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DEPARTMENT OF TRANSPORTATION URBAN MASS TRANSPORTATION ADMINISTRATION WASHINGTON, D.C. 20590

THE ADMINISTRATOR

September 1973

I am pleased to forward you a copy of URBAN MASS TRANSPORTATION ABSTRACTS - VOLUME II, a report prepared by the Office of Research, Development and Demonstration of the Urban Mass Transportation Administration.

The volume is a general index to reports generated under contract to the Urban Mass Transportation Administration and updates URBAN MASS TRANSPORTATION ABSTRACTS - VOLUME I, published in October 1972.

The report reflects UMTA's commitment to disseminate technical information of relevance to other Government agencies, state and local planning bodies, the transit industry and the general public, and contains 195 abstracts of technical reports that are available from the National Technical Information Service.

I hope you find this document useful and informative. Please contact the UMTA Transit Research Information Center if we can be of further assistance.

Sincerely,

Frank C. Herringen

FORWARD

This reference document was prepared to serve as a general index to reports, generated under contract to the Urban Mass Transportation Administration of the U.S. Department of Transportation, in furtherance of its continuing responsibility to disseminate information to government, state and local transportation planning bodies, private industry and the general public.

This document updates and is a companion to URBAN MASS TRANSPORTA-TION ABSTRACTS (Volume I) published in October 1972. Volume I may be ordered at the National Technical Information Service. The order number is PB-213-212 and the price is \$6.00.

All reports in this document are available for sale at the:

National Technical Information Service U. S. Department of Commerce 5285 Port Royal Road Springfield, Virginia 22151

Each abstract in this document contains a National Technical Information Service (NTIS) order number and price for both paper copy (PC) and for microfiche (MF). All orders to NTIS must be prepaid and contain the report order number.

Abstracts are sectionally divided and arranged by project number by the programs administered by the Urban Mass Transportation Administration, including: 1) Technical Studies, 2) Research, Development and Demonstration, and 3) University Research and Training. Section IV contains complete indexes to this volume by author (personal and corporate), title, keyword, geographical reference, and project number.

For additional information about any of the reports in this volume, please contact the Transit Research Information Center of the Urban Mass Transportation Administration (202/426-9157).

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SECTION I

TECHNICAL STUDIES REPORTS

Title: "Public Transportation Feasibility Study -- Anchorage, Alaska" Author: Bivens and Associates, Inc. (for Greater Anchorage Area Borough) Date: March, 1972 Project_No. AK-09-0001

Keywords:1. Bus, intracity4. Routes and Routing2. Public Ownership5. Management, operations3. Financing Mass Transportationand techniques

Abstract: The feasibility of establishing a public mass transportation system in Anchorage, Alaska, is examined. Financially unsuccessful bus operations in the past and a demonstration project sponsored by the Urban Mass Transportation Administration are reviewed.

The authors discuss the need for public transportation with reference to improving community-wide mobility and providing benefits for middle-income residents and minority groups. Possible applications of steam buses and people movers are described briefly.

The report develops several operational and performance requirements for a proposed transit system. Attention is given to mode choice, financing, convenience, aesthetics, capacity, fares, dependability, flexibility, speed and safety, comfort, environmental protection, and system monitoring.

Specific recommendations for the Anchorage Transit Plan are delineated with reference to routing, physical facilities, personnel, and estimates of patronage. The authors note particularly the need for adequate financing to cover costs of the proposed transit system. The report concludes with a brief discussion of organizational structure and immediate action recommendations.

> NTIS Order #: PB-213-163 PC \$3.00, MF 95¢

Title:	"Supp Stuc	lemental Appendix t y Anchorage, Ala	o the Pub ska"	olic Trans <u>p</u>	portation 1	Feasibility
Author:	Bive	ens and Associates,	Inc. (fo	or Greater	Anchorage	Area Borough)
Date:	Marc	h, 1972		Pro	oject No.	AK-09-0001
Keywords	: 1. 2.	Demography Employment	3. 4.	Land Use Routes and	l Routing	

Abstract: The report is a supplemental appendix to the public transportation feasibility study for Anchorage, Alaska. An integral element of this study was the selection of potential transit service areas within the Anchorage Borough.

The selection process consisted of a comparative analysis of several important factors. Among the factors of major importance considered were: (1) land use, (2) population, (3) employment, (4) income, and (5) the location of schools, hospitals, and other public and semi-public institutions. The volume of travel among more than 200 traffic zones throughout the urban area was also examined. The report contains in tabular and graphic form all information used in this analytical process.

The research yielded 29 proposed bus routes each of which is described briefly. Projected values for several analytical parameters are outlined.

NTIS Order #: PB-213-164 PC \$3.00, MF 95¢

Title:	"Proje Anchc	ect Report prage, Ala	t for Publ Aska"	ic Transp	ortation Feasib	ility	Study for	
Author:	Great	er Anchoi	rage Area	Borough,	Planning Depart	ment		
Date:	Augus	st, 1972			Project	No.	AK-09-0001	
Keywords	s: 1. 2. 3. 4.	Bus, int Bus, cos Weather Demograp	cracity st Effects Dhy	5. 6. 7. 8.	Intermodal Com Public Ownersh Financing Mass requirements Routes and Rou	petit ip Tran ting	tion	

Abstract: The report examines several recommendations concerning the feasibility of establishing public bus transportation in the Anchorage metropolitan area. Problems associated with the development of a transit system include low population density, competition with the private automobile, inclement weather and seasonal changes, and the negative public experience with past transit operations.

Recommendations of a privately-conducted feasibility study are reviewed; in general, this study recommended the establishment of a public bus transit system consisting of four basic subsystems and several routes which would be operated by a special transit authority.

This report develops specific refinements to the feasibility study's recommendations with an emphasis on costs and financing. A long-range action program is described along with detailed cost data.

> NTIS Order #: PB-213-165 PC \$3.00, MF 95¢

Title: '	Birmi	ngham Transit Study	tor E	Birmingha	um Regior	nal P.	Lanning Comm	ission"	
Author:	Wilbu	Smith and Associa	tes, I	Inc.					
Date:	June,	1972			Project	No.	AL-09-0002		
Keywords	1. 2. 3.	Management, operat Bus Financing Mass Tra	ions a nsport	and techr tation	niques	4. 5. 6.	Public Owne: Surveys Government,	rship urban	

Abstract: The report summarizes a comprehensive technical study of bus transit in the Birmingham, Alabama, metropolitan area. The authors note that while patronage has declined severely in recent years, public transportation remains an important community service. The purpose of this report was to evaluate the present and shortrange role of mass transit in the Birmingham area and to determine the best means by which the required level of service may be financed and administered.

All relevant aspects of the transit system are described in detail. Passenger surveys were employed to measure transit usage and ridership characteristics. Regional transportation systems are examined with particular attention focused on the Birmingham Transit Corporation (BTC), the area's major bus operator. Complete financial and inventory data for BTC are provided. The authors conclude that BTC is well-managed and operated, with costs significantly below the national average. Other bus services such as the Vestavia Bus Lines are also discussed.

Legal considerations are examined in detail. The report notes that while BTC is under the jurisdiction of the Public Service Commission, this authority extends only to the regulation of fares. Attention is focused on recent transit authority legislation which provides the nucleus for a recommended public acquisition of the bus system. Unification of the BTC and Vestavia systems is recommended under the transit authority. Specific recommendations are also advanced for management structure, routes, fares, service to low-income areas, improved facilities, promotional activities, and other considerations.

The authors underscore the fact that existing transit authority legislation does not empower it to develop independent revenue sources. Financing for the proposed improvements will necessarily come from participating local governments. Other funding sources -- including changes in the state law, county financing, and use of special taxes -- are discussed. A long-range improvement program is briefly outlined.

> NTIS Order #: PB-211-315 PC \$3.00, MF 95¢

Title: "High Speed Ground Transportation -- Documentation of Preliminary Engineering, Los Angeles International Airport"

Author: Kaiser Engineers

Date: April, 1972

Project No. CA-09-0010

Keywords:	1. 2. 3. 4.	Rail, systems planning and design Rail, stations and terminals Rail, cost Air Cushion Vehicle	5. 6. 7. 8.	Guideways Land, acquisition Topography Airport, access	
	4.	Air Cusnion Venicle	Ο.	Airport, access	

Abstract: The report documents preliminary engineering and continued development of route and structures under Phase III of the project to construct a high speed access facility serving Los Angeles International Airport and the San Fernando Valley. Earlier phases of the project involved feasibility studies and patronage forecasting.

In February, 1971, a major earthquake in southern California caused an indefinite delay in the completion of Phase III research. Consequently, the present report is a documentation only of the work completed to date. The authors note that additional engineering and vehicle-guideway development is necessary before the system can be considered for final design and construction.

The completed facility will consist of tracked air-cushion vehicles running on a special guideway through the airport access corridor. A special linear induction propulsion system for the vehicles is under development.

Attention in the report is focused on several major topics, including: (1) alignment, property acquisition, and utility relocation; (2) ground control surveys; (3) subsurface investigations; (4) guideway structures; (5) earthquake analysis; (6) stations; and (7) capital costs. The seismic studies (topic #5) were added to Phase III investigations following the 1971 earthquake. The report contains statistical documentation and design illustrations completed to date. Title: "High Speed Ground Access Study -- Los Angeles International Airport"

Author: Peat, Marwick, Mitchell and Company

Date:	April,	1972
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Project No. CA-09-0010

Keywords:	1. 2.	Air Cushion Vehicle Distribution System	5.	Rail, systems planning and design
	3.	Airport, access	6.	Rail, cost
	4.	Interfaces	7.	Ridership, volume
			8.	Bus, shuttle

Abstract: Three alternative airport access and circulation systems were analyzed with reference to ridership and cost estimates. The proposed high speed ground access system will operate between Los Angeles International Airport and the San Fernando Valley with tracked air cushion vehicles (TACV). The access system will be interfaced with an intra-airport circulation system designed to move passengers from the TACV terminus to their destinations within the airport.

Various combinations of TACV and intra-airport (either automated guideway or bus) service were examined. The three alternative systems were: (1) a 16-mile TACV and intra-airport transit system; (2) a 16-mile TACV and bus system; and (3) an 8-mile TACV and bus system. Under system #1, the authors also examined the intra-airport transit as an independent mode. The report forecasts ridership demand, construction cost, and operating cost for each alternative.

Basic assumptions and study methodology are outlined in detail. The report concludes that ridership would be greatest for alternative #1 (2.7 million passengers in 1976), with approximately 2.2 million riders estimated for alternatives two and three. System #1 would also be the most expensive, with an estimated total gross project cost of \$189 million. Systems two and three are estimated to cost \$144 and \$82 million, respectively. Assuming that financial assistance from the Urban Mass Transportation Administration will be forthcoming, the authors estimate that costs to Los Angeles Department of Airports would be approximately twice as high under system #1 as under system #3. Other data are included in the report.

> NTIS Order #: PB-212-023 PC \$3.00, MF 95¢

Author: Parsons-Brinckerhoff, Tudor, Bechetl; Wilbur Smith and Associates; Kirker, Chapman and Associates Project No. CA-09-0012 Date: October, 1972 Keywords: 1. Bay Area Rapid Transit 7. Rail, systems planning and 2. Airport, access design 3. Power Distribution 8. Rail, automatic control 4. Fare, collection 9. Rail, cost 10. Rail, rolling stock 5. Guideways 6. Financing Mass Transporta-11. Rail, stations and terminals 12. Routes and Routing tion, requirements

Title: "San Francisco Airport Access Project" [OVERSIZE DOCUMENT]

Abstract: The project summarized in this report developed recommendations for an extension of the Bay Area Rapid Transit (BART) system to provide rapid transit access at San Francisco International Airport. Project background and the need for improved airport access are discussed.

The report gives particular attention to selection of the proposed route location which will follow the Market Street Railway corridor through Daly City and Colma. Relevant aspects of the route profile and proposed service are described. The recommended route will include at grade, elevated, and subway construction; site selection criteria and evaluations are provided.

The authors review eight planning elements for system operation and maintenance. These include: (1) train operations, (2) service schedules, (3) rolling stock, (4) train control and communications, (5) power distribution, (6) fare collection, (7) support facilities, and (8) baggage handling. Estimates of patronage and revenues are considered along with specific preliminary features for the stations and guideways.

The report also contains detailed cost estimates, impact analyses, and an overall evaluation of the project in terms of urban development objectives. The report concludes with a discussion of project implementation, emphasizing financing, construction, and operation phases.

NTIS Order #: PB-213-411 PC \$6.00, MF 95¢ Title: "San Francisco Airport Access Project -- Summary"

Author: Parsons Brinckerhoff-Tudor-Bechtel; Wilbur Smith and Associates; Kirker, Chapman Consultants

Date:	May,	1972	Project No.	CA-09-0012

Keywords:	1.	Rail,	systems	planning	and	3.	Bay Area	Rapid Transit
		desi	gn			4.	Airport,	access
	2.	Rail,	cost					

Abstract: This report briefly summarizes an earlier study which examined the feasibility of extending the Bay Area Rapid Transit (BART) system to serve San Francisco International Airport. The report also recommended that BART service should also be extended through San Mateo County to Menlo Park.

This summary was prepared to answer several basic questions about the proposed BART extensions. Specific attention is focused on five questions of particular concern to the general public: (1) How can transit help? (2) How soon is it needed? (3) What will it be like? (4) How might the cost be shared? (5) Will it be built?

The report emphasizes the immediate need for improved airport access in the San Francisco area and the overall advantages improved mobility will afford to the surrounding community. The proposed route profile and station designs are described. Total costs for the airport extension are estimated in excess of \$380 million; costs for the full-county extension will be more than one billion dollars. Alternative cost-sharing and financing schemes are discussed.

> NTIS Order #: PB-212-456 PC \$3.00, MF 95¢

Title: "A Public Transportation Program for the Capitol Region"

Author: Alan M. Voorhees and Associates, Inc.

Date: July, 1971

Keywords:1. Bus, intracity3. Ridership, attraction2. Financing Mass Transportation,4. Management, operationsrequirementsand techniques

Abstract: The report outlines an immediate action program for transit improvement in the Hartford, Connecticut, metropolitan area. Service is currently provided by the Connecticut Company and other private bus operators who face rising costs and declining revenues. All relevant aspects of the existing regional transit system are reviewed, including: transit operations, facilities, management, and ridership data. The authors conclude that the present carrier is providing a necessary public service at a level comparable to other systems.

Alternative proposals are discussed in detail. The report concludes that the previous cycle of fare hikes and service curtailment is no longer a viable solution to the Connecticut Company's financial problem. Two specific options are described. The first, maintaining the present service level, was not found to generate sufficient patronage to warrant costs. The authors therefore recommend adoption of Alternative #2, a proposal to increase service and attract new ridership. Implementation of this alternative will require substantial financial support and cooperation among the regional transit organizations.

A detailed action program is outlined for both the short and long-range improvements under Alternative #2. The report focuses on corridor opportunities in nine areas and various financial considerations. Survey data and related supplementary materials are appended.

> NTIS Order #: PB-211-834 PC \$3.00, MF 95¢

Title: "Addendum Report to the Capitol Region Council of Governments' Mass Transit Study Entitled: 'A Public Transportation Program for the Capitol Region'"

Author: Alan M. Voorhees and Associates, Inc.

Date: May, 1972

Project No. CT-09-0001

Keywords:	l.	Industrial and Labor Relations	4.	Government, urban
	2.	Management, operations and	5	Government, state
		techniques	б.	Private Transpor-
	3.	Financing Mass Transportation		tation, bus

Abstract: This report was prepared as an addendum to an earlier study of mass transit in the Hartford metropolitan area which was published in July, 1971. Four months later, a series of events occurred which warranted review in the present report.

The Connecticut Company is a private bus operator whose profile of rising costs and declining patronage necessitated the original study. At that time, the authors recommended initiation of a major transit improvement program designed to attract new ridership through increased service. In November, 1971, however, the Connecticut Company announced that a new labor contract calling for increased wages could not be signed without some guarantee of public subsidies to underwrite the higher operating costs. The report describes the events of twelve days during which the transit operator and relevant public agencies acted to meet the crisis. Ultimately, a 10-month contract was signed, providing a 5.5% wage increase for transit drivers and mechanics; shortly thereafter, the Company petitioned the Public Utilities Commission (PUC) for a 33% fare increase (to 40¢) and permission to eliminate several unprofitable routes. At the time this addendum was written, the PUC decision was still pending in the wake of opposition to the fare increase by the Greater Hartford Transit District (GHTD).

The GHTD role over the next several months is discussed in detail. Specifically, the authors note three main efforts: (1) to obtain legislative sanction for town membership and financial involvement in GHTD, (2) to plan for the possible takeover of transit operations, and (3) to develop the local resources necessary for participation in Federal matching grant programs. Capital improvements to the bus fleet are considered a top priority. The provision of planning support by the Capitol Region Transportation Task Force is also discussed.

The authors recommend a continuing planning effort directed toward three principal areas: (1) monitoring of new technology, (2) further studies of transit riding patterns, and (3) development of a transit improvement program. The report also delineates a five-year action program with specific recommendations broken down for each year.

NTIS Order #: PB-211-835 PC \$3.00, MF 95¢ Title: "Transit Now for Tomorrow -- A Decade of Transit Progress for Dade County" Author: Simpson & Curtin, Transportation Engineers (for Dade County Department of Traffic and Transportation)

Date: October, 1972 Project No. FLA-09-0001

Keywords:1.Rail, systems planning3.Bus, feederand design4.Bus; rapid transit2.Distribution Systems5.Benefit-Cost Analysis

Abstract: The report describes a proposed rapid transit plan for Dade County, Florida. This project, which expanded upon recommendations of the Miami Urban Area Transportation Study (MUATS), recommended a comprehensive and coordinated transportation system consisting of four major elements. These include: (1) an initial 44.7 mile rail rapid transit system serving 48 stations throughout the metropolitan area; (2) a system of trunk line bus routes operating on expressways and arterial streets in areas not served by rapid transit; (3) a network of feeder bus routes to rapid transit stations; and (4) "mini-systems" at selected terminal locations to improve circulation and to link traffic generators with transit facilities. Each component of the proposed system is described briefly.

An analysis of costs and benefits revealed that the rapid transit construction will afford benefits in excess of \$80 million per year to the people of Dade County. Quantifiable savings will include reduced travel time costs, automobile operating costs, auto ownership costs, highway accident costs, parking costs, and parking space construction costs. Costs and projected operating results are also summarized for the proposed system. Finally, the report develops recommendations for program organization and management, emphasizing centralized coordination under the Metropolitan Dade County Transit Authority.

> NTIS Order #: PB-212-800 PC \$3.00, MF 95¢

Title: "Immediate Action Transit Program: Palm Beach County, Fla.

Author: Simpson & Curtin, Transportation Engineers (for Palm Beach County Board of Commissioners)

Date: March, 1972

Project No. FL-09-0001

Keywords:	1. 2. 3. 4.	Bus, Bus, Bus, Bus,	cost intracity jitney transfers	5. 6. 7.	Bus, school bus Public Ownership Ridership, volume

Abstract: The report outlines an immediate action program to expand and improve bus transit service in Palm Beach County, Florida. Although recently acquired by a public authority, the system has inherited several problems of the former private operator, including lack of transfer privileges, inadequate information systems, and the need for service in certain neighborhoods.

Service currently provided by the Palm Beach County Transportation Authority is discussed with reference to availability, frequency, loading standards and comfort, dependability, speed, directness, accommodation, fare structure, and public information. The authors conclude that despite a 41-day lapse of service during the interim between private and public operation, passengers have returned to transit, and, with the initiation of recommended system improvements, ridership will continue to increase.

The recommended immediate action program includes six service improvements for existing routes, one new route, the "bus service module" concept, and two changes in the fare structure. Attention is given to special policy areas, including the Comprehensive Services Delivery System (designed to improve transit access to hospitals and social service centers), private jitney operations, and school bus transportation. Jitney service presently supplements the transit operation, and because bus improvements in the immediate-action program will directly benefit the communities of heaviest jitney ridership, the authors recommend a reevaluation of this service prior to the granting of additional jitney certificates. Alternatives for coordinating school bus and transit service are discussed in detail. The authors conclude that a selective reassignment of students to transit could result in a modest reduction in school bus requirements and a substantial increase in transit revenue.

A major capital improvement program to acquire new hardware and facilities is discussed. The report concludes with a detailed operating forecast; although a sizeable deficit is projected, the authors conclude that initial losses represent a satisfactory beginning for the public operation. Fare changes (a transfer fee and monthly passes for the elderly) can be initiated at minimal cost.

> NTIS Order #: PB-211-310 PC \$3.00, MF 95¢

Title: "Immediate Action Program: Interim Report 1"

Author: Simpson & Curtin, Transportation Engineers

Date: November, 1971

Project No. FL-09-0001

Keywords: 1. Bus
2. Financing Mass Transportation, sources
3. Public Ownership

Abstract: This is the first of seven interim reports in a study of public transit needs in the tri-county area of southeastern Florida. The report addresses shortrange problems of Beach Transit, the major private bus operator in Broward County. Financial losses have threatened the discontinuation of service. An analysis of present operations revealed that while service is generally adequate, service levels should be improved to maximize ridership.

The report contains a detailed valuation of Beach Transit real estate, rolling stock, and accessories. Public participation in transit service is examined with reference to public assistance, special taxation, and joint funding programs. The authors recommend that Broward County Transportation Authority acquire the present transit system, and that a stable revenue source be secured to underwrite future operations. Capital costs of the implementation program are outlined. The report also recommends consolidation with the South Broward Transit Authority to coordinate regional operations. Specific management and service improvements are advanced.

> NTIS Order #: PB-211-307 PC \$3.00, MF 95¢

Title: "Coordinated Transit for Broward County -- Interim Report #2"

Author: Simpson & Curtin, Transportation Engineers

Date: January, 1972

In Project No. FL-09-0001

Keywords: 1. Bus, intercity
2. Public Ownership
3. Management, planning and analysis

Abstract: This is the second in a series of seven interim reports studying public transit needs in the tri-county area of southeastern Florida. Interim Report #1 examined the service of one company, Beach Transit, and made recommendations to assist the public takeover of its operations. This report focuses on the area's other major operator, the South Broward Transit Authority. Relevant aspects of this operation are examined with reference to: availability and frequency of service, loading standards and comfort, dependability, speed, accommodation service, fare structure, and public information program.

The report develops a three-phase plan for consolidating transit services throughout Broward County. Specific recommendations are advanced for consolidating services, fares, facilities, and administrative personnel. A capital improvement program is proposed along with a forecast of costs and revenues under the consolidation plan. The recommended program includes the institution of county-operated transit service between Fort Lauderdale and Hollywood, realignment of southern Broward County routes, institution of a 25¢ bus fare in the third year of consolidated operations with the possibility of operating a free transit system by the fifth year, and construction of a new maintenance facility.

> NTIS Order #: PB-211-390 PC \$3.00, MF 95¢

Title: "The Transit Rider -- Interim Report #3"

Author: Simpson and Curtin, Transportation Engineers (for Broward County Transportation Authority)

Date:	Januai	ry, 1972		Project No. FLA-09-0001
Keywords:	1. 2. 3. 4.	Ridership, profiles Surveys Age Sex	5. 6. 7.	Bus, commuter Trip Generation Private Transportation, auto- mobile

Abstract: Results of an on-board bus passenger survey conducted in Broward County, Florida, are reviewed. This area includes the cities of Hollywood, Ft. Lauderdale, and Pompano Beach. The purpose of the study was to obtain comprehensive ridership and tripmaking data for use in the development of future recommendations for improving public transportation.

Characteristics of transit riders are examined with reference to five descriptive variables. These include: (1) resident vs. tourist riders, (2) sex and age, (3) annual family income, (4) automobile ownership, and (5) automobile availability. The distinction between resident and tourist riders proved to be significant; patrons in the latter category consistently evidenced higher incomes and trip purposes most likely to be associated with recreation, shopping, and sightseeing. Approximately 80% of all passengers are female, but the ridership data were fairly well distributed among age groups. Thirty percent of the transit users are senior citizens, but the plurality of riders (19%) were found in the 40-49 age group. Other data clearly indicate that more than 90% of all riders are transit captives, the large majority of whom earn incomes of less than \$6,000 per year and do not have access to an automobile.

A second set of data were collected for transit trip patterns. Six in ten trips were made to or from work; other significant trip purposes included shopping and social-recreation. The report also examines the loci of origins and destinations throughout the metropolitan area.

Appended material describes survey procedures and outlines complete ridership profile data by route.

> NTIS Order #: PB-211-391 PC \$3.00, MF 95¢

Title: "Volusia County Transit Improvement Study -- Recommended Transit System"

Author: W.C. Gilman & Company (for Volusia Council of Governments)

Date: August, 1972

Project No. FL-09-0005

Keywords:	1.	Public Ownership	3.	Financing Mass Transportation
	2.	Ridership	4.	Government, county

Abstract: The report develops a series of recommendations for the continuation and improvement of public bus transportation in the Halifax Area of Volusia Co., Florida. Existing bus service is provided by a private carrier, but patronage revenues are insufficient to cover costs; a public subsidy is being provided to forestall the curtailment of service.

The authors' principal recommendation is for public ownership of the transit system. Alternative public ownership forms are examined in detail; the authors conclude that a County Transit Department can best perform the operation over the long-run.

The recommended transit system is outlined with reference to routes, service level, vehicles, fares, facilities improvements, personnel, and marketing. Financing requirements and sources are discussed. The report concludes with a set of recommendations for program development and management and an outline of ridership forecasting procedures.

> NTIS Order #: PB-212-223 PC \$3.00, MF 95¢

Title: "Savannah Transit Study"

Author:	Public Research and Managemer Authority)	nt, Inc. (for The Savannah Transit
Date:	December, 1972	Project No. GA-09-0006
Keywords	: 1. Bus, intracity 2. Bus, cost 3. Public Ownership	 Financing Mass Transportation, requirements Ridership, profiles Surveys

Abstract: The report summarizes a comprehensive technical study of public bus transportation in Savannah, Georgia. Regional characteristics are outlined with reference to land use, economy, population, community facilities, concentrations of economic and social problems, and future outlook.

Operational characteristics of the existing publicly-owned bus transit system are detailed. The report contains a financial analysis which identifies the need for additional sources of revenue for public transportation. The bus passenger study provides survey data covering route analysis, ridership by time periods, passenger characteristics, and operating data.

The authors develop specific recommendations for ownership and management, fiscal operations, service, equipment, and public information. Elements of the proposed transit improvement program are outlined in detail.

NTIS Order #: PB-215-155 PC \$3.00, MF 95¢

Title:	"An Ev	valuation	of Rural 1	Bus	Servi	.ce,	City	and	d County of Honolulu"
Author:	Barto	on-Aschman	Associat	es,	Inc.	and	Alan	Μ.	Voorhees & Associates, Inc.
Date:	March	n, 1972							Project No. HI-09-0003
Keywords	5: 1. 2.	Rural Ar Bus, int	eas ercity				3	3. 1.	Social Benefits and Costs Ridership, volume

Abstract: The report evaluates impacts and benefits of five publicly-assisted rural bus routes operated on the Island of Oahu in Hawaii. The analysis covers characteristics of the service area, ridership trends, rider characteristics, public attitudes toward rural transit service, trip generation, travel and demand forecasting, and other relevant data.

System patronage has increased annually since 1970, and the report concludes that public benefits of the service are far in excess of the \$600,000 annual subsidy. Specific benefits described in the report include income generation (where the transit provides access to employment opportunities), savings in welfare payments, shopping trip generation, recreational benefits, elimination of auto trips, and generally improved mobility for residents of the service area. A continuing monitoring and evaluation program is recommended. Results of a home interview survey are appended.

> NTIS Order #: PB-211-786 PC \$3.00, MF 95¢

Title: "Hawaii County Transit System" Author: Alan M. Voorhees & Associates, Inc. (for County of Hawaii) Date: May, 1972 Project No. HI-09-0004 Keywords: 1. Bus, intracity 6. Public Ownership 2. Bus, cost 7. Financing Mass Transportation 3. Bus, school bus 8. Private Transportation, bus 4. Ridership, profiles 9. Suburbs 5. Surveys

Abstract: This report documents the surveys, analysis, and conclusions resulting from a comprehensive technical study of public bus transportation in Hawaii County, Hawaii, which includes the City of Hilo. Existing conditions and resources of the island-wide transportation system are examined in depth. These include the Sampan Bus System (which combines the services of several privately-owned and maintained vehicles), a limited point-to-point service, school buses, and two programs for senior citizens.

Survey data revealed that as many as 25% of all area households had a "transportation problem" and that an additional 25% would benefit substantially from improved public transportation. Existing transportation resources are analyzed with reference to ridership and costs.

Several alternative transit systems are compared; the authors recommend public operation of two basic lines in the City of Hilo, shopper routes, and special suburban routes. Start-up costs, a proposed transit subsidy, stops and shelters, and other financial considerations are discussed. The report concludes with a recommended management organization for the public system. Appended material includes additional survey and cost data.

> NTIS Order #: PB-214-767 PC \$3.00, MF 95¢

Title: "Job Accessibility for the Unemployed: An Analysis of Public Transportation in Chicago"

Author: Mayor's Committee for Economic and Cultural Development

 Date:
 March, 1972
 Project No. ILL-09-0001

 Keywords:
 1. Employment
 5. Inner City

 2. Bus, commuter
 6. Routes and Routing

 3. Ridership
 7. Information Aids

Abstract: The report examines job accessibility for the unemployed in Chicago, Ill. Earlier studies have indicated that unemployed residents of the urban inner city lack access to private automobiles, thereby creating a dependence on public transit for mobility. The purpose of this report was to assess the adequacy of the Chicago Transit Authority (CTA) system in providing employment access for the unemployed.

The addresses of Aid to Dependent Children and Unemployment Compensation recipients were aggregated by quarter-square-mile zones to identify principal geographic concentrations of the unemployed. Employment data were also collected to identify areas in which potential jobs for the unemployed are located. An analysis of public transit service in Chicago was then performed to develop indexes of accessibility based upon relative trip times by transit between the residential and employment zones. The report concludes that in general, the transit system does provide access to concentrations of jobs for the unemployed. Travel times between some highly concentrated zones, however, were greater than 45 minutes.

A survey technique was employed to collect information on attitudinal and behavioral relationships between transportation services and employment status in Chicago. The data revealed that while both employed and unemployed low-income persons enjoy relatively equal access to public transportation, the latter group is clearly restricted in its mobility. One cause of this restriction may be a perceived lack of transit access to jobs, indicating the need for improved information systems.

The report concludes that major employment centers on the north and west sides of Chicago are well-served by public transportation, and that transit access is not a major cause of unemployment in the metropolitan area. On the other hand, the analysis does recommend improvements in service quality, especially where trip times between inner city residential areas and available jobs are prohibitive. The authors found that home-job linkages represent crosstown, rather than radial, travel patterns. The CTA route structure, however, favors radial travel, and improved crosstown express service is recommended. Improved transit access to developing employment centers such as the Lake Calumet area is also suggested. Other recommendations include: examination of "employment initiation grants" to help job-seekers defray the burden of high fares, more effective utilization of commuter railroads, and an improved CTA information dissemination system.

> NTIS Order #: PB-210-969 PC \$3.00, MF 95¢

Title: "Transit Technical Study - Greater Peoria Mass Transit District"

Author: Simpson and Curtin, Transportation Engineers

Date: October 1972

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Project No.: IL-09-0006
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Keywords:	1.2.3.	Budgets and Budget Planning Financing Mass Transportation, Routes and Routing Maintenance	sources	5. 6. 7.	Park: Bus, Bus,	ing, park- stations shelters express	and-ride and

Abstract: This report represents an analysis of the operations of the Greater Peoria Mass Transit District (GPMTD) since its inception in April, 1970. Included is a summary of what steps GPMTD has taken to reinstitute transit service in the Peoria area, as well as an evaluation and summary of its present operations with suggested areas for expansion and improvement. This report also proposes specific capital improvements required for the system, on a programmed basis. Short term improvements include park-and-ride facilities, route extensions and express service. Capital improvements include bus shelters, garage, shop and headduarters and various passenger improvements.

The plan will permit the expansion of high quality service to present and potential patrons at levels required by the growing community. From a financial viewpoint, the first full year of operations is detailed and analyzed. Projections of operating revenues and costs are presented for the next five years based on available information. The difficulty in meeting rising costs of operation from revenue and other sources is assessed with a review of possible sources of assistance and additional operational economies that can realistically be adopted by the District.

 NTIS Order No.
 PB-220-776

 PC \$3,00
 MF .95c

Title: "Bus and Rail Rolling Stock, Equipment in Metropolitan Chicago"

Author: Chicago Area Transportation Study and the Lake-Porter County Regional Transportation Planning Commission

Date: August, 1972

Project No. IL-09-0012

Keywords:	1. 2.	Rail, rolling stock Bus, design	
	3.	Management, operations and techniques	

Abstract: A computer-assisted inventory procedure was developed as a tool in formulating the rolling stock renewal component of the mass transit priority program in metropolitan Chicago. A computer tabulation of each unit was compiled, using standards provided by the individual carriers to estimate the functional economic life of vehicles in the existing transit fleet.

Results of the rolling stock inventory are broken down among bus, suburban rail, and rapid transit modes with reference to fleet size, vehicle manufacturers, and various equipment conditions such as air conditioning. The author notes that updates of this report will be produced on an annual basis.

> NTIS Order #: PB-211-887 PC \$3.00, MF 95¢

Title:	"The I Devel	Five Trip End Tra lopment"	nsit Model	l: A Descri	.pti	on of Its Theory and	
Author:	Samue	el A. Walker III	(Chicago	Area Trans	por	tation Study)	
Date:	Nover	nber, 1972			Pro	ject No. IL-09-0012	
Keywords	5: 1. 2. 3.	Computer, appli Quantitative An Trip Generation	cations alysis		4. 5.	Surveys Center City	

Abstract: Four different distribution models were investigated in an attempt to find a more suitable simulation technique for mass transit travel in the Chicago metropolitan area. Each model was tested against 1956 home interview data to determine its ability to reproduce average trip length by zone and to determine the accuracy with which both zonal interchanges and link outputs could be simulated.

Each of the four distribution models is described in detail. These include: (1) the Precalculated Interchange Model, (2) the Intervening Opportunities Model, (3) the Forced Opportunity Model, and (4) the Five Trip End Transit Model. The latter represents a combination of models one and three above, and one principal advantage is its utilization of a purpose-split of trips for transit distribution. This split consists of a subdivision of the non-CBD-oriented trip population into work-to-home trips, home-to-work trips, and all other non-CBD transit trips.

Statistical comparisons of the output from each model with the interview data showed that transit distribution in Chicago could not be handled without in some way proportioning trips to and from the CBD. Two of the four models were found to be in gross error, primarily because of their non-proportioning of CBD trips.

More extensive comparative analysis was undertaken on the remaining two models to determine if the newly developed Five Trip End Transit Model provided more or less accurate results than the original model used in 1956, the Precalculated Interchange Model. In addition to the increased flexibility and sensitivity inherent in this new model, a slight but significant improvement was found in the accuracy of simulation output.

> NTIS Order #: PB-214-782 PC \$3.00, MF 95¢

Title: "Socioeconomic Study of a Proposed Rail-Like Rapid Transit System for the St. Louis Metropolitan Area -- Volume I: Executive Summary"

Author: CONSAD Research Corporation (for East-West Gateway Coordinating Council)

Date: February 7, 1972

Project No. IT-09-0011

Keywords:	l.	Rail, systems planning and design	3. 4.	Community Response Surveys
	2.	Social Benefits and Costs	5.	Government, urban

Abstract: This report summarizes the analysis of impacts and perceptions of a proposed 100-mile, rail-like rapid transit system for the St. Louis metropolitan area. The socioeconomic analysis was undertaken to investigate the major direct and indirect impacts of rapid transit and the ways in which area residents perceive its effects.

User impacts are discussed with reference to savings in commuter travel time, vehicle operating costs, insurance, parking costs, and operations of the trucking industry. Non-user impacts include land use and value changes, increased employment opportunities, environmental improvement, and augmentation of Civil Defense facilities.

Transit planning in six selected cities is reviewed to highlight their experiences with proposed rail systems and bond issue referenda. The report also examines recent voter behavior and media attitudes in St. Louis. Survey data were collected to indicate the attitudes of community leaders and the general public towards the transit plan. Data are provided which measure the strength of public attitudes about various aspects of the proposed system, its estimated costs and benefits, and other related issues.

> NTIS Order #: PB-214-035 PC \$3.75, MF 95¢

- Title: "Socioeconomic Study of a Proposed Rail-Like Rapid Transit System for the St. Louis Metropolitan Area -- Volume II: Impacts and Public Perceptions"
- Author: CONSAD Research Corporation (for East-West Gateway Coordinating Council)

Date:	Febi	cuary 7,	1972	Project No. IT-09				
Keywords	: 1.	. Rail, desig . Socia	systems planning and n l Benefits and Costs	3. 4. 5.	Surveys Community Response Government, urban			

Abstract: The impacts and perceptions of a proposed 100-mile "rail-like" rapid transit system for the St. Louis metropolitan area are reviewed. Emphasis is placed on identifying salient factors which will affect public acceptance of the transit proposal.

