PLANNING FOR TRANSPORTATION CENTERS

E. M. Whitlock and C. D. Feske, Wilbur Smith and Associates

Better integration of transportation systems should be the goal of all transportation planners. Provision of transportation centers can aid in effecting additional intermodal transfer capability, thereby adding to the convenience of public transportation facilities. Results are presented of the approximate land use mixes involved from prior feasibility studies of transportation centers. Relative floor-area compositions are given for three proposed centers, and estimates are made of comparative proportionate development costs, operating costs, and incomes. Alternative financing considerations are also presented highlighting the economic implications of developing the centers with private funds, public funds, or a combination of each. Methods of gaining financially on depreciation and sharing design and development responsibilities are presented emphasizing the best potential of joint cooperative public-private development. Authors of the paper have attempted to emphasize the many good features of integrated transportation centers and the benefits to be derived by development of these centers. Conclusions reached are that, with a proper mixture of activities, income from the nontransportation elements can offset deficits likely to accrue from operation of the transportation components, thereby supporting the economic feasibility and planning logic of development.

•THE GREATEST CHALLENGE facing transportation planners today is to conceive ways and means of achieving better integration of all transportation modes. To ensure flexibility and balance in a transportation system, better integration of and interchange among modes is necessary. This can best be accomplished at a terminal area where transfer capability exists, as in a transportation center.

TRENDS IN TRANSIT RIDING

Less than 5 percent of all person trips in the United States are by public transportation. Transit does, however, make a substantial contribution to urban travel in the more densely populated metropolitan areas. If more transportation centers could be developed along existing and future transit routes, it is possible the modal interchange capability could induce better utilization of the entire transportation system.

The American Transit Association has prepared tabulations on transit riding trends between 1935 and 1968, indicating that fewer people are riding transit today than ever before. Table 1 gives data showing that in 1935 almost 10 billion revenue passengers used transit in the United States, excluding commuter railroads. This increased to almost 19 billion passengers in 1945, reflecting the impact of World War II and gasoline rationing. Between 1945 and the present, a gradual decline in transit passengers has been experienced. This is causing substantial concern by transportation administrators at the national planning and policy levels.

Sponsored by Committee on Passenger and Freight Transportation Characteristics and presented at the 50th Annual Meeting.

TABLE 1

TRENDS IN TRANSIT RIDING IN THE UNITED STATES, 1935 TO 1968

Year	Revenue Passengers in Millions[a]					
	Rail			Trolley Coach	Motor Bus	Total
	Street Cars	Subway-Elevated	Total			
1935	5,156	2,252	7,408	77	2,297	9,782
1940	4,182	2,282	6,464	419	3,620	10,503
1945	7,081	2,555	9,363	1,001	8,345	18,982
1950	2,790	2,113	4,903	1,261	7,681	13,845
1955	845	1,741	2,586	869	5,734	9,189
1956	625	1,749	2,374	814	5,568	8,756
1957	491	1,706	2,197	703	5,438	8,338
1958	415	1,635	2,050	593	5,135	7,778
1959	378	1,647	2,025	517	5,108	7,650
1960	335	1,670	2,005	447	5,069	7,521
1961	323	1,680	2,003	405	4,834	7,242
1962	284	1,704	1,988	361	4,773	7,122
1963	238	1,661	1,899	264	4,752	6,915
1964	213	1,698	1,911	214	4,729	6,854
1965	204	1,678	1,882	186	4,730	6,798
1966	211	1,584	1,795	174	4,702	6,671
1967	196	1,632	1,828	155	4,633	6,616
1968	187	1,627	1,814	152	4,524	6,491

Source: Wilbur Smith and Associates (18).

[a]Excludes commuter railroad, which accounts for less than one-tenth of 1 percent of transit patronage.

