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A TRANSPORT STRATEGY FOR CALIFORNIA'S DEVELOPMENT

by

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University of California, Berkeley

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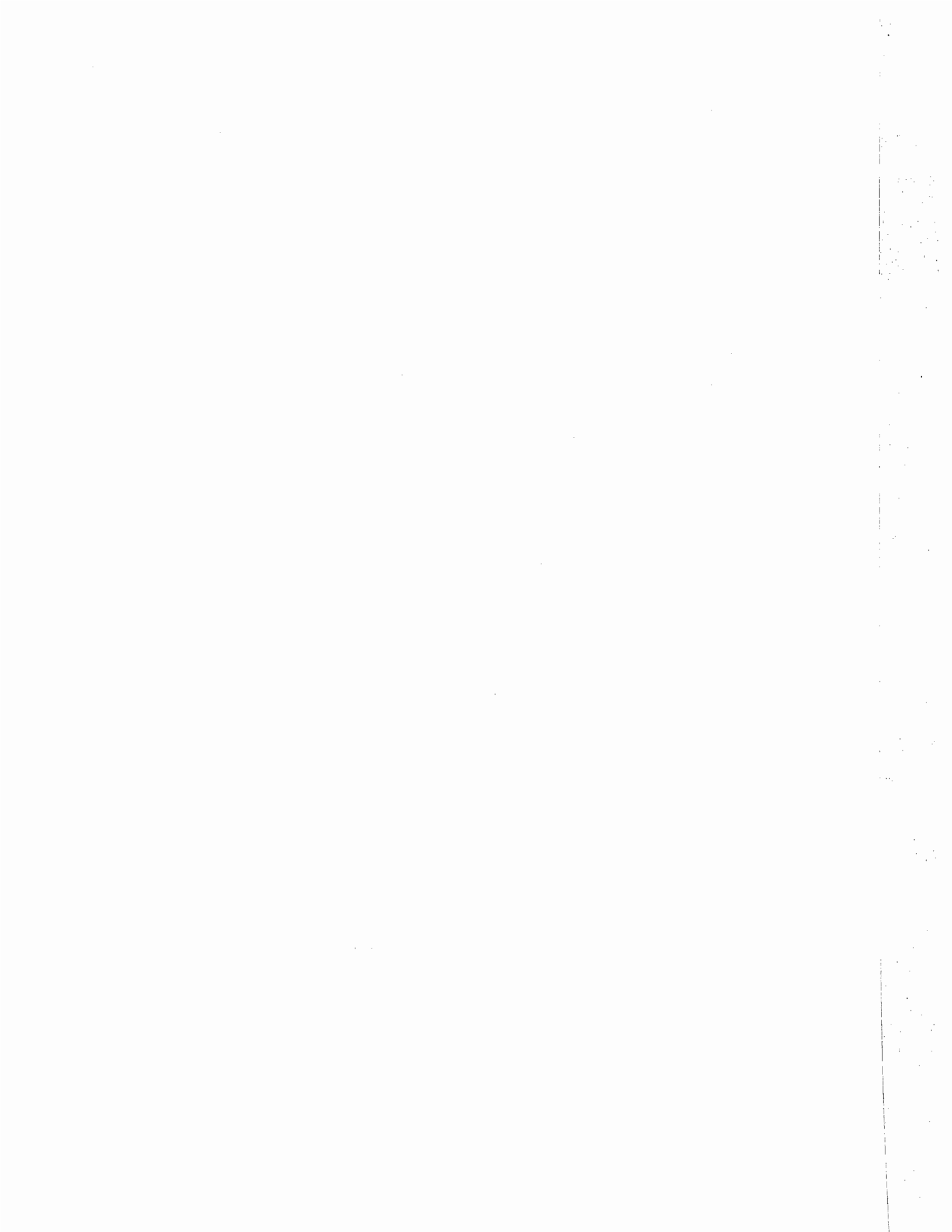
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## INTRODUCTION

The question addressed in this paper asks how to measure the value of additional expenditures for transportation compared to the value of spending for education, health, recreation, or other social services. The relevance of the inquiry has been increased by the rising costs of transportation, by the further pressures on cost from such factors as energy and metropolitan growth, and by the mounting competition for scarce resources in a period of economic uncertainty and expanding consumer demands.

The approach suggested for dealing with this practical but elusive question is based on statistical relationships between the movement of people and goods and levels of economic activity in this country and abroad. Both the history of transportation and present day comparisons among nations in different stages of development make it clear that transportation is an essential ingredient of economic progress: the rich enjoy a high degree of mobility and the poor suffer from lack of mobility. At the same time transportation is only the means by which societies achieve other objectives, and there is a limit to the resources that can be effectively allocated to movement rather than to other needs. Going beyond that limit means that the basic objectives of a society will be neglected.

The matter of deciding whether to spend more or less for transportation rather than for something else, therefore, depends on the volume of transportation needed to make other goals possible. It is not strictly speaking a matter of deciding whether to spend on transportation or on education or something else, but of understanding the role of transportation in making systems of education work. Simply stated, the value of additional expenditures for transportation is to be found in its contribution to what society is aiming at in other sectors. The task is to assure that needed transportation services are provided without generating unnecessary movement or incurring unnecessary costs.

Part I of this report attempts to explain as briefly as possible the observed relationships between transportation and levels of economic activity. The purpose is to show the ratios that have developed between the movement of people and goods and the dollar value of the materials and services that society produces. The changing relation of transport investment to total investment in different stages of economic growth is also illustrated. The purpose of this exercise is to establish a conceptional goal for transportation policy that indicates how a given expenditure for transportation can yield appropriate net gains for society in desired goods and services; how a given increase in goods and services can be achieved for the least transportation or the least outlay for transportation; and when an expenditure of resources

for transportation is sufficiently questionable to suggest that use of the resources in other sectors will be preferable.