The report summarizes direct and indirect effects of the regional system in detail. User benefits include savings on travel time, vehicle operating and parking costs, and insurance. Sizeable savings for the trucking industry would also accrue. Non-user benefits are analyzed with reference to land use and value changes, improved employment opportunities, environmental effects (ie. reduced noise and air pollution), and augmentation of Civil Defense facilities. The authors conclude that construction of the proposed rapid transit system will provide substantial benefits to all segments of the community.

The experience of transit planning and funding referenda in six other cities is reviewed. The cities include: Atlanta, Los Angeles, San Francisco, Philadelphia-Lindenwold, and Washington, D.C. The authors review issues receiving favorable response, revenue plans and cost allocations, physical planning, and other factors. Principal conclusions are that neither low per capita costs nor support by civic leaders is sufficient to ensure the successful acceptance of a proposed rapid transit system. In addition, the authors conclude that such systems must be designed with a sensitivity for public concerns and that involvement of local community and neighborhood leaders is a potentially significant positive factor. Finally, they note that the weakness of opposition and positive features of system design are the most salient factors in public acceptance of transit proposals.

Recent voter behavior and media attitudes in St. Louis are analyzed. The perceptions of community leaders and the general public were surveyed to determine regional and subregional patterns on key transit issues. Key interrelationships between effects and perceptions of the proposed transit system are emphasized; the report highlights issues to be resolved before the transit plan can be offered to voters in a referendum.

> NTIS Order #: PB-214-036 PC \$6.00, MF 95¢

Title:	"Soci	ioeco	onom	ic Stu	dy	of	а	Propos	sed	Rail	-Like	Rapid	Transit	System
	for	the	St.	Louis	Me	etro	pq	olitan	Are	a	Volum	ne III	: Append:	ices"

Author: CONSAD Research Corporation (for East-West Gateway Coordinating Council)

Date:	Febru	ary, 1972	Project No. IT-09-0011				
Keywords:	1. 2. 3.	Rail, systems planning and design Community Response Government, urban	4. 5. 6. 7.	Benefit-Cost Analysis Surveys Financing Mass Transportation Social Benefits and Costs			

Abstract: This report presents five appendices to the socioeconomic feasibility study of rail rapid transit for the St. Louis metropolitan area. Particular attention is focused on the benefits and costs of the proposed system and perceptions of transit impact by the general public.

Appendix A reviews transit experiences in Atlanta, Los Angeles, Philadelphia-Lindenwold, San Francisco, Seattle, and Washington, D.C., to determine salient factors in the public reaction to rapid transit proposals. Referenda results and other comparative data are detailed. In addition, the authors surveyed relevant planning officials in each city to measure the salience of specific events, problem areas, positive and negative impacts, group activities, financial features, and policy choices in the transit experience.

Appendix B examines the method used for assessing benefits and costs of the system. These include benefits for both users and non-users with regard to savings in time costs, automobile operation, and parking costs; improved operations of the trucking industry; and employment, land use, environmental and civil defense effects.

Appendix C reviews recent voter behavior and media analysis in the St. Louis area; voting patterns in several recent referenda are examined as possible indications of voter attitudes on a rapid transit referendum. Past voting data are compared with demographic characteristics to determine patterns of support and opposition.

Appendices D and E describe the survey forms and procedures used for interviews conducted among community leaders and voters to determine basic attitudes and perceptions of the proposed system.

> NTIS Order #: PB-214-037 PC \$6.75, MF 95¢

Title: "Socioeconomic Study of a Proposed Rail-Like Rapid Transit System for the St. Louis Metropolitan Area -- Staff Report, Los Angeles" Author: East-West Gateway Coordinating Council Date: July, 1971 Project No. IT-09-0011 Keywords: 1. Rail, systems planning and 4. Benefit-Cost Analysis design 5. Surveys 2. Community Response 6. Financing Mass Transportation 3. Government, urban 7. Social Benefits and Costs

Abstract: A feasibility study of rapid transit has recommended construction of a 100-mile "rail-like" system for the St. Louis area. Before undertaking more detailed planning steps, the authors investigated the experiences of six other cities which have proposed transit systems. In this report, attention is focused on the Los Angeles area to identify salient aspects of the community response to rapid transit which can assist in the planning of the St. Louis system.

Background information on the Los Angeles area and the Southern California Rapid Transit District (SCRTD) is provided along with a discussion of the 1968 bond issue referendum which was defeated. The report emphasizes results of an interview survey conducted among Los Angeles planning officials to identify salient issues in the referendum campaign. Attention is given to the effects of specific events and problems, centers of support and opposition, and the public reaction to particular features of the proposed transit system and the transit planning process.

The survey revealed considerable confusion prior to the election concerning the SCRTD plan and financial features of the transit proposal. Uncertainty about the system is attributed partly to changes in the preliminary feasibility plan made shortly before the vote. Opposition to the system tended to reflect the particular points of view of various groups. Neighborhood groups opposed specific elements of the route and station design; some business and civic leaders questioned the utility of rapid transit and its financial plan; opposition to the system by technical respondants related to concern about the cost-benefit analysis and overall system design. The interviews revealed that the most important perceived positive impacts of rapid transit included decreased street congestion, travel time to and from the center city, and automobile pollution; perceived negative impacts included increased taxes, "infiltration of suburbs by poor and minority groups," and preferential treatment of suburbanites. Other salient factors in the 1968 referendum defeat included poor public information about the proposal, seeming inconsistency in the presentation of cost-benefit and feasibility studies, ingrained automobile commuter habits, insufficient public involvement in the planning process, and lack of conviction by community "leaders" that rail rapid transit was the best alternative for Los Angeles.

Background information and survey methodology are summarized in detail. The report concludes with a discussion of how these findings and results can be applied to the St. Louis area to optimize public acceptance of the rapid transit proposal.

> NTIS Order #: PB-214-038 PC \$4.85, MF 95¢

Title: "Quad Cities Public Transportation Study" Author: Peat, Marwick, Mitchell and Company Date: February 14, 1972 Project No. INT-09-0016 Keywords: 1. Bus, intercity 3. Management, operations and 2. Public Ownership techniques

Abstract: The report is a comprehensive technical study of bus transit in the Quad Cities area of Rock Island, Illinois, and Davenport, Iowa. Two private operators currently provide service, but rising costs and declining revenues have necessitated an appeal for public subsidies. The report examines all relevent aspects of the problem with reference to existing service and usage, present needs, community goals and objectives, organizational and financial alternatives, alternative policies for public transportation, potential system improvements, physical assets valuation, operating organization, garage requirements, short and long-range capital improvements, and suggested future programs.

The authors recommend purchase of the existing system by the City Transit Authority and the Rock Island County Metropolitan Mass Transit District. Specific recommendations are also advanced with reference to routes, a fare increase, capital improvements, and investigation of a contract management plan.

> NTIS Order #: PB-212-117 PC \$3.00, MF 95¢

Title:	"Summary Report of a Transit De of Jefferson, Orleans, St. Bern	evelopment Program for lard, and St. Tammany	or the Parishes
Author:	Regional Planning Commission, S St. Tammany Parishes	Vefferson, Orleans, S	St. Bernard and
Date:	November 1972	Project No.: LA-C	9–0004
Keywords	 1. Urban Development, plan 2. Management, operations 3. Bus, express 4. Bus, minibus 5. Demand-Responsive System 	ning and techniques ms, Dial-A-Ride	

Abstract: This report describes an areawide transit study for the greater New Orleans area begun in March, 1971. The objectives of the study were to develop a short-term (6 year) transit improvement program to be revised annually, and to develop an organizational structure capable of implementing the program, and assuring that the recommended transit system will be unified on a regional scale.

The report traces the course of study from development of alternative concepts, the selection of one concept, the long-range implications, and the development of the Six Year Transit Improvement Program. The six year program aims to improve network service in the higher density urban area, to introduce metropolitan radial station-to-station express service which will be complemented by suburban and overnight dial bus service, and to introduce a circulation system using small buses in the Central Business District.
Title: "Report on Logan Airport Travel Study"

Author: Coverdale & Colpitts, Consulting Engineers (for Massachusetts Department of Public Works, Bureau of Transportation Planning and Development)

Date:	Octobe	er 31, 1972	Pro	ject No. MA-09-0007
Keywords:	1.	Airport, access	3.	Trip Generation
	2.	Modal Split	4.	Surveys

Abstract: An origin-destination survey was conducted among air travelers, visitors, and employees at Boston's Logan International Airport. The study focused on the air travel market in various geographic areas, the principal modes used for ground travel between these areas and Logan Airport, and the current volume of ground travel by each principal mode used for airport access. Emphasis was placed on the relative attractiveness of rapid transit for ground travel to and from the airport.

Survey procedures are outlined in detail; the report contains a comprehensive summary of survey data and selected analyses. The data reveal principal concentrations of trip generators, modal split, major travel corridors, and other conclusions.

Air travelers accounted for 32% of the 31 million person-trips made to and from the airport during the fiscal year ending June 30, 1970; 45% were made by airport visitors, and 23% were made by employees working at the airport. Approximately 82% of all person-trips were made by automobile; taxis and airport limousines accounted for seven percent and rapid transit for six percent. Significantly, however, the modal split among airport users varied according to the geographical location of trip ends in the Boston metropolitan area. For example, 16 percent of all person-trips between the airport and the Boston-Cambridge-Brookline area were made by rapid transit, and the percentage rose to 29% among airport employees commuting from these areas. An attitudinal survey revealed that both users and non-users of the transit service shared similar opinions toward rapid transit. Most respondants emphasized the importance of service frequency and reliability, and many recommended the creation of direct suburban bus service.

> NTIS Order #: PB-212-814 PC \$3.00, MF 95¢

Title: "Baltimore Region Rapid Transit System -- Phase I: Volume I"

Author: Daniel, Mann, Johnson & Mendenhall/Kaiser Engineers (for Metropolitan Transit Authority)

Date: June, 1971

Project No. MD-09-0003

Keywords: 1. Rail, systems planning and design 4. Rail, cost 5. Routes and Routing
2. Rail, stations and terminals
3. Rail, automatic control

Abstract: The report documents work completed under Phase I of a program to design a rail rapid transit system for the Baltimore, Md., metropolitan area. Of the six proposed corridors, attention is focused on two in which revenue service is slated to begin by 1978.

Principal objectives of this study were to refine and adjust earlier planning and design in accordance with current policies and to continue the preliminary system engineering. The south and northwest corridors described in this report will include more than 28 miles of aerial, subway, and other construction.

The technical discussion examines route alignments; stations; vehicle selection; program schedule; capital cost estimates; forecasts of patronage, operating costs, and revenues; operating systems such as vehicles, electrification, ventilation and heating, control and communications, fare collection, surveillance, etc.; and work conducted by other consultants to the project.

Appended material includes initial design criteria and related technical data. Design standards are formulated with reference to engineering, architectural, and patronage factors.

> NTIS Order #: PB-212-815 PC \$3.00, MF 95¢

- Title: "Plan of Assistance Incident to the Acquisition of Greater Portland Transportation Company by the Greater Portland Transit District Including Valuation of Physical Assets and Other Operational and Intangible Assets of Greater Portland Transportation Company as of March 31, 1972"
- Author: Coverdale and Colpitts, Inc. (for Greater Portland Council of Governments)

Date: July 14, 1972

Project No. ME-09-0001

Keywords: 1. Public Ownership 2. Private Transportation, bus

Accounts and Accounting
 Bus, cost

3. Budgets and Budget Planning

J. Dusy cost

Abstract: A comprehensive inventory and valuation of the assets and liabilities of the Greater Portland Transportation (GPT) Company was undertaken prior to public acquisition of the bus system by the Greater Portland (Me.) Transit District. All physical and intangible assets of the private operator were evaluated, and capital requirements for the periods both before and immediately following public takeover were identified.

Existing liabilities of GPT are outlined in detail along with a recommended pro forma operating budget. The report emphasizes the need for a reduction of operational expenses through route and schedule improvements coupled with a modest marketing program. Specific recommendations to guide the public acquisition of GPT are advanced. Complete supporting data for this report are appended.

> NTIS Order #: PB-214-223 PC \$3.00, MF 95¢

Title: "Public Transit in Greater Portland -- Summary Report"

Author: Greater Portland Council of Governments

Date:	Augus	st, 1972		Project No. ME-09-0001		
Keywords	: 1.	Bus, intracity	5.	Public Ownership		
	2.	Bus, cost	6.	Financing Mass Transportation		
	3.	Bus, school bus	7.	Management, planning and analysis		
	4.	Ferries	8.	Routes and Routing		

Abstract: The report presents principal findings and recommendations of a comprehensive technical study of public bus transportation in the Portland, Maine, area. Elements of the existing transit system are described with particular attention given to ferry service, school transportation, and the privately-owned local bus system. Operating characteristics, financial data, and subsidy requirements of the Greater Portland Transportation Company are described.

The need for continued public transit in Portland is emphasized among persons without access to an automobile. Deficiencies of the existing bus service are outlined with reference to service, organization, fragmentation of management responsibilities, lack of capital investment, and uncoordinated services. Attention is given to several reasons which warrant a public subsidy for mass transit; these include school transportation costs, costs to accommodate more automobiles in the central business district, social welfare agency costs, land use and community development costs, and loss of income in the event of service abandonment.

Specific recommendations for transit improvement are advanced with particular emphasis focused on public ownership. Organizational structure and financing alternatives under public ownership are discussed. The report also develops several specific service and routing recommendations and nine longrange proposals for improving transit service.

> NTIS Order #: PB-214-224 PC \$3.00, MF 95¢

Title: "Public Transit in Greater Portland -- Technical Document"

Author: Greater Portland Council of Governments

Date: October, 1971

Project No. ME-09-0001

Keywords:	l.	Bus, intracity	6.	Market Research
	2.	Bus, cost	7.	Routes and Routing
	3.	Bus, school bus	8.	Public Ownership
	4.	Ferries	9.	Financing Mass Transportation
	5.	Surveys		

Abstract: The report reviews technical material and other data from a comprehensive study of public transportation in the Portland, Maine, area. Socioeconomic and land use implications of changing regional mobility are described along with vehicular circulation and parking availability. Elements of the existing public transportation system are examined with reference to bus, school bus, taxi, ferry, and intercity transit service. General operating data, passenger characteristics, costs and revenue, and service features are described for each mode.

Results of an attitudinal survey of Portland residents are outlined. The report also examines legislation and relevant regulatory authorities. A consultant's report is appended detailing public transportation needs, markets, alternatives, and a proposed implementation framework.

Regional transit needs are described in depth, emphasizing new markets for transit service and mobility needs of "transit captives." Financial and bus replacement data are provided along with detailed service and routing recommendations for short and long-range improvements. These include public ownership of the bus system, fares and bus subsidies, and new route configurations focused on a central terminal point.

> NTIS Order #: PB-214-150 PC \$20.75, MF 95¢

Title: '	"Transit Improvements Plan for the St. Cloud Metropolitan Transit Commission" [OVERSIZE DOCUMENT]					
Author:	Bather ment)	r-Ringrose-Wolsfeld,	Inc. (:	for St. Cloud City Planning Depart-		
Date:	July,	1972		Project No. MN-09-0003		
Keywords	: 1. 2. 3. 4. 5.	Bus, intracity Bus, school bus Bus, cost Ridership, profiles Age	6. 7. 8. 9.	Demand-Responsive Systems Modal Split Market Research Management, operations and tech- niques Surveys		

Abstract: The report develops recommendations for improving mass transit in the St. Cloud, Minn., metropolitan area. Bus service is currently provided under auspices of the St. Cloud Metropolitan Transit Commission, but declining patronage and revenue and the need for a substantial public subsidy warranted this comprehensive technical study.

The report provides an historical perspective of public transportation trends in St. Cloud and nationally. The regional setting is described with reference to the St. Cloud trade area, urbanization, and current regional and local planning programs. Regional goals for development, transportation, and mass transit are outlined.

The existing system is described with reference to service and ridership characteristics, operating costs and revenue, non-user attitudes, and school bus operations. The present weekday service consists of four vehicles operating on seven intracity routes with one-hour headways. The ridership profile indicates that nearly one half of all riders are from families earning less than \$4,000 per year and that more than 30% lack access to an automobile. Sixty percent of all bus passengers were either over 60 years of age or under 23. The authors also conclude that a merger of school bus and transit operations would not be advantageous at this time.

Several alternative service concepts are reviewed, including: (1) conventional bus, (2) door-to-door options, (3) subscription bus, and (4) taxicab service provided for the disadvantaged. Previous experiments with door-to-door transit systems are discussed.

Ridership forecasting techniques were employed in order to determine the potential demand for mass transit. Modal split estimation models are described, and alternative forecasting methods are examined. The resulting data were used to compare three alternative transit concepts: (1) the present system of conventional buses operating with one-hour headways, (2) the same fixed-route bus service with half-hour headways, and (3) door-to-door service. The authors recommend adoption of the third alternative, a demand-responsive, door-to-door service. A detailed improvements plan is proposed with reference to service characteristics, management framework, marketing, impact on CBD parking requirements, and capital acquisition.

> NTIS Order #: PB-213-344 PC \$3.00, MF 95¢

Title: "Hattiesburg Transit Study"

Author: Wilbur Smith and Associates, Inc.

Date: August, 1972

Project No. MS-09-0003

Keywords: 1. Bus, intracity 2. Public Ownership 3. Ridership, volume 4. Surveys

5. Routes and Routing

6. Fare, cost determination

7. Bus, school bus

Abstract: The report summarizes a comprehensive technical study of public bus transit in Hattiesburg, Mississippi. The area is presently served by a private operator under contract to the City. The authors note several characteristics of the study area which are conducive to transit use and which warrant continued service despite a constant erosion of patronage and revenues in recent years.

Specific topics examined in the report include: (1) the role of mass transit in Hattiesburg; (2) existing routes, fares, school bus services, and equipment; (3) surveys of passengers, travel patterns, and employment; (4) inventory and valuation of the private carrier; and (5) specific proposals for improving transit.

Public ownership of the transit system is recommended, with operations to be carried out under a management contract. Other recommendations include capital investments in new equipment, participation in Federal grant programs, revised routes and fares, and school bus services.

> NTIS Order #: PB-212-036 PC \$3.00, MF 95¢

Title: "Transit Improvement Program for High Point, North Carolina" Author: Alan M. Voorhees & Associates, Inc. (for City of High Point) Date: November, 1972 Project No. NC-09-0001 Keywords: 1. Private Transportation, 4. Surveys bus 5. Trip Generation 2. Routes and Routing 6. Ridership, volume 3. Financing Mass Transportation, requirements

Abstract: Findings of a comprehensive technical study of bus transit in the High Point, North Carolina, area are summarized. Service is currently provided by two private bus companies, but financial difficulties and the loss of revenue from transporting school children necessitated this study to develop short range recommendations for improvement.

Both existing transit systems are described in detail with reference to routes, equipment, facilities, management, fares, patronage, and finances. Special attention is given to the transportation needs of the area's 4,000 Model Cities households for a variety of trip purposes. Survey data were collected to determine future transit needs among citizens and employers; these indicated that 80% of the households surveyed currently use transit service and that greater use could be expected if service was improved.

Several alternative solutions were analyzed and evaluated. The authors recommend that private ownership and operation of the bus system be continued, sustained by utilizing public funds. The present service level should be increased by instituting immediate service improvements and gradually inaugurating capital improvements.

> NTIS Order #: PB-214-253 PC \$3.00, MF 95¢

Title: "Mass Transit Improvement Plan"

Author: Alan M. Voorhees & Associates (for Lawton Metropolitan Area Planning Commission)

Date: A	ugus	t, 1972	Pro	ject No. OKLA-09-0002
Keywords:	1. 2. 3.	Bus, intracity Private Transportation, bus Ridership, volume	4. 5.	Financing Mass Transpor- tation Public Ownership

Abstract: This report summarizes a technical study of public bus transportation in the Lawton-Fort Sill area. Service is currently provided by a private operator, but rising costs and declining patronage have created serious problems. The purpose of this report was to examine existing conditions and outline recommendations for immediate action and short-range improvements.

All relevant aspects of the present situation are reviewed in detail with reference to operations, ridership, and revenues. Five alternative policy options are examined; these include abandonment of present service, direct subsidization of the private operator, city owned and operated service, ownership and operation by a public transit authority, and indirect subsidization. The authors recommend immediate subsidies amounting to approximately \$21,000 per year to forestall financial collapse of the transit system. Public ownership under the local Parking Authority is also recommended along with several specific service modifications.

> NTIS Order #: PB-212-917 PC \$3.00, MF 95¢

Title:	" Administration, Operations & Ecor (Port Authority of Allegheny County	nomics of Transit Division " y) Pittsburgh, Pennsylvania
Author:	Ford, Bacon & Davis, Inc., Engineer	rs, New York, New York
Date:	May 1972	Project No. PA-09-0008
Keywords:	 Schedules and Scheduling Benefit Cost Analysis Fare, cost determination 	 Financing mass transportation Ridership Management, operations and techniques

Abstract: The primary objective of this study is to present a critical review of the present operation of the Pittsburgh Transit Division in order to determine what could be done to eliminate unnecessary or unproductive elements of operating costs and to adjust the level of system operations more nearly to the needs of those who make use of it.

Matters under study include economics of the Transit Division, schedulemaking, ridership patterns, cost/revenue relationships, and management policies and practices. These studies are conducted from three main perspectives : analysis of operations, financial analysis and evaluation of alternatives.

Recommendations for improvements are made on the basis of the results of the above studies. They include: That the County Commissioners determine and inform the Port Authority Board of Directors the maximum operations deficit tollerable in each fiscal year; That the County Commissioners earmark subsidies to make up deficiencies resulting from reduced fare services to special groups such as the elderly or school students; That the Port Authority be reduced in size and that it have an Executive Officer with demonstrated managerial abilities; That programs be undertaken to upgrade the quality, morale and efficiency of the staff; That a Controller with full financial responsibilities be appointed; That a Labor Relations Director be appointed; That the Schedule Group within the Transit Division be disassociated from the operators' labor union and be given full power to make surveys of schedules and to make changes in the schedules including the freedom to reduce in size the bus fleet That a continuing program of study and improvement be maintained; That there be no fare increase. According to the report, these improvements would result in an annual savings of \$2,825,000.

A History of the Port Authority of Allegheny County is included along with many charts and maps as well as an extensive table of contents.

NTIS Order No. PB-221-143 PC \$3.00, MF 95¢ Title: " A Transit Development Program for the Lehigh Valley "

Author: Barton-Aschman Associates, Inc.

Date: May 1973

Project No. PA-09-0009

Keywords:1.Bus, intercity 2.Financing mass transportation Management, operations and techniques
 Routes and routing

Abstract: The purpose of this study was to develop an action program for the continuation and improvement of bus service in the Lehigh Valley. The important issues considered during the study and documented in this report include: the quality of bus service to be provided, the best means of owning and operating a bus service in Lehigh-Northampton counties, the costs of providing good bus service and financing bus service.

The action program consists of recommendations regarding: an improved route network and a recommended route network, level of service and types of service, the favoring of an existing zone fare structure over a single fare scheme, vehicle requirements, improvements concerning the location and design of bus stops and shelters as a means of making bus service more attractive, garage and operating station needs, personnel requirements, and street and traffic control requirements.

An ongoing managerial strategy is detailed as the transit development program is implemented. Guidelines for the creation of a comprehensive management strategy include consideration of consumer demands, local and regional planning policy, source of funds, and technological innovations.

> NTIS Order No. PB-221-373 PC \$7.00 MF .95¢

Title: "TUSCA Project -- Preliminary Planning Study" [OVERSIZE DOCUMENT]

Author: Puerto Rico Planning Board

Date: September 30, 1971 Reywords: 1. Urban Development, planning 2. Rail, systems planning and design 3. Rail, cost Project No. PR-09-0002 4. Financing Mass Transportation, requirements 5. Social Benefits and Costs 6. New Towns

Abstract: The report is an in-depth summary of analyses and recommendations stemming from the Transportation and Urban Settlements Combined Action (TUSCA) project in Puerto Rico. The study formulated comprehensive, long and short-range goals for coordinated future transportation and urban development planning.

Attention is focused on several basic recommendations of the study. First, the report recommends an island-wide rapid transit system to be designed and built in four phases by 1980. The authors estimate that such a system would become self-supporting before 1990. Second, the report emphasizes the need for integration of island-wide transit planning with urban development planning in the San Juan metropolitan area. The use of local waterways for transportation is also examined.

Third, the report recommends integrated planning of transit systems in Mayaguez and Ponce as part of the island-wide program. Fourth, the report emphasizes the need for continued development of the Cibuco new community as a regional growth center. The role of mass transit in new town planning is discussed. Fifth, the report examines the need for public transit and such relevant considerations as improved public information about transit alternatives and exploration of public subsidy requirements.

Other chapters discuss the costs and benefits of the TUSCA project and the role of public support for transportation development. Overall, this report contains the preliminary data, analysis, and goal formulations to guide the proposed island-wide transit planning program.

NTIS Order ≑: PB-211-841 PC \$6.00, MF 95c Title: "Recommended 1972 Bus Program for Houston"

Author: Alan M. Voorhees and Associates (for the Houston Transit Action Program)

Date: December 1972

Project No.: TX-09-0008

Keywords:

Routes and Routing
 Bus, express
 Bus, shuttle
 Fare, cost determination

Abstract: This report presents the findings and recommendations for Phase Two work of the Transit Action Program of the City of Houston. The basic transit analysis and community work steps that have led to the first year bus program report for Houston are summarized in the report. The consultant team interviewed a representative group of bus riders in the area, and prepared a ridership profile report. The same team analyzed the area bus system in terms of routes, schedules, vehicle appearance, customer service information, operating costs, labor relations and comparisons with other cities. The consultant team and City worked with groups and individuals to learn how people feel about transportation, and to give preliminary technical views as quickly as possible to obtain initial reactions. Consultants are examining long-range socio-economic conditions and long-range transit needs for metropolitan Houston.

The work has lead to the following conclusions: (1) the existing private bus system, although well run, is not an effective alternative means of travel for most people and cannot by itself make significant improvements; (2) improved transit will be necessary to a balanced transportation system, and with the inclusion of rapid transit, will be economically feasible in the future; (3) selected immediate improvements to the existing transit service should be made now, but major improvements need to be coordinated with rapid transit decisions; (4) public funds will have to be used, but under present law there may be limits to the actions which Houston can take. The objectives of the immediate improvements are to begin to establish a better transit riding habit and attract more riders, and to improve service for the existing riders.

The report details recommendations based on the outlined conclusions and objectives. The categories of recommendations are: public funds for transit, new bus services, equipment and facilities, customer information Systems and fares and pricing. The report discusses implementation, conclusions and alternatives, the overall work program and long-range proposals.

> NTIS Order No. PB-220-882 PC \$3.00 MF .95¢

Author:	Alan M. Voorhees and Associates (fo	r the Transit Action Program, Houston, Texas)
Date:	1973 P	roject No.: <u>TX-09-0008</u>
Keywords:	1.Urban Development, planning 2.Routes and routing 3.Financing Mass Transportation	4. Community Response

Abstract: The report summarizes the Transit Action Program organized by the City of Houston, which is the first in-depth investigation in recent times of shortand long-range mass transit needs of the area. A preliminary regional plan recommended the general development of rapid transit radiating outward from central Houston to the urbanized parts of Harris County in order to achieve a balanced transportation system. The current consultant team report and the Transit Action Program make the same general recommendation, and provide a specific program for early development of rapid transit facilities and short term bus improvements.

The bus program consists of major improvements in service to begin immediately, and to be completed in five years. Bus service is to be doubled and a series of service projects providing improvements to existing routes as well as new routes, special bus lanes and other service ideas will be introduced. The program will be coordinated with rapid transit plans to permit a simple transition as Stage One rapid projects are completed. Stage One provides for 40 miles of rapid transit service on four fixed guideways and three busway routes. Stage Two will bring the total miles of rapid transit to 80. Future extensions (Stage Three) are outlined by possible sites, however specific projects will be determined during construction and operation of the two preceeding stages.

The report describes primary types of action and concerns which include organization, planning, equipment, construction, financing and time requirments. The report also details stages of rapid transit service by major area, short-and long-range transportation alternatives, program benefits, specific Stage One issues, program implementation, and Houston's goals which include citizen involvement, agency participation and transit improvement.

> NTIS Order No. PB-220-864 PC \$3.00 MF .95¢

Title: "Analysis of Existing Transit Systems"

Author: City of Austin, Traffic and Transportation Department

Date: October, 1972

Project No. TEX-09-0010

Keywords:	1. 2. 3. 4. 5.	Bus, intracity Bus, stations and shelters Bus, cost Bus, shuttle Universities	6. 7. 8. 9.	Ridership, profiles Surveys Center City Financing Mass Transpor- tation, requirements
	5.	Universities		tation, requirements

Abstract: This technical study analyzed existing transit systems operating in the Austin, Texas, metropolitan area. Elements and characteristics of the privately owned city bus transit system are described in detail; other forms of transportation -- the University of Texas shuttle bus and the Model Cities Transportation Project -- are also discussed. Attention is focused on ridership and revenue, service characteristics, operating costs, administration, equipment, and maintenance.

The relationship among these transit systems is discussed in detail with reference to municipal controls, ridership, routes and service areas, sources of operating revenue, comparative operating costs, and service coordination.

Survey data were collected to indicate transit trip distribution and rider characteristics. All relevant data, broken down among the three transit systems, are provided. Additional surveys of both transit users and nonusers revealed demographic data, attitudes towards various transit services, and statistical profiles.

Evaluations of city and model neighborhood transit service were performed using criteria developed for routing, operations, stop selection, shelters, terminals, fares, and ridership. The report concludes with a brief description of the Austin central area; travel patterns and transit service in this area are examined.

> NTIS Order #: PB-213-413 PC \$3.00, MF 95¢

Title: "Transit Action Program: 1972-1977"

Author: City of Austin, Traffic and Transportation Department

Date:	Octob	er, l	972		Project No. TX-09-0010		
Keywords:	: 1. 2. 3.	Bus, Bus, Bus,	intracity stations and s cost	shelters	4. 5. 6.	Center City Public Ownership Fare, cost determination	

Abstract: This report develops recommendations for improving public bus transportation in the Austin, Texas, metropolitan area through 1977. Results of an analysis of existing transit service and ridership survey data are reviewed. The role of public mass transportation in Austin is discussed with reference to future growth and traffic demand, service to the central area, and community development objectives.

A short-range development program for the Austin transit system is outlined, with particular attention given to the advantages of public ownership. Specific steps for attaining immediate action goals are outlined in detail. The report concludes with an estimation of the impact of program implementation with reference to service improvements, areal development, transit facilities, fare structure, system integration, and financial aspects.

> NTIS Order #: PB-213-414 PC \$3.00, MF 95¢

Title: "Public Transportation and Employment Study"

Author: Richmond Regional Planning District Commission

Date: December, 1971	Project No. VA-09-0001	
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Keywords: 1. Employment 2. Inner City 3. Routes and Routing Bus, commuter
 Industrial and Labor Rela-

tions

Abstract: The relationship between inner city unemployment and bus transit service was studied in the Richmond region. Survey data indicated that existing job opportunity centers are poorly served by bus routes, and that inner city unemployed usually lack access to a private automobile. In addition, available employment services were found to be used by only about half of those seeking or offering work.

The authors recommend creation of Community Employment Centers in which inner city residents can obtain job information and direct contacts with potential employers. Meanwhile, changes in bus routes and inauguration of direct home-to-work services would make job opportunities accessible to inner city residents.

Long-range forecasts predict that substantial future employment growth will be contained in the center city and inner city communities. The report contains comprehensive data with reference to characteristics of inner city residents, characteristics of potential employment, the adequacy of existing public transportation, the effects of improved transit service, and future job opportunities.

> NTIS Order #: PB-213-052 PC \$3.00, MF 95¢

Title: "The Future of Transit in Planning District 15"

Author: Richmond Regional Planning District Commission

Date:	March	, 1972		Project No. VA-09-0001
Keywords :	: l. 2.	Management, operations and techniques Public Ownership	3. 4. 5.	Government, urban Government, taxation Financing Mass Transportation sources

Abstract: The report examines alternative methods for improving transit services in Planning District 15 -- Richmond, Virginia. Six elements of an optimum bus transportation system are reviewed, including: (1) route coverage, (2) regional service, (3) fare structure, (4) service frequency, (5) dependability, and (6) passenger comfort. The report underscores the importance of public transit in providing mobility for a large segment of the inner city population.

The administration of public transit in the Richmond area is examined in detail. Present institutional, financial, and ridership patterns are described; the authors develop requirements for a modernized transit system and recommend a revised administrative structure which emphasizes regional control and funding of transit operations through a public agency. Implementation of the revised structure is discussed.

Financing alternatives are explored in detail. The authors review four conventional tax sources for supplementing transit revenues, including property, parking, sales, and automobile-related taxes. The report also discusses three alternative forms which can be taken by the proposed transit agency: transportation district, metropolitan authority, or service district.

The report concludes with a capsule view of future public transportation in the Richmond area.

NTIS Order #: PB-212-856 PC \$3.00, MF 95¢ Title: "A Transit Plan for the Metropolitan Area, Seattle and King County --Summary Report" [OVERSIZE DOCUMENT]

Author: Puget Sound Governmental Conference (for Municipality of Metropolitan Seattle)

Date:	May,	1972	Project No. WASH-09-0005
Keywords:	1. 2. 3. 4.	Bus, express Bus, commuter Bus, feeder Routes and Routing	 5. Parking, park-and-ride 6. Financing Mass Transportation, sources 7. Government, taxation

Abstract: This report provides a brief summary of the proposed master transit plan for the Seattle, Washington, metropolitan area. The recommended multi-center system will serve regional activity centers with 25 express bus routes covering some 650 two-way route miles. Existing Blue Streak commuter service will be supplemented by a new express mode, the "Metro Flyer," to provide corridor service on high-speed freeways.

Approximately 100 local bus routes will operate as feeders to the express system and provide neighborhood service within communities. Other elements of the transit plan include construction of 25 park-and-ride lots, a shelter and signing program, and acquisition of new rolling stock. Financial aspects of the recommended system are described; it will be supported by an increase in local sales taxes, thus permitting reduced overall costs under a pay-as-you-go plan. The importance of citizen participation is emphasized. The report concludes with a discussion of alternatives and recommended system features.

> NTIS Order #: PB-213-558 PC \$3.00, MF 95¢

	Techni	ical Appe <mark>nd</mark> ix	**				
Author:	Puget Seatt	Sound Govern Le)	mental Confere	nce (f	for M	unicipality of Metropolitan	
Date:	May, 1972				Project No. WA-09-0005		
Keywords:	: 1. 2. 3. 4.	Bus, express Bus, cost Ridership Financing Ma sources	ss Transportat	ion,	5. 6. 7. 8.	Government, taxation Social Benefits and Costs Community Response Routes and Routing	

Title: "A Transit Plan for the Metropolitan Area, Seattle and King County --

Abstract: This technical appendix documents the methodology, substantiating data, and analysis employed in the preparation of a master transit plan for Seattle and King County, Washington. The evaluation of alternative systems was based upon analyses of existing service; service requirements for contiguous areas; travel corridors activity centers, and service concepts; and estimates of patronage and revenue. Alternative evaluation criteria are reviewed. The report contains all relevant data with reference to the Seattle metropolitan area and existing transit operations.

The recommended transit plan is outlined in detail. It will emphasize express bus service coordinated with local and feeder systems. A proposed organizational structure, capital costs for the 1980 plan, and estimates of patronage, revenues, and operating cost are discussed.

Attention is also focused on preparation of the financial plan with reference to non-farebox revenue and sources of capital assistance, state and local mass transit assistance programs, and the ultimate financial plan.

Planning and urban impact of the proposed system are examined. The report describes the community physical structure and the effect of transit on various localities in the metropolitan area. The social impact of improved mass transit is examined with reference to effects on low-income groups, the elderly, and diverted auto users. The report concludes with a detailed discussion of the community involvement program which is intended to maximize public participation in the planning and implementation of the transit master plan.

> NTIS Order #: PB-213-559 PC \$6.00, MF 95¢

Title: "A Transit Plan for the Central Puget Sound Region, An Update of the Puget Sound Regional Transit Plan"

Author: Puget Sound Governmental Conference

 Date:
 May, 1972
 Project No.
 WA-09-0005

 Keywords:
 1.
 Bus, intracity
 5.
 Government, county

 2.
 Bus, cost
 6.
 Government, taxation

 3.
 Bus, express
 7.
 Financing Mass Transporta

 4.
 Bus, rapid transit
 tion, requirements

Abstract: This report develops recommendations for a regional transportation system in the Seattle metropolitan area and updates the 1966 Regional Transit Plan. The latter embraced a partial rail system which is replaced by an allbus system in the new plan, targeted for 1980.

Existing transit service in each municipality is reviewed in detail. The general system and its service areas and routes are described for Tacoma, Bremerton, Everett, and Seattle. Special attention is focused on existing operations of the Metropolitan Transit Corporation, the area's principal carrier.

Specific recommendations of the revised regional plan are outlined for each of the participating counties. The proposed transit plan described in this report emphasizes a multi-centered system of express bus and local feeder routes as well as comprehensive programs to upgrade the quality of regional transit services.

