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Parking in Northwest: Finding a Spot in a Mix-Use Community

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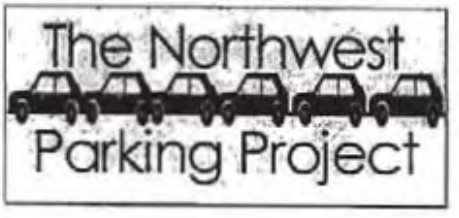

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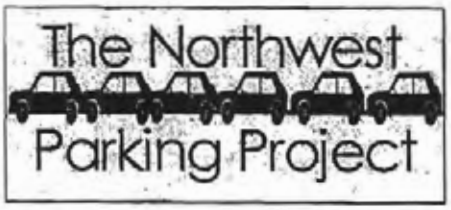
CONTENTS

LIST OF TABLES, FIGURES, AND MAPS

Introduction



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SECTION 1: INTRODUCTION

In November of 1997, the Nob Hill Business Association (NHBA) and the Northwest District Association (NHDA) went before Portland City Council and requested city facilitation in their efforts to come to agreement on alleviating parking congestion in Northwest. The request for a facilitation process was based on an impasse after 15 years of work to solve the parking problem. This impasse peaked with the dissolving of the Joint Parking Workgroup, a group of business owners, residential leaders, and the City of Portland.

Both the NWDA and NHBA are stakeholders each with particular concerns that are represented in the parking issue. Each group has forwarded or proposed solutions that the other can not agree to. The facilitator's role is to work with the stakeholders in building communication to promote feasible solutions. The Northwest Parking Project has developed a contract with the City of Portland (COP) Office of Neighborhood Involvement (ONI) to assist the facilitation process.

The Northwest Parking Project is a capstone project in the Masters in Urban and Regional Planning program at Portland State University. The Masters program provides practicing and aspiring planners with a knowledge of history, practice in methodology and a consideration of ethical responsibility surrounding the planning profession. The Planning Workshop is the culmination of the Masters Program and it allows students the opportunity to put their knowledge and skills into practice. Students teams are responsible for every aspect of the projects from locating clients and developing projects ideas, to implementing their methodology and work plan. This project is part of the PSU Workshop class.

Table 1: Timeline of Events

1977	*NW District Policy Plan*
1983	PSU Report, *Competition for Limited Spaces*
mid-80s	Joint Committee on Parking meets
1988	*Parking Study finalized by Joint Committee*
1992	PSU Consulting produces *Northwest District Shuttle Project*
1994	PSU Center for Urban Studies surveys Northwest Residents and produces *Livability Study.*
1994-96	Northwest Working Group meets with representative from the Bureau of Parking
1995	Gilmore Research conducts Telephone and Mail Survey
1995	Tri-Met conducts Employer Survey and Neighborhood Intercept Survey
1995	City of COP Bureau of Parking records license plates for analysis.
1996	NHBA produces "20-Point Plan"
1995	City Working Group inventories off-street lots.

1.1 PURPOSE

The purpose of this study is to ground the ONI facilitator in the nature of parking issues relevant to Northwest. A comprehensive examination of parking in Northwest will include a review of past efforts, an analysis of the parking supply and demand, and a detailed review of program and policy alternatives that may be applied in Northwest. The research has two primary goals: 1) is to provide objective data that will acceptable to both the NWDA and NHBA and 2) to provide policy analyses to ground stakeholders in parking theory and parking management techniques.

The study is divided into four main sections. Section 1 is this introduction and history section. Section 2 provides a background to the parking issue through a brief historical and cultural analysis of the Northwest neighborhood past and present. It provides an analysis of the parking supply and parking demand using a variety of past studies. The section frames parking in a regional context and includes a presentation of past studies, relevant data and their sources. Section 3 examines policy and program alternatives that may be relevant to Northwest. These "alternatives" are comprised of parking management techniques that have been tried in many municipalities and in other parts Portland. The analysis in Section 3 presents these policy's in an objective format. Lastly is an appendix that contains an annotated bibliography, a shared parking study and summaries of major historical documents.

1.2 HISTORY

Parking shortages in Northwest Portland are not a recent phenomenon. The area has been the setting for many forums, committees, and research projects over the past two decades (see Table 1: Timeline of Events). Planning efforts for Northwest began with the Northwest District Plan in 1977 - a follow up to the 1975 Northwest Policy Plan adopted by the Portland City Council. The Northwest District Plan solidifies the historical nature of the parking issue by emphasizing the need to "improve the efficiency of on and off street parking in order to gain maximum use of existing facilities" (Northwest District Plan, 1977).

Northwest is seen by many as a model for integrating commercial and residential land uses in an urban area. Yet, the density of these uses generates a high demand for parking that impacts the livability of the area.

While this project focuses its attention on the Northwest community, it does so with the understanding that the transportation pressures faced by Northwest residents and businesses also occur in other growing mixed-use locations. In many ways, Northwest is a prototype for regional growth goals. The Metro 2040 Growth Concept protects farm and natural resource lands from intense regional growth by implementing an Urban Growth Boundary in which urban development shall not exceed. The Growth Concept sets our 50-year plan to accommodate projected growth of 720,000 new residents, and 350,000 additional jobs. Metro's transportation and parking elements are essential to maintaining the intensification of existing urban land.

1.3 PROBLEM DEFINITION

Parking problems can be defined in many ways. One of the most straightforward ways is simply recognizing that the demand for parking in a particular area exceeds supply. What is less clear, however, is how the demand is derived. A number of questions can be raised, such as: How is the need for parking perceived? Would that actual or perceived need remain if the supply of parking was increased? Does the unavailability of parking effect peoples choices in how many vehicles they own or how they travel to Northwest? What would be the effects of increasing the supply and how could this be achieved? Would more vehicles come and take up that added supply? Would residents be compelled to own more vehicles if they perceived increased supply or decreased demand?

In the late 1980s and early 1990s, a number of efforts to bring residents together with businesses centered on a need to define the nature of the parking problem. In 1988, representatives from the business association and the neighborhood association agreed to define a "reasonable distance" from a residence that a resident should expect to park as 200 feet or one block from their door (Joint Committee on Parking, 1988, page 2).

Reports on the issue also focus on defining the problem. The 1983 PSU report examined the issue based on the requirements for parking defined in the COP Zoning Code.

In examining the parking issue and putting together a profile of the Northwest Community, this report has defined the parking problem as one based on the combined needs of the residential community, the business community, and visitors to the area. Quantifiable contributions to the parking issue include the availability of parking, the characteristics of the residential population, and the amount of employment in the area. Non-quantifiable contributions include the changing nature of business, and the effects of increased traffic on livability issues.

Our research has uncovered certain characteristics of Northwest that are important to acknowledge when examining parking in that community. Some of the more important characteristics are as follows:

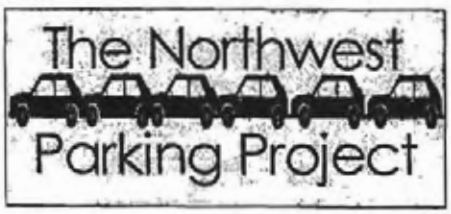
- The historic nature of Northwest and its lack of significant structural redevelopment reveal that the majority of infrastructure was built when parking demand was lower. As a result, the area has a much lower parking capacity than other more recently developed areas.

- Rising incomes of residents and intensification of commercial activity has increased the pressure on a limited parking supply. There is a direct correlation between the both variables and parking demand.

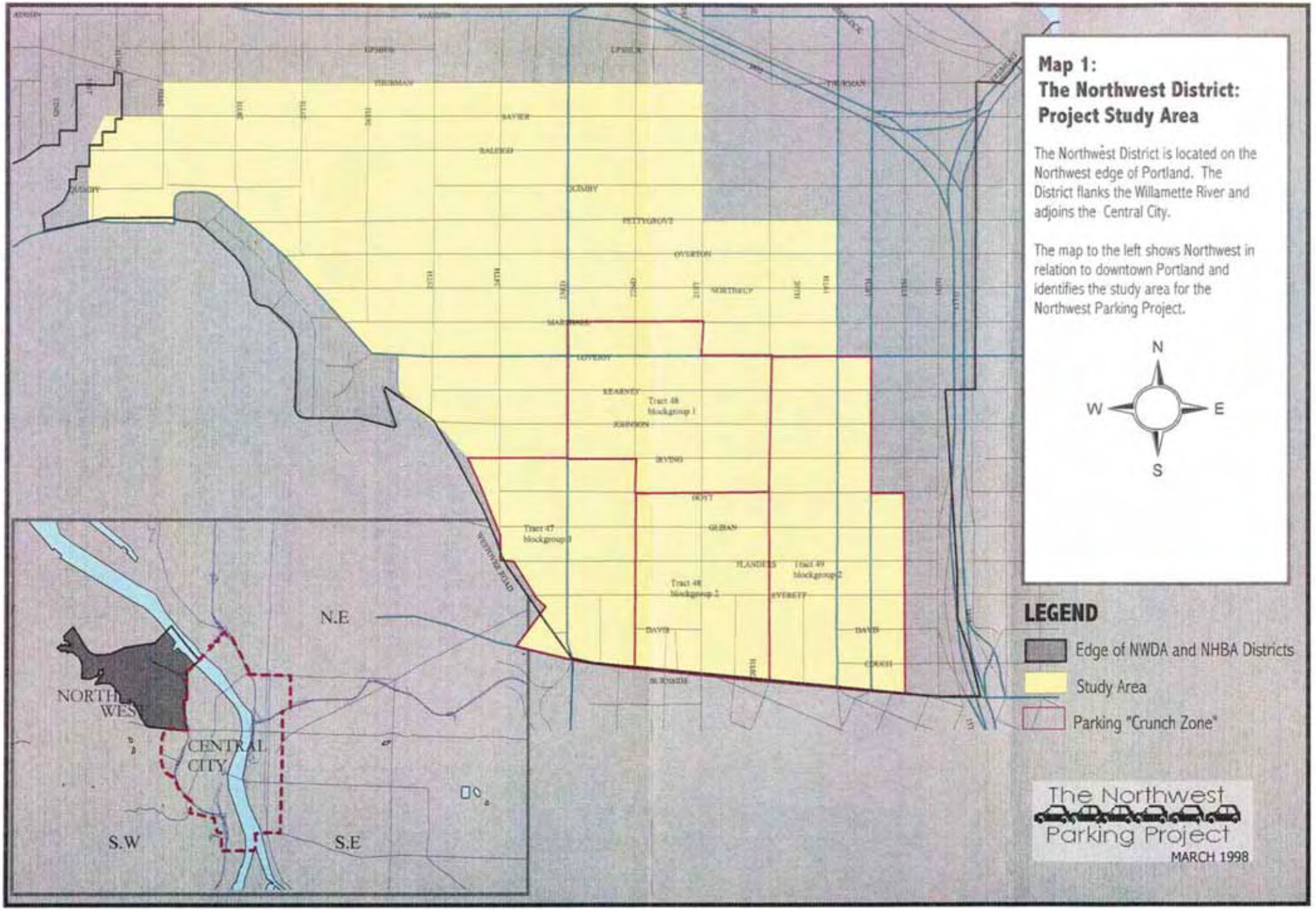
- The presence of regulated conditional uses within residentially zoned areas has resulted in an intense mix of commercial and residential land uses. The mixed-use makes defining the district as either residential or commercial difficult.

This following section of the study examines both aspects of the situation. We begin with attempts to quantify the issue.

Parking in Northwest: A Base Analysis



PSU Planning Workshop
1998


Map 1:
The Northwest District:
Project Study Area
The Northwest District is located on the Northwest edge of Portland. The District flanks the Willamette River and adjoins the Central City.
The map to the left shows Northwest in relation to downtown Portland and identifies the study area for the Northwest Parking Project.
N
W
E
S
Tract 48 blockgroup 1
Tract 47 blockgroup 1
Tract 48 blockgroup 2
Tract 49 blockgroup 2
N.E
NORTH WEST
CENTRAL CITY
S.W
S.E
LEGEND
Edge of NWDA and NHBA Districts
Study Area
Parking "Crunch Zone"
The Northwest Parking Project
MARCH 1998

SECTION 2: PARKING IN NORTHWEST: A BASE ANALYSIS

2.1 PROJECT STUDY AREA

The Northwest Parking Project has delineated the Northwest district into three distinct analysis areas. The boundaries of these analysis areas can be found in map 1, Project Study Area. Due to data constraints, the need for comprehensive analysis of the parking issue, and to avoid confusion for the reader, the NW Parking Project utilizes data in its analysis from the boundary referred to as the Project Study area or at times simply called the "study area." These areas are described below

- The City designated "neighborhood boundary" which the Business Association and District Association also share. The neighborhood boundary is defined by natural edges such as the I-405 freeway, W. Burnside Street, and the Northwest hills. At the present time the focus of the parking concerns are geographically contained within this area.

- The project "study area", or PSA, is a subset of the political boundaries where parking conflicts generally occur. Although the severity of the problem varies within the study area, virtually the entire study area suffers spillover parking pressures from the most intensely used areas. U.S. Census Bureau census tract boundaries are used to define the edges of the study area so to access a comprehensive level of socio-economic data. The study area is defined by census tracts 47, 48, and 49, stretching from W. Burnside Street to NW Thurman Street.

- The "crunch zone" is the area in which the neighbors and business owners identified the parking problem as most intense. The crunch zone includes the primary commercial strips, NW 21st Avenue, NW 23rd Avenue, and W. Burnside Street, and the highest density residential areas. For data purposes, the crunch zone was delineated by census blockgroup boundaries including tract 47 blockgroup 3, tract 48 blockgroup 1 and 2, and tract 49 blockgroup 2.

2.2 LAND USE & ZONING

Zoning

The current zoning regulations established by the 1975 Northwest District Policy Plan are intended to support the historic mixed-use nature of the area. This mixed-use nature is reflected in the fact that all the zones with the study area allow both residential and commercial use of one sort or another.

The amount of parking provided by an individual land use is based on its zoning. These requirements are based on the need to accommodate the anticipated traffic generation of that use (COP Zoning Code Chapter 33.266, 1998). Table x shows the parking requirements for zones within the study area, including residential, commercial and institutional uses. Commercial developments require between 2 and 4 spaces for every 1,000 square feet of space. Residential developments require one space for every two units except those of less than four units. There is no requirement for single-family units (COP Zoning Code, 1998).

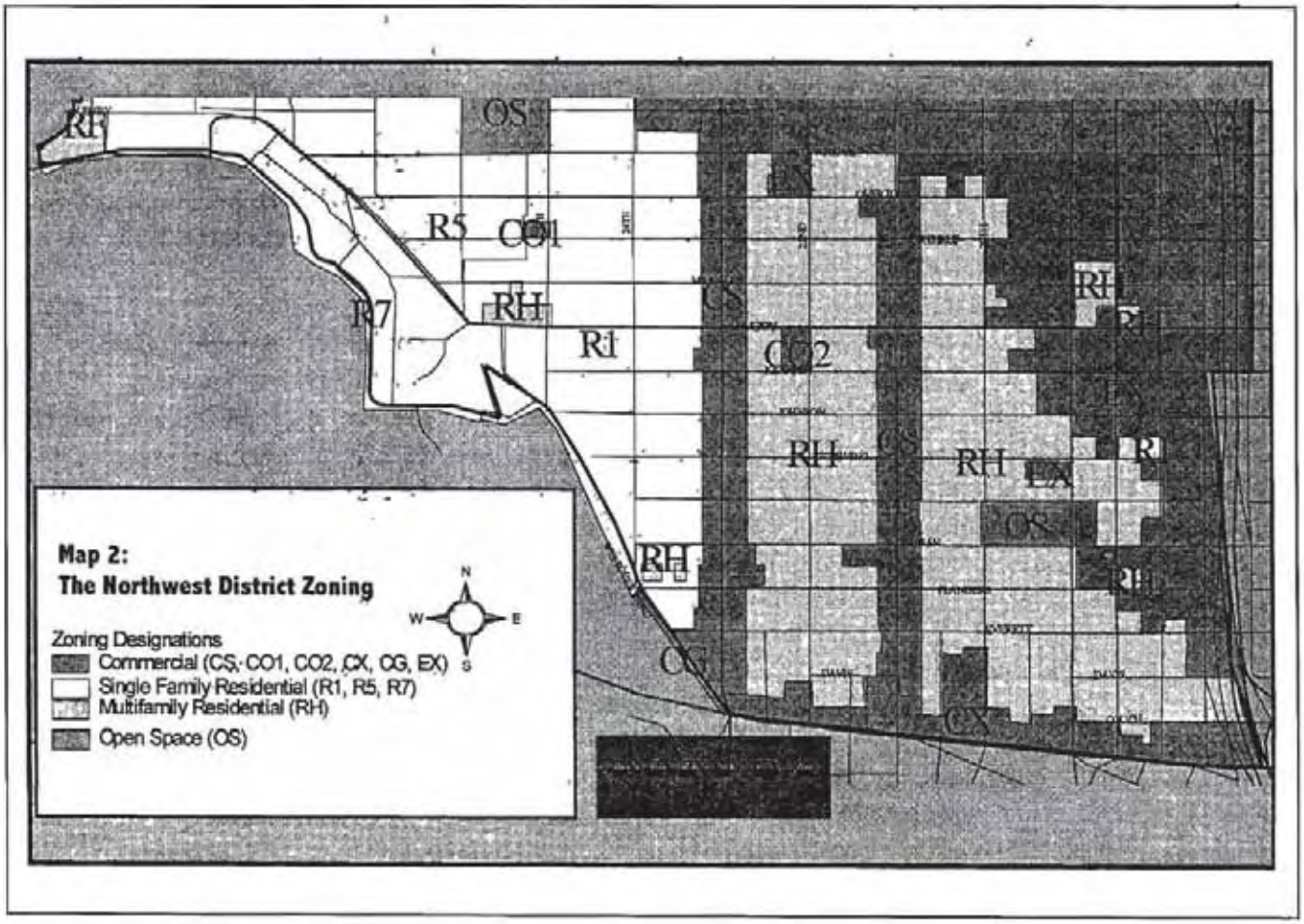
Table 2: Required Parking Spaces by Zone

Land Use of Parcel	Parking Requirements
Residential use	
All uses in RH zone	RH Zone: 0 for 1-3 units and 1 per 2 units for four plus unit buildings
Commercial Use	
Retail, Personal Service, repair oriented	1 per 500 square feet of floor area
Restaurants, bars, health clubs, gyms, and similar	1 per 250 square feet of floor area
Theaters	1 per 4 seats or 1 per 6 feet of bench area
Office	1 per 500 square feet
Institutional Use	
Parks and Open Space	Per Conditional Use Review
Schools	1 per classroom
Medical Center	1 per 500 square feet or per Conditional Use Review
Religious Institutions	1 per 100 square feet of main assembly area
Day Care	1 per 500 square feet

Source: COP Zoning Code, Chapter 33.266, 1998

Map 2, *The Northwest District: Zoning*, illustrates the zoning for the entire Northwest neighborhood including the study area. The study area is dominated by high density residential (RH) and store front commercial zoning. The primary purpose of the RH zoning designation is to encourage high-density residential development. However, the RH zone supports a wide range of commercial land uses as conditional uses. Conditional uses are land uses that are permitted but must go through review. Land uses that are conditional uses in a particular zoning designation are required to demonstrate that they will have minimal impacts on the character and livability of the neighborhood they are located in.

