

Research Report:

Transportation Problems Associated With Uneven Growth Rates

Report Number WA·RD·471



Washington State Department of Transportation

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No. WA-RD-47.1		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle Transportation Problems Associated with Uneven Growth Rates: A Case Study in Portland and Vancouver				5. Report Date August 1982	
				6. Performing Organization Code	
7. Author(s) Public Transportation and Planning Division Department of Transportation				8. Performing Organization Report No.	
9. Performing Organization Name and Address Washington State Department of Transportation Highway Administration Building Olympia, Washington 98504				10. Work Unit No.	
				11. Contract or Grant No.	
				13. Type of Report and Period Covered	
12. Sponsoring Agency Name and Address Washington State Department of Transportation Highway Administration Building Olympia, Washington 98504				14. Sponsoring Agency Code	
15. Supplementary Notes					
16. Abstract <p>Within Clark County, Washington population has grown at a much higher rate than employment. Clark County is a part of the Portland-Vancouver Metropolitan area but is separated from the remainder of the counties in the SMSA by the Columbia River and it is in another state. Since an increasing number of Clark County, Washington residents work in Oregon this uneven growth rate -- between population and employment -- has imposed unique transportation requirements.</p> <p>Statistical analysis verified the influence of population growth on Columbia River crossing travel demand. A survey of key informants and other investigations led to a conclusion that a number of factors will modify growth patterns in the future so that employment growth rates in Clark County can be expected to "catch up" with population growth.</p> <p>This study, together with other reports concerning transportation demand and facilities, provides an assessment of the future conditions and developments of Clark County that will help determine the basic transportation needs. Likewise, this study provides information about those social, economic, and land use factors that is of value in determining the type and general location of improvements. More specifically, it substantiates previous studies which concluded that additional major Columbia River crossing facilities will not be needed in the near future.</p>					
17. Key Words Uneven growth rate, interviews, land use, industrial location decision, economic development.			18. Distribution Statement No restrictions		
19. Security Classif. (of this report) Unclassified		20. Security Classif. (of this page) Unclassified		21. No. of Pages	22. Price

RESEARCH REPORT

TRANSPORTATION PROBLEMS
ASSOCIATED WITH
UNEVEN GROWTH RATES

A Case Study in Portland and Vancouver

PUBLIC TRANSPORTATION AND PLANNING DIVISION

Washington State Department of Transportation

August 1982

WA-RD-47.1, Federal Highway Administration

ACKNOWLEDGEMENT

This research study was accomplished with the assistance of public administrators and business executives associated with the following agencies: Federal Highway Administration, Clark County Industrial Bureau, Regional Planning Council of Clark County, Greater Vancouver Chamber of Commerce, Economic Development Council of Clark County, City of Vancouver, Port of Vancouver, Genstar, Hewlett-Packard, Economic Development Administration (Portland), Metropolitan Service District (METRO), City of Portland, Port of Portland, Washington County, Clackamas County and Multnomah County.

DISCLAIMER

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EXECUTIVE SUMMARY

In modern America, the population of the suburbs of most metropolitan areas has grown more rapidly than the central city. Conversely, the rate of growth of employment has frequently been greater in the central city than in the suburbs. This uneven growth of population and employment exists in the Portland-Vancouver Standard Metropolitan Statistical Area (SMSA). Some unique transportation problems have resulted from the uneven growth rate in the Vancouver suburban areas of Clark County, Washington. These areas are removed from the central city of Portland by a major river (the Columbia) and are located in a different state. This complicates the analysis and projection of future growth and makes the evaluation of transportation requirements difficult.

The uneven growth rate in Clark County has resulted in increased travel demand between Vancouver and Portland and current traffic volumes exceed highway capacities. But this is only one of the manifestations of the broader problem of uneven growth rates and their impact on transportation systems. Long-range planning and the allocation of resources for transportation facilities and services must be based on a strategy that responds to that problem.

Purpose

The purpose of this study is to identify and evaluate the impact of uneven growth rates on transportation systems in the Portland-Vancouver SMSA and to formulate recommendations that address the major problems. The requirements for facilities and services linking the Vancouver-Clark County area with the remaining portion of the SMSA in Oregon are of specific concern.

Although a literature search did not result in locating studies which specifically addressed the impact of uneven growth on the transportation system, several studies document the effects of social and economic considerations on travel. A number of recent studies concerning the need for and feasibility of additional Columbia River bridge crossings in the Portland-Vancouver corridor also provided background information.

Growth Rates in the Metropolitan Area

Population. The suburban counties of the SMSA continue to grow at a faster rate than the central county, Multnomah, in which the city of Portland is located. Clark County, in Washington, increased in population from 128,500 in 1970 to 192,300 in 1980. This constitutes an annual compounded rate of growth of 4.1 percent compared to only 0.2 percent for Multnomah County.

Employment. New jobs in Clark County have not been created as rapidly as the growth in population. The rate of growth in employment in Multnomah County is quite high despite its relatively low population growth. In 1970, 74 percent of the jobs in the SMSA were located in Multnomah County. Although the percent of the total employment located in Multnomah County has declined gradually, 60 percent of the jobs in the SMSA were still in Multnomah County in 1980. The number of persons employed in Multnomah County has increased almost twice as rapidly as that of Clark, Clackamas and Washington Counties combined. Although a comparison of employment growth rates reveals that Clark, Clackamas and Washington Counties are similar to those of Multnomah County, numerical growth in this one county is still the dominant element influencing travel in the SMSA.

The growth of employment opportunities in Portland is the major element contributing to increased commuter traffic volumes across the I-5 bridge. The population and employment estimates indicate that a significant number of individuals continue to choose to live in Vancouver/Clark County and commute to employment sites in Portland/Multnomah County.

Columbia Crossing Travel Demand

Cross-bridge travel demand between Vancouver and Portland, as measured by annual average daily traffic (ADT) counts on the I-5 bridge, demonstrate the impact on transportation of uneven growth. The greatest period of traffic increase was in the decade following the completion of the additional bridge lanes in 1958. This was also an era of rapid population growth. Although traffic has continued to increase since 1970, comparison of these data with population growth is complicated by the periodic fuel shortages. However, the long-term trends show a high correlation. Transit ridership on the line which crosses the I-5 bridge has

increased continuously since initiation of the service in January 1977. From January 1979 to June 1982 ridership increased more than threefold.

Methods of Analysis

In addition to measuring growth rates from population, employment, traffic data and other related variables, a survey of key informants was conducted. The purpose of the survey was to identify the critical factors that lead to or inhibit growth in Clark County. The statistical analysis employed data processing applications which demonstrated interrelationships among the variables for which data was collected. The results documented the nature and extent of uneven growth. The survey provided much valuable qualitative information for the evaluation of factors that modify growth patterns and transportation requirements. An analysis of development patterns in the metropolitan area and a review of local comprehensive plans and economic development goals completed the study's information and analysis efforts.

Findings

The statistical analysis documented the relationship between growth in the Portland-Vancouver area and traffic on the I-5 bridge crossing the Columbia River. Specific findings include:

- . Population and employment growth taking place in Vancouver/Clark County is positively correlated with increases in travel volume across the Interstate 5 bridge.

- . Periods of fuel shortages show a reduction in I-5 bridge traffic.

Recently completed improvements to transportation facilities and services between Vancouver (Clark County, Washington) and Portland, Oregon and others that are planned will modify growth patterns and thus future transportation requirements. Opportunities for industrial development, and therefore jobs, in Clark County have already resulted in the development of two labor-intensive high technology industrial sites east of Vancouver. The completion of the I-205 bridge

across the Columbia River will provide greater opportunities for residential, industrial and commercial developments.

The available evidence strongly supports the conclusion that Clark County will continue to grow in population at a much higher rate than the central city of Portland. Employment growth will likely be equal to the population growth. Thus, the dominant travel demand from Clark County to work destinations in Oregon will no longer increase at the same rate as population.

Recommendations

Allocation of planning and development resources by WSDOT should put the emphasis on facilities and services which serve the Vancouver urban area. This applies to the allocation of resources for construction and to long-range planning for the development of further improvements to the transportation system in the future. More specifically, priority should be given to support for C-Tran and to highway improvements for SR 14 and SR 500 which will help to consolidate development in the area immediately to the east of Vancouver.

To the extent appropriate, WSDOT should also participate in and support the following local planning and development efforts:

- . Regional land use planning by providing information essential to overall planning and to rezoning procedures.
- . Planning and development of local transportation facilities including arterial roads and streets in the vicinity of industrial development sites.
- . Interagency cooperation in planning for and development of adequate sanitary sewer systems.
- . Carpool and vanpool efforts by direct participation particularly in HOV facilities and park-and-ride lots.
- . Development of interrelated sites for commercial, residential and industrial sites in the same vicinity by assisting in the coordination

between the development of transportation facilities and private land developments which meet the local planning goals.

- Improving market and labor accessibility by providing major transportation facilities as they are required by the development of new employment centers.

Benefit

This study will benefit WSDOT by bringing decisions concerning transportation requirements into a broader context. The consideration of development patterns, and of economic, social, land use and similiar factors is of particular importance in dealing with the problems imposed by uneven growth rates in the Portland-Vancouver SMSA. The study substantiates the conclusions of previous studies that an additional bridge across the Columbia River will not be needed in the near future.

The benefits of interagency cooperation in planning and coordination of development are well known without reference to this study. However, in this particular case, WSDOT has much at stake in supporting those policies and programs which diminish the relative demand for interstate bridge facilities.

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TRANSPORTATION PROBLEMS ASSOCIATED WITH UNEVEN GROWTH RATES IN SEPARATE JURISDICTIONS

INTRODUCTION

In modern America, the suburbs of most metropolitan areas have grown more rapidly than the central city. This situation exists in the four counties that constitute the Portland, Oregon metropolitan area (Figure 1). In this metropolitan center, some unique problems have resulted from the fast growth rate in the suburban Vancouver areas of Clark County. This area is removed from the central city by a major river (Columbia River) and is located in a different state. This complicates the problem of evaluating transportation requirements and in developing facilities and services to meet the needs of the total metropolitan area. This unique situation is also a consideration in analyzing and projecting future growth.

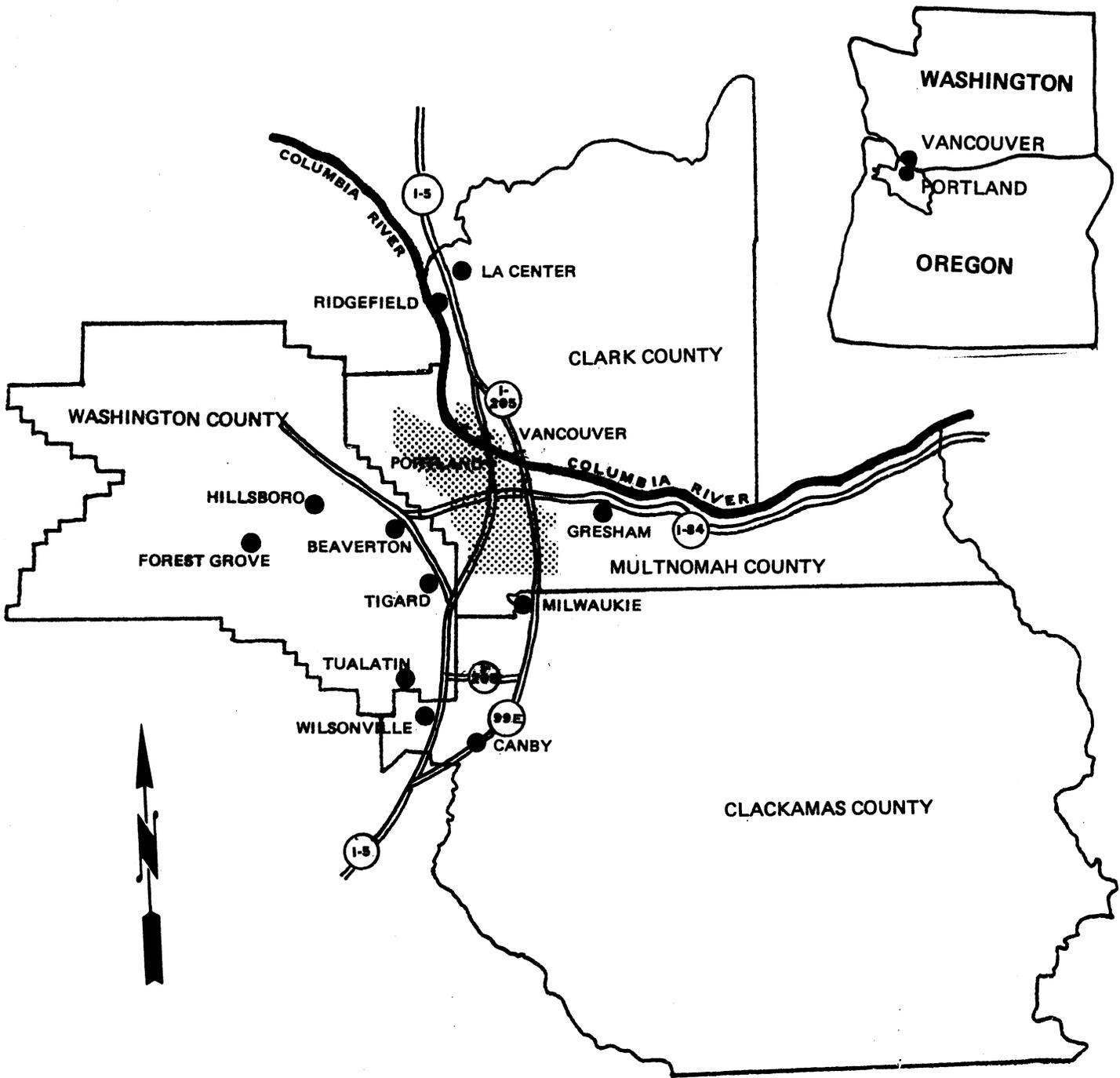
The uneven growth rate in Clark County has resulted in increased travel demand between Vancouver and Portland and current traffic volumes exceed highway capacities. But this is only one of the manifestations of the broader problem of uneven growth rates and their impact on transportation systems. Long-range planning and the allocation of resources for transportation facilities and services must be based on a strategy that responds to that problem and addresses those factors that may modify its impact on transportation requirements.

Background

Vancouver, Washington is located across the Columbia River, eight miles from Portland, Oregon. Vancouver was founded in 1825 as Fort Vancouver, a Hudson's Bay trading post, and was chartered as a city in 1889. Today, Vancouver contains about 43,000 people and is part of the rapidly growing Clark County urban area.

Portland is located on the Willamette River near its confluence with the Columbia River. It was incorporated in 1851. Events aiding in Portland's expansion were the Alaska Gold Rush, the Lewis and Clark Centennial Expedition (1905) and the completion of the Bonneville Dam. During World War II, Portland was a shipbuilding

FIGURE 1. PORTLAND - VANCOUVER SMSA



center. Today, Portland is a major industrial, commercial and educational center of the Northwest as well as being an important port and a major tourist spot. The area surrounding both Vancouver and Portland is noted for farms, timberland and orchards.

Like Clark County in Washington, the suburban counties of Washington and Clackamas, in Oregon, are growing at a much faster rate than Portland and Multnomah County. Neither Clackamas nor Washington Counties have individual cities as large as Vancouver. However, both include areas of rapid urbanization which extends out from the central city of Portland in Multnomah County.

Unlike the suburban areas in Oregon, Vancouver and Clark County currently have only one highway link to the central city. Interstate 5 is the major north-south highway route through Washington, Oregon and California. The Interstate Bridge, the I-5 crossing over the Columbia River at Vancouver, provides the only existing highway link between that city and the remainder of metropolitan Portland. Continued growth of the Portland-Vancouver Standard Metropolitan Statistical Area (SMSA)¹ can be expected. The Regional Transportation Plan² projects a population of 1.6 million by 2000, a twenty-year increase of 28 percent. As land for development within Portland decreases, the growth rates of Multnomah County and the remaining three counties in the SMSA will vary to an even greater extent than they do at present.

To handle traffic generated by population increases one might assume that additional bridges will be required to accommodate the increased travel demand between Vancouver and Portland. However, new transportation facilities might only stimulate higher uneven growth rates just as the earlier (1958) improvements to the Interstate Bridge did. A better understanding of uneven growth rates, the factors which might modify development patterns and transportation requirements are essential in making decisions to meet those requirements. This is particularly important during periods of limited resources such as we are now experiencing.