From the transportation-product ratios presented in Part I, it will be seen that Caltrans policy, state-wide and for individual projects, will need to focus on a series of trade-offs between transport investment, transport operations, and non-transport sector policies which will create an ever more favorable ratio between movement and production. Some of the elements of such a strategy are outlined in Part II.

It should be understood that this paper is basically an attempt to explore an idea, that the data available to work with are by no means satisfactory, that the relationships between transportation and economic output represent a partial analysis, and that the estimates presented should be viewed with a good deal of caution. To the extent that Caltran is interested in pursuing the concepts discussed here, and obtaining accurate data on the relationships between transportation and the economy, it will be necessary to invest a substantial effort in the collection of reliable data and in the development of the complete model of the California economy that the complexities of the relationships demand.



## I. BACKGROUND INFORMATION

The State of California has achieved a level of prosperity and an assortment of life styles that are derived in considerable degree from the excellence of its transportation. To maintain this position and to allow for further growth will require substantial continuing effort. The nature and magnitude of this effort and the likely changes in transport requirements can be anticipated by observing the world-wide relationships that have been established between transportation and economic development, and by analyzing these relationships in different stages of economic development.

### Transportation and Economic Output

Experience throughout the world indicates that there is a close and predictable relation between levels of economic activity and the capacity to move people and goods. Poor countries are relatively isolated and immobile. A mobility index for the nations of the world, reflecting such factors as passenger and freight miles per capita and the number of vehicles and miles of roads and rails in relation to land area and population, show the correlation between wealth and transportation. Taking the level of mobility in France

as 100, nations at the top of the income scale are also tops in mobility. The United States, with an income index of 189 (compared to France's 100) had a freight mobility index in the 'Sixties of 207 and a passenger mobility index of 147. Every country with a low income had a low mobility index, the latter often being less than 10.<sup>1</sup> (See accompanying table.)

It may also be observed that in early stages of economic development a given percentage increase in national income requires a proportionately higher percentage increase in volumes of transportation. In the case of freight transport this relationship declines with affluence, until the percentage increase in ton-miles of movement may become even less than the percentage increase in produce.<sup>2</sup> Opposite trends will govern passenger movement. Affluent societies will have disproportionately high passenger travel volumes for a given percentage rise in national product, as the society reduces its dependence on primary production and expands the emphasis first on manufacturing and then on services. California, of course, leads the way in this sequence.

These international comparisons have their counterpart in relationships between the incomes of individuals and their outlays for transportation. Everywhere people in low income brackets spend little on transportation, and the reasons are similar to those that explain the immobility of poor nations. The struggle to provide minimum shelter and subsistence leaves little money for other purposes, including transportation. Thus while most households in the

TABLE 1  
Mobility and Wealth of Nations

France = 100

---

<u>Selected Mobile Nations</u>	Index of		
	<u>GNP Per Capita</u>	<u>Freight Mobility</u>	<u>Passenger Mobility</u>
United States	207	189	147
Canada	148	223	149
New Zealand	114	107	-
United Kingdom	104	86	95
Denmark	102	110	119
Austria	65	67	72
<u>Selected Immobile Nations</u>			
Ethiopia	3	2	2
Burma	4	5	6
India	6	10	12
Paraguay	10	16	15
Peru	13	13	11
Colombia	21	11	9
Algeria	20	17	16

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Source: Wilfred Own, Strategy for Mobility, Brookings Institution, 1964, p. 14, Data for 1960-61.



United States with over \$25,000 income per year have a car, and 42 percent have two or more, in the income bracket below \$3,000 nearly 60 percent of households are carless, and they allocate relatively little to transportation.<sup>3</sup>

It is also evident from international comparisons and from the history of developed countries that low levels of economic activity are generally accompanied by high rates of capital expenditure for transportation. As societies eventually become more affluent, the proportion of capital outlays going for transportation is reduced. Many developing countries today are devoting from 25 to 40 percent of their total capital outlays to transportation, over twice as much as developed countries. India, Pakistan, and Colombia are good examples. Among the developed countries, the United States, Japan, and the Soviet Union have all demonstrated how an initial period of heavy investment in transportation gradually gives way to a period in which transport imposes relatively lower demands on capital. In Japan in 1896 transport and petroleum absorbed 56 percent of total investments and this figure was still as high as 49 percent in 1913 and 36 percent in 1929. In the United States before the turn of the century the railways alone accounted for 50 percent more investment than all manufacturing combined. In later years there was a sharp decline in the ratio of transportation to other investments, which levelled off at about 15 percent.<sup>4</sup>

The declining importance of transport investments in the total investment picture has been accompanied by a fairly stable volume of movement in relation to gross national product. Indirectly freight transportation figures collected on a regular basis by federal agencies show that in 1940 there were 2.7 ton-miles of freight movement for every dollar of gross national product (in 1958 dollars). Somewhat higher figures were recorded through the 1950's, and somewhat lower figures in the 1970's. By 1973 every dollar of GNP involved 2.6 ton-miles of freight movement.

This decline in the relative volumes of freight carried in relation to national product is indicated by another set of statistics recently released by the U.S. Department of Transportation. These data are for both intercity and local freight movement, and they show that in 1947 and 1958 there were 4 ton-miles of freight being moved between cities and within them for every dollar of goods and services produced.<sup>5</sup> Then as the economy grew the volume of freight per unit of output declined. By 1972 it was down to 3 ton-miles per dollar of GNP (again expressed in 1958 dollars). Under 1972 conditions a 10 percent increase in GNP was accompanied by only a 7 percent increase in total freight traffic. (This is in sharp contrast to the situation in early stages of development, when, as in India in the 1960's, a 10 percent increase in GNP required a 25 percent increase in freight movement.)

