

**LAND USE AND INNOVATIVE FUNDING IMPACTS IN A
PERMANENT BUSWAY/PARK-AND-RIDE TRANSIT SYSTEM:
WORK PROGRAM**

by

Richard L. Peterson and Robert W. Stokes
Texas Transportation Institute
The Texas A&M University System
College Station, Texas 77843

and

Barry M. Goodman Associates, Inc.
Citicorp Center, Suite 3530
Houston, Texas 77002

Technical Report 1086-2
Study Number 2-10-85-1086

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Texas State Department of Highways and Public Transportation
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The Texas A&M University System
College Station, Texas 77843

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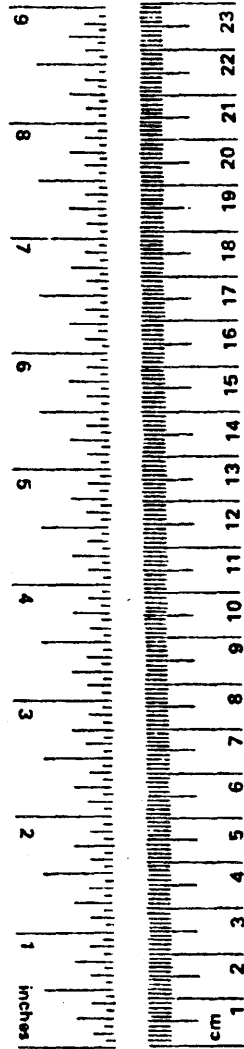
Texas State Department of Highways and Public Transportation
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January 1986

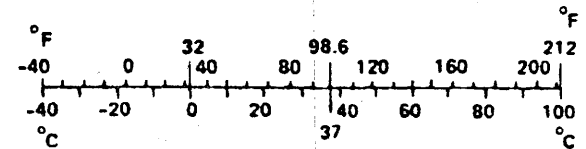
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METRIC CONVERSION FACTORS

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



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



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

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ABSTRACT

This report identifies research issues and outlines methods for performing the land use and transportation impacts phases of Project 2-10-85-1085 (between State and Goodman Associates) and Project 2-10-85-1086 (between State and the Texas Transportation Institute). The details of the data collection and analysis are closely tied to the basic procedures used in other impact studies. The research plan outlines how the work will be performed by proposing a basic framework for the data collection activities and outlining a schedule of anticipated results. This five year research effort will examine transportation and land use impacts resulting from the implementation of an extensive priority system of busways and park-and-ride facilities in Houston, Texas. A comparison of the Houston system will be made with priority treatments being implemented in other urban areas of the U.S. and Canada. Over the duration of this research, three high-occupancy vehicle (HOV) lanes with supporting park-and-ride facilities will be placed in operation in Houston's north (I-45N), west (I-10W) and southeast (I-45S) freeway corridors. The impacts resulting from these HOV treatments will be the object of this research.

Key Words: Land Use, Transportation Impacts, Transitways, Busways, HOV Lanes, Park-and-Ride, Priority Treatment, Development, Retail Sales, Mode Split, Travel Demand, Transportation Planning, Fixed Guideway, Bus Rapid Transit, Express Bus, Impact Studies, Economic Assessment.

IMPLEMENTATION STATEMENT

This project is oriented toward assisting the Texas State Department of Highways and Public Transportation (SDHPT) in the planning and impact evaluation of high-occupancy vehicle (HOV) lanes or transitways. The study concentrates on the freeway corridors in Houston, Texas where priority facilities for HOV's are being constructed. Identification of secondary data sources and a prior survey (Technical Report 1086-1) of relevant literature on similar impact studies provided the primary data bases for development of this work program. The results of this research, when completed, should assist the State Department of Highways and Public Transportation in evaluating potential land use and transportation impacts resulting from implementation of transitways and/or park-and-ride facilities.

This research may be applied nationwide by local, state and federal officials responsible for, or concerned with, busway/park-and-ride system development. Evaluation of land use impacts (if any) associated with permanent transit facility construction will provide valuable guidance to transportation planners and policy makers in assessing alternative improvements.

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

DISCLAIMER

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

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1. INTRODUCTION

1.1 BACKGROUND

The Houston Metropolitan area is currently implementing the most extensive priority treatment high-occupancy vehicle (HOV) lane/park-and-ride network in the nation. Ten miles of contraflow lanes on I-45 North have been in operation successfully since 1979. Three exclusive high-occupancy authorized vehicle lane projects (42 miles) are under construction in Houston's north, west, and southeast corridors, with plans for busways in the southwest and northwest corridors (32 miles). In addition, Houston has 16 major, permanent park-and-ride facilities in operation throughout the metropolitan area; most were built through turnkey arrangements with the private sector. This arrangement achieved cost and time benefits unprecedented in the public transit sector.

Previous busway project assessments have concentrated primarily on transportation data collection and evaluation. This research proposes to examine the impact of Houston's existing and future priority busway/park-and-ride network on land use in the Houston metropolitan area to allow a more accurate prediction of costs, benefits, and land-use impacts associated with planned or proposed HOV transitways.

Since creation of the Houston metropolitan Transit Authority (Metro) in August of 1978, permanent park-and-ride facilities have been developed through the turnkey concept. The turnkey concept involves the solicitation of proposals for a completed park-and-ride facility in accordance with Metro specifications. The turnkey process has saved Metro significant amounts of time, money, and administrative burden. The economies have been so significant, and the park-and-ride program so successful, that the federal government, through the Urban Mass Transportation Administration (UMTA), should give strong consideration to adopting the turnkey approach as an eligible method for use of federal assistance to support facility development. The demand for park-and-ride facilities have been filled to capacity shortly after opening. The turnkey park-and-ride development process has enabled Metro to meet a significant community need in a much shorter time frame than if the traditional development approach had been utilized.

This research will, in addition to analyzing land use impacts, evaluate the impact of Houston Metro's turnkey public/private development program for major park-and-ride facilities. The benefits to the public, Houston Metro, and private sector will be examined. How the turnkey approach can be made compatible with federal legal, technical and procurement requirements to allow UMTA/FHWA financial participation in projects utilizing the turnkey concept will be explored. The turnkey development approach will be tested to see if it might be equally effective to support transit terminal and maintenance facility construction.

The overall program for the land use investigation will extend over a five year period. However, each year will provide a free standing component of the research. The turnkey element will be analyzed during the first year. The land use element will be initiated during the first year and set up for longitudinal monitoring in years two and three as the first phase of the transitway program is implemented and in years four and five as land use changes begin to solidify. Houston's extensive transitway/park-and-ride program, rapid growth, and lack of zoning should provide an excellent free-market laboratory for assessing the land use impacts of fixed bus-related facilities.

1.2 OBJECTIVES

This multi-year study, initiated in late December 1984, has two primary objectives:

1. To measure, analyze, and evaluate the transportation and land use impacts resulting from the construction of permanent busways (transitways) and park-and-ride facilities in the Houston area; and,
2. To evaluate the turnkey concept and to determine its nationwide potential for park-and-ride facility development.

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

- To prepare a detailed work program compatible with other prior or ongoing impact evaluation studies (the object of this document);
- To conduct, based upon available data, case studies of transitway facilities in cities other than Houston for comparison of design and operational characteristics;
- To examine land use impacts of the Contraflow Lane in Houston's north (I-45) freeway corridor;
- To develop a "before" or pre-busway land use data base in Houston's north (I-45 North), southeast (I-45 South) and west (I-10 West) freeway corridors;
- To project anticipated land use impacts, in three Houston freeway corridors, which are likely to occur from implementing permanent busways and park-and-ride facilities; and,
- To document the first year's study data and findings in one or more reports.

