Special Report

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RTA: The $6.7 Billion Question

On March 14, the voters of the Central Puget Sound Regional Transit District will approve or reject a proposal to implement the first phase of the Regional Transit Authority (RTA) Master Plan.[1] This election will fundamentally shape the region's transportation investments through the year 2020.

The Phase I Plan has six parts: (1) A commuter rail line extending from Lakewood in the south through Tacoma and downtown Seattle to Everett in the north. (2) A light rail line extending from downtown Tacoma in the south, through downtown Seattle, to 164th Street SW, Snohomish County in the north, with an additional corridor from downtown Seattle across the I-90 bridge to the Overlake area. (3) A $100 million "starter project" in the I-405 corridor. (4) A Transit Development Fund that will direct money to projects of interest to the various subregions of the Regional Transit District. (5) Integration of the fare systems of all the district's transit systems. (6) Eight regional bus routes.

The RTA estimates that it will spend $6.7 billion (1995$) between 1995 and 2010 if the proposal is approved. The sales and use tax will increase by 0.4 cents and the annual motor vehicle excise tax will increase from 2.2 percent of vehicle value to 2.5 percent within the district. If the project holds to schedule, regional trunk bus service will begin in 1998, as will commuter rail service between Tacoma and Seattle; commuter rail service between Seattle and Everett will begin in 1999; light rail service will begin in 2002; and the system will be fully operational by 2011.[2]

As the voters of the Regional Transit District consider the RTA proposal, the Puget Sound Regional Council (PSRC) is making a second set of very important decisions on regional transportation. On December 1, PSRC issued the Draft Metropolitan Transportation Plan (MTP) for King, Kitsap, Pierce, and Snohomish counties.[3] This plan represents a substantial elaboration and update of the transportation element of VISION 2020, the regional growth and transportation strategy adopted in 1990. The draft MTP predicts that $37 billion (1995$) in the revenues will be available under current laws to fund public spending on transportation between 1996 and 2020, and it provides a model program for how these funds might be spent. PSRC believes that this program would not adequately meet the region's transportation needs, and so the draft MTP proposes an expanded $62.4 billion (1995$) program. PSRC hopes that the federal government will contribute an additional $3.5 billion to the region; the program would require $21.9 billion in new state and local taxes, however.[4]

As voters consider the RTA proposal, they should keep a number of questions in mind:

- ❑ What are the various forms of transportation within the region and how important is each to our social and economic health?
- ❑ Does the RTA's plan make sense within the context of the region's overall needs?
- ❑ How much will the system actually cost?
- ❑ How will we pay for it?
- ❑ Will paying for the RTA system mean that other more important needs will go unsatisfied?

We hope that this paper will aid voters in thinking through these very difficult issues.

Increasing Numbers of Americans Drive Alone to Work (1980 and 1990)

	1980		1990	
	Number	Market Share	Number	Market Share
Total Population	226,542,199		248,709,873	
Workers 16 yrs.+	96,617,296		115,070,274	
Drove alone	62,193,449	64.4%	84,215,298	73.2%
Carpooled	19,065,047	19.7%	15,377,634	13.4%
Public Transportation	6,174,861	6.4%	6,069,589	5.3%
Bus or streetcar*	3,924,787	4.1%	3,560,627	3.1%
Subway or elevated	1,528,852	1.6%	1,755,476	1.5%
Railroad	554,089	0.6%	574,052	0.5%
Taxicab	167,133	0.2%	179,434	0.2%
Motorcycle	419,007	0.4%	237,404	0.2%
Bicycle	468,348	0.5%	466,856	0.4%
Walked	5,413,248	5.6%	4,488,886	3.9%
Other means	703,273	0.7%	808,582	0.7%
Worked at home	2,179,863	2.3%	3,406,025	3.0%

*"Bus or trolley bus," "streetcar or trolley car," and "ferry boat" were separate categories in the 1990 Census. In the 1980 Census, these modes were aggregated to a single category, "bus or streetcar."

Sources: U.S. Department of Commerce, Bureau of the Census. *Statistical Abstract of the United States, 1994.* U.S. Department of Transportation, Federal Highway Administration Office of Highway Information Management. *New Perspectives in Commuting, 1992.*

TABLE 1

I. Trends in commuting

Between 1980 and 1990 the resident population of the United States increased by nearly 10 percent, from 227 million to 249 million. Over the period, the workforce grew by 19 percent, to over 115 million.

In both 1980 and 1990 the census recorded the transportation modes used by workers when commuting to their jobs. Table 1 summarizes the national pattern of commuting.[5] Commuting by single occupant vehicle (SOV) increased dramatically over the decade. The 22 million increase in the number of workers driving alone exceeded the 18 million increase in the workforce. The number of workers who carpooled, rode public transit, motorcycled, bicycled and walked all declined absolutely. The number who worked at home rose.

More illuminating than the raw numbers of workers that choose each mode are the respective market shares. Between 1980 and 1990, the market share of single occupant vehicles increased from 64 to 73 percent. At the same time the share of carpools fell from 20 to 13 percent, and the share of public transportation fell from 6 to 5 percent. Thus, for this decade, the primary story in national commuting was the large shift from carpooling to driving alone.

Table 2 (page 3) presents comparable data on commuting for metropolitan Seattle.[6] Between 1980 and 1990 the area's population grew by 25 percent, while the area's workforce grew by 35 percent. Over the decade, the number of workers driving alone increased by 236,000. The number of carpoolers decreased by 16,000. The number who commuted by public transit increased by 3,000. The number who bicycled to work increased by 1,000. The number who worked at home increased by 17,000.

Both in 1980 and in 1990, Seattle's SOV market share differed little from the national share. In both years, Seattle's share for public transit was higher than the nation's, while the local share for carpooling was lower. Seattle's changes in market share mirrored the national experience. Between 1980 and 1990 the fraction of workers driving alone rose from 63 percent to 72 percent. The share carpooling dropped from 18 to 11 percent. The share riding public transit fell from 11 percent to 8 percent.

Table 3 (page 4) presents data on commuting from the 1980 and 1990 censuses for twelve major urban areas of the western and southwestern United States: Dallas, Denver, Houston, Los Angeles, Phoenix, Portland, Sacramento, Salt Lake City, San Antonio, San Diego, San Francisco, San Jose.[7] Table 4 shows the correlations between the market shares of SOV, carpooling and public transit in the two years.

These twelve urban areas together with Seattle had a population of 28 million in 1980. By 1990 this population had grown 22 percent to 34 million. Over the decade the share of workers driving alone increased from 68 percent to 73 percent. The carpooling share fell from 18 to 14 percent. Public transit's market share fell from 7 percent to 6 percent. Commuter mode market shares for the thirteen urban areas are summarized on Charts 1, 2 and 3 (page 5).

Chart 1 ranks the cities by the 1990 SOV market share and shows the shares for both 1980 and 1990. In all thirteen cases, the SOV market share increased from 1980 to 1990. Seattle had the second lowest SOV share in 1980 and the fourth lowest in 1990. The area's increase between 1980 and 1990 was one of the largest, however.

Chart 2 ranks the cities by the 1990 carpooling market share and shows the shares for both 1980 and 1990. These shares decreased in all thirteen areas during the decade. In 1980, Seattle's carpool share was greater than those of five other areas. In 1990, Seattle's share was the lowest of the thirteen. Looking across urban areas, there is a positive correlation between market shares of SOV and of carpooling in both 1980 and 1990. (Because shares must sum to one, one might expect a negative correlation.) The factors that tend to increase the SOV share, such as a good network of roads and a poor public transit

Carpooling Falls More Rapidly than Transit Use in Seattle Area

	1980		*1990*	
	Number	Market Share	Number	Market Share
Total Population	1,393,872		1,743,796	
Workers 16 yrs. +	686,425		927,316	
Drove alone	433,558	63.2%	669,766	72.2%
Carpooled	122,579	17.9%	106,172	11.4%
Public Transportation	72,604	10.6%	75,041	8.1%
Bus or streetcar*	71,992	10.5%	74,250	8.0%
Subway or elevated	120	0.0%	151	0.0%
Railroad	14	0.0%	40	0.0%
Taxicab	478	0.1%	600	0.1%
Motorcycle	5,374	0.8%	3,041	0.3%
Bicycle	4,404	0.6%	5,698	0.6%
Walked	30,121	4.4%	31,963	3.4%
Other means	4,570	0.7%	5,300	0.6%
Worked at home	13,215	1.9%	30,335	3.3%

*"Buss or trolley bus," "streetcar or trolley car," and "ferry boat" were separate categories in the 1990 Census. In the 1980 Census, these modes were aggregated to a single category, "bus or streetcar."

Data for "Urbanized Area," as defined by the Census Bureau.

Sources: U.S. Department of Commerce, Bureau of the Census. *1980 Census of Population, 1990 Census of Population and Housing.*

TABLE 2

TABLE 4

Commute Mode Market Shares

Correlations

	SOV 80	CP 80	PT 80	SOV 90	CP 90	PT 90
SOV 1980	1.00					
Carpool 1980	0.30	1.00				
Public Transit 1980	-0.86	-0.44	1.00			
SOV 1990	0.85	0.57	-0.81	1.00		
Carpool 1990	0.40	0.28	-0.50	0.10	1.00	
Public Transit 1990	-0.84	-0.48	0.97	-0.89	-0.38	1.00

Cities: Dallas, Denver, Houston, Phoenix, Portland, Sacramento, Salt Lake City, San Antonio, San Diego, San Francisco, San Jose, and Seattle

Source: See Table 3, WRC Calculation

Commuting Patterns in Major Southwestern and Western Cities

	DALLAS				DENVER				HOUSTON			
	1980		*1990*		*1980*		*1990*		*1980*		*1990*	
	Number	Market Share	Number	Market Share	Number	Market Share	Number	Market Share	Number	Market Share	Number	Market Share
Total Population	2,451,342		3,198,199		1,352,188		1,517,803		2,412,189		2,902,449	
Workers 16 yrs. +	1,228,753		1,642,966		676,739		789,327		1,200,006		1,401,906	
Drove alone	878,711	71.5%	1,292,213	78.7%	447,783	66.2%	595,506	75.4%	836,716	69.7%	1,060,537	75.6%
Carpooled	245,479	20.0%	222,830	13.6%	135,240	20.0%	98,630	12.5%	261,039	21.8%	201,652	14.4%
Public Transportation	49,337	4.0%	45,648	2.8%	43,396	6.4%	36,173	4.6%	42,217	3.5%	62,957	4.5%
Walked	25,243	2.1%	29,775	1.8%	28,369	4.2%	24,051	3.0%	32,244	2.7%	31,960	2.3%
Worked at home	15,199	1.2%	36,036	2.2%	12,169	1.8%	25,936	3.3%	12,690	1.1%	27,944	2.0%
All other	14,784	1.2%	16,464	1.0%	9,782	1.4%	9,031	1.1%	15,100	1.3%	16,856	1.2%

	LOS ANGELES				PHOENIX				PORTLAND			
	1980		*1990*		*1980*		*1990*		*1980*		*1990*	
	Number	Market Share	Number	Market Share	Number	Market Share	Number	Market Share	Number	Market Share	Number	Market Share
Total Population	9,479,643		11,402,955		1,409,043		2,006,568		1,026,109		1,171,834	
Workers 16 yrs. +	4,366,309		5,457,037		620,353		949,681		479,562		582,478	
Drove alone	3,064,463	70.2%	3,920,159	71.8%	438,725	70.7%	715,181	75.3%	309,759	64.6%	426,681	73.3%
Carpooled	726,126	16.6%	821,277	15.0%	116,706	18.8%	134,956	14.2%	84,865	17.7%	70,202	12.1%
Public Transportation	254,303	5.8%	299,957	5.5%	12,606	2.0%	20,859	2.2%	46,415	9.7%	38,006	6.5%
Walked	149,152	3.4%	162,488	3.0%	18,438	3.0%	24,380	2.6%	20,466	4.3%	19,308	3.3%
Worked at home	63,390	1.5%	147,023	2.7%	9,422	1.5%	26,989	2.8%	8,977	1.9%	19,309	3.3%
All other	108,875	2.5%	106,133	1.9%	24,456	3.9%	27,316	2.9%	9,080	1.9%	8,972	1.5%