PROJECTIONS OF TRANSIT RIDING

Based on a continuation of existing trends, projections have been made of the role of transit by 1980 for metropolitan areas of varying size (Table 2). It is encouraging to note that, for urbanized population ranges of over 5 million people, an increase of over 40 percent for daily transit trips is projected. Conversely, in the smaller metropolitan areas, ranging in population between ½ million and 1 million people, a decline of about 27.5 percent of patronage is anticipated.

FUNCTIONS OF A TRANSPORTATION CENTER

A properly planned and integrated transportation center will effect modal transfer; complement area parking requirements; enhance mobility; enhance regional economy; facilitate distribution of people and goods to principal destinations; facilitate mix for a myriad of land uses; and foster changes in travel patterns, such as "reverse commuting." Basic elements that should be included in a transportation center are rail facilities; bus facilities; air facilities; parking facilities; connections to main roads;

TABLE 2

ESTIMATES OF DAILY TRANSIT RIDING IN URBAN AREAS BY POPULATION

Urban Area Population Range (millions)	Population			Daily Transit Trips		
	1960 (thousands)	1980 (thousands)	Percent Change	1960 (thousands)	1980 (thousands)	Percent Change
Over 5.0	27,557	52,500	+90.5	10,770	15,250	+41.6
1.0 to 5.0	24,676	57,500	+133.0	6,160	11,500	+86.7
0.5 to 1.0	17,047	19,700	+15.5	3,750	2,720	-27.5
0.1 to 0.5	26,270	37,800	+43.9	4,600	2,780	-39.6
Under 0.1	29,719	24,900	+83.7	2,980	—	—
Total	125,269	192,400	+53.6	28,260	32,250	+14.1

Source: 1960 data are calculated from data of the U.S. Bureau of the Census and American Transit Association. 1980 data are estimated.

taxi ranks; pedestrian waiting areas; commercial facilities; ticket offices; vertical and horizontal passenger links; pedestrian amenities; car-rental areas; vehicle diagnostic centers; limousine connections; and other supporting uses, including educational, recreational, industrial, religious, commercial, retail, and open space. The functional interrelationships of a hypothetical transportation center are shown in Figure 1.

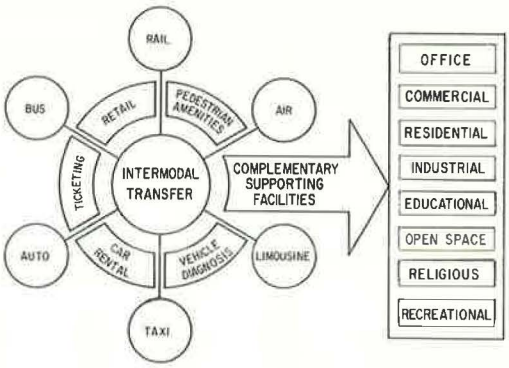

Figure 1. Functions of a transportation center.

Most of the major cities of the world have suburban railways or subway systems that afford opportunity for development of transportation centers. Some of the significant centers in the United States include Grand Central Station, Penn Station, and the Port Authority bus terminals in New York, Penn Center in Philadelphia, Union Terminal in Cleveland, Lloyd Center in Portland, and the Bay Bridge Terminal in San Francisco. A number of transportation centers exist or are now being planned in international cities such as Tokyo, London, and Brisbane.

Historically, centers for transportation have fostered, in many instances, disorganized growth and relatively rapid and disastrous change of urban areas. This can be cited by the 18th century sea and river ports, the 19th century railroad stations, and the 20th century bus depots and older airports. All of these centers were necessarily influenced by transportation economics. Because of dictated development and other factors, few older transportation centers were designed with the inherent flexibility to respond to changing conditions and have, in effect, necessarily resulted in an undesirable environment.

Important goals of a balanced transportation system are to develop an atmosphere that will make it possible for people to live and work harmoniously in a pleasant environment, to promote community goals, and to optimize use of all transport systems. Congestion in many urban centers not only is reducing efficiency but also is creating a heavy backlog of per capita investment for transport and other social overheads. Among these community costs are three of significance: land use displacements, industrial relocation, and annual tax losses.