Concurrent with the land use study, during the first year, a study of the financing mechanism which has allowed Metro to inexpensively and quickly construct the extensive system of park-and-ride lots is being performed. This part of the research will document the key ingredients which have made the Metro turnkey park-and-ride development program successful. Problems and opportunities associated with the turnkey approach will be identified along with the potential cost/benefits of using this facility development approach on a widespread (nation-wide) basis. The legal compatibility of the turnkey concept with state and federal procurement requirements will also be investigated. All of the turnkey research will be performed and documented by Barry M. Goodman Associates (Project 2-10-85-1085) during the first year of this multi-year evaluation.

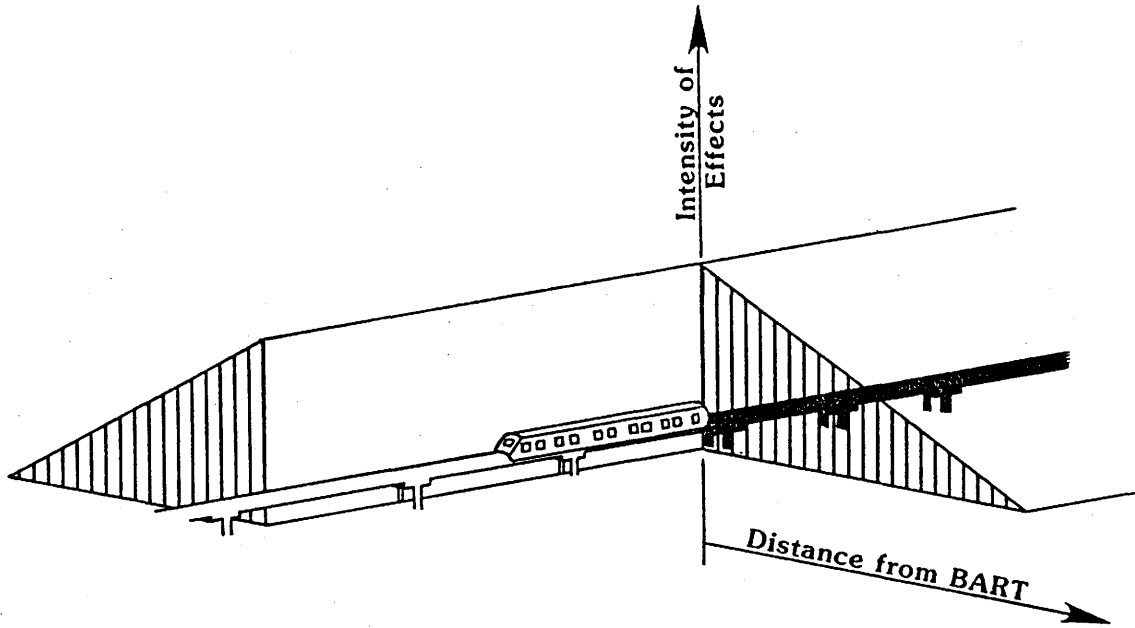
This report, based upon the results of an extensive literature search (1), provides the detailed design of the multi-year work program. Relevant work and studies, summarized herein, will enable the research team to collect and analyze data in a fashion similar to other rail and highway impact evaluation studies. This detailed work program has been prepared and submitted for approval as a separate report in the project report series.

1.3 PREVIOUS RESEARCH

A total of 203 relevant publications were identified during the literature search and review task of the project. Most of these publications were prepared during the late 1970's and early 1980's (55% of the publications were prepared after 1979). The identified publications were cross-referenced and annotated in the first report (1) prepared as part of this research effort. Only a brief review of the research works pertinent to this study is presented here. An extensive listing of publications which may be applicable to this research effort can be found in the Bibliography. The "Definition of Terms" section, found at the end of this report, covers highway, transit, land use and land value terms used throughout and provides a common basis for the reader and research team in conducting the multi-year study (2, 3, 4).

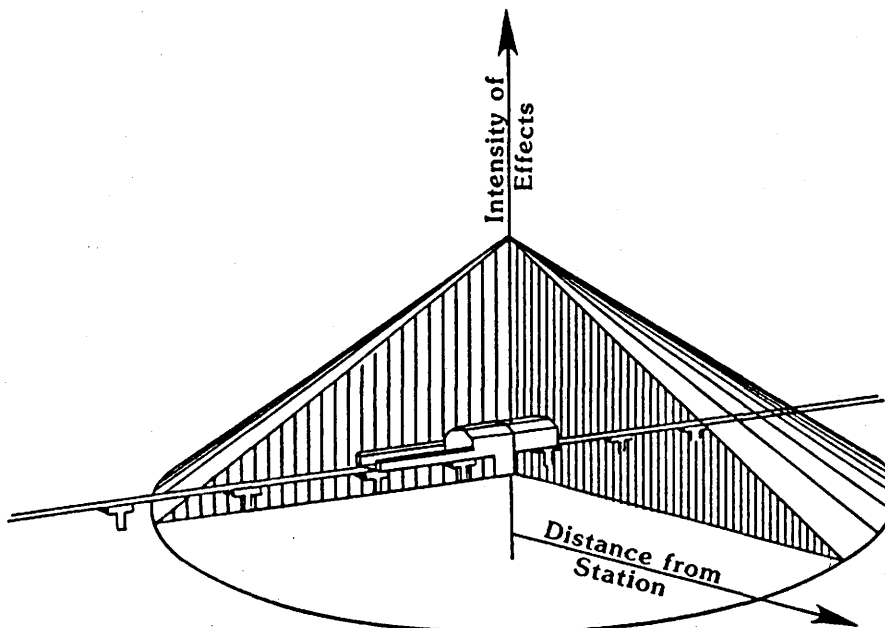
The Bay Area Rapid Transit (BART) system has been one of the most studied and evaluated rail systems in the nation. A 1976 program catalog (33) identified 147 published reports and papers on BART impacts. A 1978 report by Dyett (71) set forth recommendations for long-term monitoring of BART impacts over a five year period. Data collection efforts suggested by Dyett (71) consisted of: 1) Aerial photography (2 year intervals); 2) Building permits (annually); 3) User surveys (2 year intervals); 4) Shopper and workplace interviews (once only); 5) Retail sales in 17 areas (once only); 6) Property sales in 7 areas (annually); 7) Rents in 7 areas (annually); and 8) Key informant interviews from the public and private sectors. An earlier study by Appleyard (23) considered control strategies and "impact gradients" for investigating BART's affect on residential areas. Figures 1 and 2 illustrate the concept of diminishing impacts as a function of distance from the rail line and from a station, respectively. Appleyard contended that the exact size and shape of any BART impact depends not only upon distance but also upon the character of the area, land contour, intervening barriers, land use, composition of population and upon proximity to other transportation facilities (e.g., freeways, arterials, airports) (23). For purposes of the residential study, Appleyard (23) selected a 1-mile distance from the BART line and stations to represent the "impact zone".

The 1-mile distance selected by Appleyard (23) is considerably greater than other studies having a non-residential land use emphasis. Baerwald



Source: Reference (23), p. 20.

Figure 1. BART Impact Gradient from Fixed Guideway (Linear Function)



Source: Reference (23), p. 22.

Figure 2. BART Impact Gradient from Station (Linear Function)

(28) used one-fourth mile to investigate land use change in suburban clusters and freeway corridors. Buffington, et al. (221, 3, 47) used 3 blocks, or a distance ranging from 900 to 1500 feet, from an improved urban arterial and suggested an impact area for highways dependent upon depth of abutting properties, distance to parallel roads, and the socio-economic and physical characteristics of the area. Bain and Escudero (29) proposed an 1800 foot radius around BART stations to provide time series data for development (e.g., commercial) and land use monitoring.