The storefront commercial (CS) zone designation and the central commercial zone (CX) are the two primary commercial zoning designations for the study area. The central commercial zone extends along the entire north side of W. Burnside Street. The intent of the CX zone is to provide for a broad range of uses. This includes residential and most commercial uses. Chapter 33.130 of the COP Zoning Code describes that development within this zone "is intended to be very intense with high buildings placed closely together."



The storefront commercial (CS) zoning designation extends the entire length of NW 21st and NW 23rd Avenues. In addition, the CS zone extends west from NW 21st Avenue along NW Thurman and NW Vaughn Streets. The general characteristics of the CS zone is to preserve and enhance established commercial areas with a storefront character. The CS zone allows for a full range of commercial, business, and residential uses with both a local and regional market draw. Yet, it also requires new development to be compatible with the existing character of the surrounding zones. Development in the CS zones is also intended to be pedestrian-orientated.

Another zoning designation found in the study area is central employment (EX). The EX zoning designation is located east of NW 20th and is intended to allow mixed-uses. Chapter 33.140 of the COP Zoning Code says that the EX zone is intended "for areas of the center of the City that have predominantly industrial type development." Residential development is allowed, but is not intended to be the predominate use.

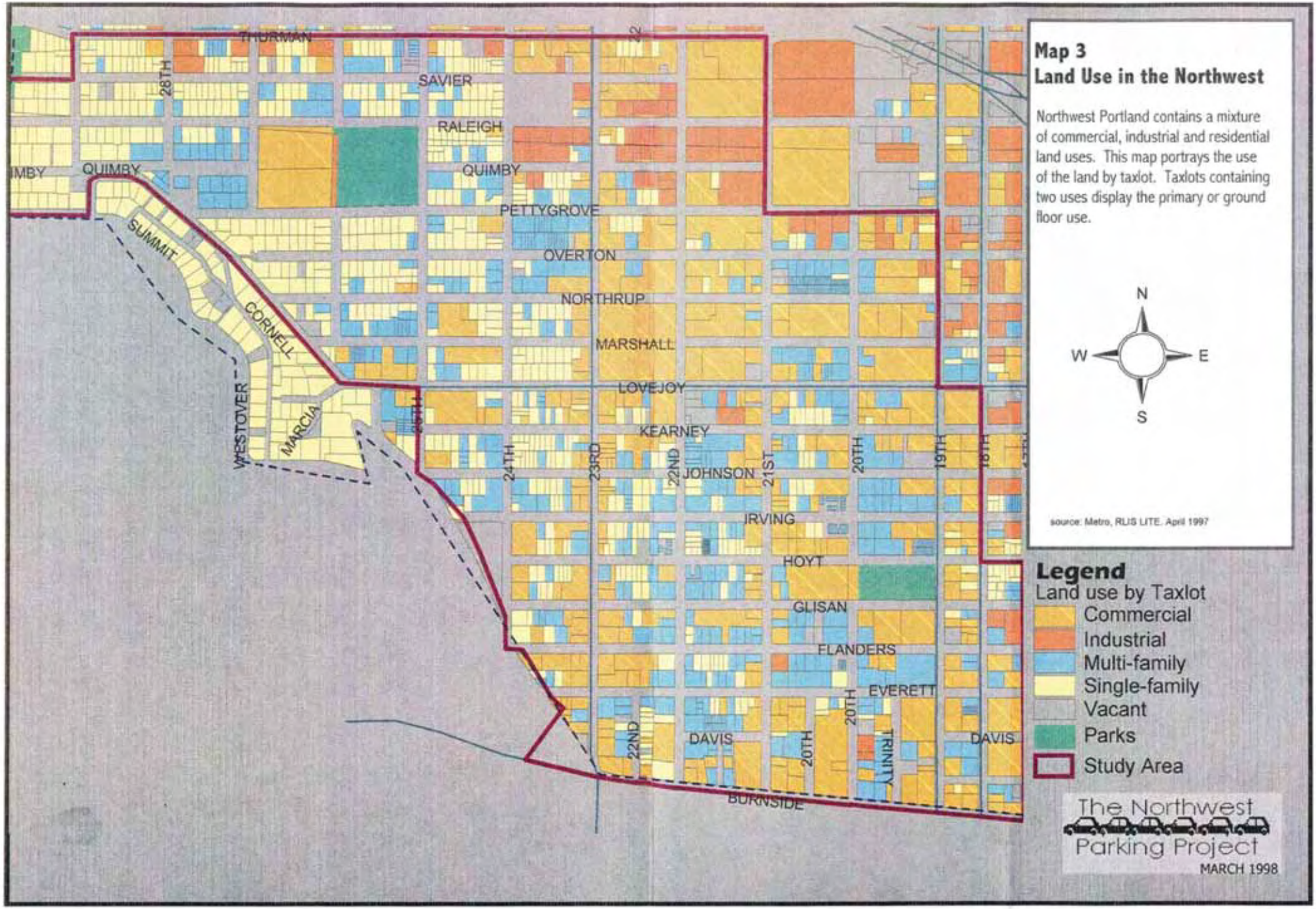
Regional Parking Requirements

Metro, the Portland metropolitan regional government and planning authority, is required by Oregon Revised Statutes and its home rule charter to implement the benchmarks established in the Statewide mandates. State Planning Goal 12, Transportation, and specifically the Transportation Planning Rule, which implements Goal 12, is designed to reduce the amount of vehicle miles traveled for all metropolitan jurisdictions. Regions shall begin to do this through reducing parking by 10 percent in a 20-year planning period ending in 2015. To accomplish this, Metro has established a comprehensive planning strategy based on a vision called the 2040 Growth Concept.

The Regional Urban Growths Goals and Objectives (RUGGO's) provide the regional policy framework to support the Metro Framework and Functional Plans that formalize the 2040 Growth Concept. Title 2 of Metro' s Urban Growth Management Framework Plan (its Functional Plan), Regional Parking, is the equivalent of a regional zoning code that sets parking requirements for all jurisdictions. Like standard zoning codes, Title 2 sets parking requirements based the density of land use designations. NW 21st and NW 23rd Avenues are designated Main Streets, a linear designation that requires mixed, high-density land uses. The Main Street designation is intended to accommodate densities of 39 residents and employees per acre.

> *"We don't have much work to do on our parking standards. COP's parking standards already meet or exceed Metro standards [Title 2]."*
>
> - David Knowles, COP Planning Director - *Address to University of Oregon Land Use Seminar.* February 27, 1998

Title 2 requires Main Streets to set minimums and maximums for particular land use categories. Parking regulations in Northwest Portland will not be substantially impacted by Title 2 because of the density required by the City's existing zoning code and their ongoing commitment of


THURMAN
28TH
SAVIER
RALEIGH
QUIMBY
PETTYGROVE
OVERTON
NORTHRUP
MARSHALL
LOVEJOY
KEARNEY
JOHNSON
IRVING
HOYT
GLISAN
FLANDERS
EVERETT
DAVIS
BURNSIDE
SUMMIT
CORNELL
WESTOVER
MARCIA
24TH
23RD
22ND
21ST
20TH
19TH
TRINITY
Map 3
Land Use in the Northwest
Northwest Portland contains a mixture of commercial, industrial and residential land uses. This map portrays the use of the land by taxlot. Taxlots containing two uses display the primary or ground floor use.
N
W
E
S
source: Metro, RLIS LITE. April 1997
Legend
Land use by Taxlot
Commercial
Industrial
Multi-family
Single-family
Vacant
Parks
Study Area
The Northwest Parking Project
MARCH 1998

reducing land use dedicated to parking. The Urban Growth Management Functional Plan (UGMFP) was adopted by Metro in order to implement the RUGGO's. The UGMFP contains policies that local city and county implementing ordinances must conform to, typically this means altering local comprehensive plans and development codes. Title 2 contains the parking regulations and standards.

Metro lists the following specific reasons Title 2 was adopted:

- Encourage the reduction of parking and surface parking lots. Title 2 encourages land uses to be located closer to one another thereby making walking more viable.
- Encourage the efficient use of land by reducing the spaces allowed for surface parking lots and thereby increasing the available land supply for commercial or residential space.
- To reduce total automobile emissions to conform with the Employee Commute Options (ECO) rule requiring a 10% reduction in employee vehicle trips by all employers with fifty or more employees at any worksite.
- Coordinate and comply with the State Transportation Planning Rule that requires a 10% reduction in parking spaces per capita over the next 20 years with the intent of encouraging a 20% reduction in vehicle miles traveled per capita.

The definition of parking under of Title 2 refers to "free, surface, off-street parking spaces for autos." Title 2 requires local jurisdictions to comply with the regional parking ratios. Perhaps the unique element of the ratios is that they set a maximum as well as a minimum parking standard for individual uses. The lower parking ratios are implemented in areas where transit is currently or expected to be at 20-minute headways during the evening peak commute hour.

RUGGO's introduce a hierarchy of land use designations ranging in density. Under this classification, NW 21st and NW 23rd Avenues are designated Main Streets, a linear designation that requires mixed use high density. The Main Street designation is intended to accommodate densities of 39 people per acre. This figure includes both residents and employees. The Main Street land use designation is designed to model a linear mixed commercial, retail, and residential land-use pattern intended to service a localized area.

2.3 RESIDENTIALCOMMUNITY PROFILE

Historically the Northwest has had a diversity of population, with housing for both white collar and blue collar classes. The district's proximity to both downtown and the industrial waterfront areas has made it an attractive location for both the city leaders who lived up on Nob Hill and for dock workers residing in "Slab-Town" on the northern edge of the district. The area began a period of decline in the early fifties as the rise of the automobile and post-war suburbanization took away much of the core residential population. The remaining population was comprised primarily of the older residents and young with an increasingly dependent population.(Northwest District Plan, 1977, p.25)

> Once a solid residential area, the Northwest has been subjected to the modifying forces of commercial, medical, and industrial investment and expansion. These factors, combined with increased property taxes, high land values, and increased absentee ownership have contributed to a subtle decline of sound residential uses and a continuing deterioration in social conditions.
>
> *-Northwest District Policy Plan, 1977.*

The late 1960s and 1970s were an age of activism for Northwest as residents. Implementation of planning efforts and coalescence between "the neighborhood feelings about quality of life and the neighborhood's path of development," (Bianco, 1994) brought renewed interest in the area.

Planning efforts of the 1980s that protected the residential enclaves drew support and popular response to the area. The underlying physical structure of its residential neighborhood remains that of forty years ago. Half of the existing housing in the area was built before 1939. Only 206 units have been constructed within the study area since 1980.

Table 3:
Study Area Housing Stock 1990: Year of Construction

	Units	Percent
Built since 1980	206	3.1%
Built 1960-1979	816	12.2%
Built 1940-1959	1,334	20.0%
Built before 1940	4,323	64.7%

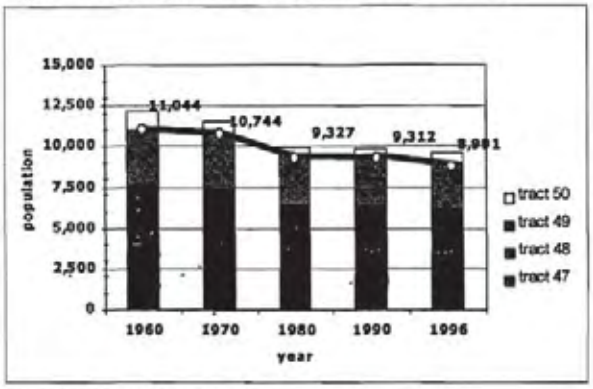
Source: Census 1990, table H-7

Population

In 1996, 11,722 people were living within the boundaries of the Northwest neighborhood. The study area contained 8,991 residents, 3,582 in Census tract 47, 2,650 in tract 48 and 2,759 in tract 49, close to 2,100 fewer people than in 1960. The population reduction was most likely due to the redevelopment of the area and the loss of housing units to development in the medical district.

Figure 1, *Population of Study Area: 1960-1996*, displays trends of declining population in Northwest over the past 40 years. The average age of those living within the study area is 39 with 50 percent between the ages of 25 and 45. Rising income may mean fewer people per housing unit.

Figure 1: Population of Study Area 1960 – 1996



source: U.S. Census Bureau

Map 4: Study Area Census Tracts

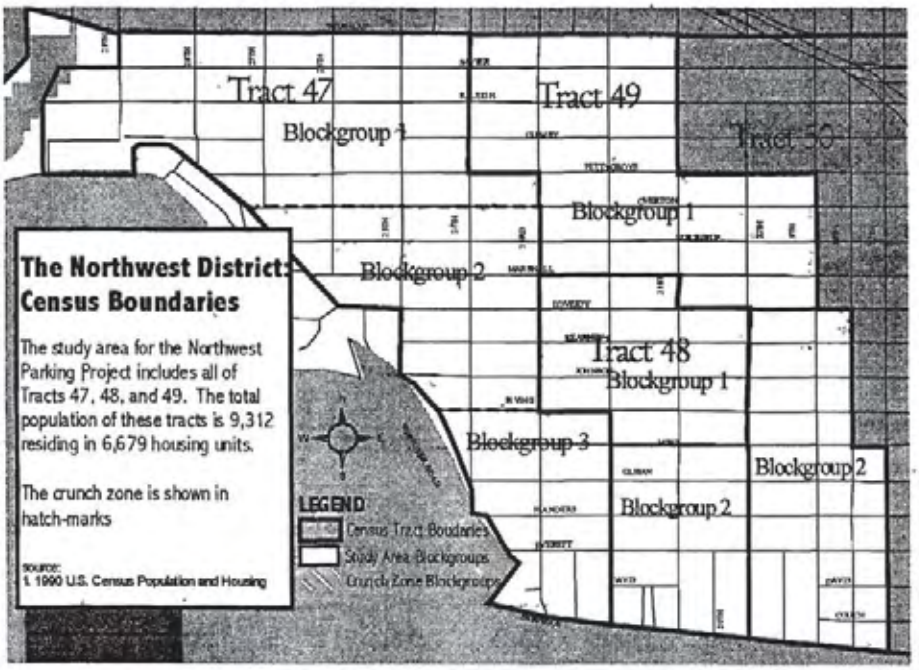


Table 5: 1990 Population of Northwest Study Area

Study Area	Population	Housing Units
Tract 47	**3,680**	**2,313**
Blockgroup 1	1,264	726
2	1,368	814
3	1,048	773
Tract 48	**2,722**	**2,082**
Blockgroup 1	1,175	807
2	1,547	1,275
Tract 49	**2,910**	**2,284**
Blockgroup 1	1,016	793
2	1,894	1,491
TOTAL	9,312	6,679

source: 1990 US Census Bureau

Housing

There is a diverse housing stock in northwest Portland including fine historic Victorian houses, apartment buildings, and newer row houses. Table 4 shows that rental housing comprise of a very high percentage of this housing stock.