New transportation planning, in many instances, has restored, preserved, and enhanced the adjacent community and related land uses. Much open space has also been preserved. It would be the challenge, therefore, in planning new transportation centers to enhance the adjacent areas and to provide total integration, flexibility for accepting change, and all necessary amenities desirable for attracting additional travel transfer opportunity from private to public modes.

A TYPICAL INTEGRATED SUBURBAN TRANSPORTATION CENTER

A functional plan of a hypothetical suburban transportation center is shown in Figure 2. It presents some of the relationships of space utilization and activities considered desirable and realistic. These include ready access to suburban highway and rail networks, good access to the local streets, and proper internal design to accommodate bus and private vehicular movements complementing other land uses. These include bus terminals; person distribution systems; information centers; lobbies; waiting areas; ticket sales facilities; helistops; office, retail, and other commercial developments; taxi holding areas; off-street parking; and airline limousines. Service stations or vehicle diagnostic centers are also suggested.

THREE CASE STUDIES

Preliminary plans have been developed for three potential transportation centers that will probably be developed in the near future. Figures 3, 4, 5, 6, and 7 show the

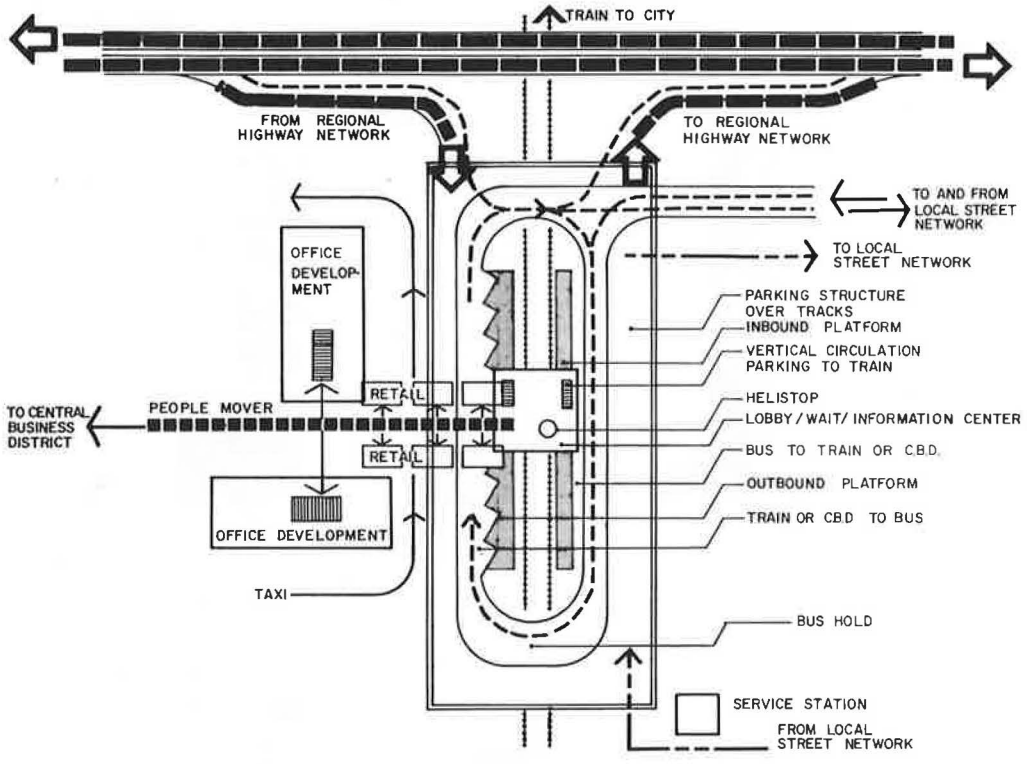

Figure 2. Functional plan of a hypothetical suburban transportation center.

