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16. Abstract

This document summarizes and cross-references over 200 publications dealing with land use and transportation impacts of highway and/or transit improvements. An alphabetical listing of citations along with an annotated bibliography is provided. Cross-referencing of the citations allows the reader to identify the publications with one or more of the following subject areas: 1) BART Rail System; 2) Economic Impact Studies; 3) Highway Impact Studies; 4) Land Use and Development; 5) MARTA Rail System; 6) Methodologies and Models; 7) Mode Change Facilities; 8) Rail Transit System other than BART, MARTA, or Washington METRO: 9) Ridesharing Programs: 10) Transitways, HOV Lanes and Priority Treatments; 11) Transportation (Travel) Impact Studies; 12) Turnkey Development: 13) Value Capture; and/or, 14) Washington METRO.

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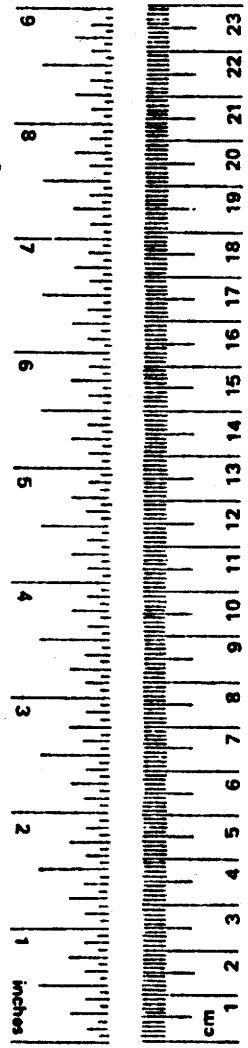
METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

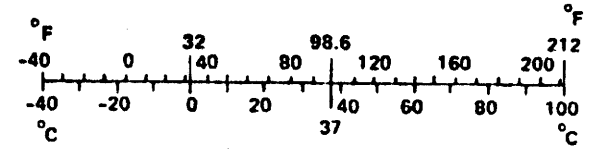
Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C



*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



LAND USE AND INNOVATIVE FUNDING IMPACTS IN A PERMANENT BUSWAY/PARK-AND-RIDE TRANSIT SYSTEM: AN ANNOTATED BIBLIOGRAPHY

by

Richard L. Peterson
Study Supervisor

and

Robert W. Stokes
Assistant Research Engineer

Technical Report 1086-1

Study Number 2-10-85-1086

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December 1985

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ABSTRACT

This document summarizes and cross-references over 200 publications dealing with land use and transportation impacts of highway and/or transit improvements. An alphabetical listing of citations along with an annotated bibliography is provided. Cross-referencing of the citations allows the reader to identify the publications with one or more of the following subject areas: 1) BART Rail System; 2) Economic Impact Studies; 3) Highway Impact Studies; 4) Land Use and Development; 5) MARTA Rail System; 6) Methodologies and Models; 7) Mode Change Facilities; 8) Rail Transit System other than BART, MARTA, or Washington METRO; 9) Ridesharing Programs; 10) Transitways, HOV Lanes and Priority Treatments; 11) Transportation (Travel) Impact Studies; 12) Turnkey Development; 13) Value Capture; and/or, 14) Washington METRO.

Key Words: Land Use, Value Capture, Transportation Impacts, Park-and-Ride, Transitways, Busways, Express Bus, Mode Change, Stations, Priority Treatment, High-Occupancy-Vehicle, HOV Lanes, Development, Retail Sales, Mode Split, Travel Demand, Transportation Planning.

IMPLEMENTATION STATEMENT

This project is oriented toward assisting the State Department of Highways and Public Transportation (SDHPT) in the planning and impact evaluation of high-occupancy vehicle (HOV) lanes or transitways. The study concentrates on the freeway corridors in Houston, Texas where priority facilities for HOV's are being constructed. A survey of relevant literature and similar impact studies provides the primary data base for this report. The results of this research, when completed, should assist the Department in evaluating potential land use and transportation impacts resulting from implementation of transitways and/or park-and-ride facilities.

This research may be applied nationwide by local, state and federal officials responsible for, or concerned with, busway/Park-and-Ride system development. Evaluation of land use impacts (if any) associated with permanent transit facility construction will provide valuable guidance to transportation planners and policy makers in assessing alternative improvements. The innovative, turnkey Park-and-Ride concept is being investigated during the first year of the study; this concept may find nationwide acceptance and application in the provision of new mode change facilities.

The study findings will be of particular interest to the State Department of Highways and Public Transportation, the Urban Mass Transportation Administration, the Federal Highway Administration, other State Departments of Transportation, local transit agencies, and various professional societies or organizations (i.e., ITE, AASHTO, TRB, ASCE, APA).

DISCLAIMER

The contents of this report reflect the views of the authors who are responsible for the opinions, findings and conclusions presented herein. The contents do not necessarily reflect the official views or policies of the Urban Mass Transportation Administration, U.S. Department of Transportation or of the Texas State Department of Highways and Public Transportation. This report does not constitute a standard, specification or regulation.

TABLE OF CONTENTS

INTRODUCTION

This first project report documents the results of an intensive literature search and provides annotations of relevant impact studies. These studies will provide the framework for designing the detailed work program to guide research activities over the five-year study period.

The overall study objectives are presented in the following section of this report. Three subsequent sections provide a summary and cross-referencing of over 200 identified publications. The section entitled "Listing of Citations and Cross-Reference Numbers" presents an alphabetical guide to the publications. The "Cross-Reference" section categorizes the citations by subject areas which include the following 14 topics:

- BART (San Francisco);
- Economic Impact Investigations/Studies;
- Highway Impact Investigations/Studies;
- Land Use and Development;
- MARTA (Atlanta);
- Methodologies and Models;
- Mode Change Facilties/Stations;
- Rail Transit Systems (Other);
- Ridesharing Programs;
- Transitways, HOV Lanes and Priority Treatments;
- Transportation and Travel Impact Investigations/Studies;
- Turnkey Development;
- Value Capture; and
- Washington METRO.

Lastly, annotated bibliographies for each of the referenced citations are provided. Any given publication may deal with one or more of the above topic areas. For this reason, a reference number frequently appears under several different subject areas.

STUDY OBJECTIVES AND PROCEDURE

This study has two primary objectives:

1. To measure, analyze, and evaluate the transportation and land use impacts resulting from the construction of permanent busways (transitways) and Park-and-Ride facilities in the Houston area; and,

2. To evaluate the turnkey concept and to determine its nationwide potential for Park-and-Ride facility development.

The evaluation of land use and transportation impacts will require before and after data to be collected during a five year study period. For the first year of the study, six secondary, supportive objectives were identified:

- To prepare a detailed work program compatible with other prior or ongoing impact evaluation studies;

- To conduct, based upon available data, case studies of transitway facilities in cities other than Houston for comparison of design and operational characteristics;

- To examine land use impacts of the Contraflow Lane in Houston's north (I-45) freeway corridor;

- To develop a "before" or pre-busway land use data base in Houston's north (I-45 North), southeast (I-45 South) and west (I-10) freeway corridors;

- To project anticipated land use impacts, in the three Houston freeway corridors, which are likely to occur from implementing permanent busways and Park-and-Ride facilities; and,

- To document the first year's study data and findings in one or more reports.

Concurrent with the land use study, during the first year, a study of the financing mechanism which has allowed Metro to construct inexpensively and quickly the extensive system of Park-and-Ride lots is being performed. This part of the research will document the key ingredients which make the Metro turnkey Park-and-Ride development program successful, to identify problems and opportunities associated with this approach, determine the potential cost/benefits of using the turnkey development approach on a widespread

basis, and to test the legal compatibility of the turnkey concept with state and federal procurement requirements. All of the turnkey research will be performed and documented during the first year of this evaluation.

This report documents the results of an intensive literature search and provides the basis for designing the detailed work program. Relevant work and studies, summarized herein, will enable the research team to pattern data collection/analysis efforts in a fashion similar to recent rail impact evaluation studies. The detailed work program will be prepared and submitted for approval as a separate report in the project report series.

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CROSS-REFERENCES FOR CITATIONS BY PRINCIPLE SUBJECT AREA

Subject Area/Reference Number:

BART (San Francisco)

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ANNOTATED BIBLIOGRAPHY

A-1. Aarts, Jan Alexander and Hamm, J., "The Effect of Ridesharing Programs on Suburban Employment Center Parking Demand," Paper for the 63rd Annual TRB Meeting, Transportation Research Board, Washington, DC, January 1984.

The Seattle/King County Commuter Pool is a regional transportation agency involved in the promotion and organization of commuter ridesharing options in the Seattle metropolitan area. A significant portion of Commuter Pool's activity involves interaction with employers, local government officials, and commercial real estate developers in an effort to encourage these groups to provide the region's commuters with incentives to rideshare.

There are presently several notable examples across the country where efforts by large employers to encourage ridesharing have been successful. There is, however, no general body of evidence that can be used by employers, government officials, and developers to predict the percentage reductions in both long-term parking demand and employee auto trips that can be achieved at a specific employment site as a result of establishing an organized ridesharing program. In order to gather information about the effects of a ridesharing program, Commuter Pool initiated a parking utilization study in the winter of 1983 involving fourteen office sites in suburban King County. Suburban sites were selected because they tend to minimize the number of extraneous variables that can complicate a parking utilization analysis. The fourteen sites selected were similar in terms of: (1) surrounding land use, (2) employee density, (3) employee activity, (4) site configuration, and (5) level of available transit service. The only notable difference between the sites was that seven of the fourteen operated organized ridesharing programs for their site employees. Average parking utilization rates were then compared betweet these two groups to determine if a measurable difference in parking demand could be detected that was due solely to the presence of the organized ridesharing program.

This paper discusses the study's objectives, research methodology, and basic findings and then analyzes some key factors that emerged in association with the ridesharing programs and the different levels of parking demand. The objective of this study was to determine what effect organized ridesharing programs have on the long-term employee parking demand experienced at suburban office sites in King County. Specifically, this inquiry was to test the assertion that transit/ridesharing incentive programs can produce a reduction in parking demand at a suburban office complex. Accurate information of this type is becoming increasingly important as local jurisdictions look for ways to reduce traffic congestion and as developers seek to reduce the amount of land devoted to parking, state the authors.

A-2. Alderson, Stephen R. and Stephanedes, Y., "Developing Compatible Land Uses - Transportation Relationships in a Changing Urban Economic Structure," Paper presented at the 1984 ASCE Annual Convention, Metropolitan Council of the Twin Cities Area, St. Paul, Minnesota, September 1984.

Maintaining a high freeway service level is essential in achieving reasonable development of land within urban corridors, state the authors. Transit can similarly play an important role in reuse and redevelopment of land in central city areas. Recognizing the economic liability of highway congestion, the Twin Cities Region of Minneapolis and St. Paul, places primary attention on land use-transportation relationships when evaluating transportation needs and designing land use and transportation plans in areas undergoing changing economic use. Such areas include, for example, high growth corridors, where traffic increases threaten the freeway service levels that provide accessibility needed to support development.

Three different approaches have been identified to maintain or improve transportation capacity and service levels desired to support development and are the subject of this paper: 1) Land use policies to reduce auto trips; 2) Highway design to encourage ridesharing; and, 3) Rapid transit alternatives. Local controls and inducements through zoning and parking regulations are expected to encourage ridesharing and reduce the number of automobile trips attracted to a major development site provided by a former stadium. In a second case, a new interstate route is to be built with high occupancy vehicle lanes for exclusive use by buses, carpools and vanpools. Finally, in an older urban corridor linking the regional metropolitan centers of Minneapolis and St. Paul, rapid transit alternatives are under study to help meet projected highway capacity deficiencies. A significant improvement in transit service levels is expected to increase land redevelopment potential. Each of these approaches are consistent with regional planning policy. The regional policies encourage intensification of development and emphasize transportation improvements for "people movement" instead of "vehicle movement" in developed corridors.

A-3. Appleyard, Donald, BART-II: Pre-BART Studies of Environment, Land Use, Retail Sales - Control Strategies (Final Report), Contract No. DOT-OS-90023, U.S. Department of Transportation, Washington, DC, June 1973, (NTIS No. PB-236 729/OSL).

The 78 page report documents the need for using controls in a study such as the residential impact study, and discusses the special problems encountered with regard to controls. It outlines the general research design and the two complementary branches of that design--the system-wide random sample approach and the selected site approach; it describes in detail the control strategy adopted for each branch. Also included is a review of some research design problems inherent in impact studies in general.

A-4. Arndt, Jeffrey C., "Turnkey Park-and-Ride Development", Transportation Research Record 877, Transportation Research Board, Washington, DC, 1982, pp. 103-110.

The Metropolitan Transit Authority (MTA) of Harris County, Texas, was approved in the summer of 1978. MTA faced enormous challenges in taking over the City of Houston transit system, HouTran, particularly because the new service area was more than twice the size of the HouTran area. The park-and-ride program provided a mechanism for quickly supplying the sprawling unserved outlying areas with transit service. Unfortunately, problems at previously leased park-and-ride lots mandated permanent construction of new facilities. The need to quickly replace existing leased lots while expanding the park-and-ride program into new markets precipitated the turnkey development process.

State law in Texas permits MTA to purchase improved real estate through a proposal and negotiation process. Therefore, the turnkey process basically involved soliciting proposals for improved real estate and entering into earnest money contracts for the selected alternatives. On completion of construction, MTA bought a finished lot capable of immediate occupancy and operation. The turnkey process saved MTA time, money, and administrative headaches. These projects were funded totally by local funds. The benefits that evolved from the program warrant consideration of modifications to Urban Mass Transportation Administration capital grant procedures so that federal funding can also be procured for turnkey lots.

A-5. Atherton, Terry J., Scheuernstuhl, G.J. and Hawkins, D., "Transportation - Related Impacts of Compressed Workweek: The Denver Experiment", Transportation Research Record 845, Transportation Research Board, Washington, DC, 1982, pp. 22-30.

This paper summarized results of an evaluation of the federal compressed workweek experiment in the Denver area. In this experiment, more than 7000 federal employees changed from standard work schedules to either a four-day workweek or nine workdays in a two-week period. Emphasis is placed on transportation impacts related to air quality and energy issues, with particular attention given to quantifying the more-indirect impacts of compressed work schedules on overall weekly household travel patterns.

The analysis approach developed to evaluate these issues essentially involves the measurement of a number of travel-related impacts prior to implementation of the compressed workweek and again one year later. Also involved is the use of experimental and control groups to isolate those impacts attributable to the compressed workweek from other impacts from factors exogenous to the experiment, such as changes in the price and availability of gasoline.

The findings indicate that compressed work schedules lead to a reduction in weekly household vehicular travel. Further, reductions are observed not only for work travel but for nonwork travel as well. Results also suggest that the compressed workweek can be compatible with other regional transportation actions such as ridesharing and transit. Although not demonstrated conclusively in the Denver experiment, the compressed workweek also appears to have the potential for improving traffic flow conditions by reducing peak-hour traffic volumes.

A-6. Atherton, Terry J. and Eder, E.S., "Impacts of CBD Fare-Free Transit on Retail Sales", Transportation Research Record 861, Transportation Research Board, Washington, DC, 1982, pp. 16-23.

Results of an analysis of changes in central business district (CBD) retail sales associated with the implementation of fare-free transit service in downtown Albany, New York, are presented. The analysis reported here was performed in conjunction with a broader evaluation effort under the Urban Mass Transportation Administration's Service and Methods Demonstration Program. In addition to examining changes in aggregate CBD retail sales, changes in sales by type of retail establishment and location relative to major bus lines were also considered.

Results are based on a time-series analysis of retail sales tax receipts provided by the New York State Department of Taxation and Finance for a panel of 115 CBD retail establishments. In addition, total retail sales tax receipts for Albany County were used as a control for the CBD panel. The analysis results suggest that CBD fare-free service has had a positive impact on sales among downtown merchants, primarily during first quarters (December 1 through February 28), which correspond to holiday shopping seasons, and among miscellaneous sales establishments (i.e., specialty and gift shops). Also, retail establishments located in close proximity to major bus routes appear to have benefitted most from the implementation of fare-free service.

B-1. Babcock, W.F., An Analysis of the Impact of Freeways on Urban Land Developments in North Carolina (Including Guidelines for Highway Planning and Design) - Final Report, Report No. ERSD-110-71-4, Federal Highway Administration, Washington, DC, June 1974, (NTIS No. PB-252 986/5ST).

An analysis is made of the impact of freeways upon land development on the entire freeway system in North Carolina with particular emphasis on the five major urban areas of the state. A very detailed analysis is made of Raleigh. Traffic generated by these land developments are analyzed. A Manual of Guidelines is developed setting forth the steps that should be undertaken by a transporation planner in the development of preliminary planning for a proposed facility that might have an effect upon an urban area. Suggestions are made concerning desirable procedures for determining the environmental impact of the proposed facility.

The 263 page manual discusses the inter-relation between land development and transportation planning. The manual and recommendations are applicable to automotively oriented developing cities in the 5,000 to 500,000 population size.

B-2. Baerwald, Thomas J., "Land Use Change in Suburban Clusters and Corridors", Transportation Research Record 861, Transportation Research Board, Washington, DC, 1982, pp. 7-12.

Diversified land use concentrations comparable with downtown in their range of functions developed in American suburbs in the last few decades. These concentrations take two forms--clusters, which usually focus on a regional shopping center, and corridors, which develop along freeways. Examples of their development are presented in case studies of the Southdale Cluster and the I-494 Corridor south of Minneapolis. Four general factors, according to the author, affect cluster and corridor development: (1) variations in the locational tendencies of different land uses, which lead comparison goods stores and higher-value residences to locate in clusters, while automobile dealers, industrial plants, and warehouses are more likely to be in corridors; (2) characteristics of the transportation system, including metropolitan freeway configuration, local characteristics within a concentration, and proximity and access to other modes; (3) historical factors and the timing of development; and, (4) other factors, including social and demographic patterns, local governmental impacts, and entrepreneurial prerogative. Clusters and corridors developed in response to heavy reliance on automobiles and trucks. Baerwald states that these modes will remain preeminent in the foreseeable future.

B-3. Bain, Henry and Escudero, E., Land Use and Urban Development Project Research Plan (Planning Document - Final), Report No. PD-17-5-75, Contract No. DOT-OS-30176, U.S. Department of Transportation, Washington, DC, September 1975, (NTIS No. PB-247 767/7ST).

The 63 page report defines the scope of the Land Use and Urban Development Project, identifies specific research issues, and outlines methods for performing the work. A theoretical framework encompassing

the various anticipated land use impacts outlines the impact process and defines the basic concepts used in formulating the research approach. The Work Elements describing the specific work to be done are closely tied to the research issues identified in the theoretical framework. Details of data collection and analysis are contained in the Work Elements. The Research Plan outlines how the work will be performed by proposing a preliminary schedule, staffing requirements and estimates of level of effort.

B-4. Bain, Henry and Lyons, F., BART Impact Program; Public Policy Project: Research Plan (Planning Document - Final), Report No. PD-22-8-76, Contract No. DOT-OS-30176, U.S. Department of Transportation, Washington, DC, April 1976, (NTIS No. PB-251 697/9ST).

The 49 page report defines the scope of the Public Policy Project, identifies specific research issues, and outlines methods for performing the work. A theoretical framework encompassing the various anticipated public policy impacts outlines the impact process and defines the basic concepts used in formulating the research approach. The Work Elements describing the specific work to be done are closely tied to the research issues identified in the theoretical framework. Details of data collection and analysis are contained in the Work Elements. The Research Plan outlines how the work will be performed by proposing a preliminary schedule, staffing requirements and estimates of level of effort.

B-5. Baker, Carole W., "The Uneven Impact of Washington's Metro," Planning, Vol. 50, No. 6, American Planning Association, Chicago, Illinois, June 1984, pp. 11-14.

Washington's Metrorail has been heralded as a triumph of subway planning and design. Metro proponents note that the system has had an impressive impact on development, states Baker. A recent study by the Metropolitan Washington Council of Governments found that more than half of the dollar value and almost half of the square footage of new, nonresidential construction in the Washington metropolitan area during the last four years has been concentrated within seven-tenths of a mile (a 15-minute walk) from a Metro station.

The station areas attracted several types of high-density development between 1979 and 1982 (the period COG studied): 45 percent of the metro area's mixed-use projects, 40 percent of its office buildings, 54 percent of the new hotels, and 42 percent of the office buildings constructed for state and local governments. Further, the COG estimates that, of the $8.5 billion in construction starts predicted for the region during the next 20 years, 64 percent, or $5.4 billion, will be near Metro stations.

Although the subway system is attracting development to stations and reshaping Washington's landscape, the impact has not been uniform

contends Baker. The COG's data show that commercial development has tended to concentrate near stations in Washington's downtown core and in the older suburbs. There was much less development in the newer suburbs--the areas that are gaining residents rapidly while older areas grow slowly or lose population. In the District of Columbia, three fourths of all commercial projects constructed during the period were in Metro station areas. Those projects accounted for 88 percent of all nonresidential square footage built in the District. In the older suburbs of Arlington County, Virginia, 58 percent of all nonresidential projects were in station areas--over 90 percent of the square footage constructed in the county. Baker indicates that even if residential development increases within station areas (which is uncertain), patterns of dispersed suburban development will likely continue. She indicates, because of the fixed rail system and its inflexibility, an ever widening circle of urban sprawl and traffic jams may be the paradoxical result of Washington's Metro.

B-6. Barrie, D.S. and Mulch, G.L., "The Professional CM Team Discovers Value Engineering", ASCE Journal of the Construction Division, Vol. 103, No. CO3, American Society of Civil Engineers, New York, New York, September 1977, pp. 423-435.

This 13 page paper reviews and summarizes the state-of-the-art of value analysis and value engineering methods developed and utilized by practitioners and public works agencies. While significant savings have been achieved in the public sector, the value engineering concept has less wide spread acceptance in the private domain.

The 3-party professional Construction Management (CM) concept has facilitated development of a simplified program based upon the elimination of adversary relationships along with utilization of the original designer to analyze technical acceptability of the proposed savings. The approach has produced significant savings on a number of projects and promises increased utilization on both "design/construct" projects and "turnkey" projects.

B-7. BART Impact Program Data Catalog (Planning Document), Prepared by Metropolitan Transportation Commission, Berkeley, California, Contract No. DOT-OS-30176, U.S. Department of Transportation, Washington, DC, December 1976, (NTIS No. PB-264 613/1ST).

The 149 page document is a description of all of the data sets that have been collected or used by the various parts of the BART Impact Program. It is divided into sections according to study areas or projects within the overall program. These areas and all of the data sets within an area contain subject keywords which appear in the index, in addition to identification keywords.

This catalog is intended for use by persons who wish to access the data itself. It contains information about the physical form of the data and its physical location, plus an abstract of each data set which may be quite lengthy. (Portions of the reproduced NTIS document are not fully legible.)

B-8. Barton, Robert M., "Revitalization of Downtown Areas Through Railroad Track Relocation and Consolidation", Paper for the 1984 ASCE Annual Convention, DeLeuw, Cather and Company, San Francisco, California, October 1984.

Maintaining the economic viability of downtown business districts is a major concern of many cities, states Barton in his paper. The flight of downtown retail stores and businesses to outlying shopping centers and satellite office parks afflicts many municipalities. Very frequently the causes, at least partially, lie in: a) the lack of sizable tracts of property in the downtown area to permit businesses to expand or to provide parking; or, b) the blighting effects of railroad activities. The availability of railroad-owned land which can be redeveloped to more beneficial uses may present an opportunity to open up new downtown retail stores, business complexes, or recreational areas, to arrest the decay or indeed to revitalize the central city.

Several voluminous government reports and a series of summary bulletins published by the United State Conference of Mayors, Railroad Land Revitailization Program, present case histories of several track consolidation or relocation projects. Spectacular examples of downtown redevelopment made possible by conversion of land occupied by obsolete railroad facilities into more beneficial uses include Pittsburgh's Golden Triangle, several mega-million dollar developments in Chicago, and the World's Fair sites in Knoxville, Tennessee, and New Orleans.

This paper focuses on four selected railroad track consolidation and or relocation projects, all located on major transcontinental rail corridors in the Western States. The objectives of Barton were to outline the adverse impacts of rail operations on the central business districts in the "before" condition, to describe basic features of each project, and to offer qualitative judgements regarding impacts following completion of track consolidation or track relocations---after a few months, after 10 years, and in one case, after 35. The four communities presented are: 1) Livermore, California; 2) Elko, Nevada: 3) Spokane, Washington; and, 4) El Paso, Texas.

B-9. Bay Area Rapid Transit: (BART) in the San Francisco Bay Area. The Final Report of the BART Impact Program, Contract No. DOT-OS-30176, U.S. Department of Transportation, Washington, DC, June 1979, (NTIS No. PB-81-107674).

This is the final report of the BART Impact Program. The program investigated not only the impacts of BART, but also why these have occurred, how the complementary actions might assure greater benefits from the BART system, and how the lessons learned from the BART experience might be useful to other areas. In addition, the distribution of the impacts among Bay Area residents is described. The influence of BART on the Bay Area's transportation system is probed, and the influence on travel behavior, the environment, economics and finance, institutions and life styles, land use and urban development, and public policy are assessed.

The report concluded that early planning was important in developing a rail transit system. Such planning should include close coordination of land use and transit planning, community support zoning of station area sites, and careful design to minimize adverse environmental impact. BART did not have a lasting impact on property prices and rents, suggesting that a policy designed to tax increases in property values near a transit station is unlikely to yield substantial revenues. In addition, problems of delays and inflationary costs demonstrated a need for flexible funding to provide for unforeseen contingencies for rail transit systems. Findings showed that a rail transit system's effects were greatest where other supportative factors are present, that major impacts occurred within the primary service area, and that goals for a new rail transit system should be based on choices between alternative sets of costs and benefits. The methods used to assess BART's impact are documented, and a discussion of factors which have affected the program's findings are presented. Tabular data are given in the 244 page document. Appendices contain a conceptual basis of the program's work. An annotated bibiliography of 75 citations is attached.

B-10. Bay, Paul N., "Working With the Private Sector", Paper Presented at APTA Western Conference in Sacramento, California, American Public Transit Association, Washington, DC, April 14, 1981.

The paper examines the initiatives taken by Tri-Met (Portland) to work with the business community to provide transit service in an cost-effective manner. Bay presents some statistics on retail activity and an "accessibility analysis" of both existing and proposed transit service availability. The accessibility investigation considered 10 geographic activity centers during peak and off-peak periods in terms of a travel time maximum (45 minutes) and number of persons within 1/4 mile of the transit route. For each activity center, the following three categories were analyzed: 1) Total employment within 45 minutes; 2) Total retail employment within 45 minutes; and, 3) Population within 45 minutes.

B-11. Berechman, Joseph and Paaswell, Robert E., "Rail Rapid Transit Investment and CBD Revitalization: Methodology and Results", Urban Studies, No. 20, Urban Transportation Center, University of Illinois, Chicago, Illinois, 1983, pp. 471-486.

A $450 million light rapid rail transit (LRRT) system is currently under construction in Buffalo, New York. This project represents a large public investment for a transportation system for which user benefits are not the sole or even a major consideration. Anticipated increases in service employment, retail activity and land development, mainly in the declining CBD area, are viewed as the major benefits. This paper describes the methodological framework used for the analysis of these impacts. Based upon the empirical results of the methodology, the paper then evaluates the overall potential of the project to promote CBD revitalization.

B-12. Bergsman, Joel, et al., Development of Methodology for the Assessment of BART's Impacts Upon Economics and Finance Research Plan (Planning Document), Report No. PD-22-7-76, Contract No. DOT-OS-30176, U.S. Department of Transportation, Washington, DC, March 1975, (NTIS No. PB-250 719/2ST).

This is a 45 page research plan for the Economics and Finance Project, one of the six major components of the BART Impact Program. The Economics and Fianance Project will determine the impacts of the construction of BART, the transportation service it provides, and the bond issues and taxes that finance it, on the regional economy and on specific economic sectors. It will also assess impacts on employment, productivity, business activity, the cost of public borrowing, public willingness to incur debt for other purposes, and the distribution of tax burdens among socioeconomic sectors of the population.

In the Research Plan, one or more work elements are defined for each of the enumerated factors. The discussion of each element includes a description of a model of the determinants of the impact, expectations as to measurability of the impacts, a consideration of alternative study methodologies, and a recommendation of a preferred methodology.

B-13. Bernard, M.J. III, Applications of the New Alternative Futures Planning Concept, (Paper presented at the 57th Transportation Research Board Meeting on January 16, 1978), Contract No. W-31-109-ENG-38, U.S. Department of Energy, Washington, DC, 1978.

Instead of using a point estimate of the future where all parameters have unique values, the method of alternative futures planning suggests that plans be developed based on several plausible futures. This 23 page paper discusses the concept, mentions some national level applications, and describes three varied local and regional applications.

The first application description is of the long-range transportation system plan being done in Northeastern Illinois. Three futures for the region instead of one are being studied. These multiparameter futures are systematically defined.

The second description is of a rail-network optimization study. Here future capital budgets and mode choices are being combined to define nine alternative futures. The last application described is an evaluation of the proposed discontinuation of service on a rapid-transit branch line. The branch is located in an area of urban decline which does, however, have the potential for massive redevelopment. The discontinuation was evaluated under various population futures for the area.

After detailing these applications, the paper stresses the commonalities in the applications of the concept. The concept is not only viable but essential to decision making under an uncertain future.

B-14. Black, J. Thomas and Hoben, J.E., Urban Land Markets: Price Indices, Supply Measures, and Public Policy Effects, Report No. 0-87420-593-X, Contract No. HUD-H-5131CA, U.S. Department of Housing and Urban Development, Washington, DC, 1980, (NTIS No. PB81-136939).

The 234 page anthology addresses techniques and approaches to monitoring the conditions and understanding the dynamics of urban land surrounding the development of metropolitan land price indices and suggest practical approaches to measuring changes in land prices. These approaches include: 1) developing an urban land price index model; 2) measuring urban land prices through multiple regression analysis of actual sales; 3) creating a panel survey for constructing a metropolitan land price index; and, 4) establishing a land price index for the San Juan Metropolitan Area (Puerto Rico).

A second group of papers describe public agency systems for monitoring land supplies with development potential and discuss the issues and problems involved in designing and implementing these monitoring systems. Concluding writings address issues regarding the effects of public policies on the land market.

B-15. Box, Paul C. and Oppenlander, J.C., Manual of Traffic Engineering Studies, Fourth Edition, Institute of Transportation Engineers, Washington, DC, 1976.

This 233 page Manual, plus accompanying study forms, covers a variety of traffic and transit studies, providing a "how-to" reference for study design, data collection, data analysis and study presentation. A total of 14 Chapters and 7 Appendices make up the publication. Topics include: 1) traffic volumes (Chapter 3); 2) traffic conflicts (Chapter 5); 3) spot speeds (Chapter 6); 4) travel times and delays

(Chapter 7); 5) origin-destination surveys (Chapter 9); 6) public transportation speed and delays (Chapter 12); and, 7) before and after analysis (Appendix B).

B-16. Boyce, David E., "Notes on the Methodology of Urban Transportation Impact Analysis", Highway Research Board Special Report #111, Highway Research Board, Washington, DC, 1970.

The methodological question is: 1) how to provide for experimental control; and, 2) how to obtain replications of the experiment. The procedure of such studies is (a) to record the values of pertinent variables, such as land value, construction value, travel volumes, and speeds, for a period of time prior to the introduction of the facility; (b) to record the value of the same variables for a comparable time period following the introduction of the facility; and (c) to compare the 2 sets of values.

B-17. Boyce, David E., et al., Impact of Rapid Transit on Suburban Residential Property Values and Land Development: Analysis of the Philadelphia-Linderwold High-Speed Line, Regional Science Department, University of Pennsylvania, Office of the Secretary, U.S. Department of Transportation, Washington, DC, November 1972, (NTIS No. PB220 693/6).

Analysis of the Philadelphia-Linderwold High Speed Line indicates a modest, positive impact on suburban residential property values which is proportional to user's travel cost and time savings. Two statistical models of residential property values are estimated with data on about 20,000 residential property transactions during 1964-1971 in Camden and Gloucester Counties, New Jersey. Using an analysis of variance model, significant effects associated with inflation (time), neighborhood quality (location) and the interaction of time and location are estimated.

