

Assessing Intercity Commuting Patterns in the Willamette Valley Using the Census Transportation Planning Package (CTPP)

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Abstract

The Oregon Department of Transportation (ODOT) recently completed a study of commuting in the Willamette Valley using data from the CTPP to help answer questions regarding the effects of commuting on transportation and growth management. Data was extracted from the CTPP database at three geographic scales to perform several analyses of commuter travel. County level data were used to provide a general description of commuting patterns. Data extracted at the minor civil division/place dataset were aggregated into travel analysis zones to evaluate commuter flows to major job centers and to evaluate commuter flows on I-5. Data extracted from the place dataset were used to evaluate relationships between travel time, jobs to worker ratios, and levels of commuting.

The CTPP proved to be a very useful tool for analyzing transportation and growth management issues related to commuting. This paper illustrates that even relatively simple analyses of data from the CTPP can provide valuable perspectives on the nature of intercity commuting in a region, its magnitude and its relationship to congestion, household location decisions and jobs/housing balance.

Introduction

The Willamette Valley is the broad, fertile valley of the Willamette River located in the northwestern part of Oregon. The Willamette River originates in Oregon's Cascade and Coast mountain ranges about 150 miles to the south of its confluence with the Columbia River. The broad valley bottom has much of Oregon's most fertile farmland and most of Oregon's population.

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Three of the state's metropolitan areas and 70% of the state's population are located in the Willamette Valley. The Portland metropolitan area is situated at the northern end of the valley. The Salem-Keizer metropolitan area is located about 50 miles to the south of Portland. The Eugene-Springfield metropolitan area is located near the southern end of the valley. By 2020, the population of valley is expected to exceed three million.

Oregonians are concerned about population growth in the Willamette Valley and its effects on urban growth and livability, air and water quality, and farm and forestlands. Transportation has strong relationships to these concerns. It accounts for a large share of energy consumption and air pollution. It affects the distribution of population and economic activities. Traffic congestion affects public perceptions of livability. Some specific concerns relating to commuting include:

- The effect of intercity commuting on efforts of metropolitan areas to control the growth of vehicular travel.
- The effect of state highway improvements on the growth of urban fringe areas and satellite cities.
- The effect of urban growth controls on housing price and availability and the potential effect on intercity commuting.
- The effect of commuting on state highway congestion, particularly Interstate 5.

Study Methods

The statewide element of the 1990 Census Transportation Planning Package (CTPP) was used as the primary source of data for the study. To simplify the use of the data, the Willamette Valley was defined by county boundaries.² Commuters were defined as all workers who work outside of their homes.

The study used the county, minor civil division, and place datasets. The county dataset was used to provide an overview of commuting patterns including the number of commuters by county, percentage of commuters who work in a different county than where they live, and inter-county commuter flows. The minor civil division and place dataset was used to describe commuting to the primary job centers in the Willamette Valley. The data were aggregated into 29 zones for analysis. Nine of the zones were the major employment centers of interest. Place data were used to examine commuting to satellite cities and relationships between commuting and jobs/housing balance.

To estimate the effect of commuting trips on I-5, 1990 commuter flow data was scaled to produce 1996 commuter flow estimates. Scaling was based on the growth of population and employment in each of the analysis zones between 1990 and 1996.

² Benton, Clackamas, Columbia, Lane, Linn, Marion, Multnomah, Polk, Washington and Yamhill Counties.

Total and peak commuter flows were converted into daily home to work trips using an adjustment factor of 0.82 to reflect absenteeism (COMSIS 1996). Peak hour commute traffic was estimated from the Census reporting of the number of commuters who leave for work between 6:30 and 8:30 AM by assuming that 85% of those commuters were traveling during the peak hour.

County Commuting Patterns

Figure 1 illustrates the number of commuters residing in each county and the proportions that work within the county where they reside and that work in other counties. Table 1 shows the number of commuters by county origin and destination. As expected, the Portland metropolitan area counties accounted for almost two-thirds of the valley’s commuters and jobs. Valley-wide, almost three-quarters of commuters worked in the counties where they lived. Only in Clackamas and Polk counties did more workers commute to jobs outside of their county of residence than inside.