The BART Impact Program was a comprehensive, policy-oriented study/evaluation which began in 1972 and was completed six years later in 1978 (70). In addition to the numerous working papers and data sources/bases (33), the study resulted in nine final reports (70):

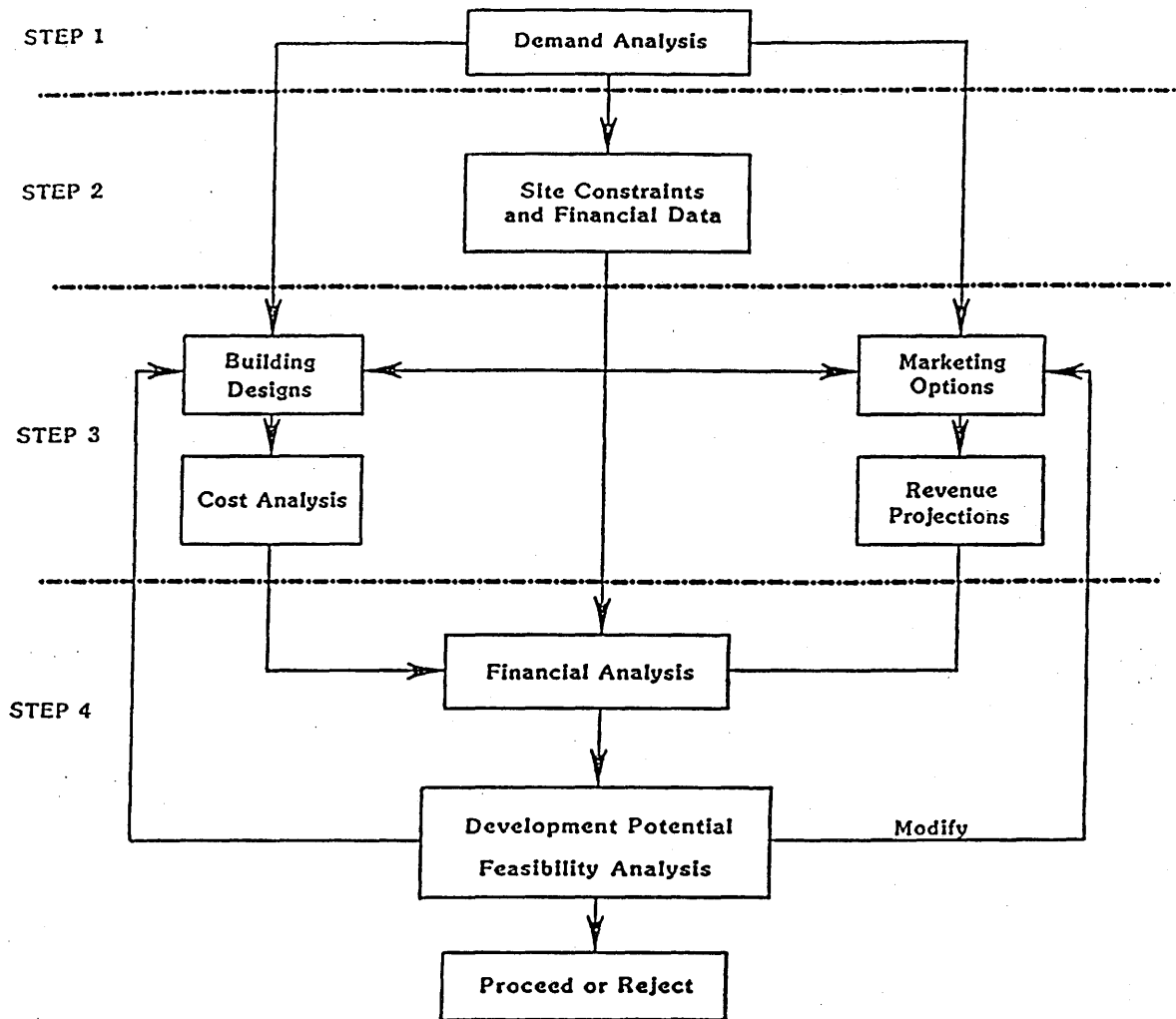
- BART in the Bay Area. The Final Report of the BART Impact Program, 1979 (35).
- Environmental Impacts of BART, 1979 (76).
- BART's First Five Years: Transportation and Travel Impacts, 1979 (88, 139, 179, 180).
- Impacts of BART on Bay Area Institutions and Life Styles, 1979 (69, 134).
- The Economic and Financial Impacts of BART, 1979 (38, 92, 94).
- Land Use and Urban Development Impacts of BART, 1979 (70, 72, 79, 104, 183).
- The Impact of BART on Public Policy, 1979 (30, 88, 89, 95, 99).
- Implications of BART's Impacts for the Transportation Disadvantaged, 1978 (62).
- Federal Policy Implications of BART, 1979 (185).

A critical element in the BART study design was the definition of the No-BART Alternative (NBA) or "the regional transportation facilities and travel patterns judged most likely to have evolved by 1976 if BART had not been built" (70). One consequence of the NBA assumption is that it provides lower levels-of-service and less capacity than the with-BART system; the NBA does not consider how much additional capacity would have been required because of increasing traffic demand and congestion (70).

One facet of the BART program, which is very similar to the Houston study objectives, included an investigation of "Station Area Land Use" (72). All 34 BART transfer stations were included in the investigation with 22 of those stations (65%) being more intensively studied. Three categories of data were collected to identify station area land use changes from 1965 to 1975: 1) ground level photos; 2) aerial photos; and 3) supplementary assessors' land use information (72). A 1500 foot radius surrounding the station was used in the BART investigation; this distance was some 300 feet less than originally proposed by Bain and Escudero (29).

The ability of a transit or highway planner to design a transportation system which promotes economic development is dependent on the planner's ability to understand the developer's decision making process. Each developer acts as an individual, reacting to his or her needs, when assessing the development potential of any specific location (i.e., adjacent a transit-way or park-and-ride site). However, when these individual behavior patterns are aggregately viewed, the collective pattern is consistent and can be simulated by a model which reduces the process to a logical sequence of procedures, as shown in Figure 3. These procedures involve four steps (148): 1) the determination of the demand potential expressed as an absorption rate for types of economic development at a special route, station or site (absorption rate is the measure of an area's ability to attract development over a period of time); 2) the analysis of various site characteristics which can alter the absorption rate; 3) the analysis of various design and marketing options which can be utilized at a specific site; and, 4) a financial analysis of alternative design and marketing strategies for the site. The analyses performed in these four steps will indicate to the developer or planner whether the project should proceed, and will suggest whether changes might make the project more valuable to the community and/or the developer (148).

Development impacts of transit investment projects may be: 1) macro-level intra-regional location shifts by households and businesses (in the aggregate) induced by the introduction of the transit facility; or, 2) station-area development effects and micro-behavioral changes. There is no apparent standard approach to the development impact analysis in transit project studies (210). Some planning studies have used qualitative assessment only, while others have applied various types of urban activity models



Source: Reference (148), p. 4.

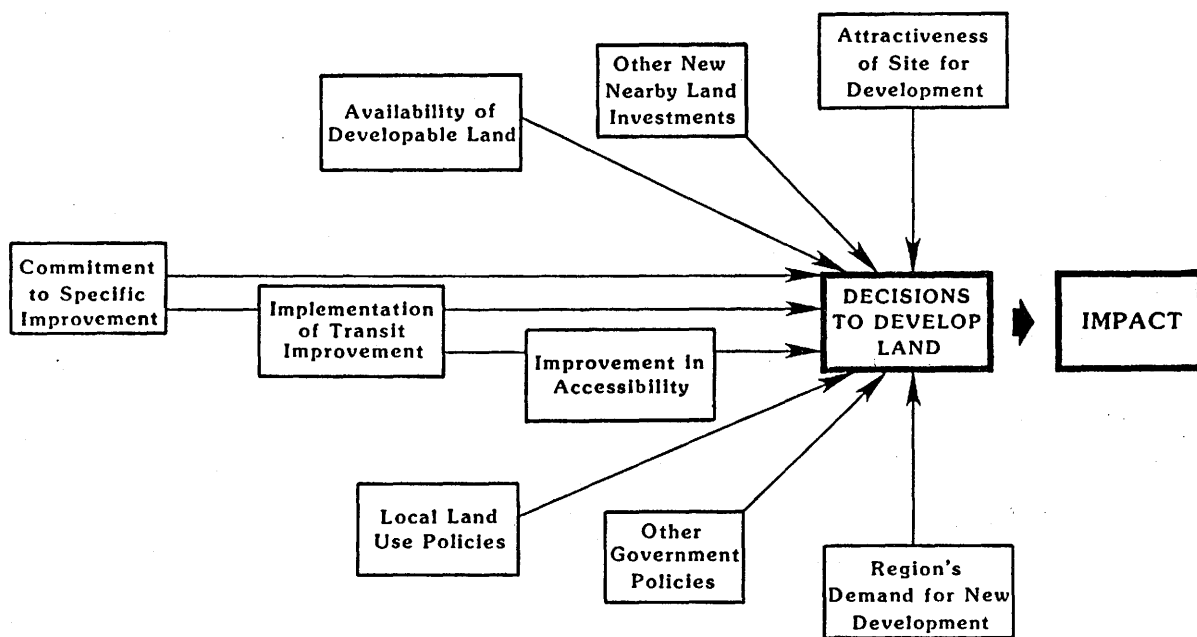
Figure 3. The Four-Step Site Development Model