B-18. Briggs, Ronald, The Impact of Interstate Highway System on Non-Metropolitan Growth (Final Report), Contract No. DOT-RC-92040, U.S. Department of Transportation, Washington, DC, December 1980, (NTIS No. PB81-212987).

The objectives of the research conducted at Texas University in Dallas and reported herein were: 1) to identify the factors involved in demographic and economic change in non-metropolitan areas of the U.S. over the period 1950 to 1975; and, 2) to establish the role of the Interstate Highway System. Three major analyses were conducted: 1) net migration, and employment change was compared for counties with and without Interstates using descriptive statistics; 2) a simple model of

highway impact was developed and tested using path analysis, in order to explicate the relationship between freeways, employment change and net migration; and, 3) the importance of transportation vis-a-vis non-transportation factors in affecting development was assessed using a series of multiple regression models. Results of the research are presented in this 125 page final report.

B-19. Brosch, Gary L., et al., Non-Federal Funding for Transit Systems: State-of-the-Art Case Analyses (Final Report), Report No. UMTA-TX-06-0045, Urban Mass Transportation Administration, Washington, DC, March 1985.

Funding for transit, both new captial investments and continuing operations, is in the midst of tremendous change guided by new political and financial realities. In particular, the rapidly escalating cost of items such as construction and labor, the price tag on current and future transit projects has generated government-directed and market-driven decisions to seek alternatives to traditional federal subsidization.

In such a context, this 81 page report explores examples of projects supported through non-federal funding. These examples entail seven different funding mechanisms; they include examinations of both the successful elements of the financing methods and discussions of the obstacles encountered. They are presented in the form of case studies, the benefit of which should be as learning experiences to those planning transit projects which will utilize non-federal funding.

The case studies and funding mechanisms included in the report are:

- Denver, Colorado; Transit Mall---Special Benefit Assessment District.
- Houston, Texas; Park-and-Ride Lots---Local Turnkey Financing.
- Los Angeles, California; Rapid Rail---Local Sales Tax.
- Los Angeles, California; Wilshire/Fairfax Metro Rail Station---Value Capture: Joint Development/Benefit Assessment.
- Montgomery County, Maryland; Ride-On Transit Service---Locally Funded Transit System.
- San Francisco, California; Embarcadero Station---Tax Increment Financing.
- Washington, DC; Van Ness/VDC and Bethesda Rail Station---Joint Development.

B-20. Bucklin, Louis P., BART-II: Pre-BART Studies of Environment, Land Use, Retail Sales - BART Impact on Retail Sales (Final Report), Contract No. DOT-OS-90023, U.S. Department of Transportation, Washington, DC, June 1973, (NTIS No. PB-236 747/2SL).

The 58 page report presents a study to determine the impact of BART on consumer shopping in the Bay Area. The first part establishes baseline data on retail sales in order to make possible eventual evaluation of post-BART alterations. The second part develops a questionnaire for use in measuring BART's effect upon consumers' attitudes toward and choices of different shopping centers. Chapters include an overview of the baseline studies, baseline study of retail sales, and the attitude study.

B-21. Buffington, Jesse L., Herndon, C.W. and Weiss, M.E., Non-User Impacts of Different Highway Designs as Measured by Land Use and Land Value Changes, Report No. FHWA-TX-77-225-2, State Department of Highways and Public Transportation, Austin, Texas, March 1978.

Many studies are found in the literature pertaining to highway impacts on non-users. This 155 page report contains a review of the types of highway impacts, highway impact assessment elements, techniques available to measure land use and land value impacts, and findings of previous studies which indicate the magnitude of land use and land value changes resulting from various types of highway improvement. The land use and/or land value impact measurement techniques are of three major types: 1) land use - land value measurement models; 2) land use - traffic models; and, 3) land use - urban development models. Those of the first group have been used much more frequently than those of the other two groups.

The finding of land use and land value studies are briefly described in narrative, tabular, or graphic form, according to the following "key" characteristics of highway improvements and affected areas: 1) location of impact area; 2) type of highway improvement; 3) stage of development of impact area; and, 4) dominant land use of impact area. The bulk of highway impact research has been directed toward measuring land use and land value impacts of new limited access highways located in suburban and rural areas. The literature contains no procedure that is designed for the highway analyst to use impact data from previous studies in predicting land use and land value impacts of proposed highway improvements. Therefore, the report suggests two procedures which can be used for this purpose. Both procedures fit the prescribed criteria for selecting an impact prediction procedure. The comparability of data from previous studies is the deciding factor as to which prediction technique should be used.

B-22. Burgwald, B., Cole, W. and Wagner, C., Investigating the Relationship Between Land Use Planning, Transportation and Energy Consumption, Contract No. DTOS59-80-C-0060, U.S. Department of Transportation, Washington, DC, January 1981, (NTIS No. PB82-122185).

The objective of the study was to increase the understanding of the relationship among land use, transportation accessibility and energy consumption in an urban context. The issues addressed include: 1) How transportation accessibility and land use planning interact for increased energy conservation; 2) The role the public sector plays with regard to incorporating and integrating transportation, land use and energy conservation; and, 3) The institutional and/or technical barriers for better integration of energy, transportation and land use considerations. The 143 page study combines an extensive literature survey in the subject areas with field case studies in five urban areas: Washington, DC; Baltimore, MD; Toronto, Canada; San Francisco, CA; Miami, FL.

B-23. Burnett, Boyd, "Traveler Response to Changes in Work Locations: The HHS/DOE Employees Post-Relocation Transportation Survey", Selected Papers on Major Issues Facing Public Transit-Productivity, Volume III, American Public Transit Association, Washington, DC, 1983, pp. 89-106.

This paper describes the results of a transportation survey conducted after two federal agencies had moved their offices from the Seattle central business district (CBD) to a CBD fringe location. The objectives of the survey were to determine whether or not the travel modes of the affected employees have changed, and, if so, why.

Of those responding to the questionnaire, a significant number (almost 40%) reported changes in their home-to-work commuting modes. Many of the employees who switched modes were former bus riders who cited transit system limitations as the reason for not riding public transit after the office relocation. This was the result in spite of substantial pre-move marketing efforts to overcome specific limitations (e.g., the need to transfer buses) was explored.

Some of the findings of the study were:

- 38 percent of the survey respondents changed commuting modes.
- Employees driving alone inflated 283 percent (from 30 to 115).
- Ridesharing became more popular; over twice as many employees rode in carpools and vanpools after the move.
- The transit share of this market dropped 30 percent.
- Total Metro riders dropped 39 percent (from 375 to 230 daily patrons).

- Average weekly transit usuage for all respondents dropped from 3.9 to 2.5 days per week.

The reasons behind these mode shifts were summarized as follows:

- Employees who stopped riding the bus often stated transit system limitations as the reason.
- The need to transfer between buses was respeatedly mentioned as a major impetus to find more convenient forms of transportation.
- The average increase in home-to-work travel times was significantly higher for transit riders than for cars and vans.
- Although rarely mentioned as the dominant reason for not using transit, the greater availability snd lower cost of parking near the new work location allowed commuters the option of switching modes.

C-1. Carp, Frances M., Theory Background of BART's Impacts on Human Perception and Response, Contract No. DOT-OS-30176, U.S. Department of Transportation, Washington, DC, March 1976, (NTIS No. PB-258 368/OSL).

This 62 page paper, relating to BART impacts, provides a review of behavioral science literature relevant to human perception and response. It oultines a possible strategy for the use of behavioral science theory---a conceptual model of the impact process is suggested which includes the element of human response and its determinants. An extensive biblography is also included.

C-2. Carter, M.M., et al., Transit Corridor Analysis - A Manual Sketch Planning Technique, Report No. UMTA-MD-06-0046-79-1, Urban Mass Transportation Administration, Washington, DC, April 1979.

The development of this manual sketch planning technqiue was undertaken for the Urban Mass Transportation Administration (UMTA) as part of its Software Systems Development Program (SSDP). This 216 page handboook is a user's handbook which describes a sketch planning technique for quick first evaluations of urban transportation planning proposals--a manual technique which does not require computers. It presents the technique's computational steps in an orderly manner and minute detail. The technique, useful in the analysis of short and long range plans for urban line-haul transit systems, does not provide a single, definitive solution but can provide alternative measures of demand, performance (cost and travel times), and impact to help local decision making. The technique has three modular phases: 1) demand estimate; 2) cost analysis; and, 3) impact analysis. It is also modular within the phases, since the user is free at many points to substi-

tute their own data or analytical techniques and to substitute local estimates for the default values supplied. The handbook has been organized into four major divisions:

1. Purposes and uses of the technique;

2. General parameters, assumptions and situations in which the technique can be applied;

3. The method and computation procedures along with examples of each step applied to a sample problem; and,

4. Nomographs and blank work sheets which can be used for making the calculations.

C-3. Cervero, Robert, "Exploring the Land Use Potential of Light Rail Transit", Paper for the 63rd Annual TRB Meeting, Transportation Research Board, Washington, DC, January, 1984.

Light rail transit has gained increasing popularity in the U.S. and Canada since the late seventies and shows signs of a promising future. Its comparatively low cost, reasonable carrying capacity, and compatability with pedestrian settings make it attractive to many areas.

This paper explores the potential role that light rail transit might play in influencing urban growth and revitalizing central city areas. Land use characteristics of cities which have recently built or are planning light rail systems are examined. Specific development strategies designed in response to new or anticipated light rail investments are also reviewed.

In order to probe some of the key factors related to the urban development potential of light rail transit, twelve study sites are examined in more detail. A number of cities are effectively using new light rail projects to lever private land investments and stimulate central city growth. Light rail is being employed along with density bonuses, parking controls, and other major public improvements to encourage concentrated land growth and redevelopment.

In some areas, however, light rail can be expected to have fairly modest land use repercussions due to such countervailing factors as a stagnant local economy, the absence of a strong local commitment to station area planning, and the siting of facilities in unattractive corridors. More so than recent heavy rail projects, it is imperative that supportive local policies be put into place if light rail transit is to have significant impacts on the landscapes of North American cities, concludes Cervero.

C-4. Cervero, Robert, "Light Rail Transit and Urban Development", Journal of the American Planning Association, Volume 50, Number 2, American Planning Association, Chicago, Illinois, Spring 1984.

Recent construction of light rail transit systems in a number of North American cities raises crucial questions about their possible effects on land use and urban development. Although serving passengers and keeping construction costs down have been the primary aims of new rail investments, the possibilities for joint development and land use are numerous.

This paper explores light rail transit's potential influence on urban growth and revitalizing central city areas. Some cities are integrating light rail transit with pedestrian malls as part of downtown redevelopment. A significant number of others, however, are downplaying the development potential of light rail transit by aligning their systems principally along abandoned railroad rights-of-way and industrial belts in order to cut costs.

For most cities in the preconstruction stages of their projects, policymakers need to recognize the trade-offs involved when the lowest-cost corridor and alignment are chosen. On the whole, the land use potential of light rail is moderately high, where there are pro-development policy environments and other complementary forces.

C-5. Charles River Associates, Inc., Predicting Travel Volumes for HOV Priority Techniques: Technical Report, Report No. FHWA/RD - 82/043, Federal Highway Administration, Washington, DC, April 1982.

This 82 page report describes research undertaken to develop a simple-to-use forecasting procedure for predicting the changes in modal volumes that result from implementing various types of freeway preferential lane projects for buses and/or carpools. First, the results of a review and assessment of existing travel forecasting models are presented. Next, a survey conducted to determine the availability of before and after data from the many high occupancy vehicle (HOV) projects that have been implemented in the United States is described.

The relevant data sets that were obtained and used in the analysis are presented. Based on the data, demand and supply relationships were developed and incorporated into a set of worksheets for applying the new forecasting procedure. Tests of forecasts and an existing Pivot Point Logit Model are described and evaluated. The worksheets that were developed, and a description of their use, is presented in an accompanying User's Guide (FHWA/RD-82-042) with the same title and authored by Thomas E. Parody.

C-6. Christensen, David L., Photo Survey of Development and Activities in the Vicinity of BART Stations - Users Guide (Final Report), Report No. FR-4-17-75, Contract No. DOT-OS-30176, U.S. Department of Transportation, Washington, DC, July 1975, (NTIS No. PB-247 768/5ST).

A general description of BART Impact Program Photo Survey data and basic instructions for their use is given in this 40 page report. The Photo Survey is a record of development and activities in the vicinity of BART stations at given points in time. The record consists of three categories of data: 1) ground level photos; 2) aerial photos; and, 3) supplementary assessor's land use information. The three kinds of data are cross-indexed by map overlays. More detailed technical information concerning procedures used in establishing and maintaining the Photo Survey data are presented in a 1975 Photo Survey Technical Report by Christensen.

C-7. Christensen, Kathleen, Social Impacts of Land Development: An Initial Approach for Estimating Impacts on Neighborhood Usages and Perceptions. The Urban Institute, Washington, DC, 1976.

The impacts of proposed development on the social character of a neighborhood are assessed from a community viewpoint. Techniques for conducting social impact evaluation are presented to determine the following: 1) public recreational area usage; 2) safe play areas for children; 3) local grocery store accessibility; and, 4) resident perception of neighborhood quality. In preparing an impact assessment for shopping, the possible measurements are:

- Changes in number or percentage of households within x minutes of desired shopping facility.
- Changes in number or percentage of households using facility by type of facility and frequency of use.
- Changes in other physical conditions affecting households' current expressed satisfaction with neighborhood shopping opportunities and number of households potentially affected.

C-8. Christoffel, Thomas J., Impacts: I-66 and Growth (Summary), U.S. Department of Housing and Community Development, Washington, DC, March 1980, (NTIS No. PB81-119497).

The 47 page report summarizes the impacts on local governments; economy and transportation; land use and environment; and housing of the completion of Interstate 66 and the projected growth as a result of the outward expansion of the Washington D.C. metropolitan area. The subject area is the Lord Fairfax Planning District, located in northwestern Virginia, made up of the counties of Clarke, Frederick, Page, Shenandoah, and Warren, and the City of Winchester. The major towns are Front Royal and Luray.

The report identifies "external" and "internal" factors affecting growth and their effect on the projections presented. General recommendations, applicable to all local governments, are presented as well as identifications of special impacts and recommendations for local governments. Maps identify development potentials at four inter-

changes. Summary sheets of recent and projected growth are shown for each jurisdiction.

C-9. Chumak, Archie and Bolger, D., "The Impact of LRT on Travel Behavior in Calgary", Paper for the 63rd Annual TRB Meeting, Transportation Research Board, Washington, DC, January 1984.

In May 1981, Calgary introduced Light Rail Transit (LRT) between the downtown and southern part of the city. The City has conducted an extensive two year monitoring program of the impact of LRT on the transportation system. This paper reports the results of this study.

The methodology was comprised of a series of before and after surveys which included conventional traffic counts, speed and delay studies and an on-board survey. An important component of the study was a home interview survey.

LRT has had a significant impact on travel to the downtown. Transit modal split across the south downtown screenline has increased from the 35 - 40% range to 50 - 55% in the AM peak period. The study also examined the public's attitudes and perceptions of the transportation systems as well as the reasons for mode choice. The majority of residents were of the opinion that both transit service and overall traffic congestion have improved with the introduction of LRT. Most travellers indicated that convenience is the critical factor in selecting between the automobile and transit. A significant portion of the population, however, identified travel time as the most important factor.

C-10. Clemons, Donald and Corpus, J., BART-II: Pre-BART Studies of Environment, Land Use, Retail Sales - Appendix C, Data Documentation for the Land Use and Investment Study, Contract No. DOT-OS-90023, U.S. Department of Transportation, Washington, DC, June 1973, (NTIS No. PB-236 750/6SL).

The 113 page report contains a detailed description of the data items collected as a part of the study of pre-BART property value changes (reported in Volumes I and VI of BART II, Part III), and a study of office space in downtown San Francisco (Volume IV of BART II, Part III). Data descriptions include longitudinal real property sales (both residential and commercial), cross-sectional real property sales (residential), and the Market Street survey (commercial).

C-11. Courage, Kenneth G., et al., Report 2 - Effects of NW 7th Avenue Bus Priority Systems on Bus Travel Times and Schedule Variability, Report No. UMTA-FL-06-0006, U.S. Department of Transportation, Washington, DC, March 1977.

Bus priority techniques have been widely implemented in recent years in an effort to improve the effectiveness of public transportation. To facilitate the evaluation of bus priority operations, a new automated technique for data recording and analysis was developed and applied to a demonstration project in Miami, Florida, in which two schemes were evaluated. The first involved preemption of 35 traffic signals along an arterial route. In the second, an exclusive bus lane was added to the system, with the signal preemption features retained.

The measures of effectiveness used to evaluate the two bus priority techniques include: 1) speed; 2) delay; 3) travel time; 4) fuel consumption; and, 5) comfort measures such as speed noise, number of stops, and speed changes. It was found that both priority techniques resulted in significant improvement in all of the measures of effectiveness. The most dramatic improvement occurred in the number of unscheduled stops, which were reduced by 87%.

The relationships between the measures of effectiveness were also explored. It was observed that a strong correlation exists between several of the individual measures of effectiveness. The average speed of the bus was strongly correlated with all the other measures. Other comparisons suggest that speed noise provides the most satisfactory indication of the degree of comfort. The measurement technique presented in this 73 page report may be useful for general application.

D-1. Daganzo, Carlos F., "Equilibrium Model for Carpools on an Urban Network", Transportation Research Record 835, Transportation Research Board, Washington, DC, 1981, pp. 74-79.

Traffic equilibrium methods are presented in the paper in which the population of motorists consists of individuals who are minimizers of a linear combination of cost and travel time. The relative importance of travel time versus cost varies across the population, but fairly mild conditions for the existence and uniqueness of the equilibrium can nevertheless be identified. The paradigm is of particular interest for carpooling studies because the occupants of carpools can divide the cost among themselves but they cannot do the same with the travel time, according to Daganzo. Thus, vehicles that have different occupancy levels will have different relative values of travel time and cost.

The model is specially well suited to the analysis of how vehicles that have different occupancies compete for segments of the roads that are crowded or have tolls. It is therefore very useful to predict the impacts of special carpooling lanes, lower tolls for high-occupancy vehicles, and other transportation-system-management strategies on the distribution of traffic over an urban network.

D-2. Dial, Robert, Levinsohn, D. and Rutherford, G.S., "Intergrated Transit Network Model (INET): A New Urban Transportation Planning System Program", Transportation Research Record No. 761, Transportation Research Board, Washington, DC, 1980, pp. 33-40.

The Integrated Transit-Network Model (INET) is a new Urban Transportation Planning System (UTPS) computer program for analysis of transit systems. Its objectives are to account for the interaction of highway and transit networks, exploit existing highway network data, provide for accurate but simple and inexpensive transit-network coding, provide input for other UTPS programs, furnish useful evaluative reports, and help bridge the gap between systems and operations planning.

A small transit network is hypothesized in this paper to demonstrate INET's features and explain its assumptions, mechanics, and operation. Special subjects are route layout, cruise and stop delay time, exclusive and mixed rights-of-way, scheduling, and cost and impact estimates. There is a brief discussion of INET's use with real transit and highway data.

D-3. Donnelly, Paget, Rail Transit Impact Studies: Atlanta, Washington, San Diego, Report No. DOT-I-82-3, Urban Mass Transportation Administration, Washington, DC, March 1982.

The Urban Mass Transportation Administration (UMTA) has supported the development of several new rail transit systems. As these projects represent significant investments of both Federal and local resources, UMTA has sponsored a number of Transit Impact Studies designed to evaluate the effects of these systems. The goals of the studies are to assess the changes in travel behavior which result from such a major change in an area's transportation system and to develop information which will aid in future investment decisions.

It was deemed appropriate to determine what initial findings were obtained and to summarize them in a convenient form. For this purpose UMTA requested that the Metropolitan Washington Council of Governments (MWCOG) sponsor an informal two-day conference on the Transit Impact Studies which was held in Washington in September 1981. This report presents a summary of that two-day conference. Included are the presentations made by representatives of each study as well as some of the discussion which followed. The systems covered by the current UMTA impact studies program have been implemented in a diverse set of urban areas. Representatives of each study described their site in order to provide a background for the observations and findings.

The Washington D.C. area has a population of about 3,000,000 persons in an area of approximately 2,500 square miles. The transit system, known as METRO, will eventually extend over 101 miles of line. As of September 1981, 37 miles of line and 40 stations were in operation. The Atlanta area has a population of about 1,800,000 in an area of 2,100 square miles. The Metropolitan Atlanta Rapid Transit Authority (MARTA) system will eventually extend over 53 miles. In September 1981, 14 miles of line and 17 stations were open. The San Diego area has a population of 1,400,000 in an area of about 1,000 square miles. The light rail line, implemented by the Metropolitan Transit Development Board (MTDB), is known as the San Diego Trolley. The single line at the time of the conference was 15.9 miles in length and had 11 stations on line as well as a number of loading locations in the downtown areas.

Each of the studies were addressing a similar set of impacts plus a number of special issues of specific local interest. In general, similar methodologies were being used to obtain information about the impacts. Study representatives presented material on the impacts being studied, the approach generally used and any important characteristics which might distinguish a particular study. All studies were addressing essentially the same set of transportation system and travel behavior impacts. These include changes in transit service levels, characteristics of transit users, changes in mode choice, congestion and traffic volume impacts and various system performance and effectiveness measures. A variety of land use and economic impacts were also being addressed, including relocation, land sales activity and prices and diverse locational and planning-related issues.

With the initiation of service, changes in total transit ridership varied with the size of the line segment opened and with the extent to which new markets for transit were penetrated. Some of the 1981 findings were: 1) Rail system ridership has been drawn primarily from former bus patronage; 2) Most rail system use is for work-oriented travel; 3) Most users arrive at rail stations by bus during the morning peak; 4) Trips on rail tend to be concentrated and centrally oriented; 5) Travel changes have been characterized more by increases in transit use than by reduction of auto use or congestion; 6) User travel time and cost changes were strongly related to the specific trip origin or destination; and, 7) In general, system implementation resulted in a major increase in travel capacity.

Just as the scale of an urban rail system investment suggests significant impacts on the transportation system, so too does it suggest impacts on land use and urban development patterns. The studies in Atlanta and Washington were addressing a number of issues in this area including changes in land use planning, development shifts, station area impacts, land sales activity and relocation. Due to the relatively small extent of the San Diego system, that study was not addressing land use impacts in any great detail. Some of the early findings were: 1) Development and implementation of the rail systems had a major impact on area land use and capital facilities planning; 2) Development did, to some extent, follow the trend toward locating in station areas, as envisioned in the land use planning; 3) Station area development has occurred primarily within 1/4 mile of the station; 4) Land sales studies in Atlanta have shown significant activity in station areas; and, 5) Relocation has generally resulted in a limited impact.

As rail systems represent major public investments, the economic impacts of such a system can be significant. The process by which the system was implemented can also have major fiscal implications. At the time this conference was held, none of the studies' efforts in this area had been underway for any substantial length of time, thus no results were yet available.

D-4. Donnelly, Robert and Arguelles, J. Implications of BART's Impacts for the Transportation Disadvantaged, Report No. DOT-P-30-79-12, Urban Mass Transportation Administration, Washington, DC, April 1979.

This is the Final Report of the Implications for the Transportation Disadvantaged Project (ITD) of the BART Impact Program. The project has examined the implications of the impacts that the 71 mile Bay Area Rapid Transit System has had to date on the transportation disadvantaged. Three special population groups are the focus of analysis --- ethnic minorities, the elderly and handicapped. These groups are of special concern for transportation planning and policy because of either low-income status or mobility related impairments.

The 144 page report integrates the study of BART's impacts on the transportation disadvantaged in each of four major impact areas examined in previous interim project reports --- environmental, mobility, economic and land use. Findings are reported from the investigation of twenty-three issues related to the entire range of BART's impacts on the transportation disadvantaged. Evaluation of these findings is made in the context of the level, nature, and degree of equity in the incidence of BART's economic impacts. Based on the findings of the study, implications for the transportation disadvantaged of a regional rapid rail transit investment are presented in terms of both effectiveness and policy considerations for other areas where similar systems may be considered.

D-5. Downey, Mortimer L., "Generating Private Sector Financing for Public Transportation", Selected Papers on Major Issues Facing Public Transit-Financing, Volume I, American Public Transit Association, Washington, DC, 1983, pp. 13-27.

Downey states that financing public transportation has become a more challenging task as traditional funding sources have dried up. New approaches are necessary, including some which tap the revenue-generating capacity of the transit systems. Such financing devices are not new to transportation, but have seldom been applied to public transit. As part of the New York Metropolitan Transportation Authority's $8.5 billion capital program, several new approaches have been tested, including the sale/leaseback of equipment, vendor financing, revenue bonds, and joint facility financing. These devices, the subject of this paper, have proven successful and are contributing to MTA's revitalization efforts.

D-6. Downer, Joseph P., "Transportation Means Business", Paper for the 1982 Mass Transit Show and Conference, Atlantic Richfield Company, Los Angeles, California, April 5, 1982.

Downer's remarks, at the 1982 Conference, were made on behalf of Atlantic Richfield Company (ARCO) which had recently moved one of their headquarters to Los Angeles. He stated that 65% of ARCO's employees in downtown LA were using some form of shared ride (i.e., buses, carpools, vanpools) transportation; 78% of ARCO's Denver employees were ride-sharing at the time. Downer posed the question of the role which business plays in transportation and why business should care? In his remarks, he proceeded to highlight several public/private ventures of providing transportation services within urban areas throughout the world, including recent developments in Houston and Dallas, Texas. Downer concluded by indicating that business prides itself on being entrepreneurial and that the transportation problem has stimulated interesting examples of business behavior (both in the private and public sectors).

D-7. Dueker, Kenneth J., Pendleton, P. and Luder, P., The Portland Mall Impact Study, Report No. DOT-I-83-7, Urban Mass Transportation Administration, Washington, DC, December 1982.

The final report of the Portland Mall Impact Study is a comprehensive analysis and evaluation of a wide range of impacts related to the Portland Transit Mall. This 144 page report assesses the primary (i.e., transit and traffic) impacts and secondary (i.e., noise, air, land use and development) impacts, and documents the significant impact the Portland Mall has had on revitalizing downtown. The report concludes with an economic analysis demonstrating the Portland Mall to be a good public investment, with benefits exceeding the cost.

The purpose of this study was to provide useful information for public and private organizations at the:

1. National level - on Portland's experience with a transit mall and possible applications to their locale by other local governmental agencies, and the transportation land use interaction that can be achieved through investment in transit; and,

2. Local level - for assessing impacts on operation, maintenance and possible extension of the Transit Mall.

D-8. Dunphy, Robert T., "The Impact of Metro Rail on Trip-Making by Nearby Residents: The Van Ness Case Study", Paper for the 63rd Annual TRB Meeting, Transportation Research Board, Washington, DC, January 19, 1984.

This paper analyzes the effects of a rail extension on travel by residents of a close-in Washington community, especially for non-work travel. Several hypotheses prevalent in the literature are stated and the findings discussed in relation to them. A paired comparison is made possible by two separate interviews of the same individuals.

Significant increases were found in transit use for both work and certain categories of non-work trips. No change was found in daily trip generation rates. Interpretations for these findings are presented in the 29 page paper.

D-9. Dunphy, Robert T., Trends Before Metrorail, Metropolitan Washington Council of Governments, Washington, DC, July 1982.

Metropolitan Washington's rapid rail transit system--Metrorail--was planned during a period of high growth. Rapid transit and land use planning were seen as tools for shaping growth. This report describes baseline trends before the system opened. Documentation of pre-Metro trends in housing, employment and retail sales permit future analyses of the effects of Metrorail. Produced as part of the Metrorail Before-and-After Study conducted by the Council of Governments.

This 78 page report describes trends before the opening of the Metrorail transit system. A companion report, Metrorail Area Planning, describes some of the initial effects of the transit system on development and land use.

Population growth forecasts have dropped dramatically since the period when Metrorail was planned. Expectations of employment increases for the year 2000 have declined, but not as much as forecasts for population and households. Residential building activity has declined each year since 1977. The largest share of new housing during the 1970's was authorized in the inner suburban jurisdictions, with Fairfax County leading in the building permits. Roughly one of every five higher density dwelling units was authorized for construction in Metrorail station areas. Studies of employment growth between 1972 and 1976 show that most new jobs are being created in the suburbs. The majority of new suburban jobs are not in locations to be served by Metro. The Federal Government was the only economic sector which grew faster around Metro stations than it grew in the rest of the region.

The region has been experiencing a decline in retail sales since 1972, particularly in the Washington central business district (CBD). The CBD decline in sales is now reflected throughout the District, and in Arlington and Alexandria as well. Metrorail will serve 12 major retail centers as well as downtown Washington, all of which may have peaked in sales. It is possible that the principal retailing effect of Metrorail may be to slow the decline of such areas, or to stabilize sales at current levels. Increased office and commerical development at major centers may be the key to longer-term retail growth, states Dunphy in the report.

D-10. Dunphy, Robert T. and Griffiths, R.E., The First Four Years of Metrorail: Travel Changes, Metropolitan Washington Council of Governments, Washington, DC, September 1981.

Metropolitan Washington's rapid rail transit system--Metro-rail--opened in 1976 and has grown in phases. This 119 page report describes changes in travel behavior related to the first four operating phases of Metro. Analyzed are characteristics of rail passengers and stations, bus travel, auto travel and travel to the central employment area. Effects of rapid transit on a major suburban employment center are described. Produced as part of the Metrorail Before-and-After Study conducted by the Council of Governments, it will be followed by a report on changes in land activities related to Metrorail.

This is one in a series of reports supported since 1976 by grants from the Urban Mass Transportation Administration. The program was established to measure the new rail system's effects on the Washington region--both direct travel changes and indirect effects such as land development.

By 1979, although only one-third of the planned 101-mile regional system was in operation, Metrorail was already carrying almost one-half of all weekday transit trips and had already become an important fixture in the regional transportation network. Perhaps even more significantly, the early success of Metro made it a highly publicized element in real estate advertising for nearby properties, in justification for development proposals, and even in political campaigns. This study describes successive evaluations before and after each segment of the rail system between 1976 and 1979.

Ridership exceeded expectations on the initial downtown segment and grew continuously as the system gradually expanded. New riders were added with each new segment of rail, and there was also growth in ridership on the segments which had already opened. Ridership was remarkably close to projections prepared in the system's planning period. Passengers used Metrorail to travel to and from work--two of every three trips--as is typical of most large transit operations. However, non-work trips outnumbered work trips on the initial downtown segment during the first four years and dominated travel entirely within the downtown area under study.

D-11. Duster, Troy and Fischer, C., Phase I - Research Plan; Institutions and Life Styles Project, BART Impact Program (Planning Document), Contract No. DOT-OS-30176, U.S. Department of Transportation, Washington, DC, January 1975, (NTIS No. PB-240 467/1ST).

The 50 page document is a research plan outlining central institutions most likely to be affected by BART, most feasible for study, and most likely to produce findings of transferability to other settings for policy-related decisions. Second, selected aspects of various kinds of life-styles are reviewed and suggestions and hypotheses presented for further study of both institutions and life-styles. The methodologies are designed to inter-connect from different angles in the study of the same problem, with a combination of ethnographic, observational, and survey research supplemented by document monitoring and analysis.

D-12. Dvett, Michael, et al., Land Use and Urban Development Impacts of BART: Final Report, Report No. DOT-P-30-79-09, U.S. Department of Transportation, Washington, DC, April 1979.

This 193 page report assesses the land use and urban development impacts of the 71-mile Bay Area Rapid Transit (BART) system, the first rail transit system to be built in the United States in 50 years. How and to what extent BART has influenced the spatial arrangement of people and activities in the San Francisco Bay Area is documented. All aspects of development that BART may have affected or potentially could affect are examined--including households' and workers' location decisions, development decisions of housing and commerical developers, retail trade and shopping patterns, and property values and rents. Changes attributable to BART are measured against pre-BART and no-BART alternatives using a variety of analytical techniques, surveys, statistical analyses and case studies. The report concludes with an assessment of the policy implications of the BART experience to date.