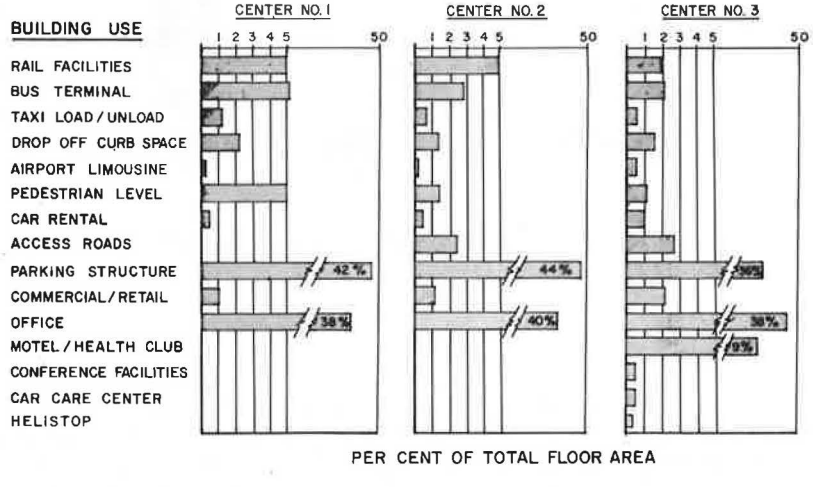

Figure 3. Comparison of floor areas of components in selected integrated transportation centers.

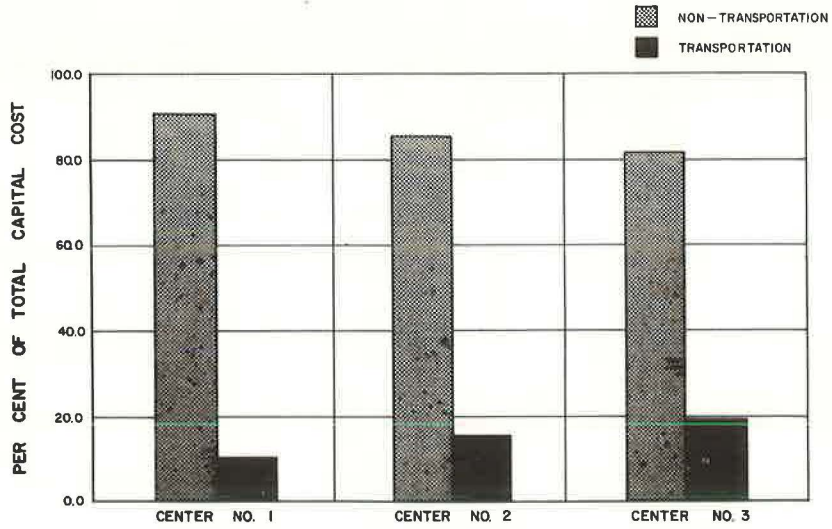

Figure 4. Estimated capital cost of components in selected integrated transportation centers.

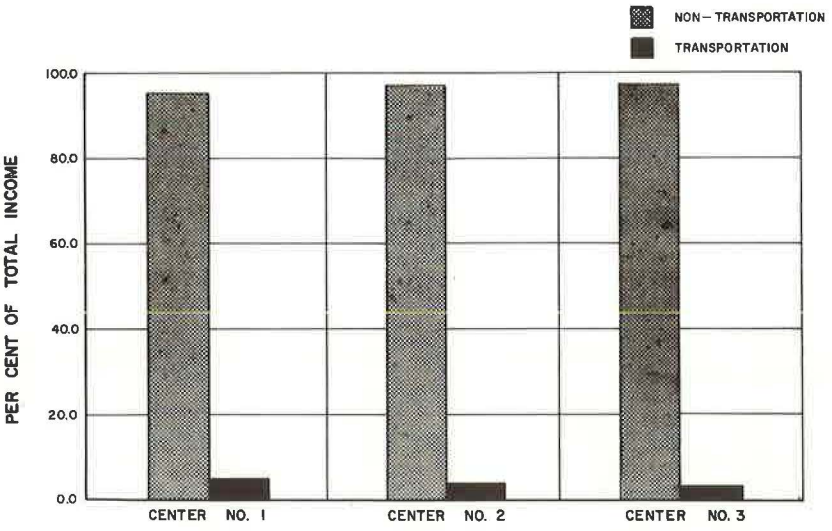

Figure 5. Estimated income of components in selected integrated transportation centers.