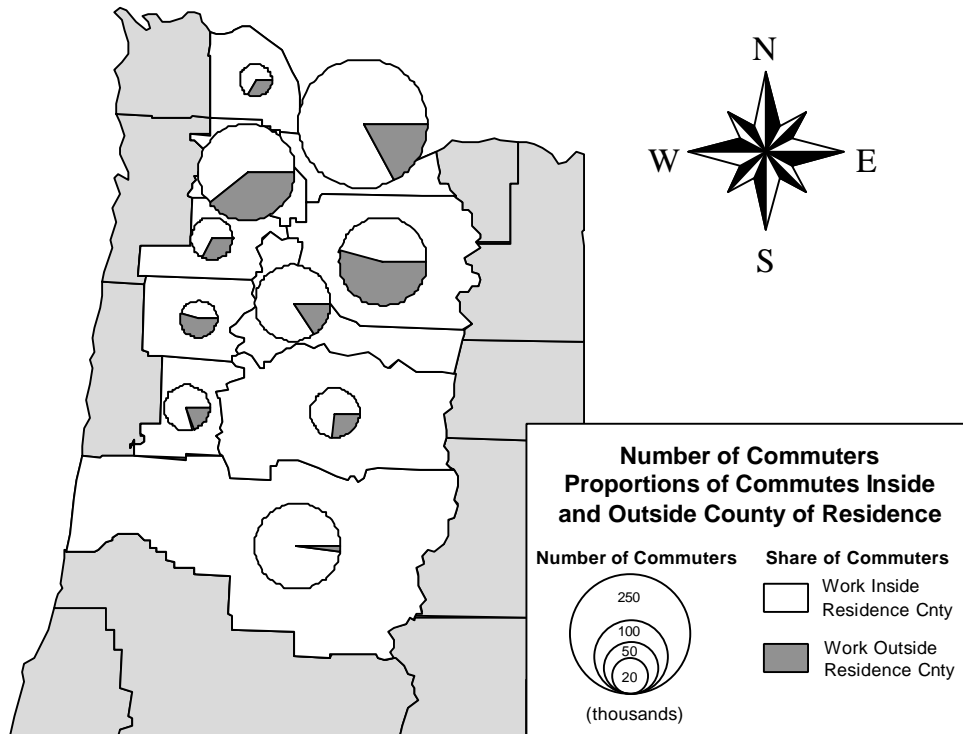


Figure 1. Number of Commuters by County and Proportions Working Inside and Outside Their Residence County

Several inter-county commuting patterns are noteworthy. The majority of inter-county commuters travel between the three counties that make up the greater Portland metropolitan area (Clackamas, Multnomah and Washington). Other flows between counties are very small in comparison. These three counties also attracted about one third of the external commuters originating from other valley counties, mostly from Marion, Yamhill and Polk Counties.

Table 1. County Commute Origins and Destinations, 1990

Residence	Workplace									
	Benton	Clackamas	Columbia	Lane	Linn	Marion	Multnomah	Polk	Washington	Yamhill
Benton	24,326	40	13	668	4,058	695	201	197	131	50
Clackamas	50	59,320	91	105	40	3,280	52,332	63	13,092	467
Columbia	0	182	8,853	5	0	30	3,162	2	1,017	24
Lane	549	85	13	116,269	1,148	348	385	21	99	8
Linn	4,406	39	0	1,579	26,468	3,266	220	117	61	25
Marion	434	3,097	49	328	2,364	79,900	2,835	2,141	2,141	889
Multnomah	47	21,548	639	137	68	1,103	222,025	53	22,966	346
Polk	510	124	20	56	359	7,894	425	8,648	209	1,120
Washington	75	7,868	749	108	28	1,051	49,201	25	92,200	941
Yamhill	71	742	27	14	16	1,149	1,998	476	3,934	17,853

Commuting to Major Urban Areas

A major limitation of analysis using county-level data is that it gives an inflated impression of the magnitude of long-distance commuting. For example, because the Willamette River splits the Portland and Salem metropolitan areas but is the boundary between counties that are part of the areas, much inter-county commuting involves relatively short trips. Inter-county commuting data also do not adequately show the spatial distribution of commute travel. These limitations can be overcome by analyzing data at a finer geographic scale. This was done using the CTPP minor civil division and place dataset. The data were aggregated into 29 zones including 9 employment centers.