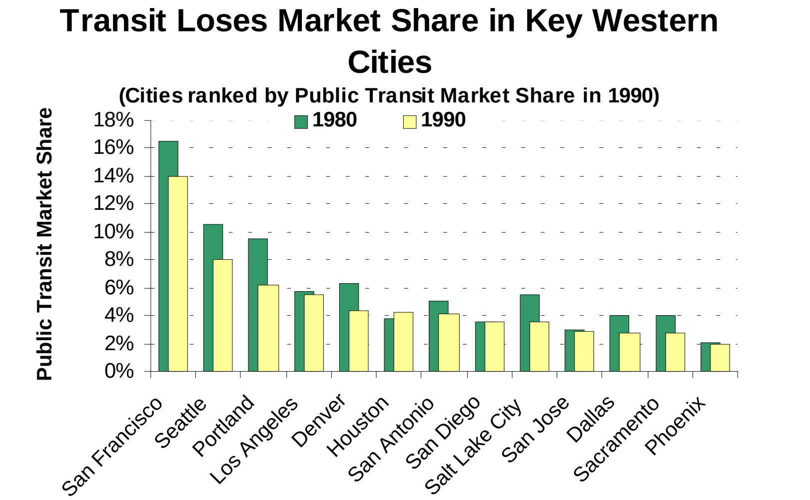
	SACRAMENTO				SALT LAKE CITY				SAN ANTONIO			
	1980		*1990*		*1980*		*1990*		*1980*		*1990*	
	Number	Market Share	Number	Market Share	Number	Market Share	Number	Market Share	Number	Market Share	Number	Market Share
Total Population	769,555		1,097,313		674,249		789,720		944,621		1,128,966	
Workers 16 yrs. +	344,952		507,788		288,634		357,260		395,748		492,678	
Drove alone	241,377	70.0%	386,334	76.1%	191,857	66.5%	271,850	76.1%	264,180	66.8%	364,910	74.1%
Carpooled	62,147	18.0%	70,454	13.9%	61,459	21.3%	48,465	13.6%	77,744	19.6%	72,613	14.7%
Public Transportation	14,003	4.1%	14,035	2.8%	15,780	5.5%	12,126	3.4%	20,271	5.1%	20,645	4.2%
Walked	10,224	3.0%	12,174	2.4%	9,973	3.5%	8,713	2.4%	21,653	5.5%	18,801	3.8%
Worked at home	5,788	1.7%	13,948	2.7%	5,142	1.8%	11,417	3.2%	4,821	1.2%	10,193	2.1%
All other	11,413	3.3%	10,843	2.1%	4,423	1.5%	4,689	1.3%	7,079	1.8%	5,516	1.1%

	SAN DIEGO				SAN FRANCISCO				SAN JOSE			
	1980		*1990*		*1980*		*1990*		*1980*		*1990*	
	Number	Market Share	Number	Market Share	Number	Market Share	Number	Market Share	Number	Market Share	Number	Market Share
Total Population	1,704,539		2,348,106		3,190,822		3,629,864		1,244,033		1,434,803	
Workers 16 yrs. +	782,264		1,160,790		1,536,879		1,859,904		627,186		766,234	
Drove alone	503,998	64.4%	828,430	71.4%	886,763	57.7%	1,167,056	62.7%	455,207	72.6%	596,481	77.8%
Carpooled	136,488	17.4%	160,249	13.8%	242,572	15.8%	239,546	12.9%	103,456	16.5%	93,606	12.2%
Public Transportation	27,186	3.5%	39,985	3.4%	255,167	16.6%	261,010	14.0%	19,636	3.1%	23,263	3.0%
Walked	71,122	9.1%	46,478	4.0%	79,188	5.2%	82,264	4.4%	15,750	2.5%	15,640	2.0%
Worked at home	14,229	1.8%	56,038	4.8%	29,219	1.9%	67,937	3.7%	9,610	1.5%	18,605	2.4%
All other	29,241	3.7%	29,610	2.6%	43,970	2.9%	42,091	2.3%	23,527	3.8%	18,639	2.4%

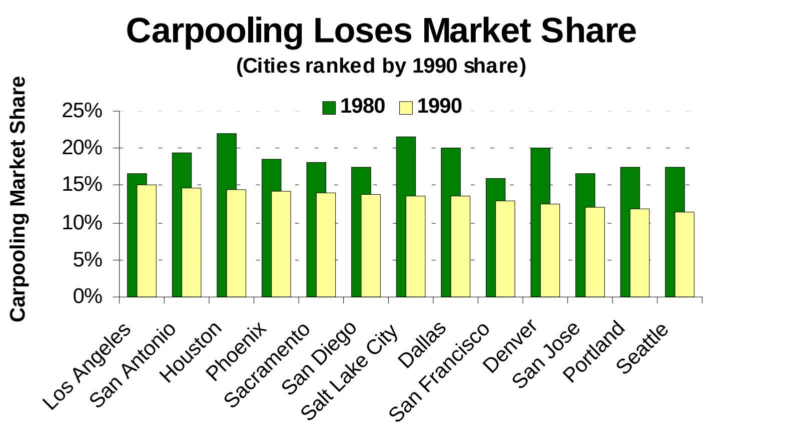
Data are for Urbanized Areas. Sources: ***1980 Census of Population. 1990 Census of Population and Housing***

TABLE 3

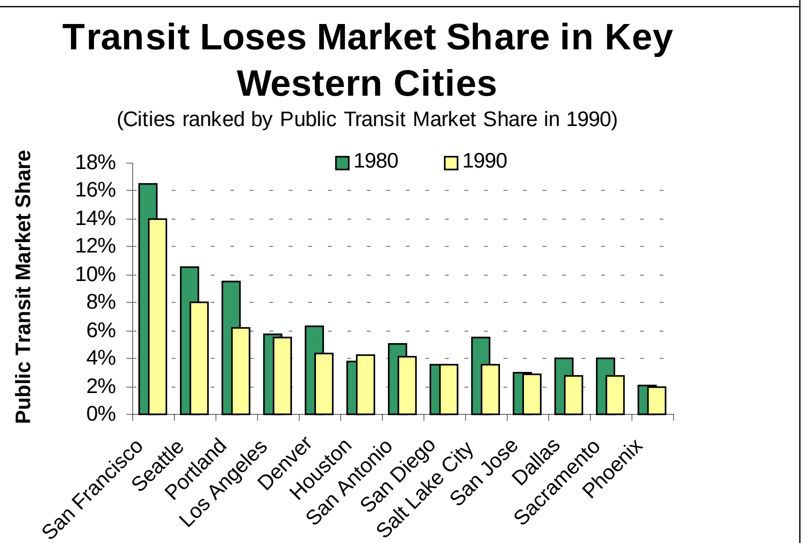
CHARTS 1, 2, AND 3



Source: *1980 Census of Population. 1990 Census of Population and Housing*



Sources: *1998 Census of Population. 1990 Census of Population and Housing*



Source: *1980 Census of Population. 1990 Census of Population and Housing*

system, tend to increase carpooling's share also.

Chart 3 ranks the cities by the share of public transit in 1990. Between 1980 and 1990 transit's market share increased in two of the areas: Houston, which went from 3.5 to 4.5 percent, and Phoenix, which went from 2.0 to 2.2 percent. Neither of these cities invested in rail during the 1980s. In fact, in the early 1990s Houston scrapped plans for a rail system, deciding instead to aggressively expand its bus network.[8] The market share or public transit fell in the other eleven urban areas.

Seattle had the second highest market share for public transit in 1980, and, in spite of the 2.5 percent fall in share it experienced, Seattle retained second place in 1990. In fact, the margin over third place Portland expanded.

Across cities, public transit's share has a strong negative correlation with SOV and a moderate negative correlation with carpooling.

In 1990, rail was an important piece of the transit network for five of these cities. Portland, Sacramento, San Diego, and San Jose all opened new light rail systems during the 1980s. The San Francisco Municipal Railway finished upgrading its trolley system to modern light rail standards in 1981. Also, in San Francisco, BART underwent a major capacity expansion program during the 1980s. Los Angeles's light rail system opened in 1991.[9]

Service began on Portland's light rail system in 1986. Even with the addition of light rail, public transit's market share dropped from 9.7 to 6.5 percent. This was the largest drop recorded among the thirteen cities.

Light rail service began in Sacramento in 1987. Over the decade, public transit's market share dropped from 4.1 to 2.8 percent.

Light rail service began in San Diego in 1981. Although the decade saw an absolute increase in commuting by transit, its market share fell slightly, from 3.5 to 3.4 percent.

For San Francisco, the market share of public transit fell from 16.6 to 14.0 percent. This represented the second largest decrease among the thirteen cities, larger than Seattle's decrease but less than Portland's. What is intriguing about San Francisco is the market share of carpooling. Between 1980 and 1990, San Francisco's SOV market share increased by much less than did Seattle's SOV share because the share of carpoolers fell by less there than it did here. Given the general negative correlation between the market shares of public transit and carpooling, one would expect that San Francisco's very high relative transit share would be accompanied by a very low relative use of carpools, but this is not the case. In part, this reflects the effects of the tolls on the Golden Gate and Bay Bridges. Both bridges exempt carpooling commuters from paying tolls, providing a financial incentive to carpool.[10] This is an example of congestion pricing to discourage SOV use.[11]

San Jose's light rail system opened in 1987. Although the number of workers commuting by public transit increased between 1980 and 1990, market share fell slightly, from 3.1 to 3.0 percent.

As Table 4 shows, across the 13 cities market share of public transit in 1990 is almost perfectly correlated with the market share in 1980. Table 5 reports the results of a linear regression of transit's market share in 1990 on the market share in 1980 and a dummy variable which takes the value of 1 in rail cities and 0 otherwise. In the typical city the 1990 market share equals three quarters of the 1980 share. And rail has a zero coefficient. The regression shows no significant relationship between rail and the 1990 share.

Regression Results

The dependent variable is the public transit market share in 1990

Intercept	0.0030
Standard Error	0.0048
Rail Dummy	0.000016
Standard Error	0.005279
1980 Transit Share	0.7644
Standard Error	0.0668
R Squared	0.9334
Adjusted R Squared	0.9200
Standard Error	0.0090
Observations	13

Note: a share of 10% would appear as .1 in this data.

TABLE 5

II. The road to RTA

In the late 1960s, a regional rail transit system was proposed as part of the Forward Thrust program of capital improvements.[12] In 1968 and 1970, local voters refused to issue general obligation bonds to fund the system.[13] No further action was taken on rail until the Puget Sound Council of Governments' (PSCOG) 1981 Light Rail Transit Feasibility Study. Following this study, the PSCOG 1982 Regional Transportation Plan included rail as a long range policy option.[14] In the mid 1980s a number of preliminary alternatives analyses were undertaken for specific corridors identified by the PSCOG study.[15] In 1989 Metro began a High Capacity Transit Program.

In 1987 PSCOG began the *VISION 2020* planning process. *VISION 2020* sought to produce in a single effort both a new regional development plan and a new regional transportation plan for the central Puget Sound region. In theory, producing the two plans simultaneously would allow a more comprehensive exploration of land use and transportation options than could be possible with separate planning efforts.