approximate composition and cost versus income implications of these centers.

Center 1 would be considered a minimum center serving only the very basic transfer needs and complementing land use requirements for a given area. Center 2 is a medium-sized center serving basic but also greater magnitudes of patronage and visitation. Center 3 is a higher activity facility with additional functions and a large amount of floor area devoted to complementary needs.

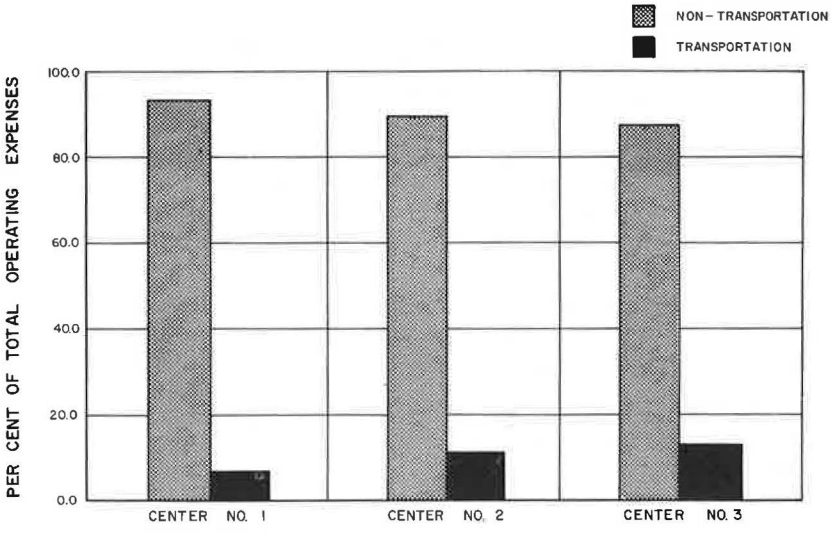

Figure 6. Estimated operating expenses of components in selected integrated transportation centers.

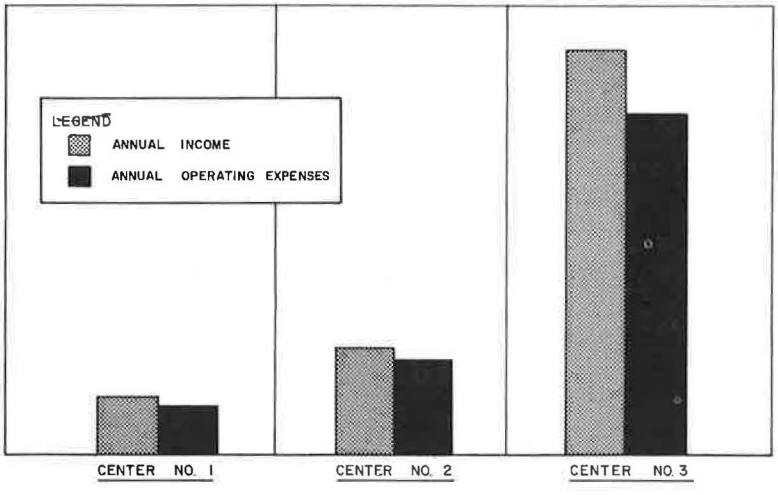

Figure 7. Comparison of annual income and operating expenses for selected integrated transportation centers.