¹A Standard Metropolitan Statistical Area (SMSA) is a county or group of contiguous counties containing at least one city of 50,000 or more residents. Contiguous counties are included in the SMSA if they form an integral social and economic system.

²METRO, Regional Transportation Plan, Metropolitan Service District. Portland, August 1980, pp. 1-49.

Study Purpose and Objectives

The purpose of this study is to identify and evaluate the impact of uneven growth rates on transportation systems in the Portland-Vancouver SMSA and to formulate recommendations to address the major problems, specifically the requirements for facilities and services linking the Vancouver-Clark County area with the remaining portion of the SMSA in Oregon are of specific concern. Study objectives are to:

1. Document the extent and nature of uneven growth in Vancouver and Clark County, Washington and in the remaining Oregon portion of the four-county SMSA.
2. Identify and evaluate the demands and capacities of existing transportation facilities connecting Clark County with the three Oregon counties.
3. Analyze the major problems of multiple jurisdictions and the differential funding levels for highway construction between the two states.
4. Identify factors that may modify growth patterns and transportation requirements.

Literature Review

Factors which influence industrial and commercial location decisions have been studied by Hewings (1977), Mills (1977), Richardson (1969) and Stafford (1979).³ These studies indicate that resources of particular interest to industrial development are the availability of raw materials, sufficient land, utilities, transportation and labor supply. Commercial location decisions are primarily based on their ability to serve a local/regional market with a high priority placed on visibility of the firm while industrial location decisions place less emphasis on visibility. However, this trend is changing as larger, well-known industries locate plants in the vicinity of freeways. For such industries, name advertising and prestige are important promotional elements (Gruen Associates, 1974).

³See Bibliography for complete references.

The effect of industrial and commercial development on population and employment growth has been examined by Gruen Associates (1974), and Chapin and Kaiser (1979). According to Gruen Associates, a reciprocal relationship between the availability of workers attracting industry has been partially instrumental in bringing industry into the metropolitan fringe. Chapin and Kaiser approach the subject from a systems framework. Activity, development and environmental systems are identified as the key systems affecting land use.

Changes in population and employment in an area require the development of supporting facilities and services. Population and employment growth has been studied by the city of Vancouver (1980), METRO (1981), the Regional Planning Council of Clark County (1980) and the U.S. Department of Energy and Bonneville Power Administration (1979). These studies indicate a rapid rate of growth in Vancouver/Clark County in the state of Washington, and in Clackamas and Washington Counties in the state of Oregon. Also in Oregon, Portland/Multnomah County has an expanding employment base and a slowed population growth rate.

Although a literature search did not result in locating studies which specifically addressed the impact of uneven growth on the transportation system, several studies document the effects of social and economic considerations on travel. In the NCHRP (Report 70, 1969) an inverse relationship was observed between population size and trips per capita which emphasized the role of the small city as a trip producer and that of the large city as a trip attractor. According to the study, the logic behind this phenomena is that individuals can satisfy their needs (work, shopping, personal business) much closer to their homes in large urban areas than in smaller ones. The effect of industrial plants and shopping centers on the transportation system has been investigated in NCHRP (Report 24, 1966). Although heavy demands on the transportation system were reported, the study was conducted in 1966 before the impact of the fuel crises, and energy conservation efforts could be studied. Other studies assumed growth to have an impact on transportation systems and proposed methods of generating trip tables for different futures (TRB-710, 1979), or provided planning guidelines for bringing social and environmental consideration into transportation decision-making (NCHRP - 156, 1975).

A major travel problem between Washington and Oregon is congestion in the I-5 corridor serving Vancouver and Portland. Recent studies on Columbia River crossings investigated the feasibility of a third Columbia River bridge. The Washington State Department of Transportation study (1980) concluded that a third bridge was not economically feasible and that existing congestion on I-5 is the result of bottlenecks north and south of the I-5 bridge and not related to the capacity of the existing bridge. The documents reviewed are listed in the Bibliography.

Methods of Analysis

The study area is defined by the boundaries of the Portland-Vancouver SMSA consisting of the two principal cities, Clark County in the state of Washington, and Multnomah, Clackamas and Washington Counties in Oregon.

The statistical analysis employed data processing applications which measured the interrelationships between the growth indicators and traffic on the interstate bridge. The results documented the nature and extent of uneven growth.

The data concerning the area's growth and the transportation problems were discussed with knowledgeable "key informants." Each of these was interviewed by WSDOT personnel utilizing a structured format. Persons interviewed were involved in economic development, long-range planning, marketing, transportation, community planning and development, and finance. They represented federal, state, regional and local public agencies as well as private agencies. The interviews consisted of a discussion of 45 questions. The information obtained was used as a basis for examining subsequent uneven population and employment growth rates in Vancouver and Portland.

In addition to these two investigative efforts, the comprehensive plans and economic development goals of local jurisdictions in the area were collected and evaluated. These in turn were compared with the historical development pattern in the Portland-Vancouver metropolitan area.

GROWTH RATES IN THE PORTLAND METROPOLITAN AREA

No single statistical measure is appropriate for the quantification of urban growth. Therefore, in this study several growth indicators were selected from among those for which data were available.

Data concerning population, employment, vehicle registration, average daily traffic and governmental regulatory and taxing policies were collected from appropriate agencies as indicated in Table 1. To analyze the impact of uneven growth on the transportation system, travel data were obtained from archives which provided average daily traffic on the I-5 bridge for a thirty-year period from 1950 to 1979. Directional peak hour traffic was not available because records older than seven years were destroyed. Information on patronage of the transit service between Vancouver and Portland was also collected.

Population Growth

Population growth is a key factor in economic development in industrial societies, and this factor is well illustrated in this state. Vancouver/Clark County is experiencing rapid economic development, with a population growth at the compounded rate of 4.1 percent per year. In the state of Oregon, Clackamas and Washington Counties are also experiencing similar rates of population growth (see Table 2). However, in Portland/Multnomah County the population growth rate has been slower at 0.2 percent per year. In general, the larger cities have grown at a much slower rate than the smaller cities and unincorporated suburban areas. This section discusses the relationship between rates of uneven population and employment growth, in comparison to industrial and commercial activities.

In 1970, Multnomah County contained over half of the SMSA population, followed in size by Clackamas and Washington Counties in Oregon, and Clark County in Washington. By 1980, Multnomah County's population percentage of SMSA population had declined to 45 percent of the total, and the estimate for 2000 is 39 percent (Figure 2). The increase in population that has occurred in Clark, Clackamas and Washington counties is due in large part to the location of new industrial and commercial firms in these counties.

TABLE 1. INVENTORY OF DATA USED

	DATA SETS				
	POPULATION	POPULATION FORECAST	TAXABLE PAYROLLS	EMPLOYMENT	RETAIL SALES
CLARK CO., WASHINGTON	1950 - 1979	5-YEAR INTERVALS TO YR. 2000	1964 - 1973	1964 - 1977	1967 - 1979
OREGON COUNTIES	1950 - 1979	1977 - 2000	1964 - 1973	1964 - 1977	1950 - 1979

	DATA SETS				
	AVERAGE DAILY TRAFFIC	VEHICLE REGISTRATION	INVENTORY TAX	SALES TAX	STATE INCOME TAX
CLARK CO., WASHINGTON	1950 - 1979 (I-5)	1950 - 1979	PHASE-OUT PROGRAM	YES	NO
OREGON COUNTIES	1950 - 1979 (I-5)	1950 - 1979	PHASE-OUT PROGRAM	NO	YES

Note: Incomplete or otherwise unsatisfactory data sets that were investigated but found not feasible to use are listed in Appendix A.

TABLE 2. POPULATION OF COUNTIES AND PRINCIPAL CITIES
 PORTLAND - VANCOUVER SMSA, 1950 to 1980

County City	<u>1950</u>	<u>1960</u>	<u>1970</u>	<u>1980</u>
Clark	85,304	93,809	126,446	192,227
Camus	4,725	5,665	5,790	5,681
Vancouver	41,664	32,464	41,859	42,834
Clackamas	86,716	113,038	166,088	241,919
Lake Oswego	3,316	8,906	14,615	22,868
Milwaukie	5,253	9,099	16,444	17,931
Oregon City	7,682	7,996	9,176	14,673
West Lynn	2,945	3,923	7,091	12,956
Multnomah	471,537	522,813	554,640	562,640
Gresham	3,049	3,944	10,030	33,005
Portland	373,628	372,676	379,967	366,383
Troutdale	514	522	1,661	5,908
Washington	61,269	92,237	157,920	245,401
Beaverton	2,512	5,937	18,577	30,582
Forest Grove	4,343	5,628	8,275	11,499
Hillsboro	5,144	8,232	14,675	27,664
Tigard	--	--	6,499	14,286
Tualitin	248	359	750	7,348

COUNTY POPULATION CHANGE

<u>County</u>	<u>1950 - 1960</u>		<u>1960 - 1970</u>		<u>1970 - 1980</u>	
	<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>
Clark	8,505	10.0	32,677	34.8	70,781	56.0
Clackamas	26,322	30.4	53,050	46.9	75,830	45.7
Multnomah	51,276	10.9	31,827	6.1	8,000	1.4
Washington	30,968	50.5	65,683	71.2	87,401	55.4
Total Four- County SMSA	117,071	16.6	183,197	22.3	242,093	24.1

FIGURE 2. POPULATION DISTRIBUTION, PORTLAND-VANCOUVER SMSA

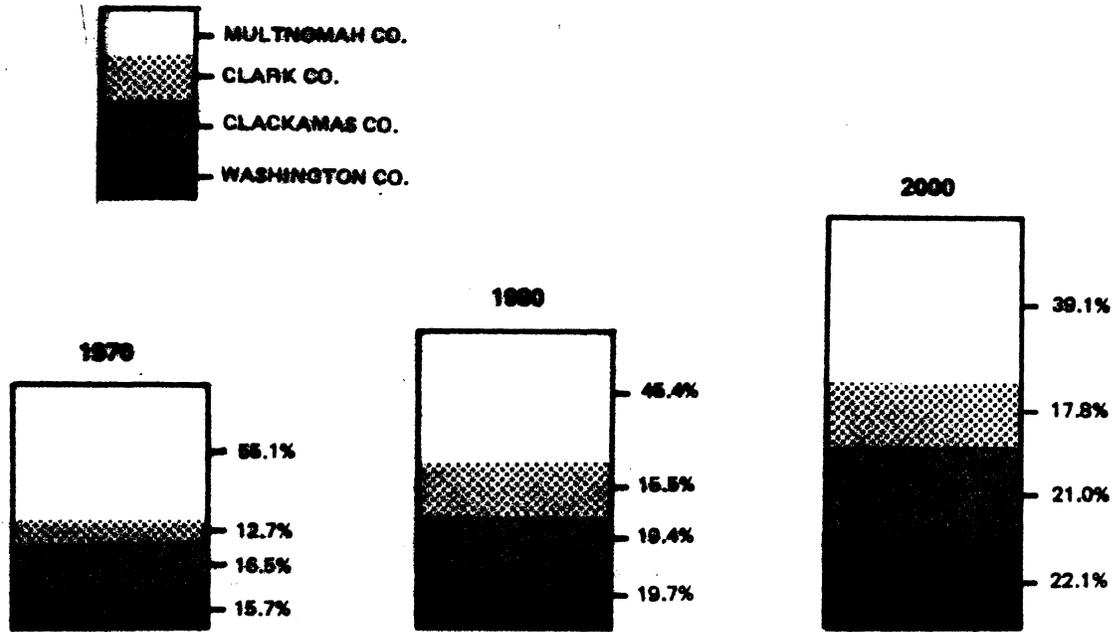
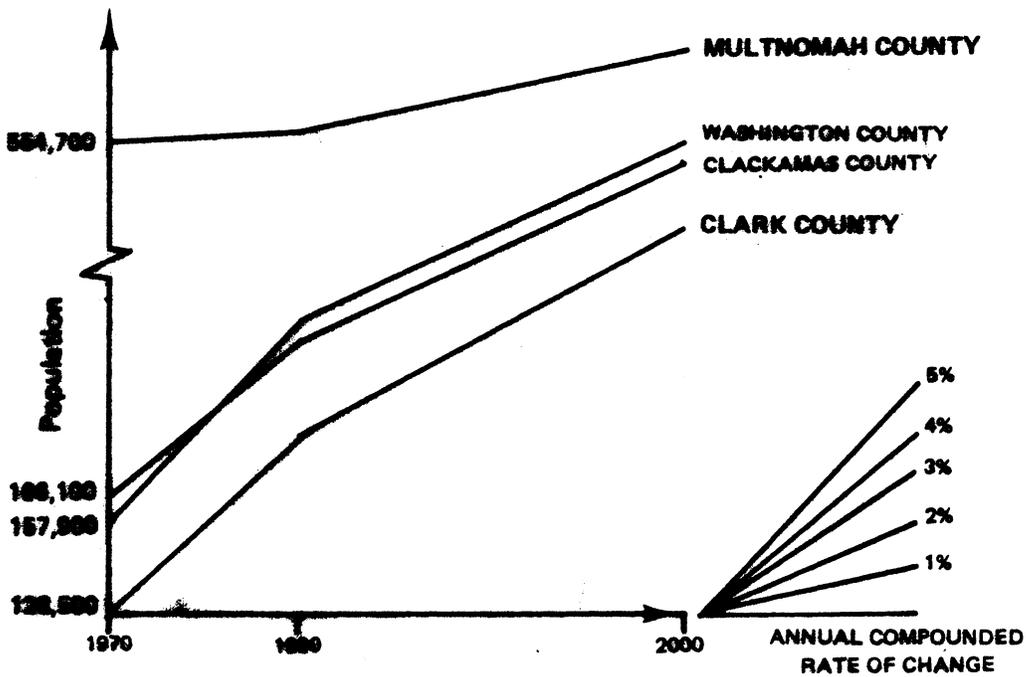


FIGURE 3. POPULATION GROWTH RATES, PORTLAND-VANCOUVER SMSA



In Clark County, a strong growth-oriented climate resulted in a population increase of 63,800 persons between 1970 and 1980, with an estimated increase of 117,700 persons by the year 2000. In contrast, Multnomah, the largest county, experienced the smallest growth. The 1980 population of 565,000 persons was an increase of 10,700 persons over the 1970 and the total is expected to increase to 651,000 by the year 2000. (Appendix B summarizes population forecast assumptions.)

Clackamas and Washington Counties have also experienced population growths similar to Clark County. Industrial and commercial developments have also accelerated the influx of population into these Oregon counties. A comparison of population growth rates by county is depicted in Figure 3.

While one-fourth of the area's population growth is attributable to natural growth, migration resulting from the employment opportunities accounts for approximately three-fourths of the growth.

Employment Growth

The relatively rapid employment growth in the Portland-Vancouver SMSA is attributable to the major development of clerical and retail industries in Portland/Multnomah County, and large light manufacturing industries in Clark, Clackamas and Washington Counties. As previously noted, the availability of land, sewerage facilities and transportation facilities in Clark, Clackamas and Washington Counties accounts for attracting large light manufacturing industries and commercial enterprises. In Multnomah County, the relative scarcity of sufficient land served by adequate sewerage facilities has tended instead to attract commercial enterprises drawn by Portland's large population base.

Employment growth varies somewhat from the population growth trends. Employment growth in Multnomah County is quite high despite its relatively low population growth (Table 3). In 1970, about 74 percent of the jobs in the SMSA were located in Multnomah County. Although a declining percentage was experienced, 60 percent of the SMSA's jobs were still in Multnomah County in 1980. The year 2000 forecast predicts that 51 percent of the SMSA's jobs will be in Multnomah County (Figure 4). The number of persons employed in Multnomah County has increased almost twice as rapidly as that of Clark, Clackamas and Washington Counties combined.

TABLE 3. EMPLOYMENT TRENDS, PORTLAND - VANCOUVER SMSA

SELECTED YEARS, 1965 - 1979

	<u>1965</u>	<u>1970</u>	<u>1975</u>	<u>1979</u>	Increase 1965 to 1979	
					<u>Number</u>	<u>Percent</u>
TOTAL FOUR-COUNTY AREA	242,912	308,988	362,391	472,998	230,086	94.7
Clark County	18,933	24,844	28,553	41,791	22,858	120.7
Multnomah County	188,776	229,768	234,794	291,918	103,142	54.6
Clackamas County	16,752	23,465	47,628	54,566	37,814	225.7
Washington County	18,451	30,911	51,416	84,723	66,272	359.2

Source: County Business Patterns, Bureau of the Census, U.S. Department of Commerce, Washington, D.C.
(Mid-March payroll reported each year for each state.)

