; to do so, the rate of construction in the next fifty years must average almost forty times that of the past. This is a task hardly conceivable with the current resources and productivity of the developing pre-industrial countries.[3]

The population in many of the cities has grown so rapidly, and the per capita income levels have risen so little, that the construction of housing, utility systems, and streets has lagged far behind the amounts

[2] Some of the urban population growth is accounted for by net immigration from other countries, but this migration takes place primarily from poorer countries to richer ones.

[3] Ernest Weissmann, "The Urban Crisis in the World," *Urban Affairs Quarterly*, Vol. I, No. 1 (September 1965), pp. 66-67.

needed just for public health and personal survival. A substantial percentage of the families already living in the urban areas do not have even a pure water supply or sanitary sewage disposal—basic urban services which are needed for public health as well as for private health and comfort. Many of them live in makeshift dwellings which are too small for comfortable eating and sleeping, to say nothing of allowing privacy and recreation.

The High Cost of Improving Urban Living Conditions

The cost of constructing basic urban facilities and low-quality housing has been high in relation to most incomes in the developing countries and will continue to be high for the foreseeable future. A given capital cost has a higher annual cost than in North America and Europe because interest rates are generally higher and available borrowing periods are much shorter. In addition, many types of materials for the utility and transportation systems and for the buildings are imported, drawing on the countries' ever precarious earnings from their exports. The annual cost per capita of housing, passenger transportation, utilities, and improvements is projected to be about 40 percent of annual per capita income in Venezuela's new industrial city, Ciudad Guayana, which is expected to have a much higher income per capita than most other Latin American cities.

The same types and amounts of facilities probably would take an even greater percentage of the lower incomes in other developing countries. The small quantities and poor qualities of urban services and housing actually consumed in the poorer countries are suggested by the fact that in Kingston, Jamaica, and in Panama City most families spend only 15 to 20 percent of their incomes on housing, utilities, and transportation.[4] By contrast, families in the United States spend about 30 percent of their incomes on these items.

The magnitude of the expenditures needed to make significant improvements in urban facilities is suggested by the following table of

[4] G. E. Cumper, "Expenditure Patterns, Kingston, Jamaica, 1954," *Social and Economic Studies*, Vol. 7, No. 2 (Kingston, Jamaica, June 1958), pp. 165-77; P. B. Paro, *Estudios de los Ingresos, Gastos y Costo de la Vida, Ciudad de Panamá, 1952-1953* (Panama City: Government of Panama, July 1954), Tables 29, 34, 37, and 50 on pp. 49, 55, 58, and 67.

net national investment proposed for India from 1961 to 1981 (4.7 rupees equal $1):[5]

Sector	*Billions of rupees (1961 prices)*
Electric power	65
Production and transport equipment	60
Other mining and manufacturing	195
Transport and communications	130
Agriculture and rural development	110
Urban housing and municipal services	150
Education, health, services, trade, etc.	90
	800

Urban housing and municipal services would take 19 percent of the optimistically large total investment over the twenty years. The total investment of 800 billion rupees is based on the assumption that India's national income will increase from 140 billion to 392 billion rupees per year from 1961 to 1981 and that net investment will increase from 11 to 18 percent of national income, or from 15 billion to 70 billion rupees per year.[6]

The prospect for the living standards in terms of housing and related amenities for much of the world's burgeoning urban population is described by Abrams:

> The magnitude of the problem in the underdeveloped world may be gleaned from the fact that more than a billion people in Africa, Asia, and Latin America, or roughly half the population of these continents, are homeless or live in housing that is described by the United Nations as a menace to health and an affront to human dignity. Worse still, in almost all the developing areas, housing conditions are steadily deteriorating. Many families pay so much for the privilege of bedding down on a floor or other space that little is left for the bare essentials of life. And as the surge to the cities goes on, the competition for space will become keener, rents will rise further, squatting and overcrowding will increase, and the effort to carry on some semblance of family life will become less and less hopeful.[7]

In sum, the developing countries need to provide housing and ser-

[5] Pitambar Pant, "Urbanization and Long-Range Strategy," in Roy Turner (ed.), *India's Urban Future* (University of California Press, 1962), p. 186.

[6] *Ibid.*, p. 185.

[7] Charles Abrams, *Man's Struggle for Shelter in an Urbanizing World* (M.I.T. Press, 1964), p. 7.

vices for a rapidly growing urban population, handicapped by low incomes and some very high costs. In view of this situation, it seems worthwhile to look for ways of providing urban facilities efficiently, i.e., so as to incur the least possible cost for whatever facilities are considered necessary and to get the greatest possible benefit from whatever expenditures are made on them.

Planning the Spatial Pattern of Urban Development

There are two major parts to the problem of choosing efficient patterns of urban development. One is the design of the internal organization of individual cities; the other is the distribution of production facilities and population among different cities and towns. In most countries the distribution of production facilities has been determined by both private businesses and government agencies, with little regard for its effect on the internal organization of the cities in which the facilities are located. The cities, in turn, have adapted in piecemeal fashion to the arrival of new production facilities and the growth of population. The result probably has been relatively efficient, compared with a policy of distributing the production facilities so as to minimize the costs of urban infrastructure, because the gross income from economic activities is likely to vary from one location to another even more than the costs.

City Size

It seems to be agreed that most of the industrial facilities needed for economic development will be more profitable for a country if they are grouped together in cities with a population of 100,000 or more.[8]

[8] "Through processes not as yet fully understood, growth appears to have a better chance of becoming self-propelling in the larger cities, that is, cities of 100,000 or more." Lloyd Rodwin, "Metropolitan Policy for Developing Areas," *Daedalus, The Future Metropolis* (Winter 1961), p. 135 and *passim*.

"One would tend to agree with the seminar group (the Seminar on Rural Industrialization and Economic Development, held in New Delhi in 1960) that cities of 20,000 to 50,000 population are probably too small to use as economic nuclei, unless there is evidence that industrial activity is developing. It does not seem feasible to consider every district town or city as a potential focal point for industrial development. . . . The usual bottleneck encountered in initiating

Lewis advocates greater development of cities with populations between 20,000 and 300,000 in India. With the nation's labor force spread out, it would be possible for urban workers to return to the land during periods of industrial depression, and in good times the urban areas would provide a more evenly distributed market and a wider spread, but less intense, demonstration effect.[9]

Trade Offs in Urban Design

There are three potential trade offs[10] in urban design useful in analyzing how the costs of an urban layout depend on the characteristics of the layout: (1) the increase in residential building costs versus the decrease in transportation and public utility costs, as the number of floors in the residential buildings is increased and the land used for them is decreased; (2) the possible decrease in sewage disposal costs versus the increase in the costs of transportation and the other utilities, when the residential density is made low enough to use soil-absorption instead of a system of sewer pipes; (3) the change (probably an in-

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village-based industry is that of too small a market for the operation of an enterprise using comparatively modern technology. For this reason some would argue that the prospects of establishing strong industrial nuclei are definitely enhanced if the program is based on cities with a population in the neighborhood of 100,000 or larger." William Bredo, "Industrial Decentralization in India," in Turner, *op. cit.*, pp. 244, 252.

"The reliability of power and communication services, the accessibility of cultural and educational facilities, the resourcefulness of local service technicians, the passability of the roads, and the work outlook of the labor force tend to fall off with movement down the scale of size and outward from the metropolitan center. As between independent cities of different sizes, those under a present population of 200,000 [in India around 1960] tend to be unable to supply so many of the desirable features of an environment which stimulates manufacturing growth that they cannot at present be seriously considered as potential growth centers. Where cities are satellite to and partially dependent upon a larger metropolitan center, this lack of facilities may be partially overcome from that center, and an industrial-growth environment may be established in centers of 50,000 people or less or in relatively new townships. . . ." Britton Harris, "Urban Centralization and Planned Development," in Turner, *op. cit.*, p. 268.

[9] John P. Lewis, *Quiet Crisis in India* (Brookings Institution, 1962), p. 179.

[10] Details and qualifications of these and other trade offs are given in Chapter 3 of Robert Jones, "Efficient Patterns of Urban Land Use, with Reference to Costs and Incomes in Latin America, Primarily in Venezuela" (doctoral dissertation, Harvard University, 1968).

crease) in average intra-urban freight transportation distances and costs versus the change (probably a reduction) in average commuting distances and costs, as the workplaces are decentralized within the city, for a fixed volume of shipments to and from the different establishments and a fixed number of commuting trips.

These trade offs are examined below in two sections—the first dealing with neighborhood layouts and the second pertaining to the design of entire cities. They are investigated by estimating construction and operating costs for several schematic layouts. The estimates were made by designing layouts with specified capacities per family for housing, transportation, and utility services and then combining the costs of buildings, mains, vehicle trips, and so forth, with the specified capacities. The underlying unit construction costs are averages of unit costs incurred (a few costs were estimated by interpolating between available data) for projects in Latin America, primarily in Ciudad Guayana, Venezuela, where the Corporación Venezolana de Guayana is developing a new industrial city. Materials and methods of construction on which the unit construction costs are based are those which appear to be efficient for use in Latin America today.[11] The major operating costs—the costs of operating the transportation system—are based on unit costs reported in studies of transportation in Venezuela.[12]

The operating costs of water and sewer lines appear to be negligible, unless the topography is too flat for gravity flow. The designs for water and sewer lines were based on the assumption that the topography allowed a uniform 1 percent slope for these lines. Operating costs of electric lines, including the value of power losses, are a substantial addition to the construction costs of the electric lines, but are small in relation to the transportation costs. Construction and operating costs

[11] For example, the costs of medium-sized water pipes are based on the costs of asbestos-cement pipe, which is currently replacing cast-iron pipe. Asbestos-cement pipe is much cheaper and has a lower coefficient of friction. Its drawback is that it is more brittle than cast-iron pipe and must be handled carefully. But in a low-wage country, the extra cost of installation is low relative to the extra cost of buying cast-iron pipe.

[12] Richard M. Soberman, "The Cost of Road Transportation in Venezuela" (processed; Corporación Venezolana de Guayana, Joint Center Guayana Project, División de Estudios, Planificación, e Investigación, File B-56, April 1963); Marc E. A. Langevin, Edwin F. Clark, and Sigivid Ribbing, *Transporte en Caracas*, Report No. TAO/Ven/14 (United Nations, 1962).

for major utility installations like water treatment plants are not included because they would be the same for the different layouts considered.

Residential Construction Costs

For economy in designing the layouts and estimating the costs, the first trade off—between the number of stories in residential buildings and the costs of utility and transportation services—was explored in two steps. First, the costs were estimated for several types of neighborhoods, with one type of residential building on all of the lots in a neighborhood. Then the costs were estimated for the major transportation and utility lines outside the small neighborhoods, for several schematic city-wide layouts. The second trade off—between the costs of sewage disposal and the costs of transportation and of the other utilities—was explored only at the neighborhood level. The cost estimates and their implications for choices of actual layouts can be presented conveniently by considering first the costs of different types of neighborhoods and then the costs of several city-wide layouts made up of several relatively efficient types of neighborhoods.

The small neighborhoods for which cost estimates were made consist of a rectangular area containing a U-shaped residential street, lined with one or two rows of residential buildings along the sides and the bottom of the "U." A main street connects the ends of the "U" and extends beyond it to the edges of the neighborhood. There is space beside the main street for neighborhood stores and institutions[13] and

[13] The location of these areas along the main road is not the only acceptable place for them; they could be located in a more compact pattern inside the neighborhood. But the location along the main road has two advantages. It allows delivery vehicles from other parts of the city to serve the commercial areas without driving on the residential streets and it uses the commercial and institutional areas as a buffer between the main road and the houses. The placement of the commercial area along the main road does not imply that small stores should not be allowed as additions to the houses on the residential streets. But it is desirable to reserve space for activities which are not carried on in house-front stores or which will leave the house-front stores if the families' incomes rise. The swath for the main road and for the commercial and institutional area is wide enough to have a separate street for access to the buildings and even to have a small park between the main road and the buildings. (A park need not be expensive; it might well be just a natural drainage channel left intact.)

space for a primary school, park, or playground inside the "U." The U-shaped street was chosen because it allows a relatively short average street frontage, for lots with a given depth and width.

Costs were estimated for houses, streets, utilities, and other improvements for six different U-shaped layouts, designated by the labels 1-4, 1-4.6, 1-17, 1-22, 4-36, and 4-71. The number before the hyphen indicates the number of stories of the residential buildings; the number after it indicates the number of dwelling units per gross acre. The lots in neighborhoods 1-4, 1-4.6, and 1-17 are wide enough for detached houses with 700 square feet of floor space, about the size being built for low-income families in several Latin American countries. The lots in neighborhood 1-22 are only 16 feet (5 meters) wide, more suitable for row houses than for even a very small detached house. It was assumed that detached and row houses had the same cost per square foot of floor space.[11] Neighborhoods 4-36 and 4-71 have four-story, walk-up apartment buildings, each containing sixteen dwelling units. These buildings, made of reinforced concrete, appeared to be the least expensive type of multi-story construction available in Venezuela.

In addition to the space for commerce and institutions along the main road, neighborhoods 1-4, 1-4.6, 1-17, 1-22, and 4-36 have 156 square feet of ground space per dwelling unit located in a common plot large enough for a primary school, playground, park, or other communal use. Neighborhood 4-71 has only 133 square feet per dwelling unit in the common plot. If the apartment buildings have a ground coverage of 2,700 square feet (four 645-square-foot apartments on each floor, plus a stairwell), they cover about 27 percent of the gross area of the neighborhood. Schools, stores, and other buildings might cover another 5 percent. Higher ground coverage probably would not allow adequate ventilation in a hot, humid climate. The approximate costs per square foot for several types of one-story houses built in Ciudad Guayana, Venezuela, and for several types of multi-

[11] One might expect that row housing could be built at a lower cost per square foot than detached houses because the wall dividing two dwelling units takes the place of two exterior walls, and the roof overhang (needed for protection against intense sun and rain) is eliminated along the sides. On the other hand, a wall dividing two dwelling units might be more expensive than two exterior walls if it gave effective soundproofing. The reported costs of constructing detached and duplex houses of the same style and quality were about the same, per square foot, in Ciudad Guayana, Venezuela, in 1964.

TABLE 2.1A. *Description of Residential Building Types*

Type	Structural materials	Quality of finishings	Method of construction
A	concrete block walls asbestos-cement roof	low	self-help
B, C	concrete block walls asbestos-cement roof	low	contract
D	light-weight reinforced concrete sections	low	self-help
E	reinforced concrete columns and roof (walls to be filled in later by self-help or contract)	low	contract
F, G, H	concrete block walls, reinforced concrete roof	medium	contract
J	masonry or poured concrete walls, reinforced concrete roof 20 cm thick	high	contract
K, P	reinforced concrete	medium	contract
L	reinforced concrete	high	contract
M, N	reinforced concrete	low	contract

story apartment houses built in Caracas are shown in Tables 2.1A and B. These costs cover materials, paid labor, and prevalent percentages charged for contingencies and for the contractor's profit and overhead. They exclude percentages charged for government administration, the cost of which probably is not proportional to the construction costs of individual dwelling units. (The absolute cost of government administration is probably higher for the low-cost houses, especially the self-help types, than for the more expensive ones.) About 10 percent of the costs per square foot are prorated costs of plumbing, fixtures, and electric wiring. The different types of self-help construction cost about 6 bolivars[15] per square foot. The method using lightweight sections of reinforced

[15] Six Venezuelan bolivars (Bs) = $1.32 at the exchange rate which has prevailed since the beginning of 1964.

TABLE 2.1B. *Construction Costs of Residential Buildings, per Square Foot*

Number of stories	Type[a]	Square feet per dwelling unit	Cost[b] of materials and contracted labor (bolivars per square foot[c])
1	A	689	6.54
1	B	560	9.82
1	C	689	8.72
1	D		3.24 to 6.28
1	E	664	5.28
1	F	759	15.25
1	G	806	15.70
1	H	866	15.20
1	J	2,475 plus 430 for a garage	35.00 to 45.00
3	K	700	24.05
3	L	1,610 (2,020 gross)	38.90 (31.20 gross)
4	M	742	14.60 to 17.20
15	N	645 to 935	24.40 to 30.00[d]
15	P	645 to 935	31.60 to 40.06[d]

SOURCE: Underlying data are from working papers of the Corporación Venezolana de Guayana on construction projects in Ciudad Guayana, Venezuela, 1962–64.

a. For description of types, see Table 2.1A.

b. This cost includes prevalent percentages for contingencies and the contractor's profit; it excludes percentages charged for government administration.

c. 4.54 Venezuelan bolivars = $1.00.

d. The variation in the estimate of cost per square foot is *not* based on the variation in square feet per dwelling unit; it arises instead from variation in the data for original construction, finishing, and elevator costs in 1956, and from variation in the estimate of changes in construction costs from 1956 to 1964.

concrete for self-help construction may become commercially available for a lower cost, but it is still in the experimental stage. Finished one-story housing built entirely by contracted labor costs about Bs 9 per square foot with low-quality finishings and about Bs 15 with medium-quality finishings. The cheapest type of multi-story construction—four-story, walk-up apartment buildings made of reinforced concrete and finished with low-quality materials—costs about Bs 16 per square foot. Fifteen-story buildings with just one elevator for 240 apartments would cost at least Bs 23 per square foot, and perhaps as much as Bs 30 per square foot.[16]

[16] All buildings listed in Table 2.1, except Type A, require some contracted labor. To the extent that some of the contracted labor is supplied by unskilled workers, it would be appropriate to subtract most of their wages and fringe bene-

TABLE 2.2. *Construction Costs of Small Dwelling Units*
(In bolivars per dwelling unit)

Building type[a]	645 square feet	350 square feet[b]
One-story		
self-help or unfinished contract construction (A, E)	4,200	2,800
low-quality contract construction (B, C)	6,000	4,000
moderate-quality contract construction (F, G, H)	9,900	6,600
Four-story, low quality (M)	10,200	6,800
Fifteen-story, low quality (N)	16,000	10,700

SOURCE: Underlying data are from working papers of the Corporación Venezolana de Guayana on construction projects in Ciudad Guayana, Venezuela, 1962-64.

a. Letters in parentheses refer to the building types described in Table 2.1A.

b. Since the costs of the bathroom and kitchen fixtures are fixed rather than proportional to the floor area, and since the size and cost of the dividing walls are likely to decrease less than in proportion to the floor area, the cost per square foot is likely to be higher for a smaller total area, as is suggested by the costs of Types B and C (see Table 2.1B), which are very similar in quality.

The estimated costs of dwelling units with 645 square feet and about 350 square feet are shown in Table 2.2 for several of the building types. The estimates show that dwelling units in the cheapest type of multi-story residential buildings cost much more than equally large units of similar quality in several types of one-story construction.

Combined Costs of Residential Buildings and Neighborhood Improvements

Some of the extra cost of the multi-story buildings is offset by lower costs for streets, utilities, and other improvements in the neighbor-

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fits from the reported costs in order to determine the real costs to the economy as a whole. Although data were not available on the number of man-hours of different labor skills used for the different types of construction, a comparison of the costs of Types A and C suggests that most of the contracted labor is supplied by highly skilled workers. A 689 square-foot house of Type C costs a total of Bs 6,000; an equally large house of Type A costs Bs 4,500 for the materials alone. Since the two types are of about the same quality, it appears that the labor for Type C costs less than Bs 1,500. In contrast, the estimated time to be supplied by the buyer of the self-help house was said to be worth Bs 3,000, probably based on the prevalent minimum wage for unskilled workers in the unionized industries since these houses were intended for workers with low but steady incomes. Some of the difference may be accounted for by greater efficiency of organization and supervision in the contract system, but a good deal undoubtedly is explained by greater skill on the part of the regular construction workers themselves.

TABLE 2.3. *Costs of Standard Improvements in Six Types of Neighborhoods*

(In bolivars per dwelling unit)

Improvement	Neighborhood number					
	1–4	1–4.6	1–17	1–22	4–36	4–71
Streets and ditches						
Design	48	102	27	37	10	6
Earthwork and gravelling	189	389	119	153	59	38
Ditch crossings	80	80	21	33		
Paving, one lane	100	200	60	80	35	21
Electric lines and street lights	343	340	191	139	41	26
Electric power losses and maintenance[a]	461	457	256	186	55	34
Water mains, for domestic use only[b]	264	226	134	99	50	41
Water mains, with additional capacity for fire flow	396[c]	525[c]	193[c]	154[c]	103[c]	66[c]
Water meter and house connection	311	465	311	311	218	195
Sanitary sewer main	355	392	184	141	49	30
Sanitary sewer connection	127	233	127	127	40	15
Transportation[d]	100	190	50	60	30	20
General site planning and walkways	290	300	80	76	36	23
Total, standard improvements	2,618	3,374	1,560	1,442	623	449
Storm sewers						
53 cm diameter	440		227	338	91	61
107 cm diameter	990		564	691	188	127

SOURCE: Underlying data are from working papers of the Corporación Venezolana de Guayana on construction projects in Ciudad Guayana, Venezuela, 1962–64.

a. Based on power losses and maintenance costs equal to 18 percent of the construction costs, capitalized for twenty years at an interest rate of 12 percent.

b. Based on the cost of water mains with a capacity of 60 gallons per hour per house. Mains with a capacity of only 10 gallons per hour per house would cost about 15 percent less.

c. Figure not included in total.

d. Includes only the costs that vary with the distance between houses (see Table 2.6). Excludes passenger transportation, on the grounds that most people would walk in these small neighborhoods and that their time spent in walking a short distance is costless to the economy as a whole.

hoods. The cost per dwelling unit for various improvements is shown in Table 2.3 for the four neighborhoods of one-story houses and the two neighborhoods of four-story apartments. The cost per dwelling unit for the whole group of standard improvements is about Bs 1,000 less in the neighborhoods with four-story apartment buildings than in the neighborhoods with one-story houses on small lots (17 to 22 lots per gross acre); it is about Bs 2,000 less in the neighborhoods with four-story buildings than in the neighborhoods with one-story houses on large lots (4 to 4.6 per gross acre).

These savings in the costs of improvements are considerably less than the extra construction cost of the low-quality, four-story building in comparison with the cheaper types of one-story construction. Table 2.4 shows that the combined cost of the building and the standard improvements is at least Bs 1,000 more per dwelling unit for neighborhoods with low-quality, four-story buildings than for the neighborhoods with one-story houses built by self-help or unfinished contract construction (Types A and E). The combined costs of buildings and standard improvements are also higher for finished low-quality, four-story buildings built by contract construction than for finished one-story buildings, unless the floor space per dwelling is only about 350 square feet and the one-story houses are placed on large lots with long connections from the houses to the utility mains, as in neighborhood 1-4.6.

Inasmuch as the cost is considerably smaller for one-story houses on small lots than on large lots, the cost of four-story buildings should be

TABLE 2.4. *Combined Costs of Low-Quality Residential Building and Standard Neighborhood Improvements*
(In bolivars per dwelling unit)

Neighborhood number	Standard improvements[a]	Construction costs of residential building[b]		Total costs	
		645 square feet	350 square feet	645 square feet	350 square feet
One-story, self-help or unfinished contract construction					
(1-4)	2,618	4,200	2,800	6,818	5,418
(1-4.6)	3,383	4,200	2,800	7,583	6,183
(1-17)	1,560	4,200	2,800	5,760	4,360
(1-22)	1,442	4,200	2,800	5,642	4,242
One-story, finished contract construction					
(1-4)	2,618	6,000	4,000	8,618	6,618
(1-4.6)	3,383	6,000	4,000	9,383	7,383
(1-17)	1,560	6,000	4,000	7,560	5,560
(1-22)	1,442	6,000	4,000	7,442	5,442
Four-story					
(4-36)	623	10,200	6,800	10,823	7,423
(4-71)	449	10,200	6,800	10,649	7,249

a. From Table 2.3.
b. From Table 2.2.

compared with the costs of one-story houses on small lots to determine whether four-story buildings might have a lower total cost than one-story houses. Table 2.5 shows that the combined cost per dwelling unit for low-quality buildings and standard improvements is considerably less in neighborhood 1-17 than in neighborhood 4-71. (The differences would be larger if the costs of neighborhood 4-36 or 1-22 were used in the comparison.) The differences, for the four combinations of the two types of construction for the one-story houses and the two amounts of floor space per dwelling unit, range from Bs 1,690 to 4,890 per dwelling unit.

Without knowing how much the families would be willing to pay for these combinations of building type and floor area, it is impossible to say which of the four comparisons would be most relevant in determining "the" difference between the costs of one-story and four-story housing. An intermediate figure of Bs 3,000 per dwelling unit will be used below, when the costs of utility lines and transportation outside the individual neighborhoods are considered.

The combined costs for the housing and improvements are not unreasonably expensive for most families in Venezuela (see Table 2.5). In 1960, the average income of the families in the bottom half of the income distribution was about Bs 3,500.[17] Annual payments of Bs 700—20 percent of their 1960 income and hopefully a smaller percentage of their incomes in the future—would cover the capital charges on an initial cost of Bs 5,220 if loans were available for twenty years at 12 percent. If loans were available for thirty years at 6 percent, Bs 700 per year would cover the charges on an initial cost of Bs 9,640.

Neighborhood Costs for One-Story Housing

The cost estimates made for the different neighborhoods of one-story housing yield several conclusions about the comparative costs of differ-

[17] This estimate is based on the 1960 population, household size, and national income and on the family income distribution reported for 1957. Sources: population: United Nations, *Economic Bulletin for Latin America*, Vol. V: Statistical Supplement (U.N., 1960), Table 6, p. 13; household size: United Nations, *Statistical Yearbook, 1964* (U.N., 1965), Table 185; national income: United Nations, *Boletín Estadístico de América Latina*, Vol. I, No. 1 (U.N., 1964), Table 25C, p. 81; family income distribution: *Comercio Exterior*, Vol. 13, No. 9 (Mexico, D.F., September 1963), pp. 681-82.

TABLE 2.5. *Differences between the Combined Costs per Dwelling Unit for Housing and Standard Improvements in Neighborhoods 4-71 and 1-17*

(In bolivars per dwelling unit)

Method of construction and floor area	Neighborhood 4-71	Neighborhood 1-17	Difference
Self-help or unfinished contract construction			
Floor area 350 square feet	7,249	4,360	2,889
Floor area 645 square feet	10,649	5,760	4,889
Finished, low-quality contract construction			
Floor area 350 square feet	7,249	5,560	1,689
Floor area 645 square feet	10,649	7,560	3,089

SOURCE: Table 2.4.

ent patterns for the streets, buildings, and utility lines and of different types of improvements, transportation services, and other services in the neighborhood.

DISTANCE-RELATED TRANSPORT COSTS. One conclusion is that the variable costs of transportation services within the neighborhood, i.e., the costs that vary with the distances between the houses, are quite small—around 5 percent of the cost of the standard improvements if the annual costs are capitalized for twenty years at an interest rate of 12 percent. The costs were estimated for neighborhood 1-4 for seven transportation services, as shown in Table 2.6. (The costs of commuting trips and of other trips going beyond the edge of individual neighborhoods are not included; they are discussed below.) Most of the cost is for labor even though the capital charges for the vehicles were based on an interest rate of 12 percent. Even if the labor costs are estimated on the basis of subsistence wages equal to one-fourth of the prevalent wages of Bs 3 or 4 per hour for unskilled workers, the total vehicle cost is much less than the total labor cost. The distance-related costs for refuse collection, fuel delivery, and freight delivery would be somewhat different from those shown in Table 2.6 if the crew sizes were changed so as to minimize the combined cost of travel and standing,[18] but these

[18] Calculations for other crew sizes suggested that, at the market wage rates, the total cost of refuse collection—including the cost for time spent standing at the pick-up points—would be lowest with a crew size of six; at the subsistence wage

adjustments would not change the fact that the distance-related transportation costs are a small percentage of the total cost for the standard improvements. The distance-related transportation costs per house for neighborhoods 1-4.6, 1-17, and 1-22 were estimated approximately in proportion to the ratio of their average street frontage to the average street frontage in neighborhood 1-4.

COSTS FOR STREETS WITH DOUBLE ROWS OF HOUSES. A second conclusion is that, with large lots, a substantial saving can be made by having two rows of houses close together on each side of a street, but that with small lots very little can be saved by doing so. In neighborhoods 1-4 and 1-17 there are two rows of houses on each side of the street. The back row on each side does not have street frontage; utility lines and walkways are placed between the two rows, which are placed only 20 feet apart so that the relatively expensive connections to the water and sewer lines are only 10 feet long. Neighborhood 1-4.6 has an arrangement typical of North American suburbs, with every house facing onto a street and set back an average of 40 feet from the utility lines. The cost per house for the standard improvements in neighborhood 1-4.6 is about Bs 750 higher than the cost per house in neighborhood 1-4,[19] even though the average area of the lots is smaller in 1-4.6 than in 1-4; the width of the lots is 49 feet in both neighborhoods.[20] In neighborhood 1-22, the cost per house for the standard improvements is about Bs 140 lower than the cost per house in neighborhood 1-17, even though all the houses in 1-22 face on a street. The cost of the extra streets in 1-22 is more than offset by the savings on the costs of the

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rates, the total cost would be lowest with a crew size of eight, based on the following formula:

$$S = [NW + C]\,[0.003 + 0.05/(N - 1)]$$

where S = cost per stop, N = crew size, W = hourly wage, and C = capital cost per hour for the truck. It was assumed that each stop required 0.05 man-hours for loading the refuse of eight houses, from the side of the road, and that it took 0.003 hours to travel an average of 30 meters between adjacent stops, at 9 kilometers per hour.

[19] See Table 2.3.

[20] Segregation of the costs in neighborhoods 1-4 and 1-17 indicated that the standard improvements cost about Bs 25 per square foot of lot width, plus about Bs 1.30 per foot of lot depth (chiefly for the main street and the utility lines along it) plus Bs 0.025 per square foot for general site planning; the other costs for individual connections and interior fixtures are the same for the lots in each neighborhood, except for the longer utility connections in neighborhood 1-4.6.

TABLE 2.6. *Distance-Related Transportation Costs in Neighborhood 1-4*
(In bolivars)

Service	Mode	Crew size	Trips per year	Cost per year for 996 houses					
				Vehicle		Labor		Total	
				C[a]	O[b]	M[c]	S[d]	M[c]	S[d]
Mail delivery	walking	1	300	—	—	3,600	900	3,600	900
Meter reading	walking	1	12	—	—	72	18	72	18
Police patrolling	bicycle	1	1,095	6	14	4,380	1,095	4,400	1,115
Refuse collection	truck	5	52	85	61	415	97	511	193
Utility repairs	motorcycle-truck	2	730	27	181	2,190	320	2,398	528
Fuel delivery	truck	5	52	35	61	415	97	511	193
Freight delivery	truck	2	900	175	405	1,350	337	1,930	917
Total				278	722	12,422	2,864	13,422	3,864
Annual cost per house								13.50	3.88
Present value, capitalized for 20 years at 12 percent								100	29

SOURCE: Underlying data on capital costs and operating costs of vehicles are from Richard M. Soberman, "The Cost of Road Transportation in Venezuela" (processed; Corporación Venezolana de Guayana, Joint Center Guayana Project, División de Estudios, Planificación, e Investigación, File B-56, April 1968), and Marc E. A. Langevin, Edwin F. Clark, and Sicivid Ribbing, *Transporte en Caracas*, Report No. TAO/Ven/14 (United Nations, 1962); underlying data on wages of skilled and unskilled labor are from working papers of the Corporación Venezolana de Guayana on construction projects in Ciudad Guayana, Venezuela, 1962–64.

a. Capital cost, annualized for twenty years at 12 percent.

b. Operating and maintenance costs, excluding drivers' wages.

c. Based on relatively low market wage rates of Bs 3 and 4 per hour, except for Bs 8 per hour for one man in each of the two utility repair crews.

d. Based on subsistence wage rates of Bs 0.75 and 1.00 per hour.

utility lines; the lots in 1-22 are only 16 feet wide, compared with 25 feet in 1-17. Adding 9 feet times Bs 25 per foot,[21] to adjust for the difference in lot width, the costs per house for the standard improvements would be Bs 1,650 in neighborhood 1-22, only Bs 80 more than in neighborhood 1-17. Since poor families seem to prize street frontage more highly than the other improvements, at least in Ciudad Guayana, Venezuela, it probably is sensible to provide all houses with street frontage from the beginning, especially if the houses are to be built by self-help methods.

> Interestingly it has turned out that the most important factor in inducing these families to build houses to replace their shanties is the construction of streets; so far the existence of streets has proved a greater inducement than water, sewage facilities, electricity or schools, apparently because it distinguishes city living from country living.[22]

SEWAGE DISPOSAL COSTS. A third conclusion from comparing costs of various improvements, services, and street layouts for neighborhoods of one-story housing is that, if the soil can absorb domestic sewage, 15 to 20 percent of the cost of the standard improvements within individual neighborhoods can be saved by using a pit privy rather than a sanitary sewer main with an individual house connection. The savings may be enough to justify using a relatively large lot to obtain the necessary absorption capacity.

