POTENTIAL FOR BETTERMENT DISTRICT FINANCING AND JOINT DEVELOPMENT APPLICATIONS TO SURFACE TRANSIT

by

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16. Abstract

This report was written as the result of a general interest by U.S. Department of Transportation officials as to the feasibility of Betterment Development Financing and Joint Development. The intent is that it will capture the interest of transit planners, as well as those interested in betterment and joint development. It proposes a general methodology for evaluating land use and investment activity with respect to land in the vicinity of surface transit facilities.

The three major objectives were: (1) to determine if there are incremental benefits accruing to land near bus, trolley, and by inference light rail facilities; (2) to examine equity issues in potential tax benefit districts serving such facilities; and (3) to examine the potential of joint development with respect to surface transit. An underlying objective was the presentation of an interactive spatial analysis system suited to the small-scale study of transit system impacts and relationship to their environment.

Criteria used to identify desirable benefit district and joint development study areas were: (1) diversity in population and housing characteristics; (2) diversity in land uses; and (3) service by a variety of transit routes. Primary focus was directed to exploring locations in the vicinity of multiple routes where levels of commercial and multi-family new investment might be particularly high.

The study concludes that the use of special benefit districts would be difficult to operationalize and that joint development opportunities are encouraging.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER I

INTRODUCTION

This report presents the findings of a research project undertaken for the Urban Mass Transportation Administration (UMTA) by the Urban Transportation Program at the University of Washington during the 1976/77 academic session.[1] The research arose out of a general interest by U. S. Department of Transportation officials in the subject of benefit district financing.[2] Benefit district financing, also referred to as betterment or special district financing, is defined here as a technique employing a compulsory one-time ad valorem charge upon real estate within a predetermined distance of some public facility for defraying in whole or in part its expense. This type of financing typically requires state enablement legislation as well as local legislation to specify the boundaries of the district, both on the assumption that adjacent or proximate land benefits from the proposed improvement. Thus the improvement, financed all or in part by a benefit district, captures value accruing to land in the benefited area, hence the term "value capture." Value capture may also include the capture of non-monetary benefits, such as when joint planning and development occurs between and among the transit agency, local government and the private sector.

A key word in the concept of betterment district financing is the reference to the ad valorem property tax. There are other methods of financing transportation improvements that give general benefit to a region as a whole through non-property taxation, such as an increment added to the general sales tax to support local transit,[3] the general sales tax extended to gasoline,[4] or

[1]UMTA Grant WA-11-0005.

[2]Discussion with C. Kenneth Orski and Philip G. Hughes, May 1976.

[3]An example is the 0.3 percent sales tax levied in King County, Washington, to support the transit function of the Municipality of Metropolitan Seattle, coterminus in area with King County.

[4]An example is the subvention of sales tax on gasoline to the counties of California under Section 325 of the California Transportation Development Act of 1971.

money from the general U. S. Treasury. Under these latter federal funding methods it is assumed that the benefits are so diffuse that their impact on adjacent or nearby land is of secondary importance. It would be possible of course to conceive of a financing scheme that would utilize both an ad valorem tax on directly benefited property as well as the indirect taxation by the methods just referred to. In spite of recent interest in betterment district financing, the general trend toward urban transportation financing has been in the direction of the use of indirect jurisdiction-wide taxation rather than the creation of benefit districts. This probably results because the nature of benefits is relatively hard to pin down, and it seems easier and more politically expeditious to use county-wide or state-wide taxation schemes other than limited area benefit district property taxation.

Interest of UMTA in looking into betterment district financing no doubt stems from the great financial demands now being made upon UMTA for assistance in the development of major urban rail systems. These systems are so costly that no stone can be left unturned in examining a multiplicity of means by which revenue may be raised for their construction and operation. There are nevertheless many local surface transit systems in operation or evolving at a much smaller scale that suggest some limited examination of the efficacy of their partial financing through betterment districts. These systems may include anything ranging from fixed-guideway downtown people movers to suburban rubber-tired bus service. What all of these systems, both large and small, have in common are corridors of facilities and services that probably have a differential impact on land at varying distances from the stops. Thus, non-users of the system who own land in their vicinity are deemed to profit by the existence of the system through the improved accessibility of their land.

A substantial amount of interest has been created recently in the subjects of both benefit districts and joint development by virtue of work undertaken for UMTA by the Rice Center for Community Design + Research[1]. Joint development infers schemes that link land and transportation developers to programming land uses that are deemed to be symbiotic with the transportation facility, and thus promote mutual benefits. Joint development, as defined here, might rely on a number of different procedures ranging from land use zoning to

[1]"Value Capture and Joint Development Application," Rice Center for Community Design + Research, Houston, January 1, 1976.

various real property development strategies requiring public/private interaction.

Interest in joint development has arisen from the relative success of the addition of the Embarcadero Station to the Bay Area Rapid Transit (BART) system in San Francisco. Here the station was developed to enhance the accessibility to the adjacent Golden Gateway Redevelopment Project.

Although the current interest in both joint development and benefit district financing has mainly to do with heavy urban rail transportation systems, there is one known probe by the Rice Center researchers into the application of joint development in respect to rubber-tired systems, in the Portland, Oregon, metropolitan area. However, no one to our knowledge has proposed a general methodology for evaluating land use and investment activity with respect to land in the vicinity of surface transit facilities, probably because the land value added in respect to these facilities is perceived to be far less spectacular than in the case of the land value increments near major urban rail stations. As a consequence, the research reported on here was addressed to three major objectives:

1. To determine if there are incremental benefits accruing to land near bus, trolley, and by inference light rail facilities;
2. To examine equity issues in potential tax benefit districts serving such facilities; and
3. To examine the potential of joint development with respect to surface transit.

In regard to the first of the three objectives noted above, the determination of incremental benefits accruing to land near bus or trolley facilities is hypothesized to be measured by one or more of the following: (1) increases in land values such as may be determined by examining sales or assessed values; (2) increases in building investment as measured by building permit activity; and (3) changes in land use that would upgrade the abutting or vicinal land in terms of income productivity or residential density. Of these three methods the second and third were deemed best for several reasons. Whereas sales data represents an exchange of property without knowing some earlier common baseline value, it does not specifically measure added investment or changes in use intensity. Building permit data, on the other hand, does measure these two variables discretely and directly. It is assumed therefore that if land is changing in use or if building investment is taking place on land--whether from new construction, repairs or alterations--the owner perceives sufficient added value in the site to warrant investment itself or both investment and change of use, particularly to a more intensive use. Whereas the measurement of investment and change in this research has not been a complex procedure, particularly because of the availability of the ten-year building permit data base and spatial analysis system, the relationship between investment and change of land use, or both, and the surface transit system cannot be inferred to be a direct one. There are many variables affecting investment in buildings and land use change other than surface transportation, including land use zoning, the age of the building stock, the potential for private renewal of the sites based on many factors such as view, racial change, and many other factors.

The equity issues ensuing from a presumed tax betterment district are a little bit more difficult to deal with. The objective here is only to examine some of the equity issues rather than arrive at estimates of equity or inequity. As an example, it would be inequitable to assume some continuous linear decay of benefit from a bus stop if a change in zoning occurs, precluding the same kind of development on one side of the zoning boundary as occurs on the other.

The third objective of the research, the potential for joint development with respect to surface transit, addresses a somewhat different set of issues than presented in the activities of the Rice Center for Community Design + Research. That investigation is concerned predominantly with large-scale land use and settlement patterns surrounding large-scale urban rail systems. One of the models they present is the symbiosis between the Embarcadero Station on the BART system and the adjacent Golden Gateway Redevelopment Project. Here the Station represented an investment of some $29 million at least a decade ago and the Golden Gateway Project represents at least an equal investment. However, by deduction, the most obvious candidates for joint development at this scale are surface transit transfer facilities catering to either transfers between bus lines or between modes such as when paratransit or private automobile travel may be coupled with a bus trip.

In general, the project was designed to see if there is any reasonability of applying benefit district financing to a surface transit system and to view also the reasonability of limited joint development programs on land impacted by local street transit access. The study site, Seattle, has been selected for both geographical convenience to the researchers and because of the existence of a substantial automated data base and interactive graphic analysis system at the University of Washington for access to the data for the Seattle area.

Seattle should resemble most cities without heavy urban rail transportation insofar as it has the typical radially oriented system of bus lines, supplanted in some of the older locations by electric trolley buses powered through overhead wires. Like most cities the transit lines have been in place for many years and thus development near them is in a state of relative equilibrium. The fact that the electric trolley program in Seattle, with relatively high-cost overhead wiring, is being continued and even enhanced suggests some potential for right-of-way investments that may be at a scale close to those of anticipated light rail.

Although the research has utilized a fairly elaborate interactive data access system that has been under development and use at the University of Washington for more than a decade, the advent of computer accessible geographical basefiles[1] is becoming more common with the advent of local experience with U. S. Census DIME Files. These files exist for over two hundred urban areas and serve as a basis for tying in census block data with transportation impact analysis. The information on value does not stem from actual records of housing sales or property sales, but rather from a file of all reported building permits for the City of Seattle for a period of ten years of a value of more than one thousand dollars. These permits include new construction in various land use categories, repairs, remodeling and other structural changes. Thus, this file represents a data base of total building investment over a ten-year period, rather than the value of the building stock at any point in time. This would be a more difficult file to obtain in many other urban areas because building permit automation has not reached a general level of acceptance in the country at large. There are other surrogates of value included in the U. S. Census data such as the number of owner occupied housing units by value ranges and the number of rental units by ranges of rental costs.

Finally, an underlying objective of the study was the presentation of an analysis methodology that might transcend the actual scope of the study itself and provide a means of general urban analysis as well as transit planning and marketing information.

Spatial analyses at a relatively gross level have been characteristic of traditional transportation planning activity, with widespread use of a zonal

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[1] Representation of the street network in machine (computer) readable code which permits automated assignment of geographical identifiers to machine readable street address identified data. (See Barb, Charles E., Jr., Automated Street Address Geocoding Systems: Their Local Adaptation and Institutionalization, RR No. 9, Urban Data Center, University of Washington, 1974.

system whereby spatial observations are aggregated to the level of traffic analysis zones, typically several square miles in size. While an analysis at this level may yield rough indicators of the actual spatial distribution of activity historically valid for highway transportation analysis, this data cannot be used in examining transit routes and other related phenomena at a meaningful level. On the other hand, with the advent of census tapes, there has been expanding work involving micro-level analyses of urban spatial data, but attention has not been focused on incorporation of transit routes and transit services as the object of analysis. The inclusion of transit system data in such studies, either in the form of a route network, or as point data indicating the individual transit stops, raises unique issues and problems not encountered in non-transit spatial studies. An additional aim of this research is to fill this gap through the presentation and application of techniques for micro-level transit route analysis.

Impetus for this research stemmed from a recognition of the need to develop better techniques for transit-related spatial analyses in order to more fully explore the issue of benefit district financing and joint development as they relate to surface bus transit systems by performing a micro-level analysis of spatial activity near bus routes.

An emphasis here is the development and presentation of some basic spatial analysis methods, and a demonstration of their use in a Seattle case study. The techniques are intended to serve as a means of viewing a transit service area, or a portion thereof, in an attempt to ascertain whether the data of interest show any discernible relationship to the transit system layout, and if so, where this relationship might be strongest. Several levels of analysis are presented and discussed, in which the analyst can choose the particular data variables and the area to be examined, and can then identify smaller areas or specific locations for more detailed analysis relevant to the problem at hand. The process is flexible and interactive, allowing for its application in a wide variety of situations, with the analyst retaining the option of directing the analysis procedure according to the particular issue being addressed.

In addition to treatment of the value capture theme, it is anticipated that the reader will gain from this report a knowledge of some general spatial analysis methods applicable to a variety of transit planning issues, and, through the example application, an awareness of their potential use and the kinds of results that could be expected. The general data requirements of such a study, and some typical problems encountered in this type of analysis are discussed as they relate to the feasibility and validity of the subject study of value capture.

The intended audience of this report includes transit planners at the operational level who are involved in evaluating existing transit system layout and planning for changes in or additions to the system, as well as those who are interested in benefit district financing and joint development. Planners currently working on the development of service and performance indicators for transit systems may also be able to relate to some of the ideas presented here.

CHAPTER II

STUDY PHILOSPHY AND METHODOLOGY

Preliminary Observations on Benefit District Financing and Joint Development as they Relate to Surface Transit

Transit related value capture schemes are predicated on the assumption that there is transit-induced value to vicinal property which can potentially be recaptured to cover all or a portion of a facility's cost. Indications of such value increases include increased demand for the land, rises in the actual worth of property, or the appearance of investment in improvements on the property. Stimulated development activity and a rise in property values, or both, near transit exist partially as a result of the presumed increased desirability of land in the vicinity of the transit improvement. This increased desirability of land will be theoretically caused in part by two distinct yet related factors--the increased accessibility offered by the transit facility, and the increased levels of activity induced by the improvement.[1] Accessibility is a measure of distance and access to opportunities via the transit system. As such, a point at the intersection of two or more transit routes has a higher accessibility level than an average transit stop by virtue of the fact that not only does a person at that intersection have direct (no transfer) transit access to a wider range of locations through the availability of more than one line, but also a larger community of people has direct transit access to opportunities adjacent to the intersection by virtue of having the lines available.

Accessibility offered by a transit system will differ from rail to bus systems. In a rapid rail system, which will rarely consist of more than three or four individual lines with relatively few transit stations widely separated spatially, proximity to any station will significantly increase accessibility. But a bus system typically will have a larger number of lines with more closely spaced stops and will thus comprehensively cover a large area. Therefore,

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[1]Mitchell, Robert B., and Chester Rapkin, Urban Traffic: A Function of Land Use (New York: Columbia University Press, 1954).

there will not be a large degree of variability in transit accessibility across the area if simple access to any bus stop is used as a measure.

In a related vein, a concentration of viable establishments near a transit stop may be a clue to increased demand for transit-adjacent property, resulting in higher land values or increased building investment or both, from which the transit system may then benefit by increased patronage. This establishment-induced activity is external to, but related to the transit system. In theory, the establishments produce trips which are served by the transit system, and in addition, the establishments profit from intermodal or interline transfers by virtue of serving some convenience shopping needs. In the latter regard, the movement of people in the vicinity of a given location, <u>outside</u> the transit system itself, is a key to an increased activity demand which may in turn spur joint development activity.

Because the lines and stops of a bus system are more numerous than in a rail system, there will likely be less transit-induced activity on the average around each bus stop than around a typical rail station. Concurrently, a larger total area of property is adjacent to transit stops in a bus system than a rail system. Thus any individual bus stops will on the average have less influence in attracting developers than its counterpart in a rail system, thereby precluding the use of value capture on practical grounds in most cases. Assuming that there is only a limited amount of investment and growth which will occur in an entire urban area over a given time period, where and in what concentrations this development occurs is the economic determinant of whether value capture may be feasible.

The motive for exploring these notions of accessibility and level of activity is the potential identification of locations that are high in both accessibility and activity, and thus may have value capture potential. Although closely related, these two phenomena do not necessarily always occur together. A given area may have good transit accessibility, being served by a number of bus lines, but if the nature of these lines is such that transit patrons generally pass straight through the location, with few boardings, alightings, or inter-route transfers, there is not likely to be much transit-induced land use activity in the area. It has been suggested earlier in this report that on the average bus stops will not generally fit the criteria of having both high accessibility and activity levels. Possible exceptions to this pattern include bus stops at line intersections where there is significant boarding and transfer activity, and where joint development such as a park and ride lot, a terminal facility and integrated convenience goods and services may be feasible. At such points the inter-line movement of people may encourage the development of pedestrian-oriented commercial establishments, which in turn may draw more people to the area. This is actually the model of the 1920 city, except for the parking facilities. An existing park and ride lot where transportation modes interface may be another potential site for value capture although we cannot take this relationship for granted because unlike the 1920 city the retailing function has an entirely different scale and setting.