FIGURE 4. EMPLOYMENT DISTRIBUTION, PORTLAND-VANCOUVER SMSA

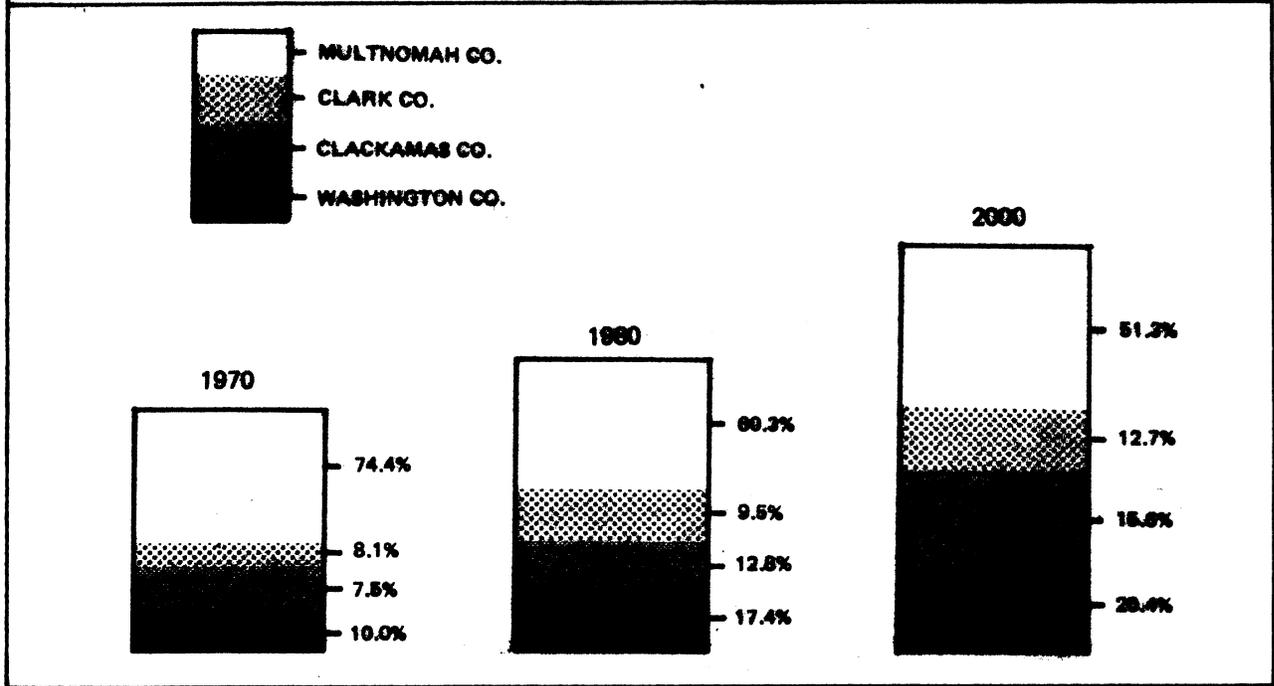
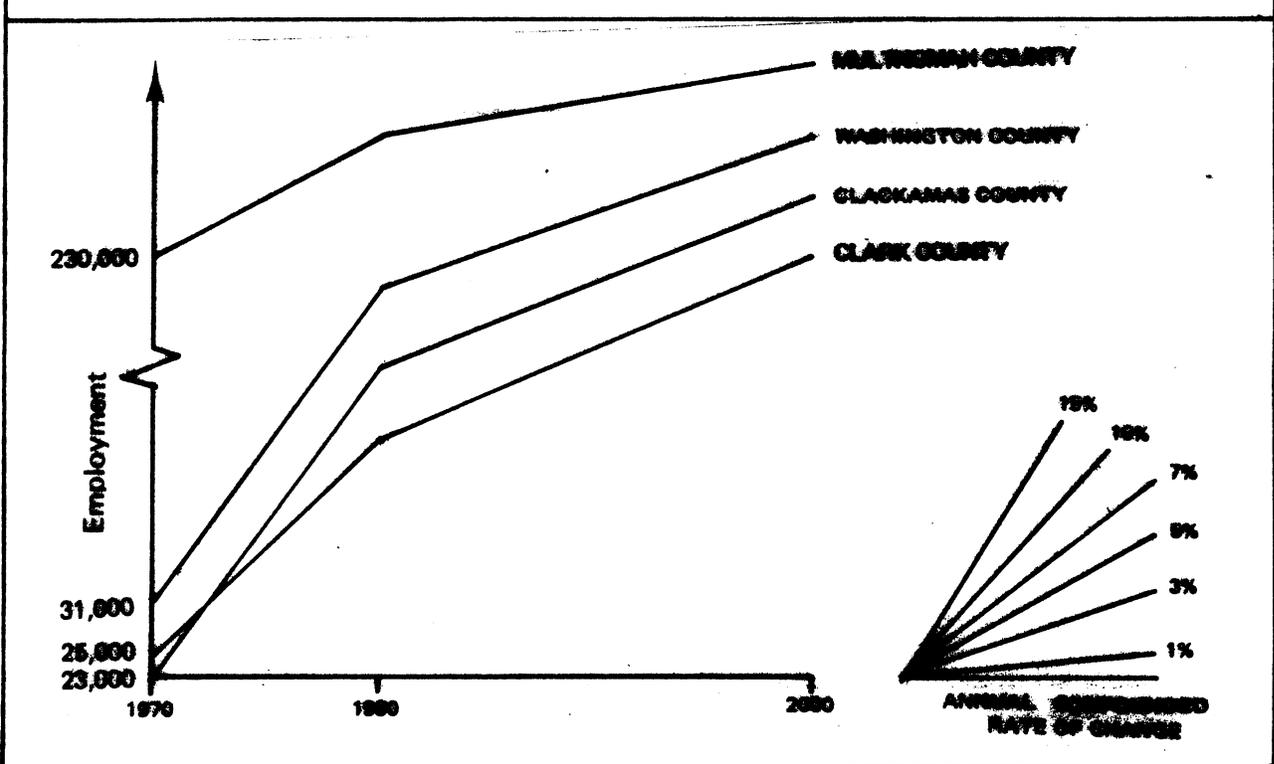


FIGURE 5. EMPLOYMENT GROWTH RATES, PORTLAND-VANCOUVER SMSA



Although a comparison of employment growth rates reveals that Clark, Clackamas and Washington Counties are experiencing similar rapid rates of growth (Figure 5), Multnomah County's numerical growth is still the dominant element influencing travel in the SMSA. Portland/Multnomah County is the major employment hub in the SMSA and draws commuters from Clark, Clackamas and Washington Counties. In both Clackamas and Washington Counties, employment opportunities have been expanding very rapidly (Table 2). It is logical to assume that residents of all the suburban counties are commuting to job sites within their respective counties as well as to employment centers in Multnomah County.

The growth of employment opportunities in Portland is a major element contributing to increased commuter traffic volumes across the I-5 bridge. The population and employment estimates indicate that a significant number of individuals who choose to live in Vancouver/Clark County commute to employment sites in Portland/Multnomah County.

The population and employment data also indicate that employment growth in Vancouver/Clark County is about one-half its population growth (Figures 3 and 5). This is the key factor in uneven growth rates which creates inordinate demand on transportation facilities between Vancouver and Portland.

Interstate Transportation Facilities and Services

Interstate 5 is a major north-south highway connecting Seattle, Vancouver, Portland and points south. It currently is the only highway connection between Vancouver and Portland. Interstate 205 (I-205) is now under construction and is scheduled for completion by late 1983. The I-205 bridge, however, will be open to traffic by the end of 1982. When opened, I-205 will cross the Columbia River about six miles east of the I-5 bridge (Figure 6).

The I-5 Columbia River Bridge is actually two parallel bridges. The first bridge, completed in 1917, connected Interstate Avenue in Portland with Vancouver. The

FIGURE 6. REGIONAL HIGHWAY SYSTEM

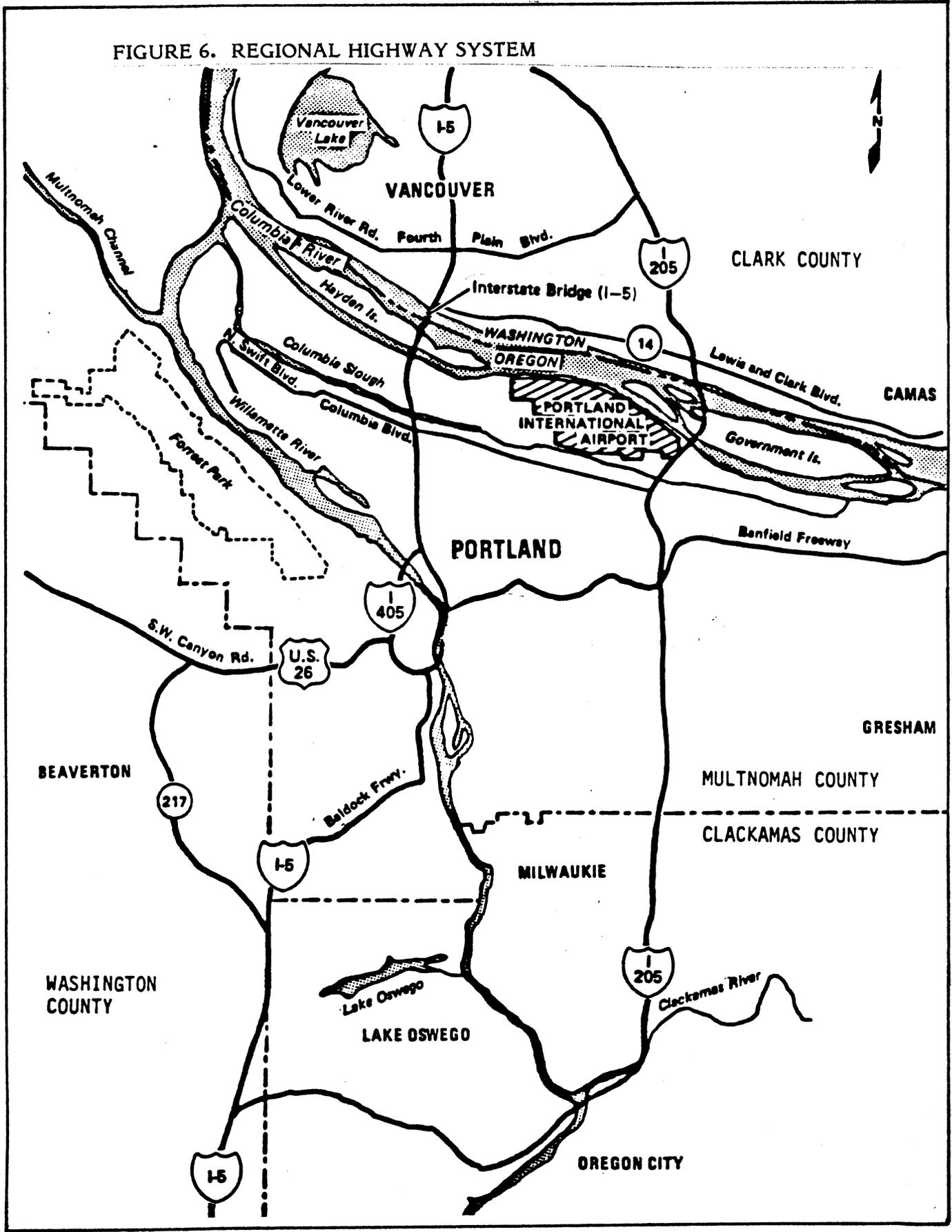


TABLE 4. COLUMBIA RIVER
INTERSTATE 5 BRIDGE, AVERAGE DAILY TRAFFIC
1950 - 1981

<u>Year</u>	<u>ADT</u>	<u>Rate of Annual Change*</u>	<u>Year</u>	<u>ADT</u>	<u>Rate of Annual Change*</u>
1950	31,600	--	1966	45,700	9.6
1951	32,200	1.9	1967	56,800	24.3
1952	34,500	7.1	1968	60,600	6.7
1953	30,400	-11.9	1969	64,200	5.9
1954	29,800	-2.0	1970	69,200	7.8
1955	32,400	14.8	1971	73,000	5.5
1956	34,400	6.2	1972	77,800	6.6
1957	33,800	-1.7	1973	83,000	6.7
1958	35,200	4.1	1974	81,300	-2.0
1959	38,500	9.4	1975	87,300	7.4
1960	33,000	14.3	1976	93,000	6.5
1961	33,900	2.7	1977	97,600	4.9
1962	36,200	6.5	1978	102,300	4.8
1963	36,300	0.3	1979	100,800	-1.5
1964	38,400	5.8	1980	100,100	-0.7
1965	41,700	8.6	1981	103,368	3.3

<u>Period</u>	<u>Change</u>		<u>Period</u>	<u>Change</u>	
	<u>Number</u>	<u>Percent</u>		<u>Number</u>	<u>Percent</u>
1950-1960	1,400	4.4	1980-1970	30,900	44.4
1960-1970	36,200	109.7	1950-1981	71,768	227.1

*In percent

Source: WSDOT Annual Traffic Reports

second bridge was opened in 1958. This Columbia River bridge is often cited as being the cause of congestion experienced in traveling between Vancouver and Portland. Although the bridge attracts considerable traffic, the congestion actually occurs at interchanges and sections north and south of the bridge, and is not the result of insufficient bridge capacity.⁴

Cross-bridge travel demand between Vancouver and Portland, as measured by annual average daily traffic (ADT) counts, demonstrate the impact on transportation of uneven growth. The greatest period of traffic increase occurred from 1960 to 1970 in the decade following completion of the additional bridge lanes (late 1958). This was also the era of greatest population growth. Although traffic has continued to increase since 1970, comparison of these data with population growth is complicated by the periodic fuel shortages. However, the long-term trends show a high correlation. (The linear regression equation, using only 1950, 1960, 1970 and 1980 data, indicates an r value of .977).

The Tri-County Metropolitan District of Oregon (Tri-Met) initiated transit service on line 5, between Portland and Vancouver, in January 1977. From January 1979 and June 1982, Tri-Met records of monthly boarding rides indicate ridership more than doubled (Table 5).

Uneven growth rates in Portland and Vancouver are sensitive to a variety of factors. The key underlying factor is the ability of the transportation network to facilitate travel and shipments. The expected completion of I-205 between Washington and Oregon as well as the improvements to the Portland-Vancouver I-5 corridor are major elements in determining future growth patterns.

⁴Washington State Department of Transportation, Legislative Study: Portland-Vancouver Corridor - Columbia River Crossing, Olympia, December 1980.

TABLE 5. VANCOUVER LINE 5
MONTHLY BOARDING RIDES
(1/79 - 6/82)

1/79	23,434	10/80	41,972		
2/79	22,092	11/80	35,085		
3/79	25,672	12/80	40,652		
4/79	25,130	1/81	41,268		
5/79	25,968	2/81	40,144		
6/79	25,596	3/81	44,884		
7/79	26,544	4/81	49,222		
8/79	29,085	5/81	47,045		
9/79	27,654	6/81	50,674		
10/79	31,919	7/81	55,472		
11/79	29,543	8/81	46,882		
12/79	31,850	9/81	50,450		
1/80	30,592	10/81	56,692		
2/80	38,551	11/81	50,972		
3/80	40,181	12/81	59,032		
4/80	38,974	1/82	54,945		
5/80	40,640	2/82	53,200		
6/80	37,953	3/82	70,980		
7/80	40,270	4/82	74,964		
8/80	38,915	5/82	65,200		
9/80	35,952	6/82	71,868		
Increases	Number	Percent			
1/79 to 6/79	2,162	9.2	12/80 to 6/81	10,022	24.7
6/79 to 12/79	4,996	19.5	6/81 to 12/81	8,358	16.5
12/79 to 6/80	7,361	24.1	12/81 to 6/82	12,836	21.7
6/80 to 12/80	2,699	7.1	1/79 to 6/82	48,434	206.7

Source: Tri-County Metropolitan Transportation District of Oregon, Portland, unpublished data.

Results of Statistical Analysis

To measure the impacts the growth rate in Clark County had on the transportation system, the average daily traffic utilizing the I-5 bridge was used as a statistical indicator. Bridge traffic was assumed to reflect other aspects of the transportation system while an increase in population was used to represent the growth rate. Population and traffic statistics were collected for Multnomah, Washington, and Clackamas Counties to determine how much Clark County population growth was impacting traffic on the I-5 bridge and how much the Oregon counties influenced traffic.