Table 2.7 shows that if neighborhood 1-4 had pit privies and public water taps, while neighborhood 1-17 had sanitary sewers and an indoor toilet, the cost of improvements per dwelling unit would be somewhat higher for neighborhood 1-17—if they also had ditches, paved streets, walkways, and transportation services, in addition to general site planning. With additional improvements, such as electricity or storm sewers in both neighborhoods, the small lots in neighborhood 1-17 would have a lower total cost; with fewer improvements, the large lots in neighborhood 1-4 would have a substantially lower cost, disregarding the costs of trips and utility lines outside the neighborhoods.

If privies are not feasible, pail-and-truck collection or communal toilets can be used to hold down the cost of sewage disposal and water

[21] See note 20, above.

[22] Lloyd Rodwin, "Ciudad Guayana: A New City," in *Cities, A Scientific American Book* (Alfred A. Knopf, 1965), p. 100.

TABLE 2.7. *Costs for Large Lots with Pit Privies and Outdoor Water Faucets, and for Small Lots with Indoor Flush Toilets*
(In bolivars per house)

Improvement	Large lot, neighborhood 1-4	Small lot, neighborhood 1-17
Water supply	268	445
Sewage disposal	70	311
Indoor toilet and plumbing	—	200
Subtotal	338	956
General site planning[a]	250	59
Ditches and paved streets	367	227
Walkways	40	21
Transportation	100	50
Total	1,095	1,313
Electricity	804	447
Total with electricity	1,899	1,760

SOURCE: Underlying data are from working papers of the Corporación Venezolana de Guayana on construction projects in Ciudad Guayana, Venezuela, 1962-64.

a. Some of the general site planning expenses probably should be included in the subtotal for water supply and sewage disposal.

supply. Table 2.8 shows the combined costs of water supply and sewage collection in neighborhood 1-17, for several combinations of quantities provided and methods used. The lowest cost based on market wage rates would be about Bs 515 per house, obtained by using small water mains with outdoor taps and pail-and-truck collection of sewage. At subsistence wage rates, using trucks for water supply and sewage disposal would cost only Bs 240 per house. If pail-and-truck collection of sewage is unacceptable, a combination of water and sewer mains and communal toilets and water taps could be provided for only Bs 600 per house. Mains, private connections, and an indoor flush toilet would cost about Bs 950 per house.

Conclusions about Different Layouts and Services for One-Story Houses

These results suggest that in planning the layout of individual neighborhoods and the qualities of service to be provided, total costs are

likely to be greatly reduced by making do with outdoor public water taps and either pit privies or pail-and-truck collection of sewage. With the large lots that are usually necessary for sanitary use of privies, significant savings can also be made by having two or more rows of houses on each side of a residential street. If street frontage is very important to the families, and if the houses are to be supplied with electricity, the lowest total cost will be obtained by using pail-and-truck sewage collection or a water-borne sewage system with communal toilets, for small lots. The addition of individual house connections and indoor plumbing costs Bs 650 or more per house, equal to the cost of about 100 square feet of housing built by self-help methods.

An efficient sequence in the course of developing a neighborhood of

TABLE 2.8. *Costs for Different Methods of Water Supply and Sewage Collection in Neighborhood 1-17*
(In bolivars per house)

Service	Method	Capacity	Cost
Water supply	outdoor faucets	240 gal./day/house	135
Sewage collection	truck	5 gal./day/house	380
			515
Water supply	truck	6 gal./day/house	120[a]
Sewage collection	truck	5 gal./day/house	120[a]
			240[a]
Water supply	outdoor faucets	1,440 gal./day/house	159
Sewage collection	sewers	1,440 gal./day/house	185
	communal toilets, 2 adjoining lavatories for 4 houses	—	250
			594
Water supply	individual connection	1,440 gal./day/house	445
Sewage collection	individual connection	1,440 gal./day/house	311
	indoor flush toilet	—	200
			956

SOURCE: Underlying data are from working papers of the Corporación Venezolana de Guayana on construction projects in Ciudad Guayana, Venezuela, 1962–64.

a. Based on a subsistence wage rate of Bs 0.75 per hour.

small lots would be to install water mains large enough to supply indoor bathrooms, but initially to have only outdoor taps and to use pail-and-truck collection of the sewage. The next step would be to install sewer mains large enough for later use of indoor bathrooms, and communal toilets. Then individual connections and indoor bathroom fixtures could be provided whenever individual families could afford them. The difference between the cost of water and sewer mains large enough for indoor bathrooms and the cost of mains adequate for outdoor taps and communal toilets is relatively small, about Bs 50 per house.

In a neighborhood where family income levels will be low for several years but are likely to rise substantially later on, it might be efficient to lay out the neighborhood with small lots, but to build houses initially on only one-third or so of the lots and use privies, having several lots available to absorb the waste from each privy. If and when the community's income level rises or its tastes change, it can put in a sanitary sewer and perhaps other improvements and simultaneously build houses on the intervening lots to keep down the cost per lot for the new services. Or if some of the families have had an increase in income or want more open space, they could be allowed to buy the adjacent empty lots. The price should include the costs of the improvements in front of these lots and, in a large city, a share of the costs of transportation and utility lines outside the neighborhood. (See the section on city-wide land use patterns, below.)

An additional advantage of keeping some small lots vacant, or of having large lots initially, is the opportunity for the families to expand their house on the ground floor without using up most of their ground space, as would happen with the small lots of 1-17 and 1-22. Extra ground space can be developed over time into the various forms of patio or courtyard which are traditional in much of Latin America. If their incomes do not rise, the families can sell off part of a large lot or rent it, though this will make it difficult to estimate and supply the demands on the utility systems, especially if the additional construction occurs at random.

City-Wide Land Use Patterns

In order to complete the comparison between the costs of using the neighborhoods of four-story housing and the costs of using single-story

housing, the costs of transportation and utilities outside the individual neighborhoods must be considered. Although the cost per family for housing and neighborhood improvements can be much lower with one-story houses than with four-story, walk-up apartment buildings, the higher feasible density with four-story buildings allows many of the streets, trips, and utility lines to be considerably shorter and generally less expensive. The costs of major streets and utility lines and of several types of trips were estimated for a number of schematic city-wide land use patterns.

The land use patterns compared are for a city with 336,000 families.[23] Half of the families are assumed to live in residential areas with an average gross density of eight families per acre, adequate for detached houses on lots about half the size of the lots in neighborhoods 1-4 and 1-4.6, or about twice the size of the lots in neighborhood 1-17. The other half of the families live in low-income residential areas with an average gross density of forty-eight families per acre, made up of neighborhoods like 4-36 and 4-71, or in areas with a density of sixteen families per acre, made up of neighborhoods like 1-17 and 1-22. The patterns have a central workplace, to which an average of one worker per family commutes from both the high-income and low-income residential areas. The central workplace is circular, with a radius of about two miles, and the residential areas form rings around it. With the low-income families living in areas having a gross density of sixteen families per acre, the radius of the whole city is about 4.4 miles; with them living in areas having a density of forty-eight families per acre, the radius is about 4 miles.

These patterns, compared with more realistic patterns, probably are biased toward reducing the relative cost of using the high-density neighborhoods. Having one job per family in the central workplace implies that over half of the city's jobs are located there, based on Venezuela's average household size of 5.6 persons and labor force participation rate of 31 percent.[24] This is probably a higher percentage than would be efficient even if a city of this size were built all at once, and

[23] With the average family size of four to six people that is prevalent in Latin America, 336,000 families would have a total of 1.4 to 2 million people, about the size of Caracas, Bogotá, Lima, and Santiago, according to recent censuses.

[24] Sources: household size: United Nations, *Statistical Yearbook, 1964* (U.N., 1965), Table 185; labor force participation rate: Simon Kuznets, "Quantitative Aspects of the Economic Growth of Nations, II. Industrial Distribution of National Product and Labor Force," *Economic Development and Cultural Change*, Supplement to Vol. II, No. 4 (July 1957), Appendix Table 8, p. 107.

TABLE 2.9. *Costs of Radial Transportation and of Major Utility Lines*[a]

Trip purpose	Income group[b]	Frequency, round trips per family per day[c]	Mode	Value of travel time, in bolivars per hour	Average cost,[d] in bolivars per family				Savings per low-income family in high-density neighborhoods,[f] in bolivars
					Pattern 1[e]	Pattern 2[e]	Pattern 3[e]	Pattern 4[e]	
Commuting	high	1	bus	0	870	870	1,090	950	
Commuting	low	1	bus	0	1,188	1,129	740	644	
Other	high	2	bus	0	1,740	1,740	2,180	1,900	
Other	low	2	bus	0	2,376	2,258	1,480	1,288	
Subtotal					6,174	5,997	5,490	4,782	
Total[g]					10,682	10,381	9,640	8,394	1,246
Commuting	high	1	taxi	4	10,100	10,100	11,610	10,680	
Commuting	low	1	bus	1	4,860	4,715	3,700	3,420	
Other	high	2	bus	0	4,116	3,998	3,660	3,188	
Other	low	2	bus	0					
Subtotal					19,076	18,813	18,970	17,288	
Total[g]					23,584	23,197	23,120	20,900	2,220
Commuting	high	1	car	8	14,480	14,480	17,530	15,650	
Commuting	low	1	taxi	2	7,750	7,450	5,675	5,275	
Other	high	2	bus	0	4,116	3,998	3,660	3,188	
Other	low	2	bus	0					
Subtotal					26,346	25,928	26,865	24,113	
Total[g]					30,854	30,312	31,015	27,725	3,129

Commuting	high	2	taxi	4	20,200	20,200	23,220	21,360	
Commuting	low	1	bus	1	4,860	4,715	3,700	3,420	
Other	high	1.5	bus	0	3,087	2,999	2,745	2,397	
Other	low	1.5	bus	0					
Subtotal					28,147	27,914	29,665	27,177	
Total[g]					32,655	32,298	33,815	30,789	1,866
Commuting	high	2	car	8	28,960	28,960	35,060	31,300	
Commuting	low	1	taxi	2	7,750	7,450	5,675	5,275	
Other	high	1.5	bus	0	3,087	2,999	2,745	2,397	
Other	low	1.5	bus	0					
Subtotal					39,797	39,409	43,480	38,972	
Total[g]					44,305	43,793	47,630	42,584	1,721

SOURCE: Underlying data on capital costs and operating costs of vehicles are from Richard M. Soberman, "The Cost of Road Transportation in Venezuela" (processed; Corporación Venezolana de Guayana, Joint Center Guayana Project, División de Estudios, Planificación, e Investigación, File B-56, April 1969), and Marc E. A. Langevin, Edwin F. Clark, and Sigivid Ribbing, *Transporte en Caracas*, Report No. TAO/Ven/14 (United Nations, 1962).

a. These estimates exclude the costs of streets, mains, and trips within individual neighborhoods, which are included in the neighborhood improvement costs (see Tables 2.3, 2.4, and 2.5) and they exclude the costs of utility lines in the central workplace, which would not vary much from one residential pattern to another.

b. High-income = upper half of the income distribution; low-income = lower half of the income distribution.

c. Assumed to take place 300 days per year.

d. The annual costs are capitalized at an interest rate of 12 percent for 20 years.

e. See Table 2.10, note h.

f. These savings are the minimum of the totals for patterns 1 and 3 minus the minimum of the totals for patterns 2 and 4.

g. The total equals the subtotal plus twice the total for truck trips and utility lines shown in Table 2.10; thus the total equals the combined cost for all the families divided among the 168,000 low-income families.

is almost certainly a higher percentage than would be efficient for a city of this size built up over several decades. Thus the number of commuters making the relatively long, expensive radial commuting trips is probably larger than would be efficient, tending to overstate possible savings in commuting costs obtained by using the high-density neighborhoods. Despite any such overstatement, the estimates show that the use of these neighborhoods would give a greater total cost than the use of one-story houses on small lots.

In addition to the costs of commuting to the central workplace from the residential rings, costs were estimated for other passenger trips and truck trips, between the residential rings and the central workplace, and for major utility lines outside the central workplace. A breakdown of transportation costs between passenger and freight transport and utility costs is shown for several different city-wide residential patterns in Tables 2.9 and 2.10.

The daily frequencies of both passenger and truck trips were based on very little empirical information about frequencies and patterns in Latin American cities and on data from transportation surveys of cities in the United States, since major transportation surveys have not yet

TABLE 2.10. *Costs of Water and Sewer Mains, Two-Lane Roads, and Truck Trips, by Residential Pattern*[a]
(In bolivars)

Item	Average cost, per family			
	Pattern 1[b]	Pattern 2[b]	Pattern 3[b]	Pattern 4[b]
Water mains	231	218	215	160
Sanitary sewer mains	46	44	44	33
Two-lane roads	107	100	106	78
Radial truck trips[c]	1,870	1,830	1,710	1,535
Total	2,254	2,192	2,075	1,806

SOURCE: Underlying data are from working papers of the Corporación Venezolana de Guayana on construction projects in Ciudad Guayana, Venezuela, 1962–64.

a. These estimates exclude the costs of streets, mains, and trips within individual neighborhoods, which are included in the neighborhood improvement costs (see Tables 2.3, 2.4, and 2.5).

b. In patterns 1 and 3, the low-income families live in neighborhoods of one-story houses, at 16 families per gross acre. In patterns 2 and 4, they live in neighborhoods of apartment houses, at 48 families per gross acre. In patterns 1 and 2, the high-income families live in the ring immediately surrounding the central workplace and the low-income families live in a ring outside this one; in patterns 3 and 4, the low-income families live in the inner ring and the high-income families live in the outer one.

c. These costs are based on an average of 22.5 round trips per family per year, at a cost of Bs 0.70 per truck-kilometer capitalized for 20 years at an interest rate of 12 percent (about 7.5 times the constant annual cost).

been made in Latin American cities. The combined number of commuting and other passenger trips to the central workplace is in accord with a figure reported for Caracas in 1955, which seems high in relation to trip frequencies in cities in the United States but which probably is explained by the prevalence of noon-hour commuting in Caracas. Since there was no data with which to estimate the breakdown between commuting trips and other trips, the costs were estimated for the present schematic layouts for two hypothetical breakdowns: the case in which all commuters make only one round trip per day and the case in which all high-income commuters make two round trips per day. The total costs do not vary much from one case to another, except in instances where the travel time of commuters is assumed to have a very high value, while the travel time of other passengers is assumed to be worth little or nothing.

The estimated frequency of the truck trips might be off by as much as a factor of two, so that the estimates of trucking costs show only the order of magnitude of the savings on freight transportation obtainable by using the neighborhoods of four-story housing. Even if the possible savings on trucking costs were twice as high as those estimated, however, the patterns with four-story housing would have a higher total cost for most of the relevant combinations of passenger trip frequencies and values of passengers' travel times.

The estimates of the costs of major utility lines and of basic two-lane roads needed to serve the residential rings indicate that the total cost of these lines and roads is much smaller than the operating and capital costs of the vehicles, capitalized for twenty years at an interest rate of 12 percent.[25] The average cost for each of the 336,000 families would be about Bs 200 for the major water mains, Bs 50 for the sanitary sewer mains, and Bs 100 for the basic two-lane roadways, or a total of about Bs 350. The combined cost per family for overhead electric transmission lines and for gas lines, if any, would be even less than the cost for sanitary sewer trunk lines.[26] The average capitalized cost per family for passenger and truck transportation ranges upwards from Bs 4,200, de-

[25] In contrast, at the neighborhood level the costs of the utility lines and other improvements are much larger than the costs of transportation. (See Table 2.3.)

[26] Major storm drainage facilities might cost several times as much as the basic roads and the other utilities put together, but their costs depend so much on the local topography and rainfall that estimates from one geographic area would have little

pending on mode of transport and value of travel time. Even more important, for the present comparison, is the fact that the variation in total utility costs from one pattern to another is much less than the variation in the transport costs.

The transportation and utility costs were estimated for two basic patterns of the residential rings—one with the ring of low-income families located closer to the central workplace and the other with the ring of high-income families located closer to it. For each of the basic patterns the costs were estimated with the low-income families living in the medium-density neighborhoods of one-story houses and in the high-density neighborhoods of four-story apartment buildings. Estimates were also made for marginal differences, with 1 percent of the low-income families living in a high-density neighborhood. For each of these patterns the transportation costs were estimated for several different combinations of modes and values of travel time. For most of the combinations, the total transportation cost was about the same with the low-income ring located closer in as with the high-income ring located closer in; the more expensive travel modes and higher values of travel time for the high-income commuters approximately offset the higher residential densities for the low-income commuters.

The possible savings in the total cost of transportation and utilities,[27] from using high-density housing, whether for all the low-income families or for just 1 percent of them, were less than Bs 2,800 per apartment unit for most of the combinations of modes and values of travel time, i.e., not enough to offset the higher combined cost of housing and improvements in the neighborhoods of four-story apartment buildings, unless the dwelling units were very small and were finished by contract construction (see Table 2.5). Only for a few combinations in which the travel time of the low-income commuters was assumed to be worth Bs 2 or more per hour, were the possible savings greater than Bs 2,800 per low-income family. In view of the high rates of unemployment that are common among unskilled workers in Venezuela and in most other countries in Latin America, it seems unreasonable to value their commuting time at as much as Bs 2 per hour, even though the market

meaning for another. Generally, both high- and low-density residential areas should be laid out so as to make the greatest possible use of natural drainage channels for storm water run-off.

[27] This includes the cost for the high-income residential ring.

wages for unskilled and semi-skilled labor are as high as Bs 3 or 4 per hour.

For the use of multi-story housing to appear efficient, the cost estimates would have to be based on one or more of the following conditions: travel time is valued at almost as much as the market wage rates, even for unskilled workers, despite high rates of unemployment; a high price has to be paid for unimproved residential land;[28] future costs are discounted at an interest rate well below 12 percent;[29] or the topography prevents economical use of large areas within a few miles of the center of the city, requiring longer average trips between the center and a given quantity of buildable land.

Decentralized versus Centralized Workplaces

To evaluate the possible efficiency of decentralizing some of the major workplaces in a large city, the costs of transportation and of major utility lines were estimated for several static patterns of workplaces and trips. These calculations, summarized below, suggest a slightly lower total cost of transportation and utilities for a decentralized pattern than for a centralized one.

TRANSPORT COSTS. Transportation costs were estimated for three square layouts about 36 square miles in area, with one, five and seventeen major workplaces which occupy 9 of the 36 square miles. One person per family, on the average, commutes to a job in a major workplace. In the patterns with five and seventeen major workplaces, one workplace at the center of the city has 30 percent of the jobs in the major workplaces; the other 70 percent is divided equally among the other four or sixteen workplaces. The commuters using the different modes

[28] An average price of Bs 16,000 per acre would imply additional savings of only Bs 667 per family from housing the families in the four-story buildings at a density of forty-eight families per acre instead of in one-story houses at a density of sixteen families per acre; this saving would give the high-density neighborhoods a lower total cost for a few more combinations of relatively high values of travel time.

[29] Discounting at 8 percent instead of at 12 percent would increase the present worth of a stream of constant annual costs by about one-third. The appropriateness of the higher discount rate is suggested by the fact that interest rates on six-month private loans are 8 percent or more in Venezuela. Rates on long-term private loans probably are much higher, to the limited extent that such loans are made at all.

and having different values of travel time live throughout the residential area at a uniform density.[30]

Average commuting distances were estimated, for the patterns with five and seventeen major workplaces, for three different tendencies of the commuters to live close to the decentralized workplace to which they commuted. The 30 percent who worked in the central workplace were assumed to have the same average commuting distance in the decentralized patterns as in the pattern with just one major workplace.

The cost of commuting to jobs outside the major workplaces is assumed to be the same for each of the three layouts, on the grounds that most of them are neighborhood service jobs which probably would be filled by people living close to them, whether or not the major workplaces were decentralized. The cost of passenger trips for purposes other than commuting is assumed to be the same for each of the layouts, since most of these trips would be made to the central business district or to the commercial and institutional activities in the residential areas. The cost of freight transportation to and from the residential areas and to and from places outside the city also is assumed to be the same for each of the layouts.

The costs of freight trips between and within the major workplaces were estimated for two different tendencies of the truck trips to have their origin and destination in the same major workplace. Table 2.11 shows the differences between the cost of commuter and freight transportation with just one major workplace and the costs of this transportation in the patterns with five and seventeen workplaces. The figures shown are average costs per family, capitalized for twenty years at 12 percent. The differences were calculated for four combinations of commuting modes, values of travel time, and patterns of truck trips. For most of the combinations, the average cost per family for commuting and intracity freight transportation would be considerably lower with five major workplaces than with just one, and a little lower with seventeen major workplaces than with five. Only in the extreme case where it

[30] The calculations for layouts with and without neighborhoods of multi-story housing suggested that the cost of transportation and major utility lines did not differ by more than about 10 percent between a layout with the lower-income families living closer to the one major workplace and a layout with the higher-income families living closer to it. Therefore, having the two groups evenly spread throughout the residential area would overstate the lowest possible total cost by not more than about 5 percent.

TABLE 2.11. *Difference between Commuting and Trucking Costs with One Central Workplace and Corresponding Costs with Five or Seventeen Separated Workplaces, in a City 10 km by 10 km*

(In bolivars per family, capitalized for 20 years at 12 percent[a])

Cost item	Five workplaces			Seventeen workplaces		
	$k=70$[b]	$k=56$[b]	$k=42$[b]	$k=70$[b]	$k=42$[b]	$k=28$[b]
Commuting mode: bus[c] 100%; commuter time value: 0 Bs/hr						
Bus cost	439	380	327	565	475	403
Trucking cost, pattern B[d]	−197	−197	−197	−228	−228	−228
Total cost	242	183	130	337	247	175
Bus cost	439	380	327	565	475	403
Trucking cost, pattern A[d]	−413	−413	−413	−544	−544	−544
Total cost	26	−33	−86	21	−69	−141
Commuting mode: bus[c] 100%; commuter time value: 1 Bs/hr						
Bus cost	439	380	327	565	475	403
Bus travel time	446	332	222	656	444	289
Trucking cost, pattern A[d]	−413	−413	−413	−544	−544	−544
Total cost	472	299	136	677	375	148
Commuting mode: bus[c] 50%, taxi[e] 50%; commuter time values: bus 0 Bs/hr, taxi 2 Bs/hr						
Bus cost	220	190	164	283	236	202
Taxi cost	549	480	407	705	595	504
Taxi travel time	298	222	146	437	296	193
Trucking cost, pattern A[d]	−413	−413	−413	−544	−544	−544
Total cost	654	479	304	881	583	355
Commuting mode: bus[c] 50%, taxi[e] 40%, car[f] 10%; commuter time values: bus 0 Bs/hr, taxi 2 Bs/hr, car 4 Bs/hr						
Bus cost	220	190	164	283	236	202
Taxi cost	823	720	610	1,057	893	755
Taxi travel time	347	333	219	655	444	290
Car cost	358	266	175	725	355	232
Car travel time	239	177	116	349	236	154
Trucking cost, pattern A[d]	−413	−413	−413	−544	−544	−544
Total cost	1,574	1,273	871	2,325	1,620	1,089

SOURCE: Underlying data are from working papers of the Corporación Venezolana de Guayana on construction projects in Ciudad Guayana, Venezuela, 1962–64.

a. Equals the product of (1) annual costs for 20 one-way trips per year (2) one-twentieth of the number of one-way trips per year, (3) the percentage of commuters using the mode, and (4) 7.469 (the capitalization factor). Value of travel time reflects only the value of commuting time. The value of the drivers' time is included in the vehicle costs.

b. The percentage of commuters working in the decentralized workplace closest to their homes is represented by k. Since 30 percent of the commuters work in the central business district, 70 percent is the maximum possible percentage.

c. Based on 600 one-way trips per commuter per year, and 1,200 one-way vehicle trips per year. The average one-way distances for the bus and taxi trips in the patterns with five and seventeen workplaces were reduced to allow for balanced passenger volumes, instead of empty back-hauls, over some of the routes.

d. Higher percentages of the truck trips begin and end in the same major workplace in pattern B than in pattern A.

e. Based on 900 one-way trips per commuter per year (e.g., 50% of the commuters make a second round trip at noon) and 1,800 one-way vehicle trips per year. The average one-way distances for the taxi trips in the patterns with five and seventeen workplaces were reduced to allow for balanced passenger volumes, instead of empty back-hauls, over some of the routes.

f. Based on 1,200 one-way trips per commuter per year and per car per year.

is assumed that all the commuters take the bus and that their travel time has no value to the economy, does the pattern with five workplaces have a higher total transportation cost than the pattern with just one workplace (for two of the three commuting patterns). Even in this extreme case, the pattern with seventeen workplaces has a lower total cost than the pattern with just one, if a large percentage of the truck trips have their origin and destination in the same workplace. If all the commuters take the bus, but have a value of Bs 1 per hour for their travel time, then the patterns with five and seventeen workplaces have a considerably lower total cost than the pattern with one workplace, even if the pattern of truck trips is relatively scattered. Or if 50 percent of the commuters take the bus and have their travel time valued at zero and the other 50 percent take group taxis and have their travel time valued at only Bs 1 per hour, the patterns with five and seventeen workplaces have a lower total cost than the pattern with one workplace, except for the pattern with seventeen major workplaces if the commuters have little tendency to live near their workplace.

With a combination of modes, trip frequencies, and values of travel time which probably approximates the situation in many Venezuelan cities today (50 percent of the workers take a bus, with their travel time valued at zero; 40 percent take a group taxi, with their travel time valued at Bs 2 per hour; and 10 percent use a private car, with their travel time valued at Bs 4 per hour), the capitalized transportation costs would average at least Bs 300 less per family with five or seventeen major workplaces than with just one.

On the basis of the estimates shown in Table 2.11, it appears that if the travel time of a substantial percentage of the commuters is worth Bs 1 or more per hour, or if a large percentage of the commuters will live close to where they work, then a pattern with several decentralized workplaces appears quite likely to have lower total costs for commuting and intracity truck transportation.

UTILITY COSTS. The savings are not so large, however, that possible increases in the costs of the utility systems can be ignored. The cost of water mains for a small city about 6 square miles in area was estimated to be roughly 20 to 30 percent smaller with one central workplace than with sixteen decentralized workplaces. The water mains cost more for

the decentralized pattern largely because the stand-by capacity needed for fire flow is much larger for the workplaces than for the residential areas. The extra cost of providing this stand-by capacity to separated workplaces was greater, in this case, than the reduction in the costs of the major mains serving only the residential area. For a larger city, the cost of water mains with a decentralized pattern of major workplaces probably would be only 10 to 20 percent larger than the cost with one central workplace.[31] Estimates of the costs of sanitary sewer lines suggested that they would be about the same with four decentralized workplaces as with one central workplace, in schematic square layouts of 6 square miles and of 36 square miles.

It is likely that a decentralized pattern would have somewhat higher costs for electric power distribution, telephone communication, and piped gas supply (if any), because the density of demand for these services would be much higher in the workplaces than in the residential areas. But these extra costs probably would be small in comparison with the extra cost for water distribution. It is possible that the costs of storm drainage facilities would be considerably higher with a decentralized pattern than with just one major employment area, but the estimates of the costs of sanitary sewers suggest that the difference would be quite small for a uniformly sloping topography. With irregular topography and natural drainage channels, a decentralized pattern might well have lower costs for storm drainage facilities.

Considering all the utilities together, it seems likely that the savings on utility costs would not be more than Bs 200 per family with a single major workplace instead of several decentralized workplaces, in a city about 36 square miles in area with eight or more families per gross acre in the residential sections and about three times as many workers per gross acre in the major workplaces. Bs 200 per family is less than all six estimates of the net savings in commuting and freight transportation costs from having a decentralized pattern of workplaces in such a city, based on the distribution of modes and values of travel time that seem reasonable for Venezuela. (See estimates for "Bus, Taxi, and

[31] The capacity needed for fire flow distribution would be a smaller percentage of the capacity needed for regular distribution; fire flow needs have been found to increase less than in proportion to the size of a city's population or the density of its central business district.

Car," bottom row, Table 2.11.) Therefore, even if a city as large as this were built up all at once, it probably would reduce the total cost of transportation and utilities to have several decentralized major workplaces rather than just one, based on the cost structure of Venezuela's economy in recent years.

This conclusion about decentralization of workplaces applies—and applies with much greater certainty—to the more realistic cases in which an increase of a million or more people in one city will take several decades.[32] In such cases, a policy of decentralizing some of the major workplaces by building a new decentralized workplace every few years, at the edge of the already built-up area, is likely to have a considerably lower total cost than a policy of adding most new workplaces around the central area. For a centralized pattern, the most efficient sequence of land uses will begin with a fairly wide ring of vacant land between the initially built-up central workplace and the surrounding residential area, and may require the eventual destruction of some housing and neighborhood service buildings while they are still in good condition. A decentralized pattern, in contrast, can begin with the housing built closer to the first major workplace—shortening the lengths of the commuting trips and reducing the annual cost of transportation, at least for the first few years. With the high interest rate that is relevant in Venezuela, these reductions in the costs for the first few years give a relatively large reduction in the present value of all the future costs. In addition to having lower transportation costs in the early years, a more decentralized pattern is also likely to have less eventual demolition of usable buildings, because the original workplaces will not expand so rapidly, if at all, as in a centralized pattern. The existence of old low-cost housing near the original workplace may induce some workers to make relatively long commuting trips to the newer workplaces in order to live in this housing. By doing so, however, they probably will be reducing their total cost of housing and transportation compared to buying newer housing closer to the new,

[32] Caracas has had the largest increases in population among Venezuela's cities, growing from 359,000 in 1941 to 694,000 in 1950 and to 1,359,000 in 1961 (República de Venezuela, Ministerio de Fomento, Dirección General de Estadística y Censos Nacionales, *Anuario Estadístico de Venezuela, 1953* [1956], Table 21, p. 24, and *1957-1963*, Vol. I [1964], Table 140, pp. 150-51).

decentralized workplaces. Even if they do not reduce their own total cost, their use of the old housing will almost certainly reduce the total cost of housing and transportation for the whole economy.[33]

Summary

Urban populations are growing so rapidly in the underdeveloped countries that a substantial percentage of urban families live in tiny makeshift dwellings and lack sanitary water supply and sewage disposal systems. In addition, many people must endure fatiguing journeys to work. Improvement of these conditions might increase the productivity of these workers as well as directly improve the quality of life for the whole urban population. To illustrate methods of determining efficient layouts which would provide housing, transportation, and utilities commensurate with family income levels, costs were estimated for several types of residential development and for several patterns of residential areas and major workplaces in the context of a large city, based primarily on the cost structure of Venezuela in the early 1960's.

The estimates showed that the total cost of housing, transportation, and utility lines in neighborhoods for several hundred low-income families would be considerably higher with the use of four-story, walk-up apartment buildings with little or no interior finishing than with the use of low-quality, one-story houses on small lots. Comparing the costs of different types of neighborhoods of one-story housing, the costs for a given size of lot can be reduced considerably by using privies or pail-and-truck sewage collection instead of indoor bathrooms. If a relatively large lot is needed for the safe use of a privy, as is frequently the case,

[33] The goal of land use planning, of course, should be to maximize benefits net of costs rather than to minimize costs. A policy of decentralizing the major workplaces may prevent some benefits of "agglomeration" from being realized. But in a large, rapidly growing city most of these benefits probably could be obtained if most of the administrative activities were located in a central business district, while manufacturing plants, warehouses, and freight transportation terminals were located in one or more areas away from the central business district. Specialized services and supplies could be provided to these outlying workplaces from the central business district on less than an hour's notice, and telecommunications would allow cheap transmission of messages between different workplaces.

the cost per dwelling unit for a standard set of neighborhood improvements[34] is likely to be smaller for a small lot with a sewer connection than for a large lot with a privy.

In the context of a large city, the costs compared should include the costs of transportation and utility lines outside the individual neighborhoods, since these costs can be smaller for a given number of families if their housing occupies a smaller land area (gross of streets and open areas). Estimates of these costs for several layouts of residential areas for 336,000 families surrounding a large central workplace suggested that total costs would be less if the families in the lower half of the income distribution lived in neighborhoods with sixteen one-story houses per acre than if they lived in neighborhoods of four-story apartment buildings with forty-eight dwelling units per acre. The use of some apartment buildings would give a lower total cost if the commuters' travel time were valued at a high percentage of the market wage rates or if future costs were discounted at an interest rate much below 12 percent, but such valuations and discount rates probably are inappropriate in Venezuela and other countries with high rates of unemployment and relatively little capital. Their use would also give a lower total cost if high prices had to be paid for the unimproved residential land or if large tracts of land near the central workplace were too swampy, rocky, or steep for low-cost construction, requiring longer trips to reach given quantities of buildable land.

Differences between the costs of transportation and utilities for several patterns of major workplaces, in a city about 36 square miles in area and with about 1 million people, suggest that the total cost would be a little lower with four or sixteen decentralized major workplaces and a central business district than with one large central workplace, even if the patterns were built all at once. In the more likely case where this much growth in one city takes several decades, developing a new major workplace every few years at the edge of the then existing residential area probably would cost much less than having a single expanding major workplace at the center of the city. The likely efficiency of decentralizing the workplaces over time also reduces the number of cases in which the use of the four-story apartment buildings would allow lower total costs. The savings on transportation and utility costs

[34] This includes streets and electric lines as well as water supply and sewage disposal.

from using such buildings, estimated for a pattern with one large central workplace, probably are higher than they would be for a pattern with several decentralized workplaces.