The major objective of the Land Use and Urban Development Project of the BART Impact Program was to determine how and to what extent the BART system has influenced the spatial distribution of people and activities and whether the early expectations of BART's impacts on urban form have been realized. With this goal in mind, the study of BART's impacts on land use became a study of urbanization in the Bay Area during the past 15 years. Every aspect of development that BART may have affected was examined with the objective of identifying and measuring BART's effects. Changes both in the immediate vicinity of BART stations and in development patterns at the regional scale were analyzed.

BART has influenced land use and urban development in the Bay Area both directly (through its service and its local physical effects) and indirectly (by affecting zoning regulations, redevelopment financing, and civic improvements). To date, the effects have been small, relative to expectations, but not inconsequential. To a limited extent, both office and housing construction have been influenced by BART, and the BART system is becoming a common, though not highly ranked, factor in the location decisions of households and employers. BART has been less influential in the sphere of retail activity. Retailers almost completely disregard BART in their location decisions. Sales data show no advantages for stores with near-BART locations. BART is being used to reach downtown shopping districts and outlying retail areas. Survey data suggest a potential shift in shopping patterns toward three BART-served areas has occurred. BART has affected property prices and rents, but the impacts are small. At a regional scale, BART has not had a measurable impact on population and employment growth, but development in BART-served corridors and downtown is somewhat greater than it would have been had BART not been built, indicating a distributional effect. Many projected land use impacts have not been realized. For example, high density residential development has not occurred in BART station areas zoned for such uses. Possible reasons for the lack of development include insufficient time for the effects to occur, zoning restrictions and the absence of demand.

D-13. **Dyett, Michael V., Recommendations for Long-Term Monitoring (Working Paper on BART Study), Report No. DOT-BIP-WP-54-5-78, U.S. Department of Transportation, Washington, DC, July 1978, (NTIS No. PB-291 016/4ST).**

Options for monitoring the impacts of the Bay Area Rapid Transit (BART) system on land use and urban development are examined and evaluated in terms of the importance for policy making, the probability of impact and the measurement feasibility. Analysis techniques are discussed, and monitoring issues in each station area summarized. A recommended long-term monitoring program is presented in the 50 page paper, including a cost estimate for the first five years.

D-14. **Dyett, Michael V., Station Area Land Use; BART Impact Program - Land Use and Urban Development Project, Contract No. DOT-OS-30176, U.S. Department of Transportation, Washington, DC, November 1977, (NTIS No. PB-282 996/8ST).**

The 37 page report summarizes time series data on BART stations compiled for the Land Use and Urban Development Project. Data collection and classification methods are described, and data sources are documented. Station area land use changes during the period 1965-77 also are summarized.

E-1. **Ellis, Raymond H., Worrall, R.D. and Sherret, A., Transportation System and Travel Behavior Project Research Plan (Planning Document), Report No. PD-14-3-75, Contract No. DOT-OS-30176, U.S. Department of Transportation, Washington, DC, May 1975, (NTIS No. PB-242 439/8ST).**

The Transportation System and Travel Behavior (TSTB) Project of the BART Impact Program was to assess the impacts of BART upon the characteristics and performance of the Bay Area transportation system--including BART, parallel and complementary transit services, and the highway system--and the responses of travelers to BART and related transportation system changes, including traveler perceptions, attitudes, and behavior. The 122 page report includes discussion of a conceptual framework of the impacts processes, the major research questions to be addressed, the priorities for the research, the research methods, and finally, the major work elements of the TSTB Project.

E-2. **Employment Impacts of Transit Capital Investment and Operating Expenditures, American Public Transit Association, Washington, DC, April 1, 1983.**

Public transit has long been recognized as a major public service of growing importance in small areas and of continued vital concern in large metropolitan areas. Until recently, however, little has been

known about the employment impacts of transit capital and operating programs, either at the national or local levels. This study was conducted to provide detailed information on the employment impacts of various public transit investments at the national level, and to provide guidelines on how similar analyses can be carried out at the local or regional level.

The study estimates the number of full time-equivalent jobs created for each $100 million of expenditure in various types of transit projects and programs. This information, coupled with similar analyses done by local transit managers and planners, will play a major role in reaffirming the importance of a strong transit program at the national, state and local level. The methodology used is based on the application of input-output analysis (I-O) techniques to measure labor-earnings impacts of transit investments on 37 major industry groups which make up the U.S. economy. The specific I-O model used was the Regional Industrial Modeling System (RIMS II) developed by the U.S. Department of Commerce, Bureau of Economic Analysis (BEA). This model is a 1980 updated version of the national Input-Output Structure Study.

The employment impacts of transit capital expenditures are estimated for three major types of projects: 1) new rail starts; 2) rail modernization; and, 3) bus facilities. The study finds that employment impacts vary only slightly among these project types. An expenditure of $100 million in a new rail system project is estimated to generate a total of 3380 direct FTE's (full time equivalent employees). The same amount of investment would generate 3213 FTE's in rail modernization projects, and 3149 in bus projects. The total (direct and indirect) employment impacts for the three project types are 7990 FTE's, 7600 FTE's and 7450 FTE's, respectively.

The direct employment impacts of transit operating expenditures are estimated in two categories, on-site and off-site. On-site impacts include employment created within the transit industry and off-site impacts are generated in industries supplying services and materials to transit. Compared to capital projects, transit operating expenditures create substantially more jobs in the national economy. Specifically, the impacts are 20 percent higher than new rail starts, 26 percent higher than rail modernization, and 29 percent higher than bus projects.

It is clear from the analysis that transit investments have significant employment impacts. It is hoped that this report will provide a useful resource for transit operators as well as federal, state, and local policy makers in assessing these important impacts.

E-3. Engelen, Rodney E., Coordination of Transportation System Management and Land Use Management, NCHRP Synthesis No. 93, Transportation Research Board, Washington, DC, September 1982.

This report presents the results of a survey of current practice in the coordination of transportation system management (TSM) and land use management (LUM). In undertaking this study, emphasis was placed on

the "state-of-the-art" in the coordination of transportation and land use actions at the level of "operating environments." TSM is defined not as the individual projects and actions being undertaken, but rather the work of planning and coordinating such actions for areas or corridors that constitute "operating environments." Although this definition may appear to overlook the solid experience and research that has been accomplished at the project level, it does focus on the area- or corridor-wide approach, which must be pursued if the objectives that have generated TSM and LUM are to be achieved. Because there are few significant examples of the formal coordination of TSM and LUM, the examples discussed in this synthesis are drawn from a wider area, including standard, or at least desirable, area and comprehensive planning practice.

As pointed out, the type and number of actions that might be taken to meet the objectives of TSM or LUM are limited only by imagination and by the nature of the problem to be resolved. The actions fall into four categories: 1) control/develop land; 2) control access to transportation; 3) control physical features of transportation; and, 4) control or influence transportation system use. Possible applications for coordination of TSM and LUM, with specific examples of current practice where available, for each of nine operating environments (major employment sites, major activity centers, outlying commercial centers, neighborhoods, central business districts, regions, arterial corridors, freeway corridors, and modal transfer points) are discussed in this synthesis.

The advantages of coordinating TSM and LUM have been recognized for years; many of the concepts and principles built into zoning and subdivision regulations are based on this recognition, although the concepts and principles are not always applied. One of the major factors standing in the way of coordination is lack of understanding of the economic benefits, particularly in developed areas. Another factor is the separation of funds used for transportation and land development.

E-4. Environment Project Research Plan (Planning Document on BART Study), Contract No. DOT-OS-30176, U.S. Department of Transportation, Washington, DC, January 1975, (NTIS No. PB-257 442/4ST).

This 188 page Research Plan is a presentation of the technical approach to be used in assessment of the environmental impacts of the Bay Area Rapid Transit (BART) system. The research plan was designed to respond to the differing interests and needs of its readers: 1) substantive aspects of BART's effects on the Bay Area environment; 2) study strategy and methodology; 3) approaches to assessment of specific kinds of impacts; and, 4) applicability of the study's findings to other locations are all considered.

E-5. Ercolano, James M., "Utilizing Limited Stop Bus Operations: An Evaluation", Paper for the 63rd Annual TRB Meeting, Transportation Research Board, Washington, DC, January 1984.

Possessing a possible capability for serving a ridership demand market between that of regional express and local bus operations, limited-stop bus services in Manhattan were evaluated in terms of comparing performance characteristics and passenger usage to those found in local service on the same routes. Random spot survey results and recent secondary data sources revealed the following: 1) considerable travel time savings; 2) faster average operating speeds; 3) a rider preference for using limited buses (where available); and, 4) attraction levels comparable to local bus service.

Modest operating cost savings were computed, with stopping frequencies closer to express service being the most economical. Annual savings from peak vehicle reductions amount to over 60% of total possible economies expected through using limited bus runs for roughly half the peak period trips on suitable routes.

Within the body of this evaluation, two sets of bivariate regression models were computed and calibrated to serve as general sketch planning guides. These models were used for reviewing routes that may benefit from limited service implementation according to peak travel times by one-way route distance, and peak operating costs by peak travel times. The Recommendations and Conclusions segment of this paper lists 5 warrants explaining what service revisions and performance modifications are essential if limited bus operations can be feasibly used to cut costs and attract ridership.

E-6. European Conference of Ministers of Transport, Exchange of Information on Investment Criteria Applied to Transport Infrastructure Projects, Report ISBN 92-821-1070-2, Sale of Publications Department, Organization for Economic Cooperation and Development (OECD), Washington, DC, 1981.

The purpose of the conference and subject of this 98 page report was to initiate a mutual exchange of information and experience on selection criteria for investments in the field of transport networks. One of the main subjects of discussion concerned the economic and social assessment methods used to select suitable investment projects in the field of transport infrastructure. There was a general consensus that it is absolutely vital to apply these methods in the preparation of todays decisions. Through these methods, it is possible to bring to light in a systematic way all the necessary information needed for decisions of major financial importance and to clarify the more complex factors of interdependence. In practice, the following economical and social assessment methods are applied:

- financial appraisal calculations;
- cost-benefit analyses;
- socio-economic cost-effectiveness analyses; and,
- multi-criteria analyses.

The mutual exchange of experiences and ideas showed a basic consensus on the necessity of applying overall economic or socio-economic assessment methods for major investment decisions. There are two main

reasons. One is that the social aspect of traffic investments has considerably increased in recent years. Another is the interdependence existing between the decisions taken in the different transport branches, while taking into account the increasing density of the traffic network and the extent to which transport demands have been met.

Despite basic agreement on the appraisal of problems inherent in assessing investments, different concepts concerning the concrete development of assessment methods have evolved. This applies both to the choice of a given assessment method, and to the relevance of those individual parameters that are of importance for overall assessment. In order to assess investment projects of international importance, it will be necessary to obtain some form of agreement on a generally accepted procedure. Such an agreement can only be based in part on objective and scientific elements; some differences are due to political reasons, which cannot be corrected by applying scientific methods. If further efforts are taken to strengthen mutual agreement on investment criteria recommendations, the following points should, as presented in the report, be considered:

a) the national and international benefits derived from investments in transport infrastructure;
b) the effects of investments in transport on the environment;
c) the effects of investments in transport on energy policies;
d) the intermodal effects of investments in transport; and,
e) the choice of the discount rate (opportunity cost) for assessing investments in transport infrastructure.

F-1. Fajans, Michael H. and Dyett M.V., Program - Wide Case Studies; Land Use and Urban Development Project - BART Impact Program (Working Paper), Contract No. DOT-OS-30176, U.S. Department of Transportation, Washington, DC, July 1978, (NTIS No. PB-291 388/7ST).

The 166 page paper consists of in-depth, policy-oriented case studies of BART's impacts on selected communities, synthesizing all case study work in the BART Impact Program. The variety of BART impacts are described for downtown San Francisco and downtown Oakland, representing urban core areas; the Mission District of San Francisco, the Rockridge neighborhood of north Oakland, and Richmond, representing urban residential area; and Walnut Creek and Fremont, selected as typical suburban residential communities.

BART impacts on the natural environment, public policy, institutions and lifesyles, transportation service and travel behavior, as well as land use and urban development are evaluated in terms of pre-BART and no-BART alternatives. Comparative statistics on population, employment, housing, land use and travel behavior are presented, and pre- and post-BART land use and zoning are mapped for each study area. Each case study concludes with an analysis of similarities and differences, and an assessment of the policy implications of the BART experience to date.

F-2. **Falcke, Caj O., Study of BART's Effects on Property Prices and Rents (Working Paper), Contract No. DOT-OS-30176, U.S. Department of Transportation, Washington, DC, July 1978, (NTIS No. PB-292 401/7ST).**

The 142 page paper addresses BART's effects on residential and commercial property prices and rents. Multiple regression analyses were carried out on eight study sites throughout the service area. The separate study site analyses were synthesized to derive observations applicable to more than one station area. At most sites, the data permitted separate analyses of pre-service (anticipatory) effects, immediate, and longer term (post-service) impacts.

The study addresses specific issues of the timing of BART impacts as well as joint distribution effects. Information from key informants was used in specifying study areas, determining variables to be included in the models, and in corroborating analytical results.

F-3. **Fauth, Gary R. and Gomez-Ibanez, J.A., "New Location Patterns and U.S. Transportation Policy (Abridgement)", Transportation Research Record 716, Transportation Research Board, Washington, DC, 1979, pp. 36-38.**

The paper states that during the next 20 years, geographic shifts of jobs and residences from the central cities to the suburbs, from larger to smaller metropolitan areas, and from the Northeast to the sunbelt cities of the West and South are expected to continue. Potentially, these changes might aggravate or mitigate particular U.S. transportation problems and thus influence the policies designed to solve them. Furthermore, U.S. transportation policies might be called on to arrest or slow the central-city-to-suburb and regional shifts in population that are viewed by many analysts as having undesirable consequences.

Fauth and Gomez-Ibanez suggest that neither of these potential impacts are likely to be realized. The impact of expected location changes on transportation problems in the near future is likely to be relatively modest, so that the response of transportation policy should be correspondingly small. Future transportation policy will be molded principally in reaction to other developments, such as rising per capita incomes. Moreover, transportation policy should not be used to control or arrest these new trends. Whether such control is socially desirable is questionable. However, transportation policy would be ineffective because it has only very limited leverage over the residential and business location decisions that underlie the migration of population, according to the authors.

F-4. **Fondahl, John W. and Paulson, B.C., Development of Research in the Construction of Transportation Facilities - A Study of Needs, Objectives, Resources, and Mechanisms for Implementation, Contract No. DOT-OS-60150, U.S. Department of Transportation, Washington, DC, August 1979, (NTIS No. PB-301 389/3SL).**

This second-year report concentrated on two topics related to the subject matter. One concerns the implementation of research results and innovative techniques. Incentives and obstacles to such implemention are identified. Proposals for more rapid and effective application of research results are made. Increased utilization of demonstration projects, bid alternates, "Turnkey" contracts, and follow-up measures are discussed. A special study of measures by the Japanese construction industry to achieve cost reduction through innovation is included.

The second topic concerns problems created by early planning, design, and organizational decisions. Experience originating in current or recent projects such as BART, WMATA, and MARTA is examined to identify such problems that have serious impact both on costs and the environment desirable for innovative efforts. This 146 page report concludes with a number of recommendations that the researchers believe could be beneficial in achieving needed improvements in both topic areas.

F-5. Fratessa, Carolyn and Lim, W-Y., Systan's Macro-Analytic Regionwide Transportation Model: Applications Manual, Report No. DOT-I-83-57, Urban Mass Transportation Administration, Washington, DC, March 1983.

SYSTAN's Macro-Analytic Regionwide Transportation (SMART) model is a sketch planning tool for evaluating public transportation alternatives for metropolitan areas. The model and its documentation were developed as part of the Paratransit Intergration Program sponsored by the Office of Bus and Paratransit Technology and the Urban Mass Transportation Administration and by the Office of Technology and Planning Assistance of the Office of the Secretary of Transportation. The Integration program is concerned with the development and application of macro-analytic techniques for policy and preliminary planning at the local level. The SMART model documentation consists of three volumes:

1. Application Manual: This report describes the use of the model to formulate, evaluate, and compare public transit options for urban regions. It discusses the structure of the model and the purpose of each major component. It also includes detailed application information for four case studies. The document is designed for use by transit planners who must assess the suitability of the model and, if appropriate, use it to investigate urban transportation alternatives.

2. User's Guide: The guide focuses on the preparation and formatting of data for use in the model. The document builds on material in the Applications Manual.

3. Program Maintenance Manual: The manual describes the internal structure of the computer program, including module structure and linkage and data structures.

G-1. Gaegler, Annette M., March, J.W. and Weiner, P., "Dynamic Social and Economic Effects of the Connecticut Turnpike", Transportation Research Record 716, Transportation Research Board, Washington, DC, 1979, pp. 28-32.

This paper summarizes the findings of a study of the long-term social and economic impacts of the Connecticut Turnpike on the eastern Connecticut region. Data developed in a 1965 report, The Connecticut Turnpike--A Ribbon of Hope, were updated and the dynamics of change in the highway corridor were investigated. Changes in population, manufacturing employment, retail sales, and assessed property values were related to increases in accessibility afforded by the Connecticut Turnpike and were compared for towns adjacent to the turnpike and for control towns in the eastern Connecticut region that were not located on the turnpike. Findings from the study indicate that the Connecticut Turnpike has had a continuing influence on the level and distribution of population and economic activity in the eastern Connecticut region.

The paper reported that, during the first 6 years the turnpike was in operation, only the eastern Connecticut towns located directly on the turnpike grew faster in population than the state as a whole. Since then, towns throughout the entire eastern Connecticut region have grown faster than the rest of the state. Although increases in population were widespread throughout the region, increases in manufacturing employment, retail sales, and land values were concentrated in towns along the turnpike. Moreover, among the turnpike towns significant differences in impact were found. The study concludes that the Connecticut Turnpike has had a significant long-term impact on the eastern Connecticut region, but that not all towns in the region have shared equally in that growth.

G-2. Gersten, Marvin C., "I-395/I-66 Traffic Management System", Journal of Transportation Engineering, Vol. 110, No. 5, American Society of Civil Engineers, New York, NY, September 1984, pp. 455-466.

On December 22, 1982, the Virginia Department of Highways and Transportations (VDH&T) officially opened 10 miles of I-66 in the Northern Virginia suburbs of Washington after 20 years of planning, environmental studies, court battles, and a final ruling by the U.S. Secretary of Transportation as to design and operational characteristics. These characteristics are unique, including only two lanes in each direction, prohibition of trucks at all times, parkway-like esthetic treatment and exclusive High-Occupancy Vehicle (HOV) operation of the peak direction roadways during commuting periods.

In response to the Secretary's decision, studies were conducted by the Department to determine the feasibility of implementing a modern traffic surveillance, control, and motorist information system to achieve the operational objectives set forth for I-66. At the same time, it was decided to include the 12-mile section of I-395 (Shirley Highway) as part of this system due to its unique center two-lane

reversible roadway HOV operation and serious congestion problems being experienced on the flanking three-lane directional roadways during peak commuter periods.

In 1978, the Department engaged Howard Needles Tammen & Bergendoff, with Sperry Systems Management as its subconsultant, to conduct preliminary engineering studies; prepare final plans and specifications for roadway bottleneck improvements and the surveillance and control system; and monitor implementation of the combined I-66/I-395 Traffic Management System. Final plans were completed and advertised in the fall of 1981 and construction began in early 1982. Installation of the system is expected to be completed this fall followed by a six-month operational test period. Full scale systems operation by the Department is anticipated to begin in early 1985.

G-3. Goepfert, Carl W., "Turnkey Projects for Downtown People Movers", Transportation Engineering Journal, Vol. 108, No. TE4, American Society of Civil Engineers, New York, New York, July 1982, pp. 383-391.

Los Angeles, Detroit, and Miami received proposals for construction of downtown people mover systems. The requests for bids contemplated "turnkey type" construction contracts. The multiplicity of requirements for functional and environmental compatibility lead to a complex proposal preparation process but allows the owner to deal with a single contractual entity in negotiations.

The background of the people mover projects, the design, and contract development, and a comparison with more conventional procedures are all briefly presented within this 9 page paper. Advantages of the alternative procedures are described in the context of three ongoing projects.

G-4. Gomez-Ibanez, Jose A. and Lee, D.B., "Economic Evaluation of Highway Investment Needs", Transportation Research Record 940, Transportation Research Board, Washington, DC, 1983, pp. 21-27.

The purpose of economic analysis, as stated by the authors, is to ensure that society's resources are put to their best use, including the allocation of resources among various public-sector activities and between public and private uses. The principal tool in the economic evaluation of public programs is benefit-cost analysis. In barest outline, benefit-cost analysis involves four steps: 1) the prediction of all the desirable and undesirable effects of the programs or projects under consideration; 2) the valuation of these effects in common terms, usually dollars; 3) the calculation of the net benefits for each project or program; and, 4) a choice among alternatives based on their net benefits.

FHWA has been required by Congress to prepare biennial reports on the condition of the U.S. highways and the need for highway investment since 1968. Although these needs reports have become more sophisti-

cated with each edition, they still fall short of a full economic analysis of highway investment according to the authors. Within this paper, the role that economic analysis might play in needs reports is explained, the use of economics in past reports is evaluated, the general categories of benefits and costs that should be considered are outlined, and quantitative benefit-cost evaluation for determining highway needs is illustrated.

As reported by the authors, transportation is seldom desired as an end in itself but rather as a means toward some other end (i.e., producing or distributing goods and services, earning a living, shopping, or vacationing). As a result, improvements in highway use inevitably produce a variety of indirect impacts throughout the economy, many of which may be regarded as beneficial. It is important to understand, according to Gomez-Ibanez and Lee, that these indirect benefits, with few exceptions, merely reflect a transfer of the direct benefits in reduced highway user costs from the highway user to other parties and as such cannot be counted as separate and additional benefits from highway investment. Land values increase at sites that are made more accessible because the direct reduction in time and operating costs gained by users enables them to pay a higher rent for the use of the land; the landowner captures part of the direct savings in the form of higher rents. Similarly a manufacturer will move to a site that has a lower rent or consolidate operations in larger plants or warehouses because the reduction in highway transportation cost now makes this location or scale of operation more profitable. The paper states that the savings from relocation or consolidation therefore can be no greater than the direct reduction in highway user costs otherwise the firm would relocate or consolidate even without the highway improvement.

FHWA has not estimated indirect economic impacts in past highway needs reports, although it has prepared estimates of the effects of highway investment on the gross national product (GNP), the consumer price index (CPI), and the productivity indexes for the 1982 report, report the authors. The authors contend that the changes in the GNP, the CPI, and productivity are indirect economic impacts, and should not be regarded as reliable measures of benefits or cost for the purpose of evaluating highway programs.

G-5. Graebner, L.S., Higgins, T. and Curtis, E., The Impact of BART on Local Transit Service and Financial Policy (Working Paper), Contract No. DOT-OS-30176, U.S. Department of Transportation, Washington, DC, September 1977, (NTIS No. PB-292 402/5ST).

The 119 page paper assesses the public policy impacts of BART on existing and planned local transit service and its financing in the three BART counties in the San Francisco Bay Area. Three specific policy areas were considered: 1) The impact of BART on changes in service, routes, fare, transfer and personnel policies of existing local transit operators; 2) the impact of BART on the creation of new local transit systems to provide feeder service to BART as well as local transit service; and, 3) the impact of BART on changes in State, regional or local policies for financing local transit service.

G-6. Graebner, Linda S., et al., The Impact of BART on Public Policy, Report No. DOT-P-30-79-07, Urban Mass Transportation Administration, Washington, DC, April 1979.

This 126 page report summarizes the findings and conclusions of the Public Policy Project and presents policy implications for other metropolitan areas planning for rapid rail transit development. Impacts of BART on public policy actions and decision-making processes are assessed in four areas: 1) organization; 2) finance; 3) land use; and, 4) transportation. These BART public policy impact findings are interpreted for each of three different types of communities: 1) urban core; 2) urban residential; and, 3) suburban.

G-7. Graebner, Linda S., et al., The Local Implications of BART Development: Final Report, Report No. DOT-P-30-79-11, Urban Mass Transportation Administration, Washington, DC, April 1979.

This 154 page report presents the final results of the Local Policy Implications Work Element. The report assesses whether BART has achieved the original objectives of local communitites. The report also outlines local policy implications in the form of practical guidelines for local government officials either considering an investment in rapid rail transit or in the process of designing and constructing a rapid rail transit system.

Implications are presented for each of nine original community objectives for the BART system. This material is further organized into five chapters relating to major areas of local policy: 1) transportation; 2) land use; 3) finance; 4) economic development; and, 5) environment.

G-8. Graff, Donald L. and Knight, R.L., Environmental Impacts of BART: Final Report, Report No. DOT-P-30-79-05, U.S. Department of Transportation, Washington, DC, April 1979.

This 153 page report is a summary of the results and accomplishments of the Environment Project of the BART Impact Program. The study consisted of a detailed assessment of BART's current environmental impacts, including direct (i.e., wayside) impacts as well as indirect impacts (resulting from development in BART station areas) and effects on the system's patrons. Assessment was made using both technical impact evaluations (e.g., noise measurements) and surveys of the responses of those affected. In addition, indications of BART's construction impacts and further impacts associated with the system's full-service level of operations are described and evaluated.

The summary section states key conclusions from the study, briefly outlines the supporting findings, and concludes with implications for

rapid transit planning and design in other cities. The body of the report presents more detailed findings, conclusions, and implications. Further details of methodology and findings are provided in a series of published technical memoranda, which are referenced at the end of the report.

BART has not had much impact on its environment was one particular conclusion significant in view of the system's large size, the intensive local activity generated at stations, its variety of configurations, and the diversity of environments through which it passes. Moreover, it was planned and largely completed before environmental concerns had attained their present importance in public policy. There are exceptions to this conclusion in that impacts vary throughout the system, both in degree and nature, depending on variations in BART itself and in its surroundings. However, the system's environmental impacts--both during construction and through its early operations--have been small enough in most places to require careful study even to detect. This "low profile" of impact is confirmed by surveys of BART users and nearby residents, according to the authors.

G-9. Grefe, Richard and McDonald, A.N., The Economic and Financial Impacts of BART: Final Report, Report No. DOT-P-30-79-04, U.S. Department of Transportation, Washingtion, DC, April 1979.

The 71-mile Bay Area Rapid Transit (BART) system was the first regional scale rapid transit system to open in the United States in over 50 years. This 117 page report assesses the economic impacts of BART's $1.5 billion capital expenditures and $60 million annual operating expenditures on the Bay Area's regional economy.

This report documents the changes in regional sales, income and employment in the nine-county San Francisco Bay Area which were stimulated by BART's capital and operating expenditures. BART's impact on minority and female employment opportunity during construction and operations is evaluated. The impact of BART's construction expenditures on construction wage rates within the region is analyzed.

The tax incidence and tax burden of financing BART's capital construction and operations are identified. The impact of BART's bond issue on other public borrowing and the cost of public borrowing is evaluated. The impact of transportation service on regional economic development is researched through shift/share analysis and an interviewing program.

This project aimed to assess any economic development impacts accruing to the nine-county region which could be traced to BART. The question of whether BART induced changes in the patterns of land use and development within the Bay Area is not the subject of this project. That question was considered as part of the Land Use and Urban Development Project of the BART Impact Program. Economic or financial impact is defined as the difference between two courses of events, as measured against the same criterion at the same point in time. Evaluation of a BART impact is, then, an assessment of BART as measured against an

alternative transit system which might have been in place in 1976. The BART Impact Program has established a hypothetical No-BART Alternative (NBA) as the transportation system judged most likely to have evolved in the central Bay Area by 1976 had the decision to build BART not been made in 1962. The NBA serves to isolate net effects of BART from those changes which occurred as a result of factors other than BART.

G-10. Grefe, Richard, et al., The Impact of BART on the Competitive Advantage and Efficiency of Bay Area Business Operations, Contract No. DOT-OS-30176, U.S. Department of Transportation, Washington, DC, August 1977, (NTIS No. PB-273 485/3ST).

This 123 page technical memorandum evaluates the economic effects of BART's transportation service on the competitive advantage and efficiency of Bay Area business operations. The scope of the analysis includes: 1) potential economic impacts resulting from improved transportation service and accessibility for workers to jobs; 2) impacts of regional competitive advantage due to locational advantage or regional image; and, 3) possible economic efficiencies associated with BART service. The study methodology, which is also documented, includes a shift/share analysis of Bay Area employment since 1962, extensive interviews with industrial and commercial decisionmakers, and four case studies.

G-11. Grefe, Richard and McDonald, A.N., The Impact of BART on Economics and Finance - Interpretive Summary of the Final Report, Report No. DOT-P-30-80-05, U.S. Department of Transportation, Washington, DC, December 1979.

This 13 page summary report documents the changes in regional sales, income and employment in the nine-county San Francisco Bay Area which were stimulated by BART's capital and operating expenditures. BART's impact on minority and female employment opportunity during construction and operations is evaluated. The impact of BART's construction expenditures on construction wage rates within the region is analyzed.

The tax incidence and tax burden of financing BART's capital construction and operations are identified. The impact of BART's bond issue on other public borrowing and the cost of public borrowing is evaluated. The impact of transportation service on regional economic development is researched through shift/share analysis and an interviewing program.

G-12. Grefe, Richard, McDonald, A.N. and McLeod, D., Theoretical Framework for the Evaluation of Economic and Financial Impacts of BART (Working Paper), Contract No. DOT-OS-30176, U.S. Department of Transportation, Washington, DC, July 1976, (NTIS No. PB-261 362/8ST).

The 76 page Working Paper outlines the theoretical framework for evaluating the economic and fiscal impacts of the construction and operation of the Bay Area Rapid Transit (BART) system. Impacts described in the Working Paper include: 1) direct construction expenditures; 2) operating expenditures; 3) impacts on the economy because of changes in transportation services; 4) fiscal burden; and, 5) impacts on the use of bonded debt in the San Francisco Bay Region.

G-13. Gruver, James and Reulein, W., "Estimating the Impacts of Changing Highway Conditions", Transportation Research Record 940, Transportation Research Board, Washington, DC, 1983, pp. 1-7.

This paper presents a discussion of the Highway Performance Monitoring System (HPMS). The analytical package is a series of computer models designed to use the annually updated HPMS sample inventory data to estimate needs, determine the relationship between highway investments and highway performance, and assess the benefits and costs associated with various investments. The models express highway performance in terms of sufficiency indexes, vehicle operating costs, fuel consumption, and overall running speed. This system-level planning tool is described and examples of the data output are given by the authors. Investment performance curves are presented to illustrate the consequences of different investment levels. Although it is concluded by Gruver and Reulein that the current analytical package is useful for assessing the effects of future investments on future system performance, there is a need to bring this package together with economic analyses and econometric forecasting tools to permit economic impact analyses of various sectors of the economy, including highway users and industries.

As summarized in the paper, the calculated user cost factors are expressed in terms of rates. The factors include fuel consumption, vehicle emissions (carbon monoxide, hydrocarbons, and nitrogen oxide), vehicle operating costs, average overall travel speeds, and three types of accidents: 1) property damage only; 2) nonfatal injury; and, 3) fatal. With these factors, comparisons can be made between today's highway performance and future performance levels achieved with various investment levels and investment strategies. The comparison can then be used to determine the relationships that exist among investment, travel, user costs, and improvement types.

The logic of the analytical process used for impact assessments is built around a series of tables, curves, and equations developed by FHWA through in-house or contract research efforts. These components of the process can be changed when udpated or improved data or relationships are available. The major components of the model are:

1. Daily distributions of traffic by functional class and design type;
2. Speed estimating relationships by design type and congestion level;
3. Adjustments for pavement condition and alignment speed;
4. Estimating relationships for speed-change cycle, stop cycle,

and speed-change magnitude by vehicle type;
5. Idling-time relationships;
6. Tables for fuel consumption, travel time, and operating costs;
7. Pavement condition adjustment factors for vehicle operating costs and fuel consumption;
8. Vehicle classification data by area and functional class;
9. Emission rates by vehicle type and calendar year; and,
10. Three classes of accident rates by design type and AADT carried.

H-1. Hallam, C.E. and Pindar, G., "Predictions of Land Use Traffic Impact", Transportation Research Record 940, Transportation Research Board, Washington, DC, 1983, pp. 51-61.