Composition

All centers have rail facilities, bus terminals, taxi load and unload areas, curb frontage for "kiss-and-ride" travelers, off-street parking, car-rental areas, connections to local and interregional access roads, and provision for airport limousines. Pedestrian levels are included to provide the necessary separation of vehicles and people. A large proportion of the building areas include office and commercial-retail uses.

As envisaged, Center 3 would contain a motel with health club facilities and conference rooms in addition to a vehicle diagnostic area. In total, the most significant

proportion of area is devoted to parking and office space. This parking should be designed to accommodate demands of both the commuters of the suburban railroad and bus system and the office workers and visitors at the complex.

It is interesting to note that, in planning for traffic demands, two distinct peak periods are contemplated whereby the commuter would likely have peak arrival and departure times before and after, respectively, the office worker and visitors to the office buildings. This will ensure certain economics and dual use of the same road systems to serve both categories of travelers.

Capital Cost

Approximate percentage costs of nontransportation versus transportation elements of the centers are shown in Figure 4. For the largest integrated center, approximately 20 percent of the total cost is estimated to be transportation oriented. This includes off-street parking, access roads, bus terminal facilities, and pedestrian distribution systems. The nontransportation cost elements include office space, commercial and retail facilities, waiting areas, motels, and the more significant income-producing elements of the plan.

Income

The anticipated relationship between incomes from transportation and nontransportation elements of the centers is shown in Figure 5. The likely income from transportation elements amounts to only about 5 percent of the total income-producing capacity of a self-liquidating center. Sources of income include parking charges from users, rentals from ticket sales areas, charges imposed on bus companies using the facility, charges to car-rental agencies, and perhaps landing fees for the helistop.

Operating Expenses

Relationships of operating expenses for transportation and nontransportation elements of the centers are shown in Figure 6. These expenses exceed the proportionate share of income in the transportation categories. For the transportation elements, these operating expenses include cost of personnel salaries and other costs related to operation of the parking facility, maintenance of the facilities, and provision of a successful center.

For the nontransportation elements, costs of utilities, maintenance, repairs, and cleaning are included. In both instances (transportation and nontransportation), appropriate amortization costs are taken into account.

Cost-Income Summary

Figure 7 shows relative estimates of annual income and operating expenses for the three study centers. In all cases care has been taken to develop a transportation center concept whereby economic stability can be maintained. A tax contribution to the local governments has been included for only the nontransportation uses in these calculations.

TABLE 3

COMPARISON OF PRIVATE AND PUBLIC FINANCING CONCEPTS

Item	Public	Private
Depreciation allowance	None	Straight line or accelerated
Source of funds	Tax-free bonds	Bank mortgage
Local taxes	Negotiable	Negotiable
Federal income tax	None	Full tax rate
Land value appreciation	None	Available as equity
Return on investment	None	Varies according to risk
Equity requirement	None	20 percent minimum

Financing Considerations

It is doubtful that a proper transportation center could be developed by either private or public groups individually. First, the legality of a public agency developing income-producing land uses on a speculative basis is to be challenged. Second, it is doubtful whether private interests would emphasize in the planning, design, and construction of a center all those transportation-related elements that should

be provided to effect all goals of a successful center. In this context, financing terms and treatment of income, depreciation, tax abatements, and other fiscal items become rather complex with resounding implications.

Table 3 gives a relative comparison of the implications of financing a center by using either public or private funds. On the one hand, a public agency can likely receive development funds at cheaper interest rates than can a private developer. On the other hand, the public agency cannot take advantage of annual depreciation of the property or appreciation of adjacent land values; nor can the agency reflect a profitable return on an investment of this type. The private developer, however, can take advantage of depreciating the property from a standpoint of tax reporting and realize appreciation of the land value on the equity involved in the investment.

Because of these facts, it appears appropriate to develop an integrated transportation center under quasi-public-private sponsorship. In this way certain advantages can be achieved to offset the disadvantages incurred if the center were developed singly by either the private or the public sector.