for quantitative analysis. Ex post studies have included attitude surveys, evaluation of new development activity, and land price analysis. Urban activity models have never been applied on a wide-spread basis for transit impact assessment, perhaps because relatively few have been conveniently calibrated and made available for use (210). Models have been, however, applied to analyze development impacts of BART and of the Buffalo LRT (146, 210).

Findings on development impacts of transit investment projects have been mixed at best, regardless of method. A summary of earlier studies (116) throughout North America and Europe indicated that major transit investments did tend to stimulate CBD development, but not necessarily under conditions of overall urban economic decline or disinvestment, and mostly when coordinated with other public investment. The study (116) also found that major transit projects had induced some development shifts beyond the CBD, but usually in cases where favorable local economic and public policy conditions existed (210). On the other hand, ex post studies of the Washington Metro have indicated residential development shifts, particularly in the vicinity of stations, due to the transit line, but this effect could be mostly a relocation of new development within suburban subareas rather than significant intra-regional shifts (132). In any event, little evidence has been found to date that strongly supports the objectives of transit investment as effective land use policy, other than supporting the vitality of the CBD (116, 210).

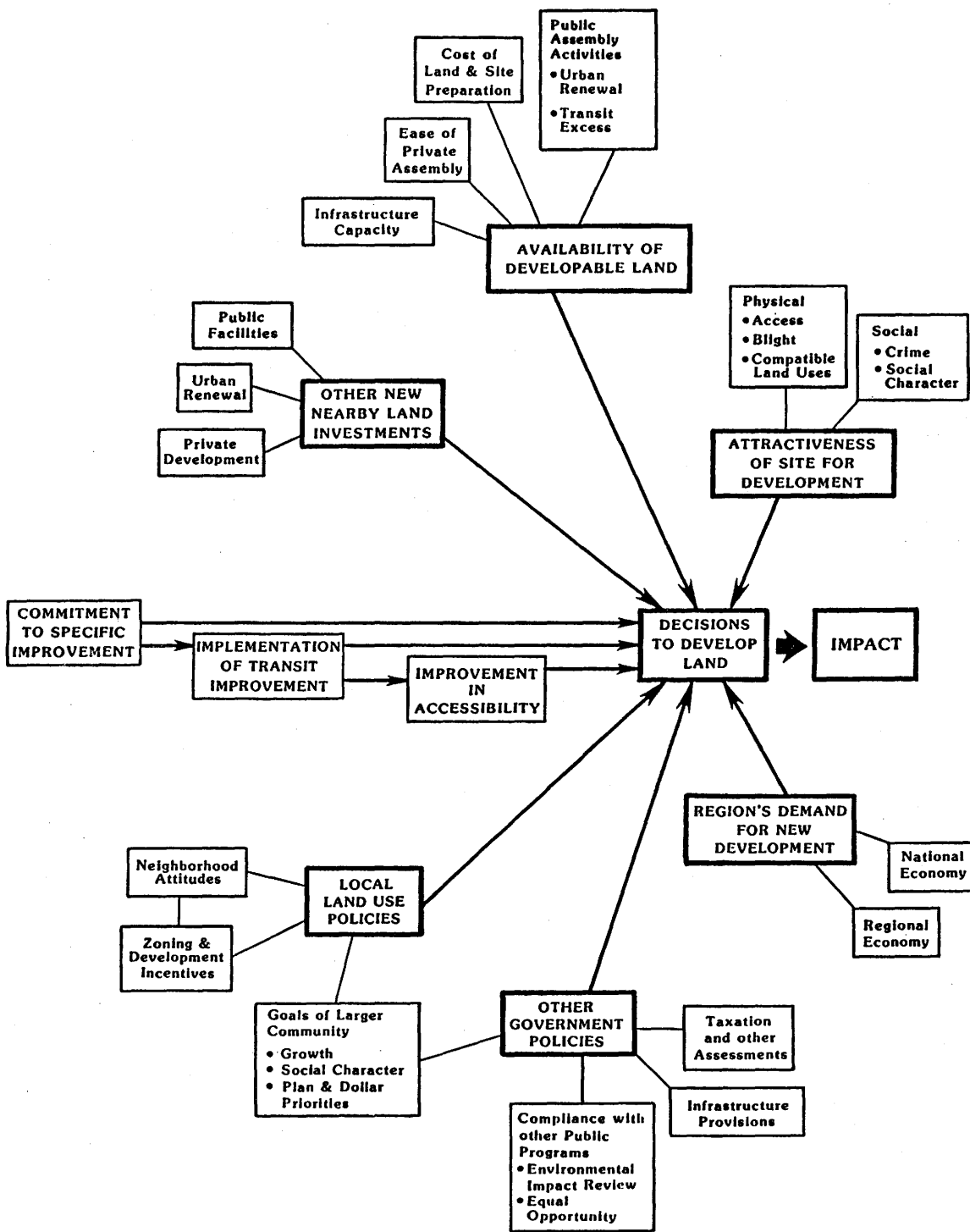
Key factors influencing land use intensification include (116): 1) the region's demand for new office, retail and apartment development; 2) availability of developable land; 3) local policies and zoning (or lack of zoning); 4) attractiveness of available sites; and, 5) other nearby land investments. Figure 4 shows these key factors influencing land development decisions while Figure 5 presents other determinants interacting with these factors in the decision making process (116).

Given the relative newness of busways in the nation, very little data have been collected or experience gained with land use impacts resulting from these types of transportation improvements. For the most part, all research and evaluations have concentrated on the traffic or transportation impacts realized from these priority treatments (5, 20). Therefore, this study effort is new to the research community and to the literature.



Source: Reference (116), p. 7.

Figure 4. Key Factors Influencing Land Use Impact



Source: Reference (116), p. 204.

Figure 5. Factors Influencing Land Use Impacts and the Decision Making Process

2. WORK ELEMENTS

2.1 LITERATURE REVIEW

The initial task in the study was to conduct a literature review to enable this study to benefit from other relevant work and studies. The results of the literature review are summarized in Section 1.3.

2.2 CASE STUDIES

In addition to the literature review, case studies of transitway facilities in other urban areas will be prepared for comparison of facility type, operations, and land use impacts. These investigations will rely upon available data and local studies or investigations done by the particular jurisdictions or agencies.