Five alternative land use and transportation visions for the region were presented on April 27, 1990 in a Draft Environmental Impact Statement.[16] These were:

No Action

Cities and counties would individually decide how to accommodate growth. No public investments would be made in the region's transportation network.

Existing Plans

Cities and counties would individually decide how to accommodate growth. There would be a regional role in coordinating the local land use plans to reduce negative interjurisdictional externalities. Transportation investments would include a 101 mile regional rail system and a modest expansion of highway capacity.

Major Centers

Growth would be forced to concentrate in Seattle, Tacoma, Everett, Bellevue, Bremerton, and a major city in south King County. There would be a 142 mile regional rail system and a 51 mile commuter rail system. There also would be a limited expansion of the highway system.

Multiple Centers

Growth would be forced to concentrate, but in a relatively large number of centers. There would be a 123 mile regional rail system and a 25 mile commuter rail system. Each center would be the focus of a local bus network. There would be a greater expansion of the highway system than with the major centers alternative.

Dispersed Growth

Market forces would determine where growth occurs. Automobiles would remain the primary mode of transportation. The highways would be widened where possible and the network would be extended into rural areas.

In the Final Environmental Impact Statement, the PSCOG identified a sixth vision, an amalgam of the Major and Multiple Centers Alternatives, as its Preferred Alternative.[17] A significant change regarding transportation occurred between the draft and final EIS. The PSCOG had come to recognize that, because each land use vision was linked to a specific transportation system, land use planning was mechanically driving transportation planning. The planning process had failed to deliver the promised comprehensive exploration of transportation alternatives. The final EIS attempted to finesse this difficulty by reinterpreting all of the rail systems described in the draft EIS as generic "regional rapid transit" systems of unspecified technology.[18]

Thus, the *Preferred Alternative* included a 130 mile Regional Rapid Transit System. The alternative sought to concentrate population and employment in a limited number of centers. The role of regional rapid transit would be to provide high capacity (high volume and high speed) transportation between the centers. The system's technology would be determined in the future, after a through analysis of the alternatives. On the map, however, this regional rapid transit looks to be the Regional Rail of the *Major Centers Alternative* renamed.[19] [20] Experts who advocate buses over trains for regional transit stress that optimal bus routes differ from optimal train routes.[21]

The preferred alternative was formally adopted by the Assembly of the Puget Sound Council of Governments on October 25, 1990.[22]

In early 1990 the Legislature passed the Growth Management Act and the High-Capacity Transportation Act. The Growth Management Act allowed the creation of Regional Transportation Planning Organizations. The PSCOG became the Regional Transportation Planning Organization for the central Puget Sound region, and it adopted *VISION 2020* as its transportation plan under the act. The High-Capacity Transportation Act allowed local transit officials to begin planning a regional rapid transit system. In August 1990, under authority of this act, Metro, Pierce Transit, Community Transit, Snohomish County Transportation Authority (SNO-TRAN), and the Washington State Department of Transportation formed the Joint Regional Policy Committee (JRPC). In 1991, under the direction of the committee, the Regional Transit Project took over from Metro the job of planning a regional system. The High-Capacity Transit Act also created the Expert Review Panel to provide independent oversight of the technical elements of the high capacity transit planning.

On October 1, 1991 the Puget Sound Council of Governments was reconstituted as the Puget Sound Regional Council (PSRC).

In November, Congress passed the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). ISTEA required that a *Metropoli-*

tan Planning Organization (MPO) be created for each urban area with at least 50,000 residents. MPOs are required to prepare twenty-year long-range plans and three-year transportation improvement programs. MPOs with more than 200,000 residents are designated *Transportation Improvement Districts*. These MPOs are guaranteed shares of the federal transportation funds provided to their states. PSRC is the MPO for the central Puget Sound region, and *VISION 2020* has served as its initial transportation plan under ISTEA. ISTEA earmarked $300 million for a "Puget Sound Core Rapid Transit Project" and $25 million for a "Seattle Tacoma Commuter Rail Project."

On October 12, 1992, the Regional Transit Project issued a Draft Environmental Impact Statement.[23] The Draft EIS presents three alternative packages of transportation improvements. The first was called Transportation Systems Management (TSM). TSM would provide greatly expanded bus service together with a number of roadway improvements to increase the speeds at which buses move on the highways. The second alternative was Transitway/TSM. This added to TSM a network of transitways which would physically separate buses and other high occupancy vehicles. The final alternative was Rail/TSM. This included a 125 mile rail rapid transit system, a 40 mile commuter rail line, and TSM. Rail/TSM was the Regional Transit Project's preferred alternative.

In June of 1993, JRPC adopted the Regional Transit System Plan, which was based on the EIS Rail/TSM alternative.[24] This plan proposed $8.3 billion (1995$) in capital spending through the year 2015 to create two distinct regional rail systems.[25] The first system, Commuter Rail, would connect Everett, Seattle, Renton, and Tacoma with diesel trains running on existing freight tracks. The second system, dubbed Rapid Rail by JRPC would connect these four cities with electric trains running on a new right-of-way. Rapid Rail also would extend east from Seattle across the I-90 bridge to Totem Lake and Redmond. Either Commuter Rail or Rapid Rail would extend from Tacoma south to Lakewood. The JRPC plan left undecided the choice between heavy rail and light rail equipment for Rapid Rail, but specified that the trains would achieve maximum speeds ranging from 35 to 70 miles per hour and average speeds from 25 to 40. To achieve these speeds the trains would run primarily in exclusive right-of-ways.

During the summer of 1993, Snohomish, King, and Pierce counties formed the Central Puget Sound Regional Transit Authority which would carry forward the JRPC plan.

III. Varieties of rail

The JRPC plan mentions three rail technologies: commuter rail, heavy rail, and light rail. Commuter rail would run on the existing network of freight tracks.[26] The trains would be diesel powered, although the lines could be electrified in the future. Commuter rail can be rapidly implemented and, at the present time, the freight rights-of-way are underutilized. Because the rails are already in place, the initial capital outlay for commuter rail would be fairly low.[27]

The terms heavy rail and light rail often confuse people, in part because the terms are not used consistently. Generally, heavy rail runs on tracks built exclusively for transit, drawing electric power from a third rail (for example, BART in San Francisco).[28] With its source of power on the ground, a heavy rail system must be designed to keep people away from the tracks. Often heavy rail systems are "grade-separated," running through tunnels or on elevated tracks. Sometimes heavy rail is placed "at grade" within freeway rights-of-way. In any event, a by-product of protecting people from the third rail is a system that is free of interference from pedestrians and automobiles and, therefore, achieves fairly high speeds. Light rail trains draw power from overhead wires, and this results in a more variable technology. Modern light rail has evolved from the old streetcar.[29] At one extreme of the range of modern light rail is surface light rail transit (LRT). LRT runs on streets and highways, predominantly in exclusive lanes. Interference from cross traffic holds speed down. At the other extreme is light rail rapid transit (LRRT). LRRT is fully grade separated, and system performance is comparable to heavy rail.

As the degree of separation increases, both cost and performance increase.[30] The JRPC's Rapid Rail would utilize either heavy rail or LRRT. JRPC explains that LRT is not the optimal technology for high capacity transit:

The level of service that can be achieved with surface light rail systems is significantly lower than that of grade separated systems. The most important aspects of the level of service [are:]

Speed

A high-volume rail line should operate at an average speed that is competitive with automobiles traveling the same distance. A slow system will not attract a major share of potential transit demand. Speed is a function of several factors, including exclusivity of right of way, distance between stations, and dwell time at stations. A surface light rail system like MAX in Portland would operate at average speeds of 18 to 20 mph, relatively slow compared to the grade-separated Rail/TSM Alternative, which would average 35 to 40 mph.

Capacity

Surface LRT operating across intersections is typically limited in terms of train length and frequency. Train length will be limited to something shorter than a city block, since trains cannot block intersections when stopped at stations. Train frequency is also limited since there must be time for cross traffic to clear intersections between trains. Conventional transit practice and highway standards suggest that when train frequencies are under 6 minutes, cross traffic on arterials will be affected to the extent that grade separation is necessary. Between 6 and 12 minute headways, traffic levels, levels of service on cross streets, and the importance of cross streets to the community and emergency services become important criteria for assessing operational feasibility. These constraints limit the capacity of surface light rail systems, as compared to grade-separated systems.

Schedule Reliability

Because surface LRT must deal with cross traffic and crossing pedestrians, slowdowns and stoppages will sometimes occur at intersections, particularly at peak hours when congestion or accidents prevent crossing vehicles from clearing the intersection. These considerations will reduce system speeds, schedule reliability, or both.[31]

IV. The RTA Master Plan

On September 17, 1993 the RTA began to develop the plan that will be considered by the region's voters. Public reaction to the JRPC proposal suggested that approval of voters would be difficult to obtain for a project of that magnitude.[32] Partially in response to this, the 1994 Legislature amended the High Capacity Transit Act to allow the RTA to break its project into phases and to seek construction approval of the district's voters one phase at a time.

On September 9, 1994 the RTA issued the "Phase I Study Options Results Report."[33] This report presented three options for the first phase of construction. When choosing a phase one plan, however, the RTA board could "mix and match" elements that were included in none of the three explicit options.

Study Option 1, identified as the "regional bus emphasis," featured a 89 mile commuter rail system, extending from Lakewood to Everett, with a spur to Renton. Capital cost for commuter rail was estimated to be $610 million; while annual operating and maintenance costs for the completed line were estimated to be $31 million. Option 1 also featured a 13 mile "starter" light rail line, from the downtown Seattle to Sea-Tac.[34] Outside of the downtown Seattle transit tunnel, the light rail would run at grade, with an average speed of 20 miles per hour.[35] Capital cost was estimated at $665 million; annual operating and maintenance costs for the completed line, $29 million. The RTA would also spend $800 million on buses. Spending through 2005 would total $2.4 billion. (All amounts are 1995 dollars.)

Study Option 2 was called the "surface rail emphasis." This included a 96 mile commuter rail line running from Lakewood to Everett, with a spur from Tukwila through Renton to Bellevue. Capital cost for this would be $670 million; annual O&M, $36 million. Option 2 also included 44.7

miles of light rail in four corridors: downtown Tacoma to Federal Way, Sea-Tac to downtown Seattle, downtown Seattle to Northgate, and downtown Seattle to South Kirkland (via the I-90 bridge.) 77 percent of this route would be at grade. The average speed would be 22 miles per hour. Capital cost would be $2.4 billion; operations and maintenance costs, $89 million. $400 million would be spent on buses. The total spending through 2005 would be $4 billion.

Study Option 3 was called the “Grade-separated rail emphasis.” This included 82 miles of commuter rail linking Lakewood and Everett. Capital cost would be $560 million; annual O&M, $26 million. Option 3 included 66.1 miles of light rail. There would be segments between downtown Tacoma and the Tacoma Dome, Federal Way and downtown Seattle, downtown Seattle and Northgate, downtown Seattle across the I-90 bridge to Overlake, and South Kirkland to Tukwila. Interchanges between light rail segments would be possible at downtown Seattle and Bellevue. Interchange between commuter rail and light rail would be possible at Tukwila and downtown Seattle. 72 percent of the track would be at grade; average speed would be 26 miles per hour. Capital cost would be $3.6 billion; annual O&M, $130 million. $400 million would be spent on buses. Spending through 2005 would total $5.1 billion.

When the board of the RTA finished the process of mixing and matching, the system that was adopted was longer and more expensive than any of the three study options. Phase I would extend through 2010 rather than 2005 as envisioned in the Study Options Results Report. The total cost was set at $6.7 billion. That total included $350 million for buses, $590 million in subregional transit development funds,[36] $574 in commuter rail capital costs, $4.015 billion in light rail capital costs, $900 million for rail O&M, $190 million for debt service, and an $85 million reserve.