The authors state that the current procedures for prediction of the traffic impact of proposed land use developments and their parking requirements are based on historical and nonquantitative assessment procedures, which has in many cases led to the preparation by local governments of inappropriate parking codes. Research recently undertaken in New South Wales, Australia, aimed at provision of a more quantitative basis for impact prediction, is presented in the paper. Surveys were conducted at sites in each of the following land use categories; 1) motels; 2) service stations; 3) car dealerships; 4) dealers of car accessories and tires; 5) hotels; 6) road transport terminals; 7) warehouses; 8) recreation; 9) fast food sites; 10) factories; 11) licensed clubs; 12) office blocks; 13) shopping centers; 14) home units (apartments); 15) homes for the aged (retirement villages); and, 16) restaurants.

Survey results were analyzed by using linear regression techniques. Descriptive models developed are presented in the form of regression equations. Use of these models should take into consideration their accuracy and the range of independent variables for which they are applicable. In situations where it was not possible to develop models, proposed land use developments may be compared with developments surveyed in the study that possess similar characteristics, and a subjective assessment may be made. The use of the survey data as a standard data base should be of considerable value in maintaining a common standard of impact assessment. The models should improve the accuracy of impact prediction and assist in the development of more reliable parking codes and design guidelines, according to the authors.

H-2. Henke, Cliff, "The Other Rapid Transit?" Metro, Volume 80, Number 4, Metropolitan, Redando Beach, California, July/August 1984, pp. 14-18.

Just a decade old, busways are becoming more viable as a fixed guideway option to cities, directly competing for the LRT market, according to Henke. According to the most recent count, 12 busways are in operation, under construction, or undergoing preliminary engineering towards final design and ground-breaking. Remarkably, three of the top ten fixed guideway projects evaluated by UMTA recently as being the

most cost-effective were busways. The highest ranked of all proposed fixed guideways by the agency is Seattle's electrified bus tunnel, to be built downtown.

The earliest busways built in the United States, the El Monte and the Shirley Busway in Washington, D.C., represented one of the few situations where highway and transit interests melt, states the author. Built in 1974 with federal highway trust fund and state assistance, these projects were designed to supplement--but never seriously intended to replace--the private car.

The legacy of this transportation mode is a microcosm in what politically happened to transit in the 1970's when car-bound America was forced to find ways to conserve fuel. Both busways, originally designed for exclusive use by buses, succumbed to the inevitable competition from alternative high-occupancy-vehicle proponents such as vanpool groups and private subscription bus service and allowed these vehicles on busways.

Henke continues with a summary of several busway projects, including those found in:

- Washington, D.C.;
- Los Angeles, California;
- Baltimore, Maryland;
- Houston, Texas;
- Seattle, Washington; and,
- Pittsburgh, Pennsylvania.

H-3. Higgins, Thomas J., The Impact of BART on State Highway Plans and Policies, Report No. DOT-BIP-WP-30-8-77, U.S. Department of Transportation, Washington, DC, October 1977.

This 59 page report presents an assessment of the impact of BART on State highway plans and policies. BART impacts evaluated include changes in highway facility development to access or parallel BART, changes in State highway policies with respect to BART and the outcome of agreements between the State and BART on joint use of highway facilities.

This report was designed to answer several overall questions about BART and State Highways:

- Has BART caused any reduction in highway facilities and plans?
- Has BART affected State policy, general or specific, relating to highways and/or rapid rail?
- What were the effects of BART and State negotiations on joint use of highways?

The study approach also included deriving hypotheses about the probable impacts of BART on State highway facilities and policies.

These hypotheses were derived from evidence about policy-making in bureaucracies generally and within the California Highway Department in particular. This evidence suggested that we should be surprised to find BART had a significant impact on highway development and policies, other than to produce policies protective of State interests. Nor was it expected State facilities would be markedly reduced as a result of BART.

H-4. Hoel, Lester A. and Richards, L.G., Planning and Development of Public Transportation Terminals, Report No. DOT-RSPA-DPB-50-81-19, U.S. Department of Transportation, Washington, DC, January 1981.

This report describes the proceedings of a National Conference on the Planning and Development of Public Transportation Terminals held in Silver Spring, Maryland on September 21-24, 1980. The conference included both formal papers presented to plenary sessions and small group workshops focused on particular design issues of current importance.

Formal papers covered all aspects of transit station planning and design, with special attention to passengers, access and traffic, and operations and maintenance. Recent experiences in transit station design and renovation were reviewed, including intermodal terminals, from both domestic and international perspectives. Particular systems described in detail included WMATA, BART, MARTA, and New York. An overview of the Methodology for Transit Station Design was also presented.

Workshops dealt with nine topic areas: 1) Transit Station Design Methodology; 2) Intermodal Terminal Planning, Design and Operations; 3) Passenger Processing and Information Systems; 4) Station Access and Traffic; 5) Station Maintenance and Operations; 6) Transit Station Security; 7) Design for the Handicapped; 8) Joint Development, Land Use and Station Impacts; and, 9) Computer Methods and Transit Station Simulation.

H-5. Holden, Allen and Peterson, R.L., Bus Priority Measures for The City of Fort Worth, Transportation Planning Division, City of Fort Worth, Fort Worth, Texas, March 1978.

This 59 page report examines traffic signal pre-emption for improved transit service and recommends a demonstration program for detailed evaluation of the concept. A monitoring/evaluation strategy was set forth for the proposed program which included 13 performance measures and related data collection methods: 1) Accident history (accident reports); 2) Auto speed on arterial (time and delay study); 3) Auto delay on arterial (time and delay study); 4) Intersection traffic flow (manual counts); 5) Overall bus speed (on-board study); 6) Bus travel time (on-board study); 7) Maximum bus speed (on-board study); 8) Number of stops (on-board study); 9) Total bus delay (on-board study); 10) Bus ridership and revenue (passenger records); 11) Evaluation of bus stop locations (on-site evaluation); 12) Bus opera-

ting cost (operating records); and, 13) Corridor analysis (all collected data). Data collection was to be performed by the City staff and transit agency (CITRAN) personnel.

H-6. Hupp, R. Craig, "Vanpool Travel Characteristics In Southeast Michigan (Abridgement)", Transportation Research Record No. 823, Transportation Research Board, Washington, DC, 1981, pp. 15-17.

This paper describes the results of a travel survey that was distributed by the Southeast Michigan Council of Governments to all participants in employer-sponsored vanpool programs in the seven-county southeast Michigan region. The purpose of the survey was to collect socioeconomic, travel, and attitudinal data from participating vanpoolers. This paper summarizes the results of the socioeconomic and travel portions of the survey.

Data were collected that describe the vanpooler's modal shift to pooling, use or disposal of the automobile left home by commuters who previously drove, and total vanpooler travel before and after joining the pool. Vanpooling in the Detroit area attracts few transit users and draws riders nearly equally from drive alone and ridesharing. It was found that vanpooling does not have a significant impact on automobile ownership. Only 15 percent of the respondents reported that either a vehicle was sold or its purchase postponed as a result of vanpooling. However, only 20 percent of respondents reported that the vehicle left home was used by other household members and its use was substantially less in terms of mileage than the former commuting use. Finally, the total travel impact of vanpooling was a reduction in automobile travel of 339 miles/month (4,068 miles/year) for the average vanpooler.

J-1. Jarzab, James T., "Use of Impact Models to Identify Economic Effects of Transportation Capital Projects", Paper presented at 1984 ASCE Annual Convention, Northeastern Illinois Planning Commission, Chicago, Illinois Planning Commission, Chicago, Illinois, January 15, 1985.

Questions are often raised about transportation and other capital projects regarding the economic stimulus which can be expected from their implementation. Tools for identifying the economic effects resulting from the implementation of capital projects have been rather limited. However, the past few years have seen the development of several economic impact models which hold promise for supplying analysts with improved information.

The purpose of this paper is not to describe the inner workings of economic models, but rather to provide examples of the types of studies which can be conducted using available economic models. While a particular model used as an analysis tool in this paper may not be generally

available or appropriate for every analysis, it is likely that a similar model is currently available--or will soon be available--for most areas of the country. As special purpose economic models proliferate it is also likely that models sensitive to the particular needs of transportation professionals will also be developed.

As stated by Jarzab, the economic value of a transportation improvement to an economy is two-fold: 1) there is the net value of the construction activity which accompanies most transportation projects. (This effect includes the direct and indirect stimuli to the economy); and, 2) there is the value of the operating cost savings to the economy because of decreased travel time and cost of operations resulting from the project.

Unfortunately, the network improvements resulting from capital programs have not been modeled; therefore, the findings presented here reflect only the economic activity resulting from the construction phase of a project or group of projects. Construction impacts are for the most part transitory, and the more lasting economic impact may in fact be the operational improvements resulting from the program. The analyses presented in this paper were developed by the Northeastern Illinois Planning Commission (NIPC) and use three different economic models: 1) Location Quotient Model; 2) Input-Output Forecasting Model; and, 3) Input/Output Impact Model.

J-2. Jonash, Ronald S., The Impact of BART on Land Use and Development Policy (Working Paper), Contract No. DOT-OS-30176, U.S. Department of Transportation, Washington, DC, September 1977, (NTIS No. PB-291 957/9ST).

The 92 page working paper assesses the relationship between the construction and operations of BART and changes in local land use policy and resulting changes in actual land use and development. This study presents findings in four areas: 1) Local government involvement in BART station location and design decisions related to land use policy; 2) BART impacts on local government planning studies, rezonings and use of special development incentives or controls; 3) BART impacts on local government policy regarding BART-related joint development, particularly public improvements, redevelopment and marketing; and, 4) The impact of BART-related land use policy upon actual changes in land use and development.

K-1. Kalauskas, Charles, et al., An Analysis of the I-93 Preferential Lane, Central Transportation Planning Staff, Contract No. MA-09-0051, Urban Mass Transportation Administration, Washington, DC, July 1981.

This 44 page report presents an examination of the I-93 Preferential Lane (Boston area) which extends northward from the Mystic-Tobin Bridge in Charlestown. When first opened in 1974, the preferential

lane was approximately 0.4 miles long. Two subsequent extensions of the lane -- the last of which was opened in August 1979 -- have increased its length to 1.4 miles. The following points summarize the results of the investigation of the lane's operation:

- The preferential lane carries approximately 25 percent more passengers than each of the general use lanes.
- Despite the extension of the preferential lane, travel time differences between vehicles using the preferential and general lanes have decreased over time.
- The number of vehicles using the general lanes has not changed significantly from 1974 to 1980.
- The number of vehicles using the preferential lane destined for downtown Boston and points south has not changed significantly from 1974 to 1980.
- Queue lengths in the general lanes have increased to the point where vehicles using the preferential lane may encounter delays prior to the entrance point.
- The only significant increase in public transportation patronage in the I-93 travel corridor has been on the private carrier express buses that use the preferential lane.

K-2. Kalauskas, Charles, et al., Southeast Expressway - Evaluation of the Downtown Express Lane, Central Transportation Planning Staff (CTPS) Technical Report #3, U.S. Department of Transportation, Washington, DC, December 1977.

On May 4, 1977, the Massachusetts Department of Public Works (MDPW) reserved the existing northbound left lane of Boston's Southeast Expressway for buses and three-or-more-occupant carpools during the morning peak period (6:30 - 9:30 A.M.). This started Phase I of an effort to increase the vehicle occupancy of the highest-volume roadway in Massachusetts in anticipation of a major viaduct reconstruction project. Phase 2 of Reserved Lane operation began the morning of June 2, 1977, by carrying the Reserved Lane through the three-lane construction bottleneck. Phase 3, in which the three-or-more-occupant per vehicle requirement was enforced, commenced the morning of October 18, 1977, and continued until the termination of the Lane on November 2, 1977.

This technical report analyzes and evaluates the operation of the Reserved Lane, known locally as the Downtown Express Lane. The report addresses a number of impacts of the Lane's operation on the Expressway (carpool formation, express bus ridership, Express Lane utilization and compliance, traffic volumes, auto occupancy, shift in time of travel, travel times and safety) and off the Expressway (public transportation operation and ridership, fringe parking utilization and alternate highway route usage). Analysis shows that the Express Lane succeeded in increasing carpools by 32 percent during Phases 1 and 2, and by 70

percent during Phase 3. Express bus ridership increased only slightly. Rapid rail ridership in the corridor increased significantly during all phases. Travel times for Express Lane users improved significantly, but travel times in the general-purpose lanes increased and proved erratic during Phase 3. There was no significant increase in the number of accidents on the Expressway. Despite a trend towards continuing commuter shifts to alternative HOV modes (a ten percent shift),

the public outcry and concern of public officials regarding the deteriorated travel conditions in the general-purpose travel lanes led to termination of the project after 2 1/2 weeks of enforced operation.

K-3. Karash, Karla H., "The Effect of an Auto Restricted Zone in a Transit Oriented Downtown", Paper for the 1984 ASCE Annual Convention, Massachusetts Bay Transit Authority, Boston, Massachusetts, August 1984.

The downtown shopping area of the City of Boston, known as the Downtown Crossing (DTC), has had an auto restricted zone (ARZ) since September of 1978. Over five million federal and city dollars were spent to brick over streets, change traffic patterns, and add benches and lighting. While there has been some past controversy over the effect of that zone on retail in the area, there is general agreement currently that the zone has had a positive effect. Auto restricted zones have a mixed record overall in American Cities and the success of the Boston ARZ is due to a number of factors including the growing nearby employment in the Downtown and the excellent transit service. The purpose of this paper is to discuss the past and future economic impact of the ARZ, and the likely impacts of transit and other improvements.

In 1981 the Boston Redevelopment Authority (BRA) initiated a study to evaluate measures to further improve the Downtown Crossing. The BRA was interested in determining the economic effect of additional retail development, better maintenance and security, and additional parking. In addition, some merchants in the area wanted the ARZ reassessed as they were not convinced that it had helped the area. The BRA hired a team of retail experts to develop a gravity model for the Boston region. The gravity model, however, would not provide information on the economic effect of qualitative programs like better maintenance and security, or the effect of the ARZ itself. A methodology proposed by MIT researchers held promise for answering the qualitative questions. The MIT approach for assessing the effects of the ARZ was called the "lens model". The lens model gets its name from its original founder, Egon Brunswik (1952), who referred to people's perceptions as lenses through which they interpret physical characteristics or events.

K-4. Keefer, Louis E., "An Interim Review of Nine UMTA Assisted Joint Development Projects", Paper for the 63rd Annual TRB Meeting, Transportation Research Board, Washington, DC, January 1984.

System interface and joint development projects represent potentially significant revenue sources for mass transit operators whether those operators provide only all-bus service or rapid transit and commuter rail services. As the terms are used in this report, "joint development" is basically real estate development closely linked to public transportation services and station facilities; "system interface" is a direct physical connection between a transit station and an adjacent property usually added after the station has been built.

The purpose of this paper, which deals only with joint development, is to assemble and analyze possible indicators of the relative success of nine joint development projects begun under the former Urban Initiatives Program. Since none of the projects were yet completed, "success" was projected in terms of the principal benefits expected to accrue. These benefits include induced net additional transit ridership and farebox revenues, and earmarked proceeds from the sale or lease of joint development property.

In considering the author's conclusions, the reader should understand that the calculations (involving many assumptions and much estimation), were intended as a "scaling effort". The results are only an approximation to determine whether UMTA investment in joint development projects may be relatively better or worse than UMTA investments in extending existing, or building new, rapid transit lines. Keefer was aware that his data base lacked the completeness needed for reaching more definitive conclusions. He was also aware that his methodology for comparing the two types of investment omits certain costs and benefits that a more rigorous examination would almost certainly take into account. Within the context of the data available, and the methodology used, however, considerable care was exercised to avoid a deliberate bias in favor of finding joint development investments superior.

Keefer concludes that participation in joint development projects holds promise of substantial financial payoffs both for UMTA and for transit operators. The accumulated experience from a growing number of successful projects appears to be allaying the concerns of most transit operators and real estate developers.

K-5. Keefer, Louis E., <u>An Interim Review of Nine UMTA-Assisted Joint Development Projects-Summary Report</u>, Report No. DOT-I-83-46, Urban Mass Transportation Administration, Washington, DC, October 1983.

As used in this 57 page report, "joint development" is basically real estate development closely linked to public transportation services and station facilities, often involving the use of air rights and providing pedestrian access via underground passages, surface routes or

skyways; "system interface" is a direct physical connection between a transit station and an adjacent property usually added at some point "after" a station has been built, and is usually not part of a joint development project, per se. It has become generally accepted that transit operators should equitably share some part of these value enhancements through the concept of "value capture," according to Keefer. The purpose of this report, which deals only with joint development and not with system interface projects, is to assemble and analyze possible indicators of the relative success of nine joint development projects. The projects are located in: 1) Baltimore; 2) Boston; 3) Buffalo; 4) Cambridge; 5) Cedar Rapids; 6) Davenport; 7) Miami; 8) Philadelphia; and, 9) Santa Ana, California. Since none of the projects were yet completed, "success" is projected in terms of the

principal benefits "expected" to accure. These benefits include induced net additional transit ridership and farebox revenues, and earmarked proceeds from the sale or lease of joint development property.

Some research findings include:

- UMTA's $49.5 million investment leveraged another $103.1 million of public investment and well over $700 million of private investment. Leverage ratios as high as 44:1 were recorded.

- UMTA grant applicants indicate that the nine projects will create between 27,000 and 32,000 new permanent jobs.

- The 9.7 million square feet of floor space provided will yield a net increase of almost $17 million in annual property taxes. Proceeds from the sale or lease of joint development property, earmarked for transit system improvements, will run at least $1 million annually, and probably much more.

- In general, the larger projects, as measured in terms of total investment and floor space added, seem likely to be the most successful; however, even small projects can represent an excellent investment.

- Projected transit ridership and farebox revenues may be "extremely" significant; additional farebox return could be sufficient to repay UMTA's $49.5 million investment in less than six years.

- UMTA's cost for inducing ridership will be only $1,000 to $2,000 per additional daily transit trip; significantly lower than most other grant investments (i.e., about $14,000 per additional trip in Washington's Metro and Atlanta's MARTA).

K-6. Kenyon, Kay L., "Increasing the Mode Split Through Parking Management: A Suburban Success Story", Seattle/King County Commuter Pool, Seattle, Washington, August 1983.

Accommodating commute trips in rapidly growing suburban cities that do not have high levels of transit service is a difficult challenge. Yet many cities, including Bellevue, Washington, must face this challenge if development is to continue at the current rapid pace.

This paper describes a new employee transportation program at the first building in downtown Bellevue to be constructed under the terms of a new zoning code. The transportation program, serving 900 Pacific N.W. Bell Telephone employees, includes a substantial ($60/month) parking fee as a disincentive to drive-alone commuting, and discounted or free parking for carpools. Parking demand must be accommodated by 410 parking stalls in the monitored parking garage.

The intensive assistance provided by Seattle/King County Commuter Pool (the regional ridesharing agency) and the City of Bellevue ridesharing staff was instrumental in achieving a 60% employee carpool participation rate. Only 19% of the employees are driving alone to work. Seventeen percent utilize transit. Other critical success factors are the ability of a single firm to coordinate a program, and the predisposition of employees accustomed to high levels of transit service in Seattle, to form carpools in Bellevue.

K-7. Kern, Clifford R. and Lerman, S.R., "Models for Predicting the Impact of Transportation Policies on Retail Activity", Transportation Research Record 677, Transportation Research Board, Washington, DC, 1978, pp. 34-41.

With the increasing importance of transportation system management and transportation control plan strategies, transportation planners have been called on to forecast the impacts of new policy options that existing planning tools are ill-suited to simulate, according to the authors. Comprehensive urban activity, or land-use, models present an obvious example of this deficiency. Because they attempt to forecast the spatial distribution of all urban activities for the entire metropolitan area, these models invariably require a large data base, a major calibration effort, and substantial computational resources. Moreover, because of their generality, they often do not specify carefully the behavioral structure that lies behind observed location patterns. As a result, important determinants of location decisions are omitted from the models, and policies that affect these determinants cannot be accurately represented, in the opinion of Kern and Lerman.

This paper describes a case study that develops two alternative models with a much sharper, policy-oriented focus and substantially reduced requirements for data and computational resources. The case

selected for study involves the hypothetical adoption of transportation control measures to improve air quality in the Denver central business district and the potential impact of controls on retail activity. The two models are a cross-section, lagged-adjustment regression that identifies determinants of aggregate sales at any location and a set of disaggregate travel demand models that predicts the equilibrium between shopping trips and retail activity. The forecasts of both models are consistent in predicting substantial declines in retail activity in response to restrictions on automobile access and negligible offsetting effects of improvements in transit service. The authors conclude that compensatory nontransportation measures that enhance downtown amenities or the uniqueness of downtown retail opportunitites may offset the negative influence of reduced accessibility.

K-8. Keyser Marston Associates, Inc., Long Beach-Los Angeles Rail System Transit Project: Economic Development Strategy, Los Angeles County Transportation Commission, Los Angeles, California, April 1984.

This paper presents the economic development strategy prepared for the Los Angeles County Transportation Commission (LACTC) in conjunction with the planning, construction and operations of the Long Beach-Los Angeles Rail Transit Project (LRTP). The purpose is to provide LACTC with a definition of the strategy, a policy framework, administrative procedures, organization and staffing guidelines, and financing considerations.

The paper contains five sections. Section I states the purpose of the report, contains an overview of the organization of the report, and provides a summary of the economic development strategy. Section II outlines the analytical approach utilized in delineating the economic development strategy by reviewing the conclusions from previous reports prepared during the work effort. Section III summarizes the issues related to preparation of the strategy while Section IV discusses the implementation of the strategy. Section V summarizes conclusions of the report. The appendix contains a detailed description of a prototypical development.

Essentially, the economic development strategy prepared for LACTC is the pursuit of a coordinated program of real estate-related activities to protect and enhance the public investment in the LRTP, and to encourage private investment and employment creation in the transit corridor, within the parameters of LACTC's policies, legal authority and funding availability. Primary focus of the strategy is real estate-related activities engendered in connection with the planning of the LRTP, and continued into the construction and operating phases of the project. The real estate activities center on planning for a proper integration of adjacent land uses with transit facilities, and assemblage and disposition of development sites. Other ancillary economic development activities are selectively included in the strategy only when they are specifically required to support components of the real estate-related activities.

K-9. Khisty, C.J., "Land-Use-Allocation Model for Small and Medium-Sized Cities", Transportation Research Record 730, Transportation Research Board, Washington, DC, 1979, pp. 34-38.

A residential land-use-allocation model most suitable for use in small and medium-sized cities is described in the paper. It can also be used in large metropolitan areas to serve as a check or backup method on the reasonableness of forecasts produced by more sophisticated models. The model makes use of Gompertz curves and the concept of holding capacity to allocate regional totals to planning areas. Residential development factors are then used to further distribute these planning-area totals to small areas such as census tracts or traffic zones. In an ex post facto test of this model in which the U-statistic was used as a measure of performance, the accuracy of the method was found to be excellent in comparison with that of sophisticated, computer-oriented urban development models. Use of the procedure, according to Khisty, will save money, time, and personnel, all of which are important considerations for planning organizations that work under a fixed budget.

K-10. Kihl, Mary and Flathers, T., "Intergration of Land Use, Transportation, and Energy Planning in Midsized Cities", Transportation Research Record 940, Transportation Research Board, Washington, DC, 1983, pp. 28-33.

The authors report that in the last 10 years numerous strategies have been employed by federal, state, and local governments in an effort to facilitate energy convservation. However, many of these strategies appear to have been directed toward short-term solutions. Broad-based concerns about the long-term efficiency in using energy resources appear remote and somewhat unreal to those concerned about personal efficiency and convenience in tripmaking. Whereas federally assisted highway projects helped to scatter urban residents into automobile-dependent suburbs, revised land use plans initiated by local government and carried out with the cooperation of investors might potentially help restore more energy-efficient environments according to Kihl and Flathers. The paper considers the extend to which city planning efforts have formally or informally accepted that challenge in the decade since 1973. The study focuses on the use of such land use planning policies as the encouragement of infill and the development of neighborhood service centers as means of affecting modifications of travel patterns. After an analysis of the experiences of a national sample of 10 midsized cities, it was concluded that 10 years after the Arab oil crisis the potential for redirecting development patterns in midsized cities has only recently been recognized.

The authors conclude that although the flexibility of some current planning techniques facilitates the redirection of land use, midsized cities have also been fairly successful in using more traditional approaches such as variable utility rates and limited sewage line expansion. Cities with planning objectives indicating a need to redirect development patterns have generally been able to effect at least

some changes in land use with whatever approaches were supported politically. Outside regulations or public lack of concern inhibited others from pursuing similar strategies. The key elements, per the authors, which forge the links between land use, transportation, and energy are not city size, terrain, location, or the use of specialized planning techniques but rather public determination, a positive political climate, and clearly defined planning objectives.

K-11. Kim, T.J., "Effects of Subways on Urban Form and Structure", Transportation Research, Vol. 12, University of Illinois, Urbana, Illinois, August 1978, pp. 231-239.

The 9 page paper describes a general equilibrium model that was built which shows how the locations of employment and residences are related to alternative transportation systems. The model was applied to different size cities. The analysis suggests that the construction of a subway system will not necessarily result in the revitalization of the central business district (CBD) or in the reversing of the trend toward suburbanization. Although land rent is generally higher in the city without subway systems than in the city with subway systems, the steeper rent gradient, along with other findings, suggest that the rate of suburbanization of the city without subways systems is not significantly higher than of the city with subway systems.

K-12. Knight, Robert L. and Trygg, L.L., Land Use Impacts of Rapid Transit: Implications of Recent Experiences, Contract No. DOT-OS-60181, U.S. Department of Transportation, Washington, DC, August 1977 (NTIS No. PB-287 190/3ST).

The 266 page report seeks to display available evidence on the extent to which recent (post-World War II) major rapid transit improvements in the United States and Canada have influenced urban land use. From this compilation are derived several types of conclusions. The factors governing the size and nature of land use impacts of transit are determined; implications for related future research are identified. The report's intended use is as a resource for those involved in the planning and evaluation of possible improvements in urban transit systems.

K-13. Kulkarni, R., et al., Maintenance Levels-of-Service Guidelines, NCHRP Report 223, Transportation Research Board, Washington, DC, June 1980.

Highway managers, at state and district levels, will find this report helpful in the difficult task of establishing levels of service for different elements of a highway that are consistent with regard to multiple and often conflicting considerations such as safety, riding comfort, economics, environmental impact, protection of investment, and aesthetics. Systems analysts will find the report helpful in explain-

ing the application of decision analysis principles to maintenance planning. The report provides a procedure that allows for different levels of service to be established for various maintenance conditions, road classifications, and local values. Local values are reflected in the levels of service through systematic assessment of tradeoffs between different considerations.

K-14. Kumer, Ashok and Gur, Yehuda, "Consideration of Alternative Access, Egress, and Line-Haul Travel Choices Within UTPS Framework", Transportation Research Record No. 895, Transportation Research Board, Washington, DC, 1982, pp. 11-17.

In many large metropolitan areas more than one line-haul transit service is often available in some travel corridors. Examples include express bus and rail rapid transit, commuter rail and rail rapid transit, private transit, private suburban bus lines and competing service provided by a regional transit operator. This is especially true as one moves away from the core area and travel corridors become wider. Coupled with the choice of line-haul modes are several choices of accessing these modes such as walk, feeder bus, park-and-ride, and kiss-and-ride.

This paper addresses these issues and describes a systematic procedure for analyzing such mode choices. It is argued that straightforward use of urban transportation planning system (UTPS) programs prevents meaningful analysis of important policy issues due to their all-or-nothing assignment principle, when real access-egress and line-haul choices have to be considered.

L-1. Lee, Douglass B., BART-II: Pre-BART Studies of Environment, Land Use, Retail Sales - Impacts of BART on Prices of Single Family Residences (Final Report), Contract No. DOT-OS-90023, U.S. Department of Transportation, Washington, DC, June 1973 (NTIS No. PB-236 746/4SL).

The 53 page report presents a statistical analysis of the effect of the anticipation of BART service on sales values of single family homes in central Contra Costa County. Chapters include discussion of longitudinal residential samples, cross-sectional residential samples, and a commerical sample.

L-2. Lee, Douglass B., Jr., "How to do a Transit Station Land-Use Impact Study", Transportation Research Record 677, Transportation Research Board, Washington, DC, 1978, pp. 28-33.

Lee indicates that several improvements in the conceptual basis and methodology for studies of land-use impacts have occurred over the past two decades. However, he continues, the framework is still incomplete because the need to incorporate the policy context into the study

design has not been fully recognized. A revised model for impact studies is proposed, and the approach is illustrated by a case study of a planned rail rapid transit station in this paper. One of the major differences between this and previous methods is that the method described acknowledges several possible outcomes or impacts as a function of alternative public policies in addition to the transit station itself. Five categories of impacts are evaluated: 1) public facilities; 2) environment; 3) market; 4) neighborhood; and, 5) costs and revenues.

L-3. Levinson, Herbert S., "Urban Travel Characteristics", Transportation and Traffic Engineering Handbook, Second Edition, Institute of Transportation Engineers, Washington, DC, 1982, pp. 255-307.

A chapter on urban travel characteristics, written by Herbert S. Levinson for the ITE Handbook, contains information on trip generation, trip purpose, trip lengths, and travel modes; shows how populations, density, income, car ownership, and age influence travel behavior; and summarizes central business district travel. It also shows how people respond to changes in transportation service or costs.

The information can be used to analyze current conditions, to evaluate traffic impacts of proposed developments, and to derive broad-gauged estimates of future travel demand. The various factors and relationships can help to formulate and assess traffic modernization programs and transportation system management plans. They can serve as a benchmark in evaluating changes in characteristics as they relate to revisions in transportation systems. The principal focus is on transportation characteristics of U.S. and Canadian cities; however, selective information is provided on cities throughout the world for comparative purposes.

L-4. Liew, Chong K. and Liew, C.J., "Use of Multiregional Variable Input-Output Model to Analyze Economic Impacts of Transportation Costs", Transportation Research Record 747, Transportation Research Board, Washington, DC, 1980, pp. 5-12.

The authors state that transportation cost plays a crucial role in determining regional development and trade flows. A lower transportation cost increases the trade flows among regions and contributes to regional development. A higher transportation cost reduces trade flows and deters regional development. An improvement in transportation facilities, such as the construction of highways, waterways, and railways, stimulates regional economic development and interregional trade flows, since such improvement reduces transportation cost.

A multiregional variable input-output model is introduced in the paper to investigate the impact of a change in transportation costs on regional development and trade flows. Regional technical coefficients and trade coefficients are endogenous variables to the model and are sensitive to transportation costs as well as other input costs. Each

industry is assumed to have a linear logarithm production frontier with a constant return to scale. Profit-maximizing price frontiers are obtained from the dual relation. These prices are expressed in terms of transportation costs, wage rates, land prices, input elasticities, and parameters of technical progress. These prices determine the regional technical coefficients and trade coefficients. The impact of a change in transportation costs on trade structure, regional growth, and inflation is investigated by using 1963 three-region, 10-sector interindustry flow data as a base. The authors found that an increase in transportation cost between regions reduces the trade coefficient between the regions and increases the "own" trade coefficient, (i.e., the purchases from other regions decrease and the purchases from local markets increase as the costs of transportation increase). An increase in transportation cost hampers regional development, but its sensitivity differs among industries according to the paper.

L-5. Liskamm, William H. and Conradt, R., Serramonte Transit Center Study, Report No. DOT-I-83-45, Mass Transportation Administration, Washington, DC, June 1983.

The purpose of this study was to determine, from the Serramonte Center plan for the San Mateo County Transit District, guidelines for achieving the successful design and operation of a bus station and bus access arrangement on a shopping center site, including identification of the important problems and issues involved, and suggestion of methods to overcome the problems and achieve the construction of such a project. The scope of the study was necessarily limited by budget and time schedule, and by the fact that the construction of an actual bus station on the site was not likely to occur in the near future. Because there are no planners, architects, or engineers now designing the expansion plan for construction, the design possibilites that can be drawn are only sketches of the future construction that may actually occur. The actual arrangements of building areas and parking structures were only assumed in a general way.