A rapid rail system may benefit from the fact that its location is permanent, or at least immovable in the short run. Particularly important for joint development applications, developers who seek to invest close to a transit improvement would most likely view a rapid rail facility as a more stable fixture than an easily movable bus transit stop, at least from the standpoint of physical constraints. The high potential flexibility of a bus system layout, portending a useful ability to respond to changes in population, employment, and land uses over time, renders the sites of bus stops and lines as apparently less permanent, which may affect the perception of potential investors or developers. Thus, by deduction, to interest a potential developer in investing in an area proximate to a transit improvement, the developer must see evidence that the transit facility is stable, and that it will not be relocated by merely transplanting bus stop signs. The potential for joint development in a bus system may thus be limited to sites where a permanent transit-related facility may be located, eliminating most individual bus routes from consideration except where two or more lines occupy the same route or where lines intersect. Bus system facilities which may have a potential for joint development programs include park-and-ride lots, and actual bus station structures which might be constructed at major line intersection points, or perhaps at locations where a number of residential feeder buses converge to begin the line-haul portion of their routes along a major arterial to an activity center.

The use of a special benefit district including only a portion of the transit service area as a taxation district is predicated on the assumption that the area within the district receives special benefits as a result of the transit improvement. It is difficult to prove that bus transit directly causes a rise in land value proximate to the transit facility. Additionally, a typical urban bus transit system so completely covers its service region that it may be difficult to single out particular areas receiving higher benefits for inclusion in a special benefit district. Thus these problems essentially preclude the feasibility of benefit district financing for transit.

For the techniques involving joint development schemes, there is no need to prove the economic impact of the transit facility. Rather, the transit agency participates with private or other public entities, or both, in developing the area adjacent to a transit stop improvement. If there is a demand for land proximate to a transit stop with resulting development activity, the transit agency may be able to participate in promoting the venture and benefit through increased ridership or the retention of riders. For application of joint development techniques, therefore, there must be a visible, permanent transit stop facility associated with relatively high accessibility and activity levels, as indicated earlier. Thus there may exist potential within a bus system at such sites as park and ride lots, or actual transit station structures along with some convenience shopping and services. Such a station facility would most likely consist of a central structure incorporating direct transit activity such as intermodal and inter-route transfers, with mutually supportive non-transit establishments, such as small shops, eating establishments and services.

A full assessment of the potential for application of these techniques to bus transit systems requires detailed investigations into additional issues to the ones primarily addressed here, such as zoning, legal and regulatory implications as in the case of paratransit service, etc. The focus of this research is to delve into a limited area of the overall issue, particularly the potential for joint development, by exploring the relationship between bus stop locations, and building investment and population and housing characteristics in the vicinity. In evaluating possible joint development actions proximate to a transit stop, it must first be ascertained whether there exists a demand for development in the area. Through an examination of the spatial relationship between various types of building investment and the location of bus facilities, this issue can be partially addressed. An analysis of related population and housing data examined at the block levels offers additional opportunity to explore the demand potential and equity considerations involved in potential joint development.

Data Analysis Requirements and Methodology

Apart from the issues of value capture, a major effort of this research has been concentrated on exploring the applicability of a spatial analysis component of an urban information system to transit planning. Given an urban area transit route network, the problem was to explore how small-scale spatial data could be related to the transit system, particularly in regard to potential benefit district and joint development applications, and secondarily toward other transit analysis, marketing and planning possibilities.

There are two basic categories of spatial data to be considered, point data and areal data. Point data includes occurrences or observations referring to specific locations, such as the incidence or value, or both, of events associated with street address entities; for example, building permits by types and value. Sources of point data include municipal files and house or household type special surveys; for example, assessment and traffic accident records from municipal files and mortgage foreclosures from a special survey. An arbitrary decision has been made here to characterize the housing unit, hence the land parcel, as a point, although actually it has some area. At the scale useful for most urban analyses the housing unit or site parcel can be considered as a point.

Area data refers to that data which has been tabulated, averaged or summed for a set of geographic areas, such as census blocks or tracts. The predominant unit of small-area urban data analysis is the city or census block, and the greatest general resources for block data are the tape records of the decennial U. S. Census of Population and Housing.

To obtain block summary data from point data, desirable for some analyses, a means must be established by which individual data records can be located in space, and thus related to the locations of summary area polygons. This requires the existence of a Geographic Base File (GBF) and access software (i.e., a geoprocessing system), enabling street address locations or intersections to be "geocoded," yielding both specific and summary area spatial identifiers. A system of this type is now available for over 200 urban areas in the form of the U. S. Census Bureau's DIME files (geographic basefiles) and ADMATCH (address matching) systems.[1] The spatial codes appended to any data record by such a

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[1]Although the Bureau of the Census supplies local area GBF's and access software at cost, the expertise to use it does not exist in many areas. Also, the GBF's become outdated in growing areas, requiring supplementary work to rectify them locally.

system may include unique x and y coordinates, specific areal references such as blockface x,y coordinates, nominal area references such as census tract and block numbers, and street network references, such as adjacent street segment or nearest node (Barb, 1974).

To begin the spatial analysis underlying this research, the bus line network and the point and areal data files must be geocoded. An area-wide transit network is composed of a number of bus lines, which in turn consist of strings of access points, or bus stops. The location of each stop along a line is designated by the nearest street intersection, which is geocoded to yield unique spatial coordinates for the stop. All data files similarly defined by point locations (i.e., street addresses) are also assigned unique coordinates as well as standard geographical units (e.g., census tracts and blocks) in which the observations are located. In this analysis, data records specifically describing established geographic areas are spatially located through the use of the x,y coordinates of the area centroid. All geocoding is carried out using a common spatial coordinates system such as the Universal Transverse Mercator (UTM) or state plane-coordinate system.

When all data records have been geocoded, various methods can be explored by which non-transit spatial data can be related to the bus network. Initially, distances were calculated between the location of building permits and the nearest bus stop in the system. Due to the rectangular grid orientation of typical urban street networks, rectangular distance, or $\Delta x + \Delta y$, is used as the distance measure between any two points. A problem in this type of micro-level analysis is involved in the use of areal data, such as block summary data, geocoded to a single centroid. Here the calculated distance from a bus stop to an area centroid represents only an average distance of the point observations to their nearest transit stop. However, the possible error introduced by this condition is not considered serious enough to bias results for the scale of analysis at hand.

Using these basic distance calculations, a data file can be related to the bus system in a number of ways. First, each point's location can be associated with the nearest bus stop, and this distance can be recorded as a measure of level of transit accessibility at that location. Second, the location of all points within a summary area, say a census block, can be represented as one block centroid, whose distance to a bus stop can be recorded. Third, to get an overall measure of how "accessible" a group of data points is, a distribution of points about the access point location can be made by ranges of distance to yield the typical distribution statistics. Thus, the characteristics of all points within, or beyond, a given distance can be examined by selecting the subset of data points meeting a given distance criteria.

As an alternative measure of the level of transit service, a value can be calculated which indicates the number of bus lines within a given distance of a data point's location, say one-fourth mile, termed the "influence level." Examining the maximum value for this variable, and grouping data points according to influence level values, yield an indication of the intensity at which bus lines serve these data locations.

These sorts of associations form the building blocks of a wide range of possible analysis techniques. For any particular study, the appropriate techniques may be selected based in part on the goals of the research, and on the data files being analyzed. Further possibilities include grouping occurrences on the basis of the nearest bus stop, thus allowing for a description of the area served by each individual stop. Similarly, descriptive statistics can be derived for the service area of particular bus routes.

Three general questions emerge with respect to benefit district financing and joint development which can be addressed through the use of this system. As enumerated below, each question can be answered for the bus system as a whole, subareas of the region, or specific stops.

1. <u>Does the general character of the urban form change with distance to the bus system?</u> This question is addressed by arraying data values, relating either to the location of individual data points or block centroid summaries, on the basis of their distance to the nearest stop in the system. Summaries are then made for each distance and the characteristics of each band compared to others to determine if any differences exist between geographic areas surrounding the system's access points.
2. <u>Is the spatial distribution of a given variable influenced by the location of the bus system?</u> By spatially displaying and analyzing the transit network and the data item of interest (e.g., demographic or economic), an examination can be made of possible spatial associations between the network and the data items. Such an approach would be useful if certain characteristics were deemed necessary for the

identification and establishment of benefit districts or joint development locations.

3. <u>Does the location of a stop affect the characteristics of its service area?</u> This question focuses on a stop level unit of analysis. Data describing the urban form, such as the location of new multi-family housing units, are grouped by the nearest stop. Stops exhibiting desired characteristics may then be located and comparisons between types of stops can be carried out to determine the significance of possible network impacts on the urban area. This analysis is most applicable to the identification of network locations most amenable to joint development activity.

CHAPTER III

EXPERIMENTAL DATA ANALYSIS AND FINDINGS

There are numerous contributing factors which must be considered in assessing benefit district or joint development potential for a bus system. As mentioned previously in this report, these include a number of issues which do not lend themselves directly to a spatial analysis, such as general market conditions, politics, and legislative or regulatory restrictions. It has already been suggested on a deductive basis that benefit district financing probably is not feasible for surface transit by virtue of the need to prove causality between transit service and value added in surrounding areas. Nevertheless, it is important to ascertain whether there is in fact any relationship between urban form and transit stop locations so that transit's relationship to its environment may be better understood and perhaps utilized in some operational transit planning or joint development way. The objectives of the ensuing case study analysis, therefore, are to test for the existence of variations in urban characteristics relative to transit routes and suggest how any observable variability might be used for the mutual benefit of both transit and land developers.

Study Area

Seattle's Metro Transit operates a county-wide public transit system consisting of 96 routes. Because the necessary data files were not available for all of King County, the study was restricted to the City of Seattle. Furthermore, available resources dictated that only limited subareas could be dealt with in detail. A variety of criteria were used to identify desirable study areas, including diversity in population and housing characteristics, diversity in land uses, and service by a variety of transit routes. The subsequent choice of two areas was based on knowledge of Seattle's neighborhoods, an examination of Metro Transit's Rider Map showing all bus routes, and the desire that the two areas differ significantly from one another. The areas selected, shown in Figure III-1, were Ballard, a neighborhood in northwest Seattle, and an area to the east of the Central Business District (CBD), termed the Central/Lake Washington Area. The

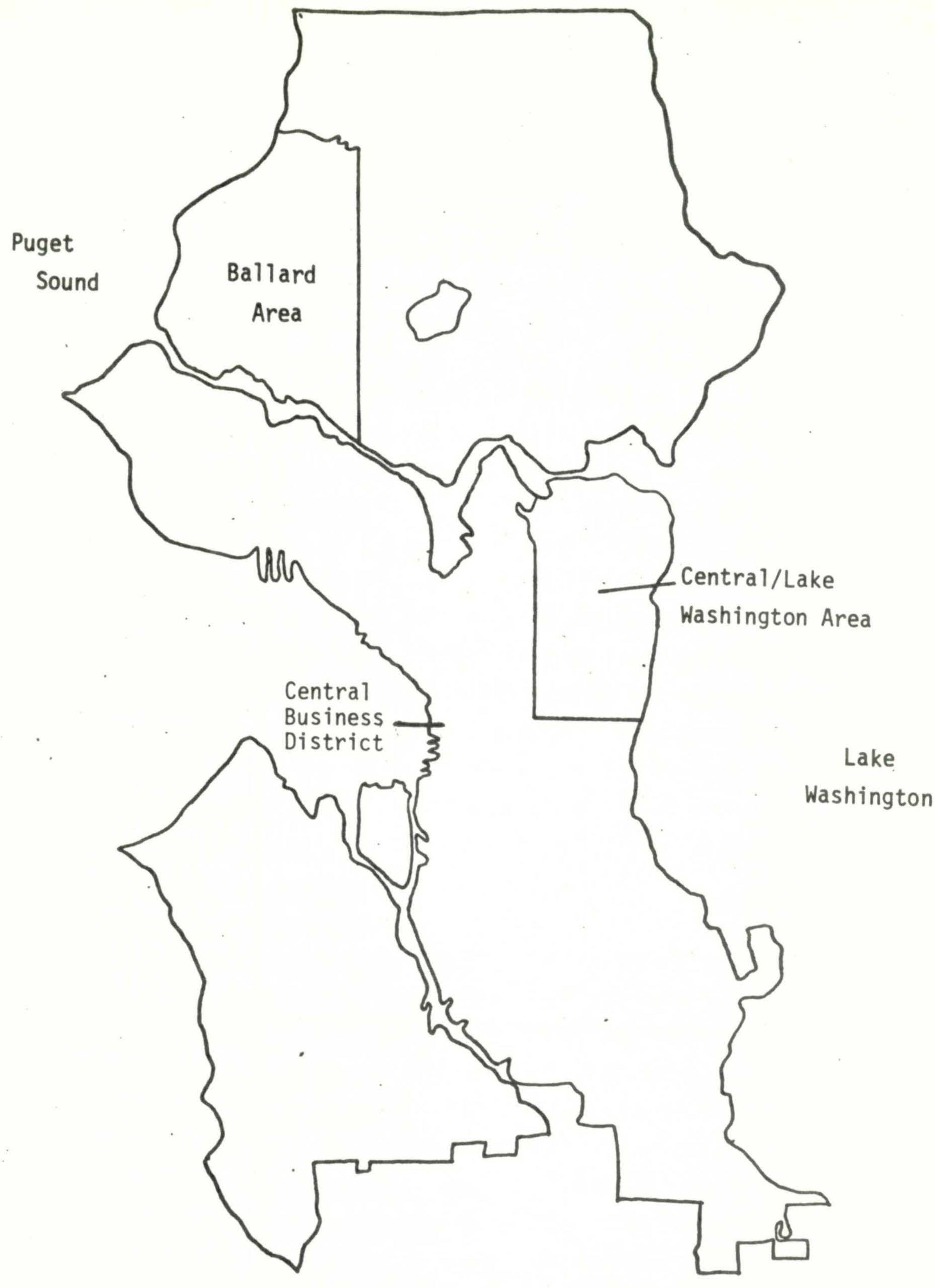

Figure III-1
Locations of Study Areas Within City of Seattle

premise of a scientific sample is not made, nor considered important, in a probe type study of this kind.

The Ballard community is one of the oldest in Seattle, having existed as a separate city before annexation by Seattle. The heavily Scandinavian population is basically middle class, with some areas of wealthier population located on bluffs overlooking Puget Sound. In the southern part of the Ballard area bordering the Lake Washington Ship Canal, there exists a considerable level of industrial activity. The 756-block area is served by six bus routes, four north-south routes oriented toward the Central Business District, and two cross-town bus routes, as shown in Figure III-2.

The Central/Lake Washington Area was also settled early in Seattle's history. Although there are wealthier enclaves in areas overlooking Lake Washington, some neighborhoods of the interior are suffering from decline. There exists a mix of single and multi-family housing in all price ranges, and a large minority population. Ten transit routes pass through this 615-block area, as illustrated by Figure III-3.

Data Description

Two basic data files were chosen for use--building investment data consisting of records of all building permits issued in Seattle from 1960 through 1969, and block-level population and housing data from the 1970 U.S. Census. Because of difficulties in compiling sufficient land use data over time, the building permit file was selected as a means of evaluating development activity, and by inference values of sites relative to transit locations. The population and housing data were chosen to permit an assessment of possible impacts vis-a-vis equity considerations from a transit improvement or value capture program on surrounding areas, or both.

The census data, from the 1970 U.S. Census of Population and Housing, supplied statistics for every city block for such variables as total population, population by age, sex, and race, type of housing units, and value and rental levels of housing units. Each block record also included the geocoded x and y coordinates of the block centroid as an addition to the census information. A comparision of summary census statistics for the two study areas is shown in Table III-1.