Table 4: Study Area Occupancy

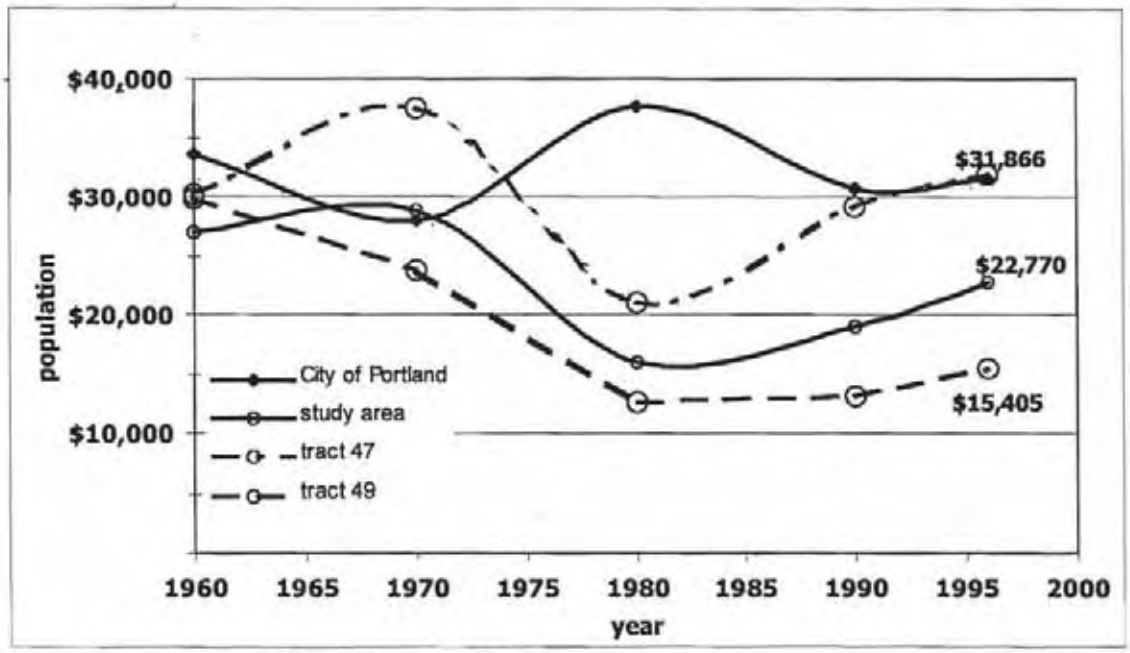
	Study Area	Crunch Zone
Renter Occupied Units	5,628	3,867
Owner Occupied Units	598	164
Total	6,226	4,031
Percentage Renter	90%	96%

source: 1990 U.S. Census STF 330

Income

Incomes in Northwest have historically been lower than the COP average. Yet, as income trends flatten out in Portland as a whole, income in Northwest continues to rise. Figure 2: Median Household Income in Northwest shows the growth in income for Northwest residents compared to the city as a whole. Income trends for census for the wealthiest and least wealthy census tracts in the study area appear in the graph.

Figure 2: Median Household Income in Northwest: 1960 – 1996



Source: US Census Bureau :Decennial housing and population statistics
Oregon State University, Department of Political Science at the following URL:
"www.osu.orst.edu/Dept/pol_sci/sahr/cpi96cf.gif"

Vehicle Ownership Trends

Between 1980 and 1996 the number of occupied dwelling units in the COP increased by 25 percent. In that same period the number of households with at least one vehicle increased by 35 percent. On average, City households owned 1.45 vehicles per household, 45 percent of all households owned more than one auto (Census, 1990). While these figures point to increased mobility of the city's population, it also indicates an increased demand for parking spaces for more people consuming more housing.

Vehicle ownership in Northwest has been consistently lower than in the city as a whole. In 1980, 38 percent of the city had more than one car while 12 percent of Northwest households more than one. In 1990 this percentage had risen to 14 percent of households and remains today. Table 5 shows growth in automobile ownership more clearly. Between 1980 and 1996, households in the study area owning more than one vehicle increased by 37 percent (3,179 to 4,357), vehicles per unit increased by 28 percent while occupied units only increased by six percent.

Table 5: Growth in Car Ownership for Northwest* Portland

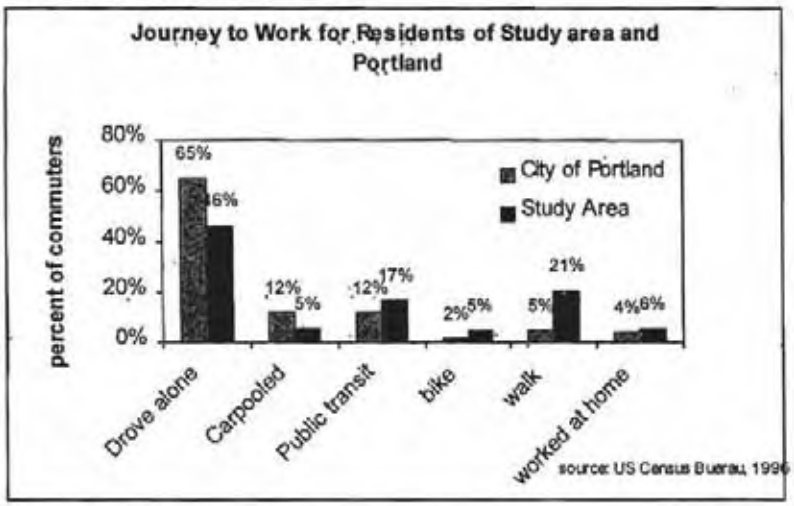
Year	number of units with more than one vehicle	vehicles per unit	# of occupied units (Households)
1980	3,179	0.65	6,161
1990	3,744	0.78	6,226
1996	4,357	0.83	6,502

source: 1980 Census, 1990 Census, 1996 ACS Census.
* includes census tracts 47, 48, and 49.

Travel Behavior

Residents within the study area drive alone to work 19 percent less than the city average, walk to work 400 percent more and take transit 42 percent more often than the city as a whole. Automobile ownership is directly correlated to travel behavior.

Figure 3: Journey to Work



2.4 BUSINESS COMMUNITY PROFILE

Changing Nature of Northwest Business Community

Nationwide, the nature of commercial activity is changing. Larger stores with economies of scale that attract customers from large geographic regions are providing goods and services once provided by neighborhood businesses. Much of this regional shopping activity takes place in new developments that take advantage of cheap land and adequate space for parking. While much has been written about the harmful effect of this new retail paradigm on the traditional mixed-use neighborhood retailer, less attention has been placed on neighborhoods that are "successful" at reorienting their neighborhood commercial activity to regional specialties.

Northwest Portland is enjoying a revival of commercial activity in Northwest 21st and 23rd Avenues. The shops and restaurants along NW 21st and NW 23rd Avenues attract visitors from across the region. While the area has long been a center of commercial activity, the type of activity continues to change. Observations contained in the 1983 PSU report and the point to changes in business activity that continues to this day.

> " *Analysis at a more detailed level reveals that the intensity of commercial uses is increasing. This means that many neighborhood convenience establishments are being replaced by shops or restaurants that attract customers from a wider region. Non residents are attracted to the commercial area because shops sell a unique product or service available at limited locations in the metropolitan region.*" (Gilmore, Telephone Survey. 1995)

As residents go outside the neighborhood to get there disposable goods, older communities are left with low-value, predominantly service type businesses or they attract small stores that serve a niche market missed by the larger retail centers. Northwest businesses have long been transforming into more of the niche type market with a regional draw, as acknowledged in the PSU study from 1983.

> " *Along both NW 21st and NW 23rd Avenues, general commercial uses have increased slightly (from 1970 - 1983). In general, single family dwellings have experienced a dramatic decrease in numbers, and industrial uses have decreased along 21st Avenue.* (PSU Study, 1983)."

The change from a neighborhood services orientation to a regional draw can increase demand for parking while failing to increase the parking supply. Businesses that focus on neighborhood services typically attract fewer vehicles as customers can walk to them. The likelihood of customers coming to these businesses from outside the neighborhood is low as similar local draw businesses exist in other districts As the proportion of customers from outside the immediate neighborhood grows, automobile use for shopping increases and the need for parking grows. The

1983 PSU study estimated that approximately 70 percent of patrons surveyed came from outside the neighborhood. "It appears," says the report, "that with every increase in regional commercial uses, the demand for and the deficit of parking spaces increases accordingly." The PSU study notes that this trend towards regional business orientation in Northwest is continuing. Today, fifteen years after the study was completed, this trend has indeed continued.

Impacts of Economic Vitality

The Northwest neighborhood has enjoyed a sustained period of economic prosperity over the past 15 years. While prosperity aids the health of the community, it can also require a neighborhood to face new issues. Increased commercial activity and increased car ownership per household has raised the demand for parking. A multitude of small-scale commercial enterprises along 21st and 23rd Avenues flanked by residential areas, many with medium and high density, creates a varied parking demand and makes implementation of a single policy difficult. While many solutions have been discussed over the years, no specific, comprehensive district parking management policy has been implemented.

Employment numbers for Northwest are difficult to estimate. This is largely due to the mix of uses within buildings. Although a comprehensive employment survey has been suggested, none has been conducted as of this date. The Northwest District Plan counted 512 firms employing 13,000 people within the entire Northwest District, including the industrial area. Estimates of employment for the retail section of Northwest (presumably not including medical facilities) from the 1992 Shuttle Survey Parking Study place the number at 300 businesses and 2,160 employees (NW District Shuttle Project, 1992). At least 50 nighttime commercial businesses (operating after 6pm), mainly restaurants, taverns, and a movie theatre, were counted in the crunch zone.

2.5 PARKING AVAILABILITY (SUPPLY)

Parking supply consists of on-street and off-street spaces. On-street parking is a portion of the public right-of-way that is devoted to public parking: These spaces are regulated through a variety of parking management techniques, the three most common being: metering, timing, and permits. Off street parking includes private driveways and garages for single family residences, commercial lots, residential lots, and public lots. This section provides a base of theoretical information and an analysis of the parking supply in the PSA.

City zoning codes generally require urban land-uses to provide off-street parking. This off-street parking supply is intended to insulate the community from spillover parking pressures. On-street parking may serve as primary, overflow or convenience parking but if unregulated is not reserved for any clearly identified use. Parking management often clearly defines the intended use or user of on-street parking.

For Northwest, as with many communities that were platted before the need to supply extensive automobile parking, the availability of off-street parking is limited. On a gross scale, commercial and residential developments fall short of the off-street parking required by present day zoning codes. Therefore, many residents, employees and visitors must compete for on-street parking.

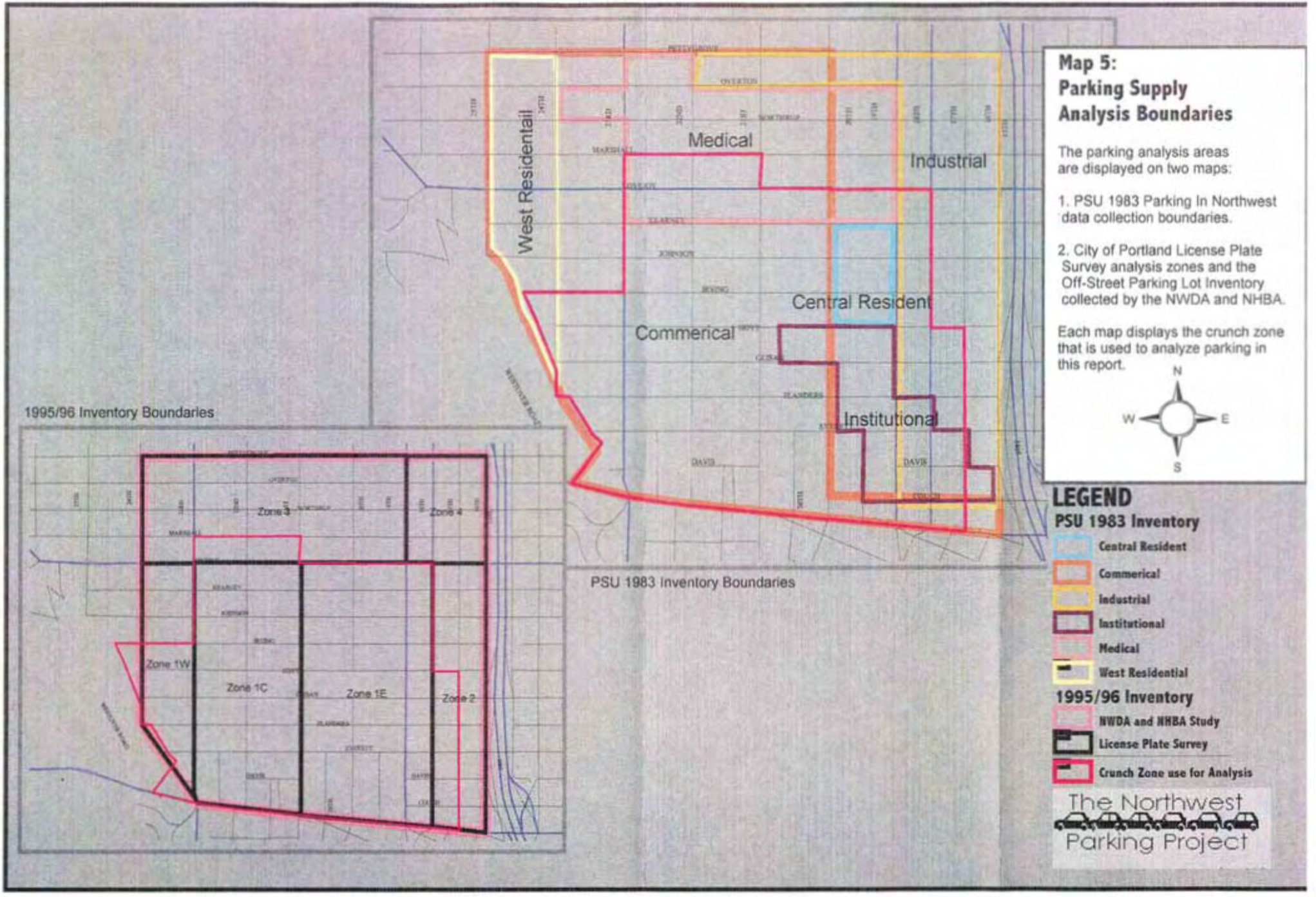
Sources of Information

The study analyzes parking supply based on three data collection efforts: a 1983 PSU inventory; the City of Portland License Plate Survey, 1995; and the Off Street Parking Lot Inventory conducted by the NHBA and NWDA in 1996. Each inventory analyzes parking supply for the areas between W. Burnside Street, NW 16th, NW Pettygrove, and NW 25th Avenues. Map 5, *Parking Inventory Analysis Areas*, displays the boundary shared by each study and finer boundaries that each study used to analyzed their data.

1983 PSU Workshop Project: Competition for Limited Spaces

Calculating the parking supply and demand for Northwest requires an intensive inventory of all on-street and off-street spaces and an analysis of potential demand. No such estimate has been undertaken for Northwest recently, however, a 1983 study by a PSU masters program did a comprehensive inventory based on a count of parking spaces and zoning requirements for individual land uses.

Results for the 1983 study are presented in the table below. By dividing the district into 6 communities, the report is able to compare parking availability for each area separately. Using a zoning based analysis, the study reports an aggregate deficit of 3,000 spaces when on-street spaces are left out of the calculations. Inclusion of on-street spaces results in a surplus of 1,188 spaces. Individually there appears to be a shortage of parking spaces for both the medical communities surrounding Good Samaritan hospital and the institutional


Map 5:
Parking Supply
Analysis Boundaries
The parking analysis areas are displayed on two maps:
1. PSU 1983 Parking In Northwest data collection boundaries.
2. City of Portland License Plate Survey analysis zones and the Off-Street Parking Lot Inventory collected by the NWDA and NHBA.
Each map displays the crunch zone that is used to analyze parking in this report.
N
W
E
S
West Residential
Medical
Industrial
Central Resident
Commerical
Institutional
PSU 1983 Inventory Boundaries
1995/96 Inventory Boundaries
Zone 3
Zone 4
Zone 1W
Zone 1C
Zone 1E
Zone 2
LEGEND
PSU 1983 Inventory
Central Resident
Commerical
Industrial
Institutional
Medical
West Residential
1995/96 Inventory
NWDA and NHBA Study
License Plate Survey
Crunch Zone use for Analysis
The Northwest
Parking Project

community surrounding the churches and schools. None of the communities were deemed to have adequate parking without use of the on-street spaces.