Commuter flows to the major employment centers are shown in Table 2. Approximately 80% of the commuters who worked in one of the major employment centers also lived in one of those centers. Over 70% of those people worked in the same center where they lived. Over 90% of the commuting between the major employment centers took place between the four centers (Portland, West Metro, Southeast Metro, Gresham) that make up the Portland metropolitan area.

The data reveal several commuting patterns even at a relatively unsophisticated level of analysis.

- Commuter flows from outside the Portland metropolitan area are small compared to flows between portions of the Portland metropolitan area.
- Commuting up the I-5 corridor into the Portland metropolitan area from counties to the south is very small compared to commuting flows within the Portland metropolitan area.
- Eastbound and westbound commuter flows into several of the centers are larger than northbound and southbound commuter flows.

- The Eugene-Springfield area sends very few commuters to workplaces outside of Lane County and attracts commuters primarily from places within Lane County.

Table 2. Commuting to Primary Willamette Valley Job Centers, 1990

Residence	Workplace									
	Portland	West Metro	Southeast Metro	Gresham	McMinnville	Salem-Keizer	Albany	Corvallis	Eugene-Springfield	Residence Total
Portland	169,243	16,781	12,425	5,808	128	649	29	23	114	205,200
West Metro	41,542	55,229	6,236	520	130	599	7	46	59	104,368
SE Metro	27,574	6,719	23,347	761	52	532	23	31	62	59,101
Gresham	19,989	1,231	1,544	9,983	14	43	16	14	13	32,847
McMinnville	199	331	64	-	4,922	201	-	15	8	5,740
Salem-Keizer	1,433	767	565	41	284	53,897	535	290	192	58,004
Albany	96	16	10	-	-	684	8,500	2,049	71	11,426
Corvallis	100	68	19	16	29	340	985	16,001	187	17,745
Eugene-Spfld.	295	27	47	8	-	202	102	195	72,275	73,151
Columbia Co.	2,971	462	134	25	6	16	-	-	5	3,619
Wash. Co.	7,862	13,899	1,086	137	83	129	-	29	21	23,246
Rural Portland	7,245	964	615	1,463	-	41	-	-	10	10,338
NW Clack. Co.	11,200	2,980	7,539	713	11	337	5	-	8	22,793
SE Clack. Co.	4,638	669	4,274	543	5	118	-	8	15	10,270
Mt. Hood Corr.	3,195	295	664	1,687	-	39	-	-	-	5,880
Yamhill Co.	1,898	2,567	580	19	3,050	803	12	46	12	8,987
Molalla Area	1,125	605	951	71	17	1,648	20	12	8	4,457
Woodburn Area	802	812	1,006	16	9	841	21	-	6	3,513
Stayton Area	130	30	36	3	27	3,630	587	92	11	4,546
Rural Salem	112	34	101	16	27	5,596	82	18	30	6,016
Polk Co.	239	48	78	8	182	4,485	204	377	36	5,657
Rural Albany	12	3	15	-	7	196	1,797	954	46	3,030
Linn Co.	83	20	17	7	-	541	2,381	981	1,438	5,468
Benton Co.	36	26	7	-	6	167	265	4,672	228	5,407
West Lane Co.	39	-	8	-	-	23	30	50	4,722	4,872
Rural Eugene	14	-	6	-	-	21	-	11	4,825	4,877
NE Lane Co.	-	-	-	-	-	7	-	19	2,694	2,720
SE Lane Co.	-	-	-	-	-	-	6	13	2,592	2,611
South Lane Co.	6	-	-	-	-	9	2	-	2,836	2,853
Workplace Total	302,078	104,583	61,374	21,845	8,989	75,794	15,609	25,946	92,524	708,742

Commuting from Satellite Cities

The CTPP place level dataset can be used to illustrate the influence of major employment centers on satellite city development. This dataset includes tables that report median and mean travel times to work by travel mode and by origin and destination for all commuters and for commuters who leave for work between 6:30 and 8:30 AM. The

study compared the mean single-occupant vehicle travel time to Portland, Salem and Eugene with the percentage of commuters who commute to each of these destinations.