The investment data file included records of all building permits issued by the City of Seattle for the decade 1960 through 1969 with values rounding to $1000 or more. Included in each record were the building permit number, the type of

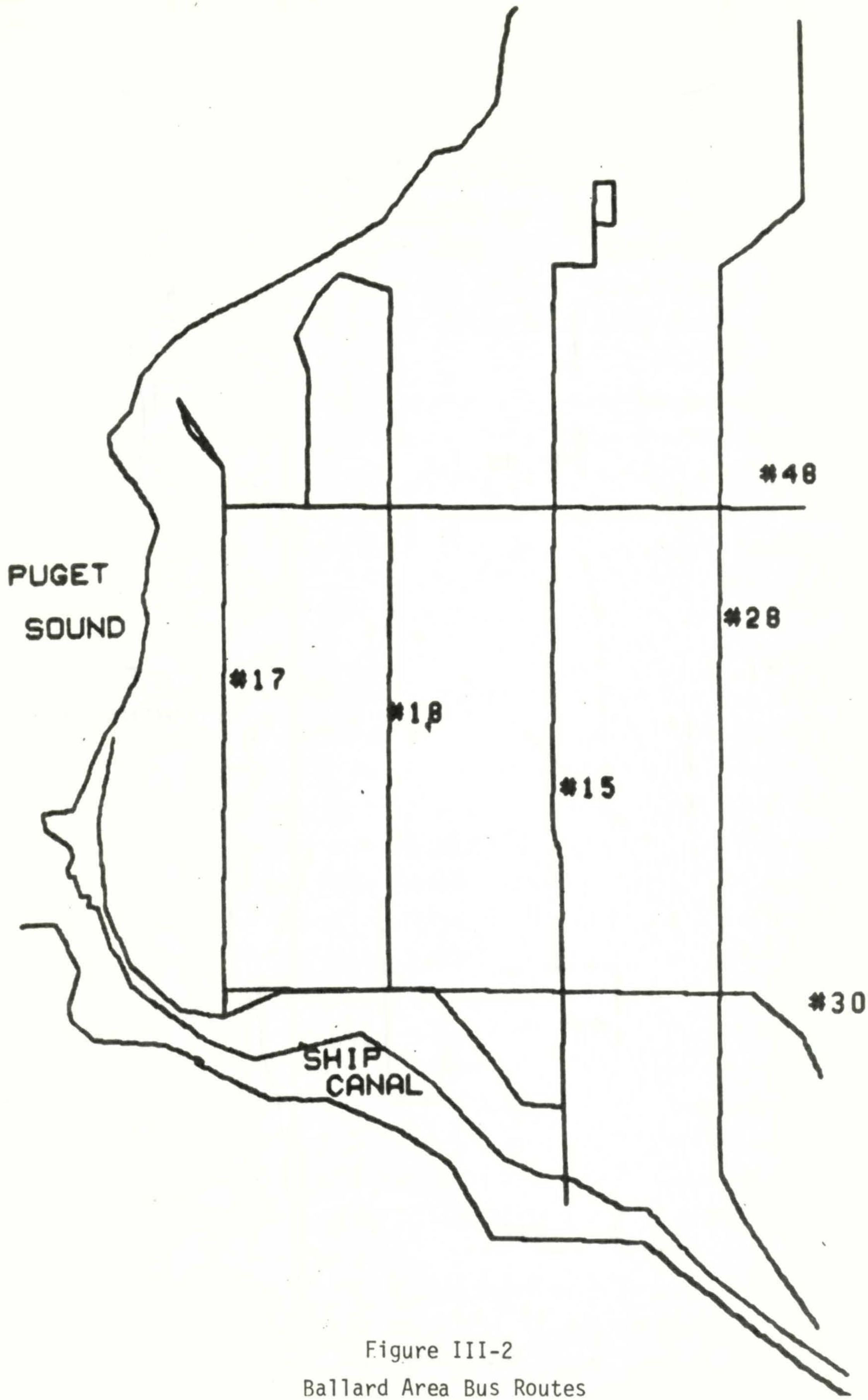

Figure III-2
Ballard Area Bus Routes

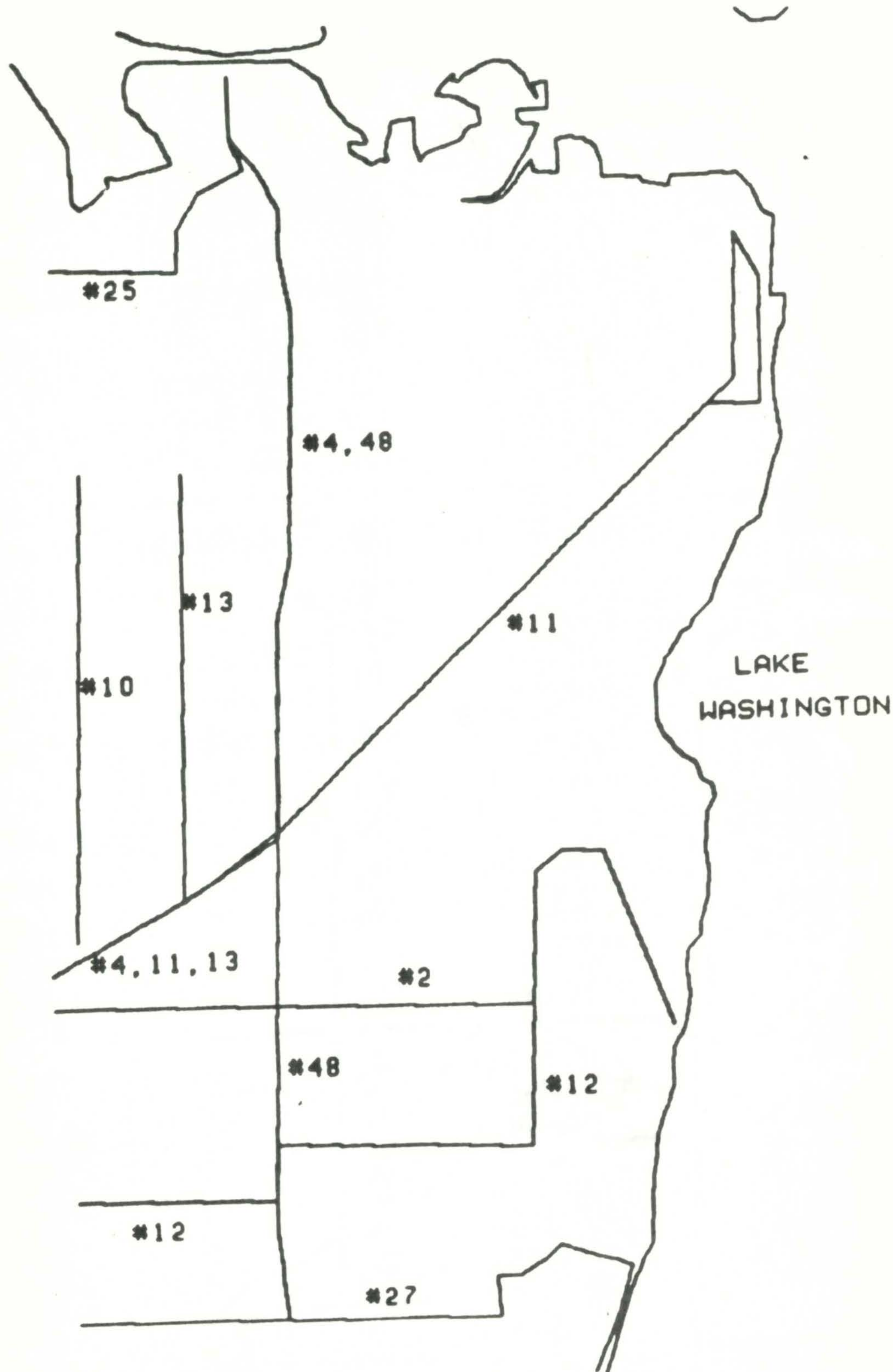

Figure III-3
Central/Lake Washington Area Bus Routes

TABLE III-1

Comparison of Summary Census Statistics for Ballard and the Central/Lake Washington Area

	Ballard	Central/Lake Washington Area
Number of blocks	756	615
Number of bus routes	6	10
Number of unique bus stops	129	128
Total population	48,530	38,061
Black population (and % of total)	111 (0.2%)	17,435 (45.8%)
Other non-white population (and %)	765 (1.6%)	1,695 (4.5%)
Elderly (over age 65)(and %)	7,520 (15.5%)	4,763 (12.5%)
Total housing units	19,927	15,534
Single-family units (and % of total)	14,338 (72.0%)	9,303 (59.9%)
Multi-family units (and % of total)	5,513 (27.7%)	6,231 (40.1%)

permit, the estimated value of construction, the street address of the construction, the date the permit was issued, the change in number of units for residential permits, and the land use code for non-residential permits. In addition, these records were geocoded resulting in unique x and y coordinates appended to each record. This file represented a comprehensive summary of all building investment which occurred in Seattle during that decade. A comparison of 1960 to 1969 investment activity is shown in Table III-2.

Study Approach and Theoretical Basis

The theory being applied here is that benefit accrues to non-users in the vicinity of the transit system, that areas receiving benefits can be identified, and some portion of this value recaptured through taxation or joint development. The goal then is to find a way to identify areas which may be receiving transit-induced benefits through a spatial examination of the transit environment. Because of the general assumption that areas amenable to receiving induced benefits have relatively high accessibility and level of activity, two types of building investment--commercial and multi-family new construction--were singled out as the best available indicators of benefit or development potential.

The choice of these investment types was based on several factors. The willingness of investors to commit funds for substantial construction such as that required for commercial and multi-family building is indicative of some perceived desirability of the location. If the location of these construction types is spatially related to transit service, then a functional relationship may also exist. Simultaneously, both these investment types typically encourage the diurnal movement of a relatively large number of people, either residents of apartment buildings, or patrons of commercial establishments, or both. Thus the presence of commercial or multi-family new investment, or both, in an area may be an indication that activity levels high enough to benefit transit may exist. Because permits for repairs or alterations, or both, to multi-family dwellings were issued the same type code as those to single-family housing units, only permits for new multi-family construction were used here. For commercial investment, both new construction and repairs or alterations were included.

The earlier discussion relating bus and rail system characteristics, and raising key issues to be addressed in value capture, suggests two possible ways to approach the problem of exploring benefit district or joint development potential in regard to a bus system. Under the first scheme, it is assumed that transit system impacts, and thus non-user benefits, may occur at any stop within the

TABLE III-2

Comparison of 1960 through 1969 Investment
Activity for Ballard and the Central/Lake Washington Area

	BALLARD		CENTRAL/LAKE WASHINGTON AREA	
	No. or value of permits	percent of area total	No. or value of permits	percent of area total
Total number of permits issued	2,943		2,262	
Total value (000's of dollars) of permits issued	46,290		51,737	
Breakdown by type of permit:				
Single-family new				
- number of permits	433	14.7%	226	10.0%
- value (000's of dollars)	8,948	19.3%	5,312	10.3%
Multi-family new				
- number of permits	280	9.5%	89	3.9%
- value (000's of dollars)	17,656	38.1%	13,821	26.7%
Commercial				
- number of permits	207	7.0%	202	8.9%
- value (000's of dollars)	10,868	23.5%	29,085	56.2%

bus system. In this case, the procedure would be to analyze the investment data as a function of distance to the nearest bus stop in an effort to establish whether there exists variation in the character of the area with increasing distance from the transit system.

Alternatively, emphasis on the ideas of increased accessibibility and level of activity as prerequisites for intensive development suggest that focus be directed to locations where bus lines intersect or share the same street segment. These sites may have particular potential for joint development activity in the form of a bus station integrated with non-transit development. Thus the thrust of this chapter is to examine the two study areas using each of these schemes, to analyze and compare the resulting area characterizations, and to evaluate each scheme with respect to the question of value capture potential.

Data Analysis Process

The initial data preparation step was to obtain from Metro Transit the locations, by street intersection, of all bus stops within the two study areas, and geocode these records to supply unique spatial coordinates. The census block level data for the necessary tracts was obtained, and all building permit records occurring in either of the two areas were extracted from a previously established magnetic tape file. Treating each of the study areas separately, the census block records and the building permit records were then processed by a computer program which performed the necessary distance calculations. For each spatial entity record, the rectangular distance was calculated between the entity (either permit location or block centroid) and every bus stop in the area. The nearest bus stop to the entity location and its associated distance were recorded for the respective study areas.

The analysis procedure incorporated use of an interactive graphic spatial analysis system called System X, developed and operational at the University of Washington's Urban Data Center. Included in the system software are routines providing for the input, storage, and manipulation of spatial data, as well as for its display on a cathode ray tube (CRT) screen, and the generation of a variety of tabular and graphic reports. The census and investment data file records, including the results of the distance calculations, were input to System X for the analysis.

From the results of the distance calculations for the census block data, the maximum distance from any block centroid to the nearest bus stop representation was found to be 2290 feet (0.43 mile) for Ballard, with 696 of the 756 block centroids within one-quarter mile (1320 feet) of a bus stop. In the Central/Lake Washington Area, the maximum distance was 2990 feet (0.57 mile) and the proportion within one-fourth mile was 562 out of 615 block centroids. Thus over 91 per cent of all blocks were within one-fourth mile of a bus stop. The maximum distances to bus stops for the building permits corresponded closely to the block centroid statistics, with over 90 per cent of all permits located within one-fourth mile of a bus stop.

Because the bus system so completely covered the study areas, it was necessary to examine variations in the data within the areas to explore any spatial relationships between the data files and bus stop locations. Using area-wide summary statistics, the distributions around bus stops of permits of various types were compared. The values used for this comparison were the average distances to the nearest stop for all permits and also for individual permit types. The results for Ballard, shown in Table III-3, indicate that commercial permits were, on the average, closer to bus stops than residential permits, and also that multi-family new investment occurred nearer transit than did single-family new construction. These initial results suggest that high-intensity development occurs close to bus lines.

The next step was to examine the spatial distribution of the data points at a small scale to see if any relationships appeared. The two basic schemes presented earlier were used--examining distributions of occurrences by distance bands from bus stops, and focusing on locations near sites where bus routes intersected or shared a common street segment. The initial examination of the data involved generating cumulative percentage graphs to show the overall distribution of several aggregate variables (such as total dollar value of investment, population, or number of housing units) and to reveal any similarities and differences among the distributions of sub-category variables (such as various investment types, minority population groups, or single and multi-family housing units). Comparable graphs were drawn for each of the two schemes.

First, the distance distributions of all permit locations and block centroids, respectively, were graphed by one-sixteenth-mile distance bands in respect to all stops in each study area to determine if simple distance to stops was an important factor. The second approach focused on the hypothesis that the existence of multiple routes was a major determinant of transit impact. Under the latter scheme, a value was calculated for each data point, either specific permits for permit data or block centroids for census data, giving the number of bus routes within

TABLE III-3

Average Distance to Nearest Stop
by Permit Type for Ballard

Type of permit	Number	Average distance to nearest bus stop (feet)
All	2,945	633
Commercial	207	518
- new	99	585
- repairs/alternations	108	456
Multi-family new	280	638
Single-family new	433	863

one-fourth mile of the location, called the "influence level." To graph distributions under this scheme, data points were grouped according to influence level, and cumulative percentages were calculated beginning with all data points with the highest influence level, and adding lower influence levels incrementally.

Using the building investment data file, examples of these cumulative percentage graphs are shown in Figures III-4 and III-5, depicting the distributions of the total Ballard investment value for three permit types--commercial, multi-family new, and single-family new investment. The first graph shows the distance band distribution, using one-sixteenth mile increments. The second graph presents influence level groupings, starting with four, the maximum influence level in Ballard.