The consulting team interviewed managers and staff members of Serramonte Center and SamTrans to determine their interests and concerns about bus facilities and services on the Serramonte site, and to identify possible issues for further consideration in the study. The issues were then reviewed at a joint meeting of Center and Agency representatives, and certain issues were selected for further study. A survey of shopping center employees was conducted to determine the conditions of bus usage by workers on the site.

Sketch plans were prepared for alternative station locations and arrangements. The plans were reviewed separately, and then jointly, with the Center and the Agency in order to determine likely problems and preferences, and suggest methods of overcoming the problems.

L-6. Lundberg, Barry D. and Aller, T.L., "Joint Development in Cedar Rapids", Planning, Volume 50, No. 6, American Planning Association, Chicago, Illinois, June 1984, pp. 11-14.

Most of the interest in joint development and value capture related to transit has focused on large cities that are building or expanding rail transit systems. Lundberg and Aller investigated a recent transportation center project in a mid-sized Iowa city and contend that smaller communities also can use transit as the keystone for joint development.

The Cedar Rapids Ground Transportation Center (GTC) complex was opened in November 1983 and was a "hallmark for the nation" in public-private partnership. The $31 million complex includes: the city bus system's main downtown station; an intercity bus terminal with ticket offices, baggage storage, and parcel services; a 13-story, 140,000-square-foot private office building; a 500-car parking garage; a pedestrian mall concourse that connects to the central business district; four skywalk links to adjacent development; and a 96-unit housing project for the elderly and handicapped.

The paper examines the planning of the complex and the resulting benefits including:

1) Renovation of a major office building;
2) Renovation of an abandoned warehouse for a high-tech industry;
3) A new central library connected to the center; and,
4) A new riverfront park across the street.

L-7. Lutin, Jerome M. and Markowicz, B.P., "Interactive Model for Estimating Effects of Housing Policies on Transit Ridership", Transportation Research Record 835, Transportation Research Board, Washington, DC, 1981, pp. 47-52.

The authors state that planners and urban policymakers have long recognized that a strong relationship exists between urban development forms and the existence of rapid transit systems in cities. In recent years, new transit systems have led to significant positive changes in urban development. It is believed that the existing high level of automobile accessibility tends to obscure the increases in mobility achieved by transit. Many planners and policymakers believe that transit systems can be more effective in meeting the travel needs of the public, more energy efficient, and require less subsidy if land use planning in transit corridors can be coordinated with the planning of the transit system itself, according to the authors.

This paper reports on computer graphics developed as part of an interactive computer model designed to assess the impact of housing policies on transit ridership in urban transit corridors. A set of programs was written in APL to implement the model in an interactive computer environment, with computer graphics used for both input and model output. A mode-split model that uses U.S. Bureau of the Census

data predicts ridership for the transit line, based on discrete combinations of mode and access mode including walk-and-ride, park-and-ride, kiss-and-ride, and feeder bus. The program permits the analyst to input alternative residential patterns, with respect to location and density, in the transit corridor and to evaluate the effects on transit ridership by comparing various alternative housing policies. Computer graphics are used at two levels. First, as an input mode, graphics allow the planner to create new transit route alignments and station locations by using a screen cursor. The program then models station choice from the zones, on the basis of a number of variables, including driving or walking times to stations, transit fares, line-haul travel times, etc. As an output mode, graphics are used to display socioeconomic data, mode-split results, or any algebraic combinations of input or output data. Different types of graphic displays are used for data presentation at the zone level or station level. Throughout the development of the graphics, special attention was given to the readability of the output. The paper reflects the general effort to produce more visually attractive and commonly understandable outputs. Included in the paper are a description of the program design and organization, examples of graphic output, and a discussion of the ability of the model to provide useful output to policymakers.

M-1. MacDonald, Ray, "Practical Solutions for the Financing and Construction of PRT Systems", International Conference on Personalized Rapid Transit, Vol. 1, Paper 7, University Colorado, Center for Urban Transportation Studies, Boulder, Colorado, September 1975.

The 24 page paper states that as long as transit authorities try to serve the automobile generated urban forms of today with existing technolgoy, they will have limited success, high costs, public resistance and very limited impact upon urban development patterns. MacDonald contends that this is true for PRT systems as well as the more conventional type of transit systems. It is obvious that in most low density areas there is insufficient demand for two major transit modes and even PRT systems cannot attract more than a 15% to 20% mode split in most urban areas. This limits the guideway coverage of any economical system. It is this cost-partronage spiral which inhibits transit from reaching the "critical mass" where it might become sufficiently effective to induce major changes in urban development and travel patterns. PRT should not be planted in a hostile environment but rather in a receptive, fertile and possibly protected environment. The paper describes such receptive environemnts, along with financing and other aspects of PRT.

M-2. May, Adolf D., "Demand-Supply Modeling for Transportation System Management", Transportation Research Record 835, Transportation Research Board, Washington, DC, 1981, pp. 80-86.

May states that operational problems are encountered in the existing transportation system, and inefficient use results when traffic demands exceed traffic capacities. The byproducts of such operational

situations are increased travel time, less-reliable service, higher accident rates, greater fuel consumption, and increased vehicle emissions. Historically in the United States, the normal approach to a solution was to increase capacity when such operational problems were encountered. Such actions were generally very expensive, often disrupted the environment, and encouraged further growth in the traffic demand.

This paper gives a review of the development and application of a family of operational planning models that are used to predict impacts and traveler responses resulting from traffic management strategies in freeway corridors, arterial networks, dense networks, and rural highways. An overview of the long-term research program and the identification of current research efforts are also included. One of the major goals of the research program, according to May, is to propose policy guidelines for implementing traffic management strategies. Initial policy guidelines for freeway priority lanes, freeway-entrance control, arterial priority lanes, arterial-signal control, dense networks, and rural highways are included. The following conclusions are drawn in the paper: (a) increased attention should be given to controlling the demand side of operational problems by spreading demand over space, time, and mode and by reducing the total demand level; (b) increased attention should be given to assessing energy and environmental impacts of improvement alternatives as well as to continuing the assessment of safety and levels of service; (c) creative techniques need to be devised to generate and screen traffic management strategies prior to analytical evaluation; and (d) greater use of operational planning models by facility operators is essential if our existing transportation system is to be managed effectively.

M-3. McQueen, James T., et al., The Evaluation of the Shirley Highway Express-Bus-on-Freeway Demonstration Project, Urban Mass Transportation Administration, Washington, DC, August 1975, (NTIS No. PB-247 637/2ST).

The primary goal of the project was to demonstrate that express bus-on-freeway operations can improve the quality of bus service and lead to an increase in the people moving capability of peak period transportation facilities for an entire urban corridor. Other project goals were to demonstrate the effectiveness of this technology as a means of reducing auto pollutant emissions and gasoline consumption, improving the mobility of the transportation disadvantaged and the economic condition of the transit operator.

An analysis of bus operations is presented in the 154 page report which shows that the project effected an improvement in the quality of the Corridor bus service, evidenced by the reduction in travel times by bus, and the increase in both the reliability and the coverage of the bus system.

M-4. Merchant, James P., Gussman, V. and Falcke, C.O., Study of Retail Sales and Services (Working Paper on BART Study), Contract No. DOT-OS-30176, U.S. Department of Transportation, Washington, DC, April 1978, (NTIS No. PB-291 443/OST).

The 84 page study focuses on how BART is influencing the distribution and volume of retail sales in the BART service area. Shoppers in six retail areas were surveyed to ascertain how their shopping patterns had changed since BART service began. Retailers throughout the BART service area were interviewed to determine whether BART influenced their location decisions or retail sales. Sales tax data in seventeen retail areas were analyzed to search for sales trends associated with proximity to BART.

M-5. Metropolitan Planning Organization, DPM Assessment Study Design: Miami Downtown People Mover, Metropolitan Dade County, Miami, Florida, September 1980.

The Urban Mass Transportation Administration Downtown People Mover Program is intended to demonstrate if the Shuttle Loop Transit Systems can provide a reliable and economic solution to local circulation problems in downtown areas. UMTA is funding at least four DPM systems and simultaneously requiring local agencies to measure impacts and performance of those systems. This study design describes an effort to measure the actual impacts created by the DPM. Impacts would be measured in the following areas:

- travel in the Central Business District (CBD);
- demographic make-up of the DPM service area;
- economic vitality and development of the service area;
- system costs and revenues;
- use and community perceptions;
- environmental impacts; and,
- performance of the DPM as an urban travel mode.

Each of these impact areas are addressed in the study design in terms of the data collection activity required and the measurement critieria to be applied. The data collected in the study will allow:

- better land use planning by measuring the ability of the DPM to encourage growth and new development;
- better transit service planning by measuring the assessibility provided to essential services for the elderly and handicapped populations;
- better transportation planning by measuring the need to increase roadway capacity in the study area;
- an analysis of the applicability of the DPM to other County activity centers, such as the Civic Center Hospital and Government office complex; and,

- better transportation analysis tools by making it possible to update the regional transportation and land use planning techniques.

The data will also be useful in updating the five year Transit Development Program, the Long Range Transportation Master Plan for the year 2005, and fulfilling other basic Metropolitan Planning Organization planning requirements. The work described in the study design is to be done over a four to six year time period. It is estimated to cost approximately $1.3 million. The project is broken into three parts including: 1) analysis of preconstruction impacts; 2) construction-related impacts; and, 3) impacts related to actual operations.

M-6. Metropolitan Washington Council of Governments, Economic and Transportation Impact Analysis: Takoma Park Study Area, Washington, DC, February 1968, (NTIS No. PB-184 235).

The impact study, described in this 115 page report, extends for about one quarter mile from the access point of a proposed rapid transit station on Cedar Street. The total area includes portions of the District of Columbia and unincorporated sections in Montgomery and Prince George's counties.

M-7. Metropolitan Washington Council of Governments, Metrorail Station Area Planning: A Metrorail Before-and-After Study Report, Report No. DOT-I-83-50, Urban Mass Transportation Administration, Washington, DC, August 1983.

The Washington area Metrorail transit system was planned to improve travel and to reduce dependence on the automobile. In addition, the proposed transit system was seen as an opportunity to channel growth and development in a rapidly growing metropolitan region. The long-range policies plan for the Washington region called for future growth to take place in suburban corridor cities and new towns linked to Washington by freeways and rapid transit lines. The system plan calls from completion of 101 miles of rail and 86 stations by 1996.

Section 2 of this 169 page report describes responsibilities for station area planning and highlights the responsibilities of Federal, state and local governments. Section 3 describes the Washington Metropolitan Area Transit Authority (WMARA) which operates the Metrorail and bus systems. The WMATA development program was established to promote more intensive development at transit stations and encourages: 1) joint development of transit properties and adjacent real estate; 2) direct connections between transit stations and adjoining development; and, 3) coordination of Metro station planning with comprehensive planning performed by local governments. Section 4 contains descriptions of 18 Metrorail station areas studied during 1980 and 1981, with an emphasis on land use planning affecting the various stations. The following findings, based on the case studies, are:

1. Within the study areas, there has been considerable planning in anticipation of Metro.

2. By 1980, relatively few Metro related projects had actually been initiated. Time required for development was much longer than expected because:

   - Implementation of rail service was slower than expected;
   - The time required for the development process at many of the Metro stations is even longer than usual; and,
   - The high interest rates since 1979 have made real estate development a much higher-risk business.

3. Availability of Metro makes nearby properties more attractive for development. However, an understanding of the importance of Metro requires:

   - A recognition that there must be sufficient market demand to sustain additional development; and,
   - A good understanding of what the market can support, even in a strong market area.

4. Uncertainty over the future of a particular station is a strong deterrent to development.

5. Projects actually being implemented around Metro stations are primarily office complexes, generally with other commerical uses. High-density residential development has not been significant in most case study areas.

M-8. "Metrorail Impacts on Washington Area Land Values", Subcommittee on the City; Committee on Banking, Finance, and Urban Affairs, U.S. House of Representatives, Washington, DC, January 2, 1981.

A sample of the land value increases generated by the opening of Metro leads to the finding that a minimum of $2 billion in land values has already been added to the existing land value base. This amount does not count any of the values being added to land adjacent to stations that are not yet in operation, all of which are the scenes of rapidly rising site values. Also, the $2 billion amount does not count any of the downtown D.C. blocks that are more than two blocks from Metro, though most observers agree that the Metro impact zone includes land three or four blocks (an easy walk) from the nearest station. The implications, as presented in the staff study, of the $2 billion worth of enhanced land values are:

1. Taxpayers created these values, through their contributions to Federal, state and local governments and should be gaining tax relief from these riches.

2. The biggest share of these new values is going to the people who own land within easy access of Metro stations.

3. A trickle of these new values is into local governments via property taxes.

4. In only four joint development projects, WMATA is leasing space over its stations to reap from commercial users a perpetual rent from the values it has created; 4 out of 41 operating stations is almost an insignificant proportion.

5. There are ways that the US. Department of Transportation, transit authorities and local governments could be capturing a greater share of new values fostered by the rapid rail systems:

   - Extension of the joint development process.
   - Purchase of excess land around new stations, which can be sold for early recapture or rented to reap long-term returns.
   - Creation of special assessment districts, especially in commercial areas, so that property owners receiving special benefits can be charged for their new advantages.
   - Modernize the property tax so it can recoup more of these "Metrodollars" in the tax base. Land values should be taxed at much higher rates, while simultaneously reducing or eliminating the taxes on housing and other buildings.

In the DC area, hindsight shows how many of these opportunities have been lost or diminished. However, every effort should be made, during completion of the last half of the Metrorail system, to apply land value recapture devices to the fullest extent possible, the study concludes.

M-9. Minkus, David, Impacts of BART on Bay Area Institutions and Life Styles, Report No. DOT-P-30-79-06, Urban Mass Transportation Administration, Washington, DC, April 1979.

This 109 page report focuses on the effects of BART on the Social Institutions and Life Styles of Bay Area residents. The project addresses the impacts of BART on three primary institutional spheres and their clients: 1) local political institutions including community responses to BART; 2) Institutions of Higher Education and their students; and, 3) Health Care Institutions and their clients.

At the institutional level, case studies are designed to assess BART-related changes in the organization of institutional activities, and to determine changes in the social experience and expectations of their participants. The study of life style impact focuses upon direct and indirect impacts of BART upon the use and experience of different

transportation modes, commuters, household routines, family routines, and the family as an institution. BART has had limited impacts on Bay Area life styles and social institutions. It has had the greatest impact upon commuters from suburban residential communities to the central business districts of San Francisco and Oakland.

M-10. Minkus, David and Gelb, P.M., Impacts of BART on Bay Area Health Care Institutions; BART Impact Program, Contract No. DOT-OS-30176, U.S. Department of Transportation, Washington, DC, March 1977, (NTIS No. PB-266 614/7ST).

The 55 page report describes the effects of the Bay Area Rapid Transit (BART) System upon local health care institutions, as determined by surveys of patient travel to medical care facilities having varying degrees of public transit and BART service. Administrative personnel were also interviewed to discover and report upon institutional policy-making responses to the presence of BART.

M-11. Misch, M.R., et al., Guidelines for Using Vanpools and Carpools as a TSM Technique, NCHRP Report 241, Transportation Research Board, Washington, DC, December 1981.

A fundamental strategy of transportation system management is to encourage more efficient use of highway and roadway vehicles and space through higher vehicle occupancies. Although highways and transportation departments, transit authorities, and other public agencies can and do encourage increased commuter use of carpools and vanpools in large and small urban areas in a variety of ways (computer matching, purchase of vans for vanpooling, parking incentive programs, preferential highway treatment, etc.), many people fail to take advantage of, or even resist, these opportunities when offered. Decisions to participate in commuter-ridesharing arrangements are based on many factors (economic, social, and psychological). Not well understood until now is how the two ridesharing alternatives of carpooling and vanpooling differ in their appeal to commuters in urban regions, and how the great variety of incentives for carpooling and vanpooling affect their use. An understanding of the underlying factors that motivate the decision to rideshare has been necessary in order to assess the full potential of ridesharing development and to determine effective strategies to achieve that potential. Many existing institutional factors shape the kinds of carpooling and vanpooling incentives: 1) regulatory; 2) zoning; 3) insurance; 4) profit motive; 5) funding limitations; and, 6) sponsor types. The determination of effective strategies and the subsequent evaluation of their implementation require methods and criteria that consider social, economic, travel, energy, and environmental impacts, as well as the perceptual, preferential, and attitudinal concerns of the public and decision-makers generally. Such concerns and impacts until now have not been determined or assessed.

This manual is of principal interest to urban transportation policy makers and practitioners, especially ridesharing practitioners, concerned with transportation system management. Furthermore, it is of interest to heads of ridesharing departments in private and public sectors. The policy maker now has a ready reference of core information needed to assess the potential of ridesharing as an element in the Transportation Improvement Program. Urban transportation practitioners can find a host of how-to-do-it information to assist in: 1) targeting the market; 2) determining appropriate ridesharing incentives; 3) selecting the appropriate ridesharing, and organizational types; 4) identifying federal policies and programs relevant to ridesharing; 5) determining a role for transit operators in the ridesharing program; and, 6) evaluating the effectiveness of proposed and on-going ridesharing programs.

M-12. Moore, Charles Thomas, Land Use Analysis In A Highway Corridor Area, Report No. HPR-13-B, Bureau of Public Roads, U.S. Department of Transportation, Washington, DC, February 1968, (NTIS No. PB-179 583).

The primary purpose of this 144 page research effort was the continuation and intensification of economic base and land use analyses in a multi-county corridor area with Birmingham, Alabama, and Interstate Highway 65 as the Major foci. Specific attention was given to land use at ingress and egress points on Interstate Highway 65 and to economic base analysis in a multi-county corridor area. Other supply-side studies of transient-oriented facilities and public and semi-public facilities responses to highway construction provide insights into the impact on land uses of new highways according to Moore.

M-13. Muse, Edward C., "Environmental Planning and Design for Rapid Transit Facilities", Transportation Research Record 716, Transportation Research Board, Washington, DC, 1979, pp. 1-8.

The National Environmental Policy Act of 1969 and related environmental laws mandated certain environmental considerations for major federal actions. The prinicipal tool for documenting these considerations was the environmental impact statement. This requirement, interpreted and implemented by each federal agency, has given environmental planning concerning federally funded public improvements, such as transit facilities, its scope. This paper discusses the environmental planning studies and methodologies involved in preparing an impact statement for rapid-transit projects under the Urban Mass Transportation Administration. Emphasis is given to major issues, including alternatives analysis, environmental-impact analysis (including "land use and urban development" considerations), and analysis of parklands and historic properties. The Metropolitan Dade County Rail Rapid Transit System is used as an example.

As reported in the paper, the impact on land use and urban development in a study should focus on the relation of the transportation improvement to current and projected land-use trends and adopted plans and policies. Land-use impact analysis for Dade County's rapid transit system involved considering each project's influence on existing land-use patterns, compatibility with existing plans, and opportunities for new development. To determine the compatibility of the system with existing plans, the proposed project was evaluated in terms of how it would support and complement the Comprehensive Development Master Plan. Opportunities for new development were calculated based on the existing character of the land, the probable impact of the transit stations, and the land-use trends in the area.

N-1. Nicholls, William L., Sampling and Field Work Methods of 1973-74 BART Impact Travel Study (Working Paper), Report No. MTC-WP-1-3-74, Contract No. DOT-OS-30176, U.S. Department of Transportation, Washington, DC, July 1974, (NTIS No. PB-235 046/0).

The 138 page Working Paper summarizes the survey methods of the 1973-74 BART Impact Travel Survey. The main body of the report presents a detailed description of the methods and procedures employed in the survey which should be of primary interest to analysts of the survey data and to those reviewing the survey from a methodological perspective.

Three appendixes are attached. The first lists additional sampling, field work and coding documents employed for the survey. The second provides facsimiles of the introductory letter mailed to sample households prior to interviewing. The third provides a series of maps showing the boundaries and time zones of the survey's four study areas.

N-2. 1981 Transit Impact Monitoring Program Annual Report: Technical Appendix, Atlanta Regional Commission, Atlanta, Georgia, January 1982.

This document is the Technical Appendix of the 1981 Annual Report for the Transit Impact Monitoring Program (TIMP) conducted under the leadership of the Atlanta Regional Commission. The TIMP is intended to measure, analyze, and evaluate the various transportation and land use impacts of the construction and operation of MARTA rail transit service in the Atlanta Region. This report highlights the progress and findings in the fifth year of the TIMP.

A work program was developed that detailed the major impact monitoring activities with component work elements including the writing of study designs, identification of impact measures, data collection procedures, and data analysis methods. The current TIMP Work Program requires three modes of reporting information: 1) Event-oriented reports (studies and reports that are triggered by major events or milestones in the development of the MARTA system): 2) technical

information reporting (study designs, data collection procedures, annual up dates of impact measure data, case study reports, and various other reports); and, 3) the Annual Report (meant to provide an overview of the purposes, progress, and current status of all that is happening in the TIMP).

The 1981 TIMP Annual Report has two volumes. The first volume contains a brief, topical overview of findings of the program so far. The second volume is this technical appendix which provides additional detail and methodology. The Technical Appendix is organized according to the titles and sequencing used in the TIMP Work Program. There are sixteen Tasks comprising the Work Program (Tasks 1 through 8 relate to transportation impacts, Tasks 9 through 14 to land use impacts, Task 15 is the production of reports, and Task 16 is the production of computer graphics).

N-3. Noguchi, Tomoki, "Shaping a Suburban Activity Center Through Transit and Pedestrian Incentives: Bellevue CBD Planning Experience", Transportation Research Record 861, Transportation Research Board, Washington, DC, 1982, pp., 1-6.

Downtown Bellevue is a typical suburban central business district (CBD) and is emerging as one of the major activity centers in the metropolitan Seattle region. With cooperation from transit and other agencies, the City of Bellevue took several actions related to land use and transportation in recent years. In essence, the City's goal is to direct the anticipated growth to create a people-oriented urban activity center through transit, pedestrian, and other incentives. Actions taken on parking management, the pedestrian mall, the transit center, and the incentive transit service agreement will have significant impacts on the intensity of activity and the pattern of development in the Bellevue CBD.

The City has adopted land use regulations necessary to transform the suburban automobile-oriented center into an urban activity center designed for people. However, land use regulations alone will not be enough to achieve this goal. According to the author, if land use regulations are closely coordinated with transportation elements, such as those described, the impacts would be much greater. The experiences gained during the Bellevue CBD planning process are valuable to others who are working in similar circumstances in other parts of the nation if planners and decision-makers hope to transform a suburban automobile-oriented CBD into a people-oriented activity center.

O-1. O'Carroll, Susan Jones and Spivack, G.S., "Joint Development and the Los Angeles Metro Rail--A Status Report", Paper for the 63rd Annual TRB Meeting, Transportation Research Board, Washington, DC, January 1984.

The purpose of this paper is to document the beginnings of the Joint Development experience in Los Angeles. As part of the preliminary engineering phase of its Metro Rail Project, the Southern California Rapid Transit District (SCRTD) Board of Directors adopted a set of land use and development policies geared towards both encouraging a pattern of land use consistent with the City's adopted concept of development, and assuring a stream of revenue to help defray the construction, operating and maintenance costs of the system.

The SCRTD intends to use Joint Development and Value Capture techniques to accomplish these two aims. To implement these policies, the SCRTD has established a Masterplanning process aimed at achieving early regional concensus on joint development issues and established cooperative agreements with the Community Redevelopment Agency of Los Angeles (CRA) and the City of Los Angeles for the development of detailed Metro Rail Station Area Master Plans. These agreements are the first step in the creation of a cooperative entity which is designed to guide Joint Develoment around stations.

Although it is too early to judge the success of the SCRTD's approach, its actions are significant because they have occurred so early in the development of the rail transit system. If the SCRTD is successful in establishing concensus through the Masterplanning process, the Metro Rail Project may become the best test, begun to date, of the benefits of Joint Development, according to the authors.

O-2. OECD Road Research Group, Transport Choices for Urban Passenger - Measures and Models, Organization for Economic Cooperation and Development (OECD), Washington, DC, September 1980.

The report is the result of a study carried out in 1978 and 1979 on methods to describe and influence modal split. Experts from twelve OECD Member countries pariticpated to review the international state-of-the-art in this field which is gaining in prominence due to the economic, environmental and energy constraints of urban transport. The report presents some of the alternative strategies for influencing modal split and describes available measures and some of their possible effects (Chapter I).

Chapter II presents the results of a survey regarding the aims, measures taken or visualized to modify modal split, the type of investigations carried out (including data collection), the effects obtained and the achievement of the aims. In Chapter III, a short historical overview of existing urban transport models is given with special emphasis on the modal split models. The Chapter deals with the different types such as elasticity models, aggregate (zonal) models and prediction. Practical experience of modelling and data requirements are also discussed in this Chapter with reference to some of the exam-

ples described in Chapter II. From considerations of the need for a more comprehensive understanding of urban travel behavior, Chapter V examines the future research fields regarding the possible development of modal-split models, also taking into account the subjective factors which govern travellers' selection of transport modes. Items such as interaction between modal split and other components of transport modelling procedures, inertia effects, land use/transport interactions and behavioral variables are also discussed. Chapter VI presents the conclusions and recommendations of the Group regarding improvement of modal-split models and their ability to describe the effects of certain measures which influence the relative use of transport modes.

Urban travel patterns may be thought of in terms of two distinct yet complementary properties: 1) the structural properties; and, 2) the marginal properties. The structural properties are dictated by urban spatial characteristics which in turn are determined mainly by factors exogenous to the transport sector including land-use policy, the housing market, and so on. The marginal properties of travel are reflected in the characteristics of travel by the alternative modes between particular origins and desitinations such as travel time and costs.

Most measures which influence mode choice decisions have focused on the marginal properties of trips. Policy changes have concentrated on the public transport system through improvements to the level-of-service and fare reductions. Most of these measures have been largely ineffective although groups of measures directed simultaneously towards a number of the individual trip components may be more effective. It seems clear that substantial changes in the use of the different transport modes will be achieved only if fundamental changes in the structure of urban travel are achieved.

O-3. OECD Road Research Group, Urban Public Transport: Evaluation of Performance, Report ISBN 92-64-12127-7, Publications and Information Center, Organization for Economic Cooperation and Development (OECD), Washington, DC, October 1980.

This Road Research Group was established to examine the issue of urban public transport performance, and to identify approaches to evaluating public transport service through the use of performance measures. As services expand and capital investments are made, the need to evaluate performance and assure that the operation of the service is both efficient internally and in its larger community also expands.

Chapter I of this report introduces various concepts of transport performance and relates them to different users and purposes. Chapter II discusses these various specialized groups and their perceived needs for performance measures. Chapter III discusses performance parameters and data collection problems, followed by discussion of various functions served by performance indicators in Chapter IV. Chapter V of the report gives attention to the central issue of the design of performance indicator packages for various contexts and situations, with

Chapter VI finally concentrating on projected research needs in this important subject area. The report's Appendix includes a summary of selected case studies of interesting approaches used in some Member countries in their performance evaluations.

The report suggests, that more attention should be given to total surface system performance, and to the development of indicators for all elements-both public and private-of the system as it impacts on the community and its economic and social development.

The OECD Group concluded that there are packages of indicators which are applicable to most urban public transport systems, in three general areas:

1) internal assessment (efficiency);
2) service planning (efficiency and effectiveness); and
3) external assessment (effectiveness).

These three sets of indicators represent a basic approach to performance evaluation for any public transport system; their direct applicability and usefulness will be a function of the uniqueness of each system, its goals and objectives, its transport and traffic system environment, and the particular goals and strategies of local governments. The report recommends that further attention be given to a broader look at transport systems and indicators, across all modes. The performance of public transport cannot be evaluated in a vacuum; its relationship to other elements of the system is critical in decisions regarding the overall performance of transport in any community, both in terms of efficiency and effectiveness. It is increasingly the whole transport system or sector that is being related to broad social, economic, and development goals, yet total system performance is rarely in focus for decisions on any scale.

O-4. Ou, Fong-Lieh and Rupe, J., "Use of IRPM for Transportation and Land-Use Planning in National Forests", Transportation Research Record 964, Transportation Research Board, Washington, DC, 1984, pp. 29-36.

The authors state that the use of optimization methods in developing cost-effective road networks is an increasingly important area of research in transportation and land use planning. The potential benefits of optimization models include fast response to planning issues and the capability to evaluate various resource development scenarios and transportation polices. However, an optimization model requires that both transportation and land use policies be tied together and that their related variables be considered simultaneously.

As reported in the paper, the U.S. Department of Agriculture (USDA) Forest Service has been developing the Integrated Resource Planning Model (IRPM) as a planning tool for integrating transportation systems and land use. IRPM is composed of several mathematical programs, including: 1) linear programming; 2) mixed-integer linear programming; and, 3) goal programming. The model's purpose is to optimize transportation systems in conjunction with resource allocation and

scheduling. The model and its application procedure are presented, along with a case study within this paper. The result of the study indicates that IRPM is capable of evaluating various transportation system options, land use strategies, and environmental scenarios. Although the model was developed primarily for use by Forest Service transportation planners and land management analysts, its utilization for planning a cost-effective transportation system and optimum land use patterns could extend beyond National Forest System lands according to Ou and Rupe.

P-1. Paaswell, R.E., et al., An Analysis of Rapid Transit Investments: The Buffalo Experience, Report No. DOT-I-81-32, Urban Mass Transportation Administration, Washington, DC, July 1981.

The role that a new fixed rail transit facility plays in the 1980's is a question asked by many sectors. The public sector wants to be assured that its current co-objectives of capturing a significant share of the travel market, and having a significant positive impact on land use are met. The private sector wants to be sure that all of the attributes associated with such development will come to function as it makes its investment decisions. Finally the technical people (local and regional planners and operators) want to ensure, through careful planning and analysis, that the public and private investment decisions are maximized.

To address the concerns of all these groups, this 88 page study was designed with the following objectives:

1. To define the nature (extent and timetable) of the transit investment and to establish the private sector response.

2. To determine the interactive nature of public sector and private sector policies, that may conflict with or reinforce the transit investment.

3. To define and use analytic techniques to measure the impact of the investment strategies.

4. To apply the above to the case study of Central Business District (CBD) revitalization in Buffalo, N.Y.

A methodological framework within which these objectives were achieved is presented. Both qualitative and quantitative techniques were developed.

P-2. Padron, Manuel, "Build Here: Transit's Rallying Cry", Planning, Vol. 50, No. 6, American Planning Association, Chicago, Illinois, June 1984, pp. 6-10.

Public-private joint development projects on transit agency-owned land are influencing development patterns in an increasing number of cities; Padron takes a look at what's happening in six of them in this paper. He reports that as federal funds for rail transit construction and operating subsidies become increasingly harder to get, cities are seeking creative ways to bring more capital into their transit systems. One method that has received a lot of attention is "joint develoment": the shared use of a piece of property to the benefit of both a public transit agency and a private party. The author states that joint development has a long history dating back to the mid- to late-1800's when private railroad companies received large grants of land from the federal government. The sale of this excess land led to the development of cities and towns along the railroad lines and the creation of vast fortunes for the railroads. In the 20th century, the federal interstate highway program radically changed development patterns across the country, bringing profits to many adjacent property owners, according to Padron.

Historically, states the author, governmental agencies and transit authorities have been inefficient in developing and managing real estate holdings. Since public agencies are subject to political pressure and often ill equipped to negotiate real estate deals, it may be in an agency's best interest to enter into an agreement--a long-term lease for example--with a developer who is experienced in generating the most profit possible from a piece of property.

Station-area development frequently is confused with the term joint development, indicates Padron in his paper. Station-area planning and development may or may not occur on property owned by a transit agency and may or may not be coordinated with the agency. A related point made in the paper is that the term joint development often is used interchangeably with "value capture"--a concept that encompasses the various means by which a community shares in the economic benefits of publicly funded improvements. Yet joint development is just one of several value-capture mechanisms, albeit the most used, and successful, one to date. Other techniques include station cost sharing, connector fees, lease of advertising space, concession rights, and special transit tax districts.

Padron limited his review to projects that were either under construction or for which agreements had been signed or legislation enacted. The value-capture projects presented were located in:

- Toronto, Canada;
- Washington, DC;
- Atlanta, Georgia;
- Miami, Florida;
- Baltimore, Maryland; and,
- Los Angeles, California.