1. The population has steadily increased in Clark County between 1970 and 1981. That increase has not been constant, at various times spurts of growth have occurred. (Figure 3)
2. A statistically significant positive correlation exists between an increase in population and an increase in the number of motor vehicles registered in Clark County.
3. Statistically significant positive correlations exist between an increase in population and motor vehicle registrations and an increase in the average daily traffic on the I-5 bridge.

The statistical analysis demonstrated the following correlations which held true for Clark County. The correlations were all significant at the .05 level or less and the level of confidence for each correlation was determined to equal .99. When interpreting the results, take into account that the standard error of estimate equaled plus or minus 5 percent.

The question was raised, would any other variable contribute to a decrease in traffic on the bridge even though the population and number of autos in Clark County was increasing. The variable of increased fuel costs was chosen as a possible example. Traffic statistics for 1973-1979 were compared to traffic statistics for 1980-1981. The Pearson R formula was used to correlate the data. It was found that:

Despite an increase in population and the number of vehicles registered, traffic on the I-5 bridge decreased between 1973-1979. In statistically comparing the traffic statistics, intervening variables such as population differences and annual vehicle registrations were controlled for. Assuming that between 1973-1979 Clark County residents experience the greatest increase in fuel costs, it is concluded that an increase in fuel costs between 1973 and 1979 contributed to a relative decrease in traffic on the I-5 bridge.

For a detailed explanation of the statistical results and the reasoning underlying the statistical analysis, see the section entitled Statistical Analysis in Appendix C.

Multiple Jurisdiction Issues

The growth and development of the SMSA and particularly that of Clark County has been influenced by the multiplicity of governmental jurisdictions. Within the SMSA there are no less than 40 incorporated cities, four counties, and innumerable special purpose districts. As previously noted, Clark County is within the state of Washington where taxation, allocation of resources for transportation facilities and services and laws governing land use and development differ somewhat from those in Oregon.

Regional Transportation Planning. In 1979, Oregon voters approved the creation of the Metropolitan Service District (METRO). This replaced the Columbia Region Association of Governments (CRAG) that had included Clark County.⁵ When METRO was formed, Clark County was excluded from this regional governmental body since it was a part of Washington. The Clark County Regional Planning Council became the new Metropolitan Planning Organization (MPO) for local governments within the Washington State portion of the SMSA. One of the first tasks undertaken by METRO was development of a regional transportation plan.

⁵Final Report, Governor's Bi-State Task Force on Transportation for the Portland-Vancouver Corridor, Economic Consultant Oregon LTD, et al. Portland, 1981, p. ii.

The plan does include consideration of transportation between Portland and Vancouver, specifically use of the I-5 and I-205 bridges for both transit and other vehicular use. However, it does not consider the related transportation requirements within Clark County.⁶

Concurrently with this effort WSDOT undertook a legislative study of the feasibility of a third bridge across the Columbia River between Vancouver and Portland. The need for better coordinated transportation planning led to the establishment of the Bi-State Task Force on Transportation. The final report of the Task Force (pp 5-9) included an analysis of alternatives to the construction of a new bridge. The alternatives included:

- Limiting travel demand through growth management, i.e., the land development policies of Clark County and the city of Vancouver.
- Increasing the capacity of the existing system to accommodate the demand through transportation systems management, i.e., ramp modification, ramp and lanes for high occupancy vehicles and transit lanes, etc.

Although the Bi-State Task Force provided appropriate information and analysis relative to the key issues of concern to both states, its functions ended with publication of its final report. Recognition of the need for coordinated areawide planning is reflected in a recommendation concerning the establishment of Bi-State Policy Coordination Committee and for a closer working relationship between METRO and C-TRAN, its counterpart in Clark County. This committee has only recently been organized as the Bi-State Policy Advisory Committee. Staff representatives constitute a parallel technical committee. The work programs of the Clark County Regional Planning Council and METRO include staff support for the work of the two committees.

⁶Metropolitan Service District. Regional Transportation Plan for the Portland Metropolitan Area, Portland, 1980.

The work of the task force, although successful, demonstrates the problem of undertaking and implementing areawide planning involving two states. The following quotation from the Final Report of the Task Force (pp 32-33) illustrates.

It is not inaccurate to say that Task Force members and staff from Oregon regarded the Task Force as an important forum where they could initiate their objections to what they suspected would be the likely recommendation of the WSDOT study: a third auto-bridge across the Columbia. When WSDOT reported that a third crossing was not cost-effective and the finding was corroborated subsequently by consultants to the Task Force, the majority of the problems and purpose of the Task Force were removed.

The experience supports the emphasis on the function of providing a forum for conflicting views among constituent agencies. It is the very fact that the area is governed by a multiplicity of jurisdictions that makes this function most important. As much as it is needed, the proposed Bi-State Policy Coordination Committee will not necessarily overcome the need for ongoing areawide planning and coordination between urban development and the resultant transportation requirements.

Differential Funding Levels. In Washington State the primary source of funds for transportation facilities and service is the motor fuel tax of 12 cents per gallon.⁷ In addition to the motor fuel tax, the Motor Vehicle Fund receives revenues from annual vehicle registration fees, gross weight fees and miscellaneous revenues collected from right-of-way sales, property rentals, interest earnings and special permits and fees.⁸ Oregon's revenue sources are similar. However, the 1982 motor fuel tax is only eight cents per gallon and motor vehicle license fees are also lower. Revenue sources and distributions for the two states are summarized in Table 6. Detailed comparisons are presented in Appendix D.

⁷The 1977 enacted "Variable Gas Tax" was 21.5 percent of the average retail price of gasoline, but not to exceed a maximum of 12 cents per gallon. The price increase of 1979 eliminated the "variable" aspects of the tax. In 1981, the law was amended to provide for a tax of 10 percent of the average retail price per gallon with a minimum of 12 cents and a maximum of 16 cents. The rate has remained at 12 cents except for the six month period from July through December 1981, when it was 13.5 cents per gallon.

⁸Washington State Department of Transportation, State Transportation Plan, Volume III, Financing Plan, p. A-6.

**TABLE 6. RECEIPTS AND DISBURSEMENTS FOR
STATE HIGHWAYS, OREGON AND WASHINGTON, 1970 to 1980**
(Thousands of Dollars)

<u>Total Receipts*</u>	<u>Oregon</u>	<u>Washington</u>
1970	\$165,674	\$260,634
1971	201,769	326,685
1972	192,811	370,473
1973	171,390	279,137
1974	195,515	298,518
1975	199,502	314,389
1976	184,741	297,860
1977	170,768	378,451
1978	213,211	406,518
1979	248,307	540,031
1980	351,355	534,776
Receipts per capita 1980	\$ 133.46	\$ 129.42
<u>Total Disbursements**</u>	<u>Oregon</u>	<u>Washington</u>
1970	\$154,304	\$272,582
1971	212,232	304,875
1972	216,939	345,168
1973	163,055	291,801
1974	171,107	287,288
1975	229,033	309,213
1976	173,246	299,356
1977	180,156	332,617
1978	209,138	407,791
1979	264,294	530,513
1980	353,359	600,099
Disbursements per highway mile 1980	\$46,750.38	\$83,297.80

*Motor fuel taxes, motor vehicle and carrier taxes, payments from federal and local governments and bond sales.

**Capital outlays, maintenance and traffic services, administration, highway law enforcement and safety, bond interest, and debit retirement.

The differences are highlighted by the comparison with a per capita computation of revenues and a per highway mile computation of expenditures. Given the difference between the two states, other than population and highway miles, the comparative data need to be qualified (e.g., Oregon does not have responsibilities comparable to Washington's state ferry system). Nevertheless, it is clear that over the years Oregon's resources for new highway construction have been even more limited than its neighboring state to the north.

The difference in funding levels between states involves other issues as well. Over the years, many more Washington residents, residing in the Vancouver area, are employed in Oregon than are Oregonians in Washington. Hence, improvements in the Portland-Vancouver corridor provide a greater number of Washington residents with better transportation facilities. Although Washington residents receive the greater benefit, Oregon has the predominant responsibility for the costs.

FACTORS THAT MAY MODIFY GROWTH PATTERNS AND TRANSPORTATION REQUIREMENTS

Opinions of Key Informants

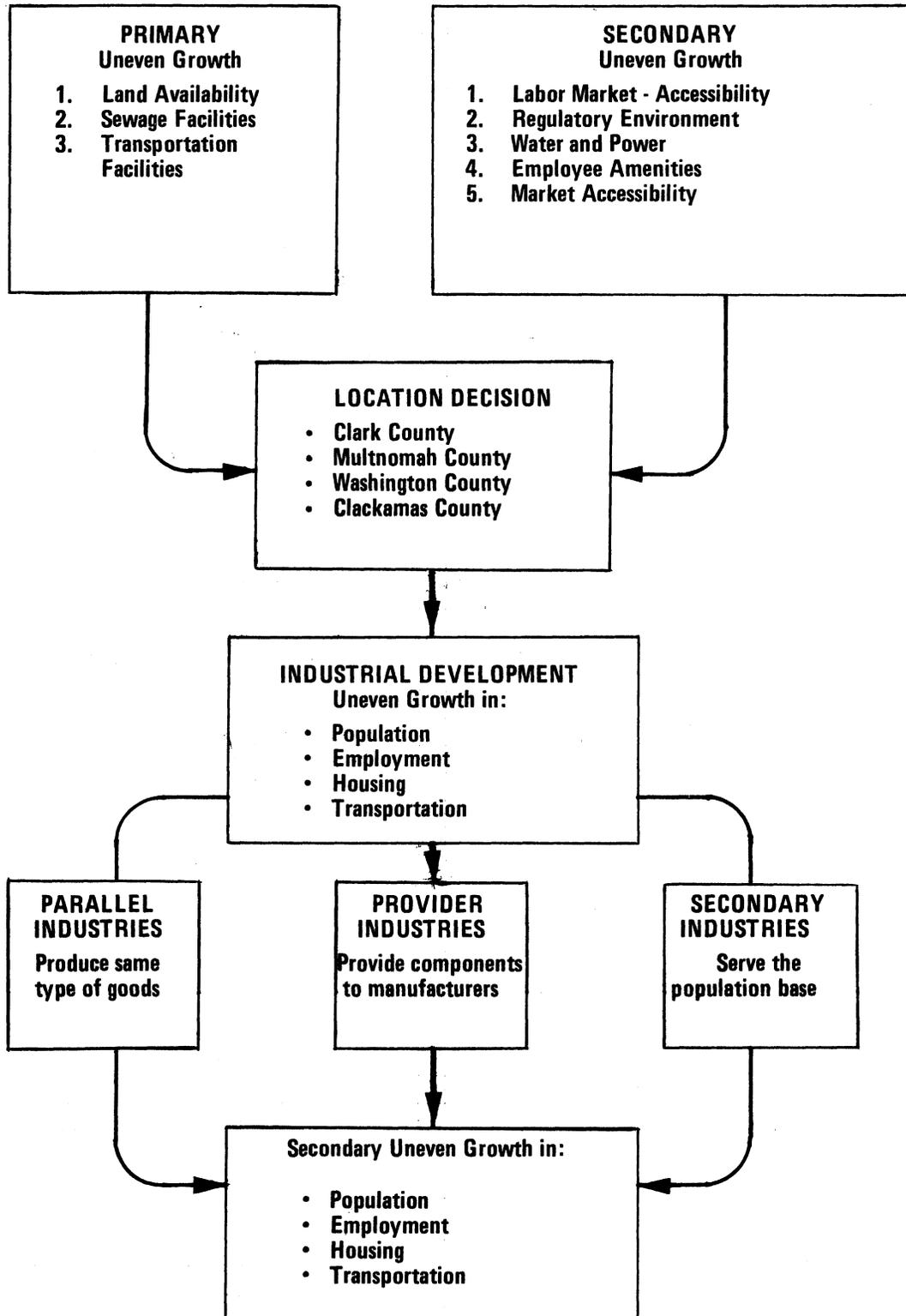
To further define and clarify the underlying considerations that influence industrial and business location decisions, the structured interviews with selected key informants were helpful (see Appendix E). Business executives and government administrators in Vancouver and Portland were selected and interviewed.

An attempt was made to identify key elements contributing to growth (Figure 7). Three primary elements are significant in this context: land, sewerage facilities, and transportation. These elements are considered "primary" because the absence of any one will significantly alter an otherwise favorable decision. It follows, further, that differences in these factors will lead to uneven growth in selected areas.

Secondary elements include labor market, regulatory environment, water and power, recreational amenities of the natural environment, cultural amenities of the cosmopolitan area, and low relative cost of obtaining goods and services. These factors are considered "secondary" because the differences from county to county are less significant than the three primary factors.

Industrial development tends to attract other types of development. The location of a major firm in an area eases the entry of "parallel" industries that manufacture similar goods. "Provider" industries are also attracted since they manufacture specific components required by the large firms. Next, "secondary" industries enter the area to provide goods, services, entertainment and recreation to the growing population. Each additional industry in turn generates growth in population, employment, housing and travel demands.

FIGURE 7. UNEVEN GROWTH ELEMENTS



Primary Elements

Based on the interview survey, the primary elements contributing to Vancouver's rapid growth are noted and analyzed.

Land

Although land is available in all four counties, developers prefer an assembled larger tract (10 or more acres). In general, adequate land, with the required infrastructure, is difficult to obtain in the Portland area. Electronic industries typically acquire land in excess of near term need to provide for long term development and expansion. A twenty-year expansion potential is characteristically sought by large light manufacturing firms looking for sites. This factor, plus zoning controls, underlie the industrial park concept.

The need for an assembled tract also is necessary for most residential developments. Developers in eastern Multnomah County have tended to acquire large parcels of land for resale or development in smaller parcels. This move reflects the trend toward industrial subdivision whereby an entrepreneur sells or leases land to industrial concerns. Economic development specialists stated that more small development activities are occurring in eastern Multnomah County than in Clark County since land restrictions tend to dampen large development in larger urbanized areas.

Commercial and industrial land for development is available in Multnomah County, although significant constraints exist due to the high cost of infrastructure such as sewer systems. Also, the available undeveloped land is less amenable to rezoning. This situation results from the desire of Oregon planners to relate economic development to the ability of the local governments to finance construction of infrastructure systems. Although this strategy is rational, some inflexibility results which appears to be a major factor contributing to the location of large industrial firms in eastern Clark County despite a long process in obtaining a zoning change. The availability of land in eastern Clark County has also permitted a very large planned community to be initiated.

Conditions identified by respondents that contribute to the decision of industries and businesses to move out of Portland were: (a) deteriorated urban industrial areas with traffic circulation problems, and (b) unavailability of adjacent land for expansion.

Such restrictions in urbanized areas make more rural areas, such as that in the corridor formed by I-205, attractive sites for development if supporting services and facilities are available or can be readily provided. In some instances, Portland has been able to ameliorate circulation problems by relocating roads and railroad tracks.

Zoning controls also tend to concentrate industrial development in specific areas. Persons interviewed stated that developers perceive land use controls to be more stringent in Oregon than in Washington. The Urban Growth Boundary (UGB) in Oregon (adopted by METRO) establishes boundaries within which development may take place over the next 20 years (see Figure 8). Many developers seeking approval to develop land believe that the Urban Growth Boundary is restrictive. However, the consensus among respondents in Oregon is that the UGB should not be expanded and that changes would result in inadequate sewerage and transportation services for the expanded area.