TABLE 2

Relation of U.S. Intercity Freight Transportation to GNP\*

---

<u>Year</u>	<u>Ton-miles of Intercity Freight (in billions)</u>	<u>Ton-miles per Dollar of GNP (1958 dollars)</u>
1940	619	2.7
1945	1,027	2.9
1950	1,063	2.9
1955	1,275	2.9
1960	1,314	2.7
1965	1,638	2.6
1970	1,936	2.3
1973	2,214	2.6

---

Source: GNP from Council of Economic Advisers, Economic Report of the President, February 1975, p. 250. Freight ton-miles from Transportation Association of America, Oct. 1973, p. 8 and Quarterly Supplement, January 1974, p. 8.

\*These data are for intercity transportation only, and differ from the DOT estimates on page 10 that include both intercity and local freight movement.

A somewhat different situation is found in the case of passenger transportation. If regular federal sources of travel data are used (which omit public transit, taxi, and other urban data), it is found that in 1940 Americans were generating 1.4 passenger-miles for every dollar of GNP (in 1958 dollars). By 1973 the figure had risen to 1.6. Adding local public transportation and other data not previously available, by 1972 there were closer to 2 passenger-miles of travel per dollar value of national product. Thus a 10 percent increase in GNP now involves a 20 percent increase in passenger travel.

When movement is expressed in absolute volumes of transportation service, annual travel in the United States has increased from an estimated 500 miles per capita in 1916 to over 5,000 miles today. Intercity freight traffic increases have been from about 5,000 ton-miles per capita in 1926 to 7,500 ton-miles in 1974. The money outlay for freight and passenger movement has also been rising. In relation to GNP, the 1972 freight bill of \$101 billion was 9.6 percent of the GNP, up slightly from the 9.4 percent of a decade before. The passenger bill of \$120 billion has risen more rapidly in relation to GNP, from 10.2 percent of the total in 1961 to 10.9 percent in 1971.<sup>6</sup>

Consumer expenditures for transportation are a further indication of the upward trends in outlays for transportation. Since 1947 the percent of consumer expenditures in the United States

TABLE 3

Passenger Miles of Travel in Relation to GNP

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<u>Year</u>	<u>Total Passenger Miles (Billions)</u>	<u>Passenger Miles Per Dollar of GNP (1958 dollars)</u>
1940	330	1.4
1950	550	1.4
1955	713	1.6
1960	784	1.6
1965	920	1.5
1970	1,185	1.6
1973	1,355	1.6

---

Source: Council of Economic Advisors, Economic Report of the President, February 1975, p. 250, and Transportation Association of America, October 1973, and Quarterly Supplement, January 1974.

were being allocated to transportation has been rising, from 9.4 percent in 1927 to 13.9 percent in 1974, with the exception of the World War II years when the ratio fell below 6 percent because of gasoline rationing and the cessation of automobile production. The increase has amounted to a steady rise of about 0.09 percent per year.

Public expenditures for transportation have risen to keep pace. The total, by all levels of government, has increased in current dollars from the 1947 level of \$3.5 billion to \$28 billion in 1973 -- an eight-fold rise. Most of this expenditure is for highways, which in 1973 accounted for \$24 billion of the \$28 billion total. The amount of public expenditure devoted to transportation is now 12.5 percent of the total transportation bill.

The current outlook suggests further upward pressures on both private and public sector outlays for transportation. In the private sector a dominant item will be energy. In the public sector the problems of urban traffic and transit modernization will command increasing attention, but also the tasks of modernizing the great mileage of highways off the Interstate Highway System, much of which has been neglected because of the heavy concentration of resources on Interstate routes. The effects of inflation may also have further damaging effects on the public sector to provide basic transportation facilities, and the trend toward energy conserving vehicles can be expected to reduce the revenues available from current fuel tax rates.

TABLE 4  
Transportation Expenditures by Consumers  
As Percent of Total Consumption Expenditures

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<u>Year</u>	<u>Percent</u>	<u>Year</u>	<u>Percent</u>
1909	5.2	1941	10.2
1914	6.1	1947	9.4
1919	8.1	1948	9.9
1921	8.6	1949	11.2
1923	9.8	1950	12.1
1925	10.6	1951	11.2
1927	9.6	1952	11.0
1929	9.9	1962	12.9
1930	9.1	1967	12.7
1935	9.6	1972	13.7
1940	9.9	1974	13.9

---

Source: Twentieth Century Fund, America's Needs and Resources,  
Brookings Institution Reprint No. 6, August 1955, p. 248,  
and U.S. Department of Transportation, 1974 National  
Transportation Report, December 1974, p. II-3.

These unfavorable conditions affecting transportation needs and resources will be accompanied by mounting costs in other sectors of the economy and by a possible shift in emphasis toward public and private non-transportation requirements that have been neglected, notably housing, health, education, and environment.