The authors provide a detailed financial analysis with reference to funding sources and projections of system costs and revenue. State and local tax options are reviewed. The capital and operating costs associated with public transit in the various regional counties are examined along with the financial program recommended through 1976.

Seven appendices discuss citizen participation, standards and criteria, operating surveys, implications of local political events, financial analyses of local transit operations, agency review comments, and computer applications for regional transit networks.

> NTIS Order #: PB-213-446 PC \$3.00, MF 95c

Title: "Bellevue Area Transit Study" Author: Puget Sound Governmental Conference Date: June, 1972 Project No. WA-09-0005 Keywords: 1. Urban Development, planning 4. Bus, express 2. Traffic, analysis 5. Bus, rapid transit 3. Demand-Responsive Systems, 6. Bus, school bus Dial-A-Ride

Abstract: This report summarizes a comprehensive technical study of Bellevue, Washington, which was prepared in conjunction with the Seattle metropolitan plan and the four-county Puget Sound Regional Transit Plan. The Bellevue area has witnessed substantial growth and development in recent years, and the improvement of public transit service represents a top priority in future planning.

Several trends in this growth pattern are discussed in detail, and the Bellevue micro-model for traffic assignment is described. Attention is focused on future transit alternatives for the area and on impacts of the proposed Metropolitan Area Transit System. Major components of this plan include express bus service from six park-and-ride lots and an extensive local bus system. Proposed routes are described in detail; the possibility of implementing a supplementary local Dial-A-Bus service is also examined.

The report emphasizes the potential integration of school bus and transit service in Bellevue. Policy factors in transit planning are reviewed with reference to pedestrians, parking, land use, and several special recommendations.

> NTIS Order #: PB-213-248 PC \$3.00, MF 95¢

Title: "General Criteria for Transitway Design -- Milwaukee County Transitway"

Author: Barton-Aschman Associates, Inc. (for County of Milwaukee)

Date: December, 1968

Keywords:	1.	Bus, rapid transit	6.	Vehicle, design
	2.	Bus, busway	7.	Guideways
	З.	Rail, systems planning and	8.	Topography
		design	9.	People Mover, Transit Ex-
	4.	Rights-of-Way		pressway
	5.	Speed and Speed Control	10.	People Mover, Alden StaRRcar

Abstract: General design criteria for a proposed rapid transitway in Milwaukee County, Wisconsin, are presented. This facility will provide an exclusive right-of-way for high-speed rapid transit vehicles serving the Milwaukee central business district. Emphasis is focused on design flexibility to accommodate new forms of rapid transit vehicles in the future.

While no specific vehicle system has been selected to operate on the transitway, five alternative rapid transit modes are reviewed to determine operating characteristics that would impose constraints on transitway geometry. These modes include conventional buses, the General Motors RTX experimental bus, "Skybus," the Alden "StaRRbus," and conventional rail rapid transit. Each vehicle system is described with reference to physical dimensions, weight, line-haul speed, acceleration, deceleration, maximum operating grade, turning radius, and special guideway requirements.

Based upon the vehicle analysis, general design criteria were developed for a transitway with reference to design speeds, level of service, pavement width, stopping distance, grades, vertical curves, clearances, horizontal curves, superelevation, typical sections, bridge design, drainage, and such miscellaneous features as fencing, lighting, and special lanes for acceleration and deceleration.

> NTIS Order #: PB-208-994 PC \$3.00, MF 95¢

Title:	"Documentation	of the	e Travel	Simula	ation	Models	Used	in	the	Mass
	Transit Techni	ical Pi	Lanning	Study :	in Mil	lwaukee	Count	y"		

Author: Southeastern Wisconsin Regional Planning Commission

Date: D)ecemi	ber, 1971		Project No. WI-09-0001
Keywords:	1. 2. 3. 4.	Trip Generation Modal Split Surveys Quantitative Analysis	5. 6. 7. 8.	Urban Development, plan- ning Traffic, analysis Ridership, volume Land Use

Abstract: This report documents the review, refinement, and application of travel and demand forecasting techniques for a comprehensive technical study of transportation planning requirements in the Milwaukee County, Wisconsin, region.

Attention is given to the procedural development of four travel simulation submodels used in the Milwaukee County Mass Transit Technical Planning Study. These include simulation models of: (1) Trip Generation, (2) Modal Split, (3) Trip Distribution, and (4) Traffic Assignment. The analyses focus upon extensions of relationships found to exist between land use and travel.

The analysis yielded forecasts of trip generation and travel demand for 1990. These data were compared with results of a 1963 origin-destination survey to project traffic requirements for future transportation systems and to provide a practical link between land use and transit planning.

NTIS Order #: PB-208-393 PC \$3.00, MF 95¢

SECTION II

RESEARCH, DEVELOPMENT AND DEMONSTRATION REPORTS

Title: "Reduction of Robberies and Assaults of Bus Drivers - Volume I: Summ and Conclusions"					
Author:	Stanford Research Institute and	University of California			
Date:	April, 1970	Proj. #: CA-06-0029			
Keywords:	 Crime and Crime Prevention Bus, driver Benefit-Cost Analysis Management, operations and techniques 	5. Surveys 6. Ridership 7. Demography 8. Fares			

Abstract: The primary objective of the study was to develop an understanding of the nature and causes of robbery and assault of bus drivers and to propose and evaluate potential solutions to those problems.

The overall approach for the study was to use criminological research methods to determine the exact nature of robberies and assaults against bus drivers, and then to evaluate a series of possible solutions in terms of technical feasibility; cost; effectiveness in reducing crime; and acceptability to transit management, to drivers, and to the riding public.

In evaluating countermeasures, the Stanford Research Institute (SRI) used a variety of systems analysis and cost-benefit analysis techniques. To help determine criteria for evaluation, SRI surveyed the management of two of the participating transit properties. Countermeasures were evaluated through combinations of mathematical modeling, cost-benefit analysis, and laboratory experimentation, as well as analysis of experience with comparable systems on and off buses.

Studies of the University of California School of Criminology staff were oriented both toward definition of the problem and evaluation of countermeasures in terms of public and driver attitudes. To accomplish these tasks, the project was divided into four major study phases. The operator phase focused on the driver himself; the community phase concentrated on rider attitudes and the community environment in neighborhoods where bus crime was prevalent; the police and criminal justice phase was concerned with the attitudes and organization of the police and the criminal justice system in dealing with bus crime; finally, the offender's phase studied the characteristics of the perpetrators of bus crime.

In studying these four phases, a variety of techniques were used; surveys, reviews of files, and face-to-face interviews were employed. Other specific techniques employed are summarized in the report.

The authors note that transit systems can take passive measures to reduce the crime problem; these include improved driver training and intensive community relations efforts, particularly among the disadvantaged. The authors also suggest using as countermeasures physical barriers (such as shields between drivers and passengers) and cameras (on low traffic runs to record each passenger who boards).

The recommendations indicated are: (1) installation of exact fare systems, (2) adoption of paid rider schemes, (3) development of special driver training and community relations programs, (4) simplification of fare structures, (5) stabilization of driver assignments, and (6) strict nondiscrimination in hiring and personnel policies.

> NTIS Order #: PB-197-532 PC \$3.00, MF 95¢

Title:"Reduction of Robberies and Assaults of Bus Drivers -- Volume II:
The Scope of the Crime Problem and Its Resolution"Author:Gordon E. Misner and William F. McDonald (University of California
at Berkeley for Alameda-Contra Costa Transit District)Date:December, 1970Project No.CA-06-0029Keywords:1.Crime and Crime Prevention
2.5.Fare, collection
3.Bus, driver
3.6.Inner City
4.7.Information Aids
8.

Abstract: This report examines the incidence and prevention of crime on public transportation systems. Attention is focused on the social and criminological aspects of robberies and assaults of bus drivers. Data were obtained in Oakland, Seattle, Atlanta, Chicago, and Washington, D.C., to determine the nature and extent of bus crime with reference to the bus driver, the offender, the community, and the criminal justice system.

The occurrence of deviant social behavior is studied in detail. Particular attention is focused on the interactions between bus drivers and passengers which are frequently prone to conflict. The report also examines the social role of urban mass transportation and the context of transit crime as a reflection of sociological factors. The police response to bus robberies is discussed and a profile of bus robbers is developed. The report concludes with a review and evaluation of several selected anti-crime strategies.

One principal finding of the research was that ready-fare measures have effectively reduced the incidence of bus robberies. However, the problem of assaults remains alarming. The authors emphasize the need to examine robberies and assaults in a broader context which embraces all forms of antisocial behavior on public transportation. Most assaults were found to arise from interactions between drivers and passengers which are structured by existing transit operations. The most common points of conflict are collections of fares and transfers.

The authors recommend that detailed studies be made in the areas of public attitudes toward mass transit, vandalism, changes in vehicle design, public perception of transit crime, and the morale among drivers. Other anticrime measures include ready-fare systems, special arrangements with police, two-way radios, elimination of hold-overs in isolated areas, rotation of drivers' schedules, reduction and/or elimination of service in high-crime areas, and other hardware measures. Driver training programs should include instructions for dealing with transit crime and conflict-prone situations. The importance of clarity in transit information systems is also emphasized, since many assaults apparently stem from misunderstandings of transit fares, zones, routes, transfers, etc. Transit operators are encouraged to develop programs to improve anti-crime measures and cooperation with area schools.

> NTIS Order #: PB-198-056 PC \$6.00, MF 95¢

- Title: "Reduction of Robberies and Assaults of Bus Drivers -- Volume III: Technological and Operational Methods"
- Author: Stanford Research Institute (for Alameda-Contra Costa Transit District

Date:	April	, 1970		Project No. CA-06-0029
Keywords:	1. 2. 3.	Crime and Crine Prevention Fare, collection Bus, driver	4. 5.	Communications Vehicle, monitoring

Abstract: The report is a detailed analysis and evaluation of technological and operational methods for reducing robberies and assaults of bus drivers. Initially, the authors approached the subject in three alternative areas: (1) methods to deter bus crime, (2) methods to "thwart" crimes in progress, and (3) methods to assist in the apprehension of criminals. The initiation of an exact fare plan in the system under study altered the methodology so that particular emphasis in the report is given to: (1) a detailed analysis of the exact fare countermeasures, and (2) measures to specifically reduce the incidence of assaults.

Several criteria for evaluating crime-reduction techniques are outlined. Results of questionnaires circulated among transit riders and bus drivers are detailed in the appendices. The authors also discuss in depth their conclusions about several generic proposals. Particular emphasis is given to the questionnaires of bus riders and operators since the major considerations for implementation of any crime-reduction method are to minimize passenger inconvenience and to maximize driver acceptance.

The report contains analyses of specific crime-reduction methods. Six categories of such techniques are identified, including: exact fares, alarm systems, aids for identifying and tracing suspects, physical protection for drivers, bus communication systems, and surveillance of transit operations. In each case the authors evaluate the proposals according to technological development, economy, passenger inconvenience, and the extent to which the systems are expected to actually reduce crime. Results of operational experience with the systems are included where applicable.

> NTIS Order #: PB-198-057 PC \$3.00, MF 95¢

Title: "Goals and Guidelines: Rankine Cycle Propulsion Systems for Application to Urban Buses and Other Heavy-Duty Vehicles"

Author: Roy A. Renner (International Research & Technology Corporation)

Date: December 1, 1972

Project No. CA-06-0031

Keywords:1. Bus, design5. Air Pollution2. Propulsion Systems, diesel6. Fuel, consumption3. Propulsion Systems, external7. Safetycombustion8. Maintenance4. Noise and Noise Control

Abstract: Preliminary goals and guidelines are presented for the development of low-emission Rankine Cycle Engine (RCE) external combustion propulsion systems for urban transit vehicles. Both interim and long-range goals for power systems are described, so that development can progress toward prototypes having properties acceptable to fleet operators.

Under the California Steam Bus project, three conventional 40-foot transit buses were converted to RCE power. Operational testing demonstrated low exhaust emissions and reduced noise levels, but both parameters were judged capable of further improvement. Road performance was competitive with conventional diesel propulsion. The purpose of the guidelines presented in this report is to address several of the particular areas needing improvement. Emphasis is given to the need for lower fuel consumption, increased system reliability, and production economy.

The general guidelines cover only RCE powerplants, although guidelines for other external combustion systems are recommended. Principal areas covered in the report include: (1) a description of the bus and its characteristics; (2) general power system requirements; (3) performance criteria; (4) fuels and fuel economy; (5) objectives for reduction of emissions, noise, and heat release; (6) operational safety; (7) operating characteristics; (8) reliability and maintenance factors; (9) resources and materials utilization; (10) production considerations; (11) cost projections; and (12) applications.

> NTIS Order #: PB-218-143 PC \$3.00, MF 95¢

Title: "California Steam Bus Project Final Report"

Author: James A. Lane, <u>et</u>. <u>al</u>. and Roy A. Renner (California Legislature, The Assembly Office of Research)

Date: J	Janua	ry, 1973	Pro	Project No. CA-06-0031				
Keywords:	1. 2. 3. 4.	Bus, design Bus, driver Propulsion Systems, extern combustion Propulsion Systems, diesel	5. 6. 7. 8. 9.	Fuel, types Fuel, consumption Air Pollution Surveys Noise and Noise Control				

Abstract: The California Steam Bus Project was undertaken to evaluate the technical feasibility and public acceptance of the External Combustion Engine (ECE) as a low-emission, quiet propulsion system, using city buses as demonstration vehicles. Emphasis was placed on the early demonstration of potential, rather than extensive development or technical perfection.

The title "Steam Bus" was adopted after the project's engineering contractor chose Rankine cycle systems to exemplify the ECE. Three contractors developed and installed steam propulsion systems in three 40-foot transit coaches, replacing the original diesel engines. The three steam buses were tested and demonstrated in the metropolitan areas of Oakland, San Francisco, and Los Angeles. The buses traveled 8,372 road miles under steam power, including about 800 miles in revenue service.

The report presents research findings with reference to performance, emissions, noise, fuel consumption, operating characteristics, revenue service, an overall project summary, and the potential for fuel consumption and emissions improvement. The report concludes that ECE-powered buses equal or exceed the road performance of standard diesel vehicles.

Several specific recommendations for future research, development, and demonstration of the Rankine cycle ECE for transit buses are advanced. Other sections of the report discuss project history, technical experience, public attitudes, and potentials for improvement. Relevant illustrations and technical data are presented.

> NTIS Order #: PB-217-508 PC \$3.75, MF 95¢

Title: "California Steam Bus Project Final Report -- Surveys"

Author: Scientific Analysis Corporation

Date: 1973

Project No. CA-06-0031

Keywords:1. Bus, design6. Community Response2. Bus, driver7. Management, operations3. Propulsion Systems, dieseland techniques4. Propulsion Systems, external
combustion8. Air Pollution5. Surveys9. Qualitative Analysis

Abstract: Under the California Steam Bus demonstration project, Rankine cycle external combustion propulsion systems were installed on three conventional motor coaches, replacing the original diesel engines. This report presents survey data collected among bus passengers, transit managers and bus drivers concerning attitudes toward the steam-powered vehicles.

For comparative purposes, passengers were surveyed on both conventional diesel and modified steam buses. Characteristics of the survey samples and methodology are described. The findings revealed a high public concern for the problems of air pollution and an overwhelmingly favorable response to the steam buses. All relevant data and major crosstabulations are presented.

The survey of transit managers focused on the role of steam bus technology as an attractive anti-pollution measure. Respondants emphasized economic factors and the need for continued research and development.

Lastly, in-depth personal interviews were conducted with each of five operators of both diesel and steam buses. Comfort, operating, and general attitude factors were stressed. Findings are presented with reference to quietness, smoothness, power, odor, smoke, safety, pollution, handling, operation, and passengers' reactions. All five drivers expressed a preference for the steam bus.

> NTIS Order #: PB-217-511 PC \$3.75, MF 95¢

Title: '	'itle: "The California Steam Bus Project Technical Evaluation"						
Author: Roy A. Renner (International Research & Technology Corporation)							
Date:	Janua	ary, 1973		Project No. CA-06-0031			
Keywords :	: 1. 2. 3. 4.	Bus, design Bus, cost Propulsion Systems, diesel Propulsion Systems, external combustion	5. 6. 7. 8.	Air Pollution Noise and Noise Control Fuel, consumption Instrumentation			

Abstract: This report provides a technical evaluation of the California Steam Bus Project which demonstrated the potential of low-emission, quiet external combustion propulsion for transit vehicles. Three contractors (William Brobeck & Associates, Lear Motors Corporation, and Steam Power Systems, Inc.) supplied and installed Rankine Cycle powerplants in conventional motor coaches, replacing the original diesel engines.

In both experimental operation and revenue service, exhaust emissions were found to be considerably lower than the 1975 California requirements for heavy-duty vehicles. Substantial reductions in sound levels were also measured in one of the buses. In comparison with standard diesel engines, the steam propulsion systems can weigh less and operate with similar or improved road performance.

This technical evaluation examines project objectives and chronology, power systems generally, test methods and instrumentation, driving cycle tests, results of the technical evaluation, and future possibilities. Particular attention is focused on future improvements in the non-optimized demonstration vehicles to further reduce exhaust emissions and high fuel consumption. Other conclusions and recommended refinements of the pre-production prototypes are summarized in detail.

> NTIS Order #: PB-218-139 PC \$3.00, MF 95¢

Title: "California Steam Bus Project"

Author: Kerry Napuk (Scientific Analysis Corporation)

2. Propulsion Systems, diesel

Date: 1973 Project No. CA-06-0031

Keywords: 1. Bus, design

- 5. Air Pollution
- 6. Fuel, consumption
- 3. Propulsion Systems, external 7. Maintenance
- 4. Noise and Noise Control

combustion

- 8. Research Operations

Abstract: The California Steam Bus project is summarized in this final report of the project manager to the California State Assembly which, in conjunction with the Urban Mass Transportation Administration, financed the development and demonstration of Rankine Cycle external combustion propulsion systems for urban transit vehicles.

Project history, organization, and financing are summarized in detail. Under Phase I, three contractors (William M. Brobeck & Associates, Lear Motors Corporation, and Steam Power Systems) were selected to install steam powerplants in conventional motor coaches, replacing the standard diesel engines. Each contractor was paired with a transit system operator (AC Transit, San Francisco Municipal Railway, and the Southern California Rapid Transit District) during Phase II under which the modified buses were demonstrated in experimental testing and revenue service. Operational experience of the steam buses in each system is reviewed in detail.

The report also summarizes the overall technical experience of the demonstration program. Road performance was comparable to that of dieselpowered vehicles, with marked reductions in exhaust emissions and noise. The author concludes, however, that fuel economy was poor and that maintenance requirements were excessive.

Policy considerations are examined, particularly with reference to additional future pre-production phases.

> NTIS Order #: PB-217-509 PC \$3.00, MF 95¢

Title:	"California Steam Bus Project Project Report on Community Attitude Surveys, Phase I"						
Author:	Author: Frank J. Stefanich, Jr. (Scientific Analysis Corporation)						
Date:	1973		Pro	ject No. CA-06-0031			
Keywords	: 1. 2. 3. 4. 5.	Bus, design Propulsion Systems, diesel Propulsion Systems, external combustion Surveys Air Pollution	6. 7. 8. 9.	Community Response Ridership, profiles Private Transportation, automobile Qualitative Analysis			

Abstract: Preliminary to a demonstration of Rankine Cycle external combustion propulsion systems in urban transit vehicles, survey data were collected to measure the extent of public concern about air pollution and the extent to which California residents see the need for alternatives in transportation to alleviate or reduce air pollution.

Three surveys were conducted by Survey Research Centers at the Universities of California at Berkeley and Los Angeles. In addition, a survey of patron attitudes on steam and diesel buses was designed and pilot tested by the Scientific Analysis Corporation. Follow-up data will be collected as prototype modified steam buses developed under this project enter revenue passenger service.

In the initial surveys, attention was given to public attitudes concerning the most serious contemporary problems, the relative danger of smog and air pollution, frequency of bus use, the principal causes of air pollution, means of redressing air pollution, reasons for present level of bus use, impact of steam propulsion for buses on air pollution, and attractiveness of steam buses.

Although each survey was unique, several common questions permitted cross-survey analysis. Generally, concern for the problem of air pollution was very high, and automobiles were ranked with "industry" as the principal cause. Other findings are summarized in detail, and data tabulations are appended. Sampling methods for each survey are also discussed.

NTIS Order #: PB-217-510 PC \$4.50, MF 95¢ Title: "Steam Bus Symposium Proceedings"

Author: Scientific Analysis Corporation

Date: November 17, 1971

Project No. CA-06-0031

Keywords:1.Bus, design3.Air Pollution2.Propulsion Systems, external
combustion4.Government, state

Abstract: This report contains the proceedings of a symposium on steam bus technology held in Washington, D.C., on November 17, 1971. The principal advantage of external combustion propulsion is pollution-free operation, a critical requirement for urban transit vehicles under such emission-control standards as those imposed by the California Pure Air Act.

Government spokesmen at the symposium represented the U.S. Department of Transportation, the Urban Mass Transportation Administration, and the Environmental Protection Agency (EPA). Other speakers discussed the "EPA Rankine Cycle Program," the "Role of the California Legislature" in passing landmark emission-control legislation, and "Combustor Research and Emission Goals."

In addition, steam bus designs produced by Steam Power Systems, Inc.; William M. Brobeck & Associates; Lear Motors Corporation; and Vought Aeronautics Company are described. The Proceedings contains the complete text of remarks delivered at the symposium along with relevant charts, photographs, and other illustrations.

> NTIS Order #: PB-212-535 PC \$3.00, MF 95¢

Title: "Workshop on Transportation for New Towns and Communities"

Author: Institute of Public Administration

Date: December, 1969

Project No. DC-06-0008

Keywords:	1.	New Towns	7.	Elevators
	2.	Urban Development, planning	8.	Dual-Mode Systems
	3.	Land Use	9.	Distribution Systems
	4.	Housing	10.	Conveyors
	5.	Center City	11.	Government, Federal
	6.	Relocation	12.	Demography

Abstract: The report contains seven papers presented to a workshop on transportation systems for new towns and communities. "Compatible Automation of New Town Transportation" by Dwight M.B. Baumann examines the modal interchange problem with particular emphasis on applications of dual-mode automobiles and vertical-horizontal elevators. Conventional mass transit and moving sidewalk alternatives are discussed, and attention is given to the application of personalized capsules with vertical-horizontal capabilities. Implementation methods are also examined.

"How Land-Value Impacts of Transportation Arteries Affect New-City Development" by Anthony Downs explores the implications for public policy of landvalue increases generated by expressway and rapid transit lines in new towns. "An Analysis of the Impact of Transportation Systems on Other Systems of the City" by John P. Eberhard develops a basis for measuring the incremental impacts of alternative transportation systems upon the performance characteristics of movement, metabolic, information/communications, and enclosure systems.

"Trade-Offs Involving City Size, Density and Building Type" by Irving Hoch investigates optimality in new town configurations and the interrelationship among design variables. Trade-offs between city size and income, accessibility and space, and privacy and economy are discussed. Attention is given to the impact of externalities in selecting parameters for new town development. "New Towns, Urban Growth Strategies and Transportation" by Lloyd Rodwin examines the need for a national urban growth strategy. Elements of such a policy would include redevelopment of central city social, physical, and economic conditions; relocation of inner city populations in less congested areas and new cities; and development of large growth centers in lagging regions.

"What Settlement Patterns in the Post-Industrial Age?" by Melvin M. Webber examines transportation problems in an era when proximity between residential and employment centers is no longer necessary. Reliance on private transportation modes and the need for mobility among persons lacking access to automobiles are emphasized. "New Towns, Overspill, and Metropolitan Deconcentration: Some Lessons from Glascow" by Lowdon Wingo explores the effects of land clearance on population displacement and "overspill." Glascow, Scotland, is presented as a case study where regional planning has allowed persons displaced by urban core redevelopment to move into a planned pattern of new towns spatially organized by a high-performance transportation net.

> NTIS Order #: PB-198-613 PC \$6.00, MF 95¢
Title: "Subway Environmental Survey: Port Authority Trans-Hudson Corporation"

Author: DeLeuw, Cather and Company

Date: October, 1971

Project No. DC-06-0010

Keywords.	1	Rail, systems planning and	4	Air Conditioning
Reywords.	•	design	5.	Heating
	2.	Rail, stations and terminals	6.	Underground Structures
	3.	Environment and Environmental	7.	Noise and Noise Control
		Control	8.	Vibrations

Abstract: The report documents results obtained in an environmental survey of the Port Authority Trans-Hudson (PATH) system. The study was undertaken as part of a larger investigation to develop comprehensive subway environmental design criteria; an essential component of this research thus focused upon conditions prevailing among the major operating properties in different cities.

Data were collected in a detailed questionnaire which covered all relevant aspects of the Newark-Manhattan transit network. Specific topics included general information, system description, tunnel sections (ie. environmental conditions, ventilation, design criteria, shock waves, dirt and cleaning operations, emergencies and smoke control, and future design considerations), stations, vehicles, environmental criteria for electrical and mechanical control equipment, and recommended programs for future research and development.

Specific responses to the survey instrument are reproduced in the report. Appended material includes a schematic diagram of the tunnel system; traffic distribution; distance and running times between stations; tunnel cross sections; simultaneous temperatures of tunnels, platforms, and outside ambients; schematic diagram of mechanical ventilation system; recap of 1970 emergencies by category; charts, formulae, calculations, and tests conducted in 1923; electrical characteristic curves on PATH vehicles; and noise and vibration criteria.

The PATH system, which carries over 70% of all rail passengers entering New York City from New Jersey, was established in 1962 as a subsidiary of the Port of New York Authority. Particular attention is focused on the renovation of the system's Hudson Terminal, now part of Manhattan's World Trade Center complex. This facility became the first fully air conditioned rapid transit station ever constructed in North America.

Air conditioning considerations for the Hudson Terminal platform are described in detail. Computations of cooling requirements are also presented. In addition, the report reviews noise and vibration considerations, results of a 1970 investigation of airborne particulate matter, and a 1964 study which tested the capacity of existing fans to serve as an emergency ventilation system.

> NTIS Order #: PB-210-322 PC \$3.00, MF 95¢

Title: "Subway Environmental Survey -- New York City Transit Authority" Author: DeLeuw, Cather and Company, Consulting Engineers Date: December, 1971 Project No. DC-06-0010 Keywords: 1. Rail, systems planning and 4. Environment and Environmental design Control 2. Rail, stations and terminals 5. Heating 3. Tunnels and Tunneling 6. Air Conditioning

Abstract: The report documents results obtained in an environmental survey of the New York City Transit Authority (NYCTA) subway system. The study was undertaken as part of a larger investigation to develop comprehensive environmental design criteria; an essential component of this research focused upon conditions prevailing among the major operating properties in different cities.

Data were collected in a detailed questionnaire which covered all relevant aspects of the New York subway network. Specific topics included general information; system description; tunnel sections (ie. environmental conditions, ventilation, design criteria, shock waves, dirt and cleaning operations, emergencies and smoke control, and future design considerations); stations; vehicles; environmental criteria for electrical and mechanical control equipment; and recommended programs for future research and development.

Specific responses to the survey are reproduced in the report. Appended material covers general information on geology and waterproofing; the history of subway ventilation in New York; sketches of the present ventilation system and emergency criteria for new lines; and drawings of representative stations, tunnels, and vent shafts.

The NYCTA system is the largest of the operating properties surveyed for this project; it consists of nearly 240 route miles and handles 4.4 million daily riders. While the City has always owned its subway facilities, the NYCTA was not created until 1940 at which time three separate operations were consolidated. For this reason, environmental design criteria differ among the various subway lines. Originally, piston action of the trains was to have been the sole means of ventilating station platforms; later, however, open gratings to the surface and vent fans were added to supplement the ventilation system. The authors note that existing ventilation standards are volumetric only, with insufficient attention being given to other factors. The report examines station temperature data collected in 1967 for a study of air conditioning feasibility by the General Electric Company.

Noise is judged to be an outstanding problem in the NYCTA system. The existing ventilation methods are presently under review.

NTIS Order #: PB-211-073 PC \$3.00, MF 95¢

- Title: "Subway Aerodynamic and Thermodynamic Test (SAT) Facility: Single-Track Aerodynamics"
- Author: Developmental Sciences, Inc., Aerospace Technology Division (for Institute for Rapid Transit)

 Date:
 August, 1972
 Project No. DC-06-0010

 Keywords:
 1. Aerodynamics
 6. Rail, systems planning and design

 2. Testing Facilities
 7. Rail, rolling stock

 3. Drag
 7. Rail, stations and terminals

 5. Vehicle, design
 8. Rail, stations and terminals

Abstract: An investigation of single-track subway aerodynamics was performed at the Subway Aerodynamic and Thermodynamic Test (SAT) facility. The purpose of this study was to collect experimental data for comparison with theoretical research as part of a larger program to develop comprehensive environmental design criteria for subways.

Facilities and instrumentation used for data acquisition are described in detail. The aerodynamic experiments were performed for nine trains with varying blockage ratios in both steady and unsteady operation. Test results are provided for the smooth round tunnel, rough round tunnel, and smooth rectangular tunnel. The project emphasized aerodynamic characteristics associated with tunnel venting, train roughness, train geometry, and station configuration. The authors conclude that the experimental findings successfully replicated the results of a theoretical near-field drag model developed at CalTech.

> NTIS Order #: PB-213-158 PC \$3.00, MF 95¢

Title: "Summary Report of Activities and Accomplishments of Phase I"

Author: Parsons, Brinckerhoff, Quade & Douglas, Inc. (for Associated Engineers/A Joint Vehture with DeLeuw, Cather & Company and Kaiser Engineers)

 Date:
 October, 1971
 Project No. DC-06-0010

 Keywords:
 1. Environment and Environmental Control
 4. Rail, rolling stock

 2. Rail, systems planning and design
 5. Underground Structures

 3. Rail, stations and terminals
 8. Thermodynamics

Abstract: The report presents a summary of accomplishments under Phase I (ie. first year) of this project to develop comprehensive environmental design criteria for subways. The authors note that environmental control facilities may represent as much as ten percent of subway construction costs and as much as 50% of operating power requirements for traction. The magnitude of these costs highlights the need for design optimization techniques especially developed for such environmental considerations so that subway planners, along with rapid transit system operators and environmental engineers, can economically design, develop, modernize, and expand new and existing systems throughout the United States.

The ultimate product of this research will be a handbook containing detailed information on environmental criteria, analysis, and control for subway rapid transit systems. Pursuant to this objective, Phase I activities emphasized several major areas. Basic research already underway developed data in identifying near and far-field aerodynamic phenomena. Construction of the vehicles in confined spaces (VICS-120) facility will permit experimental studies of subway aerodynamics based upon the scale modeling program of applied research initiated under Phase I. Analytical solutions of the aerodynamic and thermodynamic effects in subway systems have also been examined.

The mathematical modeling program identified current state-of-the-art methodologies and formulated physical and geometric data from which prototypical scale models of vent shafts, tunnels, and stations were developed. Concurrently, a program of field surveys was conducted to develop a finite identification of the major environmental problems in existing systems and a history of independent research, studies, and remedial actions taken. These survey data were used to guide the overall research program into the most critical problem areas. Finally, a comprehensive research bibliography was prepared.

A total of 37 milestone and interim reports were produced during Phase I which review specific research activities. These are summarized in a detailed review of Phase I accomplishments, broken down with reference to criteria, analysis, subway environmental survey reports, research bibliography, and handbook outline.

> NTIS Order #: PB-205-259 PC \$3.00, MF 95¢

Title: "Initial Data Acquisition from Vehicles in Confined Spaces (VICS-120) Facility, and Final Results from VICS-70"

Author: California Institute of Technology, Graduate Aeronautical Laboratories

Date:	October, 1971			Project No. DC-06-0010				
Keywords:	1.	Testing Facilities	4.	Pressure	and Pressure	Measure-		
	3.	Drag	5.	Vehicle,	design			

Abstract: The report describes work completed under Phase I of a project to develop experimental aerodynamic data for subway vehicles. The research was undertaken at the Vehicles in Confined Spaces (VICS) facilities at Caltech. The overall project is aimed at generating comprehensive environmental design criteria for urban subway systems.

Tests were made using a circular model centered in the tube by means of two sets of three equal-length skids. Initial experiments verified the importance of eccentricity as a test parameter. Other investigations centered around the effects on vehicle drag of a simulated undercarriage. Vehicle drag data were determined by observing the motion of the model; use of the model pressure signature as an alternative procedure for determining drag was also examined.

The test data were employed to develop a computer program, the Basic Analytical Model I, which is included in the report. By using this model, the various elements which contribute to the total aerodynamic drag can be examined and their relative importance determined. A comparison between experimental and computercalculated pressure signatures is included to validate the program output.

The VICS-70 facility was used for the eccentricity investigation and initial portions of the simulated undercarriage investigation. The facility is described in detail with reference to design, instrumentation, and related hardware. The VICS-120 facility was used for the remaining tests under Phase I. The report focuses particular attention on comparisons between theoretical and experimental data with reference to pressure signatures and the determination of aerodynamic drag from pressure signatures.

NTIS Order #: PB-211-031 PC \$3.00, MF 95¢ Title: "Factors for Evaluation of Center City Transportation Plans" Author: Murray Kamrass (Institute for Defense Analysis) Date: August, 1969 [Revised April, 1970] Project No. DC-06-0035 Keywords: 1. Benefit-Cost Analysis 2. Center City 3. Quantitative Analysis 4. Time Costs 5. Access, planning and control

Abstract: A modified benefit-cost method has been recommended for evaluating projects under the Urban Mass Transportation Administration's Center City Program. This report describes thirteen factors or attributes of urban transportation systems which must be considered in the model to estimate the impact of transportation improvements on four basic groups of potential beneficiaries. These groups include: (1) transportation system users, (2) business and real estate interests, (3) persons residing in proximity to transportation rights-of-way, and (4) the general community.

An earlier report generated under TRD-51 developed a list of urban transportation goals for each impact group. The evaluative methodology will therefore attempt to quantify empirically the impact of each factor on each group in order to identify the distribution of benefits and costs.

The thirteen factors include: travel time, access, noise, safety, vibration, air pollution, economic efficiency, growth and development, emergency responses, comfort and amenities, intrusion, attractiveness for the commuter, and flexibility. Available quantitative data for each factor are provided.

NTIS Order #: PB-212-459 PC \$3.00, MF 95¢ Title: "Concepts for Evaluating Center City Transportation Program and Projects -- Interim Report"

Author: Murray Kamrass, et. al. (Institute for Defense Analysis)

Date: December, 1969

Project No. DC-06-0035

Keywords: 1. Benefit-Cost Analysis 2. Center City

Abstract: A general approach to evaluating projects under the Center City Program is outlined and discussed. Components of the overall program are projects being conducted in groups of five, eight, and twenty-one cities by various contractors of the Urban Mass Transportation Administration. Each project is described briefly.

The purpose of this report was to develop an evaluation methodology for center city transportation improvements. An examination of alternative approaches to program evaluation indicated that a modified benefit-cost analysis method could best describe center city project impacts. The authors also conclude that a functional definition should be used to delineate center city areas.

The benefit-cost model will measure transportation effects on goals outlined for four impact groups: transit users, business and real estate interests, persons residing near transportation rights-of-way, and the general community. The report also describes five subtasks for refining the evaluative model. Appended materials discuss the impact of noise in the center city and a preliminary classification of capital items for rail systems. Title: "Center City Transportation Needs of Transit-Oriented Cities -- Summary of the National Urban Coalition Seminar, Boston, Massachusetts, April 1-2, 1970"

Author: Elizabeth Parker and Murray Kamrass (Institute for Defense Analysis)

Date: A	pril	., 1970		Project No. DC-06-0035
Keywords:	1. 2. 3. 4.	Center City People Mover Rail, systems planning and design Interfaces	5. 6. 7. 8.	Distribution Systems Urban Development, planning Financing Mass Transporta- tion, requirements Freight Movement

Abstract: In conjunction with the U.S. Department of Transportation's Center City Transportation Program, seminars were held to identify priority projects and transportation requirements in three categories of cities. This report presents a summary of the Boston seminar which focused on Category III cities. These cities are generally characterized by well-developed and extensive transit systems patronized by a wide spectrum of the population, and they include Boston, Chicago, Philadelphia, and New York. The authors note that two additional cities, San Francisco and Cleveland, because of substantial developments in their public transit systems, can also be classified in Category III.

The seminar identified a wide range of priority transportation projects associated with improving or extending existing systems, increasing efficiency and amenities of these systems, providing high-capacity people movers in the center city, improving interfaces among existing systems, and developing a more effective goods distribution system. Such improvements, the authors note, require extensive and expensive projects for which financing and planning are complex.

Presentations of center city transportation requirements in each Category III city are reviewed. The report notes that two fundamental areas of problems were identified: (1) access to center city, and (2) circulation within the center city. Access links were found to have received principal attention in the Category III cities, with insufficient development of circulation systems or satellite activity centers.

Particular attention is focused on problems affecting the planning and financing of urban transportation projects. Coordinative problems and requirements for long and short-range planning are also discussed. Although circulation improvements were found to represent a problem common to cities in Categories II and III, the specific systems needed differ markedly. In particular, the report cites a need for the development of high-capacity people mover systems for downtown circulation. Additional requirements for new equipment acquisition, improved multi-modal interfaces, and for effective goods movement systems are noted.