The boundaries of the 1983 study include spaces within the "industrial community" along the eastern edge of the District. While inclusion of this area adds to the overall picture, it is misleading because these spaces, especially off-street lots, are committed to industrial uses and are unavailable to residents, employees, and visitors. When the industrial community is excluded from the study, a new picture emerges with a deficit of 2,563 spaces and a surplus of 652 spaces when on street are developed.

The 1983 PSU report provides a comprehensive analysis of parking spaces by analyzing off-street spaces, on-street spaces, and on-street time limited spaces. While this information is comprehensive, it lacks detail on space location and may be out of date. The License Plate Survey provides a rough count of on-street spaces and driveways. The off-street lot inventory by the NWDA and NHBA provides a spatially defined and accurate analysis of supply of off-street lots and spaces within each lot.

Table 6:
Estimates of Parking Demand and Parking Supply in Northwest, 1983

		Demand	Supply			Surplus (deficit)	
community	boundaries	based on 1983 Zoning	off-street	on-street	total	w/o on-street	w/ on-street
1. Commercial	24th to 20th, Burnside to Pettygrove, plus blocks along Burnside to I-405.	3,872	3,206	2,244	5,450	(666)	1,578
2. Medical	23rd to 19th, Overton to Kearney, plus on block to west and one block to north	3,088	2,056	746	2,802	(1,032)	(286)
3. Central Residential	19th to 20th, Hoyt to Kearny	296	197	173	370	(99)	74
4. West Residential	24th to 25th, Westover Road to Pettygrove	387	341	363	704	(46)	317
5. Industrial	16th to 19th, Everett to Pettygrove	1,475	1,032	979	2,011	(443)	536
6. Institutional	19th to I-405, Burnside to Hoyt (approximate)	781	335	229	564	(446)	(217)
Total	as reported	9,115	6,109	4,194	10,303	(3,006)	1,188
Total less Industrial	excludes industrial community	7,640	5,077	3,215	8,292	(2,563)	652
Total less W. Res.	conforms to Inventory Boundary	8,728	5,768	3,831	9,599	(2,960)	871

source: "Northwest Parking Study," PSU, 1983

1995 Off-street Parking Lot Inventory

In the fall of 1995, members of the Nob Hill Business Association and the Northwest District Association conducted an inventory of off-street parking lots in 1995. The inventory includes information on the number of lots and their location, the number of spaces in each lot, and its use. Lots were divided into those serving residential uses and those serving commercial uses. In the winter of 1998, the Northwest Parking Group digitized this inventory in order to estimate the availability of these lots.

The inventory counted 146 lots within the crunch zone, containing over 2,704 spaces, seventeen percent of which are residential.

Table 7:

Off-Street Parking Inventory, 1996

	Entire Inventory		Crunch Zone	
	lots	spaces	lots	spaces
Residential	50	628	40	471
Commercial	194	3,854	106	2,233
Total	244	4,482	146	2,704

1995 City of Portland License-Plate Survey

In 1995 the City of Portland recorded the license plates for vehicles parked in Northwest in an effort to identify the composition of vehicles using on-street spaces. The study identified resident vehicles by checking the registration address of the license. Because many residents of Northwest may own vehicles registered to an address elsewhere, a system was devised to identify these "suspected residents." Other methods were used to identify commuters and visitors. Unfortunately, the study failed to identify a majority of the vehicles parked in the area.

Since 1995, the Nob Hill Business Association has enlisted the services of Trueheart Data Consultants to further analyze the original data. This analysis, due out in Spring of 1998, may shed additional light on the situation. Preliminary results from Trueheart have produced an estimate of on-street parking spaces as recorded by the survey and an estimate of driveways as well.

The estimates of parking spaces and driveways are presented in the table below. The driveways serve as a proxy for off-street residential lots. Assuming that each driveway accesses 1.5 off-street spaces, there are 708 driveways equally 1,062 off-street single-family spaces in the inventory boundary.

Further analysis by the Northwest Parking Project estimates the number of spaces and driveways in the "crunch zone." Estimates are based on the sum of zone 1C; 1E; half of 1W; thirty percent of zone 2; and ten percent of zone 3.

Table 8:

On-Street Parking Spaces and Number of Driveways for Inventory Boundary

ZONE	Boundaries	Parking Spaces	Driveways
Zone 1C	23rd to 21st, Lovejoy to Burnside	822	149
Zone 1E	18th to 21st, Lovejoy to Burnside	1,186	149
Zone 1W	23rd to 24th, Lovejoy to Burnside	398	77
Zone 2	16th to 18th, Lovejoy to Burnside	554	86
Zone 3	19th to 24th, Pettygrove to Lovejoy	900	169
Zone 4	16th to 19th, Pettygrove to Lovejoy	321	78
	Area Total	**4,180**	**708**
	estimated in crunch zone*	**2,462**	**379**

source: Trueheart Data Consultants, 1998
* Northwest Parking Project, 1998

Residential Parking Supply

The 1983 PSU study determines supply and demand of parking. This analysis reports a supply of 6,109 off-street parking spaces and 3,544 on-street spaces in the study area.

Table 9: Parking Supply by 1983 PSU report

Number of Spaces
6,109 off-street parking spaces
3,544 on-street parking spaces
650 on-street time limited parking spaces
Total
10,303 total parking spaces for the 1983 study area

The 1983 inventory does not adjust supply for timed on-street parking spaces. Since timed spaces suggest turn over, the effective supply of a timed space is higher then a non-timed space. The inventory reports the number of spaces as if they were untimed rather then effective parking calculated by applying time limits.

The Parking Group has done an analysis on the License Plate Survey and Off-Street Parking Lot Inventory in order to get a second estimate of parking supply. The method to combine the data requires four basic steps and two basic assumptions. Step 1 is a summation of on-street spaces and off-street lots to obtain Subtotal 1. Step 2 assumed that each off-street lot possessed a driveway. To obtain the number of driveways minus those that led to off-street lots, Driveways 1, a driveway was removed for each off street lot. Step 3 assumed that each driveway in Driveways 1 held the capacity of 1.5 parking spaces. Driveways 1 was multiplied by 1.5 to obtain the total amount of driveway parking, Sub Driveways. The total on and off-street large-lot supply, Subtotal 1, was added to the total amount of driveways spaces, sub Driveways, to obtain the Total Supply.

Step 1	**Step 2**	**Step 3**	**Step 4**
On-street Spaces	Driveways	Driveways 1	Subtotal 1
+ Large off-street lots	- Large off-street lots	* 1.5	+ Sub Driveways
Subtotal 1	Driveways 1	Sub Driveways	TOTAL SUPPLY

The total supply of parking in the crunch zone is 5,522 spaces. Of those, 3,289 spaces are available to residents: 2,462 on street and 827 off street (356 spaces in 237 driveways (Trueheart Data Consultants, 1998) and 471 in off-street lots. The commercial off street supply is 2,233

2.6 PARKING DEMAND

There are two methods for estimating parking demand. One is to estimate relative demand by looking at residential population and vehicle ownership to determine total vehicle ownership for a particular area. Another is by looking at the land use within an area to determine parking needs based on the minimum zoning code requirement. The 1983 PSU study takes the second approach, estimating total demand for the study are to be 9,115 spaces (PSU, 1983).

Calculating demand based on the 1983 zoning requirements, PSU calculated a demand for 9,115 parking spaces. The study concludes that a shortage of over 3,000 off-street parking spaces exists between the required code and built scenarios. When on-street parking spaces are added, a surplus of over 1,000 spaces is reported.

Table 10	Without on-street	With on-street
Demand	9,115	9,115
Supply	6,109	10,303
Available parking	-3,006	+1,188

Source: PSU, 1983.

This second method of determining demand has several shortcomings, as the report acknowledges. Foremost is the conservative nature of the zoning code.

> *"The Zoning Code is a conservative, minimum estimate of parking spaces required for individual uses and may underestimate actual demand. For example, residential structures with four units or more require only one parking space for every two units and structures with three or less units require one parking space per unit."* (PSU, 1983)

The report also notes the lack of required spaces for certain commercial zones (there is an assumption that patrons and employees will take public transportation or park on-street).

Given the shortcomings of the 1983 estimate of demand and the age of the data, a new estimate of demand is appropriate. The NW Parking Project estimate separates demand into two categories, business and residential.

The Northwest Parking Project estimates approximately 4,000 residentially owned vehicles in the PSA and 2,900 in the crunch zone (Census, 1996). Past surveys of parking behavior indicate that approximately half of the vehicles in the study area, 2,000, are parked on the street (Gilmore Telephone Survey, 1995). The NW Parking Project estimates that 71 percent (2,073) of residential vehicles park on street in the crunch zone, an estimated derived using 1996 Census demand data and parking supply data from section 2.5.

Residential demand for parking is a function of the number of housing units in an area and the number of vehicles per unit in the area.

Table 11: Vehicles in Households for Northwest COP

	Northwest Parking Study Boundaries			Survey of Northwest Residents
	1980 Census	1990 Census	1996 Census	1995 Telephone
No vehicles in HH	31%	42%	35%	20%
One vehicle	50%	46%	53%	52%
Two vehicles	17%	5%	11%	22%
Three or more	2%	7%	1%	6%
	100%	100%	100%	100%

Source: Census, 1980, 1990 and 1996 and Telephone Survey, 1995

Demand for businesses are more difficult to generate. The NW Parking Project considers business demand as a function of the employees, customers and the mode split of each group. This demand is difficult to generate because employment data for individual businesses are not provided through public services. More difficult is calculating the customer based automobile demand for businesses. This requires knowledge of at least building square footage and use.

As stated in Business Profiles, section 2.4, the nature of Northwest's businesses are also changing. These businesses are less dependent on local customers and are attracting more outside patrons. As reported by an intercept survey done by the 1992 PSU Consulting Group, 94 percent of non-residents drove while 87 percent of the residents did not drive. And of the total respondents, 62 percent were non-residents. The NW Parking Group counted 50 businesses that attract evening business along NW 21st, NW 23rd and W. Burnside in the crunch zone.

2.7 CONCLUSION: ANALYSIS OF PARKING

This section provides an analysis of the parking situation for the parking crunch zone during p.m. hours. The p.m. is defined as post 6 p.m. on a typical weekday. This analysis shall explain the conflicting use of parking through supply and demand. Parking supply is calculated by summing on-street and off-street spaces (see section 2.6). Off-street spaces include parking lots and driveway parking. Demand is discussed as a sum of residential car ownership and p.m. business attractions (see section 2.7). The data sources for parking supply are the COP License Plate Survey and the Off-Street Parking Lot Inventory by the NWDA and NHBA, 1995. Parking demand is estimated using the 1996 U.S. Census Bureau: American Community Survey and first-hand counts of p.m. business attractions.

Supply Analysis

The total supply of crunch zone parking is 5,522 spaces. Of those, 3,289 spaces are available to residents, 2,462 on street and 827 off street: 356 spaces in 237 driveways (see methodology, section 2.5, pages 19-20; Trueheart Data Collection, 1998) and 471 in off-street lots. The commercial off street supply is 2,233, with 249 spaces allocated specifically for nighttime attractors (analysis of Off-Street Parking Lot Inventory).

Demand Analysis

Demand is calculated as potential residential demand plus potential commercial demand. In 1996, the U.S. Census Bureau reported 2,900 residentially owned vehicles within the crunch zone, .69 vehicles per 4,189 households. The crunch zone also contains over 50 businesses within NW 21st, NW 23rd and W. Burnside that attract customers during the p.m. hours. Demand estimates vary for nighttime commercial attractors by use, size and time. This study does not attempt to calculate the commercial demand rather address the lack of parking for nighttime commercial activity and residential parking. Applying conventional trip attraction rates found in the Institute for Transportation Engineers manuals, Trip Generation and the Traffic Engineering Handbook, may be used to generate a more detailed estimate.

Calculating the Implications of Supply and Demand

An efficiently used on-street parking infrastructure is considered to be 85 percent occupied during peak hours (Barton-Aschman, 1983; Rick Williams, interview 1998). The calculations of supply and demand shall consider parking infrastructure for both the 100 percent and 85 percent occupied scenarios. Yet, the analysis shall assume that each space is accounted for and potentially used by Northwest residents, employees or visitors.

Of the 2,900 residential vehicles within the crunch zone, 471 are in residential lots and 356 in driveways, leaving 2,073 residential automobiles to park on street. Of the estimated 2,462 on-street spaces, residential automobiles use approximately 84 percent of the total during the p.m. hours. 438 on-street spaces are left over and available for visitors to both residential homes and business.

The commercial parking supply consists primarily of 2,233 off street spaces within 106 off street parking lots. Of the 106 lots, 11 lots with 249 spaces are currently dedicated specifically by the p.m. businesses and it the other lots are believed to be unavailable. Therefore, when applying the 100 percent method, 687 spaces, 438 on street and 249 off-street, are available to visitors, patrons and employees of 50 p.m. business in the crunch zone. An average of 13.7 spaces per business exists assuming residents have first preference to park. The 85 percent efficiency applies only to on street parking spaces used for business activity. Therefore, of the 438 on street spaces, 372 will be occupied at any one time. The available supply decreases to 621 spaces, average of 12.4 spaces per business.

This analysis suggests that the availability of parking is constrained during weekday evenings. Of course the above analysis does not reflect the real interaction of the supply and demand of the crunch zone infrastructure. In reality, the excess demand generated by insufficient residential and commercial off-street parking cause on street competition for spaces.

There are methods to increase parking supply (see Appendix II, Annotated Bibliography). One is to apply efficiency measures such as various on street parking management techniques. A second is to utilize shared parking. Managing parking supply can also limit the use of the spaces to preferred users. A permit program may prohibit or limit the use of on street parking for those without a permit, often visitors. Demand management programs, such as developing a pricing scheme for parking spaces, will impact the current parking scenario.

On Street Parking Management

Applying time limits to on street spaces used for business clients can increase effective parking supply. During a 5 hour business period (6 p.m.- 11 p.m.), and untimed space is effectively one parking space. That space with a 3 hour parking limit will be used twice, doubling the supply, and a 2 hour limit will ensure that 3 automobiles use the space. Enforcement of time limits is essential to applying the scenario.

Shared Parking

Shared parking will increase the supply of parking. Presently, commercial shared parking may only occur in commercially zoned areas. A Multiple Use Permit program is being discussed to allow both commercial and residential shared parking in any zoned area (see section 3.2).

Permitting Limited Use

A permit program to limit commercial use of on street parking should not constrain the supply past the analysis performed here because the analysis assumes residential preference. Yet as stated above, the analysis does not reflect the actual competition for spaces between visitors, employees and residents. A parking permit program would limit that competition but may be expensive for multi-automobile households. This may be desirable for single family households and undesirable for multi-person rental households.

Pricing

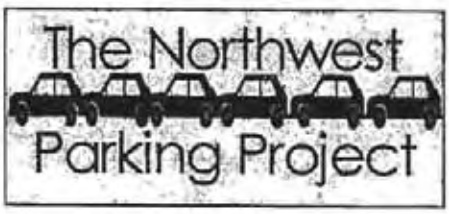
Pricing is the most effective means to an efficient parking supply. Meters are easily monitored and off street lots are used for extended periods of time.

Conclusion

The problem of parking in Northwest is multifaceted, yet simply put, there are not enough spaces to accommodate the demand. There are many possible solutions but all will have external impacts, will be positive to certain interests and harmful to others. Thus, when framing the issue, stakeholders must build a compromise to the implications of parking strategies. For the manipulation of the parking infrastructure must have a purpose and an intended user group, these must agreed upon before policy or programs options are feasible for the district.

Once policy objectives are clarified, a variety of solutions should be considered. Section 3.0, Policy and Program Options, discusses management programs, permits, pricing and transit use in greater detail to aid with this second stage of implementing solutions.

Policy and Program Options



PSU Planning Workshop
1998

SECTION 3: POLICY AND PROGRAM OPTIONS

There are many parking programs that are used by jurisdictions to control the use of parking and to ensure adequate supply. This section examines a variety of programs and policies that are widely used to manage automobile parking in urban areas.

There is a substantial wealth of information available on parking management techniques and efforts made towards examining and implementing parking policies. Some of the most common techniques are outlined below. A comprehensive parking management strategy will likely include the following programs, but should not overlook the myriad of other techniques available. Please refer to the appendices of this document for more background information on parking management techniques.

3.1 ON-STREET PARKING MANAGEMENT

Explanation/Definition

On-street parking is defined as those parking spaces that exist in the public right-of-way (Graham, 1998). The COP has three on-street parking management goals, these are(COP Bureau of Traffic Management :

1) Effectively manage on street parking by balancing changing demand and "maximizing" revenue;

2) Supporting economic development, traffic flow, transit usage, and air quality by "altering the supply, operations, and/or demand for both on- and off-street parking", and

3) Addressing local and regional air quality and congestion management issues by developing policies and strategies that promote alternative modes of transportation to the single occupancy vehicle. These goals are implemented for both individuals and businesses.

On-street parking management techniques include metering, timed spaces, commercial loading, emergency spaces, and permit programs, among others. The control of the on-street parking is clearly central to the issue discussed by both residents and business. Control of on-street parking includes enforcement as well as regulation. Enforcement of timed or metered parking is essential to the success of on-street parking management.

