

TRANSPORTATION IN LATIN AMERICA

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ABSTRACT

During the 1980s, many studies adopted an historic perspective, examining the role of transportation technology as a shaper of economic relations and geographic change. Others addressed the impact of more recent technologies, such as the ecological consequences of roads on the process of settlement in lowland forests and the effects of intermodal systems on ports and trans-isthmian trade. Few studies were the work of geographers. A research agenda for the 1990s should address how Latin American geography may change as the result of advances in both transportation technology and the growth of communication media such as computer networks and fax systems. The role of transportation networks in facilitating the appearance of urban axes also needs attention, as does the way transport improvements may be critical to the development of region-wide economic integration.

Transportation involves the physical movement of goods and people, using particular motive technologies and following distinctive geographical routes. Impetus for movement comes from land use diversity but actual movement depends on the costs of interaction. Once movement connects places, land uses change and geographic relationships are modified (Rimmer 1986). Yet, it has always been hard to distinguish cause and effect. Does transportation initiate economic and social connections between places, or are transport structures the result of pre-existing pressures for interaction? The answer is important for policy analysis. For instance, has settlement of agricultural land in South America's humid tropical lowlands occurred because of government policies to build new roads linking plateau and forest, or did spontaneous pioneers on this new frontier prompt improved transport linkages which then integrated these areas into national economies (Dickinson 1986)?

Much of the literature on transportation in Latin America, and most government policy on the topic, seems to have emphasized the causative role. In the 1950s and 1960s particularly, when scholars sought solutions to Latin America's economic development problems, investments in social overhead capital, especially transportation infrastructure, were regarded as prerequisites for growth. And policymakers from national governments as well as the World Bank could rarely resist the attraction of costly but dramatic road and rail projects that would somehow transform economic landscapes at a stroke. Mexico's *Chihuahua al Pacífico* railroad, and Peru's *Carretera Marginal de la Selva* highway were but two examples (Gauthier 1984). This same fascination with the power of dramatically new transportation technology to forge instant interaction between previously unrelated places also often infected nineteenth-century railroad investors and their compliant Latin American governments (Rees 1982). And of course, the search for new routes to render the New World less of an obstacle to trade between Pacific and Atlantic rim countries has bedazzled explorers and promoters since Columbus.

In the 1980s, despite the paucity of scholarship on transportation, the work we do have continues to reflect an inclination to see motive technology and extensions of service as creating, rather than responding to, geographic change.

PROMINENT THEMES IN THE 1980s LITERATURE ON TRANSPORTATION

Transportation in the Past

The largest group of studies of transportation with a 1980s imprint adopts an historic perspective. They focus on issues of foreign ownership and the role of transportation as a force for integrating the national economy.

Most prominent of these is Coatsworth's (1981) examination of nineteenth century Mexican railroads (see also Cordero 1981). Following the approaches of Fogel and Fishlow towards quantifying the impact of railroads in advanced economies, Coatsworth finds that in Mexico, railroads contributed little to domestic industrial growth but much to the fortunes of foreign mine owners. The railroads' principal consequence, he argues, was to revive the profitability of the great estate and contribute to the concentration of wealth that finally precipitated the Mexican Revolution. [end p. 191] Randall (1985) demurs, claiming that the move to Mexicanize foreign railroad ownership before the end of the nineteenth century demonstrated that prior to the 1910 Revolution Mexicans were already well aware of the negative consequences for domestic economic development of a foreign-owned route network that duplicated earlier patterns of staple production.

In Argentina, the economic consequences of foreign ownership and national control also pervade studies of railroad development. British investors early developed what was to become Latin America's densest railroad network (Lewis 1983), but during the period of its greatest growth (1900-1914), when 12,000 miles of track were added, French investors were in active competition with their European neighbors (Regalsky 1989). The outcome was often affected by the ability to co-opt local staple producers and use different railroad gauges, the latter a competitive technique of railroad competition used in the United States South before the Civil War. But while Southern railroads ultimately saw the mutual advantage of adopting a common gauge permitting network integration, Argentina, to the present, suffers from the competitive legacy of differential gauges. Indeed, the hold of foreign-owned railroads was only loosened with the introduction of truck transportation and a road-building program in the 1930s. With nationalistic feelings towards external domination running high, the Argentine government held foreign railroads increasingly hostage by regulating tariffs in the face of rising operating costs and holding down railroad revenue by encouraging modal alternatives for moving Pampas grain (Heras 1987). Investments in railroad maintenance declined and the oft-reproduced map of railroad density is now increasingly misleading as the rail net plays an ever more anachronistic role in the movement of goods and people.