CONCLUSIONS

It can be concluded that a real potential exists for development of fully integrated transportation centers. These centers should be located in close proximity to regional transportation facilities and near areas of major trip generation to complement adjacent land uses. In large metropolitan areas, it is conceivable to plan for a system of regional transportation centers in outlying communities.

An integrated center can be complex and costly to build from a design standpoint. To ensure economic stability, nontransportation functions should be provided to offset likely deficits from operation of the transportation elements. Sponsorship should, therefore, be by both the private and the public sectors.

REFERENCES

1. A Look at Downtown Cleveland Traffic, Transportation and Parking Problems. Wilbur Smith and Associates, prepared for the Downtown Cleveland Council, Dec. 1964.
2. Automobile Facts and Figures. Automobile Manufacturers Association, 1970.
3. Buffalo Transportation Center, Site Selection. Bertram D. Tallamy Associates, prepared for the Niagara Frontier Transportation Authority, Oct. 1969.
4. Chicago Area Transportation Study, Final Report. Survey Findings, Vol. 1, Dec. 1959.
5. Chicago Area Transportation Study, Final Report. Data Projections, Vol. 2, July 1960.
6. Chicago Area Transportation Study, Final Report. Transportation Plan, Vol. 3, April 1962.
7. Complementary Commuter Service Needs, Penn Central Railroad, New Haven Division. Wilbur Smith and Associates, prepared for the Connecticut Research Commission, March 1970.
8. Curtin, J. F. Transit Trip Estimation—San Francisco Bay Area. Jour. Urban Planning and Development Div., Proc. ASCE, Vol. 93, No. UP4, Dec. 1967, pp. 215-230.
9. Evaluation of Bus Transit Demand in Middle Sized Urban Areas. Wilbur Smith and Associates, prepared for Federal Highway Administration, Aug. 1966.
10. Future Highways and Urban Growth. Wilbur Smith and Associates, prepared for Automobile Manufacturers Association, Feb. 1961.
11. Harris, R. W. Proposed Transportation and Visitor Center. Transportation Engineering Jour., Proc. ASCE, Vol. 96, No. TW3, Aug. 1970, pp. 301-317.
12. Heenan, G. W. Realty Values and Rapid Transit. Paper presented at 88th Annual Meeting of American Transit Association, Montreal, Oct. 1969.
13. New Haven Railroad Station and Line Improvements, Preliminary Plans and Cost Estimates. Tri-State Transportation Commission, New York, Sept. 1966.

14. Park 'n Ride Rail Service, New Brunswick, N.J. Tri-State Transportation Commission, New York, May 1967.
15. Rapid Transit to the San Francisco International Airport. San Francisco Airport Architects and Wilbur Smith and Associates, Oct. 1969.
16. San Jose—Santa Clara County Bus Study. Wilbur Smith and Associates, June 1969.
17. Technical Report on Transportation and Parking, Market Street East, General Neighborhood Renewal Plan, Philadelphia, Pennsylvania. Wilbur Smith and Associates, Sept. 1966.
18. The Potential for Bus Rapid Transit. Wilbur Smith and Associates, prepared for the Automobile Manufacturers Association, Feb. 1970.
19. Bus Service Collapses in Some Small Cities as Passengers Desert. Wall Street Journal, Aug. 1970.
20. Transportation and Parking for Tomorrow's Cities. Wilbur Smith and Associates, prepared for the Automobile Manufacturers Association, July 1966.
21. Smith, W. S. Urban Planning Guide, Transportation Planning. Urban Planning and Development Div., ASCE, 1969, pp. 195-251.
22. Whitlock, E. M., and Wolf, P. M. Environmental Effects on Siting Transportation Terminals. Report to Governor's Conference on New York State Transportation, March 1969.
23. Wynn, F. H., and Levinson, H. S. Some Considerations in Appraising Bus Transit Potentials. Highway Research Record 197, 1967, pp. 1-24.