Politicians and planners in the developing countries and national and international aid agencies tend to be preoccupied with economic growth. Their attention is focused on increasing agricultural and mineral production and exports and on expanding industrial output. Scant attention is paid to developing the cities efficiently. When confronted with the need for urban facilities, planners generally conceive of plans and projects in terms of "schools" or "hospitals" or "low-income housing," without considering their implications for transport and utility costs. If whatever gains achieved in economic growth are not to be wiped out not only by population growth per se but also by the costs of providing shelter and utilities for the vast increases in city populations, development planners are going to have to plan for and make choices with regard to urban development in order to hold down the total costs of building and servicing cities—costs which, in any case, are going to absorb an increasing proportion of the budget of virtually all countries.

CHAPTER 3

Transport and Food

WILFRED OWEN

GETTING ENOUGH TO EAT is not only the highest priority problem facing most of the world's people today, but one that threatens to worsen rapidly in the years immediately ahead. According to the Food and Agriculture Organisation (FAO), food requirements of the developing nations will increase by a staggering 112 percent by 1985. Transport policy makers have a vital role to play in the war against hunger, both in providing necessary transport facilities and services and in contributing to wise investment decisions in related areas that can help assure the supply of additional food and its distribution to consumers.

The most important factor contributing to higher food needs is population growth, which is being intensified by industrialization and urbanization. Not only is the total demand for food increasing, but more food has to be moved greater distances to feed increasing numbers of nonagricultural families. Transport is becoming a primary factor in food production processes as well, for with the gradual disappearance of unused land in most parts of the world the principal means of increasing productivity is to apply fertilizer, seed, insecticides, and mechanical equipment to existing cultivated areas. This means moving these supplies from the urban-industrial sector.

If agriculture is to respond to the growing demand, therefore, it will be necessary to accommodate increased traffic flows in both directions: inputs moving from urban areas to the farm, and output moving from the farm to the city. The task involves very large additions to rural

road networks, extensive investment in trucks, the expansion of storage and processing facilities, and new institutional arrangements for managing and financing the total system.

The Effects of Transport on Agriculture

The relation between good transportation and the ability to grow and market more food has been demonstrated in many parts of the world. In Thailand, the Friendship Highway transformed partially used jungle land along its hundred-mile route into highly productive and prosperous farms. Travel time was reduced from eleven hours on the old road to three on the new. The production of sugar cane, vegetables, bananas, and other fruits more than tripled in three years. Surplus corn was exported to Japan.[1]

In Bolivia, the highway from Cochabamba to Santa Cruz reduced travel time in the rainy season from several weeks to fifteen hours and provided a link between the country's food supplies and its people. Until then the price of home-grown rice was 50 percent higher than imported rice because of the high cost of transport. The highway largely eliminated costly imports.

In Costa Rica, before the Inter-American Highway was constructed, driving beef cattle on the hoof from grazing lands to San José often resulted in a 40 percent loss of weight, and imports were necessary to supply local needs. With an all-weather highway, it was possible to deliver truck-trailer units of cattle over night, and Costa Rica became self-supporting in meat.[2]

Where transport has been added to the other ingredients of a successful program for food and agriculture the results have been rewarding. Conversely, there are many more examples of how lack of transport has frustrated the effort to produce more food. In many areas, agriculture is extremely limited by poor quality and high cost of rural mobility. Access roads become impassable for two to three months of

[1] Wisit Kasiraksa, *Economic Effects of the Friendship Highway* (Bangkok: SEATO Graduate School of Engineering, 1963).

[2] U.S. Department of Commerce, World Trade Information Service, *Motor Transport in Middle America*, Bulletin 4, No. 55-13.

the year, costs are high, marketing possibilities are uncertain, and incentives to produce are low. It has not been possible to change traditional patterns of production or to alter traditional methods of cultivation except where transport is adequate. Thus, transport serves as a means of moving ideas and information as well as goods.

Poor transport has the added effect of preventing farmers from specializing in the crops that offer the best return. Where transport is inadequate, each grower attempts to keep his family and livestock supplied with all their needs, and he retains more food than he may actually need. He knows that if he runs short it will be difficult to tap other sources, and more expensive because of high transport costs.

Inaccessibility means that plant protection and fertilizing operations are subject to infrequent deliveries and unreliable schedules. Agricultural extension workers find it too time consuming to visit farmers off a hard-surfaced route. The fact that fruits and vegetables constitute only 3 percent of world protein consumption is attributable in part to poor transport, for these and other foods that could readily increase the supply of proteins, vitamins, and minerals all require good transportation.

It would be a mistake to overemphasize transportation, however, for a package of many ingredients is necessary to increase agricultural output, including irrigation, seed and other supplies, technical assistance, credit, marketing and storage, processing facilities, and adequate prices. The decision maker has to weigh all of the significant factors and combinations of factors capable of increasing output. A systems approach to agricultural development is essential if the problem of feeding the world's people is to be successfully resolved.

Inputs Needed for Higher Yields

The package approach has been made necessary by the need for marketable surpluses and the necessity of producing them on land already in use. It is no longer possible to produce more food simply by extending the area under cultivation. Major increases in output can be accomplished only from higher yields per acre. India, China, and Pakistan, which account for 60 percent of the total population of the underdeveloped world, are now almost entirely dependent on more intensive cultivation of land already being farmed.

Achieving "a yield-per-acre takeoff" presupposes improved transport.[3] One of the most important transport tasks will be the movement of fertilizer. In the early 1950's, world consumption of fertilizers totaled 17 million metric tons. Less than a decade later, the total had risen to 29 million metric tons. The largest increases were in Latin America, where consumption rose 163 percent, and in the Far East, where the increase was 115 percent. While many factors contribute to higher agricultural yields, including improved seed, insect and disease control, irrigation, drainage, and mechanization, "the use of commercial fertilizer is probably the factor most responsible."[4]

Experiments designed to isolate the productivity effects of fertilizer have been conducted in a number of countries, and the results, summarized in Table 3.1, show the very substantial increases in yield that can

TABLE 3.1. *Effect of Fertilizer on Yields of Selected Crops*

Country	Crop	Duration of experiment (years)	Percent increase in yield per fertilized hectare[a]
India	Tea	10	92
Western Germany	Hay	10	146
India	Tapioca	1	197
Tanganyika	Peas	1	217
United States	Wheat	4	247
Puerto Rico	Sugar Cane	5	318

SOURCE: U.N. Food and Agriculture Organisation, *The State of Food and Agriculture, 1963* (Rome: FAO, 1963), p. 144.

a. With most favorable combination of primary nutrients, nitrogen, phosphorus, and potassium.

be obtained. But for the most part the use of plant nutrients has just begun, and per-acre yields in developing countries have as yet increased very little. From the late 1930's to 1960, the increase for Asia and Latin America was only 10 percent, compared to 190 percent for North America. In India the low level of agricultural productivity reflects the fact that fertilizer consumption is one-hundredth the level achieved in Japan. The fact that the 1970 food grain target is 125 mil-

[3] Lester R. Brown, "Population Growth, Food Needs and Production Problems," *World Population and Food Supplies, 1980* (American Society of Agronomy, February 1965), p. 11.

[4] U.N. Food and Agriculture Organisation, *The State of Food and Agriculture, 1963* (Rome: FAO, 1963), p. 137.

lion tons, a 65 percent increase over 1965, indicates the extent to which fertilizer applications must be depended on in the immediate future. Present plans call for expanding the use of nitrogen fertilizer fivefold by the early 1970's, from two-thirds of a million tons to 2.4 million tons per year.

Tanganyika provides another illustration of the trends. Between 1945 and 1960 there was a twentyfold increase in the tonnage of fertilizer imported, most of it used by estate agriculture producing sugar and tea, but with increasing amounts going to other users. The growing demand for food has made it increasingly difficult to increase fertility by letting the land lie fallow for fifteen or twenty years. Fertilizers can now supplant these ancient soil maintenance methods, but in Africa, as elsewhere, the economic barrier is often "the high cost of carrying fertilizer from port to farm. . . ."[5]

The effective use of fertilizer requires not only that supplies be moved, but that they reach the cultivator at the right time. This means roads, vehicles, and a network of distribution centers in rural areas, within easy reach of the farmer. The lack of such facilities precludes the general use of fertilizers, as well as the adoption of other technological innovations. ". . . It can be stated with confidence that reduction of distribution costs is now the essential condition for bringing many technical innovations effectively into play."[6]

Many other inputs needed for intensive agriculture will add to the transport burden. They include seed, sprays, and mechanized equipment. In India the area to be treated with plant protection materials is expected to quadruple in the next five years, requiring a 160 percent increase in the availability of pesticides, weedicides, and rodent control materials. The use of hand and power sprayers and dusters will add further to the distribution of agricultural inputs. The small gasoline engines used for plant protection, small irrigation works, and other purposes will include new power-operated machines and manually operated equipment.

[5] William O. Jones, "Food and Agricultural Economies of Tropical Africa," *Food Research Institute Studies*, Vol. II, No. 1 (Stanford University, February 1961), p. 10.

[6] William O. Jones, "Environment, Technical Knowledge, and Economic Development in Tropical Africa," *Food Research Institute Studies*, Vol. V, No. 2 (Stanford University, 1965), p. 112.

The Potentials of Package Programs

The possibility of achieving more productive agriculture by concentrating the various needed agricultural inputs in certain areas has been demonstrated in India. The so-called package program for intensive agricultural production has included help to the farmer in farm planning, soil preparation, water management, and the application of fertilizers, seed, pesticides, tools, power sprayers, dusters, and other farm machinery. The program also involved a variety of "off-the-farm" activities essential to increased productivity, including training, credit, cooperatives, and storage. But in spite of the reliance on large volumes of inputs, plus the marketing of increased output, the program did not include measures designed to improve transportation. As could be expected, however, the areas where intensive efforts have been a success are those that are more accessible.

An example is the package program in Ludhiana District of the Punjab, where intensive cultivation has led to marked increases in wheat production per acre wherever access by road has made the program operable.[7] After three years of the five-year experiment, the yield per acre had increased 40 percent, the area under cultivation had grown, and total output had expanded 68 percent. In three years the consumption of chemical fertilizers increased fivefold.[8]

As a result of these efforts, farmers in Ludhiana District were getting an additional return of 126 rupees per acre compared to extra costs of 54 rupees. And in Orissa, rice yields have averaged 2,574 pounds per acre in the package districts compared to 1,760 pounds elsewhere. The added return was 110 rupees per acre, compared to added costs of 60 rupees.[9]

[7] Ludhiana District has 800,000 acres and 1.2 million people. It is about 40 miles by 20 miles. In each of the ten blocks of the district, there are 80 villages, 1,000 to 2,000 huts, 300 depots for the sale of fertilizer, and 1,000 rural credit societies.

[8] Intensive Agricultural District Program, "Story of Wheat, Groundnut and Maize in Ludhiana" (processed; Ludhiana, 1964).

[9] Ford Foundation, "India's Intensive Agricultural District Program," India Program Letter 134 (processed; New Delhi, July 10, 1964).

The Importance of Market Roads

The backward state of agriculture in two-thirds of the world is obviously the result of a wide variety of deficiencies, including inadequate water supplies, the absence of other inputs for commercial agriculture, the lack of organized markets, the dearth of financial resources, and the dominance of traditional viewpoints that perpetuate stagnation. But often an underlying factor is the absence of ties with the outside world through communications and trade channels. An extreme case of how lack of transport inhibits development is the State of Uttar Pradesh, one of the poorest areas of India yet agriculturally one of the richest. This state of 90 million people in the Gangetic plain suffers from extremely low physical and financial returns per acre despite rich soil. The natural course of economic development in this area would be the development of rural-urban trade that supplied tools, fertilizer, implements, and consumer goods for the farm population in return for the food and agricultural raw materials needed by the rapidly growing urban sector. This trade has not developed, and a visit to this area over long mileages of the most wretched roads cannot fail to leave a distinct impression that the time and cost of developing any marketing relations between the two sectors would be prohibitive under existing transport conditions. Actually, 36 percent of all the villages in this area have no road at all.

In many areas of the Punjab, village-access roads have a clay content that becomes so slippery during two to three months of the monsoon that they cannot be walked on, let alone used by animal-drawn carts or bicycles. It has not been possible to grow vegetables and other perishables for market except where transport is sufficiently fast and reliable to enable producers to move their produce to town daily.

On a poor road the trip to market, if it is possible at all, may be too hard on the bullocks. Their primary task is to do the plowing and cultivating, so that farmers are reluctant to use them for transport except under favorable conditions. Milk producers living on a poor road also find it difficult to market their milk because the milk collector, who travels by bicycle, is able to carry at least twice as much milk on a

good road, and therefore avoids collecting from farms with poor access.

The return realized by wheat farmers is also limited by the cost of transport over bad roads to the main highway. Average charges to hire bullock cart transportation were found in one location to be from 10 to 20 cents per 82 pounds for only a few miles. This cuts the farmer's margin and often makes it unprofitable for him to attempt to market his produce.

Farmers on bad roads have additional problems. They find it difficult to persuade rural electric authorities to extend service to areas where maintenance of lines will be impeded by poor access. Plant protection measures as well as fertilizing are made difficult due to infrequent deliveries and unreliable schedules. A very small percentage of high school age children are able to get to school. Literacy workers shun the village that is poorly served by road, and agricultural extension workers find it either impossible or too time consuming to visit farmers on muddy roads. Villages far from an all-weather road complain of being unable to get help in constructing a well. Thus, even where a variety of help is available to the farmer, it will stop short of his farm unless it is easily accessible. Access to market is not simply a matter of having a road, however, but of distance to be traveled to the nearest market and the condition of the route. For example, of the villages with no road, 46 percent are 5 to 10 miles from an important market, and 21 percent are more than 10 miles away. Even the 26 percent of Uttar Pradesh villages located on a surfaced road are often remote from market, with fully 11 percent more than 10 miles from a ma-

TABLE 3.2. *Accessibility of Villages to Road System, Uttar Pradesh*
(Percent of total villages)

Region	On surfaced road	On unsurfaced road	On no road	All villages
Eastern	28	42	31	100
Central	29	35	36	100
Western	34	32	34	100
Hill	11	42	47	100
State as a whole	28	37	36	100

SOURCE: Government of Uttar Pradesh, Uttar Pradesh Transport Survey (Preliminary Report) (Kanpur, February 1967).

jor center where they can both sell their produce and buy needed supplies. Such distances are considerable for farmers who depend on bullock carts, camels, or headloading. But for the other 38 percent of the villages located on unimproved dirt roads that are often no more than a track, the trip to market is much more difficult. Some 15 percent are more than 10 miles from a market center, and 22 percent are 5 to 10 miles distant.

Effects of Improved Transport

What happens to agriculture when transport is improved along with the supply of other farm inputs is seen from the rural works program in East Pakistan. Until recently, 80 percent of all farms had no direct access to a road. Transport in this area is particularly hampered by the combination of low-lying land, intricate river system, and monsoon flooding. Farm-to-market transportation has been accomplished principally by country boat, a method made unreliable during the winter drought and summer rains.

Several years ago an effort was begun to remedy some of the conditions that made agricultural yields in East Pakistan among the lowest in the world. The farming population was idle during the four dry winter months. Half the landowners were in debt. Their repayment obligations forced them to market their crops as soon as they were harvested, and at prices far below what the same crops would command a few months later. High interest rates discouraged the financing of fertilizer and other inputs.

The situation was not the kind that one would expect a roadbuilding program to cure. Yet the rural public works program in East Pakistan, concentrating on roadbuilding in relation to the development of agriculture, has demonstrated how roads plus other necessary measures can in combination create the environment necessary for successful agriculture.[10]

The beginning of a way out was the establishment of an Academy for Village Development, with the objective of training rural develop-

[10] Pakistan Academy for Rural Development, *Fourth Annual Report, June 1962-May 1963* (Comilla, East Pakistan, 1963).

ment officials for work in agricultural extension, administration, and public works. One of the principal undertakings was to organize the villages into multipurpose cooperative societies which could pool savings and provide loans to acquire needed agricultural inputs. A central cooperative federation was established to provide credit to the individual cooperatives, to rent equipment, and to provide for maintenance and repairs. Cooperative storage facilities and marketing made it possible for farmers to obtain better prices, and the cost of what they purchased was reduced through cooperative buying.

The next step was the launching of a pilot rural works program financed by the Department of Agriculture. Some work was done to improve irrigation and flood control, but the major program was low-cost road construction. Thousands of miles of roads were built or repaired, and bridges and culverts constructed. There was a project every 10 miles throughout the province, involving great numbers of workers. Physical accomplishments from 1961 to 1964 included the improvement or construction of 24,000 miles of village-to-market roads and more than 700 miles of asphalt roads. Work was also done on 5,400 bridges and culverts.

Now it was possible to market crops by rickshaw and bullock carts rather than headloading. The result was an 80 percent reduction in transport costs that increased the return realized by the farmer by more than 21 cents for 82 pounds of paddy. In addition, the amount of wages paid to those who worked on the program greatly stimulated purchases in the area and the cooperatives expanded very rapidly. In addition, the program helped to uncover significant skills and leadership qualities among rural residents.[11]

Transport as an Input to Agriculture

In some instances the construction of a rural road may induce an immediate response in improved agricultural output. New settlers often move in and begin cultivating even before construction is completed. These results can be expected when a road is built through fer-

[11] Richard V. Gilbert, "The Works Programme in East Pakistan," *Development Digest*, Vol. III, No. 2 (National Planning Association, July 1965), pp. 19-30.

tile country inhabited by enterprising farmers, and where there are urban or foreign markets sufficiently accessible. But there are many examples of roads that have been built under less favorable conditions which have led to no appreciable increases in agricultural output. When a highway is built through relatively poor land and difficult topography and where there is an absence of markets or of inputs necessary to increase production, these factors individually or in combination will limit the development impacts of better access.[12]

Attempts to improve rural road transport are often based on plans that reflect political and geographic factors rather than the needs of agriculture. In the United States, for example, there are now 400,000 miles of rural roads that are considered to have no economic justification and that should no longer be a public responsibility.[13] These roads were not built as part of a program to increase agricultural output, but rather as a means of responding to political pressures or of laying out tracts of land for speculation. How can the developing nations avoid such a waste of resources in carrying out their programs for increased food production? If they were to follow the example of the more developed countries, in which 3 to 4 miles of road have been built for each square mile of cultivated land, the world highway network would have to be increased from the existing 10 million miles to 16 million miles. The additional 6-million-mile network would cost at least $30 billion.

The answer to the question lies in planning roads as an integral part of intensive agriculture, as one of the essential ingredients of increased production and marketing. This means adding road costs to other input costs and comparing the total with the anticipated increase in food and other agricultural output.

To illustrate, a 10-mile stretch of road that is surfaced to permit commercial agriculture may be expected to influence the surrounding land to a depth of at least 1 mile from the roadway. A total of 10 square miles on each side of the road, or 20 square miles in all, will be opened up for intensive cultivation, or a total of 12,800 acres. These

[12] See George W. Wilson, Barbara R. Bergmann, Leon V. Hirsch, Martin S. Klein, *The Impact of Highway Investment on Development* (Brookings Institution, 1966).

[13] U.S. Department of Commerce, Bureau of Public Roads, *The Local Rural Road Problem* (January 1950).

acres can be assumed to have an average yield of 1,000 pounds of wheat per acre even with a bad road. Of this output, as much as 20 percent, or 200 pounds per acre, might be sold. The total marketed surplus for the entire 12,800 acres would amount to 2.5 million pounds. The rest would be consumed locally.

A good road, by making it possible to use substantial amounts of fertilizers and other inputs, could create the conditions necessary to double output to 2,000 pounds per acre. If it is assumed that all of this additional 1,000 pounds of output are sold, the marketable surplus is increased by 10.3 million pounds. The extra costs incurred to obtain the increased yield during the first year are listed in Table 3.3.

In this example, however, the full cost of the new road in India, 4.1 million rupees, is charged to the first year of the program. If this item is allocated over a ten-year life span, the annual capital cost, assuming a 20 percent interest rate, would be only about 33,000 rupees, and total input costs would be reduced to 3.9 million rupees. Either way, the costs are less than the increased income that would be realized from the extra 12.8 million pounds of wheat. At a market price of one-third of a rupee per pound, total value of the extra crop would be close to 4.3 million rupees. Return on the investment is about 12 percent.

TABLE 3.3. *Estimated Cost of Doubling per Acre Yield of Wheat in India*

(In rupees)

Item in cost	Cost per acre	Total cost, 12,800 acres
Fertilizer	120	1,536,000
Seed	50	640,000
Irrigation	110	1,408,000
Plant protection	15	192,000
Road construction (10 miles)[a]	25[b]	300,000
Road maintenance	3[b]	30,000
Cost of carting[c]	2[b]	23,000
Total extra cost	326	4,129,000

SOURCE: Input costs from Kanpur Agricultural College, Uttar Pradesh.

a. Road costs based on Ministry of Transport estimate of 30,000 rupees per mile, with 10 percent for maintenance.

b. Rounded figure.

c. Transport cost is based on assumption of 3 paises per maund-mile for marketing by bullock cart. Truck costs would be lower.

Additional benefits would accrue from the reduction in transport costs for the 200 pounds of marketable surplus per acre that previously moved over the poor road, and is now transported over the improved road. Transport costs by bullock cart are reduced from 5 to 3 paises per maund-mile when a road is surfaced with stone or gravel.[11] These savings would amount to 3,040 rupees per year for the area served by the 10-mile road, assuming that the surplus of 2.5 million pounds previously realized through the old methods of production will move an average of 5 miles over the improved 10-mile road section en route to market. Additional savings not included here would result from cheaper transportation of the inputs employed in the area prior to the more intensive cultivation before the road was improved.

Note that when measured in cost per acre, the outlay required to build an access road is a relatively small part of the total inputs required for intensive agriculture. Even assuming that the road will be paid for entirely during the first year, road cost per acre is less than half the cost of seed; and total road construction and maintenance costs are less than 10 percent of the intensive cultivation program. Even if road costs should be doubled to meet difficult soil and monsoon conditions, outlays would still be modest per acre, especially when allocated over the life of the facility.

The return on 4.1 million rupees devoted to intensive agriculture, based on added income of 4.3 million rupees, is about 5 percent. If road costs are allocated over the life of the road, the return is about 12 percent. Additional benefits would be realized in the social changes in village life following construction of an all-weather road, including improvements in education, better school attendance, and availability of medical and veterinary services.

By considering roads and vehicles in the same category as seed and fertilizer, therefore, transport planning is made part of the process of agricultural programming, and is directly related to the expected costs and benefits of commercial agriculture. Viewing the problem of access in this way makes it possible to locate transport facilities where their payoff in agricultural output will be greatest.

[11] A maund is equal to 82 pounds. One paisa = 1/100 of a rupee. A rupee is valued at $0.75.

The Shift to Trucks

Low-cost rural transport requires the substitution of motorized vehicles for animal transport where volumes and distances are more than minimal. In India the role of the bullock cart has begun to decline with the improvement of roads and the availability of trucks. It was once common to carry freight up to 50 miles by bullock, but now 25 miles is generally the limit. In addition, the multipurpose bullock is losing his economic justification as a means of transport, because the introduction of electricity for mechanical equipment has reduced the nontransport uses of animal power. Tubewells, tractors, and mechanical threshers release the bullock from water baling, plowing, and threshing. Even before this, however, the reputation of animals as a means of low-cost hauling was often an illusion. Average ton-mile costs may be as high as 20 to 40 cents, while service is no better than 3 miles per hour.[15]

The substitution of farm trucks for animal-drawn carts will be hastened by better roads as well as by other mechanization in agriculture. Trucks generally do not operate on unimproved dirt roads or tracks, but small pickups and three-wheelers quickly appear on rural roads that have been improved to motorable standards. On the longer haul to market, growing volumes of agricultural products have been moving by truck. For perishable produce, such as fruit from northern Pakistan to Karachi, vegetables from the Punjab to Delhi, milk collection around major cities in all parts of the world, the time required to transport by rail often precludes the movement altogether or involves heavy losses from spoilage en route.

On many routes the most important types of motor truck freight are fruits and vegetables, agricultural equipment, fertilizer, and fodder. Approximately 40 percent of total tonnage trucked from Delhi to Bombay represents products of agriculture. Truck transportation has grown despite every kind of obstacle: poor roads, inadequate terminals, the

[15] For details on bullock cart performance, see Government of India, Planning Commission, *Role of Bullock Carts and Trucks in Rural Transport—Case Studies* (New Delhi, 1963).

high price of vehicles, high taxes, restrictive licensing policies, and police harassment of vehicle operations at local tax barriers and other check points. The evidence illustrates how desirable truck transport has become from the standpoint of farm economics, even where service is extremely poor.

In Ghana the process of marketing food has been greatly enhanced in recent years by the advent of trucking and the consequent expansion of cash cropping. In a recent survey of truck operations, it was found that 55 percent of food destined for Accra was moving over 50 miles, and that 30 percent came from places 100 miles away or more. With speedy truck transport, a high degree of specialization in food cropping had developed. None of the regions supplying Accra shipped any appreciable volume of more than one commodity.[16]

In Tanganyika, the small Asian traders who buy from communities deep in the bush are consolidating small shipments for transportation by truck to large trading establishments at railhead, where they are then dispatched to consuming centers or export points. The place of the small trader is now being taken by the cooperatives, which have been made possible by the truck.[17]

The rapid expansion of truck transport is indicated in Table 3.4. During a recent eight-year period the number of trucks in many developing countries increased from 100 to 200 percent. Still, in many less developed countries, the number of trucks per thousand people is far below what is necessary to support commercial agriculture. In Japan, for example, there are 35 trucks per thousand people. In India and Pakistan the figure is 0.5 per thousand. Roadbuilding efforts are stimulating the use of trucks, but greater efforts are needed to make available small, low-cost farm trucks and to furnish credit on favorable terms for cooperatives and other farm agencies that could help distribute farm inputs and act as a collecting agent for the produce of individual farmers.

[16] Thomas P. Poleman, "Ghana's Urban Food Economy," *Food Research Institute Studies*, Vol. II, No. 1 (Stanford University, May 1961), p. 163.

[17] N. R. Fuggles-Couchman, *Agricultural Change in Tanganyika, 1945-1960* (Stanford Research Institute, August 1964).

TABLE 3.4. *Growth in the Number of Trucks, Selected Countries, 1956-64*[a]

Country	Number of trucks		Percentage increase, 1956-64
	1956	1964	
Nicaragua	2,461	4,577	86
Peru	43,616	73,232	68
Mexico	194,491	352,681	81
Argentina	148,505	496,500	234
Brazil	301,449	655,874	118
Chile	41,370	82,548	100
Turkey	35,050	80,695	130
India	94,102	219,591	133
Pakistan	13,100	21,137	61
Thailand	19,300	59,160	207
Burma	9,200	18,400	100
Nigeria	16,625	33,455	101
Algeria	50,663	86,500	71
Sudan	9,495	16,540	74
Japan	687,000	3,324,749	384

SOURCE: U.S. Department of Commerce, *World Motor Vehicle Registrations* (January 1956), and U.S. Department of Commerce, *World Motor Vehicle Production and Registration, 1963-64* (January 1965).

a. From January 1956 to January 1964.

Storage and Processing

Storage capacity and processing plants are also important adjuncts to the transport network. Agricultural products containing high protein content are highly perishable, especially in the heat and humidity of most developing countries. According to the FAO, a large proportion of the world's food grain is lost because storage is either unavailable or inadequate.[18] Scientifically designed storage capacity of the right size and in the right location is needed to assure that what is produced is protected from the weather and from disease and infestation.

[18] U.N. Food and Agriculture Organisation, *The State of Food and Agriculture, 1964* (Rome: FAO, 1964), p. 125.

The relation to transport is obvious. Often it is desirable to retain crops rather than dump them on the market all at once, which produces disastrous effects on prices and on the returns to farmers. Transportation to storage facilities is necessary, and this can be the means of bringing together the small output of individual farmers to permit large transactions at satisfactory prices. Storage capacity also reduces the congestion on the transport system that results at the harvest, so that investment in storage may be more economical than the provision of peak transport capacity.

Closely related to storage is the possibility of processing agricultural output. Processing not only helps to protect and preserve food, but permits a substantial loss of weight to take place before long-distance transport is undertaken. This net saving in tonnage hauled is in addition to other benefits. One of these is the creation of local employment and additional income from value added to unprocessed materials. Another is the creation of by-product wastes which can often be used locally for still further processing.

The supply of proteins as well as vitamins and minerals would be greatly enlarged if beans, peas, and lentils could be made available in larger amounts. These vegetables contain three to four times as much protein as grains. They also add to the productivity of the soil. Thus another way to achieve more adequate diets would be to alter production patterns to take advantage of indigenous vegetables and of protein-rich milk and milk derivatives. All of these foods require good marketing and transportation facilities and, in particular, improved rural truck transport.

Financing Transport for Food

The problem of financing rural transport remains. Roads present the greatest problem. In any self-help program, farmers may have to cover the cost of a road the year it is built. Even though the road may last ten years, the cost is thus incurred well in advance of the benefits. Even if the discounted flow of benefits exceeds the cost, the cash is simply not available. If fertilizer were paid for on the same basis, cultivators would be asked to pay for ten years' supply in advance, without credit. Actually the cultivator buys for each crop, and can get the necessary

loan to be paid back when the effects of the expenditure have been realized.

Transport inputs need to be supplied on the same basis. What is needed is a means of defraying the initial cost of road construction that will permit the farmer to pay after the investment begins to produce. This could be accomplished by a state-operated revolving fund out of which the total cost of market access roads would be provided for communities agreeing to pay back into the fund all or part of the cost over a five- to ten-year period. Full or partial repayment could then be made in property taxes payable through the increased revenues from commercial agriculture. Thus transport would be purchased like other farm inputs, and methods of finance would encourage the selection of road improvements on the basis of agricultural productivity.

Substantial efforts are now being made to assist the agricultural sectors of developing countries through the construction of fertilizer plants, irrigation schemes, experimentation with improved seed, and the introduction of electric power and mechanized farm equipment. The time is particularly appropriate for positive measures to assure that the coming period of commercialized agriculture will not be retarded by the inability to distribute the supplies of inputs or to market the resulting surpluses.

For this purpose it is recommended that donor countries add to current aid efforts a global "transport for food" program which will make available in the form of grants a foreign exchange fund for the purchase of necessary roadbuilding equipment and farm trucks, and imported materials necessary to provide an agricultural transport network. Part of this fund could be used to make available transistor radios for sale to farm households where there is also a critical need for information on marketing conditions, prices, weather, and technical assistance on farm problems.

The local currency created through the sale of these components of a rural transport and communications program could then be credited to national or state revolving funds out of which 100 percent of the cost of local roads would be paid, with repayment terms stipulated in accordance with local conditions. Part of both the foreign exchange and local currencies might also be used for the construction of storage and processing facilities.

A transport for food program is long overdue. For many years the

major foreign assistance efforts in transport have been directed to major arteries of transport—railways, main highways, airlines, ports, and shipping. The amount of help for transport to assist in overcoming the isolation of rural farm areas has been negligible. The result in nearly every country is the dualism that finds intercity transport becoming increasingly modern and rural transport standing still. A shift in emphasis to make up for lost time could help provide the rural-urban links essential to the transformation of agriculture. Unless these links can be strengthened, the success of other efforts may still prove unequal to the task of averting a critical shortage of food.