> NTIS Order #: AD-707-314 PC \$3.00, MF 95¢

Title: "Proceedings, IDA Urban Transportation Workshop -- February 3 through 5, 1969"

Author: Jane-Ring F. Crane and Elizabeth A. Parker (Institute for Defense Analysis)

Date: October, 1969

Project No. DC-06-0035

Keywords:	l.	Modal Split	7.	Small Cities
	2.	Qualitative Analysis	8.	Routes and Routing
	3.	Poverty	9.	Research Operations
	4.	Bi-Modal Systems	10.	People Movers
	5.	Rail, automatic control	11.	Urban Development, planning
	6.	Tubes and Tube Vehicles		

Abstract: In February, 1969, the Institute for Defense Analysis held a three-day workshop attended by contractors for the New Systems Study to discuss the results and implications of their findings. The 18-month study had been sponsored by the Department of Housing and Urban Development to summarize urban transportation stateof-the-art, recommend promising new systems for future research and development, and provide insights into the present "transportation problem." The purpose of this report was to summarize the remarks of 19 speakers at the workshop.

The proceedings included: (1) "The Impact of Urban Transportation Systems on Urban Life" by R.E. Engelen of Barton-Aschman Associates, Inc.; (2) "Transit Usage Forecasting Techniques: Modal Split Models" by T.J. Soltman of CONSAD Research Corporation; (3) "Oualitative Aspects of Urban Travel Demand" by R. Rea of Abt Associates, Inc.; (4) "The Transportation Demands of Disadvantages Groups" by L.A. Hoel of Carnegie-Mellon University; (5) "Projection of Urban Personal Transportation Demand" by D. Mendelson of Peat, Marwick, Livingston and Company; (6) "Improvements in Urban Transportation Through the Quantum Jump" by J. Gross, Jr. of Day & Zimmerman Consulting Services; (7) "Evolutionary Urban Transportation Improvements" by J.D. Garcia of the Institute of Public Administration; (8) "Future Urban Transportation Systems" by D.C. Henderson of Stanford Research Institute; (9) "Urban Influences of Future Transportation Systems" by R.A. Burco of Stanford Research Institute; (10) "Bi-Modal Systems" by R.A. Wolf of Cornell Aeronautical Laboratory, Inc.; (11) "Command-and-Control Systems" by R.V. Emling of General Electric Company; (12) "Gravity-Vacuum Transit System" by W.H. Avery of Johns Hopkins University; (13) "Urban Transportation Development Environment" by M.A. Sulkin of North American Rockwell; (14) "Systems Analysis of Urban Transportation" by W.F. Hamilton of General Research Corporation; (15) "Special Transportation Requirements in Small Cities" by B.W. Macy of Midwest Research Institute; (16) "Near Term Improvement: Routing and Scheduling Changes" by S.E.G. Elias of West Virginia University; (17) "Potential RD&D Projects" by K.L. Nielsen of Battelle Memorial Institute; (18) "MIT Pallet System" by D. Wilson of the Massachusetts Institute of Technology; and (19) "Overview of Federal Support for Urban Mass Transportation" by P.L. Sitton of the Urban Mass Transportation Administration.

> NTIS Order #: AD-699-158 PC \$3.00, MF 95¢

Title: "The M&O Subway, Fort Worth, Texas"

Author: Joseph A. Navarro and Elizabeth A. Parker (Institute for Defense Analysis)

Date: December, 1969

Project No. DC-06-0035

Keywords:1.Rail, shuttle4.Parking, park-and-ride2.Rail, systems planning5.Center Cityand design6.Ridership, attraction3.Fare, cost determination7.Private Transportation

Abstract: The M&O Subway in Fort Worth, Texas, was studied as a unique innovation for improved center city transportation. The Subway is privately owned and operated without charge to the public by Leonards' Department Store, a major commercial establishment located in the Fort Worth CBD.

Since the middle 1950's, the store experimented with various methods to provide free transit service for its customers. Shuttle buses were originally used to carry shoppers from a 24-acre flood control area of river bottom land where free parking space was provided. Time and convenience factors, however, made the bus service less attractive than driving.

In January, 1962, Leonards' announced that as part of an extensive \$2 million expansion program it would build a subway between the parking lot and the store and provide free transit service to the six-block store area. The authors note several factors which simplified the process of planning and implementation. Construction of the subway line began in February, 1962, and was completed in almost exactly one year.

Characteristics of the M&O transit system are described in detail. Its total length is slightly more than one mile, with approximately 1,400 feet of underground tunnel. The system links four stations located on the parking lot with one terminal in the store. Ridership estimates indicate that 2,000 persons use the system for work-related trips and that 8,000 to 10,000 persons daily use the system for shopping purposes. During the Christmas season, daily ridership may be as high as 25,000. In addition, some 90% of all store employees use the park-and-ride service. Other features of the system are described in detail.

Flexibility of the subway is examined, and the authors conclude that potential expansion to include other center city areas is feasible. Financial data are also presented; total construction cost for the M&O line was between \$1.22 and \$1.47 million. Annual operating and maintenance costs of the free transit service are approximately \$240,000. A lunch-hour bus service operated by Leonards' between the store and the Fort Worth Federal Building is described briefly.

The authors conclude that the M&O subway has important implications for the future of center city transportation. They note that improved circulation systems are reflected indirectly in land use patterns, retail sales, property values, and environmental benefits. The Subway has also demonstrated a potential role for the private sector in developing urban transportation and proved that existing technology can be translated into economically feasible public transit service.

> NTIS Order #: AD-701-338 PC \$6.00, MF 95c

Title: "Study and Evaluation of Urban Mass Transportation Regulation and Regulatory Bodies -- Part I: Summary and Main Report"

Author: R.L. Banks & Associates, Inc., Stanford Research Institute, and Real Estate Research Corporation

Date: May, 1972

Project No. DC-06-0044

Keywords:1.Government, Federal2.Government, state3.Government, urban

Financing Mass Transportation
 Urban Development, planning

6. Public Ownership

Abstract: The report presents a comprehensive analysis of urban mass transportation regulation and regulatory bodies. Current problems are examined in historic perspective to reveal the basic issues confronted by transit regulators.

Current regulatory patterns are discussed in detail with reference to regulated matters (ie. franchise provisions, fares, financial options, and service standards), neglected substantive issues, public and private ownership, and recent developments. Profiles of regulatory practice are illustrated in case studies from Atlanta and San Francisco, along with a general overview of national trends.

The coordination of regulation and planning is emphasized throughout. In this sense, the regulatory function embraces not only franchising and operational specifications, but also the relationship between transit and general development of the surrounding community. The authors are particularly concerned with the use of regulatory powers to stimulate the application of new technologies and to enforce coordinated urban planning.

Several analytical tools for improving transit are reviewed, particularly in regard to collecting and analyzing information for urban decision-making. Case studies in cities such as Atlanta, San Francisco, Cleveland, and Philadelphia are described. The authors advance general recommendations to improve transit analysis and the handling of data.

Policy options for organization, finance, and review/appeal are also examined. The authors are particularly concerned with the political implications of transit regulation. Several interest groups are identified, and the responsiveness of regulatory bodies to each is discussed.

The authors note several management and organizational alternatives for performing the regulatory function. A desirable structure is synthesized and described with reference to functions, scope, checks and balances, and finances. The report concludes with guidelines for constructive action.

Section I of the report is a comprehensive summary of the subsequent material. Data for this research were collected in surveys of both public and private officials.

Title:	"Study and Evaluation of Urban Mass Transportation Regulation and Regulatory Bodies Volume II: Appendices" (Final Report)					
Author:	R.L.	Banks & Associates,	Inc., <u>et</u> . <u>al</u> .			
Date:	May,	1972	Pr	oject No. DC-06-0044		
Keywords	: 1. 2. 3.	Government, urban Government, state Bibliographies	4. 5.	Land Use New Towns		

Abstract: The report contains seven appendices to a study of transit regulation as a basic aspect of urban planning and decision-making. In this context, the regulatory function embraces not only franchising and operational specifications, but also the relationship between transit and general development of the surrounding community.

Appendix A is a comprehensive bibliography of data sources used in the study of transit regulation. This section also includes a list of persons interviewed in various cities throughout the United States. Appendix B examines the structure of transit regulation in selected metropolitan areas. Cleveland, Denver, and Philadelphia were chosen for in-depth analysis; sixteen other cities are also surveyed.

Appendix C covers the legal basis for regulation with reference to the development of regulatory institutions. Appendix D outlines cases and controversies in transit regulation with numerous citations from major precedents. The analysis is broken down among cases in the legal, economic, and social spheres. Appendix E identifies a wide range of innovative solutions to urban transportation problems which are available for near-term application. The purpose of this section is to suggest potential regulatory and implementation problems associated with each category.

Appendix F examines land development trends affecting transportation regulation, particularly with regard to land use planning and control. Attention is focused on transportation regulation in new towns and other developing areas where transportation and land use planning coordination should be maximized. Appendix G is an overall work statement summarizing principal tasks performed under this research project.

NTIS Order #: PB-211-078 PC \$6.75, MF 95¢ Title: "The State-of-the-Art in Urban Gaming Models"

Author: Envirometrics, Inc.

Date: July, 1971

Project No. DC-06-0067

Keywords: 1. Games and Game Theory 2. Urban Development, planning 3. Computer, applications

Abstract: This report investigates state-of-the-art in urban gaming models. Gaming models are manual or automated simulation exercises in which teams of players assume the roles of various institutional actors to illuminate the interaction among subsystems of the urban environment. For this analysis, 18 individual gaming models were divided among three general categories: (1) Manual Grid Board Games [including CLUG, LUGS, URBAN DYNE, NEW TOWN, LOC 1, and LOC 2]; (2) Other Manual Games [METROPOLIS, SIMSOC, COMMUNITY, OLD TOWN, and TRANSPORTATION]; and (3) Computer-Based Games [METRO, GSPIA, CITY I, APEX, BUILD, CITY MODEL, and SYSTEMS]. Each separate gaming model is described in detail, and a bibliography of pertinent references is appended.

A general overview of the urban gaming models is provided with reference to principal subsystems included in the simulation. These subsystems are: (1) Environment (ie. location with respect to the outside system, topography, climate and weather, natural resources, and pollution); (2) Man-Made Concretions (ie. buildings, links, and terminals); (3) Transportation; (4) Technology; (5) Population (ie. population units, employment, education, health and welfare, and migration and housing); (6) Business (ie. construction, production, sales and finance); and (7) Government (ie. fiscal, services, and regulation).

Other dimensions of the gaming models are analyzed. These include systemic vs. role-playing models, models vs. games, manual vs. computer-based models, and playability vs. reality. In addition, the models are briefly classified according to the complexity of use by participants, and the report concludes with a discussion of their future potential. Attention is given to the derivation of many present gaming models from the early CLUG and METROPOLIS models.

Appended material includes an annotated bibliography, the use of gaming models for citizen participation exercises, a brief comparison of conventional transportation model techniques and those employed in CLUG and CITY MODEL, incorporating experiments within the CLUG model, summaries of additional gaming models, a thumbnail description of a general game, a list of persons and gaming shops involved in urban gaming, and an outline of symbols used and a definition of principal terms.

> NTIS Order #: PB-201-944 PC \$3.00, MF 95¢

Title: "Final Report on a Before and After Transit Innovation Study "

Author: Jordan J. Louviere (University of Iowa, Institute of Urban and Regional Research, Center for Urban Transportation Studies)

Date: January 1973

Keywords:	1.	Management,planning and analysis	5.	Social benefits and costs
	2.	Market research	6.	Surveys
	3.	Research operations	7.	Bus, rapid transit
	4.	Ridership, attraction	8.	Community response
		,		

Abstract: The purpose of this report is to discuss the rationale and events leading up to the initiation of a study designed to elicit information about user and non-user attitudes toward the Iowa City public bus system, to discuss the methodology employed in the attitude survey, and to discuss the findings and implications for further research.

The research was precipitated by an impending change in the ownership, operations, equipment, routes, fares, headways, and other aspects of the transit system. This impending change provided the opportunity to research a "before" and "after" study of the system. Objective ridership data and attitude surveys were both included in the methodology, although the more subjective attitude surveys compose a greater portion of this report.

The two main questions posed in this survey were (1), a rating of the various aspects of the bus service according to how satisfactory they were to the individual respondant and (2), open-ended responses to the most liked and the least liked aspects of the bus service and how the respondant felt that the system might be made more attractive.

There were four surveys taken, all of them by mail: (1) a "before" survey in August of 1971 in which 262 usable answers were collected, (2) an initial "after" survey in November, 1971, taken from the 262 above, of which 147 responded, (3) another random "after" sample in November 1971 whose purpose it was to provide an additional estimate of public sentiment and to serve as a check as to the representativeness of the initial survey, and (4) an on-board survey of just bus users.

The results showed significant increases in public satisfaction following the system change $\ \cdot$

NTIS Order No. PB-221-435 PC \$3.75 MC .95¢ Title: "The 'Northwest Passage' Project: A Market Analysis Covering Performance of the Pedestrian Interchange, 1969-1971"

Author: A.C. Nielsen Company

Date:	Octobe	er, 1971	Pro	ject No. IL-06-0009
Keywords:	1.	Rail, commuter	5.	Ridership, profiles
	2.	Rail, stations and terminals	6.	Surveys
	3.	Interfaces	7.	Market Research
	4.	Pedestrians	8.	Trip Generation

Abstract: A pedestrian walkway was constructed to facilitate the interchange of passengers between a commuter railroad terminal and a rapid transit station in downtown Chicago, Illinois. This report presents results of a detailed market research survey undertaken to assess the impact of improved accessibility on usage of the Chicago and North Western (C&NW) and the Chicago Transit Authority (CTA) rapid transit.

In all, eight separate surveys were conducted over three stages of the project. Data were collected in "platform" and "on-train" passenger surveys conducted before, immediately after, and approximately 15 months after construction of the "Northwest Passage" interchange. In addition, "unified" telephone surveys were conducted during Stages II and III.

Specific findings and tabulations of the market research analyses are presented with reference to general survey responses, frequency of transit use, trip purpose, origin and destination, modal split, familiarity with the other rail service, utilization of the passenger interchange, and other commutation characteristics. Complete survey methodology, response rates, and other procedural information are provided.

Principal conclusions of the report are focused on commutation habits and "combination riders" who used both CTA and C&NW service. The authors conclude that the "Northwest Passage" walkway has been effective in bringing new riders to both systems and in encouraging combination ridership.

> NTIS Order #: PB-210-240 PC \$6.00. MF 95¢

Title: "The O'Harexpress: An Employment Access Demonstration Project"

Author: Mayor's Committee for Economic and Cultural Development

Date: August, 1972

Project No. IL-06-0011

Keywords:	1.	Employment	4.	Ridership, attraction
	2.	Airport, access	5.	Bus, commuter
	3.	Inner City	6.	Bus, express

Abstract: The O'Harexpress bus project was designed to provide employment access for residents of Chicago's inner city neighborhoods to O'Hare International Airport. The service operates non-stop between the Jefferson Park rapid transit station and the airport terminal and cargo areas.

Planning and implementation of the project are described in detail; the report also contains complete ridership and survey data. Preliminary studies revealed that airport employees and many potential job-holders lacked adequate transportation from the inner city. Once in operation, the service attracted a growing ridership; daily patronage at its conclusion was approximately 1,200.

Economic conditions and hiring trends at the airport inhibited the overall ridership growth. However, the report concludes that numerous low-income workers were able to secure previously inaccessible employment. In addition, the service provided low-cost airport transportation for numerous air travelers. Since December, 1970, the service has been maintained as a permanent operation of the Chicago Transit Authority.

> NTIS Order #: PB-212-677 PC \$3.00, MF 95¢

Title: "Transportation Information Center in the Southwest Employment Area of Washington, D.C. - Final Report"

Author: Design and Production Incorporated

Date: March, 1973

Project No. IT-06-0019

Keywords: 1. Information Aids 2. Community Response

3. Modal Split

4. Bus, commuter

Abstract: The purpose of the project was to develop and test a prototype portable Information Center to disseminate information regarding bus routes and schedules, and to facilitate the exchange of information which might lead to car pooling. The Information Center was refined as it was rotated among five buildings in the Southwest Washington Employment area. The basic components consisted of (1) a bus route locator which had a grid map enlargement showing bus routes and timetables, (2) an orientation module which had a large map and instructions for using both the bus and car pool locators, and (3) a car pool locator, which provided a grid map, and cards which would be filed by a prospective member of a car pool, and readily available for other prospective or existing car pools to refer to.

Placement of the Center and publicity were noted as important concerns, and the ease of maintainance and serviceing emphasized. The public reaction was favorable. A poll conducted before and after the Center was installed revealed that although people were drawn from bus travel, car pool contacts increased, providing a net decrease in the number of cars used for commuting to the area among the group polled.

The report notes special area features of Southwest Washington during the 1968 survey (Federal parking facilities, parking areas in lots scheduled to be developed, street construction) and provides photographs of the Center, charts on Center specifications and user polls.

> NTIS Order #: PB 220-319 PC \$3.00, MF \$1.45

Title: "Evaluation of City Transit Bus EIP Kits to Reduce Engine Smoke, Odor, Noxious Emissions and Noise"

Author: G. F. Swetnam, et. al. (The Mitre Corporation)

Date: August, 1971

Project No. IT-06-0022

Keywords: 1. Air Pollution 2. Noise and Noise Control 3. Propulsion Systems, diesel

Abstract: This report summarizes the findings of the Urban Mass Transportation Administration project for evaluation of General Motors' Environmental Improvement Program (EIP) retrofit kit. Designed for installation on General Motors city transit buses powered by two-cycle diesel engines, the kit is intended to reduce noise and engine emissions. The report provides a description of the EIP kit, a summary of its performance and range of applicability to different bus models, and estimates of costs.

The report describes installation of the EIP kit, and the effectiveness of both individual kit components and the entire system. It was found that the reduction of smoke, odor and noxious emissions resulting from fitting the EIP kit depends upon the year of manufacture and engine configuration of the bus; older buses benefit the most. Buses with EIP kits properly installed and maintained seldom produce visible smoke. When installed in older buses, the kit causes reductions in some noxious emissions, and with the kit odor production is as low as the newest model of GMC coaches. The kit results in slight noise reduction in the passenger compartment, but exterior noise increase under some conditions. The transit properties operating buses with the EIP kit under this program report that the kit can be installed, operated, and maintained within normal bus shop and maintenance facilities.

The report includes charts on the EIP kit as well as narrative material.

NTIS Order #: PB 204-813 PC \$3.00, MF 95¢ Title: "Transit Bus Noise Control Feasibility Study"

Author: Washington Metropolitan Area Transit Commission

Date: December, 1972

Project No. IT-06-0022

Keywords: 1. Noise and Noise Control 2. Propulsion systems, diesel

Abstract: This report deals with a noise control feasibility study administered by the Washington Metropolitan Area Transit Commission, using a diesel bus furnished by the D.C. Transit System. The study grew from an earlier project which evaluated the General Motors' Environmental Improvement Program (EIP) designed to reduce smoke, odor, noxious emissions and noise in diesel powered mass transit buses. The EIP kits reduced objectionable exhaust emissions, but did not significantly reduce noise levels.

The major objective of the noise control program was to explore areas of potential noise reduction and to determine the feasibility of the application of specific techniques which could be developed into retrofit kit for installation on existing vehicles. The four areas investigated under the project were: (1) direct mechanical noise radiation from the power plant, (2) noise associated with the engine cooling system, (3) engine exhaust system noise, and (4) engine induction air system noise.

The report describes equipment and strategies related to the four noise areas and the test plan. The results of the tests showed that most of the noise control treatments contributed measurably to the overall sound level reduction. Based on data obtained during acceleration tests from a standing start, the noise control treatments and techniques designed for use in this program are comparable to a reduction in loudness of approximately 50 per cent.

The report concludes with suggestions for further investigations, improvements and development of the more promising noise reduction treatments into a retrofit kit. An appendix of technical support activities is included in the report.

NTIS Order No. PB-220-809 PC \$4.85 MF .95¢

Title:	"The Shirley Highway Expre Project - Project Descript	ess-Bus-On-Freeway Demonstrat: tion"	ion
Author:	Gerald Miller (National B	ureau of Standards, Technical	Analysis Div.
Date:	August, 1971	Project No. IT-06-0024	
Keywords	: 1. Lane, reserved 2. Bus, priorities 3. Bus, express	4. Bus, commuter 5. Highway, planning 6. Routes and Routing	7. Parking, park and ride

Abstract: The Shirley Highway Express-Bus-On-Freeway Demonstration Project is described in this Phase I interim report. The principle object of the project is to test the hypothesis that the provision of rapid and improved bus service over an exclusive busway between residential areas and concentrated employment locations will attract significant numbers of passengers commuting by car. The report outlines the history of the project, and describes the Shirley Highway and major District of Columbia employment areas.

Three major elements of the project are examined in detail: (1) the busway, including the exclusive lane of Shirley Highway and the bus priority lanes in the District; the locations and operation of busway entrances and exits and auto peak period traffic operations described for comparison, (2) the bus transit operation involving new buses on new routes and schedules; existing peak period bus service is described as well as the first increment of new service including the utilization of the busway in the Pentagon area, (3) the residential fringe parking, with shopping centers and new lots providing free parking for bus users.

Existing roadway and bus operations are described and presented graphically, and procedures for data collection are documented. Improvements for 1971-1972 are presented.

NTIS Order No. #: PB 218-983 PC \$3.00, MF 95¢ Title: "The Shirley Highway Express Bus-On-Freeway Demonstration Project/ First Year Results"

Author: National Bureau of Standards, Technical Analysis Division

Date: November, 1972

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Project No. IT-06-0024
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Keywords:	1.	Bus, commuter	7.	Traffic, peak-hour
	2.	Bus, express	8.	Traffic, congestion
	3.	Bus, priorities	9.	Ridership, profiles
	4.	Lane, reserved	10.	Ridership, attraction
	5.	Modal Split	11.	Air Pollution
	6.	Surveys	12.	Parking, park-and-ride

Abstract: First year results of the Shirley Highway Express Bus-On-Freeway Demonstration Project are reviewed. Key elements of this project include exclusive bus lanes, new feature buses, and park-ride lots coordinated with the express bus service. A background description of the project and the evaluation program are outlined in detail.

Emphasis is given to the attainment of nine basic objectives. These include: (1) increasing the auto-to-bus modal shift, (2) promoting economic viability, (3) reducing traffic congestion during peak-periods, (4) increasing people-moving efficiency of the Shirley Highway, (5) reducing vehicle-related air pollution, (6) reducing travel times for motorists and transit users, (7) improving reliability of transit service, (8) increasing the perceived value of transit, and (9) improving the mobility of young, old, physically handicapped, and low-income travelers. The report notes that significant progress toward these goals occurred during the first year of operations.

The authors note that a primary measure of project effectiveness is the "bus market share" of peak-hour trips -- ie. the corridor-wide percentage of person-trips which are potentially bus trips and which are made by bus. It is therefore significant to note that the bus market share increased from approximately 27% in 1968 to 39% in 1972. Over 5,000 additional daily patrons have been attracted to the express bus service since its inception, accounting for some 3,000 fewer automobiles traveling inbound each day via eight major arteries in the Shirley Highway corridor. The report also documents reduced air pollution, improved travel times, project costs, and patron attitudes.

Profiles of corridor bus and auto commuters were developed from survey data. The report describes characteristics of both groups surveyed in October, 1971, and comparisons between them. A profile of park-and-ride commuters is also provided. The impact of innovative bus features is briefly summarized. Attitude surveys revealed that attempts to make the standard buses more luxurious were not particularly important in attracting new riders. Such factors as seat assurance, air conditioning, and reliable schedules were mentioned by only about half of all riders as features affecting modal choice. The durability of bus carpeting and special seat covers is discussed.

> NTIS Order #: PB-214-333 PC \$3.00 MF .95¢

Title: "Urban Rapid Rail Vehicle and Systems Program"

Author: The Boeing Company, Vertol Division, Surface Transportation Systems Department

Date:	July,	1972		Project No. IT-06-0026
Keywords	: 1. 2. 3. 4.	Rail, automatic control Rail, cost Rail, rolling stock Rail, systems planning and design	5. 6. 7. 9.	Testing Facilities Bay Area Rapid Transit Vehicle, design Research Operations Maintenance

Abstract: The Urban Rapid Rail Vehicle and Systems Program is directed to enhance the attractiveness of rail rapid transportation to the urban traveler by providing him with transit vehicles that are as comfortable, reliable, safe, and economical as possible. This report reviews the progress achieved towards completion of eight basic tasks under the overall program during its first year.

These tasks include: (1) program management, (2) review of the Bay Area Rapid Transit [BART] system, (3) development of the State-of-the-Art car [SOAC], (4) research and development of the Advanced Concept Train [ACT-1], (5) research and development of ACT subsystems [ACT-2], (6) advanced planning for an operational demonstration of the ACT system [ACT-3], (7) an economic analysis of urban rapid rail transportation, and (8) human factors engineering.

Aspects of the program management task include integration, management, and control of all program elements. Testing of the BART prototype was reviewed to recommend methods for improving the development of the SOAC and ACT vehicles. Use of a performance specification for vehicle procurement, car component testing, demonstration of the prototype, maintenance operations, interaction between the BART contractor and the vehicle manufacturer, maintainability, safety, reliability, and acoustic testing are examined.

The SOAC is designed to demonstrate current state-of-the-art in rapid rail vehicle technology. The report outlines results of the source selection and design phases. A summary of SOAC features is provided with reference to interior and exterior design; provisions for elderly and handicapped passengers; propulsion, braking, and control; and other vehicle systems. Production, fabrication, and quality control subtasks are also discussed.

Progress towards the other program objectives is noted briefly. Four subcontractors are performing parallel ACT design and specification development efforts. The development of SOAC cost estimates has been undertaken in the economic analysis phase. Two-thirds of the Human Factors subtasks have been completed and separate memoranda have been issued on the results.

> NTIS Order #: PB-212-848 PC \$4.50, MF 95¢

Title:	"Guideline Specification for Urban Rail	Cars"
Author:	W.H. Dunton and P.R. Norton (The Boeing	; Vertol Company)
Date:	March, 1973 Project No:	IT-06-0027
Keywords:	1. Rail, rolling stock	4. Propulsion Systems
	2. Rail, systems planning and design	5. Safety
	3. Rail, materials	

Abstract: This report is the guideline specification to be used as the standard form for the preparation of detailed procurement specifications for the design, construction and test of self-propelled urban rail cars. The guidelines are for both commuter and rapid transit rail cars. The purpose of the specifications is to establish uniform practices for the preparation of procurement specifications for these types of vehicles to aid in the use of comparative analysis of the specification content. The report covers general system requirements and subsystems of the vehicle including program management, demonstration, product support and data requirements.

The report defines criteria for general system requirements, system performance characteristics, system strength requirements, system material descriptions, system environmental requirements, vibration criteria, and noise control. The report also includes discussion of elements within the system such as car body, coupler and draft gear, doors, heating, cooling and ventilation, lighting, power and traction, trucks and suspension system, friction braking system, communication system and automatic train control system.

Specifications are applicable to this type of equipment as a class and not unique to one design.

NTIS Order No. PB-220-678 PC \$6.00 MF .95¢ Title: "Over-the-Water Program Design -- Volume I: Summary"

Author: Roman Krzyczkowski, et. al. (Interplan Corporation)

Date: December, 1971

Project No. IT-06-0029

Keywords: l. Hydrofoils 2. Ferries 3. Air Cushion Vehicle

Abstract: The potential for Over-the-Water (OTW) applications of urban mass transportation was investigated. This volume contains a summary of the study results with attention given to both technological and demandrelated analyses.

With regard to technology, the authors conclude that while a "bus-onwater" concept shows promise, no such vehicle has been sufficiently demonstrated. The report provides an overview of OTW technology (including hydrofoil and surface effect vehicle craft); summarizes current testing, research, development, and evaluation; examines the manufacturing industry; and reviews operating experience with OTW applications in several countries. In order to achieve operating velocities above 20 knots, the authors conclude that surface effect or hydrofoil technology must be employed. Surface effect vehicles operate on the principle of hydrostatic pressure by inducing a low-pressure cushion of air beneath the craft. Hydrofoils operate on the principal of hydrodynamic lift.

With reference to demand, the authors conclude that some 80 cities indicate a potential for OTW as an urban transit mode and that a market of nearly 500,000 daily trips in the 30 most promising cities is estimated. Particular attention is given to 12 cities judged to be promising candidates for an early demonstration of OTW service. These include: San Francisco, Miami, Seattle, New Orleans, Tampa, Portland, Philadelphia, Pittsburgh, New York, Honolulu, Washington, and the Chesapeake Bay Area. The report examines the nature of demand, the location and magnitude of demand, and implications of the demand estimate.

Alternative programs for further development and demonstration are discussed. The report contains an annotated bibliography of relevant source material.

> NTIS Order #: PB-216-066 PC \$3.00, MF 95¢

Title:	"Over- ating	The-Water Program Desi Experience"	gn Vol	ume II: Technology and Oper-
Author:	Roman	Krzyczkowski, <u>et</u> . <u>al</u> .	(Interpl	an Corporation)
Date:	Decem	ber, 1971		Project No. IT-06-0029
Keywords	: 1. 2. 3. 4.	Hydrofoils Air Cushion Vehicle Ferries Vehicle, design	5. 6. 7.	Aircraft, STOL Aircraft, VTOL Financing Mass Transporta- tion, requirements

Abstract: The potential for over-the-water (OTW) applications of urban mass transportation has been investigated. This report reviews OTW technology and operating experience. A survey was conducted to determine state-of-the-art in OTW technology with reference to vehicle operational characteristics, the flight of high-speed ships, and other vehicle types such as V/STOL aircraft and alternative hull designs.

The achievements of hydrofoils and surface effect vehicles (SEV's) are discussed along with an overview of existing models grouped by manufacturers in the United States, Great Britain, France, Switzerland, and the Soviet Union. Current research and development programs in the field are discussed, and some future designs are reviewed. Appended material includes data sheets for existing SEV and hydrofoil designs and a brief discussion of noise considerations.

Operating hydrofoil, SEV, helicopter and STOL, and commercial ferry systems are described. Elements of these operational systems are noted with reference to craft design, operational characteristics, reliability, safety, and passenger acceptance. Economic aspects of OTW operations are also addressed. These vehicle systems have received only limited application in urban transit service, and thus lack sufficient operational experience to permit in-depth evaluation. Operating systems in the United States are reviewed with reference to present status and the extent of legal, financial, and political difficulties.

> NTIS Order #: PB-216-067 PC \$3.00, MF 95¢

Title:	"Over Nati	-the-Water P: onal Demand"	rogram Desig	gn Volume	e III:	Estimation	of Potential
Author:	Roma	n Krzyczkowsł	ki, <u>et</u> . <u>al</u> .	(Interplan	Corpo	ration)	
Date:	Dece	mber, 1971			- 1	Project No.	IT-06-0029
Keywords	5: l. 2. 3.	Hydrofoils Ferries Ridership,	attraction	4. 5. 6.	Fare Bene: Marke	, cost dete fit-Cost An et Research	rmination alysis

Abstract: The report estimates potential national demand for over-the-water (OTW) applications of urban mass transportation. The nature of such demand was addressed in a trade-off analysis to determine salient factors in commuter transportation choices. Attention is given to the trade-off between cost and convenience and to the effect of transfer availability. The authors also examine supplementary, non-commuter markets which include offpeak travelers, airport access, out-of-city tourists, and city people moving to the countryside. Operating costs of OTW systems may preclude the use of OTW transit modes for door-to-door service, but a system employing transfers could prove highly convenient to commuters and efficient in decongesting city traffic with daily fares below \$5.00.

A survey of demand characteristics in several cities is presented. These include Portland, Miami, New York, St. Petersburg-Tampa, Philadelphia, Pittsburgh, and Honolulu. Emphasis is focused on three potential candidate cities selected for OTW demonstration projects -- San Francisco, Seattle, and New Orleans. Nationwide demand implications are also summarized. The authors conclude that by 1980, total demand for urban OTW systems in some 30 selected metropolitan areas would be approximately 500,000 daily trips. Implications of the demand estimate are examined with reference to required craft and facilities, cost, employment generation, and economic feasibility. Capital costs distributed nationally are estimated to be approximately \$600 million, spread over five years; annual operating costs would be approximately \$400 million. Insufficient operating experience precludes a more detailed evaluation of economic feasibility. If the projected demand levels are realized, OTW transit service could divert between one and ten percent of all daily commuter trips from automobiles to the waterborne mode.

The report also develops evaluation criteria for the proposed OTW demonstrations. Checklists of principal considerations relating to planning, demand, system design, and operation are presented. Particular attention is focused on the advantages and disadvantages of conducting further efforts in the field at this time.

> NTIS Order #: PB-216-068 PC \$3.00, MF 95c

Title: "Urban Goods Movement Program Design"

Author: N. Simons, Jr., et. al. (Battelle Columbus Laboratories)

Date: June, 1972

Project No. IT-06-0029

Keywords: 1. Freight Movement 2. Trucks and Truck Lines 3. Traffic, congestion 4. Traffic, control

Air Pollution
 Government, urban
 Intermodal Competition
 Rights-of-Way
 Center City

Abstract: A series of program plans and projects directed towards resolving several problems which affect the transportation of commodities within urban areas were assessed. Each set is related to one of five general problems and is defined in terms of its effects on the shipper, carriers, consignees, and general public.

The five categories of problems include: (1) excessive costs, (2) traffic congestion, (3) pollution, (4) land use development, and (5) institutional arrangements. They are measured respectively in terms of cost reductions, increases in profits, relief of congestion, reduction of pollution, and effective integration in the process of urban development.

Nine innovative urban goods movement projects were assessed in this study, including: (1) urban freight consolidation, (2) use of standardized shipping units, (3) spatial separation of goods and people movement, (4) temporal separation of goods and people movement, (5) required off-street loading and unloading facilities, (7) use of urban fringe terminal systems, (7) combined freight/passenger movement, (8) automated systems for urban goods movement, and (9) automated terminal operations.

The authors conclude that the existing system of urban goods movement is inefficient, thereby increasing costs and generating negative externalities on the urban system; that system improvements first benefit the automobile traveler through reduced traffic congestion; and that previous studies have focused principally on truck movements rather than goods movements.

Each of the proposed alternative goods movement projects is reviewed with reference to problem impact, range of application, principal beneficiaries, impediments to implementation, and need for action in the public sector. On the basis of these analyses, the authors recommend further research, development, and demonstration of three proposals: freight consolidation, traffic restrictions, and joint use of exclusive rights-of-way by buses and goods movement vehicles. Freight consolidation would emphasize more efficient goods movement by integrating the commodities otherwise hauled by separate vehicle systems. An analytical investigation of traffic restrictions would identify the effects of alternative traffic controls on improved goods movement efficiency. The final recommendation would examine the potential advantages of joint use of exclusive urban rights-of-way by mass transit and goods movement systems.

> NTIS Order #: PB-216-899 PC \$6.00, MF 95¢

Title: "Functional Specifications for New Systems of Urban Mass Transportation"

Author: R.D. Leis, E.S. Cheaney, and N. Simons, Jr. (Battelle, Columbus Laboratories)

Date: November, 1972

Project No. IT-06-0029

Keywords:1.Vehicle, design4.Rights-of-Way2.Safety5.Personal Rapid Transit3.Quality Control6.Distribution Systems

Abstract: The objective of this project was to establish functional specifications as the basis upon which detailed technical engineering specifications for generic types of new systems of urban transportation may be developed. Desired attributes of an urban transportation system were identified from the viewpoints of: (1) riders (ie. travel time, travel cost, comfort, convenience and safety); (2) system operators (ie. revenue-producing potential, cost structure, reliability, maintainability, versatility and adaptability); and (3) the general public (ie. environmental effect, esthetics, safety, partitioning effects, displacement effects, and land-use impact).

System performance specifications were developed to display the identified attributes at three levels of specificity. (1) General functional specifications are described with reference to safety and emergency control, esthetics, vehicle design, stations and service variables, cost, and right-of-way externalities. (2) Generic demand-related functional specifications are outlined with reference to high-density circulation, collection, and distribution; low-density circulation, collection, and distribution; and line-haul service. (3) Finally, specifications for generic technology-oriented elements are developed with reference to safety, service-level, and other factors.

Problem areas requiring additional research include comfort criteria, safety doctrine, service-level requirements, and a user-preference model. A biblio-graphy of related documentation is appended.

The report may be considered either as an overview of the subject or as a handbook of the nature and current practice regarding design variables, acceptable ranges of variation and trade-off considerations.

NTIS Order #: PB-217-613 PC \$5.45, MF 95¢ Title: "Project FARE Task II Report, Urban Mass Transportation Industry Reporting Capability -- Part I: Survey Findings"

Author: David L. Harvey, John W. Nagel, and William T. Van Lieshout (Arthur Andersen & Company)

Date: November, 1972

Proj. No. IT-06-0034

Keywords:	1. 2.	Accounts and Accounting Budgets and Budget Planning	4.	Management, planning and analysis
	3.	Management, operations and techniques	5. 6.	Financing Mass Transportation Surveys

Abstract: A questionnaire survey of 191 transit systems and related field studies are analyzed to define uniform Financial Accounting and Reporting Elements (FARE) for the urban transit industry. Existing financial reporting systems were studied to identify problems of comparability; the authors cite a need for standardized transit information data and accounting methods.