Applicable Situations

The management of on-street parking is implemented by the COP in a manner that maximizes the ability to respond to individual and business needs. Active parking management is applied to many areas of the City including the Northwest District. In the Northwest study area timed parking is currently used and metered parking is not (Graham, 1998).

Winners/Losers

Residents, business owners, and all stakeholders in the Northwest District are potential winners or losers of potential on-street parking management practices. The management of on-street parking has a significant impact on the parking capacity of the district. For example, the simple change from a two hour space to a one hour space increases parking capacity by 100 percent. In addition to the time component, the hours that the timed space is applicable for is of importance. Special district needs for such things as movie theaters and restaurants may be improved by extending timed parking into the early evening hours.

Legal Implications

Title 16, Vehicles and Parking, of the COP Municipal Code provides the City with the authority to regulate on-street parking. This title regulates everything from parking zones, metered parking, and area parking permit programs. However, according to Bill Graham, the COP City Council adopted Title 16 without overly specific regulatory language in order to allow sufficient judgement. In other words Title 16 provides broad authority but allows for equally broad discretion. COP staff indicate that this allows them to regulate on a site specific basis rather than by black and white rules. In conclusion, the City has complete authority to mange the on-street parking resource to ensure general safety, economic vitality, and livability.

Meter Parking

Explanation / Definition

Metering is one of the most recognizable parking regulatory measures. In business zones, on-street parking is most often intended for short duration's (two hours or less). Periodically, parking meters or ticketing machines will be programmed for longer or shorter periods. Although it may seem like a contradiction metering works to increase turn over rates.

Applicable Situations

Currently, parking meters are not used in the study area. In place of meters are signed curb segments along and adjacent to NW 21st and NW 23rd Avenues that limit parking to mainly two hour maximums. Some of these signed segments also limit parking to 1 hour, 30 minutes, 20

minute's etc. There appears to be no consistent method for their placement. Generally, the two-hour limit is the most widely used regulation on the two main commercial arterials. Enforcement by the COP is the only means of monitoring these spaces. It is not known what percentage of these spaces experience illegal parking and how often violations occur.

Meters should be viewed as one component of a larger parking strategy that works to reduce on-street parking and increase turn over rate (OECD, 1980). One argument that commercial interests often make against the implementation of on-street metering is that it could work to reduce the number of people coming into a given commercial district. This argument is commonly made by Central Business District retailers in their battle against the large amounts of free parking offered at suburban malls.

A metering system combined with other strategies could be implemented in multiple variations. One scenario might involve placing meters on the two main commercial arterials of 21st and 23rd Avenues. Overall, these are the most desirable spaces in the community since they are close to both the main commercial area and the highest density residential area. The literature suggests that a price structured metering systems would be the most effective strategy at increasing turnover (OECD, 1980). In this scenario, the less expensive long-term parking spaces would be located further from the commercial areas and the more expensive shorter duration meters would be located directly adjacent to commercial businesses (OECD, 1980).

Legal / Political Implications

Politically, there are potential problems with this scenario. Pushing short-term spaces away from the core business area (into spaces that are currently long-term) and increasing the cost (there currently is no direct cost to users) of spaces adjacent to businesses are just two problems. While this scenario may work to increase the automobile turnover rate, it is unlikely that it would increase it in a significant way as "signed" short-term spaces are simply replaced with metered short-term spaces.

Many studies indicate that increasing the level of enforcement of one and two-hour time limit spaces will improve turnover rates and the probability of finding a convenient on-street space. Enforcement is also generally seen as the most important component of the viability of many on-street parking management techniques. (OECD, Scannell, et al).

Replacing conventional parking meters with new technologies such as in-car meters has also been shown to increase turnover rates. One technology is in-car meters. These function like electronic debit cards. A driver prepays for a card, places it on the dashboard and turns it on while parking. The driver turns the meter off upon returning to the car (OECD, 1980). Another technology includes a device that detects when a driver has pulled out of a parking space and then can zero out any time left, in effect resetting the meter. These devices have been used in Tokyo for the last ten years and have been recently tested in the United States.

Winners and Losers

A combined metering and permit program could have the effect of pushing more automobiles into the limited number of metered spaces on the two main arterials as spaces are taken away on the residential streets by the permit system. The effects of a combined metering and permit system are difficult to gauge from a hypothetical scenario. It is assumed that metering alone would likely have a minor effect compared to the impact of say a combining metering with a residential permit program. A detailed examination of a residential permit program follows.

Residential Permit Program

Explanation / Definition

Residential permit parking systems (RPPS's) are widely used parking management tools that allow residents of a defined geographic area to receive preference in parking in that area for a least a portion of a 24-hour period. Permit programs are based on the principle of eliminating long-term nonresident parking. They can be strictly "reserved" permit programs or "time limit" parking programs or a combination of both (Martin, 1992).

The reserved permit parking regulation can be implemented on streets and can operate on a full or part time basis.

In all cases, the number of parking permits issued should not exceed the number of legal parking spaces in a given block.

The time limit exemption program is designed to increase the availability of on street parking for residents by discouraging long-term nonresident parking on residential streets. This regulation is less restrictive than reserved permit parking since motorists lacking permits are allowed to park on the street for a period of time not exceeding the signed time limit.

Jurisdictions generally tailor permit systems to accommodate their particular situation. This approach insures an analysis of real local problems on a scale that reflects the community. A tailored program should reflect the needs and wishes of those in the local community. Additionally, if the RPPS is not part of a comprehensive parking strategy and does not utilize effective pricing measures that reflect the true demand for parking in the area in question, a logical, long-term solution is less likely (Martin, 1992). Determining a comprehensive system tailored to the needs of NW is beyond the scope of this analysis, however. Appendix A-II, Annotated Bibliography, refers the reader to resources that may be used in further research.

Applicable Situations

A parking permit system in Northwest could be applied to access municipal, commercial or private facilities, whether they are attended or not. Parking permits can also be targeted to the

time period and place of congestion. Complex price structures could be devised using differently priced permits varying by location, time of day and duration of parking (OECD, 1980).

For instance, a simple plan would require the display of a purchased permit on all parked cars in a given zone between the hours of 7 a.m. and 6 p.m. Variation by area could be achieved with a number of differently priced zones with a different sticker required in each. To vary prices by parking duration, permits could be required for long-term users only, or less expensive stickers could be offered for short-term parking. Similarly, permits could be issued in hourly denominations so that commercial patrons could purchase one two-hour sticker while commuters would have to purchase four, for instance (Martin, 1992).

This type of strategy has the advantage of affecting all types of parking. Greater reductions in congestion could be expected, as drivers would not be able to escape charges by changing the facility they use. Also, greater revenues would be obtained as all parked cars would be affected. Since charges are applied directly to the users themselves, operators have no opportunity to absorb or redistribute the cost burden. These revenues could possible be used to fund additional enforcement or the creation of a Northwest Traffic Management Association (TMA) similar to the Lloyd District TMA.

Permits are typically quite easy to administer. They could be offered in a number of denominations such as daily, weekly, monthly and annual. Daily and weekly permits could be purchased at retail outlets in a manner similar to the distribution of lottery tickets while annual permits could be distributed through the mail. Refunds for unused permits, made necessary by relocation or changes of vehicle ownership, could be handled at a limited number of outlets (Martin, 1992).

The enforcement of a permit system would be very different from other pricing schemes such as a tax or surcharge and could present some problems of administration. For instance, if each resident received a permit for every car they own, the permits could be loaned to friends or employees. Also, residents who normally park in their own off-street space may conceivably obtain a permit find it more convenient to park on the street thereby decreasing the number of spaces for other permit holders.

3.2 SHARED PARKING

Explanation/definition

Shared parking is defined as parking space that can be used to serve two or more individual land uses without conflict or encroachment. The opportunity to implement shared parking is the result of two conditions: 1) variations in peak accumulation of parked vehicles as the result of different activity patterns of nearby land uses; or 2) relationships among land use activities that result in

peoples' attraction to two or more land uses on a single auto trip to a given area or development (Urban Land Institute, Shared Parking, 1983).

Shared parking will typically be established through two types of arrangements. One, a developer builds a multiple use development whose uses generate peak parking loads at different times of the day. Parking is provided and shared amongst all uses. Ideally, the quantity of spaces supplied is only enough to serve the peak capacity of all the uses at any one point during the day. The developer will build fewer spaces then if he was required to build for the cumulative load generated by each use's peak. For example, a new development has offices (150 parking spaces needed) and a theatre (100 parking spaces needed). With shared parking, only need 185 parking spaces may be required because the theatre does not need the 100 spaces until 7pm, at which time most of the employees will be gone. Two, single land-use lots with parking will permit nearby land users to utilize their spaces during the off-peak hours or when not needed. Offices and banks often allow restaurant patrons to utilize their parking after 6pm.

Applicable Situations

Northwest Portland has ample opportunity to utilize commercial off-street parking lots for shared parking. As explained in the Inventory for Off-Street Parking Lots (Appendix I), commercial lots are most applicable for shared parking opportunities since residential lots are often utilized all day. The parking inventory found that 96 commercial lots containing 2,178 spaces exist within the study boundary (W. Burnside, NW 16th, NW 25th, and NW Pettygrove), see map 5 in appendix 1.

The lots identified through the parking inventory are presently used primarily for a single use thus offering potential for shared use at off-peak hours. More recent developments, such as the Kitchen Kaboodle mixed use development, were built with shared parking as a design feature. Commercial parking entices shoppers to this location and residential parking increases the value of housing units. Future mixed-use developments in the Northwest should consider utilizing a similar shared parking model.

Since parking peaks occur at different times and days of the week for different land uses, so do shared parking opportunities. Churches are the only use that have been identified with weekday a.m. availability. Retail and office are both classified for weekday, post 6p.m. availability. Office and institutional uses are classified for weekend availability.

The Inventory for Off-Street Parking Lots maps shows the parking lots in Northwest. The most significant contributor of p.m. parking spaces is Good Sam Hospital with over 400 structured parking spaces. The northeast and southeast sectors also have significant p.m. parking availability. Although lots are more scare on the western side of the study area, these lots provide quality opportunity for valet parking, as do the commercially zoned lots in that area.

Winners and Losers

All parties that desire increased parking capacity with no or minimal infrastructure additions are winners with shared parking. Shared parking will not take parking away from any party, rather increase total parking capacity. Shared parking thus allows a more efficient use of the existing infrastructure. Shared parking is also useful to new developers, or developers that redevelop lots, since it permits them to use more of their lot for building square footage and less for parking. Shared parking for new developments may be particularly valuable in areas that are have land constraints or that commit a great deal of their land to parking.

Shared parking will have both positive and negative externalities. Increases in free parking may attract more automobile users rather than allocate spaces to the existing users. Increasing the parking capacity may both increase mode split toward automobiles and increase the gross number people that visit the Northwest. Businesses may desire this increase of visitors because it should bring more business. Yet, untimed parking may also increase the amount of time that visitors park, thus decreasing the effective parking capacity. Business interests may strive to implement timed, shared parking to increase parking turnover. Since off-street parking is private the parking patrol for these spaces is not the City's responsibility.

An increase in parking will increase the automobiles that flow through the Northwest District. As traffic increases so may congestion worsen. At the present state, both residents and businesses have acknowledged the traffic congestion problem. As more parking is added transportation planning should be done to analyze the potential for increases in automobile use as well as an assessment of the effectiveness and performance of transportation facilities.

One solution to increasing capacity without substantially increasing congestion would be to develop residential only shared parking lots. In the short-run, resident only lots would not substantially increase residential automobile ownership, rather provide new parking spaces. Yet in the long run more parking will increase the ratio of automobiles per residential household. Presently the US Census tracts 47, 48 and 49 have a combined vehicle ownership rate of .78 autos per household. Without tract 47 the rate drops to .62 and with only tract 48 and blockgroup 4902 the split drops to .5 automobiles for each household. These low automobile densities are partially a function of good transit, proximity to business to residences and lack of residential parking. As shown through the Census statistics, car ownership increases as housing density decreases and parking becomes more available. Census trends also show that automobile ownership has increased for all households between 1980 and 1996. Still, increases in parking for residents would not increase automobile ownership as quickly or greatly as would the increase of automobiles from visitors.

Zoning

As described in the Base Analysis section of this document the study area includes six different residential, commercial, and industrial zoning designations. Two of the predominate zoning designations are Storefront Commercial (CS) and High Density Residential (RH). The CS zone

does not require any off-street parking as noted in Chapter 33.266 Table 266-1 of Portland's Zoning Code. The RH zone requires no parking for buildings with 1 to 3 units and 1 space per 2 units for all buildings with four or more units. The remaining zoning designations of the Northwest District require varying amounts of parking based on the use occupying the building.

As illustrated by the Zoning Map (Map 2, p.7) the CS zone district typically only extends 50 to 75 feet from both NW 21st and NW 23rd Avenue. Therefore, many of the retail sales, service, and office commercial uses located in the Northwest District fall within the High-Density Residential (RH) zone and are allowed only as conditional uses. In order to be allowed the uses must meet the approval criteria found in Chapter 33.815, Conditional Uses. In order for the conditional use to be approved it must be consistent will all provision (such as parking) of the proposed use, as well as meet the specific conditional use criteria found in Chapter 33.815.105 (A-E). These criteria require the overall residential appearance and function of the area will not significantly changed due to the proposed use. That the proposed use is compatible with any City designated resources. The use must ensure that elements such as noise, glare, safety, and light-night operations will not compromise livability. The proposed use must be in conformance with the City's Transportation Element. All public services, such as water, sewer, police, and fire, must be able to service the proposed area. Finally, the proposed use must be consistent with any plan districts.

Presently, commercial parking is a prohibited use in areas with an RH zoning designation. This presents a regulatory hurdle for the possibility of providing shared parking on a significant number of underutilized parking lots located in the Northwest District.

Multiple Use Parking Opportunities and Constraints

The Nob Hill Business Association contracted with Bob Stacey, formally with Ball Janik Attorneys, to craft a regulatory method to allow shared parking and to allow the more efficient use of existing off-street parking resources identified in the Northwest District.

Originally, a Mixed Use Parking Plan to allow for shared parking opportunities was proposed. However, at the direction of City staff and the NHBA the proposal was changed from a district plan to an overlay district. This change was made to elevate the concerns of other Portland neighborhoods that felt that a mixed-use parking overlay zone could be used in their areas. The Northwest Plan District would establish a system by which a Shared Parking Permit could be issued for nonresidential parking lots. These permits are proposed to be processed as administrative land use decisions, with notice to the neighborhood committee, but no public hearing. This would allow a minimum of processing time under clear and objective decision standards. It should be noted that the proposed language would allow the use of nonconforming parking lots to be used. Mr. Stacey suggests that requiring a lot owner to comply with all landscape and buffering regulations would be a significant disincentive to participate in the shared parking permit program.

Another opportunity discussed in conjunction with the use of shared parking lots is valet parking. Chapter 33.226.100, Parking Regulations, allows for stacked or valet parking if an attendant is present to move vehicles. If stacked parking is used for required parking spaces, a guarantee must be filed with the City to ensure that an attendant will always be present. Additional regulations governing setbacks and parking lot layout are included in Section 33.266.140 of the zoning code.

3.3 REMOTE PARKING WITH SHUTTLE BUS

Another strategy is the implementation of a district shopper bus that could run on a 10-minute headway. This type of circular bus provided by a smaller less expensive bus could provide timed transfers to both the light rail station and to existing bus service to the downtown transit mall.

In March of 1992 a group of PSU students, dubbed the PSU Consulting Group (Northwest District Shuttle Project, 1992), set out to determine the feasibility of running a weekend shuttle bus service through Northwest. The study examined a "small-bus customer oriented shuttle" that would circulate between 23rd and 21st and a remote lot, possibly a industrial lot located beneath I-405. Their research focussed on the effectiveness of the service in relieving parking congestion, the public receptivity to the idea, and the economic feasibility of the system.