CHAPTER 4

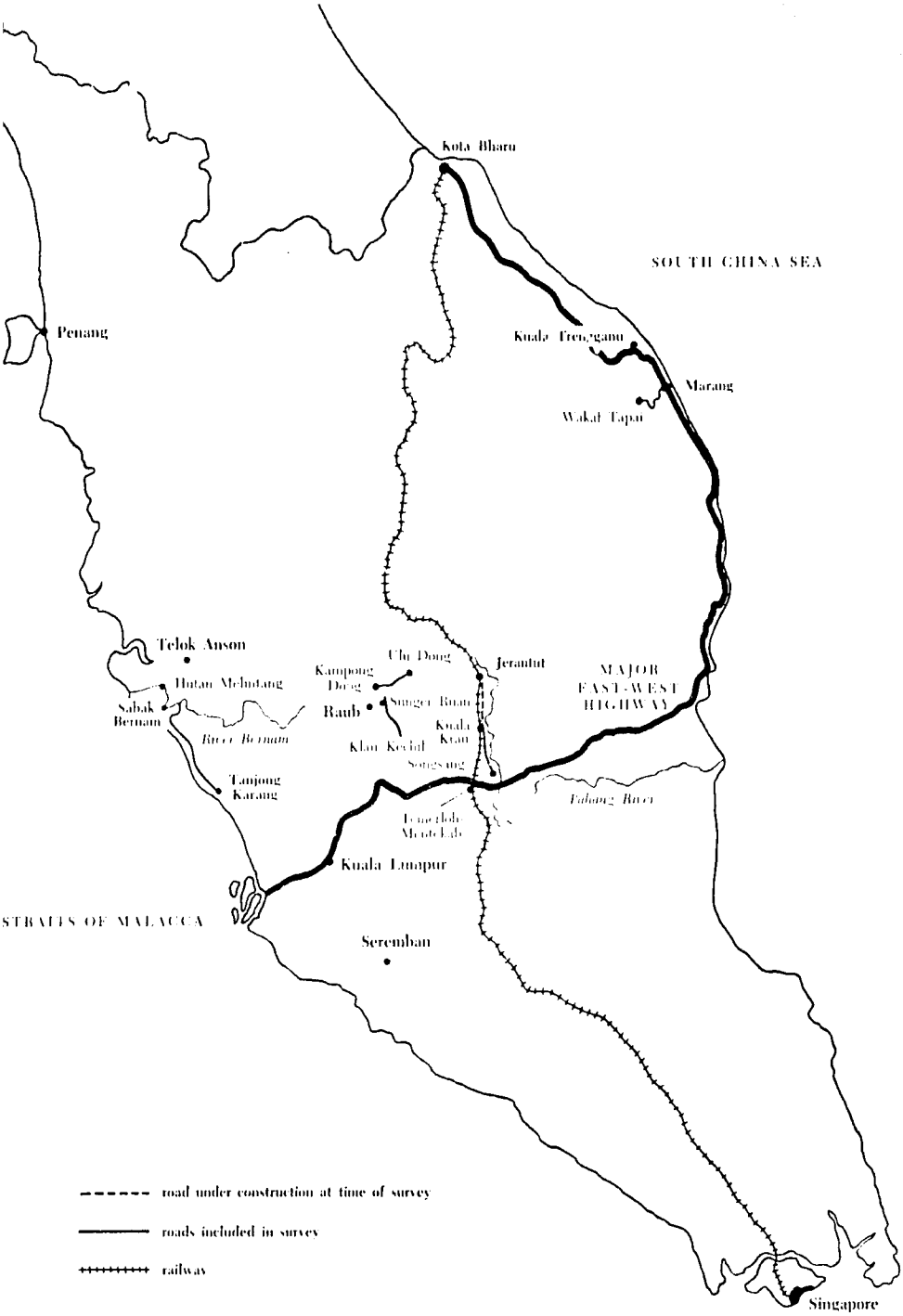
Social Benefits through Improved Transport in Malaya

WILLIAM HUGHES

THE EFFECTS OF FIVE ROADS constructed in rural areas in Malaya in the early 1960's illustrate the kinds of social benefits which a road, in conjunction with other investment, can bring to a relatively isolated village. The construction of rural feeder and penetration roads was one of the principal instruments for raising living standards—a primary goal of the first two government-sponsored economic development plans for Malaya.[1] In order to assess the effectiveness of this policy, five roads built during the second Five Year Plan period were selected for case studies. Extensive interviews were conducted with villagers in order to find out how the roads had affected their lives. Table 4.1 shows that a total of 2,776 households were interviewed[2] during the survey. Construction on each of the roads was begun in 1962 and the survey was made during the first six months of 1964 when

[1] The first Five Year Plan was for the years 1955-60; the second was for 1960-65. The present plan (for 1966 through 1970) is for the Federation of Malaysia, of which Malaya is a part. Rural roads have not been assigned as high a priority in the present plan because the government felt that a good deal—although certainly not all—of what needed to be done in this field had been accomplished in the first two five-year plans. At the end of 1965, there were about 8,000 miles of roads in Malaya, about 70 percent of which were hardtopped. Except for the three major trunk routes (see Map 4.1), the roads are primarily of the feeder or rural development type.

[2] Interviews were carried out by students of the University of Malaya, under the direction of the author.



MAP 4.1. *Roads and Hinterlands Surveyed in Malaya*

none of the roads was fully completed, although all were in use. Thus, whatever benefits the villagers derived from the roads must be regarded as short-run, almost immediate—the full potential impact was not felt by early 1964.

In conjunction with constructing roads, the government of Malaya coordinated investments in schools, clinics, community centers, and similar institutions in the villages to be served by the roads. The particular investments made in each region are listed in the descriptions of the five roads and their surrounding hinterlands given below.

For the study no attempt was made to select highways which were known to be, or likely to be, successful. One of those selected, the Marang road, is located in the narrow eastern coastal belt, remote from large population centers, while another road (the Hutan Melintang road) is situated on the western coast and will ultimately constitute part of a main route to Kuala Lumpur. The other three roads—the Dong, Kuala Krau, and Klau Valley roads—are clustered fairly close together in the high central region of the country (see Map 4.1).

Marang Road

The Marang highway runs fourteen miles inland to Wakaf Tapai from the eastern coast and may eventually form the eastern section of a major east-west highway. The Marang region is overwhelmingly agricultural. The main cash crop is rubber—about 28 percent of land in use in the road's hinterland is devoted to rubber planting. Approximately

TABLE 4.1. *Hinterland Areas and Number of Households Interviewed*

Area	Household interviews	Approximate percent of total households	Approximate area influenced by roads, in square miles
Marang	658	80	48
Kuala Krau	663	90	81
Dong	259	95	54
Klau Valley	429	95	44
Hutan Melintang	767	75	111

SOURCE: Field survey made by the author in Malaya, 1964.

one-fourth of the households are engaged in subsistence farming. A rice mill, a rubber smoking shed, one rubber dealer, and several small retail shops comprise the remaining economic activities of the area.

Before construction of the road the distance was traversed by a narrow track, much of which passed through streams and swampland and was not passable even by bicycle. At the time the road was under construction, the government also built several related facilities, including a community center, a clinic, and quarters for the village headman.

A traffic survey made in 1964 indicated that little traffic was flowing between Marang and Wakaf Tapai, so the primary purpose of the road was to provide transport between the two towns. The main trading and administrative center of the region is Kuala Trengganu, and both Marang and Wakaf Tapai had more trade and other dealings with this town than with each other.[4] Most of the traffic had been local, plying between the villages along the road.

Kuala Krau Road

The Kuala Krau highway is situated just to the east of the central mountain range, paralleling it in a north-south direction. The hinterland of the road is primarily rubber-producing, with 58 percent of the land under cultivation devoted to this crop. Virtually no other economic activity takes place. The southern terminal of the road is at Songsang, on the trunk highway from Kuala Lumpur to the eastern coast. From Songsang it runs north 18 miles to Kuala Krau and then continues to Jerantut. The sealed hardtop surface of the 18-mile stretch to Kuala Krau was completed in October 1963. At the time of the survey (1964), the section north of Kuala Krau was only just being cut, and was not expected to be finished until the end of 1964. Facilities in the area, which were built at the same time as the road (and which should be regarded as part of the total investment), included a school, a mosque, two community halls, two large health centers, and six midwife clinics.

Throughout its total length of 40 miles, the road runs between the navigable Pahang River to the east and the main line of the Singa-

[4] The road from Wakaf Tapai to Kuala Trengganu is not shown on Map 4.1.

pore-Kota Bharu railway to the west. The river is just a few hundred yards from the railway at Kuala Krau; the greatest distance between these two older facilities along the 40-mile stretch is 6 miles. Thus, the highway cut through much of the hinterland between the older means of transport and diverted considerable traffic from both the railway and the river. Nevertheless, the survey made in early 1964 indicated very light traffic. The highway is intended to serve as a trunk road which would eventually constitute one section of a commercial transport link between northwestern Malaya and the eastern coast.

Dong Road

The Dong road runs for nine and one-quarter miles northeast from Kampong Dong to Ulu Dong. The upper part of the valley at Ulu Dong is a very old, settled part of the country where, prior to the road, transport was by path, or by boat or raft along a narrow river. Construction of the road to a minimum standard was completed by November 1962. At the time of the survey only three-quarters of a mile had been sealed; the remainder was being surfaced with rock screenings. In addition to financing construction and maintenance costs for the road, the government provided $10,000[1] for a mosque and $4,000 for a community center. The road was built to provide transport for timber which was to be extracted in the vicinity of Kampong Dong, and to serve as a communications link for the population (approximately 1,000) of Ulu Dong. The highway is in fact performing both of these functions.

In addition to lumbering, which was started after the road was built, the only other significant commercial activity in the Dong region is rubber production. Rubber was an important cash crop before the road, and its significance did not increase substantially after road construction was began. Of the 259 farm households in the Dong hinterland, 65 were planting rubber before the road and 69 afterward. About one-fifth of the households were engaged almost entirely in subsistence farming, with padi and vegetables as their principal crops.

[1] Figures are in Malayan dollars. One Malayan dollar = $0.327 (U.S.).

Klau Valley Road

The Klau Valley highway begins four and one-half miles south of the Dong road along a parallel valley. The first three miles of the road have long been settled by Malays, and development there follows the pattern of Dong. A vast change came over the rest of the area during the 1950's when Sungei Ruan New Village was founded to provide for a rural Chinese population. Each family was allotted four acres nearby. This population has since been moving up the valley from Sungei Ruan and settling land, often illegally, until the extent of settlement is now some nine miles from the village and along both sides of the valley, to a depth of about two miles on either side. Most settlers actually live in Sungei Ruan and commute to their holdings daily.

Farther along the valley is the village of Klau Kechil, usually known as Po Chan Village after its founder, the leading businessman, landlord, philanthropist, and benefactor of the valley. The road from the New Village to Po Chan Village was built at his instigation and under his direction, without the assistance of the government. He is also building a Chinese school for the local children.

The government has set aside 6,000 acres at the upper end of the valley for a Federal Land Development Authority scheme, and at the time of this survey the jungle was being cleared. Eventually the FLDA land will be settled by Malay and other families under government supervision. As a result of the scheme the Po Chan road has now been taken over officially by the government and it was being completed according to regular standards at the time of the survey. Associated facilities planned along the road included a clinic at Ulu Gali.

Along the newly opened areas of the valley the agricultural development is remarkable. The Chinese farmers first clear and burn off the jungle and plant padi for two seasons where the land is suitable. The land is then planted with rubber saplings and bananas to shade them. As a result of new lands being opened up, the rubber crop has doubled since the road was first under construction. However, approximately twice as much acreage is planted in bananas as in rubber. In fact, Klau Valley may be the largest banana growing area in Malaya. Much of the

crop is exported to Japan by dealers from Raub and Kuala Lumpur who pick up the bananas in their own trucks. Transport of the fruit comprises most of the truck traffic along the road.

Hutan Melintang Road

The Hutan Melintang road is situated in the densely populated west coast region of Malaya, and is part of one of the main routes serving Kuala Lumpur. The road extends from Hutan Melintang southward to Sabak Bernam, is interrupted by a ferry trip, and then continues farther south to Tanjong Karang for a total distance of 40 miles. In conjunction with the building of the road, a large irrigation project, intended to open up one of the most promising padi-growing areas in Malaya, was initiated. The laterite surface was completed in 1963 and the road was being bituminized at the time of the survey.

Before the highway there was a very poor track which was all but impassable much of the time, even by bicycle. Freight traffic was generally routed north by boat to Telok Anson or, more usually, by track to Sabak Bernam. The traffic—passenger and goods—then boarded a boat for Hutan Melintang downstream where a road connected to Telok Anson. As most of the traffic was eventually destined for the markets of Kuala Lumpur, the extra distance was considerable and the handling involved was both expensive and time consuming. From Sabak Bernam the journey to Kuala Lumpur, including the river trip, was about 150 miles. With the completion of the Sabak Bernam-Tanjong Karang road it was reduced to something over 90 miles.

The route was completed in January 1963 with the introduction of ferry service across the River Bernam. The highway has had a considerable effect on the direction and volume of trade. Sabak Bernam is the center of one of the largest copra-producing areas in Malaya, and before the highway was built copra was transported entirely by ship to Penang and Singapore. Today all the copra moves south by truck, thus radically changing the channels of trade. Padi and coconuts—the two principal cash crops of the Hutan Melintang highway hinterland—were produced far more extensively after the road was built. All cash crops in the area increased approximately 32 percent in terms of value.

In addition to copra production and cash cropping, there was more

commercial activity in the Hutan Melintang hinterland than in the hinterlands of the other four roads considered in this chapter. There were two wholesalers in the region (one dealing in general goods and one in motorcycles, radios, and bicycles), several rice and saw mills, and five large agricultural estates (producing rubber, coconuts, and palm oil). There were also seven produce dealers, all of whom were large operators. For example, one copra dealer grossed about $2.1 million[3] in the first year after the road was built. The comparatively extensive business activity of the region reflects the fact that the road is located in the more developed and populous western part of the country, and that it links important trading and production centers with the capital.

Traffic on the new road in the Hutan Melintang area was more extensive than on the other four new roads. Peak days were noticeable—for example, there were forty-five cars going north on Thursday and seventy-one on Friday. While the daily bus traffic was minor during the week, thirty-three buses traveled north on Friday and thirty-seven south. Taxis showed the same variation. It is thought that the Friday peak was caused by travelers to the mosques. Trucks did not show the same variation in flow—the northbound traffic was usually either returning to Telok Anson empty after having delivered consumer goods or else was delivering consumer goods from Kuala Lumpur. In the reverse direction, truck traffic was either going south to Kuala Lumpur loaded with rice or copra or coming from Telok Anson with consumer goods.

Attraction of Roads to Newcomers

In terms of inducing new people to move into the surrounding areas the drawing powers of the five roads were striking. New settlers came to these rural regions from towns as well as from other rural areas.

In order to assess the attraction of the new roads, residents were asked when they had arrived in the area and why they had come. In Marang, of the 658 householders surveyed, 343 (or 52 percent) had moved to the area. Of this 52 percent, 30 percent had come between

[3] This figure is in Malayan dollars. The equivalent in U.S. dollars is approximately $686,700.

1962 (the year when the improvement or construction was begun on all five roads) and the first four months of 1964. In Kuala Krau, of the 58.5 percent of the householding families who had moved into the vicinity, nearly 30 percent had come since 1962. In the Dong hinterland, 82 percent of the families were not native to the area, but only 23 percent had arrived since 1962. In Klau Valley, 426 households out of 429 interviewed had moved to the area—over 70 percent of them during the so-called "emergency" period in the 1950's when the government of Malaya, assisted by the British armed forces, was engaged in counter-guerilla warfare. The others had moved into Klau Valley after the construction of the road. The hinterland of the Hutan Melintang area is relatively new. Until fairly recently, the principal inhabitants were fishermen and other coastal and riverine people. Here 90 percent of the householders interviewed had moved to the area. Many of these families had also settled in new villages during the "emergency" period; only 21 percent had arrived since 1962. However, as Table 4.2 indi-

TABLE 4.2. *Year Household Moved to Present Location*

Year	Marang		Kuala Krau		Dong		Klau Valley		Hutan Melintang	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1894–1903	–	–	–	–	1	0.5	–	–	–	–
1904–13	–		1	0.3	–	–	–		–	–
1914–23	2	0.6	4	1.0	–	–	–	–	3	0.4
1924–33	9	2.6	10	2.6	9	4.2	3	0.7	8	1.2
1934–39	16	4.7	17	4.4	13	6.1	2	0.5	32	4.6
1940–43		–	3	0.8	7	3.3	–	–	10	1.4
1944–49	30	8.7	54	13.9	20	9.5	10	2.3	80	11.5
1950	2	0.6	11	2.8	2	0.9	41	9.6	9	1.3
1951	1	0.3	3	0.8	4	1.9	63	14.8	13	1.9
1952	6	1.7	12	3.1	8	3.8	35	8.2	22	3.2
1953	2	0.6	4	1.0	1	0.5	20	4.7	10	1.4
1954	27	7.9	25	6.4	15	7.1	42	9.9	59	8.5
1955	7	2.0	7	1.8	2	0.9	7	1.6	22	3.2
1956	15	4.4	16	4.1	14	6.6	23	5.4	40	5.8
1957	12	3.5	25	6.4	11	5.2	34	8.0	33	4.8
1958	19	5.5	17	4.4	8	3.8	16	3.8	24	3.5
1959	17	5.0	24	6.2	12	5.7	20	4.7	72	10.4
1960	28	8.2	22	5.7	21	9.9	14	3.3	39	5.6
1961	48	14.0	21	5.4	16	7.5	20	4.7	68	9.8
1962	32	9.3	40	10.3	15	7.1	23	5.4	56	8.1
1963	57	16.6	55	14.2	27	12.7	53	12.4	72	10.4
First four months of 1964	13	3.8	17	4.4	6	2.8	–	–	21	3.0
Total	343	100.0	388	100.0	212	100.0	426	100.0	693	100.0

SOURCE: Field survey made by the author in Malaya, 1964.

cates, more new residents came to each of the five regions in 1963 than in any other individual preceding year, despite the "emergency" period resettlement schemes of the 1950's.

Reasons for New Settlers

Before the Marang highway was begun, about half of the people came to open up new land, which they planted with rubber or padi. About 10 percent of the householders came seeking jobs, and evidently found them working in the fields, while about the same proportion came into inherited land. The others came for various personal reasons. After construction of the highway was begun, about half of the new settlers came to open up new land, this time along the road. About 20 percent of the newcomers came to seek employment, while 10 percent came to start retail or trading businesses. Apart from fairly local shifts in population, most of the new residents came from the main towns in the area, which for many meant a change in ways of living. Although the survey could not document a movement in the opposite direction, at least it can be said that the new Marang rural highway was attractive to urban dwellers—one of the objectives of rural development in Malaya.

In Kuala Krau, prior to the coming of the road, about one-quarter of the people moving into the area came for work. The railway which runs from Kelantan to Gemas seems to have put Kuala Krau on the map as far as hopeful workers were concerned. About 20 percent came with specific plans to start businesses, mainly retailing. Some 30 percent came to open new land. After the highway, fully half of the newcomers came to take advantage of lands being opened up by government programs. The remainder came to seek work, to start businesses, or because of other attractions of the road.

In Dong about half the newcomers, before and after the road, came to open land, while 25 percent came to marry. Klau Valley gained many of its residents during the major "emergency" settlement program. The immediate prosperity of the area attracted others. Before the highway 25 percent came in search of jobs, which were plentiful. Others came to start businesses, or simply because it was too crowded in the old location. To an even greater extent than in Marang, new-

comers (apart from those who came during the "emergency" period) had arrived from urban areas, even from such large towns as Seramban, Kuala Lumpur, and Penang.

Fully one-half of the present Hutan Melintang population moved in before the highway to open up new land, and another 25 percent came to seek work. The rest came mainly to set up businesses. After the highway, nearly 25 percent came because of the road, mostly from more isolated places farther inland; 20 percent had come to open up new land, largely under the auspices of the large irrigation and drainage scheme. Even more came to start businesses. The roads generally had a substantial impact on the mobility of people, and provided an attraction for urban and rural dwellers.

Effects of Roads on Occupations

It might be expected that the opening up of a new highway, by making new opportunities available, would have a considerable effect on the occupations of people in the area. Under certain circumstances, after a new road first linked a village with the outside world, one could conceive of rubber tappers becoming taxi drivers, padi planters operating gas stations, or fishermen becoming shopkeepers. By and large this did not happen in any of the hinterlands, and the new trades —such as bicycle and auto repairing, retailing and processing—have gone mainly to newcomers. In all of the study areas, after the roads were built only isolated instances of occupation changes were reported.

In some cases, new jobs created in connection with the roads went to newcomers because the people already living in the hinterlands did not possess the necessary skills. In other cases, the absence of "prior dynamism"[6] on the part of the preroad residents could well account for their failure to obtain the new jobs. In either case, it is clear that the coming of the road did not transform the way of life of the formerly isolated Malayan villager in less than two years. It is possible, however, that the new roads, together with the complementary investments

[6] See George W. Wilson, Barbara R. Bergmann, Leon V. Hirsch, and Martin S. Klein, *The Impact of Highway Investment on Development* (Brookings Institution, 1966), pp. 211-12. In essence, "prior dynamism" refers to a "development mentality"—an eagerness to take advantage of opportunities when they appear, or even to seek them out.

made by the government, will contribute to the creation of a development mentality in those people who were not formerly progress oriented. For example, the new roads have made education possible for many people to whom it had not been available previously.

In addition to the absence of a propensity to change occupations on the part of preroad residents in all five areas, there was also a marked absence of change from subsistence farming to cash cropping. Only in Klau Valley was there a significant decline in subsistence farming, and the number of households engaged entirely in subsistence farming was small to begin with. (The number of families in this category dropped from thirty-three to sixteen.)

Changes in Housing

An improvement in the quality of housing of a significant number of the families living in the hinterlands of the five roads would have been considered a social benefit, probably partially attributable to the new roads. The proportion of families whose housing improved considerably was, however, negligible. Considering all of the householders of the hinterlands of the five roads together, the percentage of families living in the two lowest categories in terms of quality of dwelling was 44 percent before the roads were built. The comparable figure after the roads were constructed was 40 percent.[5] It should be remembered, however, that the roads were not begun until 1962, and that the interviews took place during the first six months of 1964. Nevertheless, this information is significant in that it indicates that improved housing, like occupational changes, was not an immediate by-product of the new transport facilities.

Increases in Educational Opportunities

The expansion of educational opportunities was a prompt result of the construction of the roads. This increase came about through the

[5] In Klau Valley, there was a large number of families living in the highest standard of local housing. This was due to a government-sponsored program for new settlers.

introduction of school buses and through building new elementary schools. Government investment in educational facilities was coordinated with investments in the new rural roads. The availability of school buses meant that students could attend high schools and special schools (such as religious schools) where formerly this was impossible. Thus, enrollment in all postelementary schools and in special schools increased significantly after the roads were built. In Marang, for example, enrollment in the Arabic school has doubled since the coming of the road, and pupils who previously traveled by foot or by boat now use the school bus. The implications of these new opportunities for advanced education are substantial—particularly since prior to the coming of the roads only 2 percent of the 2,463 household heads interviewed had completed high school and only seven individuals had completed a university or trade college course.

Total school attendance—elementary as well as secondary—is shown in Table 4.3. Data are not available which could be used to relate this absolute increase in school attendance to the age composition and numbers of children in each district before and after the roads. It is known, however, that virtually 100 percent of the children of elementary school age are now in school, whereas before the roads this was not the case. In addition, the number of schools relative to the increase in school attendance indicates a qualitative improvement in education.

Table 4.3 also shows that, even though average household incomes actually declined in two of the hinterland areas after the roads were built, school attendance increased and new schools were built. Thus, education improved in areas where there was no economic advancement, as well as where incomes were rising.

Newspaper Readership

Before the coming of the highways, not one of the people in households interviewed read a newspaper regularly. After the highways were opened, newspaper reading began—not extensively—but a start was made. In Dong, of the 187 households interviewed (none of whom read newspapers before the road was built), 39 were reading newspapers.

In Klau Valley, of the 328 householders interviewed, 48 were read-

TABLE 4.3. *Increases in School Attendance and in Schools in the Hinterland Areas, before and after Road Construction*

Item	Marang		Dong		Hutan Melintang		Kuala Krau	
	Before	After	Before	After	Before	After	Before	After
School attendance actual	650	839	386	424	1,636	2,033	1,039	1,144
Number of schools	5	7	1	2	n.a.	n.a.	6	8
Average household income[a]	784	757	982	1,077	875	1,200	1,939	1,824

SOURCE: Field survey made by the author in Malaya, 1964. Data are not available for the Klau Valley road hinterland.

a. Figures are in Malayan dollars: 1 Malayan dollar = $0.327 (U.S.).

ing newspapers after the highway was built. In Marang new readership was negligible. Only 8 householders of the 625 interviewed were reading newspapers after the road was built. Kuala Krau residents reported new readerships in 22 households. Of 474 householders interviewed in Hutan Melintang (none of whom, as in the other areas, was a regular reader before the road), 86 became newspaper readers after the road was constructed.

Increase in Medical Care

Improvement in medical care became apparent after the construction of the roads. In Marang, for example, a trained midwife was not available to most of the households before the road. The nearest midwife was in Kuala Trengganu, which meant a walk of some 20 miles. Since the roads' construction, however, midwives are accessible by bus or taxi, and a mobile service has also been established. As a result of the highway, there is no reason why midwife services should not be available to almost every woman. Often the services of a bomoh (medicine man) were used in childbirth, as well as for other types of medical and dental care. After the highway, the bomohs lost much of their business and influence.

In Kuala Krau most of the doctors and dentists were located in Mentekab or Temerloh at the southern end of the highway and could be

reached only by infrequent trains or by arduous boat journeys, which usually took several hours. After the road, new doctors established themselves in Kuala Krau. For those still traveling to the southern towns, taxi or car transportation was available, and the journey was cut to thirty minutes, at the most. Also, new government dental clinics have been established along the road.

The Dong residents gained similar benefits. The midwives, doctors, and dentists were generally located in Raub, some 18 miles from Ulu Dong. The nearest medical facilities were at the main road at Kampong Dong which meant a walk of up to 9 miles for most people, or a long journey by raft or boat. After the road was built, a clinic with a midwife was established at Ulu Dong. One respondent reported that she now goes to the midwife on a scooter, which she much prefers to the raft. In addition to the midwife, a doctor is available at Ulu Dong and another provides a mobile service.

Since the construction of the highway, a dentist, a midwife, and a doctor have started to serve Klau Valley from Sungei Ruan village, saving many people a walk of at least 8 miles. In Hutan Melintang medical facilities were available at fairly short distances even before the highway. However, the task of reaching them has been eased considerably.

Table 4.4 indicates the extent to which modern medical and dental facilities were being used at the time of the survey by native-born families in each of the five areas, as compared with settlers in the areas. Nearly all of the newcomers took advantage of the modern facilities. This would not appear to be surprising, since people willing to make major changes in their lives, such as moving to a new area, might be

TABLE 4.4. *Native-Born and Settler Families Reported Using Medical Facilities*[a] *after Highway Construction, by Area*

Family characteristic	Marang	Kuala Krau	Dong	Klau Valley	Hutan Melintang
Native-born families in area	324	277	51	3	73
Number using medical facilities	150	135	23	0	35
Settler families in area	326	383	190	398	659
Number using medical facilities	320	365	180	371	634

SOURCE: Field survey made by the author in Malaya, 1964.
a. Clinics, qualified doctors, dentists, midwives.

expected to make other changes as well. Also, those new settlers who had moved from urban areas might have been accustomed to modern medical care in the towns. What is perhaps more striking is the fact that nearly half of the native-born families had stopped patronizing the village medicine men and were going to doctors, dentists, trained midwives, and clinics by the time of the survey—which was made roughly two years or less after initial construction was begun on the roads.

Greater Marketing Opportunities

The new highways created a much greater access to markets. Not only could markets in the larger villages and towns be more easily reached, but local daily markets were now possible because of an increased supply of goods entering each area. For example, in the Marang district a marketplace had been constructed by the government before the highway was built, but was unused for a considerable length of time. After the highway was useable, traders came daily from as far away as 10 miles by bicycle or motorcycle to buy fish and other items, and returned home in the late afternoon for the opening of their own local market. Before this, fresh fish was a rarity, even though the sea was only 10 miles away.

The table below, showing the methods of transport used by farmers to reach dealers before and after the Hutan Melintang highway was constructed, indicates a substantial increase in the use of motor transport for hauling commercial agricultural products to dealers in one of the five hinterland areas after the road was built.

	Cycle	*Foot*	*Boat*	*Jeep*	*Motorcycle*	*Truck*	*Bus*	*Car/Taxi*
Before highway	301	14	42	2	1	—	—	—
After highway	251	8	10	18	9	50	1	13

Availability of Other Amenities

The new highways also created better lives in many other ways. In most cases the building of the road not only made it easier for rural dwellers to reach facilities some distance away, but facilities were

made available locally through the building of community halls, mosques, schools, adult education centers, clinics, mobile post offices and other government services, libraries, visiting Chinese theaters, and traveling dispensaries. Small amenities, such as visiting ice cream vans in Marang, occasional trips to the cinema in Raub, or visits to barbers and beauticians were not without significance in rural life and are undoubtedly part of the forces that will change Malaya's social structure. It is understandable that people would travel miles through difficult country for purposes of trade before the highway, but would not do so for social amenities. The typical villager's first cinema show or his first use of postal facilities had to await the coming of the highways. Whatever the economic consequences of the roads, the social benefits have meant a better life for a great many people.

Conclusion

The survey shows quite plainly that social development took place in the hinterlands of all five roads. The development took the form of increased attendance at schools, greater use of medical facilities, increased reading of newspapers, use of governmental services and facilities, and introduction to the other amenities of modern life. This expansion in use of various social services occurred independently of changes in personal incomes—which actually went down in some of the areas under study.

Provision of the roads alone would not have caused this expansion to occur, but it was the roads, in conjunction with other investments, which stimulated the development. If social development is a policy goal, such packages of investment may be desirable in many developing countries, even in cases where rural roads alone could not qualify for investment funds on normal economic grounds.

CHAPTER 5

The Colombian Experience, 1950-62

RICHARD WEISSKOFF

THE TOPOGRAPHY OF COLOMBIA presents one of the most formidable and fascinating problems in the world. Located in the northwestern corner of the continent, this South American republic is sliced by three massive ranges of the Andes Mountains into an array of broken plateaus, river valleys, rolling plains, and tropical jungles.

Colombia is a country of immense natural resources, but much of its wealth remains unexploited and its population inaccessibly isolated within its mountain confines (see Map 5.1). Although the area of Colombia is greater than that of Texas and California combined, most of its 16 million people are densely settled in four rather compact areas. These are the four economic regions of Colombia (see Map 5.2).

The Eastern Highlands region includes the national capital of Bogotá and the plateaus of the Eastern Cordillera. The Cauca Valley region forms the fertile agricultural zone between the Central and Western Cordilleras. Antioquia is the major industrial region, and the fourth area, on the Atlantic coast, is an agricultural and commercial center. The national barriers to movement between regions have reinforced their geographical isolation.

As noted in Map 5.2, roughly two-thirds of the entire land area of Colombia is not included in any of these four economic regions. East and south of the Cordillera Oriental, the vast expanses of plains merge into the lowlands of the Amazon rain forest. Considerable portions of these lands southeast of Villavicencio lie submerged as swamp during the rainy season and reappear as grazing lands during the dry season.

Inaccessibly located in the shadow of the Cordillera Oriental, the inhabitants of these "Llanos Orientales" have remained on the fringes of Colombian organized population.

In 1950 a survey mission of the International Bank for Reconstruction and Development singled out weaknesses in transport as the greatest problem retarding economic progress. The survey mission recommended the improvement of all transport facilities in a specific program which was financed in a series of seven loans by the World Bank between 1951 and 1961.

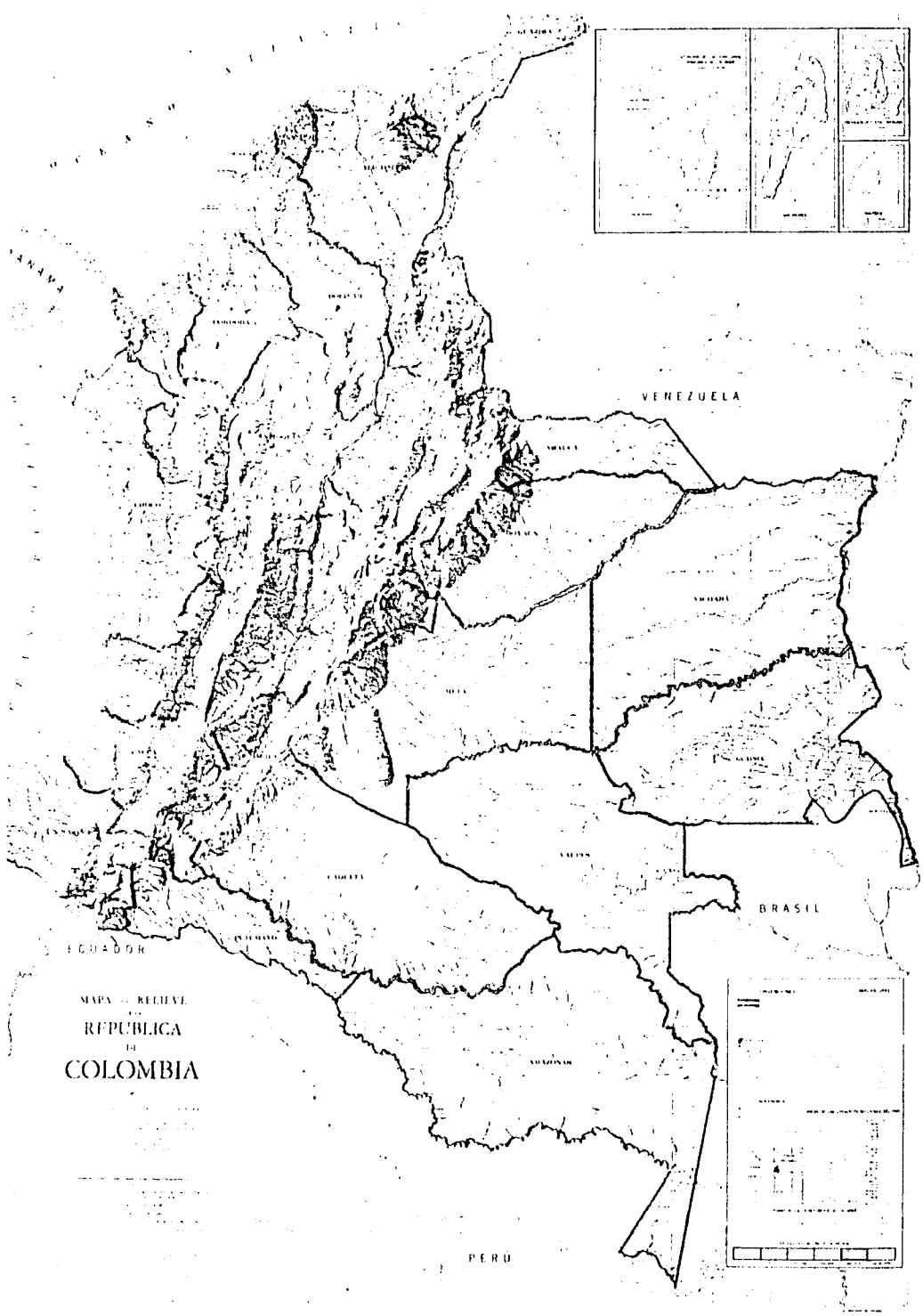
Emergency investment to improve roads and railroads was immediately undertaken, and 3,000 kilometers of improved roads were paved. A new railroad line was completed which cut through the tropical forests of the Magdalena Valley to connect the Atlantic coast with the highland interior. This single engineering project represents one of the greatest railroad construction feats since World War II in spite of its ultimate shortcomings. It is a monument to the spectacular efforts made by Colombians to overcome the barriers of geography which have hampered their country's economic progress. In addition to the highways and railroads, four seaports were expanded, inland channels were dredged, and the inland waterways fleet was modernized.