In Colombia, foreign domination of railroad construction resulted in a similarly fractured transportation network. Bogotá was always the most isolated of the Spanish viceregal capitals, and traffic movement had traditionally depended on the Magdalena River as well as mule and human portage over mountain tracks that could rarely be called roads. In the first quarter of the present century, the railroad penetrated Colombia's notoriously difficult physiography, but more than half the companies were chartered in England and the lines built were short, unconnected sections designed to bring coffee to the industrialized world rather than to support an integrated national economy (Horna 1982). After the 1930s, the Colombian government turned to air transport and road construction in an effort to forge national growth out of regional diversity but flirted again with railroads by building the Atlantic Railway between Santa Marta and Honda that opened in 1963. The project was justified because of the belief that stream flow and navigability on the Magdalena, which the line parallels, had deteriorated because deforestation had reduced rainfall, a belief regularly taught in Colombian schools. In a well-crafted study, Townshend (1981) claims this belief to be a myth. The Magdalena had always been a difficult pathway because of high labor costs and the many overnight stops required to traverse the river's braided course. There is no evidence of its further deterioration as a waterway, although the 1950s were a period of cyclical drought and low water. Prior to the railroad's completion, highway construction between both Medellín and Bogotá and the Caribbean coast had rendered the railroad obsolete. A contemporary study of Colombia's Ministry of Public Works by Hartwig (1983) explores the administrative reasons for the country's continued inability to produce a rational national transportation system.

Overcoming the Trans-Isthmian Obstacle

Since the earliest Spaniards, schemes to reduce the trans-oceanic land barrier have been a feature of the literature on Latin American transportation. The past decade has been no exception. Clayton (1987) recalls

the history of Commodore Vanderbilt's steamship line, established in 1851 to carry eager prospectors from New York and New Orleans to the California mines via a 376-mile passage across Nicaragua. From this early experience, the American passion for a trans-isthmian canal developed, with different United States political factions championing routes through Nicaragua and Panama. The final decision in Panama's favor in 1902 owed not a little to apprehensions engendered by the eruption that year of Momotombo volcano in Nicaragua only a few days after the devastating eruption of Mt. Pelée in Martinique had killed 30,000 in the city of St. Pierre.

More recently, the growing obsolescence of the Panama Canal, both as to capacity and depth, and the 1977 treaty authorizing slow transfer of the Canal to Panamanian control (Augelli 1985) has prompted the revival of old schemes. Winberry (1987) recounts centuries of effort to improve transit across the Isthmus of Tehuantepec, culminating in the Mexican Landbridge Project to upgrade the late nineteenth century Tehuantepec Railway and modernize port facilities in Salina Cruz and Coatzacoalcos at either end of the line. Opened in 1982, the project has had no more success than the original railroad, which one commentator had described as Mexico's "white elephant" (Glick 1953). Winberry believes improvements in the Panama Canal, completion of an oil pipeline across [end p. 192] western Panama, the Mexican government's withdrawal of support for upgrading and electrifying the rail connection, and an economic downturn in world shipping in the early 1980s all account for the lack of the project's success.