In the distance band graph, Figure III-4, 89 per cent of the area's commercial investment value, 71 per cent of multi-family new, and 34 per cent of single-family new value occurred within one-eighth mile of bus stops. The higher proportions of commercial and multi-family construction within one-eighth mile of bus stops suggest that there is indeed more intensive development activity at these locations, possibly indicative of transit-induced attraction in the vicinity of bus stops. Figure III-6 shows all Ballard block centroids within one-eighth mile of a bus stop.

Figure III-5 shows an alternative approach to exploring sites where transit-induced benefits may have occurred. In this case, focus is initially directed to those areas, shown at the left of the graph, within one-fourth mile of four lines, that is, where the influence level is four (note reversed scale). In subsequent steps, areas within one-fourth mile of three lines, then two lines, and so on, are accumulated. Choosing a cutoff level so as to include all locations served by two or more bus lines, the area encompassed included 54 per cent of all commercial investment value, 39 per cent of multi-family new, and 13 per cent of single-family new investment value. The high proportions of commercial and multi-family new investment within this area may indicate an affinity of these uses for proximity to transit service benefits which might occur at the locations served by multiple routes. Figure III-7 shows the portion of Ballard blocks which have an influence level equal to or greater than two. This is a more clustered area than under the distance band criteria. It should be noted that this indicator also identifies a few locations midpoint between routes as well as the intersection locations of bus lines.

While these graphs indicate the spatial variation of selected investment types, they do not provide information on the mix of investment types within a

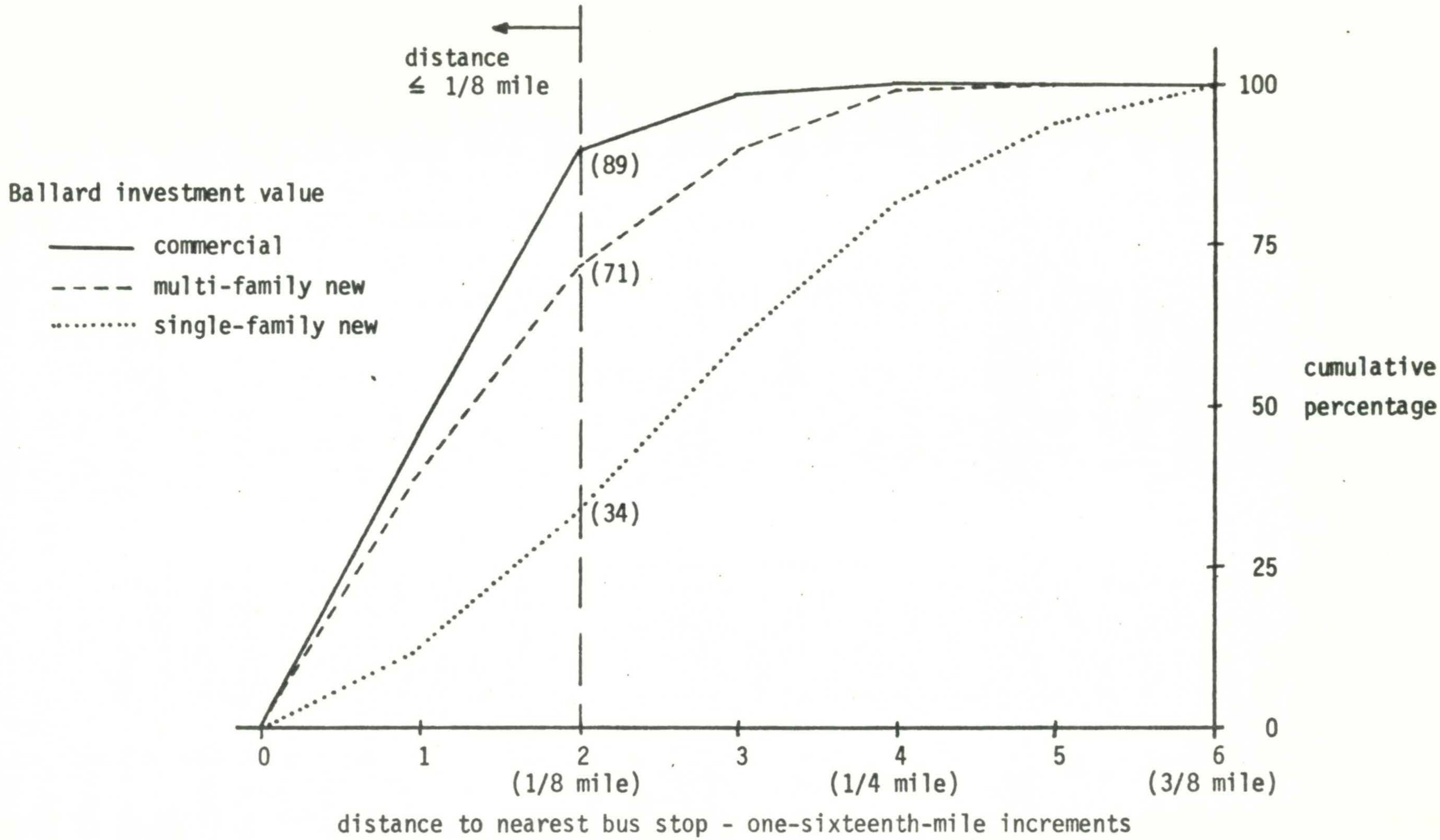

Figure III-4

Cumulative Percentage Graph of Ballard Investment Data:
Distance Band Scheme

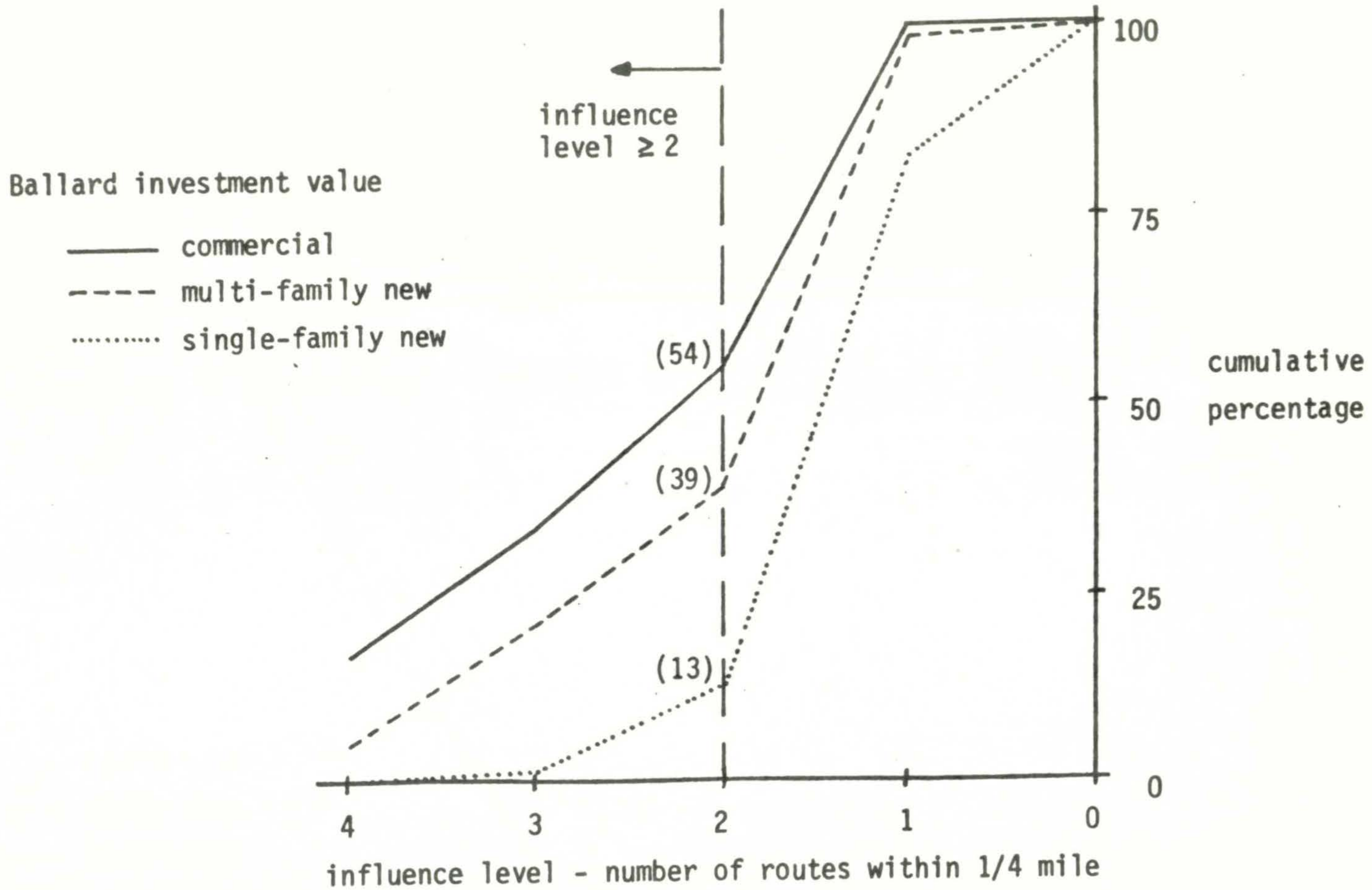

Figure III-5

Cumulative Percentage Graph of Ballard Investment Data: Influence Level Scheme

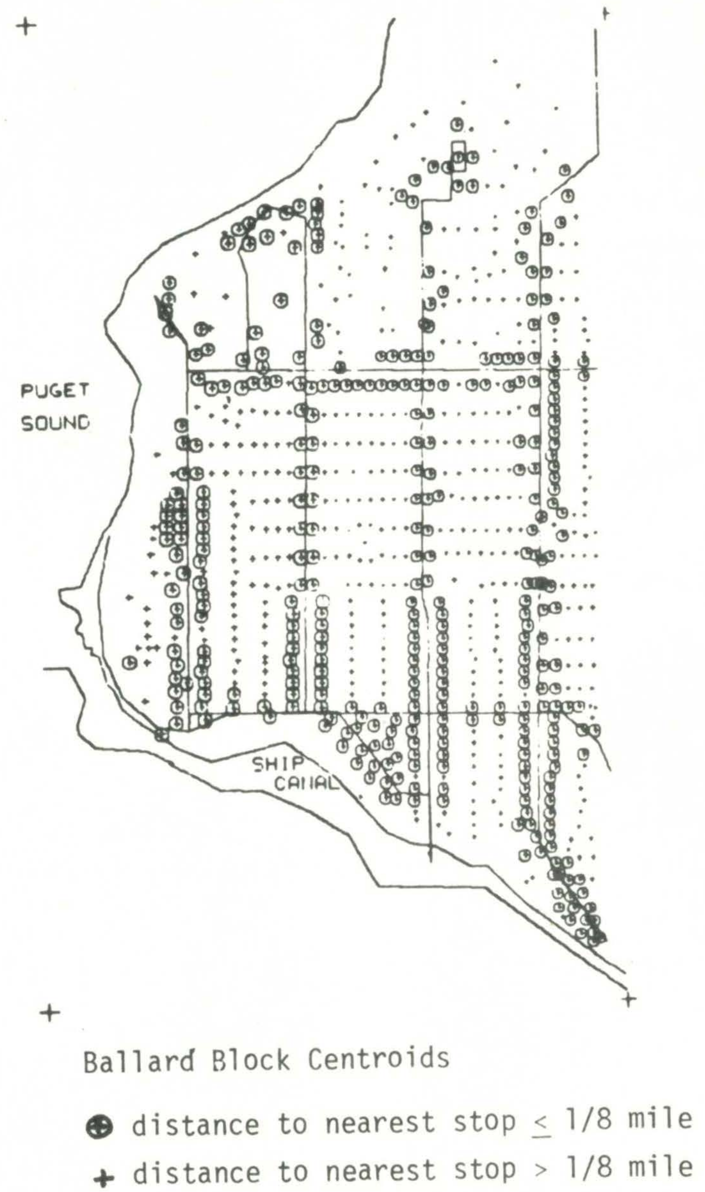

Figure III-6
Ballard Blocks Within One-eighth Mile of Bus Stops

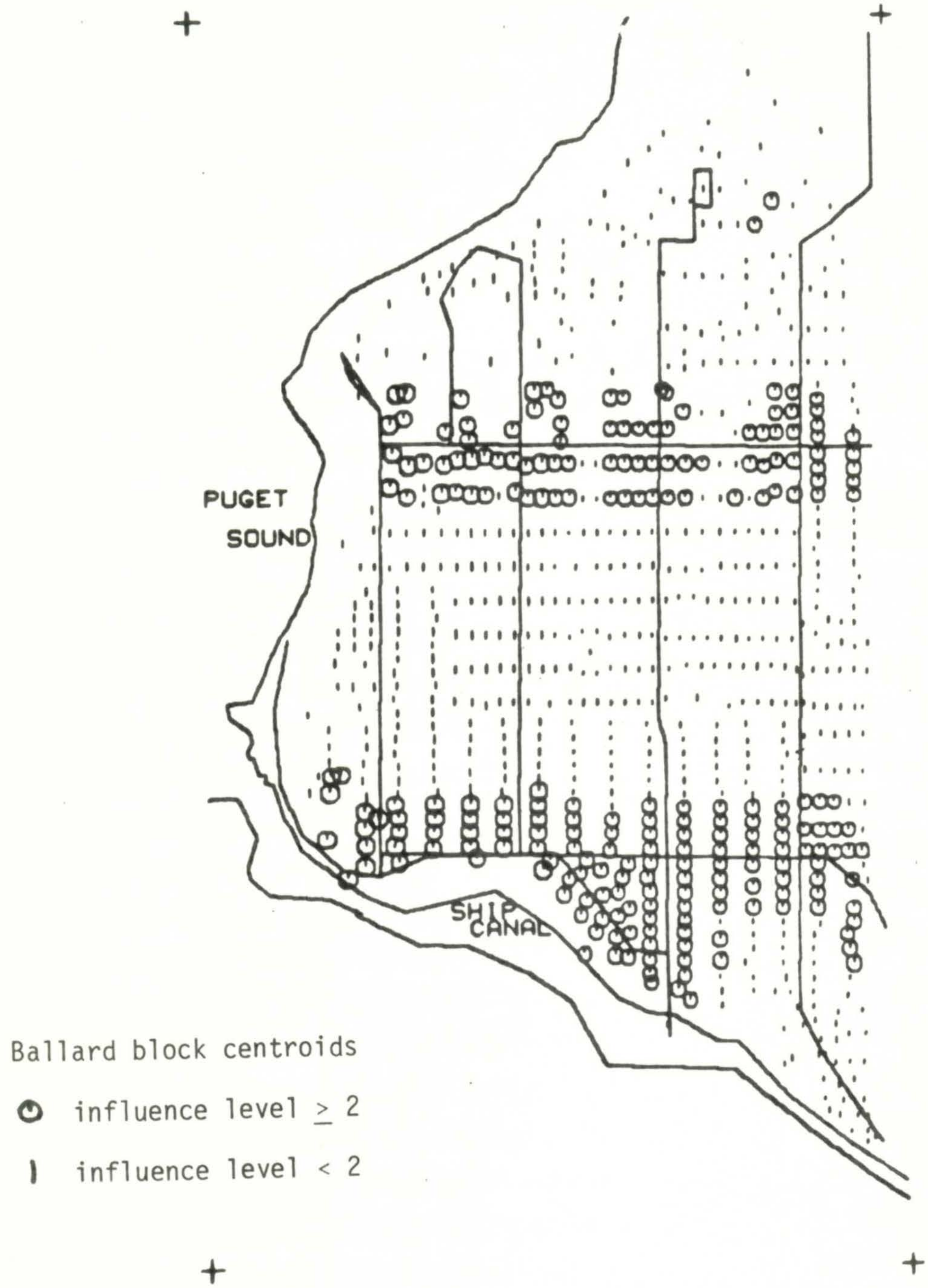

Figure III-7

Ballard Blocks with Influence Level Greater Than or Equal to Two given area. Therefore, additional graphs were produced to show what per cent of total investment in each analysis group (i.e., distance band or influence level) was associated with commercial or multi-family new development.