Despite these enormous investments in transport, there are glaring deficiencies and confusion in the operations today. Railroads, highways, and inland waterways duplicate one another and compete for traffic; yet all are being improved simultaneously. A new Atlantic port is being constructed, while two other nearby ports handle insufficient cargo. Certain regional demands for transport are met with surplus capacity, while others suffer from shortages of specific types of service.

It now appears that in one decade Colombia has moved from a position of too little emphasis on transport to too much and that an alarming proportion of the nation's resources has been allocated inefficiently in the process. Not only has the lack of transport facilities ceased to be a noticeable constraint on the nation's development, but, as a 1961 survey notes, "greater and more imminent bottlenecks appear to be in other areas."[1]

Yet the most important investments in transportation were not made without planning. The new railroad, the highway system, and the port

[1] Parsons-Brinckerhoff-Quade & Douglas, *Plan for Improvement in National Transportation* (Bogotá: Ministry of Public Works, 1961), p. 7.



MAP 5.1. *Physical Geography of Colombia*

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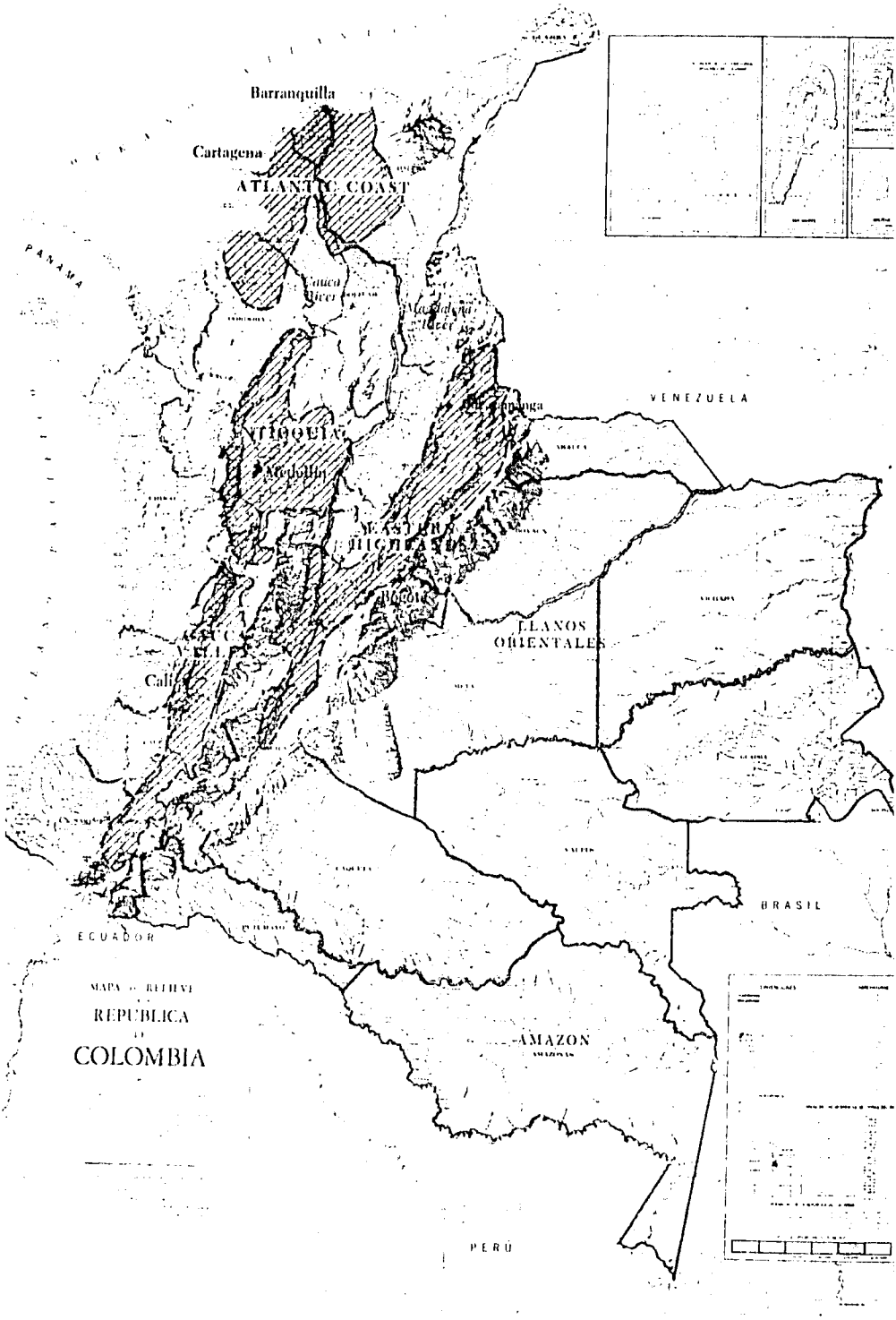

MAP 5.2. *Economic Regions of Colombia*

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expansion had all been undertaken as part of a general program. Many of the projects had been endorsed by the World Bank, and the loan agreements were effected only after careful evaluations of the projects and their probable consequences.

This study is an investigation of transport investment decisions in Colombia between 1950 and 1962. The first section examines the transport facilities and trade patterns as they existed in Colombia in 1950. The following sections review the 1950 development program of the World Bank and the sequence of transport improvements which grew out of the Bank loans. In order to understand the results of these programs, the fourth section analyzes the economic basis and its interaction with politics during the period of transport investment.

In conclusion, an attempt is made to learn from the Colombian experience. What are the errors in the allocation of transport investment which should not be duplicated by other countries faced with similar problems in economic development?

The Four Economies of Colombia in 1950

Geography and history have been responsible for the emergence of four major regions in Colombia as centers of population and production. In 1950, when the World Bank mission first visited Colombia, each of these four regions—the Eastern Highlands, the Cauca Valley, Antioquia, and the Atlantic coastal region—had developed into a self-sufficient unit with its own character, dialect, and regional loyalties. The metropolitan areas within each zone were supplied with food by the agricultural hinterland. The industrial products which moved between zones were foreign imports and exports, although some goods, such as salt mined near Bogotá, sugar grown in the Cauca Valley, and oil pumped from the lower Magdalena Valley, were exchanged between the regions. Otherwise, the World Bank mission found that, in 1950, as in the centuries before, each area satisfied its own basic requirements.

The Eastern Highlands: Bogotá

Located on the temperate, wind-swept sabana (savanna), Bogotá is both the national capital and the major city of the highland plateau

region of the Eastern Cordillera (see Map 5.2). As the national capital, Bogotá maintained its position, inherited from the colonial era, as the undisputed political, judicial, and cultural center of the country. Its universities had established the city as the nucleus of professional education. The pride of the Bogotano in literary and cultural activity had earned for the city the epithet "Athens of the New World." The city served as the financial and banking capital of Colombia. Bogotá was also the center of an extensively pastured region. "There is scarcely a foot of undeveloped land," Eder reported as early as 1913.[2] In addition to dairying and sheep grazing activity, this region led in the production of wheat, corn, potatoes, and barley.

Light industry, protected from foreign competitors by the natural tariff of high transport costs from the coast, had an early start in Bogotá. In 1950 the factories of the sabana were producing consumer goods primarily for the regional market. In addition, plants manufactured textiles, chemicals, fertilizers, and tires. The coal mines of the northern sections of the region yielded 430,000 metric tons in 1950—more than any other region in Colombia—and the salt mines of Zipaquirá supplied a major part of the national market.

To the northeast, the sabana rises abruptly into the higher plateau farming region of Boyacá, an area of subsistence agriculture and small market towns. Here inefficient farms, using primitive means of transport, sent surplus wheat, barley, and potatoes to the Bogotá market. Boyacá was also one of the best endowed mining regions in Colombia. In 1950, the government had just begun the construction of a coke plant for the iron and steel works of Paz del Río, located near extensive iron ore, coal, and limestone reserves. Farther to the north, isolated on a plateau imbedded in the Cordillera Oriental, the city of Bucaramanga produced cement and textiles for its own consumption and was known as the tobacco growing center of eastern Colombia.

Southwest of the sabana, the highland plateau dips down to the warm regions of the Magdalena Valley. In some areas of the valley, rice and cotton were grown for the markets of the temperate plateaus around Bogotá. These reduced tropical lowlands, together with the sabana of Bogotá, the farming and mining areas of Boyacá, and the

[2] P. J. Eder, *Colombia* (London: T. Fisher Unwin, 1913), p. 217.

isolated city of Bucaramanga formed the eastern "economic entity" of Colombia.

The Cauca Valley: Cali

Separated from the Eastern Highlands by the 17,000-foot peak of the Cordillera Central lies a second major region of Colombia, the Cauca Valley. This region, known as "El Valle," consists of fertile plains 15 to 25 miles wide and 150 miles long. The "Garden of Columbia," Hamilton wrote of the valley in 1827,[3] the Cauca is undoubtedly the finest of the cultivated agricultural regions. By 1950, the large sugar, cotton, cacao, and rice plantations which dominated the fertile lands were becoming relatively efficient, mechanized operations on irrigated lands. Cattle grazing and dairy farming expanded and the region was known as the "California of Colombia."

Cali, the major city of the Cauca Valley, was clearly the commercial emporium of western Colombia in the early post-World War II period. Numerous industries, many established as branches of foreign firms, had begun to locate in Cali by 1950. Newer firms produced chemicals, pharmaceuticals, and paper, while older enterprises manufactured woolen and cotton textiles, rayons, clothing, and fiber products. Traditional food processing industries, such as the milling of sugar, rice, wheat, and coffee continued to grow in importance. Other towns in the Cauca Valley, especially Palmira, Buga, and Sevilla, were booming agricultural centers.

Two cities to the south of Cauca Valley, Popayán and Pasto, remained isolated from the commercial progress of the north. Popayán, an important administrative center, was the most conservative and traditional of Colombian cities. Pasto, near the Ecuadorian border, carried on its commerce with the Pacific by means of one of the most tortuous railroad trails in the world. During the colonial period, the major route of trade and communication south from Bogotá passed through Neiva, Popayán, and Pasto en route to Quito. Not until the

[3] J. P. Hamilton, *Travels Through the Interior Provinces of Columbia* (London: John Murray, 1827), Vol. II, p. 136. "The Valley is much richer than the Magdalena. The soil is deep, the pasture rich and fertile, as is proved by the large size of cattle which are very lean in the Magdalena," wrote G. Mollien, *Travels in the Republic of Colombia* (London: C. Knight, 1824), p. 281.

1930's did the Republic's southwestern cities become incorporated into the national economy.

Antioquia: Medellín

To the north of the Cauca Valley, where the merging ranges form a broken plateau, developed a third zone of settlement, the industrial region of Antioquia. Its capital city, Medellín, became known as the "Manchester of South America" and the "Chicago of the Republic."

Lacking expanses of fertile land, Antioquia had been forced to develop on the basis of small farms and on mining, trade, and manufacturing. Even in the colonial era, the Antioqueño had earned the reputation of being more practical, more persevering, and more enterprising than the Bogotano or Caleño. It was the wealth of the mines of Antioquia that supported the armies of Bolivar, and it was Antioqueño capital that financed the banking activity on the sabana.[1]

During the nineteenth century the expansion of Antioquia from the mining settlements of Medellín proceeded southward into the present Departments of Caldas and northwest Tolima. The Antioqueño pioneer began extensive planting of coffee on the uplands after 1880. With the successful extension of the coffee crop southward, the Antioqueño built the new city of Manizales, which by 1950 had become the largest supplier of premium mild coffee in the world.[2] Coffee has remained the principal export and foreign exchange earner of Colombia.

Industrial activity began in Antioquia early in this century with the importation of modern textile machinery from Europe. As a result of continued tariff protection after World War II and domestic investment of coffee earnings, Antioquia had developed by 1950 into the leading manufacturing region in Colombia. In textiles, Medellín led in the spinning and weaving of cotton, wool, rayon, and viscose; its chemical plants manufactured fertilizers, pharmaceuticals, soap, and plastics. Several foundries, a steel mill, and factories for metal furniture and tin containers formed the core of a successful metal-working

[1] David Bushnell, *The Santander Regime in Colombia* (University of Delaware Press, 1954), p. 98. Eder, *op. cit.*, Chap. XIII, "Banking."

[2] James J. Parsons, *Antioqueño Colonization in Western Colombia* (University of California Press, 1949), Chap. X, "Coffee," pp. 136-53.

industry. The machine shops of Medellín produced sugar-milling and coffee-processing equipment for the agricultural areas, as well as machine parts and castings. In addition to these industries, Medellín also produced glass, pottery, cement, and shoes.

By 1950, Medellín had become the second largest city in Colombia and the most important industrial center. Its total electric power generating capacity was one-third of Colombia's entire power output. "Today," Parsons wrote of Antioquia in 1949, "this sober, vigorous, and vital culture group, product of four centuries of geographical isolation, constitutes close to one-third of Colombia's population, virtually monopolizes its industry and commerce, and grows three-quarters of its great export coffee crop."[6]

The Atlantic Coast Region: The Three Ports

Sealed from the interior by the rugged highlands of the Western Cordillera, the fertile lowlands of the Atlantic coastal region form the hinterland of the three historic northern ports of Colombia: Barranquilla, Cartagena, and Santa Marta. The three cities of this region have grown independently of each other and isolated from the three interior areas.

By 1950 Barranqailla had become the third largest city in Colombia, the major Atlantic port, and control point of the Magdalena River navigation. Its industry included textiles, metal working, the repair shops of the national airlines, a brewery, and the largest cement plant in Colombia.

Located to the west on the most ideal natural harbor in South America, Cartagena was the capital of a rich agricultural area stretching south into the valley of the Sinú River.[7] In 1950, local industries of Cartagena included food processing and milling of sugar and grains.

Santa Marta, the smallest of the three coastal cities and historically the oldest existing settlement on the South American mainland, remained an isolated banana port serving the tropical plantations of the lower Magdalena Valley.

These areas—the Atlantic coast, Antioquia, the Cauca Valley, and

[6] Parsons, *op. cit.*, p. 181.

[7] R. B. Cunningham Graham, *Cartagena and the Banks of the Sinú* (London: William Heinemann, 1920), p. 103.

the Eastern Highlands—formed the four economic regions of the political union of Colombia. "It is rather as though Lagos, Manchester, Havana, and Honolulu were all within common frontiers, speaking the same language but subject to the central authority of Kyoto," commented a journalist on the diversity of the regions.[7]

The Transport Situation in 1950

In spite of the isolation and the formidable mountain barriers which separated the four regions, definite routes for interregional and foreign trade had evolved by the middle of the present century. With internal growth came improvements in the transportation facilities of each of Colombia's four economic entities.

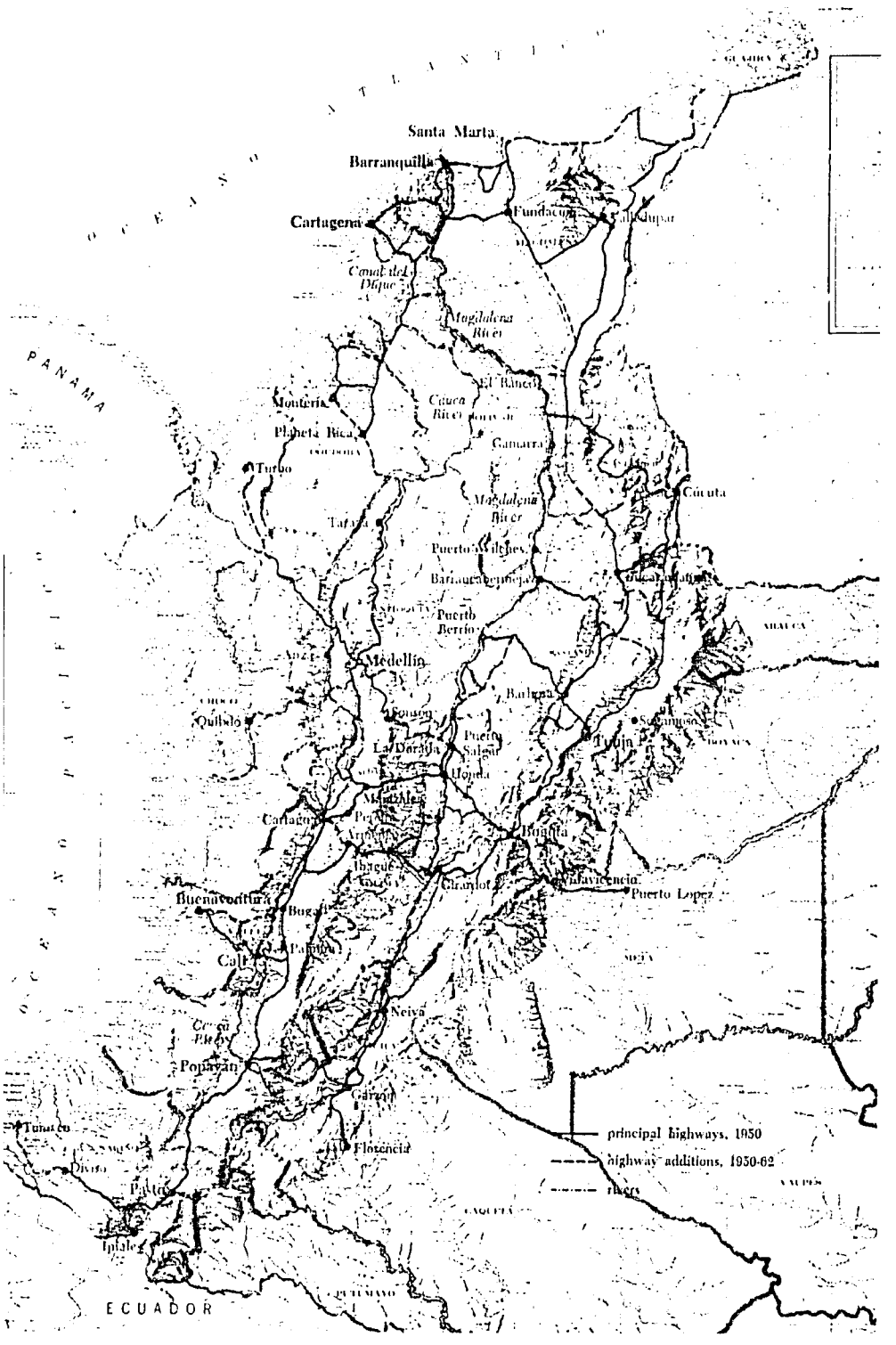
An examination of the transport facilities in Colombia in 1950 reveals a puzzle of crudely connected pieces accumulated over centuries of deterioration, repair, and substitution. Two patterns of transportation were apparent: first, within each of the regions, goods moved from the farm to the market, from the outlying towns to the central city, and from the cities out to the agricultural hinterlands; second, goods also moved between regions. In particular, the import-export trade, in spite of its low volume, was of considerable importance and value.

The facilities of the four regions reveal the patterns of trade developed by 1950. Each metropolitan area had become the center of a spider web of roads and rail networks. Each area had made those improvements in transport that tended to unite it as a region. Bogotá, for example, was the center of five radiating railroad lines of different gauges and an extensive network of inadequately maintained roads which extended to all parts of the sabana, to Boyacá, and down from the highlands to the Magdalena Valley[8] (see Maps 5.3 and 5.4).

Within the Cauca Valley, the Pacific Railroad extended the entire

[7] James Morris, *The Road to Huddersfield: A Journey to Five Continents* (Pantheon, 1963), p. 179.

[8] A traveler wrote of these highland railroads, "Colombians fancy railroads will work the complete regeneration of their torpid country, but such as we have seen were only miniature samples of the real thing, of slight practical value even when they extended all over the Republic." Harry A. Franck, *Vagabounding Down the Andes* (Century, 1917), p. 17. "The track and rolling stock of the Sabana railway are, as might be expected, of the most primitive kind. The transportation of the rails, cars, and locomotives to the plateau was in itself a Herculean task." H. J. Mozans, *Up the Orinoco and Down the Magdalena* (Appleton, 1910), p. 317.



MAP 5.3. *Colombian Highway Network, 1950-62*

length of the valley from Popayán to Cali north through the Department of Caldas and, since 1928, to Armenia. Cali was connected by rail with the harbor of Buenaventura in 1915 (see Map 5.3). Movements of coffee and oil (there were no pipelines) produced the largest proportion of revenue for the railroads. Refined sugar, cement, chemicals, and metal products composed the bulk of the freight moving within the region.

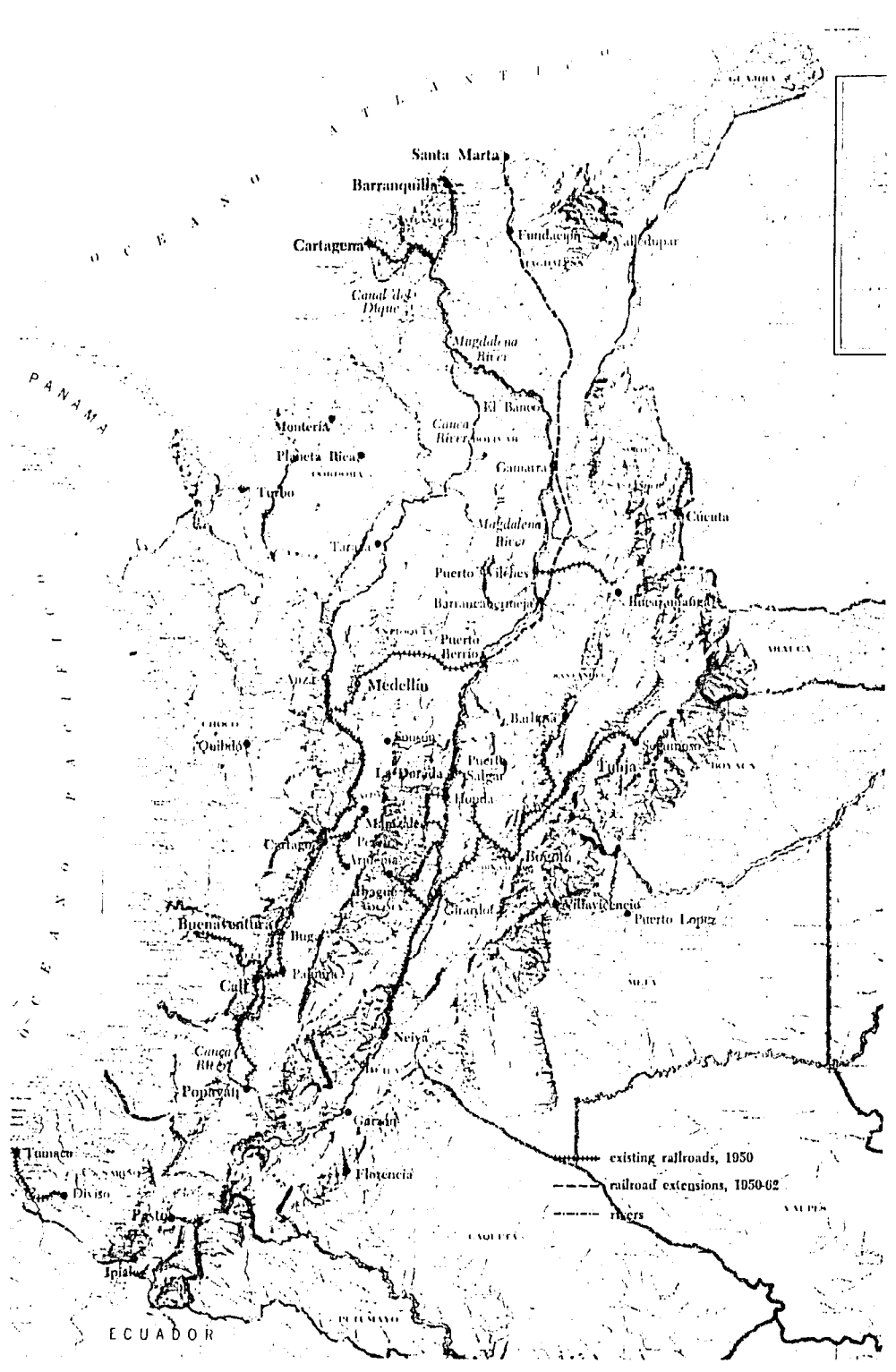
To the north of the Cauca Valley, the Pacific Railroad was connected in 1948 to the Antioquia line through some of the roughest terrain in Colombia. This link provided an all-rail line from Medellín to the Pacific port of Buenaventura. A second railroad, completed in 1929, ran eastward from Medellín through the mountains to the Magdalena River port of Puerto Berrío. Medellín was also the center of four radiating roadways. "Highway traffic is still predominantly local," Parsons wrote.[10] But this *revolución carretera*, as the Colombians called the construction of highways, permitted the Antioquian economy to expand rapidly within the region.

In the Atlantic coastal area, transportation depended on the waterways. No all-weather roads connected the three coastal cities, and most intercity trade was carried on by coastal shipping along the Caribbean.

Cartagena, once the most powerful port of South America, had been first connected to the Magdalena River in 1680 by the Canal del Dique, and later in the nineteenth century by railroad. Barranquilla, its major rival, constructed a new channel in 1936 which opened the mouth of the Magdalena to oceangoing ships. With the expansion of the new inland port, the city of Barranquilla became the principal Atlantic terminal for the interior. The major problem, however, which threatened the existence of the city continued to be the proper clearance of the mouth of the Magdalena. Known as Bocas de Ceniza, "Mouth of Ashes," the channel was difficult to maintain, and ocean ships, before entering, were forced to "top-off" cargoes at Cartagena or Santa Marta during low water seasons. Maintenance of the entrance required continuous investment in the channel construction and dredging.

The least developed of the Atlantic ports was Santa Marta. As early as 1881, rail construction was initiated to link the port to the interior

[10] J. J. Parsons, *op. cit.*, p. 171. See Francisco Javier Cisneros, *Report on the Construction of a Railway from Puerto Berrío to Barbosa* (Van Nostrand, 1878).



MAP 5.4. *Colombian Railroad Network, 1950-62*

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terminal of Fundación. The United Fruit Company of Boston acquired banana plantations and the railroad in 1899, and by 1950 the area was the major producer of bananas in Colombia and exporter to the European markets.

The transport facilities within regions—from port to city, from farm to central market, from mines to factories—had formed no single integrated network in their service of internal needs. Only the Pacific departments were connected by an almost continuous railway network. Within the Eastern Highland region itself, the railroads were of different gauges and equipment. Their roadbeds, constructed over several eras, conformed to various sets of engineering standards, and steep grades and sharp curves limited the capacity of the lines.

Between regions the constraint imposed by the lack of transport facilities was even more severe. Interregional trade consisted of a series of transshipments from rail to water to rail or from rail to highway to rail. Cargo from Barranquilla moved up the Magdalena on steamer as far as Puerto Salgar (with possible delay of thirty to sixty days during the dry season) and then by rail to Bogotá (see Maps 5.3 and 5.4). The industry of Medellín was opened to Magdalena traffic only with the completion of the railroad to Puerto Berrío in 1929. Another isolated line connected the mountain city of Bucaramanga to Puerto Wilches on the Magdalena River.

While the major trade outlets from these three cities led to the Magdalena River, this water route was an unreliable channel of commerce. Navigation up the river by steamer to the interior was limited during the dry season by shifting sandbars and shallows, and during the high water season by floating logs and other obstructions. "The fame of the Magdalena," wrote one observer, "rests not upon its length or its width or its depth, but upon the fact that it has been from the beginning the way into Colombia, and upon the spectacular difficulty of its navigation." Nevertheless, "more water than land and more mud than water," the Magdalena continued as the backbone of inland transportation in Colombia.[11]

[11] Blair Niles, *Colombia* (Appleton-Century, 1939), p. 329. Earlier, Arthur C. Veatch had noted, "We believe that the sooner the leaders of this nation are able to abandon all thought of the Magdalena as the main avenue of traffic the sooner will the country make a real step forward in its growth and development." *Quito to Bogotá* (George H. Doran, 1917), p. 299. For a description of steamers working themselves loose from sandbars, see Isaac F. Holton, *New Granada: Twenty*

Due to the seasonal "disability" of the Magdalena River and as a result of the opening of the Panama Canal, Buenaventura became the leading port. Coffee and cargo from the interior region were forced to move from Medellín south by rail and from the Eastern Highlands over the Quindío Pass into the Cauca Valley during the dry season.

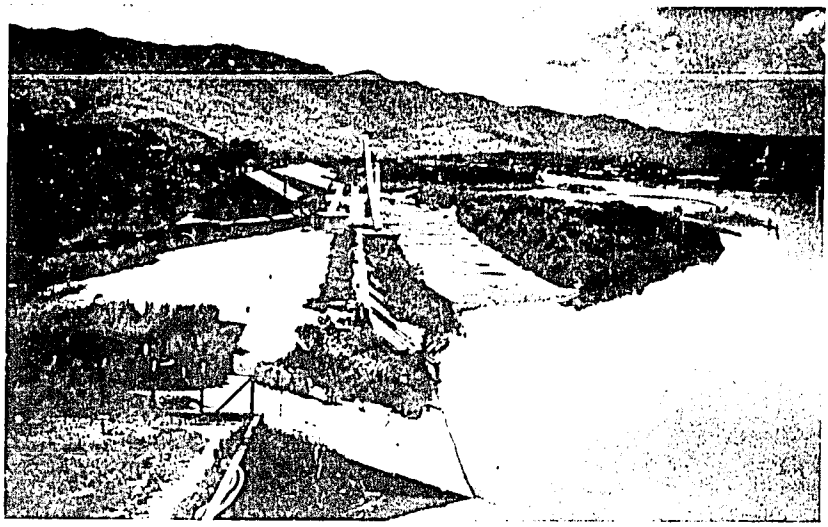
Coffee, Colombia's most valuable export, moved by two routes. After 1929 the crop from northeast Antioquia and the Magdalena Valley traveled on the rail connection to the Magdalena River and then by boat to Barranquilla and Cartagena. Coffee from southern Antioquia, Caldas, and the Cauca Valley was shipped by the all-rail route for export from Buenaventura.

The numerous transfers involved in the routes described above imposed extra handling costs, high insurance rates, and serious losses due to breakage and pilferage. Movement of goods was slow, inefficient, and expensive.

The system of rail, river, and road transportation was supplemented by the development of air service between all the major cities of Colombia. Organized in 1919 by German pilots, the commercial airlines expanded greatly after World War II. Due to the difficulty in the interregional overland routes and the relatively low-cost service, by 1950 the airlines were the principal carrier for passenger travel over distances exceeding 50 kilometers.

The Colombian government, during the general prosperity that followed World War II, had initiated plans to improve the general transport system. The railroads were to be extended and unified. Construction had already begun on a new mountain railroad from Barbosa to Bucaramanga, a 223-kilometer line which would eliminate the Magdalena "disability." A second major project was a 100-kilometer link between Ibagué and Armenia across the Quindío Pass. Of the 14 kilometers of tunnel, the longest would be 5 kilometers. Additional projects included railroad extensions from Medellín north to the Atlantic coast, another from Popayán to Pasto, and a rail cutoff from Buenaventura to Buga, north of Cali. All of these projects represented new lines in

Months in the Andes (Harper and Bros., 1857). For an account of the earliest steamboat concession during the War of Independence, see R. L. Gilmore and J. P. Harrison, "Juan Bernardo Elbers and the Introduction of Steam Navigation on the Magdalena River," *Hispanic American Historical Review*, Vol. XXVIII, No. 3 (August 1948), pp. 335-59.



During the dry season the Puerto Salgar barge terminal on the Magdalena River channel emerges as a mud bank. Hopper cars wait on the railroad siding near warehouses, cranes, and loading platform. Photo by Donald Dewees.

Rail and highway bridge over the Magdalena River from La Dorada to the Puerto Salgar terminal, here seen during the high water season. Photo by Nereo, Bogotá.

mountainous areas, which would be of extremely high cost to the National Railroads.[12]

New highway construction represented an equally ambitious program. In 1949 alone, the Department of Public Works had contracted for 101 separate projects on all parts of the general highway network. Like the railroad program, there was a notable absence of national priorities and a great dispersion of effort guided by regional interests and immediate export needs.