Other trans-isthmian proposals involve alternative canals, especially interest in a sea-level canal west of the old Canal Zone border by Japanese investors, whose demand for oil, coal, and grain requires ever larger bulk tankers. Such proposals raise environmental questions, especially concerning species transfer. Some 10,000 species of marine organisms populate the oceans around Panama, although opinions vary from 10 percent to 50 percent over what proportion already exist on both the Atlantic and Pacific sides. At the very least, Pacific predators such as the coral-eating crown-of-thorns starfish and venomous yellow-bellied sea snake have not yet found their way to the Atlantic, mainly because the fresh water of Lake Gatún in the center of the present canal forms an effective barrier to salt-water creatures. However, Pacific mean sea-level is one foot higher than that of the Atlantic, while Pacific tides off Panama vary by 21 feet compared to two feet on the Atlantic side, almost certainly assuring species transfer in a sea-level waterway. The transfer would probably occur even if improvements were limited to widening the existing canal (Leschine 1981), since so much more salt-water would have to be pumped into Lake Gatún to assure sufficient operation of larger, downstream locks that progressive salinization and breakdown of the lake as a biotic barrier would follow.

Additional projects continue to surface as advances in transportation technology appear. Recently, the Colombian government proposed an intermodal 160-mile landbridge using road and pipeline to link advanced containerport facilities to be built on the Gulf of Urabá and Cupica Bay on the Pacific (Thurston 1990). Whether such an alternative could compete with the United States intermodal system prompts some doubt, since two-thirds of all Panama Canal traffic presently originates in, or is destined for, the United States. Nevertheless, this latest proposal demonstrates that the five century's-old perception of associating improved trans-isthmian transportation with incomparable wealth remains alive.

Waterborne Commerce

Much of Latin America's transportation involves its connections to the rest of the world and focusses on port traffic and maritime trade. Oribe Stemmer (1989) has reviewed cycles in freight rates influencing nineteenth century trade between Europe and South America and concludes that major staples such as wool, coffee, processed copper and cotton came to be controlled by overseas oligopolistic cargo liner companies while rates for seasonal agricultural products were restrained by competition for cargoes among tramp steamers.

The impact of modern containerization, resulting in intermodal transport, has dramatically altered the nature of transportation patterns on both land and sea. Nowhere are these changes more manifest than in port development. Marti (1985) assesses Chilean ports to determine how many sites can support on-shore container facilities and concludes that this new technology may actually reduce the number of ports capable of significant growth since containers support general, rather than bulk, cargo flows, and require high levels of traffic to justify the substantial investment in facilities. This observation should temper the enthusiasm of a number of Caribbean governments, who view investment in containerport facilities based on their advantages of location alone as a major opportunity to stimulate growth (James 1990; Luxner 1990; Robinson 1990). If anything, container technology is more likely to further geographically concentrate transport patterns on fewer rather than more points of contact with the world market.

Urban Transportation

The profusion of bus and truck routes spreading out into many remote parts of Latin America over the past thirty years has clearly aided migration from the countryside and small towns to a few major cities. However, urban transportation systems within these sprawling metropolitan areas are frequently overwhelmed and their condition has prompted a small literature. Yurac (1984) has considered geographic variables in planning Antofagasta's urban transit system while Schuurman (1987) has argued more generally that access to public transport is a critical need of the urban poor, whose often peripheral residence places them far from employment and services.

Mexico City, that most pathological of Latin American cities, generates most commentary on urban transportation. Grajales and Rosano (1983) examined the political forces behind the growth of the Mexico City airport; Guiterrez de MacGregor et al. (1983) assessed the impact of nationalization on the city's bus service; and Davis (1986) studied the effect of conflicting growth policies on the Mexico City subway system. Stimulated in **[end p. 193]** part by the 1968 Olympic Games, the metro's growth was rapid but brief and ultimately failed to keep pace with the expanding city. Today, it is so congested and densely packed with riders that separate cars are reserved for women and children.

Roads to the Frontier

Movement to empty tropical forest lowlands in Latin America's "other" migration and road building programs have played a major part, particularly in Brazil where highways have been the principal instruments of directed settlement, designed to produce what Delson and Dickenson (1984:122) have called a "controlled landscape." Begun in the 1960s with construction of the Brasília to Belém highway, the colonization program expanded in the following decade with development of the east-west Transamazônica, and the Cuiabá-Pôrto Velho link through the forests of Rondônia. (Moran 1982:18-23; Gauthier 1984).