P-3. Page, John H. and Demetsky, M.J., "Planning Development with Transit Projects", Thornton Hall, Civil Engineering, University of Virginia, Charottesville, Virginia, September 1984.

One of the principal objectives of a transit project is to stimulate economic development, according to Page and Demetsky. It is desirable to have early involvement of private sector developers in the transit planning process. However, the private sector seldom becomes involved before a transit project is nearly completed, and transit planners and public officials seldom reflect developers' decision processes into their planning in order to increase the range of economic development opportunities.

This study develops the site development model which simulates the long- and short-range decision processes of developers. These decision processes involve four steps: 1) determination of development; 2) analysis of site constraints on development; 3) anaylsis of various design and marketing options; and, 4) the financial analysis of an individual project.

Three uses of the model for typical development problems are illustrated using data from the King Street Station in Alexandria, Virginia, a station on the Washington, DC Metro System. The three applications include: 1) assessment of development potential for various locations surrounding the transit station; 2) consideration of different project designs at the same site; and, 3) the development of the marketing strategy for a preliminary design.

P-4. Page, John H., Demetsky, M.J. and Hoel, L.A., "A Methodology for Transit Station Impact Analysis", Paper for the 63rd Annual TRB Meeting, Transportation Research Board, Washington, D.C., January 1984.

A methodology is developed for the identification and evaluation of impacts created by transit terminals. A catalog of transit studies is presented which enables the user to initiate the evaluation process with the identification of critical impacts using a cross- and self-interactive matrix procedure. The cross-interaction matrix examines the impact that the station has on its environment as influenced by local land use patterns. The self-interaction matrix establishes the station design elements and identifies the most sensitive station design components. Where important impacts exist, strategies for preventing or managing the issues involved are developed in terms of altering the station design variables or site location, or promoting changes in neighboring land use so as to provide an acceptable environment.

P-5. Page, John A., et al., Catalog of Transit Station Impact Case Studies, Report No. DOT-I-83-53, Research and Special Programs Administration, Washington, DC, August 1983.

The public's acceptance of urban and intercity transportation systems is greatly influenced by the negative or positive environmental impacts created by terminals. The transit station itself is a major physical force within a community and can serve to enhance a neighborhood by bringing vitality and activity or to diminish its value by adding congestion, noise and blight. When public officials examine their options for economic development, transportation terminals offer a unique opportunity to integrate the goals of private sector development, neighborhood enhancement, and community-wide renewal.

This research considered the design of a public transportation terminal from the perspective of its effect on neighborhoods, urban revitalization, traffic congestion and parking. The effects of terminal facilities on the surrounding environment and the changes that take place when a new or renovated facility is constructed in an area were examined. Emphasis was placed on developing a taxonomy of factors to be used as a guide in assessing the environmental effects of a public transportation terminal. The objectives of the research program were:

1. To develop an understanding of the impacts on community revitalization and/or decline of public transportation terminal facilities.

2. To identify those elements of a passenger transportation terminal that create impacts on the local land use.

3. To provide a comprehensive definition of those elements within a community affected or influenced by a new transit station.

4. To develop a procedure for assessing the environmental and economic effects of station designs on communities and neighborhoods.

No formal methodology has been documented that provides the passenger terminal planner, the policy maker, or the public with a conceptual overview of the elements involved in the assessment of transportation terminal impacts. This research established a framework and associated data to be used for guiding the generation and evaluation of alternative transportation terminal exterior facilites and features at a pre-selected site in the system. The efforts reported here consist of a summary of the present state of knowledge concerning passenger terminal impacts and methods currently in use to evaluate and design for station effects. A set of impact factors related to transit station development is established and related to the associated goals and objectives as seen by the community, the user and the operator. The catalog is a collection of relevant references on all elements encompassed in the station impact assessment problem. The data provides a starting point for analyzing transit station impacts on the community

setting. It provides reference material for developing alternatives at a particular station site and enhances the formalized evaluation process. It can be used to replace or supplement local data as the resources of the study require.

P-6. Page, John H., et al., Impacts of Public Transportation Terminals on Land Use and Community Development (Methodology for the Analysis of Transit Station Impacts), Contract No. DTRS 5681-C-00031, U.S. Department of Transportation, Washington, DC, January 1984.

A methodology is developed for the identification and evaluation of impacts created by transit terminals. A Catalog of Transit Station Studies is used to initiate the evaluation process with the identification of critical impacts using a cross- and self-interactive matrix procedure. The cross-interaction matrix examines the impact that the station has on its environment as influenced by local land use patterns. The self-interaction matrix establishes the station design elements and identifies the most sensitive station design components.

Where important impacts exist, strategies for preventing or managing the issues involved are developed in terms of altering the station design variables, site location or promoting changes in neighboring land use so as to provide an acceptable environment. The application of the method using spread sheet computer software is described in the 41 page report.

P-7. Parker, Jeffrey A., "Maximizing the Use of Private Credit Markets for Transit Investments", Transportation Research Record 967, Transportation Research Board, Washington, DC, 1984, pp. 37-42.

Parker examines the opportunities created by the 1982 Surface Transportation Assistance Act to increase the role of private capital markets in financing transit investments. These opportunities include: 1) the potential for more extensive grant anticipation financing using the Section 9 block grant as a credit source; 2) potential impact on contract authority flowing from Highway Trust Fund dollars on financing options available to grantees under the Section 3 discretionary program; and, 3) the potential impact of federal funding under the 1982 Surface Transportation Assistance Act on the terms and availability of credit for the non-federal portions of transit capital budgets.

The impact of these opportunities on future applications of existing financing tools to transit capital projects is examined in the paper. Existing credit instruments, such as dedicated tax revenue bonds, transit revenue bonds, service contract bonds, general obligation debt, toll revenue bonds, and grant anticipation notes are described and examples are cited.

The conclusions reached indicate that the 1982 Surface Transportation Assistance Act will permit opportunities for longer-term grant anticipation financing and should favorably influence the terms and availability of credit for the non-federal portions of transit capital budgets. Realization of these opportunities can be expected to reduce overall project costs by allowing construction schedules to be optimized and interest costs to be lowered, according to the author.

P-8. Parody, Thomas E., "Predicting Travel Volumes for High-Occupancy-Vehicle Strategies: A Quick-Response Approach", Transportation Research Record 976, Transportation Research Board, Washington, DC, 1984, pp. 49-56.

The development of a set of demand and supply models that predict peak-hour travel volumes for high-occupancy-vehicle (HOV) strategies on freeways is described. The demand models were estimated by using a consistent series of before-and-after empirical data from a number of actual HOV facilities located across the United States. Supply models were developed on the basis of speed-volume relationships that estimate changes in running speeds and travel times on the general-purpose lanes for different volume levels and capacity configurations. These models have been incorporated into a set of easy-to-use worksheets to predict equilibrium travel flows of vehicles on the general-purpose freeway lanes and of carpools and buses on the HOV lane or lanes.

The models forecast the net change in volume due to mode shift, time of day, trip generation, and route diversion behavior. Consequently, the models provide more information on anticipated travel impacts than can be obtained by using mode-choice models alone. Because the forecasting procedure is designed to provide quick-response results, data requirements are minimal and these data should be readily available to most planning agencies.

The accuracy of the forecasting procedure should be interpreted as sketch-planning-level responses that, if conditions warranted, would be subjected to additional and possibly more refined analyses. However, test applications of the prediction procedures described by the author yielded favorable results.

P-9. Parody, Thomas E., Predicting Travel Volumes for HOV Priority Techniques: User's Guide, Report No. FHWA/RD-82/042, Federal Highway Administration, Washington, DC, April 1982.

This 61 page report is a user's guide for a quick-response, low-cost procedure that can be used to forecast travel demand and supply impacts of implementing four different types of priority techniques for high occupancy vehicles (HOV) on freeways. The procedure involves

performing a straight forward set of calculations using a hand-held calculator and a set of worksheets provided in the report. Input data consist of modal volumes, travel times and speeds, and roadway geometrics and capacity. Example applications of the forecasting procedure are provided.

The HOV alternatives that can be analyzed with this User's Guide can be classified into four groups based on the modes allowed onto the HOV-lane in the before and after periods. The "after period" is assumed to represent conditions present about one year following the HOV lane implementation. The four HOV alternatives are:

Before Period	After Period
1. No HOV lane	Bus-Only HOV lane(s)
2. No HOV lane	Bus and Carpool HOV lane(s)
3. Bus-Only HOV lane(s)	Bus and Carpool HOV lane(s)
4. Bus and Carpool HOV lane(s)	Bus and Revised Definition of Carpools

P-10. Partners for Livable Places, The Way to Go: The Benefits of Quality Design in Transportation, Technology Sharing Program, U.S. Department of Transportation, Washington, DC, April 1983.

By the early 1970's, it was apparent that the nature of federal involvement in transportation should shift to provide for greater participation by state and local governments and the private sector. Two major premises were generally accepted: 1) planning for transportation should more fully integrate the interests and goals of many segments of our society; and, 2) expenditures on transportation should also serve the investment needs of economic development, without causing significant harm to healthy neighborhoods or the quality of the environment. In this context, the U.S. Department of Transportation (DOT) decided to encourage careful attention to quality design in the construction and rehabilitation of transportation projects and facilities; major federal projects and other investments in transportation should produce broad and lasting benefits, (quality investments will be most likely to produce such benefits over time).

The cases studied in this report demonstrate that city, state, and regional authorities have shown a keen sense of responsiblity for the aesthetic quality of transportation projects. The positive effect of well-designed transportation projects on the visual environment is becoming apparent to many local communities. Notable progress has occurred in: 1) highway and roadside enhancement; 2) in adaptive reuse of obsolete historic railroad stations; 3) in improvement of the pedestrian environment in cities; 4) in redevelopment of obsolescent waterfronts; and, 5) in reclamation of despoiled areas in cities and countryside.

One goal of this study is to further develop the case for regarding design and art as essential elements in transportation planning, even in an era of tightening budgets. The study examined a variety of cases ranging from relatively inexpensive programs to large-scale projects. A second goal was to develop guidance and examples to assist transportation planners and citizens. The research did not unearth the case study material that would support a refined and definitive cost-benefit analysis of investment in visual appeal in transportation. Certain types of benefits, however, seem to emerge such as:

- Long term investment--a high-quality transportation facility may increase return on investment and decrease costs of expansion and adaptation;

- Economic development and rational land use--an attractive system can be used by planners to influence urban development throughout a city or region;

- Commercial revitalization--retail business can increase as a result of aesthetically planned transit;

- Private investment--public expenditure on art and aestheic planning can leverage considerable development in the private sector;
- Utilization of wasted resources--unused land along a transportation right-of-way can be developed as a community asset;

- Improved resources for tourism--roads taking advantage of scenic beauty or made more attractive in themselves can bring an area increased tourist revenue;

- Community image-building--the effort to eliminate or reduce a transportation eyesore can spark a new spirit throughout a community;

- Improved pedestrian circulation--an attractive pedestrian environment can make walking a significant mode of transportation with concomitant increases in access to stores and offices and lower transportation costs;

- Increased potential for intermodal travel--the right facility can be the keystone of a true transportation network;

- Increased ridership--good design helps induce new groups of riders to use mass transit; and,

- Cost efficiency of transit marketing--art can be an inexpensive and effective way of courting riders for mass transit.

To one degree or another, at least several of these benefits can be deduced with a degree of conviction. In recent cases, the benefits may just be beginning to flow or may not yet have reached their full magnitude. Later data may therefore allow more conclusive quantification of results. In other cases, the benefits may be self-evident to the observer but difficult to quantify because information is often

fugitive, existing in odd places if at all. This study cites the dollar costs of quality design elements only when these can be clearly distinguished from other elements of the project, and when the figures appear to be reliable.

P-11. Payne-Maxie Consultants and Blayney-Dyett, Urban and Regional Planners, The Land Use and Urban Development Impacts of Beltways: Case Studies, Report No. DOT-P-30-80-31, U.S. Department of Transportation, Washington, DC, June 1980, (NTIS No. PB81-242141).

The 273 page report assesses the land use and urban development impacts of circumferential, limited access highways in eight urban areas--Atlanta, Baltimore, Columbus, Louisville, Minneapolis-St.Paul, Omaha, Raleigh, and San Antonio. Subjects addressed include the local influences on beltway planning and the impact of the belt; decision-makers in planning and construction of the beltway; and, both successful and ineffective strategies for mitigating beltway impacts.

P-12. Payne-Maxie Consultants and Blayney-Dyett, Urban and Regional Planners, The Land Use and Urban Development Impacts of Beltways - Final Report, Report No. DOT-P-30-80-38, U.S. Department of Transportation, Washington, DC, October 1980.

This study, jointly commissioned by the U.S. Department of Transportation and the U.S. Department of Housing and Urban Development, presents an assessment of beltways' land use and urban development impacts and describes the urban and transportation policy implications. Prior research and the findings of a comparative statistical analysis and detailed case studies were examined to determine: 1) what effects beltways have had; 2) why beltway-induced changes have occurred; 3) who was affected by such changes; and, 4) how federal and local government agencies can work with business and community groups to capitalize upon the potential benefits offered by beltways and to minimize or eliminate their anticipated adverse effects. Of particular concern to the federal government is the possibility that beltways may undermine central city revitalization efforts and attempts to achieve compact, energy-conserving and environmentally sound land use patterns.

The findings and conclusions of this study should be of interest to and usable by a broad spectrum of individuals and groups, including federal decision makers, local land use and transportation planners, members of business, community and civic organizations, academics, and environmentalists. The study produced four publications on the land use and urban development impacts of beltways, one or more of which may serve the purposes of the reader not interested in the entire research effort. Available are Executive Summary, Case Studies, and Guidebook, as well as this volume, the Final Report. The study methods relied primarily on prior research, a comparative statistical analysis of 54

metropolitan areas (27 with beltways and 27 without), and eight detailed case studies of the effects of beltways.

The most important discovery of the statistical analysis is that beltways and beltway attributes, such as length, distance from downtown, interchange spacing, and age are less important than non-beltway factors shaping regional economic growth and the distribution of population, employment, housing, and retail sales. The Case Studies explore the effects of beltways on local land use and transportation planning and capital improvement programming, development decisions, housing and employment opportunities, and central city revitalization efforts. The socio-economic, fiscal, and environmental consequences of beltway construction in each metropolitan area also are assessed. Finally, the case studies include an analysis of measures that enhance the benefits of beltway construction and reduce or eliminate its adverse effects.

P-13. Payne-Maxie Consultants and Blayney-Dyett, Urban and Regional Planners, The Land Use and Urban Development Impacts of Beltways - Guidebook, Report No. DOT-P-30-80-39, U.S. Department of Transportation, Washington, DC, October 1980.

This guidebook is intended to provide local officials, particularly transportation and land use planners and members of affected business and community groups, with a conceptual framework for evaluating a proposal to build a beltway -- a limited-access highway partially or completely circling a city -- in their region. It pin-points for critical analysis the possible consequences of beltway construction and measures to enhance or reduce these consequences in localities with different characteristics, planning policies, and development review procedures. Hidden policy questions are made explicit for consideration, and criteria are provided for evaluation of the benefits and disbenefits of implementing beltway plans. Impacts that are addressed include:

- Effects on travel and location decisions;
- Effects on development decisions;
- Effects on land use and public facilities programming;
- Economic and social consequences; and,
- Environmental consequences.

Examples of beltways' impacts in selected metropolitan areas are presented drawing on a survey of related literature, a comparative statistical analysis of 27 beltway cities, and eight case studies. Methods for analyzing mitigation measures and making tradeoffs also are presented. Finally, the guidebook directs the reader to some of the most pertinent, valuable and current reference material for assessment techniques for beltway impacts, descriptions of planning steps to modify foreseeable impacts of beltway construction, and case studies on existing beltways.

The guidebook will be useful to transportation and land use planners charged with evaluating proposals to build new beltways or to

expand the capacity of existing beltways. Members of business and community groups may also find this guidebook helpful for identifying ways in which a prospective beltway may affect them before the decision-making process is over and construction has begun. Where beltways already have been built, local planners and elected officials may find the chapter on mitigation and enhancement measures helpful for its descriptions of ways to maximize benefits and reduce potential harmful effects. Assessment techniques presented in the guidebook also could be used in conducting urban impact analyses of beltway proposals.

P-14. Payne-Maxie Consultants and Blayney-Dyett, Urban and Regional Planners, The Land Use and Urban Development Impacts of Beltways - Summary, Report No. DOT-P-30-80-40, U.S. Department of Transportation, Washington, DC, October 1980.

This study, jointly commissioned by the U.S. Department of Transportation and the U.S. Department of Housing and Urban Development, presents an assessment of beltways' land use and urban development impacts and describes the urban and transportation policy implications. Prior research and the findings of a comparative statistical analysis and detailed case studies were examined to determine: 1) what effects beltways have had; 2) why beltway-induced changes have occurred; 3) who was affected by such changes; and, 4) how federal and local government agencies can work with business and community groups to capitalize upon the potential benefits offered by beltways and to minimize or eliminate their anticipated adverse effects. The findings and conclusions of this study should be of interest to and usable by a broad spectrum of individuals and groups, including federal decision makers, local land use and transportation planners, members of business, community and civic organizations, academics, and environmentalists.

The study consists of three major components: a survey of pertinent literature, a comparative statistical analysis of 54 metropolitan areas and eight detailed case studies of beltway cities. Several bodies of writing and research were reviewed, including land use and location theory, beltway impact studies, other highway impact studies, foreign experience with highway impacts, and sources on methodology.

The second major element of the study, the comparative statistical analysis, consists of a sample of 27 American "beltway" cities and 27-non beltway cities meeting the same initial criteria. A large data base was assembled and a multivariate analysis undertaken to determine beltway influences on population, employment, trade, residential movement, vehicle miles traveled and the relationship between beltways and other factors on urban development by type of beltway.

P-15. Peterson, Richard L., Exclusive Bus/Carpool Lanes for the Fort Worth Metropolitan Area, Traffic Engineering Department, City of Fort Worth, Fort Worth, Texas, February 1974.

This 207 page report was prepared in reponse to EPA requirements, set forth in October 1973, to designate exclusive bus/carpool lanes within eight, radial travel corridors and on three CBD streets by January 1976. The study examines existing mode splits, travel times and traffic demands in conjunction with various preferential treatment alternatives (ie., With-Flow Lanes, Contraflow Lanes, Signal Pre-Emption). Results of the study, in part, led to implementing an area wide ridesharing program, exlcusive bus lanes in the Fort Worth Central Business District, and a transit "free-zone" within the downtown area. Under the prevailing traffic and geometric conditions, exclusive lanes on the radial travel corridors could not be justified; however, continued surveillance and evaluation was recommended due to the constantly changing traffic picture.

P-16. Pincus, Diane and Hodnett, J., "Public Transit and the Business Community", American Public Transit Association, Washington, DC, 1981.

The paper briefly outlines examples of the role that transit plays in stimulating central city business stability and growth. Based on the preliminary research, the report includes findings that draw a positive relationship between transit and the health of the central business district. Cities such as Washington, D.C., and Philadelphia are attracting new investment in locations directly accessible by transit. In several cities, retail sales are heavily dependent on transit and are increasing with the opening of new transit facilities. Employment opportunities and local government tax receipts are also on the rise as a result of transit-related development in several cities, according to the authors.

P-17. Politano, Arthur, "Urban Blight and Highways in the Central Cities: Theoretical and Practical Perspectives (Abridgement)", Transportation Research Record 747, Transportation Research Board, Washington, DC, 1980, pp. 63-66.

A basis is provided by Politano for a better understanding of the causes of urban blight and the relation between urban blight and highways. A literature review on the causes of urban blight is presented, and examples of mitigative measures taken in various cities are described. Several federal programs that could be, or are being, used to fund revitalization and development efforts in central cities are briefly discussed.

Preliminary analysis, set forth by Politano, found that highway transportation constitutes only one of many factors that contribute to

the formation or urban blight. In order to succeed, therefore, any effort to reduce blight should address as many causal factors as possible, including social, psychological, economic, and physical ones.

Based on the author's analysis, three types of mitigative measures appear to have the potential for reducing highway-related blight: (a) TSM, (b) zoning controls, and (c) joint-development. The first two are simple and inexpensive to apply. The joint-development alternative is both expensive and complex, and joint funding of projects appears to be a necessary means of making this alternative possible. Participants in a joint funding venture could include private industry, relevant federal agencies, and state and local governments, according to the paper.

P-18. Pomeroy, Lee Hames, Blyn, J. and Burdick, S., "Land Donations as Local Match on Small Scale Transit Projects", Selected Papers on Major Issues Facing Public Transit - Financing, Volume I, American Public Transit Association, Washington, DC, 1983, pp. 29-38.

Due to a decline in revenues, the Tri-County Metropolitan Transportation District of Portland, Oregon, determined it necessary to explore alternatives to a cash local match on high priority UMTA funded projects. One alternative currently in use is the substitution of donated property in place of cash match. In the context of several case studies, this paper discusses the use of property donated by public and private entities.

Several issues must be dealt with when considering the use of donated property in an UMTA funded project according to the authors. For example, the federal issue of "continuing control" and the local issue of donor participation in development, use and revenues. While the case studies demonstrate that land donation can be a viable means of providing non-cash match, the transit agency's control over the project must be balanced with the needs of the donor.

P-19. Potter, Stephen, "The Transport Versus Land Use Dilemma", Transportation Research Record 964, Transportation Research Board, Washington, DC, 1984, pp. 10-17.

The transport sector, according to Potter, seems remarkably inflexible to changes in fuel prices and energy measures. The suggestion is made that the long-term land use and social effects of cheap motorized travel has produced a land use and transport system that is dangerously inflexible to changing needs and that planning and transport investment methods tend to unnecessarily heighten such problems.

The degree of land use conflict between alternative modes of travel is examined in a case study of the British new towns within this paper. These towns have been built to a wide variety of land use and transport designs, some specifically intended to reduce the degree of

transport conflict. The nature of this paper is strategic and general and seeks to identify the key factors involved and broad social and planning principles rather than specific details.

The case study of the British new towns suggests that it is possible to provide urban structures that are capable of accommodating wide variations in travel patterns and energy availability. Potter concluded that equitable and energy-efficient land use policies are entirely feasible, but the political status of planning is too weak for them to be implemented.

P-20. Public Technology, Inc., "Economic Impacts of Transportation Restraints", U.S. Department of Transportation, Washington, DC, September 1980.

Throughout history transportation has played a major role in determining the economic character of cities. Today, American urban transportation is dominated by the private automobile which has caused central areas of major cities and the radiating highways to become congested during portions of the day. Traffic congestion, lack of parking spaces, and pollution problems related to the internal combustion engine contribute to the declining quality of many urban centers. To combat these problems, many cities are implementing restraints to discourage or restrict automobile use, especially in downtown areas. There is, however, concern among private businesses and local and regional government officials over the economic consequences of such actions.

The major concerns raised by elected and appointed officials relate to the effects of traffic restrictions on local businesses, on an area's tax base, and on traffic and businesses outside a restricted zone. This Information Bulletin addresses these concerns by discussing the following issues:

- The diversity of restrictions now in use in U.S. cities;
- The known effects of transportation restrictions on economic, business, commerical, and recreational activities;
- Information gaps; and,
- The need for further work.

P-21. Public Technology, Inc., Joint Development: A Handbook for Local Government Officials, Report No. DOT-I-83-48, Urban Mass Transportation Administration, Washington, DC, September 1983.

The purpose of this 111 page handbook is to promote joint development by providing local officials and transit managers with guidance on how the process works, including what steps need to be taken by the public sector and what types of issues and problems may emerge during the process. Because there is great variety in the types and scale of

possible joint development projects, the handbook can not identify any one best system but can point to the techniques that are available and note those procedures and approaches that many local officials involved in joint development agree are important to a successful project.

The handbook is based on information drawn from five sources. As part of this project, sponsored by the Urban Mass Transportation Administration (UMTA), Public Technology, Inc. (PTI) has prepared a series of case studies on joint development projects underway throughout the United States. These studies, which are included in the Appendix, form the basis for much of the handbook. In 1978 and 1981, PTI sponsored Joint Development Marketplace Forums, and the Proceedings from those meetings have provided useful material for this document. The third source has been interviews with consultants and officials involved in joint development. Also, material has been drawn from the growing body of literature on joint development. Finally, the handbook includes short descriptions of the practices of a major transit system operator that has a strong commitment to joint development, the Washington Metropolitan Area Transit Authority (WMATA).

P-22. Public Technology, Inc., Proceedings of the Joint Development Marketplace '80, Report No. DOT-I-81-4, Urban Mass Transportation Administration, Washington, DC, June/July 1980.

The "Marketplace" gave jurisdictions with developable parcels adjacent to transportation facilities an opportunity to market those sites to a national audience of developers and financiers. Over 450 persons representing more than 40 local jurisdictions, federal agencies, development interests and lending institutions attended the forums.

One of the innovations at the 1980 Marketplace was a review of the exhibits by a three-member panel of developers and development consultants. Most of the exhibiting jurisdictions chose to have their exhibits formally reviewed. In reporting on their findings, members of the review teams made the following points:

- Cities should provide enough market data to allow a developer to make his own assessment of the project;
- Not all jurisdictions have a glamorous reputation and they must be willing to honestly deal with negative impressions which may exist;
- Cities are well advised to designate a central contact person for a given project so that a developer doesn't have to deal with a myriad of local agencies and officials; and,
- Strong, consistent public support is essential to seeing joint public-private ventures through to fruition.

These excerpts from the proceedings are intended to be helpful to those who are interested in developing and pursuing joint development projects. As several speakers at the Marketplace noted, joint development has never and will never happen by accident. Each of the parties involved must make it happen through whatever innovations are necessary.

P-23. Public Technology, Inc., "The Coordination of Parking with Public Transportation and Ridesharing", Information Bulletin No. DOT-I-82-29, U.S. Department of Transportation, Washington, DC, June 1982.

There has been increased recognition at all levels of government that a partial solution to peak period traffic congestion, which places the greatest burden on the urban transportation system, is the coordinated management of the growth in demand for the use of transportation facilities and services. Demand management attempts to offer commuters an alternative to driving alone through:

- Ridesharing--including carpools, vanpools, and privately leased buses. About 26 million Americans commute to work by one of these modes daily.

- Public Transit--including bus and fixed rail transportation services that are available to the general public. Over five million Americans travel by these modes daily.

- Parking Policy--managing the quantity, location, cost, and availability of parking to improve the operation of a jurisdiction's parking system.

Coordination of parking policies with public transportation and ridesharing, however, often does not take place. To a large degree, this is due to the widespread belief that changes in parking policies that reduce traffic congestion will reduce both the number of people entering the city and the level of business or retail activity. Few attempts have been made to evaluate the interrelations between parking controls and supporting transportation policies, such as:

- Improved transit services;
- Staggered work hours; and,
- Priority treatment lanes for high-occupancy vehicles.

Local governments may choose to coordinate parking with public transportation and ridesharing programs, the replacement of parking by more appropriate uses of urban land, and the reduction, and possible elimination, of highly subsidized commuter transit service from the suburbs to the city. Parking policies such as preferential parking for carpools and vanpools can increase the attractiveness of ridesharing where no adequate public transportation exists. This Information Bulletin examines parking policies that act as incentives to high occupancy vehicle travel, especially for commuter work trips. The report discusses:

- Parking Incentives to Increase Ridesharing;
- Parking Incentives to Increase the Use of Public Transit;
- Alternative Transportation Assistance Programs; and,
- Bicycle Parking.

P-24. Pushkarev, Boris and Zupan, J., Urban Rail In America: An Exploration of Criteria for Fixed - Guideway Transit, Report No. UMTA-NY-06-0061-80-1, Urban Mass Transportation Administration, Washington, DC, November 1980.

The purpose of this 336 page study was to explore what range of travel volume may be sufficient to warrant what type of fixed-guideway investment; to indicate the location of urban corridors where such travel volumes may be found; to offer a rough, tentative assessment of the national market for fixed-guideway facilities; and, to aid in focusing local alternatives analyses on the most promising locations.

The fixed-guideway modes primarily considered are rapid transit, light rail, and automated downtown people movers; commuter rail is referred to only peripherally. The variables used to scale the magnitude of the prospective investment include: 1) space per passenger; 2) service frequency; 3) labor savings compared to bus operations; 4) energy savings compared to modes previously used; 5) land savings compared to modes previously used; 6) construction cost related to recent investment decisions; and, 7) operating speed.

Based on operating experience, functions are developed relating the various variables to travel volume and minimum travel volume criteria or thresholds are formulated. These criteria are applied to estimated travel streams originating in 29 major downtowns and to actual volumes on some existing systems to indicate which of them may warrant what number of fixed-guideway lines of what length. A numerical Appendix includes 50 pages of historical and analytical tables.

R-1. Robert J. Harmon and Associates, Inc., Miami's Downtown Component of Metrorail: Public-Private Conventure Financing Using A Special Assessment District, Report No. DOT-I-84-16, Urban Mass Transportation Administration, Washington, DC, February 1984.

On September 19, 1981, a committee of thirteen downtown private business people and five public or quasi-public representatives unanimously endorsed a resolution to implement a private/public coventure. The funding program involved a benefit assessment district to provide sufficient revenue to pay the principle, interest and market placement costs of $20 million in municipal bonds. In addition, their consensus support was given to: 1) the negotiation of $10 million in additional funding through station cost sharing agreements; and, 2) if necessary, use of tax increment financing to ensure that this system would be implemented.

This case study report documents the step-by-step process of consensus building that was required to achieve this precendent-setting decision. The report also delineates the Federal, State and Local implications of this decision on future fixed guideway system development in the State of Florida and throughout the United States. While at the time the decision was reached, the outlook for fixed guideway system development in the United States was tenuous, these individuals' collective actions became a "beacon" to the entire State of Florida that cooperative private/public sector efforts could be achieved and that private sector (i.e., local business community) involvement would be essential to the future development of "new fixed guideway systems." The action by the local business community of downtown Miami was not in any sense a contribution -- it was a calculated investment, that was successful.

The most immediate tangible result of this decision is that in early 1985 the Miami Downtown People Mover (DPM) will be in revenue operation. This precedent for Private/Public Coventure financing and its respective local jurisdictions has altered the State of Florida's financial strategy for new fixed guideway system implementation. Without the timely and challenging commitments and fortitude of local DPM professionals, this historically significant event would not have occurred, state the authors.

R-2. **Rollins, John B, Memmott, J.L., and Buffington, J.L., Effects of Roadway Improvements on Adjacent Land Use: An Aggregative Analysis and the Feasibility of Using Urban Development Models, Report No. FHWA-TX-81-226-22, State Department of Highways and Public Transportation, Austin, Texas, May 1981.**

The effect of improving existing urban roadways on surrounding land use is an important consideration in highway agency decisions regarding roadway improvements. Such decisions should consider the economic impact of proposed improvements.

In an effort to identify the kinds of effects which urban roadway improvements have on surrounding land use over time, a study has been made of several urban locations experiencing roadway improvements during the past several years.

Land use and related data were collected on eighteen locations in the Bryan-College Station, Dallas-Fort Worth, and Houston metropolitan areas. Following individual analyses of the study sites, data on all eighteen locations were aggregated for the purpose of statistically analyzing relationships between land use and various related factors. Chapter II of this 139 page report describes the categorical and regression approaches to the statistical analysis and reports the results thereof.

A popular approach to forecasting regional urban growth is the use of urban development models. Using information on residential and employment locations, trip orgins/destinations, and population and

employement projections, these models attempt to predict patterns of future growth in a metropolitan area. Chapter III explores the suitability of urban development models as an alternative approach to modeling the relationship between urban land development and roadway improvements.

R-3. Rouphail, Naqui M., "Operational Evaluation of Bus Priority Strategies", Paper for the 63rd Annual TRB Meeting, Transportation Research Board, Washington, DC, January 1984.

The primary objective of this study was to evaluate the impact of two bus priority techniques on the operation of bus and non-bus traffic. The strategies studied were: 1) contra-flow bus lane on a downtown street; and, 2) signal settings based on minimizing passenger rather than vehicle delays. The operational setting reflected actual observations on a Chicago downtown street, where a contraflow bus lane was installed in the summer of 1980.