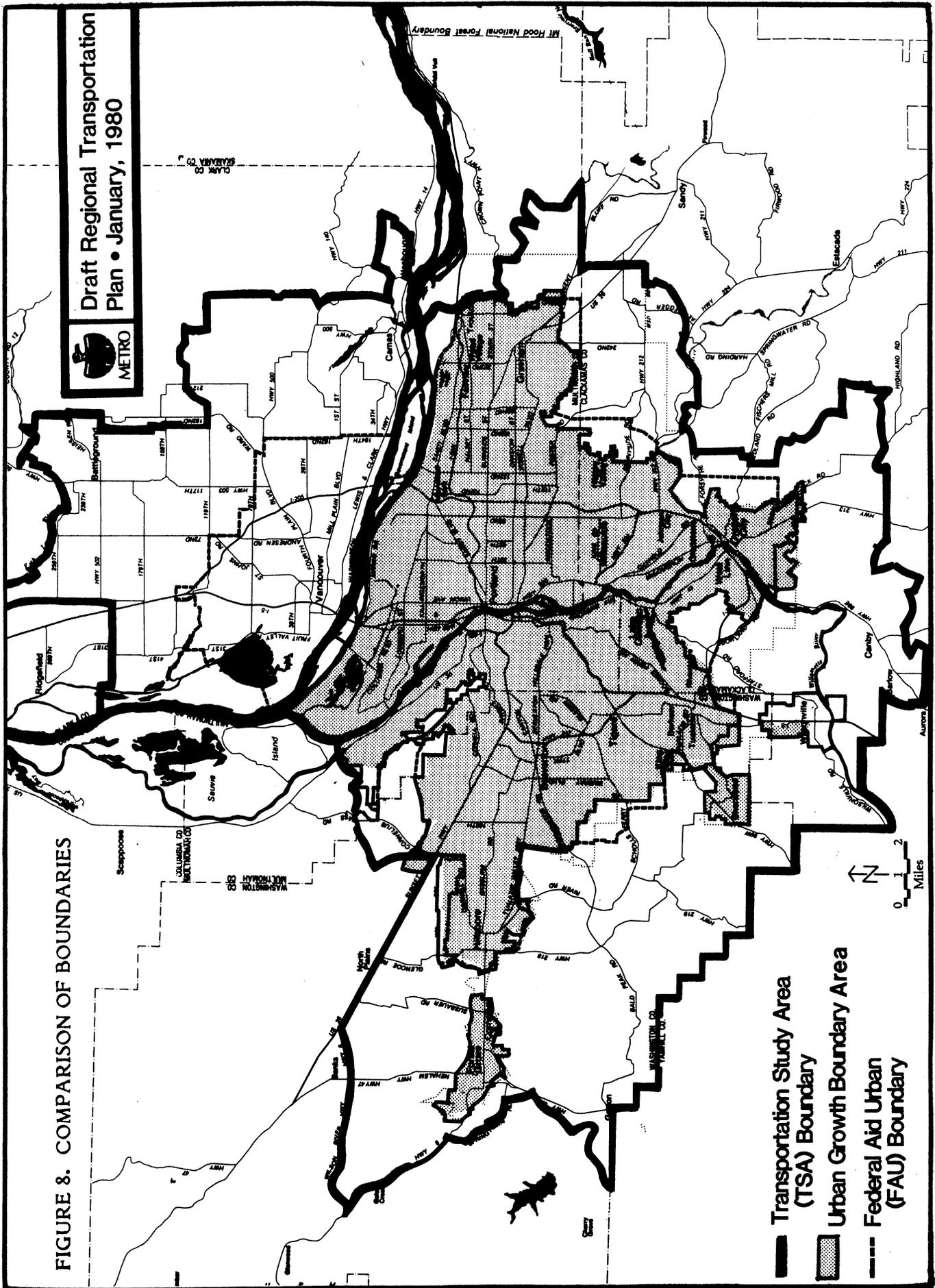
Respondents reported concern that growth should only be allowed as sewerage treatment facilities become available, thereby avoiding the difficult and costly alternative of building infrastructure facilities after development. In the interviews, it was stated that costs associated with "redevelopment" would be recovered through higher prices for goods and services in Oregon relative to Washington. However, the resulting higher Oregon prices would place Oregon at a competitive disadvantage to Washington. Land adjacent to the Portland International Airport is affected in this manner although it is considered a desirable location for distributive (warehouse) and smaller light manufacturing industries.

Another type of concern expressed by persons interviewed in Oregon involves the flood plain land between the Columbia River and Portland where high development costs would be incurred.

Draft Regional Transportation
Plan • January, 1980



FIGURE 8. COMPARISON OF BOUNDARIES



- Transportation Study Area (TSA) Boundary
- ▨ Urban Growth Boundary Area
- - - Federal Aid Urban (FAU) Boundary

However, if the momentum to develop continues, even in a national climate of low economic activity, major developments may take place in this area, similar to growth in the Rivergate area. The price of adjacent land with infrastructure does not appear to be a significant factor in deterring land purchases for industrial development.

Sanitary Sewer Systems

The pace at which development can occur is heavily dependent on proper sewerage collection, treatment and disposal systems. The problem is how to dispose of a steadily increasing volume of wastes without polluting the water supply, thereby creating a health hazard or a public nuisance.

In critical locations where a public sewerage control system is inaccessible or non-existent, septic tanks with drain fields have been used. However, failures of septic disposal systems are relatively common. In addition, population growth has increased the number of septic tanks discharging effluent into saturated ground. If uncontrolled, the increased septic tank disposal of sewerage from industrial, commercial and residential developments would substantially increase the potential health hazards created by sewerage flow to water supplies or appearing at the surface of the ground.

Major sewerage conditions which continue to dampen development in the SMSA are:

- . Limitations that may exist in the capacity of the existing public sewerage control system to handle current flow.
- . The high cost of undertaking construction of sewerage systems.
- . The relative unavailability of sufficient revenues to commence sewerage-related construction activities in many areas.

Multnomah County. Presently, two regional shopping centers (Gateway and Mall 205) are on septic tanks. Concern is expressed regarding nitrates effluents leaching into underground supplies of water.

High development costs associated with major sewage construction projects have inhibited the development of designated industrial and commercial land available in eastern Multnomah County. Hence, as the demand for large parcels adequately served by infrastructure continued, large light industry firms began to locate in Clark, Washington and Clackamas Counties rather than Multnomah County.

Clark County. Development east of Vancouver includes Genstar, which is developing a planned community that also includes two large electronics firms, Hewlett-Packard and Tektronix. Sewer facilities to support additional growth are present in this part of Clark County. Hence, additional firms are indicating their intention to locate here. Vancouver Mall has also been located in this area and will be accessible to Oregon markets upon completion of I-205 in late 1983. The area in western Clark County, along the I-5 corridor contains land designated for light industry. Due to varying needs for sewerage control service, this is not as easily developable as a planned community-electronics complex.

Washington County. Washington County, Oregon, has continued pressures for industrial, commercial and residential development. However, in 1970, the pollution of rivers and streams forced state health agencies to restrict new construction throughout the urban area of Washington County. Economic development activity was halted when urbanization pressures reached their height.

The Unified Sewerage Agency (USA) was conceived to provide sewer service and correct the severe surface water contamination problem. By 1974, most cities had contracted with USA for provision of sewerage control service. Federal and local funds were channeled into major plant and sewer pipeline construction, and the majority of the restrictions were lifted.

The United Sewerage Agency's three major plants located in Tigard, Hillsboro, and Forest Grove serve all major cities within Washington County. Offering one of the most advanced systems in the Pacific Northwest, these sanitary sewer services

appear to be capable of expanding to meet the needs of the county throughout the foreseeable future.

Completion of an up-to-date countywide master plan for drainage control and the formation of a regional drainage district are two additional options being considered. At present, development pressures which arise are sometimes at odds with drainage control objectives.

Clackamas County. Development in Clackamas County appears to be served by an adequate sewer system. Sewer facilities are normally provided at approximately the time when the affected site is to be developed. Currently, large light manufacturing firms are locating in the Urbanizing East District and the Wilsonville/Canby District in Clackamas County.

Transportation

The third primary element contributing to uneven rates of growth is transportation. Planning, land acquisition, construction, maintenance, improvements and holding costs associated with transportation facilities represent a substantial financial investment, frequently the largest single public investment made by an area.

The transportation system enables growth to take place in areas previously inaccessible. Once growth begins to take place, transportation systems attract and encourage additional growth. The interactive relationship of a transportation system with the area's land use is both highly visible and dynamic.

In recent years, the economic and social costs of transportation facilities have forced a realignment of priorities upon cities and communities. Yet transportation facilities continue to be a valuable community resource. Problems associated with traffic circulation and access to local and regional markets and facilities must be solved in developing areas. Travel demands generated by natural growth as well as from movements entering and leaving an area are giving rise to significant traffic pressures in urban and developing areas.

Clark and Multnomah Counties. While the construction and completion of certain highway and road improvements are highly desirable, alternatives to building additional new highways and roads in light of scarce funds are also being sought. The Legislative Study, Portland-Vancouver Corridor, Columbia River Crossing, December 1980, proposed:

- Maintenance of structural integrity and operational safety of the existing highway system, and completion of committed projects identified in the Regional Transportation Plan, Draft Two for the Portland Metropolitan Area, and the Washington State Transportation Plan and the Comprehensive Plan for Clark County.
- Implementation of Transportation System Management (TSM) actions in the I-5 corridor for obtaining greater user and safety from the existing transportation network. (Proposed TSM actions include variable advisory signs on I-5 and I-205, bus pre-emptors and ramp metering, high-occupancy by-pass lanes on the on-ramps, park-and-ride lots and flyer stops, and promotion of vanpools and carpools.)

Washington County. The county road system is reported in Washington County's Overall Economic Development Plan: 1980 Update to be on the verge of total collapse. In March 1980 the approval of County Road Ballot "A" provided no increased revenues for roads. It simply made up for revenue no longer realized from the state gas tax as a result of declining fuel consumption.

Highways in Washington County during peak hour service are heavily congested. Hillsboro and Tualatin have completed transportation plans while Beaverton and Tigard are presently developing studies. Work on plans for Forest Grove and Cornelius has not yet begun. Federal funds are being sought to develop a Westside Public Transit Study.

Clackamas County. According to Clackamas County's Planning Background Report, Economics, Review Draft - May 1979, the transportation system in Clackamas County is generally adequate. Completion of I-205 is expected to facilitate further growth due to quicker access to Portland International Airport and other areas.

Clackamas County's rural areas generally do not enjoy an urban level of service. The regional transit system is considered generally inadequate in serving existing commercial and industrial areas. Insufficient public funds for improvement and dedication of roadways adds transportation facility development costs to the location costs of large firms selecting the more rural areas of Clackamas County. It appears that the constraint on highway and roadway funding will continue.

Role of Transportation in Location Decisions. Another important locational factor for the new industries is proximity within one-half hour to a major airport. The enormous value and compact size of silicone wafers and other electronics components and instruments sometimes require their shipment by commercial airlines rather than by air cargo. The Portland International Airport (PIA) provides this service within the SMSA.

The PIA could place these large firms in either Washington or Oregon. The expected completion of I-205, however, greatly enhanced the attractiveness of locating in Clark County where sufficient land with infrastructure is also available. Completion of I-205, is expected to provide shippers with faster access to PIA from Vancouver (15 minutes across the Columbia River using I-205 compared with one-half hour west along SR 14 to I-5 and across the river).

The expected completion of I-205 was also a predominant factor in the site selection of Vancouver Regional Shopping Mall, a regional center serving shoppers from both Vancouver and Portland.

Existing congestion on the I-5 bridge is considered by persons interviewed in Clark County as the most significant drawback in establishing a regional business in the county. Part of the I-5 bridge traffic will be diverted to I-205 upon its completion. Traffic congestion will also be eased by planned facility improvements on I-5 north and south of the bridge. However, increased use of paratransit and other multi-occupancy vehicles supported by high-occupancy vehicle lanes, park-and-ride lots, flyer stops and other TSM actions will be necessary to further improve mobility.

The proposed 15-mile Banfield light rail transit (LRT) line connecting downtown Portland with suburban Gresham in eastern Multnomah County is expected to

relieve traffic pressures along the Banfield corridor in the eastern part of the Portland metropolitan area.

Secondary Elements

The secondary elements underlying uneven rates of growth are considered less significant to the location decisions of large industrial firms. Therefore, large industries do not appear to concentrate heavily on these factors in reaching location decisions. According to those interviewed, the benefits derived from secondary uneven growth elements are considered more for their value as "extras" after a decision to locate has been reached.

Labor Market Accessibility

The Portland-Vancouver SMSA's labor market is quite broad and diverse. Difficulties have not been experienced in obtaining the required levels of labor skill. Assembly line and technical personnel are recruited from local sources, and highly skilled personnel are usually recruited from outside the area. Approximately equal proportions of these three groups are required by the electronics industry. Regional shopping centers (e.g., Vancouver Mall) can employ up to 1,800 full-time personnel and require only a small percent of highly skilled individuals. The rest of the labor for retail and office employment is drawn from the labor pool in the local area.

As increasing industrialization takes place in Clark County, the labor market residing in the county (as well as in Oregon) will require a more effective means of commuting to job sites in Clark County. Therefore, the uneven growth rate of the labor force is expected to particularly affect the transportation system as commuter traffic volumes increase. If the current patterns continue, greater travel demand will be placed on east-west arterials within Clark County, than on the I-5 and I-205 bridges.

Taxing and Regulatory Environment

Home Purchases. Oregon has a Veterans Administration (VA) program for home purchases which is not available in Washington. Although the present decline in home purchases nationwide has affected both Portland and Vancouver, the VA program has favored the purchase of homes in Oregon over Washington. This factor will help growth in Oregon.

State Income Tax. Oregon has a state income tax and Washington does not. Washington residents working in Oregon are required to pay Oregon's state income tax. Oregon also has a corporate income tax.

State Sales Tax. Washington has a sales tax; Oregon does not. While Washington residents are required to pay the state sales tax, the sales tax is not imposed on out-of-state residents provided they have purchased a non-resident permit (\$1.00) issued by the Washington State Department of Revenue. This non-resident program was enacted in 1967. In fiscal 1980, approximately 5100 permits were sold statewide.

These differences in taxing and regulatory environment in the Portland-Vancouver area should not alter immediately the uneven growth rates in population and employment. The conditions are such that the advantages versus the disadvantages of living, working, and buying in Portland, as opposed to Vancouver, are expected to reach a balance over time as Clark County develops and diversifies its economic base through growth in its office and retail industries.

Possible adverse effects on location decisions due to the Washington State sales tax is offset by a state income tax in Oregon. In addition, doing business in Portland is reported by respondents to be more expensive than in Vancouver due to the relatively higher overhead costs which Portland businessmen must cover. Most of those interviewed believe that it is therefore more expensive to do business in Portland than in Vancouver. Respondents stated that the higher overhead costs are transferred to consumers, and that the cost of goods and services is relatively higher in Portland than in Vancouver. However, as a group, respondents concluded that due to Washington's sales tax, the price of goods and services is about the same in both Portland and Vancouver.

As fuel costs and travel times increase, major shopping centers in Vancouver are expected to serve a larger proportion of the existing Vancouver market and provide greater shopping opportunities to Clark County residents. With the completion of I-205, the Vancouver Shopping Mall anticipates attracting more Oregon shoppers. At the same time, I-205 can be also expected to promote retail activities in Oregon.

Water and Power

Adequate supplies of water are presently available but demand is increasing in both areas. Power rates are currently lower in Vancouver than in Portland. Though lower power rates are an attractive feature, the cost of power in Portland is still relatively low when compared to other areas of the United States. Even if power rates rise in Vancouver, the increase is not expected to significantly affect growth rates.

Scenic and Recreational Resources

Employee amenities most often referred to by those interviewed are either found in both Portland and Vancouver or are accessible to their residents. These amenities are the natural attractiveness of the Northwest, indoor and outdoor recreational opportunities, and social and cultural activities associated with a major cosmopolitan city. Large firms point these features out to prospective employees, hoping that employees will be attracted both by their company's job opportunities and by the quality of life reflective of this area's natural surroundings.

Market Accessibility

The largest manufacturing firms locating in the area recently have been high technology electronics industries.

Manufacturers of silicone wafers and other electronic components are suppliers to large manufacturers of electronic instruments. Market accessibility for these firms means locating near or adjacent to the firms they supply. Other industries

competing with the large manufacturers of electronic instruments are also attracted to the area. Market accessibility for major electronics firms (such as Hewlett-Packard and Tektronix) means proximity to a large aircarrier airport since their products are high-value cargo and their markets are located primarily outside the area.

Secondary services (restaurants, theaters, retail and office employment) are also a significant part of the area's total population and employment growth. These industries/businesses typically enter areas where the population base is growing. Accessibility for these service-oriented businesses, is convenient location within or near population centers since a major portion of their business depends on the local market. These conclusions along with a summary of other interview results are presented in Appendix F.

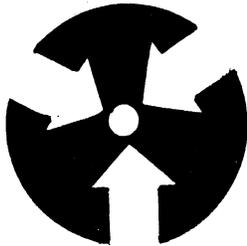
Development Patterns

The Portland-Vancouver SMSA demonstrates that maturation of a metropolitan area is characterized by a succession of stages in which various development patterns dominate its growth.⁹ Figure 9 illustrates and defines each of these four development patterns.