Examples of these graphs are shown in Figures III-8 and III-9, again using Ballard investment data. As in previous figures, the x-axis of Figure III-8 shows distance bands from bus stops, while the x-axis of Figure III-9 depicts influence levels. In both cases the values shown on the y-axis represent the percentage of total investment value that was either multi-family new or commercial. In the distance band graph, Figure III-8, the first value, 77 per cent, represents all occurrences within one-sixteenth mile of the closest stop (band 1), the second value, 74 per cent, all occurrences within one-eighth mile (bands 1 and 2) and so on. Similarly for influence levels in Figure III-9, the first value, 93 per cent, represents the percentage of total investment value that was either multi-family new or commercial for all permits with an influence level of four, the second, all permits with an influence level of three or above, and so on. In this way, the final value under each scheme represents the percentage for the entire area.

With increasing distance from bus stops, multi-family new and commercial investment represented a progressively decreasing proportion of total investment value, from a high of 77 per cent to an area-wide value of 62 per cent. The relationship was more striking using influence levels, where these two types comprised 93 per cent of all investment value in areas served by four bus lines.

These graphs, coupled with the previous cumulative percentage graphs, thus show two aspects of the relationship. While generally the results from these two approaches corroborate each other, situations could exist where the two methods show different results. An example might be where a given investment type occurs very close to bus stops and multiple route locations. and thus shows high percentages using the first method, but if it constitutes a relatively minor proportion of total area investment value, it would not comprise a very large share of total investment for any distance band or influence level. This difference would not be likely to occur in this study where the investment types being focused on represent significant proportions of total investment.

A similar examination was conducted using census data to explore whether areas encompassing either (1) all locations within one-eighth mile of all bus stops, or (2) all locations within one-fourth mile of two or more bus routes, might have differential impacts on any population or housing categories of census data. Examples of the variation in characteristics for different subareas are presented in Tables III-4 and III-5. It can be seen that differences exist between

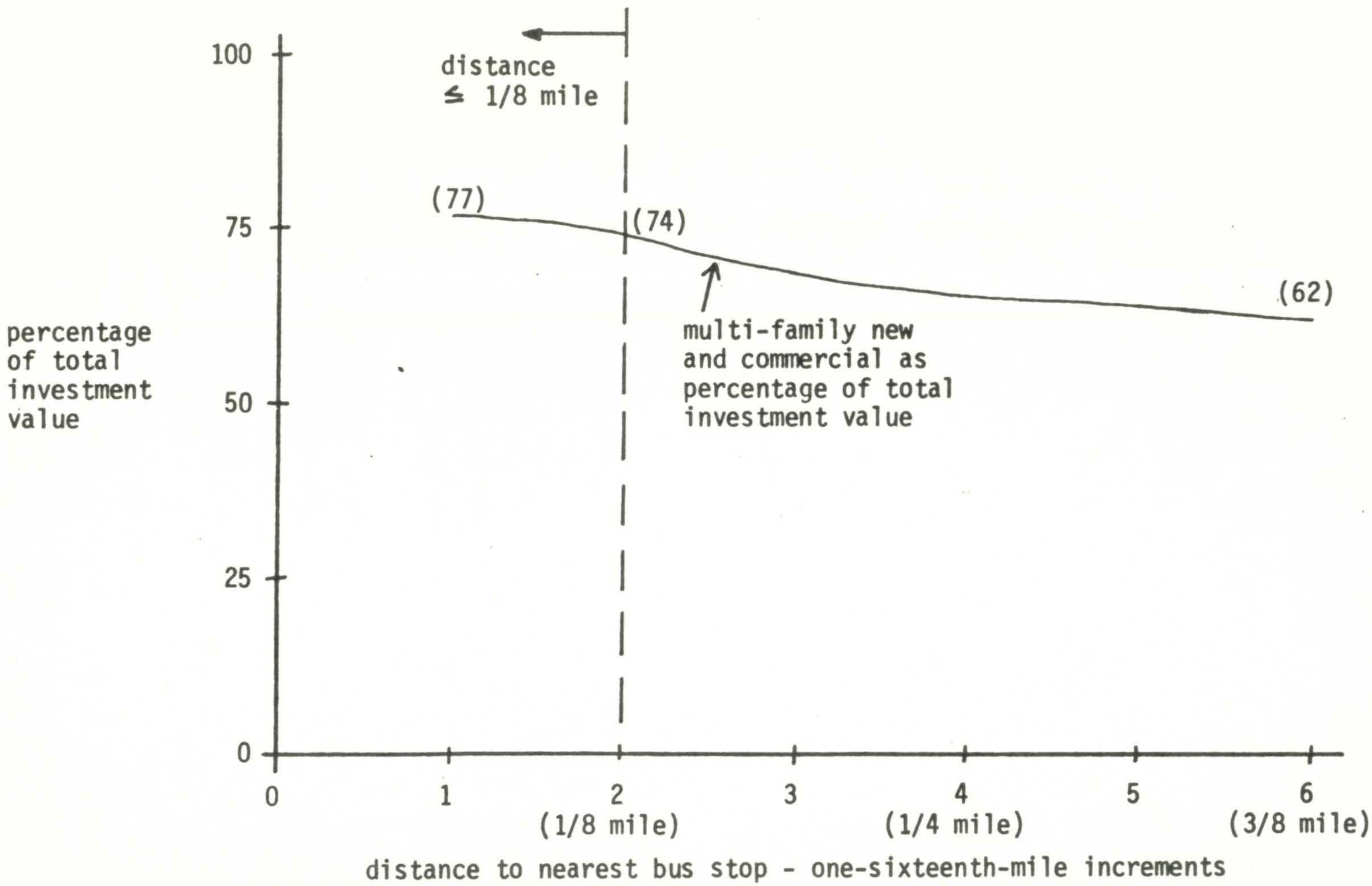

Figure III-8

Selected Investment Types as Percentage of Total Ballard Investment Value:
Distance Band Scheme

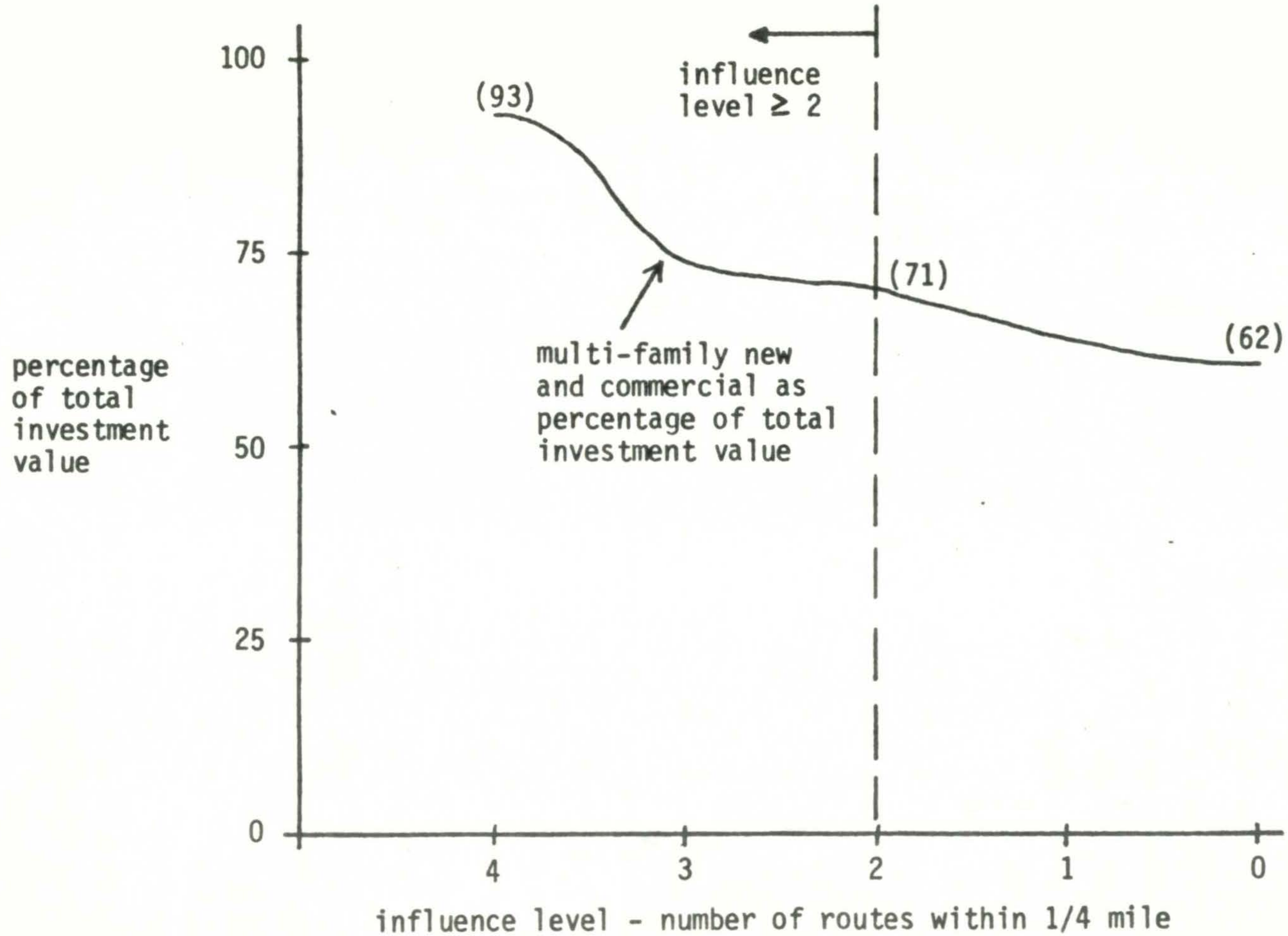

Figure III-9

Selected Investment Types as Percentage of Total Ballard Investment Value:
Influence Level Scheme

areas which would be affected and those that would not under both techniques for identifying impact areas even though the socio-economic variations differ somewhat between the two study areas.

In Ballard, those blocks most closely associated with transit service have proportionally more elderly people, a higher percentage of housing units are rented and more of these rental units have low rents than in other portions of the area. At the same time, the housing stock does not include many high valued owner-occupied units especially when compared to blocks beyond a quarter-mile of any transit stop. The two Ballard tables suggest that the impact of a subarea tax or of joint development projects would be absorbed more by the elderly, non-homeowners, and lower income groups than if an area-wide tax were applied.

The Central/Lake Washington region illustrates slightly different impacts. The elderly community is not concentrated near transit service in this area, but the black population does live in the more highly served parts. The density of transit service is quite high here as over 50 per cent of the total population resides in the areas defined as most highly accessible to transit. Of particular interest in this area is that the percent of rental units is much higher within one-eighth mile of a stop than further away, but there is not such a distinction in terms of the number of routes serving the area. However, the proportion of low value rental units shows the opposite trend. That is, rental value is relatively unaffected by distance to a transit stop but is significantly associated with the number of routes serving the area. Thus, the types and degree of variation in the character of areas cannot be easily generalized.

The results of these examinations emphasize that although general statements may not be possible, there are indications that areas adjacent to transit lines or in the vicinity of multiple routes are different in some respects than surrounding locations. Obviously, there was no attempt to control for factors other than transit (e.g., effects of zoning, physical features, etc.) but the existence of variations between areas indicates that consideration must be paid to differential impacts on population subgroups. Because of the range of possible financing and development schemes, no statement can be presented here as to the extent of the impacts or the type (i.e., positive or negative). It is apparent however that each individual situation must be addressed separately and that equity considerations cannot be overlooked.

Thus there is evidence that there are increased levels of development both proximate to bus stops, and in areas served by more than one bus route. The presence of numerous other contributing factors makes isolation of transit

Table III-4

Variations in Selected Socio-Economic Characteristics for Ballard

A. Distance to Nearest Stop

	≤ 1/8 mile	1/8-1/4 mile	≥ 1/4 mile	Area Total
No. of blocks (% of area total)	356 (47.1)	340 (45.0)	60 (7.9)	756 (100.0)
Population (% of area total)	20,813 (42.9)	23,047 (47.5)	4,670 (9.6)	48,530 (100.0)
% Elderly	18.2	13.8	12.1	15.5
Occupied Housing Units (% of area total)	8,900 (46.8)	8,507 (44.7)	1,621 (8.5)	19,028 (100.0)
% Units Renter Occupied	45.6	24.8	15.9	33.9
% Rental Units Low Valued	21.1	16.1	7.0	19.0
% Owner-Occupied Units High Valued	17.0	18.1	32.3	19.4

B. Number of Routes within 1/4 Miles

	≥ 2	1	0	Area Total
# of Blocks (% of area total)	232 (30.7)	464 (61.4)	60 (7.9)	756 (100.0)
Population (% of area total)	13,304 (27.4)	30,556 (63.0)	4,670 (9.6)	48,530 (100.0)
% Elderly	18.2	14.8	12.1	15.5
Occupied Housing Units (% of area total)	5,857 (30.8)	11,550 (60.7)	1,621 (8.5)	19,028 (100.0)
% Units Renter Occupied	48.6	28.9	15.9	33.9
% Rental Units Low Valued	25.2	14.6	7.0	19.0
% Owner-Occupied Units High Valued	13.9	19.2	32.3	19.4

Table III-5

Variations in Selected Socio-Economic Characteristics for Central-Lake Washington Area

A. Distance to Nearest Stop

	≤ 1/8 mile	1/8-1/4 mile	≥ 1/4 mile	Area Total
# of Blocks (% of area total)	346 (56.3)	216 (35.1)	53 (8.6)	615 (100.0)
Population (% of area total)	21,106 (55.5)	14,191 (37.3)	2,764 (7.3)	38,061 (100.0)
% Elderly	13.3	11.0	14.3	12.5
% Black	49.2	43.7	30.7	45.8
Occupied Housing Units (% of area total)	8,173 (59.7)	4,545 (33.2)	978 (7.1)	13,696 (100.0)
% Units Renter Occupied	55.1	31.0	15.9	44.3
% Rental Units Low Valued	26.5	25.1	17.3	26.0
% Owner-Occupied Units High Valued	16.5	26.7	64.7	25.9

B. Number of Routes within 1/4 Mile

	≥ 2	1	0	Area Total
# of Blocks (% of area total)	331 (53.8)	231 (37.6)	53 (8.6)	615 (100.0)
Population (% of area total)	20,935 (55.0)	14,362 (37.7)	2,764 (7.3)	38,061 (100.0)
% Elderly	11.6	13.5	14.3	12.5
% Black	52.2	39.4	30.7	45.8
Occupied Housing Units (% of area total)	7,290 (53.2)	5,433 (39.7)	973 (7.1)	13,696 (100.0)
% Units Renter Occupied	46.8	46.0	15.9	44.3
% Rental Units Low Valued	32.0	18.2	17.3	26.0
% Owner Occupied Units High Valued	16.7	27.2	64.7	25.9

impacts extremely difficult, and in fact it could well be that the location of development along a bus route is due to the zoning history. It is clear, however, that these related occurrences of transit service and development activity are mutually supportive, but a claim of any cause and effect relationship would be tenuous. A possible sequence of conditions is that initial selection of zoning corridors along transit lines (trolley lines originally) established long term settlement characteristics. Thus it is impossible to assert that there is potential for using special benefit district taxation as a means of recapturing transit-induced non-user benefits.