At 68.7 miles, the light rail system was 2.7 miles longer and $375 million more expensive than the Option 3 system. Compared with that system, the adopted proposal extended 11.8 miles north of Northgate into Snohomish County and included a 7.1 mile segment between Federal Way and the Tacoma Dome. Eliminated was the 17.5 mile light rail link between South Kirkland and Tukwila.[37] The board had intended to connect these cities by commuter rail, as in Study Option 2, but homeowners along the right-of-way objected to the noise of diesel engines.[38] The $100 million which would have funded commuter rail in this corridor was given in Transit Development Funds to the East and South King County subregions for a “starter project.”

Where Study Option 3 had the route from downtown Seattle to Northgate totally grade separated, the adopted proposal had the trains running at grade through the University and Roosevelt Districts. The City of Seattle was allocated $215 million in Transit Development funds which might be applied to tunneling for this segment. The First Hill station would not be completed as part of Phase I. While Study Option 3 had the whole route down Martin Luther King Way (from Rainier Avenue to the Boeing Access Road on elevated tracks, the Phase I Proposal puts the last one and one half miles at grade.[39]

Commuter Rail Travel Times

	Lakewood	So. 56th St.	Tacoma	Puyallup	Sumner	Auburn	Kent	Tukwila	Boeing Access	Argo	Spokane Street	King Street	Interbay	Ballard	Richmond Beach	Edmonds	Mukilteo	West Everett
East Everett	135	130	124	111	108	100	91	84	78	73	69	61	52	46	36	29	11	3
West Everett	131	127	121	108	105	97	88	81	75	70	66	57	49	43	33	26	8	
Mukilteo	123	119	113	100	97	89	80	73	67	62	58	49	41	35	25	18		
Edmonds	105	101	95	82	79	71	62	55	49	44	40	31	23	17	7			
Richmond Beach	98	94	88	75	72	64	55	48	42	37	33	24	16	10				
Ballard	88	84	78	65	62	54	45	38	32	27	23	14	6					
Interbay	82	78	72	59	56	48	39	32	26	21	17	8						
King Street	69	64	58	45	42	34	25	18	12	7	3							
Spokane Street	65	61	55	42	39	31	22	15	9	4								
Argo	61	57	51	38	35	27	18	11	5									
Boeing Access	56	52	46	33	30	22	13	6										
Tukwila	50	46	40	27	24	16	7											
Kent	43	39	33	20	17	9												
Auburn	34	30	24	11	8													
Sumner	26	22	16	3														
Puyallup	23	19	13															
Tacoma	10	6																
So. 56 th St.	4																	

Sources: RTA, WRC

TABLE 6

Light Rail Travel Times: Overlake to 104th SW

	Overlake	NE 24th	Crossroads	Bellevue East	Bellevue Center	SE 6th	South Bellevue	Mercer Island	Rainier/I90	International District	Convention Center	Capital Hill	Campus Parkway	45th Street	65th Street	Northgate	145th Street	175th Street	Mountlake Terrace	Lynnwood	Alderwood Mall
164 th St.	79	76	73	70	65	61	56	52	46	44	39	37	32	30	26	22	17	14	10	6	3
Alderwood Mall	76	73	70	67	62	58	53	49	43	41	36	34	29	27	23	19	14	11	7	3	
Lynnwood	73	70	67	64	59	55	50	46	40	38	33	31	26	24	20	16	11	8	4		
Mountlake Terrace	68	65	62	59	54	50	46	42	36	33	28	27	21	19	16	11	7	3			
176th	65	62	59	56	51	47	42	38	32	30	25	23	18	16	12	8	3				
145th	61	58	55	52	47	43	39	35	29	26	21	20	14	12	9	4					
Northgate	57	54	51	48	43	39	34	30	24	22	17	15	10	8	4						
65th	52	49	46	43	38	34	30	26	20	17	12	11	5	3							
45th	49	46	43	40	35	31	26	22	16	14	9	7	2								
Campus Parkway	47	44	41	38	33	29	24	20	14	12	7	5									
Capital Hill	41	38	35	32	27	23	19	15	9	6	1										
Convention Center	40	37	34	31	26	22	17	13	7	5											
International District	35	32	29	26	21	17	12	8	2												
Rainier/I90	32	29	26	23	18	14	10	6													
Mercer Island	26	23	20	17	12	8	4														
South Bellevue	22	19	16	13	8	4															
SE 6th	18	15	12	9	4																
Bellevue Central	14	11	8	5																	
Bellevue East	9	6	3																		
Crossroads	6	3																			
NE 24th	3																				

Sources: RTA, WRC.

TABLE 7

Light Rail Travel Times: Northgate to Downtown Tacoma

	9th & Pacific	S 13th	S 19th	S 24th	Tacoma Dome	Fife	Milton	S 348th	Federal Way	Star Lake	Kent-Des Moines	S 200th	Sea Tac	S 158th	S. 144th	Boeing Access	Henderoen	Othello	Columbia City	McClellan	Rainier/I90	International District	Convention Center	Capital Hill	Campus Parkway	45th	65th
Northgate	105	103	102	100	99	92	88	82	77	70	66	60	56	52	50	44	40	36	32	28	26	22	17	15	10	8	4
65th	100	99	97	96	94	88	83	77	73	66	61	56	52	48	45	39	35	32	28	24	22	17	12	11	5	3	
45th	97	95	94	92	91	84	80	74	69	62	58	52	48	44	42	36	32	28	24	20	18	14	9	7	2		
Campus Parkway	95	93	92	90	89	80	78	72	67	60	56	50	46	42	40	34	30	26	22	18	16	12	7	5			
Capital Hill	89	88	86	85	83	77	70	66	62	55	50	45	41	37	34	28	24	21	17	13	11	6	1				
Convention Center	88	86	85	83	82	75	71	65	60	53	49	43	39	35	33	27	23	19	15	11	9	5					
International District	83	81	80	78	77	70	66	60	55	48	44	38	34	30	28	22	18	14	10	6	4						
Rainier/I90	78	76	75	73	72	65	61	55	50	43	39	33	29	28	23	17	13	10	6	2							
McClellan	76	74	73	71	70	63	59	53	48	41	37	31	27	23	21	15	11	8	4								
Columbia City	72	70	69	67	66	59	55	49	44	37	33	27	23	19	17	11	7	4									
Othello	68	66	65	63	62	55	51	45	40	33	29	23	19	15	13	7	3										
Henderson	64	63	61	60	58	52	47	41	37	30	25	20	16	12	9	3											
Boeing Access	31	59	58	56	55	48	44	38	33	26	22	16	12	8	6												
S 144th	55	53	52	50	49	42	38	32	27	20	16	10	6	2													
S 158th	52	51	49	48	46	40	35	29	25	18	13	8	4														
Sea Tac	48	47	45	44	42	36	31	25	21	14	9	4															
S 200th	44	43	41	40	38	32	27	21	17	9	5																
Kent Des Moines	39	37	36	34	33	26	22	16	11	4																	
Star Lake	34	33	31	30	28	22	17	11	7																		
Federal Way	27	26	24	23	21	15	10	4																			
S 348th	23	21	20	18	17	10	6																				
Milton	17	15	14	12	11	4																					
Fife	12	11	9	8	6																						
Tacoma Dome	6	4	3	1																							
S 24th	4	3	1																								
S 19th	3	1																									
S 13th	1																										

Sources: RTA, WRC

TABLE 8

Politics shaped the Phase I proposal. For example, one of the commuter rail's greatest selling points was that it could be up and running very quickly.[40] Up until the last minute there were news reports that no proposal would be able to command a majority of the board members' votes.[41] Board members were torn between two conflicting goals, to propose a system that would serve a large number of voters and to hold down costs.[42] The ultimate compromise added mileage to the north and to the south, while it downgraded from light rail to commuter rail to the east of Lake Washington and from grade-separated to at-grade in parts of Seattle. Here, the flexibility of light rail, the ability to trade-off cost against speed, worked to the system's disadvantage.

Table 6 (page 13) shows travel times between commuter rail stations.[43] A trip from the northern terminus in Everett to the southern terminus in Lakewood will take two hours and fifteen minutes, at an average speed of 36.2 mph.

RTA provisionally plans to run light rail over two routes, downtown Tacoma—Northgate and Overlake—SW 164th Street Snohomish County.[44]

Tables 7 and 8 (pages 13 and 14) show travel times between stations along these routes.[45] By light rail, the average speed on the trip from 164th SW in Snohomish County to the International District Station (IDS) in Seattle is 26.4 miles per hour. The average speed from Overbrook to IDS is 25.7 mph; from downtown Tacoma to IDS, 24.9 mph.

A transfer time should be added for trips that span two routes. The average transfer time can be estimated as one half of the headway on the route the rider is transferring to. With the light rail on the surface through the University District, the minimum feasible headway for either route would be 12 minutes. The minimum headway on commuter rail is 30 minutes.

The speed of the light rail system falls far short of the standard that JRPC set for its Rapid Rail system. The role of regional rapid transit was summarized nicely by the Expert Review Panel:

> …[C]apacity and speed are critical components of the system's ability to support land use goals. The system must have the capacity to carry the anticipated long-term growth in demand in critical corridors; to attract this demand it must be able to operated reliable, high speed, peak period service competitive with the auto. There are places in the region where at-grade operation in surface street right-of-way will probably be consistent with a fast, reliable, high capacity system. There are other places, particularly in the central core, where it will not.[46]

We cannot overemphasize the importance of the land use/transportation link. The high capacity transit investment, from inception through final project planning and construction, must support the region's land use vision and plans. Any analysis which does not make this link its central focus misses the mark in terms of examining the single factor most critical to the success of the entire endeavor.[47]

V. The critics of light rail

A number of U.S. cities have built light rail systems in recent years, and a great deal of skepticism has accompanied this construction. Many have questioned if the benefits of these systems will justify their great costs.[48]

John Kain, a Professor of Economics at Harvard University, is one of light rail's most prominent critics.[49] Early in his career, Kain co-authored a highly regarded study of urban transportation.[50] This study concluded that in most cases buses provided a less expensive means than trains for line-haul mass transit. Essentially the cost advantage of buses come from their ability to share right-of-way with automobiles and trucks. Only at very high volumes do the lower operating costs of trains overcome the higher capital cost.[51]

Kain is particularly critical of surface light rail systems. "LRT has none of the advantages of heavy rail (high capacity and performance) and all of the disadvantages (costly, exclusive right-of-ways and structures, fixed route structures, and an inability to pass or to operate off the rail right-of-way)."[52] For an area like metropolitan Seattle, Kain argues that a well crafted bus system will provide superior rapid transit than a mixture of trains and buses.

Bus rapid transit has several inherent technological advantages over heavy rail and LRT systems that should enable it to perform better than these modes in most situations,…The small unit size of buses, frequently cited as a disadvantage of advocates of rail transit, is actually an advantage in most situations, since it permits more frequent and/or more direct service and lower trip times.

The longer trip times of light and heavy rail systems are attributable to the fact that trains cannot pass one another, even where patterns of demand and trip volumes would permit. As peak hour volumes decline and routes become longer, the performance advantages of express bus operations increase.

The much lower costs per passenger trip and high performance of the so-called "Freeway Flier" alternative are explained by the fact that these systems can be closely tailored to demand and because the heavy capital costs of the high performance roads they use may be shared with other users. Where express buses are able to share the huge costs of high performance right-of-ways with other users, the costs of bus rapid transit have become a fraction of those of light or heavy rail or bus transit on exclusive right-of-ways.[53]

The Study Options Report acknowledges that buses could provide higher quality regional transit than light rail. During construction, RTA will operate trunk buses along the rail corridors. As the rail system is completed, the buses will be redeployed to their ultimate routes. There is a potential pitfall, however:

Operating an interim trunk bus system has another challenge. Theoretically, it should start to develop the travel market that will eventually be served by rail. However, some of the rail lines will be located on reserved rights-of-way not accessible to buses. Many future rail stations may be impossible for a bus to serve. If fewer stations are served in the interim, the trunk buses could actually operate more quickly than the trains that eventually replace them. When rail finally does begin operation, the former trunk bus passengers may feel that their service quality has degraded due to the increased travel times.