2.3 TURNKEY PARK-AND-RIDE

The turnkey park-and-ride investigation is concerned with the following four areas of the process:

- 1. Documentation of Houston Metro's Experience.** This task will require a full analysis of Metro request-for-proposal documentation, selection criteria, and park-and-ride development experience. Issues and problems which have resulted from use of the unorthodox turnkey approach will be identified. This task will include contact and meeting with successful and unsuccessful developers of park-and-ride facilities through the turnkey process. Benefits resulting from Houston Metro's use of the turnkey development process will be quantified. Emphasis will be placed upon a comparison of the turnkey process with the normal facility design/development process. Areas to be reviewed include:

Timing

Cost

Quality of Construction

Inspection Capability

Risk to Transit Authority
Risk to Private Developer
Cost Savings

2. **Determination of the Legal Feasibility of Widespread Use of the Turnkey Development Process.** The compatibility of the turnkey development process with state law will be reviewed. Several cities and their states will be reviewed for potential turnkey application and benefits. State procurement regulation and policies which might affect the use of turnkey development will be reviewed. The potential utilization of the turnkey park-and-ride development program on a nationwide basis will be assessed. Recommendations for changes in state legislation which could impact the turnkey concept will also be developed.
3. **Determination of the Economic Benefits of Nationwide Application of the Turnkey Concept.** Scenarios for a broad estimate of the need and opportunity for park-and-ride facility development in large urban areas over the next 10 years will be developed. Scenarios for nationwide cost savings which would result from successful widespread use of the turnkey development process, over use of the conventional development process, will be formulated. The impact of widespread use of the turnkey concept on the need for federal, state, and local support of the park-and-ride facility development will be estimated. Other facilities which may benefit from a turnkey procurement will be identified.
4. **Recommend Changes at the Federal Level.** UMTA policy, legislation, and current procedures will be reviewed to determine compatibility with the turnkey program. Changes necessary in federal and state procurement requirements to accommodate the turnkey park-and-ride development process on a nationwide basis will be recommended.

2.4 CONTRAFLOW LANE IMPACTS

Impact on land use in Houston's north corridor during the history of Contraflow operations will be examined. Public and private sector decisions regarding land use directly resulting from priority bus/vanpool treatment and

park-and-ride facilities will be assessed throughout the north corridor (I-45N) from Houston's downtown to south Montgomery County. Data will be included from the Contraflow service-and-methods demonstration program evaluations performed by the Texas Transportation Institute, Transportation Systems Center, and Metro.

2.5 PARK-AND-RIDE IMPACTS

The research will also evaluate the land use impacts of Metro's Park-and-Ride program on the surrounding community; including increases in land values, land use, developer benefits, community benefits, and associated problems.

2.6 PROJECTED LAND USE IMPACTS

Information gained through examination of Houston's north corridor demonstration Contraflow operation, other recent land use actions, and observations from other cities will be used to project land use impacts likely to occur from implementation of permanent transitways in conjunction with park-and-ride lots in the west (I-10 West), southeast (I-45 South), and north (I-45 North) corridors of Houston.

3.1.2 Case-Studies

To the extent possible, the following information will be gathered for each of the case studies of transitways:

1. A general description of the urban area in which the transitway is or will be located (e.g., population, land area, land uses, employment, and general traffic conditions).
2. Information on current and/or projected system configuration (length, cross-section, access points, terminals and transfer facilities), current and projected traffic volumes, authorized users, and enforcement/operating procedures and problems.
3. Reports and studies on existing and/or proposed transitways (e.g., documents dealing with the traffic/transportation, land use, economic and social/environmental impacts of transitways). Maps, artist renderings, and/or plan sheets will also be obtained.

At this time, it is anticipated that the case studies will focus on existing or proposed transitway projects in the following 13 urban areas of north America:

- Houston, TX;
- Los Angeles, CA;
- Pittsburgh, PA;
- Baltimore, MD;
- Seattle, WA;
- Miami, Fl;
- Minneapolis, MN;
- Ottawa, Canada;
- Washington, DC;
- Denver, CO;
- Phoenix, AZ;
- Atlanta, GA; and
- San Francisco, CA.

A sample letter and tentative mailing list for gathering the case study information are presented on the following pages. A follow-up survey is proposed for the fourth year of the study.

In addition to a mail-out/telephone survey of transitway projects, site visits are proposed for projects in California, Pennsylvania, and Canada. The initial case studies are scheduled for completion in 1985.

3.1.3 Transportation Data

Transportation data needed in the study will be obtained from previous and on-going studies conducted by TTI, Metro, and other research agencies (e.g., SDHPT, Transportation System Center). Table 1 presents a summary of some TTI studies considered relevant to this research effort.

3.1.4 Land Use Data

Land use data needed in the study will also be obtained from secondary sources. Basic data needs include:

1. Aerial Photos of Corridors
2. Site Photos of Park-and-Ride
3. Land Use Maps
4. Population and Employment Data for each Corridor
5. Activity Center Definitions
6. Building Space (Sq. Ft.) in Activity Centers
 - a. Commercial
 - b. Retail
7. Influence Zone Characteristics (1500 ft. surrounding Park-and-Ride; 3000 ft. along freeway)
 - a. Office Floor Area
 - b. Retail Floor Area
 - c. Retail Sales Area
 - d. Residential Units
8. Developer Survey/Opinions
 - a. Land Use Plans and Changes
 - b. Marketing Plans and Changes
 - c. Impact of Transitway on Development Patterns and Land Values

THE TEXAS A&M UNIVERSITY SYSTEM

TEXAS TRANSPORTATION INSTITUTE

COLLEGE STATION TEXAS 77843-3135

URBAN MOBILITY PROGRAM

College Station
(409) 845-1535
857-1535 (Texan)

Houston
(713) 686-2971
850-1390 (Texan)

CASE STUDIES SAMPLE LETTER

Dear Mr.

The Texas Transportation Institute, in cooperation with the Texas State Department of Highways and Public Transportation and the Urban Mass Transportation Administration, is currently conducting a study to assess the land use and transportation impacts of transitways. One of the initial tasks in the study is the compilation of case study information on existing and proposed transitways in North America.

For the purposes of our study, we are defining a transitway as a freeway facility which is physically separated from the general purpose freeway lanes and intended for the exclusive use of authorized high-occupancy vehicles.

If you or your agency has information regarding the planning, design, implementation, and/or operation of transitways in your area, we would appreciate hearing about your experiences. Specifically, the following information would be particularly useful to us at this stage of the study.

- 1) A general description of the urban area in which the transitway is or will be located. Information on population, land area, land uses, employment, and general traffic conditions will be needed to develop comparative profiles of existing and planned transitways in North America.
- 2) Any information on current and/or projected system configuration (length, cross-section, access points, terminals and transfer facilities), current and projected traffic volumes, authorized users, and enforcement/ operating procedures and problems would be appreciated.
- 3) A listing of reports and studies on existing and/or proposed transitways in your area would be useful. We are particularly interested in documents dealing with the traffic/ transportation, land use, economic and social/environmental impacts of transitways. Maps, artist renderings, and/or plan sheets would also be useful.

Any information you can provide will be greatly appreciated. If there are any charges (copying, mailing, etc.) for the materials, please let us know.

I will be contacting you by phone in the next several weeks to discuss the study in greater detail. In the meantime, should you have any questions, please feel free to contact me at our Houston office. Thank you for your assistance.