Methodology for the questionnaire survey and field interviews is outlined in detail. A sample questionnaire is provided in a separate document generated under this project.

Questionnaire results are analyzed with reference to general characteristics of the transit industry; accounting system characteristics; revenue, cost, and asset accounting procedures; and non-financial operating data. The authors conclude that accounting and data collection practices vary widely throughout the transit industry and that reporting categories are inconsistently defined. Results of the field studies include an overview of transit industry operations and a summary of information requirements.

A subsequent task of this project will develop a recommended financial, accounting, and reporting system. Some preliminary suggestions for this task, based upon experience gained in the survey of transit operators, are provided.

> NTIS Order #: PB-213-474 PC \$3.00, MF 95¢

Title:	"Proj Repo	ect FARE Task II Report, Urban rting Capability Part II: S	Mass Tra ample Que	ansportation Industry estionnaire"
Author:	Davi (Art	d L. Harvey, John W. Nagel, an hur Andersen & Company)	d William	m T. Van Lieshout
Date:	Nove	mber, 1972	[Proj. No. IT-06-0034
Keywords	5: 1.	Surveys	4.	Budgets and Budget
	2.	Management, operations and		Planning
		techniques	5.	Management, planning
	3.	Financing Mass Transportatio	n	and analysis
			б.	Accounts and Accounting

Abstract: A questionnaire survey of 191 transit systems and related field studies were conducted to define uniform Financial Accounting and Reporting Elements (FARE) for the urban transit industry. Existing financial reporting systems were studied to identify problems of comparability; the authors cite a need for standardized transit information data and accounting methods.

This report contains sample copies of the comprehensive questionnaire forms used to survey transit operators and commuter rail systems. Data were collected in nine specific areas, including: (1) overall operating data, (2) bus operations, (3) rapid rail operations, (4) streetcar operations, (5) trackless trolley operations, (6) financial policies, (7) accounting system characteristics, (8) transit system organization and regulatory requirements, and (9) expected changes.

Results and analysis of the survey are provided in a separate document generated under this project.

> NTIS Order #: PB-213-475 PC \$3.00, MF 95¢

Title: "Survey of Public Reaction to TRANSPO Personal Rapid Transit Systems and UMTA-Sponsored Bus and Rail Exhibits"

Author: Century Research Corporation

Date: November, 1972

Project No. IT-06-0037

Keywords:1.Personal Rapid Transit5.Community Response2.Bus, design6.Surveys3.Rail, rolling stock7.Qualitative Analysis4.Vehicle, design8.Public Relations

Abstract: Surveys of visitors to the United States International Transportation Exposition (TRANSPO-72) were conducted to determine the public reaction to four personal rapid transit (PRT) systems, an experimental urban transit bus, and a rail car from the new San Francisco Bay Area Rapid Transit system.

The purpose of these surveys was to determine what people did or did not like about the vehicles, their acceptance of the guideways in various locations, and their estimates of the types of trips for which they would use the vehicles. Methods and questionnaires used in the surveys are described along with special problems encountered and general results and conclusions. Personal interviews were conducted with PRT riders as they exited from the stations; visitors to the bus and rail car exhibits were also surveyed. A structured questionnaire was used for all interviews, and one of every five respondants from the PRT systems also participated in a longer interview using methods of indirect attitude assessment.

Overall, reactions to the demonstrations and displays were extremely favorable. Most respondants found the PRT systems to be comfortable, convenient, and quiet, and they believed that such vehicles could be used for a wide variety of trip purposes. The PRT was generally viewed as an attractive alternative to travel by automobile in congested city streets. Visitors to the bus and rail car exhibits were particularly impressed with the overall appearance and comfort of the vehicles.

> NTIS Order #: PB-214-819 PC \$6.00, MF 95¢

11tle:	Resul	ts"	10111 001	LING SYSTEM -	volume 1:	Study
Author:	Teled	yne Systems Company				
Date:	July,	1972			Project No.	IT-06-0041
Keywords	: 1. 2. 3. 4.	Vehicle, monitoring Communication Topography Line Supervision	5. 6. 7. 8.	Management, niques Computer, ap Sensors Quantitative	operations oplications e Analysis	and tech-

Abstract: Reserach has been conducted to develop and test alternative real-time Automatic Vehicle Monitoring (AVM) systems. This report describes the Teledyne Systems Company AVM design which locates vehicles by LORAN C method. The report describes baseline system configuration; system design; baseline system costs; effects of variations in areal coverage, fleet size, sampling rate, silent alarm, and accuracy; demonstration equipment; and experimental results. This AVM application was developed to facilitate the location of fleet vehicles in an urban situation, such as transit buses.

LORAN C systems employ LORAN (Long-Range Radio Navigation) transmissions available from a relatively small number of transmitter reference sites. Any given vehicle derives data representative of its position with respect to three of the reference transmitters (a master and two or more slave stations) and relays this information to a central data processing center where the vehicle location is computed.

Results of a groundwave attenuation experiment are discussed in detail. Using the existing LORAN C master transmitter in Cape Fear, N.C., and reference transmitters in Nantucket, Dana, Ind., and Jupiter, Fla., the authors attempted to calculate the distances to which this method could perform accurately. Separate tests were undertaken in rural, suburban, urban residential, urban industrial, and urban high-rise areas, each of which offers varying interference characteristics. The data revealed nearly complete LORAN C coverage in high-rise areas up to 450 miles from the respective transmitters; in industrial and suburban areas accuracy was recorded up to 550 and 800 miles, respectively.

A detailed urban environment experiment was also conducted to demonstrate the LORAN C method in downtown Philadelphia. Data are provided for vehicles monitored under various conditions. The report concludes that LORAN C is an appealing technique for use in AVM systems because of its long-range capability, relatively high precision, and freedom from RF spectrum allocation problems. However, to achieve the required precision it is necessary to employ a differential LORAN mode in which local propagation anomalies are mapped and temporal variations are monitored for use in compensating the basic measurements. Other specific recommendations are summarized.

> NTIS Order #: PB-216-332 PC \$9.00, MF 95¢

Title: "New Systems Requirements Analysis Program, Project Implementation Plan -- Work Item 5: Special Studies"

Author: PRC Systems Sciences Company

Date: July 6, 1972

Project No. IT-06-0044

Keywords: 1. Research Operations 2. Management, operations and techniques

Abstract: This report presents a general project implementation plan for special studies undertaken in support of the Urban Mass Transportation Administration (UMTA) Transportation Planning System (UTPS). The special analyses for which implementation guidelines are developed would not have been provided for in the original research program planned for reasons of time constraints, subject matter, or other factors.

General project implementation guidelines are presented with regard to establishing a special study, project milestones, management plan, project interrelationships, project flow, and documentation standards and reporting requirements. The material presented in this report describes the implementation and management procedures for special studies as directed by the UMTA program manager, and does not relate to any specific studies underway. Appendices contain project directives, nomenclature, and approved work statements for pending special studies.

> NTIS Order #: PB-214-288 PC \$3.00, MF 95¢

Title: "New Systems Requirements Analysis Program --Technical Development Plan"

Author: PRC Systems Sciences Company

Date: July, 1972

Project No. IT-06-0044

Keywords: 1. Urban Development, planning
2. Management, planning and analysis

Abstract: This report contains the Technical Development Plan (TDP) for the work to be performed in the refinement, development, and delivery of software and documentation for the Urban Mass Transportation Administration's Transportation Planning System. This TDP is a portion of the New Systems Requirements Analysis Program. The Program is guided by four objectives: (1) to extend present planning tools into a computer-based methodology applicable to multimodal transportation systems, (2) to make this methodology readily available to State and local transportation planning agencies, (3) to fully test the methodology during its development and to demonstrate it in the operational environment of selected pilot cities, and (4) to fully document the methodology, provide ongoing support of its use, and provide for its continued development. The responsibilities outlined in this report are the technical development portions of the program. The report describes five work items specified in the present contract for the TDP: (1) prime contractor management, (2) development of sketch planning technique, (3) extension of existing capability, (4) microsimulation capability, and (5) special studies. Each work item is discussed in terms of its background, the general approach to performing the required work, a schedule of work, a detailed description of what work is to be accomplished, the cost of the work, the organization of the personnel who will perform the work and the requirements for facilities, data and interfaces, to accomplish the work. Software documentation and test and evaluation standards as well as acceptance criteria are presented.

> NTIS Order #: PB 218-862 PC \$5.45, MF 95¢

Title: "Automatic Vehicle Monitoring System"

Author: F.R. Brown, R.N. Jekel, D.A. William (Cubic Corporation)

Date: October 1972

Project No.: IT-06-0046

Keywords:

Vehicle, monitoring
 Algorithms
 Communications

4. Computer, applications

Abstract: This report describes the testing of existing equipment configured to solve the problem of automatic vehicle location and monitoring in the Philadelphia, Pennsulvania environment. The method is that of multilateration from fixed sites using CW/FM phase comparison techniques configured in a oneway range difference type solution. Further developed and implemented, the multilateration vehicle location technique will furnish usable accuracies in most urban and suburban areas.

The report details the system of automatic vehicle monitoring, describing the technique including communications, computer functions, systems configuration and baseline system variations. The report describes the testing in Philadelphia and notes the following conclusions: (1) the basic vehicle location technique forms a viable solution to the fundamental vehicle location tasks of automatic vehicle monitoring, (2) multilateration techniques are easily integrated with command/control communications to afford a complete solution to the automatic vehicle control problem, (3) the communications technique is straightforward (little technical risk) and makes use of existing transceivers, and from an overall standpoint it can be considered extremely cost effective. This is so inasmuch as both 'outbound' and 'inbound' communications are shared, i.e., the outbound polling and data communications from the base station share existing voice channels without interference by use of digital voice overlay techniques. Inbound data from the vehicle is shared via frequency multiplex techniques on common AVM carriers, and (4) the theoretical signal-to-noise margins set forth in the test plan were substantiated in the real world urban environment.

Budgetary costs and schedules associated with development implementation, installed and operating the baseline system are also included in the report.

NTIS Order No. PB-221-046 PC \$6.00 MF .95¢ Title: "Automatic Vehicle Monitoring System"

Author: Sierra Research Corporation

Date: February, 1973

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Project No. IT-06-0047
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Keywords:	1.	Communication	6.	Management, operations and
	2.	Vehicle, monitoring		techniques
	3.	Crime and Crime Prevention	7.	Schedules and Scheduling
	4.	Line Supervision	8.	Computer, applications
	5.	Quantitative Analysis	9.	Codes and Coding
			10.	Sensors

Abstract: Research has been conducted to develop and test alternative realtime Automatic Vehicle Monitoring (AVM) systems. This report describes the Sierra Research Corporation AVM design which locates vehicles by phase multilateration. The authors note that AVM systems can provide bus transit operations with true command and control capability for the first time, and can thus help to improve schedule adherence, reduce waiting times due to headway devlation, improve operating efficiency, and enhance the attractiveness of public transportation. AVM equipment can also provide for a covert alarm signal transmission from the vehicle to report robberies and other emergency situations.

A baseline system configuration for the automatic monitoring of 1,000 vehicles is described in detail. Other sections of the report discuss equipment used, system operations, a cost analysis, baseline system variations, and urban experiment results.

The system employs a vehicle-mounted two-way radio to transmit a tone (in an assigned time slot) which is received by multiple sensors located around and within the urban area, and then sent to a base station via dedicated telephone lines. At the base station, the data are fed into a computer where time difference-of-arrival computations are performed and the vehicle position is displayed. The use of time-multiplex controls for data transmission reduce interference with other vehicles and minimizes radio spectrum requirements. The entire AVM function (including the digital data message transmission) is provided by a single modular unit in the vehicle. Voice radio transmissions are limited by the use of more than 1,000 precoded digital messages. AVM applications for various fleet vehicle operations (such as police and emergency vehicles) are noted.

The results of field testing in the Philadelphia area are presented. Over a period of approximately 34 test hours, vehicles with AVM equipment operated over three routes, logging some 180 miles. All aspects of the demonstration are presented with reference to test area, data extraction, algorithms, vehicle positioning tests, and recent and future tests. Technical data and supplemental analyses are provided in twelve appendices.

> NTIS Order No. PB-216-165 PC \$9.00, MF 95¢
Title: "New Systems Requirements Analysis Program -Project Implementation Plan -- UTPS Pilot Applications"

Author: TRW, Inc.

Date: November, 1972

Project No. IT-06-0049

Keywords: 1. Urban development, planning

2. Management, planning and analysis

3. Computer, applications

Abstract: This report outlines the Project Implementation Plan for pilot applications of the transportation planning techniques being developed in the Urban Mass Transportation Administration's New Systems Requirements Analysis Program. The plan delineates the detailed steps that will be followed in performing the pilot applications in selected cities of the UMTA Transportation Planning System (UTPS). Each UTPS component to be developed over the next three years will be completely demonstrated and evaluated through the pilot applications phase of the program. The results of pilot applications will provide information for UTPS modifications and enhancements as well as the basis for a case study document manual illustrating applications to transit planners and other potential users.

In general, the pilot application of each version of UTPS will include three major pieces of analysis effort: (1) operational demonstration -- the system will be implemented in a regional transportation planning environment in Washington, D.C. and Albuquerque, New Mexico, (2) data processing validation -- the system will be reviewed to determine that the programs do work as documented; analysis of programming efficiencies, restrictions on program use, and operating procedures will be identified and documented, and (3) functional evaluation -- an assessment of the user documentation, output specifications, input requirements, and relevance of the software capabilities both to users and potential users of the system.

This document details how these analysis will be conducted and outlines the outputs which may be expected. In addition, the time schedule, organization, and management control procedures to be utilized in all pilot applications are presented.

> NTIS Order #: PB 218-863 PC \$4.50, MF 95¢

Title: "New Systems Requirements Analysis Program - Project Implementation Plan, Work Item 2: Transportation System Evaluation Indicators"

Author: Peat, Marwick, Mitchell and Company

Date: September 1972

Project_No.: IT-06-0050

Keywords: 1. Urban Development, planning 2. Management, planning and analysis

Abstract: This report presents the Project Implementation Plan (PIP) to develop and test a set of transportation system evaluation indicators for use in the multimodal transportation planning process. Specifically, these indicators are defined as evaluation measures designed to aid in the estimation of probable levels of success of planned/proposed transportation systems and services in achieving local objectives.

The work program fashioned to lead up to the development of a recommended set of indicators consists of a series of tasks and subtasks, including the following: (1) the development and refinement of this work program and the preparation of the PIP, (2) the formation of a review committee representing the public transportation planning community and the utilization of this committee to periodically critique the results and direction of the study, (3) the testing of the indicator set with typical planning scenarios for one and maybe two cities, and (4) the compilation of the results of the investigations in a final report. The report notes that particular attention will be on the generation of a set of indicators which will provide for effective and convenient extrapolation of the experience from one area to another and which will apply to a broad range of conditions and projects. The final set of recommended indicators will be accompanied by suggested formats, reporting procedures and potential data sources.

This report presents a detailed outline of individual work tasks, including a program for interaction with the professional planning community to ensure adequate consideration of user requirements. Various types and measures of transit systems are also discussed. In addition to the description of the proposed technical work steps, this document contains time schedules, organizational arrangements, and management control procedures for the project.

NTIS Order No.: PB-218-868 PC \$4.50, MF 95¢

Title:	"New Systems Requirements Analy Work Item 3: Development of Sk	rsis Program, Project Implementation Plan - actch Planning Techniques"
Author:	Peat, Marwick, Mitchell and Com	ipany
Date:	July 1972	Project No.: IT-06-0050
Keywords:	 Urban Development, planning Computer, applications 	J

Abstract: This report outlines the project implementation plan for the development of new and interactive transportation techniques and methodologies as part of the Urban Mass Transportation Administration's New Systems Requirement Analysis Program. These proposed Sketch Planning techniques are intended to supplement the current urban transit planning process and thereby to extend the capabilities of the UMTA Transportation Planning System. The current urban transportation planning process is expensive and extremely time comsuming to apply. The goals of the Interactive Sketch Planning work item are a rapid and accurate planning technique, and a drastically reduced cost for the analysis of new technology systems. Potential ways of developing a rapid, economical, accurate and interactive planning process for Sketch Planning purposes through utilization of time-share computers, cathode ray tube hardware, improved data reduction, network abstraction, and new evaluation procedures are indentified.

A detailed outline of individual tasks is provided including a program for interaction with the professional planning community to ensure adequate consideration of user requirements during the development phase. Descriptions of the conceptual design, programming, testing and documentation of the proposed methodologies are provided. This document also contains organizational and management control procedures for this project.

> NTIS Order No.: PB-218-865 PC \$5.45, MF 95¢

Title: "New Systems Requirements Analysis Program, Station Simulation Symposium -- Work Item 4: Station Simulation Capability "

Author: Peat, Marwick, Mitchell & Co.

Date: November 1972

Project No. IT-06-0050

Keywords: 1. Urban Development, planning4. Signs and Signals2. Rail, stations and terminals5. Rail, systems and design planning3. Bus, stations and terminals5. Rail, systems and design planning

Abstract: This document contains the proceedings of the Station Simulation Symposium held on November 9 and 10, 1972. The purpose of the symposium was to gather the views and requirements of the professional planning community regarding uses and applications of the proposed Station Simulation Model. This simulation model was developed to represent the linkage among modules of a characteristic transit station and to trace the movement of persons through the station. Part I of the proceedings summarizes the purpose of the symposium, the major issues discussed, and the conclusions and recommendations of the participants. Part II includes a sample letter of invitation, resumes of planning professionals attending, and the detailed notes of the symposium proceedings, arranged by discussion topic.

Conclusions on the various aspects of the station simulation study are discussed individually, with the professional's name and his recommendations.

This report is one of many included in an extensive analysis of New Systems Requirements Analysis.

NTIS Order No. PB-218-864 PC \$4.85 MF .95¢

- Title: "New Systems Requirements Analysis Program -- General Functional Specifications for a Transit Station Simulation Model"
- Author: Barton-Aschman Associates, Inc. and Peat, Marwick, Mitchell and Company

Date:	Novemb	ber 3, 1972		Project No. IT-06-0050
Keywords	: 1.	Rail, stations and terminals	4.	Computer, applications
	2.	Bus, stations and shelters	5.	Computer, programming
	3.	Interfaces	6.	Pedestrians

Abstract: This report outlines general functional specifications for a transit station simulation model. The overall simulation concept is introduced and discussed along with a general description of the operating environment of transit stations. The basic station configuration is represented by a linkage among modules for queuing, movement generally, and "event generation."

The simulation technique focuses on the movement of persons through the station and is predicated upon the time at which certain events take place. The report also discusses input requirements for the simulation package, necessary acceptance tests, and data requirements.

Appended material includes the findings of a literature search including the characteristics of components used in transit station design, human factors engineering in transit station design, and a preliminary outline of a User's Manual for the simulation model package.

> NTIS Order #: PB-214-337 PC \$5.45, MF 95¢

Title: "New Systems Requirements Analysis Program, Indicators and Interactive Sketch Planning Symposium--Work Item 2: Transportation System Evaluation Indicators and Work Item 3: Interactive Sketch Planning Techniques."

Author: Peat, Marwick, Mitchell and Company

Date: December, 1972 Project No. IT-06-0050

Keywords: 1. Urban Development, planning 2. Computer, applications

Abstract: This report presents the proceedings of the Indicators and Interactive Sketch Planning Symposium held on December 18, 1972 in Washington, D.C. The purpose of the symposium was to gather the views and requirements of the professional public transportation planning community regarding the development and uses of indicators and interactive sketch planning techniques. The proceedings report consists of two parts. Part I summarizes the purpose of the symposium, the major issues discussed, and the specific comments, conclusions and recommendations of the participants. Part II includes a sample letter of invitation, resumes of the planning professionals who attended the symposium, and detailed notes of the proceedings.

A detailed questionnaire was developed and distributed to members of the planning committee. The report summarizes views regarding planning requirements expressed by committee members. Some of the requirements include: (1) Interactive Graphics - a feasible approach which would be applicable on a regional, corridor and small-area focus, (2) Data Sources - census data should be sufficient for regional and corridor level analysis, however supplemental data on non-work travel would be needed, (3) Network Representation - detailed conventional networks should be established for base reference, however simpler network representation would be required for evaluating entire transportation systems, (4) Land - Use Forecasts, (5) Demand Models - demand models should be behavioral, and a stochastic formulation, and transferable model calibrated using local data would be preferred, (6) Assignment Techniques - multiroute assignment is essential, and (7) Evaluation Methodology - more interactive graphics evaluation outputs are required for service, financial, and developmental impacts.

> NTIS Order #: PB 218-867 PC \$4.85, MF 95¢

Title: "New Systems Requirements Analysis Program - Transportation System Evaluation Indicators -- Final Report "

Author: Peat, Marwick, Mitchell & Co.

Date: May 1973

Project No. IT-06-0050

Keywords: 1. Urban development, planning 2. Computer applications

Abstract: This report is based on a study which develops a set of transportation system evaluation indicators for use in the multi-modal transportation planning process. Because the planning process reflects a great variety of objectives, and because many of these objectives are often in conflict, there must be an evaluation component for the trading off of these objectives and attainments, one against the other. This report does not deal with the actual process of the mechanics of evaluation, but rather with the identification of criteria put into the planning process, with the various objectives pertinent to the development and to the operation of transportation systems, and with the available methods for assessing the achievement of these objectives.

Section I contains introductory material. Section II presents the more detailed bases for the development of such a set of indicators. Lists of objectives and suggested accompanying measures or indicators are presented and discussed in Sections III through VI, where the transportation system is viewed from the composite perspective of the total community, from the individual perspectives of both the user and the non-user of transportation systems, and from the perspectives of the operators of these services. Fianlly, general conclusions and recommendations are presented in Section VII.

The indicators developed in the main body of the report are intended to aid, in a general way, the complex process of transportation system evaluation. A set of simplified indicators in synthesized in Appendix A in order to aid in the sketch planning process in particular and to possibly provide some discipline for organizing and computing or estimating indicators in certain other planning situations. Some illustrative applications for the Washington, D.C. metropolitan area are presented in Appendix B. Many of the indicator computations in this report imply the use of computerized procedures and some requisite software capabilities are summarized in Appendix C. Appendix D is a bibliography and Appendix E summarizes, as an illustration of some Federally generated indicators stated in general or unexplicated form, UMTA's Capital Grant Guideline and associated criteria for the funding of local transit improvements.

> NTIS Order No. PB-221-572 PC \$6.00 MF .95¢

Title: " Cincinnati: East Side Demonstration Corridor Program - Final Report "

Author: Vogt,Sage and Pflum Consultants and Barton-Aschman Associates,Inc. for Ohio-Kentucky-Indiana Regional Planning Authority

 Date:
 September 1971
 Project No. IT-06-0062

 Keywords:
 1. Ridership, attraction
 5. Kiss-and-Ride

 2. Corridors
 6. Bus, stations and shelters

 3. Bus, priorities
 7. Center City

 4. Parking, park-and-ride
 7. Center City

Abstract: This report summarizes the Cincinnati East Side Corridor Demonstration Program which was designed to test the use of bus terminals in conjunction with express service linking suburban areas to the Cincinnati central business district. The goal of the overall Urban Corridor Demonstration Program is to design, test and evaluate practical solutions to transportation problems. These solutions should be comparatively low-cost, readily implementable, and use joint finding techniques of the Urban Mass Transportation Administration and the Federal Highway Administration.

Suburban bus terminals are one element in the recommended system. A total of six outlying terminals would be located at strategic points in the Corridor. Each terminal would provide for auto-to-bus transfer in the form of all-day parking facilities and auto passenger drop-off areas. Bus service wouldbe increased during peak hours and would become express after the last inbound stop is made at the suburban terminal. Intersection improvements would be made to facilitate the flow of vehicles along major arterials and to give preferential treatment,whenever possible, to express buses. A vigorous promotional and marketing program is recommended to attract new riders to the improved system and to create a favorable attitude towards transit.

The Cincinnati East Side Corridor Program is intended to serve as a laboratory for testing the economic feasibility and effectiveness of selected projects with potential application in other suburban areas. Major emphasis has been placed on an evaluation program so that the urban areas may derive the maximum benefit from experience gained in this program. Title: "I-35 W Urban Corridor Demonstration Project:Bus-Metered Freeway System - Final Report"

Author: Bather-Ringrose-Wolsfeld, Inc.; Simpson & Curtin, Inc.; Intech, Inc.; Carmichael-Lynch, Inc.; Minnesota Highway Department (for Metropolitan Council, Minnesota Department of Transportation Planning)

Date: September 1971

Project No IT-06-0062

Keywords:I.Traffic Analysis, congestion3. Bus, express2.Traffic Analysis, peak-hours4. Bus, priorities

Abstract: This report summarizes completed work and presents the recommended implementation plan for a bus-metered freeway system on the I-35 W corridor of Minneapolis under the Urban Corridor Demonstration Program.

The overall goal of the Urban Corridor Demonstration Program is to test and demonstrate the use of existing tools and technology using joint funding by the Urban Mass Transportation Administration and the Federal Highway Administration in order to remedy the problem of traffic congestion during peak hours in corridors leading to and from central business districts. In May, 1970, eleven metropolitan areas were selected by the Department of Transportation for demonstration projects under this program. The I-35 W corridor, south of the City of Minneapolis CBD, was one of the corridors chosen.

The bus-metered freeway system, detailed in this report, provides priority access to the freeway via exclusive bus ramps. Automobiles are metered into the system to use available capacity below that volume which jeopardizes the desired level of service. The recommendation of this report is to proceed with the development of the bus-metered freeway system in the I-35 W corridor. Analysis of the Concept, the engineering detail, the operations, and the cost indicates the feasibility of combining a freeway surveillance and control system and a freeway express bus system. The major benefits of such a system include increased accessibility to the Minneapolis CBD, reduced parking requirements in the CBD, improved mobility for corridor residents, and increased knowledge of the factors which influence modal choice.

This report includes an inventory of the transportation condition of the I-35 W corridor, the recommended surveillance and control system to be used, two transit service plans, a marketing program, and a financial and implementation summary.

Title: A Study of Operator and Mechanic Training Needs in the Transit Industry -- Volume I: Findings and Conclusions "

Muthor: Harold L. Henderson, et. al. (INTEXT, Transportation Research Division)

Date: December 1971

Project No. MA-06-0011

Keywords: 1. Management,training techniques 4. Maintenance, personnel
2. Manpower and Personnel 5. Surveys
3. Bus, driver

Abstract: This study represents surveys of 188 transit properties which were conducted in order to determine the training needs of operators and mechanics in the urban mass transportation industry. The findings and conclusions of che study are presented with references to survey methodology, site visit interviews and observations, questionnaire results, and specific recommendations for training development

Analyses of present and future manpower requirements and technology advances underscored the need for an industry-wide training development model. The on-site surveys include relevant non-transit training programs.

The authors conclude that insufficient budgeting and unsophisticated training techniques are major factors in the current shortage of skilled operators and mechanics. The report contains a detailed summary of survey findings and specific suggestions for improved training. A transit development model is presented along with future manpower and technology trends in the industry. Organization and operation of a training academy is also discussed.

The appendices to this study are located in Volume II (PB-221-360).

 NTIS Order No.
 PB-221-359

 PC \$9.00
 MF .95¢

Set of Vol. I and Vol. II PB-221-358 PC \$13.00

112

Author: INTEXT, Transportation Research Division

Date: December 1971

Project No. MA-06-0011

Keywords:	1.	Management, training techniques	4.	Maintenance,	personnel
	2.	Manpower and Personnel	5.	Surveys	
	3.	Bus, driver			

Abstract: This study represents surveys of 188 transit properties and onsite visits which were conducted in order to determine the training needs of operators and mechanics in the urban mass transportation industry.

Volume II contains several appendices to the final report, which emphasizes the need for improved transit training development. The study is comprised of visits to seventeen transit properties and six non-transit sites, a pilot survey of twenty motor bus and rapid transit properties, and a national survey which includes all 188 transit systems.

The appendices include listings of respondants and sample copies of the survey questionnaires and visit reports. The report also contains a summary of existing transit training manuals, supplementary training materials, and other relevant information, and examples of "showcase" training approaches, techniques and programs.

NTIS Order No. PB-221-360 PC \$5.45 MF .95¢

Set of Vol. I and Vol. II PB-221-358 PC \$13.00

Title:	" Standard Light Rail Vehicle Specification - Contract Section " (Revised to include Addenda 1-4)				
Author:	Massa Munic	chusetts Bay Transporta ipal Railway Improvemen	ation Author at Corporati	rity and San Francisco Ion	
Date;	Octob	er, 1972	Proj	iect No. MA-06-0015	
Keywords	: 1.	Rail, systems planning and design	g 2. 3.	Rail, rolling stock Construction, contracts	

Abstract: This specification describes a standard United States Light Rail Vehicle (technically defined as electric multiple-unit articulated subwaysurface light rail cars). These vehicles commonly operate as urban trolleys on street tracks with an overhead electrified power source. Performance parameters and design characteristics contained in this specification were developed in cooperation with mass transit operators, consulting engineers, and the Urban Mass Transportation Administration.

This report details contractural information for potential manufacturers of the light rail vehicles. The contract specifications were developed by the Light Rail Vehicle Committee (BSFC) which was comprised of operating properties in Boston and San Francisco.

Specific contract documents indexed in this report include general information for bidders and the Invitation to Bid, BSF Committee Agreement, Proposal to manufacture light rail vehicles for BSFC, contracts, performance bond, and power of attorney.

This report supercedes the old Contract Section report without the Addenda (PB-212-687).

 NTIS Order No.
 PB-220-747

 PC \$3.00
 MF .95¢

Title:	" Standard Light Rail Vehicle Specification - Technical Section " (Revised to include Addenda 1-4)						
Author:	Massachusetts Bay Transportation Authority and San Francisco Municipal Railway Improvement Corporation						
Date:	Octobe	er, 1972	Pro	ject No. MA-06-0015			
Keywords	: 1. 2. 3. 4. 5. 6.	Rail, rolling stock Rail, systems planning and design Couplings Air Conditioning Lights and Lighting Propulsion Systems, electric	7. 8. 9. 10. 11. 12.	Suspensions Brakes and Braking, friction Communications Quality Control Construction, contracts Vehicle, design			

Abstract: This specification describes a standard United States Light Rail Vehicle (technically defined as electric multiple-unit articulated subwaysurface light rail cars). These vehicles commonly operate as urban trolleys on street tracks with an overhead electrified power source. Performance parameters and design characteristics contained in this specification were developed in cooperation with mass transit operators, consulting engineers, and the Urban Mass Transportation Administration.

This report details design and engineering specifications for all components of the light rail vehicle. Topical headings in the report include: general requirements, systems requirements (ie. general design criteria and performance specifications), car body, couplers and draft gear, operator's cab, door control, air comfort system, lighting, auxiliary electrical hardware, propulsion system, truck assemblies, friction brake system, vehicle communications, emergency systems, support system, management systems and quality assurance, materials and workmanship, owner-furnished equipment, diagnostic test equipment, and design illustrations.

This report supercedes the old Technical Contract report with does not include the Addenda (PB-212-278).

NTIS Order No. PB-220-748 PC \$3.00 MF .95¢ Title: " Standard Light Rail Vehicle Specification - Final Project Report "

Author: Massachusetts Bay Transportation Authority

Date: February, 1973

Project No. MA-06-0015

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Abstract: This final report results from the need to develop a successor to the PCC light rail car design of the 1930's while decreasing the unit cost of new light rail cars. The report supplements two preceding reports generated by the project - a technical report (PB-220-748) and a contract report (PB-220-747) by providing a record of the circumstances, rationale, and procedures used in those reports and by reviewing and documenting the project itself.

The report gives a brief introduction to electric railway systems and a background on the need to develop new rail car designs which led to the Standard Light Rail Vehicle Specification Project. The objective of the project was to design a standard light rail vehicle which could be used by many different cities, based on the belief that a standard design would increase the market for such a vehicle and lower its production cost. The report reviews project organization, selection of the vehicle size, potential purchasers, and preparation of the technical specifications and contract documents.

The report concludes with a discussion of the ways in which the project objective was met. These include: (1) Additional suppliers were encouraged to submit bids to prime manufacturers, (2) Cities with an immediate need for replacement of obsolete vehicles mutually agreed to combine their requirements in order to obtain a lower unit price, and (3) Manufacturers were asked to review the specification and suggest ways to reduce the cost of the car.

> NTIS Order No. PB-220-773 PC \$3.75 MF .95¢

Title: "Measurement of the Effects of Transportation Changes"

Author: Charles River Associates, Inc.

Date: September, 1972

Project No. MA-06-0017

Keywords:	1. 2.	Surveys Quantitative Analysis	6.	Management, planning and analysis
	3. 4.	Research Operations Urban Development, planning	7.	Access, planning and con- trol
	5.	Land Use	8.	Ridership, volume

Abstract: The problem of measuring urban transportation impacts is examined. The authors review existing impact studies and delineate several shortcomings of the before-and-after research design. Studies of highway effects are particularly criticized for failing to develop and test explicit hypotheses and for their implicit assumption that impacts are confined to the immediate area and measurable only as increased land values. Transit impact studies, which the authors distinguish from demonstration project evaluations, have been more successful in using a variety of analytical techniques and in focusing attention on system-wide effects and user demand.

A conceptual framework for analyzing transportation impacts is introduced. This proposed methodology emphasizes both short and long-range effects of transportation change. Impact is measured by immediate changes in travel behavior and performance of the system; long-run effects are measured in terms of the demand and supply of urban land having different accessibility characteristics and the effect on access of the transportation change.

Alternative research designs and strategies are evaluated within this conceptual framework. The authors note particularly the need to analyze transportation impacts in a non-experimental context, since differences among urban systems often preclude replication of demonstration results. Several internal and external "threats to validity" are described and used to compare alternative research designs. The report also suggests several research designs which are superior in performance to conventional before-and-after methods.

Data requirements for the proposed impact research design are discussed, and the report identifies several variables for analyzing both short and long-run transportation effects. Data collection methods are examined with reference to a wide variety of survey types. Considerations in designing a continuing transportation survey are reviewed. A final section of the report outlines an overview of the recommended research strategy for measuring the effects of transportation changes.

Appended material includes reviews of highway impact studies, transit studies, and demonstration projects; models of short-run urban transportation demands; land use location theory; a review of existing data sources; and the statement of work for this project.

> NTIS Order #: PB-213-491 PC \$10.60, MF 95¢

Title: "Light Rail Transit Systems -- A Definition and Evaluation"

Author: Vukan R. Vuchic (for Transportation Systems Center)

Date: October, 1972

Project No. MA-06-0025

Keywords:	1.	Rail, cost	5.	Intermodal Competition
	2.	Rail, rolling stock	6.	Bus, cost
	3.	Rail, commuter	7.	Ridership, volume
	4.	Rail, systems planning and	8.	Headways
		design		

Abstract: The purpose of this report was to define and evaluate light rail (ie. streetcar-like) systems. Existing light rail applications in the United States and Europe are examined, and the author concludes that European experience has demonstrated the potential utility of this mode for urban transportation. An analysis of modern transit requirements based on areal coverage, competitive level of service, and acceptable cost parameters indicated a "gap" in intermediate services between bus and full-scale rail rapid transit modes. In this context, light rail could transport between 2,000 and 15,000 passengers per hour in one direction at a higher level of service (ie. shorter headways) than buses and at much lower cost than conventional rail transportation. Unawareness about modern developments and operational characteristics is cited as a major barrier to more effective applications of light rail systems in this country.

The report provides a detailed light rail system description with reference to physical components, operating characteristics, and costs. Vehicle specifications, rights-of-way and alignment, stations, and other design features are reviewed. Performance characteristics are examined with reference to area coverage, speed, capacity and headways, reliability, comfort, safety, environmental effects, and passenger attraction. Investment and operating costs are detailed along with potential methods of transit financing. In a recent comparison between light rail and bus modes, the former was judged to have lower total costs.

The results of present light rail applications are described with reference to city sizes and densities, types of service, relationship with other modes, passenger characteristics and trends, and planning for future light rail systems. A detailed comparison between light rail and bus, rapid transit, and proposed new systems of urban transportation is also provided.

An evaluation of light rail and its potential for North American cities outlines several advantages and disadvantages. Advantages include a higher service level than buses, a lower investment cost than rapid transit, a shorter construction period, popularity with passengers, and flexible service. Disadvantages include unsuitability for low volume lines, more irregular service than rapid transit, fixed routes, public belief that rail modes are obsolete, and a general "stigma" about light rail as a "lower" type of rail system. The author, however, concludes that a strong potential for light rail applications exists in many American cities of medium to large size.

The report recommends increased future attention to light rail systems, and that a demonstration of the concept be undertaken.