The first of these is the "converging" growth pattern when an urban center emerges as a region's central place. This is followed by the dominance of the "push" growth pattern when the population expands outward to new areas and then "pull" growth when these suburban areas draw activity and travel from the central city. In the final stage "independent" growth in the outlying cities is the dominant pattern. In less than fifty years the Portland-Vancouver SMSA has experienced the first three phases of growth dominance and now signs of the fourth and final phase are emerging.

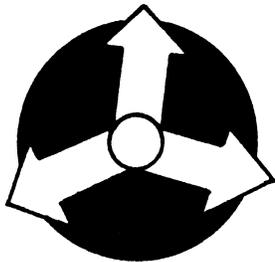
⁹See Appendix A, Bibliography.

FIGURE 9. GROWTH MOVEMENTS: PORTLAND-VANCOUVER SMSA



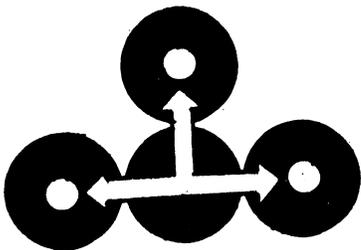
"Converging" Growth Movement

Portland/Multnomah County is a major center acting as a magnet in attracting development growth and travel from surrounding counties.



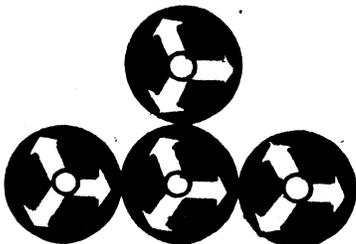
"Push" Growth Movement

Development expands outward from densely developed core in Portland to surrounding areas, viz., Vancouver/Clark County in Washington, and Clackamas and Washington Counties in Oregon.



"Pull" Growth Movement

Growth centers developing in Clark, Clackamas and Washington Counties act as magnets pulling activity and travel from Portland/Multnomah County.



"Independent" Growth Movement

Development occurs as indigenous growth not dependent on development spilling over from Portland/Multnomah County.

The constraints on transportation imposed by the Columbia River restrict the effect of these development patterns on Vancouver and Clark County. Construction of the freeway and additional lanes to the interstate bridge in 1958, was soon followed by expansion of metropolitan growth (i.e., "push" movement) to include Vancouver and much of Clark County. Now that the I-5 corridor between Portland and Vancouver has become capacity restricted, the possibility of "pull" movement patterns is lessened. Development of new electronics plants east of Vancouver will stimulate further urbanization in a "pull" growth pattern. This outward movement into Clark County will be facilitated by the new I-205 bridge (see Figure 6). Likewise, the employment needs of the new plants will hasten "independent" growth patterns for Clark County. The bridge links the new developments to the international airport on the Oregon side of the Columbia. However, most new employees will find greater opportunities for housing and access to commercial centers to be greater in Clark County than on the Oregon side of the river in the vicinity of the bridge.

The new dominance of "independent" growth movements should be accomplished with a stability of travel demand on the I-5 interstate bridge. Should this occur, growth in Clark County would no longer be as highly correlated with traffic on that bridge as has been the case until now.

Planning and Economic Development Goals

The Portland-Vancouver SMSA is a progressive, growth-oriented area which is experiencing rapid and complex changes. Appropriate economic development goals assist in the management of growth trends and their influence on industrial and commercial location decisions. This is true in Portland-Vancouver as it is in other parts of the nation. Appendix G contains a detailed examination of the industrial and commercial activities taking place in Portland-Vancouver as well as the constraints facing future development in each of the four counties.

The goals for economic development in Clark County were developed by the Regional Planning Council of Clark County and are contained in the Clark County Overall Economic Development Plan, 1980 Update. The goals are:

- . Increase industrial employment and diversification.
- . Increase trade and service employment.
- . Increase tourism employment.
- . Provide effective management and utilization of water resources.
- . Maintain agricultural production.
- . Use the county's mineral resources in an environmentally sound manner.
- . Maintain and encourage forest production industry resources.
- . Develop additional energy resources and increase conservation of existing energy supplies.
- . Provide effective management of fish and wildlife resources.
- . Develop the full employment potential of the unemployed.
- . Improve community facilities and services.
- . Improve the transportation system.

All of these suggest a positive approach to economic development.

The economic development goals developed by the Multnomah County Economic Development Advisory Commission (documented in the Overall Economic Development Plan 1979, Volume 2) are:

- . Provide present and future employment opportunities to meet the needs of citizens of Multnomah County.
- . Encourage economic development activities which are compatible with the constraints and potentials of the Portland Metropolitan area.
- . Maintain and encourage a stable and diversified economy in Multnomah County.
- . Facilitate communication and coordination of economic development activities between the public and private sectors.
- . Develop and implement an Overall Economic Development Plan.

The economic development goals of Multnomah County reflect the large population and employment base in the Portland Metropolitan area and the need to ensure future employment opportunities.

Clark County's growth emphasis is not only on diversifying its economic industrial and business base, but also on maintenance, management and utilization of Clark County's agricultural, mineral, forest, fish, wildlife and energy resources. The availability of serviced land, is a prime factor in Clark County's ability to attract major light manufacturing electronics industries. Conversely, Multnomah County is experiencing some constraints in accepting major light manufacturing firms due to the lack of adequately serviced land.

The Clark County Comprehensive Plan¹⁰ proposes that 75 percent of the population growth to 1990 be accommodated in the Vancouver area. Specific land use proposals, for residential, industrial and commercial development and planned public facilities and services, would concentrate urban expansion in the area to the east and northeast of Vancouver presently bisected by I-205.

Land use and development controls, intended to implement the plan, just like economic development goals do not guarantee that development will occur. Clark County must compete for new industry with other counties in the SMSA. In the same way the Portland-Vancouver metropolitan area must compete with other comparable urban centers across the country. However, with regard to the issues of concern in this study, the question is not so much if such development will occur, but rather if its location, when it occurs, will result in increased travel demands across the I-5 bridge. Taken in this light, the development goals, when supported by local land management policy, will modify development patterns. Reserving sites for employment intensive industries and allocating land for residential and commercial development in the same vicinity will facilitate growth with minimal impact on I-5 bridge traffic.

¹⁰Clark County Regional Planning Council, Clark County Comprehensive Plan, Vol. I, Existing Conditions, Population, and Economic Forecasts, Vol. II, Plan, Map, and Text, Vancouver, WA. 1979.

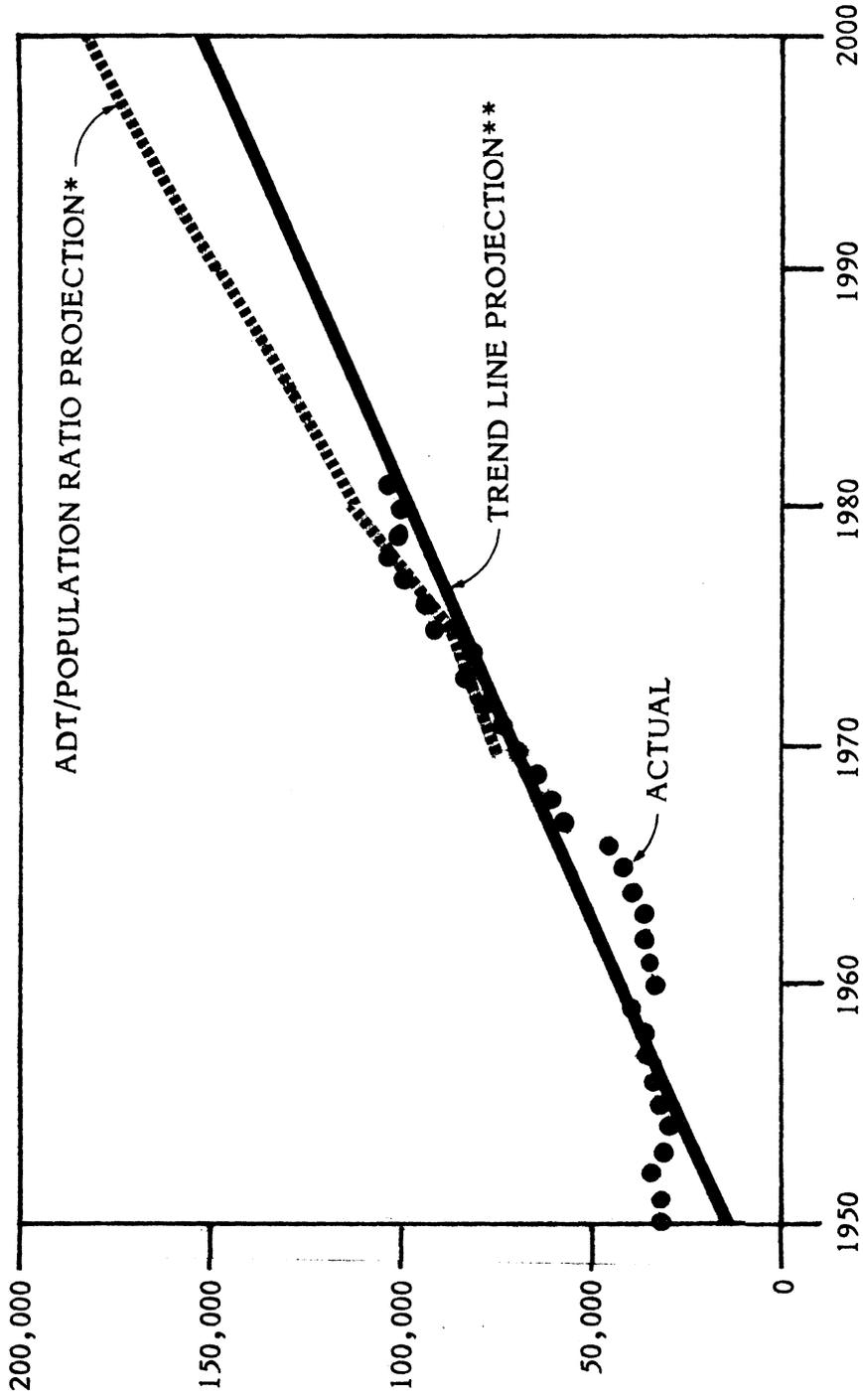
Implications for Transportation Requirements

Even though population growth in the Pacific Northwest region has been slowed by the current economic recession, growth of the Portland-Vancouver SMSA will probably resume. Given the conservative nature of the Metro forecasts, their predicted population of 1,600,000 by 1990 and 1,740,000 for 2000 are not unrealistic. In any case, long-range planning for transportation requirements to the year 2000 must consider potential population growth of no lesser amount. If Clark County continues to accommodate the same proportionate share of population growth as in the past 30 years, the critical issue is whether additional transportation facilities in the Vancouver-Portland corridor will be required.

If one assumes that future traffic demand on the I-5 Bridge will continue to grow at the same rate as it has in the past, then one must conclude that additional facilities would be needed before the year 2000. Projecting future bridge requirements on the basis of the ratio of Clark County population growth and traffic (ADT) on the I-5 Bridge would indicate an even higher future traffic demand. These two approaches to the estimation of future bridge requirements are illustrated in Figure 10.

Taking into consideration the factors which may modify growth patterns provides quite a different view. If additional traffic capacity across the Columbia were to be provided, the new facilities might influence development patterns to the extent that the projected need would constitute a self-fulfilling prophecy. A more critical question is: Will the economic development of Clark County and of the entire metropolitan area be seriously restricted if additional capacity is not added to the corridor? The analysis for this study strongly supports the conclusion that it will not.

FIGURE 10. PROJECTIONS OF FUTURE I-5 BRIDGE TRAFFIC



* Straight line (linear regression) projection of the ratio of I-5 Bridge ADT to Clark County population

** Straight line (linear regression) projection: I-5 Bridge ADT

The opinions of key informants suggest that Clark County will gain an even greater share of new industrial plants and thence a greater proportionate share of the total area's population (see Table 7). Since peak-hour travel demand, made up essentially of work travel, is the most significant factor in traffic demand, the assumption that population growth in Clark County will result in a comparable growth in Vancouver to Portland traffic demand does not hold up.

This is borne out by the variation in growth rates between population and traffic counts. Traffic counts on the I-5 bridge increased over 100 percent from 1960 to 1970, but by less than 50 percent from 1970 to 1980 (see Table 4). On the other hand, the 1970 to 1980 decade saw a greater rate of population growth than the previous ten years (see Table 2). While in the long term traffic demand correlated with population growth, the relationship has deteriorated in more recent years as employment in Clark County has risen (see Table 3).

TABLE 7. DISTRIBUTION OF POPULATION GROWTH AMONG COUNTIES
 PORTLAND-VANCOUVER SMSA, 1950-1980

	1950-1960		1960-1970		1970-1980		1950-1980	
	<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>
Total Four-County Area	117,071	100.0	183,197	100.0	252,093	100.0	542,361	100.0
Multnomah	51,276	43.8	31,827	17.4	18,000	7.1	91,103	16.8
Clark	8,505	7.3	32,677	17.8	70,781	28.1	111,923	20.6
Clackamas	26,322	22.5	53,050	29.0	75,830	30.1	155,203	28.6
Washington	30,968	26.5	65,683	35.9	87,401	34.7	184,132	34.0
Three Suburban Counties	65,795	100.0	151,370	100.0	234,093	100.0	451,258	100.0
Clark	8,505	12.9	32,677	21.6	70,781	30.2	111,923	24.8
Clackamas	26,322	40.0	53,050	35.0	75,830	32.4	155,203	39.4
Washington	30,968	47.1	65,683	43.4	87,401	37.3	184,132	40.8

CONCLUSIONS AND RECOMMENDATIONS

Summary of Findings and Conclusions

Uneven growth rates in the four county Portland-Vancouver SMSA have imposed significant requirements on the area's transportation system. The constraints on that system imposed by the Columbia River and by jurisdictional differences between the two states of Washington and Oregon have imposed unique problems on Clark County and the Washington State Department of Transportation (WSDOT).

This has required giving much greater attention to development patterns, and to land use, and other social and economic factors. In this case, these have a more important role in determining future transportation requirements than in those cases where projections of traffic and population are generally sufficient.

From the analysis undertaken, it is the conclusion of this study that Clark County has reached that stage in its development when future growth can be accommodated with greater independence from the central city of Portland, particularly with reference to intercity transportation facilities (meaning Columbia River bridges). The disadvantages of restricted accessibility between Vancouver and Portland will be more than offset by advantages of the Vancouver area to new industry such as availability of sites, labor supply, taxing policy, etc.

Certainly economic interdependence will continue to grow and social integration into the life of the metropolitan area will not diminish. Nevertheless, the relative importance of those factors which serve to increase peak hour traffic demand, particularly home to work travel, probably will decline in importance. Although there has been a high correlation between population growth and increases in bridge traffic, such a correlation is not a cause and effect relationship which will necessarily continue in the future. With the shift to Clark County of job creating economic development, the principal cause of increased bridge traffic has been reduced.

In terms of WSDOT policy, this means that construction of additional bridge facilities across the Columbia will not be needed before the end of the decade, and quite likely a real need may not arise for many years thereafter. Further, capital

intensive measures to improve interstate transit must be justified in terms of energy conservation rather than as a means of accommodating increased work travel demand.

Recommendations

The nature of this study is to look at the broad issues raised by uneven growth in the Portland-Vancouver SMSA. Thus, recommendations deal with comparable broad policy issues. The basic recommendation is for WSDOT to place its emphasis on facilities and services which serve the Vancouver urban area. This applies to the annual allocation of resources and to long-range planning for the development of further improvements to the transportation system. More specifically, priority should be given to support for C-Tran and to highway improvements for SR 14 and SR 500 which will help to consolidate development in the area immediately to the east of Vancouver.

To the extent appropriate, WSDOT should also participate in and support the following local planning and development efforts:

- . Regional land use planning by providing information essential to overall planning and to rezoning decisions.
- . Planning and development of local transportation facilities including arterial roads and streets in the vicinity of industrial development sites.
- . Interagency cooperation in planning for and development of adequate sanitary sewer systems.
- . Carpool and vanpool efforts by direct participation particularly in HOV facilities and park-and-ride lots.
- . Development of interrelated sites for commercial, residential and industrial sites in the same vicinity by assisting in the coordination between the development of transportation facilities and private land developments which meet the regional and local planning goals.

- . Improving market and labor accessibility by providing major transportation facilities as they are required by the development of new employment centers.