In spite of all the severe weaknesses in the transport network, the period immediately following World War II was relatively prosperous for the Colombian economy. The high cost of interregional transport discouraged the concentration of industry in any one region and restricted the market to the immediate area. The export-import trade, once freed of the wartime constraints, led to congestion in existing port capacity, forcing relocations and distortions of the traffic flows to whichever port was able to provide the service needed. Cargo was divided almost evenly between the Pacific and Atlantic ports. Given the condition of the rail network and the unpaved highways, it was apparent that considerable improvement in transport would have to be undertaken if the demands of the developing economy were to be met.

The Mission of the World Bank

In 1949, Colombia invited the International Bank for Reconstruction and Development to "provide an objective, unbiased analysis" of the country's potentialities and problems. A General Survey Mission, the first of its kind organized by the World Bank, examined the entire range of the Colombian economy. The mission report,[13] "as long, almost as intricate as the Old Testament,"[14] was first an inventory

[12] *Revista del Consejo Administrativo de los Ferrocarriles Nacionales de Colombia*, Números 76-78 (Bogotá: Editorial Santafe, 1949-50)

[13] International Bank for Reconstruction and Development, *The Basis of a Development Program for Colombia* (IBRD, 1950), more commonly called the "Currie Report" after the chief of the mission, Dr. Lauchlin Currie, a former professor of economics at Harvard University and economic advisor to President Franklin D. Roosevelt.

[14] Morris, *op. cit.*, p. 186.

of the economy as it existed at the time of the study and second the outline of a five-year development plan, including provisions for foreign financing.

Within the entire development plan, the emphasis was put on transportation. Although the plan anticipated a more or less balanced approach to development, including housing, industry, and agriculture, 30 percent of all investment was to be channeled into transport during the coming five years. Accompanying the projected investments, the program also called for reforms, especially in finance, administration, and public regulation.

As part of the program, the mission presented a general transportation plan stressing two major principles. First, all investment in transport was compared to alternative investment in other sectors. The amount of capital for improvement of roads, for example, was limited by the needs of housing and the power projects. Second, the projects were planned in relation to the industrial and agricultural sectors and their demands for transport services. The first consideration represents the opportunity cost of capital; the second is a reminder that transportation is a derived demand and depends on the location and needs of the producing sectors.

The transport recommendations of the World Bank mission were based on analysis of traffic flows and a diagnosis of the shortcomings of the system as it existed. The major factor responsible for the high transport costs, the report concluded, was the dependence on the Magdalena River. The program sought the elimination of the Magdalena River disability and a provision for all-year access to the Atlantic ports. The projects would relieve Buenaventura of much of the excess freight caused by seasonal funneling of the nation's trade through one port instead of three.

The Magdalena River disability could be overcome by a relatively economical addition to the railroad network. As a first step, the costly construction of the four extensions, including the mountain railroad from Barbosa to Bucaramanga and the tunnel route from Ibagué to Armenia was to be halted. Instead, the new plan proposed to study a link from La Dorada to Puerto Berrió to Puerto Wilches along the floor of the Magdalena River Valley. This connection of 250 kilometers, built on fairly level ground, would join the three existing rail systems

in Colombia. The plan also required an administrative organization and the resetting of several branch lines to achieve a uniform yard gauge throughout the country.

To insure the success of the Magdalena Valley Railroad, further investment in the Atlantic ports would be necessary. The mouth of the Magdalena River would be maintained; the Dique Canal, connecting Cartagena and the river, would be dredged and deepened; and the river channel north of Puerto Wilches would be stabilized for shipping.

The mission also presented a highway program based on better use of the resources already being devoted to roads. Highway expenditure would be limited to a few major links to connect the existing networks in the populated and industrial areas of the country. Only 4 percent of the road system was to be paved.

The transport plan, like the rest of the program, represented a working guide for the ensuing years and was not intended to be a detailed allocation. The suggested rail and road projects were essentially ideas for the improvement of the existing transport network. The plan opposed both the independent railroad and highway projects and the port improvements contemplated by the Colombian government and its agencies.

The Currie Report was the first overall view of transport in Colombia. Because it considered rail, highway, water, and air modes together, the report was a clear departure from the tradition which had been followed in the past. By coordinating transportation with economic development, it provided a challenge to those who would implement its recommendations.

The Era of Investment

Highway Program

The World Bank report was submitted in June 1950, and steps for its implementation were initiated at once. The Colombian government appointed a nonpartisan Economic Development Committee composed of six distinguished citizens which met twice weekly to review the report. Aided by a group of foreign technicians including Dr. Currie, the committee drafted its own recommendations for the specific investments.

The greatest lever for implementing the development program was to be neither the committee nor government appropriations but rather the understanding that international lending agencies would make $200 million available in support of the recommended projects. It was to be stated in the conditions for these loans that institutional reforms would be effected and coordinated planning of investment achieved.[15]

One of the first programs endorsed by the committee was the immediate improvement of the national roads. Due to the continued neglect and unusual rains, by 1951 the roads had deteriorated to such an extent that further investment in reconstruction was essential in order to bring them up to serviceable standards. To meet these needs, the Economic Development Committee offered a two stage program of construction, restoration, and maintenance, known as the "Plan Vial." The first stage, to be completed in three years, included only 155 kilometers of new highway construction and improvement of 2,906 kilometers of existing network. The cost of this was estimated at 90.1 million pesos.[16]

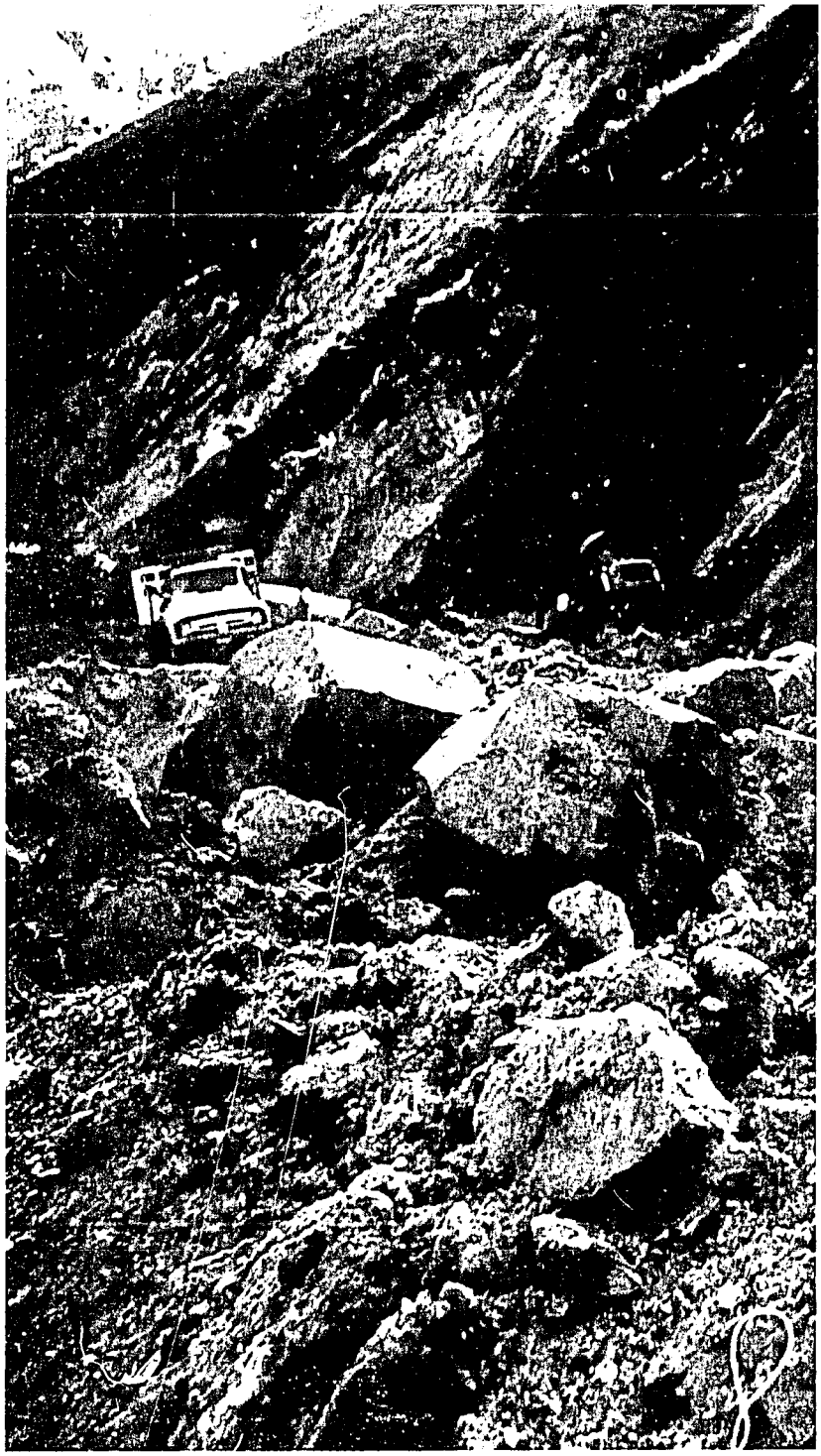
The World Bank, in responding favorably to the committee's two stage program, expressed reservations of the ability of Colombia to undertake a larger four year plan proposed by the Ministry of Public Works.[17] The organizational training requirements for the committee's smaller program alone would represent a considerable task for the Colombian economy.

The program selected by the World Bank included improvements on the major truck lines and paving of the highway from Cali to Buenaventura. The new construction would be concentrated on the Cartagena-Medellín highway, giving Medellín its needed outlet to the northern coast. All other projects then being undertaken by the Ministry of Public Works were to be abandoned and resources would be concentrated on the projects specified in the Bank program. The guiding principle of the Plan Vial, in the absence of any cost-benefit analy-

[15] Comite de Desarrollo Economico, *Informe final* (Bogotá: Banco de la Republica, September 1950 and August 1951), see especially Chap. XII, XIII, XXI.

[16] At exchange rate of 1.95 pesos = $1.00.

[17] See Jorge Leyva, *Programa de construcción y reconstrucción de carreteras nacionales de la República de Colombia, 1951-1954* (Bogotá: Ministerio de Obras Públicas, Imprenta Departmental, January 1951). The program would cost 165.2 million pesos, include about five times more construction and improvement of some 4,110 kilometers of roadways.



Landslides often occur on new Andes highways until slopes stabilize. On the Supía–Medellín road, a truck waits as a bulldozer begins clearing. Photo by author.

sis, rested largely on linking major cities and the creation of a single unified economy. Because of the urgency of the transport situation in Colombia, the Bank allowed an exception to its general practice of requiring complete engineering studies prior to a highway loan. On this emergency basis and an initial loan of $16.5 million, the World Bank in 1951 formally stepped into transport financing in Colombia.

Once construction got underway, the contractors ran into several unforeseen difficulties. First, due to recurring landslides in the mountains, additional heavy equipment was needed. Second, climatic conditions suggested that the original provision to pave only 15 percent of the network would lead to excessive maintenance costs after completion of the reconstruction. Third, supplementary funds were needed for even minimal maintenance activity and for the training of Colombian staff. By late 1952, within a year after the highway program had begun, it was clear that dollar and peso funds would be insufficient to complete the program. In September 1953 the World Bank extended a second highway loan for $14.35 million.

As construction progressed, traffic using highways increased beyond the expectation of the Ministry and the World Bank. The contractors were forced to revise the engineering standards of the projects by reducing gradients and curves, adding bypasses, replacing substandard bridges, and thickening pavements to carry the heavier traffic loads. With the upward designing of the roads, the entire character of the program changed from what had begun as an emergency rehabilitation project to a full-scale construction program.

In June 1956 the World Bank extended a third highway loan of $16.5 million for the completion of the same basic plan that had been outlined in 1951 and 1953. Again, several unexpected factors contributed to the delay in the progress of the work. Domestic inflation had the effect of doubling construction costs between 1956 and 1960, reducing the value of the national budget. The government, slow to readjust its contracts to the inflationary prices, also pursued a policy of spreading its funds among numerous local contractors rather than concentrating on a few projects and using equipment to capacity. Unit price contractors, in order to cut losses, performed inferior work, while many cost-plus contractors, rather than receive insufficient fees on their fixed overhead, stopped work with government approval.

The maintenance program that had been written into the second

and third highway loans had never been put into operation. In spite of the reorganization of the highway department, little administrative efficiency had been gained. By 1960, nine of the twenty-eight maintenance shops had yet to be completed, and the weight regulations remained unenforced. An inspection by World Bank officials in 1960 indicated that due to the lack of maintenance and the overloading of vehicles, many of the roads were breaking up.

Late in 1960, Colombia approached the World Bank for a fourth loan. After a comprehensive review of the national highway program, the Bank extended a loan and credit of $39.0 million in August 1961. In granting this fourth loan, the Bank imposed a stringent set of conditions in an effort to avoid repetition of the earlier difficulties. The government of Colombia was required to employ consultants, and design standards were not changed without the agreement of the World Bank staff. A full maintenance program was carried out, and weight control regulations were reimposed. The largest single construction project was specified as completion of the highways between Medellín and Cartagena, first begun under the initial program in 1951.

The road program undertaken in Colombia during the 1950's had been of unprecedented magnitude both for the country and for the Bank. The major difficulties encountered in the execution of the program had no counterpart in the Bank's previous experience with highway work. By 1961 it became evident to Bank officials that a single program involving 3,000 kilometers of road in generally mountainous terrain was much too large an undertaking for the available resources of the country. Over ten years, Colombia allocated at least 1,776 million pesos to total highway spending, including large amounts outside the Bank-supported program which, when converted by using annual foreign exchange rates, amounted to some $491.5 million.[18]

The Railroad Program

While Colombia was undertaking the tremendous road construction improvement program, the government was also pursuing, simultaneously and independently, a program for rehabilitation and extension

[18] Highway expenditures available from Ministerio de Obras Públicas, *Memoria* (Bogotá: Imprenta Nacional), annually 1953-61.

of the national railroads. The railroad program, like the highway plan, grew out of the recommendations of the World Bank mission of 1950 and was also financed by a series of four loans from the IBRD over the ten-year period from 1952 to 1962.

The first project was the Magdalena Valley Railroad (later to be known as the Atlántico Railroad) planned from Puerto Salgar north along the Magdalena River to Puerto Berrío, to Puerto Wilches, and to terminate at Gamarra, a total length of 380 kilometers. The last section of 116 kilometers north of Wilches had been included in the project because the terminal port of Gamarra was thought to be the furthest point upstream of year-round, night-and-day navigation. Rail freight would then proceed down the river on barges. The project would accomplish the joint objectives suggested in the 1950 World Bank report of integrating the entire rail network as well as eliminating the Magdalena River disability.[17] The first loan for the railroad, signed in August 1952, designated $20 million for construction and $5 million for new repair shops near Bogotá.

The Minister of Public Works had tentatively planned to build a highway from Gamarra north to Fundación to provide an all-land connection of the Magdalena Valley Railroad to the southern terminal of the 90-kilometer Santa Marta Railroad (see Map 5.3, p. 132). But before highway construction could begin, the Minister was ousted by the military coup of June 13, 1953, and replaced by the new administration of General Rojas Pinilla. Instead the new government proposed an all-rail extension of the Magdalena Valley construction to the existing Santa Marta Railway. Although dissatisfied over delays already experienced by the railroads, the World Bank approved a $15.9 million loan in June 1955 for the Magdalena extension.

"There should be no great difficulties encountered in the construction of a railway line following the valley route . . ." the aerial surveyors had written in early support of the project. "It is the only route of easy construction . . . and a line with easy curvature and flat grades can be

[17] See Jorge Leyva, *Application to the International Bank for Reconstruction and Development for the Financing of the Magdalena Valley Railroad in the Republic of Colombia* (Bogotá: Ministry of Public Works, Imprenta Departmental, September 1951). Also Gibbs and Hill Inc., *Reconstruction and Development Program* (Bogotá: Gibbs and Hill for the National Railroads of Colombia, August 1951).

secured without excessive grading cost."[20] However, once construction got underway, it became apparent that the cost had been considerably underestimated. Working beneath the heavy foliage innocuously shown in the aerial photographs, the international engineers were surprised to find swampy lowlands and a high water table aggravated by seasonal inundations which had been first described centuries before by travelers in the Magdalena Valley. Extensive bridge construction and drainage structures were required, and these higher construction costs, aggravated by domestic inflation and the government's reluctance to appropriate the required funds, retarded progress.

By July 1961, when the Atlántico line finally opened, the entire condition of the railroad network was alarming. In spite of the new equipment, the railroads continued to incur deficits year after year. Rehabilitation of the old lines had never been carried out, and an operating loss of 5.83 million pesos in 1958 had increased to some 16.41 million pesos at the end of 1961. One-quarter of the existing diesel fleet was continually out of service awaiting repair and spare parts; derailments, numbering 667 in 1960, continually punctured service. The entire service reputation of the railroad suffered due to poor management and inefficient operations.[21]

[20] Quoted in Leyva, *op. cit.*, p. 8, and from Lockwood, Kessler & Bartlett, Inc., "Magdalena Valley Road Study," Section II.

[21] See Madigan-Hyland South American Corp., *Rehabilitation of National Railroads of Colombia* (New York: Madigan-Hyland for the National Railroads of Colombia, April 1956). All the work by the Madigan-Hyland Corp. was done for the National Railroads and further citations will only give the dates of reports; Madigan-Hyland quarterly *Progress Reports* and *Completion of Atlántico Railroad and Review of Financial Problems* (March 1959). See also, Ferrocarriles Nacionales de Colombia, "Programa para asegurar la consolidación y rehabilitación de la red ferrea de Colombia durante 1959 y 1960" (processed; Bogotá: Imprenta Naciónal, February 23, 1959). For early opposition to the railroad scheme by Colombian engineers, see Sociedad Colombiana de Ingenieros, *Anales de ingeniería*, Vol. LVII, No. 628 (Bogotá: Editorial Minerva, 1949), p. 14. See also Robert Nathan Associates, *Programa de desarrollo económico del valle del Magdalena y norte de Colombia* (Bogotá: Ministry of Public Works for the National Railroads of Colombia, 1960), for a comprehensive report on the areas opened up by the railroad. Some of the region has proved to be rich alluvial soil needing additional investment for drainage; in other areas the soil is poor and quickly eroded.

For an account of railroad construction and loan history, see Institute of International Studies and Overseas Administration, *Public International Development Financing in Colombia*, Report No. 6 (Columbia University School of Law, 1963), pp. 71-84.

Figures from the balance sheets of the National Railroads; these losses include the entire railroad system, but no depreciation or interest charges.

In the ten years following the first World Bank loan, a unified rail system had been realized with the completion of the links between Puerto Salgar to Puerto Berrío and the construction of the Atlántico Railroad to the northern coast. However, the necessary rehabilitation and reorganization of the entire system and a sound financial operation had yet to be achieved.

Other Transport Improvements

Along with the major investment in highways and railroads, Colombia was also improving other means of transport. Minor investments were committed for improvement of seaports and inland channels. On the Pacific coast, additional warehouses were built for the port of Buenaventura. On the Atlantic coast, Barranquilla and Cartagena rivaled each other for the inland trade. Barranquilla alone was spending between 2 and 3 million pesos annually to maintain the channel at Bocas de Ceniza, while Cartagena modernized its port handling equipment. Santa Marta was beginning the construction of warehouses and additional pier facilities in preparation for the Atlántico Railroad traffic.

The Magdalena channel was also being improved for inland shipping. The Canal del Dique which provided Cartagena with access to the Magdalena was deepened and widened, and construction proceeded on the new river terminal of Gamarra, despite the government's decision to extend the railroad to Santa Marta.[22]

Airport facilities were expanded as well, and the low-cost service offered by the commercial airlines continued to attract increases in long distance passenger traffic. Between 1954 and 1957, the national government invested 45.55 million pesos in airport construction.[23]

The Transport Situation in 1961

By 1961, a few economists had come to suspect that perhaps too much of the nation's resources had been devoted to transport invest-

[22] See Madigan-Hyland, *Economic Feasibility of the Capulco Transfer Terminal* (February 1960).

[23] See Ministerio de Obras Públicas, "Navegación y puertos," *Memoria, 1958*, pp. 47-61; "Conservación del río Magdalena," pp. 62-73; "Empresa colombiana de aeródomos," pp. 94-99. Also *Memoria, 1959*, pp. 129-40; and *1960*, pp. 275-99. See also Jaime Salazar Montoya, *El transporte en Colombia* (Bogotá: Comité Nacional de Planeación, 1958), Vol. 1, Chap. 4, "El transporte aéreo," pp. 191-237.

Steam locomotives are still in use in various parts of the railroad network. This oil-burning engine hauls tank cars to the Ibagué terminal. Photo by Paul O. Roberts.

ment. The World Bank had estimated that more than 10 billion pesos in 1961 prices had been devoted to transport improvements during the previous decade. Taking 1959 as a typical year, a study reported, "Transportation alone absorbed more of the investment resources of the national Departmental and Municipal Governments than all other sectors of economic and social activity together . . ."[21]

It was clear that the general transportation situation had become entangled in the network of its own making. Many of the early deficiencies had been overcome, but major gaps remained in the transport system. Direct road connections between Medellín and Bogotá, the two most important cities in Colombia, still had not been completed, and Medellín, the major industrial center, lacked a direct and dependable route to either of the coasts. The railroad system had been tenuously unified by the new Atlántico line, but a more direct all-rail link between the Eastern Highlands and the Cauca Valley remained to be undertaken. (See Map 5.4.)

The value of what had been built was also open to question. The new Atlántico Railroad began service (three years behind schedule) in July 1961, at a total construction cost of over twice the original estimates. Diesel barges continued to operate on the Magdalena River generally as far as Puerto Berrío, and, in certain seasons, to La Dorada. The massive diversion of cargo from river to rail was slow to occur.

In spite of the opening of the new railroad track, the project actually remained quite incomplete. Segments of the Fundación-Santa Marta and Sabana Railroads which had been built at the end of the last century had yet to be rehabilitated in order to allow heavy locomotives to move to all parts of the system. The other three major links of the Colombian National Railroads—Bogotá to Salgar, Medellín to Berrío, and Bucaramanga to Wilches—were in need of renovation, and the critically poor condition of these older sections destroyed the efficiency of the new line.

Furthermore, the Atlántico Railroad terminated at Santa Marta, a port still being constructed. A seasonal banana crop was given priority in the use of the loading facilities and delayed other cargo on its single pier and warehouse. Even after expansion of the port, a maximum of four ships could be expected to fit within the physical constraints of the Santa Marta harbor.

[21] Parsons-Brinckerhoff-Quade & Douglas, *op. cit.*, p. 4.

At the same time that Santa Marta was suffering from a lack of port capacity, the two nearby ports of Barranquilla and Cartagena operated with surplus equipment. Further silting at the mouth of the Magdalena River closed the port of Barranquilla for months at a time and discouraged extension of the rail connection. The failure to complete an all-weather road from Medellín north prevented the port of Cartagena from competing for the import-export traffic of the interior. Because of poor connections of both Cartagena and Barranquilla with the new Atlántico Railroad, the advantages of a speedy, low-cost route between the two major Atlantic ports and the interior were never realized. The two major Atlantic cities remained isolated from the interior regions.

Faced with delays in reaching the Atlántico Railroad and inefficiencies in terminal handling, almost half of the export-import cargo, especially coffee, continued to move through Buenaventura. While the Atlantic ports worked under capacity, Buenaventura still suffered from congestion in its loading operations.

Transport connections were adequate in some regions. In other areas, however, it was evident that a general duplication of facilities had been created, and, contrary to pre-investment expectations, the resulting competitive service was leading to losses on all projects. Roads had been paved which paralleled rail routes, and with the improvement of trucking services, traffic was diverted from the railroads.

The result of ten years of intensive transport investment was the apparent improvement of four separate systems for moving cargo. Export freight from Bogotá, for example, could move via one or any combination of three competing modes to any one of three major ports on one of the two coasts of Colombia. More highly valued cargo was flown by air service. Rail, road, water, and air carriers all shared the movement of freight in such a way that some facilities were operating at capacity while others remained underutilized by the traffic flows.

The Economics Examined

The investment in transport was undertaken as one phase of a vast development program for Colombia. When, thirteen years after the initiation of the program, the observer recalls that careful prepara-

tion had preceded each loan and that each project had referred to the authority of the 1950 World Bank report, it is puzzling that so much effort has resulted in an array of such uneconomic facilities and duplications. A summary of the funds actually allocated to each transport mode as compared with the amounts recommended in the World Bank report is shown in Table 5.1.

When, after ten years and seven major loans, it is evident that general duplications have occurred, it is important to investigate those factors which might have contributed to the apparent misallocation. What had the World Bank failed to consider which later undermined the basis of the entire transportation program?

Five Factors Relevant to Investment Errors

(1) TRANSPORT PLANS ISOLATED FROM ECONOMY. Despite the original efforts of the 1950 World Bank Mission, the decisions concerning transport became removed from the context of the development program as implementation got underway. It had been understood at the time of the Currie Report that the World Bank would support the general development program with $200 million in foreign exchange over five years. By 1952, however, the World Bank had reformulated its position on development financing and confined its lending activities to certain types of projects—primarily roads, railroads, and electric power. With

TABLE 5.1. *Comparison of the 1950 World Bank Program and Actual Investment*
(In millions of pesos and percentages)

Mode of transport	World Bank Program, 1951–55		Actual, 1951–55	
	Pesos	Percentage	Pesos	Percentage
Roads	42.3	35	628	74
Railroads	74.5	62	175	21
Ports	2.9	3	43	5
Total	119.7	100	846	100

SOURCES: World Bank Program, International Bank for Reconstruction & Development, *Basis of Development Program for Colombia* (IBRD), 1950, p. 475.

Ministerio de Obras Públicas, Departamento de Contabilidad, "Apropriaciones para gastos en las diversas dependencias del Ministerio de Obras Públicas en el lapso de los 12 últimos años," *Obras Públicas, Revista del Ministerio*, No. 5 (Bogotá, April-July 1957), frontispiece chart.

the abandonment of the general program, the government of Colombia readily undertook that portion of the development plan for which extensive financing was available. The general conditions of the World Bank loans—to provide only the foreign exchange portion of projects—encouraged extensive public investment in areas to which the Bank offered to contribute. What had been originally conceived as a balanced investment program became a rather specialized series of projects, and Colombia had plunged into an expansion of its public works to the neglect of other sectors of public investment.[24]

Furthermore, by including transport in the World Bank plan, the locational distribution of the facilities had been implicitly determined. New construction was to provide road links between the major cities and integrate the entire rail network. This was a national transportation proposal fitted for national development.

The plan had identified the major transport problem as the Magdalena disability. Consequently, between 1953 and 1958, much of the investment in road building was confined to the eastern regions of the country. The roads from Cúcuta on the Venezuelan border to Bucaramanga and Barbosa were almost entirely paved. Highways leading to the capital and the connections with Boyacá were greatly improved.

Yet industrial needs for transport were greatest in the western regions of the country, especially in Cali and Medellín. Here, the movement of raw materials and manufactured goods created a demand for transport facilities which was not met by allocation of public transport investment. The Cali-Manizales-Medellín region, for example, produced 45.3 percent of the value of national output in 1956. Yet between 1953 and 1958, only 29.9 percent of the national government's total highway investment was spent in this region. The Eastern Highlands, however, which was responsible for 36.5 percent of the manufacturing production in 1956, received 48.5 percent of national highway investment (see Table 5.2).

[24] Professor Hirschman points out that much of the "over-all, integrated development program" had been stated in vague objectives and never translated into specific investment projects ready to be undertaken. "Thus, in the investment field, the only important achievement of the International Bank Mission to Colombia was the highway and railroad program, which was also the only one to have been spelled out in fairly concrete terms." Albert O. Hirschman, "Economics and Investment Planning: Reflections Based on Experience in Colombia," in Center for International Studies, M.I.T., *Investment Criteria and Economic Growth* (New York: Asia Publishing House, 1961), p. 42. These conference papers were presented in October 1954.

TABLE 5.2. *Regional Comparison of Value of Output and Actual Highway Investment*

Region[a]	Percentage of value of output,[b] 1956	Percentage of highway investment,[c] 1953–58	Percentage of highway investment,[c] 1958–62
West			
Pasto, Popayán	3.7	3.1	6.8
Cali, Manizales, Medellín	45.3	29.9	24.3
Coast-West			
Montería, Cartagena	5.6	13.7	13.5
Coast-East			
Barranquilla, Santa Marta	8.9	4.8	8.5
Eastern Highlands	(36.5)	(48.5)	(46.9)
Cúcuta, Bucaramanga, Tunja	9.9	22.5	31.0
Bogotá	20.8	15.5	5.6
Ibagué, Neiva	5.8	10.5	10.3
Total	100.0	100.0	100.0

a. Regions are broken into departments, which are designated by capital city.

b. Robert Burns, "Regional Distribution of Economic Activity by Industry, 1956," in Discussion Paper No. 53: "Data Collection for the Macro Economic Model of Colombia," Transport Research Program (processed; Harvard University, April 1967), pp. 17–22. Values added have been calculated by region for the following sectors: general agriculture, coffee, mining, petroleum and gas, livestock, foodstuffs, nonfood consumption goods, industrial goods, construction, transport services, utilities, banking, housing, and other services.

c. See Table 5.3.

Despite the regional pattern of industrial location, there was a failure to adjust the transport plan. By isolating transport from the general development scheme of the nation, locational needs were disregarded.

(2) TRANSPORT MODES CONSIDERED INDIVIDUALLY. In addition to being isolated from the context of the general development plan, each transportation decision was reduced to the modal framework. Decisions involving rail, road, water, and air systems were considered largely independently of one another. Project allocations were made without taking account of all changes taking place in the entire transportation system. The railroad studies overlooked the improvements on the highways and on the inland waterways. Highway plans, especially after the 1955 decision to extend the Magdalena Railroad, were not altered. Freight estimates on the railroads were made by assuming a linear increase in rail traffic. Truck service had never been regarded as a threat to the rail traffic. On the contrary, it had been argued, the traf-

fic generated by the improved feeder highways would create additional freight for the railroads.[26]

Road projects were planned to integrate the entire road network, disregarding the railroad links between cities. Pre-investment analysis demonstrated that proposed "shortcuts" in the highway system would yield an extremely favorable return, but it was overlooked that much of the expected traffic on the new highway would result from diversion from the alternative railroad route. The Buenaventura-Buga highway, for example, shortcuts a branch of the Pacific Railroad. Work proceeded on sections of the Eastern Trunk highway from Bogotá to Santa Marta as if the Atlántico Railroad itself had never been planned. In spite of the eventual justification of many of these road projects, it appears that little attention had ever been focused on the interaction of the rail and road improvements. At the same time that the government was expanding the roads to relieve the congestion and lower transport costs, it was undertaking a rehabilitation program to strengthen the railroad's competitive position and increase its handling capacity.

(3) PROJECTS ISOLATED FROM MODES. Within the modal context, projects were taken apart and decisions were made piecemeal in terms of the smallest possible unit. Road projects were examined link by link and the effects of these successive links on the entire network were disregarded. The pre-investment study for extension of the Magdalena Valley Railroad, for example, had considered the costs of traffic from Gamarra to Santa Marta and the revenue that would be earned by the new line.[27] This, however, was merely one section of the entire railroad. When the line is considered as a unit with the rest of the railroad network, a different analysis is required.

[26] See Madigan-Hyland, *Traffic, Revenues and Expenses of the Colombian Railroads* (January 1953); *Economic Feasibility of the Magdalena Valley Railroad Extension* (July 1954).

[27] "No analyses have been made to establish economic justification or benefit-cost ratios for the roads, since all roads included in the recommended program show a substantial volume of important traffic . . . that the economic justification is considered to be self-evident," wrote the consultants in the report on which the fourth highway loan was based. OLAP-Ingeneria, *National Highway Program* (Bogotá: OLAP-Ingeneria for Ministry of Public Works, May 1961), p. 2. Madigan-Hyland, *Economic Feasibility of the Magdalena Valley Railroad Extension* (July 1954).

The decisions to construct the Magdalena Valley Railroad and then to extend the line to Santa Marta, renaming it the Atlántico Railroad, actually involved commitments to the entire network of the National Railroads of Colombia. In order to function, traffic had to flow into the new railroad from connecting feeder lines. But these crucial connections—Bogotá to Salgar, Medellín to Berrío, Bucaramanga to Wilches, and even Santa Marta to Fundación—were in urgent need of rehabilitation. These supporting lines all needed major investments in rolling stock and locomotives and, with the heavier diesels, further replacement of bridges and rails was required. While the newer, low-cost segments of the network earned profits, the gains from the recent construction were being destroyed by the deterioration of its supporting lines. The entire administration of the railroads demanded reorganization, and the eleven decentralized "divisions" and independent lines were yet to be cemented into a single enterprise, the Colombian National Railroads, if the new Atlántico Railroad was to function successfully.

One of the most important links of the entire railroad system was neglected entirely: the final connection with Barranquilla, the most important port on the north coast. None of the schemes for using barges or truck-trailer transfers was an adequate substitute for the all-rail route.[25]

(4) PROJECT EVALUATIONS MISCALCULATED. In addition to the errors committed by removing each link from the modal network, other errors were made in the methodology for evaluating transport projects. Requirements of private investment were excluded from decisions involving public investment. Private costs were omitted in evaluating alternatives, and rather than consider total costs to the economy, evaluations were based only on those costs which would be incurred by the borrowing enterprise. In highway evaluations, only the costs of roadway construction were considered in the comparison to the benefits to be gained. Private costs, such as the purchase of rolling stock, were entirely neglected.