The Brazilian government's objectives were twofold: to provide land and opportunity to the poor, landless farmers of the overpopulated Brazilian Northeast; and to bring the vast but remote Amazon basin, with its perceived mineral and agricultural wealth, into the national economy (Delson and Dickenson 1984; Wesche 1983). The 1980s saw many critical analyses of this program. Only one-third of the settlers came from the Northeast, and while estimates vary, the Transamazon highway may have attracted only between thirty to fifty thousand newcomers by the mid-1980s (Fearnside 1986:157). Moreover, government policy switched from encouraging small-holding to promoting large-scale ranches of up to 66,000 hectares (Smith 1982:23).

The highways, probing the forest as red gashes across a green carpet, have made the Amazon part of Brazilian consciousness. Cattle production, mineral extraction, and lumbering have all increased the flow of resources to the national economy. But as numerous domestic and foreign commentators have observed, these changes have been at the expense of an irreversible destruction of rainforest environments and of the

indigenous indians who have long dwelled within them (Miller 1985).

The Brazilian government's response to the forces unleashed by its highway colonization schemes has been mixed. Until recently, proprietors seeking to affirm ownership of non-productive forest land could show intent by burning, a policy which has now been reversed (Brooke 1989). Policies to establish protective Indian forest reserves have also been introduced. But policies proclaimed in distant Brasilia are often weakly enforced and, at the same time, Brazil's geopolitical interest to preserve its ill-defined northern borders has prompted the "Calha Norte" project, a 150 kilometer-wide boundary zone from the Atlantic to the point where the Amazon enters Brazil, to be marked by a northern perimeter highway which will further advance the destructive forces associated with the construction of forest roads (Sternberg 1987).

The Brazilian approach to road construction in pioneer areas is not unusual. In Panama, the government with United States financing has pushed the Pan-American Highway deep into the isolated and water-filled Darien peninsula, reaching its present terminus of Yaviza in 1980. Herlihy (1989) has carefully charted the consequences: deforestation; lumbering; land colonization by roadside settlements; extensive cattle ranching; and the concentration of much of the indigenous population into planned villages. Despite the creation of an extensive national park bordering Panama's frontier with Colombia, in part to conserve original rainforest habitats and in part as a buffer against the spread of foot-and-mouth disease from South America, external continent-wide pressure will probably see the eventual completion of this last remaining link in the highway between Alaska and Tierra del Fuego. Once more, the highway most likely will be the initiator of settlement and ecological change.

In a study of settlement in the Ecuadorian Amazon, Rudel (1983) considered an alternative, "settlement first, roads second" approach to development, which was adopted in the Upano-Palora region. In most cases of road colonization, wealthy speculators buy up land parcels along the proposed road alignment and the distribution of any subsequent development benefits becomes highly skewed. In the Ecuadorian case, however, the government encouraged settlers to populate areas to which a road was later promised. The results were mixed. The remoteness of settlements prior to the roads and the uncertainty of the final highway route reduced speculation and made for a more egalitarian pattern of landholding. At first, government presence was weak, forcing greater self-reliance on the part of colonists to contribute to social infrastructure such as schools, which reduced government costs. But lack of planning resulted in a less than optimal matching of land claims and ecologically beneficial land use (Rudel 1983, 398-402). The overall outcome in this one project does suggest, however, that spontaneous colonization [end p. 194] before road-building may retard the conversion of land from small-holders to large-scale absentee landowners, which is the more usual outcome when roads are built before settlement.

A RESEARCH AGENDA FOR THE 1990s

The literature on transportation in Latin America reported here is generally limited both as to topic and degree of attention to any one theme. Moreover, less than half the work is by geographers. Yet, in the recent past, transportation systems have grown across the continent and the movement of people and goods has increased. Between 1960 and the middle of the past decade Latin American truck and bus registrations grew on average by more than a factor of five, compared with 3.2 in the United States; autos by a factor of seven, compared with two in the United States; and air passenger kilometers flown grew by a factor of 2.2, identical to the United States rate of growth. At the same time, a modal shift was clearly evident as the aging and inefficient railroad systems deteriorated: railroad freight traffic declined in all but Brazil, Cuba, Mexico, and Peru, while miles of track in operation contracted nearly 8 percent (Wilkie 1990:52-63). In the face of such changes, research questions and themes abound as the following examples suggest.