It was found that bus operation improved significantly as a result of dedicating an exclusive lane to bus traffic, as demonstrated by an increase in overall bus speed on the route. The signal priority technique implemented by means of the TRANSYT-7F model enhanced bus operation even further. The degree of bus operation improvement, however, was dependent on whether the buses operated in mixed traffic or on exclusive lanes.

It was also noted that vehicle-miles of travel for non-bus traffic were lower after the implementation of the bus lane. Some improvements in non-bus traffic operation may be attributed to that factor.

Finally, a limited field study was conducted to test bus performance indices predicted by the TRANSYT model. The observed and simulated overall bus travel speeds were found to be comparable at the 5% significance level.

R-4. Rowan, Neilon J., Woods, D.L. and Stover, V.G., Alternatives for Improving Urban Transportation - A Management Overview, Technology Sharing Report 77-215, Federal Highway Administration, Washington, DC, October 1977.

This publication was prepared as part of a course development program having the same title. The training course referred to throughout this publication is 3 days long and has been conducted for a number of Federal, State, and local highways agencies.

This report provides practical information that can be used to improve the efficiency of the existing transportation system. The emphasis is placed on "getting the most out of what we have." Alternatives presented include improving traffic operations, improving urban goods movements, ride sharing programs, demand management, transportation pricing, and improved public transit.

Mobility is the backbone of industry, and the principal sustenance of the urban community. Without mobility, progress in our community is stifled; with it, growth and prosperity prevail, state the authors.

Mobility manifests itself in transportation. Transportation is not automobiles, buses, trains, airplanes, and other transport objects, but people and goods. The desires of people and their need for goods create the demand for transportation. Their preferences in terms of time, money, comfort, and convenience dictate the types or modes of transportation to be used. Transportation is not without its limitations (i.e., time, space and economy). Therefore, the basic premise of transportation management is to serve the people's needs within the constraints of time, space, and available resources.

Due to unprecedented advancements in technology and affluence of society in recent years, our current transportation system has developed rapidly to a stage of early maturity. That is, a basic system framework is established; we have extensive air, rail, highway, waterway, and pipeline subsystems throughout the country. With such rapid development there are inherent inefficiencies in the system. These inefficiencies have resulted in operational problems, particularly in the urban areas, where demand is high and space is limited. The authors cite various alternatives available for the improvement of urban transportation. This publication was intended to provide the transportation manager an overview of alternatives, with emphasis on the applicability, the benefits, and the trade-offs associated with each alternative.

S-1. Sauerlender, Owen H., et al., The Highway Corridor: Predicting the Consequences of Alternative Highway Locations (Final Report), Report No. TTSC-7214, Pennsylvania Department of Transportation, Harrisburg, Pennsylvania, November 1972, (NTIS No. PB-226 076/8).

The purpose of the study was to test the feasibility of estimating by means of probabilistic activity models the primary and secondary economic impacts on local minor civil divisions caused by a major change in highway transportation within a corridor. The theoretical framework of the study and the calibrated models were developed using secondary data drawn from a sample of three major highway corridors in Pennsylvania. Statistical measurements of the model's performance showed that it was indeed feasible to make these estimates according to the 362 page report.

S-2. Schaevitz, Robert C. and Scheider, M.I., "Development of a Local Financing Strategy to Meet Multimodal Transportation Needs in Orange County, California" Selected Papers on Major Issues Facing Public Transit - Financing, Volume I, American Public Transit Association, Washington, DC, 1983, pp. 39-55.

The authors contend that the shift in transportation funding responsibility from federal and state government to local government has led to increased urgency in financial planning at the local level.

A study was conducted to develop a comprehensive financing strategy to raise $7 billion through local means for transportation improvements in Orange County, California over the next fifteen years. The transportation improvement program developed for the anaylsis included both transit and highway elements. Project funding deficits were estimated after an assessment of future federal and state funding availability. Eighteen local revenue mechanisms were examined initially. Revenue estimates, institutional studies, telephone surveys, and an analysis of the benefit/burden characteristics of alternative combinations of mechanisms contributed to a final selection of seven mechanisms for inclusion in a recommended strategy: 1) sales tax; 2) transit fares; 3) road tolls; 4) development fees; 5) benefit assessments; 6) tax increment financing; and, 7) joint development.

The study concludes that it is possible to fund the anticipated shortfall through local means, that the public desires a balanced program of highway and transit construction, and that management of the program might be best accomplished through decentralized revenue collection and centralized system planning and budgeting. The sales tax was found to be the best all around local option. Value capture mechanisms were found to be attractive from the equity standpoint, but offered only limited revenue potential and were less applicable to transit projects, particularly bus transit. Overall, the comprehensive approach proved to be effective in providing a fully documented basis for selecting viable local financing options, facilitating decision-making and focusing subsequent activity. The approach, highlighted in this paper, should have application in many areas contemplating significant investment in public infrastructure.

S-3. Schneider, Jerry B., Transit and the Polycentric City, Report No. DOT-I-81-33, Urban Mass Transportation Administration, Washington, DC, September 1981.

The role of transit in aiding the implementation of regional land use plans that call for the creation of major diversified centers in the outer city is investigated. The polycentric city concept is defined and illustrated by reference to regional planning work in the Twin Cities of Minnesota and several other U.S. cities. Arguments for and against the concept are outlined and the results of a survey relating to the present status of the concept in 48 metropolitan areas are presented. An evaluation frame-work is developed and applied in visits to 14 American, two Canadian, and one English urban region.

The most interesting work on this topic was found in Vancouver, B.C., and Toronto, Ontario. Other interesting work has been done in the Twin Cities and Denver. The results of the field work are summarized and 18 specific examples of noteworthy progress toward the development of outer city centers of significant scale are described. A discussion of the national potential for outer city centers is developed from several perspectives.

S-4. Schwartz, Gail Garfield, Where's Main Street U.S.A.?, Eno Foundation for Transportation, Inc., Westport, Connecticut, 1984.

This 91 page book is part fact and part speculation. It gathers the most relevant information about the traditional American downtown and links it to speculation about how the future might change contemporary Main Street in cities large and small. It calls upon experience, observation, and the scholarly work of many specialists. It is not an "ought to" treatise. It is intended as a "think piece" that will stimulate any person who is interested in the dynamics of community change to ponder the future.

The author demonstrates that the weight of the past will be an important determinant of future events, and contends that the present is the future becoming. In this book, Schwartz has disagreed on occasion with some respectable conclusions drawn by very responsible researchers. While this is not meant to suggest that their work was faulty, it does mean that even experts differ in their prognoses for the future of Main Street. A book such as this is never finished. New projects are announced almost daily, and the preliminary expectations of others change with operating experience gained over time. National policies change, and legislation that seemed imminent during this writing could fade into oblivion. The book focuses on the big picture, in part by looking at many individual changes in many Main Streets, and in part by examining other forces affecting the way we live and work, and where this activity occurs. In some cities it will take two more generations for the pattern of these changes to become clearly imprinted. But only a decade was needed in fast-growing places, such as Miami, Florida, where sprawl and central business district concentration proceed apace, simultaneously. There is no single answer to the question "Where's Main Street?" The only thing certain is that few Main Streets will be the same in twenty years as they are now, and fewer still will be the same as they were twenty years ago, according to the author.

S-5. Selected Value Capture Opportunities Related to the Rapid Transit System In Metropolitan Atlanta, Atlanta Regional Commission, Atlanta, Georgia, May 1978.

The MARTA rapid transit system was soon to be a reality at the time this report was prepared. The spectrum of benefits promulgated by officials and planners of the MARTA system covered a wide range, much more than just the reduction of traffic congestion and time expended on commuter travel. Benefits also included the following:

- Fostering central Atlanta's growth;
- Generation of highly accessible development modes;
- Increased property values; and,
- Reduction of future land area devoted to transportation facilities.

To a large extent these "other" benefits depend upon the integration of rapid transit and land development. But in other U.S. cities where rapid transit systems have been built, the mechanisms to achieve this integration have often gone unexplored. As a result, opportunities have been missed and, in many cases, these benefits have been permanently precluded, according to the report. The document pointed out that the value (or wealth) created by the MARTA system would not be readily quantified, nor easily discerned. Some of the value accrue to private property owners in the form of increased property values, increased retail sales, and so on. This may be termed "private" value capture. But the value capture perspective is that the rapid transit system should be viewed largely as the creation of wealth for the collective public, and that the value created by and success of the system should be measured in terms of overall "public" benefits. In this study, the term "value" means something of value to the general public and would include things both tangible and intangible, monetary and nonmonetary, as well as socially, aesthetically, financially, and economically valuable creations. Definitions of the two interrelated concepts which are the subject of this report are provided:

- Value Capture - refers to efforts by public agencies to protect, retain and optimize the public value and public benefits created by the development of major public improvements such as MARTA.

- Joint Development - refers to the integrated development of the social, economic, and physical environment with a major public improvement such as MARTA.

Both concepts are concerned with achieving the broadened benefits that rapid transit can provide to an urban area.

This report was a continuation of the Atlanta Regional Commission's (ARC) work in analyzing system-wide issues associated with rapid transit. The purpose was to introduce the concept of value capture, value capture techniques, and to identify some of the value capture opportunities available at transit stations; to develop some of the issues associated with value capture policy; and, to suggest specific strategies whereby public and private participants could capture the financial, community design, and joint development benefits.

S-6. Selsam, Robert E., "Generating Private Contributions for Station Improvement Through Public Development, Incentives and Controls", Selected Papers on Major Issues Facing Public Transit - Financing, Volume I, American Public Transit Association, Washington, DC, 1983, pp. 69-77.

This paper discusses a wide range of alternative means used in New York City to stimulate private investment in transit stations. Projects discussed by Selsam include:

- Joint developments of projects where a single piece of property is shared by the transit operator and a private developer;
- Coordinated development, not necessarily on a single parcel, where the whole is greater than the parts;
- Direct private investment in commercial ventures within a station;
- Voluntary private investment; and,
- Private investment in stations through public incentives or controls.

The paper then focusses on various types of public incentives, and reviews their applications:

- Comprehensive public development (urban renewal);
- Negotiated amenity package;
- Special districts (with easements, funds, and mandated public improvements); and/or,
- General zoning provisions.

Specific projects are used and set forth in the paper to illustrate each of these concepts. The magnitude of private investment committed to transit station improvements in New York City is significant, as is the future potential states Selsam. At the present time (1983), projects totaling an estimated $100 million in private investment are either underway or committed.

S-7. Sherret, Alistair, BART's First Five Years: Transportation and Travel Impacts; Report No. DOT-BIP-FR-11-3-78, U.S. Department of Transportation, Washington, DC, May 1978.

BART, the 71-mile San Francisco Bay Area Rapid Transit System, began passenger service in 1972. The final section, the transbay link between San Francisco and Oakland, opened in 1974. Ridership has grown to about 140,000 passenger trips per day, 60,000 of them transbay. This 202 page document is the final report of a research study assessing the impacts of BART on transportation and travel in the Bay Area. The BART System, its costs, the service it provides relative to bus and automobile, and the nature of its ridership are described. BART's impacts on modal split, bus ridership and service, and highway traffic and congestion are analyzed. Implications for planning rail transit elsewhere are drawn.

BART's ridership and impacts are less than were widely predicted. This reflects both on the optimism of the predictions and the shortcomings of BART's current service. As intended, BART's most significant improvements in travel times have been for long-distance trips by transit, particularly transbay, to downtown San Francisco. Accordingly, the predominant use of BART is for long-distance commute trips. BART carries 21% of transbay commute trips. Areawide, BART's share of trips for all purposes is between 2% and 3%. Total bus ridership has changed little because the loss of riders from services paralleling

BART has been offset by the use of bus to get to and from BART. Impacts on San Francisco-Oakland Bay Bridge traffic have been less than expected because new trips by car have appeared to replace those removed by BART.

S-8. Sherret, Alistair, BART's First Five Years: Transportation and Travel Impacts; Report No. DOT-P-30-79-08, Urban Mass Transportation Administration, Washington, DC, April 1979.

BART, the 71-mile San Francisco Bay Area Rapid Transit System, began passenger service in 1972 with the transbay link being opened in 1974. This is the final report of a research study assessing the impacts of BART on transportation and travel in the Bay Area. The BART System, its costs, the service it provides relative to bus and automobile, and the nature of its ridership are described. BART's impacts on modal split, bus ridership and service, and highway traffic and congestion are analyzed; and implications for planning rail transit elsewhere are drawn.

BART's ridership and impacts are less than were widely predicted. This reflects both on the optimism of the predictions and the shortcomings of BART's current service. As intended, BART's most significant improvements in travel times have been for long-distance trips by transit, particularly transbay, to downtown San Francisco. Accordingly, the predominant use of BART is for long-distance commute trips. BART carries 21% of transbay commute trips. Impacts on San-Francisco-Oakland Bay Bridge traffic have been less than expected because new trips by car have appeared to replaced those removed by BART, according to this 254 page publication.

S-9. Sherret, Alistair, 1977 Work Travel Survey Methods and Findings - Bart Impact Program (Working Paper), Report No. DOT-BIP-WP 58-3-78, U.S. Department of Transportation, Washington, DC, December 1978.

BART, the 71-mile Bay Area Rapid Transit System, serving San Francisco, Oakland, Berkeley, and their suburbs, is the first regional-scale rapid transit system to open in the United States in over 50 years. This 122 page report is one of a series assessing the impacts of BART on transportation and travel in the Bay Area. It describes the methods and results of a survey of 8,400 persons employed in the areas most accessible by BART. The sample represents 506,000 daily work

trips to the survey area. A novel sampling design was used in which self-completion questionnaires were distributed to workers at their workplaces. Detailed information was obtained on the travel mode choices available to workers, the characteristics of their journey-to-work alternatives, and the reasons for their mode choices.

BART's share of journey-to-work trips into the survey area from residences in the primary BART service areas is 18%; bus, 16%; and automobile 66%. The BART share varies greatly for specific origin-to-destination corridors and trip lengths; BART's highest share is for long-distance commute trips to downtown areas. Of all trips from residences in the primary service area, respondents considered 40% to be possible by BART; BART presently carries about 40% of these possible trips, which suggests a high potential for increased patronage. Typically, relative travel times and reliability of service are among the most important determinants of travelers' mode choices.

S-10. Siccardi, A. Joseph, "Economic Effects of Transit and Highway Construction and Rehabilitation", Paper for the 1984 ASCE Annual Convention, DMJM Phillips, Reister, Haley, Inc., Denver, Colorado, October 1984.

This 35 page paper, and supporting appendices, explores the economic effects of highway construction specifically as a result of economic development funds which have been available to the states for a decade. The introduction includes summary values as to the dollars that have been appropriated by the Congress and utilized by the states. The summary comments are supported by comprehensive materials included in the Appendix to the paper. The introduction also includes an analysis as to the Congressional intent for the program.

The paper is based upon the results of a questionnaire developed by the author and directed to the states who participated in the program and documents the type of projects completed by the states as well as the philosophical base from which the projects were selected. It explores before and after study methodologies by the states, the Federal Highway Administration, and the Government Accounting Office on behalf of the Congress to determine the effectiveness of the program. The paper documents the author's views on the activities of the states he believes to have utilized the funds most effectively based upon the real or perceived economic effects of the effort. Some judgmental comments as to the need for the program in light of the present emphasis for highway dollars being directed toward resurfacing, rehabilitation and reconstruction efforts of the various highway systems are offered by Siccardi.

The paper attempts to locate and evaluate the results of multi-purpose projects wherein FHWA/UMTA funding have been used in a synergistic manner so as to accomplish results not attainable by either funding source alone because of individual program constraints. Conclusions are drawn from the research and presented in a manner that

will hopefully stimulate further discussion of this important topic in times when the funds for apparent needs exceed the ability of our nation to satisfy all those needs.

S-11. Skaburskis, Andrejs, Survey of Data Sources for the Land Use and Urban Developmen Project (Working Paper), Report No. WP-13-5-75, Contract No. DOT-OS-30176, U.S. Department of Transportation, Washington, DC, June 1975, (NTIS No. PB-242 440/6ST).

The 71 page Working Paper identified data sources which appeared relevant to the study of BART's impacts on land use. The purpose of this report was to help design a Research Plan for the BART Impact Program Land Use Project. Thirty-seven data sources are described in detail. Use of the data and some analytical methods are described.

S-12. Skaburski, Andrejs, The Impacts of BART on Property Values - A Case Study of the Rockridge Neighborhood, Contract No. DOT-OS-30176, U.S. Department of Transportation, Washington, DC, January 1976 (NTIS No. PB-258 367/2ST).

This 100 page Working Paper describes BART's impact on the sales price of single-family houses in the Rockridge neighborhood. The Rockridge area of Oakland and its recent history are described as are the hypotheses to be tested, and the general research strategy. Four specifications of an econometric model are discussed, and the variables used in the regression equations are identified. The before-after, the cross-sectional and the cross-sectional-longitudinal approaches are evaluated. The four models were used to test the null hypothesis that changes in sales prices of comparable houses did not correlate with distance to the BART station.

S-13. Skinner, R.E. and Deen, T.B., BART Impact Program: Federal Policy Implications, Report No. DOT-P-30-79-10, U.S. Department of Transportation, Washington, DC, April 1979, (NTIS No. PB82-163924).

In September 1972, the first service of the Bay Area Rapid Transit (BART) system was initiated; and within two years, service was provided on all 71 miles of the system. To determine the impacts of this system on the Bay Area and its residents, the BART Impact Program (BIP) was established.

This 61 page report draws upon the findings of the BIP to assess the implications the BART experience has upon Federal Policy. After summarizing the BART impacts as measured by the BIP, the report describes caveats which affect the transferability of BART data and limit the ability to draw generalized policy implications based solely on the

BART experience. These caveats relate to the design of the BART system, the representativeness of the San Francisco Bay Area, BART equipment failures, BART service availability, and the definition of the no-BART alternative.

S-14. Sosslau, Arthur B., Hassam, A.B., Carter, M.M. and Wickstrom, G.V., Quick Response Urban Travel Estimation Techniques and Transferable Parameters: User's Guide, NCHRP Report 187, Transportation Research Board, Washington, DC, 1978.

This report is of interest to planners involved in travel demand estimation. Of the numerous travel demand analysis techniques currently available, most use some form of computer models; but documentation and dissemination of many of the techniques have been quite limited. This Transportation Research Board (TRB) research included a survey of current policy-related issues, and identification of available travel demand techniques to address these issues, and the development of new techniques to provide quicker response. This report provides simplified manual techniques and transferable parameters that can be used as viable alternatives to the more costly, data-intensive, computer models; a companion document, "NCHRP Report 186", describes and evaluates other manual and computer methodologies that are available.

The User's Guide covers the following elements: 1) trip generations; 2) trip distribution; 3) mode choice; 4) auto occupancy; 5) time-of-day distribution; 6) traffic assignment; 7) capacity analysis; and, 8) development density/highway spacing relationships. Manual methods are described; however, tables, graphs, and other transferable parameters may be used by computer methods as "default" values where more appropriate local information may not be available. For traffic assignments, three procedures are described for manual application including a sketch-planning diversion process for estimating possible shifts between competing facilities in a corridor. A manual process is included for developing relationships between land use and highway spacing to permit the rapid development of a "first-cut" estimate of future highway need based on a desired level of service. Given a land-use distribution, trip length is computed, future trip ends are estimated, link volumes are determined, and then desirable spacings are determined. Comparisons of desired and existing spacings provide a measure of need for an area. A variation is to run the procedure backward, solve for desired volumes, and, with existing spacing, determine the amount of land use that can be accommodated by the highway system.

S-15. "Status Report: Metrorail Before and After Study", Metropolitan Washington Council of Governments, Washington, DC, April 1, 1981.

In order to capitalize on the experiences with the Washington Metro system to improve transit planning in Washington as well as in other cities, the Urban Mass Transportation Administration awarded a contract to the Metropolitan Washington Council of Governments in July

of 1976 to design and conduct the first phase of a "Before and After" study of the Metrorail system. This first phase resulted in the recommendations for a complete program which is described in this paper. An advisory panel was assembled to review the state-of-the-art of such transportation impact studies, especially the BART Impact Program, and make recommendations for a program of appropriate studies of the Washington Metro system. These recommendations were further refined by a special committee as well as other COG, state and local staff. During this program development, it appeared that conducting such a major transportation impact study of the Washington Metro system would have many unique features and opportunities. The timing of Metro's staged opening, the current status of the areawide transportation planning program, and other circumstances in the Washington area provided special features for Metro. The most significant are:

- Analysis of the Incremental Implementation of the Metro System. (Determine the changes is general direction and magnitude of impacts as each stage of the system opens);

- Transferability of Findings between Washington and other Cities (to learn about the effects of a transportation improvement in such a way that this knowledge could be transferred to other cities);

- Private Sector Involvement; and,

- Serve as a Clearinghouse on Metro-related Research (such Metro-related research should be assembled and built upon in order to increase the practical value of such research).

The underlying philosophy which guided the development of the impact program was developed. Some of the general recommendations which helped set the direction for further study were:

1. Avoid global alternatives (program was to concentrate on focused studies dealing with specific impacts);

2. Establish clear chains of causality which relate impacts to prime causes rather than to measure indirect impacts;

3. Resist collecting perishable data before clear understanding of what the data will be used for;

4. Rather than a few large scale studies it is better to do many small scale investigations, and spend more effort only on those which show promising results;

5. Take advantage of the incremental implementation of Metro to study the marginal improvements and impacts of each stage, rather than to simply make observations on a completed system; and,

6. Try to maximize transferability of the BART Impact Program.

S-16. Studholme, Edward D., Metro Impact in Arlington County: A Case Study and Evaluation of a Transit Growth Model (Final Report), Report No. UTC-11, Contract No. DOT-UT-394, Urban Mass Transportation Administration, Washington, DC, June 1971, (NTIS No. PB-204 934).

The land development impacts resulting from the imposition of the METRO rapid transit system on Washington's urban fabric are likely to be determined by three factors: 1) the efficiency of the transit system itself; 2) the response of the private land development market to this efficiency; and, 3) deliberate public policy intervention, aimed at coercing and/or inducing specific types of development around transit stations. In an effort to evaluate the importance of this third factor, this study analyzes Arlington County's response to the coming of METRO.

The 47 page report is presented in two parts. The first part traces the evolution of a new transit growth model as it is precipitated by selected growth issues in the community and evaluates it in terms of major constraints which influence the planning and implementation processes. The second part evaluates the model in terms of its impact on the tax base of the community by comparing the net revenue contributions of residential with commerical office development.

T-1. Taggart, Robert E. Jr., Walker, N.S. and Stein, M.M. "Estimating Socioeconomic Impacts of Transportation Systems", Transportation Research Record 716, Transportation Research Board, Washington, DC, 1979, pp. 9-20.

This study develops a methodology to estimate the socioeconomic impacts of multimodal transportation plans and programs in Maryland. The impacts include government expenditures (i.e., personal income, employment, and population), of plan implementation, socio-economic impacts of expenditures displacement of businesses and households, and land use, accessibility, safety, and socioeconomic impacts of new transportation services and facilities (i.e., personal income, employment, and population). The methodology consists of 26 impact-estimating equations, each of which was developed for statewide, regional, and county levels of detail. As a test application, the equations were used to evaluate the impacts of a 20-year $10-billion Maryland transportation plan. Socioeconomic impacts related to expenditures and new facilities or services were shown to generate $18 billion in personal income over this period with an average annual population impact of 100,000 people.

The paper suggests that the current state-of-the-art fails to accommodate impact assessment methodology in the following respects:

1. Most models consider only the highway mode; none incorporate all modes of transportation.

2. Few models consider transportation programs other than capital improvement programs or provide the capability to integrate the effects of various programs.

3. Most models focus on determining the demand for transportation facilities and services; few models determine the population and economic-activity impacts of transportation.

4. The models that do provide estimates of the effect of transportation (highway mode) on population and employment distribution fail to account for growth induced by transportation.

5. Most techniques that assess the socioeconomic effects of transportation were developed for and are currently applicable to project planning only.

6. No universally acceptable framework for the integration of the complex of socioeconomic impacts and their application to the evaluation of proposed transportation programs is available. Deficiencies which remain are:

    a. Incomplete understanding of the cause-and-effect relationship between transportation system change and economic development;

    b. Lack of techniques to accurately determine the combined impacts of a set of transportation program;

    c. Insufficient detail of impact estimates;

    d. Lack of techniques to estimate system-level impacts of a set of individually minor projects that compositely may be of large significance;

    e. Difficulties in determining the incidence of impacts;

    f. Uncertainties associated with long-range projections of variables critical to impact estimates; and,

    g. Incomparable impact-estimating capabilities among types of system changes.

T-2. TenHoor, Stuart J. and Smith, S.A., "Parking-Requirement Reduction Process for Ridesharing: Current Practices, Evolving Issues, and Future Directions", Transportation Research Record 940, Transportation Research Board, Washington, DC, 1983, pp. 44-51.

The authors report that due to rising land cost and local government's desire to reduce the economic, environmental, and energy problems associated with single-occupant vehicle commuting, both the public and the private sectors have sought methods of mitigating these problems. Concern about these high costs has resulted in the emergence of transportation system managment (TSM) actions. TSM advocates short-term, low-capital-cost efforts to improve transportation system capacity. Parking management and ridesharing are two key, mutually complementary TSM actions, state TenHoor and Smith.

Current U.S. practices in instituting the process of reducing parking supply requirements when ridesharing at the development site reduces parking demand are reviewed in the paper. Key issues regarding developer support for such reductions, how programs are legally guaranteed and monitored, and who pays for such reductions are discussed. Recommendations on factors to consider when such a process is carried out are presented by the authors.

The authors identify several important needs for the future development of ridesharing and TSM provisions for local zoning ordinances:

1. Improved technical information on the relationship between ridesharing measures and parking demand (both developers and policy makers may continue to have reservations about moving forward with such provisions unless clear evidence is presented on the potential benefits and the likelihood of success);

2. Better knowledge of how lenders perceive such provisions and creation of an educational process to familiarize key groups with the purpose and benefits of ridesharing provisions;

3. Better methods of providing assurances that commitments will be fulfilled without unduly discouraging developers from participating in the program of parking reductions in exchange for ridesharing commitments; and,

4. Continual updating of parking-requirement reduction processes for ridesharing nationwide and dissemination of information on the subject as it becomes available.

The authors conclude that there are many competing objectives that come into play in the development process. Certain transportation objectives (ie., promoting more efficient modes of travel) cannot be isolated from others. The desires and impacts on the many groups with an interest in land development, parking, and transportation must be considered and all such parties should be involved in the process. Participants should include developers, citizens, employers, attorneys, lenders, and public agency staff of various disciplines. There must be a keen awareness of how the development community views such actions, as stated in the paper.

T-3. Texas Urban Development Commission, Urban Texas: Policies for the Future, Institute of Urban Studies, The University of Texas at Arlington, Arlington, Texas, November 1971.

The Texas Urban Development Commission's mandate required that it take a broad approach to its study of urban development in Texas. The Commission, established by the Governor in 1970, reviewed the capability of Texas governmental institutions to deal with urban problems

and defined long-range development goals to help make the urban areas of the state better places to live. The Commission identified both strengths and weaknesses in the overall response of the State's institutions to the challenges thrust upon them.

The Commission tried to make its main contribution through the identification of roadblocks to further improvement. Topics dealt with throughout this report revolve around questions of basic governmental authority as provided by the State's constitutional and legal framework, the organization of State and local government for dealing with urban challenges, planning for improved governmental performance both on a State and regional basis, the problem of adequate manpower to perform essential urban functions, and the important subject of financing urban needs.

The Commission began work in December, 1970 to initiate an intensive research effort to identify a broader range of issues and develop potential solutions for further consideration. This involved the preparation of a number of special reports by the Commission staff, members of the Commission, and other contributors. Through this process the Commission selected important areas of long-range concern to urban Texas and fashioned a series of recommendations which were intended as a guide for the development of public policies and institutions in subsequent years.

The Commission viewed this report as a comprehensive analysis of the important aspects of life in the urban areas of Texas. The conclusions and recommendations presented are the product of scores of meetings involving the entire Commission or its individual committees. A large number of state and local officials, members of the academic community, and representatives of private organizations also participated. Included in the report are sections dealing with urban growth and land use, land resource management, land development codes and urban transportation systems and services.

T-4. The Influence of Central City Radial Freeways on Manufacturing Location Location Decisions, Volume 1, Contract No. DOT-FH-11-7765, Federal Highway Administration, U.S. Department of Transportation, Washington, DC, September 1973, (NTIS No. PB-265 474/7ST).

The 238 page report explores the influence of central city radial freeways on manufacturing development in ten study areas located in 8 central cities of the Northeast and Southeast. Radial freeway influence is found to be positive in 1) revitalizing existing, declining central city industrial areas; 2) strengthening existing, stable industrial areas; and, 3) developing new industrial areas. The 264 manufacturing firms located in the study areas employed more than 36,700 workers, generated nearly $6.8 million in local tax revenues and an estimated $231 million in annual wages.

No major negative environmental impacts were identified beyond those normally associated with urban development or beyond the scope of contemporary performance standards. Operating charactersitics of

the sample firms showed them to be central city-oriented, given the presence of the nearby freeway. Open-ended interview results demonstrated that most manufacturing location decisions were based on one to three of six critical factors: 1) availability of space; 2) price of space; 3) access to sales; 4) access to labor; 5) access to supplies; and, 6) the presence of the freeway itself.

T-5. The Influence of Central City Radial Freeways on Manufacturing Location Decisions, Volume 2, Contract No. DOT-FH-11-7765, Federal Highway Administration, U.S. Department of Transportation, Washington, DC, October 1973, (NTIS No. PB-265 474/4ST).

The contents of the 197 page report include: 1) corridor transportation and land-use analysis; 2) corridor economic and manufacturing analysis; and, 3) critical location factors. Key descriptors of the contents are Urban developement, Manufacturing, Plant location, Freeways, Central city, Employment, Economic impact, Industries, Revenue, Taxes, Highway transportation, and Land use.

T-6. "The Location and Design of Bus Transfer Facilities-An Information Report", Technical Council Committee 5C-1, Institute of Transportation Engineers (ITE), Washington, DC, January 1982.

The objective in the Committee's assignment was to develop planning and design guidelines for the location and design of bus transfer facilities. The Committee's scope of research for this effort included the following:

1. An inventory of the state-of-the-art (library research and identification of all current standards for location and design);

2. New data assembly via limited field reconnaissance and other investigations to provide basis for comprehensive understanding of the problems of bus transfer points; and,

3. Based upon the results of the above two tasks, identify needs for new standards.

This report is the first of two reports summarizing findings and recommendations. It reviews the existing information and state-of-the-art concerning the current practices employed in locating and designing bus transfer facilities. The second report will build upon these findings as recommended guidelines for the location and design of bus transfer facilities.

T-7. Timoney, Ana, BART Impact Program Report Catalog (Planning Document), Contract No. DOT-OS-30176, U.S. Department of Transportation, Washington, DC, July 1976, (NTIS No. PB-262 676/OST).

The 83 page report catalog contains the BART Impact Program management documents which are available through the National Technical Information Service. The report is divided into six sections: Section I and II: The Pre-BART data collection, Section III: Working Papers, Section IV: Planning Documents, Section V: Technical Memoranda and Section VI: Final Reports.

T-8. Toft, Graham S. and Mahmassani, H.S., "Transportation and High Technology Economic Development", Paper for the 63rd Annual TRB Meeting, Transportation Research Board, Washington, DC, January 1984.

High technology industries constitute a major growth sector of the U.S. economy and have, as such, become the center of considerable attention from concerned state and local economic development agencies and others concerned with national industrial competitiveness. These industries present spatial and production characteristics different from traditional manufacturing, including special transportation requirements, which have not received adequate attention to date by transportation planners and policy makers.

This paper discusses the transportation implications of this major economic change within a framework that considers the stages of the industrial innovation process. In particular, implications for air transportation-related measures for fostering high technology growth are addressed, along with recommendations for further research aimed at addressing many unresolved theoretical and design issues.

T-9. Transit Impact Monitoring Program: A Preliminary Analysis of the Impact of MARTA's Omni Station on Omni International Atlanta, Atlanta Regional Commission, Atlanta, Georgia, September 1981.