Sincerely,

Robert W. Stokes

CASE STUDIES MAILING LIST

Dave Roper
Deputy District Director
California Department of Transportation
District 7
P.O. Box 2304
Los Angeles, CA 90051
(213) 620-3654

Hank Cusack
Port Authority of Allegheny County
2235 Beaver Avenue
Pittsburgh, PA 15233
(412) 237-7289

Kenneth Goon
Maryland Department of Transportation
Mass Transit Administration
109 East Redwood
Baltimore, MD 21202
(301) 659-3434

Clifford L. Kurtzweg
Traffic Design Engineer
Washington Department of Transportation, D-1
6431 Corson Ave South, C-81410
Seattle, WA 98108
(206) 764-4171

Gary C. Price
Traffic Operations Engineer
Florida Department of Transportation
609 Suwanne Street
Tallahassee, FL 32301
(904) 488-4284

Glen C. Carlson
Manager-Traffic Management Center
Minnesota Department of Transportation
1101 4th Ave South
Minneapolis, MN 55409
(612) 341-7500

Ian G. Stacey
Regional Municipality of Ottawa-Carleton
222 Queen Street
Ottawa Ontario
K1P 5Z3
(613) 560-1293

Eugene D. Arnold
Virginia Highway and Transportation
Research Council
P.O. Box 3817, University Station
Charlottesville, VA 22903
(804) 293-1931

Richard D. Bauman, Director
Regional Transportation District
1600 Blake Street
Denver, CO 80202
(303) 628-9000

Brian Pearson
Orange Co. Transit District
11222 Acacia Parkway
Garden Grove, CA 92642
(714) 971-6305

Lou Schmitt
Arizona Department of Transportation
205 S. 17th Avenue
Phoenix, AZ 85007
(602) 255-7371

Archie C. Burnham
State Traffic and Safety Engineer
Georgia Department of Transportation
2 Capitol Square
Atlanta, GA 30334
(404) 656-5423

Larry Dahms, Executive Director
Metropolitan Transit Committee
101 8th Street
Oakland, CA 94607
(415) 464-7700

Table 1. TTI Studies Relevant to Transportation/Land Use Impacts

(Project 1085/0186)

Project No.	Study Term (Date)	Short Title and Investigator	Relevant Data Collected or Anticipated
0304/0305	1984-85	Gulf Freeway (Christiansen for Metro)	a. To be Determined
0306/0307	1984-85	Katy Freeway (Christiansen for Metro)	a. To be Determined
0308/0309	1984-85	North Freeway (Christiansen for Metro)	a. To be Determined
0413 (0183/ 0184)	1983-85	Data Collection (Morris for SDHPT)	a. Intersection Volume Counts. b. Travel Times/Speeds. c. Travel/Traffic Data on All Houston Freeway Corridors.
0189/0309	1985-86	Assessment Traffic Control for Transitway Construction (Borchardt/Morris Christiansen for SDHPT and Metro)	a. Level of Mobility within Transitway Corridors. b. Motorist Perceptions of Transitway Construction Activity. c. Survey of Park-and-Ride Users/Local Bus Users/Motorists in North Corridor (n=1000 to 1200).

Table 1. Continued

Project No.	Study Term (Date)	Short Title and Investigator	Relevant Data Collected or Anticipated
0189/0309 (con't)			<ul style="list-style-type: none"> d. Core Group (from 'C' to be surveyed about every 3 months through August '86. (Home mailouts) e. Survey Compatible with Prior Pittsburgh Survey. f. On North Freeway during 1985-86; to be expanded to SW and NW Freeways (maybe) in '87 or '88.
2077	1983-84	Effectiveness of Transit Operations (Bullard for SDHPT)	<ul style="list-style-type: none"> a. Contraflow Effectiveness on North Freeway. b. On-Board Park-and-Ride User Surveys at 8 Houston Lots. c. Non-User Surveys surrounding Addicks (Katy) and North Shepherd (North) Lots.
2339	1984-87	HOV Studies (Christiansen for SDHPT)	<ul style="list-style-type: none"> a. Before Transitway Data on Gulf Freeway (3-years). b. Before Transitway Data on Gulf Freeway (1-year). c. Before Transitway Data on North Freeway (1.5-years).

Table 1. Continued

Project No.	Study Term (Date)	Short Title and Investigator	Relevant Data Collected or Anticipated
2339 (con't)			d. Before Data Being Volumes, Travel Times/Speeds, Occupancies, Vehicle Classifications, Usage of Park-and-Ride Lots and Transit Patronage. e. Data Collected Quarterly
2484	1984-86	Carpool Impacts on Transitway Operation (Bullard/Christiansen for SDHPT)	a. User and Motorist Surveys on Katy during 1985 (n = 1277). b. User and Motorist Surveys on Katy Gulf and North During 1986 (n = 4000 est.).
2086H	1984-89	This Study (TTI/BGA)	a. Developer Interviews b. Photo Record of Park-and -Ride Sites (Periodic). c. Real Estate Values. d. Rent Values. e. Other as Identified.

The necessary data will be obtained from one or more of the following sources:

1. Major Developers/Corporations
2. "Referrals" by those contacted
3. Houston Chambers of Commerce (Central and Outlying)
4. Neighborhood Associations
5. State Dept. of Highways and Public Transportation (Houston & Austin)

6. Houston-Galveston Area Council
7. City of Houston (Planning, Public Works and Traffic)
8. Houston Metro
9. Rice Center
10. University of Houston
11. A&M Real Estate Research Center
12. State Comptroller
13. Appraisal District
14. Realtors and Houston Board of Realtors
15. Property Research Company
16. Census Data
17. Map Companies
18. Others as Identified

At this time, it is anticipated that basic land use data will be compiled on a parcel-by-parcel basis for the transitway and park-and-ride areas of influence. However, the level of detail used in the final analyses will depend, in large part, on the level of detail of the available data.

3.2 ANALYSIS OF I-45N CONTRAFLOW LANE

The impacts of the I-45N contraflow lane, and its associated park-and-ride facilities, on land uses in Houston's north corridor will be examined. The contraflow lane evaluation will be used to develop and refine the procedures for the balance of the study (i.e., evaluation of transitway and park-and-ride impacts in the other Houston corridors; see Section 2.6).

Land use patterns for the before period (1973-79) will be compared with those for the after period (1979-85) and the location, extent, and nature of any changes will be documented. The effects of the contraflow lane and park-and-ride facilities on these land use changes will be evaluated through interviews with developers and property owners in the corridor. While the analyses will concentrate on the primary zones of influence for the contraflow lane and park-and-ride facilities, the geographic boundaries of the analyses will be expanded or contracted if the interview process suggests such re-definitions are necessary.

3.3 PROJECTED LAND USE IMPACTS

Information and experience gained through examination of Houston's north corridor demonstration contraflow operation, other recent land use actions, and observations from other cities will be used to project land use impacts likely to occur from implementation of permanent transitways and park-and-ride lots in the west (I-10 West), southeast (I-45 South), and north (I-45 North) corridors.

3.4 ANNUAL ACTIVITIES

Year one and year two tasks should provide a good "before" data base in each corridor. In addition, preliminary estimates of likely impacts will be made. These tasks plus documentation will constitute the first phase of the land use impacts portion of the study.

Years two through five of the program will involve continual monitoring of the transitway development and implementation program and the land use impacts associated with it. The first phase of the Katy Transitway (west corridor) began operations in the fall of 1984. Various portions of all three facilities are scheduled to begin operation in increments until October of 1987 at which time the final segment of the North Freeway Transitway (north corridor replacement for the contraflow demonstration) will be operational. Thus, monitoring of significant portions can proceed during years two and three. During years four and five the entire transitway system operations will be monitored.

The lack of formal zoning in Houston means that land use changes can occur more rapidly than in other cities and evidence of these changes should appear within the five year period in some, if not all, of the corridors. Study renewals for the remaining years will be prepared, with the proposed work tasks detailed, on an annual basis.

Table 2 presents a preliminary listing and tentative time frames for the reports which are anticipated as part of this five-year research effort.

Table 2. Preliminary Reporting Schedule

Report No.	Documents/Reports: Short Title	Estimated Date of Publication
1	Literature Review	May 1985*
2	Work Program	July 1985**
3	Case Studies	August 1985
4	Turnkey Park-and-Ride	August 1985***
5	Contraflow Impacts	December 1985
6	Before Data	January 1986
7	Park-and-Ride Impacts	December 1985
8	Land Use Projections	December 1985
9	Second Year Report	August 1986
10	Third Year Report	August 1987
11	Fourth Year Report	August 1988
12	Fifth/Final Report	August 1989

* Report 1086-1 (1)

** This Report

*** Documented by Goodman and Associates; Study 2-10-85-1085

4. WORK COMPLETION SCHEDULE

The proposed scheduling of the major research activities is presented in Table 3. The overall program for the land use investigation will extend over a five year period. However, one or more free standing components of the research will be produced each year, as indicated under the "Documents/Reports" activities of Table 3.