Thus the evidence suggests that man has been passing through several stages in the relation of transportation to development. At an early stage there was an undersupply of transportation, the radius of travel and the capacity to get things moved was low, and so was productivity. This was the stage of poverty and immobility, a stage that today still pervades much of the developing world. A second stage of transport mechanization and the industrialization of economic systems followed, when large outlays for transportation were necessary to produce a given increase in production, and transport investment was a high proportion of total investment. In this stage new transport technology made it possible to substitute fossil fuel energy for human energy, and greatly to expand the output of the economy. A later stage of motorization and affluence increased the effectiveness of transport technology and made it available to a large number of people. This stage has reached a point in the United States where in some urbanized areas, for the first time in history, there is probably too much transportation. Yet services are poor because the use of motor vehicles exceeds the capacity to accommodate them. A possible fourth stage, which the United States,



TABLE 5

Government Expenditures for Domestic Transportation

(Millions of Dollars)

Year	Federal	State and Local	Total
1947	532	2,994	3,526
1950	904	4,208	5,112
1955	1,064	6,839	7,903
1960	3,661	8,588	12,249
1965	5,319	10,865	16,184
1970	6,857	17,048	23,905
1973 (est.)	7,980	20,262	28,242

Source: Association of American Railroads, "Government Expenditures for Highway, Waterway, and Air Carriers," May 1973, Table 1, p. 5.

Europe, and other developed areas may be entering, is one in which a better understanding of the relation of transportation to goals in other sectors could promote measures for bringing about a better balance between transportation and the rest of the economy. This period will hopefully be one in which transportation policy is seen as an integral part of the process of achieving national goals, with more emphasis on standards of living and not just moving.

The fact that we try to measure the values produced by additional transportation as compared to the values that might be produced by using the resources elsewhere reflects a misconception of the role of transportation. Transportation is not itself a goal, but a means of attaining the goals of society. When transportation is erroneously regarded as an end in itself, the result may be that other sectors are neglected and transport becomes a means of escape or of compensation for the low priorities assigned to housing, community development, and other needs. The concept of transportation-output ratios and of the ways of improving such ratios may provide a better framework in which to assess the appropriate role of transportation.

#### The California Picture

California is different in many respects from most of the United States. It has been more prosperous, it has greater recreational resources, its development has been comparatively recent, and its growth has been dominated by the automobile. With a

population of approximately 21 million, or 10 percent of the U.S. total in 1974, the state accounted for 10.7 percent of the nation's personal income and for 10.9 percent of its motor vehicles. But more important, Californians are farther into the post-industrial society than the rest of the world, including most of the United States. Based on the high percentage of the labor force engaged in services and the decline in blue collar jobs and farm workers, California has been post-industrial for half a century and is still leading the trend.<sup>7</sup> In 1970, the state had a substantially smaller percentage of workers in primary production than did the rest of the United States, a smaller percentage in secondary employment (manufacturing and construction), and a higher percentage in government, trade, professional services, and other tertiary activities.

In this report the historical relationships between transportation and economic activity for the United States are applied to California; for every dollar of value in goods and services produced in the state, 3 ton-miles of freight movement will be assumed. Increments of growth in future years will probably require fewer ton-miles per dollar of state product in view of the mounting importance of services and the more rapid rise of passenger rather than goods movement.

It is estimated that California's gross state product in 1974 was about \$89 billion in 1958 dollars.<sup>8</sup> Based on nationwide data, something on the order of 250 billion ton-miles of freight

movement was needed to support this level of economic activity.<sup>9</sup> Detailed data for freight movement in California would probably indicate that the state figure differs somewhat from the national average owing to differences in geography and economic activity.

In addition to the task of assuring the continued movement of this volume of freight, growth of the state economy will mean that further capacity must also be available. Assume, for example, that over the next three years there is a 10 percent increase in state product, raising the total by some \$9 billion (in constant 1958 dollars). The effect would be to increase transport requirements by 27 billion ton-miles per year. But a decline in the ratio of freight movement to gross state product (to 2.5 ton-miles per dollar, for example, instead of 3) would mean that the freight traffic increase would be closer to 22.5 billion ton-miles.

The ratio of passenger travel to total output in California appears to be greater than the national average of 2 passenger miles per dollar of gross national product. A combination of affluence, good weather, differences in life styles, and plentiful space is partly responsible, together with the greater proportion of employment in services, which generally involves more people movement. Based on an estimated \$89 billion of state product and 220 billion passenger-miles of travel, Californians appear to be travelling 2.5 miles for every dollar of state product, which is 25 percent above the U.S. figure.<sup>10</sup>

Passenger travel in California, given a continuation of current trends, seems destined to become a more important consideration in the total state transportation picture. A 10 percent increase in state product would mean a 25 percent increase in vehicle-miles of travel. Another 50 billion vehicle-miles would be generated if such a rise occurred in real state product. This possibility may be constrained, however, by travel restrictions in connection with clean air requirements and higher fuel prices, and by a consequent shift to mass transportation.

## II. MEASURING THE VALUE OF ADDITIONAL TRANSPORT

Based on observed ratios between transportation and economic output, for every dollar added to California's state product (in 1958 prices) it will be necessary to provide for an estimated 3 ton-miles of freight and 2.5 passenger-miles of travel. Caltrans will have to supply the appropriate public facilities and establish the relevant public policies. Since the objectives of society lie mainly in end products rather than in the transportation means that make them possible, transportation expenditures will have value only to the extent that they support other sectors and do so without wasting resources.

The overall strategy should be to provide for the transportation of people and goods necessary to assure other objectives, to reduce costs, to take advantage of economic trade-offs that reduce transport needs, and to influence decisions in other sectors that will help increase the ratio of goods and services output to units of transportation.

More specifically, spending for transportation will have a higher value than spending for something else when:

a) such spending for transport maintains the ratios of movement to output that have been attained in the economy to date;

b) what is spent makes more effective use of the existing system, thus bringing about a more favorable ratio between transportation investment and total investment;

c) when further transportation capacity supports sufficient new production of goods and services (above the costs of transport) to maintain or improve the relationships between transport and economic output.