[25] See Robert Nathan Associates, *op. cit.*, p. 194. See also Ministerio de Obras Públicas, "La conexión del ferrocarril del Atlántico con Barranquilla," *Memoria, 1960*, Vol. V, p. 403-72. Madigan-Hyland, *Comparative Studies for Transfer of Railroad Freight between Barranquilla and Ciénaga* (April 1961).

In the rail evaluations, the cost estimates included all those charges for which the railroads were responsible, such as rolling stock, but they did not include all related costs of the project. The costs of Santa Marta port facilities and the crucial highway connection to Barranquilla had *not* been included in the cost estimates. "These improvements," it had been argued, "estimated to total about 23 million pesos, were planned by the Colombian government independently of the railroad project."[29]

Actually, two very different methods were employed for the evaluation of rail and road projects. The road analysis, by omitting all private rolling stock requirements, is at best a partial economic comparison of the resources required of the government and the benefits to be derived by private carriers. The railroad studies performed by the engineering consultants to the World Bank make no pretense of being economic evaluations; as their titles indicate,[30] they are financial studies and as such provide little basis for comparison of the true economic resources required for successful operation of the project.

Even as financial studies, the railroad reports proved to be extremely poor predictors. Revenue, for example, had been estimated in terms of the competitive rate offered by the water carriers operating along the same route. Once faced with railroad competition, water carriers actually cut their rates below those previously offered in the noncompetitive position. The railroad not only realized considerable difference between anticipated and actual revenue, but also lost freight to the water carriers due to the inadequate terminal connections at Santa Marta and the excessive delays and handling charges incurred in transshipping freight to other Atlantic ports. Similarly, truckers, instead of losing cargo to the railroad, actually diverted traffic by offering faster, more dependable service at a competitive rate.

In the financial analyses, there is little understanding of the trade off between time and price differentials. The original study of the Magdalena Valley Railroad, for example, demonstrated that user charges from Bogotá north along the rail-river route would be slightly less

[29] Madigan-Hyland, *Economic Feasibility of the Magdalena Valley Railroad Extension* (July 1954), p. 108.

[30] See Madigan-Hyland, *Traffic, Revenues and Expenses of the Colombian Railroads Including the Proposed Magdalena Valley Railroad* (January 1953); *Reorganization and Rehabilitation Program* (April 1953); *Completion of Atlántico Railroad and Review of Financial Problems* (March 1959).

than the alternative rail route to the Pacific port. The Buenaventura route, however, required two days; the Magdalena route before the extension would require six to seven days. The study concluded that most of the traffic from Bogotá would move north to the Atlantic. This assumption that shippers would choose the slower route and lower rate led to the overestimation of the anticipated cargo.

Apart from the errors of piecemeal implementation and financial analysis, more serious results can be traced to the economic concepts which underlay the suboptimization procedure. The investment in facilities was seen as the "supply of transport" as well as a social overhead requirement. The government, in providing transport capacity, planned its projects to meet the expected "demand" for these facilities. The first problem was the exact determination of present demand using traffic counts. Future traffic was forecast by simply extrapolating the current growth trends.

Once construction began and by virtue of the improvements themselves, traffic increased by considerably more than all previous trends had indicated. Facilities had to be reconstructed and standards upgraded. This surprising increase in traffic was attributed to the "remarkable growth of industry," and new forecasts were undertaken.

The extrapolation of simple trends to forecast demand led to exaggerated errors when underlying factors were shown to be subject to wide ranges of fluctuation. A major justification for the Atlántico Railroad depended on the movement of import cargo from the northern ports to Bogotá. However, because of balance of payments difficulties, the import flow has greatly fluctuated since 1956. Yet major changes in the quantity and composition of this trade had never been seriously considered.

It must be noted in all fairness that the traffic forecasts for the Atlántico Railroad were considered to be extremely conservative. "Development" cargo from opening up the Magdalena Valley had not been included in the estimates. However, once the railroad was completed and the expected import-export traffic did not accrue, a new justification was created: the main purpose of the railroad was to open up these new lands. Yet many Colombian engineers and economists had suggested that railroad building in lowland regions for almost speculative development purposes was an extremely expensive substitute for an exploratory highway.

(5) METHODS OF EVALUATING PROJECTS. Another factor which contributed to the discrepancy between the forecast and actual traffic was the relationship between prices and demand. Early studies had not anticipated much variation in transportation with changes in price. Yet the demand for transport for certain commodities proved to be very dependent on shipping prices. For example, the quantity of refined sugar consumed by the Eastern Highland region and shipped from the Cauca Valley was very much a function of the transportation rates. After improvements in highway conditions and a consequent decline in trucking rates, movement of sugar increased more than indicated by past trends.[31]

Declines in prices on one transport mode have also led to a decrease in freight carried by the other modes; that is, there is a high cross price elasticity of transport demand between competing carriers. A fall in trucking rates relative to railroad rates has led to diversion of freight from rail to truck.[32]

Subsidization of Highway Transport

In Colombia much of the unexpected growth of the trucking industry was not the result of "natural growth" of demand for transport. Rather, it was implicit in government policy, however unintentional, to subsidize the trucking industry and enable truckers to charge a relatively low price to users. Railroad rates, on the other hand, were raised on the loan condition that the National Railroads at least attempt to meet all operating costs.

ABSENCE OF USER CHARGES. Costs of highway construction are met in most countries by direct user charges, such as tolls, or by indirect taxation, such as gasoline and tire excises and registration fees. In Colombia, however, toll charges were infrequently established and user taxes were maintained at an extremely low level. Railroad user prices included maintenance and right-of-way costs as well as minimum labor charges enforced by an advanced labor code and effective unions.

[31] See *Revista del Consejo Administrativo de los Ferrocarriles Nacionales* (Bogotá), monthly for years 1950-52. These magazines give detailed information on truck movements between the Magdalena and Cauca valleys and the variation of specific commodities.

[32] See National Railroads, *Los ferrocarriles en cifras, Boletín mensual* (Bogotá), for changes in traffic and revenue with rate increases.

Highway users, on the other hand, merely had to meet operating and vehicle costs and a flexible return to the self-employed owner-operators. The right-of-way was provided practically without charge.[34]

Truckers have managed to underbid the railroads on competitive hauls, not because total trucking costs are less, but because the price charged to the shipper is below the actual economic cost. This difference between the full costs of truck transport and the price paid by the user represents the government subsidy.[35]

RAIL AND ROAD PRICING POLICIES. Railroad rates were set at the insistence of the World Bank to cover operating, maintenance, and capital costs. At the same time, the Bank refused to insist on the imposition of tolls on the Bank-financed highways. The already unfavorable competitive situation became locked between this contradictory policy of the World Bank and the basic planning errors of the preceding decade. Furthermore, the government through improper manipulation of the pricing mechanism accelerated the shift from railroad to highway use. Rates for both the railroads and trucks are set by the same government agency, the Superintendency of Economic Regulation. Although rates for rail are given as unitary and inflexible, only maximum trucking rates are established. This has resulted in considerable underbidding of the regulated price, especially for the back haul from the ports to the interior.[35]

ABSENCE OF IMPORT CONTROLS. In addition to rate and tax policies favorable to highway users, the Colombian government also permitted

[34] An attempt to raise the level of user charges was resisted by general transportation strikes which paralyzed the country on January 6 and 7, 1959, and destroyed the weight control stations. The increase in gasoline tax was revoked, and other means were sought for raising revenue for roadbuilding. See article in *El Colombiano*, Medellín, July 15, 1962, entitled "El reajuste en los transportes—Las nuevas tarifas son otro efecto retardado de la devaluación del 57," pp. 4-5.

[35] The World Bank report of 1950, the Madigan-Hyland reports of 1951 and later years, and the Parsons report of 1961 all stress the nonprice advantages of trucking. Handling, speed, prompt repayment of losses, dependability, are the typical service advantages of the trucking industry in Colombia. The poor administration by the railroads and the failure to tie Barranquilla into the network add to the advantage of truck competition on parallel routes.

[36] For a very similar situation in Great Britain, see Gilbert W. Walker, *Road and Rail, an Enquiry into the Economics of Competition and State Control* (London: W. W. Norton, 1942). In July 1963, the trucking organizations of Bogotá were petitioning the government for a "unique set of rates" which would also terminate the predatory competitive practices between independent truckers.

unrestricted importation of vehicles for cargo purposes. From 1950 to 1952, Colombia imported between 6,000 and 6,500 trucks annually. In 1954 and 1955, however, more than 12,000 new trucks entered the country. The government, in approaching the World Bank for financing an expanded road program, then cited the "surprising increase" in vehicles, gasoline consumption, and quantities of freight being hauled by road. By failing to impose government controls on trucking, in spite of heavy government investments in railroads, government policy itself intensified road-rail competition.

INTRINSIC ABILITY OF TRUCKERS TO LOWER COSTS. The trucking industry itself is organized in such a way as to avoid the same legal constraints as those imposed on the railroads. Because most truckers are owner-drivers, they may pay themselves an equitable salary which is lower than the legal minimum wage and does not include the usual social benefits enjoyed by employees of the government railroads. By sleeping in his own cab on the overnight haul, a driver may choose not to restrict himself to the shorter working day of government employees. The trucker, therefore, retains the option of reducing his own wage when he bids against the railroad for freight.

Inaccuracies in Cost Estimates

Because of these several legal, regulatory, and pricing factors, projections of truck operating costs were consistently higher than actual costs. Estimates of railroad operating costs, on the other hand, were consistently lower than actual costs. Attainable rail costs had been estimated on the basis of ideal railroad performance in other countries; it had been assumed that similar costs would be realized by the Colombian railroads after a reorganization,[36] and that efficient management could be quickly transplanted to Colombia. The low-cost operation of the recommended Atlántico Railroad had been based on this principle. Predictions of railroad profits depended on savings which would result from more efficient labor practices.

[36] Madigan-Hyland, *Traffic, Revenues, and Expenses of the Colombian Railroads* (January 1953), expected considerable cost savings from improvement in management practices of the railroads.

After the first loan was granted and administrative reforms were initiated, it was recognized that management practices could not be altered so easily. As the new line was opened, the spreading of surplus personnel never took place and extra personnel again were hired in addition to the already existing surplus. The supposed savings of a capital-intensive operation were never realized. "Theoretically it would be possible to achieve considerable savings by reducing payrolls . . . particularly through the labor-saving devices inherent in newly acquired equipment," a Madigan-Hyland official wrote in 1959. "In practice this is against the policy of the railroad management as well as of the government."[37]

This failure to develop adequate cost data from the relevant and attainable efficiencies, combined with the misuse of pricing regulations by the government, contributed to the errors in traffic forecasts and to the resulting misallocation of resources.

The Politics Examined

Certain allocations remain unexplained by the methodology which supposedly guided the investment decisions. Some results are so contradictory that the decisions appear to involve a rejection rather than a misapplication of rational criteria. Construction during the 1950's proceeded according to the Highway Program which had been approved by the Colombian Economic Development Committee with the assistance of the World Bank. By the end of the period under review (1962), it was apparent that the plan had been only selectively followed. Although roads had been started as indicated by the plan, only scattered projects in certain regions had been completed. Highways from Bogotá to Girardot, from Bogotá to Honda, from Bogotá north to Tunja, and from Bucaramanga to Cúcuta were paved and became the best transport roadways in the country (see Map 5.3). Construction was also concentrated on several major routes, such as Cali-Buenaventura, Medellín-Cali, Ibagué-Armenia, and Cartagena-Barranquilla.

In other regions, however, progress was considerably slower. The

[37] Madigan-Hyland, *Completion of Atlántico Railroad and Review of Financial Problems* (March 1959), p. 5.

One of Colombia's newest paved highways cuts the slopes of the Eastern Cordillera on the descent from Bogotá to Villavicencio. Photo by Paul O. Roberts.

Medellín-Cartagena road, originally proposed in 1951, still had not been opened to all-weather traffic by 1961. Improvements on the Medellín-Cali road had not been completed and halfway through the Western Cordillera the series of costly shortcuts from Buenaventura to Buga had exhausted project funds.

Regional Allocation of Highway Expenditures, 1953–66

While the World Bank had outlined and financed a wide-ranging road network, the actual total investment had come to represent an apparently irrational pattern of regional disbursements. Some of the through-links between cities had indeed been accomplished despite enormous difficulties; other roads of equally high priority had barely been opened to seasonal traffic.

Total expenditures on highway projects by groups of departments are presented in Tables 5.3 through 5.5. These data represent the sums spent by the national government for highway construction during three periods, 1953-58, 1958-62, and 1962-66. (The third period was included to show the important pattern of recent years.) The completed contracts, expenditures, and location of construction are published annually by the Ministry of Public Works. The data presented were abstracted from these contract lists and arranged according to location. It may be noted that due to domestic inflation, the peso values from one period to another are not comparable. The purpose of these tables, however, is to examine the percentage distribution of expenditures in each period and the changes in this distribution over time.

The most striking shifts in total expenditure (see Table 5.3) occur in the increases in the Pasto-Popayán (southwestern) and Ibagué-Neiva (southeastern) departments during the three periods. The decrease in the "East-West Crossing" represents the completion of the Ibagué-Armenia road. Bogotá suffers the greatest decline from the first period to the second. The regional subtotals reflect a continuous increase, percentage-wise, in expenditures in the western areas.

The changes in expenditures of the important trunklines is more clearly demonstrated in Table 5.4. The shift to the western regions occurs with the increased spending on the Popayán-Cali road and on the northwestern links of the Medellín-Cartagena road (Coast-West). In-

TABLE 5.3. *Spending on Highway Construction in Colombia, by Region, 1953-66. Total National Government Expenditures*

Region[a]	1953–58		1958–62		1962–66	
	Pesos[b]	Percentage[c]	Pesos[b]	Percentage[c]	Pesos[b]	Percentage[c]
West						
Pasto, Popayán	20,047	3.1	30,387	6.8	71,550	14.9
Cali, Manizales,[d] Medellín	157,081	24.6	102,624	23.1	123,311	25.6
Subtotal	177,128	27.8	133,011	29.9	194,861	40.5
Coast-West						
Montería,[e] Cartagena	87,084	13.7	60,094	13.5	66,563	13.8
Coast-East						
Barranquilla, Santa Marta	30,740	4.8	37,547	8.5	38,102	7.9
Subtotal	117,824	18.5	97,641	22.0	104,665	21.8
Eastern Highlands						
Cúcuta, Bucaramanga	88,448	13.9	76,633	17.3	32,591	6.8
Tunja	54,650	8.6	60,890	13.7	39,531	8.2
Bogotá	98,875	15.5	24,801	5.6	31,866	6.6
Ibagué, Neiva	33,232	5.2	40,351	9.1	60,815	12.6
Subtotal	275,205	43.2	202,675	45.6	164,803	34.3
East-West Crossing						
Ibagué to Armenia	67,251	10.6	10,8742	2.4	16,652	3.5
Total	637,408	100.0	444,201	100.0	480,981	100.0

SOURCE: Ministerio de Obras Públicas, *Memoria* (Bogotá: Imprenta Nacional, 1958–66). Annuals give list of contracts, locations, costs.

a. Regions are broken into departments, which are designated by capital city.

b. Figures are in current pesos. The average exchange rate for the 1953–58 period was 4.55 pesos=$1.00; for the 1958–62 period, 6.60 pesos=$1.00; for the 1962–66 period, 11.25 pesos=$1.00.

c. Percentages refer to proportion of total central government highway construction funds spent in each department or region. Percentages may not add to totals due to rounding.

d. Divided into two additional departments, Risaralda and Quindío in January 1967.

e. Divided into one additional department.

creased work on the eastern trunklines from Bucaramanga to Santa Marta and the completion of the Santa Marta-Barranquilla highway are reflected in the increase in the "Coast-East" category. While some of the change in the expenditures in the World Bank program can be traced simply to the completion of a given segment of the network, this table reveals the time sequence actually followed in the lines of construction along the broad routes.

The expenditures in Table 5.5 represent the construction projects

outside the World Bank program, which are left to the discretion of the Ministry of Public Works and to the Congress. These expenditures had been planned to allow the central government to complement the World Bank program by building penetration roads to connect previously isolated regions. Table 5.5 illustrates the dramatic changes in regional projects which were carried out independently of the World

TABLE 5.4. *Spending on Highway Construction in Colombia, by Region, 1953-66. Expenditures on Roads Included in the World Bank Program*

Region[a]	1953-58		1958-62		1962-66	
	Pesos[b]	Percentage[c]	Pesos[b]	Percentage[c]	Pesos[b]	Percentage[c]
West						
Pasto	....	....	....	....	12,688	3.6
Popayán	....	....	....	....	45,547	13.0
Cali, Manizales,[d] Medellín	118,948	30.6	63,629	32.9	96,749	27.7
Subtotal	118,948	30.6	63,629	32.9	154,984	44.3
Coast-West						
Montería, Cartagena	48,951	12.6	34,898	18.0	49,300	14.1
Coast-East						
Barranquilla, Santa Marta	16,512	4.3	17,959	9.3	29,271	8.4
Subtotal	65,463	16.9	52,857	27.3	78,571	22.5
Eastern Highlands						
Cúcuta, Bucaramanga	75,146	19.4	11,335	5.9	10,460	3.0
Tunja	8,496	2.2	35,330	18.3	23,417	6.7
Bogotá	52,926	13.6	9,484	4.9	25,749	7.4
Ibagué	0	0.0	6,803	3.5	29,010	8.3
Neiva	0	0.0	3,122	1.6	10,922	3.1
Subtotal	136,568	35.2	66,074	34.2	99,558	28.5
East-West Crossing						
Ibagué to Armenia	67,251	17.3	10,874	5.6	16,052	4.8
Total	388,230	100.0	193,434	100.0	349,765	100.0

SOURCE: Ministerio de Obras Públicas, *Memoria* (Bogotá: Imprenta Nacional, 1958-66). Annuals give list of contracts, locations, costs.

Note: Table 5.3 is broken down into Tables 5.4 and 5.5. Figures for each region or department add up to comparable figures in Table 5.3.

a. Regions are broken into departments, which are designated by capital city.

b. Figures are in current pesos. The average exchange rate for the 1953-58 period was 4.55 pesos = $1.00; for the 1958-62 period, 6.60 pesos = $1.00; for the 1962-66 period, 11.25 pesos = $1.00.

c. Percentages refer to proportion of total central government highway construction funds spent on World Bank road projects in each department or region. Percentages may not add to totals due to rounding.

d. Divided into two additional departments, Risaralda and Quindío in January 1967.

TABLE 5.5. *Spending on Highway Construction in Colombia, by Region, 1953-66, Excluding World Bank Program Expenditures*

Region[a]	1953-58		1958-62		1962-66	
	Pesos[b]	Percentage[c]	Pesos[b]	Percentage[c]	Pesos[b]	Percentage[c]
West						
Pasto	8,656	3.5	23,890	9.5	5,550	4.2
Popayán	11,391	4.6	6,497	2.6	7,765	5.9
Cali	14,023	5.6	14,168	5.6	1,579	1.2
Manizales[d]	3,417	1.4	4,265	1.7	8,069	6.1
Medellín	20,693	8.3	20,562	8.2	16,914	12.9
Subtotal	58,180	23.3	69,382	27.7	39,877	30.4
Coast-West						
Montería, Cartagena	38,133	15.3	25,196	10.0	17,263	13.2
Coast-East						
Barranquilla, Santa Marta	14,228	5.7	19,588	7.8	8,831	6.7
Subtotal	52,361	21.0	44,784	17.8	26,094	19.9
Eastern Highlands						
Cúcuta, Bucaramanga	13,302	5.3	65,298	26.0	22,131	16.9
Tunja	46,154	18.5	25,560	10.2	16,114	12.3
Bogotá	45,949	18.4	15,317	6.1	6,117	4.7
Ibagué	19,426	7.8	28,397	11.3	11,880	9.1
Neiva	13,806	5.5	2,029	0.8	9,003	6.9
Subtotal	138,637	55.6	136,601	54.5	65,245	49.9
Total	249,178	100.0	250,767	100.0	131,216	100.0

SOURCE: Ministerio de Obras Públicas, *Memoria* (Bogotá: Imprenta Nacional, 1958-66). Annuals give list of contracts, locations, costs.

NOTE: Table 5.3 is broken down into Tables 5.4 and 5.5. Figures for each region or department add up to comparable figures in Table 5.3.

a. Regions are broken into departments, which are designated by capital city.

b. Figures are in current pesos. The average exchange rate for the 1953-58 period was 4.55 pesos = $1.00; for the 1958-62 period, 6.60 pesos = $1.00; for the 1962-66 period, 11.25 pesos = $1.00.

c. Percentages refer to proportion of total central government highway construction funds spent on World Bank road projects in each department or region. Percentages may not add to totals due to rounding.

d. Divided into two additional departments, Risaralda and Quindío in January 1967.

Bank program. During the period 1958-62, for example, the total appropriation for roads *outside* the World Bank program was somewhat greater than the appropriation for the program itself, although it was supposedly understood that the highest priority was to be placed on completing the original trunkline program.

The Role of the World Bank

The pattern of transport investment cannot be explained entirely in terms of the general technical methodology used by the World Bank and the Ministry of Public Works. It must be remembered that the World Bank conceived its role in less developed countries as strictly that of a financial and technical organization. "It is a proper Bank," Morris has written, "run by professional bankers lending money at rates of interest, not extortionate but scarcely open-handed, expecting to see a profit on its cash and on the projects it financed."[38]

In Colombia, the Bank's policy was to study the transport facilities based on the needs of the nation. The supply of transport facilities within the country was planned according to the requirements for such facilities. The loans were provided on the basis of the relative profits or benefits of the proposed projects.

It is suggested that the policies of the World Bank, by attempting to remain above the regional and political rivalries within the country and by claiming adherence to proper financial criteria, actually resulted in the predominance of certain regional forces over the program. The transport projects had been planned and financed as a part of a national development program. As the plan was split up into pieces, regional rather than economic considerations became more important in the allocation of the projects. The national programs, designated in the foreign loans, were broken up and assigned priorities according to these regional demands. Also, the loans freed government resources for other purposes, and these investments again were guided by noneconomic considerations.

In spite of the intentions of the World Bank, the allocation of highway resources in particular was never removed from a political context. Throughout the period under review, the various Ministers of Public

[38] Morris, *op. cit.*, p. 43.

Works exercised considerable influence over the allocation of funds for highway investment, not only through their control of expenditures for highways outside the World Bank program (as shown in Table 5.5), but also through governmental control of the counterpart funds necessary to the implementation of IBRD-sponsored projects.[39] After 1958, the Congress commanded the position of shifting contracts and assigning priorities. Rather than the commercial centers receiving the bulk of road investment funds, it appears that certain regions were successful in asserting their demands through political pressures and received a disproportionate share of road investment.

Regionalism in Colombian Politics

Political alignment in Colombia is conceived in terms of two traditional parties, Conservatives and Liberals, which have alternated in national office and trace their rivalry back to the early years of independence. On close examination of the national elections, however, it is evident that party rivalry is in part the expression of intense regional rivalry. The coastal departments of Atlántico, Bolívar, and Magdalena (with the cities of Barranquilla, Cartagena, and Santa Marta) are traditionally and overwhelmingly Liberal; the Department of Nariño (Pasto) is traditionally Conservative. While smaller towns may be characterized as Liberal or Conservative, cities are divided between both Liberal and Conservative families. Both parties have strong representation in most departments.[40]

Early Years of the Highway Program

The 1951 program of the Economic Development Committee followed a definite national plan designed to tie the major cities together by an all-weather network. It appears that few important transport de-

[39] For a discussion of the influence of party politics on the internal workings of the Ministry of Public Works, see below, p. 173. The portfolio of the office changed hands frequently. One minister served from 1951 to 1953, three from 1953 to 1958, and two from 1958 to 1962.

[40] See Contraloría General de la República, Dirección Nacional de Estadística, "Estadística electoral," *Anales de Economía y Estadística* (Bogotá), elections of March and October 1945, May 1946, March 1947, October 1947, March 1958, for department and municipality results.

cisions were made on party basis. For example, in the selection of a route from Bogotá to Medellín, the compromise plan concluded a high priority highway through Manizales, and only secondarily, the northern route through Bogotá, La Dorada, and Sonsón to Medellín. The Economic Development Committee resolved the sectional rivalry, weighting the alternative routes by the economic importance of the Caldas region. During the first years of highway investment, the basic highway network, especially the connections between the major cities, were opened to traffic. In 1953, a military regime came into power. During the years of military government from 1953 until 1957, work continued on the important routes as outlined in the 1951 loan.

The Middle Period—The Atlántico Railroad

It was during this period that the military government undertook to extend the railroad to the Atlantic coast. The original 1952 project to construct a short jungle railroad and to renovate the old lines appears to have been a technical decision by the national government, hinging on the studies by the engineering consultants and, of greater importance, on the availability of dollar loans for the undertaking. But the 1954 decision to concentrate even more resources on the railroad was essentially a political one—the military regime intended to integrate the northern part of the country with the interior and, at the same time, reduce the dependence of Bogotá on the port of Buenaventura by giving the capital its own route to the ocean. This decision was regarded as a "logical extension," a "marginal decision," proposed by the military regime and confirmed by the World Bank with a second railroad loan.

Once the Atlántico Railroad enters the transport picture, other distortions become evident. Investment plans for major eastern highways were never adjusted. Regardless of the rail service which would connect the interior cities of Bogotá, Bucaramanga, Tunja, and less directly Cúcuta, with the Atlantic coast, investment in these eastern highways proceeded without revision. Another effect of the Atlántico decision was to divert rehabilitation funds for construction of the railroad extension and delay renovation of the older supporting links in the system.

The most disastrous shortcoming of the railroad plan was the failure to connect the ports of Barranquilla and Cartagena. Indeed, it is diffi-

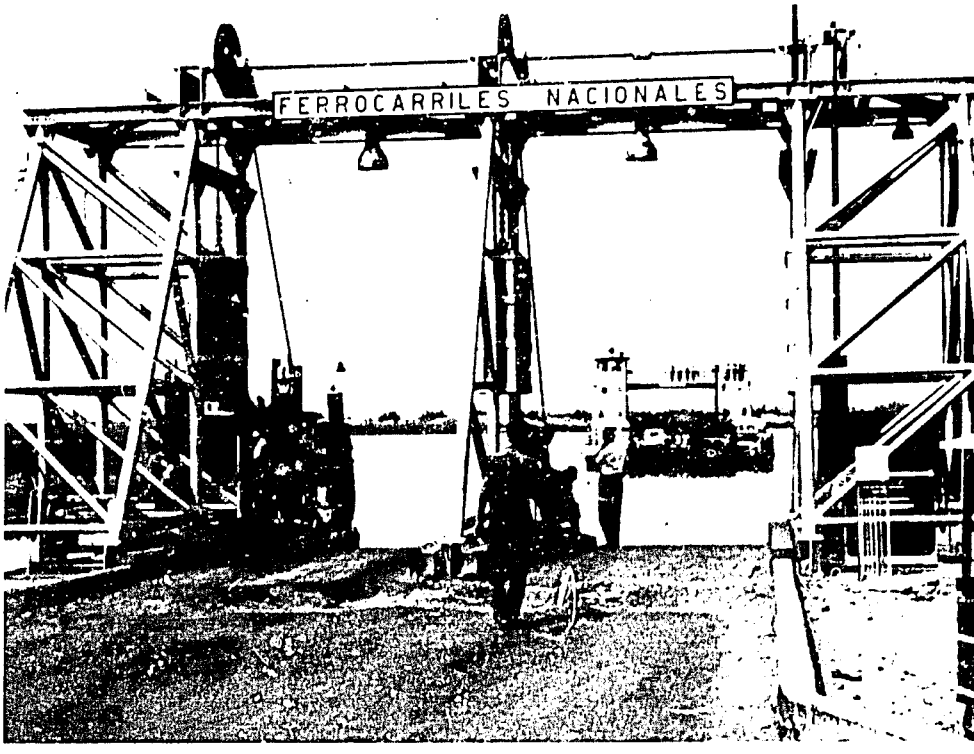
cult to comprehend why, despite the commercial and industrial importance of the two largest seaports, these Atlantic coast cities did not succeed in "pulling" the railroad from its eastern terminal of Santa Marta. Minor technical reasons did support the terminal site: the report of the consultants indicated that truck-trailer and ferry links to Barranquilla would be adequate, and that the formal connection of the Atlántico Railroad with both Cartagena and Barranquilla should be considered in some future project. Furthermore, the uncertain condition of the mouth of the Magdalena River contributed to the reluctance of the national government to extend the rail project to Barranquilla.

Aside from these technical arguments, the major factor certainly appears to be the rivalry between the ports of Barranquilla and Cartagena. To terminate the railroad at Barranquilla without the spur to Cartagena would have favored the central port. To extend the railroad to both cities, on the other hand, was thought to be too large an undertaking.

It appears that the government abdicated the choice of ports rather than become further embroiled in the intense rivalries of the Atlantic cities. The question of terminal, which in the first stage of the Magdalena Railroad had been so carefully considered, was lost in the extension project to the coast. Unresolved by the engineering reports, the coastal rivalries cancelled rather than amplified each other's claim to the terminal, and the central government opted for what appeared in the short run to be the least expensive alternative. "It is as if the transcontinental railroad in the United States terminated in Atlantic City," commented Dr. Currie on the eventual choice of terminal. As a result, the railroad merely connects the Eastern Highlands to the port of Santa Marta; it does not integrate the important coastal cities with the interior of Colombia. It is in no sense an "Atlántico" railroad.

The Civilian Regime—Congressional Dominance

From 1952 until 1958, in the absence of civilian rule, road funds were dispersed by executive decree, and the Minister of Public Works took complete responsibility for the highway program. With the departure of the foreign consultants in 1957 and the return of civilian rule in 1958, the National Congress appropriated funds for the highway program and determined the geographical location and size of the con-



The National Railroads operates the ferry that crosses the Magdalena River connecting Barranquilla with the Santa Marta highway and the Atlántico Railroad. A major project will be a bridge spanning the river. Photo by Paul O. Roberts.

tract. Instead of concentrating highway expenditures on relatively few projects in key locations, appropriations were dispersed to many projects favored by the Congress. Table 5.6 shows the process of "atomization" of highway construction expenditures. Although high priority routes had supposedly been identified in the World Bank plan, regional factions acting through the Colombian Congress remained in effective control in determining the pace and placement of transport investment. It can be concluded that the progress on the "apolitical" World Bank program of road and rail construction was, during the period after 1958, set by congressional appropriation of the counterpart funds.

Recent Developments: 1961 to 1966

In 1961, recognizing the competitive situation in all the transport modes and the duplication of investment that had taken place over the decade, the World Bank recommended that the Colombian government undertake a comprehensive study of all its transport facilities.

TABLE 5.6. *Changes in the Size and Number of Contracts for Highway Construction*

Year	Number of highways	Number of highways with appropriation less than 500,000 pesos	Percentage of these minor contracts to total	Average appropriations,[a] in pesos
1953	63	13	21	400,000
1955	68	57	84	245,000
1960	109	72	66	235,000
1962	328	267	81	163,000

SOURCE: Ministerio de Obras Públicas, "Informe que presenta el comité técnico para el estudio del plan de construcción de obras públicas, a la Comisión de Ordenamiento de la Administración Pública" (processed; Bogotá, March 21, 1963), p. 8.

a. In 1955 prices.

The National Transport Study, completed in December 1961, has since set policy for current improvement.[11]

The report hardly presents a unified program. It is rather a collection of five studies coordinated by a single engineering firm. It makes no attempt to estimate the benefits or the risks involved in the costs of its recommendations. Nor is there any notice of the interaction between the components of the transportation system. No alternative projects are proposed.

On the recommendation of the Railroad Report of the National Transport Study, the World Bank extended a loan of $30 million to the Colombian National Railroads in June 1963. The loan, granted on the provision that the management of railroads be strengthened and given the power to set rates and fares, was to be used for the rehabilitation of entire railroad networks and for the purchase of new diesel locomotives and rolling stock. It was estimated that the railroads would be meeting expenses by 1967. The report had also recommended expansion of all four of Colombia's harbors, and two new berths in each of the ports of Buenaventura, Barranquilla, and Santa Marta. Consider-

[11] Parsons-Brinckerhoff-Quade & Douglas, *op. cit.* The major volume, 265 pages, is divided into two sections, an inventory of facilities and the program. The complete report includes a summary volume and five supplementary volumes of specialized study on railroads, highways, airports, inland waterways, and ocean ports. It represents by far the largest single study undertaken of Colombian transport.

able investment was also recommended for the dredging and maintenance of Bocas de Ceniza, the entrance to Barranquilla.

By June 1963, this channel to Barranquilla had become virtually closed to ocean shipping due to sedimentation of the Magdalena River. The shallow 16-foot depths prohibited the entrance of all deepwater ships. Santa Marta, in spite of port expansion programs, was unable to handle all the diverted cargo.