Even if the same stations and routes of travel can be duplicated, there is another problem: disruptions of traffic on those routes due to construction of the rail lines. In the final analysis, it may be necessary as a practical matter to operate some interim trunk bus lines on parallel, high speed roadways, realizing that some passengers may have to adjust to slower service in the future.[54]

Of course, this compares trains with buses that run from train station to train station. If the bus service were designed to take full advantage of the mode's flexibility, it would be even more attractive to riders.[55]

Kain has also been a vocal critic of the tactics that have been used

Forecast and Actual Cost per Passenger
(For Recent Rail Transit Projects)

Weekday Rail Passengers (thousands)

	Heavy Rail				Light Rail			
	Washington	**Atlanta**	**Baltimore**	**Miami**	**Buffalo**	**Pittsburgh**	**Portland**	**Sacramento**
Forecast	569.6	NF	103.0	239.9	92.0	90.5	42.5	50.0
Actual	411.6	184.5	42.6	35.4	29.2	30.6	19.7	14.4
% difference	-28%	--	-59%	-85%	-68%	-66%	-54%	-71%

Capital Cost (millions of 1998 $)

	Heavy Rail				Light Rail			
	Washington	**Atlanta**	**Baltimore**	**Miami**	**Buffalo**	**Pittsburgh**	**Portland**	**Sacramento**
Forecast	4,352	1,723	804	1,008	478	699	172	165
Actual	7,968	2,720	1,289	1,341	722	622	266	188
% difference	83%	58%	60%	33%	51%	-11%	55%	13%

Annual Operating Expense (millions of 1998 $)

	Heavy Rail				Light Rail			
	Washington	**Atlanta**	**Baltimore**	**Miami**	**Buffalo**	**Pittsburgh**	**Portland**	**Sacramento**
Forecast	66.3	13.2	NF	26.5	10.4	NF	3.8	7.7
Actual	199.9	40.3	21.7	373.5	11.6	8.1	5.8	6.9
% difference	202%	205%	--	42%	12%	--	45%	-10%

NF indicates no forecast of an item was obtainable from published sources.

Source: U.S. Department of Transportation, Transportation Systems Center, *Urban Rail Transit Projects: Forecast versus Actual Ridership and Costs,* Cambridge, MA, 1989.

TABLE 9

by transit officials to sell light rail to the voters. For example, he finds that in Dallas, officials attempted to conceal from the public travel forecasts that were unfavorable to the light rail system.[56] In Houston, Kain found that the trunk bus system offered by local officials as an alternative to the light rail system which they actually favored simply duplicated the rail system with trunk buses. It failed to exploit the potential for buses to provide more direct service than trains.[57]

The Transportation Systems Center of the U.S. Department of Transportation at Cambridge, Massachusetts prepared a widely noted study on the accuracy of the forecasts used to justify the construction of rail mass transit systems. The principal author of this study was Don H. Pickrell.[58] Pickrell looked at heavy rail projects in Washington, Atlanta, Baltimore, and Miami, and at light rail projects in Buffalo, Pittsburgh, Portland, and Sacramento. He compared estimates of ridership, capital cost and operating expense made for each project at the time the choice among alternative transit improvement projects was actually made with subsequent experience. The findings are summarized in Table 9 (page 17). Heavy rail ridership averaged 57 percent below forecast; light rail, 65 percent. Heavy rail capital costs averaged 58.5 percent above forecast; light rail, 27 percent. Heavy rail operating expense averaged 150 percent above forecast; light rail, 16 percent.[59]

The Pickrell paper was prepared for the Office of Grants Management of the Urban Mass Transportation Administration as part of an effort to improve the methods used by local officials when planning transit investments. As a result of that effort, RTA's cost and ridership forecasts are probably more accurate than those reviewed by Pickrell.[60] [61]

Pickrell also concludes that these investments in rail have not proved to be as cost effective in increasing transit ridership as a variety of other means that have been used by local transit operators.[62]

VI. The RTA Financial Plan

The RTA's plan lists six broad sources of revenue: a local sales tax, a local motor vehicle excise tax, the farebox, federal grants, state grants, and investments by private firms. The plan includes two major categories of rail cost, capital and O&M. The prospects for federal funds is the topic of Section VI. The costs and other revenues are the topics of this section.

Sales Tax

To estimate sales tax receipts, RTA starts with the actual taxable sales in 1993 for King, Pierce, and Snohomish counties. PSCR estimates that in 1990, 92 percent of the three counties' retail employees are within the Regional Transit District. The RTA concludes that 92 percent of the three counties' retail sales in 1993 occurred within the district. They project that in future years retail sales within the district will grow at the rate that PSRC projects for the region as a whole. This procedure should overestimate future taxes. The 1990 census showed 84.5 percent of the three county population living within the boundaries of the district. The portions of the PSRC region outside of the district, (notable Kitsap County and much of Snohomish County), will experience more rapid population growth than the regional average;[63] conversely, the growth for the district should be less than the regional average.[64] As the population outside the district grows, the proportion of retail activity occurring outside the district should rise.[65] The differential sales tax should further encourage retail activity outside the district.[66] It is ironic that the transit system that is intended to support the regional land use vision of concentrated growth creates a financial incentive to disperse economic activity.

Motor Vehicle Excise Tax

RTA starts with the actual valuation for vehicles within the three counties for 1993. Since 84.5 percent of the three counties' population live within the district, it assumes that 84.5 percent of the valuation falls within the district. The PSRC projects that, for the region, the growth rate of the MVET tax base will exceed that for the sales tax base by 0.4 percent per year on average. The RTA therefore expands the MVET by 0.4 percent more than it expands the sales tax in each period. The MVET estimates are subject to the same criticism as the sales tax estimates. The district's population growth will fall short of the regional average. And the tax creates an incentive for families and business to relocate in order to avoid the tax.[67]

Farebox Revenues

RTA estimates that they will be able to recover 40 percent of rail operating costs and 20 percent of bus operating costs from the fareboxes. RTA feels that the 40 percent is a reasonable expectation given the experience of other rail systems. The 20 percent is roughly the average for transit operations in the region.

State Grants

The RTA projects that it will receive on average $55 million (1995$) in grants from the State of Washington in each year between 1995-2020. (The technical appendix states that "the RTA adopted the assumption that state funding would equal 20 percent of the rail capital cost."[68] $55 million a year through 2010, the scheduled end of construction, sums to less than 20 percent of the capital cost. From 1995-2020, it sums to more than 20 percent.) RTA hopes that the state will impose some new transportation taxes, and that a portion of these taxes will be dedicated to RTA. The State Transportation Commission has floated a proposal to raise a number of transportation taxes. The political viability of the Commission proposal is unclear, however. Governor Lowry recently declined to endorse it.[69] There is some surplus transportation money in the current budget, but with the talk in the Legislature of tax-cutting, it is not at all clear that is money will be available to the RTA.

If the state does not adopt a new tax for the RTA, the Master Plan indicates that the RTA might get money through several existing state sources: the High Capacity Transit Account, the Transportation Improvement Account, and the Central Puget Sound Public Transportation Account.

The High Capacity Transit Account receives money from the MVET. The PSRC estimates that between 1996 and 2020 the RTA will receive $185 million (1995$) from this account. The Central Puget Sound Public Transportation Account receives money from the MVET. Between 1996 and 2020 the PSRC expects this amount to provide local transit agencies $326 million (1995$). Any money that the RTA receives from this account will, in effect, come from these agencies. The Transportation Improvement Account is funded from the Motor Fuel Tax. The PSRC expects this fund to provide $508 million (1995$) for county roads and city streets. Any money that RTA received from this account would thus come from the region's cities and counties.

Private Investments

The RTA hopes to get $288 million (1995$) towards construction from private sources. This comes in annual installments of $18,025 million in the years of 2005 to 2020. The RTA has not identified specific sources for these funds. As they note, "[t]he five percent assumption is somewhat aggressive."[70]

Capital Expenditures

We have not been able to provide an independent evaluation of RTA's estimated capital cost.

Operating Cost

RTA estimated what the O&M for the proposed system would have been in 1991 from the actual O&M costs of comparable transit systems in 1991. It then projected those costs to succeeding years by assuming that they grow year by year at the general rate of inflation. Operation and maintenance are services, however, and services are notorious for stagnant productivity. Rising real costs of services is sometimes called Baumol's disease, after an economist, William Baumol, who has written on the subject.[71] The problem is essentially this: Labor represents a very high fraction of the O&M costs. Wages paid to workers tend to grow more rapidly than the price of goods in general. For example, from 1947 to 1992 the real hourly compensation of workers in the non-farm business sector increased an average of 1.7 percent per year. In the face of these constantly rising wages, employers must continually improve labor productivity if they are to prevent their costs from rising. The question, then, is whether RTA's labor productivity will grow sufficiently to offset the growth of real wages. The introduction of trains is an act of technical change, and this hopefully will increase labor productivity. But while working with an existing technology, productivity growth is problematic.

In 1992, for the thirty largest transit agencies nationally, salaries, wages and benefits on average represented 82 percent of operating expenses less the cost of purchased transportation.[72] Were real wages to rise at the postwar average rate, and if productivity were stagnant, O&M costs would rise by 1.4 percent per year. The regional economic forecast underlying RTA's tax projections has the average employee's compensation increasing by a much lower rate, 0.54 percent per year, over the period 1990-2020. This implies an upward creep of 0.44 percent per year in real O&M expenses.

VII. Federal money

The RTA Master Plan anticipates that New Starts, the federal program that funds new mass transit systems, will contribute $1.12 billion (1995$) towards construction. There are two fundamental reasons for skepticism that RTA will be able to get these funds. Over time, the emphasis in federal transportation policy has been shifting from funding specific local projects to making more general block grants. And projections of the federal budget deficit suggest that all federal programs will be under tremendous pressure in future years.

Congress generally authorizes federal programs for highways and mass transit through multi-year acts. For example, the current authorizing act, the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), spans fiscal years 1992-1997. A typical federal spending transaction passes through three stages. First, a federal agency receives *budget authority* under some law. Second, the agency incurs an *obligation* to pay money. Finally, it discharges that obligation through an *outlay* of funds. For most programs, budget authority is granted through an *appropriation.* For transportation programs, the traditional form of budget authority is *contract authority*. The authority granted under ISTEA is contract authority. While contract authority represents permission to incur an obligation, it does not represent permission to make an outlay. Permission to make outlays for ISTEA programs comes from the annual appropriations acts for the Department of Transportation.

The federal government funds state and local transportation projects through two types of programs. Under *formula* programs, money is allocated to states and localities on the basis of formulas written into law. Under *discretionary* programs, state and local governments apply in competition with one another for a limited number of grants from the Department of Transportation.

ISTEA authorizes $151 billion in spending, and it marks a significant redirection of federal transportation policy.[73] Spending has shifted away from discretionary programs and toward formula programs. This shift reflects the widely held belief the system of discretionary grants leads to inefficient transportation investments. Projects for which grants are available appear artificially cheap to state and local decision makers. ISTEA also gives state and local officials more latitude to transfer funds between formula programs.

The bill provided $7.2 billion to complete the 40,000 mile interstate highway system. The interstates are the center of a newly designated 155,000 mile National Highway System. ISTEA authorized $38 billion for this system. Beyond the national highways, the bill pushed decision making responsibility to the states. All other highway programs were consolidated in a single $23.9 billion Surface Transportation Program, and local officials were given a great deal of flexibility in determining how these funds were spent (including the ability to fund mass transit).