Funds spent for transportation will have a lower value than a comparable use of resources for other public and private needs when:

a) they increase investment without first achieving reasonably effective use of existing facilities;

b) they maintain or create distortions in the system through neglect of public transit, poor integration of systems, selection of inappropriate technology, acceptance of inefficient equipment, and persistence of uneconomic pricing policies;

c) they provide new transport capacity in the wrong places or without the assurance of needed investments in other sectors to increase the output of goods and services;

d) they ignore the possibilities of non-transportation solutions that might make additional transport unnecessary.

These factors affecting transport values relate to both state-wide strategy and individual projects, since the sum of project accomplishments determines total system performance.

The implementation of a Caltrans strategy based on these principles can be summed up under three general types of actions. All are aimed at maintaining current levels of economic activity and supporting further growth of the state's economy, but would attempt to do so with a declining ratio of transportation and transportation outlays to economic activity. The elements of such a strategy would be to assure that new transportation investments are made in direct support of specific objectives in other sectors; that costs are reduced by assigning priority to measures that make more effective use of available facilities; and that uneconomic movements are avoided, partly through Caltrans policies with respect to pricing and transit, and partly by efforts on the part of Caltrans to promote non-transportation solutions to transportation problems through the actions of other agencies. The three suggested approaches for Caltrans implementation are illustrated in the following sections.

#### Supporting Increased Production of Goods and Services

If resources allocated to transportation are to be as productive as possible in supporting goals in other sectors, one way is to assure that transport expenditures are part of an overall economic development strategy. In the past it has been customary to build transport capacity on the assumption that other developments would follow to make the project viable. Today it makes more



sense for transportation projects to be conducted jointly with other developments as a single package, so that transportation is integrated with other sector objectives and there is built-in economic justification.

The Caltrans staff should therefore include experts with a thorough understanding of the needs of other sectors which depend on transportation. This staff should be able to assess the transportation problems and requirements of other sectors and to give priority to transport expenditures that promise the greatest economic and social yields. This means specifically relating what is done in transportation to what needs to be done for agriculture, manufacturing, education, health, recreation, and social services, and what may be required for special groups in society, including low-income families, the carless, the old, the young, the disabled, the student, the suburbanite, and the rurally isolated. How can better transportation contribute to a higher quality of life?

This aspect of Caltrans strategy calls for staffing that equips the Department with experts in such areas as agriculture, recreation, business, sociology, and urban and regional development. Data requirements can be met in major part by establishing the necessary working relationships with other departments of the state government. But Caltrans would need to be equipped to translate various sector goals into an effective transportation response through appropriate allocation of resources for transport and appropriate transport project design.

### Reducing Transportation Costs

To get more state product per unit of transportation expenditure also involves policies and programs that will reduce transportation costs. The combination of promoting more product for a given transport project and at the same time reducing the unit cost of transportation will hasten the decline in transportation-to-output ratios. Although new transport investments may facilitate more production, at this stage of California's development the most effective strategy will be in reducing costs. Since freight traffic-to-output ratios are declining while more passenger travel is being generated for each dollar of final product, cost reduction should focus on passenger transportation. About 95 percent of passenger travel is automobile use (the balance is air, rail, and bus), and most of the cost is in the private sector, so that energy efficiency and automobile design warrant a high priority.

For example, the present level of expenditures for transportation incurred to purchase fuel would not be needed if automobiles were designed for greater economy. A transportation strategy calls for public policies aimed at assuring consumers an energy-conserving vehicle better adapted to urban use, safer, longer-lasting, and economical to maintain and repair. An important element of transportation strategy should be the promotion of policies aimed at hastening more energy-efficient vehicle designs.

The U.S. Department of Transportation has indicated that by 1985 a 60-80 percent increase could be achieved in gasoline mileage through changes in automobile design, wholly apart from major changes in propulsion systems. Legislation pending in Congress would impose heavy taxes on cars failing to meet energy-conservation standards. California's influence in promoting these and other changes in the motor vehicle could help to reverse the continuing upward trend in the percentage of consumer expenditures devoted to transportation.

Lacking action at the national level, California might enact relevant legislation setting standards for vehicles eligible to operate within the state. Other possibilities of reducing transportation costs may be found in shifting more home-to-work travel from automobile to bus through improvements in the quality of bus service, cost-related pricing policies for automobile use in cities, and restrictions on driving and parking in congested urban areas. Many of these measures will be required to help meet federal clean air specifications by the 1977 deadline, and it is estimated that the result may be substantial reductions in driving. A reduction in the number of cars owned by California families as a result of these conditions could substantially reduce the total transportation bill, but the net economic effects would have to be evaluated in terms of the reductions in mobility and in automobile-related activity and employment, as well as in the impact of alternative consumer spending.

A Caltrans strategy should also seek to reduce highway and transit congestion that results from pricing policies and work schedules that result in excessive concentration of movement in rush hours. It is now being demonstrated here and in Europe that flexible working hours can bring considerable satisfaction to workers, increase productivity for business, and reduce the peaking of home-to-work travel. The value of public funds devoted to expanding rush-hour transit and expressway capacity, that might be rendered unnecessary by congestion pricing, is zero or negative compared to the values the same money could create if applied effectively in such sectors as housing, health, education, or urban redevelopment.

The possibilities of cost reduction might also be looked for in the staggering of week-ends to reduce the heavy concentration of Friday and Sunday recreation travel, as well as to increase the capacity of summer and winter sports facilities that are overcrowded two days a week and underutilized at other times.