Figure 2 shows the relationship between travel time and commuting to Portland. It can be seen that an exponential function fits the data fairly well. Commuting drops off rapidly with increasing travel time. For example, while a city located 20 minutes away from Portland could be expected to send about 60% of its labor force to Portland, a city located 40 minutes away would send less than 20% of its workers there. Cities that are more than 50 minutes away send less than 10% of their workers to Portland. This relationship can be used to estimate the effect of highway improvements on satellite city growth.

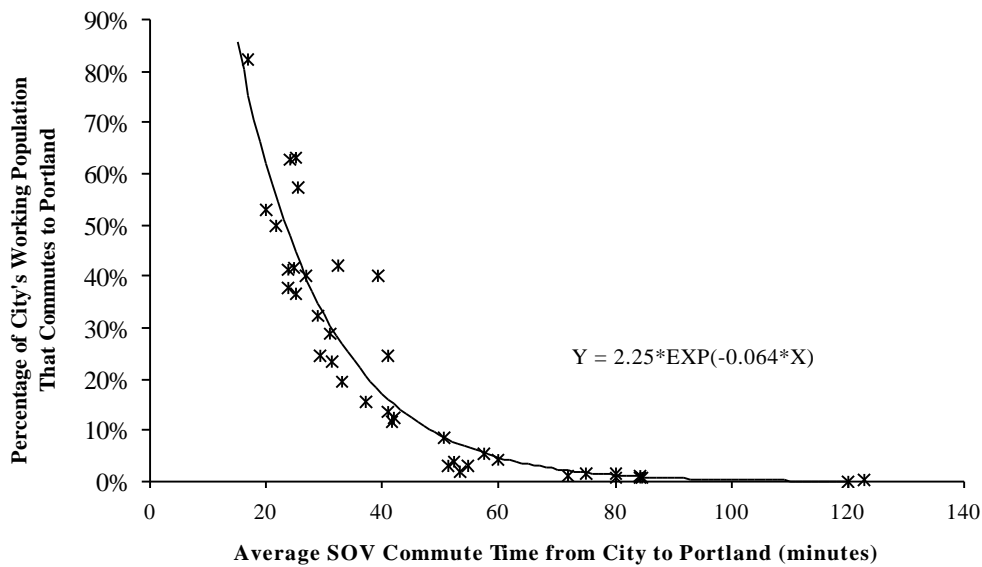


Figure 2. 1990 Commute Travel Time from Incorporated Cities in the Willamette Valley and the Percentage of Workers Who Commute to Portland

Commuting and Jobs-Housing Balance

CTPP place-level data was also used to explore the hypothesis that intercity commuting is caused, at least in part, by imbalances between jobs and housing in cities. Although the CTPP data do not permit a thorough analysis of this hypothesis, they do permit a general assessment to be done which compares the relative effects of job-housing balance vs. job accessibility on commuting.

The ratio of jobs located in a city to the number of employed city residents was used as the measure of jobs-housing balance. The percentage of employed city residents who work at jobs within the city was used as the measure of commuting. A measure of employment independence was also included because some imbalances between jobs and housing are likely to exist because households and business have different priorities for locations.

Figure 3 shows that Willamette Valley cities fall into three groupings based on their relationships to the major job centers. ‘Group 1’ includes the cities that are the dominant employment centers in their portions of the valley and cities that are most remote from these job centers. About two-third or more of the residents of these cities work where they live. ‘Group 3’ includes cities that are located near the dominant employment centers. About a third or fewer of the residents of these cities work where they live. ‘Group 2’ includes cities that are neither near nor far from the major job centers (except for Springfield³). These cities occupy the middle third in terms of the percentage of commuters who work where they live. The ratio between jobs and employed persons appears to be a less significant factor than proximity to employment centers in its effect on intercity commuting. Internal commuting varies widely among cities that have the similar ratios of jobs to employed residents.