Locating Potential Sites for Joint Development Activity

Because joint development schemes do not require proof of transit impact, the ensuing analysis focused on exploring the potential for these types of programs. The intent was to further explore spatial relationships in an effort to identify criteria and methods to help in singling out potential sites for joint development. Previous results indicated that commercial and multi-family new building permits were located, on the average, closer to transit than other types, and that there were high concentrations of these investment types within one-eighth mile of bus stops and in areas served by two or more bus routes. These results supported further exploration for potential sites for joint development.

Focus was directed toward developing a process whereby locations amenable to joint development programs might be identified. As discussed earlier, joint development programs applicable to bus transit systems would probably be associated with actual bus station structures, integrating access to and transfer within the bus system with supportive non-transit development, or similarly visible and permanent transit facilities such as park and ride lots. Park and ride lots are most often located in outlying locations, where low densities make widespread walk access to the bus system impracticable. This tendency suggests that there is little likelihood for locating a park and rode lot in either of these two Seattle study areas.

Therefore, the concept of developing an interline or intermodal transfer facility was considered to be the most viable joint development scheme and was examined in more detail. Locations most conducive to the qualities necessary for this type of facility would be areas simultaneously high in accessibility and level of activity. Thus primary focus was directed to exploring locations in the vicinity of multiple routes where levels of commercial and multi-family new investment might be particularly high.

Whereas the analysis procedure described so far centered on viewing an entire study area, the concentration on exploring specific sites for joint development potential incorporated substantial use of the interactive graphic capabilities of System X. While the area-wide statistics indicated average distances to, and distributions about, bus stops for the various permit types, viewing the actual locations of these permits on the CRT showed whether specific types of development clustered in particular subareas. This allowed for the identification and singling out of locations where there were concentrations of investment that warranted closer examination. As was also true of the area-wide analysis, any complete assessment of value capture and joint development potential must consider numerous issues beyond the scope of this research. However, by isolating the particular locations to be considered for further examination, many of the other issues (e.g., zoning, political considerations, land assemblage requirements, etc.) can be more precisely defined and addressed.

To explore these spatial relationships visually, all multi-family new and commercial building permits were scattered on the CRT for each of the two study areas, located by the unique x and y coordinates appended by the geoprocessing system. This scattergram for Ballard is shown in Figure III-10. The commercial permits were located to a great extent along bus lines, with the largest concentration of commercial activity occurring in the southern part of Ballard, where service is provided by several bus lines. Lesser concentrations are found along one of the major north-south routes (#15), especially near the northern intersection of lines #15 and #48. The clustering of multi-family new permits is even more evident. Over 78 per cent of all permits of this type in Ballard were located in a rectangle in the southern part of the area, primarily due to zoning restrictions.

As can be seen from the zoning map pictured in Figure III-11, the extent of the multi-family new construction corresponds to the areas zoned for multi-family residences. The zoning restrictions for commercial activity are also shown, and the scattergram of commercial permits corresponds to areas zoned for this purpose. Yet within areas zoned for commercial development, there still exist noticeable clusters of permits, indicating that factors other than zoning may also influence the location of commercial investment. Thus zoning restrictions can play a significant role in relating tranist service and urban development. Efforts must be made to determine how zoning relates to transit systems at present and how it could be used to facilitate future joint development endeavors.

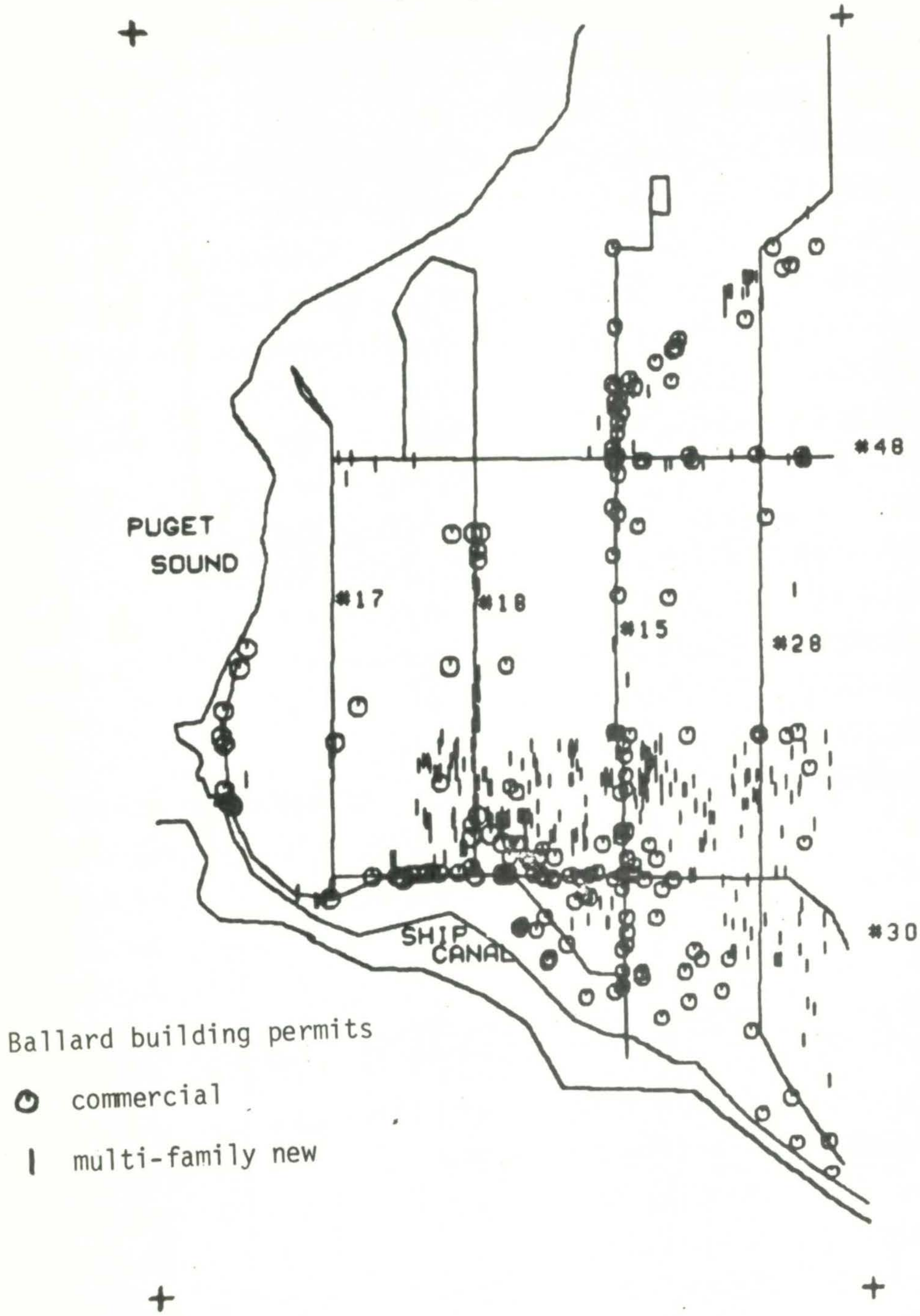

Figure III-10

Multi-family New and Commercial Permits--Ballard Area

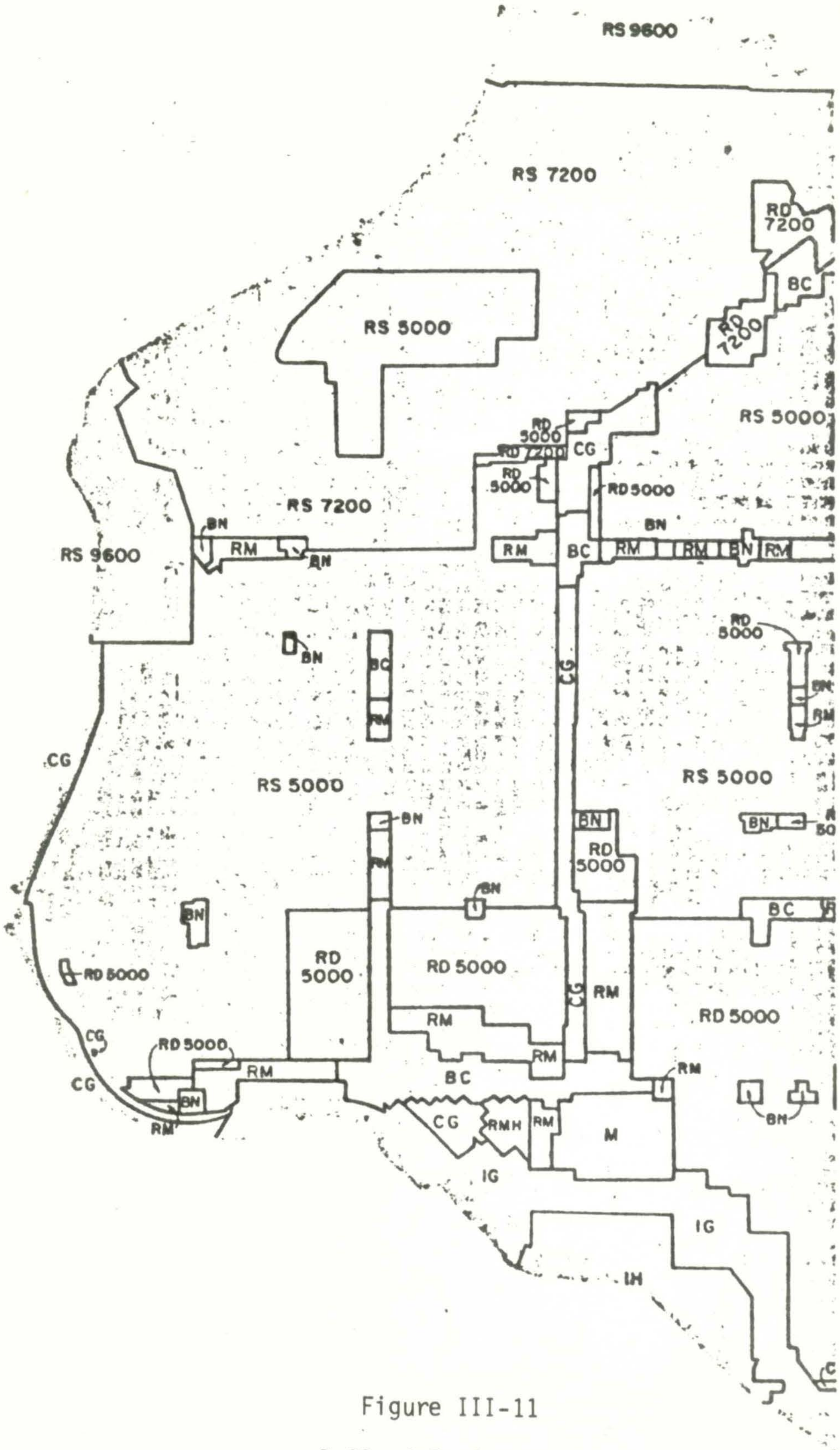

Figure III-11

Ballard Zoning Map

ZONING CLASSIFICATIONS

RS 9600	Single family residence low density
RS 7200	Single family residence medium density
RS 5000	Single family residence high density
RW	Residence water front
RD 7200	Duplex residence medium density
RD 5000	Duplex residence high density
RM 1600	Multiple residence lowest density
RM (800)	Multiple residence low density
RMH (350)	Multiple residence high density
RMV 200	Multiple residence high density, variable height
RMV 150	Multiple residence highest density, variable height
BN	Neighborhood business
BI	Intermediate business
BC	Community business
BM	Metropolitan business
CM	Metropolitan commercial
CMT	Metropolitan commercial temporary
CG	General commercial
M	Manufacturing
IG	General Industrial
IH	Heavy industrial

Legend for Figure III-11
(Figure on preceding page)

A similar area-wide CRT scattergram of commercial and multi-family new permits was generated for the Central/Lake Washington Area, shown in Figure III-12. Although there was less clustering of permits in this area than in Ballard, commercial permits were located to a great extent along bus routes, and there were small clusters at several of the route intersections. Multi-family new permits were found almost exclusively in the southwestern portion of the area, although there were no large, dense concentrations of these permits. As an example of how potential joint development sites might be identified and explored, a window was first defined within this southwestern portion of the area within which there appeared to be relatively high concentrations of both commercial and multi-family new investment (indicated by dotted line in Figure III-12). An expanded view of this window was then displayed (Figure III-13). Inside this window's boundary, there occurred 15 per cent of all Central/Lake Washington Area block centroids, and 19 per cent of all building permits. Of greater relevance to the issue of joint development is that 33 per cent of the total value of buliding construction in the Central/Lake Washington Area occurred within the window, including 42 per cent of the area's total commercial permit investment value. The average distance to the nearest bus stop for permits in this window was 426 feet, as compared to 696 feet for the entire Central/Lake Washington Area, and commercial building permits in the window were at an average distance of 289 feet. These results signaled that there might be sites within this window that exhibited a potential for joint development activity. Based on this visual evaluation of the data, several individual bus stops were identified for further, site-specific examination. In the example presented here, data in the vicinity of the intersection of lines #2 and #48 (stop #4808), indicated by a star in Figure III-13, was analyzed.

To view the surrounding data as it related to stop #4808, distances were calculated from every building permit and every block centroid to this stop. The spatial distributions of occurrences within one-fourth and one-eighth mile of this stop were analyzed, both quantitatively and visually. Figure III-14 shows the CRT display of this stop and block centroids and commercial building permits within one-fourth and one-eighth mile (dotted lines); there were no permits for multi-family new investment within these distances. As can be seen, the commercial permits were clustered around the stop, with only one permit between the one-eighth mile and one-fourth mile distance lines. Within one-eighth mile of the stop, commercial investment comprised over 94 per cent of total investment value, and represented almost three per cent of all commercial investment value in the Central/Lake Washington Area.