> *" In its ideal form, shuttle buses would visit several designated parking areas on the perimeter of the Northwest District, picking up prospective shoppers, diners, and wanderers, then carrying them up and down NW 21st and NW 23rd. Patrons could get off at any of several predetermined stops, and they would later be returned to their cars at the remote lots. Fares would be minimal, the pace would be relaxed, and the usual concerns about parking spaces, parking tickets, and car security would be nothing more than an unpleasant memory. "(PSU Consulting Group, Shuttle Parking Report)*

Market Analysis

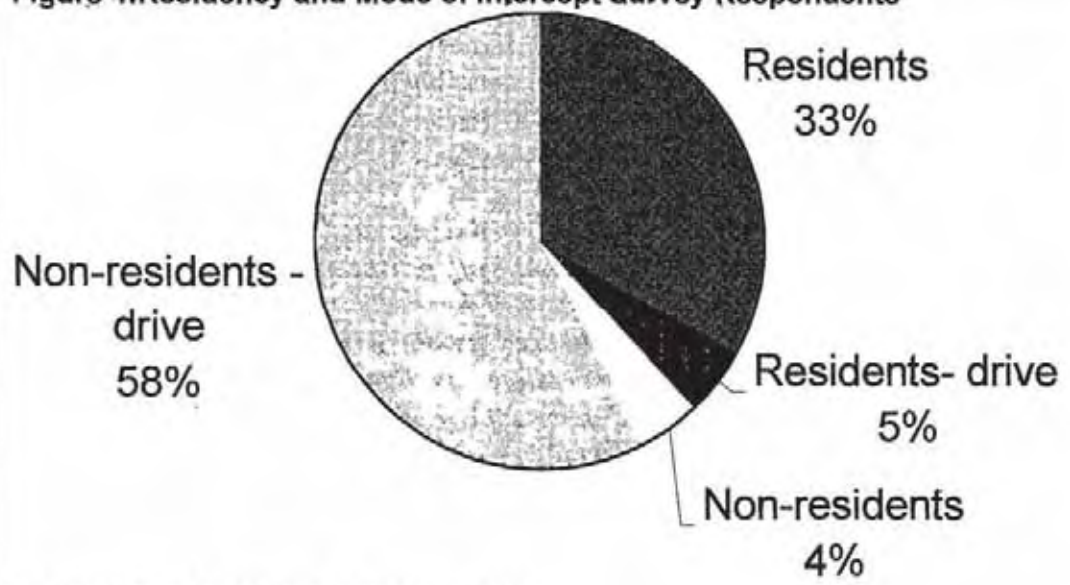
The project used an intercept survey and a survey of business owners and managers to determine public receptivity to the idea of a shuttle bus system. The intercept survey polled 184 people on the street during a weekend in May. Respondents were asked where they lived, how they got to Northwest and about their willingness to use a shuttle system. Thirty-eight percent of those surveyed lived in the area. Sixty-three percent drove to the area. 102 of those surveyed said they would be willing to use the shuttle if one were provided.

Table 12: Willingness to Use a Shuttle (Shuttle Project)

Willing to use shuttle	102
unwilling	82
Why unwilling?	
rather walk	47
service inconvenient	10
prefer Tri-Met	7
prefer Car	5

source: PSU Consulting Group, 1992

Figure 4:Residency and Mode of Intercept Survey Respondents



source: PSU Consulting Group, 1992

Business Focus Groups

The project estimated there to be 300 businesses in Northwest who altogether employ 2,160 employees (Northwest Shuttle Study, 1992). Sixty-eight managers and business owners returned surveys and eleven attended focus group sessions. Results of the merchant survey indicates 62 percent of all employees commute to work from outside the Northwest District and 38 percent live in the area. Of these 1,004 work during the day and 335 work during the evening hours.

Employee Shuttle

The study examines two types of shuttles, one for both visitors and employees and one for employees only. The employee shuttle could either be run by the business community or run co-operatively with Good Samaritan Hospital who runs a shuttle from 15th and Northup lot to the hospital. The visitor shuttle would work on weekends and ferry shoppers into the commercial district. Although the visitor shuttle was seen as an effective way to increase the amount of visitors to Northwest, the cost estimates prove prohibitive.

> *"(The visitor shuttle) is the most costly and the most difficult to implement, but it has the greatest potential for aesthetic appeal and goodness of fit with the tastes and expectations of the neighborhood." (page 22).*

While the study seemed confident that the increased patron traffic and resulting increased sales per square foot would entice businesses to support the system they cautioned that success hinges on social acceptance of system. The authors say the shuttle "must pick up patrons at the point at which they enter the District, move them quietly and cleanly to points of interest, then return them promptly to the parking facility." (page 7).

Competition with Tri-Met would not pose a problem. The report surmises that an internal circulation system would be used by a clientele separate than Tri-Met's. While Tri-met is used largely by residents traveling out of the area, the circulation system would be used by visitors to move around Northwest and to get to their cars.

Recommendations of Report

In conclusion the report recommended against a customer shuttle. Such a shuttle would cost close to $150,000 a year to operate and projected fares would only capture $60,000 of that. Even the assumed $20,000 per year subsidy of the program by businesses would not cover anywhere near the cost of such a program. Implementation of an employee shuttle using a remote lot held greater promise. Cost of such as system would be less, given a reduced need for amenities and a reduced level of service. Such a system would free up 500 parking spaces, according to the report(PSU Consulting Group). Employee use would be reliant on instituting disincentives such as permit parking or timed parking elsewhere in Northwest. Without on-street management programs, employees would tend to choose free convenient on-street parking over the free shuttle.

Report Recommendations

- Expand timed parking to all of NW 23rd and NW 21st Avenues.
- Publicize public transit and parking alternatives
- Investigate residential permit system.

Recent Developments

The Nob Hill Business Association has investigated a shuttle service both for employees and for visitors. Cost was the number one barrier according to members of the NHBA. Businesses did not see funding the project themselves and Tri-Met is unwilling to fund a shuttle system as it is outside their purview. Tri-Met is specifically oriented towards providing alternatives to cars and saw the shuttle system as something that facilitated the use of the automobile. Another barrier to implementation is the lack of interest from industrial lot owners in the area. Preliminary work to ascertain the possibility of using Consolidated Freight lot got no response from the company (Tom Raneri, 2/26/98).

3.4 ENCOURAGE TRANSIT RIDERSHIP

As a neighborhood designed around a streetcar system, Northwest still retains a strong orientation to transit. Tri-met runs four bus lines through the area including Bus number 15 with 10-minute headway to downtown. Transit ridership in Northwest remains consistently high. In a ten year period between 1985 and 1995 ridership increased by 33 percent on Bus number 15, 31 percent on bus number 17, and 64 percent on Bus number 77. The steady increase in transit ridership may suggest that as resident population and economic activity in the area have grown opportunities to increase transit usage will increase in Northwest.

Two strategies can be used to increase the share of trips that are taken on transit in the Study area. The first strategy is to increase the supply and frequency of transit service. However, simply increasing transit supply may not be enough to increase ridership. Therefore, a demand strategy should be employed in conjunction with supply adjustments. These strategies include but are not limited to transit marketing, special price incentives, and when appropriate disincentives for personal passenger vehicle use.

Regional Transit Policies

Title 2 of the Urban Growth Management Functional Plan sets stricter parking ratios for areas with high levels of transit service than areas not served by transit. This stricter standard reflects the relationship between good transit service and decreased parking needs. Metro defines areas such as Northwest, that have transit service with 20-minute headways during the peak commute hour, as Zone "A".

NW 21st and NW 23rd Avenue's are each designated Metro 2040 Main streets. While main streets contain an intense mix of street-orientated business and single- and multi-family housing that increases transit usage, most people still arrive by car(Metro 2040 Main Streets Report, 1996)

Supply Strategies

As the Northwest community works to entice those not currently taking transit to do so, new systems around the outskirts of Northwest may provide renewed opportunity in this regard. Several potential transit opportunities that may lead to changes in service to the study area include the opening of the Westside Max line in September 1999, and the continued preparation for the Central City Street Car. The success of the Eastside Max has been attributed in part to the attractiveness to people who are not typical transit riders. Weekend ridership from Gresham has been steadily strong. If a new route design that provides an effective timed transfer service between the Stadium Light Rail Station and NW 21st and NW 23rd Avenue are developed, it may be possible to attract shoppers who now arrive to the study area by automobile.

In addition to providing increased supply, two possible physical improvements should be considered. On NW 21st and NW 23rd curb extensions replaced traditional bus stops that requires a bus to pull out of traffic and park at the sidewalk. Expanding this program to other transit streets such as NW Everett, NW Gilsan, NW Burnside, and NW Burnside provides several advantages to transit and non-transit users. Additional parking spaces are provided on the street where the normal bus stop is eliminated, space outside the regular sidewalk is available for a bus stop shelter, and transit time is decreased, as buses are not required to maneuver in and out of traffic. Also crossing distances for transit riders is minimized at every stop location, providing safer and more convenient access to transit at the same time as enhancing the safety of all pedestrians.

Tri-Met Intercept Survey

In Fall 1995, the Gilmore Research Group undertook a pedestrian intercept survey to determine the effects of Tri-Met's holiday bus program involving increased service and promotions. The survey queried respondents about their trip purpose, reasons for driving, and likelihood of transit use for subsequent visits to the neighborhood.

The Tri-Met survey included 237 auto users and 31 bus riders.

Respondents to the survey were generally unaware of the holiday bus service (62%). In response to were they had heard about the holiday bus service the newspaper was cited the most (21%), with the radio cited (18%).

In addition, the engineering for the Central City Street Car is continuing. The development of the Central City Street Car provides both opportunities and constraints for the parking issue in the study area. The designers of the streetcar are proposing 10-minuate headways when the line becomes operational. This level of service combined with dedicated track space will provide an attractive reliable service with a similar transit capacity as the current Number 15 bus line. However, the operation of the Central City Street Car may create another parking pressure as commuters may find it more attractive to park in the Northwest and ride the streetcar to the

downtown employment areas. The attractiveness of fixed rail transit also attracts higher ridership numbers and particularly people that do not typically use transit service, and therefore may attract shoppers who otherwise using their private car.

Demand Strategies

According to several studies on the issue, employee transit passes can increase employee transit use. Programs such as bus pass subsidies for employees included bus passes subsidies. Discounted bus passes may influence automobile drivers to begin riding the bus. Free passes may be more effective because the employee who has a bus pass (that may have not bought one otherwise) may periodically use it. This type of program would encourage the use of transit and potentially decrease the reliance on single occupancy vehicles. In turn, this program would help mitigate parking and traffic congestion. In order to promote transit use several Tri-Met schedule and information kiosks could be located with the study area. These kiosks could provide schedule information, route maps, automated ticket and pass sales, and trip planning.

Transit offers the opportunity to bring people into Northwest with negligible impacts on traffic congestion and no impact on the parking congestion. While employees, residents and visitors use transit, it is employee travel that has the greatest impact on reducing parking needs. Full time employees taking transit will free one on-street space for the duration of their shift. Yet increased residential ridership does not directly remove autos from the street. To remove residentially owned automobiles from the street, residents must own less vehicles. Due to the difficulty of shifting auto owners to non-owners, employees based demand strategies may be most effective.

The Nob Hill Business Association is currently participating with Tri-Met to coordinate several demand strategies to provide discounted employee bus passes, free transit ride program for customers, and a general increased awareness of transit ridership opportunities.

Transit Elements in Business Association's Transportation Strategy
(Nob Hill Business Association, November 1996)

- Employer Transit Pass Discounts for Employees
  Current Tri-Met program offers passes that are subsidized by employers (tax-deductible). New annual pass program may be cheaper for businesses in areas with high potential ridership.

- Shop-and-Ride Program for Shoppers & Visitors
  Tri-met tickets for return trips when making minimum purchase.

- Develop Transit, Parking & Access Guide
  Businesses would offer a clear and easily-understood resource for visitors to the neighborhood describing transit options.

Conclusions

Increases in transit ridership hold promise as ridership data indicates there has been steady growth in ridership within the existing transit service and capacity. Transit is an important element of the policy tools available to residents and business, and when used in conjunction with other strategies will help address the parking issue in the Study area. Ongoing service evaluation based on passenger loads and opportunities for Tri-Met to partner with the stakeholders in the study area will also help increase opportunities for transit use. There are no losers with a good transit policy. With increasing residential density and business intensity transit use will become an increasingly attractive and necessary alternative to the single occupancy vehicle.

SECTION 4: CONCLUSION

"As there is no single parking problem, there is no single solution. Creative solutions specific to neighborhood areas will be the most effective method of increasing (parking) availability and decreasing impacts."

Northwest Joint Committee on Parking, April 1988

Through comprehensive research and analysis of the parking issue in Northwest Portland, the answer to the question of whether there is a parking problem is unclear. However, what is certain is that there is an ongoing debate over parking in the area.

Parking in Northwest is and has been a community-based issue. Most of the stakeholders in the community perceive that something is wrong with regard to parking in their area and have believed this for over the past two decades. This in and of itself qualifies parking as a legitimate planning topic that needs attention.

Parking as a planning issue is a complex topic and often leads to controversial discourse amongst those involved. Planning for parking includes an interplay between equity and efficiency, transportation and land-use, zoning and economics. The parking situation in Northwest is no different. On the one hand it is a neighborhood dilemma that will require solutions based on the needs and wishes of the local stakeholders. On the other hand it is a regional issue, and solutions will inevitably effect regional travel patterns, perceptions of planning and the viability of high density mixed use development. Still, another argument is that solutions for the parking issue will require a market-based approach to efficiently allocate a limited amount of resources.

A solution for the parking dilemma will likely incorporate elements from all of the potential solutions described above. Traditional community equity based planning, regional planning needs and goals of transportation and land use will need to be considered. As this study shows, the present situation has been led almost exclusively by the neighborhood for the past 20 years with little progress.

In seeking a solution, it is hoped that this report will serve as a starting point. The data and objective analysis provide here is intended to provide the base analysis on which a balanced planning effort is undertaken and a comprehensive solution reached.

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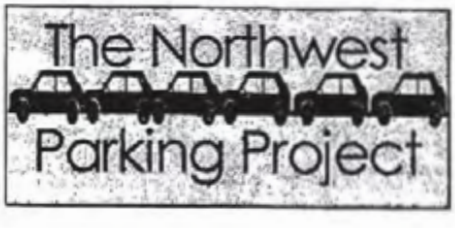
Appendices

Appendix I -
Shared Parking Report

Appendix II -
Annotated Bibliography of Parking Issues



PSU Planning Workshop
1998

Appendix I

Shared Parking Report

PSU Planning Workshop
1998

APPENDIX I: SHARED PARKING ANALYSIS

The Northwest Parking Study has identified the location and the use of all the off-street commercial parking lots that are located near the high-use commercial zone in Northwest. The inventory identifies 100 commercial lots, 44 of which are zoned Commercial and 56 are zoned Residential. Information on lot location, the number of parking spaces, and the use of the lot (residential or commercial) is from an inventory of off-street parking lots completed by the Joint Committee on Parking in 1996. Tax-lot information from Metro was used to identify the parcel owner in 1994. Further information on the use of commercial lots was recorded in February of 1998. Five types of use were identified: office, retail, restaurant, church, and other. This use classification allows the assessment of availability by time of day and time of week.

Assumptions on Availability

Because the use of commercial lots within a residential zone is restricted to that of the adjoining building, many of these lots are underutilized during certain times of the day and week. This inventory attempts to estimate the availability of these lots based on the type of business using the lot and the likely times that business would be closed. For example: it can be assumed that off-street parking lots used by offices could be available in the evenings (after 6pm) or on the weekends. Parking spaces used for retail establishments could likewise be available in the evening hours but are probably not available on weekends. *Table 1: Assumptions of Availability for Shared Parking Inventory* shows the assumptions used by Northwest Parking Project in assessing the potential availability of commercial lots in Northwest. These assumptions were arrived at through literature and through conversations with the Business association (meeting with Nob Hill Business Association, 2/12/98). The table shows a limited availability of parking lots before 6pm for all commercial uses except for churches. After 6pm availability of off-street lots increases as offices and retail shops close their doors. It is assumed that office parking could be available on the weekends, and that private parking lots would not be available at any time.

Table 1: Assumptions of Availability for Shared Parking Inventory

USE	Available pre-6pm?	Available post-6pm?	Available weekends?
Office	no	yes	yes
Retail	no	yes	no
Restaurant	no	no	no
Church	yes	yes	no
Private Parking (paid and unpaid)	no	no	no

Estimates of Lot Availability

The assumptions on availability are used to estimate the number of spaces available at certain times within the study area. Table 2, *Estimated availability of residentially zoned commercial parking lots in Northwest Portland* shows the number of residentially zoned, commercial-use parking lots that could be available for each of three time periods. Availability before 6pm would be limited to the 227 spaces in five church lots. Over 1,000 parking spaces could be available in 43 lots on weekday evenings. Over 500 spaces that could be made available during weekend hours.

Table 2: Estimated availability of residentially zoned commercial parking lots in Northwest Portland

	Parking Lots	Parking Spaces
Before 6pm	5	227
After 6pm	43	1,019
On Weekend	29	501

source: Northwest Parking Study

These represent the potential parking lots available if all commercial lot owners to make their lots available. Also, although all the lots are within the central area of Northwest, some are more remote than others. These numbers represent supply over a large area and may not correspond to locations where parking is demanded in the hours that it is available.