NTIS Order #: PB-213-447 PC \$3.00, MF 95¢ Title: "Fifteen-Oh-One to Sixteen-Thirty: Technical and Managerial Lessons from One Experience in Introducing New Technology to Improve Urban Mass Transportation"

Author: Charlton R. Price and D. Sam Scheele (Social Engineering Technology)

Date: November, 1972

Project No. MA-06-0025

Keywords:	1. 2. 3.	Rail, commuter Rail, rolling stock Rail, systems planning	5.	Management, operations and tech- niques Management, planning and analy-
	4.	Vehicle, design	7.	sis Construction, contracts

Abstract: The authors' experience in introducing new urban transportation technology to an existing system is reviewed as a case study in management and organizational practice. The case involved the acquisition of 130 new, double-deck, self-propelled, electrically-operated commuter rail cars (numbered 1501 to 1630) as part of a five-year effort to improve service on the suburban lines of the Illinois Central Railroad operating in the South Chicago area.

Five stages of the project are examined in detail, including: (1) creation of an organizational framework, (2) development and design of the vehicles, (3) bidding and contracting, (4) production of improved transit technology, and (5) delivery and operation. Because the new rolling stock involved unique applications of innovative technology, the experience may be instructive for similar projects in the future.

The report emphasizes three types of changes in the on-going procurement system which characterized the refinement of management objectives and procedures as the project continued. These included innovations or improvements that can be simply substituted and do not otherwise modify the larger system, new approaches for reaching performance objectives that rearrange the way in which various sub-tasks are accomplished, and redefinitions of the problem or reconceptualization of the objectives for the system that can result in more appropriate solutions. These types of changes are shown to result in a dynamic management system for introducing new transportation technologies.

The authors conclude that in their experience, each of the major participants approached the project with different points of view, emphases, and perspectives that required resolution as the procurement moved from design through construction phases. These principal actors included the railroad management, the Transit District trustees, and the vehicle manufacturer.

> NTIS Order: PB-213-448 PC \$3.00, MF 95¢

Title:	"Status Report Urban-Rail Supporting-Technology Program: Fiscal Year 1972 Year End Summary"					
Author:	R. J. Madigan (Transportation Systems Center, U.S. DOT)					
Date:	April 1973	Project No. : MASS-06-0025				
Keywords:	 Research Operations Rail, rolling Stock Vehicle, design Instrumentation 	5. Tunnels and Tunneling 6. Noise and Noise Control 7. Wheels				

Abstract: This report outlines activities managed by the Transportation Systems Center for the Urban Mass Transportation Administration, Office of Research, Development and Demonstrations' Rail Programs Division, in support of advancing urban rail technology. The emphasis has been in the area of rapid transit, however the long-range applications of the Program will benefit both commuter rail and light rail.

The test and evaluation has been directed toward long and short range goals. Efforts to meet the immediate testing requirements of the program have been underway since the first test series in April 1971. During FY1972, four series of tests were conducted on the 2.41 mile UMTA High-Speed Ground Test Center Track at Pueblo, Colorado. A long-range effort was concentrated on development of plans, efficient operating procedures, and a measurement, data acquisition and processing capability. A general vehicle test plan was prepared and measurement requirements were defined. Instrumentation and data acquisition systems are being procured to meet these requirements.

The major instrumentation and equipment development activities, in order of emphasis, were in the areas of general vehicle performance, track geometry, track wayside, and State-of-the-Art-Car support. This effort was directed toward the establishment of a basic measurement capability, in support of the evolving program plan for the test and evaluation of rapid rail cars, car subsystems, and track structures. The report describes these instrumentation and equipment development activities, as well as facilities development (the rapid rail test track, power system, service and maintenance facilities, rail dynamics laboratory and supporting services), and the technology program.

Under the category technology development, several projects are described including a tunneling plan, noise abatement project, wheel/rail dynamics research facility and descriptions of various contractor reports.

NTIS Order No. PB-220-846 PC \$3.00 MF .95¢ Title: "Columbia Demonstration Program -- Phase I Report"

Author: Columbia Park and Recreation Association

 Date:
 September, 1969
 Project No. MD-06-0005

 Keywords:
 1. New Towns
 6. Bus, intracity

 2. Surveys
 7. Bus, minibus

 3. Market Research
 8. Fare, cost determination

 4. Quantitative Analysis
 9. Management, operations & techniques

 5. Trip Generation
 10. Routes and Routing

Abstract: This report summarizes activities under Phase I of a program to develop and demonstrate an optimal public transportation system in the new town of Columbia, Maryland.

The demonstration program emphasized eight postulates formulated on the basis of survey data collected during Phase I. Attention is given to the verification of these postulates which include: (1) financial precommitment, (2) the socio-psychological profile of Columbia residents, (3) management techniques, (4) active user/system interface, (5) special events, (6) regular service trips, (7) service for the transit deprived, and (8) convenience trips.

The general approach to this project consisted of four principal activities, including research of the existing data base, a market opinion survey, mathematical analyses, and operational demonstration experiments. Each of these activities was aimed at verifying the basic postulates described above.

The demonstration experiment design focuses on five major elements of the proposed transit system: (1) equipment and vehicles, (2) fare structure, (3) service level, (4) operational techniques, and (5) routing modes. Activities undertaken during Phase I included research of previous demonstration projects, an opinion survey of Columbia residents to determine general attitudes about public transit, development of a mathematical Transfer Logic Model and pricing methodology, and operation of a fixed route/fixed schedule minibus service. The report describes each element of the Phase I program in detail along with ridership and operational data.

Plans for a continuing demonstration program are outlined. Attention will be given to three alternative service modes (regular, Shopper's Special, and special events). Projected costs for future stages of the demonstration are reviewed.

Appended material includes working papers from the demonstration program which describe special events, routine trips, special service, and data collection; survey activities; and the data reduction program.

NTIS Order #: PB-198-612 PC \$3.00, MF 95¢ Title: "Augmented Block Guidance for Short-Headway Transportation Systems" Author: G.L. Pitts (Johns Hopkins University, Applied Physics Laboratory) Date: September, 1972 Project No. MD-06-0008

Keywords:	1.	Personal Rapid Transit	5.	Headways
_	2.	Guides and Guidance	6.	Computer, applications
	3.	Rail, automat c control	7.	Quantitative Analysis
	4.	Safety	8.	Electronic Vehicle Guidance
			9.	Speed and Speed Control

Abstract: This report describes an automated block guidance vehicle control concept that meets the requirements for automatic fail-safe operation of short-headway transportation systems. The automated block guidance (ABG) concept represents a specific vehicle-follower approach to headway regulation and control for personal rapid transit and other short-headway systems.

Operation of the ABG concept is described in detail. This system employs inductive antenna in equal-length blocks which transmit the block aspects continuously; vehicles detect the transmitted aspect with a separate onboard antenna and receiver. Consequently, the transmitted aspect signal is used to communicate the number of blocks separating a vehicle from the one ahead. The ABG concept introduced in this report utilizes separate controllers to perform two basic subfunctions of longitudinal control: safety and spacing control.

The ABG is described with reference to collision-avoidance control, vehicle overspeed protection, and spacing control. Emphasis is given to the development of the ABG concept into design constraints. Results of a detailed computer simulation to evaluate the performance of ABG controls are presented. Simulation data are provided with reference to speed transition, lock-in, stalled vehicles, drop-out and diversion, and merging. Derivation of the Collision Avoidance Constraint equations is appended.

> NTIS Order #: PB-214-391 PC \$6.00, MF 95¢

Title: " Analyses of Some Dual-Mode Personal Rapid Transit System Operations "

Author: M.C.Waddell and W.J. Roesler (Johns Hopkins University, Applied Physics Laboratory)

Date: September 1972

Project No. MD-06-0008

Keywords:

Personal Rapid Transit
 Dual-Mode Systems
 Guideways

4. Rail, Automatic Control

5. Benefit,Cost Analysis

 Rail, Systems Planning and Design

Abstract: This report examines operational and cost considerations associated with dual-mode personal rapid transit systems (DM/PRT). The term DM/PRT as used in this report denotes an urban transit system which employs small cars capable of travel over existing streets under manual control or over guideways under automatic control, which would permit travel between origin and destination to be free of enroute stops. Occupancy of a car would therefore be limited to a person or group with a common origin and destination.

In order that a large number of trip origins and destinations are readily available, hundreds of miles of one-way guideways are needed. The initial cost ranges from 2 to 6 million dollars per mile, 80% of which is for guideway. Thus, the overall cost for a single urban area would be at least 1 to 3 billion dollars.

The report points out that a possible way to cut costs would be to install a dense guideway grid only in those sections of the city where heavy traffic is experienced. Elsewhere in the city the dual-mode vehicle would be driven manually. However, the cost for additional cars, parking and storage might still equal or even exceed the cost for an all-guideway system. It was therefore determined that operation of the DM/PRT would be very costly and that it would be impossible to eliminate the risk of potential collisions between vehicles, warranting additonal study for an alternative means of increasing capacity.

The study also points out that vehicles must be thoroughly reinspected each time they enter a guideway unless pallets are used for guideway travel, in which case the PRT vehicle would be single-mode and thus manually controlled since the guideway engineering would be totally incorporated within the pallets.

Another problem discussed is that of parking. If the guideways are installed principally in high-traffic areas in order to cut down on costs, the resulting costs of parking cars in these areas would be prohibitive, whether the cars were parked in the high-traffic areas or whether they were parked elsewhere and retrieved upon request.

Some of the analyses contained in this report include inspection requirements of the cars, parking problems, cost of the systems, and investigations on how best to operate the trains. Many graphs and charts are included to illustrate the findings.

> NTIS Order No. PB-220-157 PC \$3.00 MF .95¢

Abstract: Automatic speed and headway regulation of closely spaced vehicles by use of a linear single-car follower control law is examined. Performance criteria are identified and formulated as algebraic relations for controller gains applied to both the vehicle's tachometer feedback and to inputs representing the relative velocity and the spacing variation between vehicles. Determination of the gains using these relations insures both individual vehicle and vehicle-string stability and provides a technique for selecting a headway maintenance program by choosing a parameter defined as the ratio of the stopping distance of a vehicle under control of the regulation system to the emergency stopping distance.

It is shown that numerical values of gains that meet the design criteria are dependent on knowledge of the vehicle loading and the velocity of headwinds encountered during operation, and that variations in these parameters typical of real systems can result in satisfactory performance.

Theoretical formulation of the controller model is described in detail. Regulation system design, approximate formulations of ride quality, and the effects of wind and vehicle mass variations on system performance are discussed. To illustrate and verify the theoretical formulations, a computer simulation was employed. The report provides complete results of the simulation exercise which proved to replicate those produced by the theoretical formulations.

> NTIS Order #: PB-212-502 PC \$3.00, MF 95¢

- Title: "Operating Strategies for Demand-Actuated ACGV Systems -- Volume II: Evaluation and Comparison"
- Author: W.J. Roesler, et. al. (Johns Hopkins University, Applied Physics Laboratory)

Date: March, 1972

Project No. MD-06-0012

Keywords:	1. 2. 3. 4.	Personal Rapid Transit Rail, automatic control Rail, stations and terminals Rail, systems planning and design	5. 6. 7. 8.	Schedules and Scheduling Routes and Routing Computer, applications Guides and Guidance
		design		

Abstract: Previous research conducted under UMTA Project TRD-73 described evaluation procedures for three classes of operating strategies for demandactuated Automatically Controlled Guided Vehicle (ACGV) transit systems. This report presents the results of these evaluations.

Attention is focused upon three major tasks associated with vehicle management in urban ACGV transit systems: (1) selection of a vehicle to respond to a request for service at a station, (2) disposition of an empty vehicle after it has discharged its passengers at a station, and (3) selection of a route for a vehicle to follow once its destination has been determined.

The three classes of operating strategies are compared with reference to general characteristics, response to changes in demand, and merging congestion. Common simulation data from the evaluation process are also presented.

Separate sections describe the evaluation of each class of strategies. Results of a single station simulation are also reported along with a brief discussion of station operations.

Two principal conclusions of this research are emphasized. First, a workable strategy for vehicle management in an ACGV transit system can be devised. Elements of such a strategy will depend essentially upon the specific network configuration and operational characteristics of the system. Second, no practical optimum exists among alternative strategies, given their inherent sensitivity to the spatial pattern of passenger demand. The most desirable strategy under these conditions will therefore function adequately over a wide variety of demand patterns. Other specific conclusions and data are also presented.

> NTIS Order #: PB-213-003 PC \$3 MF 95¢

Title: " Maxi-Cab Commuter Club - Final Report "

Author: American Academy of Transportation (for the Flint Transportation Authority)

Date:May 1972Project No. MI-06-0007Keywords:1. Bus,commuter
2. Management,operations and
techniques5. Fares,cost determination
6. Advertising and Promotion
7. Budgets and Budget Planning
8. Demand-Responsive3. Management,planning and
analysis
4. Routes and routing8. Demand-Responsive

Abstract: This report summarizes a three year demonstration project in Flint, Michigan. The goal of the project was to demonstrate the possibilities of a door-to-door bus service for a specific passenger group, as competition with the private automobile. Other study objectives were to demonstrate specialized marketing techniques for such a service, to determine the cost effectiveness of this special service integrated with existing general purpose bus service, and to determine the effective mix between general purpose or regular route operation and special purpose bus pool operation in medium-sized cities.

Although the study did not reach the stated objectives, a large amount of useful data was accumulated. Some of the problems involved in the project were reliability of service, a longer than anticipated pick-up and delivery time of passengers, the variance of work shifts and schedules at each place of employment, and an awkward organizational structure.

Positive results of the project included the demonstration of the potential of origin-destination plotting, the discovery that techniques learned in Flint can be used to determine the potential for vehicle pooling by single and multiple traffic generators, that data on fare structures could be useful to other communities, and the development of better methods for improving the image of mass transit through advertising and promotion techniques which were used in the Maxi-Cab program.

> NTIS Order No. PB-220-903 PC \$3.00 MF .95¢

Title: "Internal Administrative Procedures, Operational/Financial Data Analysis - Technical Report Number 5"

Author: American Academy of Transportation (for the Flint Transportation Authority)

Date: April, 1971

Project No. MI-06-0007

Keywords:	1.	Bus, Commuter	6.	Ridership, Attraction	
	2.	Management, Operations and	7.	Routes and Routing	
		Techniques	8.	Schedules and Scheduling	
	3.	Fares, Cost Determination	9.	Trip Generation	
	4.	Fares, Passes	10.	Community Response	
	5.	Advertising and Promotion			

Abstract: The report presents a brief history of the Flint, Michigan commuter, door-to-door bus pool demonstration project, in terms of the public takeover of the private system, and project planning and objectives. The report is in two sections: internal administrative procedures, and analysis of operational and financial data. The emphasis is on fine-grain data designed to provide significant insights into various elements of the service ranging from customers' application to the operational records of the project vehicles.

The internal administrative procedures are described in detail. This procedure covers billing, routing and scheduling credits, cancellations, the process of establishing new commuter runs, and the process of making administrative decisions. Unanticipated needs, such as frequent rescheduling due to the high rate of factory transfers among the commuters, are described in terms of the procedures designed to deal with these problems.

The report includes appendices of written material, maps, charts, forms and other data mentioned in the explanatory text.

NTIS Order #: PB- 220-902 PC \$7.50 MF .95¢ Title: "Flint Transportation Authority, Technical Report No. 6, A Study to Determine Attitudes Towards Maxi-Cab - Survey Results "

Author: Ross Roy Inc. Detroit, Michigan

Date: April 1971

Project No. MI-06-0007

Keywords: 1. Market Research 2. Community Response 3. Demand Responsive 4. Ridership Attraction

Abstract: This report covers the survey of an attitude study conducted by the Flint Transportation Authority to determine the reaction of the people of Flint, Michigan toward the Maxi-Cab Commuter Club project, which had then been in operation for two years. Three different groups were studied and their opinions were compared and contrasted. These were: those who were presently subscribing to the service ("The Users"), those who had used the service in the past and had canceled ("The Former Users"), and those who had never used the service ("The Non-User").

Users and Former Users were interviewed through the mail because it was felt that the least expensive means of interviewing would suffice since they had personal experience with the service. Non-Users were interviewed over the telephone because their total lack of experience with the service required a more personal approach. Their names were chosen at random from the Flint telephone directory.

Results of the study were generally positive.

NTIS Order No. PB-221-298 PC \$12.75 MF .95¢ Title: "Multi-Service Transportation Project"

Author: City of Kansas City, Missouri, Transportation Department

Date: 1972

Project No. M0-06-0003

Keywords:	1.	Inner City	4.	Ridership, profiles
	2.	Poverty	5.	Market Research
	3.	Employment	6.	Routes and Routing

Abstract: The multi-service transportation project was designed to improve the mobility of underprivileged inner city dwellers, some 20% of whom were estimated to lack access to existing fixed-route bus service in the Kansas City metropolitan area. Objectives of the demonstration were to identify the needs of groups which lack adequate transportation and to design, implement, and evaluate a corrective system. A detailed market planning study was conducted to determine the potential ridership groups with reference to area characteristics, demographic features, and trip-making.

Under Phase I of the project, specific bus routes were designed and operated for both general purpose and work trips. Under Phase II, a demand-responsive (subscription) bus service was operated to meet specific needs of inner city residents traveling to health, welfare, and other service centers.

Project management and financing are emphasized in the evaluation. The authors conclude that total project ridership represented approximately 53% of the potential market. Each of the service elements is described in detail with reference to route development, contract and equipment, fares and transfers, ridership, and other relevant considerations.

Although the special services proved unprofitable, the authors conclude that substantial benefits were accrued to the low-income community. Public support for similar ventures in the future is recommended.

> NTIS Order #: PB-212-257 PC \$3.00, MF 95¢

Title: "Haddonfield Dial-A-Ride: First Progress Report"

Author: State of New Jersey, Department of Transportation

Date: November, 1972

Project No. NJ-06-0002

Keywords:1. Demand - Responsive Systems,
Dial-A-Ride3. Community Response2. Bus, minibus4. Trip Generation5. Ridership, attraction

Abstract: The first progress report of the Haddonfield, New Jersey Dial-A-Ride Demonstration Project explains the demand-activated, door-to-door bus service; the locale where it operates; public response; and effectiveness of the system. The service area of the project is 6.4 square miles in Southwestern New Jersey with a population of 24,400. The communities Dial-A-Ride serves are varied in their ethnic concentrations and in socioeconomic levels. The system consists of twelve 17-passenger buses which are radio dispatched.

Three modes of service are offered by Dial-A-Ride: Gather (from many locations to one), Scatter (from one location to many) and Many to Many. These service modes can be, and are mixed. The report discusses the distribution of ridership, vehicle productivity (defined as the number of requests per vehicle per time period) and the quality of service (defined as time -- wait time, pick up time deviation and ride time). The report briefly notes Dial-A-Ride's excellent relations with labor unions and includes news articles, all favorable with the exception of one article concerning taxicabs and Dial-A-Ride's competition. Public comments are briefly noted. The report includes numerous charts on population characteristics, service, time, efficiency, fare structure, ridership and ridership distribution of the system, and other demand-activated systems in the United States.

It is emphasized that the project's purpose is to accumulate data; throughout, however, the success of the service is noted. Certain modifications and refinements of the system are projected. Dial-A-Ride will be expanding its service area, changing its fare structure, increasing the number of vehicles and coordinating them with varied demand periods, and will install a computer with manual backup to gain further information of demand-activated transportation. Further reports will be submitted on the progress of Dial-A-Ride.

> NTIS Order #: PB - 220-171 PC \$3.75, MF 95¢

Title: "A Conceptual Overview of Demand Responsive Transportation Systems"

Author: Douglas Medville (The Mitre Corporation)

Date: February, 1973

Project No.: NJ-06-0002

Leywords: 1. Demand Responsive Systems 2. Market Research 3. Computer, applications	 4. Ridership, profiles 5. Fare, determination 6. Management, operations and techniques
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Abstract: This report discusses various issues related to the implementation of demand responsive transit in light of data obtained from systems that have been or are in operation, in order to determine the role that such systems will have in the future. Demand responsive transportation is a family of transit service concepts in which the schedules and routing of vehicles may be adjusted to serve the specific needs of individual customers. Demand responsive systems can fulfill a variety of transportation needs - both as a supplement to and a substitute for existing transit modes. This report outlines four categories of demand responsive systems: (1) route deviation - the vehicle follows a fixed route, however upon request and perhaps payment of additional fare, the vehicle will deviate from the fixed route in order to pick up or drop off a passenger at a requested location, (2) combined demand activated and conventional - a partial route deviation service in which a vehicle can deviate to pick up and drop off passengers for a portion of its route, (3) pure demand responsive service, and (4) terminal to terminal demand responsive service.

The issues discussed in the report concerning implementation of a demand responsive system include system dynamics, such as service area size, vehicles, fare structure, wait and ride times, and hours of operation; potential market; vehicle productivity; economic viability, including discussion of public versus private ownership, the economic criteria for success, and operating costs and revenue; and the utility of computer control functioning in areas such as vehicle assignment and operations, and vehicle accountability. As examples for discussion, the report uses operational demand responsive systems in Canada and the United States.

> NTIS Order No. PB-220-863 PC \$3.00 MF .95¢

Title: "Report on Testing and Evaluation of the Transit Expressway"

Author: MPC Corporation

Date: February 20, 1967

Project No. PA-06-0009

Keywords:	1.	Rail, cost	5.	Tracks and Trackage
	2.	Rail, rolling stock	6.	Wheels
	3.	Pneumatics	7.	Surveys
	4.	Propulsion Systems, electric	8.	People Movers, Transit Expressway

Abstract: The report describes engineering, operating, and cost factors of a frequentservice rapid transit system specifically designed to provide mass transportation service in medium-density urban areas. Results of technical feasibility tests are reported along with results of a passenger survey. The Transit Expressway is a new concept in fully-automated rapid transit involving many innovations such as automatic train operation. The allelectric vehicle resembles a bus and runs on four pairs of driven pneumatic tires. Each roadway has tracks spaced 22" apart; a steel "I" beam called the "guide beam" is mounted between these and used to steer each axle. The system concept is based on the use of compact, minimum weight automated vehicles operating singly or in trains.

The roadway and structures installed in the South Park project were tested and evaluated to determine foundation settlement, structural sway caused by passing trains, and guide beam and girder deflection from applied live loads. Rain and snow storms were observed; roadway surface and structural joints were studied from the aspect of durability and noise. Structural design concepts and construction controls are also reviewed. Many engineering evaluations were undertaken in order to adapt the Transit Expressway vehicles to a commercial transportation system.

The 565 volt, three phase, alternating current power distribution system and its protective equipment was evaluated from the standpoint of its adequacy to serve the requirements of the South Park demonstration project. Collection of the alternating current power and on-board handling and rectification of the alternating current power was examined.

The following aspects of the Transit Expressway operation were evaluated: (1) radio interference, (2) audible wayside noise, (3) electrical energy consumption, (4) electrical shock hazard, (5) emergency procedures, and (6) system wear and replacement of parts.

Location of the Transit Expressway project in South Park provided exposure to the public view and also insured having ample riders for test purposes. The primary method of data collection was a printed questionnaire which was developed specifically for this study. The public indicated striking acceptance of the Transit Expressway system and its vehicles, except for the lack of front and rear windows. People were also pleased with the inside and outside appearance of the vehicle and generally were satisfied with the smoothness, quietness and comfort of the ride. The on-board observations of riders during the test period indicated most persons were not aware of the simulated automatic operations.

If the South Park project is used for continuing technical development work, it is recommended that the program not be slowed by further public acceptance testing, since these data were adequately collected in the initial demonstration period.

> NTIS Order #: PB-174-757 PC \$3.00, MF 95¢

Title: "Transit Passenger Shelters: Basic Design Principles"

Author: Dr. Frank Ehrenthal (Virginia Polytechnic Institute)

Date: January, 1973

Project No. VA-06-0003

Keywords: 1. Bus, Stations and Shelters 2. Weather Effects 3. Handicapped

Abstract: The report analyzes the problem of passenger shelter design with the object of maximizing user comfort, safety and convenience while considering the constraints of environmental fit (size of shelter, location and aesthetics) and cost (initial investment, operating maintenance and replacement).

This analysis is used to develop a list of design criteria for shelters and a prototype shelter. Elements of design which are recommended are: (1) Flexibility in size and arrangement of enclosure walls, (2) Maximum possible transparency of enclosure on all sides (3) Modular measurements -- 50 square feet, 6 feet minimum depth and 7 feet width, (4) Heat reflecting opaque roof, (5) Enclosure walls at least 9 inches above street, (6) At least two access openings at opposite ends of the space -- openings at least 32 inches wide, (7) lighting at reading level in the shelter, (8) Radiant floor heating for snow removal and ambient warmth, (9) Unit support system as free as possible of ancillary furnishings, (10) Structure designed for local weather conditions, (11) Shelter space free of convenience facilities, i.e. phones, etc., (12) Avoidance of exposed sharp corners and use of durable finishes, (13) Concealment of non-permanent assembly jointing, (14) Functional appearance, and (15) Cost range of \$20 to \$30 per unit square foot, F.O.B. site, and a minimum useful life of 15 years.

The report also contains information on other problems confronting the shelter designer and an appendix on cities surveyed for transit shelter information in the United States in 1970.

NTIS Order #: PB 220-303 PC \$5.45, MF \$1.45 Title: "Application of Computers to Transit Information Services - Volume I "

Author: Catherine S. Owen, John L. Vialet, Peter Wood (The Mitre Corporation)

Date: December 1972

Project No. VA-06-0004

Keywords:1.Information aids 2.Communications 3.Computer applications

Abstract: This study investigates the possibility of using computers in transit telephone information services. Telephone information systems are a common public service provided by transit companies in order to disseminate information on transit routes and schedules, to interpret or verify information in printed schedules and to disseminate information about temporary service disruptions and special transit services to sporting events.

The contractor has investigated possible applications for computers in the area of transit telephone information services. During the initial stages of the study, a representative group of transit properties was visited to determine the operating characteristics of their present telephone information services. As a result of these visits, it was possible to identify those aspects of transit telephone information services that would benefit most from the introduction of computer and data processing techniques. It has been shown that computers can be usefully employed in the telephone information service of larger transit properties, and their introduction is likely to lead to improved service for the public. The major area for cost saving is in training time, although it is unlikely that the savings in training cost alone would justify the introduction of a computer. Cost savings would also be possible if several independent information centers were consolidated into a single system. The overall potential for cost reductions through the use of computers is, however, limited, because information services are labor intensive and the introduction of computers would not effect production improvements which would compensate for the added cost of computer usage.

The complete study report consists of two volumes: Volume I is an executive summary containing a minimum of technical material. Volume II (PB-221 - 749) is a detailed report which contains the complete report text including statistical data and technical appendices.

NTIS Order No. PB-221-748 PC \$3.00 MF .95¢ Vol. I & II as a set-PB-221-747 \$7.00 Title: "Application of Computers to Transit Information Systems - Volume II "

Author: Catherine S. Owen, John L. Vialet, Peter Wood (The Mitre Corporation)

Date: January 1973

Project No. VA-06-0004

Keywords: 1. Information aids 2. Communications 3. Computer applications

Abstract: This study presents a detailed report on the practicality of using computers in transit telephone information services. Telephone information systems are a common public service provided by transit companies in order to disseminate information concerning routes, schedules, service disruptions, and special transit service to sporting events and other public gatherings. During the initial stages of the investigation, a representative group of transit properties was visited to determine the operating characteristics of their telephone information services. As a result of these visits it was possible to identify those aspects of transit telephone information systems that would benefit most from the introduction of computers and data processing techniques.

Volume I (PB-221-748) is an executive summary using a minimum of technical detail. Volume II contains the complete report text including statistical data and technical documentation. The following topics are covered in detail: system characteristics, potential computer applications, state-of-the-art improvements, and appendices which include a detailed task analysis and a description of factors which affect an ideal system configuration. Four appendices are devoted to computer topics. The first contains a discussion of the requirements for data storage and retrieval, the second contains techniques for route selection, the third contains estimates of the cost of the computer system, and the fourth contains a review of the impact of computers inthe information retrieval process.

> NTIS Order No. PB-221-749 PC \$4.85 MF .95¢ Vol. I & II as a set-PB-221-747 PC \$7.00

Title:	" Transit Telephone Information Systems "						
Author:	Catherine S, Owen, John L. Vialet (The Mitre Corp.)						
Date:	October 1972				Project No. VA-06-0004		
Keywords:	1. 2.	Informa Communi	ition a cation	aids ns		3. 4.	Public_relations Computer applications

Abstract: This report is primarily intended as a guide for transit properties considering the establishment of a new telephone information service and will also be of use to transit properties that wish to evaluate the effectiveness of existing information services. The report contains an outline of the requirements that must be met when setting up an efficient, manually operated transit telephone information service.

The beginning is an analysis of system requirements, including data on representative system operating costs. This material is followed by recommendations for system inauguration and maintenance and a section which discusses the operation of regional transit information systems. The conclusion is a discussion of alternate methods of information distribution being used to minimize the need for telephone information systems. An appendix includes samples of forms which can be used to extract useful information regarding system operations.

Some of the principal findings of this study are: typical transit properties receive between one and two telephone inquiries per hundred passengers, new transit systems may initially receive up to twenty inquiries per each hundred passengers carried, average work output for the typical system is thirty-two information requests per clerk per hour, specialized training will result in better service as well as increased job satisfaction, local telephone companies would be willing to provide specialized training for information operators, and, in addition to telephone information centers, alternate methods of communicating transit information should be used to provide a more effective and balanced information program.

The contractor has also prepared reports for the Urban Mass Transportation Administration on the possible application of computers to the operation of transit telephone information systems. These are: "Application of Computers to Transit Information Services, Volume I - Summary" (PB-221-748) and "Volume II - Detailed Report" (PB-221-749).

 NTIS Order No.
 PB-221-459

 PC \$4.50
 MF .95¢

Title: "Automatic Fare Collection "

Author: Peter Wood (The Mitre Corporation)

Date: October 1972

Project No. VA-06-0004

Keywords: 1. Fare, passes 2. Fare Collection

Abstract: This report is a state-of-the-art review of Automatic Fare Collection (AFC) systems from simple coin operated turnstiles to complex electronic systems which use magnetically coded tickets.

Because the fare structure adopted by a transit system has a major impact on the method of fare collection, this report opens with a discussion of the alternative methods employed in establishing fares, with examples taken from operating systems.

Specific matters covered by the report include: a description of AFC systems which are in actual operation, a description of proposed or demonstrated systems, an evaluation of potential applications for AFC systems in the United States, a description of alternative configurations of AFC systems, and a bibliography which concludes the report.

Systems which have been studied and included in this report are: British Rail (Glascow Electric), Sapporo (Japan), Turin Transportation Authority and the Hamburger Verkehrsverbund, Illinois Central Railroad, PATCO, BART, London Transport and the Washington Metropolitan Transit Authority.

NTIS Order No. PB-221-448 PC \$4.85 MF .95¢

- Title: "Blue Streak Bus Rapid Transit Demonstration Project--Phase II Interim Report"
- Author: Alan M. Voorhees and Associates, Inc. (for the Washington State Highway Commission, Department of Highways and the City of Seattle, Department of Transportation)

Date: July, 1972

Project No. WA-06-0004

Keywords: 1. Bus, priorities 2. Bus, commuter 3. Lane, reserved 4. Parking, Park and Ride

Abstract: Survey results and other data collected during Phase II of the Blue Streak bus rapid transit demonstration in Seattle, Washington, are presented. The purpose of the project is four-fold: (1) evaluation of the transit patronage which can be generated by rapid transit bus service operating partially on exclusive rights-of-way; (2) establishment of a warrant for reserved freeway lanes and/or ramp for such exclusive bus use; (3) evaluation of the sensitivity of potential transit users to improvements in transit service; and (4) evaluation of the "change of mode potential" by studying the operation of a park-and-ride facility in conjunction with bus rapid transit service. The Blue Streak service operates in a major high-density CBD access corridor on the I-5 freeway. A major feature of the service is exclusive bus use of a key reversible ramp connection between I-5 and CBD. Phase I of the project was a study of traffic characteristics and travel patterns prior to the inauguration of the Blue Streak services. Phase II consisted of a survey and analysis of traffic and travel after Blue Streak had been in operation for one year. The Phase II study was conducted in the summer of 1971.

This report contains a brief chapter highlighting significant aspects of the Phase II--Phase I relationship, followed by analysis of economic and general travel pattern trends, survey comparisons in greater detail, and operational aspects of the bus rapid transit service. The various appendices present detailed tabulations of the Phase II--Phase I comparisons plus details about trends and transit operations. Some of the interim findings include: (1) transit travel time decreased with Blue Streak operation, (2) transit ridership on Blue Streak routes counters the general decline in travel as evidenced by significant increases in patronage, and (3) park-ride lot usage indicates that this aspect of the Blue Streak is quite successful. Demographic, socioeconomic and travel trends are presented and provide a context for interpreting Blue Streak data. More complete and intensive evaluations of the project will be presented in the final report.

> NTIS Order #: PB 218-879 PC \$3.00, MF 95¢
Title: "A Mathematical Model for Optimizing the Assignment of Man and Machine in Public Transit"

Author: Samy E.G. Elias (West Virginia University)

Date: September, 1966

Project No. WV-06-0001

Keywords:1.Manpower and Personnel4.Computer, applications2.Schedules and Scheduling5.Computer, programming3.Quantitative Analysis5.Computer, programming

Abstract: Increasing labor costs in the urban mass transportation industry have underscored the need for fast and economical scheduling techniques. This report presents a mathematical model for optimizing the assignment of vehicles and manpower (ie. "run-cutting") in public transit.

An integer linear programming model was initially developed, but the unwieldy number of necessary variables and constraints precluded its utility. Consequently, a heuristic model was designed to solve the problem of man and machine scheduling.

Testing and validation of the heuristic are reported in detail. The author concludes that this method proved highly efficient and economical. Only about 20 minutes were required to develop a machine schedule for a route with 24 blocks. In a previous study it was also shown that by employing a computer to perform the heuristic assignment function, the training period required for schedule-makers could be cut from ten years to one.

All relevant data are presented with reference to model development, selection of variables, computer programming, and validation. The report concludes that a complete analysis of manpower scheduling problems should also consider service schedules and routing requirements. This is because even minor variations in vehicle assignments to meet flexible service demands can significantly affect the optimal scheduling of manpower.

Other scheduling techniques, such as the Decomposition Principal or the Quadratic Programming Approach, are discussed briefly, but the author concludes that neither shows promise for near-term solution. Thus a heuristic method will, for the forseeable future, represent the optimal method for fast, efficient, and economical transit scheduling.

> NTIS Order #: PB-174-419 PC \$3.00, MF 95¢

Title: "UMTA Transportation Planning System, Reference Manual"

Author: Urban Mass Transportation Administration, Office of Research, Development and Demonstration, New Systems Requirements Analysis Branch

Date: September 15, 1972

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RDD-1
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Keywords: 1. Computer, applications
2. Computer, programming
3. Codes and Coding

Abstract: The UMTA Transportation Planning System (UTPS) is a collection of IBM System/360 computer programs for use in planning multi-modal transportation systems. The objective of UTPS is to provide a readily available, easyto-use, and fully tested program package for transportation planners attempting to solve a wide variety of problems. UTPS presently consists of 14 separate but interrelated computer programs designed for use in the IBM 360 operating system.

This document, the reference manual, summarizes relevant information for operators of the UTPS system, and it is intended to be used as a concise reference for persons already familiar with the usage of the programs. Specific sections include statements of system controls, subject program controls, program writeup organization, software system description, catalogued procedures, and actual program writeups.

> NTIS Order #: PB-212-473 PC \$3.00, MF 95¢

- Title: "UMTA Transportation Planning System -- Network Development Manual"
- Author: Urban Mass Transportation Administration, Office of Research, Development and Demonstration, New Systems Requirements Analysis Branch

Date: September 15, 1972

RDD-3

Keywords: 1. Computer, applications 2. Computer, programming 3. Corridors

4. Codes and Coding

Abstract: The UMTA Transportation Planning System (UTPS) is a set of computer programs for use in planning multi-modal transportation systems. The basic UTPS software is aimed at the mid-level of analysis -- that is, specific routes and corridors as have been used for typical areawide transportation planning studies. A critical element of these analyses is the ability to accurately represent existing and planned transportation systems. This manual provides an overview of the UTPS network analysis programs and discusses in detail the preparation and coding of transportation networks.

The report describes several functions for which transit networks are developed and the application of UTPS network analysis programs. Network components include the zoning system, lines, modes, links, and nodes. Brief descriptions of the basic transit planning programs are provided along with input and data requirements.

The physical preparation of network data and maps is discussed along with network coding and editing procedures. Problem situations and solutions are outlined, along with a discussion of specialized networks. Parameters for the various programs are covered in the appendices. Overall, this report is intended to provide a basic manual for users of the UTPS software to simulate multi-modal transportation systems.

> NTIS Order #: PB-212-930 PC \$3.00, MF 95¢

- Title: "New Systems Requirements Analysis Program, UMTA Transportation Planning System (UTPS) -- Sketch Planning Workshop Proceedings"
- Author: Urban Mass Transportation Administration, Office of Research, Development and Demonstration

Date:	Octobe	er 19, 1972	Rビリー5		
Keywords:	1. 2. 3.	Urban Development, planning Computer, applications Computer, programming	4. 5.	Quantitative Analysis Trip Generation	

Abstract: This report summarizes the proceedings of a User's Workshop conducted on October 19, 1972, in conjunction with the Urban Mass Transportation Administration's (UMTA) New Systems Requirements Analysis Program. It augments previously disseminated information on the proposed sketch planning techniques currently under development for inclusion in UMTA's Transportation Planning System (UTPS) and focuses on comments and reactions to the proposed planning techniques. The sketch planning package under discussion involved various models to permit quick and economical analysis of transportation alternatives.