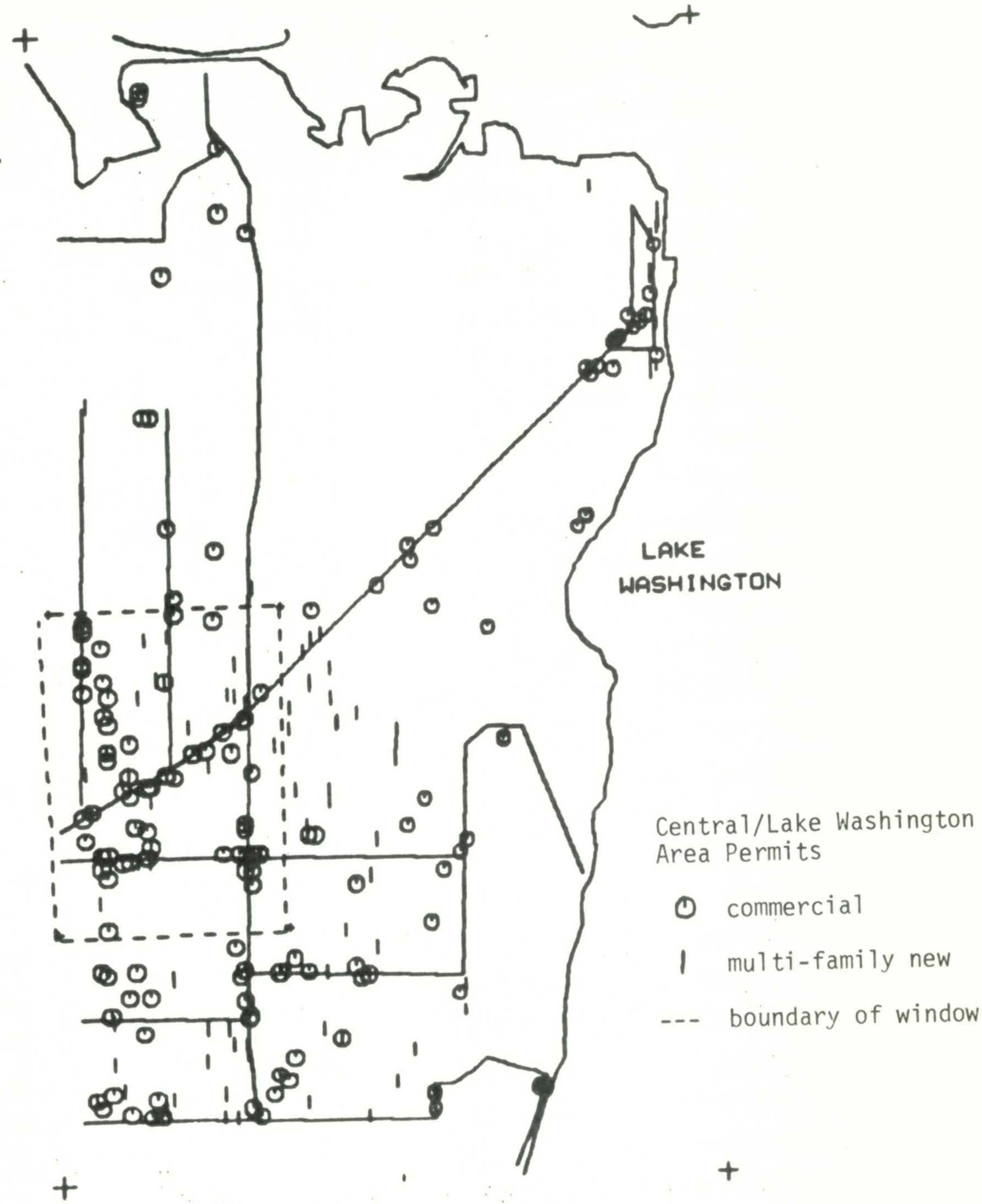

Figure III-12

Multi-family New and Commercial Permits--
Central/Lake Washington Area

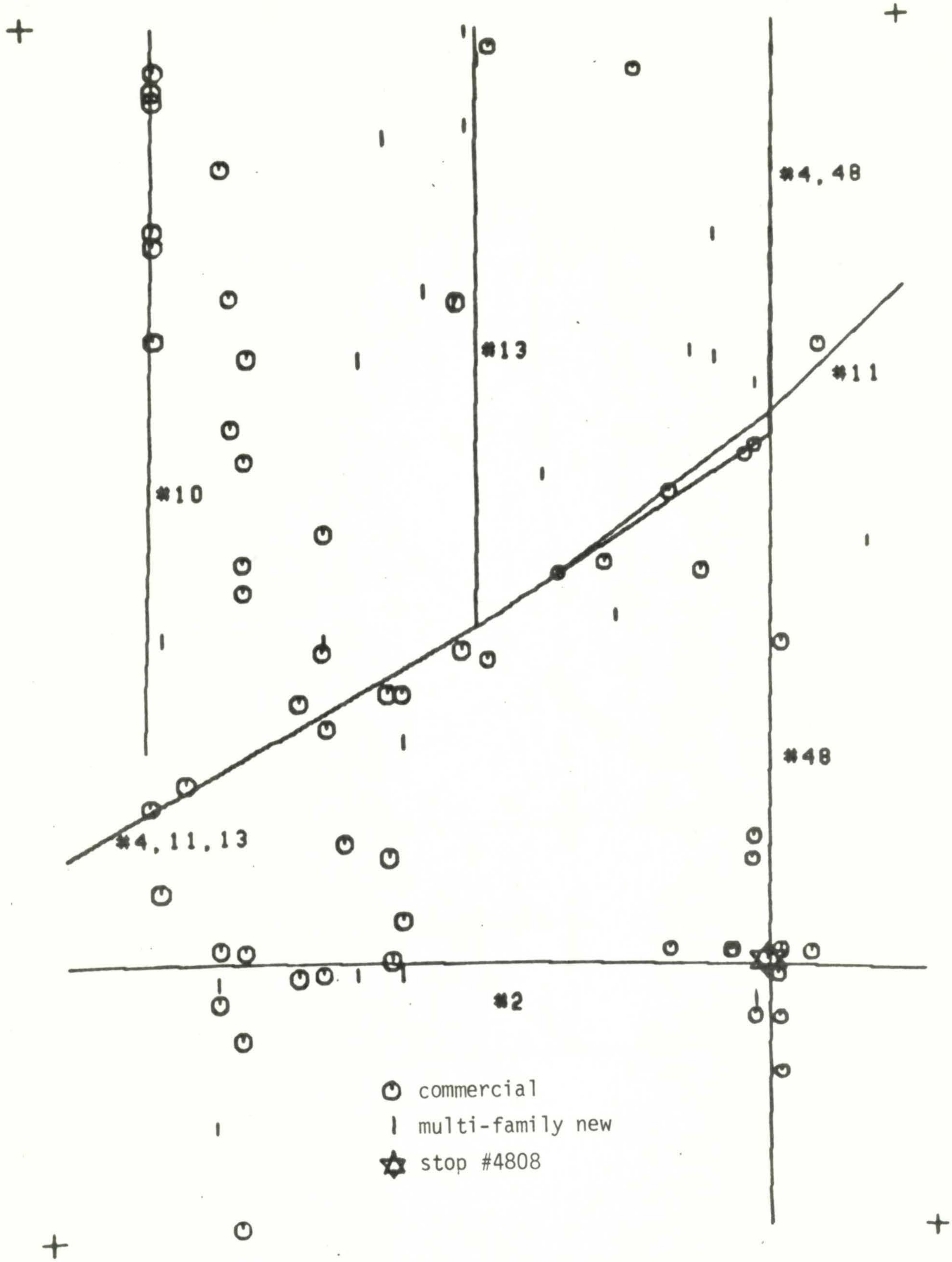

Figure III-13

Expanded View of Central/Lake Washington Area Window

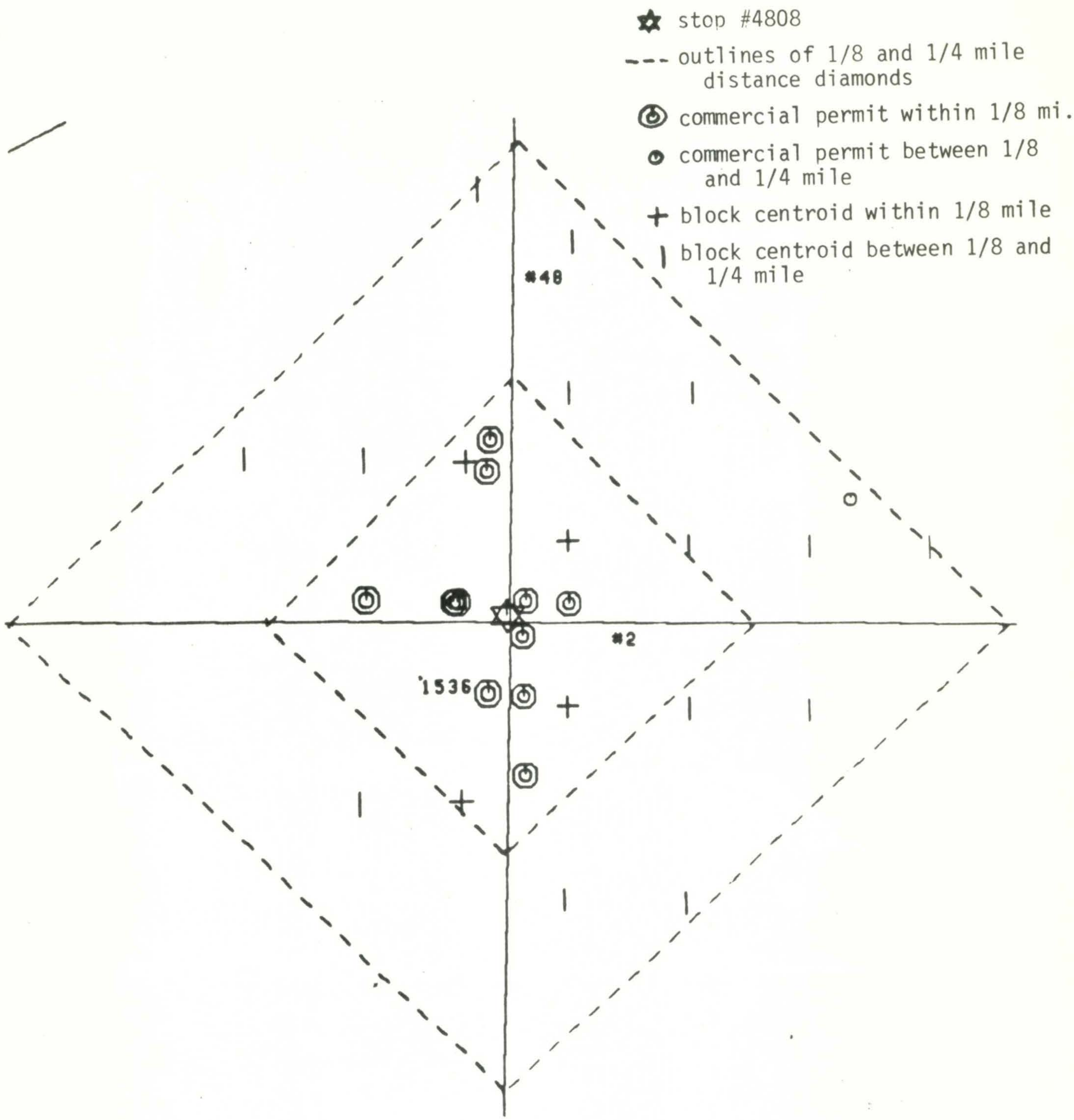

Figure III-14

Close-up of Area Surrounding Stop #4808

The location of block centroids relative to this intersection is also shown in Figure III-4. Since blocks are relatively large entities when viewed on this small scale, it can be seen that the inclusion or exclusion of a particular centroid from a distance band diamond was largely determined by the size and orientation of the area's blocks. The one-eighth mile diamond encompassed four block centroids, or 0.7 per cent of the Central/Lake Washington Area total. Of greater interest for this analysis are the results that within these four blocks, and also within the 18 blocks inside the one-fourth mile line, over 33 per cent of the housing units were of either low value or low rent (as compared to 20 per cent for the entire Central/Lake Washington Area), and over 93 per cent of the population was non-white (vs. an area-wide figure of 50 per cent). These figures indicate that any transit project at that location would disproportionately affect low income groups (e.g., through demolition of low-cost housing) and non-whites.

At this level of analysis, it is also possible to begin examining specific details of the data units falling within the defined area. As an example, Table III-6 consists of selected attributes of the 13 building permits which occurred within a quarter mile of stop #4808. The characteristics of each permit can consequently be examined relative to the matter at hand. For instance, the permit labeled 1536 in Figure III-14 can, from the listing, be identified as a commercial repair or alteration permit (type 6) to a retail food establishment (land use code 5410) involving an investment of $90,000. This permit was issued in August 1960 and it is located 280 feet from the stop in tract 79 on block 104. Information at this scale allows the analyst to answer very precise questions about the character and change occurring in very small areas. Therefore, multiple locations can be evaluated, compared, and prioritized or reduced in number before extensive fieldwork takes place. It is also evident that such an approach could play an important role in monitoring the specific changes which occur during the course of any value capture application or transit improvement.

This process of beginning at the area-wide level and progressing to smaller windows until finally centering in on a single site shows one way of approaching the issue of exploring joint development potential. In an actual application by a transit agency interested in using joint development programs as a means of value capture, a number of further steps would be taken, and, although precluded here because of the lack of necessary data, these steps will be mentioned.

Because of the extremely small scale of any site-specific analysis, reliable results depend on the use of data on an equally fine scale. Thus parcel-level

permit number	permit type	land use code	zoning code	value (000's of dollars)	date	coordinates x	coordinates y	census tract	census block	distance to stop #4808 (10's of feet)	influence level
934	6	0	21	0	463	3882	7741	77	302	124	2
1070	5	6111	31	73	268	3806	7713	77	305	20	2
1110	5	0	31	55	769	3794	7714	77	305	9	2
1536	6	5410	31	90	860	3783	7688	79	104	28	2
1542	6	0	31	0	361	3784	7751	79	103	46	2
1583	5	7640	31	70	862	3750	7715	79	106	44	2
1622	5	5540	31	12	364	3774	7714	79	103	19	2
1667	5	4813	21	300	266	3785	7760	79	103	54	2
1682	6	5530	31	5	167	3775	7714	79	103	18	2
1729	6	0	31	20	1169	3793	7687	79	104	27	2
2161	5	5410	31	95	463	3793	7665	88	509	49	2
2174	6	6110	31	8	1063	3793	7665	88	509	49	2
2182	6	5300	31	20	264	3793	7704	88	509	10	2

Table III-6

Listing of Statistics for Permits Around Stop #4808 data is a necessity for analyzing specific locations. In order to avoid the need to deal with a massive volume of parcel-level data, initial examinations can be conducted at larger scales using availbable data, such as has been illustrated here. After a close scrutiny of an overall area has been performed, several potential sites can be identified for more detailed examination. Then parcel-level data need be collected for only these sites, the number of which will depend largely on available resources for collecting and coding parcel data.

The specific data items to be included in parcel level records will vary depending on the specific analysis being performed. In general, the data for each individual parcel which will allow for a rigorous and reliable assessment of site specific conditions relevant to joint development will include owner, land value, value of improvements, zoning, present land use, and extent of development. Also useful at this stage are an indication of the availability of the parcel, and a measure of the expected ease of assemblage of parcels at a particular location into a unit that could accommodate the proposed transit facility and associated development.

Thus joint development programs do seem to have a potential in a bus transit system. An actual evaluation by a transt agency of joint development proposals would require further research into other relevant concerns, including general market conditions, and legal and regulatory restrictions. But this general methodology is useful for exploring the transit system environment at a small scale, and identifying particular locations which appear favorable for joint development.

CHAPTER IV

DISCUSSION AND CONCLUSIONS

Experiments entered into in the preceding chapters have presented a methodology for examining the abutting and vicinal land use and investment environment of a surface transit system. Coupled with a block level demographic study[1], we have used a powerful tool to investigate transit service in a micro-level environment hitherto unattainable without street address level geoprocessing and the advantages of graphical interactive computing. There should be some useful fallout from this analytical approach.

The findings apropos of benefit district financing are essentially negative in terms of the ability to recognize land value added from transit service separately from other variables, such as zoning, age of housing stock, technological obsolescence of commercial building sites in terms of land platting, etc. There may be even a negative impact of bus transit on adjacent residential land uses from noise, fumes, potential danger to children, unesthetic outlook and other factors. Also, it is difficult to separate bus impacts from arterial traffic impacts. Unlike urban rail systems, in such areas as San Francisco, Atlanta and the District of Columbia, which have relatively few stops and impact only a few dozen areas around the stops, bus systems are quite ubiquitous and have many hundred, if not thousands of stops in any moderately sized urban area. As a consequence, whatever impact surface transit systems have is shared among many locations, with far less than spectacular opportunities on the average at each one. Furthermore, bus lines may be viewed by investors as relatively unfixed over time, and hence their locational decisions more uncertain of long-range impact benefits than in the case of rail transit. In fact, however, bus lines are very stable over time, running a difficult political course for their change. In regard to vicinal value of

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[1]See also: Jalali, Iraj, An Application of a General Purpose Automated Spatial Analysis and Display System to the Production of Transit Route Profiles, Unpublished masters thesis, University of Washington, 1977.

land near bus stops, the one conclusion that appears to have significance is that more activity may be anticipated in areas with multiple transit lines serving them. The findings apropos of joint development are more encouraging and are dealt with in Point 3 following. The conclusion of this study are organized under subheadings which include explanations wherever they appear intuitively or deductively logical.