Information on Specific Lots

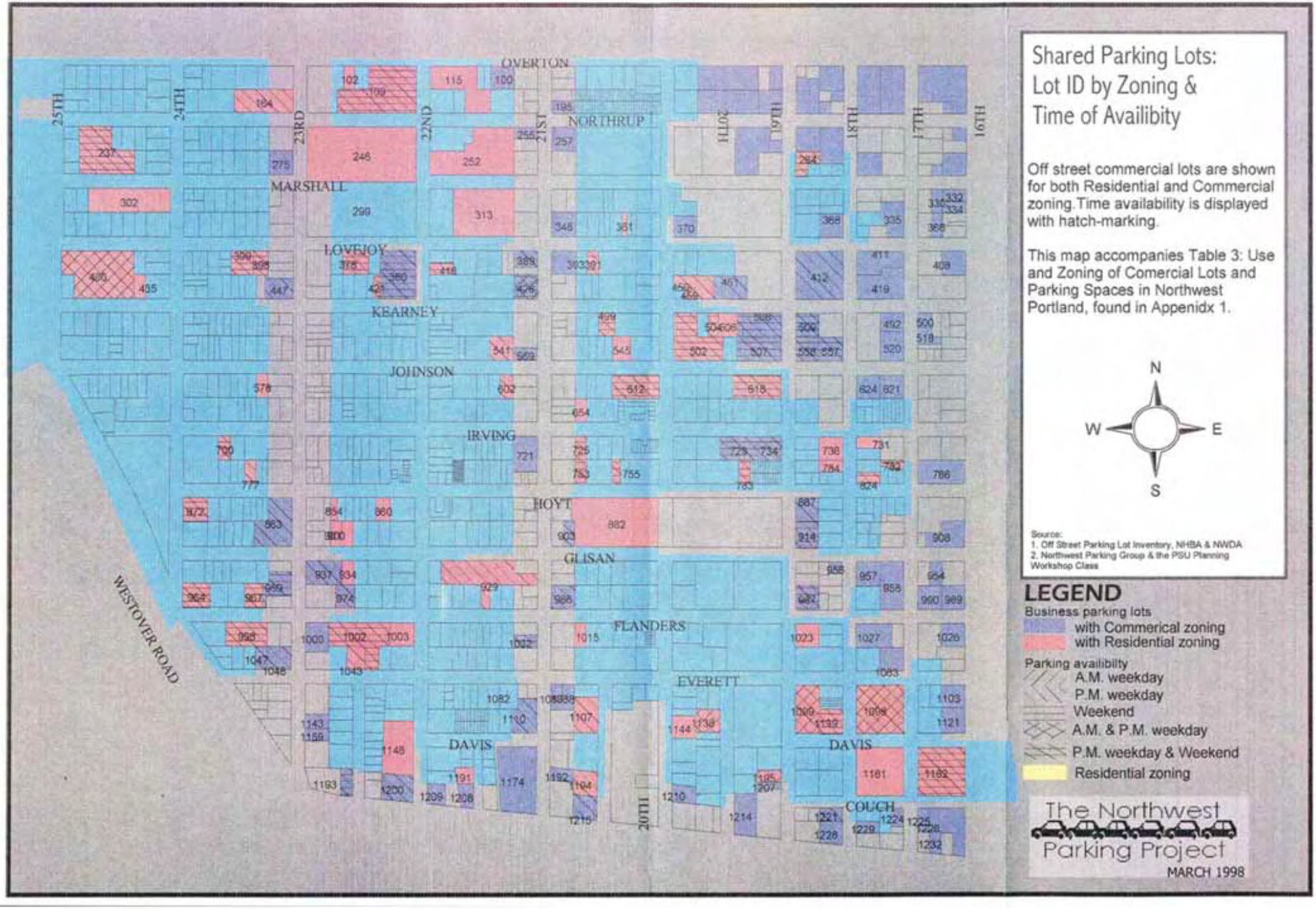
Table 3: *Use and Zoning of Commercial Parking Lots and parking Spaces in Northwest Portland*, gives specific information on use and availability for each of the 100 commercial lots included in the inventory. The lot # of each field corresponds to the numbers on the attached map, *Shared Parking Lots: Lot ID by Zoning & Time Availability*, that shows the location of each lot. The table shows the owner in 1994 and the number of spaces in the lot. Zoning designations are indicated by an R for Residential zones and a C for commercial zoning. Use is divided into five categories according to observations in February 1998. Availability is based on use and the previously mentioned assumptions of availability. The final columns on the table tally availability of lots and spaces for all the residentially-zoned parking lots in the study area. It is from these numbers that the results in Table 2 are derived.

Table 3: Use and Zoning of Commercial Lots and Parking Spaces in Northwest Portland continued...

				Use					Availability			R-Zoned Lots and Spaces: by time of Day					
												Pre-6pm		Post-6pm		Weekend	
Lot #	OWNER (1994)	spaces	zoning	office	retail	rest	church	other	pre-6p	post-6p	wknd	lots	spaces	lots	spaces	lots	spaces
934	BURKHARDT LTD LIABILITY CO	8	R					may be paid				-	-	-	-	-	-
937	ROSEHILL INVEST L L C	9	C		1					1		-	-	-	-	-	-
956	ELLISTON INVESTORS &	9	C	1		1						-	-	-	-	-	-
959	DAVIS ANNE TR &	13	C	1						1	1	-	-	-	-	-	-
964	PERRIN MARIANNE L	11	R	1						1	1	-	-	1	11	1	11
967	ALSUHAIMI KHALID	17	R	1						1	1	-	-	1	17	1	17
974	HOME TOM S TR ET AL	27	C		1					1		-	-	-	-	-	-
986	UBEHO INVESTMENT CO	16	C	1	1					1		-	-	-	-	-	-
987	CONGREGATION BETH ISRAEL	30	C	1						1	1	-	-	-	-	-	-
998	GIUSTINA E DANIEL L 60% &	14	R	1						1	1	-	-	1	14	1	14
1000	LAWRENCE GEORGE EST CO	32	C					paid				-	-	-	-	-	-
1002	KINGERY ANNE M ET AL	63	R	1						1	1	-	-	1	63	1	63
1023	FIRST CHURCH OF CHRIST	31	R					institutional				-	-	-	-	-	-
1032	EMA LIFE INC	6	C	1						1	1	-	-	-	-	-	-
1043	KINGERY ANNE M ET AL	18	R	1	1					1		-	-	1	18	-	-
1047	BIRNBACH MAX	12	C		1					1		-	-	-	-	-	-
1048	BIRNBACH MAX	5	C		1					1		-	-	-	-	-	-
1087	BINGHAM STUART S	12	C	1	1							-	-	-	-	-	-
1088	REALTY GROUP INC	6	C	1								-	-	-	-	-	-
1096	ARCHDIOCESE OF PORTLAND	89	R				1		1	1		1	89	1	89	-	-
1099	TRINITY EPISCOPAL CHURCH	68	R				1		1	1		1	68	1	68	-	-
1107	FRED MEYER INC	40	R		1					1		-	-	1	40	-	-
1110	HARRIS DAVID L	15	C		1					1		-	-	-	-	-	-
1138	TRINITY EPISCOPAL CHURCH	21	R				1		1	1		1	21	1	21	-	-
1139	DOUGHERTY JOHN E &	16	R	1						1	1	-	-	1	16	1	16
1143	DANIEL JANICE L	7	C		1			paid				-	-	-	-	-	-
1144	STADIUM COURT APARTMENTS LLC	28	R	1				office/resident				-	-	-	-	-	-
1148	RUNHIL INVESTMENT COMPANY	40	R			1		valet parking				-	-	-	-	-	-
1174	PORTLAND TOWER CORP	43	C		1	1						-	-	-	-	-	-
1182	ARCHDIOCESE OF PORTLAND	22	R					school		1	1	-	-	1	22	1	22
1192	ARDIEL JOHN E	18	C			1						-	-	-	-	-	-
1193	VICTORIAN INN LIMITED	13	C	1						1	1	-	-	-	-	-	-
1194	BIRNBACH MAX	10	R		1					1		-	-	1	10	-	-
1195	FIRST INTERSTATE BK OF OR TR	29	R				1		1	1		1	29	1	29	-	-
1200	REDDING PHOEBE S-1/2 &	10	C		1					1		-	-	-	-	-	-
1207	FIRST INTERSTATE BK OF OR TR	32	C					private parking				-	-	-	-	-	-
1209	C S J INVESTMENTS	32	C			1						-	-	-	-	-	-
1214	FIRST NATIONAL BK OF OR TR	36	C			1						-	-	-	-	-	-
1215	KEY BANK OF OR	6	C	1	1					1		-	-	-	-	-	-
1221	JOHNSON EDITH T TR	7	C		1					1		-	-	-	-	-	-
1228	MC DONALD'S CORP	16	C			1						-	-	-	-	-	-
100	TOTALS	2448	1	51	29	11	5	16	6	74	43	5	227	43	1,019	29	501
		C=	44														
		R=	56														

Table 3: Use and Zoning of Commercial Lots and Parking Spaces in Northwest Portland

				Use					Availability			R-Zoned Lots and Spaces: by time of Day					
												Pre-6pm		Post-6pm		Weekend	
Lot #	OWNER (1994)	spaces	zoning	office	retail	rest	church	other	pre-6pm	post-6pm	wknd	lots	spaces	lots	spaces	lots	spaces
		2448	56%	51	29	11	5	16	6	74	43	5	227	43	1,019	29	501
109	GOOD SAMARITAN HOSPITAL &	32	R	1						1	1	-	-	1	32	1	32
115	GOOD SAMARITAN HOSPITAL &	70	R					Good Sam				-	-	-	-	-	-
164	NORTHRUP MEDICAL BUILDING	56	R	1	1					1		-	-	1	56	-	-
237	D P THOMPSON CO	32	R	1						1	1	-	-	1	32	1	32
246	GOOD SAMARITAN HOSPITAL		R					Good Sam				-	-	-	-	-	-
252	GOOD SAMARITAN HOSPITAL &	200	R					Good Sam				-	-	-	-	-	-
284	WALSTROM DONALD H	8	R	1						1	1	-	-	1	8	1	8
311	BRZEZINSKI GARY A-1/2 &	0	R					Good Sam				-	-	-	-	-	-
378	HURST WILLIAM W	15	R	1						1	1	-	-	1	15	1	15
380	MEDICAL BUILDING LAND CO	177	C	1						1	1	-	-	-	-	-	-
389	SHORES ROBERT L	14	C		1					1		-	-	-	-	-	-
391	BULKLEY JONATHAN D-80, &	7	R	1						1	1	-	-	1	7	1	7
393	EISENBERG PAUL & CHRISTINE	8	C			1						-	-	-	-	-	-
398	PHILLIPS PAUL B	13	R	1						1	1	-	-	1	13	1	13
399	INSTITUTE FOR TRADL MEDCNE	10	R	1						1	1	-	-	1	10	1	10
400	CONGREGATION SHAARE TORAH	20	R				1		1	1		1	20	1	20	-	-
412	FUTURES	66	C	1	1					1		-	-	-	-	-	-
416	LEGACY HEALTH SYSTEM	70	R	1						1	1	-	-	1	70	1	70
421	LEGACY HEALTH SYSTEM	8	R	1						1	1	-	-	1	8	1	8
428	LOVEJOY PROPERTY JOINT	9	C						1	1	1	-	-	-	-	-	-
435	ALANO CLUB	60	R					Alano Club				-	-	-	-	-	-
447	SINGER RICHARD D & SINGER	11	C		1					1		-	-	-	-	-	-
450	MOYER LARRY R	15	R		1					1		-	-	1	15	-	-
451	MOYER LARRY R	16	C	1	1					1		-	-	-	-	-	-
459	MC KEOWN SCOTT A	0	R	1						1	1	-	-	1	-	1	-
499	CENTRAL CITY CONCERN	14	R	1						1	1	-	-	1	14	1	14
502	HOUSING AUTHORITY	0	R	1						1	1	-	-	1	-	1	-
504	JENSEN BARBARA J TR	19	R	1						1	1	-	-	1	19	1	19
507	OREGON STATE OF	36	C	1						1	1	-	-	-	-	-	-
508	CRONIN & CAPLAN REALTY GROUP	22	C	1						1	1	-	-	-	-	-	-
509	WALDROP GARY D	15	C	1						1	1	-	-	-	-	-	-
541	THE HAROLD & ARLENE	28	R		1					1		-	-	1	28	-	-
557	MEYER WILLIAM I &	6	C	1						1	1	-	-	-	-	-	-
558	JOHNSON STREET ASSOC	29	C	1						1	1	-	-	-	-	-	-
569	WEBBER HOMER D	8	C		1					1		-	-	-	-	-	-
602	ARVIDSON RANDALL A	18	R		1					1		-	-	1	18	-	-
612	REALTY GROUP INC	21	R	1						1	1	-	-	1	21	1	21
618	JOHNSON STREET ASSOC	21	R	1						1	1	-	-	1	21	1	21
700	GROTHAUS LOUIS C TR	6	R	1						1	1	-	-	1	6	1	6
721	GURSANUS HELEN F	24	C			1						-	-	-	-	-	-
725	JENSEN FRANK R TR &	10	R	1						1	1	-	-	1	10	1	10
729	OREGON STATE OF(LEASED	5	C	1						1	1	-	-	-	-	-	-
734	CARR BERNARD	12	C	1						1	1	-	-	-	-	-	-
753	ANGEL REXFORD E	6	R	1						1	1	-	-	1	6	1	6
755	EPISCOPAL LAYMEN'S MISSION	18	R	1						1	1	-	-	1	18	1	18
777	SINGER MILTON &	31	R		1					1		-	-	1	31	-	-
782	STURGIS SUSAN &	10	R	1						1	1	-	-	1	10	1	10
783	OREGON STATE OF(LEASED	15	R	1						1	1	-	-	1	15	1	15
784	BLANCHET HOUSE OF	13	R			1						-	-	-	-	-	-
824	O'DONNELL MARK P ET AL	15	R	1						1	1	-	-	1	15	1	15
854	ASHLEY SALLY G	10	R			1						-	-	-	-	-	-
863	GLISAN STREET ASSOCIATES	48	C		1					1		-	-	-	-	-	-
872	GROSS ROBERT J &	8	R	1						1	1	-	-	1	8	1	8
882	SCHOOL DISTRICT NO 1	0	R					Institutional				-	-	-	-	-	-
887	ERICKSON RONALD G-50.20% &	14	C		1					1		-	-	-	-	-	-
900	MC FARLAND JOSEPH R &	5	R					vacant				-	-	-	-	-	-
903	GRAMBO RICHARD O & JAN G	20	C		1					1		-	-	-	-	-	-
914	VITALITY SYSTEMS INC	12	C	1						1	1	-	-	-	-	-	-
929	DURST WILLARD TR ET AL	75	R		1					1		-	-	1	75	-	-



Shared Parking Lots: Lot ID by Zoning & Time of Availibity

Off street commercial lots are shown for both Residential and Commercial zoning. Time availability is displayed with hatch-marking.

This map accompanies Table 3: Use and Zoning of Comercial Lots and Parking Spaces in Northwest Portland, found in Appenidx 1.

N
W E
S

Source:
1. Off Street Parking Lot Inventory, NHBA & NWDA
2. Northwest Parking Group & the PSU Planning Workshop Class

LEGEND

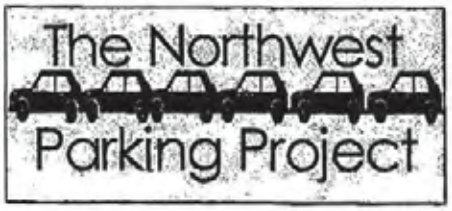
Business parking lots
- with Commerical zoning
- with Residential zoning

Parking availibilty
- A.M. weekday
- P.M. weekday
- Weekend
- A.M. & P.M. weekday
- P.M. weekday & Weekend
- Residential zoning

The Northwest Parking Project
MARCH 1998

Appendix II

Annotated Bibliography of Parking Issues



PSU Planning Workshop
1998

APPENDIX II: ANNOTATED BIBLIOGRAPHY

This annotated bibliography offers brief elaboration's on documents uncovered in an extensive search of parking management literature.

Barton-Ashman Associates, Inc. "Shared Parking Demand for Selected Land Uses." Urban Land. September, 1983.

This paper serves as a summary to the Urban Land Institute's extensive 1983 study titled Shared Parking.

The viability of a shared parking program relies on at least one of two conditions. First is when the activity patterns of adjacent or nearby land uses differs by hour, by day, by season. The second is when people are attracted to two or more land uses on a single auto trip to a given area or development.

This report is primarily a tool to help municipalities conduct shared parking analysis. The general goal of most shared parking analysis conducted by municipalities is three-fold. First, they want to establish the parking demand for single land uses defined in terms of peak unit demand, hourly accumulation, and seasonal variation. Second, they want to determine from direct observation the peak parking demand for mixed-use developments. Third, through combining the results for single land uses with survey data for mixed-use developments, it is possible to identify the effects of shared parking on total space requirements. This is shown in terms of the reduced number of parking spaces needed to serve peak activity periods.

The article offers a recommended shared parking method and guidelines for implementing shared parking. The study Shared Parking goes into these in detail.

Barton-Aschman Associates, Inc. Shared Parking. ULI, 1983.