A general strategy for reducing transport outlays would include many other elements: much wider application of traffic engineering techniques, more effective allocation of street space among autos, trucks and transit, curtailment of on-street parking in urban areas, more extensive use of group-riding taxis, the encouragement of car pooling, and the dispersal of congested traffic by routing it over lesser used segments of the total system. As long as these measures are not being taken to any great extent, expenditures for

new transportation capacity can be expected to have little or no value in terms of their contribution to gross state product compared to other uses of the same resources.

The potential benefits to the economy of transport efficiency measures are substantial. If it were possible by better bus and taxi service to effect a 20 percent reduction in auto use for the work trip, which accounts for one-third of California's 130 billion vehicle miles of auto travel annually, a total of 8.6 billion vehicle miles of travel would be eliminated from the morning and evening rush hours. At out-of-pocket cost savings of 6 cents per vehicle-mile, automobile operating costs would be reduced by half a billion dollars per year, and 1.5 billion dollars a year could be saved if 10 percent of California cars (1.1 million units) were given up because of better public transit. The cost of moving 20 percent more people by public transit would have to be taken into account in estimating the net savings resulting from the shift, but offsetting benefits might result for both transit vehicles and automobiles from reduced congestion.

#### Reducing Transport Volumes

The trend in freight traffic per unit of output in the United States is down, and passenger miles in relation to output are up. Part of a Caltrans strategy should be to explore the possibilities of getting the same state product for less movement,

either by eliminating transport volumes that have a low value or by supporting travel-saving programs through such means as urban design or innovations in communications.

In the preceding section the search for an appropriate strategy suggested that by reducing motor vehicle operating costs and fuel consumption and by improving mass transit it might be possible to reduce consumer outlays for transportation. If this were possible, and if the resources could be directed elsewhere, they could create more value in housing or other sectors than in supporting unnecessary transportation. But in the public sector an opposite strategy may be relevant in affecting the choice of whether to spend for transportation or something else. This strategy relates to public sector pricing.

Motorists are paying a uniform price for highway service through gasoline taxes, regardless of the cost of the service. This cost may be quite high during peak traffic periods in urban areas, since expressways and extra lanes are often built primarily to provide capacity for hours of heavy use. The motorist in peak periods is thus being undercharged. He also avoids paying the social costs of driving, including costs of air pollution, noise and other environmental effects. If an effort were made to collect the economic and social costs of automobile use on heavily traveled routes and in heavily traveled hours by tolls or special charges, there would undoubtedly be a reduction in the volume of unnecessary trips and

a reduction in the amount of public expenditures allocated to highways. Assuming that some low-priority travel were discontinued (unnecessary trips to the store, unimportant errands and visits), the value of expenditures once required to accommodate these marginal trips would be minimal, and the value of applying comparable resources to the more urgent needs of health care, better schools, recreation facilities, or housing would be greater.

A reduction in unnecessary transportation might also be accomplished by measures taken outside the transportation field. To illustrate, the lengthening work trip, shopping trip, and journey to recreation and play space is in part the result of the planless and disorderly development of urbanized areas, the neglect of local neighborhood services and amenities, and the failure to achieve a desirable mix of housing, community facilities, and employment opportunities. Large sums now being devoted to urban transport might be saved in the long run by expenditures for urban redevelopment that would have greater value because they would be creating better living conditions as well as reducing unnecessary movement.

Caltrans is obviously not in a position to carry out urban growth and redevelopment policies, but it could provide an important input to such a strategy. It could do so by helping to finance the redesign and relocation of urban streets, the abandonment of streets for playspace and other uses, the development of pedestrian and bicycle networks, the creation of pedestrian shopping malls,

the design of vehicle-free zones, and the introduction of good public transit substitutes for the automobile. A combined program for transportation and the environment could produce significant benefits for California cities by shifting public funds from less valuable to more valuable uses.<sup>11</sup>

Other possibilities for reducing passenger movement in a service-oriented economy lie in the use of visual communications and computer information systems that may make some types of routine trips unnecessary and that may have even greater effects in permitting the dispersed location of offices and research organizations in areas relatively free of traffic congestion. The promotion of telecommunications that cost no more for long distance than short would make possible a shift from expensive and time-consuming business travel to regular and more frequent video phone communication, document transmittal, and information exchange.

Because Caltrans represents a new institutional arrangement for transportation, it is in a position to innovate in an area where innovation is badly needed. The time is appropriate to extend the responsibilities of transportation agencies beyond the task of supplying transportation to the broader task of solving transportation problems. It is these broader responsibilities that will open the door to public sector outlays for non-transportation approaches to transportation problems. As these types of solutions find wider application, trends in the ratio of passenger travel to output may be reversed.



An analogy can be found in the field of health. As the nation's health bill has soared and the demand for hospital beds and doctors has increased, the general level of physical well-being in the United States has not shown commensurate improvement. Attention has therefore begun to focus on the conditions underlying the demand for medical treatment and on the possibilities of prevention. Comparable conditions suggest the need for a program of transportation prevention, especially in urbanized regions which have been allowed to grow without concern for the difficult transportation problems they help to create.

This aspect of a Caltrans strategy requires a new approach that calls for close liaison with other public and private agencies in a position to solve transportation problems through non-transport means. But Caltrans staff will need to be the initiators of such actions and will have to supply the analyses that demonstrate the greater value of attacking problems at their source rather than temporizing with symptoms.