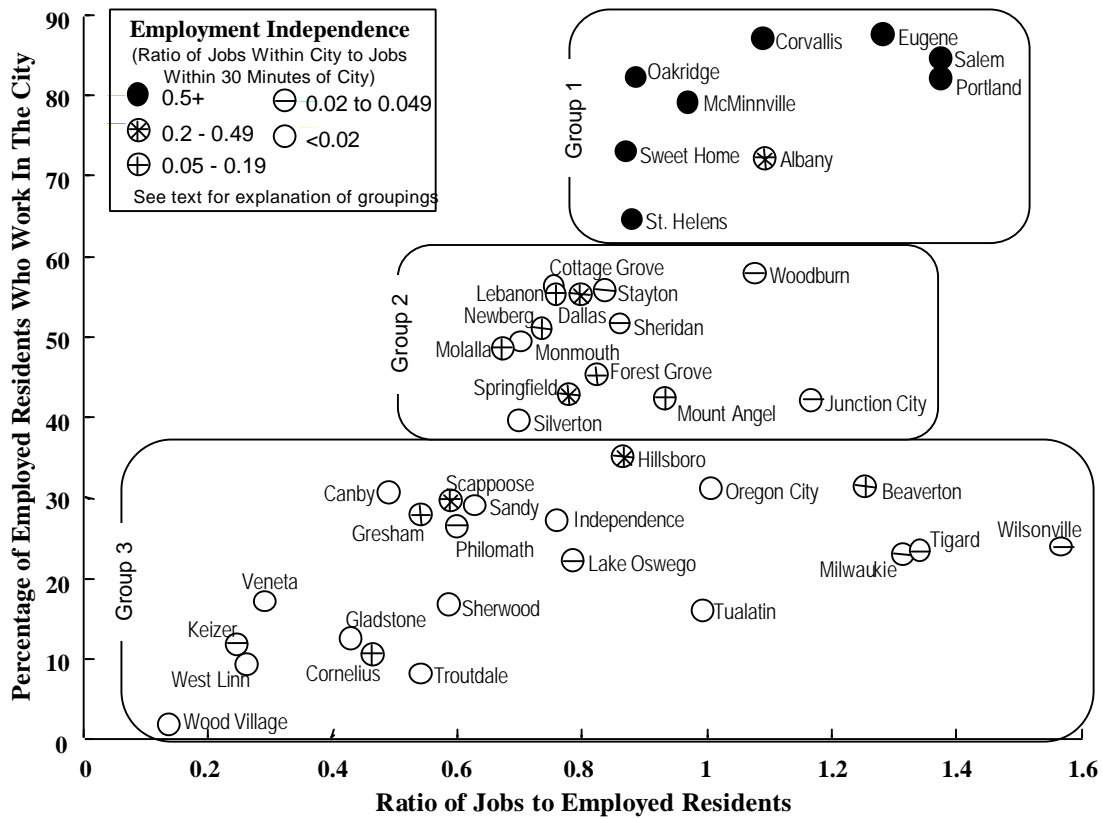


Figure 3. Relationship of Commuting to ‘Jobs/Housing Balance’ for Willamette Valley Cities

There appears to be a weak relationship between the ratio of jobs to employed residents and internal commuting among the Group 3 cities. The minimum and maximum percentages of internal commuting appear to increase with increasing ratios. However,

³ Springfield may be in this group because of its relative strength as a job center in the Eugene-Springfield metropolitan area.

between these minimums and maximums there is wide variation in the ratio of jobs to employed residents which is unaccompanied by much variation in internal commuting.

Intercity Commuting and Congestion on Interstate 5

1996 traffic volumes were estimated from adjusted commuter flows and assigned to I-5 to gauge the relative effect of commuters on traffic congestion. Traffic assignments were based on the judgment of the analyst of what would be the most likely routes for intercity commuters to take. Commuter flows from each analysis zone were either assigned or not assigned to I-5. This was a reasonable thing to do in most instances because the analysis was not very detailed and because in most cases there are clear differences in travel times among alternative travel paths. Figures 4 and 5 show estimates of daily northbound and southbound intercity (but not intracity) commuter traffic on I-5.