Part I of these proceedings presents position papers on specific sketch planning topics prepared by individual professionals at the conference. The topics include manual sketch planning, travel demand estimation, network representation, evaluation of alternatives, and additional comments on evaluation.

Part II summarizes the major comments, findings, and conclusions gathered during the small-group discussions among workshop participants with reference to each of the major topics presented above.

NTIS Order #: PB-214-263 PC \$3.00, MF 95¢

SECTION III

UNIVERSITY RESEARCH AND TRAINING REPORTS

Title: "The Costs of Private Automobile Usage to the City of San Francisco"

Author: Douglass B. Lee, Jr. (University of California at Berkeley, Institute of Urban and Regional Development)

Date: April, 1972 Project No. CA-11-0006 Keywords: 1. Private Transportation, automobile 3. Government, urban 4. Government, taxation 2. Financing Mass Transportation 5. Budgets and Budget Planning

Abstract: This research investigated the costs of private automobile usage to the City of San Francisco. The author hypothesized that a detailed accounting of public costs associated with automobile usage would reveal a substantial "subsidy" which warranted a reexamination of financing policies visa-vis support for urban mass transportation.

Current direct costs were identified with reference to street maintenance, traffic control, motor vehicle code enforcement, traffic accidents, parking, driver education, and disposal. The author also notes indirect costs of general administration and the capital costs of new and improved facilities. Estimates of these costs were developed for FY 1970 based upon auto-related expenditures of 14 relevant municipal agencies. The report concludes that total auto-related service costs to the City equalled \$42,454,000. Expenditures by each of the relevant city and county agencies are examined in detail.

Municipal revenues derived from automobile usage are described with reference to property and sales taxation; fees, licences, and other user charges; intergovernmental transfers; fines; and other revenues (such as San Francisco's business tax, interest, and income from parking meters). Revenue estimates were developed for each of these sources.

Based upon these data, the author computed a total deficit of \$12,745,000 which, in effect, amounts to a sizeable public subsidy for automobile transportation. Six alternative tax measures for recovering user charges from automobile operators are discussed.

NTIS Order #: PB-220-222 PC \$3.75 MF 95¢ Title: "An Analysis of the 1968 Rapid Transit Vote in Los Angeles"

Author: Brian Stipak (University of California at Los Angeles, School of Architecture and Urban Planning)

Date: October, 1972

Project No. CA-11-0007

Keywords:	1.	Government, urban	5.	Race
	2.	Demography	6.	Quantitative Analysis
	3.	Community Response	7.	Ridership, profiles
	4.	Rail, systems planning and design	8.	Surveys

Abstract: In November, 1968, Los Angeles area voters defeated Proposition A, a proposal to fund construction of the Southern California Rapid Transit District (SCRTD) system. This paper reports the results of a multiple regression analysis performed to test the correlation between several socioeconomic variables and the bond issue referendum vote.

Census data were collected at the tract level and combined with election returns by precinct. In describing the SCRTD referendum, attention is given to three influential variables. Distance from the nearest proposed transit station was found to correlate inversely with favorable voting patterns. Sixty-eight percent of the units located less than three miles from the proposed system voted more than 45% in favor; conversely, 79% of all units located more than three miles from a transit station voted below 45% in favor. In addition, the author found that the mean favorable vote declined directly with distance, although the cumulative impact of this variable tended to diminish with added increments.

The analysis also revealed a moderate negative association between voting for Proposition A and median tract income. This relationship was shown to be nonunidirectional, indicating that support for rapid transit was stronger in high and low-income areas. A third variable studied was ethnicity. The data indicate that support was stronger among blacks, persons with Spanish surnames, and Orientals than among whites.

Other factors -- including age, population density, partisanship, and voter turnout -- produced problems of multicollinearity and were not strongly associated with the referendum vote. The author also compared voting on Proposition A with the results of other referendum items on the 1968 ballot to determine whether the SCRTD defeat was attributable to a "mood of the electorate." The findings, however, indicate that voter shifts occurred on the various proposals, thus suggesting that issue distinctions were drawn by voters.

A multiple regression technique was employed to measure the combined effects of distance, income, and ethnicity; the final equation was found to explain 57% of the variance in the election results, a statistically significant product. The author concludes that commonly accepted explanations of bond issue failures in general, and transit proposals in particular, underestimate the quality of the electoral decision. The report recommends that such referenda in the future should more explicitly incorporate the preferences of middle-income voters and be a part of a comprehensive regional transportation plan.

NTIS Order #: PB-214-252 PC \$3.00; MF 95¢

Keywords:	1. Market Research	3. Management, operations and techniques
Date:	March 1973	Project No. CA-11-0008
Author:	Christopher H. Lovelock	(Stanford University, Graduate School of Business)
Title:	"Consumer Oriented Appro	aches to Marketing Urban Transit"

Abstract: This study sees marketing playing a key role in development and management of urban transit operations because of its focus on understanding and satisfying consumer needs. One goal of the study was to determine the feasibility and efficacy of increased marketing activity in an industry which has emphasized engineering and economic considerations.

Marketing strategy must be based upon detailed knowledge of the consumer; how the consumer goes about deciding to make a trip and selecting a mode of transportation for it. With a view to facilitating understanding of this decision process and how it may be influenced, a microanalytic model of modal choice behavior was developed in flow chart form, based on a review of the literature on modal choice, brand choice and the diffusion of innovations. Unlike most modal choice models, the focus is on the relationship between psychological variables and modal choice, highlighting the inadequacy of available information.

To improve knowledge of these variables, a large scale consumer survey was undertaken which may be regarded as a prototype of the research effort required. Sample design and delivery procedures made it possible to focus on subjects in the San Francisco Bay area for whom both public and private transportation are available and viable alternatives for many trips. These design and delivery techniques are described in detail.

Various multivariate statistical techniques are used to analyze the resulting survey data. Significant relationships are found between modal choice behavior and certain attitudes toward public transit and driving. The hypotheses that knowledge of transit services would prove closely associated with the extent of transit usage and that a marketing orientation on the part of bus transit carriers would result in more favorable consumer perception of bus travel, were strongly supported. Multiple regression analysis is employed to examine the relative interactions between modal choice behavior and the various attitude, perception and knowledge measures.

The report proceeds to outline three basic strategies which may be used by transit management to stimulate patronage: (1) improving the physical attributes of vehicles and facilities, (2) improving the operational characteristics of the services, and (3) undertaking persuasive communications campaigns. By highlighting the consumer's need for information and the relationship between modal choice behavior and attitudinal and perceptual variables, the survey findings indicate that relatively inexpensive marketing and communications strategies might prove effective in encouraging use of public transportation. The study concludes with several proposed strategies involving the use of different elements in the marketing mix.

> NTIS Order No. PB-220-781 PC \$10.60 MF .95¢

Title: " Optimal Design of Transportation Networks with Fluctuating Demands -A Case in Multicommidity Network Flows "

Author: Jose Luis Aburto Avila (Stanford University, Department of Industrial Engineering)

Date: December 1972

Project No. CA-11-0008

Keywords: 1. Algorithm 2. Benefit/Cost Analysis 3. Codes and Coding Computer Applications
 Routes and Routing

6. Intercity

Abstract: This study analyzes network configuration and the allocation of traffic in an urban community through the use of an integer programming algorithm which has been coded for digital computer implementation, and numerical results are presented. The study presupposes the knowledge of the needs and goals of an urban community, its physical characteristics and the technological feasibility of transportation under consideration. The goal is to provide a basis for network appraisal methodology for the systematic interconnection of the main centers of urban activity and for the assignment of routes.

The problem of designing a transportation network that will best satisfy expected demand for travel among a set of centers of activity is formulated by identifying for each origin-destination pair, all the alternative feasible routes that meet prespecified criteria. Modal choice is assumed a function of travel time. The model generates expected demands for travel, from a probability distribution function of travel time associated with each origindestination pair.

Assuming constant demand over routes and infinite capacity over arcs, the problem is a linear program in binary variables with a binary matrix of coefficients and a binary RHS. A solution procedure is developed which first reduces the size of the feasibility set. The reduced problem is then optimally solved with an implicit enumeration technique. A computationally more efficient algorithm is presented which will in general obtain a suboptimal solution but will provide a bound on the value of the optimal solution. The approach is found to provide flexibility for the sensitivity analysis of the key parameterssuch as the distribution of demand.

An extensive bibliography is provided.

NTIS Order No. PB-221-164 PC \$6.75 MF .95¢

Title:	"A New Role for Planners: Working With Community Residents in Formu lating Plans for Street Patterns Before Decision-Making"							
Author: J. Eugene Grigsby, III and Bonham Campbell (University of Califon at Los Angeles)								
Date:	Febi	ruary, 1972		Proj	éct No. CA-11-0009			
Keywords	: 1. 2. 3.	Surveys Urban Development Highway, planning	, planning	4. 5. :	Community Response Public Relations			

Abstract: This research investigated the role of citizen participation in urban transportation decision-making. Two independent methods were designed and tested for determining community preferences for neighborhood street patterns in the Pico-Union area of Los Angeles, California. The purpose of this study was to examine alternative methods for producing information that would be used by the neighborhood as well as by city transportation planners.

The two methods included: (1) a home-interview survey approach, and (2) a photo-comparison method which enabled residents to compare photographic simulations of many possible re-designs of a typical street. Results of the two methods generally agreed, although some differences occurred when simple changes were made in the orientation and sequence of the photographic simulations.

The authors conclude that methods can be developed for obtaining information useful to urban planners at the neighborhood level by involving residents in an iterative learning and decision process. Complete data and survey findings are contained in the report.

> NTIS Order #: PB-214-396 PC \$3.75, MF 95¢

Title: "The Role of Psychological Needs in Mass Transit"

Author: Claire Tehan and Martin Wachs (University of California at Los Angeles, School of Architecture and Urban Planning)

Date: December, 1972

Project No. CA-11-0009

Keywords:	1. 2. 3.	Qualitative Analysis People Mover, Dashaveyor People Mover, Transportation Technology, Inc. Bus, design	5. 6. 7. 8.	Advertising and Promotion Social Benefits and Costs Seats and Seating Personal Rapid Transit
	4.	Bus, design		

Abstract: This research explored psychological considerations in the planning of urban mass transportation systems. The authors surveyed recent psychological literature to identify a set of basic human needs which might be applied to improve the image and quality of mass transit. These include personal growth needs (ie. affiliation, esteem of others, self-identify, and autonomy) and ego-defensive needs (ie. security, conformity, rejection, and space).

Conventional bus operations and two modes of personal rapid transit (the Dashaveyor and the Transportation Technology, Inc. systems) were evaluated by their satisfaction of passengers' psychological needs. For example, the "exclusive" use of personal rapid transit by individual riders is cited as a partial satisfaction of the need for "rejection." The design of seating arrangements to be side-facing or face-to-face can produce a conflict between the needs for "affiliation" and "security."

The authors emphasize the importance of psychological considerations in evaluating alternative transit modes. Heretofore, such analyses have stressed such quantitative factors as capacity, trip time, operating concept, and vehicle performance, with insufficient attention given to the psychological needs of transit users.

The report also discusses how a psychologically-oriented approach could be marketed to maximize the attractiveness of public transportation. Advertising strategies which underscore the qualitative aspects of mass transit as they affect passengers' psychological needs are reviewed. The authors conclude with four recommendations for additional future research.

> NTIS Order #: PB-216-161 PC \$3.75, MF 95¢

Title:	"Integra Planning	ting Localized System "	wide Objectives	in Trans	portation	
Author:	Martin W	achs, Barclay Hudson,	, Joseph Schofer	(Univers	ity of Calif.	at L.A.)
Date:	January,	1973	Projec	t <u>No</u> , CA-	11-0009	
Keywords:	1. 2. 3. 4.	Urban Development, p Benefit-Cost Analysi Social Costs and Ber Community Response	olanning is nefits			

Abstract: Traditionally, the transportation planner works with system-wide unitary objectives and uses standard evaluation approaches. Training, analytical techniques and commitment to comprehensiveness have tended to lead the planner to apply unitary criteria to all levels of planning. In this context, the report discusses unitary (system-wide) and disaggregated (localized) planning conflicts. The report focuses on methods for integrating unitary and disaggregated objectives in the transportation planning process. Four prototypical evaluation approaches are examined with this question in mind, 'Is it possible to devise planning strategies and methods which achieve an acceptable balance between systematic service requirements and localized requirements?' These evaluation techniques are analyzed in three ways: (1) the nature of impacts which can be incorporated, (2) amenability of the approach to differential interpretation of impacts, and (3) sensitivity to dimensions of network impact arising in particular neighborhoods. The four approaches considered are: COST BENEFIT ANALYSIS (or benefit cost ratio, best applied to situations where financial considerations are prime), "MIXED-BAG" COST-EFFECTIVENESS (the ratio of monetary costs to non-monetary benefits), INTERACTIVE GRAPHICS (a graphic aid for design and decisions), and DIALECTICAL (an approach to operationalizing the need to mix the processed knowledge of the planner with the personal knowledge of the communities of interest which might be affected by specific impacts of network plan implementation.

The report emphasizes that these evaluation techniques are not mutually exclusive, and can all be incorporated into the planning process. Techniques such as benefit-cost and cost-effectiveness analyses may serve as methods for including consideration of important, quantifiable impact issues in plan evaluation. Dialectical approaches represent specifications for the format of a planning process. Interactive graphic techniques allow rapid response to the questions and suggestions of community residents in readily understandable formats. The report also suggests that the ultimate need for a new urban transportation planning technology may result in the inversion of traditional planning strategy - a technology which recognizes communities as the fundamental systems units.

> NTIS Order No. #: PB-218-855 PC \$3.75, MF 95¢

Title:	"Before and After Benefit-Cost A	nalysis in Urban Transportation"
Author:	Elizabeth Peterson and Frank G. at Los Angeles)	Mittelbach (University of California
Date:	September, 1972	Project No. CA-11-0009
Keywords:	 Benefit-Cost Analysis Highway, planning Social Benefits and Costs Urban Development, planning 	

Abstract: The report investigates the accuracy and utility of benefit-cost analysis in urban transportation. Benefit-cost analysis is described in detail along with conceptual and practical problems.

The Santa Ana Freeway in Los Angeles is the selected case study to compare ex-ante and ex-post benefits and costs with reference to time value savings for freeway users and highway commodity savings. Using this case study, the report examines expected benefits and costs and compares them with actual results. The analysis reveals significant differences between the benefits and costs anticipated and those which were observed. Assumptions in the ex-ante analysis are discussed in detail. One primary conclusion of the comparison is that benefit-cost analysis, when applied to actual experience, incrementally, provides a broader survey of the effects than when applied only in a prospective context. The report concludes with recommendations to improve the effectiveness of benefit-cost studies in urban transportation decision-making.

> NTIS Order No. #: PB-218 -831 PC \$4.50, MF 95¢

Title: "Physical Accessibility as a Social Indicator"

Author: Martin Wachs and T. Gordon Kumagai (University of California at Los Angeles, School of Architecture and Urban Planning)

Date: October 20, 1972

Project No. CA-11-0009

Keywords: l. Access, planning and control	4.	Medical Centers
2. Qualitative Analysis	5.	Trip Generation
3. Employment	6.	Urban Development, planning

Abstract: Physical accessibility to employment and social service centers is used as a qualitative measure of urban living and a component of the "social report" for a city or region. Accessibility refers to the relative ease with which various opportunities can be reached by any group of urban dwellers.

An opportunity framework is developed to measure accessibility in terms of both location and available transportation. This framework is interpreted as an approach to evaluating transportation and regional plans which differs from approaches based on travel volumes and travel times that are currently employed in urban planning systems.

The use of measures of accessibility is illustrated with data on travel to employment and health care facilities in the Los Angeles area. The authors found substantial differences in accessibility between these destinations, and that the differences were related to socio-economic status and to spatial location of communities within the region.

> NTIS Order #: PB-212-740 PC \$3.75, MF 95¢

- Title: "A Feasibility Study of Free Bus Service for a Street Corridor of Denver"
- Author: Robert D. Reish and Vasant H. Surti (University of Colorado, Denver Center, Center for Urban Transportation Studies)

Date: September, 1972 Project No. CO-11-0001

Keywords:	1.	Fare, reduction	3.	Ridership, volume
	2.	Bus, cost	4.	Quantitative Analysis

Abstract: A survey of automobile users was conducted in an area of Denver, Colorado, to determine the feasibility and benefits of operating a free (ie. no cost) bus transit service. The selected study area contained most of the three existing bus routes that run in an east-west direction from suburban areas east of the center city to downtown.

The survey data were expanded to estimate the probable increase in transit ridership that would result from the elimination of fares. Transportation costs were then analyzed and compared between the present system and a free fare situation.

The study concluded that total transportation expenses were less under a free system, but that the margin of advantage was relatively small. Additional economic and environmental benefits were cited in arriving at the conclusion that free bus service is potentially beneficial, but that it will require testing under closely monitored conditions.

> NTIS Order #: PB-212-802 PC \$3.00, MF 95¢

- Title: "Modal Choice and Attitude Patterns for a Medium Size Metropolitan Area"
- Author: Charles A. Hall and Vasant H. Surti (University of Colorado, Denver Center, Center for Urban Transportation Studies)

Date:	October, 1972			Project No. CO-11-0001
Keywords:	1.	Modal Split	3.	Quantitative Analysis
	2.	Surveys	4.	Ridership, profiles

Abstract: The purpose of this study was to evaluate the factors which jointly influence the utilization of public transportation systems and to develop techniques of analysis and prediction that can assist the planning of future transit in response to needs. A questionnaire survey of employees in the Denver central business district was employed for data collection.

The authors provide a general background of bus transit in Denver and survey. methodology. All relevant statistical material is provided.

The report analyzes a wide variety of factors generally believed to influence modal split. Two matrices were developed to test the correlation among various survey responses. One matrix examined the interrelationship among several attitudinal variables; the second focused on various modal split factors, such as personal characteristics, travel patterns, and the availability of different transportation modes.

A multiple regression procedure was employed to analyze the combined effect of several variables on modal split. A statistically significant functional relationship was demonstrated. These data are compared with similar research findings obtained by an earlier study in Chicago. Modal choice prediction models were developed by using a number of variables that would jointly have an effect on the mode selection process.

The authors conclude that three particularly revealing variables in this analysis were the number of drivers per family, the number of autos per household, and trip time. The survey also revealed that a large number of respondents were particularly favorable to innovative transit modes such as park-and-ride express transit and downtown minibus service.

> NTIS Order #: PB-212-801 PC \$3.00, MF 95¢

Title: "A Feasibility Study of Exclusive Bus Lanes: A Case Study of the Denver Central Business District "

Author: Charles A. Hall and Vasant H. Surti (University of Colorado, Denver Center, Center for Urban Transportation Studies)

 Date:
 April 1973
 Project No.
 CO-11-0001

Keywords: 1. Bus,priorities 2. Lane, reserved 3. Routes and routing 4. Traffic, peak hour

Abstract: This report applies the discussion of preferential bus lanes to the downtown Denver area. Three basic concepts are selected for evaluation: a preferential bus lane, an exclusive bus lane, and a contraflow bus lane. Buses can conduct an effective passenger movement operation if they can be provided with an exclusive or possibly even a preferential lane in the downtown area. By providing a special lane, the buses no longer need to interfere with the through traffic, which should increase the capacity for automobile traffic or perhaps even lessen automobile congestion, while faster bus service should result in greater bus ridership.

The transit system and the traffic situation in the Denver Central Business District are described and alternate methods of improving traffic flow are identified and defined. The alternatives include: (1) prohibit rush hour right or left turns for automobiles, (2) reroute buses to more compact travel patterns, and (3) select peak hour or all day preference or exclusion systems. Warrants are found to be adequate for exclusive privileges and the samedirection bus lane is determined to be the best service for downtown Denver. Warrants do not exist except during morning and evening rush hours.

The report details project implementation and conpares the same-direction exclusive bus lanes with alternative solutions. A bibliography is included.

NTIS Order No. PB-221-448 PC \$4.85 MF .95¢ Title: "Downtown Bus Transportation"

Author: Lawrence D. Goldstein (Consortium of Universities, Urban Transportation Center)

Date:	June,	1972	Project No.	DC-11-0003
			~	

1.	Bus, design	4.	Center City
2.	Bus, minibus	5.	Ridership, profiles
3.	Distribution Systems	6.	Surveys
	1. 2. 3.	 Bus, design Bus, minibus Distribution Systems 	1. Bus, design4.2. Bus, minibus5.3. Distribution Systems6.

Abstract: The research examined special downtown bus systems in forty cities throughout the United States. Data were collected in questionnaires received from fourteen cities using small-size buses and nine cities using standard vehicles. Emphasis is focused on vehicle design, type of service (including route coverage, headways, vehicles in service, fares, patronage, and duration of service), system costs, public response, and impact on center city traffic circulation.

The experience of cities using the different size buses is examined. Small size vehicles were mainly selected for convenience and cost. The author notes that small buses are most frequently employed for center city circulation in pedestrian areas or for shuttle service. Standard size vehicles were mainly selected to promote compatibility with the existing bus fleet. Ridership profiles in both systems were essentially similar.

The report develops several recommendations for efficient use of small and conventional vehicles, integrated downtown bus transportation service, and user-oriented planning functions. Complete survey data are appended.

NTIS Order #: PB-212-616 PC \$4.50, MF 95¢ Title: "The Transportation Needs of International Visitors to the District of Columbia in the Bicentennial Era"

Author: Oliver Kerr and Raymond B. Palfrey, Jr. (Consortium of Universities, Urban Transportation Center)

 Date:
 June, 1972
 Project No. DC-11-0003

 Keywords:
 1. Ridership
 3. Public Relations

 2. Information Aids
 4. Tourism

Abstract: The 1976 National Bicentennial Celebration is expected to attract some 100,000 daily visitors to Washington, D.C. This report examines the transportation needs of international tourists in the Nation's Capital and develops appropriate recommendations.

A brief description of the proposed Bicentennial Celebration is provided. Existing public transportation in Washington was examined in detail; the authors conclude that three problems limit the utility of the transit system for foreign visitors: (1) fragmented service, (2) orientation of the bus system to peak-hour work trips, and (3) ineffective transit information systems.

The report forecasts increased international tourism in the United States and evaluates the tourist facilities in Washington as insufficient to meet the projected demands of Bicentennial visitors. Results of a "mini-survey" of foreign tourists in Washington are included. Attention is focused on available sources of transit information.

The authors conclude with a brief review of transportation planning for 1976 and twenty specific recommendations to improve public transit for the foreign visitor. The latter emphasize information sources, upgraded bus and rapid transit service, promotion of pedestrian and bicycle circulation, and stronger regulation of downtown parking.

> NTIS Order #: PB-212-899 PC \$3.00, MF 95¢

- Title: "The New Town and Transportation Planning -- General Overview With a Case Study of Columbia, Maryland"
- Author: Cameron Wiegand (Consortium of Universities, Urban Transportation Center)

Date: Spring, 1970

Project No. DC-11-0011

Keywords:1. New Towns3. Government, Federal2. Research Operations4. Personal Rapid Transit

Abstract: The report presents a general overview of new town development and transportation planning with a case study of Columbia, Maryland. In his introductory text, the author explains basic problems associated with urban sprawl which particularly frustrate transportation planning. The principal advantage of new town developments is their ability to incorporate a wide range of appealing features without substantial disruption of existing activities. The author also notes that such innovative transit modes as Dial-A-Ride, personal rapid transit, dual-mode vehicle systems, and other major activity center systems can be implemented more easily ip the new town environment where installation problems are minimized.

Emphasis is given to transportation planning in the new town of Columbia, Maryland. This development is described in detail along with an overview of the transportation planning process and the Columbia transit program. On-going studies, including current research and development and the Columbia transit demonstration program, are summarized.

The new town as a testing ground for innovative technology is discussed along with present Department of Transportation policies for the funding and location of research and development programs. Specific problems, comments, and recommendations concerning the Columbia transportation experience are advanced. These include plans for "Guideway III" rapid transit system. The author concludes that the estimated \$34 million pricetag for Guideway III is not particularly burdensome given its potentially favorable impact.

> NTIS Order #: PB-194-203 PC \$3.00, MF 95¢

Title: "Social Problems and Community Values in Planning Goal Formulation"

Author: Merl Coon (Florida State University, Department of Urban and Regional Planning)

Date: July, 1972

Project No. FL-11-0003

Keywords:1.Social Benefits and Costs4.Joint Development2.Urban Development, planning5.Qualitative Analysis3.Community Response

Abstract: In this report methodological questions regarding social research have been analyzed in the context of transportation projects with special attention given to the problems associated with goal formulation. The expanded goal identification process is discussed by introducing a three-dimensional approach which includes functional, ethical, and meaning dimensions. The essential premise of this work is that joint development of transportation projects must include a social-cultural as well as a physical context in the process of community goal identification.

The first part of this paper addresses the identification of a social problems context in transportation research. Specific attention is given to the problem of identifying community goals and values to be integrated with transportation planning. Contextual problems of definition are discussed. Attention is given to social problems defined in terms of an organizational context which emphasizes constitutive factors. In this sense, emphasis is focused on the concept of integration in social organization.

The second part of the paper develops a general methodology for incorporating community values into planning goal formulation. This strategy is based on symbolic interaction theory and the participant observation method. The relationship among values, attitudes, and the community response to technological change is introduced. By and large, the purpose of this method is to ensure the introduction of community values in the planning of joint development projects.

> NTIS Order #: PB-214-917 PC \$3.00, MF 95¢

Title: "Psychological Implications of Public Transportation Service"

Author: William T. Olsen and Seward Smith (Florida State University, The Transportation Center)

Date: January 1973

Project No. FL-11-0003

Keywords:	1.	Surveys	3.	Age
	2.	Ridership	4.	Sex

Abstract: The report deals with research which is based on an attitude survey of people in Clearwater, Florida, who actually used or had an opportunity to use bus services provided under a demonstration program sponsored by the Florida Department of Transportation. A large portion of the Clearwater area is a retirement community.

A survey instrument was developed to help planners identify the feelings people have about traveling by public transportation modes as well as the ways in which these feelings vary with different kinds of people. The survey developed and used in the Clearwater area included preference ratings of various design and service characteristics of a bus system, establishment of improvement priorities and consumer ratings of the importance of being able to use transportation services to travel to various activities.

The report describes the related demonstration project, the survey area, and categorical characteristics (health, age, sex, transit user - non-user) of those who responded to the survey. The report concentrates on the psychological reactions caused by various bus travel situations. These reactions were in terms of concern for risk of personal injury, concern for health risk, feelings of pressure (time stress), and annoyance or aggravation. It is concluded that in order to ensure the possibility of effective utilization of public transportation by groups whose characteristics differ somewhat from those of the public at large, planners must attempt to remove all unnecessary physical and psychological impediments to travel.

> NTIS Order #: PB 218-334 PC \$3.00, MF 95¢

Title:	"Psychological 1	Factors	Affecting	Urban	Travel:	Responses	to	Crowding
	in Transit Veh	icles"						

Author: Larry L. Yancy (Florida State University, Transportation Center)

Date: July, 1972

Project No. FL-11-0052

Keywords: 1. Bus, commuter 2. Ridership 3. Surveys Qualitative Analysis
 Seats and Seating

Abstract: This research has examined crowding in transit vehicles as a psychological factor affecting urban travel. The author reviews general psychological literature and the characteristics and goals of urban transit systems. Methodology and development of the research design are also described in detail.

A model of psychological reaction to crowding in passenger transit vehicles was developed as the synthesis of two principal variables: (1) psychological stress as perceived in crowded conditions, and (2) adaptation level. Five interrelated hypotheses about the effect of these variables on transit use were tested using survey data collected among residents of a student housing complex at Florida State University.

Participants in the survey were shown several sketches illustrating the interior of a standard bus vehicle under a variety of crowding conditions. These ranged from a situation in which most seats were unoccupied to one in which all seats were occupied and many persons were standing in the aisles. Respondants ranked the sketches and selected appropriate statements from several psychometric scales to reflect their attitudes. Samples of the questionnaire instrument, scales used to measure qualitative responses, and sketches are appended.

The author concludes that psychological stresses due to crowding are measurable phenomena and that a significant relationship exists between the level of crowding and the level of stress. Other conclusions are discussed in detail. Attempts to detect differences in stress levels according to differences in survey respondants' characteristics proved inconclusive.

> NTIS Order #: PB-215-625 PC \$3.00, MF 95c

Title: "Functional Space and Transportation"

Author: Kozmas Balkus (Florida State University, The Transportation Center)

Date: July, 1972

Project No. FL-11-0052

Keywords: 1. Joint Development 2. Urban Development, Planning

Abstract: In planning it is helpful to view urbanized areas as functional spaces. The report discusses the structure and hierarchy of functional spaces including household, neighborhood, community, city and urban metropolitan areas. Distance and other factors that shape the form of function systems serve as criteria for ascertaining the hierarchy of urban spaces. Three main factors characterize urban form and tend to influence the optimality of transportation systems: development density, interactions and arrangement of facilities.

The city as a functional space consists of a hierarchy of subspaces and of elements of functional systems. Transportation is one of these functional systems. The optimality of transportation elements in such functionally constituted urban spaces depends upon how the elements of other functional systems are arranged. In this context, the report examines urban functional space and spatial constants of travel, and develops a hypothetical linear joint development project.

> NTIS Order #: PB 218-459 PC \$3.00, MF 95¢

Title: "Structural and Socio-Economic Factors of Commuting"

Author: Anthony J. Catanese (Georgia Institute of Technology)

Date: November, 1970 Project No. GA-11-0019

Keywords:	l.	Surveys	4.	Ridership, profiles
	2.	Bus, commuter	5.	Trip Generation
	3.	Rail, commuter		

Abstract: The report analyzes structural and socioeconomic characteristics and patterns of commuting in four major urban regions. The areas studied were selected to represent a variety of urban configurations, and they included: (1) a highly centralized region (New York City), (2) a center-oriented region (Philadelphia), (3) a suburban-oriented region (Milwaukee), and (4) a highly-decentralized region (Los Angeles).

The purpose of this research was to test certain hypotheses which were synthesized from previous studies of the commuting problem. Data were collected in more than 32,000 home interviews in the four cities; the report examines data limitations and alternatives for temporal and spacial measurement in detail.

Both structural and socioeconomic factors were analyzed. Structural factors include standard commuting models, urban size, distance, and direction. Socioeconomic factors include family income, sex, age, race, education, and automobile ownership. Analytic methodology is outlined in detail.

The research yielded a number of significant empirical findings. Commuting patterns throughout the four regions indicated a structural basis which, despite much unexplained variance, can be modeled. Neither type of urban structure nor population size seemed to greatly affect the commuting patterns. The author concludes that changes over time in urban growth patterns have invalidated the hypothesis that commuting direction is basically a pattern of conflux and dispersion; cityto-suburb and inter-suburban commuting have increased significantly. Family income represented the most statistically significant socioeconomic variable, and it appears to have a direct association with work trip distance. Males were found to travel longer work distances than females, and a marginal inverse association was revealed between distance and age. In addition, while racial groups appeared to travel similar distances, education was found to be positively associated with longer stages. Automobile ownership also correlated with trip length, but the author concludes that this association may be more accurately described as a function of family income.

The report concludes with a discussion of implications for urban planning and recommendations for further research.

NTIS Order #: PB-196-792 PC \$3.00, MF 95¢ Title: "Application of Demand Activated Transit Technology to Iowa City, Iowa"

Author: James W. Stoner (University of Iowa, Center for Urban Transportation Studies, Institute of Urban and Regional Research)

Date: August 1972

Project No. IA-11-0032

Keywords: 1. Demand responsive 2. Demand responsive dial-a-ride 3. Small cities

Abstract: This report presents an overall view of demand-responsive systems for use in small cities with specific application to Iowa City, Iowa. The report opens with a discussion of the demand activated concept and its applications. Previous research studies are then reviewed along with operational systems. The author attempts to point out the relationship between past work, operational implementation and future research.

Chapter III covers the demand estimating procedures used in prior studies and outlines the difficulties in predicting demand for the mode. A distinction is drawn between the outputs required for a research oriented model and those required for planning operational implementation.

Chapter IV discusses the application of the concept to the Iowa City area and the distinctive problems involved. Several forms of application of the demand responsive concept are considered, along with the private and public transportation forms.

Chapter V presents reflections on institutional and economic impacts and their consideration in the implementation process. Political and legal aspects and considerations are also evaluated.

Extensive footnotes and bibliography are also included.

NTIS Order No. PB-221-449 PC \$5.45 MF .95¢ Title: "Urban Transportation Planning References -- A Checklist for Library Collections (Revised Edition)"

Author: Northwestern University, The Transportation Center

Date: April, 1972 Project No. IL-11-0005

Keywords: 1. Urban Development, planning 2. Bibliographies

Abstract: This report is a comprehensive bibliography of urban transportation planning references. This revised listing updates a previous edition prepared in March, 1970. Bibliographic entries include books, reports and documents (ie. general references, reports prepared under the New Systems Study, and reports prepared under the Center City Transportation Program), conference proceedings, directories, bibliographies, periodicals, and urban transportation area studies. This comprehensive listing is intended to serve as a checklist for library collections of principal works in the field of transportation planning. In addition, the report contains a listing of eight major transit planning agencies and an address appendix.

> NTIS Order #: PB-214-648 PC \$3.75, MF 95¢

Title:	"Pedes	trian Movement: Selected	d Refere	nces, 1965-June, 1972"
Author:	Kathe: Transj	rine Sigda Bartholomaus portation Center)	(Northw	estern University, The
Date:	June,	1972		Project No. IL-11-0005
Keywords	: 1. 2. 3.	Bibliographies Pedestrians Safety	4. 5. 6.	Distribution Systems Conveyors Sidewalks

Abstract: This bibliography lists 250 selected references in the field of pedestrian movement. Each item contains complete bibliographic data and a brief description of its topical content. The report is indexed by author, and it contains an address list of periodicals and publishers.

The entries are broken down among four principal categories: (1) General Research [including surveys, pedestrian flow, circulation in specific geographical areas, and overall pedestrian systems]; (2) Safety [including accidents and injuries to pedestrians, crosswalks and pedestrian-oriented traffic control devices, design of automobiles and street appurtenances to minimize pedestrian injury, educational programs in pedestrian safety, etc.]; (3) Facilities [including pedestrian-vehicle separation through malls, pedestrian trafficways, sidewalks, moving walkways, and other physical aids to convenience and comfort pedestrian movement]; and (4) Mathematical Models.

> NTIS Order #: PB-214-672 PC \$3.00, 95¢

Title: "Bus Transit Planning and Operations, Selected References"

Author: Northwestern University, The Transportation Center

Date: June, 1972

Project No. IL-11-0005

Keywords:	1.	Bibliographies	7.	Bus,	design
	2.	Routes and Routing	8.	Bus,	minibus
	3.	Schedules and Scheduling	9.	Bus,	jitney
	4.	Vehicle, monitoring	10.	Bus,	busway
	5.	Dual-Mode Systems	11.	Bus,	priorities
	6.	Bus	12.	Bus,	feeder

Abstract: This bibliography lists 483 references published between 1965 and 1971 on the operation and development of bus transit in the United States. The entries include reports, conference papers, and periodical articles drawn from the Transportation Center Library collection. Arrangement is topical with each entry identified by a section/item alphanumeric. The report concludes with a geographic index.

Topical categories include: general research; vehicle and driver routing and scheduling; access and waiting time; speed and delay in street traffic; identification, communications, and control; fares and fare collection; buses; minibuses and jitneys; feeder service; freeway operations; busways; dual mode; demand service; and area studies.

> NTIS Order #: PB-214-751 PC \$3.00, MF 95¢

Title: "An Annotated Bibliography on Urban Goods Movement"

Author: Peter L. Watson (Northwestern University, The Transportation Center)

Date: November, 1972

Project No. IL-11-0021

Keywords: 1. Bibliographies 2. Freight Movement 3. Distribution Systems

4. Trucks and Truck Lines

Abstract: This report is an annotated bibliography on urban goods movement containing 275 entries from books, articles, reports, and other source materials.

Each entry includes complete bibliographic data and a brief abstract capsulizing major topics covered. The bibliography is indexed by author and by 19 subject categories including: trucking, terminals, transportation studies, railroads, urban planning, models, highways, mass transit, transport economics, location, distribution, transportation facilities, regulation, goods movement, traffic/congestion, transportation demand, manuals, general, and miscellaneous.