TABLE 3

<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="font-size: small;"> <p>— Original Schedule</p> <p>- - - Revised Schedule</p> <p>### Work Completed</p> </div> <div style="text-align: center;"> <p>SCHEDULE OF RESEARCH ACTIVITIES</p> <p>FOR RESEARCH PROJECT</p> </div> <div style="font-size: small;"> <p>Reports</p> <p>△ Anticipated</p> <p>▲ Completed</p> </div> </div>		1984-1985												1985-1986												1986-1987																						
		Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.											
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6. DEFINITION OF TERMS

Abandonment - The relinquishment of the public interest in right-of-way or activity thereon with no intention to reclaim or use again for highway purposes; sometimes called vacation (2).

Absolute Change - The actual change in land use (number of acres) and land value (dollars per acre) measured between project time periods in continuous or discrete terms (3).

Abstract of Title - A document showing the condensed history of the title to property, containing portions of all conveyances or other pertinent instruments relating to the estate or interest in the property, and all liens, charges, encumbrances, and releases (2).

Abutting Property - A tract of study area land immediately adjacent to a highway/transit improvement which is under one ownership and not separated by another road (3).

Accrual Method - The accounting procedure which recognizes revenues and expenses when they occur regardless of when cash is received or paid (2).

Acquisition or Taking - The process of obtaining right-of-way (2).

Adjusted or Real Dollars - Dollars that have been adjusted for inflation (3).

After Construction Period - A period which begins after the construction is completed and extends to some point in time afterwards; usually extends to the time the impact study was completed (3).

At-Grade Highway - A highway facility which is neither depressed or elevated (3).

Before Construction Period - A time period selected as a base for measuring land use and land values in the study area prior to any specific planning for the highway improvement and, desirably, prior to the public

sector being made reasonably assured of its construction (i.e., public funding); there is a lack of consistency in the literature about how the "before" period is identified, but usually is 3 to 5 years in length (3).

Benefit - General benefit is the advantage of accruing from a given highway improvement to a community as a whole, applying to all property similarly situated; special benefit is the advantage accruing from a given improvement to a specific property and not to others generally (2).

Betterment - The improvements, adjustments, or additions to a highway which more than restore it to its former good condition and which result in better traffic serviceability without major changes in its original construction (2).

Bus - A self-propelled rubber-tired vehicle designed to accommodate 16 or more passengers and to operate on streets and roads; an express bus is a conventional bus that operates in limited-stop service on an exclusive busway or in mixed traffic on freeways or arterials (2).

Buspool - The chartered operation of commuter (subscription) buses by groups for transportation to work (2).

Bus Priority System - A means by which buses are given an advantage over other traffic, e.g., through preemption of traffic signals or bus lanes (2).

Busway - A special roadway designed for exclusive or predominant use by buses in order to improve bus movement and bus passenger travel times; it may be constructed at, above, or below grade and may be located in separate rights-of-way or within highway corridors (2).

Captive Transit Rider - A person who does not have immediate access to private transportation or who otherwise must use public transportation in order to travel; also known as transit dependent (2).

Carpool - A group of people who share their automobile transportation to designated destinations on a regular basis (2).

Charter Service - Transportation provided on a contractual basis at a fixed charge (2).

Closed Interchange - One that provides access to abutting properties by indirect routing only (3).

Clover Leaf Interchange - A full interchange which allows traffic turning right or left to proceed on inter-connection ramps that have no stop signs or traffic signals (3).

Commercial Land - All land improved with a building used to house a retail or service business (3).

Commercial Traffic Serving Land - All land improved with a building used to house a service station, restaurant, or motel business; commercial non-traffic serving land is all other land improved with a building used to house other types of retail and service business (i.e., grocery and clothing stores) (3).

Commuter - A person who travels back and forth regularly between two points; term often used in reference to a suburban resident who travels daily into the city to work. (The term "reverse commuting" is used to refer to those who live in the city but travel to jobs in the suburbs) (2).

Commuter Bus - A bus which takes people from a place near their residences to a place near their work, usually in a trip with few or no stops and from a suburb to a city (2).

Commuter Parking Lot - A parking lot in which people traveling from home to work may park their cars and continue on their trip either by carpool, vanpool, bus, commuter bus, rail or other form of public transportation; also known as a Park-and-Ride Lot (2).

Contraflow - Movement in a direction opposite to the normal flow of traffic (2).

Contraflow Lane - A highway or street lane on which, during certain hours of the day, public transit or other specially designated vehicles operate in a direction opposite to that of the normal flow of traffic on that lane during the remainder of the day (2).

Control of Access - The condition where the right of access to land abutting a highway improvement is fully or partially controlled by public authority (3).

Control Area - A geographic area similar in all respects to the study area except that the control area is far enough removed from the highway improvement project so as to have been unaffected by it (3).

Corridor - A strip of land between two termini within which traffic, topography, environment and other characteristics are evaluated for transportation purposes (2).

Current or Actual Dollars - Dollars which are not adjusted for inflation (3).

Deed - A written instrument conveying real property or interest therein, ususally under seal; a "quitclaim" deed conveys, without warranty, any title, interest, or claim which the grantor may have in the estate conveyed; a "warranty" deed contains a covenant by the grantor to the grantee to warrant and defend the title of the estate conveyed (2).

Degree of Influence - A term used to describe the amount of land use and land value change in the study area that can be attributed to the highway or transit improvement (3).

Density - The number of vehicles per mile on the traveled way at a given instant (2); also refers to any unit of measure (i.e., population) per specified area (i.e., square mile) at a given point in time.

Depressed Highway - One with the "through" lanes situated below grade (3).

Developed Area - An area which has experienced development to the extent that over 95 percent of the unimproved land has succeeded to higher uses (3).

Diamond Interchange - A full interchange which has stop signs or traffic signals on the intersecting turning ramps (3).

Direct Compensation - Payment for land or interest in land and improvements actually acquired for highway (or transit) purposes; sometimes called direct damages (2).

Divided Road - One which separates the traffic traveling in opposite directions with a directional separator, such as a natural, structural, or striped barrier (3).

Driveway - A private road giving access from a public way to a building on abutting grounds (2).

During Construction Period - The period required for detailed planning and construction of a highway/transit improvement in an impact study area; the "during" period normally extends from the time of the contract letting for construction to the opening of the facility to traffic (3).

Easement - A right to use or control the property of another for designated purposes (i.e., drainage, planting, scenic, sight, slope) (2).

Elevated Highway - One with the "through" lanes situated above grade by means of earthen or concrete structures (3).

Encroachment - Unauthorized use of highway right-of-way or easements as for signs, fences, buildings, etc. (2).

Exclusive Bus/Carpool Lane - A lane reserved for buses/carpools only on a street, highway, bridge, or tunnel that other traffic is restricted from using (2).

Express Service - The provision of higher speeds and fewer stops than are generally found on other portions of the system or on the same route in local (transit) service (2).

Freeway - An expressway with full access control (2).

Frontage or Service Road - A road contiguous to and generally paralleling a highway/freeway and so designed as to intercept, collect, and distribute traffic desiring to cross, enter, or leave the highway and which may furnish access to property that otherwise would be isolated as a result of the controlled access (3).

Fringe Parking - A park/ride lot located outside the central business district (2).

Full Control of Access - Where preference is given to "through" traffic by providing access conditions with only selected public roads and by prohibiting crossings at grade or direct private driveway connections; highways of this type are called "limited access" facilities (3).

Full Interchange - One that allows traffic to enter and exit in both directions (right or left-hand turn) (3).

General Benefit - A benefit received by non-users and is accrued indirectly from a highway/transit improvement, such as the benefit accrued to non-abutting properties in the study area (3).