ISTEA allocated $16.1 billion for bridges. $8.2 billion went to minimum allocation programs, which give extra money to states which otherwise would receive less than they paid into the Highway Trust Fund. A $6 billion program helps metropolitan areas meet the standards of the 1990 amendments to the Clean Air Act. $6.2 billion went to 539 special road projects specified by individual senators and representatives.

ISTEA included $18 billion in formula grants for mass transit and $13.4 billion in discretionary grants. Among the discretionary programs, NEW Starts received $6.2 billion; rail and fixed guideway modernization received $4.9 billion; and buses received $2.3 billion.

ISTEA required that states create Metropolitan Planning Organizations, and guaranteed those with 200,000 residents direct funding under the Surface Transportation Program.

In contrast to ISTEA's general theme of pushing decision making down to the states, the bill included a record number of "earmarks," under which Congress directly determines the projects that will receive federal funding. The then Chairman of the House Public Works Committee, Robert A. Roe, D-NJ, inserted 458 “demonstration” road projects in an attempt to gain the support of other lawmakers for a 5 cent increase in the gas-tax. Roe called the package “A Nickel for America.” Transportation Secretary Samuel K. Skinner called the projects “paying America with pork.” Eventually, the tax increase was dropped from the bill. The special projects remained, however.[74]

Congress also directly chose the mass transit projects that would be funded under the New Starts program. Two earmarks were for what has become the RTA project, $300 million for the Puget Sound Core Rapid Transit Project and $25 million for the Seattle Tacoma Commuter Rail Project.[75] (These earmarks set aside $325 million in contract authority for RTA. They did not create an obligation.)

Shortly after his inauguration in 1993, President Clinton initiated a *National Performance Review* under the direction of Vice President Al Gore. In his September 7, 1993 report to the President,[76] Gore recommended in general that the federal government “empower state and local governments” by consolidating a number of categorical grant programs into larger block grants. Two of Gore’s specific recommendations for the Department of Transportation were aimed at the ISTEA earmarks. He recommended rescinding funding for the highway demonstration projects and rescinding balances that remained unobligated after three years under the New Starts Program. [77] [78]

These recisions of contract authority were incorporated in President Clinton’s 1995 budget,[79] but for the most part they were not enacted by Congress.

President Clinton’s Fiscal 1996 Budget proposes a major restructuring of the Department of Transportation. As part of the restructuring, the New Starts program would disappear, consolidated into a new Unified Transportation Allocation Grant. This Unified Transportation Allocation Grant is a formula grant. The Budget indicates that the “Government will honor previous commitments for specific construction projects.” It is unclear whether RTA’s unobligated earmarks would count as a commitment. In any event, if Congress accepts the Clinton proposal, $325 million[80] would be an upper limit on the New Starts money for the RTA.[81]

RTA would be eligible to receive money coming to the state under the new Unified Transportation Infrastructure Grant. This will be a formula grant, however. Any funds that RTA receives would otherwise be spent on highways, roads, streets, bridges, or local public transit within the state. Federal funding of transportation investments through formula grants is intended to make local officials recognize that there are opportunity costs to any specific investment project.

VIII. The effect of Phase I on congestion

Congestion occurs when highway capacity is scarce. Supply and demand, the economist's traditional tools for evaluating the allocation of scarce resources, clarify the congestion problem.

Population growth increases the demand for automobile transportation. Population in the central Puget Sound region grew by 82 percent from 1960 to 1990 and is expected to grow a further 50 percent from 1990 to 2020. Other factors combine to increase further the demand for automobile transportation. People choose where to live in order to be close to family and friends, to have access to good schools, and to be near to recreational resources. As a result, many locate a fair distance from their workplaces. Low cost suburban land has made it possible for families to live in low density neighborhoods and for employers to locate in low density work sites. These home and workplaces are not easily connected by public transportation. As a result, automobile travel has grown even more rapidly than the region's population.

Up to now, government has tried to increase the highway network to accommodate the growth in population. However, the ability to expand road capacity in the future will be constrained, in part because of the higher cost of right-of-way acquisition. Therefore, we should expect that population growth will increasingly outpace highway system development. Buses and carpools substitute for additional highway capacity. A full bus takes up less space than would be required if each passenger rode alone in a personal car. Commuter and light rail lines would similarly lessen the competition for scarce highway capacity.

A driver bears considerable costs when operating a car: gasoline, upkeep, depreciation, and the value of his or her time. The driver even pays for road construction and maintenance to the extent that they are funded through the gasoline tax. But there is one important cost that the driver does not pay. On a congested road, each additional driver decreases the speed at which traffic flows. He or she increases the travel time of every other driver. Individual drivers do not pay for the time costs they impose on others; therefore the private cost of travel by car is less than the social cost.

Anthony Downs has identified a phenomenon he calls triple convergence, which neatly illustrates the importance of the notion of equilibrium in understanding congestion.[82] Consider commuting from Seattle's northern city limit to downtown. There are a number of different routes that a driver can take: I-5, Aurora Avenue, Lake City Way – Roosevelt – Eastlake and Greenwood – Holman Road –15th Avenue, for example. If traffic moves at the speed limit, I-5 will provide the quickest route to downtown. With a large number of commuters, however, there will be congestion, and travel on the freeway will be significantly slower. Drivers will respond to the increased time cost of travel on I-5; some by taking another route, others by adjusting their commuting schedule. Still others will shift to another mode of transportation. If the capacity of I-5 were somehow increased and commute patterns remained unchanged, traffic would move much more rapidly. But people will now find I-5 more attractive, and some will shift back to the freeway from other routes, other times, and other modes, until a new equilibrium distribution of choices is reached. Traffic speeds will not increase by as much as one would expect because behavior will change as a result of the increased capacity.

The RTA proposal fights congestion in two distinct ways. First, the train systems add to the transportation capacity of the region, providing a transportation option that some people will find inherently more attractive than the automobile. Second, by charging riders fares far below the cost of service, RTA may induce some drivers to give up their cars, allowing those who continue to drive to move more rapidly.

Economists agree that congestion results because drivers do not bear the full costs of their decisions to drive.[83] There is, therefore, little reason for an individual driver to economize on auto use. Further, the choice for low density residential locations and low density work sites is a consequence of artificially low costs of driving. Similarly, the choice of single occupant vehicles over public transit or carpooling is encouraged by these low costs. Increasing the cost can influence individual decisions.

A number of different mechanisms have been proposed to increase the cost of driving. Economists refer to these proposals collectively as congestion pricing. The most straightforward example would be a higher gasoline tax. But the gas tax is a fairly blunt tool. Charges that focused on specific pieces of congested roadway would be better. Advancing technology has recently made possible the electronic collection of tolls. This allows tolls that are finely graduated by time and location, and it avoids the congestion that accompanies toll booths. Higher parking fees for commuters have also been proposed.[84] Congestion pricing is the major recommendation of the PSRC's Draft Metropolitan Transportation Plan.

The economist William Vickrey observes,

In a more general vein, traffic often behaves like population. It has been said that if nothing stops the growth of population but misery and starvation, then the population will grow until it is miserable and starves. Similarly, if the use of private automobiles to the cores of large metropolitan areas is so attractive, under uncongested toll-free conditions, relative to other modes, that in effect nothing stops

TABLE 10

Road Mileages

	1990 Baseline	Added by Package 1	Package 2 beyond Package 1	Packages 3&4 beyond Package 2
Freeways				
Centerline Miles	334.5	1.5	3.2	-4.4
Lane Miles	1769.5	10.6	14.8	-8.2
HOV Miles	47.1	270.6	11.6	51.9
Principle Arterials				
Centerline Miles	210.5	4.4	0.7	7.0
Lane Miles	608.8	71.1	23.3	56.5
HOV Miles	0.1	15.9	0.5	24.8
Minor Arterials				
Centerline Miles	4340.4	66.6	-0.5	4.8
Lane Miles	12702.8	601.7	15.5	103.0
HOV Miles	0.8	69.6	5.1	18.1

Source: PSRC, *Metropolitan Transportation Plan: Technical Report MTP-12.*

> the growth of such traffic but congestion and delay, then such traffic will grow until sufficient congestion and delay are generated to constitute a deterrent, or until the core begins to suffer from gangrene, at which point a cumulative decline may set in that may be difficult to reverse, even with a belated introduction of appropriate toll graduation.[85]

Congestion pricing, however, meets with substantial public resistance.

The PSRC has developed an elaborate Regional Transportation Model, which shows the relative weakness of capital investment as a tool against congestion and the relative strength of congestion pricing. This model divides the region into 832 distinct Transportation Analysis Zones. The modeling effort begins with an aggregate economic model for the region. The economic forecasts then become inputs into a land use allocation model. The land use allocation model is solved simultaneously with a trip generation model to determine travel patterns.

The *Draft Metropolitan Transportation Plan* reports the results of Regional Transportation Model simulations to the year 2020 for four separate packages of transportation investments. The Draft MTP describes the packages in this way:

Package 1: Financially Constrained provided a "subsistence-level" package of preservation, maintenance, and transportation system management approaches[.]…The package included small increases in freeway, arterial, and transit system capacity over the 1990 baseline.

Package 2: Moderate Capital Investment Focus assumed …[completion of] the first phase of the high capacity transit system. The package also [completed] WSDOT's core HOV system.

TABLE 11

System Performance in Simulations by the Puget Sound Regional Council

	1990 Baseline	2020 Trend	2020 Package 1	2020 Package 2	2020 Package 3	2020 Package 4
Daily Vehicle miles traveled (millions)	63.4	103	102.5	98.7	90.3	98.4
Vehicle miles traveled (millions) during the PM peak period	20.2	32.6	32.2	31.3	28.6	31
Average vehicle speed (mph) during the PM peak	26.2	18.3	19.9	20.2	24.6	20.4
Hours of delay during the PM peak period on arterial/freeway network	150,000	660,000	581,000	528,000	189,000	487,000
Percent Mode choice for all trips						
SOV	67.7	64.9	60.3	59.9	50.4	58.7
Carpool	28.3	31.2	36	31.6	38.7	32.6
Transit	4	3.9	3.7	8.5	10.8	8.7
Percent Mode choice for work trips						
SOV	72.8	71.1	70.4	72.2	55.4	69.4
Carpool	19.7	20.6	21.3	16.4	26.6	17.9
Transit	7.5	7.7	8.3	11.4	18	12.7
Percent Mode choice for nonwork trips						
SOV	61.4	62.6	53.9	46.9	33.2	47.3
Carpool	36.1	35.4	43.9	48.2	61.8	47.7
Transit	2.5	2	2.2	4.9	5.2	5
Percent of network experiencing congestion during PM peak period						
Freeways	27.2	44.7	45.8	49.9	40.3	47.2
Regional Arterials	8.1	26.7	24.3	22.8	15.5	21.7
Overall	12	27.1	26.2	24	17.9	22.6

Source: Puget Sound Regional Council, Draft Metropolitan Transportation Plan, December 1, 1994

Moderate investments would also be made for completing “missing links” in the regional highway network, expanded transit service and terminal facilities, and incremental improvements for nonmotorized travel….

Package 3: Demand Management Focus assumed full build-out of the regional high capacity transit system, completion of freeway and major arterial HOV improvements, and additional incremental improvements in pedestrian, bicycle, and special freight-and-goods access facilities. [R]evenues … would be raised initially through traditional sources…. …[Later years would fund transportation investment through congestion prices:] greatly increased fuel taxes, vehicle registration fees based on miles traveled, and road and parking pricing strategies. This package was designed to connect transportation revenues closely with system use and to minimize the growth in overall vehicle travel.