Shared Parking serves as a guide for developers to implement shared parking for mixed-use developments. The book discusses the concepts of shared parking, provides peak parking ratios for various urban land uses and a methodology by which calculations can be made to determine parking needs for a new development. Shared Parking provides the design, operation and management techniques for shared parking. The book also provides the survey forms that were used in collecting the data the book.

Shared parking can lead to a more efficient use of land. The net number of spaces demanded at any one peak time for mixed-use developments can be much less than that required by the zoning code. Thus if the developer provides the net-peak, they can minimize parking and maximize gross leaseable area (GLA).

Shared parking occurs most efficiently where there is a mix of uses whose peak demand for parking is at different times during the day. Residents and restaurants, offices and movie theatres, banks and hotels each different use patterns. Shared Parking provides parking trends for these uses.

Edwards, John. Parking: The Parking Handbook for Small Communities. 1994

This book is a parking analysis and policy handbook that is geared for towns of between 500 and 50,000 residents. It also may be used for smaller segments of a larger city. The book goes into detail on collecting data, analyzing data, decision making, and implementing programs. The Parking Handbook conveys three basic concepts that should be addressed when solving parking problems:

- Understanding the existing supply and demand for parking, and being able to predict future demand;
- Manipulating the future demand for parking to fit the structure, design and performance of an area;
- Employing common sense and efficiency in solutions.

The first two chapters cover getting organized, collecting data and analyzing the parking demand. Chapters 3 and 4 deal with improving efficiency and increasing the existing parking infrastructure. These remainder of the book deals with the implementation and management of parking policies and programs.

Hazel, Martin. "Permit Programs Increase On-Street Parking Availability in Residential Areas." ITE Journal. May, 1992.

This article examines a local municipality's effort to institute a strategy tried with success by many cities: a multi-leveled permit parking program. The program was implemented in 1977 and the article highlights not only the pros and cons of the system, but it details how the city administers the program. A review of this program is included in the NW Parking Project Report.

Kuah, Geok. "Estimating Parking Demand for Mixed-Use Developments Subject to TSM Ordinances," February, 1991. ITE Journal.

The author examines how to calculate parking demand for mixed-use developments.

Traditionally, a development's parking demand is calculated based on parking code requirements as stipulated in city and/or county parking ordinances. These parking ordinances are developed mostly to regulate parking supply to meet peak parking demand at single use developments.

The author notes that a clear procedure for estimating parking demand is essential to developers, public officials, and traffic engineers. It is particularly useful in situations where the tenant density deviates from the average density for a specific use or in cases where the regular parking code requirement have been perceived to be flawed.

The procedure for estimating parking demand is complex. It involves many factors, including project size, type of zoning, type of people and number of people expected to visit a site, and the availability of alternative transportation modes.

Most of the existing literature on estimating parking demand deals primarily with single use projects. Literature on estimating parking demand for mixed-use developments (MXD's) is scant and no literature to date has dealt with parking demand estimation for MXD's subject to Transportation System Management (TSM) ordinances or the interactions between shared parking and parking reductions because of TSM programs.

The article proposes a methodology for estimating parking demand for MXD's planned in jurisdictions with TSM ordinances. Unlike the regression based method which estimated parking demand for specific land uses by performing a regression analysis on parking occupancy data collected across the country, the authors method is a project specific, user based approach that extends the concept by Weant in 1990's Parking. It accounts for potential parking reductions resulting from the implementation of TSM programs and the sharing of parking space for MXD's.

In estimating parking demand for the MXD, the following steps should be used:

- Identify the various groups of users of the MXD;

- Estimate the total number of employees and non-employees;
- Estimate the adjusted parking demand (using equation 1 above) for each user group;
- Estimate the number of person trips and vehicle trips by mode with and without TSM programs;
- Calculate the average vehicle occupancy with and without the TSM program;
- Determine parking reductions resulting from the proposed TSM program for employees;
- Determine parking reductions associated with shared parking using the parking accumulation schedule;
- Subtract the parking saved as a result of the TSM program and of shared parking from the unadjusted parking demand obtain the adjusted parking demand.

This methodology not only takes into account parking reductions because of TSM programs, but it also addresses the saving of spaces because of shared parking among different land uses of the MXD's. Savings in the number of parking spaces from the TSM programs is achieved through a reduction in automobile mode share and an increase in vehicle occupancy rate. Savings in the number of parking spaces resulting from shared parking is realized because parking demand for different land uses peaks at different times of the day.

McGuiness, Erin and Sue McNeil, ASCE. "Statistical Models to Predict Commercial and Parking Space Occupancy." Journal of Urban Planning and Development. December, 1991.

This paper examines the use of simple analytical models to estimate quantitatively the demand for site-specific commercial and parking space. The influence of location and other site characteristics on demand is captured and quantified through regression equations for occupancy, based on data from the Pittsburgh, Pennsylvania Central Business District.

Parking space is believed to be a function of location, accessibility and presence of mixed-use development. The author notes in his analysis of pricing that demand for parking is not sensitive to price changes, but just the opposite. As price increases, occupancy does also. Statistically this is correct, but other factors are at work that can be captured by looking at particular marketing conditions. Parking cost is a function of the fee paid and the user values (accessibility, security and safety). If the *user* values the external costs more than the fee paid, than

maybe using a more expensive lot is of no consequence. Specifically, parking lots with higher fees may more accessible to a driver's final destination. This is not true of all cases.

Merriman, David. "Subsidized Parking and Neighborhood Nuisances." Article No. UE961093, Journal of Urban Economics. 1997.

The author's core argument in this brief article is that the expansion of subsidized parking encourages travelers to switch from public transportation to auto travel. This demonstrates that, if parking demand is price elastic, a one unit increase in (subsidized) parking will result in more than one additional parker, adding to neighborhood spillovers.

Subsidized parking is defined as free or below market price parking.

The implication for Northwest is this: if the demand for parking in Northwest is price elastic and if more capacity is added without charge and if the spaces are filled to capacity already (which they are), adding an additional free parking space will result in more than one additional automobile parker.

Another implication is that institutions (example, City of Portland) may reduce neighborhood nuisances from spillover parkers by raising the price they charge for parking when their lots/curbs are filled to capacity. Even though the increase in price may have no impact on the number of subsidized parkers, it may reduce the number of spillover parkers since it lowers the benefit from finding a subsidized space.

Mildner, Gerard C.S., James Strathman and Martha Bianco. "Parking Policies and Commuting Behavior." Transportation Quarterly. Winter, 1997.

The authors look at parking regulations, transit service levels, and travel and parking behavior in multiple U.S. cities. A key finding is that cities with interventionist parking policies (i.e. high parking prices and limited supply), frequent transit service, and a high probability that drivers will have to pay to park are the most likely cities to have high transit ridership figures.

Nelson, R.B. "A Tale

The author studies the parking programs of four cities in Europe.

of Four Cities and Their Car Parks." Transport. March, 1988.

He makes the argument that European parking programs will generally not work in the United States. This is because of our lack of transit ridership and the European's ability to move many more drivers to subways, commuter rail and lightrail.

European systems also institute complex pricing schemes with regard to parking which are generally not used in the United States.

Oliver, Gordon. "Portland Revs Up for Action." Planning. August, 1994.

This article from 1994 gives a good overview of the recent issues and future of transportation planning in Portland. Of note is the City's decision to lift the 20-year parking lid in downtown Portland. In place will be a "parking ratio rule" that will work to reduce the number of new parking spaces by requiring local governments to establish maximum parking ratios for new development. Its goal is a 10% reduction in vehicles trips generated by new retail, commercial and industrial development. The state parking rule also calls for a 10% reduction in parking spaces over the next 20 years.

In the Lloyd District, a close in mixed-use community in NE Portland, maximum parking ratios translate to 2 spaces for every 1000 square feet of office space. The City allows 0.7 and 1.0 space for every 1000 feet of office space downtown.

Organization for Economic Cooperation and Development. "Evaluation of Urban Parking Systems." Paris, 1980.

This research report from 1980 goes into detail about various parking strategies implemented in mainly European cities and some U.S. cities. The arguments, however, are intended to be applied universally. A summary of some of their main points is provided below.

Parking Strategies: Aims and Instrument: Parking strategies should be made within an overall framework of urban policy and integrated traffic and transportation management. An effective strategy requires a number of measures to be taken simultaneously and in a co-ordinated manner which makes it all the more difficult to assess the influence of each individual action and hence predict it's effectiveness in other circumstances.

Parking: Broad Concerns: The paper identifies the following broad concerns with regard to parking:

- Space
- Air pollution
- Noise
- The perception that a parking space is available for people coming from outside the district
- Highest and best use of street space and
- Off-street space security

Districts are a System of Variables: The paper looks at individual districts (neighborhood's, CBD's, etc.) as a system of variables, these include:

- *Input variables:* those that are outside the direct influence of governmental intervention.
- *Instrument variables*: are controlled by government measures.
- *Output variables*: sometimes referred to as indicators, are not directly controlled by the authorities, but are a result of the interaction between the input and the instrument variables.

Also, the paper also suggests the need to look at physical planning, legislation, finance and enforcement variables.

The Parking System: Analysis Areas: The paper discusses the following issues that should be included in a comprehensive parking strategy:

- Searching time for an empty space;
- Walking distance - do not allow employees to park within a specified distance from problem area;
- Information systems - to direct visitors to shared parking/less congested facilities. Much of this will be done by word of mouth;
- Cost of parking - a function of the money costs of the space and other costs of searching time and walking distance. In essence, fees, location, capacity and information influence cost. Fees and taxes are the most effective means in obtaining a practical use of parking facilities. They work in advance (i.e. before the decision on the travel mode is made;
- User category - defining users for shared parking;

- Illegal parking – enforcement;
- Space requirements - what is the location and capacity of new facilities in the district?;
- Revenues- should be considered as a by-product of a strategy and not as a target.
- "A parking strategy may be defined as a coherent package of parking or parking-related measures and courses of action within a comprehensive transportation plan to reach certain aims over a given period of time."

Parking Strategies: Definition and Review: Main points include the following:

- Location: fringe/urban residential;
- Facility: private/commercial/municipal;
- Temporal: peak/off-peak or week/weekend. Could have strategies that discourage commuters and encourage off-peak travel benefiting business;
- Duration and accumulation;
- Pricing;
- Parking price variation;
- Car occupancy and trip purpose;
- Parking permit systems;
- An overview of the basic assumptions of a parking permit system is included in the paper;
- On-street parking charges:
- On-street parking is generally intended for short-term use (two-hours or less).

Price Elasticity: Price elasticity of parking may be influenced by a variety of factors, these include: .

- Type of use: hourly or by subscription;
- Frequency of use;
- Geographic location of facilities;
- Time lapse following a fee change.

Application of Graded Pricing for On-Street Parking:

- Apply a normal rate for short-duration parking and a preferential rate for longer duration parking such as for residents.

- Fee Collection Systems and Equipment for On-Street Parking:
- Parking meters: simple to use and no additional walking distance. Disadvantages are rate variations are a function of availability of coins, unaesthetic, present obstacles on the footpath;
- Ticketing machines: (1 unit for 20 to 50 spaces) simple, a short walking distance, equipment installation;
- Parking cards: no device, flexibility in pricing structure, low cost to municipality, higher risk of fraud;

Peng, Zhongren, Kenneth J. Dueker, and James G. Strathman. "Residential Location, Employment Location, and Commuter Responses to Parking Charges," Transportation Research Record 1556. 1996.

The authors argue that individuals are relatively more responsive to marginal changes in parking costs than to marginal changes in other vehicle operating costs. They report that researchers have found a substantial reduction in parking demand and automobile commuting when commuters pay for parking. An estimated 95% of US workers do not pay for parking at their job site. The article based its findings on data from household activity survey that questioned 2,200 households. They survey was conducted by Metro in 1994.

Strathman and Dueker found that the likelihood of being charged for parking was inversely related driving alone.

The authors note a "chicken and egg" dilemma: that is, the choice of residential location is conditional on mode choice and mode choice is conditioned by residential location. If one has a strong preference for transit, it is more likely that the choice of residential location will be made with regard to transit service. Mode choice is bound to one's residential location choice and people living in different areas will have differing responses to transit service improvements or increased parking charges.

In Portland, for residents who live in the urban core, 10.7% bike or walk to work, 11.14% take transit, 57.21% drive alone, and 20.95% carpool. For those who work in the central core, 13.81% walk or ride a bike, 28.45% take transit, 39.75% drive alone, and 18% carpool.

Transit use is dependent not only on accessibility, but also transit

headway's. Transit headway has a significant positive effect on driving alone. Other factors include:

- Trip chaining increases the likelihood of driving alone;
- Distance from employment location is a dominant negative factor for walk and bike commuters;
- Household size is significant and positive in the carpool mode, it is household oriented both for urban and suburban residents;
- Household income is significant for suburban transit users, but not for urban transit users;
- Gender is not significant for any mode choice;
- Age significantly effects people's choice for bike or walk.

Shaw, John. "Parking Legislation and Transportation Plans." Transportation Quarterly. Spring, 1997.

This paper argues for more municipalities to incorporate the federal Intermodal Transportation Efficiency Act (ISTEA) legislation into local and regional transportation plans. The author then goes on to discusses the sections of ISTEA that apply to parking.

ISTEA was passed by Congress earlier this decade. It has created a new framework within which transportation planning is to be conducted, including the preparation of regional plans.

ISTEA identifies a number of factors that should be considered by local governments, state and regional planning organizations. The author goes through these issues in detail.

Smith, Wilbur. "Automobile Parking Trends." Transportation Quarterly. July, 1983.

In this lengthy article, the author offers a few points that are of relevance to the Northwest situation. These include:

Parking Pricing Policies

To encourage short-term parking, rates have been increasing in many cities in areas of high parking demand. In Honolulu, for example, meter rates have increased 100 percent in these areas and this has resulted in an increase in parking turnover by more than 11.5% between the hours of 7am and 3pm and 41% during the lunch hour. Available off-street spaces have increased by 58% in the same time period.

The author notes that the residential parking permit program

(RPPP) is the most widely adopted new parking policy in many jurisdictions. Without exception, he notes, communities that have implemented RPPS's feel that the parking problems they hoped to correct were substantially or completely resolved.

One point of note is his mention of a San Francisco developer who is financing a parking garage by selling the individual parking spaces directly to private interests. In addition to the purchase price, buyers must pay a monthly fee for maintenance and insurance. They must also pay property taxes. Buyers, however, have the right to rent, sell or bequeath their title to space(s) purchased. Financing is available and the interest is tax deductible.

Swanson, Parking: "How Much is Enough, Local Standards Need Beefing Up." Planning." July, 1989.

The author provides a variety of examples of parking requirements for various land uses by researching a host of municipal zoning codes from around the United States. His basic argument is that "going by the book" in applying parking standards is the wrong approach. He argues that too much time is spent by planning commissions, city councils, etc. reviewing and discussing detailed technical issues associated with various projects. Planning professionals should be given this task to free up these officials to work on broader policy issues.

Parking needs are constantly changing and policies need to change with them. Things such as: car size, aesthetics, changes in demand, etc always are in flux. Many shopping malls now require less and hospitals more, made so by the increased reliance on outpatient care. He notes that "parking is the [planning] fulcrum because urban form follows parking."

Saltzman, Robert M. "An Animated Simulation Model for Analyzing On-Street Parking Issues." Simulation. August, 1997.

This paper examines an area of San Francisco that is similar to Northwest Portland with respect to density and activity. Occupancy rate for spaces usually exceeds 95% for most if every day. The author asks and provides potential answers to these questions:

- What can be done to increase a driver's chances of finding an on-street space?
- What is the impact on system performance of increased

enforcement of the one-hour time limit?

- How would new meter technologies affect performance from the viewpoint of the city management and parking public?

Scannell, Nancy J. "Urban Metered Curb Parking as a Factor in Retail Sales: An Econometric Case Study for Chicago, Illinois. Thesis. University of Illinois at Chicago. 1992.

This Ph.D. thesis is the first attempt to apply true economic analysis to the issue of on-street parking and its effect on retail business. Scannell's core argument is based on econometric analysis of parking in Chicago. It concludes that retailers are not harmed by the absence of on-street metered parking near their business.

The paper also points out that the only true way to come to a rational and lasting parking policy is through a comprehensive approach based on economic principals. This is something that has always been deferred to administrative based programs where the direct costs of parking are set arbitrarily.

She argues that turnover rate does appear to increase with metering, but this is directly related to the effectiveness of the local enforcement program. The study also showed that parking usage is relatively insensitive to increases in prices. Parking elasticity was determined to be about 0.30. Furthermore, adding additional off-street parking will not necessarily decrease the quantity demanded on street spaces.

One other key point she makes is that parking demand is a derived demand because it reflects the attraction of users to various land uses - this is likely the cause of so much frustration in finding a solution to many parking problems, i.e. no one can agree on who is parking where and for how long and why. Worse still is the inability of groups to decide the potential effects of altering the current situation - there is no empirical data, only assumptions.

Finally, she points out that meters only came into use in 1935 with there implementation in Oklahoma, City. At that time, businesses were adamantly opposed to there installation.