1. Impact of Zoning

No doubt the single greatest variable of concern relating surface transit to land value is that of land zoning classification. Most busways in American cities have followed the earlier routes of trolleys and have become juxtaposed with ribbons of commercial zoning. Both the transit lines and land use have been in place now for many decades. In Seattle, for example, the first zoning ordinance of 1917 established commercial use corridors along all trolley lines. It is only in the outlying areas of the city, annexed decades later, that the ribboned commercial zoning was not invariably extended when the bus lines replaced and extended the trolley routes. Consequently, the land use model which almost universally characterizes North American cities is one of block frontages of commercial zoning bordering the streets on which surface transit runs, which, coincidentally, are also arterial streets for the most part. This generally means that an abrupt change in land use occurs at the alley line just beyond the first row of lots bordering surface transit.

Obviously, even at the scale of commercial activity in the Twenties, Thirties, and Forties, there was insufficient demand to use the entire perimeter of commercial zoning along arterials thus described. As the scale of commercial activity changed from arterial-oriented to small neighborhood integrally planned shopping centers and then to large regional planned shopping centers, further demand for commercial use along transit lines evaporated. In fact much of the existing ribbon commercial development was technologically obsolete and there was a deterioration of uses.[1] In lieu of commercial development, multi-family housing tended to move in on a portion of the arterial margins, and therefore we have the general configuration of a lot-deep row of

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[1] Examples are to be seen in every city where gasoline service stations become used car lots, restaurants and second-hand stores.

duplexes and small apartment buildings, usually three or four-story walk-up apartments, lining a fair amount of the bus line perimeter in American cities. The affinity of much small-scale convenience commercial development for proximity to the bus line is beyond dispute. However the development of multi-family new buildings by conversion is only partially occurring along the perimeter of bus lines because there are many other variables which influence private renewal.

Of interest in this study are the relatively large concentrations of new multi-family buildings occurring in some areas served by more than one transit route (Figure IV-1). This would seem to suggest more affinity of rebuilding for areas with a higher transit influence value[1] than for location along any one single line. However, a cause and effect relationship between surface transit and land use change is still not conclusive in our study because a view of the zoning map, Figure III-11, shows the impact of either land use policy or market conditions (assuming that zoning usually lags a market demand rather than leading it), or both, relating to the opportunity to replace single-family dwellings with multi-family units. Of special interest in regard to locations A and B, shown in Figure IV-1, is that the land within about one-half mile of these areas was part of the original plat of Ballard, with very small lots characteristic of turn-of-the-century land subdivision. The original houses were very small wood frame structures, and by the late Sixties had completed their life cycle. The scale of land subdivision changes abruptly in the area just north of the line P-Q, which represents one additional variable in the impact picture.

These subtleties of land use changes are nowhere as dramatic as the major changes of land use that accompanied the development of urban freeway corridors during the late Fifties and Sixties, well documented in the Transportation Research Board (then the Highway Research Board) literature.[2] These localized impacts suggest an obscured cause and effect relationship between surface

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[1]As explained earlier the transit influence value is the number of separate transit lines within a given distance of a property.

[2]As examples, see Garrison, Wm. L., et al., Studies of Highway Development and Geographic Change, University of Washington Press; Seattle, 1969; and Horwood, E. M., Richard L. Ludwig and Carl Zellner, Community Consequences of Highway Improvement, National Cooperative Highway Research Report No. 17, National Academcy of Sciences, National Research Council, Washington, D. C., 1964.

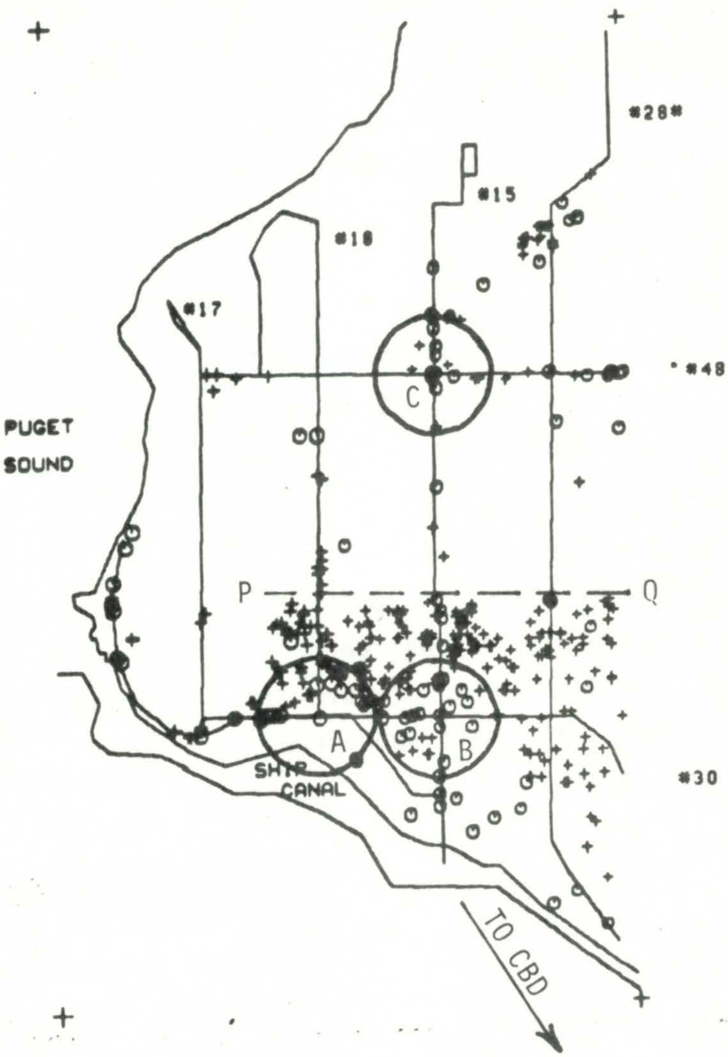

Figure IV-1

Ballard Locations With High Multi-family and Commercial Activity and Multiple Route Influence transit and land benefits that makes it difficult to determine the consequences of the transit system apart from the impacts of commercial zoning and arterial auto traffic. It would clearly be difficult to introduce a policy of ad valorem tax contribution by adjacent land to transit facilities based on this obscure cause and effect relationship. There could be, furthermore, counter-productive implications of a policy to allocate some of the costs of surface transit to adjacent property. Much of the land use adjacent to transit lines is in a state of quiescence or decay, particularly within a few miles of the central business districts of our cities. It would be highly dysfunctional to add an additional tax burden to what is at best a rather modest private land redevelopment effort as older homes adjacent to or near bus lines are removed and low density multiple unit structures or updated commercial units are built.

2. Impact of Area-Wide Tax Support for Surface Transit

One of the major developments in surface transit over the past decade has been its socialization in terms of broad public tax support. With the fare box covering only a very small portion of the operating cost in all but a handful of high density eastern cities, we foresee that a difficult political problem would arise in an endeavor to allocate even a small percentage of the cost of street level transit service to adjacent land. In Seattle, for example, the fare box receipts cover only between twenty and twenty-five per cent of the operating cost of the bus and trolley system. The deficits in the Seattle area are covered by both the national tax base through the Section 5 Subsidy Program of the Urban Mass Transportation Act of 1964, as amended, and a county-wide increment of 0.3 per cent on top of the five per cent state sales tax.[1] Similar subsidy support dimensions exist in most urban areas. With the advent of a strong labor position under Section 13(c) of the Urban Mass Transportation Act, we can foresee little expectation that subsidies will diminish because labor characteristically moves in with demands that feed off federal support.

With the overwhelming subsidy support for surface transit coming from urban region-wide, state and national subsidies it seems politically impractical

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[1]Some additional transit funding support in the State of Washington is available from a state subvention of part of the motor vehicle excise taxes.

to gain small incremental support advantages from the creation of betterment districts for surface transit. If both the national and general urban-region taxpayers are accounting for 70 or 80 per cent of the operating costs, then it would be difficult to persuade adjacent landowners to pick up a share under a very weak case of cause and effect relationship between transit service and land benefits. The one exception may lie in the extension of service to a new outlying community, but even for this exception there seems little likelihood that the property tax base is appropriate. If the benefit is community-wide and no significant fixed capital improvements can be related to land, as in bus transport, it would be difficult to make a case for the adding of value to property. Furthermore, it is doubtful if the variables would be much different for a light rail system with the one exception of the apparent permanency of the alignment.

3. The Use of Joint Development

Joint development potential remains the most interesting prospect stemming from our investigations. We see the potential for joint development at a modest scale arising out of the creation of structures and facilities at a few logical transfer points where existing transit lines converge and where there is some indication of viability in surrounding land.

Consider the three locations, A, B, and C in Figure IV-1, with a circle of one-quarter-mile radius indicated in each case to give a scale effect. Locations A and B, one-half mile apart, are the centers of both commercial and multi-family residential rebuilding activities. They are in an old and established community, Ballard, about fifteen minutes by bus from downtown Seattle. The community has had a recognized social structure for almost a century, when it commenced as a small fishing town. It is one of the few Seattle communities that maintains an ethnic tradition, Scandinavian in this case. Although relatively old for a community of a western city, and having a slightly older population than the city as a whole, Ballard nevertheless continues to be an attractive area for settlement.

Location C, a mile and one-half north of B, differs from A and B in that it is essentially an arterial crossroads with some commercial viability. Unlike the locations A and B, it is surrounded mainly by single family developments at considerably lower density. The three locations are not only existing transfer points for the bus system, but of all the possible transfer points in the study area these three have the attribute of viable surroundings. The joint development that we envision for any of these points, particularly A or B, is a small terminal structure to facilitate out of the weather bus-to-bus, automobile-to-bus or paratransit vehicle-to-bus transfers. We foresee the functional need for such a terminal as facilitating the substitution of paratransit services for full line support services during weekends and off-peak periods, to permit a rationalization of the bus routes by the substitution of either scheduled demand actuated or flexible paratransit services to connect to the line-haul system for relatively empty buses operating at the outbound ends of the lines.

In support of the above notion one can observe from Figure IV-1 that bus Lines 17, 18 and 15 all pass through or near point B. B is also a way point on Line 30, a cross-town route. Thus the line-haul service could possibly be terminated at point B during periods where there is high inefficiency in the trip end patronage by providing some form of supplementary service either on a contract basis with paratransit purveyors or directly operated by the trunk provider. The location C is only at the intersection of two lines, radial Line 15 and cross-town Line 48, and obviously there is a small tributary area of service here, but nevertheless transfer to a paratransit mode at C may reduce line-end losses for Lines 15 and 48.

Obviously, these land investment findings do not show trip demand, but only suggest increased potential for trip density at the origin end by virtue of increased land use density. An additional map of transit users depicted by geocoded points of origin and destination would be helpful in assessing the pattern of trip demand in regard to any route rationalization scheme. Such data will shortly be available from a city-wide on-board bus origin-destination study conducted by Seattle METRO Transit on May 18, 1977, and is the type of data now becoming available nationally for transit use analysis and planning. On-board counts on the lines shown in Figure IV-1 would give an indication of passenger flux for justifying any route rationalization scheme. The above indicates what kind of information is needed to go along with joint development planning in addition to land use and investment data.

We envision the joint development possibilities as being, at the minimal end of the scale, a realtivley open bus wayside location with an adjacent taxi stand and passenger shelter associated with a small commercial complex. This would be appropriate for a site near C, Figure IV-1. At a location of greater intensity, like A or B, we envision the joint development possibility as being a transfer facility with an off-street parking structure, a taxi stand, and perhaps half-a-dozen convenience-type commercial establishments. Other possibilities relate to tie-in between municipal services and transport facilities such as the linkage of police, fire, recreation and library facilities with the transfer facility.

Historically, trolley transfer points were commercial activity nodes before the advent of planned shopping centers, the sixteen-cubic-foot refrigerator/ freezer and automobile shopping. These transfer or line-end points were locations where some convenience shopping took place. The European city, with lower automobile usage, still has many such locations, often at or near urban rail stations. Some observers believe that North American cities will resume these proportions as motor fuel becomes relatively dearer. We cannot see this as an early event and mandate to sustain investment in joint development as discussed above because we are locked into a land use system that will not permit us to change our transport styles rapidly. Merchandising costs at the scale of convenience shopping at such proposed joint developments is bound to be higher than the mass merchandising of the ten thousand-square-foot supermarket in an auto-oriented regional shopping center. Nevertheless recent interest in route rationalization through the advent of paratransit suggests some studied probes into site planning and administrative organization for small-scale joint developments. This should be an activity that qualifies for one of UMTA's funding programs.

4. Equity Issues

A discussion of benefit district financing and joint development with respect to urban transit would not be complete without some reference to equity issues. With the use of either of these mechanisms there are bound to be some winners and some losers.

The philosophy of a tax-benefit district is that those on whom the tax is levied for an "improvement" benefit to the degree of taxes paid. In actuality, landowners differ in their financial capability to take advantage of opportunities, or conversely are affected differentially in the process of selling their property to those who may be able to gain potential benefits from situs by virtue of having knowhow and capital.

One issue of concern in regard to any benefit district financing for urban transit, rail or bus, is the land use zoning configuration. For equity to exist on the basis of land use potential, zoning and benefit district boundaries would have to be carefully coordinated. Another issue regards the market for land use and use change. Market potential cannot be assumed. What we have learned from the Bay Area Rapid Transit system (BART) in regard to only a "sputter" of development at all but one or two of the system's stations should be a sobering thought.[1] If tax benefit districts are drawn with liberal boundaries there is little doubt that market potential may only accrue to a small portion of the district. This raises the spectre of inequity of opportunities among those taxed. Another form of inequity exists if the taxing district is too small, again illustrated by the BART system in the development around the Embarcadero Station, the first station approached when riding to San Francisco from the Eastbay side. There a taxing district included the Golden Gateway Redevelopment site, abutting the station to the north of Market Street, wherein a portion of the station costs were to be covered by a tax on the anticipated increase in land values of the renewal project.[2] (Interestingly, this is the only station on BART with significant vicinal land development.) However, the development just south of Market Street at this station is even more significant than the Golden Gateway Project itself. As a consequence there was a non-uniform treatment of financial contribution from adjacent and vicinal land. Had BART received the benefit of tax increment from the south half of the Embarcadero Station area to the same extent it did from the north half, it would have shifted about thirteen million dollars of cost from the property taxpayers as a whole within the BART taxing district to the owners of the limited area just south of the station.[3]

In regard to joint development at the scale of surface transit an equity issue is the degree to which any benefits will be cost effective in terms of the total scale of transit financing. With surface transit systems running great

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[1]Webber, Melvin M., The BART Experience--What We Have Learned. Monograph No. 26. Institute of Urban and Regional Development and Institute of Transportation Studies, University of California, Berkeley. 1976.

[2]A description of the Embarcadero Station taxing scheme is found in the work of the Rice Center for Community Design and Research at Rice University, Houston, under U.S. DOT Contract PUR-2-30667.

[3]Visit to Embarcadero Station site by Edgar M. Horwood, February 28, 1977.

deficits, wherein relatively minor savings are eagerly sought in route or service reduction, the financing of joint development features will have to be at a rather modest scale, if they are to occur. Otherwise the costs will be borne by the general taxpayers thorugh both federal and local subsidies--a question of equity. In this regard we have some interesting examples of subsidy from the general taxpayer in the case of most park-and-ride facilities, wherein the users of the lots rarely pay anything near their true economic costs. Without caution, a joint development project could easily shift the burden of costs to the general taxpayer.

Finally, in regard to equity, we have to view the population base affected by any taxing scheme. As an example, our studies show that in the Ballard area there is a 50 per cent higher agglomeration of older people (above 65) within one-eighth mile of transit lines than beyond. In addition, the housing stock close to transit consists of a significantly higher percentage of rental units, especially those with low rents. This implies that the impacts of any very localized tax benefit district may fall unduly on the aged through increased rents. Perhaps this is the most significant caveat concerning benefit district financing for local transit arising out of our studies.