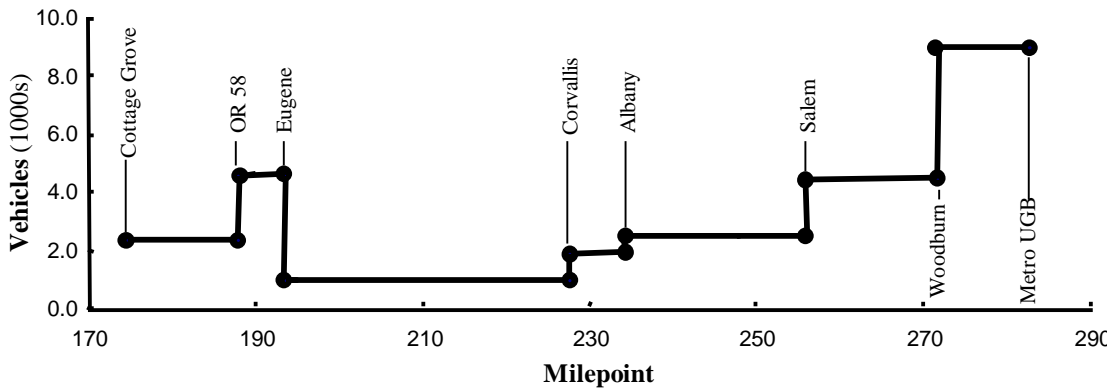


Figure 4. Estimated Northbound Intercity Commuter Traffic on I-5, 1996.

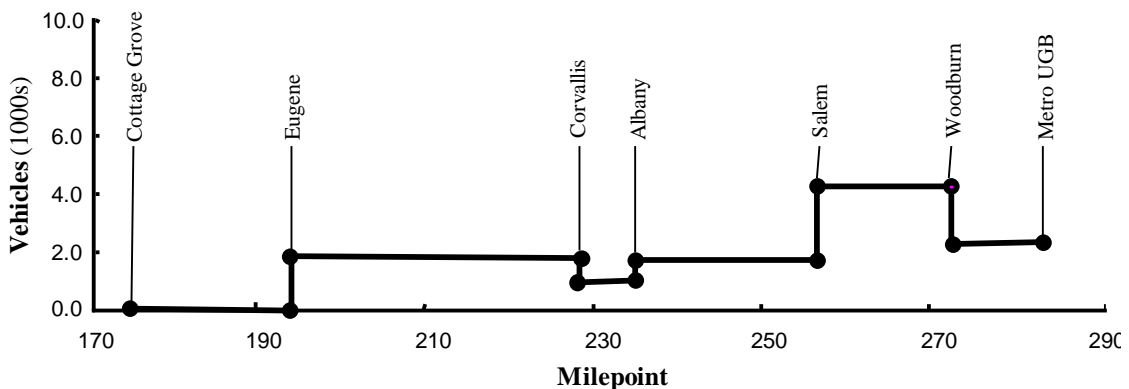


Figure 5. Estimated Southbound Intercity Commuter Traffic on I-5, 1996.

These figures show the dominant effect of the Portland metropolitan area. Three times more commute traffic is destined for the area than leaves the area. The Portland metropolitan area attracts a sizable number of commuters from the greater Salem area, 50 miles to the south. But Salem also strongly attracts commuters from the areas that

surround it. Southbound flows into Salem are about equal to northbound flows out of the Salem area. Neither Salem nor Portland has much effect on the Eugene-Springfield area.

The highest direction peak-hour commuter flows were compared to the directional freeway capacity to assess the effect of intercity commuting on I-5 congestion. This is illustrated by Figure 6. Commuter traffic uses as much as 20% to 30% of the capacity of the freeway for most of its length in the Willamette Valley. Higher amounts are used south of Eugene and north of Salem. Commuters use as much as 60% of the freeway’s capacity north of Woodburn.