Package 4: Capital Investment Focus assumed the same package of transportation facility and system improvements as Package 3. The revenues needed to support this substantial investment would be generated from conventional sources… .[86]

The first column of Table 10 (page 24) shows the 1990 road mileage in the Regional Transportation Model. Moving to the right, the columns show the increments by which each package would expand the region’s network of roadways. (That is, the package 2 column gives the difference between the total network mileages under packages 2 and 1.) Even in the most optimistic scenario, the PSRC foresees little expansion in roadways.

Table 11 presents results of six simulations of the Regional Transportation Model. Besides the four packages, the table shows the model’s simulation of the actual 1990 experience and a scenario (Trend) that assumes no addition to the roadway network.

Comparing the Actual 1990 with the 2020 Trend shows the degree to which population growth with no expansion in the region’s network of roads would significantly increase congestion. Average speed during the PM peak period on the road network drops from the 26.2 miles per hour to 18.3. The percentage of freeways experiencing congestion during the PM peak increases from 27.2 to 44.7; the percentage of arterials, from 8.1 to 26.7; the combined percentage, from 12.0 to 27.1.

Another measure of congestion, *hours of delay during the PM peak period on the arterial/freeway network*, appears in the table. This measure is somewhat misleading when population is growing. Imagine that the capacity could increase in lockstep with the population so that road speeds everywhere were unchanged. Hours of delay would increase in lockstep with the population,

TABLE 12

Taxes for a Family of Four
(1995 dollars)

Income	Sales Tax	MVET	Total
20000	44	25	69
30000	55	32	87
40000	65	38	103
50000	75	43	118
60000	85	47	132
80000	104	56	160
100000	122	63	185

Source: WRC Calculations.

although congestion did not increase. To serve as a meaningful intertemporal index of congestion, hours of delay must be deflated to take out the effects of population growth.[87] Deflating to the 1990 population would make the 2020 Trend delay 440,000 hours, still a considerable increase over the 1990 figure.

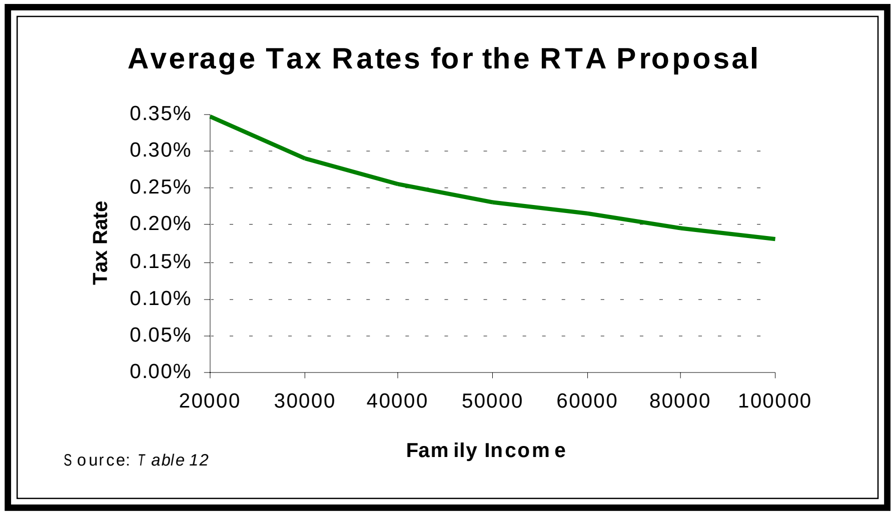


CHART 4

Package 1 yields some improvement in congestion relative to the 2020 Trend. Average vehicle speed at the PM rush increases by 1.6 miles per hour, a 7 percent increase. Hours of delay falls by 79,000, a 12 percent decrease. Nevertheless, congestion is much worse than the 1990 baseline.

RTA Phase I is the major investment that Package 2 adds to Package 1. As the Draft Metropolitan Transportation Plan notes, Package 2 yields "very little improvement in systemwide performance when compared to Package 1."[88] The share of transit in work trips does rise from 8.3 to 11.4, but all of these riders come out of car pools. The share of single occupant vehicles actually rises. Average vehicle speed rises by only 0.3 miles per hour. The percent of the freeway network that is congested during the PM rush actually increases from 45.8 to 49.9. The hours of delay measure seems to show a somewhat greater easing of congestion. But once rail is added to the mix of transportation options, hours become meaningless as an indicator of performance. The measure only counts the time of people on the roadways. Moving people from roads to rails lowers hours of delay, no matter what effect it has on their travel time.

Package 4 adds to Package 2 completion of the RTA rail system and some highway construction. (The package includes new bridges across Lake Washington and the Tacoma Narrows. We are skipping Package 3, for the moment.) With these investments, the share of carpools increases by 1.5 while the share of transit increases by 1.3. The average speed during the PM rush increases from 20.2 to 20.4. Evaluating Package 4 the Draft MTP says: "There was minor improvement in systemwide performance compared to Package 2, but the incremental improvement for Package 4 may not be worth the substantial increase in investment over Package 2."

Package 3 adds congestion pricing to Package 4, and this has a large effect. The share of carpools increases by 10.8 while the share of transit increases by 5.3. Average speed increases from 20.4 to 24.6 mph. The percent of the freeway network congested during the PM rush falls from 47.2 to 40.3 percent.

After reviewing these results, the Draft Metropolitan Transportation Plan reaches the conclusion: "The strategies assumed in Package 3 appear to present the region with its best opportunity to advance the land use and economic development goals of VISION 2020."[89] A somewhat different set of conclusions seems warranted. Major incremental improvements only cane with Package 1 and Package 3. In particular, the RTA Plan shows little effect in and of itself on regional congestion. It seems that the investments of Package 1 together with congestion pricing, would represent an extremely cost effective alternative. Under such a plan the revenues generated by the congestion prices could be used to substantially reduce (and possibly eliminate) local tax collections to support roads and transit.[90]

IX. Taxpayer cost

Under the RTA proposal, the sales and use taxes would increase from 7.9 percent to 8.3 percent in the portions of the Regional Transit District within Pierce County and the City of Everett, and from 8.2 percent to 8.6 percent in the rest of the district. The annual motor vehicle excise tax (MVET) will increase from 2.2 percent of vehicle value to 2.5 percent. Table 12 (page 26) presents estimates of the annual cost of these taxes on homeowning families of four with various annual incomes. Median incomes of families in King, Pierce, and Snohomish Counties are $54,880, $48,244, and $50,615, respectively. Based on these figures, the median family would pay about $125 per year in King County, $118 a year in Snohomish County, and $107 in Pierce County.

Chart 4 graphs the average tax rates for families of four as a function of income. These average rates fall as income rises, reflecting the regressivity of the RTA package of taxes.

The uncertainty of federal, state, and private support makes it difficult to say how much the RTA proposal will eventually cost the typical taxpayer. RTA hopes that the state will impose other new taxes to help fund the project. A calculation of taxpayer burden ought to include these taxes. Beyond that, it is highly likely that RTA will attempt to obtain funds from various state and federal transportation programs. These funds would otherwise pay for other transportation improvements within the region. Any improvements that are foregone as a consequence should properly be counted as a cost of the project – economists call this an opportunity cost. On the other hand, if local taxes are raised to replace the funds preempted by RTA, these taxes ought to be counted as a cost of the project.

If construction proceeds according to plan, RTA will collect the full 0.4 percent sales tax and 0.3 percent MVET for 16 years. The rates would then presumably drop to levels necessary to cover operating subsidies and repay the bonds. If RTA gets less federal, state, or private support than is called for by the plan, it will have three options: lengthen the construction timetable, issue more bonds, or return to the voters to request that their taxes be increased.

[1] Central Puget Sound Regional Transit Authority, *The Regional Transit System Master Plan, Fighting congestion. Moving people.* Seattle, October, 1994.

[2] RTA Master Plan, pp.3-1 to 3-26.

[3] Puget Sound Regional Council, *Draft Metropolitan Transportation Plan, A Proposed Update of VISION 2020, the Region's Adopted Growth and Transportation Strategy,* Seattle, December 1994.

[4] Draft MTP pp. 84, 86, B-3, and B-4. The 3.2 percent inflation rate assumed by RTA has been used to convert the PSRC estimates into 1995$.

[5] The data in Table 1 come from the 1980 and 1990 censuses and are reported in U.S. Department of Commerce, Bureau of the Census, *Statistical Abstract of the United States, 1994* and U.S. Department of Transportation, Federal Highway Administration Office of Highway Information Management, *New Perspectives in Commuting*, 1992.

[6] The data are from the 1980 and 1990 censuses and are for the Seattle "Urbanized Area." The census defines the boundaries of urbanized areas "to provide a better separation of urban and rural territory, population, and housing in the vicinity of large places." U.S. Department of Commerce, Bureau of the Census. *1980 Census of Population. Vol. 1 Characteristics of Population.* U.S. Department of Commerce, Bureau of the Census. *1990 Census Database: 1990 Census of Population and Housing Summary Tape File 3C.*

[7] U.S. Department of Commerce, Bureau of the Census. *1980 Census of Population. Vol. 1 Characteristics of Population.* U.S. Department of Commerce, Bureau of the Census. *1990 Census Database: 1990 Census of Population an Housing Summary Tape File 3C.*

[8] Chris Bushell, (ed.), *Jane's Urban Transport Systems 1994-1995,* Coulsdon, Surrey, United Kingdom.

[9] *Jane's Urban Transport Systems 1994-1995* and Chris Bushell, (ed.), *Jane's Urban Transport Systems 1990*, Coulsdon, Surrey, United Kingdom

[10] The large number of hitchhikers in business suits from Marin County to San Francisco is a consequence of this incentive. This is not a joke. Toll free carpooling has resulted in an explosion of spontaneous ride share by commuters across the Golden Gate Bridge.

[11] Congestion pricing is discussed in Section VIII.

[12] This history is drawn for the most part from Regional Transit Project, *Regional Transit System Plan, Final Environmental Impact Statement,* Municipality of Metropolitan Seattle, March 1993.

[13] In the folklore surrounding rail transit in Seattle, Atlanta's system is often identified as the system Seattle would have built had the Forward Thrust bond proposals been approved by voters. In 1980 the market share of public transit in the Atlanta urbanized area was 9.2 percent. In 1990 the share was 5.9 percent.

[14] PSCOG, *VISION 2020 Growth Strategy and Transportation Plan for the Central Puget Sound Region Draft Environmental Impact Statement,* April 1990, p. 5.

[15] These included the North Corridor preliminary alternatives analysis by

PSCOG/Metro (1984), the Multi-Corridor Project by PSCOG/Metro (1986), the North Corridor Extension Project by SNO-TRAN (1986), and the Tacoma-Seattle Connections Project by the Pierce County Subregional Council.

[16] PSCOG, *VISION 2020 Growth Strategy and Transportation Plan for the Central Puget Sound Region Draft Environmental Impact Statement.*

[17] PSCOG, *VISION 2020 Growth Strategy and Transportation Plan for the Central Puget Sound Region Final Environmental Impact Statement*, September 1990.

[18] On page 9 of the Final Environmental Impact Statement the following note appears: "The term 'rail,' used throughout the Draft EIS, has been replaced with 'regional rapid transit.' The new term denotes that the actual technology for a given corridor must be decided only after the technology alternatives have been studied. The technology eventually used could be rail or other technology with similar capacity…To save the expense of reprinting, the term "rail" has not been changed on the following "glossy" pages that describe the five Draft EIS alternatives. However, the reader is advised that 'rail' should be read as 'regional rapid transit.'"

[19] The commuter rail system is not part of the preferred alternative. The one piece of the regional rapid transit that is not a part of the previous regional rail is a segment extending south from Renton to Kent, an area that would have been served by commuter rail. Compare the maps on pages 49 and 51 of the Final Environmental Impact Statement.