### A Summary View

Given the nature of economic systems to date, and the evaluation of technology to date, it can be concluded that high levels of living depend, among other things, on high volumes of transportation. The task of public policy, under conditions of tightening resource constraints, is to discover which types of transport and transport expenditures are creating limited values, and how a reduction in these marginal expenditures might permit greater values to be created in other sectors. But the relationships between transportation and the economy also suggest that policy changes in non-transport sectors will have to be made if maximum values are to be realized from transportation outlays. It is the probing of both sides of the equation that will achieve the highest total values for society. In the process the following general conclusions may be expected to emerge:

- 1) Expenditures that maintain the existing transport system (pending identity of marginal expenditures to be dispensed with) will have a higher value than any alternative use of the funds because they assure the necessary support for investments already made in other sectors.

2) Measures taken through better management, regulation, pricing, and traffic control achieve needed additions to the capacity of the system without further investment because they make more effective use of capital funds already invested in transport and they release funds for productive use in non-transport sectors (given the ability to transfer state resources from one program to another). Both effects will act to create a more favorable transport to output ratio.

3) New capital investments in transportation will have an equal or higher output than alternative uses of capital if the effect is to add sufficiently to the total output of goods and services (above transport costs) to maintain or improve the transport-to-production ratio.

4) Measures that reduce the physical volume of transport through the application of non-transportation solutions carry a high priority by releasing resources to be expended on desired goals rather than on means.

No one would have thought to ask the question, at the beginning of this century, whether the value of added transport was greater or less than the value of ~~something~~ something else that might have been accomplished with the same resources. For in the early period of railway expansion, pioneer highways, and farm-to-market roads, transport investment was a prerequisite of economic development, and there were seemingly no limits to the transport that was needed.

Now, with a pervasive network of transportation already in place, the question of transportation versus other social needs has suddenly become relevant. Unlike earlier times, the variety of demands for scarce resources is unlimited; there are alternative transport and non-transport technologies to choose from; and there are obvious inefficiencies in the existing system and its operation.

The fact is that consumers today do not have energy-efficient automobiles, very little effort has been made to supply good public transit, much of the economic regulation governing freight haulage is wasteful, low-cost traffic engineering and pricing solutions have been neglected, and the underlying land-use and environmental causes of traffic generation in urbanized areas have been almost totally ignored.

It can therefore be concluded that in both the public and private sectors millions of dollars are being spent for transportation that would have a higher value if used for other needs. A partial transfer of resources could be effected through better operation of the system without any diminution of transport volumes. Additional savings could be effected by cutting down on trips of marginal importance without any noticeable impact on levels of living. Still further savings might be possible through changes in land use, life styles, and non-transportation technology that could reduce the generation of traffic. Potential savings through vehicle design and reductions in the use of energy might be the greatest of all.

The challenge for Caltrans, then, is to identify those areas in which greater economy and efficiency are possible in the supply of transportation, and those areas in which factors affecting demand can help bring about a more workable and equitable operation of the system already built. The task can be guided conceptually by continuous monitoring of the relationships between transportation and the performance of the economy, measured by the volume and costs of movement and the output of goods and services.

A more favorable balance needs to be achieved between transportation and the value of what it helps other sectors to produce. For continued prosperity, but also a more satisfying way of life, the goal should be a further reduction in the ratio of ton-miles and passenger-miles per dollar of state product, and of transport dollars to total dollars. The result could be the release of marginal transportation funds that produce little value for use in other sectors where the urgency of the need assures higher values.

### III. ALTERNATIVE APPROACHES CONSIDERED

In arriving at a suggested strategy in Part II, the recommended approach was viewed in the light of several approaches to the same problem that have been used by state and federal governments and by transportation planning departments abroad. These include the use of projections of population and economic activity, estimates of motor vehicle ownership and other transportation implications, and projections of the amount of public funds that would need to be spent to provide facilities to accommodate resulting levels of traffic. These overall estimates provide an indication of the level of public expenditures that appear to be justified in the future, to be supplemented by individual project analyses using cost-benefit analysis or cost-effectiveness studies.

A recent example of national projections is supplied by the U.S. Department of Transportation's 1974 National Transportation Report, which is a compilation of state estimates with suggested downward revisions by federal officials.<sup>12</sup> The 1974 survey notes that over the next fifteen years there is likely to be a lower transportation growth rate, especially in passenger travel, that substantial investments will be justified as parts of the existing system deteriorate or become obsolete, but that the extent of

justifiable outlays will depend on whether significantly higher standards are demanded by the public and whether efforts are made to achieve significantly greater efficiency in the performance of existing facilities. The Department also takes the position that projections based on past trends need to be reviewed in light of the more recent outlook for energy and the economy, with emphasis on the question of what the country can afford.

On the more optimistic side, gains in productivity continue to be made in the movement of freight and in air transportation, and there are now prospects for greater efficiency through reform of transport regulation. Federal financing has begun to help revive public transit and to increase the possibilities of more efficient movement of people in urban areas.

In the federal summary of public sector needs for all forms of transport as submitted by the states, transportation capital requirements for the period 1972-90 were estimated at \$532 billion (in constant 1971 dollars) of which \$249 billion was for highways. This figure represents an average annual capital outlay of \$29 billion -- somewhat more than the total 1973 public outlay for transportation capital, maintenance, and operating outlays.

The federal government revised this estimate downward on the grounds that the capital estimates for highways, equal to 1.5 percent of GNP, would be too high. Historically this figure has been only about 1.2 percent, and even the latter figure is in excess

of the revenues that historical trends indicate will be available. (The figure of available revenues has averaged about 1 percent.) On this basis, and in view of the levelling off of the population and the uncertainties of energy supply, the Department of Transportation reduced the state estimates of highway capital needs to \$286 billion (compared to the state figure of \$429 billion) to hold capital investment at 1 percent of GNP where it would conform with projected highway user taxes.