This study was undertaken as a part of the Atlanta Regional Commission's Transit Impact Monitoring Program (TIMP), for the prupose of comprehensively studying rail transit's impact on the Atlanta metropolitan area. As a part of the TIMP, case studies of specific geographic areas were undertaken periodically to analyze the effects of rapid transit in-depth.

The Omni International Atlanta is a multi-use facility located near the western edge of Atlanta's downtown core area. Opened in late 1975, the Omni contains a spectrum of facilities and services within its four major components which include two office towers, a hotel, a two-level shopping mall, and an entertainment center. It is situated adjacent to two other major air rights developments--the Georgia World Congress Center and the Omni Coliseum--which together attracted nearly two million visitors in 1980.

On December 22, 1979, the MARTA West Line and the Omni Station opened. Within six months the Omni Station had the fourth highest patronage in the MARTA system behind Five Points (the central station) and the East and West Line terminus stations at Avondale and Hightower. This case study of the Omni International Atlanta was under taken because shortly after the MARTA West Line opened reports of the beneficial effects of the MARTA Omni Station on the Omni International Atlanta complex appeared in Atlanta newspapers, on television, and through other media sources. Reports of high patronage at the Omni Station and increased visitation rates to the Omni International Atlanta complex were generating a situation never before experienced. Although the reports were accurate as to the generally perceived improvement of the Omni complex they were not based on a comprehensive analysis of the full range of factors and impacts that were at play.

This case study was therefore conceived and designed to determine the "baseline" conditions that existed prior to the opening of rail transit service and to measure in both quantitative and qualitative terms the changes that have occurred since rail service began. Although the study is intended to be a comprehensive analysis of transit's impacts on all aspects of the Omni International Atlanta, the primary focuses in this first year was on the retail portion of this multi-use project. The methodology described in the report relates to the retail component study method.

T-10. Transit Impact Monitoring Program Annual Report, Atlanta Regional Commission, Atlanta, Georgia, December 1979.

This 81 page document is the 1979 annual report for the Transit Impact Monitoring Program (TIMP) conducted under the leadership of the Atlanta Regional Commission (ARC). TIMP is intended to measure, analyze, and evaluate the various transportation and land use impacts of the construction and operation of MARTA rail transit service in the Atlanta region. This report highlights the progress in this third year of the TIMP.

ARC staff's transit impact monitoring activities began in 1977 with the East Line Pilot Project. This "pilot" study isolated the East Line of the MARTA system, the first corridor where rail and feeder bus would become operational. Drawing upon experience gained in the pilot study, especially in research areas involving compatibility and availability of data sources, impact measure methods, and analysis capabilities, the program in 1978 expanded the East Line Pilot to include the entire MARTA rail system. With this expansion the program and data collection was significantly increased to enable impact measurement in a variety of diverse transportation and land use issue areas.

Although this 1979 TIMP manifests continuity with the previous impact monitoring efforts, several changes have refined the overall program approach. New characteristics of the program include a detailed work program that specifies internal (within ARC) and external

task responsibilities and schedules, consultant services, reporting schedules, and cost estimates. The general objectives of the current TIMP remain basically the same:

1. To monitor short-term (i.e., construction) impacts of MARTA;

2. To examine long-term impacts that result in changes in land use patterns and densities, and travel behavior; and,

3. To evaluate the performance of the rail system and feeder bus service and determine if operational changes are warranted that might significantly improve transit service.

However, because of the recognition that the nature of transportation and land use impacts are different, the scheduling and reporting procedures for the program have been altered. For example, many of transportation impacts will be specifically tied to the opening of line segments following the phased implementation of MARTA rail service. Land use impacts, on the other hand, occur much more gradually and are not so sensitive to specific line openings. Therefore, inasmuch as the data for land use impact measurement are mainly secondary data, it can be gathered on a routine annual basis. This report is organized according to the titles and sequencing used in the TIMP work program. There are sixteen tasks comprising the work program. Tasks 1 through 8 relate to transportation impacts, Tasks 9 through 14 to land use impacts, Task 15 is the production of this annual report, and Task 16 is the production of computer graphics that support many of the Tasks throughout the program. The primary purpose of this annual report is to provide a status report on all of the Tasks and work elements that make up TIMP. The status report of each Task follows the following outline:

1. OBJECTIVES OF TASK AND WORK ELEMENTS - (Purpose and objectives are explained along with the individual work elements);

2. STATUS OF TASK/ACCOMPLISHED WORK/FINDINGS AND CONCLUSIONS - (significant findings or conclusions are discussed); and,

3. DATA COLLECTION AND DATA ANALYSIS METHODS/TASKS RELATIONSHIP TO PREVIOUS WORK AND OTHER TIMP TASKS - (data collection methods are briefly described along with analysis methods and relationship of work done in this Task to other work).

T-11. Transit Impact Monitoring Program - Residential Attitudes Survey: MARTA East Line, Atlanta Regional Commission, Atlanta, Georgia, December 1981.

The purpose of this study was to conduct a residential attitude survey of persons residing in close proximity to the MARTA East Line in the Eastlake neighborhood. This survey is in support of the ARC Transit Impact Monitoring Program (TIMP) Work Program Task No. 9. The major goals of the residential attitude survey are to:

- Identify the relative importance of MARTA's environmental impacts as perceived by residents exposed to them.

- Estimate the extent to which factors other than MARTA influence residents' perceptions of MARTA.

This survey is intended to reveal a broad cross-section of attitudes. It was designed to maximize variation in reported attitudes.

T-12. Transit Impact Monitoring Program - Residential Attitude Survey: MARTA West Line (Hightower Station Area), Atlanta Regional Commission, Atlanta, Georgia, October 1981.

The purpose of this study was to conduct a residential attitude survey of persons residing in close proximity to the MARTA West Line in the Hightower neighborhood. This survey is in support of the ARC Transit Impact Monitoring Program (TIMP) Work Program Task No. 9. The major goals of the residential attitude survey are:

- To identify the relative importance of MARTA's environmental impacts as perceived by residents exposed to them. The survey findings should be presented in a manner that provides ARC data on the residents of the critical causes of both negative and positive impacts; and,

- To estimate the extent to which factors other than MARTA influence residents' perceptions of MARTA.

This survey was intended to reveal a broad cross-section of attitudes and was designed to maximize variation in reported attitudes.

T-13. Transit Impact Monitoring Program: Results of Station Area Studies, Atlanta Regional Commission, Atlanta, Georgia, August 1981.

The role of Station Area Studies in the Transit Impact Monitoring Program (TIMP) is to provide direct, first-hand observations of activity around MARTA stations. During the first stage of transit station design, ARC and MARTA staff estimated the patronage, parking demand, and the mode of access and egress for transit stations. This TIMP work tests the adequacy of station design parameters and points out areas where adjustments are needed now that stations are in operation.

Overall, the Station Area Surveys are intended to collect data concerning:

- Station patronage;
- Parking in MARTA lots;
- Mode of access to MARTA transit stations;
- On street parking, especially in residential neighborhoods; and,
- Pedestrian volumes and exposure to conflict with vehicles.

In carrying out this research, six hypotheses were formulated and data were collected to test hypotheses. According to the study designs written jointly by MARTA and ARC staff, data are collected at least twice in selected transit stations - once before revenue service begins, and again after rail and feeder bus service has been established. "Before" and "after" data is compared in order to measure changes which have occurred. Since the "before" and "after" cases are only a few months apart, it is assumed that, in most cases, changes are attributable to MARTA's operations. In cases where intervening events affect the conclusions, those events are described and the direction of influences indicated. In most cases, data collection took place over a sufficient period so that day-to-day variation is controlled. However, it was noted that these data include significant random variation which could not be statistically controlled within the limits of resources available for this phase of the work.

T-14. "Transit Station Access", Technical Council Committee 5C-6, Institute of Transportation Engineers (ITE), Washington, DC, December 1980.

The original scope of this work was: To develop design guidelines which consider level of transit service (headways), patronage, parking requirements, access and egress, pedestrian circulation (horizontal and vertical), waiting areas, attendant facilities, free and pay areas, safety, security systems, and accommodations for elderly and handicapped. Because of the magnitude of the original scope, the Committee elected to only develop design guidelines for transit station access by all modes.

The access facilities to be provided at a transit station should be based on the patterns, by mode, of the existing and projected traffic in the vicinity of the station, the projected traffic volumes destined for the station, and the existing and potential future characteristics of the site and the surrounding area. Patrons will arrive at and depart from transit stations by six basic modes. These modes, in order of priority for convenience and directness of routing, are:

1. Pedestrian;
2. Bicycle;
3. Bus;
4. Kiss-and-Ride and taxicab;
5. Motorcycle; and,
6. Park-and-Ride.

To determine traffic volumes destined for the station, the study should first identify the modal split. Suburban stations will often have all six of these modes while at urban stations, parking and kiss-and-ride facilities may not be provided. The maximum possible segregation between modes of transportation in the station area should be provided in the following order of priority: 1) Between pedestrians and other modes; and, 2) Between public and private transportation.

Number of entrances/exits should be minimized. The provision of signs in conformance with the MUTCD should guide arriving and departing passengers. Special consideration in the design of station access should be given to handicapped and elderly passengers. Access roads should conform to local codes or to the standards of AASHTO. At least two independent access routes should be provided to each station, if possible. Access routes for emergency and service vehicles should be identified. Emergency equipment such as fire trucks and ambulances should have access to all sides of the station. Service vehicles should be accommodated in areas other than the passenger entry zone. The need to accommodate any or all of the six modes will affect the placement of the station structure. The physical facilities to be furnished for each mode is an issue which should be addressed early in the design process. When the station is one element of a joint development program, coordinated treatment of access facilities should be initiated in the preliminary planning and design phase.

T-15. Transportation Research Board, Technical Aspects of Urban Transportation Alternative Analysis, Contract No. DOT-UT-70060, Urban Mass Transportation Administration, Washington, DC, July 1978.

The report contains the proceedings of the invitational seminar held for the purpose of summarizing the current practice of urban transportation alternative anlaysis and for identifying the key issues warranting resolution. Four major areas are treated: 1) identification of alternatives; 2) prediction of impacts of alterntives; 3) environmental impact statement as an element of the alternative analysis process; and, 4) evaluation and decision making. The procedures employed in the alternative-analysis process are described and the need for further refinement and development of analytical tools is suggested. The report is structured around a series of key issues of concern in the alternative-analysis process. Recommendations are made for steps to be taken by the Urban Mass Transportation Administration to assume more uniform application of technical procedures.

U-1. University of Georgia, Mass Transit Management: Case Studies of the Metropolitan Atlanta Rapid Transit Authority, Report No. DOT-I-81-1, Urban Mass Transportation Administration, Washington, DC, March 1981.

Atlanta, Georgia is one of a limited number of cities constructing a new rail rapid transit system. The new transit authority has experienced a variety of gestation and early existence problems. Their solutions seemed to be worth sharing with existing and embryonic urban public transportation agencies, as well as other individuals interested generally in public agency management problems. This document is an attempt to document Atlanta's experience for these other groups and examines a series of case studies on the various key management-oriented events and developments at MARTA. This document contains the six Case Studies considered to be of the most general interest.

The case studies, in abbreviated form, include:

1. Assessing Electoral Defeat (of the 1968 referendum);
2. MARTA and the 15 Cent Fare;
3. Low Fare: Economic Analysis;
4. Reorganizing Manager's Office;
5. Arbitration Process for Resolving Contract Disputes; and,
6. Marketing in MARTA.

U-2. Urban Land Institute, Joint Development: Making the Real Estate - Transit Connection, Executive Summary, Report No. DOT-I-79-13, Urban Mass Transportation Administration, Washington, DC, July 1979.

This 15 page summary highlights the advantages of public/private partnerships in transportation developments. The report concludes that the prospects appear bright for future joint development providing that:

- Public officials implement land use and transit planning decisions which exploit transit as a development tool; and,
- Private developers and public officials are willing and able to work together to consummate the necessary deals.

The experiences from case studies demonstrate that public/private arrangements are entering a new era of sophistication. Joint development, with its synergistic qualities, offers excellent opportunities to combine public and private efforts in order to contribute to the well-being of our major metropolitan areas. From these joint development cases, it is possible to define the following guidelines for developers and public officials:

- Evaluate thoroughly all real estate potentials and requirements at the front-end of the process--normally at the point of serious project planning--rather than after irrevocable public sector decisions about route alignment, station location, land acquistion, positioning of access points, and related items have been made;
- Establish public policies for approaching land disposition, coordinated construction, operations, etc., which are compatible with normal operations in the real estate industry. These policies should satisfy developers, permanent lenders, and others in the development process such as title insurers, property insurers, lenders of construction financing, future tenants, etc;
- Base the roles and commitments of public and private parties on the market conditions at each specific site. The market conditions should determine the level of incentives needed, if any, to attract private capital, or the extent of rewards the public sector should receive for its participation;

- Define roles and commitments in a manner that is simple and relatively easy to administer, with all interests knowing they are expected to contribute and that certain risks will be theirs;

- Ensure explicit and adequate funding for publicly financed project components; and,

- Structure the sharing of risk in a manner that is perceived by business, government, and the public-at-large as fair and unbiased.

V-1. Valk, Peter J., "Commuter Demand for Ridesharing Services (Abridgement)", Transportation Research Record No. 823, Transportation Research Board, Washington, DC, 1981, pp. 17-21.

Ridesharing has recently become one of the most discussed topics in the fields of transportation system management and energy conservation. It is increasingly being looked on by both public and private sectors as a short-term answer to a variety of economic and environmental ills. Ridesharing behavior is manifested in two distinct ways: 1) regular ridesharing refers to the adoption of shared commuting on an ongoing basis; and, 2) emergency ridesharing is characterized by swift, but short-term, shifts from driving alone to pooling for the home-to-work trip. This paper characterizes both types of behavior and addresses the implications for providing assistance to commuters in both settings.

V-2. Vlachos, Evan C., Secondary Impacts and Consequences of Highway Projects (Final Report), Contract No. DOT-OS-50043, U.S. Department of Transportation, Washington, DC, October 1976, (NTIS No. PB-267 294/7ST).

This study is a preliminary attempt to explore secondary impacts of highway projects by relating conceptual premises with empirical investigations. The rationale arises from the legal imperatives of both the Council on Environmental Quality Guidelines and necessities of accounting for long-range consequences of present projects.

The document intends to provide some preliminary definitions and, in a systematic approach, delineate an approach to secondary, indirect or induced effects. A variety of approaches could help indicate the range of questions on secondary effects as well as the procedures that may contribute to a better understanding of the long-range ramifications of highway improvements. The underlying preoccupation of the 322 page document is outlining the conditions that make forecasting of alternative futures both possible and plausible.

V-3. Voorhees and Associates, Inc., Transportation Pooling, Report No. UMTA-IT-06-0092-74-1, Urban Mass Transportation Administration, Washington, DC, January 1974.

With the advent of impending energy shortages in the winter of 1973-74, the U.S. Department of Transportation embarked on an accelerated program to promote increased use of high-occupancy vehicles. As part of this program, reports were prepared on major aspects of carpool programs designed to assist local areas in initiating successful pooling or ridesharing programs. This report is a collection of ten indiviual reports which were published as separate documents in January 1974, by U.S. DOT. The individual reports or documents contained in this publication are: 1) Review of Carpool Activities; 2) Organization for Carpooling; 3) Approaches to Matching; 4) Legal and Institutional Issues; 5) Incentives to Carpooling; 6) Transit/Taxi Coordination; 7) Vanpools; 8) Buspools; 9) Pooling for the Disadvantaged; and, 10) Carpool Backup Systems.

The goal of a Carpool/Buspool Program is to satisfy travel requirements more efficiently by increasing passenger occupancy in autos and buses, thereby reducing the number of vehicles using the streets and highways. Achievement of that goal calls for coordination among many institutions within a metropolitan region including public agencies and citizen and business groups. The information and techniques presented in this report may be considered as a guide to the development of a sound program in a metropolitan area.

V-4. Vuchic, Vukan R., Urban Public Transportation - Systems and Technology, Prentice-Hall, Englewood Cliffs, New Jersey, 1981.

The author's original intent in writing this book was to present a systematic coverage of all major aspects of transit, thus providing the much needed technical information for transit operators, planners, academics, and others working in this area. It became obvious that the field is so comprehensive that its adequate treatment requires more than one volume. Therefore this book presents definitions, descriptions, and analyses of transit systems and technology (i.e., physical systems and their predominantly engineering aspects). Transit planning, operations, and policy areas are subjects of a subsequent volume. A major emphasis in this book is placed on a systematic description of the basic concepts, terms, and relationships: a number of new definition, classifications, and analyses are included. Through the use of practical examples and applied models, the book is intended to serve both professionals working in transit and planning agencies, government, consulting and equipment manufacturing companies, and theoretical analysts, such as academics and other researchers.

Chapters 4, 5, 6, and 8 of the book present detailed descriptions and analyses of different transit modes, with emphases corresponding to their technical/operational complexities and their relative roles in urban transportation. The most comprehensive chapters are those covering highways and rail transit modes, which provide a vast majority of

transit services in most cities around the world. Presentation of transit system performance, referring to the modes described in Chapters 4, 5, and 6, is given in Chapter 7. It consists of a blend of theoretical analyses and empirical data, particularly focussing on capacity.

Each chapter includes a selected bibliography for the respective area. Abbreviations used in the book are explained in Appendix II, whereas Appendix III contains definitions of terms and concepts referring to transit systems and technology. As mentioned, this book attempts to develop and systematize the basic concepts and technical aspects of transit modes, and to illustrate them through most advanced transit systems, including those in United States and foreign cities.

W-1. Watterson, W.T., "Estimating Economic and Development Impacts of Transit Investments", Paper for the 64th Annual TRB Meeting, Transportation Research Board, Washington, DC, January 1985.

While economic and development impacts are frequently included as positive objectives of major transit investments, the issues, methods, and results of actual impact analysis remain rather crude and are sometimes misleading. This paper reports empirical analysis on economic and development impacts from a study of major transit investment for the Seattle area, using state-of-the-art econometric and spatial interaction models.

Economic impacts are found to be quite sensitive to assumptions on financing local shares of transit investment, although project financial planning and economic impact analysis have rarely been considered together. Development impacts, in terms of both job and household locations, are modest overall and are concentrated in the vicinity of the central business district that was to be the focus of the transit service, despite the magnitude of the investment involved. The research findings are somewhat tentative, but do suggest directions for applied research in quantitative analysis with operational models, to the end of clarifying for policy purposes the potential impacts of major investment projects.

W-2. Wattleworth, Joseph A., et al., <u>Report 1 - Evaluation of the NW 7th Avenue Express Bus and Bus Priority Systems</u>, Report No. UMTA-FL-06-0006, U.S. Department of Transportation, Washington, DC, September 1977.

This 128 page report presents a summary of the evaluation of Phase I of the I-95/NW 7th Avenue Bus/Car Pool Systems Demonstration Project in Miami. The twenty-six month Phase I evaluation consisted of evaluation of several techniques for providing express buses with a priority service on an urban arterial street.

Four bus priority systems were implemented and evaluated on NW 7th Avenue in Miami. These systems were: 1) buses with traffic signal preemption capability in mixed mode operation; 2) buses with traffic signal preemption capability in a reversible exclusive bus lane; 3) buses in the exclusive lane with traffic signal progression; and, 4) buses with traffic signal preemption capability in the exclusive lane with traffic signal progression.

For the traffic pattern and geometric configuration on NW 7th Avenue, it was found that the travel times for both buses and autos were reduced under each of the priority treatments. Auto accident rates were unaffected but the provision of the exclusive bus lane introduced some problems with bus accidents. Buses moved up to 25% of the passengers and represented less than 2% of the vehicles in the potential trips. Several inefficiencies in the transit system reduced the economic viability of the transit service.

The report presents summaries of all of the studies that were conducted and presents a comprehensive economic viability analysis.

W-3. Wattleworth, Joseph A., et al., Report 4 - Modal Shift Achieved on the NW 7th Avenue Express Bus System, Report No. UMTA-FL-06-0006, U.S. Department of Transportation, Washington, DC, September 1977.

The purpose of this 70 page report was to evaluate the modal split achieved by the Orange Streaker express bus system. Screenline studies and a home interview were conducted to obtain the data necessary to establish a proportional relationship producing modal split of project trips.

The modal split increased with early ridership increases but leveled off with a leveling trend in ridership. The significant increases in modal split achieved in the early months of the study period could not be directly attributed to the attactiveness of the Orange Streaker service due to the impact of other factors, such as the energy crisis. The fact that modal split did not decline at the end of the energy crisis indicates patron satisfaction and suggests that the service represented a viable alternative to the automobile.

W-4. Wattleworth, Joseph A., Wallace, C.E. and Courage, K.G., Report 5 - Effect of the Park N Ride Facility on Usage of the NW 7th Avenue Express Bus System, Report No. UMTA-FL-06-0006, U.S. Department of Transportation, Washington, DC, June 1977.

This 65 page report presents a description of the Golden Glades Park 'n' Ride Facility and an assessment of the impact of the facility on usage of the I-95/NW 7th Avenue Express Bus/Car Pool Systems Demonstration Project during Phase I. The Golden Glades Facility is an intermodal transfer facility which provides parking for persons transferring from the auto mode to the express bus or carpool mode. The

Facility serves as a staging area for Orange Streaker buses and carpools with provisions for kiss 'n' ride and local bus transfers, as well as the park 'n' ride transfers. Covering 8.1 acres and providing 967 parking spaces, the facility is located at the southern end of the Project market area with access to the project corridor via NW 7th Avenue.

This report represents an analysis of data from daily MTA starter counts, input/output studies, air photo studies, system user and intermodal transfer studies, which were used to determine the type of use, growth, and distribution of vehicles as they arrived and left the facility. The analysis showed that the number of AM peak period bus passengers at the end of Phase I was about 800 per day, having grown at a rate of roughly 10 passengers per month during Phase I. A maximum of about 450 vehicles parked in the facility each day at the end of Phase I, representing a growth of about 10 daily cars per month. The number of daily carpool formations in the facility averaged about 44 and was expected to increase when a flyover connection was opened between the facility and the priority lanes on I-95.

Of all the vehicles entering the facility in the morning peak period, about 59% were park 'n' ride vehicles driven by bus passengers, 7% were car pool vehicles, 27% were kiss 'n' ride vehicles and 7% were park 'n' ride vehicles driven by carpool passengers. From the data it was estimated that about 35-50% of the express bus ridership would have been lost to the auto had parking not been provided in conjunction with the express bus service. In addition, an estimated 20% of the bus passengers would have been lost to the auto if kiss 'n' ride access had not been provided. Further, virtually all of the carpools would have been disbanded or would need to stage elsewhere had the parking facility not been provided at the Golden Glades Facility. Thus, it was concluded that, in an express bus service of the type represented by the Orange Streaker service, both parking and provision for the kiss 'n' ride maneuvers are very important elements of the service.

W-5. Wattleworth, Joseph A., et al., Report 6 - Effects of NW 7th Avenue Bus Priority Systems on NW 7th Avenue Traffic Stream Flow and Passenger Movements, Report No. UMTA-FL-06-0006, U.S. Department of Transportation, Washington, DC, September 1977.

The purpose of this 208 page report was to document the effects of several bus priority systems implemented on NW 7th Avenue in Miami, Florida, on traffic stream flow and passenger movement characteristics. Data were collected regarding traffic volume, vehicle occupancy, system delay (air photos), violations of the reserved lane, auto travel time and accidents. Analyses were conducted to determine the effects of each bus priority system on the operational characteristics of automobile traffic and passenger movements on NW 7th Avenue.

Some of the general conclusions were: 1) none of the implemented bus priority systems produced an adverse effect on auto traffic and, in fact, the auto traffic was generally improved under all bus priority

systems; 2) the bus priority system consisting of a reversible, exclusive bus lane and traffic signal progression produced better operation for the automobile traffic than did the systems which used the exclusive bus lane and traffic signal preemption; 3) the initiation of the exclusive lane was associated with a significant increase in bus accident rates (after a "start up" period, the bus accident rate decreased somewhat but still remained higher than the bus accident rate before the initiation of the bus lane) and, 4) the rate of violation of the reserved lane was relatively low (about 5%) (there was an indication that the violation rate decreased with time as drivers learned of the reserved lane and left turn restrictions)

W-6. Wattleworth, Joseph A., et al., Report II-1: Evaluation of the I-95 Express Bus and High Occupancy Vehicle Priority System, Study No. UMTA-FL-06-0006, U.S. Department of Transportation, Washington, DC, January 1978.

This 140 page report presents a summary of the evaluation of Phase II of the I-95/NW 7th Avenue Bus/Carpool Systems Demonstration Project in Miami. Phase II consisted of the evaluation of the effects of the exclusive bus/car pool lanes on I-95, The Golden Glades Park 'n' Ride Facility and a direct flyover connector between the Facility and the reserved lanes on I-95.

The bus ridership at the end of Phase II was about 900 passengers per day in each direction. This ridership and the existing fare structure was sufficient to generate enough revenue to cover about half of the cost of operation of the express bus system. A higher revenue, cutbacks in the feeder routes, elimination of the less profitable routes and off-peak direction service were suggested as possible means to accomplish a reduction in operating deficit.

The addition of the reserved lanes on I-95 produced a reduction in all travel times on I-95. When the reserved lanes were used by buses and three person carpools, the reserved lanes were highly underutilized. When the car pool eligibility was reduced to two persons, the reserved lane carried nearly as many persons per hour as the general lanes but the reserved lanes had a much lower volume to capacity ratio. Other detailed anlayses, including an economic viability analysis were also presented in the report.

W-7. Wattleworth, Joseph A., Courage, K.G. and Wallace, C.E., Report II-2: Evaluation of the Effects of the I-95 Exclusive Bus/Carpool Lane Priority System on Vehicular and Passenger Movement, Report No. UMTA-FL-06-0006, U.S. Department of Transportation, Washington, DC, December 1977.

This 74 page report presents the effects on vehicular and passenger movements of Phase II of the I-95/NW 7th Avenue Bus/Carpool Demonstration project in Miami. In Phase II, buses and carpools were allowed to use reserved lanes which had been constructed for them on I-95.

When the reserved lanes were opened on I-95, all travel times were reduced. When the minimum occupancy requirement for carpools in the reserved lanes was three persons, the reserved lanes were highly underutilized. When the minimum occupancy requirements in the reserved lanes was reduced to two persons, the reserved lanes carried about as many persons as the general lanes but the reserved lanes had a much lower volume to capacity ratio.

The violation rate was 63% when the minimum carpool occupancy in the reserved lane was three persons and dropped to about 37% when the minimum carpool occupancy was reduced to two persons. The addition of the lanes on I-95 significantly decreased the accident rate on I-95 on a daily basis. The peak period accident rate remained unchanged when the reserved lane was opened to buses and three person carpools. When the minimum occupancy requirement for carpools in the reserved lane was reduced to two persons, the peak period accident rate decreased significantly.

W-8. Wattleworth, Joseph A., et al., Report II-3: Evaluation of the Effects fects of the I-95 Exclusive Bus/Carpool Priority System on the Express Bus System, Report No. UMTA-FL-06-0006, U.S. Department of Transportation, Washington, DC, December 1977.

This 150 page report presents the evaluation of the effects of Phase II of the I-95/NW 7th Avenue Bus/Carpool Demonstration Project in Miami on the express bus and carpool operation. In addition, the effect of the Park 'n' Ride Facility and flyover ramp on the utilization of the I-95 bus/carpool priority system is presented along with the effect of the marketing program. The economic viability of the I-95/NW 7th Avenue bus/carpool priority systems is also presented.

Several factors which has been found to detract from the solvent operations of the express bus system in Phase I continued to contribute to the operating deficit of the Orange Streaker system in Phase II. These factors included the high percentage of deadhead operation, some routes with low ridership, low ridership on the feeder routes and an inadequate fare structure.

About 900 passengers (each way) used the Orange Streaker at the end of Phase II and about 550 autos were parked daily in the Park 'n' Ride Facility. In Miami, the Park 'n' Ride Facility was a very important element of the Project and at least 75% of the bus passengers used an auto to access the Orange Streaker at the Park 'n' Ride Facility. In Phase II, the average Orange Streaker passenger saved about $3.44 per day by using the service. The provision of priority lanes on I-95 for use by express buses and car pools with two or more persons was the most cost effective alternative on I-95.

W-9. Webber, Melvin M., "The BART Experience - What Have We Learned?", Monograph No. 26, Institute of Urban and Regional Development, University of California, Berkeley, California, October 1976.

The Bay Area Rapid Transit system (BART) has many characteristic of a huge social experiment, BART was to stem the much-feared decline of the older metropolitan centers, while helping to give coherent order to the exploding suburbs. By offering a superior alternative to the automobile, BART was to make for congestion-free commuting. If successful, it would provide a model for rationalizing transportation and metropolitan development elsewhere.

It was experiemental only in the sense that nothing quite like it had ever been tried before. Nowhere in America had a regional rail system been built in contemporary times, and nowhere in the world had such a rail system been built in an auto-based metropolitan area. The metropolitan region served by BART is built around a traditional European-type center with a large concentration of office employment and related service employment. Outside the small but high-density central city, the metropolitan settlement is organized in low-density suburban patterns, all of which were built around automobile transport. For test purposes, the Bay Area is further advantaged by having its urbanized areas topographically molded into narrow strips that parallel San Francisco Bay and follow the narrow valleys--a configuration superbly suited to the geometry of railroad lines, which also makes for long travel distances that, in turn, cry out for high-speed modes of transport.

It will of course be some time before definitive results of the BART evaluation are in, but enough impact research has now been done to permit an early appraisal of how well BART is accomplishing the objectives that motivated its construction, states Webber in the monograph. In turn, enough has been done to permit some judgements concerning the wisdom of building BART-like systems elsewhere. Webber examines BART's impacts and concludes that BART's score is pretty low, implying that prospects for other cities are dim.

W-10. Witheford, David K., "Urban Transportation Planning", Transportation and Traffic Engineering Handbook, Second Edition, Institute of Transportation Engineers, Washington, DC, 1982, pp. 343-379.

A chapter on Urban Transportation Planning, written by David K. Witheford for the ITE Handbook, states that this activity has been going on for centuries, shaping cities and the ways that communities live. Even so, it is still part art and part science. As new techniques are brought to bear, the processes improve. More important, they change as the needs of society change. The resulting dynamics, which affect the work and lives of all transportation professionals, offer an engrossing career challenge to many. This changing nature of urban transportation planning creates some difficulty because processes can become quickly dated. The objective of the Chapter was primarily to highlight existing practice and, secondarily, to indicate changes likely for the future.

There have been a number of relatively recent changes. Whereas environmental considerations have been a recognized issue in urban transportation planning for over a decade, energy questions only recently entered the picture as a result of threatened fuel shortages, rising fuel costs, and relatively declining incomes from fuel-tax sources. Inflation in construction costs has also had an impact. Joining with such issues is the host of broad social questions concerning transportation equity for special groups and increased involvement of the public in all matters affecting their welfare. Together, these forces have changed urban transportation planning. In the United States, at least, an era of urban freeway planning and construction has ended. A more austere era of planning to optimize the capacity of existing urban systems has clearly begun.

Reflecting such changes, this chapter emphasizes short-range more than long-range planning in first describing the planning process and then the variety of projects or studies that can be called urban transportation planning. Following a section concerned with organization for planning, the chapter ends with a review of new directions and emerging issues. Throughout, the chapter identifies examples of planning projects and lists selected references.

Z-1. Zumwalt, B.A. "Land Use Impacts of Fixed Guideway Transit Systems - Implications for Downtown People Mover Projects", Journal of Advanced Transportation, Vol. 13, (Research supported by the U.S. Department of Transportation, Washington, DC), Spring 1979, pp. 67-79.

Experiences of cities that have recently made rapid rail system investments indicate transit service improvements are a necessary but not a sufficient factor for encouraging changes in land use and urban development according to Zumwalt. Land use impacts of transit systems are complicated by a number of factors at work in the urban environment such as public policy and site characteristics, states the author in this 13 page paper.

If the Downtown People Mover (DPM) projects sponsored by the Urban Mass Transportation Administration (UMTA) are to influence land use and urban development changes, they must be supported by effective and strong government policies. These policies should emphasize modification of zoning laws, where appropiate, coordination of other governmental capital investments with the DPM system, and implementation of other joint development techniques.