On the morning of July 10th, 1963, the city of Barranquilla was shaken by a tremor originating from the river mouth. As twice before, in 1935 and 1945, the current completely washed out the blocking deposits and reopened the channel. Where soundings the day before had indicated 15- and 16-foot depths, the channel now revealed depths of 100 to 248 feet. With the return of Atlantic freight to Barranquilla, expansion of the port and creation of a free trade zone proceeded along with the port improvement programs for Santa Marta and Cartagena.

Changes in the highway program by regions during 1962-66 are given in the right column of Table 5.3. The greatest shift in spending has been devoted to bringing the outermost southwestern (Popayán and Pasto) and southeastern (Espinal and Neiva) cities into the national network. The dispersion of highway funds for projects around the country has increased in response to congressional pressures, and the average size of contract appropriations has diminished.

In addition to the reliance of the Ministry of Public Works on the Congress, the staff of the Ministry itself has been continually subject to political interference. The Minister was compelled to operate with a staff selected under a system of political parity. Most of the personnel trained during the past years were dismissed, and new personnel were selected, not on the basis of technical ability, but to satisfy the need for political equilibrium between the two parties.

With the new administration, which took office in late 1966, there have been several encouraging changes in the highway program. The recently appointed Minister of Public Works is attempting to impose more flexible design standards on highway contractors and to accelerate the asphalt paving program. In a December 1966 decree the President raised the gasoline tax by 60 percent of the retail price to provide revenue for the construction and highway maintenance programs. Weighing stations for the enforcement of loading limits have been successfully introduced on new highways. Former resistance was based on the truckers' view that these stations were the means by

which the government peremptorily imposed cash fines. Opposition to the stations has disappeared as drivers have come to value the verification of their loads and hence full compensation for their cargoes by the shipper.

By the middle of 1967, it appeared that the World Bank was terminating disbursements on the previous highway loans on the extended network specified in the 1961 loan. The World Bank Special Representative in Colombia commented on the financial terms as follows:

> The 526 kilometers of new road introduced into the Bank program in 1961 were financed by a loan of U.S. $11.3 million for 40 percent of the total cost. The expenditures by Colombia have been 60 percent of the program or U.S. $16.55 million making a total of U.S. $28.25 million or U.S. $57,000 per kilometer, also reasonable . . . considering the topography in which the roads have been constructed. The Bank has financed through four loans the sum of U.S. $73.35 million and Colombia [has financed] the equivalent of U.S. $110.45 million, more or less. . . .
>
> . . . on its own resources, the government initiated construction of another series of roads outside the program, guided solely by political instinct. These roads are estimated to be some 14,000 kilometers, which although unfinished, have served to connect many totally isolated regions. . . . Due to the expenditure on these works, the Bank program has always been left without the necessary counterpart funds.[12]

Recent developments in the railroad operation have also been encouraging. Despite pressing shortages of spare parts and rolling stock, the management has succeeded in reducing surplus employment and in raising total revenues. As a result of a recent study,[13] the administration has introduced subtle rate changes to encourage shipment of bulk cargoes on through hauls between major cities. For the year 1966, rates per ton-kilometer were raised by 11 percent while the cargo carried in ton-kilometers increased by 26 percent. Total revenues were up by 42 percent over the previous year, and operating losses were cut by some 84 percent.

The success of the railroads in capturing a larger share of the long-haul traffic, especially the import traffic from Santa Marta, has, however, resulted in seriously upsetting the balance of the Atlantic ports.

[12] Letter to the author from Dr. Constantino Lacayo-Fiallos, Special Representative of the World Bank, February 20, 1967, Bogotá (original in Spanish).

[13] Ferrocarriles Nacionales, *Estudio sobre los precios de costo y las tarifas* (Paris: Sofrerail, 1965), 2 vols.

While Buenaventura has maintained a constant share of half the import-export cargo, Santa Marta has captured 34 percent of total tonnage, compared to its 12 percent share in 1962. Most of this increase has been at the expense of Barranquilla, whose share has declined from 25 percent in 1962 to 14.7 percent in 1965, and of Cartagena whose share has fallen drastically from 22 percent to 6.5 percent in 1965. The port of Barranquilla has hardly been helped by the opening of the railroad, and Cartagena has definitely been hurt.

In response to these shifting demands, Santa Marta is now increasing its port capacity, while the national government improves all three northern ports simultaneously in order to maintain a regional balance. Cartagena, in search of cargo lost to Santa Marta, presses for completion of the Western Troncal highway in order to gain access to Medellín and the interior as an alternative to the Atlántico Railroad.

In conclusion, one wonders if any real economy was accomplished by connecting the Atlántico Railroad with the old banana link to Santa Marta. A recent study by the engineering consultants[11] reports that a 241 kilometer line would cost the equivalent of $35.2 million to tie the existing railroad with both the ports of Cartagena and Barranquilla. This sum cannot be too far above the total cost of the actual alternative that the Colombian government has been compelled to finance, that is, the virtual reconstruction of the old banana line, the expansion of rail and ship terminal facilities at Santa Marta, the upgrading of the highway to Barranquilla, and, finally, the marginal expansion of all three ports, while two are suffering from underutilization. The entire railroad project, although intended to unite the entire Atlantic coast with the interior, has benefited only Santa Marta at tremendous national expense and has upset the delicate balance of rivalry among the northern ports.

Conclusion

As transport improvements were made in Colombia, duplication and overcapacity resulted from providing each of the interior regions with its *own* access to the ports. At the end of the first decade and a half

[11] Madigan-Hyland de la Cruz & Co., Ltd., *Economic Feasibility of a Railroad Extension to Barranquilla and Cartagena* (New York, May 1965).

of major investment by Colombian transport (1966), the Cauca Valley trade was moving through Buenaventura, and Bogotá imports utilized the new Atlántico Railroad and the Eastern Troncal. Medellín traffic in part was flowing to Cartagena. Coffee was still exported by the old route on the Pacific Railroad to Buenaventura and in part by truck on the Western Troncal highway.

Yet it is ironic that so much of the resources devoted to transport facilities went into improving the export routes. Major benefits have yet to be reaped by connecting the three interior regions not with the ports but with each other. These three interior regions of Colombia—Bogotá, Cauca, and Antioquia—form the "Golden Triangle" of the country. While the connection between the Cauca Valley and Bogotá was completed early in the program, only recently have the other interregional routes been given priority.

An important allocator of transport investment, despite the efforts of the World Bank, continues to be the regional alignments within the country. When regional power coincides with regional economic requirements, then the allocation appears to be made with insight and rationality. When, on the other hand, influential regional interests attract public funds, the allocation appears as a subsidy and as inefficient investment behavior.

The lessons of the Colombian experience include warnings against the improper use of methodology in evaluating public investment. The Colombian case is testimony to the dangers of sequential suboptimization—to maximizing each project to the neglect of the systems analysis. It is a warning of the consequences of removing transportation from the development plan, and of looking at each suggestion as an individual unit on a piecemeal basis.

Above all, the Colombian case is a warning of the difficulties of isolating economics from the politics of transportation. The attempts of the economist, in deliberately trying to avoid the regional influences, may result in exactly the contrary effect: the predominance of these forces over allocation of the program's resources. In failing to allow for the regional rivalries, the financial evaluator or economic planner abstains from the critical implementation of the initial program. Some lessons of the Colombian experience may serve as policy guides in similar cases of economic development.

CHAPTER 6

Transport Planning and National Goals

EDWIN T. HAEFELE

THE ORGANIZED ASPIRATIONS of the electorate have a way of intruding themselves into the most technical plans of the experts. Transport planners try to achieve closer approximations to efficient allocation of resources but defining the "system" which is to become efficient and distributing the rewards of the efficiency remain, stubbornly, questions of social choice. In wrestling with these questions, economists solve difficult equations with unspecified utility functions and politicians seek solutions for the utility functions and ignore the rest of the equations. Transport specialists tell us how to accomplish particular transport tasks efficiently without concerning themselves with the harder question of which tasks are important. We may be approaching, in transport, Boulding's limit of "too many people, and especially too many experts [devoting] their lives to finding the best way of doing something that should not be done at all."[1]

The other authors in this volume insist, and rightly, that the issue is even more complicated. Their essays illustrate that every transport choice is intertwined with choices in other sectors and that they all depend, ultimately, on overall national decisions.

Such a conclusion only restates the problem in more lofty terms. The

[1] Kenneth Boulding, "The Economics of Knowledge and the Knowledge of Economics," in American Economic Association, Papers and Proceedings of the Seventy-eighth Annual Meeting, 1965 (*American Economic Review*, May 1966), pp. 10-11.

problems of national goal setting—regardless of the degree to which the marketplace is relied on for resource allocation—are also problems of establishing values. Even the more formalized goal setting device, national plans, ". . . are promulgated by governments as a political document; as a rally point for the cooperation and support of the electorate, and as a generator of common hopes and expectations."[2]

A paper prepared by the Economic Commission for Africa notes:

> The main objective, common to virtually all the development plans in the region is raising *per capita* income. However, each plan also provides a list of other related objectives depending on certain specific problems of the country in question and on the attitude of the respective government. So, for instance, the Senegal plan for 1961-64 had among its objectives the creation of a sense of participation of the population in the development effort, the Africanization of the important sectors, the mobilization of all the resources of the country, and the fuller integration of development activities. Tunisia, as well as a number of other countries, has among her chief aims economic decolonization, income redistribution, full employment, and a change in social structure.[3]

The importance of transport to national policies varies greatly among countries and over time. Sometimes transport is decisive to national survival. An extreme example can now be seen in southern Africa as the landlocked country of Zambia struggles frantically to build alternative supply lines so as to diminish its dependence on now undesirable transport lines through Rhodesia. Zambia seems doomed to spending hundreds of millions of dollars to insure new exits which cross only "friendly" countries. (How long can she be sure these countries will be "friendly"? How many exits should be built?) In the Zambian case, the extreme importance of the transport decision tells us at least that only the highest officials of the government should make the decision. Transport cost considerations will clearly play a subordinate role in deciding the future course of Zambian transport investments.

When the cases are less extreme, the questions of who decides transport policy questions and what criteria are used to make decisions be-

[2] Raymond Vernon, "Comprehensive Model-Building in the Planning Process: The Case of the Less-Developed Economies," *The Economic Journal*, Vol. 76, No. 301 (March 1966), p. 59.

[3] "Economic Problems of Africa," a chapter prepared by the staff of the Economic Commission for Africa (ECA) for Colin Legum (ed.), *Africa, A Handbook to the Continent* (rev. ed.; Praeger, 1966), p. 489.

come less clear. In attempting to answer these questions, we draw little comfort from organization charts and descriptive examples of how decisions are arrived at in particular circumstances or places. Once the description moves beyond the simplest organization and methods procedures, it will be found that no decisionmaking machinery developed thus far has proven so patently efficient, year in and year out, through variations in political leadership or staff competence and motivation, as to claim our allegiance. Administrative prescription is almost wholly dependent on circumstances peculiar to the case. Organizational forms come and go with the seasons.

Because of the failures of organizational and administrative prescriptions as problem-solving tools, governments have turned to tools which attempt to approximate optimal resource allocation in an economic framework. Two weaknesses of economic planning techniques are apparent, however, which lead to the conclusion that the millennium has not arrived. The first—failure to arrive at a single solution within the parameters of the problem—is a matter the economic planners themselves recognize, and efforts are being made to make explicit the necessary policy assumptions.[1] The second—inability to make choices between unlike things (e.g., investment in education versus investment in health services) or in other words, to make policy choices—is the chief reason why the political process is still relevant to transport policy in the developing countries. This second weakness is freely admitted by economic planners. It is a characteristic so habitually faced in economic planning that nearly everyone has forgotten its importance.

This chapter is an attempt to reestablish the importance of the political process in relation to transport planning and transport policy.

Transport Planning and Policy

It is essential in any attempt to relate politics to transport that a distinction be made between transport policy and transport planning. The most common distinction made between planning and policy is

[1] For a comprehensive treatment of transport decision making in an economic planning context, see Clell G. Harral, *Preparation and Appraisal of Transport Projects*, U. S. Department of Transportation, Office of Technical Assistance (1968).

that between means and ends—planning referring to "how" to accomplish, and policy referring to choices about "what" to accomplish.

The distinction would serve admirably were everyone equally convinced of its value and all people agreed on the question of where one stops and the other begins. Since that rarely happens, a more technical distinction between planning and policy in transport will be drawn here. Planning will refer to the technical process of finding solutions to determine transport problems, that is, problems for which unique solutions exist. Policy will refer to the political resolution of indeterminate transport problems, that is, problems for which an infinite number of solutions exist or perhaps no *solution,* in the strict sense, exists.

Implicit in this distinction is an assertion that transport is a phenomenon larger than that typically ascribed to it by economic planners. The other chapters in this volume would seem to support that assertion.

The essential distinction between transport planning (determinate) problems and transport policy (indeterminate) problems may be made clearer by some illustrations which move from simple determinate planning issues through to complex, indeterminate policy issues.

Problem No. 1

Provide a given annual tonnage capacity between A and B at the lowest direct cost (defined explicitly) consistent with a 90 percent reliability factor. Ignore any externalities.

COMMENT. This is a simple planning problem for which, under most conditions, a unique solution exists. The goal is specified in absolute terms and is located in time and space. "Technical" engineering and economic data are the only factors which need to be taken into account.

Problem No. 2

Improve transport between A and B in terms of speed, reliability, and safety. Amount of money to be spent specified.

COMMENT. Again this is a simple determinate problem for which a small number of solutions exist. The goal is specified in relative terms,

but relative to a present quantity or state which is measurable. If "improve" were undefined, the problem could well be unsolvable in a technical sense.

Problem No. 3

Decide what transport investments to make in a specified area. Amount to be spent specified.

COMMENT. Even though we specify the amount and thus define away the overall capital budgeting problem, we are still faced with some questions. If it is generally understood that the criterion is economic efficiency in a resource allocation sense, then the problem posed here is a determinate planning problem. If, however, there is no clearly formulated criterion for choice, then the problem quickly becomes indeterminate.

Confusion and frustration can also quickly enter the picture if certain goals are implicit but not stated to the planners. Such conditions often arise when outside consultants are brought in and given tasks with no clear policy goal specified by the government. Examples of this occurring could be cited indefinitely. One recent case should suffice. The road from Rangoon to Mandalay was being studied for possible improvement or reconstruction when it became apparent that the economic solution (supposedly the criterion) was to realign and rebuild the old road more or less in its present location. The Burmese government asked the consultants to withdraw at that point because it wanted the road relocated some distance away, although they had not clearly specified this in advance. Economic criteria were tacitly accepted until it became clear that the answer was coming out "wrong."

Problem No. 4

Decide whether or not to improve transport in an area and by how much, improve being defined and a decision rule being given.

COMMENT. It is often concluded that if a decision rule is agreed upon, e.g., make all investments which show a positive return at a 12 percent discount rate, then the problem becomes a purely technical one. This would be so, and choices could be made not only in transport, but also

between transport and other investments only if no definitional problems exist about costs and benefits. Since these problems abound, this sort of problem is only pseudodeterminate. These characteristics are typical of the usual water resource investment problem as calculated by the Army Corps of Engineers in the United States.

Problem No. 5

Develop a national transport plan and assign priorities for transport investments.

COMMENT. This task is quite typically given to a national transport agency or to a group of outside consultants. To be sure, there are pages of specifications detailing what the plan should consist of, but there are rarely any policy goals for transport specified. The transport planner, in the absence of such policy goals, makes his own. He may or may not make them explicit. The government concerned may or may not understand that he has made them. It may view this vital task, filled with policy implications, as purely technical and accept the results of the planning exercise as being somehow "scientific" or, in any event, the work of experts and therefore better than its own judgments.[5] The problem posed, however, is an indeterminate one for which only political resolution will suffice in a free society. In specific countries at particular times, transport policy may be determined by agricultural needs, by industrial goals, by the desire to earn tourist dollars, or by some other factor. In other countries at other times, transport policy may be shaped by the social problems of accidents, slums, air pollution, and noise.

Transport policy can also become an acute problem because it can be used to accomplish different goals. The problem is currently highlighted in the United States by the lack of a national criterion for judging whether the federal role in urban transport should be directed primarily to fostering more efficient movement or more pleasurable living in cities. With present technology there seems to be a conflict between the two goals, that is, one is achieved at the expense of the

[5] Such self-delusion, conscious and otherwise, is not confined to the developing countries. It is present in attempts to find "expert" solutions to urban transport problems in the United States.

other. The problem, it should be noted, does not arise because of the complexity or multiplicity of goals but because the goals are in conflict with one another and the public usually opts for both. Thus the position of transport in the governmental structure (e.g., whether urban transport is to be a part of the Department of Transportation or the Department of Housing and Urban Development) will not be determined by technical considerations, but rather by the political resolution of the goal conflict.

In making the sharp distinction between planning and policy there should be no illusion that the distinction is readily identified in most practical situations. Indeed, as the preceding illustrations suggest, the opposite is usually the case. The recent work of Lindblom[6] and others assert the reality of compounded means and ends and the futility of attempts to pry them apart for decision purposes. The strength of this assertion should be recognized. Ends are chosen because the means are available. Groups do tend to move *away* from known problems rather than *toward* known objectives. Aristotelian logic is a poor framework for the description of how public decisions are taken.

Nevertheless, for analytical purposes ends and means, goals and programs, policy and planning, must be identified and separated. In discussing transport—an activity which is rarely an end in itself—the obligation to separate means and ends is inescapable. Similarly, the opportunities for the transport expert to establish his own goals—consciously or not—are ever present and must always be guarded against. At the very least the expert must realize when he moves into the policy field in his judgments.

Organizing To Make Transport Choices

Recognizing that government organizational forms grow from the same sort of "disjointed incrementalism" that characterizes all public decisions, little practical purpose is served by either a description of how governments organize themselves to make transport choices (in most cases they do not) or a prescription of how they ought to do so.

[6] Charles E. Lindblom and David Braybrooke, *A Strategy for Decision* (The Free Press of Glencoe, 1963).

It may be worthwhile, however, to identify what is important about the organizational framework from the standpoint of what tasks need to be accomplished in the transport field.

Task No. 1—Formulating Transport Policy

The first organizational task is to insure that transport experts do not either explicitly or implicitly set their own goals. How this is accomplished depends, as always, on the individual circumstances confronting each country. It may be done in countries well served by their civil service by formally structuring the national planning commission (often the goal-setting body)[7] so that the ministry of transport is responsive to it in investment matters. In other countries a central budget office may serve to transmit national goals to the transport ministry. Appointing the appropriate political leader to head the transport ministry, or an appropriate part thereof, may suffice in more personalized situations.

The need to move control of transport policy out of the hands of transport planners is so well established as to need no further elaboration, except to note that it rarely is done. To the contrary, transport seems easily to become an end in itself, with its own political constituencies. Unfortunately the tendency to treat transport as an end in itself has been fostered by transport planners from countries such as the United States and other market-oriented, pluralistic societies. In these countries, particularly those like the United States with no central planning mechanism, one of the ways by which new goals are established is by creating a new government agency and letting it compete with other agencies for the favors of public and legislative action. It is a highly competitive device (in which means and ends can be thoroughly and everlastingly compounded) for a highly competitive atmosphere.

In most developing countries such a device is not compatible with the low level of political stability and the overwhelming influence of

[7] The national plans drawn up by national planning commissions frequently, as Vernon notes above, set national goals or policies. The fact that national planning agencies usually deal with policy reflects the common practice of using "planning" and "policy" interchangeably.

public investment decisions on the economy. Transport policy in these countries must be directly and consciously linked to economic policy, and to each of the other sectors of national attention, e.g., education, health, and social welfare. These links are in addition to necessary links with general national goals, for example, income redistribution, and with local goals (zoning, noise control, air pollution, pedestrian safety, and so forth). Since not all transport investments can be funded, priorities should be established on the basis of the emphasis on agricultural development, industrialization, defense, regional balance, and so on, as reflected in national plans and policies.

The use of development task groups focused on a region or a sector, may be warranted in cases when goals need to be more sharply defined and programs pulled together, and when the supporting and enabling services such as transport need to be understood as just that. Such task groups, properly supported, can also be useful in breaking down established departmental bureaucracies whose first loyalty has been to the departmental budget.

The task groups can also better handle some of the technical questions of trade offs between transport investment and investment in other sectors which may either reduce or postpone the need for transport. Department representatives, on the other hand, play essentially a zero-sum game, i.e., what one gains the other loses. The success of the task group can be measured by a more meaningful standard of performance. The staff should, *ceteris paribus*, be more motivated to seek the most efficient means to accomplish the task.

Task No. 2—Insuring Transport Efficiency

The organizational framework must insure that attention can be given to a constant review of governmental actions which inhibit transport efficiencies. One such area is public restrictions on entry into transport operations by private businessmen and the regulations on rates, services, and routes. These restrictions often abound in the developing countries for no more reason than that they were imposed by a colonial power some time in the past. The administrative agencies which supervise these regulations may be a potent force retarding the efficient use of existing transport facilities. Whatever the genesis of such restrictions, their continuance should be the subject of hard re-

view. While there can conceivably be sufficient political reasons to keep certain regulatory and control bodies, there is rarely any economic efficiency reason for keeping them.[8]

In a similar vein various taxing systems may have grown up or have been inherited from past regimes which seriously retard transport efficiency unnecessarily. Toll charges and taxes on highway use that are so high or so ubiquitous that they diminish the effectiveness of the highway, and thus work at cross purposes with the investment, are common in some developing countries, India being a notable example. Import taxes on trucks may often be an impediment to the efficient provision of a transport service vital to growth in some other sector.

The prevention of undue inefficiency in transport is no different, in principle, than prevention of inefficiency in any other governmental sector. The emphasis here is to show that offices and agencies far removed from transport proper, e.g., local tax bodies, may be the unwitting culprits.

It should be obvious that no single organizational device for ferreting out inefficiencies in transport will suffice for all circumstances. A railway administration can have an internal group dedicated to efficiency. They will rarely concern themselves with nonrailway activities which impinge upon railway efficiency, much less voluntarily do anything which hinders railway efficiency, however much it might help elsewhere. One of the major tasks of a transport ministry will be the pursuit of efficiency. Definitions of what efficiency means at that level will not necessarily be those of the transport-user and may be antithetical to the interests of the user. Perhaps the best insurance that inefficiencies are discovered is the employment of a transport economist with a staff relationship to the highest transport official of the government. This arrangement insures the broadest possible sweep to the inquiry, as well as the greatest motivation for discovery.

Task No. 3—Resolving Policy Conflicts

Conflicts over transport policy arise from two sources, the first because transport can serve multiple goals, the second because decisions

[8] See George W. Wilson and others, *The Impact of Highway Investment on Development* (Brookings Institution, 1966), pp. 213-15.

about transport—which are inherently connectivity decisions—are often in fundamental disagreement with other public decisions which are essentially place decisions.

MULTIPLE GOALS. If transport is responsive to many needs, the needs may call for conflicting transport policies. If transport is to be efficient, this may involve restructuring some other important aspects of government, notably tax structures, which also serve other needs. A mechanism is required to resolve these conflicts. What the procedure is like is unimportant. What is important is that it work without imposing the will of one agency on that of another. Conflict can be suppressed by fiat for a time, simply by administrative direction. Conflict resolution, on the other hand, must come about by means which are acceptable to the parties in the dispute and must leave the motivation of these parties unimpaired.

If transport planning and transport policy are conceptually distinct (and the distinction understood) and if transport policy is properly structured with respect to the national goal-setting process, the resolution of multiple-goal conflicts involving transport are enormously simplified. If, however, the response to the question "what is the role of transport in this case?" is colored by goals of the transport expert, then the problems of disentangling judgment from desire and fact from predilection can be formidable indeed.

Disputes centering on technical differences--that is, failure to agree upon the correct solution—should normally be kept on a technical level. If necessary, outside experts, whose reputation and competence are unquestioned, may be brought in to help find a solution. Only rarely should a technical solution be imposed on these questions from above, for such practices destroy the needed professionalism in transport planning.

Disputes and conflicts over policy goals, on the other hand, should not be referred down to the planning level for settlement but should be faced by whatever political choice mechanism is available to the government. More often than not, however, advocates for one or another policy are tempted to find a professional transport planner or economist who happens to agree with the policy and then to tout that agreement as "proof" of the technical correctness of the policy. This results in opponents of the policy finding their professional transport planner

who happens to agree with them and the battle is on—on the wrong level, with the public as bewildered bystanders to a technical argument. To the extent that transport planners allow themselves to be manipulated by policy advocates, they have only themselves to blame if their work environment tends to become more and more politically oriented.

It is important to differentiate the foregoing case from the case in which the politicians have much to lose and nothing to gain in the advocacy of *any* policy. Hence they may be willing, even eager, to agree that the decision is purely technical so that any blame resulting from the decision will not fall on them. The transport planner must expect to be used in this fashion from time to time. He will recognize at such times that it is not so much his expertise that is desired as it is the public neutrality of his decision. Prudence in such cases lies in making a "judicial" rather than a technical decision. Reliance on this method of resolving policy problems can never be a long run substitute for responsible political leadership.

The ability of a government to resolve policy conflicts effectively yet peacefully is the most severe test of governmental structure and political stability. Unfortunately, resolving conflicts in transport often takes the form of giving in to both sides and providing duplicating and/or excess capacity. Much of the public regulatory and administrative problems of transport can be traced to an earlier conflict which was neatly resolved by making an excess investment in transport capacity. Since most such capacity is long lived, this sort of political accommodation should be used with restraint.

CONNECTIVITY DECISIONS AND PLACE DECISIONS. Transport has both a functional and an environmental aspect. In functional terms it provides movement between two different places. In environmental terms it can often have a deleterious effect on particular places. Local interests in one place can never be the sole or determining political force concerning the function of transport. The function of transport is by definition beyond the ken of one place. How the transport is accomplished, however, is very much a matter of concern to local interests because people in the localities suffer any environmental inconveniences which the transport facilities may offer.

Thus, whether to have transport between A and B cannot be de-

cided by the inhabitants of A or B, and sometimes (national defense reasons, for example) not by the inhabitants of both. What kind of transport between A and B (seen by most transport planners to be their particular forte) is very much of concern to inhabitants of A and B and others in between if, as is likely, there are undesirable aspects of the system—for example, noise and air pollution.[9] Thus provision must be made to take account of legitimate nontransport interests (the "place" interests) of people and their local jurisdictions.

A full discussion of the resolution of transport goal conflicts and connectivity-place conflicts would lead directly into a treatment of the political process in its entirety and is far beyond the scope of this chapter. That this is so is indicative of the pervasive and ubiquitous nature of transport policy decisions. These are not technical details which are best left at a professional level. They are part and parcel of the choices which nations make about the shaping of their own futures.

Foreign Aid for Transport

The fact that transport serves many purposes and is used to achieve many goals is relevant also to policies of giving aid to developing countries. With the exception of some European countries and China, however, aid-giving countries and international lending agencies seem to prefer judging transport investments in developing countries on economic grounds. While the international agencies have little choice but to use economic criteria for judging transport projects, it is doubtful that bilateral aid should be given on such a single-minded standard. Although all developing countries may bow to the shrine of economic development, there are few that can, or wish to, subordinate everything to this goal. Recognizing the other goals and reaching a composite judgment is the task of the recipient countries. Reacting to that judgment is the task of the donor countries. Reaction involves some-

[9] As an aside, the attempt on the part of planners to anticipate unfavorable response by weighting one technology differently than another with some "social factor," and to use that single difference as the proxy for all the individual evaluations which a political process can weigh, indicates either an ignorance of political process or a contempt for citizen sovereignty.

thing more than redoing the sums to see if the arithmetic is right. It should involve political judgment of high competence.

To illustrate, let us arbitrarily divide the developing countries into three major groupings based on political types, as follows:

Type I: "Unformed" countries where no definitive political will has yet developed. Examples: South Vietnam, Congo-Kinshasa, and some of the other new states in Africa.

Type II: Countries with charismatic leadership where planning and policy emanate overwhelmingly from a single source. Examples: Egypt under Nasser, Ghana under Nkrumah, Indonesia under Sukarno, Cuba under Castro.

Type III: Countries in which the political will of the people finds an orderly expression in the policies of the governments. Examples: Zambia, Mexico, India, Israel.

Under aid policies of any shade of subtlety whatsoever, comparable transport projects proposed in countries of each of these types would be evaluated very differently indeed. The distinction would involve something more than the present method—a simple rejection if the country's overall policies are disapproved of or evaluation according to economic criteria if the country's overall policies are acceptable.

In countries of Type I, the overriding consideration for transport aid should probably be its value in helping to create a political and social adhesion to the larger and more viable unit—which in some cases may be another country. Joyce Cary in one of his novels speaks eloquently of the power of transport to create and destroy:

> The road itself seems to speak to him ". . . I shall change everything and everybody. . . . I am abolishing the old ways, the old ideas, the old law; I am bringing wealth and opportunity for good as well as vice, new powers to men and therefore new conflicts. I am the revolution. I am giving you plenty of trouble already, you governors, and I am going to give you plenty more. I destroy and I make new. What are you going to do about it? I am your idea. You made me, so I suppose you know."[10]

Transport investment could have been used and might still be used in some parts of Africa for nation and region building purposes. Criteria for these investments will not be found in the usual project level benefit-cost study. Such creative uses of transport have been lacking

[10] Joyce Cary, *Mister Johnson* (Harper and Bros., 1954), pp. 186-87.

since the nineteenth century but the need for them in some areas of the developing world is great.

Aid for transport investment in countries of Type II is also determined by political considerations which go beyond the calculations of economic costs and benefits of the investment. Just as the decision whether or not to help on the Aswan and Volta dams had to be made on political grounds, so too do the requests for transport assistance. For a donor country to consider investment in a country which is controlled effectively by one man or group on any grounds other than those dictated by Machiavelli is hard to justify. Excepting food, medicine, and other temporary assistance which can be justified on purely humanitarian grounds, investment aid must be based more on a judgment of the man or group than on the project per se. To withdraw aid or have no potential for aid in these countries, however, simply closes down an important option in exchange for the single-valued privilege of saying no.

Aid for countries of Type III is subject to two bodies of political constraints and two technical judgments. It not only must be justified at home in the donor country, but if it is to be of maximum value (that is, not given at cross purposes), it must be acceptable to the policy goals of the recipient country. Donor countries that wish to strengthen the political stability of developing countries will not dwell unduly on technical economic considerations as a prerequisite of assistance unless it is clear that recipient expectations and calculations of results are clearly wrong *within* their own assumptions or that discussion of the assumptions is also expected or desired.

An example may clarify some of the issues in cases of this type. Suppose that a country has intact an efficient railway plant and organization. It chooses to suppress the growth of trucking and passenger car movement through taxation, import restrictions, licensing, and meager highway investments. Almost certainly it will argue its case on supposedly technical grounds, citing appropriate figures of rail efficiency. Assuming that no opposition to this policy develops inside the country, there may come a time when the railway must be improved and expanded. If foreign aid is required, then foreign experts come to assess the technical choice of rail over road. This assessment may lead to the conclusion that road investment is now needed in greater quantities than the country desires.

What typically occurs at this point is a discussion which starts on technical grounds but soon shifts to policy issues. When the local experts lose the battle to resist roads on technical grounds, it becomes apparent that there is still a policy judgment against expansion of road investment. The relevant technical question at this point is, "Is the country willing to sacrifice the efficiency difference in order to satisfy this policy judgment?" Presumably, if the judgment was based on a mistaken belief about rail efficiency, the answer is no. If, on the other hand, it was rooted in deeper policy issues, the answer may be yes.

If no, the issue is settled on technical grounds. If yes, the issue is no longer technical and the foreign technical experts have no further role to play as technicians. The donor country must now decide the question of railway aid on the basis of its willingness to support the general development of the country and the leaders in power despite its disagreement with the recipient's penchant for railways. Resolving this issue may well involve the pretense of technical judgment[11] in order to keep politicians in both countries from becoming "locked in" on a position from which there is no graceful way out.

In summary, the political interests of the donor countries as well as the political circumstances of the receiving countries should be determining factors in any aid appraisal. At the same time, an important part of the appraisal is the evaluation of the economic costs and effects of the aid. Painstaking economic evaluations should not be abandoned, therefore, but rather incorporated into a larger decisionmaking framework. Technique should not become the master of purpose.

Conclusion

This chapter has argued for treating transport policy decisions in a political context. In so doing, there is a grave risk that the argument will be misconstrued to condone the abuses of political decision-making common in transport—the road that "happens" to serve the minister's country home, or the right-of-way which goes through land owned by

[11] See for example, Robert E. Asher and others, *The United Nations and Promotion of the General Welfare* (Brookings Institution, 1957), pp. 1045-46, for the case referred to earlier, when it is useful to reduce disputes to "technical" issues in order to resolve them.

political hacks. These and many more political abuses occur with regularity in many countries. To a large extent the attempt to put transport investment decisions within the framework of technical economic or engineering criteria was a defense against such abuses.

The message from the chapters in this volume is not that the attempt should not have been made, but rather that it stopped short. Now transport is subjected to another kind of abuse no less wasteful, namely, solving for efficiency at too low a level in terms of social systems and ignoring all of the distributive effects--for good and evil—of transport investment and operations. In emphasizing that energy policy, agricultural policy, urban policy, and many other national interests are vitally affected by transport decisions we mean to emphasize that national purpose—as articulated and expressed in national goals—must determine transport policy. That is the proper political context for making transport decisions and the proper environment for transport planning.

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