This method still leaves unanswered the question whether proportionately more or less should be spent in the public sector for transportation, simply adopting the historically established relationship as a maximum. It does not relate sufficiently to the specific needs of various sectors to provide a total system approach that might reveal trade-offs between transportation and other expenditures that might reduce the need for movement or its cost. But it does establish some broad dimensions of possible transport needs that can be refined by further consideration of specific projects, choices of technology, and potential savings through more efficient operations.

California's transportation planning can offer a clearer set of alternatives for determining what level of transportation spending might be justified. These include a "no build" alternative that provides only for maintenance of the system now in existence, and a higher level of expenditure or "financially constrained"



alternative that would be operated within the funding available.

A third "financially unconstrained" alternative provides for meeting desired needs independent of current financial restraints. But federal requirements established for 1977 under terms of the Federal Clean Air Standards suggest still another alternative in which restrictions on driving and greater use of mass transportation would reduce travel in some areas by substantial amounts.<sup>13</sup>

California travel has been increasing twice as fast as population. If the trends continue, there could be an 80 percent increase in travel from 1970 to 1985, according to recent state projections. But a changing set of circumstances may govern the travel outlook, including a slowing of population growth, higher fuel prices, a leveling of individual incomes, and the necessity of conforming to clean air standards. In response to these standards, transportation control plans have been developed to cover those areas not presently meeting federal clean air requirements. These plans involve expansion of public transit, carpooling, parking management, and restrictions on automobile use in congested areas. Full operation of the plans by 1977 could reduce auto travel by an average of 12 percent -- 20 percent in the South Coast Air Basin and 7 percent in the San Francisco Area Air Basin.<sup>14</sup>

The desirable approach to the justification of transportation development, however, as noted in the California Transportation Plan, is first to establish agreed-upon goals for housing, recreation, the

environment, jobs, education and other sectors, then to determine an effective transportation strategy to implement "controlled trends." But since California "lacks a comprehensive statewide planning policy, there is no broad framework within which single purpose plans such as CTP can develop."<sup>15</sup> As stated in Part II of this report, the suggested alternative is to assess individual sector plans as a means of guiding transport policies and programs and to prevent transportation from dictating development.

The Caltrans approach to determining a justifiable transportation program is similar in its details to the approach recommended in this report, and it would require the same types of personnel and data. However, the approach recommended here for further study and possible use by Caltrans provides a potential new tool for formulating state-wide strategy and for individual project guidance. It would assess transportation in terms of transportation-production ratios that historical and world-wide experience suggests might be useful in evaluating the linkages between mobility and economic development.



FOOTNOTES

<sup>1</sup>Wilfred Owen, Strategy for Mobility, Brookings Institution 1964, East-West Center Edition, 1966, p. 14.

<sup>2</sup>For example, when India increased its net national product 70 percent in fifteen years (1950-1965), the gain was accompanied by a 170 percent increase in freight movement. (Distance and Development: Transportation and Communications in India, Wilfred Owen, Brookings 1968, p. 6.) But over the years the transport ingredients of economic growth have been diminishing.

<sup>3</sup>Motor Vehicle Manufacturers Association, Automobile Facts and Figures, 1973/74, p. 30.

<sup>4</sup>Strategy for Mobility, pp. 26, 30.

<sup>5</sup>Computed in constant 1958 dollars from U.S. Department of Transportation, "1974 National Transportation Report," December 1974, p. II-19.

<sup>6</sup>Transportation Association of America, "Transportation Facts and Trends," October 1973, pp. 4, 5.

<sup>7</sup>Todd LaPorte and C.J. Abrams, "Alternative Patterns of Post-Industria: The California Experience." Working Paper No. 12, Institute of Governmental Studies, University of California, Berkeley, April 1974, p. 16.

<sup>8</sup>Larry J. Kimbell, "The UCLA Econometric Model of California," unpublished paper, 1975.

<sup>9</sup>Based on 3 ton-miles per dollar of GNP, as estimated by the U.S. Department of Transportation (see pp. 8, 10).

<sup>10</sup>Based on 1974 passenger car-miles travel, assuming that this was 95 percent of all travel, and assuming that car occupancy was the same as the national average of 1.9 persons per vehicle.

<sup>11</sup>A program for transportation and the environment is outlined in The Accessible City, Brookings Institution, 1972, pp .

<sup>12</sup>U.S. Department of Transportation, "1974 National Transportation Report," Washington, D.C., December 1974.

<sup>13</sup>State of California, Business and Transportation Agency, Department of Transportation, Volume I of the California Transportation Plan, Discussion Draft, March 1975.

<sup>14</sup>California Transportation Plan, Vol. I, March 1975 draft, p. III-7.

<sup>15</sup>Ibid. p. V-1.

#### REFERENCES

Charles L. Schultze, The Politics and Economics of Public Spending, The Brookings Institution, Washington, D.C., 1968.

Edward R. Fried, Alice M. Rivlin, Charles L. Schultze, and Nancy H. Teeters, Setting National Priorities: The 1974 Budget, The Brookings Institution, 1973

Measuring Benefits of Government Investments, Robert Dorfman, Editor, The Brookings Institution, 1965.

Transport Investment and Economic Development, Gary Fromm, Editor, The Brookings Institution, 1965.

Hans Adler, Economic Appraisal of Transport Projects, Indiana University Press, 1971.

Wilfred Owen, Strategy for Mobility, The Brookings Institution, 1964.

Wilfred Owen, Distance and Development, The Brookings Institution, 1968.

Wilfred Owen, The Accessible City, The Brookings Institution, 1972.

Transport and National Goals, Edwin T. Haefele, Editor, The Brookings Institution, 1968.