Changes in Technology

Technology of movement is a major element influencing geographic landscape patterns and, as the previous data suggest, the truck has come to dominate land transport in Latin America. But since only 20 percent of the continent's roads are paved and international trucking lines are non-existent, truck transport has tended to carry modest shipments of general purpose goods and its impact has been on small rather than large-scale enterprises. Limited water transport and a decaying rail system dogged by gauge incompatibility, track breakdowns, sections out of service, and poor equipment maintenance, still inhibit bulk cargo development and interrelated industrial growth. Questions concerning the optimum modal transport mix in Latin America still await examination.

At the same time, there has been no systematic evaluation of the effect of other technologies, such as containerization, overnight express, and especially air freight, which has made possible the development of a thriving international market for Colombian fresh-cut flowers and fresh Chilean salmon. Neither has there been attention given to the increasingly blurred distinction between communication (the geographical movement of information) and transportation (the movement of goods and people). The emergence of international computer networks and fax systems, together with economic enterprises whose main commodity is information, raise questions about the possible decline of transportation demand as such enterprises attain the ability to become ever more footloose.

Changes in the Pattern of Networks

Expansion of the existing transport network to remote regions continues to be a major feature of the geography of Latin America. Chile, for instance, has for 14 years been pushing the Panamerican Highway south from Puerto Montt through isolated fiord and mountain country. Now only 120 miles short of its target, the road has brought a flood of settlers to harvest fish, timber and minerals in this isolated region, while tourism is growing and Japanese investors roam the fiords, developing salmon production in the crystalline waters. While once studies of new transport links would have been limited to economic effects, environmental impacts of such new construction are now an equally significant concern.

In Ecuador, even human rights laws may influence the pattern of the transport network. Pipelines from the eastern lowlands include service roads that open new areas to farmers and loggers whose impact remains long after the last drop of oil is pumped. Now the Ecuadorian government has granted a concession for oil exploration to a Conoco subsidiary on land which includes a reserve of the Huaorani Indians, and Conoco seeks to build a pipeline east of the Napo river into the reserve. Fearing the same fate will befall the Huaorani as the Brazilian Yanomani -- one in five died after contact with new roads -- United States environmentalists have filed suit with the Inter-American Commission on Human Rights, claiming that the proposed road will break international law on human rights (Economist 1990). This example demonstrates not only that expansion of the transport net needs to be examined in a far broader social and physical context but also emphasizes the variety of international forces that can influence its final geographic form.

While pioneer roads and their impact gain great publicity, intensification of the transport network between major Latin American cities needs equal attention. The concentration of population and economy on single cities [**end p. 195**] is a colonial and neo-colonial legacy (Hassig 1985), but one which has been diffused since the 1960s by the construction of super-highways between clusters of major cities. The consequent appearance of megalopolitan-like zones such as Valencia-Caracas, Toluca-Mexico City-Puebla, Lima-Callao, Santiago-Valparaiso, and the Rio de Janeiro-São Paulo-Belo Horizonte triangle are transforming the patterns of economic geography and promise the possibility of a more even distribution of city-ward migration. Latin American planners already view expanded transport systems as the key to a more dispersed economy. In Mexico, for instance, plans have been made to circumvent the Mexico City metropolitan area with road and rail links connecting Puebla, Cuernavaca, Toluca and Pachuca, and tying this region to a broader axis between Vera Cruz, Queretaro, the Bajío agricultural region, and Guadalajara. The impact and efficacy of such

transport-led landscape changes need considerable study.

Finally, there remains the issue of internationalizing the transport network within Latin America. Despite construction of the Panamerican Highway, which began to have broad, positive, integrative results especially in Central America before political conflict intervened, most of the Latin American transport network still manifests its historic origins as a servant of enclave economies. Consequently, few linkages exist between countries. In South America, for instance, only 9 out of 25 frontiers possess a rail crossing and three of these require a change of gauge at the border. Any broadly successful regional economic integration will require much construction and coordination of the transport network. Almost no attention has been given in the literature to this critical need, without which the continent will remain fractured and less able to compete with the growing world tendency towards international regional clustering.

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