Benefit

This study will benefit WSDOT by bringing decisions concerning transportation requirements into a broader context. The consideration of development patterns, and of economic, social, land use and similiar factors is of particular importance in dealing with the problems imposed by uneven growth rates in the Portland-Vancouver SMSA. The study substantiates the conclusions of previous studies that an additional bridge across the Columbia River will not be needed in the near future.¹¹

The benefits of interagency cooperation in planning and coordination of development are well known without reference to this study. However, in this particular case, WSDOT has much at stake in supporting those policies and programs which diminish the relative demand for interstate bridge facilities.

¹¹Washington State Department of Transportation, Legislative Study, Portland-Vancouver Corridor Columbia River Crossings, Olympia, December 1980. See particularly Chapter 3.

APPENDIX A. INCOMPLETE DATA SETS

- Transit Ridership - Not available for the period and no specific totals kept on inter-county travel.
- Inventory Tax - Both states are phasing out this tax so no future differential burden is anticipated. Difficulty was encountered in determining inventory in specific counties since inventory taxes were paid statewide by companies operating in more than one county.
- Driver's Licenses - Not available by county. License applications are kept by testing stations and not separated by county of residence.
- Directional Peak Hour Traffic - Although a thorough search of the archives was made, Directional Peak Hour Traffic across Interstate 5 bridge during peak hours was only available for the most recent seven years of the study period. All previous records had been destroyed.
- Public Works - Expenditure data on roads and streets by county were not available in Oregon for the entire 30 year period. Data for Washington State is kept by biennium or fiscal years and not calendar years. For the earlier years in Washington, data was not separated from other public works projects within the city or county areas.
- Energy - Gas crisis years -- 1973, 1974 and 1979 -- were used as dummy variables. The number of years involved appears to be too small.

APPENDIX B. SUMMARY AND ASSUMPTIONS OF POPULATION AND EMPLOYMENT FORECASTING

This summary is based on procedures contained in the Year 2000 Growth Allocation Workshops, March-April 1981, by Metropolitan Service District (METRO).

The study area consists of the Portland-Vancouver SMSA consisting of Clark County in Washington, and Multnomah, Clackamas and Washington Counties in Oregon. The comprehensive land use plans of the region's four counties and twenty-five cities formed a composite of the degree to which each of the plans will be developed in the next 20 years. The resulting composite regional plan provided a year 2000 land use pattern to serve as the basis for predicting future travel demands. The Regional Transportation Plan (RPT) is intended to be finalized by this information so that a transportation system can be recommended which will serve the travel demand generated by this future arrangement of land development.

Assumptions

The following assumptions regarding existing and future conditions were taken into account:

1. The regional land use plan will consist of a composite of all city and county comprehensive plans. Future land development will be consistent with these plans.
2. No significant change will occur in the future with respect to currently adopted policies of jurisdictions influencing regional growth and development.
3. Current or projected transportation deficiencies were not considered as a constraint on the pattern of future land development.

4. How and where the next 20 years of growth will occur are based on the growth trends of the past decade.

Employment Forecast

Since 77 percent of the region's population growth in the past ten years has resulted from in-migration due to new job opportunities rather than a net gain in births over deaths, the employment forecast was arrived at first.

To develop the regional employment forecast (Table B-1), two recent independent forecasts were used extensively. The forecasts used were prepared by Economic Research Associates (for the Banfield Transit Station Area Planning Program) and by the Federal Bureau of Economic Analysis. The projection method related the region's future economic growth in terms of its expected share of total U.S. economic growth over the next 20 years.

Population Forecast

A population forecast (Table B-2) was developed by estimating the employment to population ratio.

Employment/Population Ratios

		Previous		
	Metro Forecasts	BEA(1).	ERA(2).	Workshop Ratio
1980	.49	.50	.45	.50
2000	.52	.55	.61	.56

The BEA projection is lower than ERA due to expected demographic changes and the post World War II baby boom. The ERA projection is high compared to BEA or Workshop projections due to its emphasis on projections of past trends.

1. BEA: Federal Bureau of Economic Analysis
2. ERA: Economic Research Associates

TABLE B-1. EMPLOYMENT TRENDS AND FORECAST: 1970-2000
 PORTLAND - VANCOUVER SMSA

	1970	1980	2000	1970-1980	
				Growth	Rate of Growth*
Clark County	25,000	59,100	123,000	34,100	9.0
Multnomah County	230,000	372,900	498,000	142,900	5.0
Clackamas County	23,000	79,300	152,000	56,300	13.1
Washington County	<u>31,000</u>	<u>107,500</u>	<u>198,000</u>	<u>76,500</u>	13.2
TOTAL SMSA	309,000	618,800	971,000	309,800	7.2

	1980-2000		Total Growth 1970-2000	
	Rate of Growth	Growth*	Rate of Growth	Growth*
Clark County	63,900	3.7	98,000	5.4
Multnomah County	125,100	1.5	268,000	2.6
Clackamas County	72,700	3.3	129,000	6.5
Washington County	<u>90,500</u>	3.1	<u>167,000</u>	6.4
TOTAL SMSA	352,200	2.3	662,000	3.9

* In percent, compounded annually.

SOURCE: Adapted from Summary of Year 2000 Growth Allocation Workshop, March-April 1981, Metropolitan Service District (METRO).

State and Metropolitan Area Data Book, 1979, U.S. Department of Commerce, Bureau of Census.

TABLE B-2. POPULATION TRENDS AND FORECAST: 1970-2000
 PORTLAND - VANCOUVER SMSA

				1970-1980	
	<u>1970</u>	<u>1980</u>	<u>2000</u>	<u>Growth</u>	<u>Rate of Growth*</u>
Clark County	128,500	192,300	310,000	63,800	4.1
Multnomah County	554,700	565,400	681,000	10,700	0.2
Clackamas County	166,100	241,900	365,000	75,800	3.8
Washington County	<u>157,900</u>	<u>245,400</u>	<u>384,000</u>	<u>87,500</u>	<u>4.5</u>
TOTAL SMSA	1,007,200	1,245,000	1,740,000	237,800	2.1

	1980-2000		Total Growth 1970-2000	
	<u>Growth</u>	<u>Rate of Growth*</u>	<u>Growth</u>	<u>Rate of Growth*</u>
Clark County	117,700	2.4	181,500	3.0
Multnomah County	115,600	0.9	126,300	0.7
Clackamas County	123,100	2.1	198,900	2.7
Washington County	<u>138,600</u>	<u>2.3</u>	<u>226,100</u>	<u>3.0</u>
TOTAL SMSA	495,000	1.7	732,800	1.8

* In percent, compounded annually.

SOURCE: Adapted from Summary of Year 2000 Growth Allocation Workshop, March-April 1981, Metropolitan Service District (METRO).

APPENDIX C. STATISTICAL APPROACH

Methods

The SHAZAM¹² computer program used in determining the relationship that exists between growth and travel volumes across the Interstate 5 bridge, is described below:

1. The Coefficient of Correlation.

The coefficient of correlation, r , measures the degree of association between two related sets of data. If two sets of data have $r = + 1.0$, they are said to be perfectly correlated positively; if $r = -1.0$, they are perfectly correlated negatively; and if $r = 0.0$, they are not correlated at all.

The coefficients of correlation were developed for the following variables:

x = ADT across the bridge

y_1 = Vehicle Registrations

y_2 = Population by County

y_3 = Retail Sales by County

2. Significance of Correlation Coefficient

For many purposes it is sufficient merely to determine whether or not there appears to be any linear relationship between the variables. In any event, the ratio of the explained variation to total variation, called

¹²White, Kenneth J., "A General Computer Program of Economic Methods - SHAZAM", Econometrica, Rice University, Houston, Texas, 1978.

the coefficient of determination, is r^2 or the square of the coefficient of correlation.

The variables in the study may then be explained: if $r = 0.4$ for variables x and y_1 , then $r^2 = 0.16$ so that only 16 percent of the total variation is explained by some relationship. Also, correlation analysis assumes variables to have a linear relationship and steps were taken when necessary to modify variables analyzed in a linear mode.

3. Linear Prediction -- Regression

If two variables are significantly correlated, it is possible to predict values of one variable from those of the other. The results are generalized to the population from those of the other. The results are generalized to the population from which the sample is drawn by means of a regression equation:

$$y' = a + bx \text{ or } x' = a' + b'y$$

The symbol y' refers to the predicted value of y from a given value of x . This equation is obtained by a technique known as least-squares and assumes that the relation between the variables can best be described by a straight line.

ANALYSIS SAMPLE:

Develop regression equations which may be used to predict the ADT across the bridge from:

1. Vehicle registrations by county and year (1950-1979)
2. Population by county (1950-1979)
3. Retail sales by county (1950-1979)

Regression Coefficients:

$$b = \frac{n (\sum xy) - (\sum x) (\sum y)}{n (\sum x^2) - (\sum x)^2}$$

$$a = \frac{y - b x}{n}$$

Even though the actual predictive value of the regression equation may be open to question, a regression equation often yields valuable information, even if the correlation is not significant. In cases where r is close to + 1.00 or - 1.00, the regression equation is extremely valuable.

4. Binomial Variable

A binomial experiment is an experiment with only two possible outcomes. The binomial experiment for the present study is to determine the extent of change, if any, when there is a possibility that a change has occurred.

Analysis sample: Do fuel shortages affect travel across a bridge?

Since there are only two possible outcomes, either a change in the trend has occurred or not, the coefficient of the binomial variables will indicate the change in the trend and whether or not that change is significant.

Hypothesizing there is a trend between 1950 and 1970. If a change does not affect the trend, the coefficient of the binomial variable will be zero (or not significantly different from zero). If a change does affect the trend, the coefficient of the binomial variable will be significantly different from zero.

Results

In measuring the impacts the growth rate would have on transportation requirements, traffic utilizing the Interstate 5 bridge was used to represent the concept "travel demand" and population statistics for Clark, Multnomah, Washington and Clackamas Counties represented "growth rates." To analyze "impact," two questions were raised:

1. If the population increases in any of the four counties, will traffic on the Interstate 5 bridge also increase?
2. If fuel costs increase, will the amount of traffic on the Interstate 5 bridge decrease despite an increase in available autos?

This last question was asked to determine if the variable "increased fuel costs" was strong enough to cancel out the impact of an increase in available autos. To ensure that population increases reflect an actual increase in available autos, population statistics were correlated with vehicle registrations.

The SHAZAM Computer Program developed by Rice University was used to interpret the raw data. The Pearson R squared formula was used to correlate the variables. The standard error of estimate was determined to equal plus or minus five percent. The following correlations were accepted if the level of significance equaled .05 or less.

1. Population increases in Clark, Multnomah, Washington and Clackamas Counties correlated at the statistically significant level with an increase in traffic on the Interstate 5 bridge. These positive correlations had a confidence level equal to .99.

To determine if increases in population actually reflected increases in traffic population, statistics were correlated with vehicle registration statistics. It was found that:

1. No statistically significant correlations existed between population and vehicle registration in Multnomah County. The reader should note that while a positive correlation (.58 confidence level) existed between increased vehicle registrations and population increases in Multnomah County, this correlation was not found to be statistically significant. Though it is quite possible that traffic did increase in Multnomah County, that increase was not statistically significantly reflected in vehicle registrations.
2. There was a statistically significant positive correlation between an increase in population and an increase in vehicle registrations in Washington and Clackamas Counties. The confidence level was determined to equal .99.
3. There was a statistically significant positive correlation between an increase in the number of vehicles registered. Those variables correlated at a .99 confidence level.

While it has been determined that an increase in population resulted in an increase in traffic in Clark, Washington, and Clackamas Counties, the question arises to what extent have traffic increases in those three counties influenced travel on the Interstate 5 bridge. To answer this question, the variable of increased vehicle registration for each of those three counties was correlated with the Average Daily Traffic (ADT) on the Interstate 5 bridge. Vehicle registrations in Multnomah County were correlated with average daily Interstate 5 bridge traffic. Only one statistically significant correlation was found -- there was a significant positive correlation between increased vehicle registrations in Clark County and an increase in the average daily traffic on the Interstate 5 bridge.

An effort was made to determine whether increases in fuel costs decrease travel on the Interstate 5 bridge despite population increases in the counties surrounding the bridge. The influence of variables such as increases in population and in the number of registered vehicles were eliminated. The Interstate 5 bridge traffic statistics for the 1973-1979 period were compared with bridge traffic statistics for 1980 and 1981.

A statistically significant negative correlation existed between an increase in fuel costs in 1973-1979 and a decrease in the average daily Interstate 5 bridge traffic. The confidence level was determined to equal .96.

Transit Ridership Forecast

The projection of ridership on the transit route over the I-5 bridge, was computed as follows:

From the data on monthly ridership over the I-5 bridge, provided by Tri-Met (Table 5), a 12-month running average was calculated for each month from January 1979 to June 1982. These data were then used in a linear regression equation in which "x" was the month of operation from January 1977 (i.e., January 1979 = 25, June 1982 = 66) and "y" was the number of "monthly boarding riders." The calculations produced a projected number of monthly riders of 153,247 for June 1990 and 260,620 for June 2000. Based upon Tri-Met's use of 22 average operating days per month these monthly forecasts are equal to 6,966 riders per day for June 1990 and 12,210 for June 2000. The coefficient of correlation was .987 and the average monthly increase (slope of the line) was 961.44. The forecast for June 1982 was 61,429 compared with the "actual" Tri-Met figure of 71,868. This difference reflects an unusually high rate for that particular month in addition to the common seasonal deviation reduced by monthly averaging. Even so, this provides some indication that the forecast may be reasonably conservative.

APPENDIX D. TRANSPORTATION FUNDING LEVELS, OREGON AND WASHINGTON

Table D-1 sets forth the funds available to the Department of Transportation in each of the two states. As shown, Washington has consistently been able to obtain approximately fifty percent more than Oregon.

Table D-2 presents the annual disbursement of funds. In any one year receipts do not balance disbursements since accounting is on a biennial basis and disbursements not common to both states are not included in Table D-2. The first column of Table D-2 is most important to the issues in this study. Although the difference between states varies considerably from year to year, Washington has allocated significantly more funds to capital outlay for roads and bridges.

TABLE D-1. RECEIPTS FOR STATE ADMINISTERED HIGHWAYS

WASHINGTON AND OREGON - 1970 to 1980
(Thousands of Dollars)

	Motor Fuel Taxes	Motor Vehicle & Carrier Taxes	All Other State Receipts	FHWA	All Other Government Payments ¹	Issue of Bonds	Total Receipts
1970 (Washington Oregon)	\$ 69,893 43,658	\$44,890 26,279	\$26,181 4,185	\$106,516 74,383	\$ 3,080 2,166	\$10,074 15,003	\$260,634 165,674
1971 (Washington Oregon)	86,525 43,920	47,150 27,833	31,114 4,851	113,699 106,902	1,044 3,261	47,153 15,002	326,685 201,769
1972 (Washington Oregon)	87,324 46,737	47,450 32,090	29,915 4,924	131,693 108,026	7,167 1,034	66,114 --	370,473 192,811
1973 (Washington Oregon)	86,883 48,003	45,663 33,941	34,614 9,162	110,731 78,664	1,246 1,620	-- --	279,137 171,390
1974 (Washington Oregon)	90,575 41,820	50,584 40,692	40,541 6,777	110,618 78,507	6,200 2,719	-- 25,000	298,518 195,515
1975 (Washington Oregon)	85,412 38,426	52,038 25,789	37,982 7,677	130,548 125,166	8,409 2,444	-- --	314,389 199,502

¹ Other Federal Agencies, also Counties and Municipalities.

TABLE D-1. RECEIPTS FOR STATE ADMINISTERED HIGHWAYS (Continued)

WASHINGTON AND OREGON - 1970 to 1980
(Thousands of Dollars)

	Motor Fuel Taxes	Motor Vehicle & Carrier Taxes	All Other State Receipts	FHWA	All Other Government Payments ¹	Issue of Bonds	Total Receipts
1976 (Washington Oregon)	81,409 47,234	51,607 43,626	42,072 4,987	115,105 82,988	7,667 5,906	-- --	297,860 184,741
1977 (Washington Oregon)	97,797 49,901	75,701 38,815	38,854 7,034	126,461 70,127	4,402 4,891	35,236 --	378,451 170,768
1978 (Washington Oregon)	115,094 51,707	71,593 52,561	55,772 7,327	161,611 86,752	2,448 14,864	-- --	406,518 213,211
1979 (Washington Oregon)	111,701 52,687	88,302 46,699	90,680 18,922	207,841 117,650	6,264 12,349	35,243 --	540,031 248,307
1980 (Washington Oregon)	124,056 60,514	89,938 65,319	53,876 45,837	249,280 158,015	17,626 6,661	-- 15,009	534,776 351,355

¹ Other Federal Agencies, also Counties and Municipalities.