> NTIS Order #: PB 219-107 PC \$5.45, MF 95¢

- Title: "A Computer System for Interactive Analysis and Planning of Urban and Transportation Systems"
- Author: Yehuda Gur (University of Illinois at Chicago Circle, College of Engineering)

Date: May, 1972

Project No. IL-11-0024

Keywords: 1. Urban Development, planning 2. Computer, applications

Abstract: This paper describes the Interactive Transportation Analysis System, INTRANS. INTRANS is a man-computer interactive graphics system designed to serve transportation and urban planners. Presently, INTRANS is being used mainly for analysis of spatial data. Its major use in the future will be as a skeleton for interactive planning models under development. INTRANS operates in the Computer Center of the University of Illinois at Chicago Circle, and it uses an IBM 370 as the central processor.

The paper defines the need for interactive graphics in planning, the areas where its use is likely to be most effective, and the major problems in its implementation and use. INTRANS is described with reference to its major elements and applications, system design, geographic identification methods, the data management system, display routines, the interpreter, and other relevant aspects. The paper concludes with a description of plans for development, both for the near and far future.

> NTIS Order #: PB-216-599 PC \$3.00, MF 95¢

Title: Design Criteria to Reduce Vibration and Noise in New Rapid Transit Systems Author: Marshall Silver (University of Illinois at Chicago Circle) Date: November, 1972 Project No. IL-11-0024

Keywords: 1. Noise and Noise Control
2. Vibrations
3. Rail, systems planning and design

Abstract: Excessive vibration and noise may have adverse effects on the acceptance by the community of new transit networks and can affect the comfort and ridership of passengers who use the vehicle. The report presents information on current noise levels existing in urban areas, and summarizes data describing noise and vibration levels generated by different components of existing transit systems. A summary of noise and vibration criteria currently being used by some major transit operators is presented, providing a basis for developing limiting noise and vibration formulas for a variety of transportation technologies.

Recommended design criteria established for operating systems are presented to assist the transportation designer in the development of criteria that satisfy local conditions. In addition, design strategies that may be used to limit the development of noise and vibration in transit system components are discussed and illustrated. These include wheels and guideways, equipment and fixed plant equipment.

 NTIS Order No.
 PB-221-416

 PC \$5.00
 MF .95¢

Title: "A Study of Bus Transit Planning in Small Urban Areas - Final Report" Author: Michael S. Herman, et. al. (Purdue University, School of Civil Engineering) March, 1973 Date: Project No. IN-11-0001

Keywords: 1. Public Ownership

2. Small Cities

5. Bus, Intracity

- 6. Financing Mass Transportation
- 3. Management, Operations and 7. Government, Urban Techniques
- 4. Management, Planning and Analysis

Abstract: In recent years private bus transit companies in small urban areas have been declining, which has often forced public takeover of systems. In order for a city to improve the bus system and operate it more efficiently, it is necessary to obtain data upon which to base recommended changes. The report discusses procedures that can provide much of the information upon which local decisions are made. In addition to providing a bus transit planning process, the report provides alternatives to a city for conducting various phases of that planning process. The information for these guidelines is from current literature, bus transit studies and discussions with persons active in the field. The study provides a broad treatment of many facets of bus transit planning, but does not claim to be all-inclusive.

The report begins with an analysis of alternatives for the first stage of planning and covers the planning process from public acquisition of the bus transit company, to implementation of the improvement and/or management plan. Categories covered in the report are: (1) Managing a Study; (2) Establishing goals, objectives and criteria for evaluation; (3) Collecting data on the existing system, area characteristics and potential ridership characteristics; (4) Projections and forecasts; (5) Alternative designs and analysis: (6) Selecting an alternative; (7) Implementation, including acquisition of operations and Federal assistance; and (8) Continuous Monitoring and evaluation of the system.

Throughout the report, local decision-making is emphasized, as is the nature of the report as only a guideline. Appendices include information and examples of a small city going through the processes outlined in the bulk of the report.

> NTIS Order No. PB-221-495 PC \$14.50 MF .95¢

Title: "Mass Transit in Scotlandville: Demand and Response"

Author: Roosevelt Steptoe and Theodore Poister (Southern University and A&M College)

Date:	Janua	ry, 1973		Project No. LA-11-0047			
Keywords	: 1. 2. 3.	Bus, express Bus, feeder Routes and Routing	4. 5.	Ridership, attraction Surveys			

Abstract: This report reviews a two-phase project to improve public bus transportation in Scotlandville, a low-density black residential area of Baton Rouge, Louisiana. Surveys of area households and travel patterns provided data for the development of a new main line bus route to the central business district and co-ordinated feeder service.

Under Phase I of the project, this new service was implemented by the local transit authority. Phase II consisted of evaluation and the synthesis of further recommendations.

Ridership surveys revealed a 15% increase in transit use under the new system; in addition, the transit service area was shown to have increased significantly. An attitude survey indicated that an overwhelming majority of riders were satisfied with the new service as opposed to only about 15% prior to implementation.

Present service and ridership are examined with reference to travel times, walking distances, travel patterns, shuttle usage, revenue analysis, and specific complaints and suggestions. Three future recommendations are advanced regarding express bus service, development of a second main line, and operation of a special shuttle route.

> NTIS Order #: PB-213-168 PC \$3.00, MF 95¢

- Title: "Studies of High Activity Density Area Circulation Systems, l: A Bibliography"
- Author: Frances T. Bolger (Massachusetts Institute of Technology, Urban Systems Laboratory)

Date:	1972			Project No. MA-11-0005
Keywords:	1.	Bibliographies	5.	Pedestrians
	2.	Distribution Systems	6.	Urban Development, planning
	3.	Center City	7.	Trip Generation
	4.	Land Use	8.	Research Activities

Abstract: This report is a bibliography of research on central business district circulation designed to update an earlier Bibliography on Central Business Districts prepared by the Council of Planning Librarians. The latter reference lists studies published between 1940 and 1962; the present report contains bibliographic data for relevant materials published between 1960 and 1969.

Bibliographic entries are broken down among eight topical categories, including: (1) general; (2) bibliographic; (3) design; (4) land use, value, and traffic generation; (5) open spaces, plazas, malls; (6) pedestrian circulation; (7) reserach methods, models, and techniques; and (8) transportation.

> NTIS Order #: PB-214-452 PC \$3.00, MF 95¢

	leted Systems"								
Author:	r: David Gordon Wilson, Henry Holton Fuller, Jr., James Bell Rothnie, and Roger Evans (Massachusetts Institute of Technology, Urban Sys- tems Laboratory)								
Date:	1972			Project No. MA-11-0005					
Keywords	: 1.	People Movers, Palleted	7.	Freight Movement					
	2	Systems	ö. 0	Propulsion Systems, electric					
	۷.	Dual-Mode Systems	9.	Guideways					
	3.	Distribution Systems	10.	Guides and Guidance					
	4.	Conveyors	11.	Power Distribution					
	5.	Computer, applications	12.	Suspensions					

Title: "Studies in Automated Guideway Transportation, 2: Four Papers on Pal-

Abstract: This report presents four papers on palleted automated transportation (PAT), an innovative dual-mode concept in which a series of pallets moves through a continuous-flow system to accept unmodified passenger vehicles, passenger capsules, and freight containers. PAT systems are propelled by vertical axis synchronous motors with shaft mounted cog gears on each pallet.

6. Computer, programming

"Pallet Systems for Integrating Urban Transportation" provides a general description of the PAT concept with emphasis given to a review of design alternatives. The relative advantages of pallet systems vs. special-vehicle or converted-vehicle dual-mode concepts are examined. The author also discusses design alternatives for suspension, propulsion, spacing control, switching, power supply, and braking. The current status of PAT technology is summarized along with a brief note on system optimization.

"Improvements of the Palleted Automated Transport System Model" reports on the physical development of a scale-model PAT for component studies. Attention is given to the variable-frequency power supply system, the addition of power commutation to a new rail design, and alterations to the vehicle model.

"Control System and Simulation of a Palleted Automated Transport System" describes the design and implementation of a central control system for PAT and a simulation exercise for its testing. Computer programs for the simulation routine are described in detail.

The final paper outlines the "Design and Construction of a Computer-Controlled Model of the Palleted Automated Transport System." Physical design of the model is described in detail with reference to model configuration, motor and drive, guide arms and power pick-ups, entrance and exit ramps, method of operation, and the acceleration control system. Preliminary design methods of the full-size vehicle suspension are also described.

> NTIS Order #: PB-214-453 PC \$3.00, MF 95¢
Title: " Personal Rapid Transit Station Design "

Author: Richard Nathenson (Massachusetts Institute of Technology, Department of Mechanical Engineering)

Date: June 1972 Project No. MA-11-0005

Keywords:	1. 2. 3. 4.	Personal rapid transit People movers Distribution systems Rail,stations and terminals	5.	Quantitative analysis

Abstract: This report is a study of station design for personal rapid transit (PRT) systems. Such stations must provide a compact but fast and efficient interface between the system guideways and the surrounding environment. The way in which guideway vehicles, people, and personal vehicles interact in the station obviously has an enormous impact on station efficiency and therefore on the overall system efficiency.

Various station designs have been assessed qualitatively, but little quantitative analysis has been done. This report enumerates on commonly mentioned station designs and suggests several other new configurations. A qualitative discussion of the advantages and disadvantages of various station designs is also given. Quantitative values of the amount of land required and the characteristic service time for each station type are developed. Comparisons of station types are made and finally, recommendations for further work are given.

Appendices include information on kinematic formulae, passenger acceleration and jerk comfort limitations, relation of radius and curvature of path to velocity and acceleration, relation between curve of guidewall and curve followed by center of vehicle, parameter analysis of simplified dock bay, station diagrams, rapid transit station design goals, and references.

> NTIS Order No. PB-221-420 PC \$5.45 MF .95¢

Title: "Archimedean-Screw Accelerators for Automatic Transportation " Author: Andrew M. Valaas (Massachusetts Institute of Technology, Department of Mechanical Engineering) Date: May, 1972 Project No. MA-11-0005 Keywords: 1. Personal Rapid Transit 2. People Movers

3. Guideways

Abstract: Continuous-flow automatic transit systems such as personal rapid transit or people movers require automatic control of acceleration and merging of individual vehicles into the mainline. This report summarizes work done in developing a mechanical accelerator which performs this task. A variablepitch screw the length of the accelerator lane was chosen as the most practical method. The various geometric parameters and relationships were studied, including force levels and efficiencies. Constraints on the design are also listed. A screw was specifically designed for a model of the proposed Palleted Automatic Transportation system, observing the passengercomfort limits on jerk and acceleration.

Two screws, one of fabricated construction and the other machined, were built and tested. The fabricated one accelerated a test pallet successfully, although with a slight roughness which, according to the author, was due to inaccuracies in the construction of the model and would not appear in large-scale systems. The machined screw performed quite smoothly. Both accelerated the pallets to a final speed of four feet per second.

A pallet was also designed for the system. Normally pallets are guided by the left guidewall, but switching was achieved by transferring guidance to the right guidewall. The operating linkage of the pallet also firmly latched the pallet to the left side.

This report indicates that further study should be done in integrating the accelerators and decelerators into a complete model of the entire system, as well as the lateral stability of pallets with various guidance systems and the type of suspension and castering required for pallet wheels.

Illustrations and a list of references are included.

NTIS Order No. PB-221-555 PC \$6.00 MF .95¢ Title: "An Extension of the Newark City Subway System: Its Ridership, Station Location, and Effects"

Author: Douglas K. Condon (Newark College of Engineering)

Date: November, 1971

Project No. NJ-11-0002

Keywords:1.Rail, systems planning and
design3.Ridership, attraction
4.2.Rail, stations and terminals

Abstract: An expanded rapid transit system for Newark, New Jersey, has been proposed. The purpose of this report was to investigate the feasibility and impact of an extension to the existing City Subway System with reference to ridership, land use, station location, and other effects. The existing system and its development history are reviewed in detail. Alignment and corridor determination of the proposed subway extension are also discussed.

Survey data were used to develop preliminary ridership estimates for the subway extension. Present land use and demand are reviewed, and the report presents calculations of future trip generation and auto diversion in the study corridor. Tentative station locations are described as reference points for land use and other impacts.

Adverse and beneficial effects of the subway extension are summarized with reference to automobile and bus usage. Effects of the proposed extension on the existing system and equipment are discussed, and the report concludes with recommendations for future research.

> NTIS Order #: PB-216-598 PC \$3.00, MF 95¢

Title:	"Development of Transportation Peaking Evaluation Procedures"					
Author:	Roger P. Moog (Newark College of Engineering)					
Date:	November 1972 Project No.: NJ-11-0023					
Keywords:	 Traffic, congestion Traffic, peak-hour Traffic, analysis Traffic, flow Surveys 					

Abstract: This report evaluates the effect of the Staggered Work Hours Program in midtown Manhattan, designed to spread out work hour schedules over a wider spectrum of times. The program goal is a lessening of peaking through the spreading out of the transportation demand of midtown workers. The procedure for evaluating this program involved classification by systems analysis nomenclature, development of a survey procedure, and formalization of a peaking evaluation procedure format adaptable to various transportation peaking studies. This format includes, in order, the following factors: (1) determination of peaking locations, (2) critical variables to be sampled, (3) survey program layout and coordination, (4) presentation of data, and (5) analysis and peaking behavior conclusions. The suggested categories in which evaluation can take place are passenger loading, travel time, regularity of service, efficiency of station operations, and level of service to the passenger.

The format for peaking evaluation described in this report will be used for surveys taken before the implementation date for Staggered Work Hours. The final benefits will not be known until the "after" surveys in the spring of 1973. Title: "An Analysis of Household Locational and Tripmaking Behavior"

Author: Robert N. Green (Newark College of Engineering)

Date: November, 1971

Project No. NJ-11-0023

Keywords:1. Trip Generation42. Ridership, profiles53. Quantitative Analysis

Demography
 Housing

Abstract: Census data for tracts located in the tri-city area of Patterson, Passaic, and Clifton, New Jersey, were used in this study of household and tripmaking behavior. The purpose of this report was to illustrate and evaluate a method by which transportation and land use planners can view the overall process of urban growth and development.

The author employed a multiple regression equation model to estimate the relationship among six dependent variables selected to describe four aspects of locational and tripmaking behavior: (1) residential density, (2) automobile ownership, (3) modal choice, and (4) length of the journey-to-work. Research methodology and analyses are examined in detail. The probable effect of various changes among the variables is also estimated.

The author concludes that income and automobile ownership are the major determinants of locational and tripmaking behavior, and that the level of transit usage among workers is not sensitive to significant changes in the level of public transportation service.

> NTIS Order #: PB-213-622 PC \$3.00, MF 95¢

Title: "An Analysis of Bus Demonstrations in Low Density Areas"

Author: Vincent J. Truncellito (Newark College of Engineering)

Date: November 1972

Project No. NJ-11-0023

Keywords:1. Bus4. Poverty2. Bus, Feeder5. Suburb3. Ridership6. Bus, Commuter

Abstract: This report concerns itself with a variety of bus demonstration projects carried out in suburban areas (in the New York Metropolitan Area). Three types of service were analyzed. The first studied the access by low-income residents to suburban employment concentration areas. The second employed low-capacity vehicles in a study of the same subject and the third is concerned with feeder routes.

Initial data concerned daily and monthly graphs of ridership, expense, and revenue figures of each route. The graphs were then studied and compared in order to determine the varying degrees of success or failure of the projects. It was found that the average results of the routes were similar despite the differences in type of service.

Taken into consideration for the study were the effects of weather, age, income, publicity, and weekday, weekend and holiday ridership. Feeder route studies included the location of trains and of parking facilities with individual statistics on the percentage of people in an individual suburban area who owned an automobile and statistics on teenagers in areas where they composed a large segment of the population.

Graphs and charts are included as well as a bibliography of reference materials.

Title: " Technical Inputs in the Urban Transportation Planning Process, Syracuse Metropolitan Area: A Case Study-"

Author: Theodore Poister (Syracuse University, Urban Transportation Institute, Metropolitan Studies Program)

Date: December 1972

Project No. NY-11-0005

Keywords: 1. Urban Development, Planning 2. Government, Urban

Abstract: This report examines one aspect of the planning process used in the field of urban transportation; the data base employed and the analytical techniques applied to it. Using the Syracuse metropolitan area and its major transportation planning effort as a case study, the report investigates the more technical side of the planning process, concentrating on the adequacy of the data used, the power of the modeling techniques employed, the scope of the process especially evaluating the alternative plans as defined by the capacity and limitations of the objective character of the techniques, and the information exchange among the participating agencies.

The purpose is the evaluation of the present state of the art and the relation of the Syracuse experience to that of other studies and literature in the field. The paper begins by identifying the institutions involved, moves to a review of the work done by the Syracuse Metropolitan Transportation Study, and concludes with observations on some of the problems encountered. The author comes to the conclusion that the SMTS study compares favorably with other transportation studies, most of which employ the same procedure, while others takeinto account fewer factors. Shortcomings pointed out include a lack of accurate measurement of transit comfort, degree of air pollution or the value of a person's travel time. However, the author is hopeful that these difficulties may eventually be surmounted through the use of attitudinal surveys and the establishment of a minimal acceptable level of factors which have a direct influence on passenger comfort and air pollution.

A bibliography is included.

Title: "Transportation Problems of the Autoless Worker in a Small City" Author: Alice E. Kidder and Arthur Saltzman (North Carolina Agricultural and Technical State University) Date: October, 1972 Project No. NC-11-0002 Keywords: 1. Employment 5. Private Transportation, auto-2. Trip Generation 5. Private Transportation, auto-3. Poverty 6. Ridership, profiles 4. Surveys 7. Modal Split

Abstract: This research examined the transportation problems of low-income residents in Greensboro, North Carolina, with special emphasis on the autoless worker. Relevant sources in the literature are reviewed, and background data on the Greensboro area are provided.

Survey data revealed a strong auto orientation among lower income families. Survey methodology and sample questionnaires are provided. Attention was focused on mode choice patterns among low-income workers and on patterns of access to employment locations. The research examined demographic characteristics, bus ridership, other modes of transportation, and comparative data from previous studies. Access patterns were investigated with reference to job search characteristics, correlates of carlessness, and other employment-related transportation effects.

Of the autoless respondents, more than half used someone else's automobile as a principal mode for the journey to work. An important segment of the working poor also included "captive" riders of the transit system; these workers were typically older, more likely to be female than male, and more likely to be black than white. Little significant difference appeared between the average hourly wages of auto-owning and autoless workers. Consequently, any alternative transportation system for the city will have to charge low fares in line with the current fare structure.

> NTIS Order #: PB-213-131 PC \$3.00, MF 95¢

Title: "The Pittsburgh Parking Strike"

Author: Lester A. Hoel and Ervin S. Roszner (Carnegie Mellon University, Transportation Research Center)

Date: December, 1972

Project No. PA-11-0007

Keywords:	l.	Industrial and Labor Relations	4.	Private Transportation, automobile
	2.	Parking, facilities	5.	Bus, commuter
	3.	Ridership, attraction	6.	Center City

Abstract: A strike by Pittsburgh area parking lot employees in August, 1972, closed all but about 1,800 of the 25,400 downtown parking places. With 900 fringe parking lots also closed, fewer than 20% of the area's total parking capacity was available. This report attempted to investigate the impact of the parking strike on commuter travel and transit usage.

A principal conclusion is that large numbers of automobile commuters found alternative means of transportation, especially in car pools and on public transit. During the strike, the number of autos entering the central business district declined by nearly 25%. The report examines the strike effects on retail business sales, entertainment patronage (a 60-70% decline), and job absenteeism. The availability of alternative transportation modes is cited as a major factor in the low absenteeism observed.

Plans for local stores to encourage transit use by offering free transit trips to shoppers, the attitudes of businessmen toward transit, and editorial reaction by the local press are described. Changes in the normal operations of bus and trolley service are discussed along with comparative ridership and revenue data for the periods before, during, and after the strike.

> NTIS Order #: PB-213-789 PC \$3.00, MF 95¢

Title: " Public Transport Innovations in Principal European Cities "

Author: Lester A. Hoel (Carnegie-Mellon University, Transportation Research Institute)

Date: May 1973

Project No. PA-11-0007

Keywords:	1. 2. 3.	Urban development and planning Land use Financing mass transportation	4. 5.	Government, urban New towns
	J.	rinancing mass transportation		

Abstract: This report describes several innovations in European public transport that have been adopted as solutions to urban transportation problems. The outcome of continued transport investment in Europe has been notable. Although the automobile is in great evidence, public transport plays a vital role in reinforcing the central city as a focus for employment for employment and commercial activity. Financing and land use planning policies are significant factors that have contributed to public transport developments in Europe and are addressed in this report.

The cities discussed include:

Hamburg - status of transportation prior to 1965, the Hamburg Transit Federation, results of integrating transport services, innovations in service and operations.

Gothenburg - improvements for a medium size city, the traffic restraint scheme.

London and Paris - renewal of older systems to serve changing transportation needs, the Aerotrain.

Rotterdam - technical innovations for a new metro line, the subsidy issue.

Runcorn - the town plan concept, the land use-transportation plan, present status of construction.

Montreal was also studied and this report addresses the function and aesthetics of the Metro system, system design and configuration, and the grid system.

The European philosophy has been to maintain and enhance the central city by improving accessibility to the center through better public transport and by enforcing that accessibility within the center by creating reserved streets for pedestrians, shopping malls, street underpasses with escalator connections, and bicycle paths. Land use control policies enforce the role of transportation systems in order to serve the adopted plans. Coordination among professional disciplines is evident in the implementation of transportation planning programs.

> NTIS Order No. PB-221-419 PC \$4.50 MF .95¢

Title: "A Comparative Study of Urban Transit Technologies: The Service Specification Envelope Approach"

Author: John C. Rea and James H. Miller (Pennsylvania State University, Pennsylvania Transportation and Traffic Safety Center)

Date: August, 1972

Project No. PA-11-0010

Keywords:	1. 2. 3. 4.	Ridership, volume Speed and Speed Control Fare, cost determination Bus, cost	5. 6. 7.	Traffic, flow Quantitative Analysis Qualitative Analysis
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Abstract: The service specification envelope is an evaluative tool for the comparative analysis and selection of alternative urban transit technologies. This concept defines the area of applicability of a given technology and assesses the relative quality of the service offered.

Economic viability and physical capacity are the basic criteria for evaluating the applicability of transit technologies. In turn, these variables are determined by the range of passenger flows for a given system in operation. Thus the service specification envelope approach determines the range of passenger flows along a transit link for which a given technology operating at a given headway may be utilized.

Three independent variables for the analysis are examined in detail. These include: (1) transit operating costs, (2) transit fare structures, and (3) capacity limit of the system. With reference to operating costs, the authors note that two additional considerations are the extent to which costs are to be covered by farebox revenues and the operating context of the system (eg. linehaul, collector-distributor, etc.). The quality of service is then determined in terms of speed, measured as feet per second.

The report contains service specification envelopes formulated for eight technologies in the linehaul and collector-distributor modes. The relative superiority of different transit technologies is revealed for various demand volumes and other parameters. Cost models for urban bus transport systems are appended.

> NTIS Order #: PB-212-851 PC \$3.00, MF 95¢

Title: "The Impact of Rapid Transit Systems on Commercial Office Development: The Case of the Philadelphia-Lindenwold Line" Author: Colin A. Gannon and Michael J. Dear (University of Pennsylvania, Transportation Studies Center) Date: June, 1972 Reywords: 1. Rail, systems planning and design 2. Suburbs, business districts description for the Philadelphia-Lindenwold Line" (University of Pennsylvania, Proj. No. PA-11-0011 3. Center City 4. Corridors 5. Land Use 6. Employment

Abstract: This research investigated the impact of a new rapid transit facility -- the Philadelphia-Lindenwold "Speedline" -- on commercial office space development along its suburban corridor. Several employment-related variables were derived as "indicators" of local-level office space activity in lieu of reliable aggregate data.

The metropolitan area was found to be undergoing a major process of suburbanization in which the rapid transit clearly plays an important role. The authors conclude that suburban office development has been stimulated by the Speedline operations which have increased the accessibility of corridors outside the center city.

However, a multitude of intervening variables precludes the precise quantification of this impact which is presently limited, but which is expected to increase with time. The nature of this impact is seen principally as a spatial displacement of business and professional activities from the center city to the suburban corridor.

> NTIS Order #: PB-212-906 PC \$3.00, MF 95¢

Title: "A Strategy for Urban Mass Transportation Route-Technology Selection"

Author: Pobert Charles Rhome (University of Pittsburgh, Urban Mass Transportation Research and Training Program)

Date: July, 1972

Project No. PA-11-0012

Keywords: 1. Routes and Routing 2. Management, planning and analysis Computer, applications
 Schedules and Scheduling

Abstract: The report develops a simulation technique to guide the selection of alternative urban transportation route and technology configurations. Emphasis is given to typical transportation planning processes, technical transportation design criteria, and operating management policy options. These complete factors are catagorized by function and defined through means of descriptive data available at the metropolitan level. These data were assembled into a model which simulates the interaction between demand for transportation and a supply function based upon available technology configurations and associated compatible route alignments. In this model, the transit travel demand is probabilistically assigned to links within a transit network utilizing a minimum time path criterion. The technology configurations are evaluated and characterized into incremental levels of service. The relationship between the travel demand and the available supply is adjusted until an equilibrium condition is reached. Once this condition is reached, the model yields: (1) link's level of service, (2) capacity of the service on that link, (3) the actual assigned patronage, (4) route miles by service level and for the total system, and (5) a financial evaluation by service level and system as to optimal fare structure, potential revenue, and operating cost.

The Pittsburgh central business area was the selected case study to test this model in application. The author concludes that the effect of decreasing the probability for traversing the network along the minimum time path was to produce an entirely different transportation route-technology configuration.

> NTIS Order #: PB 219-066 PC \$3.00, MF 95¢

Title: "Publicos Study"

Author: University of Puerto Rico, School of Engineering, Transportation Institute

Date: June 30, 1972

Project No. PR-11-0001

Keywords:1. Bus, jitney3. Trip Generation2. Private Transportation, bus4. Surveys

Abstract: "Carros Publicos" (Public Cars) are privately-owned, publicly-regulated jitneys which operate over fixed routes to provide intercity and intracity mass transit in Mayaguez, Puerto Rico. There is no other bus service in the city. This report examines the publicos system with reference to system description, importance of user-related attributes, relevance to the local economy, levels of satisfaction among drivers and riders, and economic aspects.

Survey data revealed that the system performs reasonably well and is a principal source of mobility for travelers to downtown shopping and government service centers. The system enjoys a relatively consistent patronage, and the data reveal general satisfaction among operators (most of whom own their vehicles) and passengers.

The economic analysis revealed that the publicos operate at a near break-even level; organizational assistance and fare adjustments are recommended. The report contains complete statistical data and sample survey questionnaires.

> NTIS Order #: PB-212-990 PC \$3.00, MF 95¢

- Title: "A Model Optimum System of Bus Transportation for Improving Economic Opportunities in Medium-Sized Metropolitan Areas"
- Author: John D. Williams and Larry F. Whitener (University of South Carolina, Traffic and Transportation Center)

 Date:
 September, 1972
 Project No. SC-11-0002

 Keywords:
 1. Employment
 3. Routes and Routing

 2. Poverty
 4. Bus, commuter

Abstract: This research investigated the practicality of utilizing urban bus transportation facilities to serve job training and employment needs of disadvantaged and underemployed groups in Charleston, Columbia, and Greenville, South Carolina. Data were collected in surveys of: (1) available bus service, (2) low-income neighborhoods, (3) industrial employment centers, and (4) job training programs in each city.

The results indicate that all low-income areas except one are accessible by public transportation and that several thousand potential job openings will be located within three blocks of a bus route. The authors conclude that an optimal transportation system can be developed with only minor changes to existing bus routes and the addition of some new service.

The survey data collected in each city are provided; in addition, specific recommendations are advanced for improving employment access. The report also emphasizes the importance of advertising and promotion, rider information systems, and job location access information in promoting ridership.

NTIS Order #: PB-212-786 PC \$3.00, MF 95¢ Title: "Economic Evaluation of Transportation Facility Arrangements"

Author: Jason C. Yu and Ronald K. Giguere (Virginia Polytechnic Institute and State University)

Date: September, 1972

Project No. VA-11-0001

Keywords:	1.	Quantitative Analysis
	2.	Computer, applications
	3.	Urban Development, planning

Abstract: A procedure is developed to evaluate the service provided by arrangements of transportation facilities in urban areas. Through the application of this process, a scheme of facility arrangement that optimizes service can be determined. Total community transportation cost was the selected evaluative criterion.

Three specific objectives were encompassed by this research: (1) identification of the variables required to characterize facilities, demand, and modal operating capabilities; (2) development of a model for balancing service and minimizing community transportation costs for urban transportation systems; and (3) development of a computer program to optimize facility arrangements and to evaluate the resulting levels of service.

The report briefly describes transportation facility characteristics and the development of evaluation procedures. A computerized process, labeled TRANSFARE (Transportation Facility Arrangement Evaluation), was developed to permit application of the transportation facility evaluation. A description of the TRANSFARE computer model is provided along with specific program procedures and output.

A sample urban transportation network was tested to illustrate the practical utility of TRANSFARE. The developed method applies only to a specialized auto-bus urban transportation system; however, the author concludes that minor modification will permit its application to more complex urban networks. In addition, the report concludes that given certain information about the roadway network, expected travel patterns, and modal operating characteristics and costs, an optimal facility arrangement can be determined from a set of alternatives.

> NTIS Order #: PB-214-773 PC \$3.75, PC 95¢

Title: "An Attempt to Simulate the Relationship Between Certain Social Factors and Transportation in a Low Income Area "

Author: Bruce G. Phelps and J.W.Dickey (Virginia Polytechnic Institute and State University)

Date: December 1972

Project No. VA-11-0001

Keywords: 1. Social benefits and costs 2. Computer applications 3. Poverty

Abstract: A computer simulation model of the relationship between education, health, and income was developed for a low-income area of Miami, Florida. A basic assumption was that a causal, circular relationship exists among these factors and that change in one will give rise to an accumulative advance in the others.

The estimates obtained from the model were for the ten year period from 1960 to 1970. This confirmed the general absence of change in the study area. The education, health and income components remained at or near original levels.

Using these estimates as a datum, modifications were then introduced into certain model variables to simulate the effect of an improved transit system. With the exception of health, which did seem to be noticeably affected by transit service, the general pattern of the study area remained unchanged.

The conclusions of this research were: (1) Low-equilibrium systems, such as the urban ghetto, have substantial inertia in their social processes. This inertia minimizes the effects of social and economic changes, (2) Change, to be effective, must concentrate on strategic system variables and must be of large magnitude and occur over a long period, (3) The circular connectivity of processes in ghetto areas is difficult to achieve, (4) Transportation does not appear to be an important catalyst to system change.

References and a substantial bibliography are included.

NTIS Order No. PB-220-833 PC \$4.50, MF 95¢ Title: "Communication Innovations, Urban Form and Travel Demand: Some Hypotheses and a Bibliography -- Research Report No. 71-2"

Author: Richard C. Harkness (University of Washington at Seattle, Departments of Urban Planning and Civil Engineering)

Date: January, 1972				Project No. WA-11-0003				
Keywords:	1.	Communications	4.	Trip Generation				
	2.	Bibliographies	5.	Urban Development, planning				
	3.	Center City	6.	Employment				

Abstract: Recent advances in the field of telecommunications may substantially affect future urban life and form. Possible impacts resulting from communications innovation are described, particularly as they relate to urban spatial patterns and travel demands. The author hypothesizes that improved telephone and television services may reduce the need for face-to-face contacts in certain high-communication activities. Applications are described for government, business, shopping, and other transactions which normally require interpersonal contact.

The implications of advanced telecommunications may be especially important for future urban planning. These innovations may lead to increased diffusion and sprawl of activities no longer tied to downtown areas by the need for physical proximity. In turn, employment decentralization would alter journey-to-work patterns and the viability of certain fixed-route public transit systems.

The need for increased attention to these problems is emphasized. The report outlines several specific research questions, broken down among ten basic categories. These include studies of: urban socioeconomic and spatial development, office employment and locations, office contact patterns, telecommunications systems, the effectiveness of communications substitutes for face-to-face contacts, personal attitudes toward travel, benefits and costs of substitution, the probability of office decentralization, job decentralization and travel demand, and social benefits and costs of decentralization.

The report concludes with a detailed bibliography containing more than 400 individual entries in five major topical categories and 22 subtopics. Major topical categories include: (1) communications, (2) employment, (3) location of urban activities, (4) transportation, and (5) urban.

> NTIS Order #: PB-212-411 PC \$4.50, MF 95¢

Title: "Planning Demand-Adaptive Urban Public Transportation Systems: The Man-Computer Interactive Graphic Approach -- Research Report No. 71-4"

Author:	Matth:	ias H. Rapp	(University	of	Washing	gton	at Seattle)
Date:	June,	1972				Pro	ject No. WA-11-0003
Keywords	: 1. 2.	Computer, a Demand-Resp	pplications onsive Syster	ns		3. 4.	Bus, rapid transit Modal Split

Abstract: A computer-based interactive graphic approach is developed for the planning of demand-adaptive urban transportation systems. Demand-adaptive systems are capable of modification to serve changes in a specific set of transportation needs. The author notes that planning such systems will require more sensitive models and higher degrees of computer assistance than are currently available.

The man-computer interactive graphic system described in this report was designed for analyzing transit service between many origins and a single destination (eg. work trips to a major employment center). Basic features of the transit system -- such as routes, park-and-ride lots, vehicle characteristics, headways, fares, and parking fees -- are inputs to the model. Given these characteristics, the computer can instantaneously predict and display patronage volumes, financial performance, and other impacts of the system design. Planners can thus explore and evaluate a broad range of multiple-attribute alternatives in a short period of time. The prediction process is based upon a modal split/network equilibrium model which is sensitive to all transit system characteristics.

The interactive graphic system was applied in an experiment designed to identify the characteristics of high performance bus rapid transit systems for suburban commuters to the central business district. Sixteen different alternatives were developed from various combinations of demand distribution, network characteristics, trip-making behavior, and required modal split levels. The analysis yielded general guidelines for the structuring and pricing of the bus rapid transit system.

> NTIS Order #: PB-212-540 PC \$3.00, MF 95¢

Title: "Planning Transportation Terminal Systems in Urban Regions: A Man-Machine Interactive Problem-Solving Approach -- Research Report 5"

Author: J.B. Schneider, <u>et</u>. <u>al</u>. (University of Washington, Departments of Urban Planning and Civil Engineering)

Date: April, 1971 Project No. WA-11-0049

Keywords: 1. Site Selection
2. Rail, stations and terminals
3. Bus, stations and shelters
4. Computer, applications
5. Algorithms
6. Urban Development, planning

Abstract: The report describes a man-machine interactive problem-solving system, called LOCATOR, designed to address the problem of locating transportation terminals in a large urban area. The system utilizes intuitive input to apply mathematical programming techniques to problems not otherwise amenable to such solutions due to non-linear and discontinuous functions, discrete variables, and/or ill defined trade-off functions. The LOCATOR system presented in this report was designed to provide near optimal solutions for the location of multi-modal transportation terminals in an urban area of given characteristics.

Elements of the LOCATOR system are described with reference to hardware components, operational characteristics, and a review of initial experience. Specific aspects of a test problem used to investigate the performance of LOCATOR are also reviewed in detail. Two computer-based heuristic search algorithms were developed for the two basic problems investigated in this study: (1) reduction of total travel among zones, and (2) reduction of trip length. Each algorithm is described individually.

Experiments were conducted to determine locations for V/STOL terminals in a hypothetical urban area. The results indicate that the heuristic techniques are quite powerful but not without weaknesses. Ten students employed the LOCATOR system to intuitively "find" a satisfactory solution to the test location problem. Nine of the ten were successful, and three found solutions identical to the best known solution.

The report concludes with a brief discussion of possible extensions and applications of the LOCATOR system. Appended materials include a review of user options in the LOCATOR system and a detailed description of one participant's experience in the location allocation experiment.

> NTIS Order #: PB-202-411 PC \$3.00, MF 95¢

Title: "Break-Even Benefit-Cost Analysis of Alternative Express Transit Systems"

Author: David S. Sawicki (University of Wisconsin at Milwaukee)

Date: October 1, 1972

Project No. WI-11-0044

Keywords:	1. 2.	Bus, busway Bus, express	4. 5.	Right-of-Way Modal Split Bidorship, waluma
	3.	Benefit-Cost Analysis	6.	Ridership, volume

Abstract: A computer-based benefit-cost analysis approach was employed to compare the relative advantages of alternative transit systems for the Milwaukee region. A proposed express busway system on exclusive rights-of-way was compared against the present system of conventional express buses (the Freeway Flyer) and a system of express buses operating on controlled-access freeways. The purpose of this research was to develop and test a break-even benefit-cost model, and to determine the relative economic advantages of each alternative mode for the Milwaukee region.

Prior assumptions and formulation of the model are described in detail. Breakeven benefit-cost ratios for each of the three transit alternatives were calculated for varying demand and modal split parameters. Results of the analysis are provided for five specific cases. Further analysis revealed that only the subjective value of travel time to passengers was a sensitive variable.

The data indicate that the busway proposal is economically unattractive both absolutely and in comparison with the alternative systems. A rational determination of modal split suggests the need for fewer than ten buses per hour, a demand insufficient to warrant construction of the exclusive bus right-of-way. Policy implications of these and other findings are discussed.

> NTIS Order #: PB-213-580 PC \$3.00, MF 95¢

SECTION IV

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