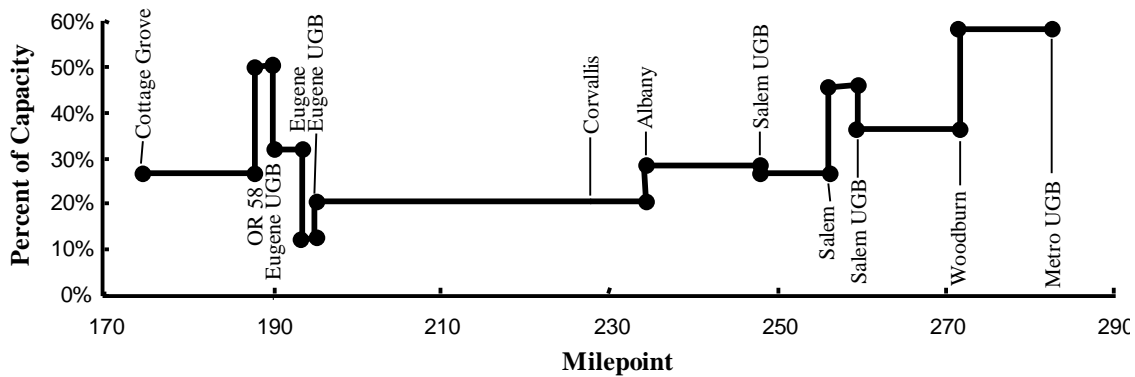


Figure 6. Comparison of Estimated Peak Commuter Traffic to I-5 Capacity, 1996

Potential Effect of Demand Reduction on Freeway Congestion

The study also estimated the potential for reducing congestion through demand reduction. During peak hours, about 77% of all Willamette Valley commuters drove alone in 1990. The cities of Portland and Corvallis had lower drive-alone percentages (65% and 69% respectively). Rough and optimistic estimates of the potential for demand reduction were computed by applying the average drive-alone rate of commuters living and working in the City of Portland to estimated 1996 commuter flows from all origins to all destinations.

If the percentage of drive alone vehicles uniformly dropped to Portland’s rate, the number of peak commuter vehicles traveling to the major employment centers might drop by over 10%⁴. Most of the reductions would take place within urban areas. Almost 50% of the reduction would be of commuters who reside and work in the Portland metropolitan area. About 20% of the reduction would involve commuters who reside and work in the other urban areas. Of the remaining 30%, about half would be of people who commute into the Portland metropolitan area from surrounding parts of Clackamas, Multnomah or Washington Counties.

⁴ Assuming all diverted drivers join existing carpools or vanpools or ride on public transportation.

Figure 7 shows how potential reductions in intercity commuters might affect the capacity of Interstate 5 during the peak hour. For most of the length of I-5 between Cottage Grove and Wilsonville, the hypothesized commuter reductions would only equal about 5% of the capacity of I-5. South of Eugene and north of Woodburn, the potential reductions might equal about 10% of the freeway capacity.

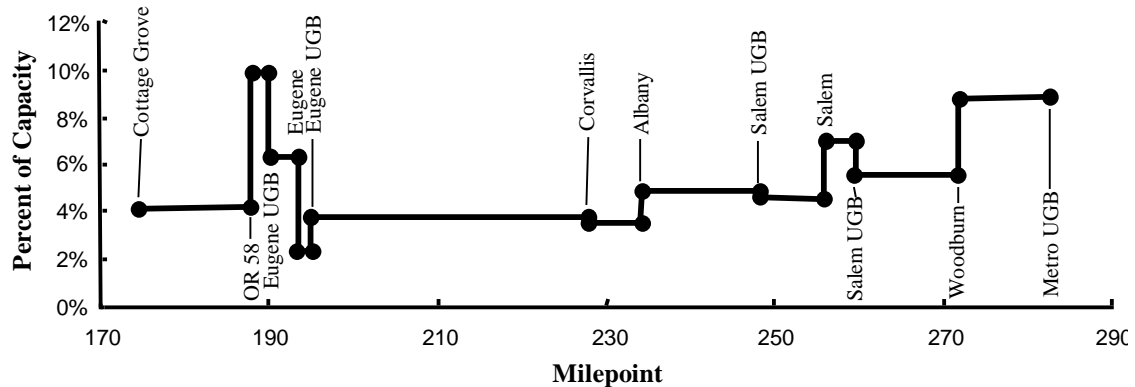


Figure 7. Comparison of Estimated Peak Commuter Traffic to I-5 Capacity, 1996

Concluding Remarks

The CTPP has proven to be a very useful tool for analyzing transportation and growth management issues related to commuting. Fairly sophisticated analysis can be done using this data source. This paper illustrates that even relatively simple analyses of data from the CTPP can provide valuable perspectives on the nature of intercity commuting in a region, its magnitude and its relationship to congestion, household location decisions and jobs/housing balance.

Acknowledgements

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Appendix I. References

COMSIS Corporation. (1996). *Transportation Planner's Handbook on Conversion Factors for the Use of Census Data Final Report*. US Dept. of Transp., Federal Highway Administration, Washington D.C.