Source: Highway Statistics - 1970 through 1980, U.S. Department of Transportation; Federal Highway Administration.

TABLE D-2. DISBURSEMENTS FOR STATE - ADMINISTERED HIGHWAYS

WASHINGTON AND OREGON - 1970 to 1980

(Thousands of Dollars)

	Capital Outlay for Roads & Bridges	Mainte- nance & Traffic Services	Adminis- tration	Highway Law Enforce- ment & Safety	Bond Interest	Bond Retire- ment	Total Disburse- ments
1970 (Washington Oregon)	\$174,908 108,682	\$ 39,267 22,138	\$13,821 8,896	\$ 20,949 8,383	\$ 8,940 1,005	\$14,697 5,200	\$272,582 154,304
1971 (Washington Oregon)	192,158 160,538	43,991 23,211	19,654 9,247	24,735 11,135	12,594 2,151	16,743 5,950	309,875 212,232
1972 (Washington Oregon)	214,596 160,293	46,524 25,610	26,601 10,066	22,492 13,506	16,787 2,314	18,168 5,150	345,168 216,939
1973 (Washington Oregon)	159,865 97,443	54,014 31,421	19,876 12,727	26,830 14,925	14,404 2,139	16,812 4,400	291,801 163,055
1974 (Washington Oregon)	153,757 101,881	59,204 30,733	18,487 13,633	26,287 18,980	14,681 1,980	14,872 3,900	287,288 171,107
1975 (Washington Oregon)	163,735 148,464	73,214 39,521	16,373 14,989	27,089 20,263	12,988 3,496	15,814 2,300	309,213 229,033

TABLE D-2. DISBURSEMENTS FOR STATE - ADMINISTERED HIGHWAYS (Continued)

WASHINGTON AND OREGON - 1970 to 1980

(Thousands of Dollars)

	Capital Outlay for Roads & Bridges	Mainte- nance & Traffic Services	Adminis- tration	Highway Law Enforce- ment & Safety	Bond Interest	Bond Retire- ment	Total Disburse- ments
1976	(Washington Oregon) 143,721 92,783	76,524 37,641	18,604 13,953	31,111 23,195	12,041 3,374	17,355 2,300	299,356 173,246
1977	(Washington Oregon) 169,258 84,739	85,529 48,275	21,581 13,893	32,443 27,697	12,008 3,252	11,798 2,300	332,617 180,156
1978	(Washington Oregon) 226,354 96,155	98,448 54,251	21,822 14,263	37,856 30,038	12,419 3,131	10,892 2,300	407,791 200,138
1979	(Washington Oregon) 323,322 163,296	113,598 56,890	21,357 16,400	45,689 22,385	12,110 3,023	14,437 2,300	530,513 264,294
1980	(Washington Oregon) 362,107 228,191	118,463 68,539	45,545 21,161	51,706 29,233	13,053 2,933	9,225 3,301	600,099 353,359

Source: Highway Statistics - 1970 through 1980, U.S. Department of Transportation, Federal Highway Administration.

APPENDIX E. INTERVIEW QUESTIONS

Location Decision

1. Do you see differences in growth rates between Portland and Vancouver?
2. What factors are industries/businesses looking at when they come to (Oregon - Vancouver)?
3. Which characteristics should be emphasized to persuade industries/businesses to relocate in this area?
4. What factors have influenced industries/businesses to turn down this area?
5. What are the main advantages of locating in the county rather than the city?
6. The main disadvantages?
7. What are the main advantages of this area as opposed to across the river?
8. The main disadvantages?
9. Are there any factors that may cause industries to relocate out of this area?
10. Are there any factors that would cause industries/businesses to relocate across the river?
11. Have firms locating in this area relocated to another area?
12. Do you know of firms with plans for expanding facilities outside this area?

Labor Market

1. We are also interested in the Vancouver/Portland situation with respect to personnel. What skills in particular are required?
2. Have industries/businesses encountered any difficulty in obtaining skilled or semi-skilled workers?
3. What kinds of difficulties have been encountered?
4. What skills in particular were a problem?
5. Have industries/businesses been able to satisfy their labor needs locally?
6. Have they had to import labor into the area?
7. What fringe benefits are available for employees?

Market

1. What is the general market in the state?
2. What is the general market outside the state?
3. Where are the major competitors in the products of this area located?
4. Does location in this area offer advantages in the production of these products?
5. Does location in this area offer disadvantages?

Transportation

1. What mode or modes of transportation did industries/businesses consider in locating in this area?

2. Is siting adjacent to or near airports an important consideration for industries in this area? Which industries?
3. What transportation services were considered in locating on one side of the river rather than the other?
4. Are employee parking and transportation factors that were considered by industries/businesses?
5. What types of parking and transportation for employees were considered?
6. Do you see transportation problems associated with the work of industries in this area?

Energy

1. What type of energy is required?
2. How much energy is required?
3. Are the energy availability and price forecasts factors which compare favorably for this area as opposed to other areas?

Socio-Cultural

1. What has been the response to economic development activities in this area on the part of the communities affected.
2. Are the social needs of employees a factor in industrial developments?
3. Are land uses being integrated within industrial developments? (commercial, recreational, housing needs)

4. Are facilities and services comprising the communities' infrastructure, such as police, fire, schools, hospitals, government being considered as part of the economic development activities of this area?
5. Are public recreational areas such as parks being considered in these economic development activities?

Public Policy

1. What do you feel state and local governments do that would be effective in attracting industries/businesses to this area?
2. Do you have information from other states that would be relevant in placing this area in a favorable competitive position? Unfavorable position?
3. Have you had occasion to get state and local tax information of other states?
4. Do you see land use restrictions creating problems for economic development?
5. Do you see land use requirements an advantage to industries on this side of the river as opposed to the other?
6. Is there adequate land for expansion?
7. We are also interested in the legal climate. By legal climate we mean legislative action and court interpretations; workman's compensation; environmental requirements; local taxes; local ordinances, etc.

In regard to such matters, would you say this area was more favorable, about the same, or less favorable to industries than across the river?

APPENDIX F. SUMMARY OF INTERVIEW FINDINGS

A. PRIMARY UNEVEN GROWTH ELEMENTS

Vancouver/East Clark County, Washington

1. Location of large electronics firms in Vancouver/East Clark County.
2. Availability of sufficient land for large industrial development.
3. Adequate sewerage system to sustain development.
4. Existing SR-14 and Interstate 5 to access Portland International Airport (PIA).
5. Congestion on Interstate 5 bridge across Columbia River.
6. Expected completion of Interstate 205 as major facility for transport of goods to PIA, and attracting shoppers from Oregon.
7. Proximity of electronics industries to PIA.
8. Constrained east-west traffic flow.

Portland/East Multnomah County, Washington

1. Location of smaller industrial, office and retail type employment groups in Portland/East Multnomah County.
2. Availability of smaller parcels of land for smaller development activities.
3. Difficulty in obtaining adequate sewerage service in Multnomah County due to high water table of available land and subsequent high development costs.

4. Expected completion of Interstate 205 and Banfield Light Rail Transit and highway related improvements.
5. PIA located in this area.
6. Large population and employment base.

B. SECONDARY UNEVEN GROWTH ELEMENTS

Vancouver/East Clark County, Washington

1. Labor market with diverse skills in immediate local area.
2. No corporate income tax.
3. No state income tax.
4. State sales tax imposed.
5. Lower property taxes.
6. Lower water and power rates than Oregon.
7. Lengthy rezoning hearings.
8. Lower cost of land.
9. Attractiveness of natural geographic area.
10. Diverse cosmopolitan center nearby (Portland).
11. Local, regional, national and international markets accessible through transportation network serving area.
12. Relative price of durable goods is lower than in Oregon.

Portland/East Multnomah County, Washington

1. Sufficient local labor resources in immediate area.
2. Imposes corporate income tax.
3. Imposes state income tax.
4. No state sales tax.
5. Higher property taxes.
6. Offers attractive VA home purchase program.
7. Higher property taxes, water and power rates than Washington.
8. Lengthy rezoning hearings.
9. Higher cost of land.
10. Higher cost of developing land.
11. Attractiveness of nearby geographic area.
12. Large cosmopolitan center with diverse amenities.
13. Local, regional, national and international markets accessible through transportation network serving area.
14. Relative price of durable goods is higher.

C. TRANSPORTATION ISSUES: Portland/Vancouver

1. An adequate system of highways, streets and roads is important to the continuing growth of Clark County.
2. Proximity to a major airport is a crucial factor to certain large firms.
3. Congestion on Oregon section of Interstate 5 bridge across the Columbia River is a major problem affecting the entire study area.
4. Completion of Interstate 205 is perceived as an advantage to electronics firms in Clark County seeking faster access to Portland International Airport and to Vancouver Mall seeking a larger share of the regional market by drawing shoppers from Portland.
5. The public transit system serving the bi-state study area is overfilled with little immediate relief expected. Transit in Portland has the highest farebox rate in the entire country (\$1 from Portland to Vancouver). Recently, the PTBA comprehensive plan was approved and Vancouver is now authorized to add buses and extend their route coverage in Clark County.
6. Paratransit service is not receiving very much attention.
7. Fixed guideway light rail transit (LTR) is seen as a way of achieving energy efficient mass transportation for the affected areas.

APPENDIX G. STATUS OF INDUSTRIAL AND COMMERCIAL ACTIVITIES

The examination of the economic development goals of the four SMSA counties benefits from a discussion of the development activities taking place as well as the constraints acting upon future development. The information presented in this Appendix serves as supportive background material to the main objectives of the study. The sources of the information presented are the economic development plans of Clark County in the State of Washington, and Multnomah, Clackamas and Washington Counties in Oregon as listed below:

- Clark County Overall Economic Development Plan, 1980 Update
- Overall Economic Development Plan - 1979, Multnomah County, Oregon
- Planning Background Report: Economics - Review Draft, May 1979, Clackamas County, Oregon
- Overall Economic Development Plan: 1980 Update, Washington County, Oregon

Clark County

- a. Vancouver: Industrial land with infrastructure in the area east of Vancouver has enabled two large electronics firms, Hewlett-Packard and Tektronix, to locate into the area. Other firms manufacturing electronics components are also encouraged by the availability of land with basic services. Genstar is developing a large planned community complex within which Hewlett-Packard and Tektronix are situated. The Fruit Valley area west of Vancouver has large parcels of industrial land available for development. The Columbia Industrial Park located along the waterfront is presently fully operational since converting shipyard to industrial space in 1963. Sites zoned or planned for light industry usage is also available in the area northeast of Vancouver.

Constraints: Transportation access is a constraint to development taking place in the area east of Vancouver, mainly due to constrained traffic circulation. The Fruit Valley area requires transportation access and basic utilities for development. Northeast of Vancouver, the industrial land sites have varying needs for water service, sanitary service, drainage and land fill.

- b. Additional Areas: The following areas in Clark County have parcels available for light industry: northern Clark County, Ridgefield, Camas-Washougal, and LaCenter.

Constraints: Varying needs for development include utilities, redevelopment and road access. In northern Clark County, the local perception is that the lack of a port district to act as coordinator of local projects, a funding conduit, and a source of local matching has slowed realization of the area's potential.

Multnomah County

Within urban unincorporated east Multnomah County, three industrial employment centers have been identified by the Multnomah County Comprehensive Framework Plan. These include: (1) Cully/Parkrose; (2) Columbia; and (3) Wilkes/Rockwood. These areas are close to labor markets and accessible to the urban transportation network. The Port of Portland is continually monitoring the status of potential development in the Rivergate Industrial District. The Swan Island Industrial Park contains developable land. Guild's Lake, Central Eastside, Albina, Brooklyn, Macadam, Banfield and Hayden Island offer development possibilities through the expensive process of redevelopment.

Constraints: For east Multnomah County, sanitary sewer service needs to be generally extended for full development. Immediately developable industrial land are mostly small parcels with a few large sites available. The main constraining factor in developing Rivergate is the inadequate capacity of the transportation system connecting Rivergate to regional freeways such as Interstate 5. Major access

problems also need to be resolved for development of available land in the Swan Island Industrial Park and Hayden Island. The majority of the available land in east Multnomah County is located in areas with a high water table. Hence, redevelopment, sewerage facilities and road access are major factors inhibiting manufacturing growth.

Clackamas County

- a. West Urban District: Closest to the Portland metropolitan core of the planning districts in Clackamas County, the West Urban District comprises a relatively high proportion of jobs in office and retail employment. The manufacturing sector accounts for approximately one-fourth of the employment with paper manufacturing exerting a relatively strong presence.

Constraints: Reflects county-wide development shortage of commercial land. County-wide development will require from 1,540 to 2,100 acres of commercial land whereas 425 are available.

- b. East Urban District: Industrial development is concentrating in the East Urban District with warehousing and wholesaling activities in the Milwaukee expressway area and near Interstate 205. This area is also strong in primary and fabricated metals processing. The Milwaukee Expressway/Interstate 205/Highway 212 area is served by rail, freeway and major utilities. Access to the Portland International Airport is possible with completion of Interstate 205.

Constraints: Excessive parcellization is considered a major factor contributing to high land prices and to the slowing down of industrial location. The Milwaukee Expressway/Interstate 205 industrial area consists of left-over wetlands which forces high development costs upon industries locating in this area.

- c. Urbanizing East District: Industrial manufacturing is also developing in the Urbanizing East District and is considered an east and southward extension of the Urban East District adjacent to it. Completion of Interstate 205 and the

Clackamas town center are expected to encourage growth in both business and housing in this area.

Constraints: None identified at present.

- d. Wilsonville/Canby District: This area reflects the county's highest proportion of machinery and instruments manufacturing. Nearly half of the development in the Wilson/Canby District is in the manufacturing sector with the electronics industry comprising a major portion. Traditionally agricultural, this area has experienced most of its growth in other industries since the completion of Interstate 5. Rapid growth in manufacturing industries is facilitated by rail, freeway and utilities.

Constraints: None identified.

- e. South Rural District: The lumber and wood products industry strongly influences the economy of the South Rural District. Growth movements north and northeast to adjacent districts may increase with decreasing timber sales since other industries are not well represented in this area.

Constraint: Poor access to the urban transportation network makes the South Rural District a relatively poor location for industries other than lumber and wood products at present.

- f. North Rural District: Logging and sawmills comprise about one-half of the manufacturing employment in the North Rural District. The recreational industry is also quite strong but is subject to economic downturns since it is associated with the recreational second-house industry.

Constraint: Poor access to the North Rural District to the urban transportation network to the east presently makes this area a poor location for industries other than logging and sawmills.

Washington County

- a. Tigard Area: Industrial and commercial activity has continued to grow in the Tigard Area which offers an attractive location for many businesses. The room needed by firms to expand, proximity to the Interstate 5 freeway and the attractiveness of the area's natural environment have contributed to making the area more independent of the converging growth effect toward Multnomah County.

Constraints: Transportation and storm sewer systems are inadequate. Transit service to industrial areas is also inadequate.

- b. Forest Grove Area: Commercial activity in the Forest Grove Area includes the entry of national chain franchises and the Ballardtowne Square shopping center. Land costs in Forest Grove are somewhat lower than in other parts of Washington County, and the presence of Pacific Univeristy is an attractive element to high technology firms. Industrial development is occurring in this area with the Tektronix Corporation negotiating for a 100 acre site in Forest Grove for its electronic components manufacturing operation.

Constraints: Substantial portions of vacant commercial land are inadequate to meet anticipated demand due to high parcellization and land committed to residential uses. New commercial development is therefore not able to gain easy entry into the area.

- c. Hillsboro Area: Continued retail-office development is expected to concentrate activity in Hillsboro so that its role as a growth center will increase. The city's water supply, open spaces and relatively sparse population density are seen as valuable elements for more economic development. The Intel Corporation has indicated intention to locate its micro-computer manufacturing plant in Hillsboro.

Constraints: Although the supply of vacant commercial land is adequate for the near term, the supply of large industrial parcels is diminishing. Land use controls (Urban Growth Boundary and the city's

urban planning area) are effective in serving development as infrastructure becomes available.

- d. Beaverton Area: Beaverton is the largest city in Washington County. Two major arterials (Highway 217 and 26) serve this city and large commercial and industrial firms are locating to the area. "Parallel, provider and secondary" type industries are also locating to Beaverton attracted by the large firms and the growing population base.

Constraints: The adequacy of the transportation system to meet the demands created by the economic growth in Beaverton is a continuing issue.

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