Grade Separation - A structure used to separate vertically two or more intersecting roadways, thus permitting traffic on all roads to cross traffic on all other roads without interference (3).

Growing Area - An area in which the population density is increasing and new buildings have been recently constructed on much of the previously unimproved land (3).

Guideway - The surface or track and its supporting structure on or in which transit vehicles travel (2).

High-Occupancy Vehicle (HOV) - A motor vehicle carrying a sufficient number of passengers to qualify for occupying a lane which is reserved for movement of a large number of people (2).

Highest and Best Use - The most productive use, reasonable but not speculative or conjectual, to which property may be put in the near future (2).

Highway - A general term denoting a public way for purposes of vehicular travel, including the entire area within the right-of-way (2).

Highway Improvement - Any road construction activity on a new or existing highway; essentially an improvement to the transportation system (3).

Impact Area - The geographic area experiencing measurable land use and land value changes; area normally runs parallel to the highway and varies somewhat in width from a few hundred feet to two miles on either side of the improved facility, depending on the depth of abutting properties, the distance to other parallel roads, and the socio-economic and physical characteristics of the area (3).

Industrial Land - All land used for the manufacture and distribution of a product to be marketed through retail outlets; category includes warehouses and storage facilities (3).

Institutional Land - All land used for schools, parks, governmental facilities, and non-profit operations (3).

Interchange - A system of inter-connecting roadways, in conjunction with one or more grade separations, providing for the interchange of traffic between two or more roadways on different grade levels (3).

Intermodal - Between, or including, more than one means of transportation; for example, an intermodal trip might consist of driving a car to a commuter parking lot and then taking a bus (2).

Intersection - Interconnecting roadways where vehicles using such roads may come into conflict (3).

Joint Development - Coordinated development of an area by the public sector and private enterprise to mutual advantage (2).

Just Compensation - That payment required by law for the loss sustained by the owner as a result of taking or damaging private property for highway purposes (2).

Kiss-and-Ride - The procedure whereby a transit or commuter passenger is driven to his or her first transit terminal point in a private vehicle by another person who then drives the vehicle away from the terminal to another destination (2).

Lateral Band - A strip of study area land running continuously along the highway improvement; it may or may not be located at an intersection or interchange (3).

Line-Haul - Transit operations along a single corridor or variety of corridors, using a fixed route (2).

Local Service - A type of transit operation that involves frequent stops and consequently low speeds, the purpose of which is to deliver and pick up transit passengers as close to their destinations or origins as possible (2).

Market - The potential consumers of a transportation product or service; a geographic area that includes a significant number of potential consumers; or the extent of demand for a transportation commodity or service (2).

Mass Transportation - A sub-category of public transportation or other conveyance publicly or privately owned provided to the general public on a regular and continuing basis (does not include school bus, charter or sightseeing service) (2).

Median - A depressed, raised or striped barrier separating traffic traveling in opposite directions (3).

Network - A system of links and nodes that describes a transportation system; the configuration of highways or transit routes and stops that constitutes the total system (2).

Node - A point that represents an intersection of two or more links used in traffic assignment; the center of a transit network (2).

Non-Abutting Property - A tract of study area land not adjacent to the highway/transit improvement but still located in the study area (3).

Non-User - One of two types of persons: 1) a user when he or she is not traveling on the highway; or, 2) a person who never travels on the highway. A person may be, and often is, both a user and a non-user according to this criteria (3).

Outer Separation - The portion of an arterial highway between the traveled ways of a roadway for through traffic and a frontage street or road (2).

Parallel Band - A continuous strip of study area land running parallel to the highway/transit improvement; band may or may not be abutting the improvement (3).

Park-and-Ride Lot - Intermodal transfer location usually from single occupant vehicles to a public transportation mode such as bus, rail, vanpool, carpool or jitney; also called a commuter parking lot (2).

Partial Interchange - Where preference is given to "through" traffic to a degree; in addition to access connections with selected roads, there may be some crossings at grade and some private driveway connections (3).

Preferential Treatment - Giving special privileges to a specific mode of transportation; for example, buses, vanpools, and carpools may be allowed to use a lane of traffic from which other vehicles are forbidden (2).

Protected Left-Turn Lane - An auxiliary lane used for left-turns only (3).

Protected Right-Turn Lane - An auxiliary lane, usually discontinuous, located at intersections(3).

Public Transportation - Service to the public on a regular basis using vehicles which transport more than one person over a predetermined route or routes from one fixed point to another; routes and schedules may be predetermined through a cooperative arrangement (sub-categories include paratransit and mass transit service) (2).

Pull In - A transit trip that is concluded by withdrawing the vehicle from revenue service into a storage area; a vehicle removed from revenue service without having completed its prescribed run; or, the trip from a finishing point to the station (2).

Relative Change - The percentage change in land use or land value based on the amount of absolute change in the respective unit of measure over the base value (3).

Remainder Property - The remaining portion of a tract severed by a right-of-way taking for a highway improvement; remainder property is usually abutting the highway project (3).

Residential Land - All land improved with a single-family or multi-family building (3).

Ridesharing - A transportation service which includes carpooling, vanpooling, buspooling and transit (2).

Roadway - The portion of a highway, including shoulders, for vehicular use (divided highway has two or more roadways); the portion of a highway within limits of construction (2).

Rural Area - An area located outside the "city limits" of any city or town and is at least two miles from a built-up area (3).

Shared Ride - A trip on which the passengers enter at one or more points of origin and disembark at one or more destinations and for which an individual fare may be paid or responsibility for the ride may be shared among the riders (2).

Special Benefits - A benefit received by non-users which is accrued directly from a highway/transit improvement (i.e., the benefit accrued to abutting properties in the study area) (3).

Stable Area - An area in which the population density is changing very little, virtually no building activity is occurring, and the buildings are being kept in a good state of repair (3).

Study Area - The impact area defined (i.e., by previous studies) which is influenced by the highway/transit improvement (3).

Subscription Bus - A transit service in which routes and schedules are prearranged to meet the travel needs of riders who sign up for the service in advance; the level of service is generally higher than that of regular passenger service (fewer stops, shorter travel time, greater comfort); buses are usually obtained through charter or contract arrangements (2).

Subscription Van - Similar to subscription bus, except that the van may be privately owned, leased for a public organization or private company, or provided by the employer of the van riders (2).

Suburban Area - An area located on the fringe of a town or city which has a population of at least 10,000 and is within two miles of a built-up area (3).

Terminal - A transportation facility for the picking up, transfer, or discharge of passengers or goods (2).

Terminus - Either end of a route (2).

Through Routing - The practice of joining ends of radial bus routes to travel through downtown rather than have each route turn back in the downtown and return to its origin (2).

Transfer Center - Centralized point for loading and unloading passengers usually in the central business district and equipped with shelter and schedule information (2).

Transitway - An exclusive, physically separated, access controlled high-occupancy vehicle priority treatment facility typically located within existing freeway right-of-way; sometimes referred to as busways, HOV lanes or AVL's (authorized vehicle lanes) (4).

Uncontrolled Access - Where no limit is placed on the number of points of ingress or egress, except through the exercise of control over the placement and geometrics of connections as necessary for the safety of the traveling public. (Highways of this type are called "full access" facilities) (3).

Undeveloped Area - An area which has experienced little or no development of unimproved land into higher uses (3).

Undivided Road - A roadway which has no directional separator, either natural or structural, separating traffic moving in opposite directions (3).

Unimproved Land - All land not improved with a building and not used for a park or school (3).

Urban Area - An area located within the "city limits" of a town or city which has a population of at least 10,000 (3).

Urbanized Area (UZA) - An area designated by the Bureau of Census meeting certain criteria of population size or density with a population of 50,000 or more (2).

User - A person traveling on the highway or transitway (3).

Vanpool - A prearranged ridesharing service in which a number of people travel together on a regular basis in a van; vanpools may be company owned, individually owned, leased and third party vanpools (2).