[20] The Joint Regional Policy Committee believed that the Regional Rapid Transit was a rail system. In *Introducing the Regional Transit Project* they write: "[Our] Bus/Rail Alternative evolved from years of evaluation and public involvement, including the conceptual rail system in *VISION 2020."* (p. 16)

[21] See John F. Kain, "How to Improve Urban Transportation at Practically No Cost," *Public Policy*, XX, 1972.

[22] Puget Sound Council of Governments, *VISION 2020*: *Growth and Transportation Strategy for the Central Puget Sound Region*, Seattle, October 1990.

[23] Regional Transit Project, *Regional Transit System Plan Draft Environmental Impact Statement*, Seattle, Municipality of Metropolitan Seattle, 1992.

[24] Regional Transit Project, *Let's Keep Moving: Regional Transit System Plan*, June, 1993.

[25] The JRPC estimated this cost as $7.5 billion (1991$). We translate to 1995$ using the GDP implicit price deflator and RTA's projected 1995 inflation of 3.2 percent.

[26] Nationally, most commuter rail lines are descended from local services offered by long distance railroads, and most are electrically powered. See Vukan R. Vuchic, *Urban Public Transportation Systems*, Englewood Cliffs, New Jersey, Prentice-Hall 1981.

[27] But the need to rent access to the freight tracks will boost operating costs.

[28] See *Glossary of Transit Terms for Section 15*, U.S. Department of Transporta-

tion, Federal Transit Administration, Audit Review and Analysis Division, Office of Capital and Formula Assistance, November 1992.

[29] Sometimes called "snail rail."

[30] See "Phase 1 Study Options Report," p. 4 and the Puget Sound Region High Capacity Transit Expert Review Panel letter of October 17, 1994, p. 2 and p. 5.

[31] Regional Transit Project, *Final Environmental Impact Statement*, p. 2-50.

[32] David Hopkins, Metropolitan King County Council, Transportation, Transit and Regional Governance Committee Staff Report, November 8, 1994.

[33] Central Puget Sound Regional Transit Authority, "Phase I Study Options Results Report," September 1994.

[34] All of the light rail mileages omit the 1.4 miles of existing track through the Downtown Seattle Transit Tunnel.

[35] That gives a 38 minute running time from King Street to the airport.

[36] The transit development funds will be spent on capital enhancements to the regional system in the various subregions. The RTA financial plan treats these moneys as capital expenditures on commuter rail and light rail.

[37] Although, swapping Tacoma Dome—Federal Way and Northgate—164th Street for South Kirkland to Tukwila increases cost by more than one would expect from the mileages. The eastside segment would be relatively cheap to build because it would use the existing Burlington Northern Railroad right-of-way.

[38] Paul Matsuoka, testimony to the Expert Review Panel, January 12, 1994.

[39] RTA inadvertently omitted the downtown Seattle transit tunnel from the verbal description of the Phase I proposal. They take the position that this is inconsequential as the "proposal is the map," which includes the tunnel.

[40] For example, in 1991 Tacoma mayor Karen Vialle was a very vocal advocate of quickly proceeding on commuter rail, "'Without demonstrating to the voters of Pierce County that they're going to see something in the near future, it's going to be very difficult to sell" an increase in the sales tax and possibly in other taxes, Vialle said.' "Seattle-Tacoma Commuter Line May Arrive Early," *Seattle Times*, December 13, 1991, C1.

[41] David Schaefer, "Panel Struggles for Consensus on Transit Plan Blueprint," *Seattle Times*, October 16, 1994, B4.

[42] David Schaefer, "Rail board nears first stop," *Seattle Times*, October 27, 1994, B1.

[43] These travel times have been compiled from station to station run times provided by RTA.

[44] The issue of routes has not yet been carefully studied by RTA. Therefore, it is quite possible that they will ultimately decide on an alternate configuration, such as Tacoma—SW 164th and Overlake—Northgate.

[45] These travel times have been compiled from station to station run times calculated for RTA by LTK Engineering Services. Times are rounded down to whole minutes.

[46] Expert Review Panel, letter of October 17, 1994, p. 2.

[47] Expert Review Panel, letter of October 17, 1994, p. 5.

[48] See Eliza Newlin Carney, "A Desire Named Streetcar," *Governing*, February,

1994, pp. 36-39.

[49] See John F. Kain, "Choosing the Wrong Technology: Or How to Spend Billions and Reduce Transit Use," *Journal of Advanced Transportation,"* Vol. 21, Winter 1988, pp. 197-212.

[50] John R. Meyer, John F. Kain, and Martin Wohl, *The Urban Transportation Problem,* Campbridge, MA: Harvard University Press, 1965.

[51] This ability to economize by sharing right-of-way is an advantage that buses share with commuter rail.

[52] Kain, "Choosing the Wrong Technology," p. 201.

[53] Kain, "Choosing the Wrong Technology," p. 206.

[54] Phase I Study Options Report, p. 99. The parallel high speed roadway is almost surely I-5.

[55] The RTA will withhold Transit Development funds from any local agencies that run express bus services that compete with the RTA trains. RTA Master Plan, p. 2-16. Likewise, RTA wants local agencies to deploy the buses freed by the start of rail service to feed the trains.

[56] Kain, "Choosing the Wrong Technology," p. 202.

[57] See John F. Kain, "Deception in Dallas: Strategic Misrepresentation in Rail Transit Promotion and Evaluation," *Journal of American Planning Association,* 56 pp. 184-196, and John F. Kain, "The Use of Straw Men in the Economic Evaluation of Rail Transport Economics," *American Economic Review,* Vol. 82 n 2, May 1992.

[58] Transportation Systems Center, "Urban Rail Transit Projects: Forecast versus Actual Ridership and Costs," Cambridge, MA, U.S. Department of Transportation, October 1989 (PB90-148693).

[59] Again, the Atlanta experience is particularly interesting since it is widely believed that project inherited the funds which would have gone to Seattle if voters had approved the Forward Thrust rail project.

[60] Indeed, Pickrell's recommendation that a peer review panel of independent experts assess the credibility of technical forecasts was followed in the case of the RTA.

[61] The American Public Transit Association has issued a response to Pickrell's paper. This includes two main objections: First, that later estimates were more accurate than those cited by Pickrell. And, second, there are reasons to choose rail other than ridership and cost. American Public Transit Association, "Off Track," Washington, D.C. 1990.

[62] "Urban Rail Transit Projects: Forecast versus Actual Ridership and Costs," pp. 53-61.

[63] The PSRC predicts, between 1990 and 2020, 39 percent population growth for King County, 63 percent for Kitsap County, 55 percent for Pierce County, and 77 percent for Snohomish County. Draft MTP, p. 9.

[64] It should be possible to use the PSRC's land-use model to estimate the fraction of the PSRC's population living in the RTD in future years. These ratios could be used to allocate regional sales to the RTD.

[65] Although the Growth Management Act is intended to limit this.

[66] After RTA first prepared its sales tax estimates, the PSRC revised upward slightly its estimates of retail sales growth rates. Those revisions were not incorporated in the RTA financial plan. But this conservative bias is

relatively small, (0.2 percent per year, on average).

[67] The local sales and MVET taxes create another invidious incentive. By discouraging the replacement of old cars with new, these taxes may actually reduce air quality. See Howard K. Gruenspecht, "Differential Regulation: The Case of Auto Emissions Standards," *American Economic Review*, 72(2), May 1982, pp. 328-331, and Robert W. Crandell, Howard K. Gruenspecht, Theodore E. Keeler, and Lester B. Lave, *Regulating the Automobile*, Washington, D.C., The Brookings Institution, 1986.

[68] "Regional Transit System Master Plan Technical Appendix," November 23, 1994, p. 15.

[69] "Lowry attacks transportation plan," *Seattle Post-Intelligencer,* B2 December 21, 1994.

[70] Technical Appendix, p. 15.

[71] William Baumol, "Productivity Policy and the Service Sector," in Robert Inman (ed.), *Managing the Service Sector,* New York: Cambridge University Press, 1985.

[72] U.S. Department of Transportation, Federal Transit Administration, "Transit Profiles of the Thirty Largest Agencies for the 1992 Section 15 Report Year," Appendix A.

[73] On ISTEA see The Washington ISTEA Steering Committee, *ISTEA Handbook,* and "Highways, Mass Transit Funded," *1991 Congressional Quarterly Almanac,* Washington, D.C. 1992 pp.137-151.

[74] Washington State received $129.3 million. Perhaps most notable was the project to improved the access to the casinos at Reno Nevada from Tom Foley's district. "© Identification of High Priority Corridors on the National Highway System…..(19) United States Route 395 Corridor from the United States border to Reno, Nevada." The bill earmarked $54.5 million for the Washington State portion of this road (but no money for Oregon or Nevada). P.L. 102-240, Section 1105.

[75] P.L. 102-240 Sec. 3037. The $325 million earmark is not indexed against inflation. Therefore this number is not directly comparable to the $1.12 billion (1995$) total in the RTA Master Plan.

[76] Vice President Al Gore, *From Red Tape to Results, Creating a Government that Works Better & Costs Less, Report of the National Performance Review,* Washington, D.C. U.S.G.P.O., 1993.

[77] The Department of Transportation's NPR taskforce urged that the Department "Get Involved with Earmarking. Expand coordination between the Executive Branch and Congress in developing project-ranking criteria. Limit earmarking to a percentage of an [operating administration's] total program budget. Limit time for obligation of funds for earmarked projects. Convert discretionary programs to formula funding where appropriate."

[78] *From Red Tape to Results, Creating a Government that Works Better & Costs Less,* DOT 17 and DOT 19 p. 150.

[79] *Budget of the United States Government, Fiscal Year 1995*. Washington, D.C., Office of Management and Budget, February 1994. p. 76.

[80] $1 million of this is being spent on the *Try Rail* demonstration.

[81] It is an open question how Congress will respond to this proposal. The Clinton Plan is similar to the transportation proposals contained in Representa-

tive Gerald H.B. Solomon (R-NY) plan to balance the federal budget by fiscal year 1999. (The Solomon plan reduces spending at the same time it consolidates the transportation grants, however.) See David E. Rosenbaum, "A Balanced Budget: What One Looked Like," *New York Times*, Nov. 28, 1994, and the Balanced Budget Taskforce, "The Balanced Budget," March 17, 1994.

[82] Anthony Downs, *Stuck in Traffic: Coping with Peak-Hour Traffic Congestion*, Washington, D.C., The Brookings Institution, 1992.

[83] See Kenneth A. Small, Clifford Winston, and Carol A. Evans, *Road Work: A New Highway Pricing and Investment Policy,* Washington, D.C., The Brookings Institution, 1989.

[84] See three papers prepared as background for the Metropolitan Transportation Plan: EcoNorthwest, "Evaluating Congestion Pricing Alternatives for the Puget Sound Regional Council," MTP-17a, PSRC, August 1994; EcoNorthwest, "Selected and Anointed Bibliography on Congestion Pricing Measures," MTP-17b, PSRC, August, 1994; and EcoNorthwest, "Modeling Congestion Pricing Alternatives for the Puget Sound Regional Council," MTP-17c, PSRC, August 1994.

[85] William S. Vickrey, "Congestion Theory and Transportation Investement," *American Economic Review*, 59(2) May 1969 pp. 251-260. In this paper Vickrey is particularly concerned with the way that the level of the toll must vary over the rush hour in order to be most effective.

[86] Draft MTP, p. 31.

[87] The RTA's newsletter makes this error when discussing congestion, "Why rail? The case for rail in the Puget Sound Region," *Choices*, v 5 n 5, November 1994, p. 3.

[88] Draft MTP, p. 36.

[89] Draft MTP, p. 37.

[90] Overall, it is disappointing that the considerable power of the Regional Transportation Model was not utilized to more thoroughly explore alternatives to the RTA plan.